Theory of Operation.

The iolink 1 is a full-duplex Tl rate radio operating in the 2.4 GHz ISM band. The data transmitted through the iolink 1 is processed in the following sequence:

LIU <-> FEC <-> Baseband (DSSS) <-> IF <-> RF ------ RF <-> IF <-> Baseband <-> FEC <-> LIU

Below, TX indicates the data stream toward the antenna and RX indicates the data stream from the antenna.

Line Interface Unit

TX:

The LIU converts the *tip and ring* input from the external device to *clock and data* (RCLK and RPOS) which are passed to the FEC. The data from the connections, RJ-48 and BNC, pass through a transformer, fuses, lightning protection and voltage limiting diodes on the input lines.

RX:

The data received from the link is converted to tip and ring. The data to the output connections, RJ48 and BNC, pass through a transformer, fuses, lightning protection and voltage limiting diodes on the output lines.

Forward Error Correction

TX:

RCLK and RPOS pass from the LIU to the FEC ASIC. The data is encoded using Rate 3/4 punctured convolutional coding which increases the data rate from Tl (1.544 Mbps) to 4/3 Tl (2.059 Mbps). The data is passed to the Spread Spectrum ASIC.

RX:

The received data from the DSSS ASIC is decoded using a Viterbi decoder.

Baseband

TX:

The baseband processing is performed by a Spread Spectrum ASIC and an A/D. The data bits from the FEC (encoded RPOS) are processed as pairs of bits, one bit for the in-phase channel (1) and one for the quadrature channel (Q); thus, two bits make one QPSK symbol and the symbol rate is half the encoded data rate. The QPSK symbols are then processed sequentially by the differential encoder, the PN code modulator and the QPSK modulator. The result is a digitized IF signal which has been spread by the PN code modulator. A 10 chiptsymbol PN code is used. The I and Q channels for the symbols are passed to the IF section.

RX:

The received signals from the IF section, RXI and RXQ, are first processed by the AID which samples at a rate equal to the data rate * code length * 2 = 41.173 MHz. The digitized signal is then passed to the Spread Spectrum ASIC and processed by the digital downconverter which converts it to baseband. This is followed by the matched filter which samples I and Q twice per chip to compute the cross-correlation and then the symbol tracking processor which detects the optimal de-spread I and Q symbols. The de-spread I and 0 symbols are sent to the differential demodulator, where the current and previous symbols are processed in order to identify the encoded bits. The bits are processed by the output data processor to produce a serial bit stream which is transmitted to the FEC on RXOUT.

lntermediate Frequency

TX:

The symbols from the Baseband are sent to the IF section as TXI and TXQ. These are mixed with a 1 1 0 MHz oscillator (with a 90 degree phase difference for I and Q) to bring them up to the IF frequency. Then, I and Q are summed and the resultant signal is passed through an AGC and filter (25 MHz bandpass) befbre being sent to the RF unit for upconverting to the 2.4 GHz transmission frequency.

RX:

The down-converted 70 MHz signal is passed through an AGC and bandpass filter, then decomposed into I and Q. The analog symbols, RXI and RXQ, are passed through the A/D as described above.

Radio Frequency Unit

TX:

The llO MHz IF signal is passed through an AGC circuit, then up-converted to 2.4GHz.This is then amplified to +25 dBm and passed through a filter to the antenna.

RX:

The signal received from the antenna is passed through an AGC circuit, then down-converted to 70 MHz and filtered before being passed to the IF cable.