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TECHNICAL DESCRIPTION OF THE CRU-2

The Central Radio Unit (CRU-2) is essentially a synthesized VHF radio combined with an FPGA based Power PC Computer board all housed in a rugged stainless steel enclosure. The purpose of this unit is to provide master communications and timing for the ION Geophysical Firefly seismic data acquisition system.

A .PDF block diagram of the CRU-2 is included.

The CRU-2 vhf radio is software controlled. The software can, among other things, control frequency and power output level. Power detectors measure forward and reflected power.

During a seismic data gathering operations (a “shoot”), one or more CRU-2s may be deployed to communicate with hundreds or thousands of Field Station Units (FSU). These communication include GPS based timing information and instruction on when to gather data and when to power down for battery conservation.

The CRU-2 also contains Ethernet capability, RS-232, Pelton shooting system interface, and two GDU high speed data transfer interfaces to commutate with a vibe-pro truck.

The CRU-2 has the ability to communicate with other distant CRUs using the Ethernet interface and external 5.8 GHz Motorola bridges.

The RS-232 interface is used for local CRU configuration and debugging.

Factory test for the FSU and CRU include programming the required power level and frequencies. The power output and frequency are measured using a calibrated automated a spectrum analyzer configuration.

Transmitter: The Analogue Devices AD9911 Direct Digital Synthesizer is used to generate and directly phase modulate an rf transmit carrier. Modulation is GMSK(Gaussian Minimum-Shift Keying). The TCVCXO fed to this chip is 24.576 MHz. Frequency stability is primarily influenced by this TCVCXO. The output of the AD911 DDS is routed through a low-pass filter with roll-off at 180 MHz. The rf carrier is fed to Analogue Devices ADF4360-8 Phase Locked Loop to generate the final rf carrier. This carrier is then fed through two power amplifier stages to boost the rf power from 0 dBm to +33 dBm. This signal is then fed to a PA module where the power is amplified to +44.5 dBm(28 watts). The rf power output is monitored with a power detection circuit LTC5507. The first power amplifier stage gain is controlled by Digital Signal Control chip 56F8037 to maintain rf power output level. The baseband signals are all digital, buffered signals.
Minimum data rate is 9600 bps.

Receiver: The receive signal is fed through a band-pass filter at the receiver input and then through to Low Noise RF Amplifiers to the first mixer stage. The incoming signal is mixed with a signal from the PLL chip at a frequency of F_{RX} + 24.576 MHz – 455 kHz, where F_{RX} is the received rf signal frequency. The output of the first mixer stage is fed through a 24.121 MHz crystal IF band-pass filter. The IF signal is then mixed down to a second IF of 455 kHz and directly demodulated by the DSC 56F8037.