28GHz Radio Operational Description

The 28 GHz radio unit (RU) is comprised of three printed circuit assemblies (PCA) – power supply/microprocessor, IF module, and microwave module - a transmitter power amp, receiver low noise amp, and waveguide filter assembly. Refer to the block diagram.

The microprocessor/power supply PCA utilizes a switch mode power supply built from discrete components and integrated circuits to convert the –48V nominal input voltage to +8V and –7V nominal output voltages. Power is distributed to the IF module PCA via a multipin connector. The microprocessor is an 8-bit microcontroller which runs a program stored in onboard FLASH memory. The microprocessor controls and monitors RU functions as well as provides communication with the indoor unit.

The IF module PCA provides multiplexing and cable protection for the signals on the RU external TNC connector, IF gain control functions, IF filtering, and DC power distribution to the microwave module PCA. The multiplexer is a discrete component design that separates the –48V DC power, telemetry, frequency reference, 350 MHz transmit IF, and 140 MHz receive IF signals. The –48V DC and telemetry signals are routed to the microprocessor/power supply PCA via multipin connector. The reference frequency is fed to phase lock loop circuitry that generates the 14 MHz reference frequency used by all phase lock loops in the RU and to the microwave module PCA via coaxial feedthrough.

The 350 MHz transmitter IF signal is routed to AGC circuitry that provides a constant signal level into the upconverter mixer. The transmit IF mixer LO is generated from the output of a VCO that is phase locked to the 14 MHz reference signal. The LO synthesizer is capable of 1 MHz step size over the 2098 MHz to 2110 MHz frequency range. The upconverted and filtered transmit second IF signal is fed to the microwave module PCA via coaxial feedthrough.

The receiver second IF signal comes from the microwave module PCA via coaxial feedthrough. The signal is filtered and downconverted to the 140 MHz receiver IF. The receive IF mixer LO is generated from the output of a VCO that is phase locked to the 14 MHz reference signal. The LO synthesizer is capable of 1 MHz step size over the 1892 MHz to 1904 MHz frequency range. The 140 MHz receiver IF is passed through switched channel filters that provide channel bandwidth filtering. The filtered receive IF is then routed to AGC circuitry that provides a constant signal level at the RU external TNC connector.

The microwave module PCA contains a VCO phase locked loop and times eight-diode multiplier chain. This synthesizer and multiplier chain produces the LO for transmit and receive frequency conversion. The LO is fed to the upconverter mixer where it is doubled and then mixed with the transmitter second IF signal resulting in the output transmit signal. The output transmit signal is filtered in the waveguide filter assembly then amplified by the transmitter power amp and filtered by the diplexer filter and routed to the antenna port. The transmit power amp is a thin-film amplifier module built with MMIC devices and is utilized in conjunction with gain control circuitry at the 350 MHz transmit IF for transmit power control.

The receiver input signal is fed from the antenna port through the diplexer filter to the receiver low noise amplifier. The receiver LNA is a thin-film amplifier module built with MMIC devices. The output of the LNA is fed to the waveguide filter assembly and then to the microwave module PCA. The receiver input signal is then downconverted using the doubled LO signal to produce the receive second IF signal which is routed to the IF module PCA.

The antenna assemblies vary dependent upon which model RU is built. Base radio units (BRU) with integral antennas utilize a waveguide sector horn antenna. Subscriber radio units (SRU) with integral antennas utilize a waveguide horn antenna with narrow beamwidth. BRU and SRU with non-integral antennas mount to a separate antenna assembly that is clamped to the RU.