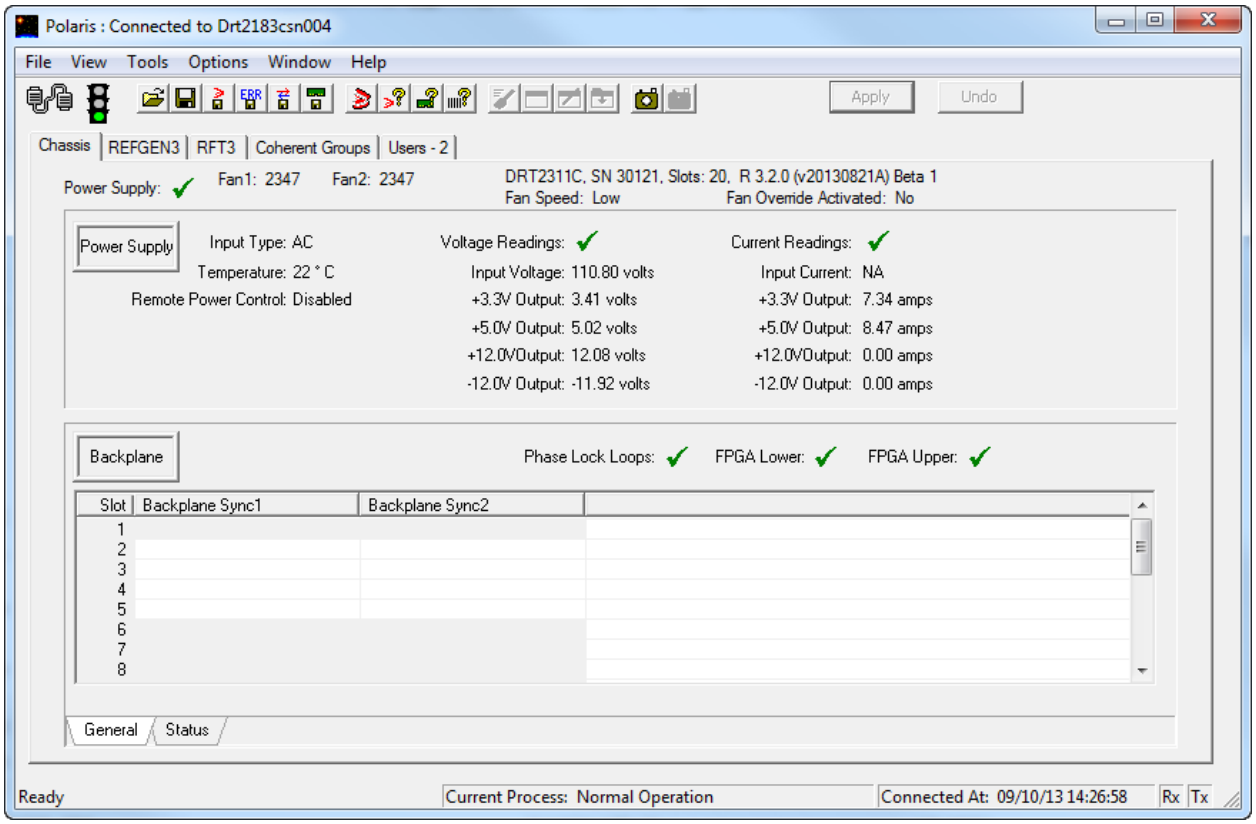
Digital Receiver Technology, Inc.

Approved for Public Release

DRT2000 System Software



DESCRIPTION

The DRT2000 System Software is provided with DRT2000-series receiver and transmitter systems. The software capability is defined by the specific chassis and the installed modules. The potential module types include RF, HF and microwave tuners, transmitters, and output modules delivered in custom configurations. Thus, a DRT2000 system may have the capability to receive and/or transmit signals, and output serialized, data packets with headers containing metadata to a backend processor. Built-in Snap Shot and FFT capability aid in calibrating the phase and amplitude imbalances from tuner-to-tuner for beamforming applications.

The DRT2000 systems are front-end receiver and/or transmitter systems used in larger collection systems where the backend processing is performed in a separate chassis. Typically, the backend processor system controls the DRT2000 system via the TCP/IP interface. The main function of the DRT2000 System Software is to provide an interface to control the receivers, transmitters, and interface cards. These larger collection systems typically use the tuners for scanning, direction finding, and beamforming.

The DRT2000 System Software includes the embedded software that runs on the DRT system, *Polaris* (GUI), *Yukon* (IP Configuration utility) and *Domain Time II* (Network Time Protocol Manager). The embedded software and *Domain Time II* run on the DRT unit; the other applications may run on the unit or a controlling computer connected to the unit.

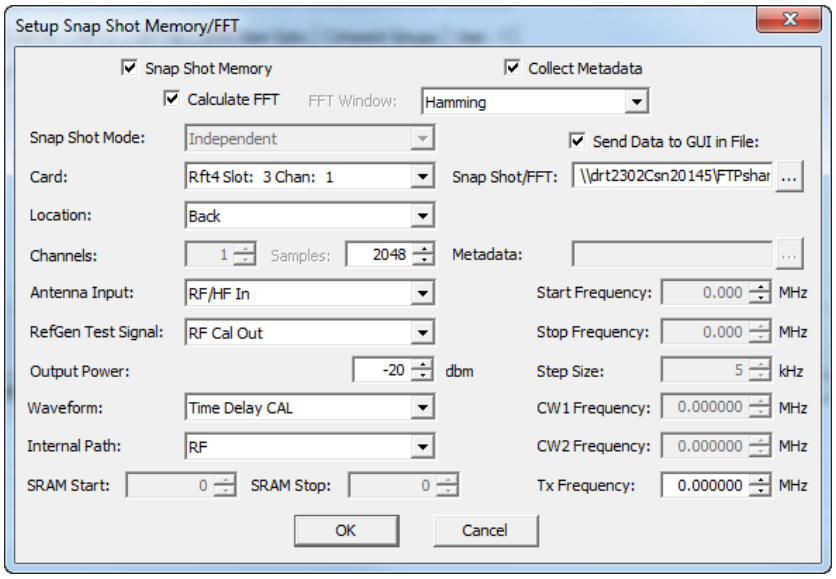
The DRT2000 Software Interface Control Document (ICD) is included with the user documentation. This document describes the TCP/IP interface between the GUI and the DRT2000. The GUI might be your own TCP/IP interface or *Polaris* running on the DRT unit or on a remote computer. The protocol supports binary messaging to improve throughput and for easier use.

Features

Features are allowed or limited based on the chassis and the type of modules installed.

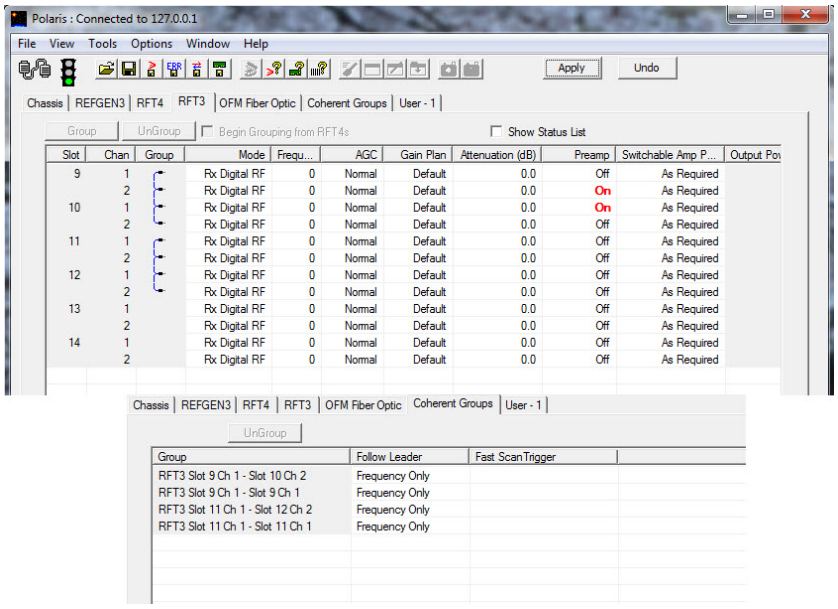
Snap Shot/FFT

Snap Shot or a Fast Fourier Transform (FFT) of the collected data can be taken and stored in a file and used to calibrate the phase and amplitude imbalances from tuner-to-tuner for beamforming and direction finding applications.



Coherent Tuning

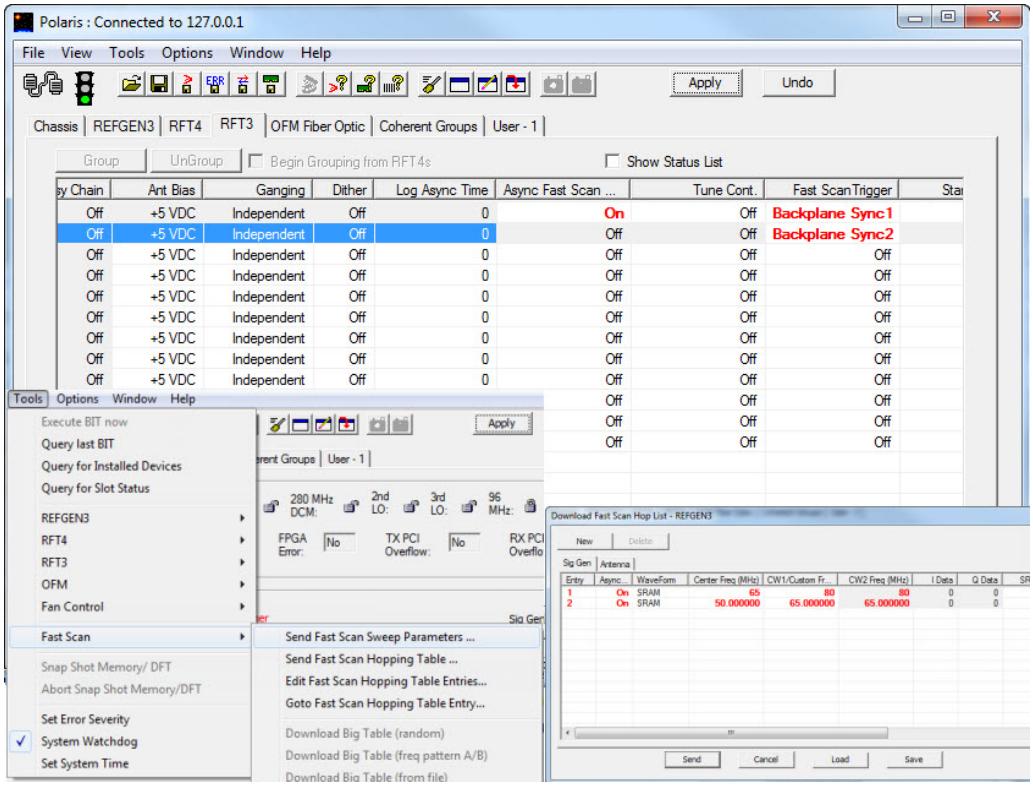
Tuners and transmitters may be operated coherently or independently. A coherent group of tuners is a group where all the tuners are in phase (RF) and using the same clock and LOs. The DRT2000 Software offers coherent group messages to aid in programming. These messages allow you to send one set of commands to the whole group instead of requiring that each command be sent to each tuner individually. These commands can be set up for “frequency only” or “all parameters.”



Fast Scan

For fast-tuning applications, the Fast Scan feature allows the system to step through a pre-loaded, user-defined frequency table. Fast Scan modes use a signal pulse to tell the tuner/transmitter to step through the table. Two different types of fast scanning modes are offered: Fast Scan Sweep and Fast Scan Hop.

- The Fast Scan Sweep mode allows you to enter start/stop frequencies and a step size.
- In the Fast Scan Hop mode the system follows a frequency hop signal with up to 600 entries.



Metadata

In DRT2000C systems, headers containing metadata from tuners and/or the backplane are included in packetized data. This data includes configuration and status information such as: frequency, attenuation, timestamp, etc.

Timestamp

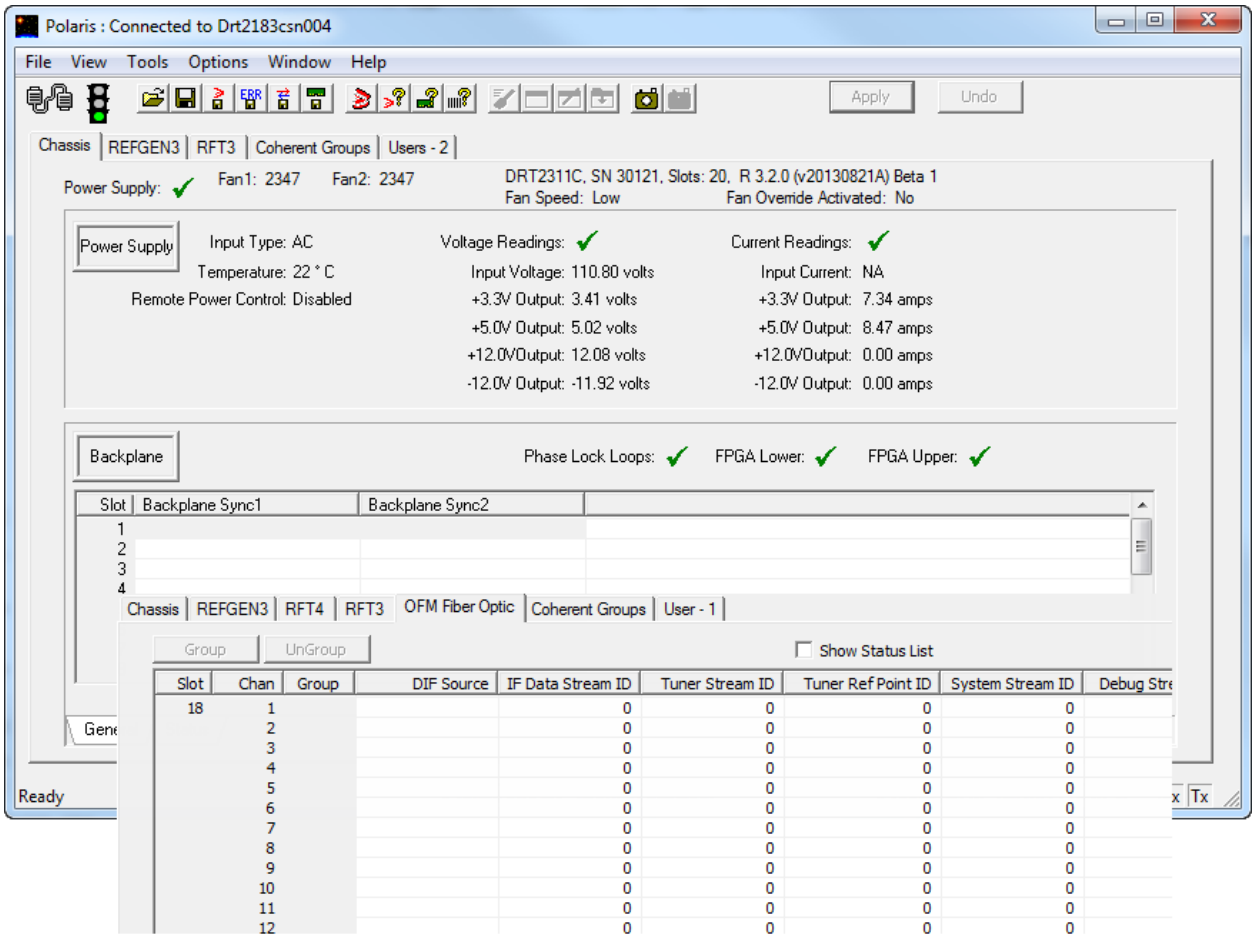
Some units can provide time tagging of data packets. The timestamp may be operated in an autonomous internal roll over mode, that is, the fraction counter counts up to 70 or 96 million and then rolls over and increments the seconds counter. Or the timestamp counters can be incremented via an externally injected 1PPS signal. When the REF3 is present the 1PPS signal may be derived from the onboard GPS receiver.

Analog Output

Units with analog tuners provide a high-level analog output for driving A/D converter or digital drop receiver boards.

Wideband Digital Data Output

Units with digital tuners and Output Formatter Module or Output Formatter Module (Fiber Optic OFM2) can output wideband digital IF data via an optical interface.

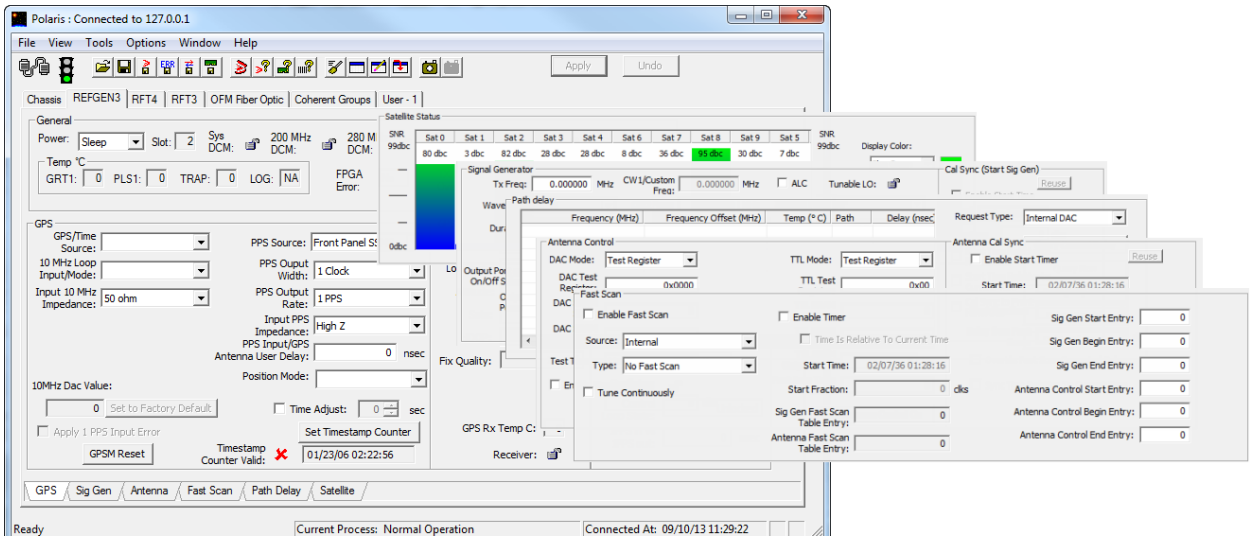


REF3 Control

The software also allows you to configure the features provided by the REF3. In *Polaris* this is done through a **REFGEN3** tab with six views.

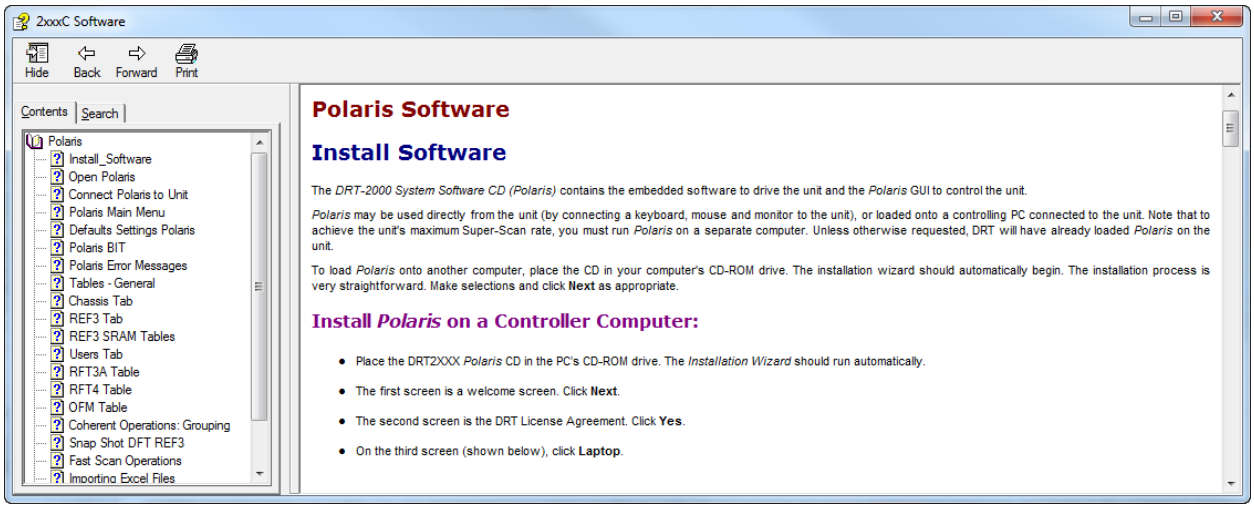
- Configure the REF3 **GPS** and **10 MHz Control Loop.** The REF3 includes an onboard commercial GPS receiver and a digital control loop which can train the 10 MHz oscillator to a 1PPS signal from the onboard or external GPS receiver, or an external 10 MHz input signal. Training the 10 MHz oscillator to GPS enables the system to provide accurate time-stamped data which enables applications such as Time Difference Of Arrival (TDOA) to be performed with the collected tuner data. GPS time and navigation data can be received from the internal GPS receiver, an external GPS receiver via NMEA, or from a Network Time Protocol (NTP) server. In addition, the internal GPS receiver may broadcast the navigation and time information via a front panel connector. Other 10 MHz clock modes such as Bypass and Free Run are also available.
- The **REFGEN3 Satellite** page displays the signal strengths of each of the GPS satellites visible to the GPS receiver in the REF3.
- Configure the REF3 **Signal Generator** to output a calibration signal that can be used for a variety of purposes such as: RF BIT, calibrating the phase and amplitude imbalances between receivers, calibrating tuner delay, etc. You can configure the REF3 to provide up to two CW signals, two canned signals or, 64K of I&Q SRAM for user-defined signals, and set the time that the signal is to be transmitted.
- The **REFGEN3 Path Delay** page displays the factors affecting the signal generator path delay and provides the path delay calibration data in a table. This path delay data is required when using the REF3 signal generator as the calibration source for TDOA applications.
- The **Fast Scan** page allows you to configure the signal generator to step through a pre-loaded table of frequencies, power levels, signal types, and antenna control patterns. Sequencing through the table may be achieved via a front panel fast scan sync input (RFT3), rear panel fast scan sync input or by setting a start and dwell time.
- Generate analog or digital **Antenna control signals** to be output through the REF3 to an antenna. The antenna control signal comprises one analog and five differential digital signals which can drive either TTL or CMOS inputs. Although currently configured to be differential, they could be changed to be single-ended and thus provide 10 control lines. Several sources may drive these signals. The first is a test register or a 1K (1024) 5-bit circular memory with programmable output rate ranging from 8 Hz to 35 MHz. Several small antenna control patterns may be stored in the memory simultaneously. The analog control is derived from a 14-bit DAC with a sampling rate of 64 kHz. Within the FPGA, prior to the DAC, to reducing aliasing, the digital signal is interpolated up to 256 kHz and filtered with a 96 tap lowpass filter. The resulting 3 dB passband is 26 kHz. The DAC values are signed hex.

REF3 Control Pages in *Polaris*



Help Files

The *Polaris* GUI provides extensive Help files with detailed explanations on how to configure the system using *Polaris*.



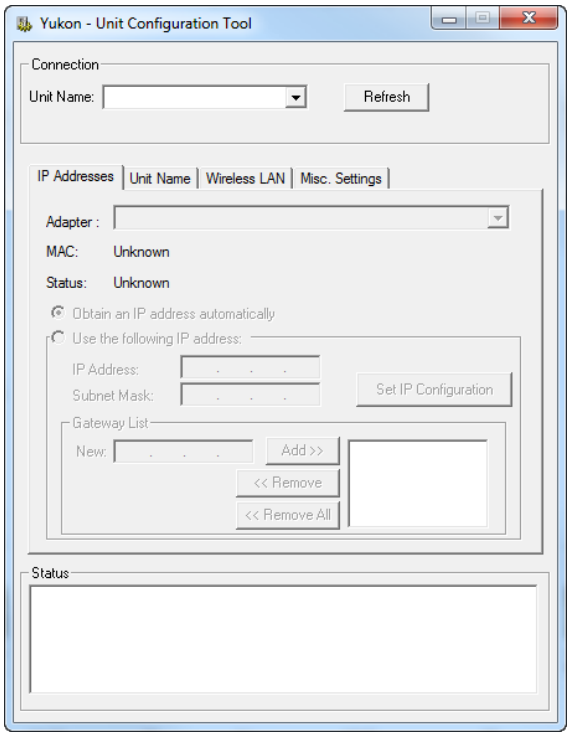
Data Types

The DRT2000 embedded software supports commands in the following data types:

- ASCII – One byte ASCII character.
- STRING – NULL terminated array of ASCII characters.
- UINT8 – One byte unsigned integer.
- INT8 – Signed one byte integer.
- UINT16 – Two bytes unsigned integer using Little Endean.
- INT16 – Two byte signed integer, 2's complement using Little Endean.
- UINT32 – Four bytes unsigned integer using Little Endean.
- INT32 – Four bytes signed integer, 2's complement using Little Endean.
- FLOAT – Four bytes IEEE floating point number using Little Endean.

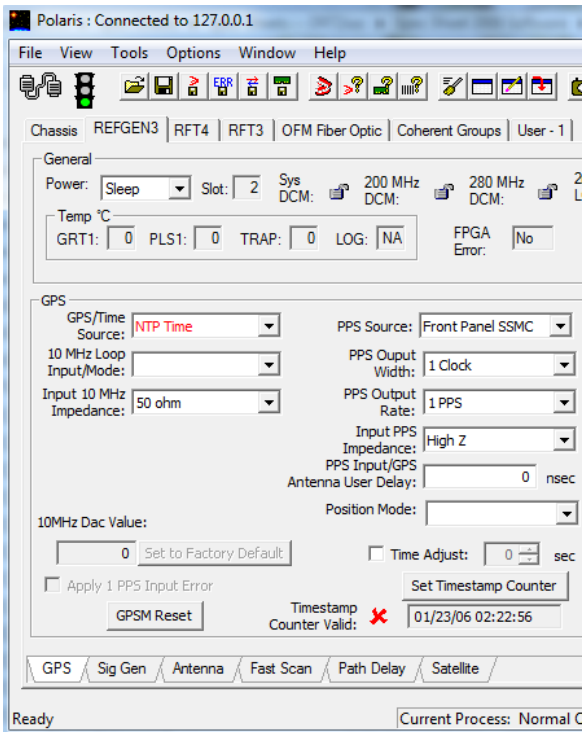
IP Configuration

DRT's software utility *Yukon* provides IP configuration capability.



Network Time Protocol

The DRT2000 Software package includes *Domain Time II*, a network time protocol program.



Controller PC System Requirements for the *Polaris* GUI

DRT software runs under the *Windows XP* operating system on the unit. You can control the unit using the *Polaris* GUI running directly on the unit, or install *Polaris* on a controlling PC and connect to the unit directly or via a network. PC system requirements for *Polaris* are:

- PC with 300 megahertz or higher processor clock speed recommended; 233 MHz minimum required (single or dual processor system); Intel Pentium/Celeron family, or AMD K6/Athlon/Duron family, or compatible processor recommended
- *Windows XP* or *Windows 7* OS
- 128 megabytes (MB) of RAM or higher recommended (64 MB minimum supported; may limit performance and some features)
- 1.5 gigabytes (GB) of available hard disk space
- Super VGA (800 x 600) or higher-resolution video adapter and monitor
- Keyboard and Microsoft Mouse or compatible pointing device

DRT2000 Product Family	DRT2183C	DRT230XC	DRT2311C
			
Max. Number of RF Channels	16 analog or 14 digital	36 analog or 32 digital	36 analog or 32 digital
Tuner Modules Supported	RFT3-40, RFT4, HFT1B	RFT3-40, RFT4, HFT1B	RFT3-40, RFT4, HFT1B
Interface Modules	One OFM2: - SFPDP, Fiber Optic POP4 - 16 Tx / Rx Channels - 3.125 Gb/s, 8B/10B Encoded - MTP / MPO Interfaces	Two OFM2: - SFPDP, Fiber Optic POP4 - 32 Tx / Rx Channels - 3.125 Gb/s, 8B/10B Encoded - MTP / MPO Interfaces	Two OFM2: - SFPDP, Fiber Optic POP4 - 32 Tx / Rx Channels - 3.125 Gb/s, 8B/10B Encoded - MTP / MPO Interfaces
Size	13.0" W x 4U (7") H x 11.5" D	19" rack mount x 4U (7") H x 18.90" D[1]	19" rack mount x 5U (8.75") H x 19.50" D[1]
Weight	41.44 lbs[2]	71.32 lbs[2]	79 lbs[2]
Power	397 W - Coherent 473 W - Independent	650 W - Coherent 850 W - Independent	650 W - Coherent 850 W - Independent

Tuner Modules:

HFT1B Receiver: 200 kHz - 32 MHz

RFT3-40 Transceiver: HF: 0.5 - 32 MHz
RF: 20 - 3000 MHz
40 MHz IF BW

RFT4 Transceiver: HF: 0.5 - 32 MHz
RF: 20 - 6500 MHz
40 MHz IF BW

Reference Generator Module:

REF3-40: 40 MHz IF BW, Ultra low noise 10 MHz Reference, 2nd & 3rd LO source, CW, PN code, GPS receiver, customer downloadable RF CAL source

1 - Depth includes Front Handles Detached and Rear Handles Folded
2 - Slides Not Included

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