GoRadio LLC

TR1000

Transceiver Theory of Operation

Revision History

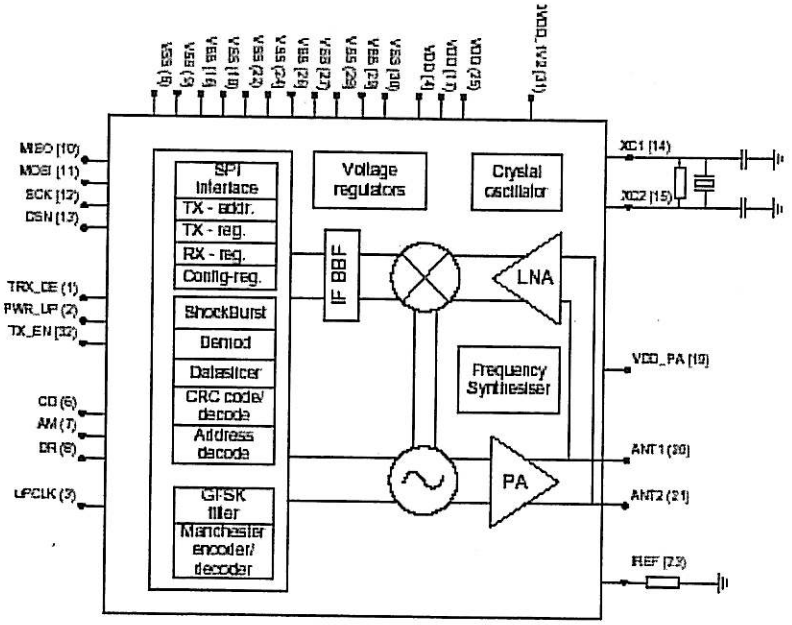
Date	Rev	Author	Description

General Description

The GoRadio LLC TR1000 industrial remote controller design is based on a chip with fully integrated microcontroller, RF transceiver, multiple input high resolution analog to digital converter (ADC), and internal voltage regulator. The industrial remote controller system consists of a "listen only" stationary receiver unit and mobile "transmit only" controller. Both units function as a complete system with programmable channels to prevent jamming during operation.

RF Transceiver

The integrated transceiver uses I&Q modulation and demodulation. The RF signal from the antenna is connected to the transceiver input port. Depending on the mode of operation, the RF switch is connected to the transmitter power amplifier or the receiver low noise amplifier (LNA). The LNA sets the system noise figure. The balanced output of the LNA is coupled into a down-converter where the RF signal is converted to an I&Q signal. The I&Q signal is processed with an IF base-band filter where undesirable signal and noise is removed, leaving only the intended signal to be processed by the demodulator. The filtered I&Q signal is also amplified and limited to a fixed amplitude before it is demodulated.



The demodulator extracts the data from the processed base-band signal. The demodulated data is then fed into the data-slicer. The data-slicer performs the task of removing amplitude variation. The fixed level data is then synchronized to the data decoder as it is bit shifted into the data register/buffer before it is fetched by the microcontroller. The microcontroller and RF section operates on a single 4 MHz clock signal. This minimizes parts count and reduces unnecessary emission. A built-in algorithm automatically handles the preamble (sync pattern), address and error control using CRC (cyclic redundancy check).

In the transmitter section, the data from the microcontroller is encoded using Manchester coding. It is then filtered using a Gaussian Frequency shift Keying filter (GFSK) to minimize occupied spectrum. The filtered I&Q transmit signal is then used to modulate the on board VCO. The balanced and filtered FSK signal is then coupled into the power amplifier where the signal is boosted to approximately +10dBm. The RF switch then couples the transmit signal into the impedance matching network. The matching network ensures maximum coupling of signal from the transceiver into the 0 dBi peak gain monopole antenna.

The stationary receiver is powered from 110 VAC whereas the mobile transmitter is powered from two AA-size batteries. The reverse polarity protection circuit in the mobile transmitter protects against improper installation of the AA-size batteries. The stationary receiver has a removable ¼ wave antenna with an option to use an external coaxial cable to allow remote positioning of the antenna. This flexibility allows the stationary unit to be housed inside a weather proof enclosure. The mobile transmitter has a built in ¼ wave antenna.