

APPENDIX B:

PRODUCT DESCRIPTION

B1: PRODUCT DESCRIPTION FOR THE TRANSCEIVER UNIT



BreezeNet Functional Description and Block Diagram Description

**AP-10, SA-10, WB-10
and
AP-10D, SA-10D, WB-
10D**

1 Functional Description.

These devices are designed to operate under IEEE 802.11 standard.
The hardware of the AP-10, SA-10 and WB-10 is essentially identical.
The device includes 3 main blocks:

- RF Block.
- BaseBand Block.
- Digital Block.

The device consists of two boards:

1. MAC Board, which contains the CPU that runs the protocol and the Ethernet port.
2. PHY Board, which contains the physical layer (Modem and RF blocks) designed to run under IEEE 802.11.

2 Block Diagram (RF Part).

The RF part has 2 main functions:

1. Modulate and transmit analog data.
2. Receive and demodulate the RF signals and forward these signals to the baseband processor in analog form.

2.1 Oscillators.

There are three RF oscillators on the RF board:

- 2.1.1 Tx VCO (Modulator), which is continuously operating at 880 MHz. This VCO is divided by two in transmit mode.
- 2.1.2 Rx VCO, which serves as LO for the second conversion. This VCO is operating at 452 MHz.
- 2.1.3 Hopping synthesizer, this is operating over the frequency range of 1960 MHz to 2040 MHz. The step size is 1 MHz.

2.2 Reference Oscillator.

There is also a Reference Oscillator that operating at 16 MHz. This reference oscillator is used as reference for all 3 VCOs.

All 3 synthesizers are frequency locked by use of PLL.

2.3 *Transmit Path.*

The transmit path consists of a modulator operating at twice the IF frequency, Hopping VCO, Up converter, PA and Diversity switch.

In transmit mode the frequency divider is operated and thus enabling the division of the modulator frequency by 2. This signal is upconverted by mixing it with the hopping signal that operates as LO. The mixed signal that is now in the 2.4 GHz band is filtered and fed to the PA, filtered again and through the diversity switch feeds the antenna.

The modulating signal is a 2, 4 or 8 levels analog signal.

2.4 *Receive Path.*

The received signal is received in any of the antennas, selected by the diversity switch, filtered and transferred to the LNA, filtered again and down converted by mixing the received signal with the hopping synthesizer. The product is the 440 MHz IF. This is where the signal is filtered and converted down to 12 MHz where it is demodulated into baseband signal. The baseband signal is filtered and transferred to the baseband processor. The output signal is a 2, 4, or 8 levels analog signal with 500 kHz bandwidth.

The radio block diagram is shown in Fig. 1.

3 Block Diagram- Modem.

The modem consists of 3 main areas:

1. The DSP processor running at 64 MHz based on internal PLL referenced by a 2 MHz clock derived from the 16 MHz reference frequency produced by the radio.
2. DSP hardware support running at 8 MHz.
3. Analog part consists of D/A running at 4 MHz, an A/D running at 1 and 2 MHz and a second A/D running at clock rate of 250 kHz.

The modem block diagram is shown in Fig. 2.

4 Block Diagram- CPU Board.

The CPU board (MAC) contains 4 main areas.:

1. CPU RISK processor running at 25 MHz 32 bits. The CPU interfaces with DRAM banks, FLASH memory, NVRAM and serial ROM.
For the SA-10, the memory bank is a 16 bit wide.
2. MAC Hardware Support, which is a state machine, implemented by an EPLD running at 500 kHz.
3. Ethernet PHY, operated by a 20 MHz crystal oscillator.
4. MAC-PHY Interface using a serial bus running at 5 MHz burst mode and an 8 bit parallel bus running at the CPU rate.

The block diagram of the CPU is shown in Fig. 3.

B2: PRODUCT DESCRIPTION FOR THE AMPLIFIER

The AMP2440 is a bi-directional amplifier designed for extending the range of the BreezeNET wireless LAN radios. 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 AMP 2440 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 Model 2440 amp will actually increase the receiver sensitivity of the radio by up to 5 dB! The ultimate result is the best possible noise figure and maximum receiver sensitivity. System gains of up to 30 dB are typical when amplifiers are used at each end of a link.

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 to ensure years of continuous outdoor operation.

Full output power of approximately 500mW is achieved with only 30 mW (+15 dBm) input to the amplifier. The amplifier goes into limiting at this point and higher input power result in only slight increases in the output power. Up to 100 mW of power may be safely applied directly to the amplifier input without any damage.

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

<u>General Specifications</u>	
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 bias injector
Lightning Protection:	Direct DC ground at antenna connector
DC Surge Protection:	600 Watt TVS at 12 VDC input from transmission cable

<u>Transmitter Amplifier</u>	
Transmit Gain:	Up to 15dB
Frequency Response:	+/-1dB over operating range
Transmit Output Power	-500 version: 500mW -250 version: 250mW
Transmit Input Power:	3mW minimum, 100mW maximum

<u>Receiver Low Noise Amplifier (LNA)</u>	
Receive Gain:	18 dB typical
Frequency Response:	+/-1dB over operating range
Noise Figure:	3.5dB approximately
Third Order Intercept:	20 dBm

<u>Mechanical and Environmental</u>	
Operating Temperature	-20°C to + 60°C
Power:	12 VDC @ 650mA or 105-240 VAC from power supply provided with kit
Dimensions:	Amplifier-3.85"x2.52"x1.46" DC Power Injector-4.42"x2.40"x1.22"
Mounting Bracket for amplifier:	Accommodates pole/mast diameters from ¾" to 3"
Kit Weight:	Approx. 1.5 lb. With U-bolts

B3: PRODUCT DESCRIPTION FOR THE DC POWER INJECTOR

The DC injector inserts DC voltage onto the transmission line to power the remote mounted amplifier. It also senses DC current drawn by the remote amplifier in order to turn on the TX LED on it.