ENGINEERING TEST REPORT

ISP DIRECT INDOOR & OUTDOOR UNITS
Model No: 2401-01 (indoor) and 2401-02 (outdoor)

FCC ID: NUX-ISP2401-2

FCC PART 15, SUBPART C, PARA. 15.247
DIRECT SEQUENCE SPREAD SPECTRUM (DSSS) TRANSMITTERS
OPERATING IN THE FREQUENCY BAND FROM 2408.625 - 2464.875 MHz

UltraTech's FILE NO.: IAW-006FTX

TESTED FOR:

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

TESTED BY:

ULTRATECH ENGINEERING LABS INC.
4181 Sladeview Crescent, Unit 33
Mississauga, Ontario
Canada, L5L 5R2

PREPARED BY: Tri M. Luu, P.Eng.

DATE: Oct. 27, 1998

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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 (1)
15.247(b) & 1.1310	Maximum Peak Power and RF Exposure Limits	Yes
15.247(c)	RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Not required (1)
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 (1)
15.247(e)	Processing Gain of Direct Sequence Spread Spectrum System	Not required (1)
15.107	AC Power Conducted Emissions	Yes
15.109	Radiated Emissions for Digital Circuit Portions	Not required (1)

Note 1: These requirements are not required to be re-tested since the modifications on the transmitter and its packaging have no impact on the RF output signal characteristics.

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 representative production units, representative.*

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: [illegible], 1998

2. EXHIBIT 2 - GENERAL INFORMATION

2.1 APPLICANT

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

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

2.2 MANUFACTURER

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

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

2.3 DESCRIPTION OF EQUIPMENT UNDER TEST

PRODUCT NAME:	ISP DIRECT INDOOR & OUTDOOR UNITS
SERIAL NUMBER:	Preproduction
TYPE OF EQUIPMENT:	DSSS Transmitters
POWER RATING:	190 mWatts
EMISSION DESIGNATION:	Direct sequence spread spectrum
DUTY CYCLE:	45% maximum
OSC. FREQUENCY(IES):	35 MHz (Rx IF), 70 MHz (Rx LO), 915 MHz (Tx IF), Tx Lo. Osc. = Tx Freq- 915 MHz.
INPUT SUPPLY:	AC 120 V 60Hz using the following alternative external switching power supply:
OPERATING FREQ:	2408.625 - 2464.875 MHz (Please refer to the attached table for each channel frequencies.)

ASSOCIATED DEVICES LISTED WITH THE ORIGINAL GRANT:

(1) Elpac external switching power supply, model WRI4232, AC IN: AC 95 250 V, 47-63 Hz, 1.2A, DC OUT: +5V, +12V, -12 Vdc or

Alternative Power Supplies:

- External Power Supply, by International Power Supply Sources, Model No.: PUP30-31 or
- External Power Supply, by Umec, Model No.: UP403A-01P or
- External Power Supply, by Elpac Power Systems, Model No.: WRI-4232

(2) One of the following antenna may be supplied with the InterAir ISP Direct System, the antenna is permanently secured to the ISP Direct Outdoor Unit using TNC connectors and heat shrink:

Selection Number	Description	Vendor	P/N	Gain (dBi)
1	1x1 Patch	Huber Suhner	64958022	8.5
2	1x10 Patch	Huber Suhner	65247322	16.5
3	Omni	Andrew	RT1N0F-024V-013A	13
4	Reflector	Conifer	18T-2400	17

(3) The RF interconnecting cable between the InterAir ISP Direct Indoor and the Outdoor Units can be selected with one of the following:

Selection No.	Description	Vendor	Part No.	Length (ft)	Loss (dB)
1	0.4" Cable – WP	Times	LMR-400-DB	150	10.2
2	0.3" Cable	Times	LMR-300	100	10.4
3	0.24" Cable	Times	LMR-240	80	10.3
4	0.2" cable	Times	LMR-200	60	10.1
5	0.5" Cable – WP	Times	LMR-500-DB	200	11
6	0.6" Cable – WP	Times	LMR-600-DB	250	11
7	0.9" Cable – WP	Times	LMR-900-DB	400	12
8	0.25" Flex	MISC	RG-223/U	30	10.5

The above item # 8, 0.25" Flex, RG-223/U cable with shortest available length (30 ft) and lowest loss (10.5 dB), was used for testing and represents the worst case.

ADDITIONAL ASSOCIATED DEVICES APPLIED UNDER THIS CLASS II PERMISSIVE CHANGE APPLICATION:

(1) **Additional Alternative Power Supplies**:

- External Power Supply, by Computer Product, Model CL40-76081, S/N: 2DFA3787
- External Power Supply, by PSA Model PSA-46-301, S/N: M75103371B2

(2) **Additional Alternative Transmitter/Receiver Antennas**:

One of the following antenna may be supplied with the InterAir ISP Direct System, the antenna is permanently secured to the ISP Direct Outdoor Unit using TNC connectors and heat shrink:

Selection Number	Description	Vendor	Model or Part No.	Gain (dBi)
1	Yagi Antenna	Cushcraft	PC2415N	16.7
2	3x3 Patch Antenna	Huber Suhner	1324-29-0006	16.5
3	3x3 Patch Antenna	Tecom	505039B	17.0
4	1x1 Patch Antenna	Antenna Specialists	ASPPT2988	8.0
5	Rubber Duck	Mobil Antenna	PSTN3-2400T	1.0

FCC ID: NUX-ISP2401

INTERFACE PORTS:

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 DESCRIPTION OF MODIFICATIONS AND CHANGES

InterAir Wireless ISP Direct Access Server
Model 2401
FCC ID: NUX-ISP2401

1. Description of System Clock Changes

The system operates using the following clocks/local oscillators (LO)/intermediate frequencies (IF):

Main Processor:	20 MHz
DSP Processor:	45 MHz
First Local Oscillator:	1493.625 to 1549.375 MHz
Second Local Oscillator:	880 MHz
Third Local Oscillator:	70 MHz
Transmit Local Oscillator:	1025 MHz
First IF:	915 MHz
Second IF:	35 MHz
Transmit IF:	110 MHz

The original system design used a 20MHz TCXO and a 50MHz VCXO. All frequencies required to drive the system processors and local oscillators were developed from these two clocks. See Figure 1. There was an integrated circuit (IC) which multiplied the 20 MHz clock by 2.5 to create the 45 MHz DSP Processor clock. This IC became obsolete and can no longer be obtained. The architecture was changed to eliminate the need for this IC as shown in Figure 2. The 50 MHz VCXO was changed to a 45 MHz VCXO. The 45 MHz output is then used to drive the DSP Processor directly. All frequencies for the clocks, LO, and IF have remained as listed above.

2. RF Board Design and Layout Changes

The RF circuit board was changed to improve the performance of the system. The RF circuit board is enclosed in a metal shield within the overall housing. The LOs on the original circuit board were being radiated within this enclosure. This energy was then coupled onto the desired signal paths and was conducted out the antenna port of the system. The LOs were also being radiated from the overall enclosure.

The 880 MHz Second LO was being coupled onto the 915 MHz IF in the transmit chain. This LO is within the filter bandwidth and was upconverted and transmitted from the system. An analysis of this problem revealed two things about the second LO design. The first is that the transmission line on the circuit board that connected the second LO to the receiver mixer was very long. The second issue was that the power on this trace was very high. This transmission line acted like an antenna and radiated the second LO throughout the RF enclosure. The design was changed to reduce this problem. The power on this trace was reduced by 20 dB by moving the amplifier from the output of the synthesizer to the input to the receiver mixer, after the long transmission line. The transmission line was changed from microstrip to co-planar waveguide and the length was cut in half by moving the location of the LO on the board. The layout was also changed in the transmit IF section to minimize the length of the trace before the upconversion stage. These changes significantly reduced the amount of radiated and conducted second LO emissions from the unit.

The 1.5 GHz First LO was also radiating from the enclosure. An analysis of this problem showed similar results to the one described above. Again, the power was reduced by 20 dB on the transmission lines that connect the first LO to the receive and transmit mixers by moving the amplifiers from the output of the synthesizer to the mixer inputs. The transmission line was again changed from microstrip to co-planar waveguide. These changes reduced the radiated emissions from the overall enclosure.

3. Additional alternative External Power Supplies and Transmit/Receive Antennas:

Additional Alternative Power Supplies:

- External Power Supply, by Computer Product, Model CL40-76081, S/N: 2DFA3787
- External Power Supply, by PSA, Model PSA-46-301, S/N: M75103371B2

Additional Alternative Transmitter/Receiver Antennas:

One of the following antenna may be supplied with the InterAir ISP Direct System, the antenna is permanently secured to the ISP Direct Outdoor Unit using TNC connectors and heat shrink:

Selection Number	Description	Vendor	Model or Part No.	Gain (dBi)
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4	1x1 Patch Antenna	Antenna Specialists	ASPPT2988	8.0
5	Rubber Duck	Mobil Antenna	PSTN3-2400T	1.0

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.

Both conducted and 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

AC Powerline Conducted Emissions were performed in UltraTech's shielded room, 16'(L) by 12'(W) by 12'(H).

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 sites 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/SIT1300F2) and Industry Canada office (Industry Canada File No.: IC2049). Last Date of Site Calibration: Sep. 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 conducted emissions are reported in units of dB referenced to one microvolt [dB(μV)].

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.

3. EXHIBIT 3 - SYSTEM TEST CONFIGURATION

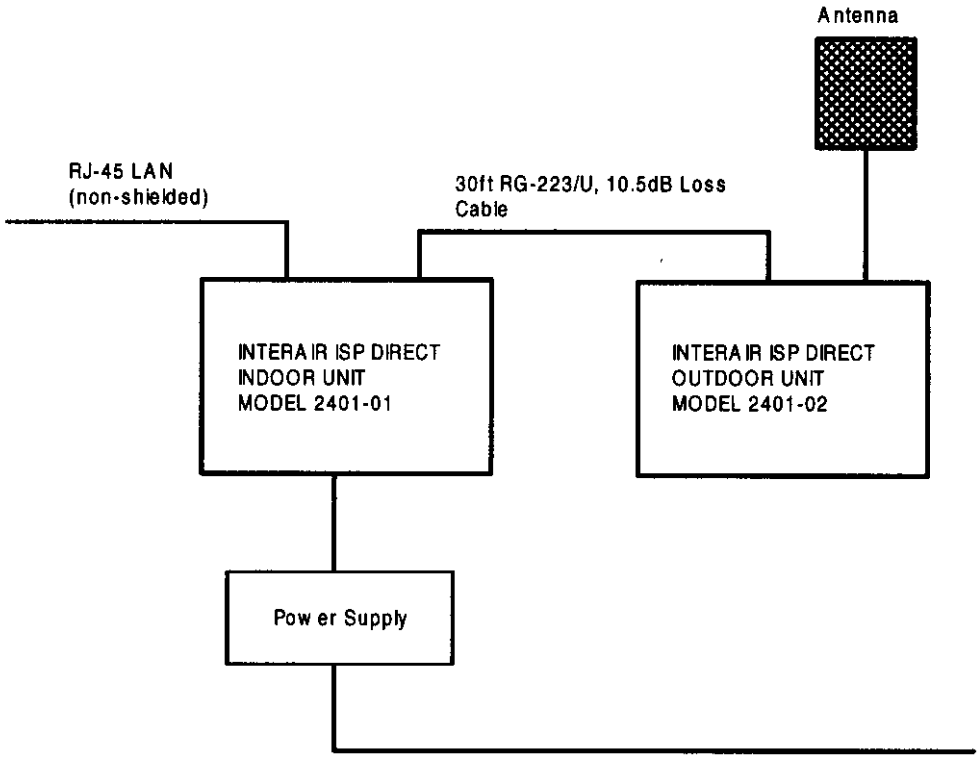
3.1 TEST SYSTEM DETAILS

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

(1) EUT: INTERAIR WIRELESS, 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.

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

3.2 BLOCK DIAGRAMS FOR CONDUCTED & RADIATED EMISSION MEASUREMENTS



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 INTERAIR WIRELESS 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 FOR COMPLIANCE

Not required.

4. EXHIBIT 4 - TEST DATA

4.1 MAXIMUM PEAK OUTPUT POWER @ FCC 15.247(B) AND RF EXPOSURE LIMIT FCC 1.1310

PRODUCT NAME: **ISP DIRECT INDOOR & OUTDOOR UNITS, Model No.: 2401-01 (indoor) and 2401-02 (outdoor)**

FCC REQUIREMENTS:

FCC 15.247(b):- Maximum peak output power of the transmitter shall not exceed 1 Watt.

(i) Systems operating in the 2400-2483.5 MHz band that used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduce by 1 dB for every 3 dB that the directional gain of the antenna exceed 6 dBi.

FCC 1.1310:- The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in 1.1307(b).

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (minutes)
(A) Limits for Occupational/Control Exposures				
300-1500	...	...	F/300	6
1500-100,000	...	...	5	6
(B) Limits for General Population/Uncontrolled Exposure				
300-1500	...	...	F/1500	6
1500-100,000	...	...	1.0	30

F = Frequency in MHz
* = Plane-wave equivalent power density

CLIMATE CONDITION:

Standard Temperature and Humidity:

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

POWER INPUT:

AC 120 V 60Hz from Elpac external switching power supply, model WRI4232.

TEST EQUIPMENT:

- HP RF Peak Power Meter, Model 8900, S/N: 2131A00124, Measuring Freq. Range: 01 - 18 GHz, 50 Ohm IN.
- HP RF Peak Power Sensor, Model 8481A, S/N: 2551A01965, Measuring Freq. Range: 0.1 - 18 GHz, 50 Ohm IN/OUT

METHOD OF MEASUREMENTS:

FCC @ 1.1310 & OST Bulletin No. 65-October 1985

$S = PG/4\Pi r^2 = EIRP/4\Pi r^2$

Where: P: power input to the antenna in mW
EIRP: Equivalent (effective) isotropic radiated power.
S: power density mW/cm^2
G: numeric gain of antenna relative to isotropic radiator
r: distance to centre of radiation in cm

FCC radio frequency exposure limits may be exceeded at distances closer than r cm from the antenna of this device

$$r = \sqrt{PG/4\Pi S}$$

FCC radio frequency exposure limits may be exceeded at distances closer than r cm from the antenna of this device

TEST ARRANGEMENT

TEST RESULTS: Conforms.

TEST PERSONNEL: Mr. Tri M. Luu, P.Eng.

DATE: Oct. 19, 1998

MEASUREMENT DATA:

PEAK POWER MEASUREMENT

Maximum Antenna Gain provided: 17 dBi
FCC Power Output Limit = 30 dBm – (17 dBi - 6 dBi)/3 = 29.3 dBm or 851 mWatts

Channel No.	Channel Frequency	Modulation Bandwidth	Data Rate (Mb/s)	Chips per Symbol	Measured Peak Power (mWatts)	FCC Limit (mWatts)
3	2408.625	Narrow	4.5	11	190	851
4	2411.4375	Medium	5.625	11	190	851
6	2419.875	Wide	11.25	11	190	851
9	2431.125	Wide	11.25	11	190	851
10	2433.9375	Medium	5.625	11	190	851
15	2453.625	Wide	11.25	11	190	851
17	2462.0625	Medium	5.625	11	190	851
18	2464.875	Narrow	4.5	11	190	851

Remarks: There was no change in the rf output powers in comparison with the original version of the transmitter.

4.2 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

CLIMATE CONDITION:

Standard Temperature and Humidity:

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

POWER INPUT:

AC 120 V 60Hz from Elpac external switching power supply, model WRI4232.

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 10^{th} 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.

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: Mr. Tri M. Luu, P.Eng.

DATE: Oct. 19-23, 1998

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 ≥ 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 = $20LOG_{10}(0.45)$ = -6.9 dB***

4.2.1 Test Config.# 1: Yagi Antenna, by Cushcraft, P/N: PC2415N, Gain: 16.7 dBi

Channel #: 3, Frequency: 2408.625 MHz **Full Rated Peak Power: 190 mW** **Modulation: DQPSK, narrow, 11 chips/symbol,** **Data Rate: 4.5 Mb/s, 2 bits/symbol**				**Power Level in 1 MHz BW: 125.3 dBuV/m** **Limit = 125.3 dBuV/m - 20dB = 105.3 dBuV/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**
1493.63	64.4	40.7	V	54.0	105.3	-13.3	** PASS
1493.63	57.6	38.6	H	54.0	105.3	-15.4	** PASS
2408.63	125.3	--	V	--	--	--	--
2408.63	113.9	--	H	--	--	--	--
2987.25	53.8	44.1	V	54.0	105.3	-61.2	PASS
2987.25	48.3	36.4	H	54.0	105.3	-68.9	PASS
4480.88	52.4	40.3	V	54.0	105.3	-13.7	** PASS
4480.88	48.7	32.4	H	54.0	105.3	-21.6	** PASS
5974.50	48.2	29.2	V	54.0	105.3	-76.1	PASS
7468.13	50.8	32.3	V	54.0	105.3	-21.7	** PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

- *FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

Aug. 13, 1998

Federal Communications Commission
7435 Oakland Mills Road
Columbia, MD 21046
USA

Attention: Mr. Joe Dichoso,

Subject: FCC ID: NUX-ISP2401, Correspondance ID: 1050, 731 Confirmation No.: EA89226

Dear Mr. Dichoso,

This concerns the confirmation statement about the installation method to meet the RF Safety Requirements and the EIRP Peak Power Rating when the transmitter is used with different antennas as per your discussion with Mr. Tri Luu at Ultratech Engineering Labs Inc. (Mississauga, Ontario).

(1) **Installation of the Outdoor Unit and Antenna for Compliance wit FCC RF Safety Requirements**: The Outdoor Unit (M/N: 24001-2) is mechanically and permanently secured to the antenna as one complete assembly. These whole assembly is required to be installed away from the users on the roof of the building or on the antenna tower located outside of the building at all time per InterAir's Installation Procedure for this equipment.

(2) As per your discussion with Mr. Tri Luu at UltraTech Engineering Labs Inc., the maximum maximum EIRP power rating of 36 dBm is not our intended power rating for this transmitter.

This transmitter, operating in 2400-2483.5 MHz band, is used exclusively for fixed and point-to-point operations. It also employs transmitting antennas with the directional gain greater than 6 dBi provided that the peak power of the intentional radiator is reduced by 1 dB fir every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Selection Number	Description	Vendor	P/N	Gain (dBi)	EIRP Peak Power Rating
1	1x1 Patch	Huber Suhner	64958022	8.5	31.3
2	1x10 Patch	Huber Suhner	65247322	16.5	39.3 See note (1)
3	Omni	Andrew	RT1N0F-024V-013A	13	35.8
4	Reflector	Conifer	18T-2400	17	39.8 See note (2)

Notes: Applied FCC Rules 15..247(b)(3)(I), the maximum peak output power at the transmitter antenna connector is with different antenna used can be calculated as follows:

(1) Antenna gain = 16.5 dBi, Measured Peak Power at RF OUT Terminal = 22.8 dBm.

FCC Limit for Peak Power at the RF OUT Terminal = 30 dBm – (16.5 dBi - 6 dBi)/3 = 26.5 dBm

Since the measured maximum peak output power of the transmitter is 22.8 dBm, which is less than the calculated FCC power limit (26.5 dBm); There is no further reduction of the maximum peak output power is necessary.

(2) Antenna gain = 17 dBi, Measured Peak Power at RF OUT Terminal = 22.8 dBm.

FCC Limit for Peak Power at the RF OUT Terminal = 30 dBm – (17 dBi - 6 dBi)/3 = 26.3 dBm

UltraTech
63 Auster Blade View Crescent
Mississauga, Ontario. L5L 5R2
Telephone (905) 569-2550
Facsimile (905) 569-2480

InterAir Wireless, Inc.

Aug. 14, 1998

Federal Communications Commission
7435 Oakland Mills Road
Columbia, MD 21046
USA

Attention: **Mr. Joe Dichoso,**

Subject: **FCC Certification Application for InterAir Wireless ISP Transmitter**
FCC ID: NUX-ISP2401,
Form 731 Confirmation No.: EA89226

Dear Mr. Dichoso,

This letter concerns the confirmation statement about the installation method to meet the RF Safety Requirements and the EIRP Peak Power Rating when the transmitter is used with different antennas as per your discussion with Mr. Tri Luu at Ultratech Engineering Labs Inc. (Mississauga, Ontario) on August 13, 1998.

(1) **Installation of the Outdoor Unit and Antenna for Compliance with FCC RF Safety Requirements:** The Outdoor Unit (M/N: 24001-2) is mechanically and permanently secured to the antenna as one complete assembly. The whole assembly is, at all times, required to be installed on the roof of the building, on the side of the building pointing outward, or on an antenna tower located outside of the building. The minimum height above the ground is twelve feet. The installation will be carried out, as mentioned, by professional technical staffs according to InterAir's installation procedures.

(2) **EIRP Output Power Rating**: As per your discussion with Mr. Tri Luu at UltraTech Engineering Labs Inc., the maximum EIRP power rating of 36 dBm is not our intended power rating for this transmitter. This transmitter, operating in 2400-2483.5 MHz band, is used exclusively for fixed and point-to-point operations. It also employs transmitting antennas with their directional gain greater than 6 dBi. The reduction of the rf peak output power per FCC Rules 15.247(b)(3)(I), *the peak power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi,* is not necessary since the maximum rf peak output power delivered to antenna terminal is much less than FCC limits. Please kindly refer to Notes (a), (b) and (c) for detailed explanations.

Selection Number	Description	Vendor	P/N	Gain (dBi)	EIRP Peak Power Rating
1	1x1 Patch	Huber Suhner	64958022	8.5	31.3 See note (a)
2	1x10 Patch	Huber Suhner	65247322	16.5	39.3 See note (b)
3	Omni	Andrew	RT1N0F-024V-013A	13	35.8 See note (a)
4	Reflector	Conifer	18T-2400	17	39.8 See note (c)

Notes: FCC Rules 15.247(b)(3)(I), the maximum peak output power at the transmitter antenna connector with different antennas used can be calculated as follows:

(a) Since the EIRP peak output power is less than 36 dBm, no reduction on the rf peak power delivered to the antenna terminal is required.

(b) Antenna gain = 16.5 dBi, Measured Peak Power at RF OUT Terminal = 22.8 dBm.

FCC Limit for Peak Power at the RF OUT Terminal = 30 dBm – (16.5 dBi - 6 dBi)/3 = 26.5 dBm

Since the measured maximum peak output power of the transmitter is 22.8 dBm, which is less than the calculated FCC power limit (26.5 dBm); There is no further reduction of the maximum peak output power is necessary.

(c) Antenna gain = 17 dBi, Measured Peak Power at RF OUT Terminal = 22.8 dBm.

FCC Limit for Peak Power at the RF OUT Terminal = 30 dBm – (17 dBi - 6 dBi)/3 = 26.3 dBm

Since the measured maximum peak output power of the transmitter is 22.8 dBm, which is less than the calculated FCC power limit (26.3 dBm); There is no further reduction of the maximum peak output power is necessary.

Please feel free to contact us if you have any further questions.

Regards,

From: Mr. David Chauncey
InterAir Wireless
485 Cayuga Road, P.O. Box 22
Buffalo, New York
USA 14225-0222

InterAir Wireless – FCC response.

1. SAR question:

-InterAir Proprietary –

The InterAir ISP Direct Model 2401 is used to transmit LAN traffic from one location to another. The distance between locations can be up to 25 miles. The product consists of an indoor unit (IDU), outdoor unit (ODU), coaxial cable assembly, and external brick power supply. The interface to the system is TCP/IP running over 10BaseT ethernet. These components are professionally installed by InterAir Wireless certified technicians at each user's location.

The IDU and power supply are installed indoors. The IDU contains the system processor, 10BaseT ethernet interface, and radio. The ODU is installed outdoors (typically on the roof) and contains the radio power amplifier/preamplifier and the antenna. The ODU is supplied to the installer with the antenna permanently attached to the box containing the amplifier electronics.

The IDU and ODU connect together using a single 50 ohm coaxial cable. The cable is available in eight standard lengths (from 40 to 400 feet) and is supplied to the installer as a completed assembly. This cable is used to transmit all RF, DC power, and control signals between the IDU and ODU. An InterAir Wireless Proprietary electrical interface is used to transmit these signals between the two units.

The requirements of CFAR 47 Part 15.203 are met by having the antenna permanently attached to the unit. In addition, the unit is professionally installed by certified technicians. The IDU contains an interlock which prohibits it from transmitting unless a properly functioning ODU is connected using one of the eight standard coaxial cable assemblies. The ODU also contains circuitry which assures that the transmit power limit is not exceeded. IDU and ODU fault indicators are located on the front panel of the IDU and are illuminated when the interlock is activated.

The ODU/antenna assembly is typically mounted on the roof away from people. Therefore, it is not necessary to perform the SAR or RF Safety Requirement tests.

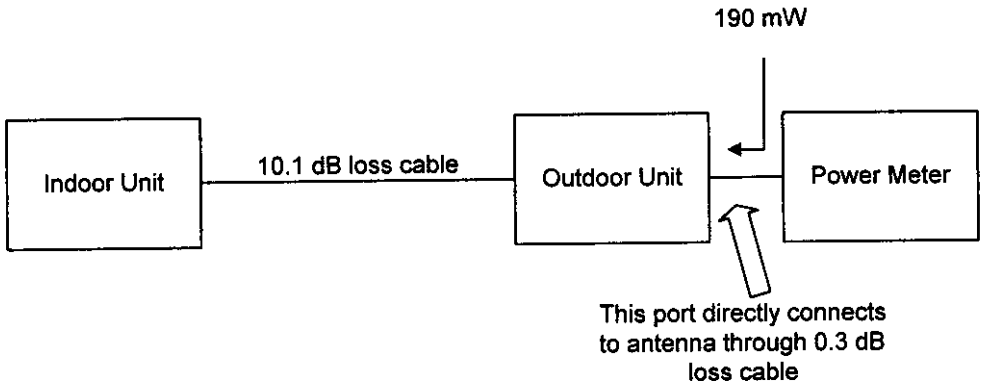
- InterAir Proprietary –

2.

The measured maximum RF output power of 190 mW or 22.8 dBm is the actual power delivered to the transmitting antenna with the minimum 10.1 dB loss cable between the indoor and outdoor units. Please note that the transmitter will not function if the indoor unit is not connected to the outdoor unit. There is no correction necessary to FCC form 731.

Please also note that selection of cable and antenna are determined by InterAir Wireless so that the total peak radiated power shall not exceed 36 dBm. For example: if the Conifer 18T-2400 reflector antenna is used the cable length is selected so that it has

minimum cable loss of 36 dBm (max EIRP allowed) – [22.8 dBm + 10.1 dBi] (power delivered from indoor unit) – 17 dBi (antenna gain)= 13.9 dB.



We, InterAir Wireless, confirm that the cables listed on page 7 of the test report are the only cables that will be supplied.

3. Process Gain tests:

See Attached Discussion

InterAir Wireless
485 Cayuga Rd, PO Box 222
Buffalo, NY 14225-0222
Contact: David Chauncey, Director of RF Engineering
Voice 716-631-6409
Fax 716-631-7849
E-Mail dchauncey@interairwireless.com

Product: ISP Direct Indoor and Outdoor Units
Model: 2401-01 (indoor) and 2401-02 (outdoor)
FCC ID: NUX-ISP2401
Reference: EA89226

CFR 47 Part 15.247 calls for a process gain of at least 10 dB for a direct sequence system. This is measured using the jamming margin method where a CW jammer is injected and the jamming margin is measured. This is done in 50 kHz increments across the passband of the system. The worst 20% of the data points are discarded. System Losses of 2 dB are assumed.

The system losses of the unit were measured and found to be in excess of 2 dB. This made the system fail the process gain requirement when previous measurements were taken. A change was made in the receiver DSP software to reduce the system losses. The unit was found to pass when measured using this new software.

A summary of the measurement follows:

Measured Process Gain $G_p = (S/N)_o + L_{sys} + M_j$

$(S/N)_o = 10.8$ dB for BER of 10^{-4}, See Appendix 1
$L_{sys} = 2$ dB
System Passband = +/- 8.5 MHz for Wideband Mode (6 dB IF Bandwidth)
= +/- 4.5 MHz for Narrowband Mode (6 dB IF Bandwidth),
See Appendix 2

$G_p = 10.8$ dB + 2 dB + M_j Must be at least 10 dB

Insert Test Data Here

1. *Processing Gain of A Direct Sequence Spread Spectrum, FCC CFR 47, Para. 15.247(e)*

PRODUCT NAME: **ISP DIRECT INDOOR & OUTDOOR UNITS, Model No.: 2401-01 (indoor) and 2401-02 (outdoor)**

FCC REQUIREMENTS:

The processing gain of a direct sequence system shall be at least 10 dB. The processing gain shall be determined from the ratio in dB of the signal-to-noise ratio with the system spreading code turned off to the signal-to-noise ratio with the system spreading code turned on, as measured at the demodulated output of the receiver.

CLIMATE CONDITION:

Standard Temperature and Humidity:

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

POWER INPUT:

AC 120 V 60Hz from Elpac external switching power supply, model WRI4232.

TEST EQUIPMENT:

- Advantest Spectrum Analyzer, Model R3271, S/N: 15050203
- Bird 20 dB Attenuator, 50 Ohm IN/OUT
- IBM PS/1 & IBM 350 ThinkPad Host Computer(s)
- Fluke RF Signal Generator, Model 6061A, Freq. range: 10 KHz - 1050 MHz.
- HP 8900 RF Peak Power Meter, Measuring Frequency Range: 100 MHz - 18 GHz.

METHOD OF MEASUREMENT:

METHOD #1:- Jamming Margin Method

The processing gain may be measured using the CW jamming margin method. Figure 1 shows the test configuration. The test consists of stepping a signal generator in 50 KHz increments across the passband of the system. At each point, the generator level required to produce the recommended Bit Error Rate (BER) is recorded. This level is jammer level. The output power of the transmitting unit is measured at the same point. The Jammer to Signal (J/S) ratio is then calculated. Discard the worst 20% of the J/S data points. The lowest remaining J/S ratio is used when calculating the Process Gain.

The signal to noise ratio for an ideal non-coherent receiver is calculated from:

$$(1) \qquad Pe = 1/2e^{(-1/2(S/N)o)}$$

where: Pe = probability of error (BER)
(S/N)o = the required signal to noise ratio at the receiver output for a given received signal quality

Ref.: Viterbi, A.J. Principles of Coherent Communications (New York: McGraw-HILL 1966), Pg. 207

Using equation (1) shown above, calculate the signal to noise ratio required for your chosen BER. This value and the measured J/S ratio are used in the following equation to calculate the Process Gain (Gp) of the system.

$$Gp = (S/N)o+Mj+Lsys$$

Where:

(S/N)o: Theoretical signal to noise ratio required to maintain the normal operation just before the BERappears. In real measurements the maximum error of 0.001 is allowed in an ideal system using their modulation scheme with all codes turned off (i.e. no spreading or processing gain).

Mj: Maximum jammer to Signal Ratio that recorded at the detected BER.

Lsys: System losses such as non-ideal synchronization, tracking circuitry, non-optimal baseband receiver filtering and etc... These losses can be in excess of 2 dB for each transmitter and receiver pair. For the purpose of this processing gain calculation we assume a Lsys at its minimum value of 2 dB.

Ref.: Dixon, R, Spread Spectrum Systems. (New York: Wiley, 1984)

The Signal-to-Noise Ratio (S/N) with respect to the probability of bit error for a differentially QPSK (DQPSK) receiver in the presence of additive white Gaussian noise (AWGN) is given by Figure 4.5.1 as attached.

Ref.: Marvin Simon, Spread Spectrum Communication Handbook, page 695.

Since the CW jamming is a tone jamming, the (S/N)o for a AWGN jamming obtained from Figure 4.5.1 can be converted to the CW jamming or tone jamming using the formula (3.97) of the Marvin Simon Spread Spectrum Communication Handbook as follows:

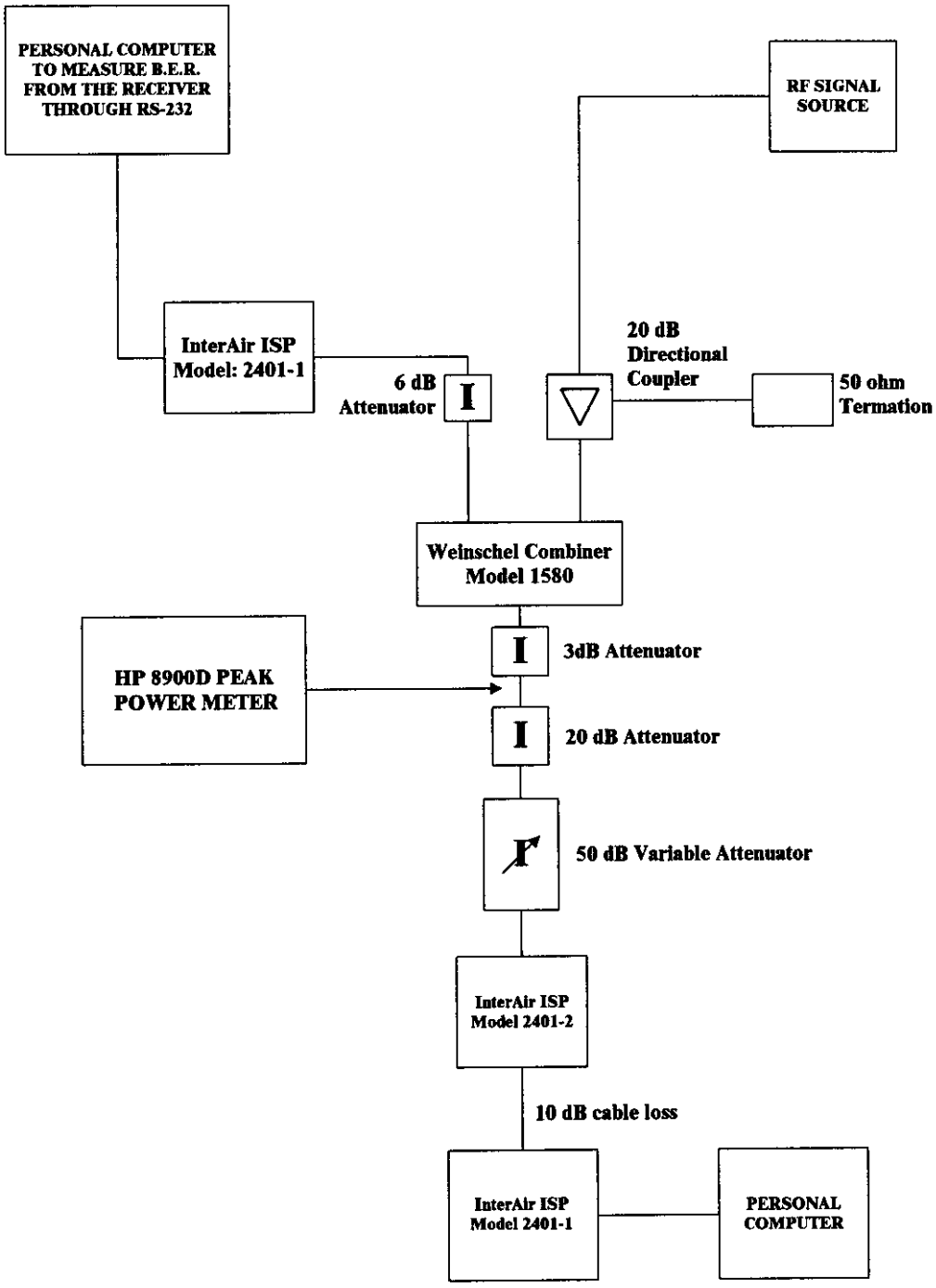
$(S/N)_o^t$ in dB = $(S/N)_o^{AWGN}$ / 0.8

TEST RESULTS: Conforms.

TEST PERSONNEL: Mr. Tri M. Luu, P.Eng.

DATE: July 23 & 24, 1998

Figure 1:- SETUP FOR PROCESSING GAIN MEASUREMENT - JAMMING MARGIN METHOD



MEASUREMENT DATA:

Channel #4, Fc = 2411.4375 MHz	Data Rate = 1.023 Mbps (DQPSK), Medium
Chip Rate = 5.625 MHz	PN Code Length = 11 chips/symbol
6 dB BW = 5 MHz	

(S/N)o = 12 dB dB per attached Figure 4.5.1
Measured Processing Gain Gp = (S/N)o + Lsys + Mj = 12 + 2 + Mj = 14 + Mj (dB)
Theoretical Calculated Processing Gain = Chip Rate/Data rate = 5.625 MHz / (1.023 Mb/s)/(2 bits/symbol) = 11.0 or 10.4 dB

Note:
- Total Peak Power from the EUT's Tx measured at the EUT's Rx Input: P_t = -72 dBm
- Jamming signal level at measured at the EUT's receiver input: J
- Mj = J-P_t
- The following shaded boxes are discarded worst measurements (18.2% of total measurement points)

SUMMARY OF TEST RESULTS	
Theoretical Process Gain	10.4 dB
Minimum Measured Process Gain with discard of 18.2% of the worst measurements	12.2 dB

Test Point	Jammer Signal Freq. +/- Fc (MHz)	Jammer Signal Freq. +/- Fc (MHz)	(BER) (DQPSK) x10-5	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
1	2406.93750	-4.50	1.0	12.0	2.0	4.7	18.7	
2	2406.98750	-4.45	1.0	12.0	2.0	4.7	18.7	
3	2407.03750	-4.40	1.0	12.0	2.0	4.4	18.4	
4	2407.08750	-4.35	1.0	12.0	2.0	4.4	18.4	
5	2407.13750	-4.30	1.0	12.0	2.0	4.2	18.2	
6	2407.18750	-4.25	1.0	12.0	2.0	4.0	18.0	
7	2407.23750	-4.20	1.0	12.0	2.0	3.7	17.7	
8	2407.28750	-4.15	1.0	12.0	2.0	3.9	17.9	
9	2407.33750	-4.10	1.0	12.0	2.0	3.5	17.5	
10	2407.38750	-4.05	1.0	12.0	2.0	3.4	17.4	
11	2407.43750	-4.00	1.0	12.0	2.0	3.4	17.4	
12	2407.48750	-3.95	1.0	12.0	2.0	3.1	17.1	
13	2407.53750	-3.90	1.0	12.0	2.0	3.1	17.1	
14	2407.58750	-3.85	1.0	12.0	2.0	3.1	17.1	
15	2407.63750	-3.80	1.0	12.0	2.0	2.9	16.9	
16	2407.68750	-3.75	1.0	12.0	2.0	2.8	16.8	
17	2407.73750	-3.70	1.0	12.0	2.0	2.7	16.7	
18	2407.78750	-3.65	1.0	12.0	2.0	2.5	16.5	
19	2407.83750	-3.60	1.0	12.0	2.0	2.6	16.6	
20	2407.88750	-3.55	1.0	12.0	2.0	2.5	16.5	
21	2407.93750	-3.50	1.0	12.0	2.0	2.2	16.2	

Test Point	Jammer Signal Freq. +/- Fc (MHz)	Jammer Signal Freq. +/- Fc (MHz)	(BER) (DQPSK) x10-5	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
22	2407.98750	-3.45	1.0	12.0	2.0	2.2	16.2	
23	2408.03750	-3.40	1.0	12.0	2.0	2.2	16.2	
24	2408.08750	-3.35	1.0	12.0	2.0	2.0	16.0	
25	2408.13750	-3.30	1.0	12.0	2.0	2.0	16.0	
26	2408.18750	-3.25	1.0	12.0	2.0	1.8	15.8	
27	2408.23750	-3.20	1.0	12.0	2.0	1.7	15.7	
28	2408.28750	-3.15	1.0	12.0	2.0	1.7	15.7	
29	2408.33750	-3.10	1.0	12.0	2.0	1.7	15.7	
30	2408.38750	-3.05	1.0	12.0	2.0	1.7	15.7	
31	2408.43750	-3.00	1.0	12.0	2.0	1.6	15.6	
32	2408.48750	-2.95	1.0	12.0	2.0	1.6	15.6	
33	2408.53750	-2.90	1.0	12.0	2.0	1.6	15.6	
34	2408.58750	-2.85	1.0	12.0	2.0	1.4	15.4	
35	2408.63750	-2.80	1.0	12.0	2.0	1.2	15.2	
36	2408.68750	-2.75	1.0	12.0	2.0	1.1	15.1	
37	2408.73750	-2.70	1.0	12.0	2.0	1.2	15.2	
38	2408.78750	-2.65	1.0	12.0	2.0	1.2	15.2	
39	2408.83750	-2.60	1.0	12.0	2.0	1.1	15.1	
40	2408.88750	-2.55	1.0	12.0	2.0	1.0	15.0	
41	2408.93750	-2.50	1.0	12.0	2.0	1.0	15.0	
42	2408.98750	-2.45	1.0	12.0	2.0	0.9	14.9	
43	2409.03750	-2.40	1.0	12.0	2.0	0.9	14.9	
44	2409.08750	-2.35	1.0	12.0	2.0	0.8	14.8	
45	2409.13750	-2.30	1.0	12.0	2.0	0.1	14.1	
46	2409.18750	-2.25	1.0	12.0	2.0	0.0	14.0	
47	2409.23750	-2.20	1.0	12.0	2.0	-0.1	13.9	
48	2409.28750	-2.15	1.0	12.0	2.0	-0.5	13.5	
49	2409.33750	-2.10	1.0	12.0	2.0	-1.0	13.0	
50	2409.38750	-2.05	1.0	12.0	2.0	-1.6	12.4	
51	2409.43750	-2.00	1.0	12.0	2.0	-1.7	12.3	
52	2409.48750	-1.95	1.0	12.0	2.0	-1.7	12.3	
53	**2409.53750**	**-1.90**	**1.0**	**12.0**	**2.0**	**-1.8**	**12.2**	
54	2409.58750	-1.85	1.0	12.0	2.0	-1.5	12.5	
55	2409.63750	-1.80	1.0	12.0	2.0	-0.9	13.1	
56	2409.68750	-1.75	1.0	12.0	2.0	-0.5	13.5	
57	2409.73750	-1.70	1.0	12.0	2.0	-0.4	13.6	
58	2409.78750	-1.65	1.0	12.0	2.0	-0.6	13.4	
59	2409.83750	-1.60	1.0	12.0	2.0	-1.1	12.9	

Test Point	Jammer Signal Freq. + /- Fc (MHz)	Jammer Signal Freq. + /- Fc (MHz)	(BER) (DQPSK) x10-5	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
64	**2410.08750**	**-1.35**	**1.0**	**12.0**	**2.0**	**-1.8**	**12.2**	
65	2410.13750	-1.30	1.0	12.0	2.0	-1.4	12.6	
66	2410.18750	-1.25	1.0	12.0	2.0	-1.4	12.6	
67	2410.23750	-1.20	1.0	12.0	2.0	-0.8	13.2	
68	2410.28750	-1.15	1.0	12.0	2.0	-0.8	13.2	
69	2410.33750	-1.10	1.0	12.0	2.0	-1.0	13.0	
70	2410.38750	-1.05	1.0	12.0	2.0	-1.4	12.6	
71	**2410.43750**	**-1.00**	**1.0**	**12.0**	**2.0**	**-1.8**	**12.2**	
72	**2410.48750**	**-0.95**	**1.0**	**12.0**	**2.0**	**-1.8**	**12.2**	
77	2410.73750	-0.70	1.0	12.0	2.0	-1.3	12.7	
78	2410.78750	-0.65	1.0	12.0	2.0	-1.3	12.7	
79	2410.83750	-0.60	1.0	12.0	2.0	-1.3	12.7	
80	2410.88750	-0.55	1.0	12.0	2.0	-1.6	12.4	
87	2411.23750	-0.20	1.0	12.0	2.0	-1.5	12.5	
88	2411.28750	-0.15	1.0	12.0	2.0	-1.2	12.8	
89	2411.33750	-0.10	1.0	12.0	2.0	-1.5	12.5	
94	2411.58750	0.15	1.0	12.0	2.0	-1.6	12.4	
95	2411.63750	0.20	1.0	12.0	2.0	-1.3	12.7	
102	2411.98750	0.55	1.0	12.0	2.0	-1.7	12.3	
103	**2412.03750**	**0.60**	**1.0**	**12.0**	**2.0**	**-1.8**	**12.2**	

Test Point	Jammer Signal Freq. +/- Fc (MHz)	Jammer Signal Freq. +/- Fc (MHz)	(BER) (DQPSK) x10-5	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
104	2412.08750	0.65	1.0	12.0	2.0	-1.5	12.5	
105	2412.13750	0.70	1.0	12.0	2.0	-1.7	12.3	
112	2412.48750	1.05	1.0	12.0	2.0	-1.4	12.6	
113	2412.53750	1.10	1.0	12.0	2.0	-1.3	12.7	
114	2412.58750	1.15	1.0	12.0	2.0	-1.1	12.9	
115	2412.63750	1.20	1.0	12.0	2.0	-0.9	13.1	
116	2412.68750	1.25	1.0	12.0	2.0	-1.2	12.8	
117	2412.73750	1.30	1.0	12.0	2.0	-1.5	12.5	
118	**2412.78750**	**1.35**	**1.0**	**12.0**	**2.0**	**-1.8**	**12.2**	
119	2412.83750	1.40	1.0	12.0	2.0	-1.6	12.4	
123	2413.03750	1.60	1.0	12.0	2.0	-1.6	12.4	
124	2413.08750	1.65	1.0	12.0	2.0	-1.1	12.9	
125	2413.13750	1.70	1.0	12.0	2.0	-0.9	13.1	
126	2413.18750	1.75	1.0	12.0	2.0	-0.7	13.3	
127	2413.23750	1.80	1.0	12.0	2.0	-0.8	13.2	
128	2413.28750	1.85	1.0	12.0	2.0	-1.0	13.0	
129	2413.33750	1.90	1.0	12.0	2.0	-1.3	12.7	
130	2413.38750	1.95	1.0	12.0	2.0	-1.2	12.8	
131	2413.43750	2.00	1.0	12.0	2.0	-1.1	12.9	
132	2413.48750	2.05	1.0	12.0	2.0	-1.1	12.9	
133	2413.53750	2.10	1.0	12.0	2.0	-0.5	13.5	
134	2413.58750	2.15	1.0	12.0	2.0	-0.2	13.8	
135	2413.63750	2.20	1.0	12.0	2.0	-0.2	13.8	
136	2413.68750	2.25	1.0	12.0	2.0	0.2	14.2	
137	2413.73750	2.30	1.0	12.0	2.0	0.2	14.2	
138	2413.78750	2.35	1.0	12.0	2.0	0.1	14.1	
139	2413.83750	2.40	1.0	12.0	2.0	0.0	14.0	
140	2413.88750	2.45	1.0	12.0	2.0	0.0	14.0	
141	2413.93750	2.50	1.0	12.0	2.0	0.0	14.0	
142	2413.98750	2.55	1.0	12.0	2.0	0.8	14.8	
143	2414.03750	2.60	1.0	12.0	2.0	1.7	15.7	
144	2414.08750	2.65	1.0	12.0	2.0	1.8	15.8	

Test Point	Jammer Signal Freq. + /- Fc (MHz)	Jammer Signal Freq. + /- Fc (MHz)	(BER) (DQPSK) x10-5	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
145	2414.13750	2.70	1.0	12.0	2.0	2.7	16.7	
146	2414.18750	2.75	1.0	12.0	2.0	2.6	16.6	
147	2414.23750	2.80	1.0	12.0	2.0	2.6	16.6	
148	2414.28750	2.85	1.0	12.0	2.0	2.7	16.7	
149	2414.33750	2.90	1.0	12.0	2.0	3.4	17.4	
150	2414.38750	2.95	1.0	12.0	2.0	3.3	17.3	
151	2414.43750	3.00	1.0	12.0	2.0	3.3	17.3	
152	2414.48750	3.05	1.0	12.0	2.0	2.9	16.9	
153	2414.53750	3.10	1.0	12.0	2.0	2.5	16.5	
154	2414.58750	3.15	1.0	12.0	2.0	2.5	16.5	
155	2414.63750	3.20	1.0	12.0	2.0	2.5	16.5	
156	2414.68750	3.25	1.0	12.0	2.0	3.0	17.0	
157	2414.73750	3.30	1.0	12.0	2.0	3.6	17.6	
158	2414.78750	3.35	1.0	12.0	2.0	3.9	17.9	
159	2414.83750	3.40	1.0	12.0	2.0	4.1	18.1	
160	2414.88750	3.45	1.0	12.0	2.0	4.5	18.5	
161	2414.93750	3.50	1.0	12.0	2.0	4.4	18.4	
162	2414.98750	3.55	1.0	12.0	2.0	4.3	18.3	
163	2415.03750	3.60	1.0	12.0	2.0	4.3	18.3	
164	2415.08750	3.65	1.0	12.0	2.0	4.4	18.4	
165	2415.13750	3.70	1.0	12.0	2.0	5.0	19.0	
166	2415.18750	3.75	1.0	12.0	2.0	5.2	19.2	
167	2415.23750	3.80	1.0	12.0	2.0	5.7	19.7	
168	2415.28750	3.85	1.0	12.0	2.0	5.7	19.7	
169	2415.33750	3.90	1.0	12.0	2.0	6.0	20.0	
170	2415.38750	3.95	1.0	12.0	2.0	5.9	19.9	
171	2415.43750	4.00	1.0	12.0	2.0	5.9	19.9	
172	2415.48750	4.05	1.0	12.0	2.0	6.3	20.3	
173	2415.53750	4.10	1.0	12.0	2.0	6.3	20.3	
174	2415.58750	4.15	1.0	12.0	2.0	6.6	20.6	
175	2415.63750	4.20	1.0	12.0	2.0	6.7	20.7	
176	2415.68750	4.25	1.0	12.0	2.0	6.7	20.7	
177	2415.73750	4.30	1.0	12.0	2.0	7.1	21.1	
178	2415.78750	4.35	1.0	12.0	2.0	7.1	21.1	
179	2415.83750	4.40	1.0	12.0	2.0	7.6	21.6	
180	2415.88750	4.45	1.0	12.0	2.0	7.5	21.5	
181	2415.93750	4.50	1.0	12.0	2.0	7.8	21.8	

Channel #6, Fc = 2419.8750 MHz	**Data Rate = 2.045 Mbps (DQPSK), Wide**
Chip Rate = 11.25 MHz	**PN Code Length = 11 chips/symbol**
6 dB BW = 8.4 MHz	

(S/N)o = 12 dB per attached Figure 4.5.1
Measured Processing Gain Gp = (S/N)o + Lsys + Mj = 12 + 2 + Mj = 14 + Mj (dB)
Theoretical Calculated Processing Gain = Chip Rate/Data rate = 11.25 MHz / (2.045 Mb/s)/(2 bits/symbol) = 11.0 or 10.4 dB

Note:
- Total Peak Power from the EUT's Tx measured at the EUT's Rx Input: P_t = -72 dBm
- Jamming signal level at measured at the EUT's receiver input: J
- Mj = J-P_t
- The following shaded boxes are discarded worst measurements (19.4% of total measurement points)

SUMMARY OF TEST RESULTS	
Theoretical Process Gain	**10.4 dB**
Minimum Measured Process Gain with discard of 19.4% of the worst measurements	**11.3 dB**

Test Point	Jammer Signal Freq. +/- Fc (MHz)	Jammer Signal Freq. +/- Fc (MHz)	(BER) (DQPSK) x10-5	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
1	2411.37500	-8.50	1.0	12.0	2.0	4.0	18.0	
2	2411.42500	-8.45	1.0	12.0	2.0	4.0	18.0	
3	2411.47500	-8.40	1.0	12.0	2.0	3.8	17.8	
4	2411.52500	-8.35	1.0	12.0	2.0	3.9	17.9	
5	2411.57500	-8.30	1.0	12.0	2.0	3.8	17.8	
6	2411.62500	-8.25	1.0	12.0	2.0	3.5	17.5	
7	2411.67500	-8.20	1.0	12.0	2.0	3.3	17.3	
8	2411.72500	-8.15	1.0	12.0	2.0	3.3	17.3	
9	2411.77500	-8.10	1.0	12.0	2.0	3.2	17.2	
10	2411.82500	-8.05	1.0	12.0	2.0	3.2	17.2	
11	2411.87500	-8.00	1.0	12.0	2.0	3.2	17.2	
12	2411.92500	-7.95	1.0	12.0	2.0	3.1	17.1	
13	2411.97500	-7.90	1.0	12.0	2.0	3.0	17.0	
14	2412.02500	-7.85	1.0	12.0	2.0	2.9	16.9	
15	2412.07500	-7.80	1.0	12.0	2.0	2.9	16.9	
16	2412.12500	-7.75	1.0	12.0	2.0	2.8	16.8	
17	2412.17500	-7.70	1.0	12.0	2.0	2.6	16.6	
18	2412.22500	-7.65	1.0	12.0	2.0	2.6	16.6	
19	2412.27500	-7.60	1.0	12.0	2.0	2.6	16.6	
20	2412.32500	-7.55	1.0	12.0	2.0	2.6	16.6	
21	2412.37500	-7.50	1.0	12.0	2.0	2.3	16.3	
22	2412.42500	-7.45	1.0	12.0	2.0	2.3	16.3	

Test Point	Jammer Signal Freq. +/- Fc (MHz)	Jammer Signal Freq. +/- Fc (MHz)	(BER) (DQPSK) x10-5	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
23	2412.47500	-7.40	1.0	12.0	2.0	2.3	16.3	
24	2412.52500	-7.35	1.0	12.0	2.0	2.1	16.1	
25	2412.57500	-7.30	1.0	12.0	2.0	2.0	16.0	
26	2412.62500	-7.25	1.0	12.0	2.0	1.9	15.9	
27	2412.67500	-7.20	1.0	12.0	2.0	1.8	15.8	
28	2412.72500	-7.15	1.0	12.0	2.0	1.7	15.7	
29	2412.77500	-7.10	1.0	12.0	2.0	1.7	15.7	
30	2412.82500	-7.05	1.0	12.0	2.0	1.8	15.8	
31	2412.87500	-7.00	1.0	12.0	2.0	1.7	15.7	
32	2412.92500	-6.95	1.0	12.0	2.0	1.7	15.7	
33	2412.97500	-6.90	1.0	12.0	2.0	1.7	15.7	
34	2413.02500	-6.85	1.0	12.0	2.0	1.9	15.9	
35	2413.07500	-6.80	1.0	12.0	2.0	1.5	15.5	
36	2413.12500	-6.75	1.0	12.0	2.0	1.3	15.3	
37	2413.17500	-6.70	1.0	12.0	2.0	1.2	15.2	
38	2413.22500	-6.65	1.0	12.0	2.0	1.1	15.1	
39	2413.27500	-6.60	1.0	12.0	2.0	1.1	15.1	
40	2413.32500	-6.55	1.0	12.0	2.0	1.1	15.1	
41	2413.37500	-6.50	1.0	12.0	2.0	1.0	15.0	
42	2413.42500	-6.45	1.0	12.0	2.0	0.9	14.9	
43	2413.47500	-6.40	1.0	12.0	2.0	1.0	15.0	
44	2413.52500	-6.35	1.0	12.0	2.0	0.8	14.8	
45	2413.57500	-6.30	1.0	12.0	2.0	0.7	14.7	
46	2413.62500	-6.25	1.0	12.0	2.0	0.7	14.7	
47	2413.67500	-6.20	1.0	12.0	2.0	0.8	14.8	
48	2413.72500	-6.15	1.0	12.0	2.0	0.7	14.7	
49	2413.77500	-6.10	1.0	12.0	2.0	0.5	14.5	
50	2413.82500	-6.05	1.0	12.0	2.0	0.6	14.6	
51	2413.87500	-6.00	1.0	12.0	2.0	0.5	14.5	
52	2413.92500	-5.95	1.0	12.0	2.0	0.4	14.4	
53	2413.97500	-5.90	1.0	12.0	2.0	0.5	14.5	
54	2414.02500	-5.85	1.0	12.0	2.0	0.5	14.5	
55	2414.07500	-5.80	1.0	12.0	2.0	0.5	14.5	
56	2414.12500	-5.75	1.0	12.0	2.0	0.3	14.3	
57	2414.17500	-5.70	1.0	12.0	2.0	0.2	14.2	
58	2414.22500	-5.65	1.0	12.0	2.0	0.1	14.1	
59	2414.27500	-5.60	1.0	12.0	2.0	0.1	14.1	
60	2414.32500	-5.55	1.0	12.0	2.0	0.1	14.1	
61	2414.37500	-5.50	1.0	12.0	2.0	0.3	14.3	
62	2414.42500	-5.45	1.0	12.0	2.0	0.2	14.2	
63	2414.47500	-5.40	1.0	12.0	2.0	-0.2	13.8	

Test Point	Jammer Signal Freq. +/- Fc (MHz)	Jammer Signal Freq. +/- Fc (MHz)	(BER) (DQPSK) x10-5	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
64	2414.52500	-5.35	1.0	12.0	2.0	-0.2	13.8	
65	2414.57500	-5.30	1.0	12.0	2.0	-0.2	13.8	
66	2414.62500	-5.25	1.0	12.0	2.0	-0.1	13.9	
67	2414.67500	-5.20	1.0	12.0	2.0	0.2	14.2	
68	2414.72500	-5.15	1.0	12.0	2.0	-0.5	13.5	
69	2414.77500	-5.10	1.0	12.0	2.0	-0.6	13.4	
70	2414.82500	-5.05	1.0	12.0	2.0	-1.2	12.8	
71	2414.87500	-5.00	1.0	12.0	2.0	-1.5	12.5	
72	2414.92500	-4.95	1.0	12.0	2.0	-1.6	12.4	
73	2414.97500	-4.90	1.0	12.0	2.0	-1.8	12.2	
74	2415.02500	-4.85	1.0	12.0	2.0	-1.8	12.2	
75	2415.07500	-4.80	1.0	12.0	2.0	-1.7	12.3	
76	2415.12500	-4.75	1.0	12.0	2.0	-1.4	12.6	
77	2415.17500	-4.70	1.0	12.0	2.0	-1.4	12.6	
78	2415.22500	-4.65	1.0	12.0	2.0	-1.2	12.8	
79	2415.27500	-4.60	1.0	12.0	2.0	-1.1	12.9	
80	2415.32500	-4.55	1.0	12.0	2.0	-1.0	13.0	
81	2415.37500	-4.50	1.0	12.0	2.0	-0.9	13.1	
82	2415.42500	-4.45	1.0	12.0	2.0	-1.0	13.0	
83	2415.47500	-4.40	1.0	12.0	2.0	-1.4	12.6	
84	2415.52500	-4.35	1.0	12.0	2.0	-1.5	12.5	
85	2415.57500	-4.30	1.0	12.0	2.0	-1.5	12.5	
86	2415.62500	-4.25	1.0	12.0	2.0	-1.7	12.3	
87	2415.67500	-4.20	1.0	12.0	2.0	-2.1	11.9	
88	2415.72500	-4.15	1.0	12.0	2.0	-2.6	11.4	
89	**2415.77500**	**-4.10**	**1.0**	**12.0**	**2.0**	**-2.7**	**11.3**	
90	**2415.82500**	**-4.05**	**1.0**	**12.0**	**2.0**	**-2.7**	**11.3**	
[redacted]								
96	**2416.12500**	**-3.75**	**1.0**	**12.0**	**2.0**	**-2.7**	**11.3**	
97	2416.17500	-3.70	1.0	12.0	2.0	-2.5	11.5	
98	2416.22500	-3.65	1.0	12.0	2.0	-2.3	11.7	
99	2416.27500	-3.60	1.0	12.0	2.0	-2.1	11.9	
100	2416.32500	-3.55	1.0	12.0	2.0	-1.8	12.2	
101	2416.37500	-3.50	1.0	12.0	2.0	-1.7	12.3	
102	2416.42500	-3.45	1.0	12.0	2.0	-1.7	12.3	
103	2416.47500	-3.40	1.0	12.0	2.0	-1.6	12.4	
104	2416.52500	-3.35	1.0	12.0	2.0	-1.6	12.4	

Test Point	Jammer Signal Freq. +/- Fc (MHz)	Jammer Signal Freq. +/- Fc (MHz)	(BER) (DQPSK) x10-5	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
105	2416.57500	-3.30	1.0	12.0	2.0	-2.0	12.0	
106	2416.62500	-3.25	1.0	12.0	2.0	-2.0	12.0	
[redacted]								
118	2417.22500	-2.65	1.0	12.0	2.0	-2.6	11.4	
119	2417.27500	-2.60	1.0	12.0	2.0	-2.4	11.6	
120	2417.32500	-2.55	1.0	12.0	2.0	-2.3	11.7	
121	2417.37500	-2.50	1.0	12.0	2.0	-2.0	12.0	
122	2417.42500	-2.45	1.0	12.0	2.0	-1.9	12.1	
123	2417.47500	-2.40	1.0	12.0	2.0	-1.9	12.1	
124	2417.52500	-2.35	1.0	12.0	2.0	-1.8	12.2	
125	2417.57500	-2.30	1.0	12.0	2.0	-1.8	12.2	
126	2417.62500	-2.25	1.0	12.0	2.0	-1.9	12.1	
127	2417.67500	-2.20	1.0	12.0	2.0	-1.9	12.1	
128	2417.72500	-2.15	1.0	12.0	2.0	-2.0	12.0	
129	2417.77500	-2.10	1.0	12.0	2.0	-2.3	11.7	
130	2417.82500	-2.05	1.0	12.0	2.0	-2.4	11.6	
[redacted]								
143	2418.47500	-1.40	1.0	12.0	2.0	-2.3	11.7	
144	2418.52500	-1.35	1.0	12.0	2.0	-2.2	11.8	
145	2418.57500	-1.30	1.0	12.0	2.0	-2.1	11.9	

Test Point	Jammer Signal Freq. +/- Fc (MHz)	Jammer Signal Freq. +/- Fc (MHz)	(BER) (DQPSK) x10-5	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
146	2418.62500	-1.25	1.0	12.0	2.0	-2.1	11.9	
147	2418.67500	-1.20	1.0	12.0	2.0	-2.2	11.8	
148	2418.72500	-1.15	1.0	12.0	2.0	-2.5	11.5	
149	2418.77500	-1.10	1.0	12.0	2.0	-2.5	11.5	
150	**2418.82500**	**-1.05**	**1.0**	**12.0**	**2.0**	**-2.7**	**11.3**	
163	2419.47500	-0.40	1.0	12.0	2.0	-2.3	11.7	
164	2419.52500	-0.35	1.0	12.0	2.0	-2.3	11.7	
165	2419.57500	-0.30	1.0	12.0	2.0	-2.3	11.7	
166	2419.62500	-0.25	1.0	12.0	2.0	-2.4	11.6	
167	2419.67500	-0.20	1.0	12.0	2.0	-2.5	11.5	
175	2420.07500	0.20	1.0	12.0	2.0	-2.6	11.4	
176	2420.12500	0.25	1.0	12.0	2.0	-2.3	11.7	
177	2420.17500	0.30	1.0	12.0	2.0	-2.4	11.6	
178	2420.22500	0.35	1.0	12.0	2.0	-2.5	11.5	
179	2420.27500	0.40	1.0	12.0	2.0	-2.5	11.5	
180	2420.32500	0.45	1.0	12.0	2.0	-2.6	11.4	
181	**2420.37500**	**0.50**	**1.0**	**12.0**	**2.0**	**-2.7**	**11.3**	

Test Point	Jammer Signal Freq. + /- Fc (MHz)	Jammer Signal Freq. + /- Fc (MHz)	(BER) (DQPSK) x10-5	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
190	2420.82500	0.95	1.0	12.0	2.0	-2.6	11.4	
191	2420.87500	1.00	1.0	12.0	2.0	-2.6	11.4	
192	2420.92500	1.05	1.0	12.0	2.0	-2.5	11.5	
193	2420.97500	1.10	1.0	12.0	2.0	-2.5	11.5	
194	2421.02500	1.15	1.0	12.0	2.0	-2.6	11.4	
195	2421.07500	1.20	1.0	12.0	2.0	-2.5	11.5	
196	2421.12500	1.25	1.0	12.0	2.0	-2.4	11.6	
197	2421.17500	1.30	1.0	12.0	2.0	-2.0	12.0	
198	2421.22500	1.35	1.0	12.0	2.0	-2.2	11.8	
199	2421.27500	1.40	1.0	12.0	2.0	-2.2	11.8	
200	2421.32500	1.45	1.0	12.0	2.0	-2.2	11.8	
207	**2421.67500**	**1.80**	**1.0**	**12.0**	**2.0**	**-2.7**	**11.3**	
209	2421.77500	1.90	1.0	12.0	2.0	-2.7	11.3	
211	2421.87500	2.00	1.0	12.0	2.0	-2.5	11.5	
212	2421.92500	2.05	1.0	12.0	2.0	-2.5	11.5	
213	2421.97500	2.10	1.0	12.0	2.0	-2.1	11.9	
214	2422.02500	2.15	1.0	12.0	2.0	-2.1	11.9	
215	2422.07500	2.20	1.0	12.0	2.0	-2.1	11.9	
216	2422.12500	2.25	1.0	12.0	2.0	-2.1	11.9	
217	2422.17500	2.30	1.0	12.0	2.0	-1.8	12.2	
218	2422.22500	2.35	1.0	12.0	2.0	-1.8	12.2	
219	2422.27500	2.40	1.0	12.0	2.0	-1.8	12.2	
220	2422.32500	2.45	1.0	12.0	2.0	-1.8	12.2	
221	2422.37500	2.50	1.0	12.0	2.0	-2.0	12.0	
222	2422.42500	2.55	1.0	12.0	2.0	-2.0	12.0	
223	2422.47500	2.60	1.0	12.0	2.0	-2.1	11.9	
224	2422.52500	2.65	1.0	12.0	2.0	-2.2	11.8	
225	2422.57500	2.70	1.0	12.0	2.0	-2.3	11.7	
226	2422.62500	2.75	1.0	12.0	2.0	-2.5	11.5	
227	2422.67500	2.80	1.0	12.0	2.0	-2.5	11.5	

Test Point	Jammer Signal Freq. +/- Fc (MHz)	Jammer Signal Freq. +/- Fc (MHz)	(BER) (DQPSK) x10-5	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
228	2422.72500	2.85	1.0	12.0	2.0	-2.6	11.4	
229	**2422.77500**	**2.90**	**1.0**	**12.0**	**2.0**	**-2.7**	**11.3**	
232	2422.92500	3.05	1.0	12.0	2.0	-2.7	11.3	
234	2423.02500	3.15	1.0	12.0	2.0	-2.6	11.4	
235	2423.07500	3.20	1.0	12.0	2.0	-2.3	11.7	
236	2423.12500	3.25	1.0	12.0	2.0	-2.1	11.9	
237	2423.17500	3.30	1.0	12.0	2.0	-2.0	12.0	
238	2423.22500	3.35	1.0	12.0	2.0	-1.9	12.1	
239	2423.27500	3.40	1.0	12.0	2.0	-1.7	12.3	
240	2423.32500	3.45	1.0	12.0	2.0	-1.5	12.5	
241	2423.37500	3.50	1.0	12.0	2.0	-1.5	12.5	
242	2423.42500	3.55	1.0	12.0	2.0	-1.5	12.5	
243	2423.47500	3.60	1.0	12.0	2.0	-1.6	12.4	
244	2423.52500	3.65	1.0	12.0	2.0	-1.6	12.4	
245	2423.57500	3.70	1.0	12.0	2.0	-1.8	12.2	
246	2423.62500	3.75	1.0	12.0	2.0	-2.0	12.0	
247	2423.67500	3.80	1.0	12.0	2.0	-2.0	12.0	
248	2423.72500	3.85	1.0	12.0	2.0	-2.1	11.9	
249	2423.77500	3.90	1.0	12.0	2.0	-1.9	12.1	
250	2423.82500	3.95	1.0	12.0	2.0	-1.9	12.1	
251	2423.87500	4.00	1.0	12.0	2.0	-1.9	12.1	
252	2423.92500	4.05	1.0	12.0	2.0	-1.6	12.4	
253	2423.97500	4.10	1.0	12.0	2.0	-1.5	12.5	
254	2424.02500	4.15	1.0	12.0	2.0	-1.7	12.3	
255	2424.07500	4.20	1.0	12.0	2.0	-1.2	12.8	
256	2424.12500	4.25	1.0	12.0	2.0	-0.9	13.1	
257	2424.17500	4.30	1.0	12.0	2.0	-0.9	13.1	
258	2424.22500	4.35	1.0	12.0	2.0	-0.9	13.1	
259	2424.27500	4.40	1.0	12.0	2.0	-0.6	13.4	
260	2424.32500	4.45	1.0	12.0	2.0	-0.5	13.5	
261	2424.37500	4.50	1.0	12.0	2.0	-0.4	13.6	
262	2424.42500	4.55	1.0	12.0	2.0	-0.3	13.7	
263	2424.47500	4.60	1.0	12.0	2.0	-0.3	13.7	
264	2424.52500	4.65	1.0	12.0	2.0	-0.3	13.7	
265	2424.57500	4.70	1.0	12.0	2.0	-0.3	13.7	
266	2424.62500	4.75	1.0	12.0	2.0	-0.5	13.5	
267	2424.67500	4.80	1.0	12.0	2.0	-0.6	13.4	
268	2424.72500	4.85	1.0	12.0	2.0	-0.7	13.3	

Test Point	Jammer Signal Freq. +/- Fc (MHz)	Jammer Signal Freq. +/- Fc (MHz)	(BER) (DQPSK) x10-5	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
269	2424.77500	4.90	1.0	12.0	2.0	-0.6	13.4	
270	2424.82500	4.95	1.0	12.0	2.0	-0.4	13.6	
271	2424.87500	5.00	1.0	12.0	2.0	-0.2	13.8	
272	2424.92500	5.05	1.0	12.0	2.0	0.2	14.2	
273	2424.97500	5.10	1.0	12.0	2.0	0.5	14.5	
274	2425.02500	5.15	1.0	12.0	2.0	1.0	15.0	
275	2425.07500	5.20	1.0	12.0	2.0	1.0	15.0	
276	2425.12500	5.25	1.0	12.0	2.0	2.0	16.0	
277	2425.17500	5.30	1.0	12.0	2.0	2.0	16.0	
278	2425.22500	5.35	1.0	12.0	2.0	2.1	16.1	
279	2425.27500	5.40	1.0	12.0	2.0	2.1	16.1	
280	2425.32500	5.45	1.0	12.0	2.0	2.1	16.1	
281	2425.37500	5.50	1.0	12.0	2.0	2.1	16.1	
282	2425.42500	5.55	1.0	12.0	2.0	2.1	16.1	
283	2425.47500	5.60	1.0	12.0	2.0	2.2	16.2	
284	2425.52500	5.65	1.0	12.0	2.0	2.2	16.2	
285	2425.57500	5.70	1.0	12.0	2.0	2.2	16.2	
286	2425.62500	5.75	1.0	12.0	2.0	2.3	16.3	
287	2425.67500	5.80	1.0	12.0	2.0	2.4	16.4	
288	2425.72500	5.85	1.0	12.0	2.0	2.8	16.8	
289	2425.77500	5.90	1.0	12.0	2.0	3.0	17.0	
290	2425.82500	5.95	1.0	12.0	2.0	3.0	17.0	
291	2425.87500	6.00	1.0	12.0	2.0	3.0	17.0	
292	2425.92500	6.05	1.0	12.0	2.0	3.0	17.0	
293	2425.97500	6.10	1.0	12.0	2.0	3.0	17.0	
294	2426.02500	6.15	1.0	12.0	2.0	2.8	16.8	
295	2426.07500	6.20	1.0	12.0	2.0	2.6	16.6	
296	2426.12500	6.25	1.0	12.0	2.0	2.6	16.6	
297	2426.17500	6.30	1.0	12.0	2.0	2.6	16.6	
298	2426.22500	6.35	1.0	12.0	2.0	2.6	16.6	
299	2426.27500	6.40	1.0	12.0	2.0	2.9	16.9	
300	2426.32500	6.45	1.0	12.0	2.0	3.0	17.0	
301	2426.37500	6.50	1.0	12.0	2.0	3.5	17.5	
302	2426.42500	6.55	1.0	12.0	2.0	3.8	17.8	
303	2426.47500	6.60	1.0	12.0	2.0	4.1	18.1	
304	2426.52500	6.65	1.0	12.0	2.0	3.9	17.9	
305	2426.57500	6.70	1.0	12.0	2.0	4.2	18.2	
306	2426.62500	6.75	1.0	12.0	2.0	4.1	18.1	
307	2426.67500	6.80	1.0	12.0	2.0	4.1	18.1	
308	2426.72500	6.85	1.0	12.0	2.0	4.6	18.6	
309	2426.77500	6.90	1.0	12.0	2.0	4.6	18.6	

Test Point	Jammer Signal Freq. +/- Fc (MHz)	Jammer Signal Freq. +/- Fc (MHz)	(BER) (DQPSK) x10-5	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
310	2426.82500	6.95	1.0	12.0	2.0	4.6	18.6	
311	2426.87500	7.00	1.0	12.0	2.0	4.5	18.5	
312	2426.92500	7.05	1.0	12.0	2.0	4.6	18.6	
313	2426.97500	7.10	1.0	12.0	2.0	4.7	18.7	
314	2427.02500	7.15	1.0	12.0	2.0	4.7	18.7	
315	2427.07500	7.20	1.0	12.0	2.0	4.7	18.7	
316	2427.12500	7.25	1.0	12.0	2.0	4.9	18.9	
317	2427.17500	7.30	1.0	12.0	2.0	4.9	18.9	
318	2427.22500	7.35	1.0	12.0	2.0	5.0	19.0	
319	2427.27500	7.40	1.0	12.0	2.0	5.3	19.3	
320	2427.32500	7.45	1.0	12.0	2.0	5.2	19.2	
321	2427.37500	7.50	1.0	12.0	2.0	5.4	19.4	
322	2427.42500	7.55	1.0	12.0	2.0	5.4	19.4	
323	2427.47500	7.60	1.0	12.0	2.0	5.6	19.6	
324	2427.52500	7.65	1.0	12.0	2.0	5.8	19.8	
325	2427.57500	7.70	1.0	12.0	2.0	5.8	19.8	
326	2427.62500	7.75	1.0	12.0	2.0	5.8	19.8	
327	2427.67500	7.80	1.0	12.0	2.0	5.7	19.7	
328	2427.72500	7.85	1.0	12.0	2.0	6.1	20.1	
329	2427.77500	7.90	1.0	12.0	2.0	6.0	20.0	
330	2427.82500	7.95	1.0	12.0	2.0	6.4	20.4	
331	2427.87500	8.00	1.0	12.0	2.0	6.2	20.2	
332	2427.92500	8.05	1.0	12.0	2.0	6.3	20.3	
333	2427.97500	8.10	1.0	12.0	2.0	6.3	20.3	
334	2428.02500	8.15	1.0	12.0	2.0	6.3	20.3	
335	2428.07500	8.20	1.0	12.0	2.0	6.6	20.6	
336	2428.12500	8.25	1.0	12.0	2.0	6.6	20.6	
337	2428.17500	8.30	1.0	12.0	2.0	7.0	21.0	
338	2428.22500	8.35	1.0	12.0	2.0	7.0	21.0	
339	2428.27500	8.40	1.0	12.0	2.0	7.1	21.1	
340	2428.32500	8.45	1.0	12.0	2.0	7.2	21.2	
341	2428.37500	8.50	1.0	12.0	2.0	7.3	21.3	

Channel #18, Fc = 2464.8750 MHz	Data Rate = 0.818 Mbps (DQPSK), Narrow
Chip Rate = 4.5 MHz	PN Code Length = 11 chips/symbol
6 dB BW = 4 MHz	

(S/N)o = 12 dB per attached Figure 4.5.1
Measured Processing Gain Gp = (S/N)o + Lsys + Mj = 12 + 2 + Mj = 14 + Mj (dB)
Theoretical Calculated Processing Gain = Chip Rate/Data rate = 4.5 MHz / (0.818 Mb/s)/(2 bits/symbol) = 11 or 10.4 dB

Note:
- Total Peak Power from the EUT's Tx measured at the EUT's Rx Input: P_t = -74 dBm
- Jamming signal level at measured at the EUT's receiver input: J
- Mj = J-P_t
- The following shaded boxes are discarded worst measurements (17.7% of total measurement points)

SUMMARY OF TEST RESULTS	
Theoretical Process Gain	10.4 dB
Minimum Measured Process Gain with discard of 17.7% of the worst measurements	12.2 dB

Test Point	Jammer Signal Freq. +/- Fc (MHz)	Jammer Signal Freq. +/- Fc (MHz)	(BER) (DQPSK) x10-5	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
1	2460.37500	-4.50	1.0	12.0	2.0	5.0	19.0	
2	2460.42500	-4.45	1.0	12.0	2.0	5.0	19.0	
3	2460.47500	-4.40	1.0	12.0	2.0	5.0	19.0	
4	2460.52500	-4.35	1.0	12.0	2.0	4.9	18.9	
5	2460.57500	-4.30	1.0	12.0	2.0	4.7	18.7	
6	2460.62500	-4.25	1.0	12.0	2.0	4.6	18.6	
7	2460.67500	-4.20	1.0	12.0	2.0	4.5	18.5	
8	2460.72500	-4.15	1.0	12.0	2.0	4.3	18.3	
9	2460.77500	-4.10	1.0	12.0	2.0	4.1	18.1	
10	2460.82500	-4.05	1.0	12.0	2.0	4.0	18.0	
11	2460.87500	-4.00	1.0	12.0	2.0	3.8	17.8	
12	2460.92500	-3.95	1.0	12.0	2.0	3.8	17.8	
13	2460.97500	-3.90	1.0	12.0	2.0	3.5	17.5	
14	2461.02500	-3.85	1.0	12.0	2.0	3.5	17.5	
15	2461.07500	-3.80	1.0	12.0	2.0	3.3	17.3	
16	2461.12500	-3.75	1.0	12.0	2.0	3.1	17.1	
17	2461.17500	-3.70	1.0	12.0	2.0	3.0	17.0	
18	2461.22500	-3.65	1.0	12.0	2.0	3.0	17.0	
19	2461.27500	-3.60	1.0	12.0	2.0	2.7	16.7	
20	2461.32500	-3.55	1.0	12.0	2.0	2.7	16.7	
21	2461.37500	-3.50	1.0	12.0	2.0	2.6	16.6	
22	2461.42500	-3.45	1.0	12.0	2.0	2.5	16.5	
23	2461.47500	-3.40	1.0	12.0	2.0	2.2	16.2	

Test Point	Jammer Signal Freq. +/- Fc (MHz)	Jammer Signal Freq. +/- Fc (MHz)	(BER) (DQPSK) x10-5	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
24	2461.52500	-3.35	1.0	12.0	2.0	2.4	16.4	
25	2461.57500	-3.30	1.0	12.0	2.0	2.3	16.3	
26	2461.62500	-3.25	1.0	12.0	2.0	2.2	16.2	
27	2461.67500	-3.20	1.0	12.0	2.0	1.9	15.9	
28	2461.72500	-3.15	1.0	12.0	2.0	1.9	15.9	
29	2461.77500	-3.10	1.0	12.0	2.0	1.8	15.8	
30	2461.82500	-3.05	1.0	12.0	2.0	1.9	15.9	
31	2461.87500	-3.00	1.0	12.0	2.0	1.8	15.8	
32	2461.92500	-2.95	1.0	12.0	2.0	1.7	15.7	
33	2461.97500	-2.90	1.0	12.0	2.0	1.6	15.6	
34	2462.02500	-2.85	1.0	12.0	2.0	1.5	15.5	
35	2462.07500	-2.80	1.0	12.0	2.0	1.4	15.4	
36	2462.12500	-2.75	1.0	12.0	2.0	1.4	15.4	
37	2462.17500	-2.70	1.0	12.0	2.0	1.3	15.3	
38	2462.22500	-2.65	1.0	12.0	2.0	1.1	15.1	
39	2462.27500	-2.60	1.0	12.0	2.0	1.2	15.2	
40	2462.32500	-2.55	1.0	12.0	2.0	0.8	14.8	
41	2462.37500	-2.50	1.0	12.0	2.0	0.8	14.8	
42	2462.42500	-2.45	1.0	12.0	2.0	0.7	14.7	
43	2462.47500	-2.40	1.0	12.0	2.0	0.9	14.9	
44	2462.52500	-2.35	1.0	12.0	2.0	1.0	15.0	
45	2462.57500	-2.30	1.0	12.0	2.0	0.9	14.9	
46	2462.62500	-2.25	1.0	12.0	2.0	0.9	14.9	
47	2462.67500	-2.20	1.0	12.0	2.0	0.8	14.8	
48	2462.72500	-2.15	1.0	12.0	2.0	0.9	14.9	
49	2462.77500	-2.10	1.0	12.0	2.0	0.9	14.9	
50	2462.82500	-2.05	1.0	12.0	2.0	0.4	14.4	
51	2462.87500	-2.00	1.0	12.0	2.0	-0.6	13.4	
52	2462.92500	-1.95	1.0	12.0	2.0	-1.0	13.0	
53	2462.97500	-1.90	1.0	12.0	2.0	-0.8	13.2	
54	2463.02500	-1.85	1.0	12.0	2.0	-0.4	13.6	
55	2463.07500	-1.80	1.0	12.0	2.0	0.0	14.0	
56	2463.12500	-1.75	1.0	12.0	2.0	-0.2	13.8	
57	2463.17500	-1.70	1.0	12.0	2.0	-0.8	13.2	
58	2463.22500	-1.65	1.0	12.0	2.0	-1.4	12.6	
59	2463.27500	-1.60	1.0	12.0	2.0	-1.4	12.6	
60	2463.32500	-1.55	1.0	12.0	2.0	-1.5	12.5	
61	2463.37500	-1.50	1.0	12.0	2.0	-1.5	12.5	
62	2463.42500	-1.45	1.0	12.0	2.0	-1.0	13.0	
63	2463.47500	-1.40	1.0	12.0	2.0	-0.6	13.4	
64	2463.52500	-1.35	1.0	12.0	2.0	-0.4	13.6	

Test Point	Jammer Signal Freq. +/- Fc (MHz)	Jammer Signal Freq. +/- Fc (MHz)	(BER) (DQPSK) x10-5	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
65	2463.57500	-1.30	1.0	12.0	2.0	-0.6	13.4	
66	2463.62500	-1.25	1.0	12.0	2.0	-1.6	12.4	
70	2463.82500	-1.05	1.0	12.0	2.0	-1.6	12.4	
71	2463.87500	-1.00	1.0	12.0	2.0	-1.4	12.6	
72	2463.92500	-0.95	1.0	12.0	2.0	-0.8	13.2	
73	2463.97500	-0.90	1.0	12.0	2.0	-0.9	13.1	
74	2464.02500	-0.85	1.0	12.0	2.0	-1.2	12.8	
80	2464.32500	-0.55	1.0	12.0	2.0	-1.2	12.8	
81	2464.37500	-0.50	1.0	12.0	2.0	-1.3	12.7	
82	2464.42500	-0.45	1.0	12.0	2.0	-1.6	12.4	
88	2464.72500	-0.15	1.0	12.0	2.0	-1.7	12.3	
101	2465.37500	0.50	1.0	12.0	2.0	-1.8	12.2	
102	2465.42500	0.55	1.0	12.0	2.0	-1.8	12.2	

Test Point	Jammer Signal Freq. +/- Fc (MHz)	Jammer Signal Freq. +/- Fc (MHz)	(BER) (DQPSK) x10-5	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
108	2465.72500	0.85	1.0	12.0	2.0	-1.5	12.5	
109	2465.77500	0.90	1.0	12.0	2.0	-1.4	12.6	
110	2465.82500	0.95	1.0	12.0	2.0	-1.1	12.9	
111	2465.87500	1.00	1.0	12.0	2.0	-1.2	12.8	
112	**2465.92500**	**1.05**	**1.0**	**12.0**	**2.0**	**-1.8**	**12.2**	
113	**2465.97500**	**1.10**	**1.0**	**12.0**	**2.0**	**-1.8**	**12.2**	
114	**2466.02500**	**1.15**	**1.0**	**12.0**	**2.0**	**-1.8**	**12.2**	
117	2466.17500	1.30	1.0	12.0	2.0	-1.3	12.7	
118	2466.22500	1.35	1.0	12.0	2.0	-1.1	12.9	
119	2466.27500	1.40	1.0	12.0	2.0	-0.7	13.3	
120	2466.32500	1.45	1.0	12.0	2.0	-1.0	13.0	
121	2466.37500	1.50	1.0	12.0	2.0	-1.3	12.7	
122	2466.42500	1.55	1.0	12.0	2.0	-1.3	12.7	
123	2466.47500	1.60	1.0	12.0	2.0	-1.3	12.7	
124	2466.52500	1.65	1.0	12.0	2.0	-1.3	12.7	
125	2466.57500	1.70	1.0	12.0	2.0	-0.4	13.6	
126	2466.62500	1.75	1.0	12.0	2.0	-0.2	13.8	
127	2466.67500	1.80	1.0	12.0	2.0	0.0	14.0	
128	2466.72500	1.85	1.0	12.0	2.0	-0.1	13.9	
129	2466.77500	1.90	1.0	12.0	2.0	-0.1	13.9	
130	2466.82500	1.95	1.0	12.0	2.0	-0.4	13.6	
131	2466.87500	2.00	1.0	12.0	2.0	-0.1	13.9	
132	2466.92500	2.05	1.0	12.0	2.0	0.7	14.7	
133	2466.97500	2.10	1.0	12.0	2.0	1.6	15.6	
134	2467.02500	2.15	1.0	12.0	2.0	1.7	15.7	
135	2467.07500	2.20	1.0	12.0	2.0	1.7	15.7	
136	2467.12500	2.25	1.0	12.0	2.0	1.8	15.8	
137	2467.17500	2.30	1.0	12.0	2.0	1.9	15.9	
138	2467.22500	2.35	1.0	12.0	2.0	2.1	16.1	
139	2467.27500	2.40	1.0	12.0	2.0	1.9	15.9	
140	2467.32500	2.45	1.0	12.0	2.0	1.7	15.7	
141	2467.37500	2.50	1.0	12.0	2.0	1.6	15.6	
142	2467.42500	2.55	1.0	12.0	2.0	1.5	15.5	
143	2467.47500	2.60	1.0	12.0	2.0	1.9	15.9	
144	2467.52500	2.65	1.0	12.0	2.0	2.3	16.3	
145	2467.57500	2.70	1.0	12.0	2.0	2.6	16.6	
146	2467.62500	2.75	1.0	12.0	2.0	2.8	16.8	

Test Point	Jammer Signal Freq. +/- Fc (MHz)	Jammer Signal Freq. +/- Fc (MHz)	(BER) (DQPSK) x10-5	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
147	2467.67500	2.80	1.0	12.0	2.0	2.9	16.9	
148	2467.72500	2.85	1.0	12.0	2.0	2.9	16.9	
149	2467.77500	2.90	1.0	12.0	2.0	3.0	17.0	
150	2467.82500	2.95	1.0	12.0	2.0	3.0	17.0	
151	2467.87500	3.00	1.0	12.0	2.0	3.3	17.3	
152	2467.92500	3.05	1.0	12.0	2.0	3.7	17.7	
153	2467.97500	3.10	1.0	12.0	2.0	3.7	17.7	
154	2468.02500	3.15	1.0	12.0	2.0	3.9	17.9	
155	2468.07500	3.20	1.0	12.0	2.0	4.0	18.0	
156	2468.12500	3.25	1.0	12.0	2.0	4.0	18.0	
157	2468.17500	3.30	1.0	12.0	2.0	4.5	18.5	
158	2468.22500	3.35	1.0	12.0	2.0	4.5	18.5	
159	2468.27500	3.40	1.0	12.0	2.0	4.5	18.5	
160	2468.32500	3.45	1.0	12.0	2.0	4.8	18.8	
161	2468.37500	3.50	1.0	12.0	2.0	4.8	18.8	
162	2468.42500	3.55	1.0	12.0	2.0	4.8	18.8	
163	2468.47500	3.60	1.0	12.0	2.0	5.0	19.0	
164	2468.52500	3.65	1.0	12.0	2.0	5.4	19.4	
165	2468.57500	3.70	1.0	12.0	2.0	5.6	19.6	
166	2468.62500	3.75	1.0	12.0	2.0	5.7	19.7	
167	2468.67500	3.80	1.0	12.0	2.0	5.8	19.8	
168	2468.72500	3.85	1.0	12.0	2.0	6.1	20.1	
169	2468.77500	3.90	1.0	12.0	2.0	6.1	20.1	
170	2468.82500	3.95	1.0	12.0	2.0	6.2	20.2	
171	2468.87500	4.00	1.0	12.0	2.0	6.3	20.3	
172	2468.92500	4.05	1.0	12.0	2.0	6.9	20.9	
173	2468.97500	4.10	1.0	12.0	2.0	6.9	20.9	
174	2469.02500	4.15	1.0	12.0	2.0	7.1	21.1	
175	2469.07500	4.20	1.0	12.0	2.0	7.3	21.3	
176	2469.12500	4.25	1.0	12.0	2.0	7.3	21.3	
177	2469.17500	4.30	1.0	12.0	2.0	7.7	21.7	
178	2469.22500	4.35	1.0	12.0	2.0	7.9	21.9	
179	2469.27500	4.40	1.0	12.0	2.0	7.9	21.9	
180	2469.32500	4.45	1.0	12.0	2.0	8.0	22.0	
181	2469.37500	4.50	1.0	12.0	2.0	8.0	22.0	

Appendix 1

The following is a Matlab program which plots the DQPSK probability of error vs. Eb/No. This was derived using a formula from the following reference:

Feher, Kamilo: *Wireless Digital Communications: Modulation and Spread Spectrum Applications*, Prentice Hall, Upper Saddle River, New Jersey, 1995, pp211-213

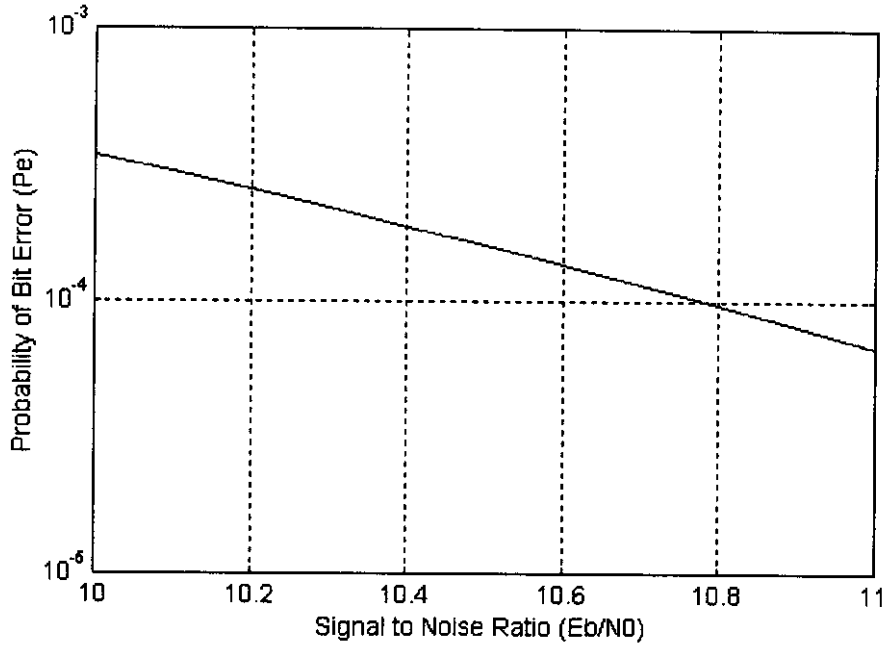
Matlab Code

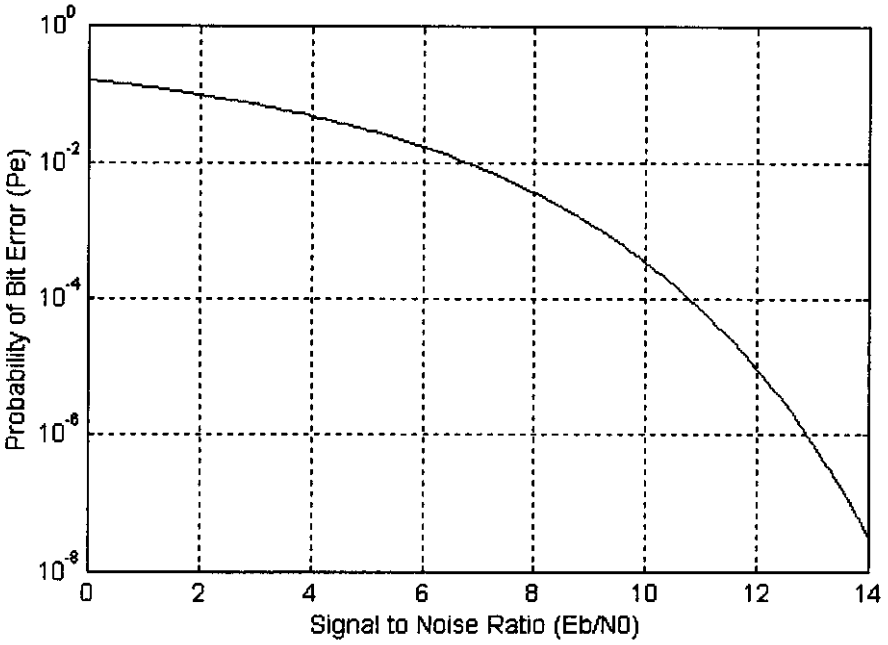
```
function [SNR,BER]=berdqpsk(K)

%this is an m-file to calculate the ber of a
%dqpsk system. The Eb/N ranges from 0 to 14 dB
%The formula used is on page 212 of Dr. Feher's
%book, "Wireless Digital Communications"
%K is the number of sums in the Q function

SNR=0:0.1:13;
GAMMA=10.^(SNR/10);
A=sqrt(2*GAMMA*(1-1/sqrt(2)));
B=sqrt(2*GAMMA*(1+1/sqrt(2)));
Q=zeros(size(SNR));
for k=0:K
   Q=Q+(A./B).^(k).*besseli(k,A.*B);
end
BER=exp(-(A.^2+B.^2)/2).*(Q-besseli(0,A.*B)/2);
semilogy(SNR,BER);
```

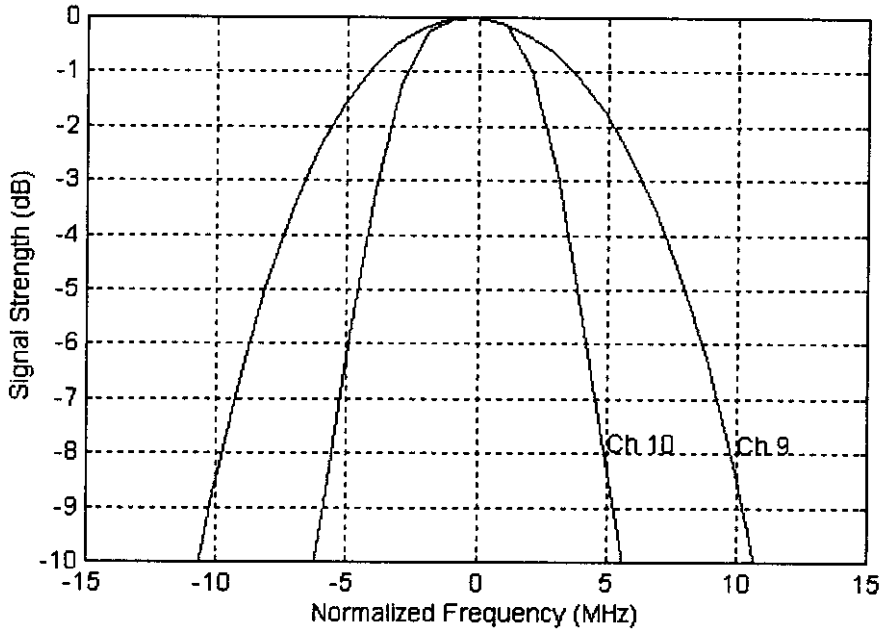
IN

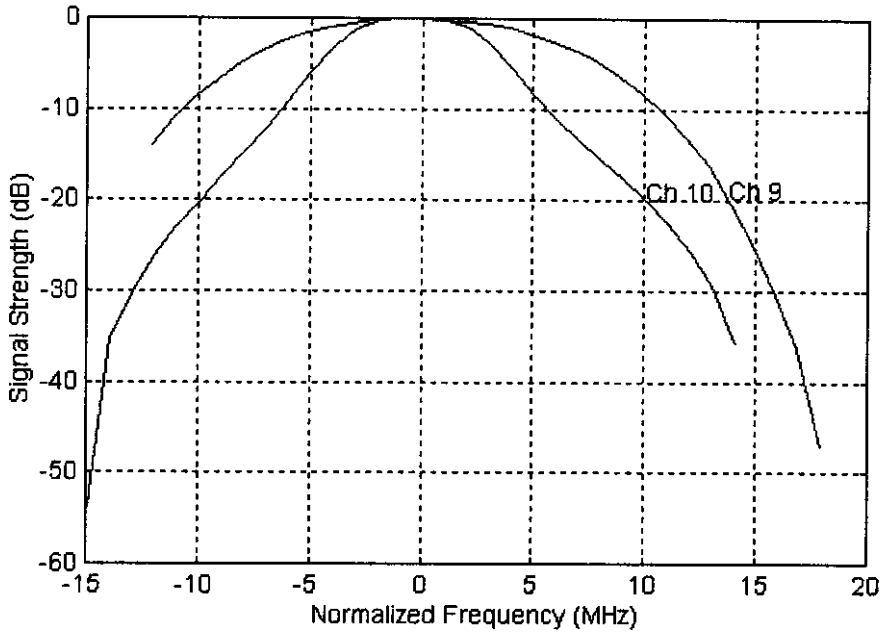

Probability of Bit Error (Pe)
10^-3
10^-4
10^-5
10
10.2
10.4
10.6
10.8
11
Signal to Noise Ratio (Eb/N0)

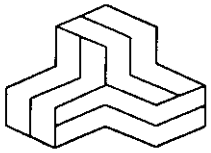

Probability of Bit Error (Pe)
10^0
10^-2
10^-4
10^-6
10^-8
0
2
4
6
8
10
12
14
Signal to Noise Ratio (Eb/N0)

Appendix 2

The receiver has two IF filter bandwidths. A signal generator was used to sweep the receiver RF input and the IF output was measured. Measurements were made on two different channels with the two bandwidths. The following plot was made from the test data. The plot represents the IF filter bandwidths of the receiver. The 6 dB bandwidth is 17 MHz in wideband mode and 9 MHz in narrowband mode.




0
-10
-20
-30
-40
-50
-60
Signal Strength (dB)
-15
-10
-5
0
5
10
15
20
Normalized Frequency (MHz)
Ch 10
Ch 9



ENGINEERING TEST REPORT

ISP DIRECT INDOOR & OUTDOOR UNITS
Model No: 2401-01 (indoor) and 2401-02 (outdoor)

FCC ID: NUX-ISP2401

FCC PART 15, SUBPART C, PARA. 15.247
DIRECT SEQUENCE SPREAD SPECTRUM (DSSS) TRANSMITTERS
OPERATING IN THE FREQUENCY BAND FROM 2408.625 - 2464.875 MHz

UltraTech's FILE NO.: IAW-004FTX

TESTED FOR:

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

TESTED BY:

UltraTech Engineering Labs Inc.
4181 Sladeview Crescent, Unit 33
Mississauga, Ontario
Canada L5L 5R2

PREPARED BY: Tri M. Luu, P.Eng.

DATE: Apr. 12, 1998

Apr. 12, 1998

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

Attn.: **Mr. Dave Chauncey, Director RF Engineering**

Subject: **Certification Application under FCC Part 15, Subpart C, Para. 15.247, Direct Sequence Spread Spectrum (DSSS) Transmitters Operating in the Frequency Band 2408.625 - 2464.875 MHz.**

Product: ISP DIRECT INDOOR & OUTDOOR UNITS
Model: 2401-01 (indoor) and 2401-02 (outdoor)
FCC ID: NUX-ISP2401

Dear Mr. Chauncey,

The product sample, as provided by you, has been tested and found to comply with **FCC Part 15, Subpart C, Para. 15.247, Direct Sequence Spread Spectrum Transmitters operating in the Frequency Band 2408.625 - 2464.875 MHz.**

Please kindly refer to page 9 of the engineering report, Our File No.: IAW-004FTX, for detailed information of the equipment modification requirement for compliance wit FCC Part 15, Sub. C, Sec. 15.205 & 15.209.

Please feel to contact us if you have any further questions.

Best Regards,

Tri M. Lieu, P.Eng.
V.P. Engineering

UltraTech
33-4181 Sladeview Crescent
Mississauga, Ontario. L5L 5R2
Telephone (905) 569-2550
Facsimile (905) 569-2480

Apr. 12, 1998

FEDERAL COMMUNICATIONS COMMISSION
7435 Oakland Mills Road
Columbia, MD 21046
USA

Subject: **Certification Application under FCC Part 15, Subpart C, Para. 15.247, Direct Sequence Spread Spectrum (DSSS) Transmitters Operating in the Frequency Band 2408.625 - 2464.875 MHz.**

Applicant:	**INTERAIR WIRELESS**
Product:	**ISP DIRECT INDOOR & OUTDOOR UNITS**
Model:	**2401-01 (indoor) and 2401-02 (outdoor)**
FCC ID:	**NUX-ISP2401**

Dear Sir/Madam,

As appointed agent for **INTERAIR WIRELESS**, please find enclosed copies of the engineering report, authorization form, application form and a cheque of US $1025.00.

If you have any queries, please do not hesitate to contact us by our TOLL FREE numbers:

OUR TELEPHONE NO.: 1-800-263-7670

Yours truly,

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

TML/AK

Encl.

UltraTech
33-4181 Sladeview Crescent
Mississauga, Ontario. L5L 5R2
Telephone (905) 569-2550
Facsimile (905) 569-2480

FEDERAL COMMUNICATIONS COMMISSION

Approved by OMB 3060-0057

FCC FORM 731

APPLICATION FOR EQUIPMENT AUTHORIZATION

For FCC use only

SECTION I – *ALL ITEMS IN THIS SECTION MUCT BE COMPLETED*

Applicant's complete, legal business name
INTERAIR WIRELESS

☐ Check here if this is a change in name and/or address not previously reported (See 47 CFR §2.934)

Applicant's mailing address (Line 1)
485 Cayuga Road. P.O. Box 222

Bureau Use Only
Equipment Code:

Applicant's mailing address (Line 2) (if required)

Engineer:

City
485 Cayuga Road. P.O. Box 222

Examiner:

State or Country (if foreign address)	ZIP/Postal Code	3. FCC ID: (a) Grantee Code	(b) Equipment Product Code (14 characters maximum, show zeros as Ø)
New York, USA	**14225-0222**	**N U X**	**-ISP2401**

4. Name, Title and Mail Stop, if any, of person at the applicant's address to receive grant, or for contact: *(See instructions)*
Mr. Dave Chauncey, Director RF Engineering

5.(a) Telephone No. (Area/Country/City code, No. and Ext.)	(b) FAX No. (Area/Country/City code, No.)
716-631-6409	**716-631-7849**

(c) Internet e-mail address: dchauncy@interairwireless.com

SECTION II - See 47 CFR §1.1103 for Fee Type Codes and Fees. Fee Type Codes are listed in Paragraph C of the attached instructions.

Enter in Column (A) the correct Fee Type Code for the service for which you are applying. Enter in Column (C) the result obtained from multiplying the Fee amount for the Fee Type Code in Column (A) by the number entered in Column (B). If requesting more than ONE service, enter additional Fee Type Code(s) in Section III below.

	(A) FEE TYPE CODE	(B) FEE MULTIPLE	(C) FEE DUE FOR FEE TYPE CODE IN COLUMN (A)	FOR FCC USE ONLY
(1)	E G C	0 0 0 1	**$ 895.00**	

SECTION III – Use when requesting more than one service. If only one service is requested, complete only Section II and Section III, item (5).

	(A) FEE TYPE CODE	(B) FEE MULTIPLE	(C) FEE DUE FOR FEE TYPE CODE IN COLUMN (A)	FOR FCC USE ONLY
2)	E B C	0 0 0 1	**$ 130.00**	
3)		0 0 0 1	$	
4)		0 0 0 1	$	

5) Add all amounts shown in column C, lines (1) Through (4), and enter the total here. This amount should equal your enclosed remittance. →

TOTAL AMOUNT REMITTED WITH THIS APPLICATION OR FILING
$ 1025.00

FOR FCC USE ONLY

The October 1992 edition of this form may be used until September 1, 1997.

ECTION IV – *Enter FCC ID from Page 1, Section I* ➤

1.(a) Instead of Applicant, FCC is authorized to mail original Grant to: *(See instructions)*

Firm name, **UltraTech Engineering Labs Inc.**
number, street, **33-4181 Sladeview Crescent**
City, State/Country, **Mississauga, Ontario, Canada**
ZIP/Postal Code **L5L 5R2**

(b) Name, Title and Mail Stop, if any, of person at above address to receive Grant: (If 1.(a) is completed, this item must be completed)
Mr. Tri M. Luu, P.Eng. – Vice President of Engineering

(a) Technical contact:
Firm Name, **UltraTech Engineering Labs Inc.**
contact person, **Mr. Tri M. Luu, P.Eng.**
number, street, **33-4181 Sladeview Crescent**
City, State/Country, **Mississauga, Ontario, Canada**
ZIP/Postal Code **L5L 5R2**

(b) Telephone No. (Area/Country/City code, No. and Ext.) **1-800-263-7670**

(c) FAX No. (Are/Country/City code and No.) **905-569-2480**

(d) Internet e-mail address: **tri.luu @sympatico.ca**

(e) Non - Technical contact:
Firm Name, **Ultratech Engineering Labs Inc.**
contact person, **Mr. Tri M. Luu, P.Eng.**
number, street, **33-4181 Sladeview Crescent**
City, State/Country, **Mississauga, Ontario, Canada**
ZIP/Postal Code **L5L 5R2**

(f) Telephone No. (Area/Country/City code, No. and Ext.) **1-800-263-7670**

(g) FAX No. (Are/Country/City code and No.) **905-569-2480**

(h) Internet e-mail address: **tri.luu @sympatico.ca**

3. Does this application include a request for confidentiality for any portion(s) of the data contained in this application pursuant to 47 CFR §0.459 of the Commission's Rules? *If "Yes" see instructions.* [X] Yes [ ] No

4. Does the applicant request that the Commission defer grant of this application pursuant to 47 CFR §0.457(d)(1)(ii)? *(See instructions)* [ ] Yes [X] No

5. Type of equipment authorization requested: (check *one* box only) [X] Certification [ ] Type Acceptance [ ] Notification

6.(a) Equipment Code and description: *(See instructions, page 4)* [N][U][X] **-ISP2401, D.S.S.S. Transmitters**

(b) Equipment will be operated under FCC Rule Part(s): Part 15, Sub. C, Paragraph 15.247

7. Application is for: (Check one box only)

[X] 1. Original equipment

[ ] 2. Change in identification of presently authorized equipment

ORIGINAL FCC ID _____ GRANT date _____

[ ] 3. Class II permissive change or modification of presently authorized equipment *(See instructions)*

8. EQUIPMENT SPECIFICATIONS: *(See instructions)*

(a) Frequency range in MHz	(b) Rated RF power output in watts	(c) Frequency tolerance %, Hz, ppm	(d) Emission designator (See 47 CFR §2.201 and §2.201)	(e) Microprocessor model number
2408.625 – 2464.875	**190 mWatts max.**	**N/A**	**Direct Sequence Spread Spectrum Transmitters**	

9. Is the equipment in this application:
(a) a composite device subject to more than one type of equipment authorization? [ ] Yes [X] No

(b) part of a system that operates with, or is marketed with, another device that requires an equipment authorization? [ ] Yes [X] No

If either of the above questions is answered "Yes" complete items 10.(a) and (b). *(See instructions)*

ECTION IV (continued) – *Enter FCC ID from Page 1, Section I* ➤

10.(a) Additional type of equipment authorization required: ☐ Certification ☐ Type Acceptance ☐ Notification

(b) The related application checked in item 10.(a) (Check one box only)

☐ has been filled at the same time as this application under the FCC ID listed below ☐ has been granted under the FCC ID listed below ☐ is in the process of being filed under the FCC ID listed below ☐ is pending with the FCC under the FCC ID listed below

FCC ID

11.(a) Name of test firm on file with the FCC, if different from applicant or contact person:

(b) Mailing address, number, street, City, State/Country, ZIP/Postal Code

(c) Telephone No. (Are/Country/City code, No. and Ext.)

(d) FAX No. (Are/Country/City code, No.)

(e) Internet e-mail address:

12. Number of exhibits submitted with this application: 6

SECTION V – Read each certification carefully before answering and signing this application.

WILLFUL FALSE STATEMENTS MADE ON THIS FORM ARE PUNISHABLE BY F INE AND/OR IMPRISONMENT (U.S. CODE, TITLE 18, SECTION 1001), AND/OR REVOCATION OF ANY STATION LICENSE OR CONSTRUCTION PERMIT (U.S. CODE, TITLE 47, SECTION 312(a)(1)), AND/OR FORFEITURE (U.S. CODE, TITLE 47, SECTION 503).

1. **SECTION 5301 (ANTI-DRUG ABUSE) CERTIFICATION:**
The applicant must certify that neither the applicant nor any party to the application is subject to a denial of Federal benefits, that include FCC benefits, pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. §862 because of a conviction for possession or distribution of a controlled substance. See 47 CFR 1.2002(b) for the definition of a "party" for these purposes.

Does the applicant or authorized agent so certify? [X] Yes ☐ No

2.(a) **APPLICANT/AGENT CERTIFICATION:**
I certify that I am authorized to sign this application. All of the statements herein and the exhibits attached hereto, are true and correct to the best of my knowledge and belief. In accepting a Grant of Equipment Authorization issued by the FCC as a result of the representations made in this application, the applicant is responsible for (1) labeling the equipment with the exact FCC ID specified in this application, (2) compliance statement labeling pursuant to the applicable rules, and (3) compliance of the equipment with the applicable technical rules. If the applicant is not the actual manufacturer of the equipment, appropriate arrangements have been made with the manufacturer to ensure that production units of this equipment will continue to comply with the FCC's technical requirements.

Authorizing an agent to sign this application, is done solely at the applicant's discretion; however, the applicant remains responsible for all statements in this application.

If an agent has signed this application on behalf of the applicant, a written letter of authorization which includes information to enable the agent to respond to the above Section 5301 (Anti-Drug Abuse) Certification statement has been provided by the applicant. It is understood that the letter of authorization must be submitted to the FCC upon request, and that the FCC reserves the right to contact the applicant directly at any time.

Original written signature of authorized signer ▲ Date (Month, Day, Year)

Tri. M. Luu, P.Eng., V.P. of Engineering

▲ Typed/printed name of authorized signer ▲ Title of authorized signer

▼ Complete items below if an agent signs the application.

(b) Agent's business name, number, street, City, State/Country, ZIP/Postal Code: **Ultratech Engineering Labs Inc. 33-4181 Sladeview Crescent Mississauga, Ontario, Canada L5L 5R2**

(c) Telephone No. (Are/Country/City code, No. and Ext.) **1-800-263-7670**

(d) FAX No. (Are/Country/City code, No.) **905-569-2480**

(e) Internet e-mail address: tri.luu@sympatico.ca

TABLE OF CONTENTS

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	Yes
15.247(b) & 1.1310	Maximum Peak Power and RF Exposure Limits	Yes
15.247(c)	RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Yes
15.247(c), 15.209 & 15.205	Transmitter Radiated Emissions	Yes
15.247(d)	Transmitted Power Density of a Direct Sequence Spread Spectrum System	Yes
15.247(e)	Processing Gain of Direct Sequence Spread Spectrum System	Yes
15.107, 15.109	AC Power Conducted Emissions & Radiated Emissions for Digital Circuit Portions	Yes (Note 1)

Note 1: The digital circuits and receiver portion of the EUT has been tested and verified to comply with FCC Part 15, Subpart B, Class A Digital Devices. The engineering test report can be provided upon FCC requests.

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 representative production units, representative.*

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 Luk, P. Eng.
V.P., Engineering

DATE: Apr. 12, 1998

2. EXHIBIT 2 - GENERAL INFORMATION

2.1 *Applicant*

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

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

2.2 *Manufacturer*

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

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

2.3 *Description of Equipment under Test*

PRODUCT NAME:	ISP DIRECT INDOOR & OUTDOOR UNITS
SERIAL NUMBER:	Preproduction
TYPE OF EQUIPMENT:	DSSS Transmitters
POWER RATING:	160 mWatts
EMISSION DESIGNATION:	Direct sequence spread spectrum
DUTY CYCLE:	45% maximum
OSC. FREQUENCY(IES):	35 MHz (Rx IF), 70 MHz (Rx LO), 915 MHz (Tx IF), Tx Lo. Osc. = Tx Freq- 915 MHz.
INPUT SUPPLY:	AC 120 V 60Hz from Elpac external switching power supply, model WRI4232
OPERATING FREQ./ 6dB BANDWIDTH	2408.625 - 2464.875 MHz

The following table shows the characteristics of each channel frequency of the transmitter:

Channel No.	Channel Frequency	Modulation Bandwidth	Maximum 6dB Bandwidth (MHz)	Chips per Symbol	Data Rate (Mb/s)	Max. RF Output Power (miliWatts)	Highest gain Antenna Used (dBi)
1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3	2408.625	Narrow	4.2	11	4.5	190	17
4	2411.4375	Medium	5.3	11	5.625	190	17
5	2417.0625	Medium	5.3	11	5.625	190	17
6	2419.875	Wide	10	11	11.25	190	17
7	2422.6875	Medium	5.3.0	11	5.625	190	17
8	2428.3125	Medium	5.3	11	5.625	190	17
9	2431.125	Wide	10	11	11.25	190	17
10	2433.9375	Medium	5.3	11	5.625	190	17
11	2439.5625	Medium	5.3	11	5.625	190	17
12	2442.3750	Wide	10.0	11	11.25	190	17
13	2445.1875	Medium	5.3	11	5.625	190	17
14	2450.8125	Medium	5.3	11	5.625	190	17
15	2453.625	Wide	10.0	11	11.25	190	17
16	2456.4375	Medium	5.3	11	5.625	190	17
17	2462.0625	Medium	5.3	11	5.625	190	17
18	2464.875	Narrow	4 .2	11	4.5	190	17

For worst case of measurements the following channels were chosen to be tested: Narrow BW: 3 & 17, Medium BW: 4, 10 & 17, Wide BW: 6, 9 & 15.

ASSOCIATED DEVICES:

(1) Elpac external switching power supply, model WRI4232, AC IN: AC 95 250 V, 47-63 Hz, 1.2A, DC OUT: +5V, +12V, -12 Vdc

(2) One of the following antenna may be supplied with the InterAir ISP Direct System, the antenna is permanently secured to the ISP Direct Outdoor Unit using TNC connectors and heat shrink:

Selection Number	Description	Vendor	P/N	Gain (dBi)
1	1x1 Patch	Huber Suhner	64958022	8.5
2	3x3 Patch	Huber Suhber	65119522	16.5
3	1x10 Patch	Huber Suhner	65247322	16.5
4	Omni	Andrew	RT1N0F-024V-013A	13
5	Reflector	Conifer	18T-2400	17

The Conifer Reflector with the highest antenna gain from the above list is chosen to be tested with the InterAir ISP Direct System for the worst case.

(3) The RF interconnecting cable between the InterAir ISP Direct Indoor and the Outdoor Units can be selected with one of the following:

Selection No.	Description	Vendor	Part No.	Length (ft)	Loss (dB)
1	0.4" Cable – WP	Times	LMR-400-DB	150	10.2
2	0.3" Cable	Times	LMR-300	100	10.4
3	0.24" Cable	Times	LMR-240	80	10.3
4	0.2" cable	Times	LMR-200	60	10.1
5	0.5" Cable – WP	Times	LMR-500-DB	200	11
6	0.6" Cable – WP	Times	LMR-600-DB	250	11
7	0.9" Cable – WP	Times	LMR-900-DB	400	12
8	0.25" Flex	MISC	RG-223/U	30	10.5

The above item # 8, 0.25" Flex, RG-223/U cable with shortest available length (30 ft) and lowest loss (10.5 dB), was used for testing and represents the worst case.

FCC ID: NUX-ISP2401

INTERFACE PORTS:

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

No 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.

Both conducted and 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*

AC Powerline Conducted Emissions were performed in UltraTech's shielded room, 16'(L) by 12'(W) by 12'(H).

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 sites 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: July 16, 1997.

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 conducted emissions are reported in units of dB referenced to one microvolt [dB(μV)].

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.

3. EXHIBIT 3 - SYSTEM TEST CONFIGURATION

3.1 Test System Details

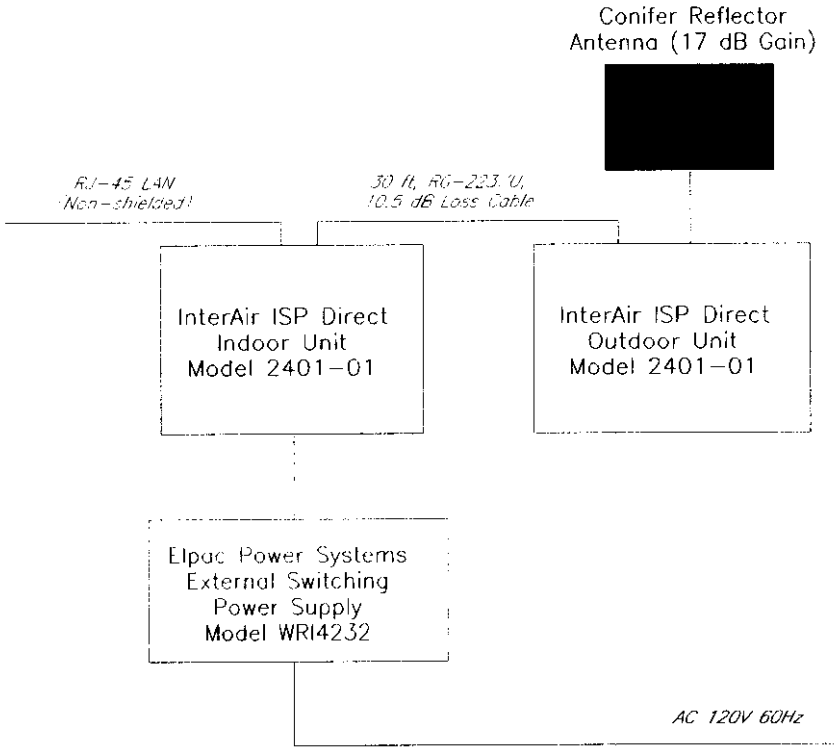
The following peripherals, FCC identifiers and types interconnecting cables were used with the EUT for testing:

(1) **EUT**: INTERAIR WIRELESS, 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.

(2) **ASSOCIATED MAXIMUM GAIN ANTENNA**: Conifer Reflector Antenna , P/N: 18T-2400, Gain: 17 dB.
I/O Cable: All I/O Cables were shielded

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

3.2 Block Diagrams for Conducted & Radiated Emission Measurements



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 INTERAIR WIRELESS 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

To achieve compliance with FCC 15.205 and 15.209 at the Transmitter local oscillator frequency (Tx Freq – 915 MHz), the following modifications were made by InterAir Wireless:

a. The front and back plastic bezel with the Ni EMI coated edges were clued to the front and back metal plates using Conductive EMI adhesive.
b. Metal shield boxes were installed at both sides (RF board and Digital Board) of the internal 40-Pin connector.
c. EMI gasket/washer was installed between the RF and Digital printed circuit boards at the 40-Pin Connector.
d. 2 mounting screws were added to secure the DC IN power jack to the back metal plate.

4. EXHIBIT 4 - TEST DATA

4.1 6 dB Bandwidth @ FCC 15.247(a)(2)

PRODUCT NAME: **ISP DIRECT INDOOR & OUTDOOR UNITS, Model No.: 2401-01 (indoor) and 2401-02 (outdoor)**

FCC REQUIREMENTS:

For a direct sequence spread spectrum system, the minimum 6 dB bandwidth shall be at least 500 KHz.

CLIMATE CONDITION:

Standard Temperature and Humidity:

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

POWER INPUT:

AC 120 V 60Hz from Elpac external switching power supply, model WRI4232.

TEST EQUIPMENT:

- Advantest Spectrum Analyzer, Model R3271, S/N: 15050203
- Bird 20 dB Attenuator, 50 Ohm IN/OUT

METHOD OF MEASUREMENTS:

The transmitter output was connected to the spectrum analyzer through an attenuator. the bandwidth of the fundamental frequency was measured with the spectrum analyzer using 100 KHz RBW, VBW = 100 KHz,. The 6 dB bandwidth was measured and recorded.

TEST ARRANGEMENT

TEST RESULTS: Conforms.

TEST PERSONNEL: Mr. Tri M. Luu, P.Eng.

DATE: Feb. 26 & Mar. 04, 1998

MEASUREMENT DATA:

Channel No.	Channel Frequency	Modulation Bandwidth	Data Rate (Mb/s)	Chips per Symbol	Measured 6dB Bandwidth (MHz)	FCC Limit (MHz)
3	2408.625	Narrow	4.5	11	4 .2	0.5
4	2411.4375	Medium	5.625	11	5.0	0.5
6	2419.875	Wide	11.25	11	8.4	0.5
9	2431.125	Wide	11.25	11	10.0	0.5
10	2433.9375	Medium	5.625	11	5.2	0.5
15	2453.625	Wide	11.25	11	8.1	0.5
17	2462.0625	Medium	5.625	11	5.3	0.5
18	2464.875	Narrow	4.5	11	4.0	0.5

4.2 *Maximum Peak Output Power @ FCC 15.247(b) and RF Exposure Limit FCC 1.1310*

PRODUCT NAME: **ISP DIRECT INDOOR & OUTDOOR UNITS, Model No.: 2401-01 (indoor) and 2401-02 (outdoor)**

FCC REQUIREMENTS:

FCC 15.247(b):- Maximum peak output power of the transmitter shall not exceed 1 Watt.

(i) Systems operating in the 2400-2483.5 MHz band that used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduce by 1 dB for every 3 dB that the directional gain of the antenna exceed 6 dBi.

FCC 1.1310:- The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in 1.1307(b).

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (minutes)
(A) Limits for Occupational/Control Exposures				
300-1500	...	...	F/300	6
1500-100,000	...	...	5	6
(B) Limits for General Population/Uncontrolled Exposure				
300-1500	...	...	F/1500	6
1500-100,000	...	...	1.0	30

F = Frequency in MHz
* = Plane-wave equivalent power density

CLIMATE CONDITION:

Standard Temperature and Humidity:

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

POWER INPUT:

AC 120 V 60Hz from Elpac external switching power supply, model WRI4232.

TEST EQUIPMENT:

- HP RF Peak Power Meter, Model 8900, S/N: 2131A00124, Measuring Freq. Range: 01 - 18 GHz, 50 Ohm IN.
- HP RF Peak Power Sensor, Model 8481A, S/N: 2551A01965, Measuring Freq. Range: 0.1 - 18 GHz, 50 Ohm IN/OUT

METHOD OF MEASUREMENTS:

FCC @ 1.1310 & OST Bulletin No. 65-October 1985

$S = PG/4\Pi r^2 = EIRP/4\Pi r^2$

Where: P: power input to the antenna in mW
EIRP: Equivalent (effective) isotropic radiated power.
S: power density mW/cm^2
G: numeric gain of antenna relative to isotropic radiator
r: distance to centre of radiation in cm

FCC radio frequency exposure limits may be exceeded at distances closer than r cm from the antenna of this device

$$r = \sqrt{PG/4\Pi S}$$

FCC radio frequency exposure limits may be exceeded at distances closer than r cm from the antenna of this device

TEST ARRANGEMENT

TEST RESULTS: Conforms.

TEST PERSONNEL: Mr. Tri M. Luu, P.Eng.

DATE: Feb. 26, 1998

MEASUREMENT DATA:

PEAK POWER MEASUREMENT

Maximum Antenna Gain provided: 17 dBi
FCC Power Output Limit = 30 dBm – (17 dBi - 6 dBi)/3 = 29.3 dBm or 851 mWatts

Channel No.	Channel Frequency	Modulation Bandwidth	Data Rate (Mb/s)	Chips per Symbol	Measured Peak Power (mWatts)	FCC Limit (mWatts)
3	2408.625	Narrow	4.5	11	190	851
4	2411.4375	Medium	5.625	11	190	851
6	2419.875	Wide	11.25	11	190	851
9	2431.125	Wide	11.25	11	190	851
10	2433.9375	Medium	5.625	11	190	851
15	2453.625	Wide	11.25	11	190	851
17	2462.0625	Medium	5.625	11	190	851
18	2464.875	Narrow	4.5	11	190	851

Note: The power density or SAR tests were not applicable to this type of equipment. Since the transmitting antenna is located outdoor far away from the user (at least 30 ft away).

4.3 RF Conducted Emissions at the Transmitter Antenna Terminal, FCC CFR 47, Para. 15.247(c)

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 at least 20 dB below that in any 100 KHz bandwidth within the band that contains the highest level of the desired power.

CLIMATE CONDITION:

Standard Temperature and Humidity:

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

POWER INPUT:

AC 120 V 60Hz from Elpac external switching power supply, model WRI4232.

TEST EQUIPMENT:

- Advantest Spectrum Analyzer, Model R3271, S/N: 15050203
- Bird 20 dB Attenuator, 50 Ohm IN/OUT
- Microphase Highpass Filter, P/N: CR220HIB, S/N: 1301, Cut-off Freq. 1.8 GHz. (Optional)

METHOD OF MEASUREMENT:

A scan was made by using a spectrum analyzer with the detector function set to PEAK mode.

Set RBW = 100 KHz, VBW = 100 KHz.

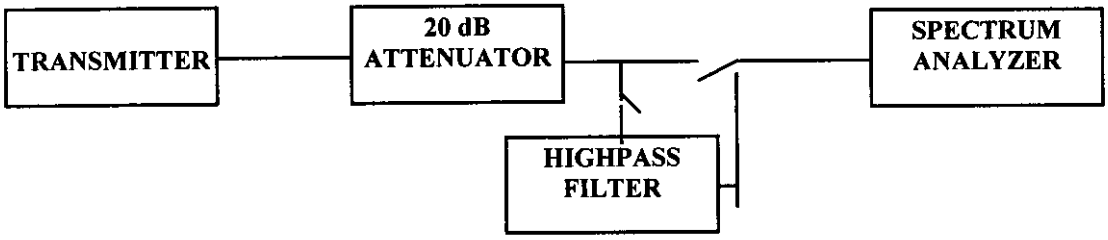
FCC CFR 47, Para. 2.997 - Frequency spectrum to be investigated

The spectrum was investigated from the lowest radio generated in the equipment up to at least the 10^{th} 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.

FCC CFR 47, Para. 2.991 - Spurious Emissions at Antenna Terminal

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of the harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in 2.989 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

TEST ARRANGEMENT



TEST RESULTS:

Conforms.

TEST RESULTS: Conforms.

TEST PERSONNEL: Mr. Tri M. Luu, P.Eng.

DATE: Feb. 26, 1998

MEASUREMENT DATA

SPURIOUS & HARMONIC EMISSIONS AT THE TRANSMITTER ANTENNA TERMINAL

TEST CONFIGURATION

- *The transmitter was coupled to the Spectrum Analyzer through a 20 dB attenuator.*
- *The insertion loss between the transmitter output terminal and the spectrum analyzer was measured to be 20 dB*
- *The channel frequencies were established on the extreme edges (both upper and lower) and middle of the 2408.625 - 2464.875 MHz band at its full rated output power. The emissions was investigated up to the tenth 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 Part 15.247(c)*

Channel #: 3, Frequency: 2408.625 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, narrow, 11 chips/symbol, Data Rate: 4.5 Mb/s, 2 bits/symbol			**Power Level in 100 KHz BW: 9.7 dBm Limit = 9.7 dBm - 20 dB = -10.3 dBm**		
FREQUENCY (MHz)	**RF LEVEL (dBm)**	**EMI DETECTOR (dBm)**	**LIMIT (dBm)**	**MARGIN (dB)**	**PASS/ FAIL**
2408.6	9.7	Peak	--	--	PASS
451.0	-46.7	Peak	-10.3	-36.4	PASS
1498.0	-44.5	Peak	-10.3	-34.2	PASS
2374.0	-43.0	Peak	-10.3	-32.7	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details					

Channel #: 4, Frequency: 2411.4375 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, medium , 11 chips/symbol, Data Rate: 5.625 Mb/s, 2 bits/symbol			**Power Level in 100 KHz BW: 9.1 dBm Limit = 9.1 dBm - 20 dB = -10.9 dBm**		
FREQUENCY (MHz)	**RF LEVEL (dBm)**	**EMI DETECTOR (dBm)**	**LIMIT (dBm)**	**MARGIN (dB)**	**PASS/ FAIL**
2411.4	9.1	Peak	--	--	PASS
451.0	-45.6	Peak	-10.9	-34.7	PASS
1496.4	-39.9	Peak	-10.9	-29.0	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details					

Channel #: 6, Frequency: 2419.875 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, wide, 11 chips/symbol, Data Rate: 11.25 Mb/s, 2 bits/symbol			Power Level in 100 KHz BW: 9.1 dBm Limit = 9.1 dBm - 20 dB = -10.9 dBm		
FREQUENCY (MHz)	RF LEVEL (dBm)	EMI DETECTOR (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
2419.9	9.1	Peak	--	--	PASS
1504.9	-38.6	Peak	-10.9	-27.7	PASS
2382.3	-38.7	Peak	-10.9	-27.8	PASS
2386.0	-41.8	Peak	-10.9	-30.9	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details					

Channel #: 9, Frequency: 2431.125 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, wide, 11 chips/symbol, Data Rate: 11.25 Mb/s, 2 bits/symbol			Power Level in 100 KHz BW: 8.7 dBm Limit = 8.7 dBm - 20 dB = -11.3 dBm		
FREQUENCY (MHz)	RF LEVEL (dBm)	EMI DETECTOR (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
2431.1	8.7	Peak	--	--	PASS
1516.1	-41.3	Peak	-11.3	-30.0	PASS
2396.5	-40.5	Peak	-11.3	-29.2	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details					

Channel #: 10, Frequency: 2433.9375 Full Rated Peak Power: 190 mW Modulation: DQPSK, medium, 11 chips/symbol, Data Rate: 5.625 Mb/s, 2 bits/symbol			Power Level in 100 KHz BW: 8.7 dBm Limit = 8.7 dBm - 20 dB = -11.3 dBm		
FREQUENCY (MHz)	RF LEVEL (dBm)	EMI DETECTOR (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
2433.9	8.7	Peak	--	--	PASS
2398.5	-45.4	Peak	-11.3	-34.1	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details					

Channel #: 15, Frequency: 2453.625 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, wide, 11 chips/symbol, Data Rate: 11.25 Mb/s, 2 bits/symbol			Power Level in 100 KHz BW: 8.9 dBm Limit = 8.9 dBm - 20 dB = -11.1 dBm		
FREQUENCY (MHz)	RF LEVEL (dBm)	EMI DETECTOR (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
2453.6	8.9	Peak	--	--	PASS
1538.6	-38.3	Peak	-11.1	-27.2	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details					

Channel #: 17, Frequency: 2462.0625 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, medium, 11 chips/symbol, Data Rate: 5.625 Mb/s, 2 bits/symbol			Power Level in 100 KHz BW: 8.6 dBm Limit = 8.6 dBm - 20 dB = -11.4 dBm		
FREQUENCY (MHz)	RF LEVEL (dBm)	EMI DETECTOR (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
2462.1	8.6	Peak	--	--	PASS
494.0	-48.7	Peak	-11.4	-37.3	PASS
1547.1	-45.5	Peak	-11.4	-34.1	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details					

Channel #: 18, Frequency: 2464.875 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, narrow, 11 chips/symbol, Data Rate: 4.5 Mb/s, 2 bits/symbol			Power Level in 100 KHz BW: 8.6 dBm Limit = 8.6 dBm - 20 dB = -11.4 dBm		
FREQUENCY (MHz)	RF LEVEL (dBm)	EMI DETECTOR (dBm)	LIMIT (dBm)	MARGIN (dB)	PASS/ FAIL
2464.875	9.5	Peak	--	--	PASS
No significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details					

4.4 *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

CLIMATE CONDITION:

Standard Temperature and Humidity:

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

POWER INPUT:

AC 120 V 60Hz from Elpac external switching power supply, model WRI4232.

TEST EQUIPMENT:

- **Spectrum Analyzer**, Advantest, Model R3271, S/N: 15050203, 100 Hz to 32 GHz)
- **Spectrum Analyzer**, Advantest, Model 3261A, SN 91720151, Input +25dBm max., 9KHz-2.6GHz, 50 Ohms, built-in Quasi-Peak Detector.
- **RF Preselector**, Advantest Model R3551, SN 92970002, 9KHz-1GHz, 50 Ohms input/output, input +25 dBm max, 30 dB gain.
- **Microwave Amplifier**, HP, Model 83017A, Frequency Range 1 to 22 GHz, 30dB 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.
- **Log Periodic Antenna**, A.H. Systems, Model SAS-200/518, SN 343, Frequency Range: 1 - 18 GHz, @ 50 Ohms.
- **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 10^{th} 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.

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: Mr. Tri M. Luu, P.Eng.

DATE: Mar. 04-05, 1998

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 ≥ 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 = $20LOG_{10}(0.45)$ = -6.9 dB***

4.4.1 Conifer Reflector Antenna, P/N: 18T-2400, Gain: 17 dB

Channel #: 3, Frequency: 2408.625 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, narrow, 11 chips/symbol, Data Rate: 4.5 Mb/s, 2 bits/symbol				**Power Level in 1 MHz BW: 116.2 dBuV/m Limit = 116.2dBuV/m - 20dB = 96.2 dBuV/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**
2408.63	116.2	109.3	V	--	--	--	--
2408.63	109.1	102.2	H	--	--	--	--
1493.00	53.2	45.4	V	54.0	96.2	-8.6	PASS
1493.00	52.8	43.9	H	54.0	96.2	-10.1	PASS
2384.50	66.4	45.2	V	54.0	96.2	-8.8	PASS
2986.00	37.9	25.4	V	54.0	96.2	-70.8	PASS
2986.00	33.2	26.3	H	54.0	96.2	-69.9	PASS
4816.00	56.5	34.5	V	54.0	96.2	-19.5	PASS
4816.00	56.1	34.3	H	54.0	96.2	-19.7	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

Channel #: 4, Frequency: 2411.4375 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, medium , 11 chips/symbol, Data Rate: 5.625 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 118.9 dBuV/m Limit = 118.9dBuV/m - 20dB = 98.9 dBuV/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
2411.44	118.9	112.0	V	--	--	--	PASS
2411.44	110.9	104.0	H	--	--	--	PASS
1496.00	54.4	44.7	V	54.0	98.9	-9.3	PASS *
1496.00	54.7	44.8	H	54.0	98.9	-9.2	PASS *
2992.00	34.7	22.5	V	54.0	98.9	-76.4	PASS
2992.00	35.5	24.0	H	54.0	98.9	-74.9	PASS
4488.00	44.4	33.8	V	54.0	98.9	-20.2	PASS *
4488.00	43.2	32.1	H	54.0	98.9	-21.9	PASS *
4822.00	55.4	34.8	V	54.0	98.9	-19.2	PASS *
4822.00	53.5	33.0	H	54.0	98.9	-21.0	PASS *
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

Channel #: 6, Frequency: 2419.875 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, wide, 11 chips/symbol, Data Rate: 11.25 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 116.4 dBuV/m Limit = 116.4dBuV/m - 20dB = 96.4 dBuV/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
2419.88	116.4	109.5	V	--	--	--	--
2419.88	108.8	101.9	H	--	--	--	--
1504.00	55.6	46.4	V	54.0	96.4	-7.6	PASS *
1504.00	48.7	40.4	H	54.0	96.4	-13.6	PASS *
3008.00	38.0	28.3	V	54.0	96.4	-68.1	PASS
3008.00	36.1	24.1	H	54.0	96.4	-72.3	PASS
4512.00	43.3	34.4	V	54.0	96.4	-19.6	PASS *
4512.00	41.8	30.2	H	54.0	96.4	-23.8	PASS *
4838.00	55.2	34.6	V	54.0	96.4	-19.4	PASS *
4838.00	50.1	30.7	H	54.0	96.4	-23.3	PASS *
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

Channel #: 15, Frequency: 2453.625 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, wide, 11 chips/symbol, Data Rate: 11.25 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 117.3 dBuV/m Limit = 117.3dBuV/m - 20dB = 97.3 dBuV/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
2453.63	117.3	110.4	V	--	--	--	--
2453.63	106.9	100.0	H	--	--	--	--
1538.00	54.8	44.2	V	54.0	97.3	-9.8	PASS *
1538.00	35.6	27.8	H	54.0	97.3	-26.2	PASS *
3076.00	47.8	40.2	V	54.0	97.3	-57.1	PASS
3076.00	44.1	36.3	H	54.0	97.3	-61.0	PASS
4614.00	39.3	28.3	V	54.0	97.3	-25.7	PASS *
4614.00	41.8	33.5	H	54.0	97.3	-20.5	PASS *
4906.00	55.4	32.9	V	54.0	97.3	-21.1	PASS *
4906.00	59.1	33.7	H	54.0	97.3	-20.3	PASS *
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

Channel #: 17, Frequency: 2462.0625 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, medium, 11 chips/symbol, Data Rate: 5.625 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 117.8 dBuV/m Limit = 117.8dBuV/m - 20dB = 97.8 dBuV/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
2462.06	117.8	110.9	V	--	--	--	--
2462.06	110.8	103.9	H	--	--	--	--
1547.00	54.4	45.3	V	54.0	97.8	-8.7	PASS *
1547.00	52.9	43.6	H	54.0	97.8	-10.4	PASS *
3094.00	45.0	37.1	V	54.0	97.8	-60.7	PASS
3094.00	39.3	30.8	H	54.0	97.8	-67.0	PASS
4924.00	55.9	35.7	V	54.0	97.8	-18.3	PASS *
4924.00	42.6	40.9	H	54.0	97.8	-13.1	PASS *
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

Channel #: 18, Frequency: 2464.875 MHz **Full Rated Peak Power: 190 mW** **Modulation: DQPSK, narrow, 11 chips/symbol, Data Rate: 4.5 Mb/s, 2 bits/symbol**				**Power Level in 1 MHz BW: 117.1 dBuV/m** **Limit = 117.1dBuV/m - 20dB = 97.1 dBuV/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**
1549.00	52.1	43.1	V	54.0	97.1	-10.9	PASS *
1549.00	52.7	44.6	H	54.0	97.1	-9.4	PASS *
2464.88	117.1	110.2	V	54.0	97.1	--	--
2464.88	110.8	103.9	H	54.0	97.1	--	--
3098.00	44.0	36.2	V	54.0	97.1	-60.9	PASS
3098.00	41.9	34.1	H	54.0	97.1	-63.0	PASS
4647.00	40.1	30.4	V	54.0	97.1	-23.6	PASS *
4647.00	41.4	32.5	H	54.0	97.1	-21.5	PASS *
4928.00	47.1	40.2	V	54.0	97.1	-13.8	PASS *
4928.00	39.3	27.4	H	54.0	97.1	-26.6	PASS *
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

4.4.2 Huber Suhner 1x10 Patch Antenna, P/N: 65247322, Gain: 16.5 dBi

Channel #: 3, Frequency: 2408.625 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, narrow, 11 chips/symbol, Data Rate: 4.5 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 126.3 dBuV/m Limit = 106.3 dBuV/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
1493.00	61.4	48.1	V	54.0	106.3	-5.9	PASS
1493.00	60.1	49.4	H	54.0	106.3	-4.6	PASS
2373.00	72.1	51.3	H	54.0	106.3	-2.7	PASS
2390.00	65.2	47.4	H	54.0	106.3	-6.6	PASS
2408.63	114.6	--	V	--	--	--	--
2408.63	126.3	--	H	--	--	--	--
4816.00	50.7	29.3	V	54.0	106.3	-24.7	PASS
4816.00	49.3	28.3	H	54.0	106.3	-25.7	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

Channel #: 4, Frequency: 2411.4375 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, medium , 11 chips/symbol, Data Rate: 5.625 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 125.3 dBuV/m Limit = 105.3 dBuV/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
1496.00	61.3	47.2	V	54.0	105.3	-6.8	PASS
1496.00	62.0	49.0	H	54.0	105.3	-5.0	PASS
2376.00	72.7	52.4	H	54.0	105.3	-1.6	PASS
2390.00	64.9	43.0	H	54.0	105.3	-11.0	PASS
2411.44	109.3	--	V	--	--	--	--
2411.44	125.3	--	H	--	--	--	--
4488.00	48.3	30.1	V	54.0	105.3	-75.2	PASS
4488.00	47.4	31.4	H	54.0	105.3	-73.9	PASS
4822.00	52.3	34.3	V	54.0	105.3	-19.7	PASS
4822.00	51.2	31.8	H	54.0	105.3	-22.2	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

Channel #: 6, Frequency: 2419.875 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, wide, 11 chips/symbol, Data Rate: 11.25 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 123.9 dBuV/m Limit = 103.9 dBuV/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
1504.00	60.1	47.0	V	54.0	103.9	-7.0	PASS
1504.00	62.8	49.8	H	54.0	103.9	-4.2	PASS
2379.30	67.1	43.9	H	54.0	103.9	-10.1	PASS
2385.30	73.1	50.3	H	54.0	103.9	-3.7	PASS
2390.00	73.2	46.1	H	54.0	103.9	-7.9	PASS
2419.88	108.6	--	V	--	--	--	--
2419.88	123.9	--	H	--	--	--	--
4512.00	48.2	29.4	V	54.0	103.9	-24.6	PASS
4512.00	47.6	30.0	H	54.0	103.9	-24.0	PASS
4838.00	55.0	33.9	V	54.0	103.9	-20.1	PASS
4838.00	50.3	30.4	H	54.0	103.9	-23.6	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

Channel #: 18, Frequency: 2464.875 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, narrow, 11 chips/symbol, Data Rate: 4.5 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 125.5 dBuV/m Limit = 105.5 dBuV/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
1549.00	61.3	46.9	V	54.0	105.5	-7.1	PASS
1549.00	60.7	47.0	H	54.0	105.5	-7.0	PASS
2383.50	67.3	42.6	H	54.0	105.5	-11.4	PASS
2464.88	111.3	--	V	--	--	--	--
2464.88	125.5	--	H	--	--	--	--
4647.00	50.2	34.6	V	54.0	105.5	-19.4	PASS
4647.00	48.3	31.0	H	54.0	105.5	-23.0	PASS
4928.00	50.4	31.0	V	54.0	105.5	-23.0	PASS
4928.00	50.4	31.5	H	54.0	105.5	-22.5	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

4.4.3 Huber Suhner 1x1 Patch Antenna, P/N:64958022, Gain: 8.5 dBi

Channel #: 3, Frequency: 2408.625 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, narrow, 11 chips/symbol, Data Rate: 4.5 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 119.5 dBuV/m Limit = 99.5 dBuV/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
1493.00	62.7	50.4	V	54.0	99.5	-3.6	PASS
1493.00	59.7	46.9	H	54.0	99.5	-7.1	PASS
2408.63	113.8	--	V	--	--	--	--
2408.63	119.5	--	H	--	--	--	--
4816.00	51.4	35.0	V	54.0	99.5	-19.0	PASS
4816.00	50.5	33.4	H	54.0	99.5	-20.6	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

Channel #: 4, Frequency: 2411.4375 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, medium , 11 chips/symbol, Data Rate: 5.625 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: dBuV/m Limit = dBuV/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
1496.00	59.3	42.7	V	54.0	105.2	-11.3	PASS
1496.00	59.5	42.7	H	54.0	105.2	-11.3	PASS
2376.70	63.8	40.6	H	54.0	105.2	-13.4	PASS
2390.00	62.8	40.9	H	54.0	105.2	-13.1	PASS
2411.44	115.5	--	V	--	--	--	--
2411.44	125.2	--	H	--	--	--	--
4488.00	48.2	34.0	V	54.0	105.2	-71.2	PASS
4488.00	48.3	32.6	H	54.0	105.2	-72.6	PASS
4822.00	49.3	34.5	V	54.0	105.2	-19.5	PASS
4822.00	50.8	35.4	H	54.0	105.2	-18.7	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

Channel #: 6, Frequency: 2419.875 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, wide, 11 chips/symbol, Data Rate: 11.25 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 123.3 dBuV/m Limit = 103.3 dBuV/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
1504.00	61.3	47.3	V	54.0	103.3	-6.7	PASS
1504.00	61.8	48.8	H	54.0	103.3	-5.2	PASS
2385.00	60.4	46.1	V	54.0	103.3	-7.9	PASS
2385.00	73.9	58.6	H	54.0	103.3	4.6	PASS
2390.00	69.1	44.6	H	54.0	103.3	-9.4	PASS
2419.88	112.8	--	V	--	--	--	--
2419.88	123.3	--	H	--	--	--	--
4838.00	50.6	30.4	V	54.0	103.3	-23.6	PASS
4838.00	53.3	36.9	H	54.0	103.3	-17.2	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

Channel #: 18, Frequency: 2464.875 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, narrow, 11 chips/symbol, Data Rate: 4.5 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 125.4 dBuV/m Limit = 105.4 dBuV/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
2464.88	114.1	--	V	--	--	--	--
2464.88	125.4	--	H	--	--	--	--
2383.50	71.5	43.9	H	54.0	98.5	-54.6	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

4.4.4 Andrew Omni Antenna , P/N: RT1N0F-024V-013A, Gain: 13 dBi

Channel #: 3, Frequency: 2408.625 MHz **Full Rated Peak Power: 190 mW** **Modulation: DQPSK, narrow, 11 chips/symbol,** **Data Rate: 4.5 Mb/s, 2 bits/symbol**				**Power Level in 1 MHz BW: 125.3 dBuV/m** **Limit = 105.3 dBuV/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
1493.00	62.0	44.4	V	54.0	105.3	-9.7	PASS
1493.00	59.6	45.4	H	54.0	105.3	-8.7	PASS
2374.10	66.4	47.3	V	54.0	105.3	-6.7	PASS
2384.00	60.1	42.7	V	54.0	105.3	-11.3	PASS
2390.00	69.4	45.7	V	54.0	105.3	-8.3	PASS
2408.63	125.3	--	V	--	--	--	--
2408.63	115.1	--	H	--	--	--	--
4816.00	52.3	32.6	V	54.0	105.3	-21.4	PASS
4816.00	51.5	32.7	H	54.0	105.3	-21.3	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

Channel #: 4, Frequency: 2411.4375 MHz **Full Rated Peak Power: 190 mW** **Modulation: DQPSK, medium , 11 chips/symbol,** **Data Rate: 5.625 Mb/s, 2 bits/symbol**				**Power Level in 1 MHz BW: 124.6 dBuV/m** **Limit = 104.6 dBuV/m**			
(MHz) FREQUENCY	(dBuV/m) RF PEAK LEVEL	(dBuV/m) RF AVG LEVEL	(H/V) ANTENNA PLANE	(dBuV/m) LIMIT 15.209	(dBuV/m) LIMIT 15.247	(dB) MARGIN	FAIL PASS/
1496.00	64.4	50.7	V	54.0	104.6	-3.3	PASS
1496.00	60.3	46.8	H	54.0	104.6	-7.2	PASS
2377.00	69.8	51.1	V	54.0	104.6	-2.9	PASS
2390.00	63.7	43.6	V	54.0	104.6	-10.4	PASS
2411.44	124.6	117.7	V	54.0	104.6	63.7	PASS
2411.44	112.0	105.1	H	54.0	104.6	51.1	PASS
4488.00	50.2	31.9	V	54.0	104.6	-72.8	PASS
4488.00	48.5	30.9	H	54.0	104.6	-73.7	PASS
4822.00	57.9	38.8	V	54.0	104.6	-15.2	PASS
4822.00	57.7	37.8	H	54.0	104.6	-16.2	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

Channel #: 6, Frequency: 2419.875 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, wide, 11 chips/symbol, Data Rate: 11.25 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 120.6 dBuV/m Limit = 100.6 dBuV/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
1504.00	63.0	46.6	V	54.0	100.6	-7.4	PASS
1504.00	60.0	42.5	H	54.0	100.6	-11.5	PASS
2385.00	67.6	46.5	V	54.0	100.6	-7.5	PASS
2419.88	120.6	--	V	--	--	--	--
2419.88	107.3	--	H	--	--	--	--
4838.00	54.1	33.7	V	54.0	100.6	-20.3	PASS
4838.00	50.0	30.3	H	54.0	100.6	-23.7	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

Channel #: 18, Frequency: 2464.875 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, narrow, 11 chips/symbol, Data Rate: 4.5 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 119.6 dBuV/m Limit = 99.6 dBuV/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
1549.00	61.1	45.4	V	54.0	99.6	-8.6	PASS
1549.00	59.8	46.9	H	54.0	99.6	-7.1	PASS
2464.88	119.6	--	V	--	--	--	--
2464.88	111.4	--	H	--	--	--	--
4647.00	50.2	35.0	V	54.0	99.6	-19.0	PASS
4647.00	48.8	33.8	H	54.0	99.6	-20.2	PASS
4928.00	53.5	38.2	V	54.0	99.6	-15.8	PASS
4928.00	53.3	34.8	H	54.0	99.6	-19.2	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

4.5 *Transmitted Power Density of a Direct Sequence Spread Spectrum System, FCC CFR 47, Para. 15.247(d)*

PRODUCT NAME: **ISP DIRECT INDOOR & OUTDOOR UNITS, Model No.: 2401-01 (indoor) and 2401-02 (outdoor)**

FCC REQUIREMENTS:

For a direct sequence system, the transmitted power density average over any 1 second interval shall not be greater than 8 dBm in any 3 KHz bandwidth within this band.

CLIMATE CONDITION:

Standard Temperature and Humidity:

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

POWER INPUT:

AC 120 V 60Hz from Elpac external switching power supply, model WRI4232.

TEST EQUIPMENT:

- Advantest Spectrum Analyzer, Model R3271, S/N: 15050203
- Bird 20 dB Attenuator, 50 Ohm IN/OUT

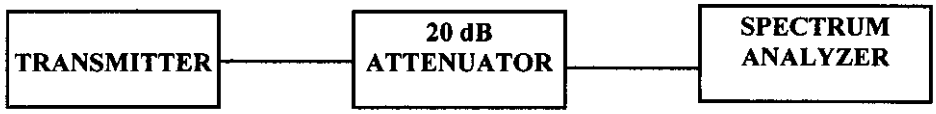
METHOD OF MEASUREMENT:

A scan was made by using a spectrum analyzer with the detector function set to NORMAL mode.

Locate and zoom in on emission peak(s) within the passband. Set RBW = 3 KHz, VBW $\geq$ RBW, Sweep = SPAN/3 KHz. For example, a span of 1.5 MHz, the sweep should be $1.6x10^6/3.0x10^3$= 500 seconds. The measured peak level must be no greater than +8 dBm.

- For devices with spectrum line spacing greater than 3 KHz no change is required.
- For devices with spectrum line spacing equal to or less than 3 KHz, the resolution bandwidth must be reduced below 3 KHz until the individual lines in the spectrum are resolved. The measurement data must then be normalized to 3 KHz by summing the power of all the individual spectral lines within 3 KHz band (in linear power units) to determine compliance.
- If the spectrum line spacing cannot be resolved on the available spectrum analyzer, the noise density function on most modern conventional spectrum analyzer will directly measure the noise power density normalized to 1 Hz noise power bandwidth. Add 30 dB for correction to 3 KHz.
- Should all the above fail or any controversy develop regarding accuracy of measurement, the Laboratory will use HP 89440A Vector Signal Analyzer for final measurement unless a clear showing can be made for a further alternate.

TEST ARRANGEMENT



TEST RESULTS: Conforms.

TEST PERSONNEL: Mr. Tri M. Luu, P.Eng.

DATE: Feb. 26 & Mar. 04, 1998

MEASUREMENT DATA:

TEST CONFIGURATION

- *The transmitter was coupled to the Spectrum Analyzer through a 20 dB attenuator.*
- *The insertion loss between the transmitter output terminal and the spectrum analyzer was measured to be 20 dB*
- *The channel frequencies were established on the extreme edges (both upper and lower) and middle of the 2408.625 - 2464.875 MHz band at its full rated output power. The emissions was investigated up to the tenth 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 Part 15.247(d)*

Channel No.	Channel Frequency	Modulation Bandwidth	Data Rate (Mb/s)	Chips per Symbol	Measured Power Density in 3 kHz BW (dBm)	FCC Limit (dBm)
3	2408.625	Narrow	4.5	11	-1.0	8.0
9	2431.125	Wide	11.25	11	1.8	8.0
17	2462.0625	Medium	5.625	11	-3.2	8.0

4.6 *Processing Gain of A Direct Sequence Spread Spectrum, FCC CFR 47, Para. 15.247(e)*

PRODUCT NAME: **ISP DIRECT INDOOR & OUTDOOR UNITS, Model No.: 2401-01 (indoor) and 2401-02 (outdoor)**

FCC REQUIREMENTS:

The processing gain of a direct sequence system shall be at least 10 dB. The processing gain shall be determined from the ratio in dB of the signal-to-noise ratio with the system spreading code turned off to the signal-to-noise ratio with the system spreading code turned on, as measured at the demodulated output of the receiver.

CLIMATE CONDITION:

Standard Temperature and Humidity:

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

POWER INPUT:

AC 120 V 60Hz from Elpac external switching power supply, model WRI4232.

TEST EQUIPMENT:

- Advantest Spectrum Analyzer, Model R3271, S/N: 15050203
- Bird 20 dB Attenuator, 50 Ohm IN/OUT
- IBM PS/1 & IBM 350 ThinkPad Host Computer(s)
- Fluke RF Signal Generator, Model 6061A, Freq. range: 10 KHz - 1050 MHz.
- HP 8900 RF Peak Power Meter, Measuring Frequency Range: 100 MHz - 18 GHz.

METHOD OF MEASUREMENT:

METHOD #1:- Jamming Margin Method

The processing gain may be measured using the CW jamming margin method. Figure 1 shows the test configuration. The test consists of stepping a signal generator in 50 KHz increments across the passband of the system. At each point, the generator level required to produce the recommended Bit Error Rate (BER) is recorded. This level is jammer level. The output power of the transmitting unit is measured at the same point. The Jammer to Signal (J/S) ratio is then calculated. Discard the worst 20% of the J/S data points. The lowest remaining J/S ratio is used when calculating the Process Gain.

The signal to noise ratio for an ideal non-coherent receiver is calculated from:

$$(1) \qquad Pe = 1/2e^{(-1/2(S/N)o)}$$

where: Pe = probability of error (BER)
(S/N)o = the required signal to noise ratio at the receiver output for a given received signal quality

Ref.: Viterbi, A.J. Principles of Coherent Communications (New York: McGraw-HILL 1966), Pg. 207

Using equation (1) shown above, calculate the signal to noise ratio required for your chosen BER. This value and the measured J/S ratio are used in the following equation to calculate the Process Gain (Gp) of the system.

$$Gp = (S/N)o+Mj+Lsys$$

Where:

(S/N)o: Theoretical signal to noise ratio required to maintain the normal operation just before the BERappears. In real measurements the maximum error of 0.001 is allowed in an ideal system using their modulation scheme with all codes turned off (i.e. no spreading or processing gain).

Mj: Maximum jammer to Signal Ratio that recorded at the detected BER.

Lsys: System losses such as non-ideal synchronization, tracking circuitry, non-optimal baseband receiver filtering and etc... These losses can be in excess of 2 dB for each transmitter and receiver pair. For the purpose of this processing gain calculation we assume a Lsys at its minimum value of 2 dB.

Ref.: Dixon, R, Spread Spectrum Systems. (New York: Wiley, 1984)

The Signal-to-Noise Ratio (S/N) with respect to the probability of bit error for a differentially QPSK (DQPSK) receiver in the presence of additive white Gaussian noise (AWGN) is given by Figure 4.5.1 as attached.

Ref.: Marvin Simon, Spread Spectrum Communication Handbook, page 695.

Since the CW jamming is a tone jamming, the (S/N)o for a AWGN jamming obtained from Figure 4.5.1 can be converted to the CW jamming or tone jamming using the formula (3.97) of the Marvin Simon Spread Spectrum Communication Handbook as follows:

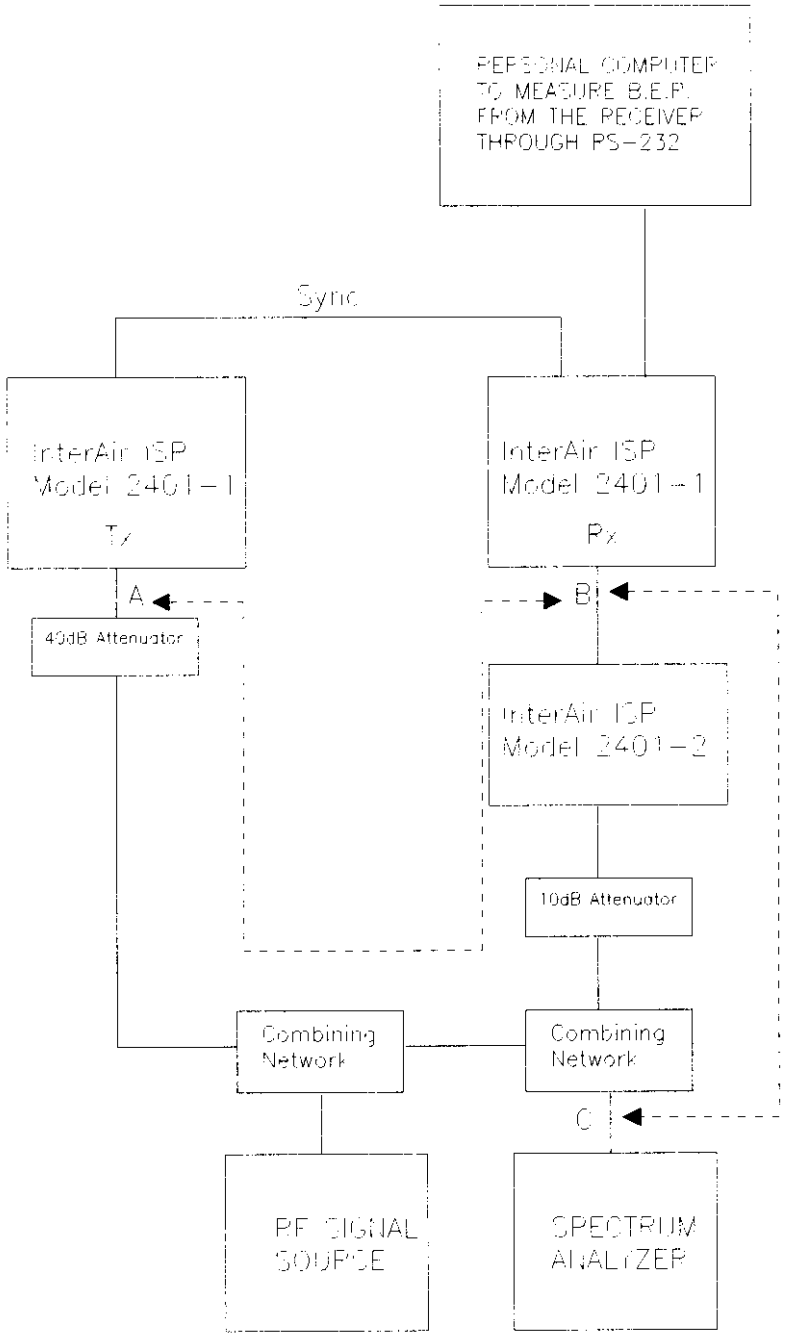
$(S/N)_o^t$ in dB = $(S/N)_o^{AWGN}$ / 0.8

TEST RESULTS: Conforms.

TEST PERSONNEL: Mr. Tri M. Luu, P.Eng.

DATE: Mar. 31 & Apr. 01, 1998

Figure 1:- SETUP FOR PROCESSING GAIN MEASUREMENT - JAMMING MARGIN METHOD



MEASUREMENT DATA:

Channel #4, Fc = 2411.4375 MHz	Data Rate = 1.023 Mbps (DQPSK), Medium
Chip Rate = 5.625 MHz	PN Code Length = 11 chips/symbol
6 dB BW = 5 MHz	

(S/N)o = 12 dB dB per attached Figure 4.5.1

Measured Processing Gain Gp = (S/N)o + Lsys + Mj = 15 + 2 + Mj = 17 + Mj (dB)

Theoretical Calculated Processing Gain = Chip Rate/Data rate = $\frac{5.625\ \text{MHz}}{(1.023\ \text{Mb/s})/(2\ \text{bits/symbol})}$ = 11.0 or 10.4 dB

Note:

- Total Peak Power from the EUT's Tx measured at the EUT's Rx Input: P_t = -46.7 dBm
- Jamming signal level at measured at the EUT's receiver input: J
- Mj = J-P_t
- The following shaded boxes are discarded worst measurements (19.1% of total measurement points)

SUMMARY OF TEST RESULTS	
Theoretical Process Gain	10.4 dB
Minimum Measured Process Gain with discard of 19.1% of the worst measurements	12.0 dB

Test Point	Jammer Signal Freq. +/- Fc (MHz)	(BER) (DQPSK)	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
1	-3.5	0.00001	12	4.5	1.7	18.2	
2	-3.5	0.00001	12	4.5	2.0	18.5	
3	-3.4	0.00001	12	4.5	1.6	18.1	
4	-3.4	0.00001	12	4.5	1.7	18.2	
5	-3.3	0.00001	12	4.5	0.6	17.1	
6	-3.3	0.00001	12	4.5	-0.4	16.1	
7	-3.2	0.00001	12	4.5	-0.4	16.1	
8	-3.2	0.00001	12	4.5	-0.4	16.1	
9	-3.1	0.00001	12	4.5	0.0	16.5	
10	-3.1	0.00001	12	4.5	0.8	17.3	
11	-3.0	0.00001	12	4.5	0.8	17.3	
12	-3.0	0.00001	12	4.5	1.6	18.1	
13	-2.9	0.00001	12	4.5	1.6	18.1	
14	-2.9	0.00001	12	4.5	1.7	18.2	
15	-2.8	0.00001	12	4.5	1.5	18.0	
16	-2.8	0.00001	12	4.5	1.1	17.6	
17	-2.7	0.00001	12	4.5	0.8	17.3	
18	-2.7	0.00001	12	4.5	0.7	17.2	
19	-2.6	0.00001	12	4.5	-0.4	16.1	
20	-2.6	0.00001	12	4.5	-2.4	14.1	
21	-2.5	0.00001	12	4.5	-2.7	13.8	
22	-2.5	0.00001	12	4.5	-2.8	13.7	
23	-2.4	0.00001	12	4.5	-2.9	13.6	
24	-2.4	0.00001	12	4.5	-2.9	13.6	
25	-2.3	0.00001	12	4.5	-2.6	13.9	
26	-2.3	0.00001	12	4.5	-2.6	13.9	

27	-2.2	0.00001	12	4.5	-2.5	14.0	
28	-2.2	0.00001	12	4.5	-2.9	13.6	
29	-2.1	0.00001	12	4.5	-3.6	12.9	
30	-2.1	0.00001	12	4.5	-4.4	12.1	
31	-2.0	0.00001	12	4.5	-4.5	12.0	
33	-1.9	0.00001	12	4.5	-4.5	12.0	
35	-1.8	0.00001	12	4.5	-4.4	12.1	
36	-1.8	0.00001	12	4.5	-3.8	12.7	
37	-1.7	0.00001	12	4.5	-3.2	13.3	
38	-1.7	0.00001	12	4.5	-3.1	13.4	
39	-1.6	0.00001	12	4.5	-3.3	13.2	
40	-1.6	0.00001	12	4.5	-4.0	12.5	
46	-1.3	0.00001	12	4.5	-4.3	12.2	
47	-1.2	0.00001	12	4.5	-3.9	12.6	
48	-1.2	0.00001	12	4.5	-3.8	12.7	
49	-1.1	0.00001	12	4.5	-3.3	13.2	
50	-1.1	0.00001	12	4.5	-3.8	12.7	
51	-1.0	0.00001	12	4.5	-3.8	12.7	
58	-0.7	0.00001	12	4.5	-4.0	12.5	
59	-0.6	0.00001	12	4.5	-3.3	13.2	
60	-0.6	0.00001	12	4.5	-2.7	13.8	
61	-0.5	0.00001	12	4.5	-3.8	12.7	
62	-0.5	0.00001	12	4.5	-4.2	12.3	
63	-0.4	0.00001	12	4.5	-4.1	12.4	
64	-0.4	0.00001	12	4.5	-4.0	12.5	
66	-0.3	0.00001	12	4.5	-3.3	13.2	
67	-0.2	0.00001	12	4.5	-3.8	12.7	
68	-0.2	0.00001	12	4.5	-3.6	12.9	
69	-0.1	0.00001	12	4.5	-2.7	13.8	
70	-0.1	0.00001	12	4.5	-3.0	13.5	
71	0.0	0.00001	12	4.5	-3.3	13.2	

75	0.2	0.00001	12	4.5	-4.5	12.0	
77	0.3	0.00001	12	4.5	-4.5	12.0	
82	0.6	0.00001	12	4.5	-4.2	12.3	
85	0.7	0.00001	12	4.5	-4.2	12.3	
86	0.8	0.00001	12	4.5	-4.4	12.1	
87	0.8	0.00001	12	4.5	-4.3	12.2	
88	0.9	0.00001	12	4.5	-4.2	12.3	
89	0.9	0.00001	12	4.5	-4.5	12.0	
90	1.0	0.00001	12	4.5	-4.5	12.0	
91	1.0	0.00001	12	4.5	-4.1	12.4	
92	1.1	0.00001	12	4.5	-3.7	12.8	
93	1.1	0.00001	12	4.5	-3.9	12.6	
94	1.2	0.00001	12	4.5	-4.0	12.5	
95	1.2	0.00001	12	4.5	-3.8	12.7	
96	1.3	0.00001	12	4.5	-4.1	12.4	
97	1.3	0.00001	12	4.5	-4.4	12.1	
99	1.4	0.00001	12	4.5	-4.2	12.3	
102	1.6	0.00001	12	4.5	-2.5	14.0	
103	1.6	0.00001	12	4.5	-2.2	14.3	
104	1.7	0.00001	12	4.5	-2.2	14.3	
105	1.7	0.00001	12	4.5	-3.8	12.7	
106	1.8	0.00001	12	4.5	-2.6	13.9	
107	1.8	0.00001	12	4.5	-2.8	13.7	
108	1.9	0.00001	12	4.5	-2.8	13.7	
109	1.9	0.00001	12	4.5	-2.4	14.1	
110	2.0	0.00001	12	4.5	-2.4	14.1	
111	2.0	0.00001	12	4.5	-2.2	14.3	
112	2.1	0.00001	12	4.5	-1.9	14.6	
113	2.1	0.00001	12	4.5	-2.7	13.8	
114	2.2	0.00001	12	4.5	-2.2	14.3	
115	2.2	0.00001	12	4.5	-2.0	14.5	
116	2.3	0.00001	12	4.5	-1.8	14.7	
117	2.3	0.00001	12	4.5	-2.2	14.3	
118	2.4	0.00001	12	4.5	-2.2	14.3	
119	2.4	0.00001	12	4.5	-2.4	14.1	
120	2.5	0.00001	12	4.5	-2.4	14.1	
121	2.5	0.00001	12	4.5	-2.4	14.1	
122	2.6	0.00001	12	4.5	-2.3	14.2	

123	2.6	0.00001	12	4.5	-2.2	14.3	
124	2.7	0.00001	12	4.5	-1.9	14.6	
125	2.7	0.00001	12	4.5	0.9	17.4	
126	2.8	0.00001	12	4.5	1.2	17.7	
127	2.8	0.00001	12	4.5	1.0	17.5	
128	2.9	0.00001	12	4.5	1.2	17.7	
129	2.9	0.00001	12	4.5	1.0	17.5	
130	3.0	0.00001	12	4.5	1.2	17.7	
131	3.0	0.00001	12	4.5	0.8	17.3	
132	3.1	0.00001	12	4.5	0.0	16.5	
133	3.1	0.00001	12	4.5	-0.7	15.8	
134	3.2	0.00001	12	4.5	-1.4	15.1	
135	3.2	0.00001	12	4.5	-1.6	14.9	
136	3.3	0.00001	12	4.5	-1.6	14.9	
137	3.3	0.00001	12	4.5	-0.5	16.0	
138	3.4	0.00001	12	4.5	0.0	16.5	
139	3.4	0.00001	12	4.5	0.4	16.9	
140	3.5	0.00001	12	4.5	0.7	17.2	
141	3.5	0.00001	12	4.5	-0.1	16.4	

Channel #6, Fc = 2419.8750 MHz	**Data Rate = 2.045 Mbps (DQPSK), Wide**
Chip Rate = 11.25 MHz	**PN Code Length = 11 chips/symbol**
6 dB BW = 8.4 MHz	

(S/N)o = 12 dB per attached Figure 4.5.1

Measured Processing Gain Gp = (S/N)o + Lsys + Mj = 15 + 2 + Mj = 17 + Mj (dB)

Theoretical Calculated Processing Gain = Chip Rate/Data rate = $\frac{11.25\ \text{MHz}}{(2.045\ \text{Mb/s})/(2\ \text{bits/symbol})}$ = 11.0 or 10.4 dB

Note:

- Total Peak Power from the EUT's Tx measured at the EUT's Rx Input: P_t = -46.7 dBm
- Jamming signal level at measured at the EUT's receiver input: J
- Mj = J-P_t
- The following shaded boxes are discarded worst measurements (17.9% of total measurement points)

SUMMARY OF TEST RESULTS	
Theoretical Process Gain	**10.4 dB**
Minimum Measured Process Gain with discard of 17.9% of the worst measurements	**10.5 dB**

Test Point	Jammer Signal Freq. +/- Fc (MHz)	(BER) (DQPSK)	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
1	-5.0	0.00001	12	4.5	-3.7	12.8	
2	-5.0	0.00001	12	4.5	-4.2	12.3	
3	-4.9	0.00001	12	4.5	-4.2	12.3	
4	-4.9	0.00001	12	4.5	-4.6	11.9	
5	-4.8	0.00001	12	4.5	-4.6	11.9	
6	-4.8	0.00001	12	4.5	-4.1	12.4	
7	-4.7	0.00001	12	4.5	-3.6	12.9	
8	-4.7	0.00001	12	4.5	-3.6	12.9	
9	-4.6	0.00001	12	4.5	-3.6	12.9	
10	-4.6	0.00001	12	4.5	-3.5	13.0	
11	-4.5	0.00001	12	4.5	-3.5	13.0	
12	-4.5	0.00001	12	4.5	-3.4	13.1	
13	-4.4	0.00001	12	4.5	-3.5	13.0	
14	-4.4	0.00001	12	4.5	-3.6	12.9	
15	-4.3	0.00001	12	4.5	-4.3	12.2	
16	-4.3	0.00001	12	4.5	-4.9	11.6	
17	-4.2	0.00001	12	4.5	-5.6	10.9	
18	-4.2	0.00001	12	4.5	-5.7	10.8	
19	-4.1	0.00001	12	4.5	-5.8	10.7	
20	-4.1	0.00001	12	4.5	-5.8	10.7	

27	-3.7	0.00001	12	4.5	-6.0	10.5	
28	-3.7	0.00001	12	4.5	-6.0	10.5	
29	-3.6	0.00001	12	4.5	-6.0	10.5	
30	-3.6	0.00001	12	4.5	-5.0	11.5	
31	-3.5	0.00001	12	4.5	-5.2	11.3	
32	-3.5	0.00001	12	4.5	-5.0	11.5	
33	-3.4	0.00001	12	4.5	-4.8	11.7	
34	-3.4	0.00001	12	4.5	-5.0	11.5	
35	-3.3	0.00001	12	4.5	-5.4	11.1	
[redacted]							
46	-2.8	0.00001	12	4.5	-6.0	10.5	
47	-2.7	0.00001	12	4.5	-6.0	10.5	
48	-2.7	0.00001	12	4.5	-5.8	10.7	
49	-2.6	0.00001	12	4.5	-5.8	10.7	
50	-2.6	0.00001	12	4.5	-5.8	10.7	
51	-2.5	0.00001	12	4.5	-5.4	11.1	
52	-2.5	0.00001	12	4.5	-5.0	11.5	
53	-2.4	0.00001	12	4.5	-5.0	11.5	
54	-2.4	0.00001	12	4.5	-5.0	11.5	
55	-2.3	0.00001	12	4.5	-4.6	11.9	
56	-2.3	0.00001	12	4.5	-4.8	11.7	
57	-2.2	0.00001	12	4.5	-5.1	11.4	
58	-2.2	0.00001	12	4.5	-5.2	11.3	
59	-2.1	0.00001	12	4.5	-5.4	11.1	
60	-2.1	0.00001	12	4.5	-5.8	10.7	
61	-2.0	0.00001	12	4.5	-5.8	10.7	
[redacted]							
64	-1.9	0.00001	12	4.5	-5.4	11.1	
65	-1.8	0.00001	12	4.5	-5.3	11.2	
66	-1.8	0.00001	12	4.5	-5.5	11.0	
67	-1.7	0.00001	12	4.5	-5.6	10.9	
68	-1.7	0.00001	12	4.5	-5.5	11.0	
69	-1.6	0.00001	12	4.5	-5.4	11.1	
70	-1.6	0.00001	12	4.5	-4.5	12.0	
71	-1.5	0.00001	12	4.5	-5.8	10.7	
72	-1.5	0.00001	12	4.5	-4.4	12.1	
73	-1.4	0.00001	12	4.5	-4.9	11.6	
74	-1.4	0.00001	12	4.5	-4.9	11.6	

75	-1.3	0.00001	12	4.5	-5.1	11.4	
76	-1.3	0.00001	12	4.5	-5.2	11.3	
77	-1.2	0.00001	12	4.5	-5.1	11.4	
78	-1.2	0.00001	12	4.5	-5.4	11.1	
79	-1.1	0.00001	12	4.5	-5.6	10.9	
80	-1.1	0.00001	12	4.5	-5.6	10.9	
81	-1.0	0.00001	12	4.5	-5.6	10.9	
82	-1.0	0.00001	12	4.5	-5.9	10.6	
92	-0.5	0.00001	12	4.5	-5.8	10.7	
93	-0.4	0.00001	12	4.5	-5.1	11.4	
94	-0.4	0.00001	12	4.5	-5.1	11.4	
95	-0.3	0.00001	12	4.5	-5.1	11.4	
96	-0.3	0.00001	12	4.5	-5.1	11.4	
97	-0.2	0.00001	12	4.5	-5.1	11.4	
98	-0.2	0.00001	12	4.5	-5.5	11.0	
104	0.2	0.00001	12	4.5	-5.7	10.8	
105	0.2	0.00001	12	4.5	-5.2	11.3	
106	0.3	0.00001	12	4.5	-5.0	11.5	
107	0.3	0.00001	12	4.5	-5.1	11.4	
108	0.4	0.00001	12	4.5	-5.3	11.2	
109	0.4	0.00001	12	4.5	-5.5	11.0	
110	0.5	0.00001	12	4.5	-5.5	11.0	
111	0.5	0.00001	12	4.5	-5.7	10.8	
112	0.6	0.00001	12	4.5	-5.7	10.8	
113	0.6	0.00001	12	4.5	-5.7	10.8	
114	0.7	0.00001	12	4.5	-5.7	10.8	
115	0.7	0.00001	12	4.5	-5.6	10.9	
120	1.0	0.00001	12	4.5	-5.5	11.0	
121	1.0	0.00001	12	4.5	-5.5	11.0	
122	1.1	0.00001	12	4.5	-5.3	11.2	

123	1.1	0.00001	12	4.5	-5.3	11.2	
124	1.2	0.00001	12	4.5	-4.8	11.7	
125	1.2	0.00001	12	4.5	-5.3	11.2	
126	1.3	0.00001	12	4.5	-5.3	11.2	
127	1.3	0.00001	12	4.5	-4.8	11.7	
128	1.4	0.00001	12	4.5	-4.7	11.8	
129	1.4	0.00001	12	4.5	-4.6	11.9	
130	1.5	0.00001	12	4.5	-4.9	11.6	
131	1.5	0.00001	12	4.5	-4.9	11.6	
132	1.6	0.00001	12	4.5	-5.5	11.0	
133	**1.6**	**0.00001**	**12**	**4.5**	**-6.0**	**10.5**	
134	1.7	0.00001	12	4.5	-5.8	10.7	
135	1.7	0.00001	12	4.5	-5.5	11.0	
136	1.8	0.00001	12	4.5	-5.4	11.1	
137	1.8	0.00001	12	4.5	-5.7	10.8	
138	1.9	0.00001	12	4.5	-5.7	10.8	
139	1.9	0.00001	12	4.5	-5.5	11.0	
140	2.0	0.00001	12	4.5	-5.7	10.8	
141	2.0	0.00001	12	4.5	-5.2	11.3	
142	2.1	0.00001	12	4.5	-4.7	11.8	
143	2.1	0.00001	12	4.5	-4.3	12.2	
144	2.2	0.00001	12	4.5	-4.2	12.3	
145	2.2	0.00001	12	4.5	-4.4	12.1	
146	2.3	0.00001	12	4.5	-4.9	11.6	
147	2.3	0.00001	12	4.5	-5.1	11.4	
148	2.4	0.00001	12	4.5	-5.1	11.4	
149	2.4	0.00001	12	4.5	-5.1	11.4	
150	2.5	0.00001	12	4.5	-5.1	11.4	
151	2.5	0.00001	12	4.5	-5.2	11.3	
152	2.6	0.00001	12	4.5	-5.3	11.2	
153	2.6	0.00001	12	4.5	-5.3	11.2	
154	2.7	0.00001	12	4.5	-5.4	11.1	
155	2.7	0.00001	12	4.5	-5.3	11.2	
156	2.8	0.00001	12	4.5	-5.4	11.1	
157	2.8	0.00001	12	4.5	-5.4	11.1	
158	2.9	0.00001	12	4.5	-5.5	11.0	
159	2.9	0.00001	12	4.5	-5.8	10.7	
160	3.0	0.00001	12	4.5	-5.9	10.6	
161	3.0	0.00001	12	4.5	-5.9	10.6	
162	3.1	0.00001	12	4.5	-5.9	10.6	
163	3.1	0.00001	12	4.5	-5.5	11.0	
164	3.2	0.00001	12	4.5	-5.5	11.0	
165	3.2	0.00001	12	4.5	-5.5	11.0	
166	3.3	0.00001	12	4.5	-5.7	10.8	
167	3.3	0.00001	12	4.5	-5.7	10.8	
168	3.4	0.00001	12	4.5	-5.7	10.8	
169	3.4	0.00001	12	4.5	-5.6	10.9	
170	3.5	0.00001	12	4.5	-5.9	10.6	

171	3.5	0.00001	12	4.5	-5.9	10.6	
172	3.6	0.00001	12	4.5	-5.5	11.0	
173	3.6	0.00001	12	4.5	-5.5	11.0	
174	3.7	0.00001	12	4.5	-5.5	11.0	
175	3.7	0.00001	12	4.5	-5.5	11.0	
176	3.8	0.00001	12	4.5	-5.5	11.0	
177	3.8	0.00001	12	4.5	-4.8	11.7	
178	3.9	0.00001	12	4.5	-4.9	11.6	
179	3.9	0.00001	12	4.5	-4.9	11.6	
180	4.0	0.00001	12	4.5	-4.9	11.6	
181	4.0	0.00001	12	4.5	-4.9	11.6	
182	4.1	0.00001	12	4.5	-4.9	11.6	
183	4.1	0.00001	12	4.5	-4.5	12.0	
184	4.2	0.00001	12	4.5	-4.5	12.0	
185	4.2	0.00001	12	4.5	-4.1	12.4	
186	4.3	0.00001	12	4.5	-4.1	12.4	
187	4.3	0.00001	12	4.5	-3.9	12.6	
188	4.4	0.00001	12	4.5	-3.9	12.6	
189	4.4	0.00001	12	4.5	-3.9	12.6	
190	4.5	0.00001	12	4.5	-3.9	12.6	
191	4.5	0.00001	12	4.5	-3.7	12.8	
192	4.6	0.00001	12	4.5	-3.7	12.8	
193	4.6	0.00001	12	4.5	-3.7	12.8	
194	4.7	0.00001	12	4.5	-3.7	12.8	
195	4.7	0.00001	12	4.5	-3.7	12.8	
196	4.8	0.00001	12	4.5	-3.7	12.8	
197	4.8	0.00001	12	4.5	-3.7	12.8	
198	4.9	0.00001	12	4.5	-3.7	12.8	
199	4.9	0.00001	12	4.5	-3.7	12.8	
200	5.0	0.00001	12	4.5	-3.7	12.8	
201	5.0	0.00001	12	4.5	-3.3	13.2	

Channel #18, Fc = 2464.8750 MHz	Data Rate = 0.818 Mbps (DQPSK), Narrow
Chip Rate = 4.5 MHz	PN Code Length = 11 chips/symbol
6 dB BW = 4 MHz	

(S/N)o = 12 dB per attached Figure 4.5.1
Measured Processing Gain Gp = (S/N)o + Lsys + Mj = 15 + 2 + Mj = 17 + Mj (dB)
Theoretical Calculated Processing Gain = Chip Rate/Data rate = 4.5 MHz / (0.818 Mb/s)/(2 bits/symbol) = 11 or 10.4 dB

Note:
- Total Peak Power from the EUT's Tx measured at the EUT's Rx Input: P_t = -49.9 dBm
- Jamming signal level at measured at the EUT's receiver input: J
- Mj = J-P_t
- The following shaded boxes are discarded worst measurements (18.8% of total measurement points)

SUMMARY OF TEST RESULTS	
Theoretical Process Gain	10.4 dB
Minimum Measured Process Gain with discard of 18.8% of the worst measurements	10.7 dB

Test Point	Jammer Signal Freq. +/- Fc (MHz)	(BER) (DQPSK)	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)	Discarded Readings
1	-2.50	0.00001	12	4.5	-1.0	15.5	
2	-2.45	0.00001	12	4.5	-1.1	15.4	
3	-2.40	0.00001	12	4.5	-0.1	16.4	
4	-2.35	0.00001	12	4.5	0.0	16.5	
5	-2.30	0.00001	12	4.5	0.8	17.3	
6	-2.25	0.00001	12	4.5	1.3	17.8	
7	-2.20	0.00001	12	4.5	2.1	18.6	
8	-2.15	0.00001	12	4.5	1.6	18.1	
9	-2.10	0.00001	12	4.5	1.0	17.5	
10	-2.05	0.00001	12	4.5	0.2	16.7	
11	-2.00	0.00001	12	4.5	-0.4	16.1	
12	-1.95	0.00001	12	4.5	-1.7	14.8	
13	-1.90	0.00001	12	4.5	-1.6	14.9	
14	-1.85	0.00001	12	4.5	-1.3	15.2	
15	-1.80	0.00001	12	4.5	0.4	16.9	
16	-1.75	0.00001	12	4.5	0.6	17.1	
17	-1.70	0.00001	12	4.5	0.6	17.1	
18	-1.65	0.00001	12	4.5	0.1	16.6	
19	-1.60	0.00001	12	4.5	0.1	16.6	
20	-1.55	0.00001	12	4.5	0.5	17.0	
21	-1.50	0.00001	12	4.5	0.6	17.1	
22	-1.45	0.00001	12	4.5	0.6	17.1	
23	-1.40	0.00001	12	4.5	2.0	18.5	

Continued ...

Test Point	Jammer Signal Freq. +/- Fc	(BER) (DQPSK)	(S/N)o	System Loss Lsys	Jammer to Signal Ratio Mj	Measured Processing Gain	Discarded Readings
24	-1.35	0.00001	12	4.5	1.9	18.4	
25	-1.30	0.00001	12	4.5	2.1	18.6	
26	-1.25	0.00001	12	4.5	2.0	18.5	
27	-1.20	0.00001	12	4.5	2.4	18.9	
28	-1.15	0.00001	12	4.5	2.4	18.9	
29	-1.10	0.00001	12	4.5	2.4	18.9	
30	-1.05	0.00001	12	4.5	3.0	19.5	
31	-1.00	0.00001	12	4.5	-4.1	12.4	
32	-0.95	0.00001	12	4.5	-5.7	10.8	
33	-0.90	0.00001	12	4.5	-5.6	10.9	
34	-0.85	0.00001	12	4.5	-5.2	11.3	
35	-0.80	0.00001	12	4.5	-5.6	10.9	
36	-0.75	0.00001	12	4.5	-5.5	11.0	
							9
							15
39	-0.60	0.00001	12	4.5	-5.2	11.3	
40	-0.55	0.00001	12	4.5	-4.5	12.0	
41	-0.50	0.00001	12	4.5	-5.0	11.5	
42	**-0.45**	**0.00001**	**12**	**4.5**	**-5.8**	**10.7**	
							10
44	-0.35	0.00001	12	4.5	-5.6	10.9	
							13
							2
47	-0.20	0.00001	12	4.5	-5.5	11.0	
48	-0.15	0.00001	12	4.5	-4.9	11.6	
49	-0.10	0.00001	12	4.5	-4.7	11.8	
50	-0.05	0.00001	12	4.5	-4.4	12.1	
							4
52	0.05	0.00001	12	4.5	-4.8	11.7	
53	0.10	0.00001	12	4.5	-4.5	12.0	
54	0.15	0.00001	12	4.5	-3.9	12.6	
55	0.20	0.00001	12	4.5	-4.4	12.1	
56	0.25	0.00001	12	4.5	-5.1	11.4	
							6
58	0.35	0.00001	12	4.5	-4.9	11.6	
59	0.40	0.00001	12	4.5	-4.5	12.0	
60	0.45	0.00001	12	4.5	-5.3	11.2	
61	0.50	0.00001	12	4.5	-4.5	12.0	
							11
							7
64	0.65	0.00001	12	4.5	-5.7	10.8	
65	0.70	0.00001	12	4.5	-5.6	10.9	
							14

Continued ...

Test Point	Jammer Signal Freq. +/- Fc	(BER) (DQPSK)	(S/N)o	System Loss Lsys	Jammer to Signal Ratio Mj	Measured Processing Gain	Discarde Reading
67	0.80	0.00001	12	4.5	-5.2	11.3	
68	0.85	0.00001	12	4.5	-5.2	11.3	
69	0.90	0.00001	12	4.5	-5.2	11.3	
70	0.95	0.00001	12	4.5	-4.6	11.9	
71	1.00	0.00001	12	4.5	-4.6	11.9	
							8
							3
74	**1.15**	**0.00001**	**12**	**4.5**	**-5.8**	**10.7**	
							5
							1
							12
							16
							17
							18
81	**1.50**	**0.00001**	**12**	**4.5**	**-5.8**	**10.7**	
							19
83	**1.60**	**0.00001**	**12**	**4.5**	**-5.8**	**10.7**	
84	1.65	0.00001	12	4.5	-5.7	10.8	
85	1.70	0.00001	12	4.5	-4.8	11.7	
86	1.75	0.00001	12	4.5	-4.4	12.1	
87	1.80	0.00001	12	4.5	-4.4	12.1	
88	1.85	0.00001	12	4.5	-4.4	12.1	
89	1.90	0.00001	12	4.5	-4.4	12.1	
90	1.95	0.00001	12	4.5	-4.3	12.2	
91	2.00	0.00001	12	4.5	-5.2	11.3	
92	2.05	0.00001	12	4.5	-3.3	13.2	
93	2.10	0.00001	12	4.5	-0.8	15.7	
94	2.15	0.00001	12	4.5	0.7	17.2	
95	2.20	0.00001	12	4.5	0.9	17.4	
96	2.25	0.00001	12	4.5	0.9	17.4	
97	2.30	0.00001	12	4.5	1.2	17.7	
98	2.35	0.00001	12	4.5	1.0	17.5	
99	2.40	0.00001	12	4.5	0.6	17.1	
100	2.45	0.00001	12	4.5	1.0	17.5	
101	2.50	0.00001	12	4.5	1.0	17.5	

Test Point	Jammer Signal Freq. + /- Fc (MHz)	(BER) (DQPSK)	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)
23	-1.40	0.00001	15.0	2.0	2.0	19.0
24	-1.35	0.00001	15.0	2.0	1.9	18.9
25	-1.30	0.00001	15.0	2.0	2.1	19.1
26	-1.25	0.00001	15.0	2.0	2.0	19.0
27	-1.20	0.00001	15.0	2.0	2.4	19.4
28	-1.15	0.00001	15.0	2.0	2.4	19.4
29	-1.10	0.00001	15.0	2.0	2.4	19.4
30	-1.05	0.00001	15.0	2.0	3.0	20.0
31	-1.00	0.00001	15.0	2.0	-4.1	12.9
32	-0.95	0.00001	15.0	2.0	-5.7	11.3
33	-0.90	0.00001	15.0	2.0	-5.6	11.4
34	-0.85	0.00001	15.0	2.0	-5.2	11.8
35	-0.80	0.00001	15.0	2.0	-5.6	11.4
36	-0.75	0.00001	15.0	2.0	-5.5	11.5
37	-0.70	0.00001	15.0	2.0	-6.4	10.6
38	-0.65	0.00001	15.0	2.0	-5.9	11.1
39	-0.60	0.00001	15.0	2.0	-5.2	11.8
40	-0.55	0.00001	15.0	2.0	-4.5	12.5
41	-0.50	0.00001	15.0	2.0	-5.0	12.0
42	**-0.45**	**0.00001**	**15.0**	**2.0**	**-5.8**	**11.2**
43	-0.40	0.00001	15.0	2.0	-6.3	10.7
44	-0.35	0.00001	15.0	2.0	-5.6	11.4
45	-0.30	0.00001	15.0	2.0	-6.1	10.9
46	-0.25	0.00001	15.0	2.0	-6.8	10.2
47	-0.20	0.00001	15.0	2.0	-5.5	11.5
48	-0.15	0.00001	15.0	2.0	-4.9	12.1
49	-0.10	0.00001	15.0	2.0	-4.7	12.3
50	-0.05	0.00001	15.0	2.0	-4.4	12.6
51	0.00	0.00001	15.0	2.0	-6.6	10.4
52	0.05	0.00001	15.0	2.0	-4.8	12.2
53	0.10	0.00001	15.0	2.0	-4.5	12.5
54	0.15	0.00001	15.0	2.0	-3.9	13.1
55	0.20	0.00001	15.0	2.0	-4.4	12.6
56	0.25	0.00001	15.0	2.0	-5.1	11.9
57	0.30	0.00001	15.0	2.0	-6.5	10.6
58	0.35	0.00001	15.0	2.0	-4.9	12.1
59	0.40	0.00001	15.0	2.0	-4.5	12.5
60	0.45	0.00001	15.0	2.0	-5.3	11.7
61	0.50	0.00001	15.0	2.0	-4.5	12.5
62	0.55	0.00001	15.0	2.0	-6.3	10.7
63	0.60	0.00001	15.0	2.0	-6.5	10.5

Continued ..

Test Point	Jammer Signal Freq. +/- Fc (MHz)	(BER) (DQPSK)	(S/N)o (dB)	System Loss Lsys (dB)	Jammer to Signal Ratio Mj (dB)	Measured Processing Gain (dB)
64	0.65	0.00001	15.0	2.0	-5.7	11.3
65	0.70	0.00001	15.0	2.0	-5.6	11.4
66	0.75	0.00001	15.0	2.0	-5.1	10.9
67	0.80	0.00001	15.0	2.0	-5.2	11.8
68	0.85	0.00001	15.0	2.0	-5.2	11.8
69	0.90	0.00001	15.0	2.0	-5.2	11.8
70	0.95	0.00001	15.0	2.0	-4.6	12.4
71	1.00	0.00001	15.0	2.0	-4.6	12.4
72	1.05	0.00001	15.0	2.0	-6.5	10.5
73	1.10	0.00001	15.0	2.0	-6.7	10.3
74	1.15	0.00001	15.0	2.0	-5.8	11.2
75	1.20	0.00001	15.0	2.0	-6.6	10.4
76	1.25	0.00001	15.0	2.0	-7.0	10.0
77	1.30	0.00001	15.0	2.0	-6.3	10.7
78	1.35	0.00001	15.0	2.0	-5.9	11.1
79	1.40	0.00001	15.0	2.0	-5.9	11.1
80	1.45	0.00001	15.0	2.0	-5.9	11.1
81	**1.50**	**0.00001**	**15.0**	**2.0**	**-5.8**	**11.2**
82	1.55	0.00001	15.0	2.0	-5.9	11.1
83	**1.60**	**0.00001**	**15.0**	**2.0**	**-5.8**	**11.2**
84	1.65	0.00001	15.0	2.0	-5.7	11.3
85	1.70	0.00001	15.0	2.0	-4.8	12.2
86	1.75	0.00001	15.0	2.0	-4.4	12.6
87	1.80	0.00001	15.0	2.0	-4.4	12.6
88	1.85	0.00001	15.0	2.0	-4.4	12.6
89	1.90	0.00001	15.0	2.0	-4.4	12.6
90	1.95	0.00001	15.0	2.0	-4.3	12.7
91	2.00	0.00001	15.0	2.0	-5.2	11.8
92	2.05	0.00001	15.0	2.0	-3.3	13.7
93	2.10	0.00001	15.0	2.0	-0.8	16.2
94	2.15	0.00001	15.0	2.0	0.7	17.7
95	2.20	0.00001	15.0	2.0	0.9	17.9
96	2.25	0.00001	15.0	2.0	0.9	17.9
97	2.30	0.00001	15.0	2.0	1.2	18.2
98	2.35	0.00001	15.0	2.0	1.0	18.0
99	2.40	0.00001	15.0	2.0	0.6	17.6
100	2.45	0.00001	15.0	2.0	1.0	18.0
101	2.50	0.00001	15.0	2.0	1.0	18.0

4.7 AC Powerline Conducted Emissions, FCC CFR 47, Para. 15.107(a)

PRODUCT NAME: **ISP DIRECT INDOOR & OUTDOOR UNITS, Model No.: 2401-01 (indoor) and 2401-02 (outdoor)**

NAME OF TEST: **AC Powerline Conducted Emissions.**

FCC LIMIT:

The RF voltage conducted back onto the public utility lines shall not exceed 250 μV or 48.0 dBμV measured from 450 KHz to 30 MHz.

CLIMATE CONDITION:

Standard Temperature and Humidity:

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

POWER INPUT:

AC 120 V 60Hz from Elpac external switching power supply, model WRI4232.

TEST EQUIPMENT:

- Advantest R3271 Spectrum Analyzer, Frequency Range: 100Hz-26.5GHz, with built-in Peak, Quasi-Peak and Average Detectors.
- HP 11947A Transient Limiter, HP, Model 11947A, Frequency Range: 9KHz-200MHz, Attenuation: 10dB HP.
- HP 7475 Plotter
- EMCO 3825/2 LISN, Frequency Range: 9KHz-200MHz
- RF Shielded Enclosure (12x16x12 feet)

METHOD OF MEASUREMENTS:

Refer to ANSI C63.4-1992.

TEST RESULTS: Conforms.

TEST PERSONNEL: Mr. Tri M. Luu, P.Eng.

DATE: Mar. 04, 1998

MEASUREMENT DATA

AC POWER-LINE CONDUCTED EMISSIONS

REMARKS

- ***All rf emissions from 450 KHz to 30 MHz were scanned, and eight highest emission levels were recorded. See attached plots.***
- ***P: Peak Detector, 10 KHz RBW, VBW ≥ RBW***
- ***Q: CISPR QUASI-PEAK, 9 KHz RBW, VBW ≥ RBW***
- ***QP/BB: for broadband emission (QP level - AVG level > 6 dB); the recorded level was QP level less 13 dB.***

FREQUENCY (MHz)	RF LEVEL (dBuV)	RECEIVER DETECTOR (P/QP/AVG)	QP/NB LIMIT (dBuV)	QP/BB LIMIT (dBuV)	MARGIN (dB)	PASS/ FAIL	LINE TESTED (L1/L2)
0.450	43.9	Peak	48.0	61.0	-4.1	PASS	L1
4.380	42.0	Peak	48.0	61.0	-6.0	PASS	L1
8.300	39.7	Peak	48.0	61.0	-8.3	PASS	L1
17.170	35.7	Peak	48.0	61.0	-25.3	PASS	L1
27.930	30.6	Peak	48.0	61.0	-17.4	PASS	L1
0.790	37.1	Peak	48.0	61.0	-23.9	PASS	L2
4.420	39.8	Peak	48.0	61.0	-8.2	PASS	L2
8.600	37.7	Peak	48.0	61.0	-23.3	PASS	L2
16.580	33.6	Peak	48.0	61.0	-14.4	PASS	L2
27.890	29.7	Peak	48.0	61.0	-31.3	PASS	L2

5. EXHIBIT 5 - GENERAL TEST PROCEDURES

5.1 AC Powerline Conducted Emissions Measurements - General Test Method

- AC Powerline Conducted Emissions were performed in the shielded room, 16'(L) by 12'(W) by 12'(H).
- Conducted power-line measurements were made over the frequency range from 450 KHz to 30 MHz to determine the line-to-ground radio noise voltage which was conducted from the EUT power-input terminals that were directly connected to a public power network.
- The EUT normally received power from another device that connects to the public utility ac power lines, measurements would be made on that device with the EUT in operation to ensure that the device continues to comply with the appropriate limits while providing the EUT with power.
- If the EUT was operates only from internal or dedicated batteries, with no provisions for connection to the public utility ac power lines, ac power-line conducted measurements are not required.
- Table-top devices were placed on a platform of nominal size 1 m by 1.5m raised 80 cm above the conducting ground plane.
- The EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN to the power source. All unused 50-Ohm connectors of the LISN was terminated in 50-ohm when not connected to the measuring instruments.
- The line cord of the EUT connected to one LISN which was connected to the measuring instrument. Those power cords for the units of devices not under measurement were connected to a separate multiple ac outlets. Drawings and photographs of typically conducted emission test setups were shown in the Test Report. Each current-carrying conductor of the EUT shall be individually tested.
- The EUT was normally operated with a ground (safety) connection, the EUT was connected to the ground at the LISN through a conductor provided in the lead from the ac power mains to the LISN.
- The excess length of the power cord was folded back and forth in an 8-shape on a wooden strip with a vertical prong located on the top of the LISN case.
- The EUT was set-up in its typical configuration and operated in its various modes as described in 3.2 of the test report.
- A preliminary scan was made by using spectrum analyzer system with the detector function set to PEAK mode (10 KHz RBW, VBW $\geq$ RBW), frequency span 450KHz-30MHz.
- The maximum conducted 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 EUT azimuth.

  Step2. Manipulate the system cables and peripheral devices to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.

  Step3. The effects of various modes of operation is examined. This is done by varying equipment operation modes as step 2 is being performed.

  Step4. After completing step 1 through 3, record EUT and peripheral device configuration, mode of operation, cable configuration, signal levels and frequencies for final test.

- Each highest signal level at the maximized test configuration was zoomed in a small frequency span on the spectrum analyzer's display (the manipulation of cables and peripheral devices and EUT operation modes might have to be

repeated to obtain the highest signal level with the spectrum analyzer set to PEAK detector mode 10 KHz RBW and VBW ≥ RBW). The spectrum analyzer was then set to CISPR QUASI-PEAK detector mode (9 KHz RBW, 1 MHz VBW) and the final highest RF signal level and frequency was record.

- ***Broad-band ac Powerline conducted emissions***:- If the EUT exhibits ac Powerline conducted emissions that exceed the limit with the instrument set to the quasi-peak mode, then measurements should be made in the average mode. If the amplitude measured in the quasi-peak mode is at least 6 dB higher than the amplitude measured in the average mode, the level measured in quasi peak mode may be reduced by 13 dB before comparing it to the limit.

5.2 *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) Calibrated A.H. Systems log periodic antenna in the frequency range 1GHz - 18 GHz.
  4) Horn Antennas:
     a) Horn Antenna, Emco, Model 3160-09, 18-26.5GHz
     b) Horn Antenna, Emco, Model 3160-10, 26.5-40GHz
     c) Mixer, Tektronix, P/N 118-0098-00, 18-26.5GHz
     d) Mixer, Tektronix, P/N 119-0098-00, 26.5-40GHz
  5) 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 ≥ 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.

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:

$$\mathbf{FS = RA + AF + CF - AG}$$

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:.

Field Level in dBμV/m = 60 + 7.0 + 1.0 - 30 = 38.0 dBμV/m.

Field Level in μV/m = $10^{(38/20)}$ = 79.43 μV/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.

6. EXHIBIT 6 - INFORMATION RELATED TO EQUIPMENT UNDER TESTS

6.1 *FCC ID Labeling and Sketch of FCC Label Location*

Refer to the attached sheets

6.2 *Photographs of Equipment under Test*

Refer to the attached photographs

6.3 *System Block Diagram(s)*

Refer to the attached sheets

6.4 *Schematic Diagrams*

Refer to the attached sheets

6.5 *User's Manual with "FCC Information to User Statements"*

Refer to the attached Users' manual

4.3 AC POWERLINE CONDUCTED EMISSIONS, FCC CFR 47, PARA. 15.107(A)

PRODUCT NAME: **ISP DIRECT INDOOR & OUTDOOR UNITS, Model No.: 2401-01 (indoor) and 2401-02 (outdoor)**

NAME OF TEST: **AC Powerline Conducted Emissions.**

FCC LIMIT:

The RF voltage conducted back onto the public utility lines shall not exceed 250 μV or 48.0 dBμV measured from 450 KHz to 30 MHz.

CLIMATE CONDITION:

Standard Temperature and Humidity:

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

POWER INPUT:

AC 120 V 60Hz from Elpac external switching power supply, model WRI4232.

TEST EQUIPMENT:

- Advantest R3271 Spectrum Analyzer, Frequency Range: 100Hz-26.5GHz, with built-in Peak, Quasi-Peak and Average Detectors.
- HP 11947A Transient Limiter, HP, Model 11947A, Frequency Range: 9KHz-200MHz, Attenuation: 10dB HP.
- HP 7475 Plotter
- EMCO 3825/2 LISN, Frequency Range: 9KHz-200MHz
- RF Shielded Enclosure (12x16x12 feet)

METHOD OF MEASUREMENTS:

Refer to ANSI C63.4-1992.

TEST RESULTS: Conforms.

TEST PERSONNEL: Mr. Tri M. Luu, P.Eng.

DATE: Oct. 20, 1998

MEASUREMENT DATA

AC POWER-LINE CONDUCTED EMISSIONS

REMARKS

- *All rf emissions from 450 KHz to 30 MHz were scanned, and eight highest emission levels were recorded. See attached plots.*
- *P: Peak Detector, 10 KHz RBW, VBW ≥ RBW*
- *Q: CISPR QUASI-PEAK, 9 KHz RBW, VBW ≥ RBW*
- *QP/BB: for broadband emission (QP level - AVG level > 6 dB); the recorded level was QP level less 13 dB.*

4.3.1 External Power Supply, by Computer Product, Model CL40-76081, S/N: 2DFA3787

EUT Operation: transmitting and receiving RF modes

FREQUENCY (MHz)	RF LEVEL (dBuV)	RECEIVER DETECTOR (P/QP/AVG)	QP/NB LIMIT (dBuV)	QP/BB LIMIT (dBuV)	MARGIN (dB)	PASS/ FAIL	LINE TESTED (L1/L2)
0.758	40.3	QP	48.0	61.0	-7.7	PASS	L1
2.548	35.5	QP	48.0	61.0	-12.5	PASS	L1
16.939	39.2	QP	48.0	61.0	-8.8	PASS	L1
23.961	40.1	QP	48.0	61.0	-7.9	PASS	L1
0.758	40.3	QP	48.0	61.0	-7.7	PASS	L2
2.548	34.6	QP	48.0	61.0	-13.4	PASS	L2
16.939	39.8	QP	48.0	61.0	-8.2	PASS	L2
23.961	41.1	QP	48.0	61.0	-6.9	PASS	L2

4.3.2 External Power Supply, Model PSA-46-301, S/N: M75103371B2

EUT Operation: transmitting and receiving RF modes

FREQUENCY (MHz)	RF LEVEL (dBuV)	RECEIVER DETECTOR (P/QP/AVG)	QP/NB LIMIT (dBuV)	QP/BB LIMIT (dBuV)	MARGIN (dB)	PASS/ FAIL	LINE TESTED (L1/L2)
0.587	41.0	QP	48.0	61.0	-7.0	PASS	L1
1.352	41.0	QP	48.0	61.0	-7.0	PASS	L1
16.811	32.2	QP	48.0	61.0	-15.8	PASS	L1
20.547	35.6	QP	48.0	61.0	-12.4	PASS	L1
0.572	39.0	QP	48.0	61.0	-9.0	PASS	L2
1.320	40.5	QP	48.0	61.0	-7.5	PASS	L2
18.036	32.7	QP	48.0	61.0	-15.3	PASS	L2
20.739	34.2	QP	48.0	61.0	-13.8	PASS	L2

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APPLICANT: INTERAIR WIRELESS PRODUCT:
MODEL: RHD1-01 & RHD1-02 SN:
EMI Detector: [✓] Peak [✓] Quasi Peak [✓] Average Temp.: 18 °C, Humidity: 32 %
Line Tested: 1, Input Voltage: 120VAC, Tested by: HT Test Date: 22/10/98

Test Performed: CONDUCTED EMISSION FCC 15B
COMPUTER PRODUCTS POWER CONVERSION MINCLAD-76081

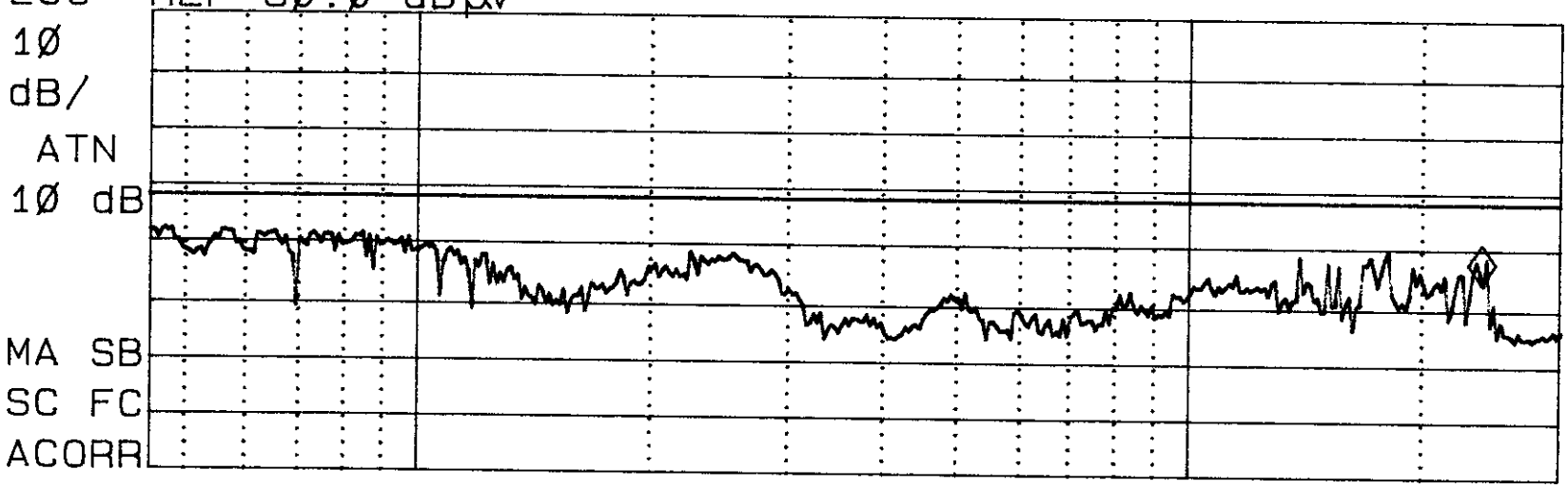
10: 38: 34 OCT 22, 1998

Signal	Freq (MHz)	PK Amp	QP Amp	AV Amp	QP Δ 1
1	Ø.757ØØØ	42.4	4Ø.3	29.4	-7.7
2	2.548475	39.3	35.5	28.6	-12.4
3	16.939375	41.5	39.2	21.6	-8.8
4	23.961300	41.9	4Ø.1	38.Ø	-7.9

No user Menu

STOP
3Ø.ØØ MHz

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 23.84 MHz
34.ØØ dBµV



START 45Ø kHz
IF BW 9.Ø kHz AVG BW 3Ø kHz
STOP 3Ø.ØØ MHz
SWP 1.33 sec

UltraTech
Engineering Labs Inc.

APPLICANT: INTERAIR WIRELESS PRODUCT: _____
MODEL: 2401-01 & 2402-02 SN: _____
EMI Detector: [✓] Peak [✓] Quasi Peak [✓] Average Temp.: 18 °C, Humidity: 32 %
Line Tested: 1, Input Voltage: 120VAC Tested by: HT Test Date: 22/10/98
Test Performed: CONDUCTED EMISSION FCC 15 B
SWITCHING POWER SUPPLY P/N: PSA-46-301

11: 24: 16 OCT 22, 1998

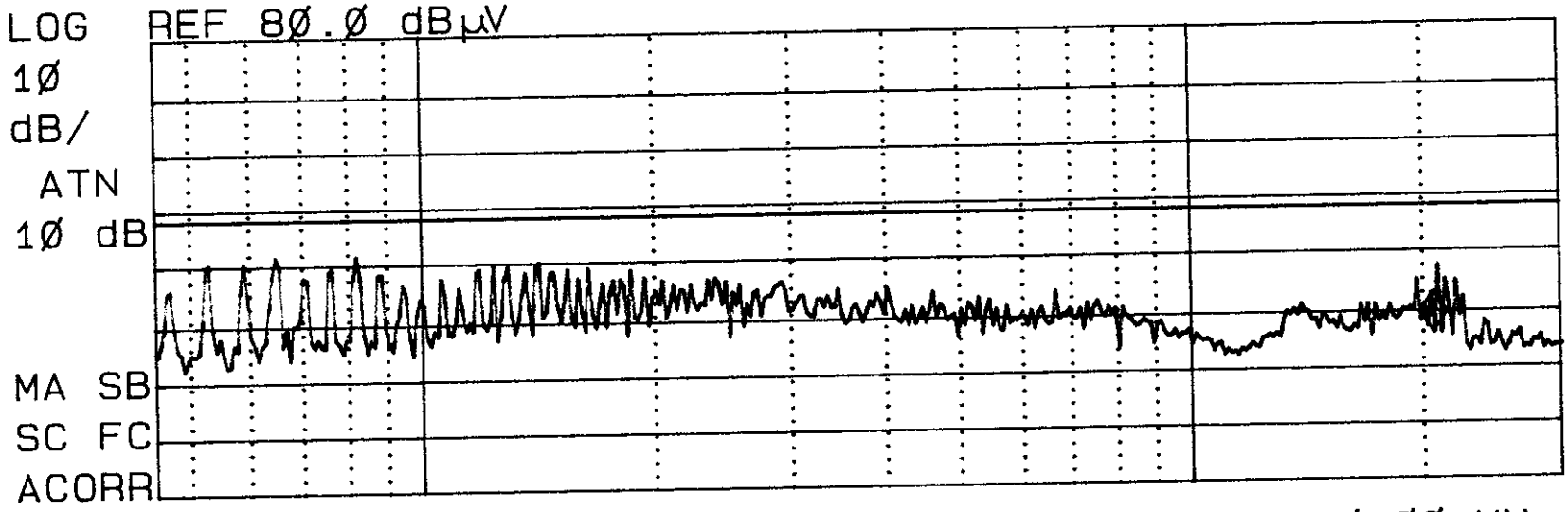
hp

Signal	Freq (MHz)	PK Amp	QP Amp	AV Amp	QP Δ L1
1	Ø.586975	43.2	41.Ø	35.9	-7.Ø
2	1.352850	44.2	41.7	33.1	-6.3
3	16.810575	35.5	32.2	19.6	-15.8
4	2Ø.546675	39.4	35.6	19.6	-12.4

No user Menu

STOP
3Ø.ØØ MHz

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2Ø.55 MHz
25.66 dBµV



UltraTech
Engineering Labs Inc.

APPLICANT: INTERAIR WIRELESS PRODUCT:
MODEL: 2401-01 & 2401-02 SN:
EMI Detector: [✓] Peak [✓] Quasi Peak [✓] Average Temp.: 18 °C, Humidity: 38 %
Line Tested: 2, Input Voltage: 120VAC, Tested by: HT Test Date: 22/10/98

Test Performed: CONDUCTED EMISSION FCC 15B
SWITCHING POWER SUPPLY M/N: PSA-46-301

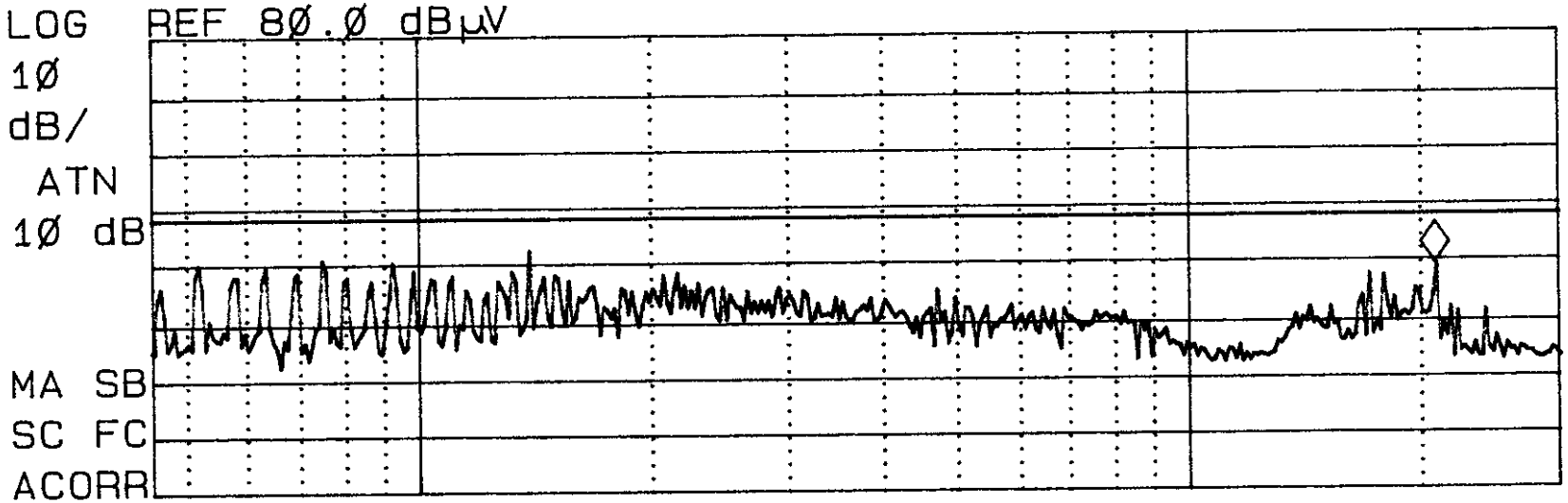
11: 10: 30 OCT 22, 1998

Signal	Freq (MHz)	PK Amp	QP Amp	AV Amp	QP∆L1
1	0.571500	42.1	39.0	34.5	-9.0
2	1.319800	43.0	40.5	33.2	-7.5
3	18.035775	36.4	32.7	21.4	-15.3
4	20.738575	38.6	34.2	19.8	-13.8

No user Menu

STOP
30.00 MHz

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 20.75 MHz
39.38 dBµV



UltraTech
Engineering Labs Inc.

APPLICANT: INTERAIR WIRELESS PRODUCT:
MODEL: 2401-01 & 2401-02 SN:
EMI Detector: [M] Peak [ ] Quasi Peak [M] Average Temp.: 18 °C, Humidity: 38 %
Line Tested: 2, Input Voltage: 120VAC Tested by: HT Test Date: 22/10/98

Test Performed: CONDUCTED EMISSION FCC 15 B
COMPUTER PRODUCTS POWER CONVERSION M/N: CLHP-16081

10: 53: 51 OCT 22, 1998

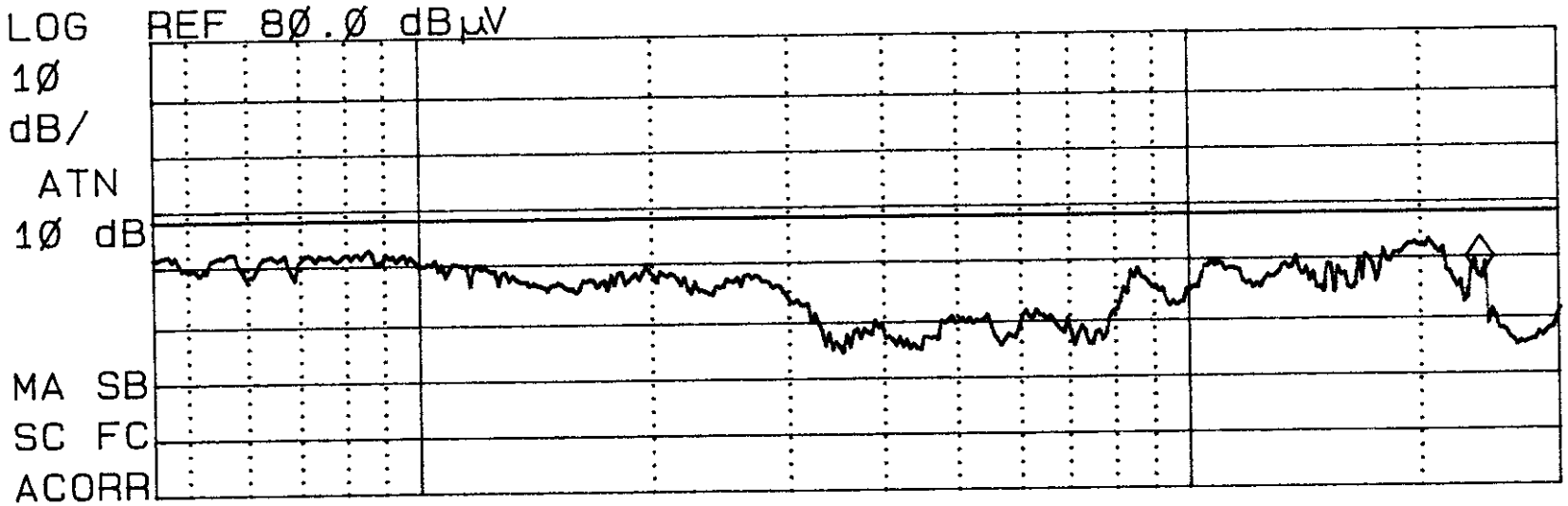
HP

Signal	Freq (MHz)	PK Amp	QP Amp	AV Amp	QP Δ L1
1	0.757810	42.5	40.3	29.3	-7.7
2	2.548470	38.3	34.6	26.8	-13.4
3	16.939374	43.0	39.8	26.4	-8.2
4	23.961300	42.9	41.1	39.0	-6.9

No user Menu

STOP
30.00 MHz

ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 23.84 MHz
36.45 dBµV



5. EXHIBIT 5 - GENERAL TEST PROCEDURES

5.1 AC POWERLINE CONDUCTED EMISSIONS MEASUREMENTS - GENERAL TEST METHOD

- AC Powerline Conducted Emissions were performed in the shielded room, 16'(L) by 12'(W) by 12'(H).
- Conducted power-line measurements were made over the frequency range from 450 KHz to 30 MHz to determine the line-to-ground radio noise voltage which was conducted from the EUT power-input terminals that were directly connected to a public power network.
- The EUT normally received power from another device that connects to the public utility ac power lines, measurements would be made on that device with the EUT in operation to ensure that the device continues to comply with the appropriate limits while providing the EUT with power.
- If the EUT was operates only from internal or dedicated batteries, with no provisions for connection to the public utility ac power lines, ac power-line conducted measurements are not required.
- Table-top devices were placed on a platform of nominal size 1 m by 1.5m raised 80 cm above the conducting ground plane.
- The EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN to the power source. All unused 50-Ohm connectors of the LISN was terminated in 50-ohm when not connected to the measuring instruments.
- The line cord of the EUT connected to one LISN which was connected to the measuring instrument. Those power cords for the units of devices not under measurement were connected to a separate multiple ac outlets. Drawings and photographs of typically conducted emission test setups were shown in the Test Report. Each current-carrying conductor of the EUT shall be individually tested.
- The EUT was normally operated with a ground (safety) connection, the EUT was connected to the ground at the LISN through a conductor provided in the lead from the ac power mains to the LISN.
- The excess length of the power cord was folded back and forth in an 8-shape on a wooden strip with a vertical prong located on the top of the LISN case.
- The EUT was set-up in its typical configuration and operated in its various modes as described in 3.2 of the test report.
- A preliminary scan was made by using spectrum analyzer system with the detector function set to PEAK mode (10 KHz RBW, VBW $\geq$ RBW), frequency span 450KHz-30MHz.
- The maximum conducted 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 EUT azimuth.

  Step2. Manipulate the system cables and peripheral devices to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.

Step3. The effects of various modes of operation is examined. This is done by varying equipment operation modes as step 2 is being performed.

Step4. After completing step 1 through 3, record EUT and peripheral device configuration, mode of operation, cable configuration, signal levels and frequencies for final test.

- Each highest signal level at the maximized test configuration was zoomed in a small frequency span on the spectrum analyzer's display (the manipulation of cables and peripheral devices and EUT operation modes might have to be repeated to obtain the highest signal level with the spectrum analyzer set to PEAK detector mode 10 KHz RBW and VBW $\geq$ RBW). The spectrum analyzer was then set to CISPR QUASI-PEAK detector mode (9 KHz RBW, 1 MHz VBW) and the final highest RF signal level and frequency was record.

- ***Broad-band ac Powerline conducted emissions***:- If the EUT exhibits ac Powerline conducted emissions that exceed the limit with the instrument set to the quasi-peak mode, then measurements should be made in the average mode. If the amplitude measured in the quasi-peak mode is at least 6 dB higher than the amplitude measured in the average mode, the level measured in quasi peak mode may be reduced by 13 dB before comparing it to the limit.

5.2 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) Calibrated A.H. Systems log periodic antenna in the frequency range 1GHz - 18 GHz.
  4) Horn Antennas:
     a) Horn Antenna, Emco, Model 3160-09, 18-26.5GHz
     b) Horn Antenna, Emco, Model 3160-10, 26.5-40GHz
     c) Mixer, Tektronix, P/N 118-0098-00, 18-26.5GHz
     d) Mixer, Tektronix, P/N 119-0098-00, 26.5-40GHz
  5) 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.

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:.

Field Level in dBμV/m = 60 + 7.0 + 1.0 - 30 = 38.0 dBμV/m.

Field Level in μV/m = $10^{(38/20)}$ = 79.43 μV/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.

Date: October 20, 1998
Tested by: Hung Trinh

INTERAIR WIRELESS

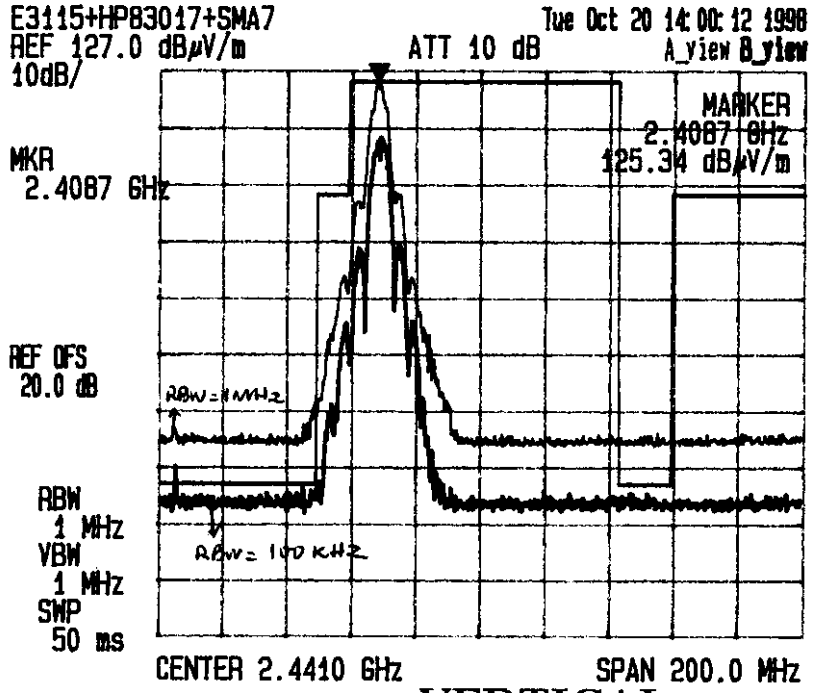
ISP DIRECT,MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

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

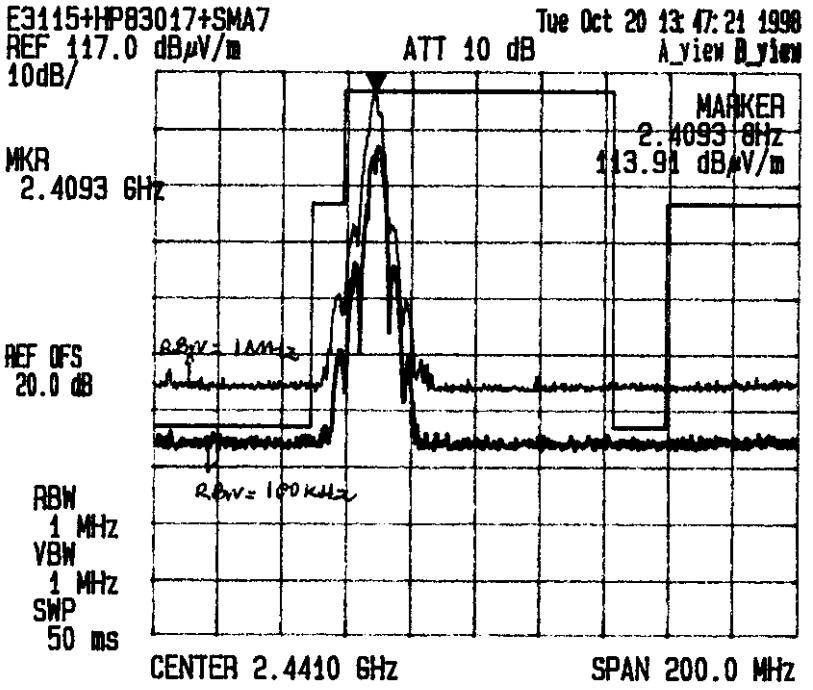
Modulation: DSSS,BW: NARROW (4.5 Mc/s), 11 chips/symbol,0.818 Mbps DQPSK

Antenna: YAGI, EXTERNAL, CUSTOMCRAFT, PC 24W15-V

Radiated Emissions Measurements @ 3 Meters



VERTICAL



HORIZONTAL

UltraTech
Engineering Labs Inc.

Date: October 20, 1998
Tested by: Hung Trinh

INTERAIR WIRELESS

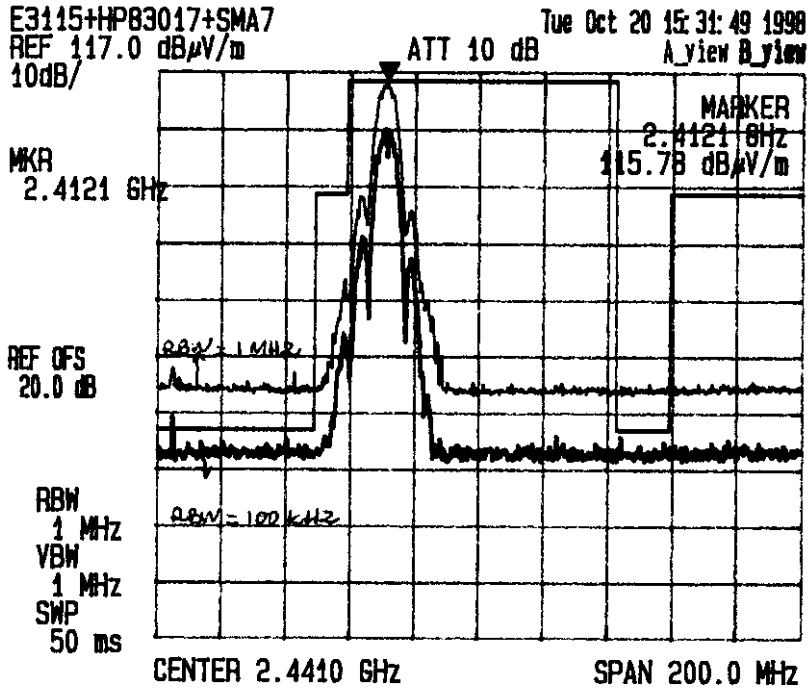
ISP DIRECT,MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

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

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

Antenna: MAGI ANTENNA, SUNCRAFT, PC RATIO 4

Radiated Emissions Measurements @ 3 Meters



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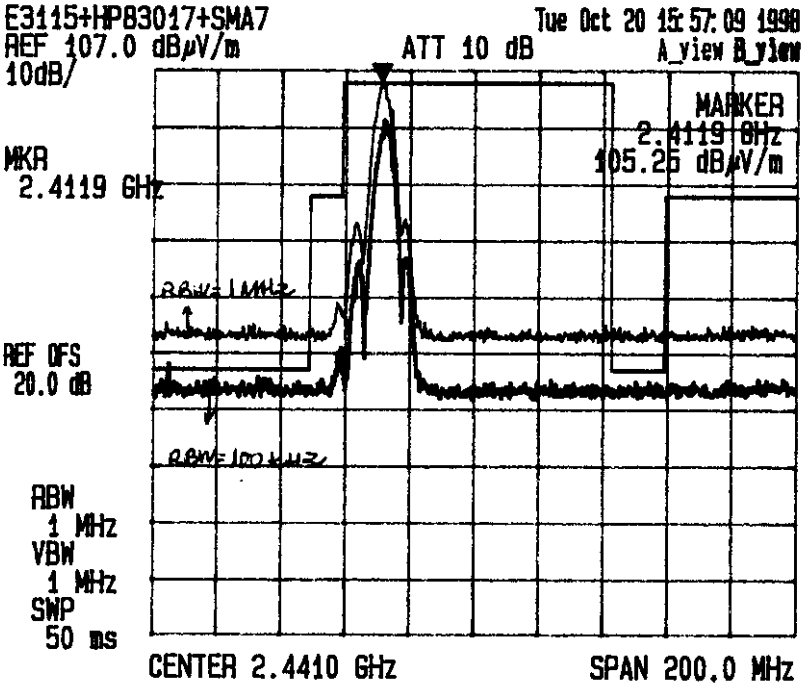


HORIZONTAL

UltraTech
Engineering Labs Inc.

Date: October 20, 1998
Tested by: Hung Trinh

INTERAIR WIRELESS

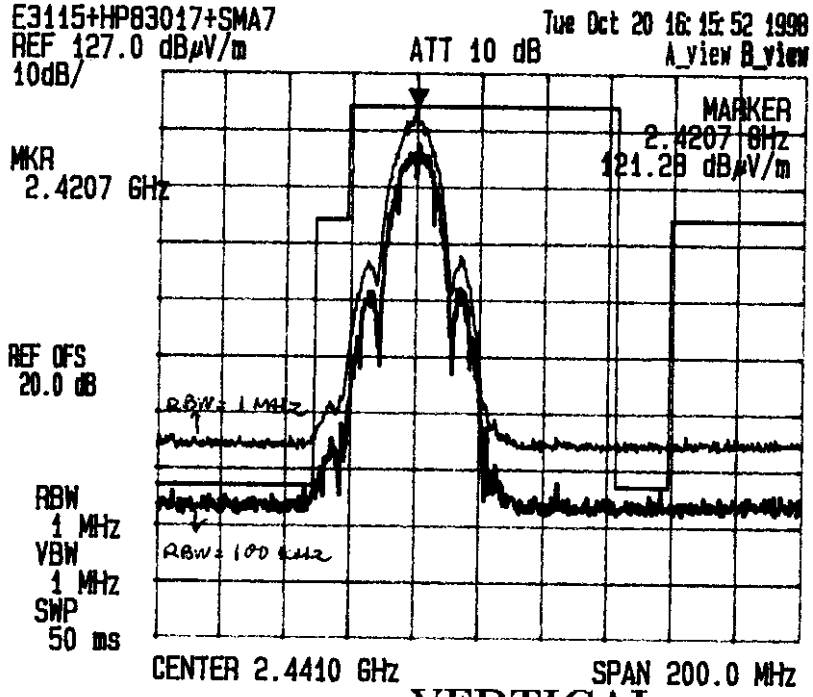
ISP DIRECT,MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

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: YAGI ANTENNA, CUSHCRAFT, PC 24615 V

Radiated Emissions Measurements @ 3 Meters



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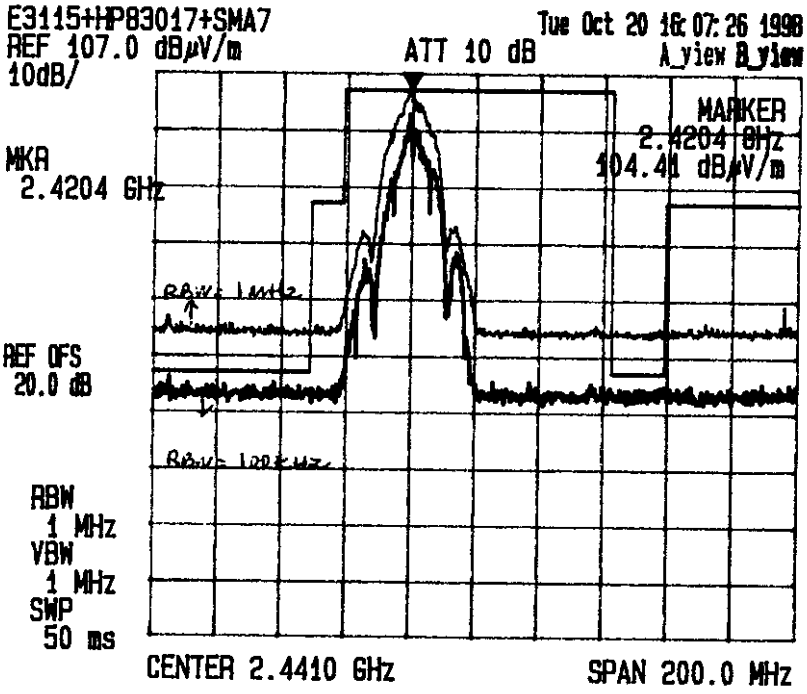


HORIZONTAL

UltraTech
Engineering Labs inc.

Date: October 22 1998
Tested by: Hung Trinh

INTERAIR WIRELESS

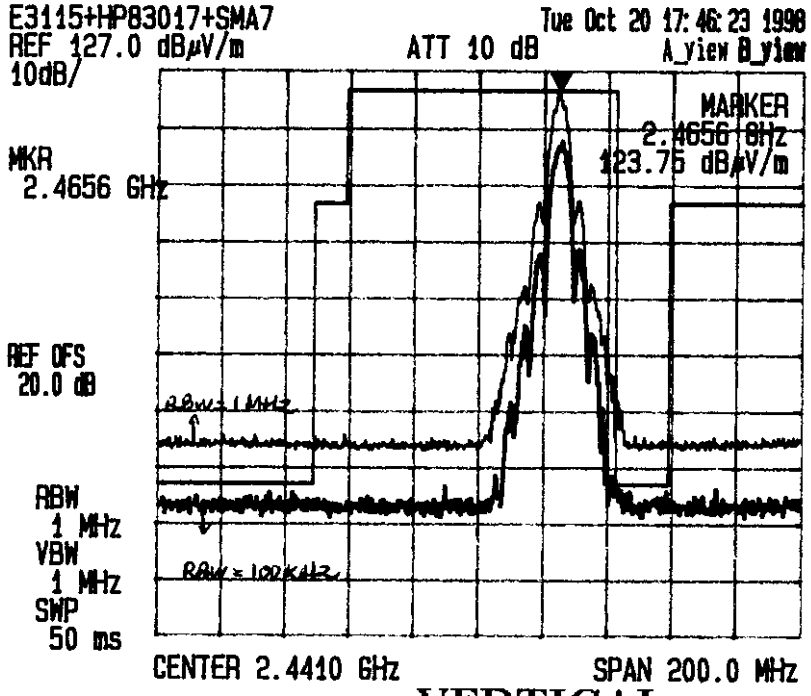
ISP DIRECT,MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

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: YAGI ANTENNA, CUSHCRAFT, PC 24WS-N

Radiated Emissions Measurements @ 3 Meters



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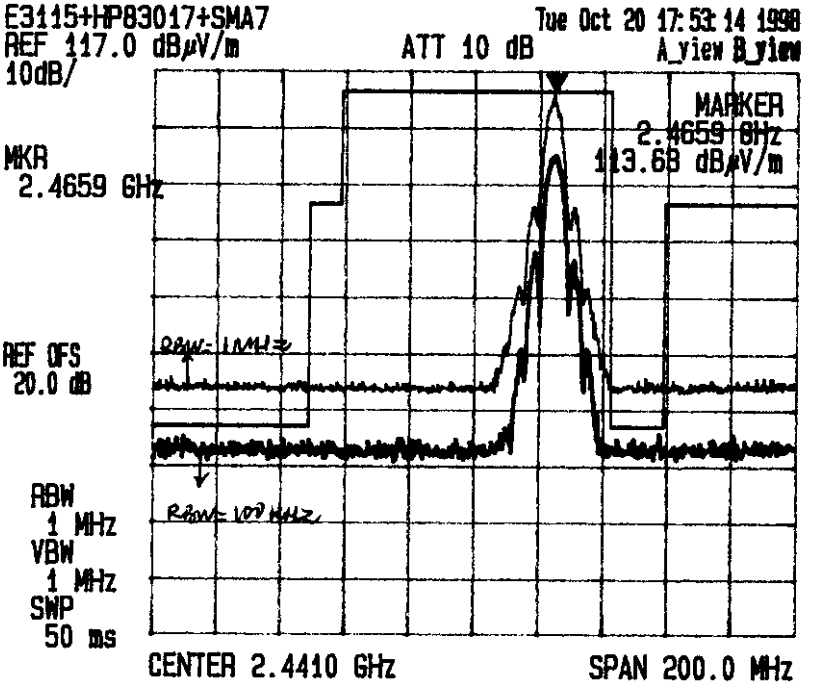


HORIZONTAL

UltraTech
Engineering Labs Inc.

Date: October 22, 1998
Tested by: Hung Trinh

INTERAIR WIRELESS

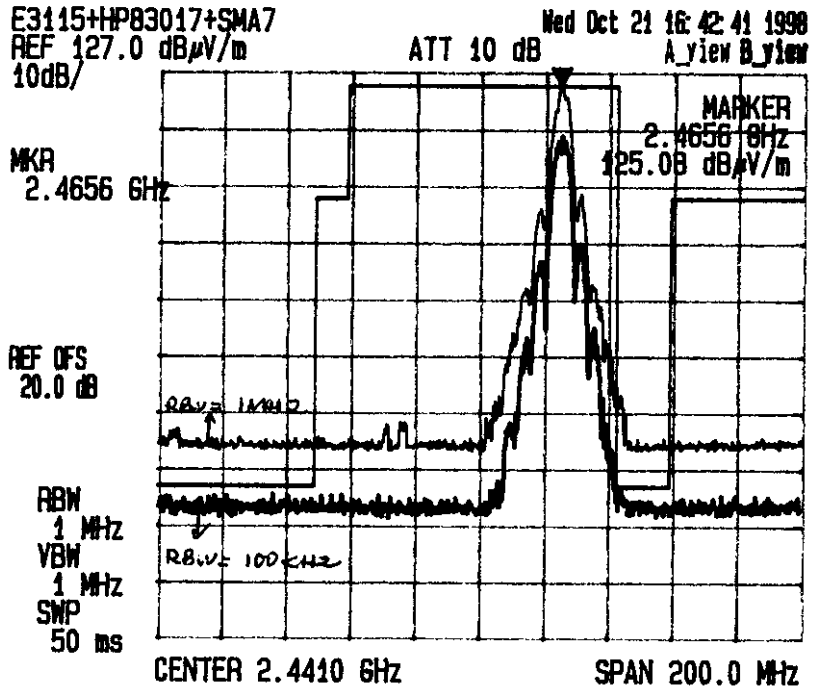
ISP DIRECT,MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

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

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

Antenna: RUBBER DUCK, MOBILE ANTENNA, RSTA13 - 2400 T

Radiated Emissions Measurements @ 3 Meters



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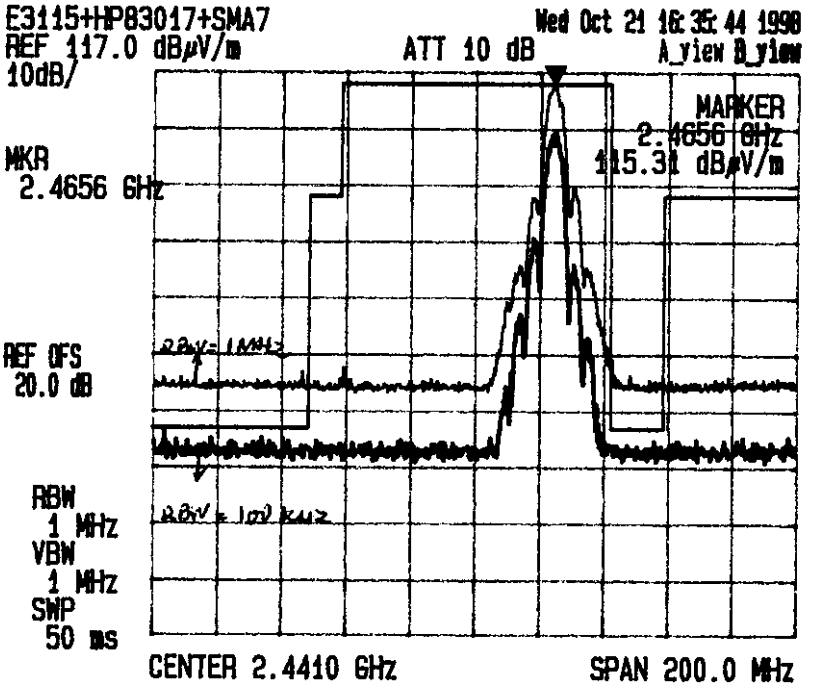


HORIZONTAL

UltraTech
Engineering Labs Inc.

Date: October 21, 1998
Tested by: Hung Trinh

INTERAIR WIRELESS

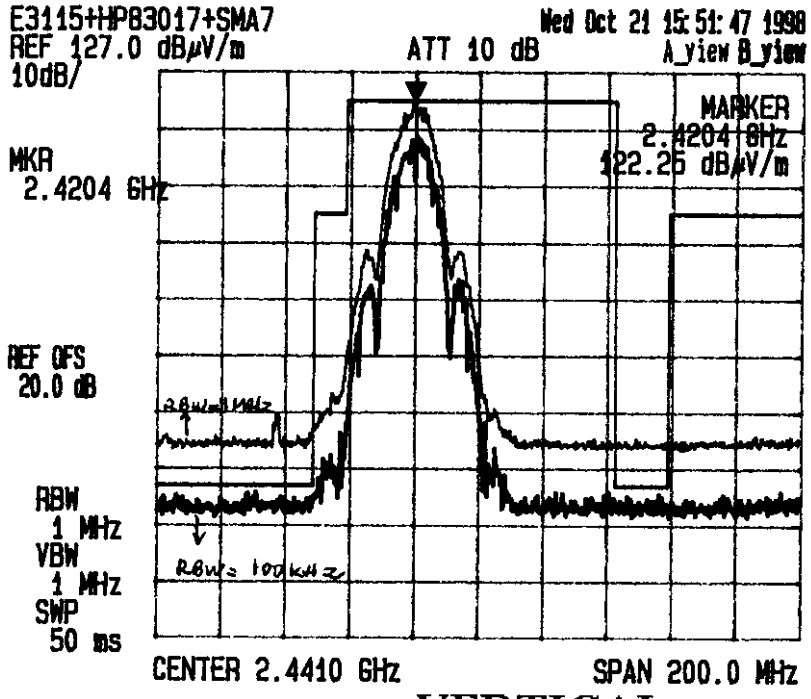
ISP DIRECT,MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

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: RUBBER DUCK, MOBILE ANTENNA, RSTN3 - 8dBi T

Radiated Emissions Measurements @ 3 Meters



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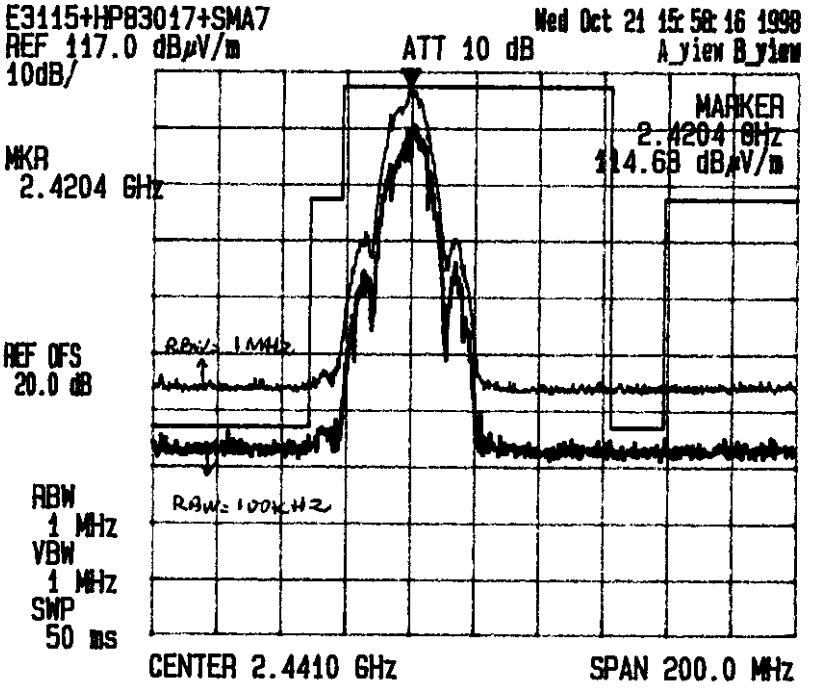

HORIZONTAL

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INTERAIR WIRELESS

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

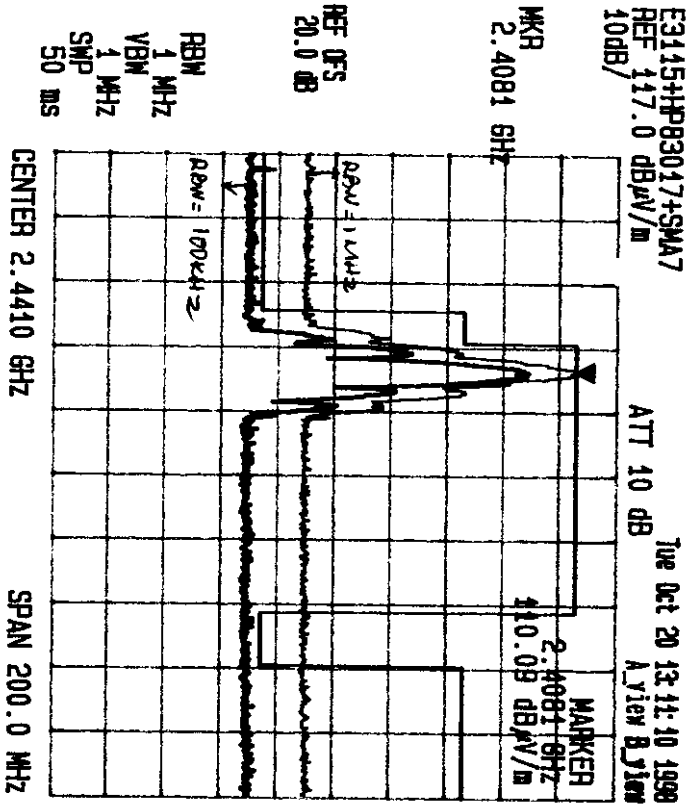
Channel# 3, Tx Frequency: 2408.625 MHz, RF Power: 0.19 W

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

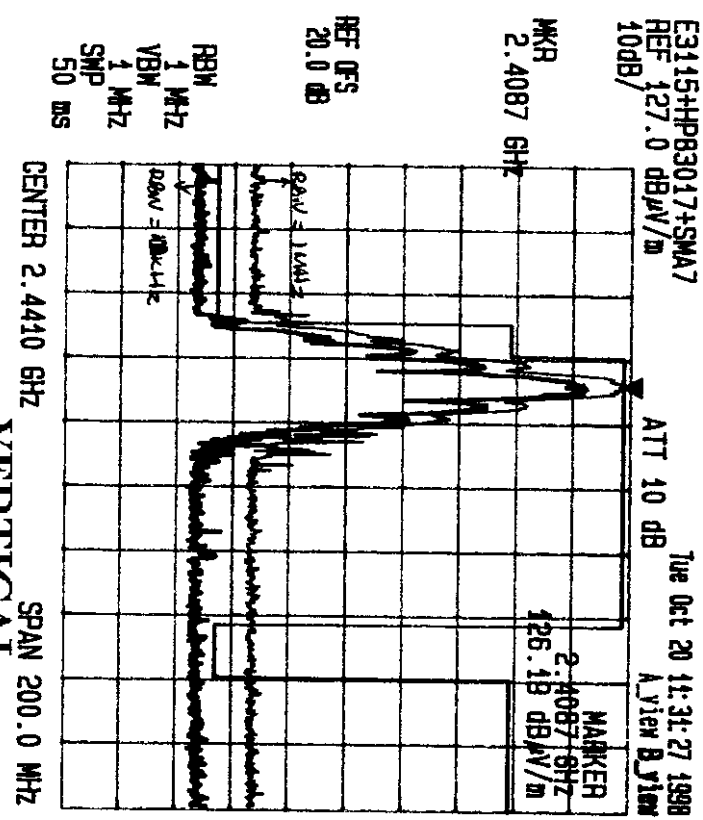
Antenna: 3x3 PATCH ANTENNA, HUBER SUHNER, 1324-19-0006

Date: October 20 1998
Tested by: Hung Trinh

Radiated Emissions Measurements @ 3 Meters



HORIZONTAL



VERTICAL

Date: October 22 1998
Tested by: Hung Trinh

INTERAIR WIRELESS

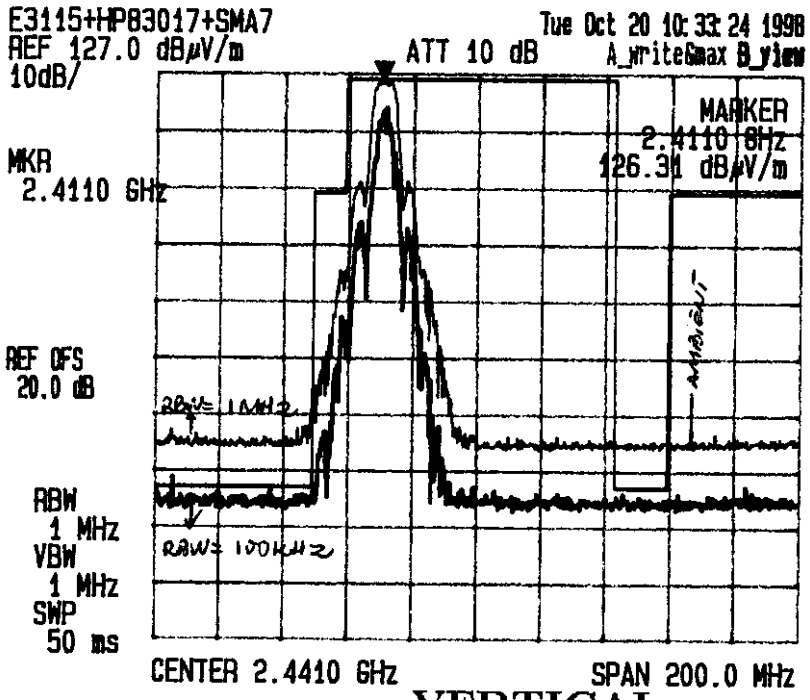
ISP DIRECT,MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

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: 3 x 3 PATCH ANTENNA, HUBER SUHNER, 13dBi-10-2006

Radiated Emissions Measurements @ 3 Meters



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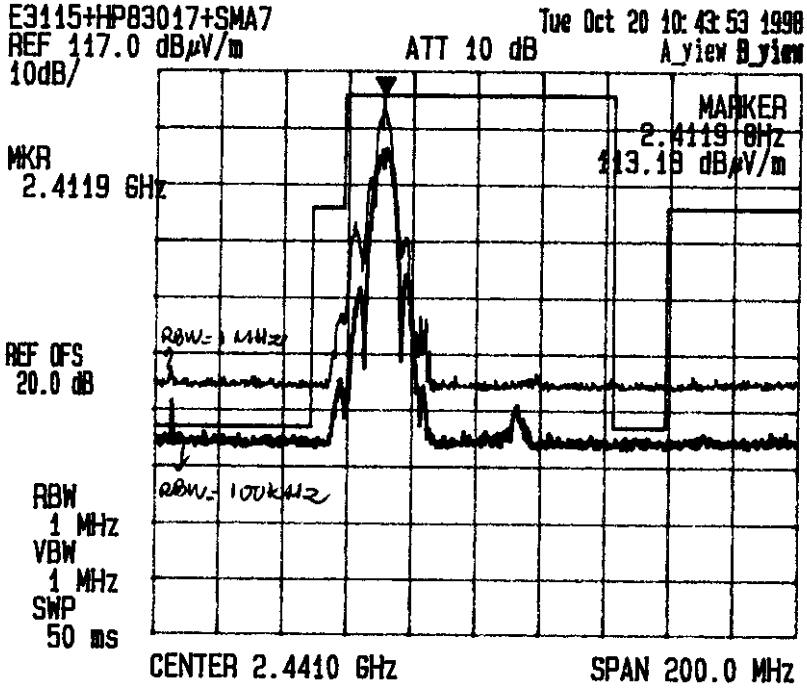


HORIZONTAL

UltraTech
Engineering Labs Inc.

Date: October 22, 1998
Tested by: Hung Trinh

INTERAIR WIRELESS

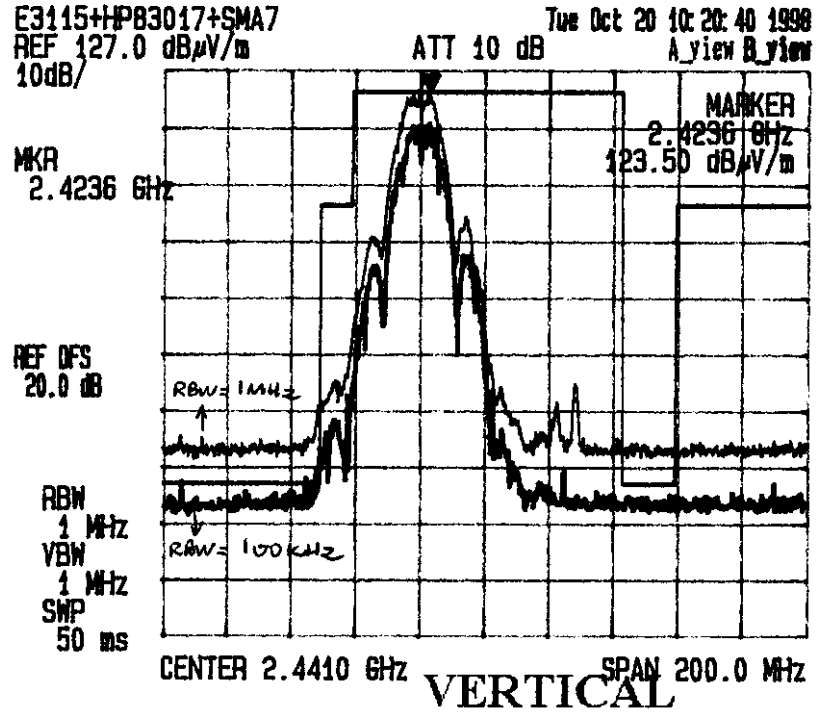
ISP DIRECT,MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

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: 3x3 PATCH ANTENNA, NUMBER SHUMER 13241-19-0006

Radiated Emissions Measurements @ 3 Meters



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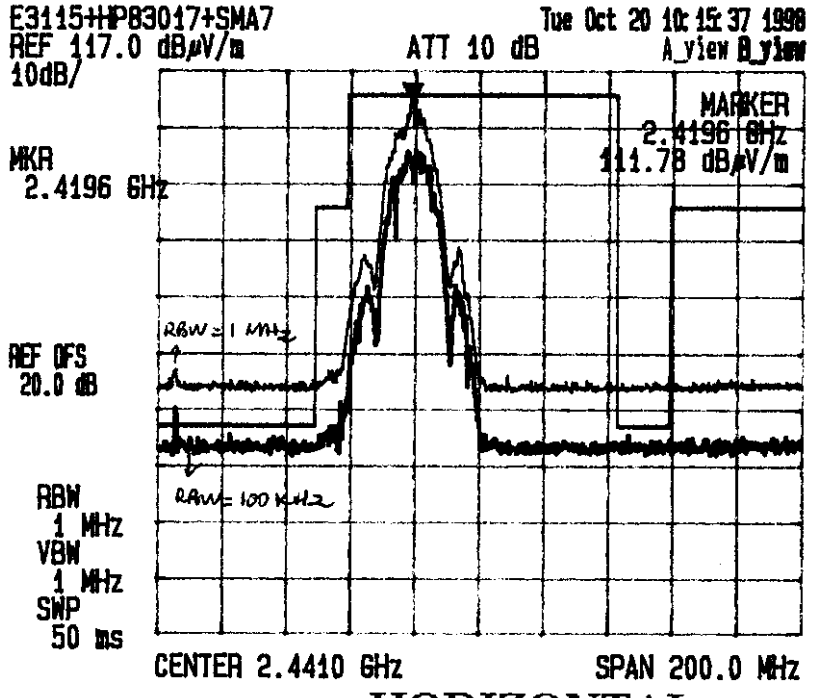


HORIZONTAL

UltraTech
Engineering Labs Inc.

Date: October 20 1998
Tested by: Hung Trinh

INTERAIR WIRELESS

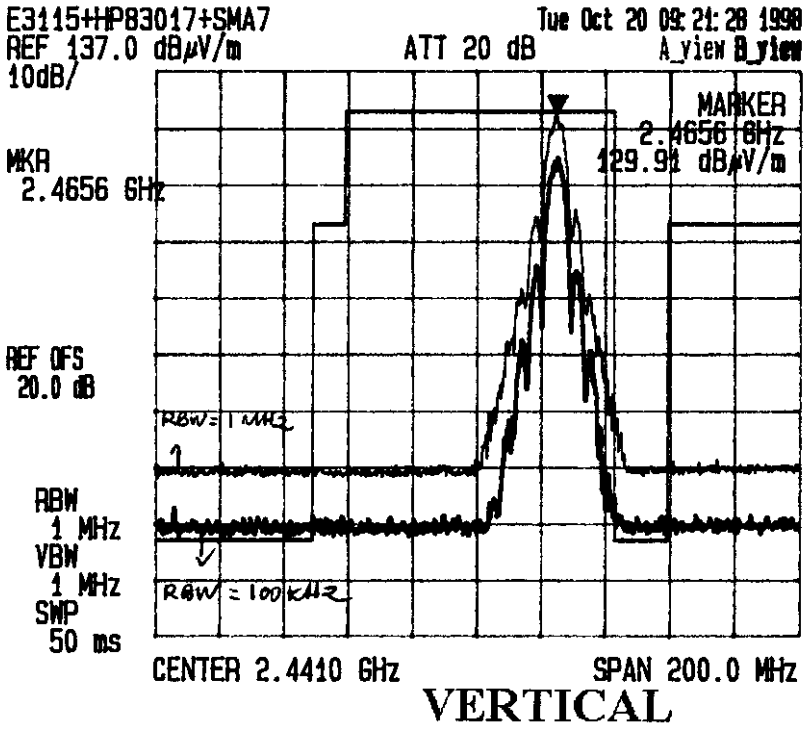
ISP DIRECT,MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

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: 3x3 PATCH ANTENNA, HUBER SUHNER, 13.24 - 19 - 0006

Radiated Emissions Measurements @ 3 Meters



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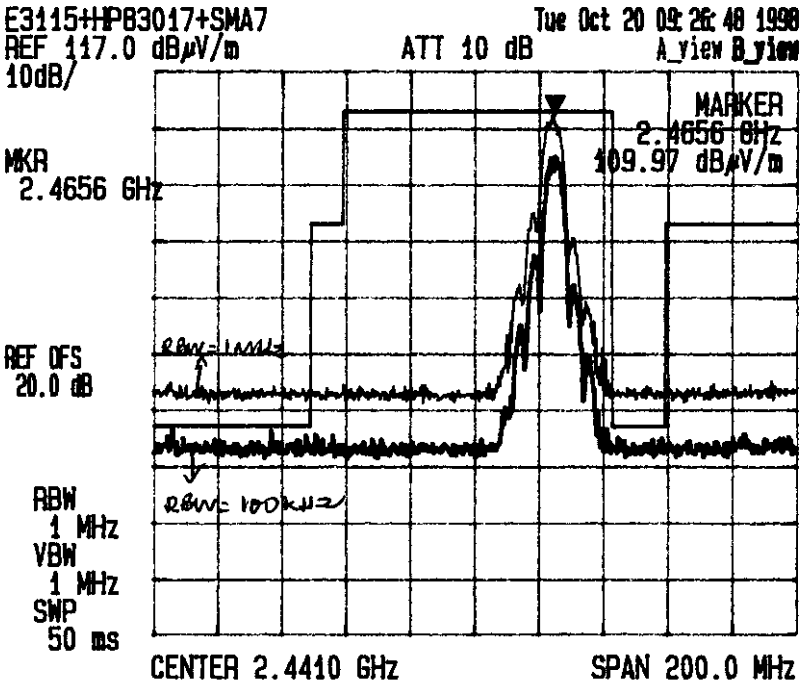


HORIZONTAL

UltraTech
Engineering Labs Inc.

Date: October 20, 1998
Tested by: Hung Trinh

INTERAIR WIRELESS

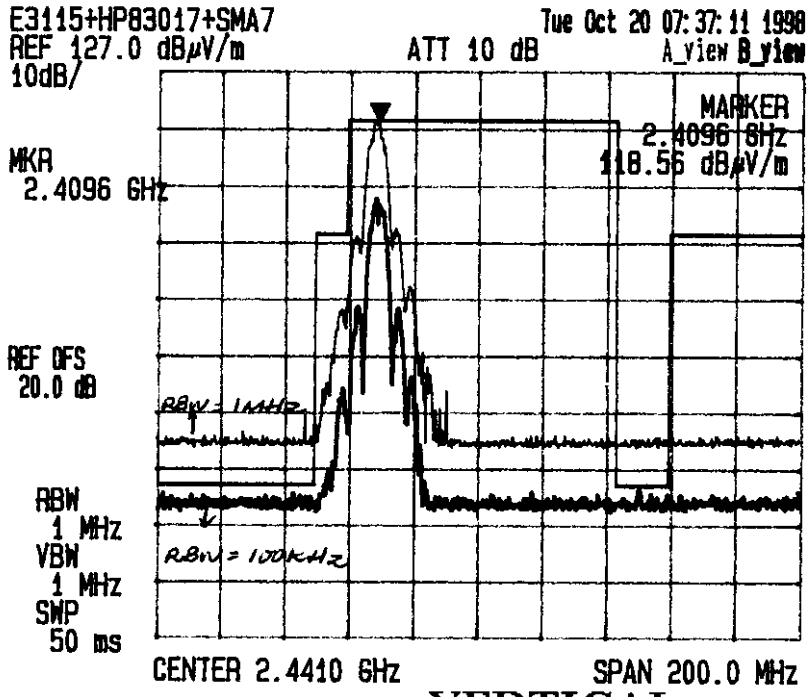
ISP DIRECT,MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

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

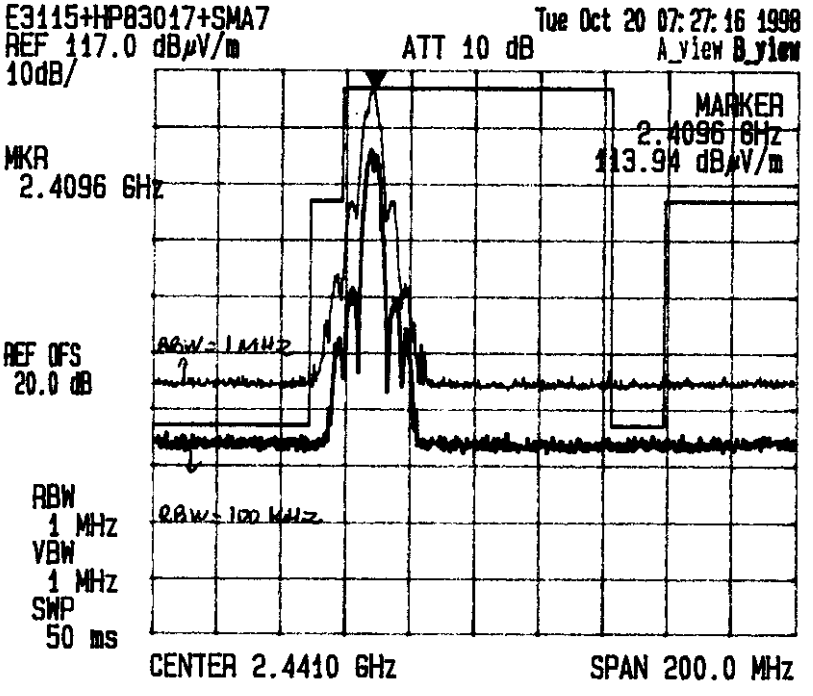
Modulation: DSSS,BW: NARROW (4.5 Mc/s), 11 chips/symbol,0.818 Mbps DQPSK

Antenna: 3 x 3 PATCH ANTENNA, TEAM, SSD.3P.B

Radiated Emissions Measurements @ 3 Meters



VERTICAL



HORIZONTAL

UltraTech
Engineering Labs Inc.

Date: October 20, 1998
Tested by: Hung Trinh

INTERAIR WIRELESS

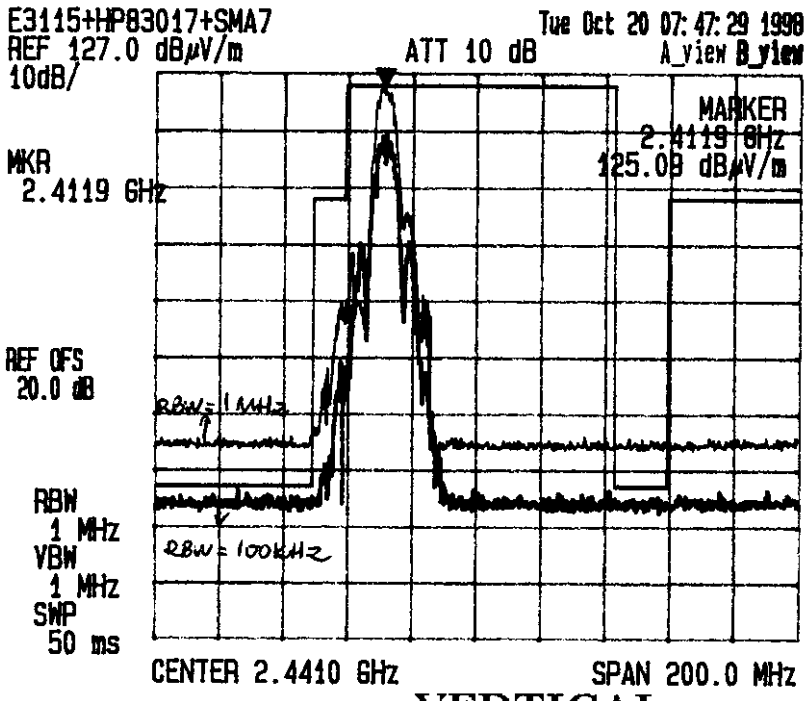
ISP DIRECT,MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

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

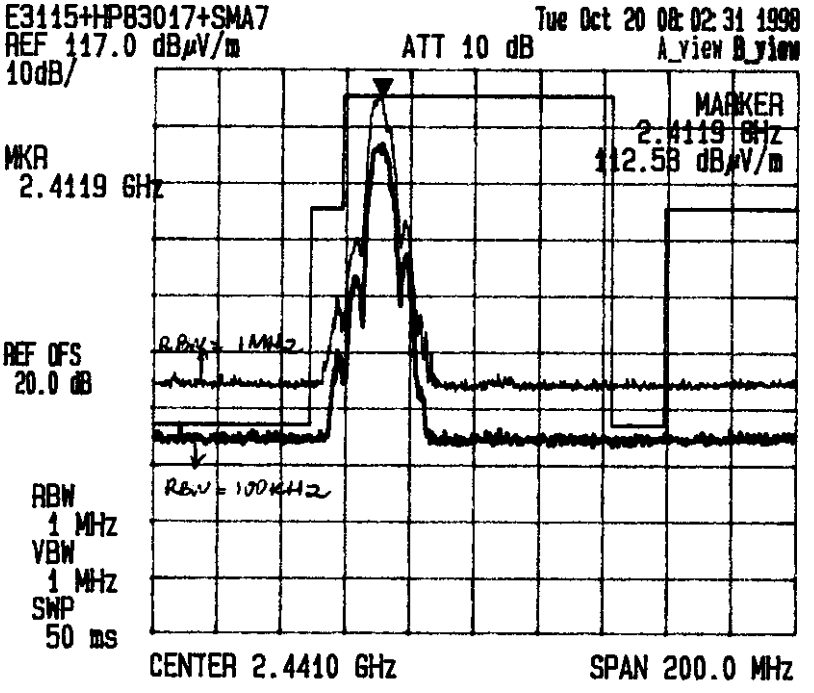
Modulation: DSSS,BW: MEDIUM (5.625 Mc/s), 11 chips/symbol,1.023 Mbps DQPSK

Antenna: 3x3 PATCH ANTENNA, TECOM, SDSD39-3

Radiated Emissions Measurements @ 3 Meters



VERTICAL



HORIZONTAL

UltraTech
Engineering Labs Inc.

Date: October 20 1998
Tested by: Hung Trinh

INTERAIR WIRELESS

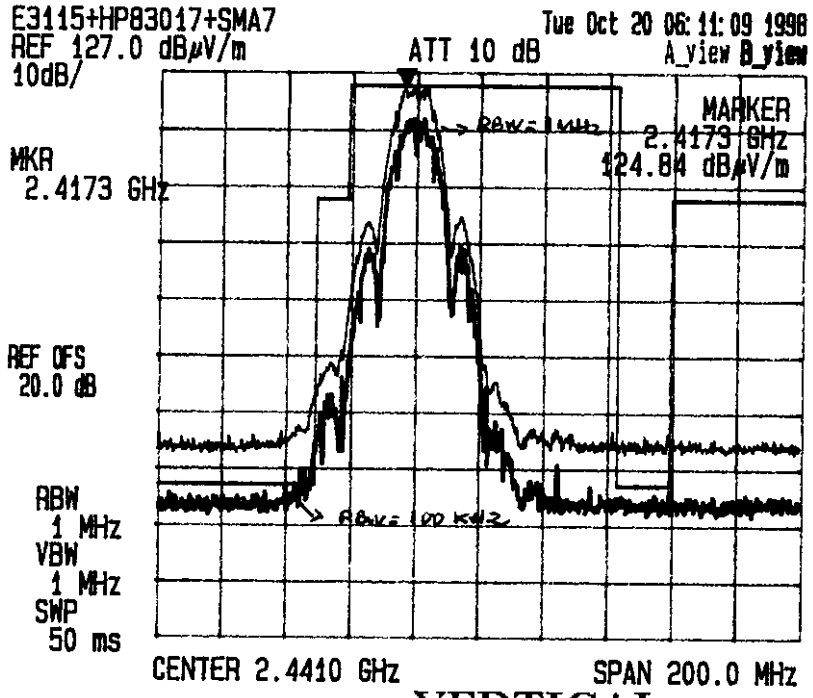
ISP DIRECT,MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

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: 3x3 PATCH ANTENNA, TELOM, SD52398

Radiated Emissions Measurements @ 3 Meters



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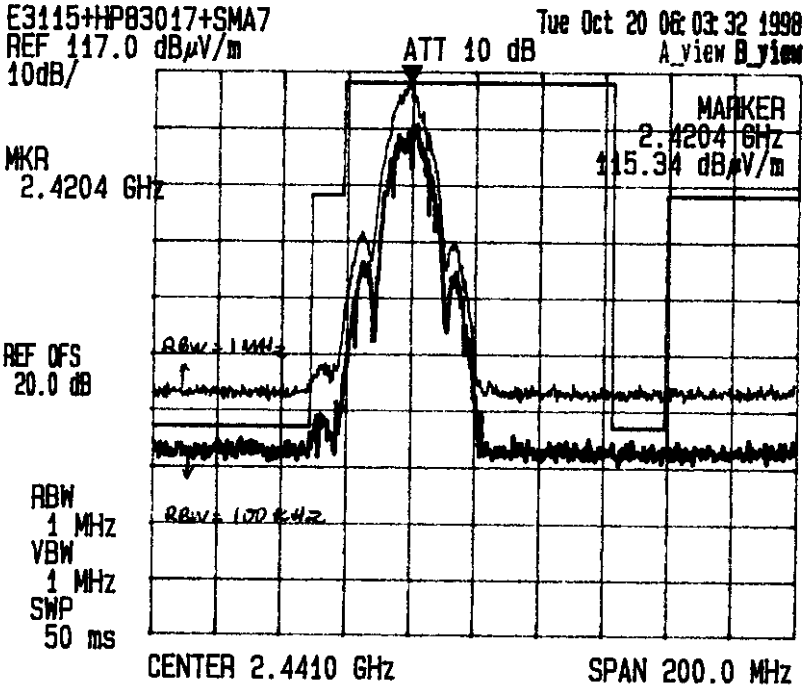


HORIZONTAL

UltraTech
Engineering Labs Inc.

Date: October 20, 1998
Tested by: Hung Trinh

INTERAIR WIRELESS

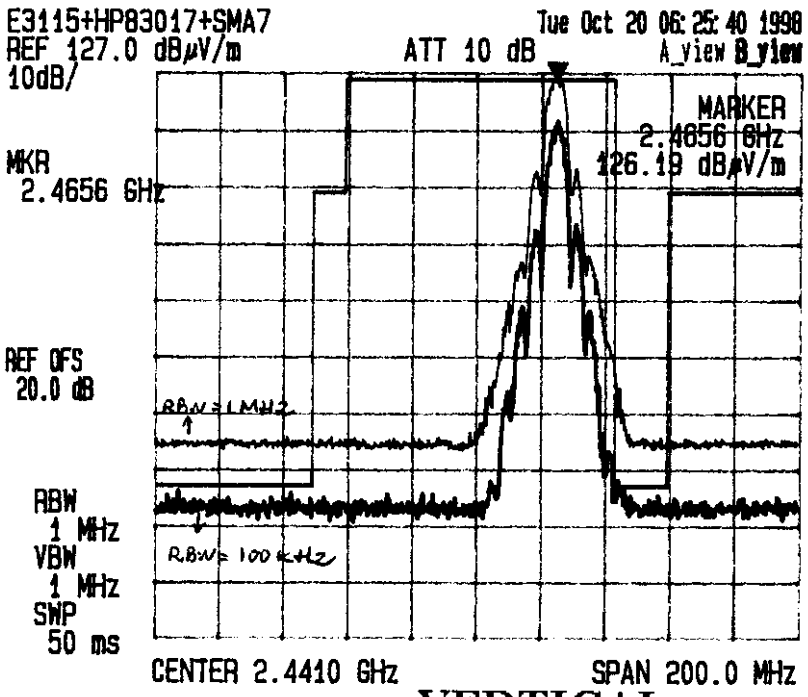
ISP DIRECT,MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

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

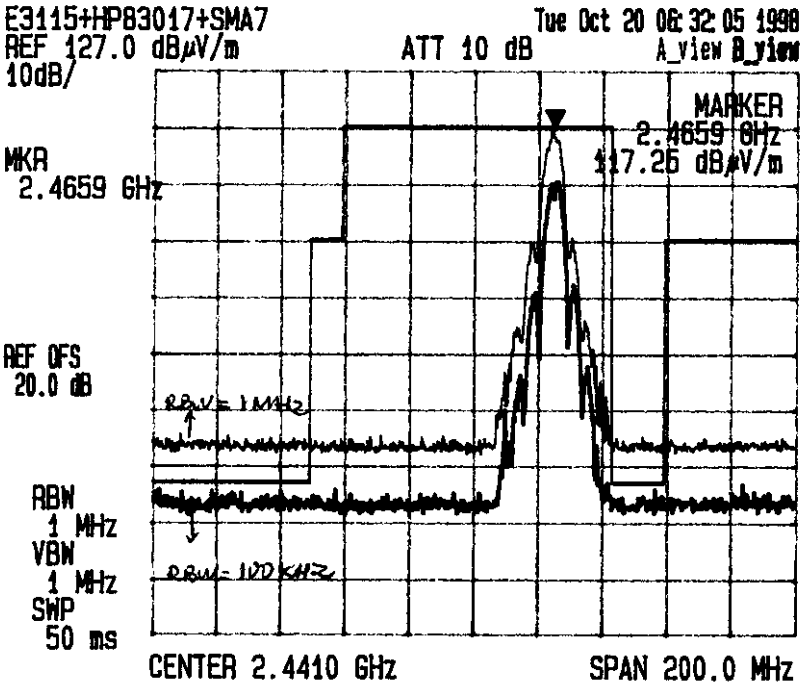
Modulation: DSSS,BW: NARROW (4.5 Mc/s), 11 chips/symbol, 0.818 Mbps DQPSK

Antenna: 3 x 3 PATCH ANTENNA, TELCOM, SDSD3G-B

Radiated Emissions Measurements @ 3 Meters



VERTICAL



HORIZONTAL

UltraTech
Engineering Labs Inc.

Date: October 21, 1998
Tested by: Hung Trinh

INTERAIR WIRELESS

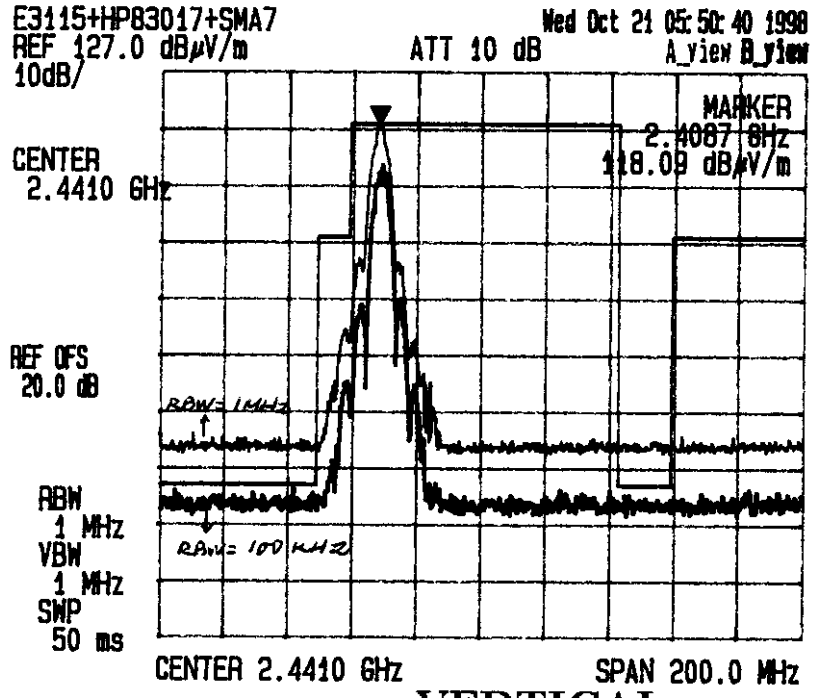
ISP DIRECT,MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

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

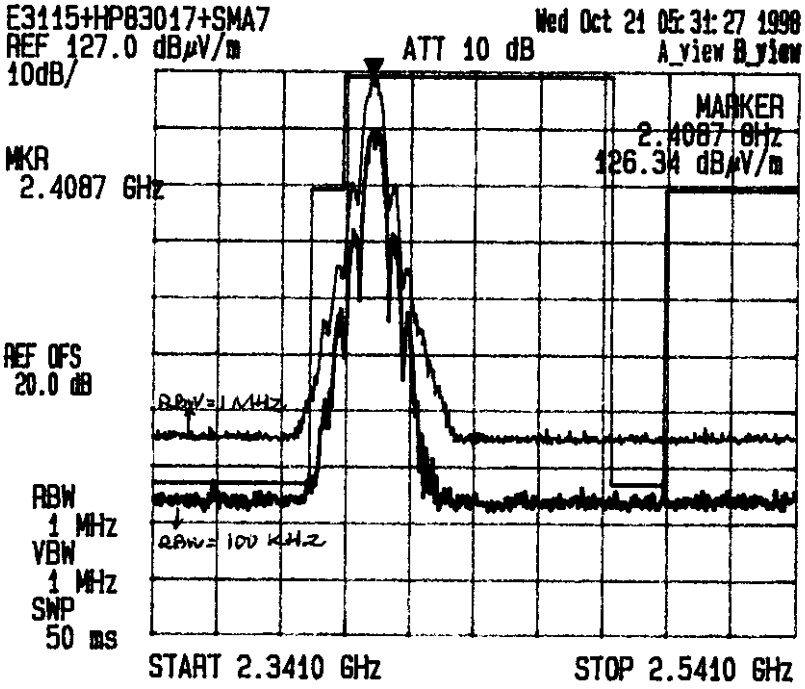
Modulation: DSSS,BW: NARROW (4.5 Mc/s), 11 chips/symbol,0.818 Mbps DQPSK

Antenna: 1x1 PATCH ANTENNA + ANTENNA SPECIALISTS, ASPDT2458

Radiated Emissions Measurements @ 3 Meters



VERTICAL



HORIZONTAL

UltraTech Engineering Labs Inc.

Date: October 21, 1998
Tested by: Hung Trinh

INTERAIR WIRELESS

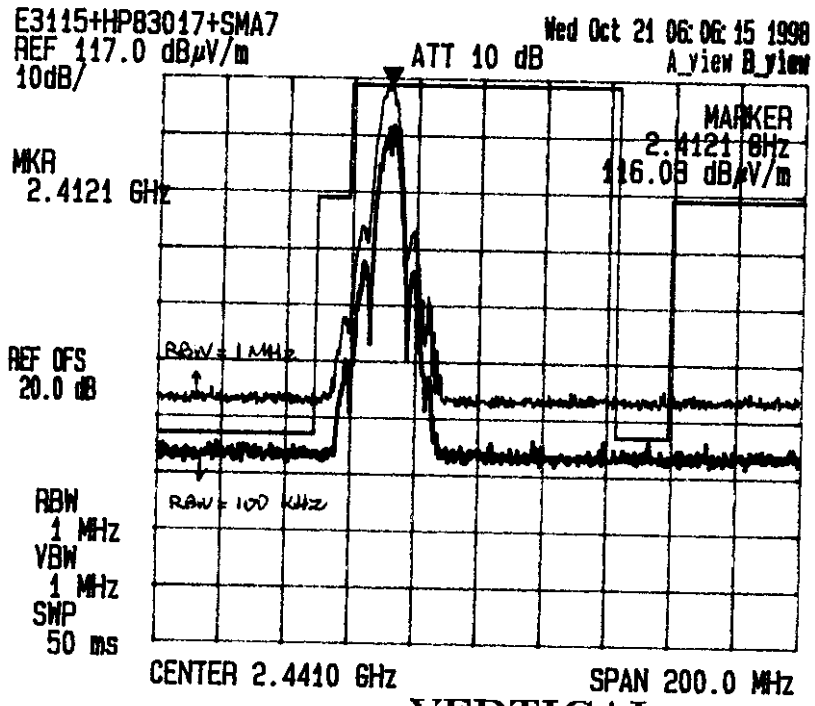
ISP DIRECT,MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

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

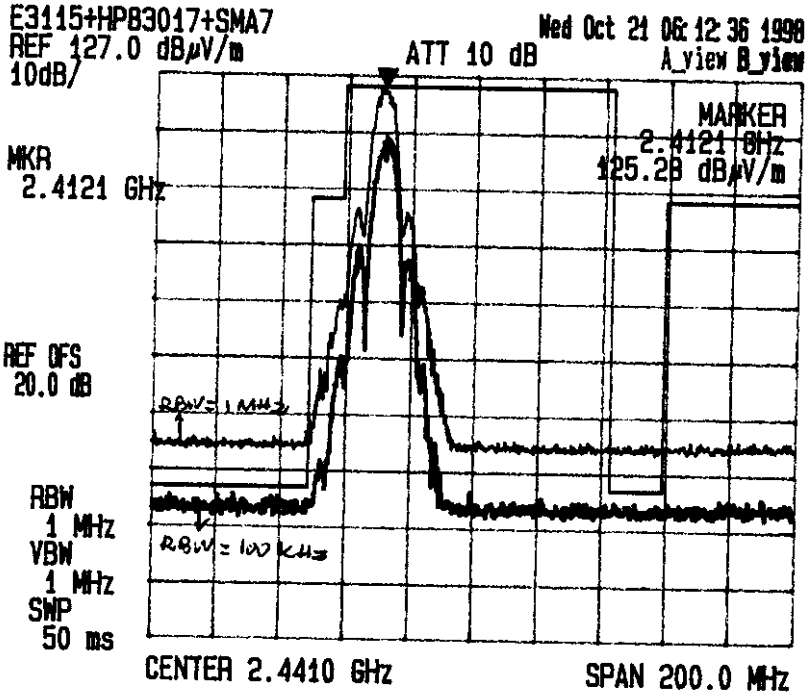
Modulation: DSSS,BW: MEDIUM (5.625 Mc/s), 11 chips/symbol,1.023 Mbps DQPSK

Antenna: 1x1 PATCH ANTENNA, ANTENNUM SPECIALISTS ASPDT 2458

Radiated Emissions Measurements @ 3 Meters



VERTICAL



HORIZONTAL

UltraTech
Engineering Labs Inc.

Date: October 21, 1998
Tested by: Hung Trinh

INTERAIR WIRELESS

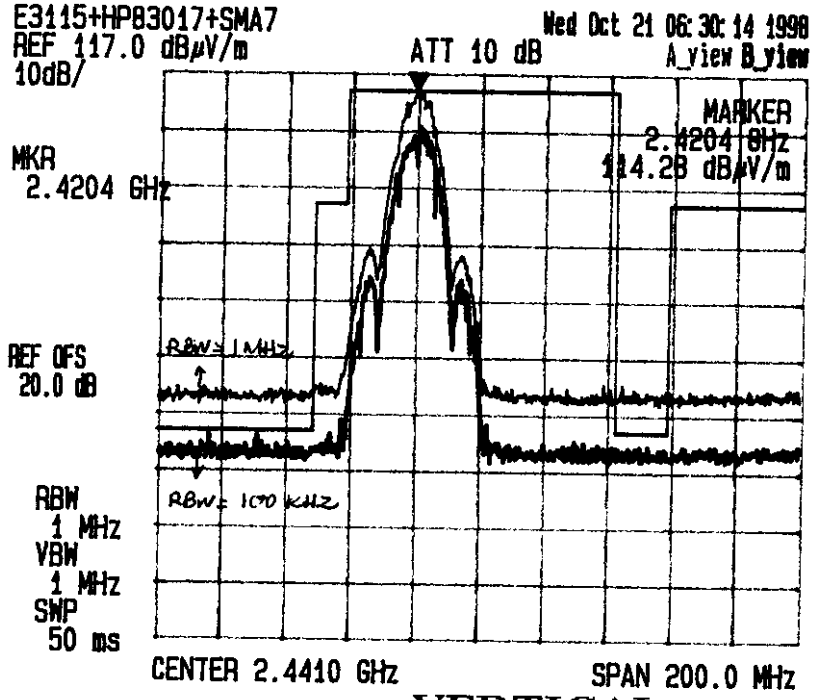
ISP DIRECT,MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

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

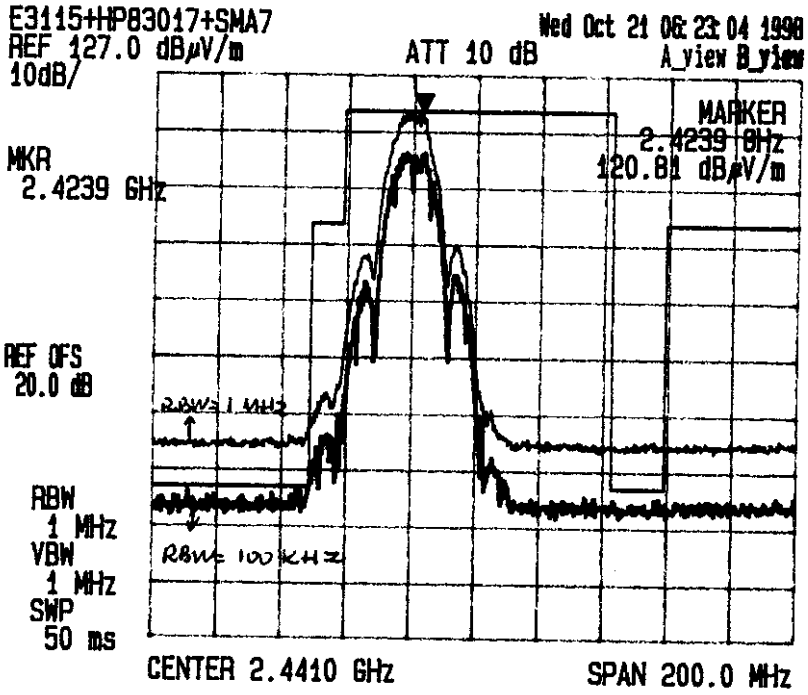
Modulation: DSSS,BW: WIDE (11.25 Mc/s), 11 chips/symbol, 2.045 Mbps DQPSK

Antenna: 1X1 PATCH ANTENNA, ANTENNA SPECIALISTS, ASP9T-2458

Radiated Emissions Measurements @ 3 Meters



VERTICAL



HORIZONTAL

UltraTech
Engineering Labs Inc.

Date: October 21, 1998
Tested by: Hung Trinh

INTERAIR WIRELESS

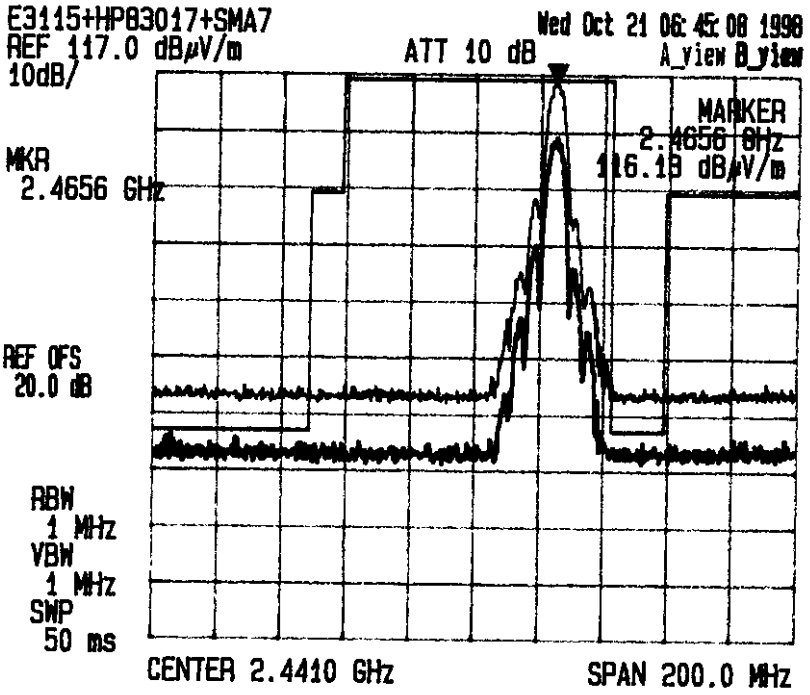
ISP DIRECT,MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

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

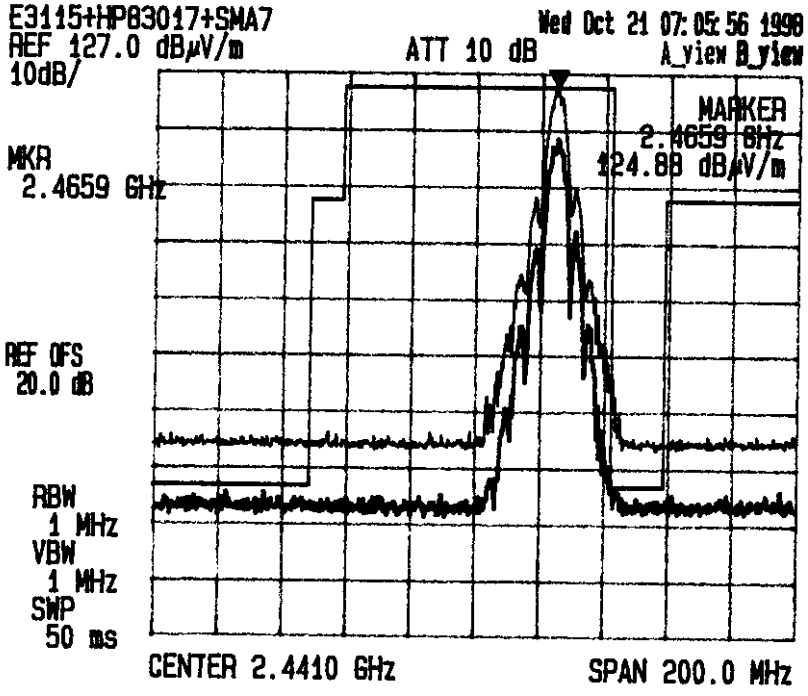
Modulation: DSSS,BW: NARROW (4.5 Mc/s), 11 chips/symbol, 0.818 Mbps DQPSK

Antenna: 1 x 1 PATCH ANTENNA, ANTENNA GAIN 9 dBi, ASPT 2988

Radiated Emissions Measurements @ 3 Meters



VERTICAL



HORIZONTAL

UltraTech
Engineering Labs Inc.

Date: October 4, 1998
Tested by: Hung Trinh

INTERAIR WIRELESS

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

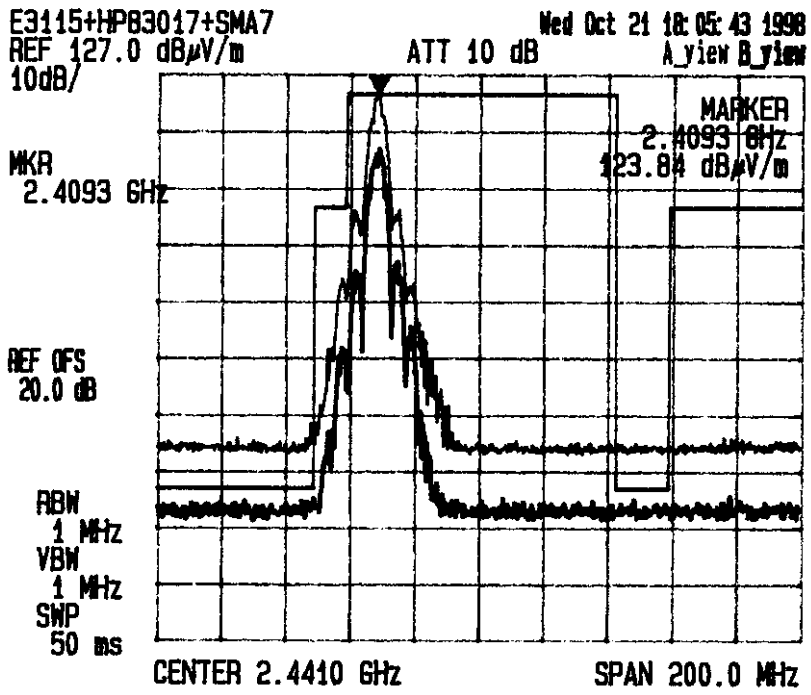
Channel# 3, Tx Frequency: 2408.625 MHz, RF Power: 0.19 W

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

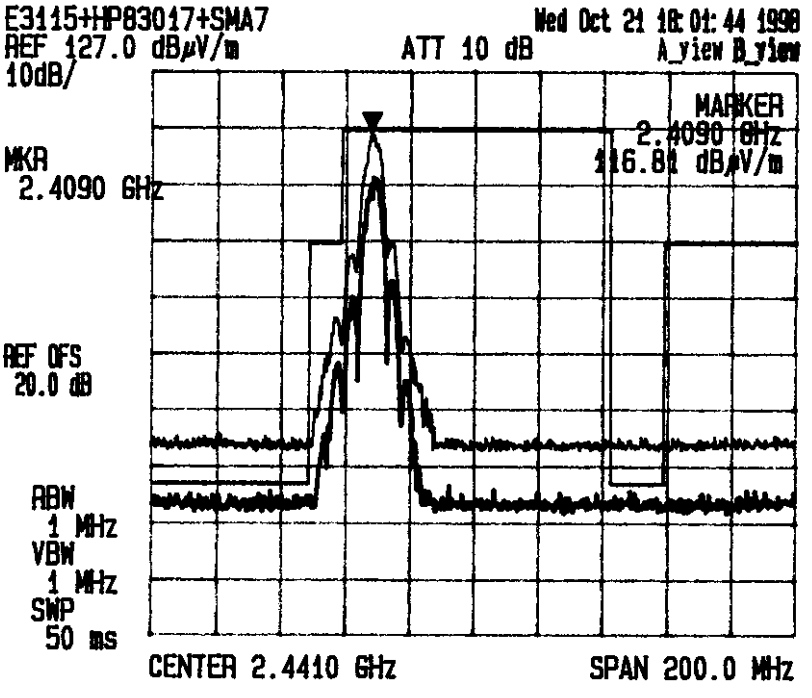
Antenna: RUBBER DUCK, MOBILE ANTENNA, PSTAN3 - 2400T

Radiated Emissions Measurements @ 3 Meters

UltraTech Engineering Labs Inc.



VERTICAL



HORIZONTAL

Date: October 21, 1998
Tested by: Hung Trinh

INTERAIR WIRELESS

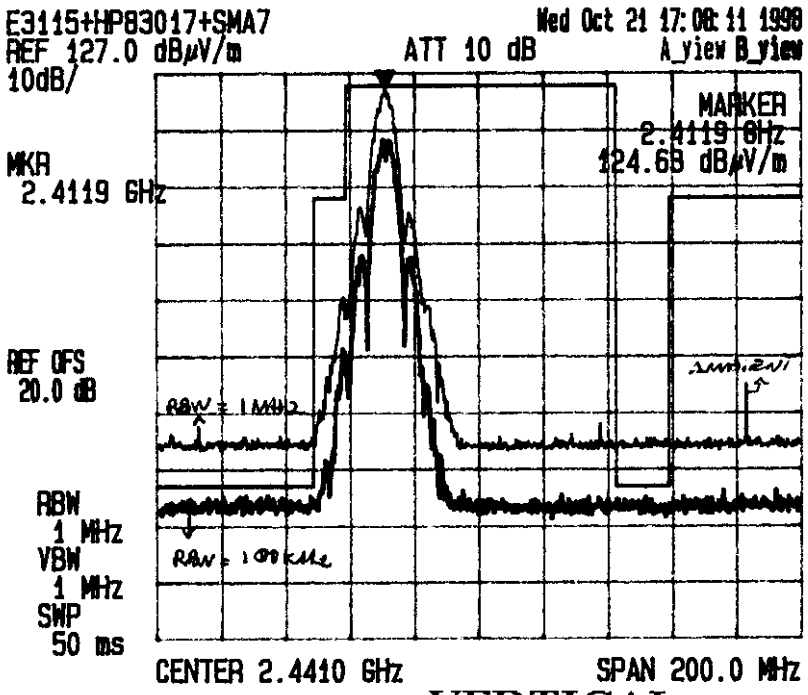
ISP DIRECT,MODEL 2401-01 (INDOOR) & 2401-02 (OUTDOOR)

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

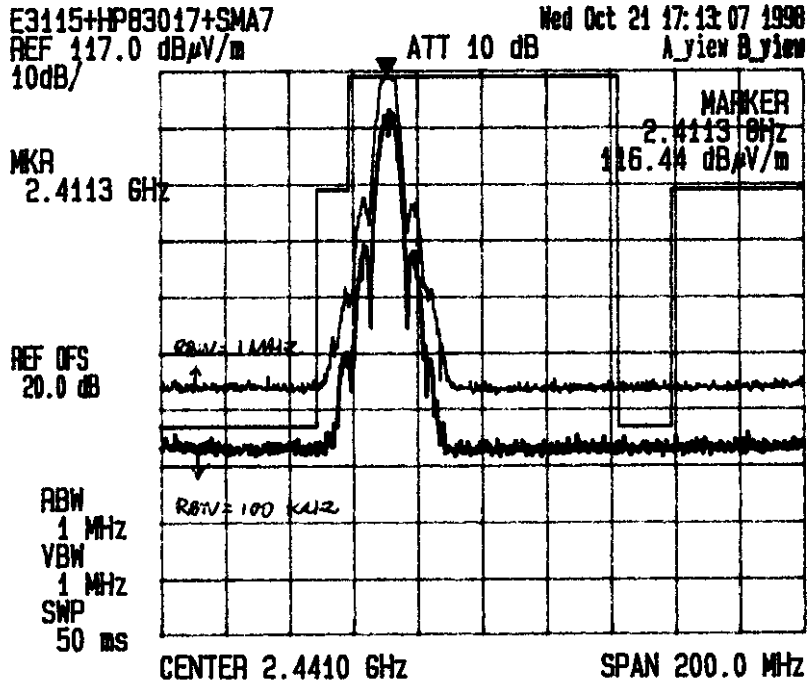
Modulation: DSS,BW: MEDIUM (5.625 Mc/s), 11 chips/symbol,1.023 Mbps DQPSK

Antenna: RUBBER DUCK, MOBIL ANTENNA, PSTN3 - RHOD T

Radiated Emissions Measurements @ 3 Meters



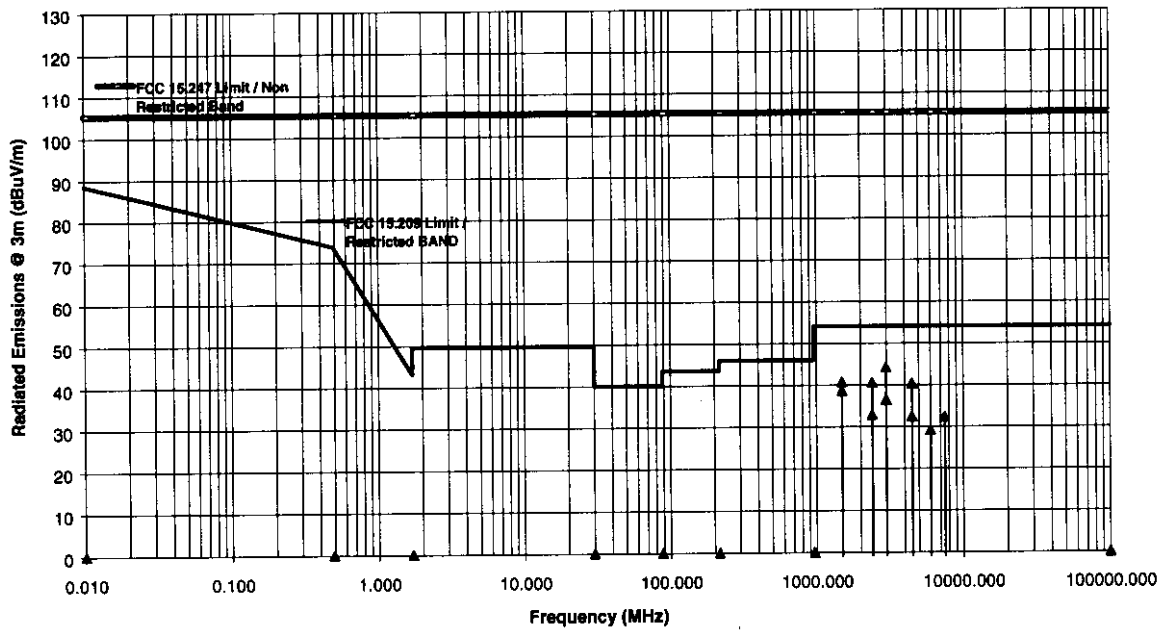
VERTICAL



HORIZONTAL

UltraTech
Engineering Labs Inc.

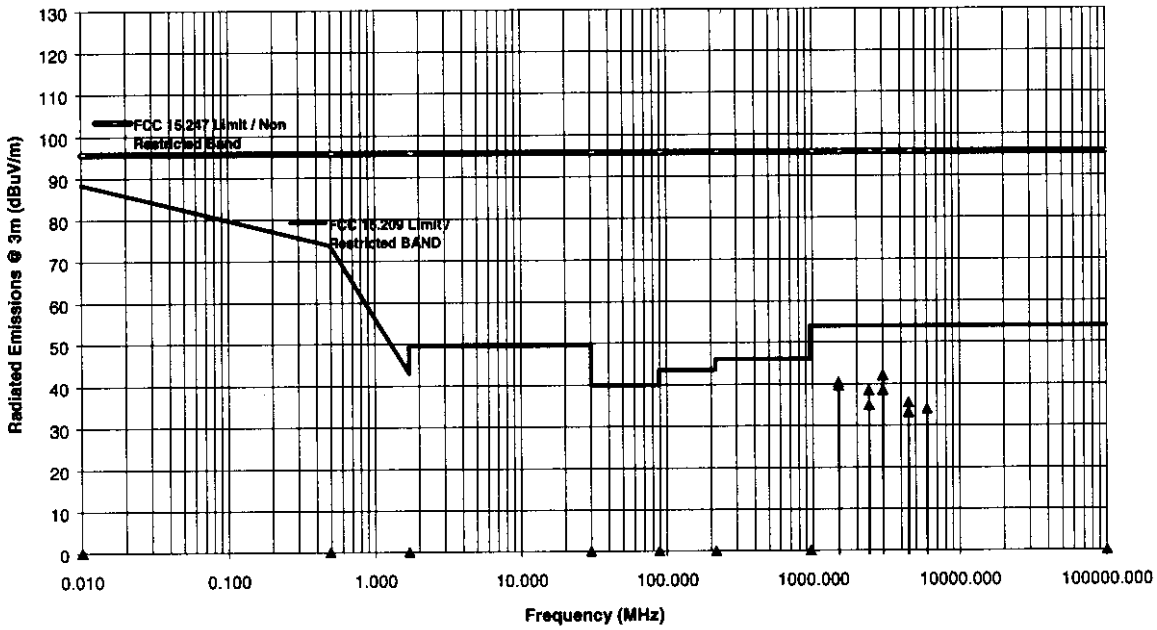
Transmitter Radiated Emissions Measurements @ 3m
InterAir Wireless ISP Direct Units, Models 2401-01 & 2401-02
Ch. #3, Center Freq.: 2408.625 MHz, Chip Rate: 4.5 MHz, Data Rate: 0.82 Mb/s (Narrow)
(Cushcraft Yagi Antenna, M/N: PC2415N)



Channel #: 4, Frequency: 2464.875 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, medium, 11 chips/symbol, Data Rate: 4.5 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 115.8 dBuV/m Limit = 115.8 dBuV/m - 20dB = 95.8 dBuV/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
1496.44	58.7	40.4	V	54.0	95.8	-13.6	** PASS
1496.44	51.2	39.6	H	54.0	95.8	-14.4	** PASS
2411.44	115.8	--	V	--	--	--	--
2411.44	105.3	--	H	--	--	--	--
2992.88	51.9	42.0	V	54.0	95.8	-53.8	PASS
2992.88	47.7	38.5	H	54.0	95.8	-57.3	PASS
4489.31	50.5	35.5	V	54.0	95.8	-18.5	** PASS
4489.31	49.7	33.1	H	54.0	95.8	-20.9	** PASS
5985.75	50.9	34.0	H	54.0	95.8	-61.8	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

- *FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

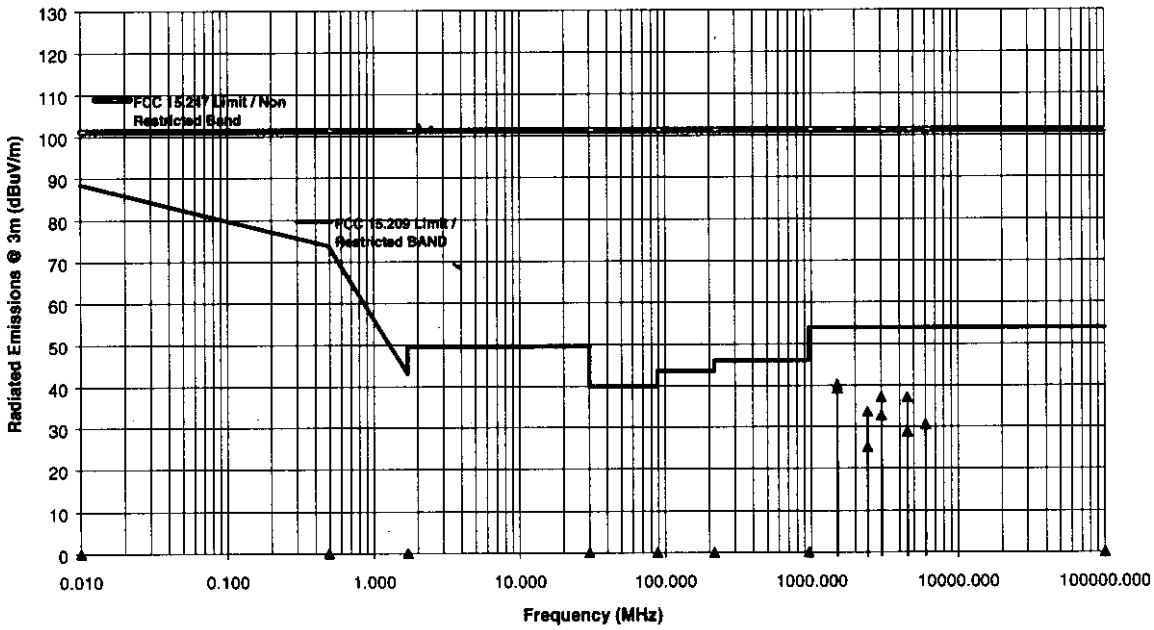
Transmitter Radiated Emissions Measurements @ 3m
InterAir Wireless ISP Direct Units, Models 2401-01 & 2401-02
Ch. #4, Center Freq.: 2411.4375 MHz, Chip Rate: 5.625 MHz, Data Rate: 1.02 Mb/s (Medium)
(Cushcraft Yagi Antenna, M/N: PC2415N)



Channel #: 6, Frequency: 2408.625 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, wide, 11 chips/symbol, Data Rate: 4.5 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 121.3 dBuV/m Limit = 121.3 dBuV/m - 20 dB = 101.3 dBuV/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	61.8	40.2	V	54.0	101.3	-13.8	** PASS
1504.88	58.1	39.3	H	54.0	101.3	-14.7	** PASS
2419.88	121.3	--	V	--	--	--	--
2419.88	104.4	--	H	--	--	--	--
3009.75	49.1	37.2	V	54.0	101.3	-64.1	PASS
3009.75	46.5	32.7	H	54.0	101.3	-68.6	PASS
4514.63	50.7	37.1	V	54.0	101.3	-16.9	** PASS
4514.63	46.8	28.8	H	54.0	101.3	-25.2	** PASS
6019.50	48.9	30.6	V	54.0	101.3	-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							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

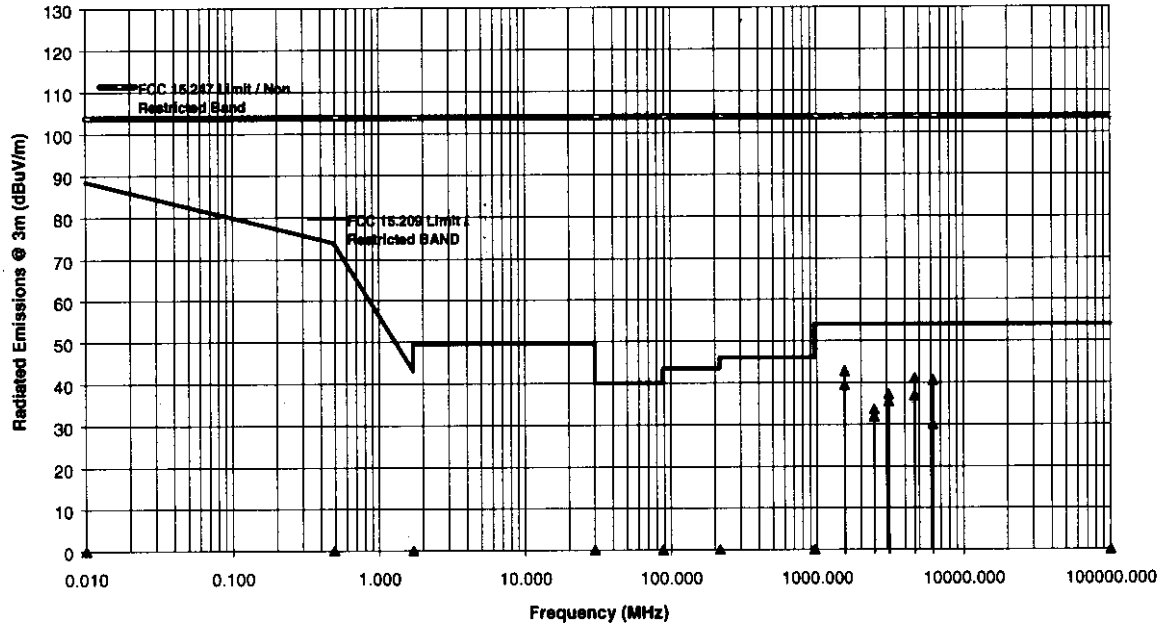
Transmitter Radiated Emissions Measurements @ 3m
InterAir Wireless ISP Direct Units, Models 2401-01 & 2401-02
Ch. #6, Center Freq.: 2419.875 MHz, Chip Rate: 11.25 MHz, Data Rate: 2.05 Mb/s (Wide)
(Cushcraft Yagi Antenna, M/N: PC2415N)



Channel #: 18, Frequency: 2411.4375 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, narrow, 11 chips/symbol, Data Rate: 5.625 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 123.8 dBuV/m Limit = 123.8 dBuV/m - 20 dB = 103.8 dBuV/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	65.6	42.8	V	54.0	103.8	-11.2	** PASS
1549.88	61.5	39.4	H	54.0	103.8	-14.6	** PASS
2464.88	123.8	--	V	--	--	--	--
2464.88	113.6	--	H	--	--	--	--
3099.75	48.6	37.2	V	54.0	103.8	-66.6	PASS
3099.75	48.0	35.5	H	54.0	103.8	-68.3	PASS
4649.63	52.2	41.0	V	54.0	103.8	-13.0	** PASS
4649.63	50.2	36.9	H	54.0	103.8	-17.1	** PASS
6199.50	52.7	40.6	V	54.0	103.8	-63.2	PASS
6199.50	49.2	30.0	H	54.0	103.8	-73.8	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

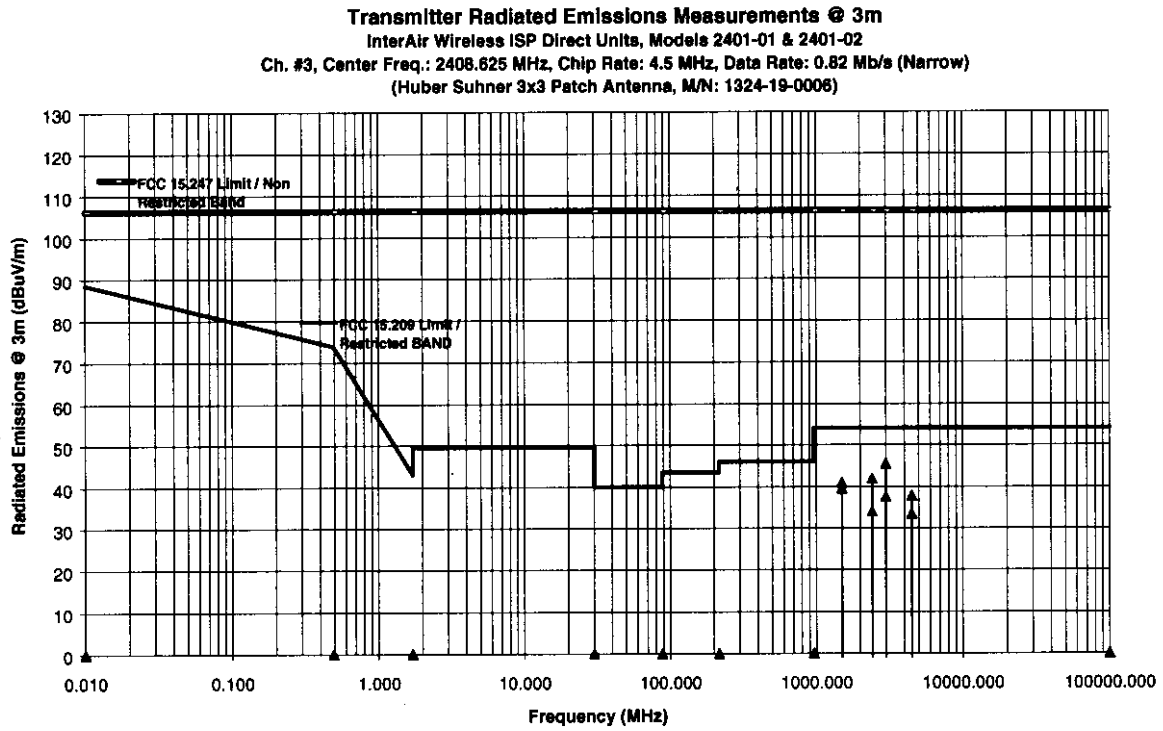
Transmitter Radiated Emissions Measurements @ 3m
InterAir Wireless ISP Direct Units, Models 2401-01 & 2401-02
Ch. #18, Center Freq.: 2464.875 MHz, Chip Rate: 4.5 MHz, Data Rate: 0.82 Mb/s (Narrow)
(Cushcraft Yagi Antenna, M/N: PC2415N)



4.2.2 Test Cohfig.# 2: (Huber Suhner 3x3 Patch Antenna, M/N: 1324-19-0006)

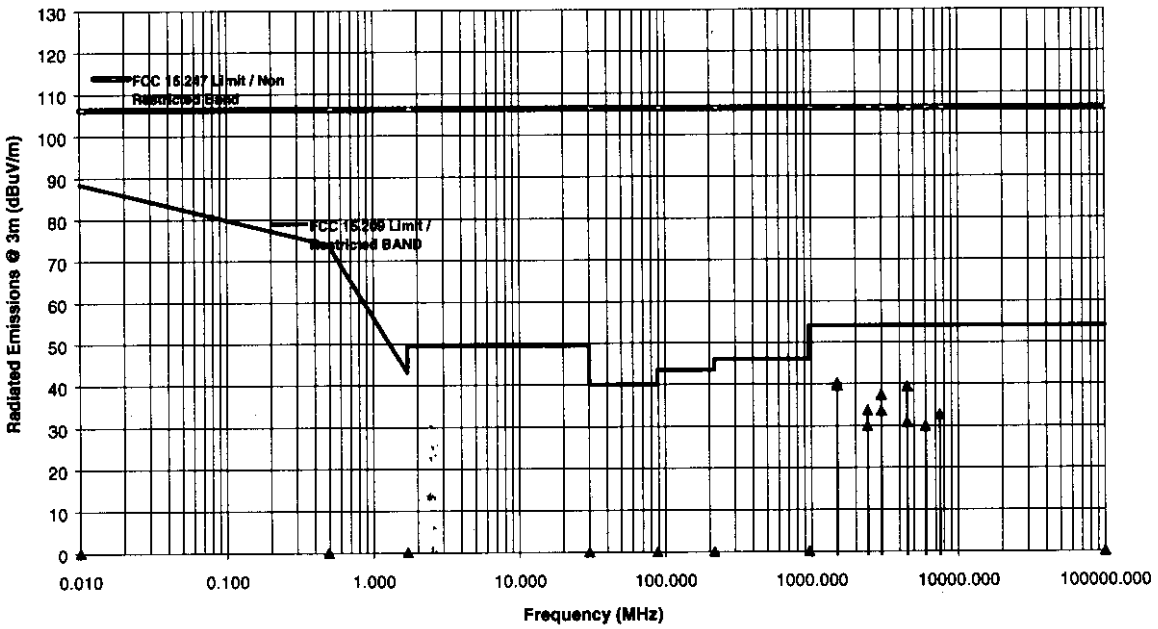
Channel #: 3, Frequency: 2411.4375 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, narrow, 11 chips/symbol, Data Rate: 5.625 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 126.2 dBuV/m Limit = 126.2 dBuV/m - 20dB = 106.2 dBuV/m			
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
1493.63	57.9	41.0	V	54.0	106.2	-13.0	** PASS
1493.63	57.7	39.6	H	54.0	106.2	-14.4	** PASS
2408.63	126.2	--	V	--	--	--	--
2408.63	110.1	--	H	--	--	--	--
2987.25	54.5	45.6	V	54.0	106.2	-60.6	PASS
2987.25	48.9	37.6	H	54.0	106.2	-68.6	PASS
4480.88	51.3	37.9	V	54.0	106.2	-16.2	** PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*



Channel #: 4, Frequency: 2408.625 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, medium, 11 chips/symbol, Data Rate: 4.5 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 126.3 dBuV/m Limit = 126.3 dBuV/m - 20dB = 106.3 dBuV/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
1496.44	57.4	40.2	V	54.0	106.3	-13.8	** PASS
1496.44	58.0	39.6	H	54.0	106.3	-14.4	** PASS
2411.44	126.3	--	V	--	--	--	--
2411.44	113.1	--	H	--	--	--	--
2992.88	48.4	37.4	V	54.0	106.3	-68.9	PASS
2992.88	47.2	33.7	H	54.0	106.3	-72.6	PASS
4489.31	51.8	39.4	V	54.0	106.3	-14.6	** PASS
4489.31	48.6	31.0	H	54.0	106.3	-23.0	** PASS
5985.75	48.9	30.0	H	54.0	106.3	-76.3	PASS
7482.19	51.3	32.8	V	54.0	106.3	-21.2	** PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

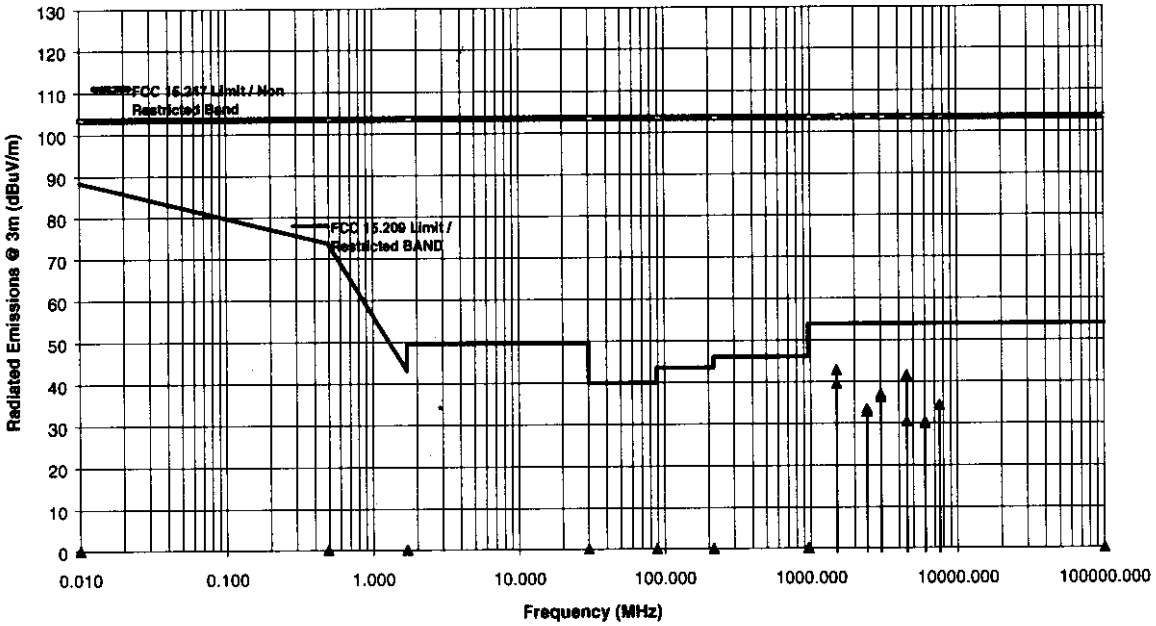
Transmitter Radiated Emissions Measurements @ 3m
InterAir Wireless ISP Direct Units, Models 2401-01 & 2401-02
Ch. #4, Center Freq.: 2411.4375 MHz, Chip Rate: 5.625 MHz, Data Rate: 1.02 Mb/s (Medium)
(Huber Suhner 3x3 Patch Antenna, M/N: 1324-19-0006)



Channel #: 6, Frequency: 2411.4375 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, wide, 11 chips/symbol, Data Rate: 5.625 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 123.5 dBuV/m Limit = 123.5 dBuV/m - 20dB = 1063.5 dBuV/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	64.6	42.8	V	54.0	103.5	-11.2	** PASS
1504.88	57.9	39.6	H	54.0	103.5	-14.4	** PASS
2419.88	123.5	--	V	--	--	--	--
2419.88	111.8	--	H	--	--	--	--
3009.75	48.8	37.1	V	54.0	103.5	-66.4	PASS
3009.75	48.1	36.2	H	54.0	103.5	-67.3	PASS
4514.63	53.4	41.4	V	54.0	103.5	-12.6	** PASS
4514.63	47.4	30.4	H	54.0	103.5	-23.6	** PASS
6019.50	48.6	30.0	V	54.0	103.5	-73.5	PASS
6019.50	48.8	30.3	H	54.0	103.5	-73.2	PASS
7524.38	52.3	34.3	V	54.0	103.5	-69.2	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

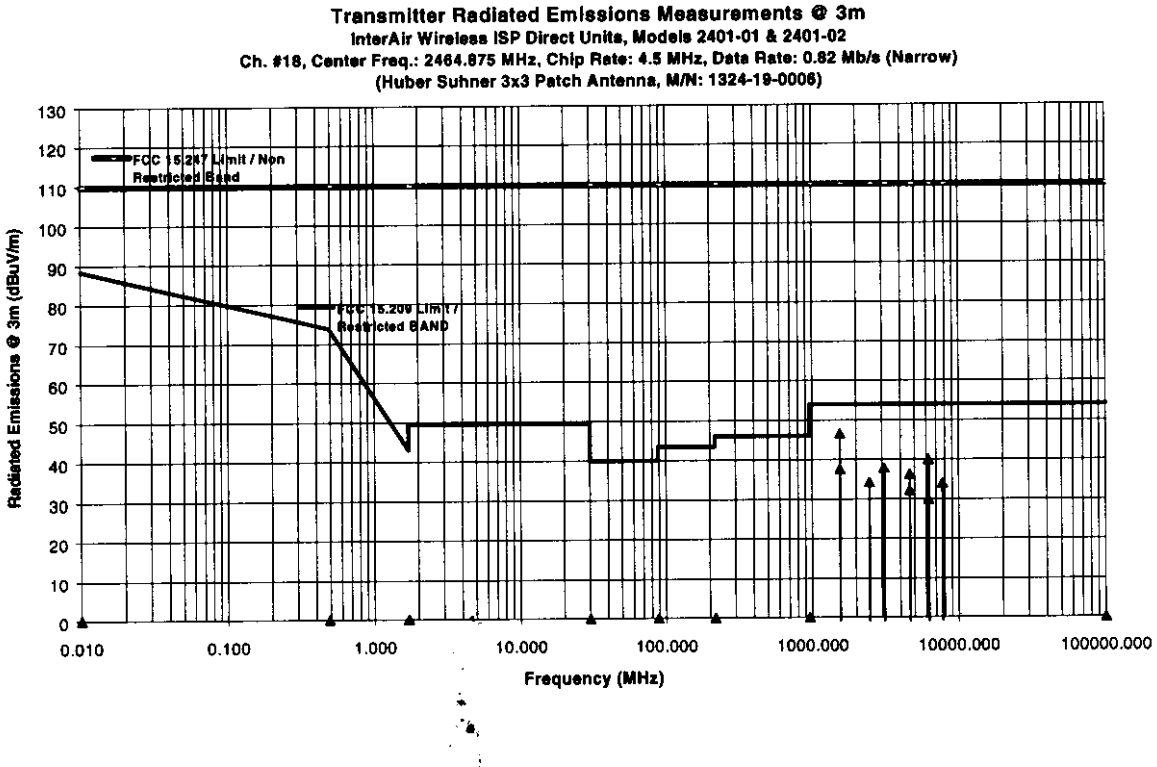
** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

Transmitter Radiated Emissions Measurements @ 3m
InterAir Wireless ISP Direct Units, Models 2401-01 & 2401-02
Ch. #6, Center Freq.: 2419.875 MHz, Chip Rate: 11.25 MHz, Data Rate: 2.05 Mb/s (Wide)
(Huber Suhner 3x3 Patch Antenna, M/N: 1324-19-0006)



Channel #: 18, Frequency: 2419.875 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, narrow, 11 chips/symbol, Data Rate: 11.25 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 120.6 dBuV/m Limit = 120.6 dBuV/m - 20dB = 109.9 dBuV/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	60.6	46.6	V	54.0	109.9	-7.4	** PASS
1549.88	46.3	37.6	H	54.0	109.9	-16.4	** PASS
2464.88	129.9	--	V	--	--	--	--
2464.88	110.0	--	H	--	--	--	--
3099.75	50.1	37.9	V	54.0	109.9	-72.0	PASS
3099.75	49.3	37.9	H	54.0	109.9	-72.0	PASS
4649.63	54.9	36.3	V	54.0	109.9	-17.7	** PASS
4649.63	49.4	32.2	H	54.0	109.9	-21.8	** PASS
6199.50	53.2	40.0	V	54.0	109.9	-69.9	PASS
6199.50	49.1	30.0	H	54.0	109.9	-79.9	PASS
7749.38	52.3	34.0	V	54.0	109.9	-20.0	** PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

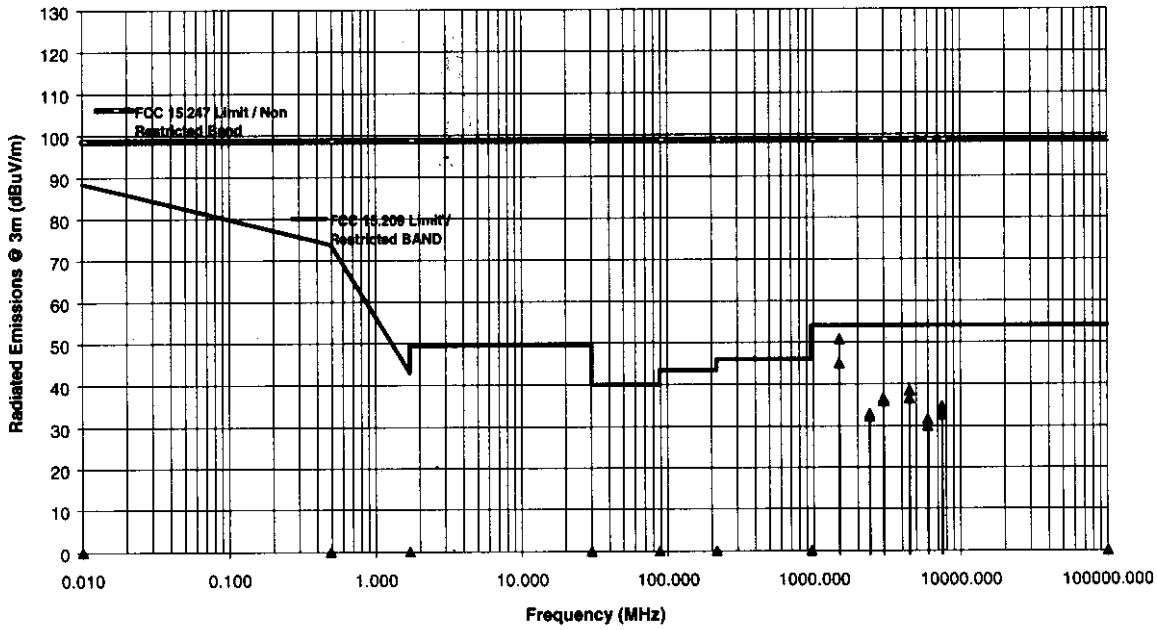


4.2.3 Test Config.# 3: (Tecom 3x3 Patch Antenna, M/N: 505039B)

Channel #: 3, Frequency: 2419.875 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, narrow, 11 chips/symbol, Data Rate: 11.25 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 118.6 dBuV/m Limit = 118.6 dBuV/m - 20dB = 98.6 dBuV/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
1493.63	63.3	50.7	V	54.0	98.6	-3.3	** PASS
1493.63	70.6	44.9	H	54.0	98.6	-9.1	** PASS
2408.63	118.6	--	V	--	--	--	--
2408.63	113.9	--	H	--	--	--	--
2987.25	48.4	35.8	V	54.0	98.6	-62.8	PASS
2987.25	48.7	36.5	H	54.0	98.6	-62.1	PASS
4480.88	52.4	38.4	V	54.0	98.6	-15.7	** PASS
4480.88	50.6	36.4	H	54.0	98.6	-17.6	** PASS
5974.50	50.5	31.6	V	54.0	98.6	-67.0	PASS
5974.50	36.9	30.0	H	54.0	98.6	-68.6	PASS
7468.13	42.2	34.6	V	54.0	98.6	-19.4	** PASS
7468.13	51.1	32.7	H	54.0	98.6	-21.3	** PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

- *FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

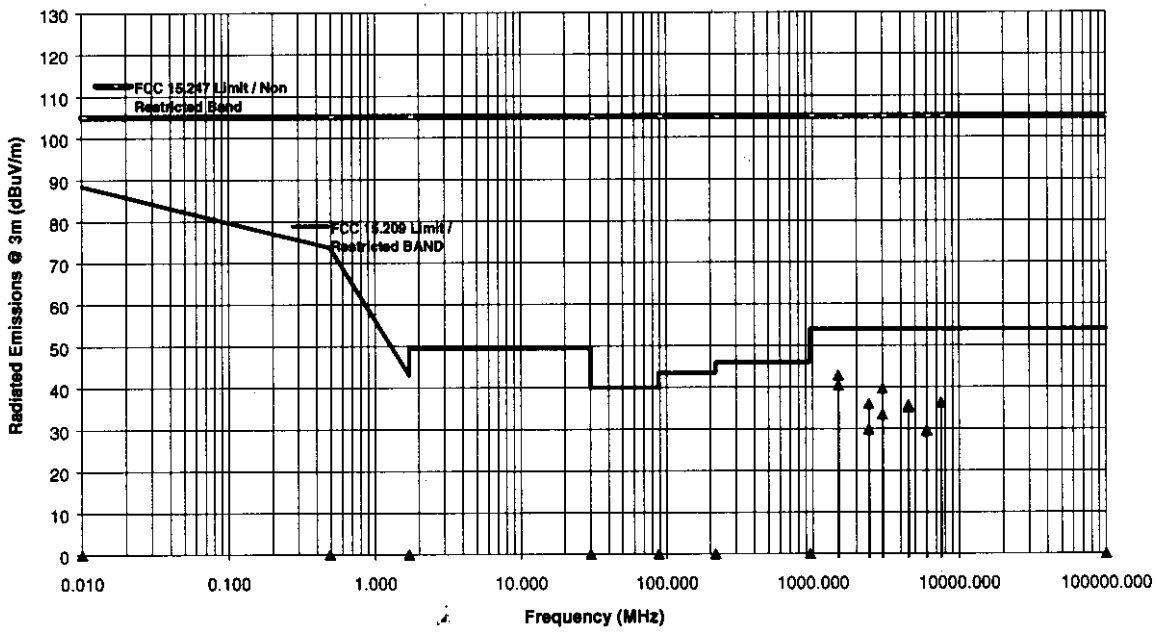
Transmitter Radiated Emissions Measurements @ 3m
InterAir Wireless ISP Direct Units, Models 2401-01 & 2401-02
Ch. #3, Center Freq.: 2408.625 MHz, Chip Rate: 4.5 MHz, Data Rate: 0.82 Mb/s (Narrow)
(Tecom 3x3 Patch Antenna, M/N: 505039B)



Channel #: 4, Frequency: 2411.4375 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, medium , 11 chips/symbol, Data Rate: 5.625 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 125.1 dBuV/m Limit = 125.1 dBuV/m - 20dB = 105.1 dBuV/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
1496.44	69.8	42.9	V	54.0	105.1	-11.2	** PASS
1496.44	68.8	40.5	H	54.0	105.1	-13.5	** PASS
2411.44	125.1	--	V	--	--	--	--
2411.44	112.5	--	H	--	--	--	--
2992.88	45.3	33.5	V	54.0	105.1	-71.6	PASS
2992.88	51.1	39.7	H	54.0	105.1	-65.4	PASS
4489.31	49.8	35.1	V	54.0	105.1	-18.9	** PASS
4489.31	50.8	35.7	H	54.0	105.1	-18.3	** PASS
5985.75	48.3	29.4	V	54.0	105.1	-75.7	PASS
5985.75	47.7	29.7	H	54.0	105.1	-75.4	PASS
7482.19	53.6	36.3	V	54.0	105.1	-17.7	** PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

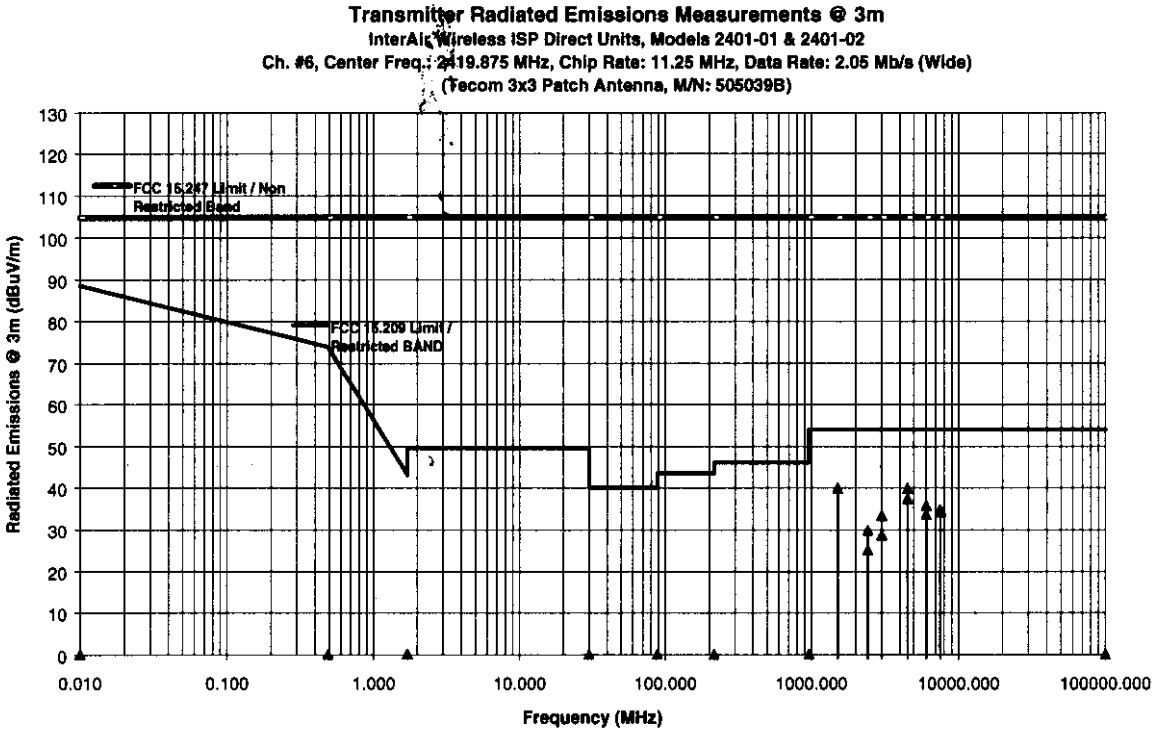
- *FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

Transmitter Radiated Emissions Measurements @ 3m
InterAir Wireless ISP Direct Units, Models 2401-01 & 2401-02
Ch. #4, Center Freq.: 2411.4375 MHz, Chip Rate: 5.625 MHz, Data Rate: 1.02 Mb/s (Medium)
(Tecom 3x3 Patch Antenna, M/N: 505039B)



Channel #: 6, Frequency: 2419.875 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, wide, 11 chips/symbol, Data Rate: 11.25 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 124.8 dBuV/m Limit = 124.8 dBuV/m - 20dB = 104.8 dBuV/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	72.2	39.9	V	54.0	104.8	-14.1	** PASS
1504.88	72.8	39.9	H	54.0	104.8	-14.2	** PASS
2419.88	124.8	--	V	--	--	--	--
2419.88	115.3	--	H	--	--	--	--
3009.75	58.3	33.4	V	54.0	104.8	-71.5	PASS
3009.75	50.2	28.6	H	54.0	104.8	-76.2	PASS
4514.63	50.6	37.4	V	54.0	104.8	-16.6	** PASS
4514.63	52.2	39.8	H	54.0	104.8	-14.2	** PASS
6019.50	52.5	35.8	V	54.0	104.8	-69.0	PASS
6019.50	51.5	33.6	H	54.0	104.8	-71.2	PASS
7524.38	53.7	34.8	V	54.0	104.8	-19.2	** PASS
7524.38	53.5	34.2	H	54.0	104.8	-19.8	** PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

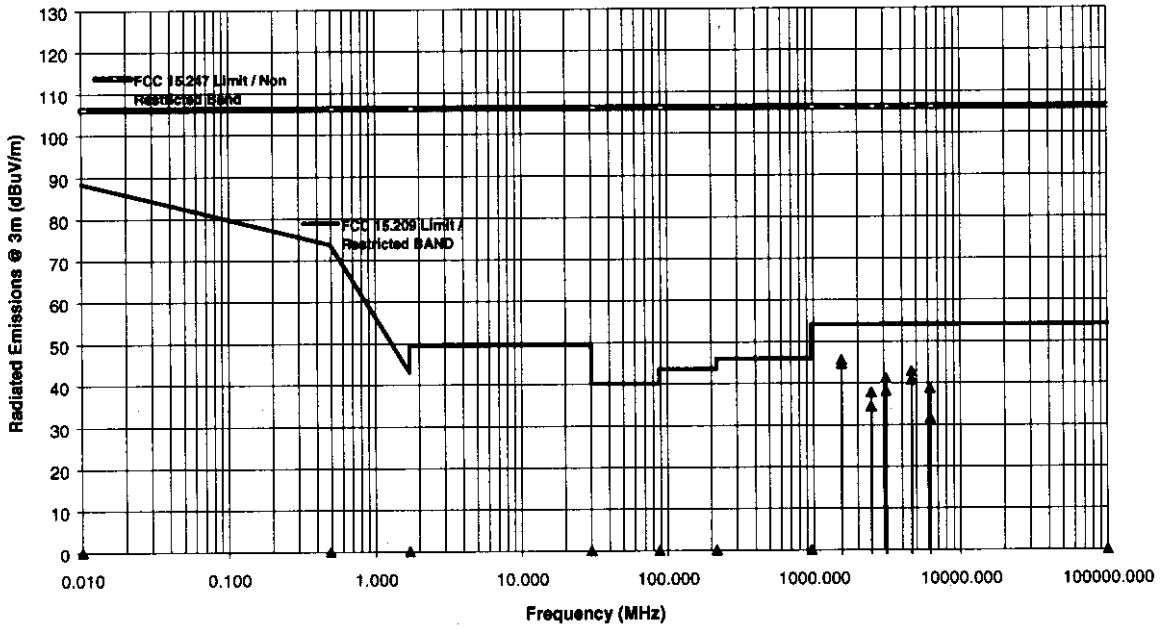
** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*



Channel #: 18, Frequency: 2464.875 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, narrow, 11 chips/symbol, Data Rate: 4.5 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 126.2 dBuV/m Limit = 126.2 dBuV/m - 20dB = 106.2 dBuV/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	71.8	45.6	V	54.0	106.2	-8.4	** PASS
1549.88	69.4	44.7	H	54.0	106.2	-9.3	** PASS
2464.88	126.2	--	V	--	--	--	--
2464.88	117.3	--	H	--	--	--	--
3099.75	52.4	41.2	V	54.0	106.2	-65.0	PASS
3099.75	50.3	37.9	H	54.0	106.2	-68.3	PASS
4649.63	55.9	42.8	V	54.0	106.2	-11.2	** PASS
4649.63	53.8	40.7	H	54.0	106.2	-13.3	** PASS
6199.50	53.4	38.6	V	54.0	106.2	-67.6	PASS
6199.50	50.2	31.6	H	54.0	106.2	-74.6	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205

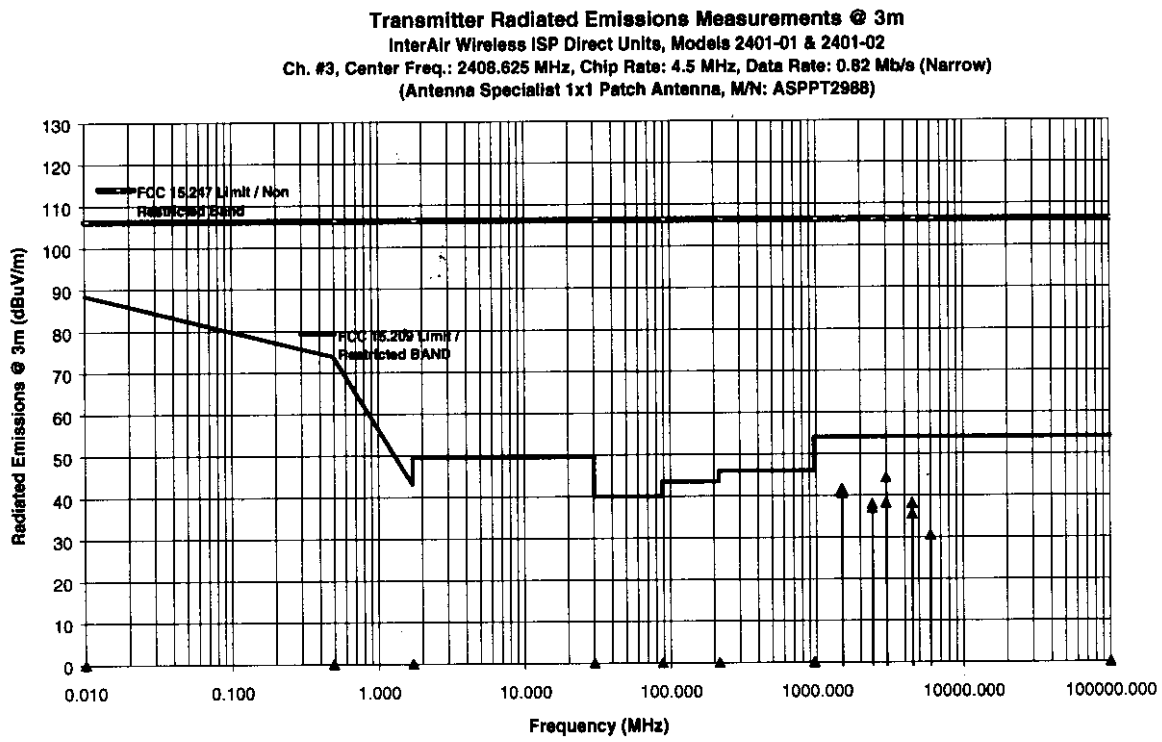
Transmitter Radiated Emissions Measurements @ 3m
InterAir Wireless ISP Direct Units, Models 2401-01 & 2401-02
Ch. #18, Center Freq.: 2464.875 MHz, Chip Rate: 4.5 MHz, Data Rate: 0.82 Mb/s (Narrow)
(Tecom 3x3 Patch Antenna, M/N: 505039B)



4.2.4 Test Config.# 4: (Antenna Specialists 1x1 Patch Antenna, P/N: ASPPT2988)

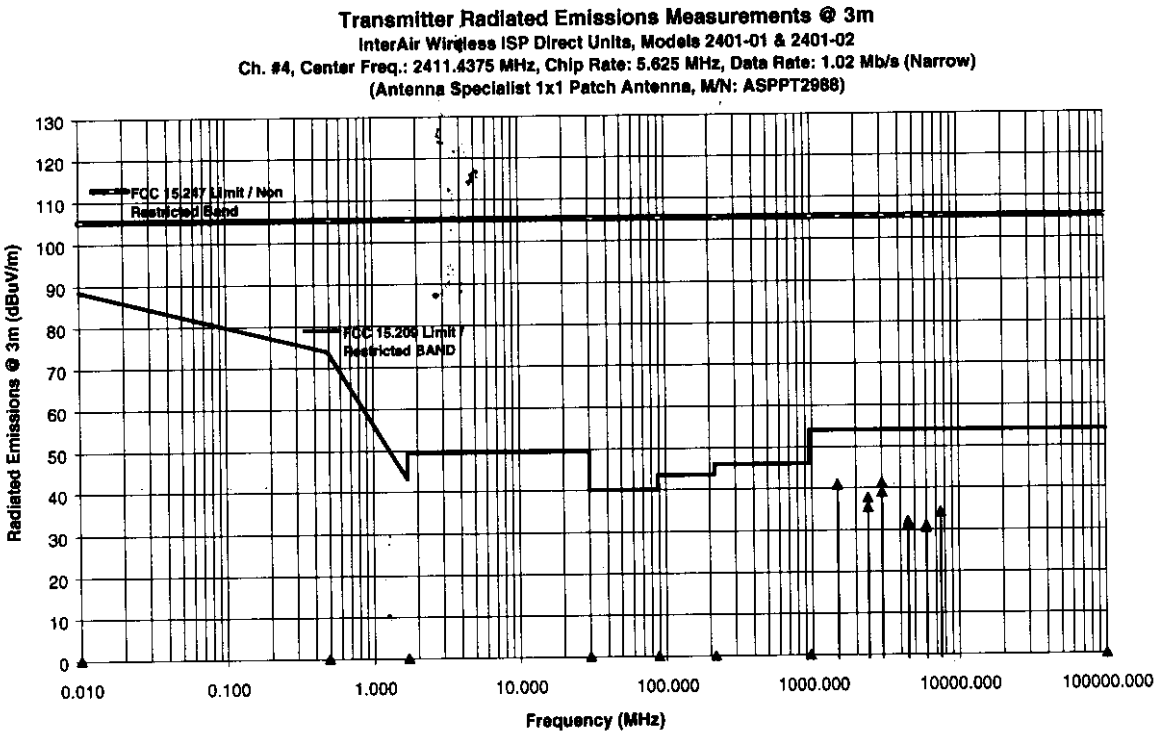
Channel #: 3, Frequency: 2462.0625 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, narrow, 11 chips/symbol, Data Rate: 5.625 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 126.3 dBuV/m Limit = 126.3 dBuV/m - 20dB = 106.3 dBuV/m			
FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.247 (dBuV/m)	MARGIN (dB)	PASS/ FAIL
1493.63	59.0	40.7	V	54.0	106.3	-13.3	** PASS
1493.63	58.3	41.6	H	54.0	106.3	-12.4	** PASS
2408.63	118.1	--	V	--	--	--	--
2408.63	126.3	--	H	--	--	--	--
2987.25	53.6	44.3	V	54.0	106.3	-62.0	PASS
2987.25	49.8	38.4	H	54.0	106.3	-68.0	PASS
4480.88	52.7	38.3	V	54.0	106.3	-15.7	** PASS
4480.88	50.4	35.6	H	54.0	106.3	-18.4	** PASS
5974.50	48.7	30.5	V	54.0	106.3	-75.8	PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205



Channel #: 4, Frequency: 2464.875 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, medium, 11 chips/symbol, Data Rate: 4.5 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 125.3 dBuV/m Limit = 125.3 dBuV/m - 20 dB = 105.3 dBuV/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
1496.44	59.0	40.9	V	54.0	105.3	-13.1	** PASS
1496.44	58.8	41.0	H	54.0	105.3	-13.0	** PASS
2411.44	116.0	--	V	--	--	--	--
2411.44	125.3	--	H	--	--	--	--
2992.88	51.7	41.3	V	54.0	105.3	-64.0	PASS
2992.88	50.0	39.0	H	54.0	105.3	-66.3	PASS
4489.31	49.2	32.1	V	54.0	105.3	-21.9	** PASS
4489.31	48.7	31.4	H	54.0	105.3	-22.7	** PASS
5985.75	49.3	31.0	V	54.0	105.3	-74.3	PASS
5985.75	49.1	30.5	H	54.0	105.3	-74.8	PASS
7482.19	51.9	34.3	V	54.0	105.3	-19.7	** PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

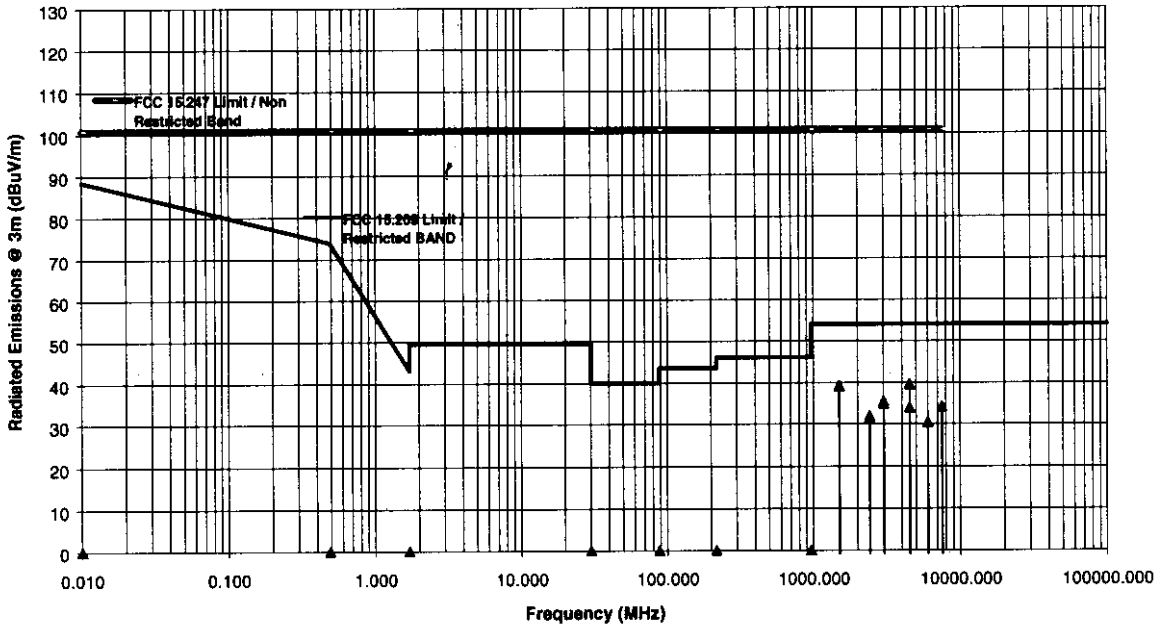
FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205



Channel #: 6, Frequency: 2408.625 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, wide, 11 chips/symbol, Data Rate: 4.5 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 120.8 dBuV/m Limit = 120.8 dBuV/m -20 dB =100.8 dBuV/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	64.2	39.3	V	54.0	100.8	-14.7	** PASS
1504.88	62.6	39.0	H	54.0	100.8	-15.0	** PASS
2419.88	114.3	--	V	--	--	--	--
2419.88	120.8	--	H	--	--	--	--
3009.75	47.4	34.9	V	54.0	100.8	-65.9	PASS
3009.75	48.2	35.5	H	54.0	100.8	-65.3	PASS
4514.63	52.7	39.6	V	54.0	100.8	-14.4	** PASS
4514.63	50.6	34.0	H	54.0	100.8	-20.0	** PASS
6019.50	49.2	30.5	V	54.0	100.8	-70.3	PASS
6019.50	49.2	30.4	H	54.0	100.8	-70.4	PASS
7524.38	52.7	34.2	V	54.0	100.8	-19.8	** PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205

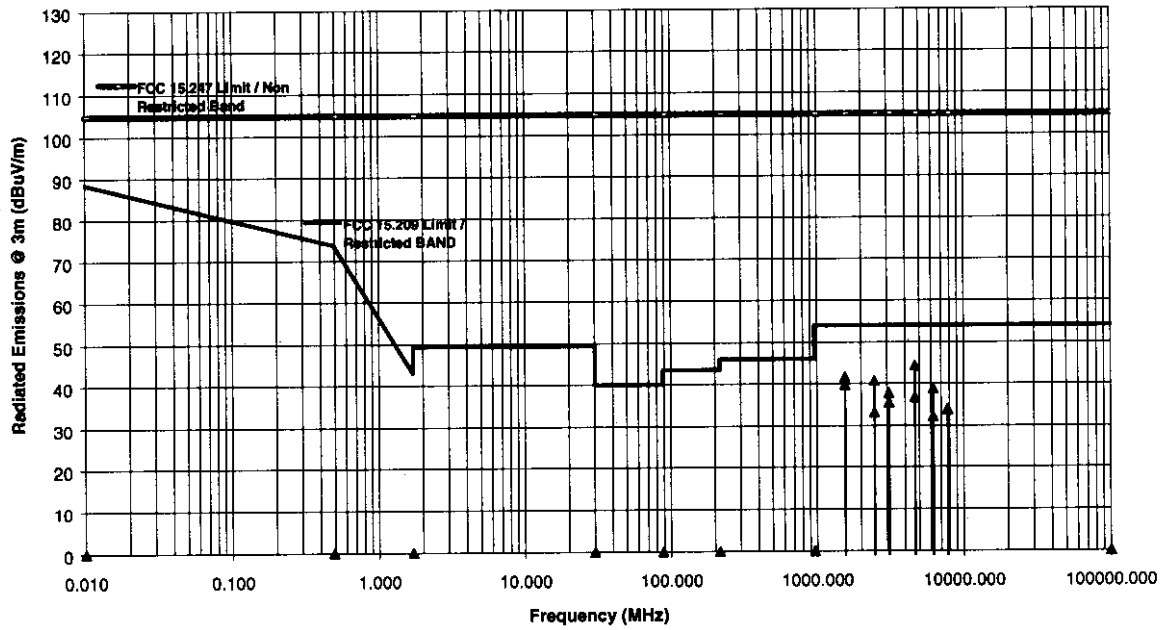
Transmitter Radiated Emissions Measurements @ 3m
InterAir Wireless ISP Direct Units, Models 2401-01 & 2401-02
Ch. #6, Center Freq.: 2419.875 MHz, Chip Rate: 11.25 MHz, Data Rate: 2.05 Mb/s (Wide)
(Antenna Specialist 1x1 Patch Antenna, M/N: ASPPT2988)



Channel #: 18, Frequency: 2464.875 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, narrow, 11 chips/symbol, Data Rate: 4.5 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 124.9. dBuV/m Limit = 124.9 dBuV/m - 20dB = 104.9 dBuV/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	63.8	41.7	V	54.0	104.9	-12.3	** PASS
1549.88	60.4	39.8	H	54.0	104.9	-14.2	** PASS
2464.88	116.1	--	V	--	--	--	--
2464.88	124.9	--	H	--	--	--	--
3099.75	49.2	37.8	V	54.0	104.9	-67.1	PASS
3099.75	48.7	35.6	H	54.0	104.9	-69.3	PASS
4649.63	54.7	44.3	V	54.0	104.9	-9.7	** PASS
4649.63	51.8	36.8	H	54.0	104.9	-17.3	** PASS
6199.50	52.1	38.9	V	54.0	104.9	-66.1	PASS
6199.50	49.5	32.2	H	54.0	104.9	-72.7	PASS
7749.38	52.3	33.7	V	54.0	104.9	-20.3	** PASS
7749.38	53.5	34.0	H	54.0	104.9	-20.0	** PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205

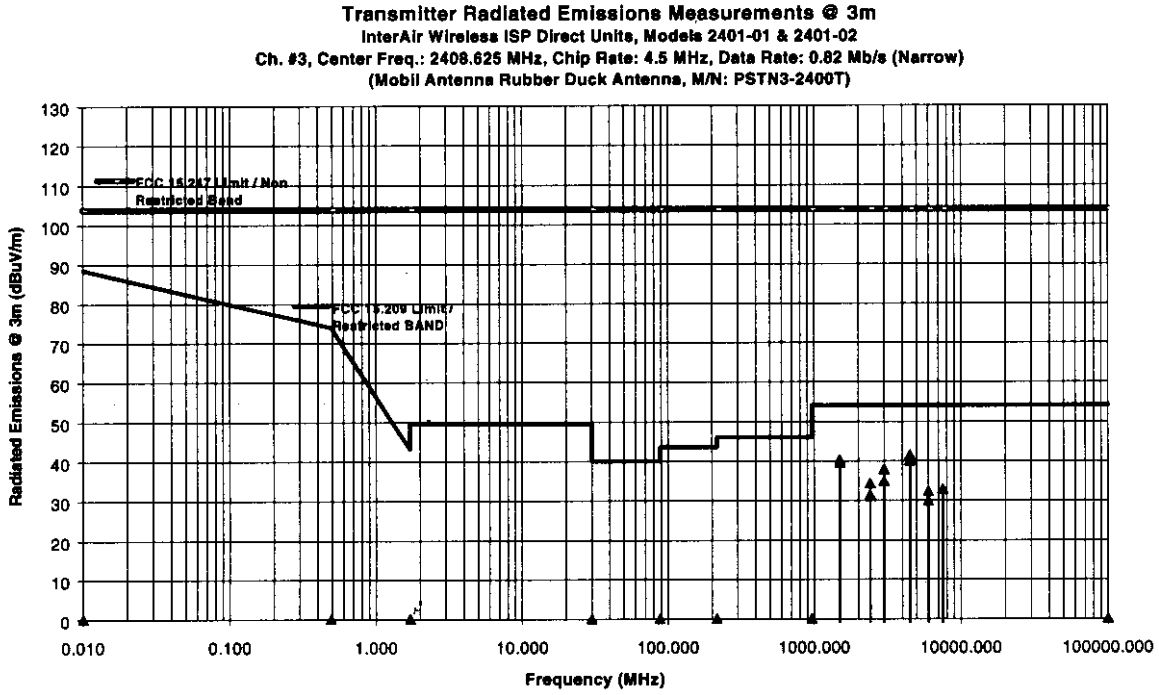
Transmitter Radiated Emissions Measurements @ 3m
InterAir Wireless ISP Direct Units, Models 2401-01 & 2401-02
Ch. #18, Center Freq.: 2464.875 MHz, Chip Rate: 4.5 MHz, Data Rate: 0.82 Mb/s (Narrow)
(Antenna Specialist 1x1 Patch Antenna, M/N: ASPPT2988)



4.2.5 Test Config.# 5: (Mobil Antenna Rubber Duck Antenna, M/N: PSTN3-2400T)

Channel #: 3, Frequency: 2462.0625 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, narrow, 11 chips/symbol, Data Rate: 5.625 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 123.8 dBuV/m Limit = 123.8 dBuV/m - 20dB = 103.8 dBuV/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
1493.63	63.9	40.2	V	54.0	103.8	-13.8	** PASS
1493.63	58.1	39.6	H	54.0	103.8	-14.4	** PASS
2408.63	123.8	--	V	--	--	--	--
2408.63	116.8	--	H	--	--	--	--
2987.25	49.4	37.9	V	54.0	103.8	-65.9	PASS
2987.25	54.0	34.9	H	54.0	103.8	-68.9	PASS
4480.88	54.3	41.4	V	54.0	103.8	-12.6	** PASS
4480.88	52.8	40.1	H	54.0	103.8	-13.9	** PASS
5974.50	48.6	29.9	V	54.0	103.8	-73.9	PASS
5974.50	49.9	32.3	H	54.0	103.8	-71.5	PASS
7468.12	52.2	32.9	V	54.0	103.8	-21.2	** PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

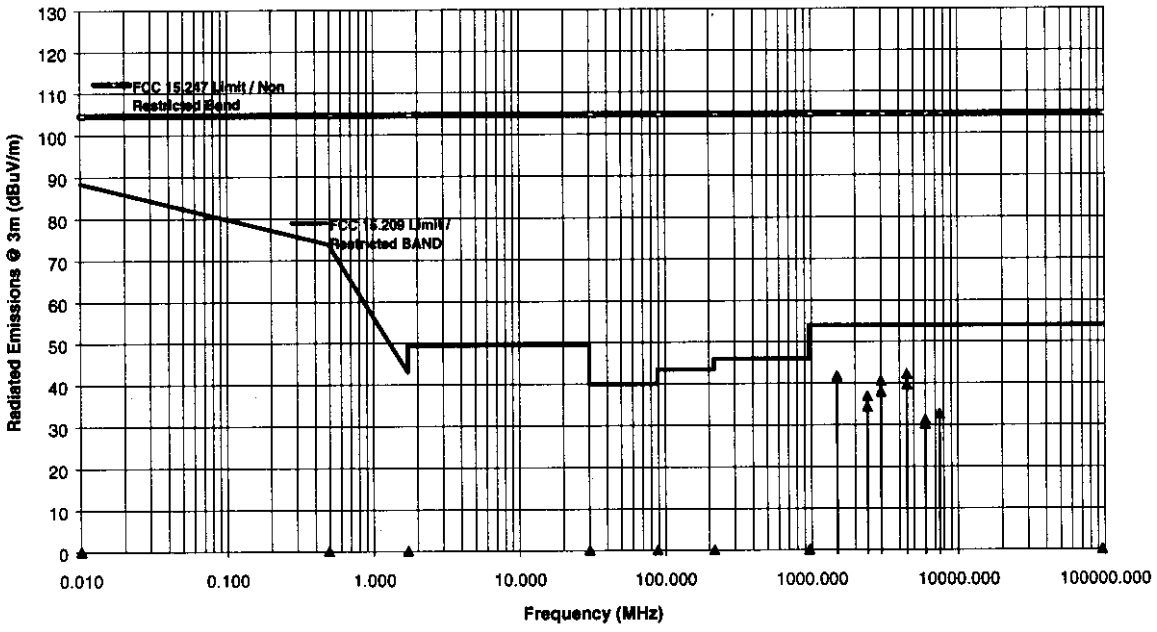
** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*



Channel #: 4, Frequency: 2464.875 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, medium, 11 chips/symbol, Data Rate: 4.5 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 124.6 dBuV/m Limit = 124.6 dBuV/m - 20 dB = 104.6 dBuV/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
1496.44	64.1	41.1	V	54.0	104.6	-12.9	** PASS
1496.44	59.2	41.8	H	54.0	104.6	-12.2	** PASS
2411.44	124.6	--	V	--	--	--	--
2411.44	116.4	--	H	--	--	--	--
2992.88	52.2	40.5	V	54.0	104.6	-64.1	PASS
2992.88	48.8	37.9	H	54.0	104.6	-66.7	PASS
4489.31	53.2	42.2	V	54.0	104.6	-11.8	** PASS
4489.31	51.8	39.7	H	54.0	104.6	-14.3	** PASS
5985.75	48.8	30.2	V	54.0	104.6	-74.4	PASS
5985.75	49.5	31.3	H	54.0	104.6	-73.3	PASS
7482.19	51.4	32.6	V	54.0	104.6	-21.4	** PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

- *FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

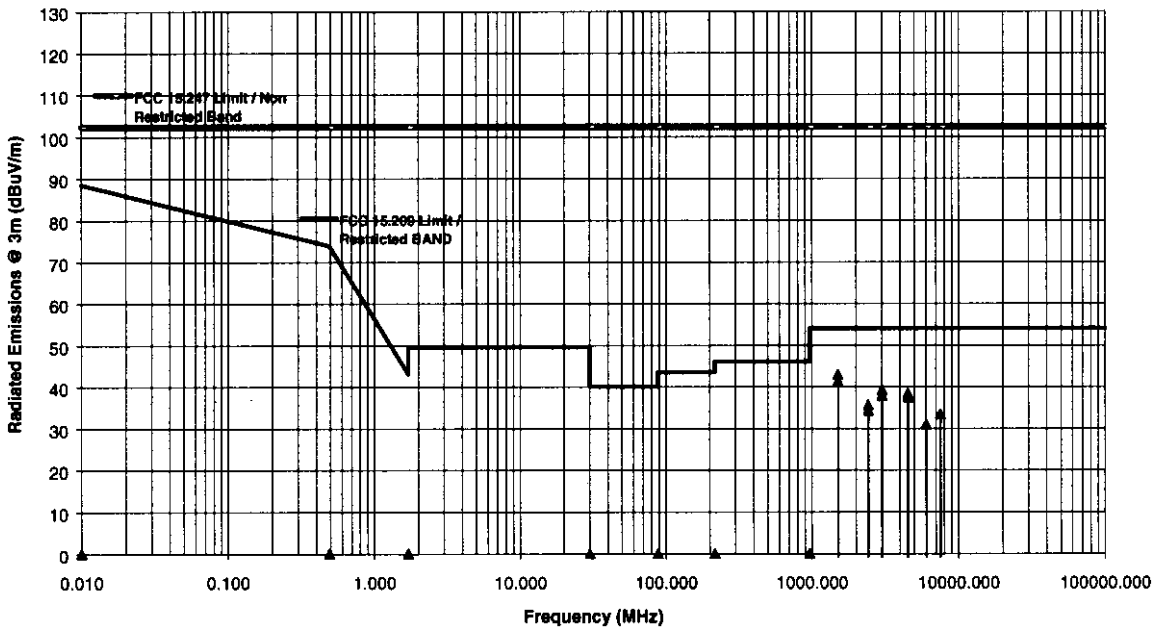
Transmitter Radiated Emissions Measurements @ 3m
InterAir Wireless ISP Direct Units, Models 2401-01 & 2401-02
Ch. #4, Center Freq.: 2411.4375 MHz, Chip Rate: 5.625 MHz, Data Rate: 1.02 Mb/s (Medium)
(Mobil Antenna Rubber Duck Antenna, M/N: PSTN3-2400T)



Channel #: 6, Frequency: 2408.625 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, wide, 11 chips/symbol, Data Rate: 4.5 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 122.3 dBuV/m Limit = 122.3 dBuV/m -20 dB =102.3 dBuV/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	67.3	42.9	V	54.0	102.3	-11.1	** PASS
1504.88	61.8	41.3	H	54.0	102.3	-12.7	** PASS
2419.88	122.3	--	V	--	--	--	--
2419.88	114.6	--	H	--	--	--	--
3009.75	49.3	39.2	V	54.0	102.3	-63.1	PASS
3009.75	47.2	37.9	H	54.0	102.3	-64.4	PASS
4514.63	51.8	38.4	V	54.0	102.3	-15.6	** PASS
4514.63	51.5	37.5	H	54.0	102.3	-16.5	** PASS
6019.50	48.9	31.0	V	54.0	102.3	-71.3	PASS
7524.38	52.5	33.4	V	54.0	102.3	-20.6	** PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

** FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205*

Transmitter Radiated Emissions Measurements @ 3m
InterAir Wireless ISP Direct Units, Models 2401-01 & 2401-02
Ch. #6, Center Freq.: 2419.875 MHz, Chip Rate: 11.25 MHz, Data Rate: 2.05 Mb/s (Wide)
(Mobil Antenna Rubber Duck Antenna, M/N: PSTN3-2400T)



Channel #: 18, Frequency: 2464.875 MHz Full Rated Peak Power: 190 mW Modulation: DQPSK, narrow, 11 chips/symbol, Data Rate: 4.5 Mb/s, 2 bits/symbol				Power Level in 1 MHz BW: 125.0 dBuV/m Limit = 125.0 dBuV/m - 20dB = 105.0 dBuV/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	69.3	44.2	V	54.0	105.0	-9.8	** PASS
1549.88	65.3	41.2	H	54.0	105.0	-12.8	** PASS
2464.88	125.0	--	V	--	--	--	--
2464.88	115.3	--	H	--	--	--	--
3099.75	48.6	34.9	V	54.0	105.0	-70.1	PASS
3099.75	46.5	33.8	H	54.0	105.0	-71.2	PASS
4649.63	52.5	38.7	V	54.0	105.0	-15.3	** PASS
4649.63	50.2	36.9	H	54.0	105.0	-17.1	** PASS
6199.50	51.0	36.3	V	54.0	105.0	-68.7	PASS
6199.50	47.8	29.8	H	54.0	105.0	-75.2	PASS
7749.38	52.4	34.1	V	54.0	105.0	-19.9	** PASS
No other significant emissions were found in the frequency range from 10 MHz to 25 GHz. Refer to attached plots for details							

FCC Limit @ 15.209 was applied for frequency fell within restricted band @ 15.205