2Wire 802.11b Theory of Operation

The 2Wire 802.11b WLAN circuitry consists of several major sections:

1) Baseband and MAC
2) Radio
3) Antenna

Each of these sections will be described in more detail in the following paragraphs

Baseband and MAC

This section consists of U41, the TI TNEXTW1100, and its associated support components. This IC performs both MAC and baseband processing functions. The MAC functions will not be described here, as they are very similar to the MAC functions performed for other physical interfaces (Ethernet, etc).

For transmission of data, the baseband processor is responsible for accepting data from the MAC, applying appropriate error correction coding, and modulating the baseband carrier appropriately. This modulated baseband is then sent to the radio section for upconversion, amplification, and transmission via the antenna circuitry. Transmission of encoded baseband data to the radio is accomplished via two differential pairs (U41-J3, J6 and U41-K1,K6). The data is encoded in I,Q format. The baseband processor is also responsible for controlling the transmit power of the radio. This is accomplished via a gain control signal routed from U41 to the radio (U41-H1), and a power monitoring signal (U41-H3) which permits the baseband processor to monitor the power amplifier's output power.

For reception of data, the baseband processor receives the baseband signal from the radio via two differential pairs (U41-F3,F1 and U41-H6,G3). This data is demodulated, appropriate error correction is performed, and the resulting data is presented to the MAC for processing. The baseband processor can also control the receive gain of the radio.

The baseband processor is also responsible for generating the 22MHz reference clock used by the 802.11b subsystem. The oscillator consists of either a fixed 22MHz oscillator (U48), or a crystal (Y4) in conjunction with a hex inverter package (U44). If the crystal is used, the frequency of operation may be adjusted by the MAC via a digital to analog converter (formed by four inverters and weighted resistors) which adjust the loading capacitance of the crystal via a varactor (D23).

The baseband processor manages the diplexer and antenna diversity switches as well.

Radio

The radio consists of U42, a Maxim MAX2820, and its associated circuitry. It is responsible for accepting modulated baseband signals and upconverting them to the 2.4GHz band of operation. Its power output is not sufficient to directly drive an antenna, so an external power amplifier (U43, Maxim MAX2242) is used to boost the power to an acceptable level. The transmitter can deliver at most 19dBm to the antenna, with a value of 17dBm being more typical. The power amplifier has an integrated power detector, which indicates power level via a voltage (U43-B2) sent to the baseband processor.

The radio is also responsible for receiving 2.4GHz signals from the antenna subsystem, amplifying them, demodulating them, and presenting them in differential format to the baseband processor.

Antenna

The antenna subsystem is responsible for switching the antenna from the transmitter to the receiver (depending on the current activity in the radio). This is accomplished via U46, the transmit/receive diplexer switch. Output from this switch is passed through a 2.4GHz bandpass filter (FL1), then to the diversity switch (U47). The diversity switch chooses which of the two system antennas is connected to the radio subsystem. Two antennas allow for polarization and spatial diversity, insuring reliable operation regardless of the orientation or position of the device at the other end of the wireless link.

The two antennas are classic PIFA (Planar Inverted “F” Array) structures fabricated at the edge of the PCB. They are (approximately) one quarter wavelenth in length, grounded at one end and fed at their 50 ohm point. The antennas length was chosen to give good VSWR across the band of interest. One of the antennas (A2) has a connector in series with it which can be used to measure the conducted power send to the antenna.