

MMDS Wireless Modem

Operational Description

3/7/03

1. **Introduction:** This product is a wireless Modem operating over the MMDS licensed band. The Modem, also known as Transceiver or Customer Premise Equipment (CPE) is based on TDD transmission mode utilizing a proprietary CDMA technology with Spread Spectrum coding techniques. The user interface to the Modem is via a USB or Ethernet port that is directly connected to the PC. The device requires a wall mount AC power supply which provides 6V DC at about 2A transmit peak power. When operated within the range of a wireless service provider, the Modem is authenticated by the base station. Once this is completed, the Base Station will then control the Modem by assigning a channel frequency and power at which the Modem will be transmitting. Depending on the distance and quality of signal received, the Modem will dynamically adjust the transmit power and modulation density to insure a robust wireless link. The Modem consists of the following five major blocks:
 - a. **Transmitter**
 - b. **Receiver**
 - c. **Digital/Modem**
 - d. **Antenna Switch**
 - e. **Local Oscillators**

Following is a brief description of each section:

- a. **Transmitter:** This section is comprised of the Digital to Analog (DAC) device which is fed from the digital section of the Modem. The DAC converts the parallel data stream (bits) to quadrature I/Q base band signals which are then modulated by an IF LO carrier of 350 MHz. The modulated IF channel is then amplified and channel-filtered using a high selectivity SAW filter. Further IF gain amplification is implemented to achieve a desired IF signal level prior to the second up conversion. An RF mixer up converter is then used to convert the IF carrier to the desired RF transmit carrier. This RF signal is then further filtered and amplified through the Power Amplifier (PA). Following the PA is an RF band pass filter which insures spectrally complaint out-of-band emissions. The RF signal is then transmitted to one of three patch antennas. The Antenna selection is done by the Digital section of the Modem which determines the optimal antenna selection.
- b. **Receiver:** The receive section consists of the same diversity Antenna section described above, an RF band pass filter acting as an image reject filter, and then the LNA section which establishes the sensitivity of the Modem. Additional amplification is done in the RF section prior to down converting the received RF channel to the desired IF frequency of 350 MHz. The IF signal is then further amplified then filtered using a SAW filter. The filtered IF channel then enters the

demodulator device which converts the analog signal to I/Q components of the base band signals. These signals are then decoded and converted to the digital data stream using an Analog-to-Digital device (ADC). The output of the ADC is then processed by the digital section of the Modem.

- c. Digital/Modem Section:** The Digital section is comprised of Digital Signal Processors (DSP), Flash, SRAM, USB (or Ethernet) controller, and other logic circuits to support Modem function. The Digital section decodes received data and determines the optimal Antenna to receive or transmit the RF signal. Further, the digital section generates the data stream fed to the DAC which in turn generates the I/Q base band signals to the modulator.
- d. Antenna Switch Section:** The Antenna switch section is comprised of three antennas combined by a switching PIN diode scheme which selects any one of the three antennas at a time. The selection of the desired antenna is determined by the Digital sections based on received signal quality. Only one antenna is transmitting or receiving at any one time.
- e. Local Oscillators:** There are two local oscillators that are used for both dual up and down conversion in the Modem. Both oscillators are synthesized and phase-locked to a single Temperature Compensated Crystal Oscillator (TCXO) of 16 MHz. The IF Local Oscillator (IF LO) is fixed at 700 MHz (which is later divided by two to feed the Modulator and Demodulator IF LO at 350 MHz). The RF LO is tuned by the Modem for the desired receive or transmit RF channel. The RF LO tuning BW is 2246-2336 MHz.