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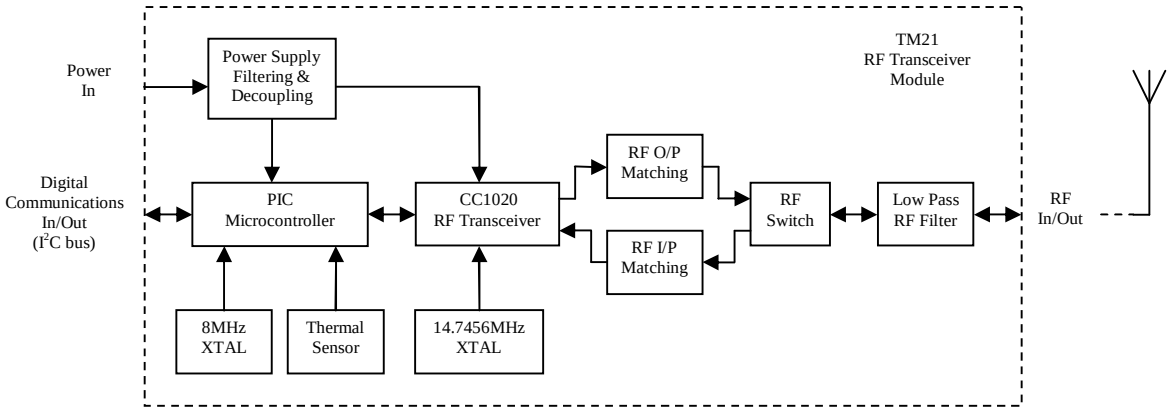
TM21 Transceiver Module – Operational Description

The TM21 Module is a low power UHF transceiver, based on a single chip transceiver (Chipcon CC1020), which can be configured to operate in various frequency bands designated for SRD systems in the 402MHz to 470MHz range. It has been designed to provide data telemetry functionality to a range of temperature profiling data loggers. The TM21 module is used in the data logger to transmit data and in the receivers to receive data. The logger is classed as mobile equipment.
The frequency band is configured during final assembly of the host equipment and is not configurable by the end user after this point other than to select channels in the pre-determined range.



Block Diagram of TM21 Transceiver Module

The Module has two connectors to interface to a host PCA. One connector carries power and the other carries all the communication and control lines. The Module is controlled over an I^2C bus which passes data in both directions.

The Module has a PIC microcontroller which acts as a data and command buffer and interface between the CC1020 and the host PCA. It translates the commands sent to the Module into register settings for the CC1020 and forwards on the send and received data in the appropriate format. The PIC also reads the Module temperature from an on-board Thermal Sensor. This data is then used to apply temperature correction to the RF frequency to maintain an accurate output frequency from the transmitter.

The power supply required by the module is 3.3V. It does not regulate its power supply from a higher voltage source. The power supply is filtered and de-coupled as required in the Module.

In transmit mode the CC1020 takes the data from the PIC and applies it to the carrier using 2-level FSK modulation and a data rate of 4800baud. The RF output then has some matching circuitry between the CC1020 and an RF switch which selects the

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signal path for transmit or receive mode. Following the RF switch is a low pass filter before the MCX antenna socket. Each frame of data is split up into two packets typically with every 16th frame being three packets long. It takes 120ms to transmit each packet of data with about 70ms between packets. The overall transmission duty cycle is determined by the sample rate selected by the user for the host data logger; this could be between 0.5 seconds between samples to several hours.

The antenna used with the loggers for transmitting is a quarter wave monopole with a gain of 1.5dBd. The output power from the CC1020 is programmable and is set to 10dBm (10mW) maximum. A ramp profile is used when turning on and off the output power to reducing switching transients.

In receive mode the signal passes through the low pass filter and then through the RF switch into the receiver matching circuitry and the CC1020 RF input. The CC1020 then locks to the signal and demodulates the data which it then passes on to the PIC.

The data transmitted has error correction coded into it to improve the performance of the telemetry system. To improve the performance even more the data packets can be interleaved up to nine times. This means that the packet of data is resent the number of times selected with the subsequent packets of data so that if interference disrupts the reception of a packet one time it is likely to be received correctly the next time it is sent or the time after that, etc. In addition to this the user can opt to enable Listen before Transmit to prevent on air clashes of transmissions if there are multiple loggers being used.

The user can select one of ten channels to use for their telemetry in order to avoid any interference that may be present. The host passes this channel information to the PIC which sets the channel by altering values in set-up registers in the CC1020 chip. The frequency range for the US and Canada is 463.525MHz to 463.975MHz. Although the module is capable of transmitting on other frequencies the user can only select the frequencies that were configured in the factory during the final test and calibration phase of the equipment manufacture.