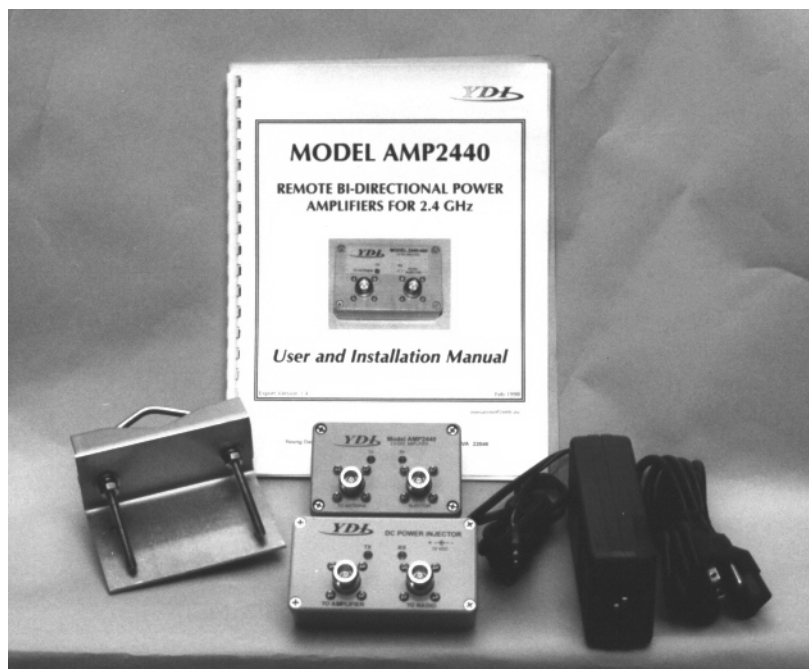


*Preliminary*

# Model AMP2440P

## **REMOTE BI-DIRECTIONAL POWER AMPLIFIERS FOR 2.4 GHz**



## ***User and Installation Manual***

Version 1.0P

June 1999

## **IMPORTANT SAFETY INFORMATION**

Connecting the RF output of a radio modem transmitter to a high gain antenna will result in concentrated signal level near the antenna. The field strength radiated by these antennas, when connected to a transmitting Model 2400 Radio Modem with AMP2440P, may exceed FCC mandated RF exposure limits. FCC rules require professional installation of these antennas in such a way that the general public will not be closer than 70 cm from the radiating aperture of any of these antennas. End users of these systems must also be informed of this safety distance requirement.

### **LIMITED WARRANTY**

Young Design, Inc. (YDI) warrants that your device is free of defects in material and workmanship for a period of one year after initial purchase. YDI will repair or replace any YDI product returned to the factory freight prepaid within one year of the purchase date.

The YDI warranty covers repairs or replacement (at YDI's option) of the product only. YDI is not responsible for the cost of removal, reinstallation, or shipping to the place of repair. YDI does not extend or modify its warranty period as a result of repair or replacement.

YDI reserves the right to void a warranty and/or bill reasonable charges for repair of a unit if the warranty seal is broken or the unit displays evidence of misuse, abuse, or tampering.

YDI is not responsible for damage to any other equipment or property, or any other consequential or incidental damages of any kind, whether based on contract, negligence, or strict liability. Maximum liability shall not in any case exceed the purchase price of the unit.

Warranties give you (the buyer) specific legal rights. You may also have other rights which vary from state to state. This warranty is only extended to purchases made in the United States of America or its possessions.

### **WARRANTY NOTICE**

The AMP2440P warranty is null and void if any of the following occurs:

1. The amplifier is opened.
2. The antenna connections are not properly waterproofed.
3. The amplifier is operated with no antenna attached to the antenna connector.

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## 1. Description

The AMP2440P is a bi-directional amplifier designed for extending the range of 2.4 GHz wireless LAN cards. The Model AMP2440P amplifier is intended only for use with the YDI Model WL2400-PCM and the WL2400-ISA 2.4 GHz Direct Sequence Spread Spectrum Wireless LAN cards. The units provide transmit power amplification as well as receive signal gain. The amplifier is installed right at the antenna's feed point, providing maximum effectiveness of transmit power. This has the effect of compensating for signal loss in the transmitter cable to the antenna. Likewise, the Low Noise Amplifier (LNA) in the AMP2440P boosts the receive signal right at the antenna prior to experiencing the loss in the transmission cable to the radio. This gain also overcomes the losses in the transmission cable between the amplifier and the radio. In fact, use of the amp will actually increase the receiver sensitivity by a few dB! The ultimate result is the best possible noise figure and maximum receiver sensitivity.

The amplifier is completely weatherproof and can be bolted to the antenna mast or tower leg using the U-bolt included. The connectors face down so that gravity will drain all water away from the amplifier enclosure. This will prevent water from settling on the face of the unit. Likewise, since the LEDs are also facing downward they can be checked for operation from the bottom of the mast.

DC Power to the amplifier is supplied through the transmission cable, using an indoor power supply and DC Injector. The amplifier unit also contains its own integral lightning protection and DC surge protection. Likewise, the DC Power Injector connected to the WLAN card offers built-in lightening if properly grounded.

Full output power of 250 mW is achieved with only 20 mW (+10 dBm) input to the amplifier.

## 2. Amplifier Features

- Transmit input levels from 3mW to 100mW
- Up to 15dB transmitter power gain
- 18dB receive gain
- Low Noise Preamp
- Weatherproof Cast Aluminum Case that is Mast Mountable
- Mounting hardware that will accommodate mast diameters from 3/4" thru 3"
- Polyurethane gasket for watertight seal on amplifier
- DC Power carried up through the transmission cable
- Power and Transmit LEDs on both the amp and the DC power injector
- Built-in Lightning and DC Surge Protection
- Heavy Duty "N" Connectors
- One Year Warranty
- Made in the U.S.A.

### 3. Specifications

#### General Specifications

**Operating Range:** 2400-2483 MHz

**Operating Mode:** Bi-directional, half-duplex. Senses RF carrier from transmitter and automatically switches from receive to transmit mode.

**Connectors:** N-female

**Indicators:** TX and RX LEDs on both the amplifier and the DC power injector

**Lightening Protection:** Direct DC ground at antenna connector on amp. Also, the DC Injector is also a lightning protector if properly grounded

**DC Surge Protection:** 600 Watt TVS at the amplifier input from transmission cable

#### Transmitter Amplifier

**Transmit Gain:** Up to 15 dB

**Frequency Response:** +/-1 dB over operating range

**Transmit Output Power:** 250 mW

**Transmit Input Power:** 3mW minimum, 100mW maximum

#### Receiver Low Noise Amplifier (LNA)

**Receive Gain:** 18 dB typical

**Frequency Response:** +/-1 dB over operating range

**Noise Figure:** 3.5 dB approximately

**Third Order Intercept:** 20 dBm

#### Mechanical and Environmental

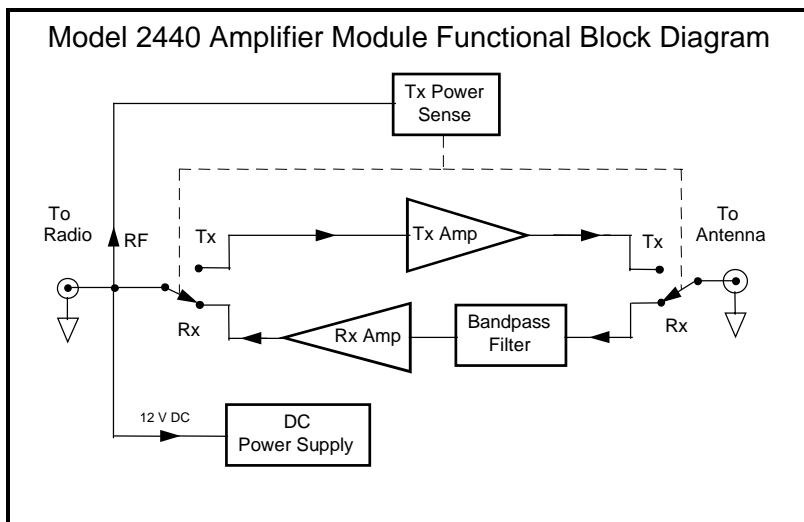
**Operating Temperature:** -20°C to +60°C

**Power:** 12VDC @ 650mA or 105-240 VAC from power supply provided with kit

**Dimensions:** **Amplifier:** 3.85" x 2.52" x 1.46"  
**DC Power injector:** 4.42" x 2.40" x 1.22"

**Mounting Bracket for amplifier:** Accommodates pole/mast diameters from 3/4" to 3"

**Kit Weight:** Approx. 1.5 lb. with U-bolts



Amplifier shown with the mounting hardware and DC Power Injector

## IMPORTANT FCC REGULATORY INFORMATION

The AMP2440P and the YDI WLAN 2400 WLAN cards must be professionally installed. Table (1) shows the FCC approved antennas that can be used with and without the YDI AMP2440P. It is the responsibility of the installer to ensure that when used in the United States (or where FCC rules apply) under Part 15 regulations, only these configurations can be used.

**TABLE (1)**

### **Antennas Certified for use with the WL2400 and AMP2440P**

| <b>MODEL</b> | <b>DESCRIPTION</b>                  | <b>Minimum Safe Uncontrolled Exposure Distance</b> | <b>Minimum Safe Controlled Exposure Distance</b> |
|--------------|-------------------------------------|--|--|
| Y2412        | 12 dB gain Yagi Antenna             | 20cm   | 20cm   |
| Y2414        | 14 dB gain Yagi Antenna             | 22cm   | 20cm   |
| A2.45 FP12   | 12 dB gain flat Panel Antenna       | 20cm   | 20cm   |
| A2.45 FP18   | 18 dB gain flat Panel Antenna       | 35cm   | 20cm   |
| A2.45 LP17   | 17 dB gain long Panel Antenna       | 32cm   | 20cm   |
| A2.45 LP15   | 15 dB gain long Panel Antenna       | 25cm   | 20cm   |
| A2408        | 8 dB gain Omni-directional Antenna  | 20cm   | 20cm   |
| A2412        | 12 dB gain Omni-directional Antenna | 20cm   | 20cm   |
| PT2421       | 21 dB gain Grid Dish Antenna        | 50cm   | 22cm   |
| PT2424       | 24 dB gain Grid Dish Antenna        | 70cm   | 32cm   |

Uncontrolled exposure distances is where the power density is  $1\text{mW}/\text{cm}^2$ . Controlled exposure distances is where the power density is  $5\text{mW}/\text{cm}^2$ . The antennas must be installed such that there will be no person closer than the specified distances in front of directional antennas or directly beside the Omni antennas.

Note: 20cm is the minimum distance regardless of what the actual calculation of the density shows.

## **4. Amplifier Kit**

Each Amplifier Kit Includes:

- Bi-directional Amplifier
- DC Power Injector
- 110/220 VAC Power Supply with 12VDC output
- Stainless Steel U-Bolt and mounting bracket for amp
- Installation Manual

## 5. Installation and Cabling Instructions

The amplifier can be mast mounted using the steel U-bolt included with the unit (Refer to the drawing at the end of the manual for a cabling diagram). The amplifier should be installed with the connectors facing downward. Use an open-end wrench to carefully tighten the bolts using the included nuts. Take care not to over-tighten the bolts.



The amplifier can be mounted to a flat surface using any of the mounting holes on the brackets mounting flanges. However, for maximum reliability, the connectors should be facing downward.

It is very important to waterproof the RF connectors on the amp. However, it is recommended that you do not tape the connectors until after all system tests have been performed. Be sure to use a high quality weather resistant electrical tape and/or other water sealant method.

The DC Power Injector is not in a waterproof enclosure and must be protected from the weather. It can be permanently mounted to a surface by putting screws through the two holes on the bottom of the enclosures. To do this, remove the four screws holding the top cover on the enclosure. Then mount the bottom of the enclosure using screws or bolts through the two holes in bottom. Replace the top cover when the enclosure is securely mounted. Avoid touching the circuit board mounted to the cover of the DC injector when the cover is off.

Refer to the Typical Installation Details drawing at the end of this manual for more information about the installation.



*Amplifier in typical*

*Shown with the YDI Model Y2414 Yagi Antenna.*

*installation.*

## 6. Amplifier Connections and Indicators

**Transmit LED:** This LED glows RED in transmit mode indicating that RF power is applied to the amplifier from the radio.

**Receive LED:** This LED glows GREEN in the receive mode when DC power is applied to the amplifier and is off when transmitting.

**DC Injector Connection:** This “N” Female connector is connected to the DC Power Injector via the transmission cable.

**Antenna Connection:** This “N” Female connector connects to the antenna with a short length of coax cable.

## 7. DC Power Injector Connections and Indicators

A DC Power Injector is an in-line device which “injects” the DC power necessary to operate the amplifier onto a transmission line. This allows the cable to carry both RF signals and DC power to the mast mounted amplifier.

**Transmit LED:** This LED glows RED when the pole mounted amplifier goes into the transmit mode. The Remote Transmit LED is driven by unique circuitry, which actually detects changes in the DC current traveling through the transmission line to the amplifier.

**Receive LED:** This LED glows GREEN when DC power is applied to the amplifier and it is in the receive mode. When toggling between transmit and receive this LED will glow slightly dimmer.

**To Radio Connection:** This “N” Female connector is connected to the radio modem via a short jumper cable.

**To Amplifier Connection:** This “N” Female connector connects to the amplifier on the mast via the transmission line.

**12 VDC:** This is the DC power input for the injector and is a standard 2.1 mm barrel jack. +12VDC should be applied with center positive.



## **8. Power Supply**

The AMP2440P comes with a power supply that have standard 2.1 mm barrel plugs (which are configured as positive (+) tip and negative ( - ) outer conductor). Although normally supplied with a power supply, any regulated 12 Volt DC 1 amp supply can be used. The power supply provided with the kit can be used with 110 or 240 VAC power.

## **9. Operation**

The unit operates automatically and there are no user adjustments.

These modems “ping-pong” back and forth between transmit and receive so quickly during normal operation that both the TX and RX LEDs will appear to be lit simultaneously. In fact, they are turning on and off so quickly that they appear to be on all the time. You can tell how quickly one of these LEDs are turning on and off by their brightness. Their glow will be slightly dimmer when they are off.

**Table A - Conversions from dBm to Watts**

| <b>dBm</b> | <b>Watts</b> | <b>dBm</b> | <b>Watts</b> |
|------------|--------------|------------|--------------|
| 0          | 1.0 mW       | 26         | 398 mW       |
| 1          | 1.3 mW       | 27         | 500 mW       |
| 2          | 1.6 mW       | 28         | 630 mW       |
| 3          | 2.0 mW       | 29         | 800 mW       |
| 4          | 2.5 mW       | 30         | 1.0 W        |
| 5          | 3.2 mW       | 31         | 1.3 W        |
| 6          | 4.0 mW       | 32         | 1.6 W        |
| 7          | 5.0 mW       | 33         | 2.0 W        |
| 8          | 6 mW         | 34         | 2.5 W        |
| 9          | 8 mW         | 35         | 3.0 W        |
| 10         | 10 mW        | 36         | 4.0 W        |
| 11         | 13 mW        | 37         | 5.0 W        |
| 12         | 16 mW        | 38         | 6.0 W        |
| 13         | 20 mW        | 39         | 8.0 W        |
| 14         | 25 mW        | 40         | 10 W         |
| 15         | 32 mW        | 41         | 13 W         |
| 16         | 40 mW        | 42         | 16 W         |
| 17         | 50 mW        | 43         | 20 W         |
| 18         | 63 mW        | 44         | 25 W         |
| 19         | 79 mW        | 45         | 32 W         |
| 20         | 100 mW       | 46         | 44 W         |
| 21         | 126 mW       | 47         | 58W          |
| 22         | 158 mW       | 48         | 64 W         |
| 23         | 200 mW       | 49         | 64 W         |
| 24         | 250 mW       | 50         | 100 W        |
| 25         | 316 mW       |            |              |

**Table B - Typical Cable Attenuation Values**

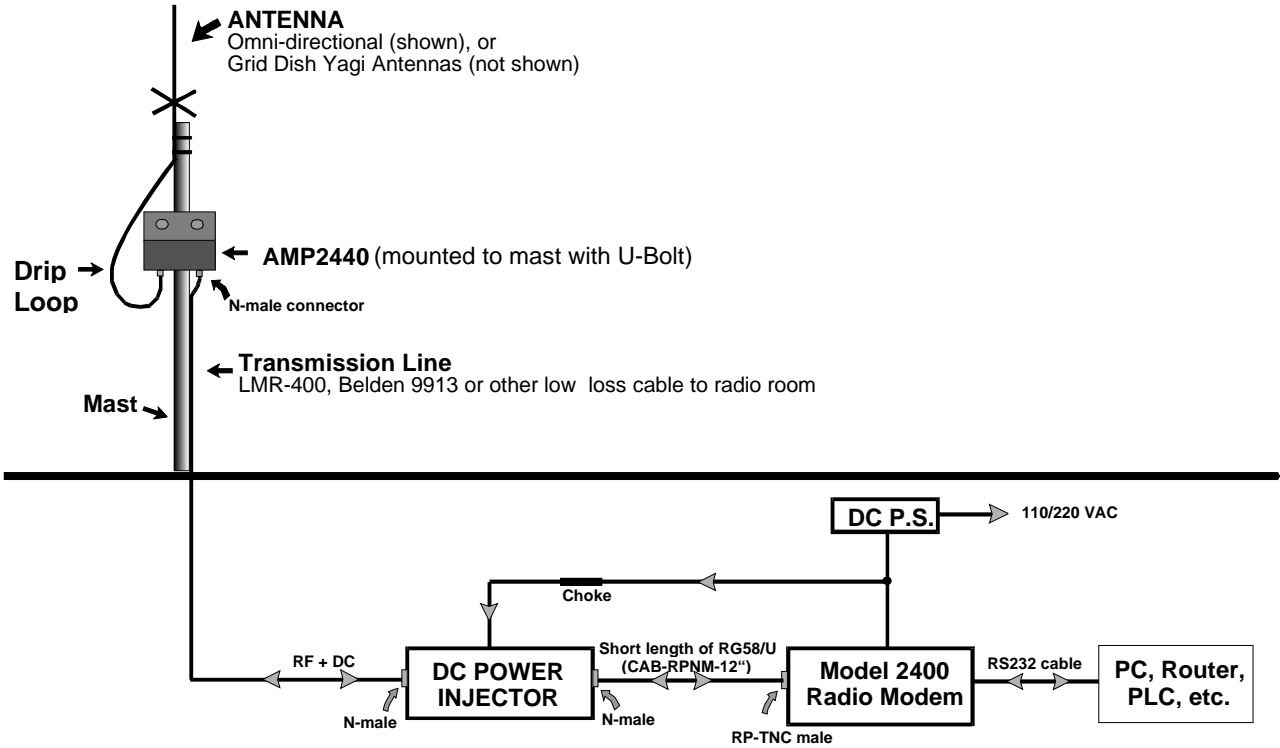
| <b>Cable Type</b> | <b>Attenuation per 100 ft (dB) at 2.4 GHz</b> |
|-------------------|---|
| Belden 9913       | 8.0   |
| LMR 200           | 16.8  |
| LMR 240           | 12.9  |
| LMR 400           | 6.8   |
| LMR 600           | 4.4   |
| 1/2 "LDF          | 3.9   |
| 1/2" Superflex    | 6.1   |
| 3/8" LDF          | 5.9   |
| 3/8" Superflex    | 6.8   |
| 1/4" Superflex    | 9.8   |

**These values are approximate. Check with cable manufacturers for exact specifications.**



**Table C - AMP2440P Typical Installation**

**TYPICAL INSTALLATION DETAILS**



If the customer does the installation, YDI will provide Antenna, pole mounted amp, DC injector, DC power supply and the Model 2400 radio modem, if ordered.

The radio installer should provide: Mast, cable from antenna to amp, transmission line from the amp to the DC injector, short cable from the DC injector to the radio modem and the RS232 cable. However, YDI can also provide any of the cables, if desired.

Drawings\diagrams\inst2440.cdr