MULTIMODE DIGITAL MODEM

ABSTRACT OF THE DISCLOSURE

A modem that operates selectively in the voice-band frequency band and at higher frequency bands is provided. This modem supports multiple line codes, like DMT and CAP.

The modem uses a Digital Signal Processor (DSP), so that different existing ADSL line codes, such as Discrete MultiTone (DMT) and Carrierless AM/PM (CAP), can be implemented on the same hardware platform. The modem negotiates in real-time, for a desired line transmission rate to accommodate line condition and service-cost requirement.

The line code and rate negotiation process may be implemented at the beginning of each communication session through the exchange of tones between the modems. A four-step MDSL modem initialization process is provided for line code and rate compatibility.

A new synchronization startup procedure for CAP based MDSL modems is provided. The handshake protocol and receiver algorithm allow reliable modem synchronization over severely amplitude distorted channels such as standard telephone twisted-pair wire. The algorithm makes use of a short length sequence to train a synchronizing equalizer at the receiver. After training to this sequence, a matched filter or correlator is used to detect the inverted sync sequence. The detection of the inverted sequence signals the start of the normal reference training of the CAP demodulation equalizers.

The MDSL line connection management process provides a simple, efficient, and flexible interface to manage the line connection between MDSL-C (MDSL in Central Office site) and MDSL-R (MDSL in resident site) in the telecommunication Wide Area Networking environment. An internal state machine in an MDSL modem records and monitors the line status and notifies the state change to the other MDSL and also the host processor. The protocol used for exchanging line connection

management messages is a simplified Link Control Protocol (LCP) for MDSL.

In a DMT system a transmitter filter is provided to reduce the length of effective channel impulse response. The implementation of the filter combines time domain convolution and frequency domain multiplication to reduce the needed computation power. The algorithm and corresponding training sequence to train the transmitter filter are provided. The filter coefficients update may occur through a feedback channel.

Figure 1a