number of comparators needed. Additionally, in the light of the fact that the A/D converter will experience several dB of variation at the Rf and IF chain because of variances in manufacturing tolerances and temperature effects, unless means are taken to eliminate the effects of these variances, up to one-half the dynamic range of a prior art A/D device may become unavailable.

One prior art solution to the problems of dynamic range in a direct sequence spread spectrum system is to increase the number of bits in the A/D converter until acceptable performance is achieved by the demodulator. The nominal signal level may then be set such that at the minimum signal level into the A/D converter, the required number of effective bits is met, and at the maximum signal level, saturation of the A/D converter is held to an acceptable level. The disadvantages of such an approach are generally seen in the additional size and corresponding cost of the A/D converter which would not be required for operation at nominal signal levels. Additionally, such approaches are generally disadvantageous in that the circuits following the A/D converter must also be designed to carry these additional bits, substantially increasing the amount of hardware and operational power requirements.

During signal acquisition and synchronization in direct sequence spread spectrum systems, it is usually necessary to adjust the timing of the receiving system to the bit timing of the received signal. By adjusting the timing, the receiving system can increase the probability that it is correctly acquiring and demodulating the correct signal. Many prior art systems used a voltage controlled oscillator ("VCO") to adjust the A/D sampling phase. This solution has the advantage of obtaining very fine sampling phase resolution but generally requires costly analog components. Another prior art solution has been to oversample the A/D input and use the closest samples. This solution, however, generally requires very fast and high power consumption A/D converters.

It is known in the prior art to demodulate a received direct sequence spread spectrum signal by using the in phase (I) and quadrature (Q) components from the correlator in the demodulator system and to use the bit synch amplitude to determine the signal quality. In such prior art systems, carrier frequency offset may be compensated for by the use of differential demodulation or by phase locked loop tracking of the carrier. Independent processing of both the I and Q components, however, generally requires twice the hardware through most of the signal processing path (one complete set of hardware for each signal component). In addition, in prior art systems, the phase locked loops can be relatively hardware intensive ad complex in order to achieve the speed necessary to acquire the short preambles of bursty communications.

Within the environment of a wireless LAN or other plural node system, it is desirable to be able to decode the communicated signals reliably: not permitting false data to be accepted as true and capturing with a high degree of probability the data which is transmitted. In addition, it is desirable to obtain such high performance while keeping relatively low the costs, sizes and power consumption of the hardware used in such systems.

Accordingly, it is an object of the present invention to provide a novel method and apparatus of acquiring a spread spectrum signal reliably and without false alarms.

It is another object of the present invention to provide a novel method and apparatus of acquiring a spread spectrum signal from one of plural transmitting nodes without prior knowledge of the time of the start of the signal.

It is yet another object of the present invention to provide a novel method and apparatus of acquiring a spread spectrum signal with a relatively small preamble in comparison to prior art systems.

It is still another object of the present invention to provide a novel method and apparatus of acquiring a spread spectrum signal from one or more of plural transmitters, having independent frequency and/or phase offsets.

It is a further object of the present invention to provide a novel method and apparatus of acquiring a spread spectrum signal in an environment having a relatively low signal to noise ratio and/or having a rapidly changing noise characteristic.

It is yet a further object of the present invention to provide a novel method and apparatus of acquiring a signal transmitted in accordance with the IEEE 802.11 standard.

It is still a further object of the present invention to provide a novel method and apparatus to acquire spread spectrum signals whether or not transmitted using the IEEE 802.11 standard.

These and many other objects and advantages of the present invention will be readily apparent to one skilled in the art to which the invention pertains from a perusal of the claims, the appended drawings, and the following detailed description of the preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a representational diagram of the format of a type of signal which can be communicated in one embodiment of the present invention;

FIG. **2** is a functional block diagram of a communications transceiver which may be used in accordance with the present invention; and

FIG. **3** is a functional block diagram of a baseband processor which may be used in the transceiver of FIG. **2**.

DESCRIPTION OF PREFERRED EMBODIMENTS

Standards have been proposed and are being developed for the communication of signals in a wireless LAN system. These standards include IEEE 802.11 typically utilize a short, bursty message format. As shown in FIG. **1**, a typical message may consist of a fixed length preamble having the fields for power ramping, synchronization, a signal field, a descrambling seed, and a unique word. Immediately upon the end of the preamble, the data starts followed by a CRC field. As specified in IEEE 802.11, the preamble may be modulated onto the carrier signal using digital Binary Phase Shift Keyed ("BPSK") modulation. The data and CRC signals may be modulated using either BPSK or Quarternary Phase Shift Keyed modulation ("QPSK"). A transceiver in accordance with the present invention may readily acquire and decode the preamble, data and CRC portions of a standard message packet. However, the present invention is in no way limited to this one packet format and may be used in many other formats.

With reference to FIG. **2**, a transceiver using one aspect of the present invention may include dual antennae **20**, **22** which can be operatively connected to the remainder of the transceiver through a selector switch **24** and a conventional antenna coupler **26** which matches the impedance of the signal to/from the antennae **20**, **22** to the transceiver. A second selector switch **28** connects the antenna coupler **26** to either a transmit circuit or a receive circuit of the transceiver. In the receive circuit, the second selector switch **28** is