Chapter 1. INTRODUCTION

This chapter describes the CST-5000 C-Band satellite terminal, referred to in this manual as “the CST-5000” (Figure 1-1).

Figure 1-1. CST-5000 Single Thread System

1.1 Description

As a single thread system, the CST-5000 consists of the following assemblies (Figure 1-1):

- Outdoor enclosure assembly (RFT-500)
- Low Noise Amplifier (LNA)

As a redundant system, the CST-5000 consists of the following assemblies:

- Two outdoor enclosure assemblies (RFT-500s)
- 1:1 redundant LNA plate (Figure 1-2)
- RSU-503 (Figure 1-3)

For more information on the RSU-503, refer to the *RSU-503 Redundancy Switch Unit Installation and Operation Manual*.

Refer to Figure 1-4 for a block diagram of the CST-5000.

The CST-5000 meets all requirements for operation on both private and regional domestic C-Band satellite networks.

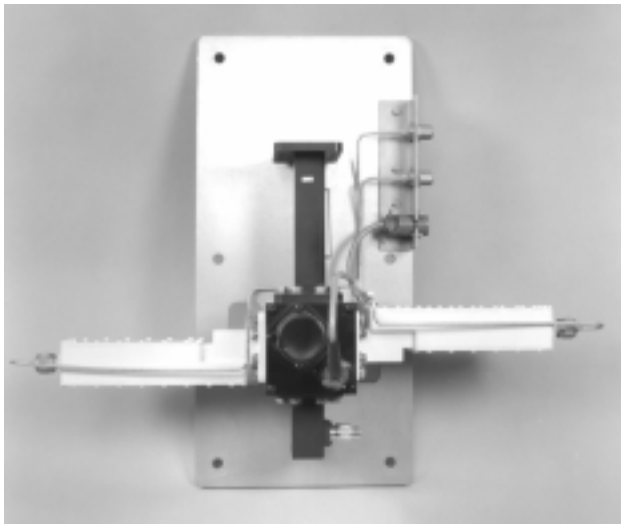

Figure 1-2. 1:1 Redundant LNA Plate

Note: Pictured above are typical LNAs. Other LNAs are available, which can be ordered from an EFData marketing representative.

Figure 1-3. RSU-503

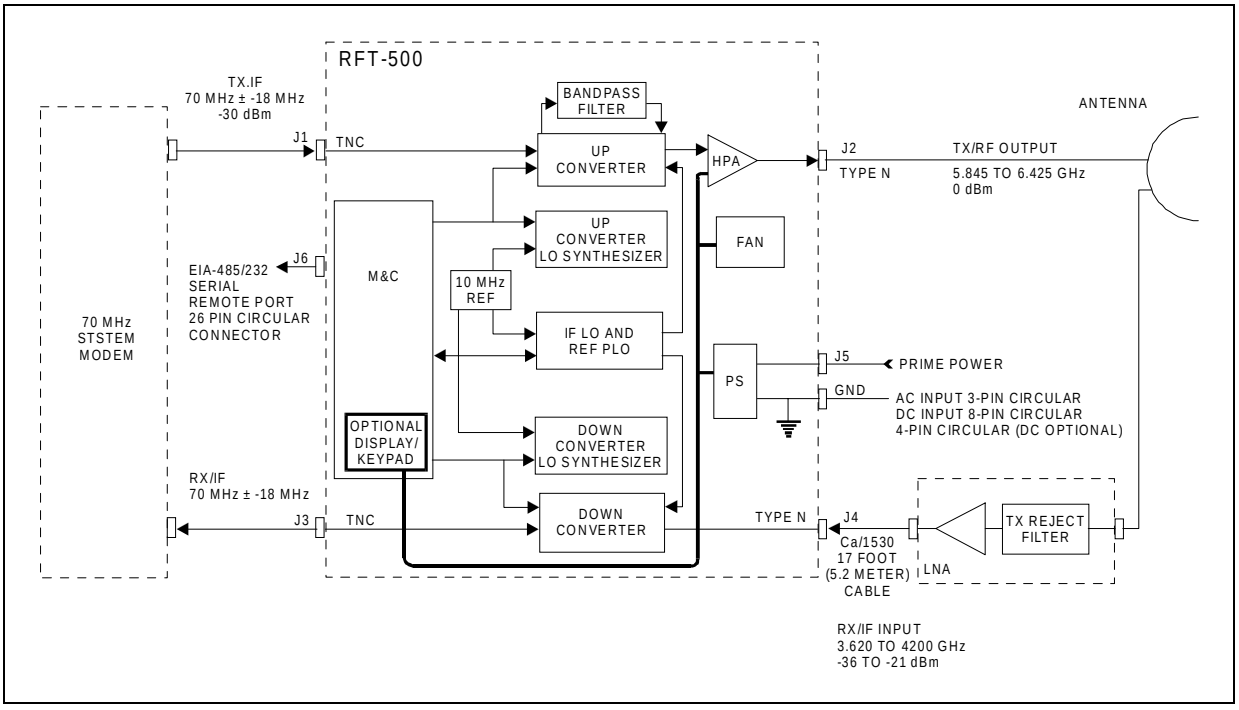

Figure 1-4. CST-5000 Block Diagram

1.1.1 Applications

When used in conjunction with EFData modems, the CST-5000 is ideal for:

- Single digit carriers up to 2.048 Mbit/s
- Multiple carrier operation over a 36 MHz bandwidth

Because the CST-5000 has a 70 MHz IF, it can also be used for other analog and digital applications.

Small to medium size earth stations are easily constructed and commissioned with the CST-5000.

When used with a high-gain antenna, the CST-5000 can also be used as the Radio Frequency (RF) electronics of a central hub in point-to-multipoint applications, as well as serving as the terminal for the end points of a network.

1.1.2 Monitor and Control (M&C)

An on-board microcomputer monitors and controls all operational parameters and system status of the CST-5000. This powerful M&C system enables the user to control functions, locally or remotely, such as:

- Output power
- Transmit/receive channel frequencies

The system also reports terminal configuration status, as well as fault status of all CST-5000 components.

The CST-5000 can be initially configured using the:

- Connection of a common ASCII/EIA-232-C terminal connected to the serial port. A simple command set then allows total configuration control and retrieval of status information.

- Optional keyboard/LCD (Liquid Crystal Display) controller within the enclosure.

If the indoor unit is a more sophisticated station M&C computer, the serial port can be set to EIA-485 for bus operation.

For more information on the M&C board, refer to Chapter 5.

1.1.3 Low Noise Amplifier (LNA)

The feed assembly consists of an LNA and a wave guide transmit reject filter.

The transmit reject filter provides receive system protection from transmit energy fed back through the antenna feed system.

The LNA standard noise temperature is 65°K, with optional upgrades down to 33°K, depending on gain over temperature (G/T) requirements.

1.1.4 Outdoor Enclosure

The RFT-500 assembly is a weatherproof enclosure housing the following:

- Solid State Power Amplifier (SSPA)
- Up and down converters
- M&C microprocessor
- Power supply and cables, which interface with an antenna subsystem

In the transmit (uplink) direction, the RFT-500 accepts a 70 MHz IF signal, and transmits it in the 5.845 to 6.425 GHz frequency band.

In the receive (downlink) direction, the terminal accepts an RF signal in the 3.620 to 4.200 GHz band, and converts the signal to a 70 MHz IF output.

Power levels range from +8 dBm (for driving an external Traveling Wave Tube (TWT) or amplifier) to 40W, depending on Equivalent Isotropically Radiated Power (EIRP) requirements.

The up and down converters are dual conversion, with individual synthesizers for independent transmit and receive transponder selection.

The microprocessor provides:

- On-line loop monitoring
- Dynamic control functions
- Configuration control
- Fault/status monitoring
- Serial computer/terminal interface

1.2 Options

Contact an EFData marketing representative for more information about the options described in this section.

1.2.1 Configurations

The CST-5000 can be ordered with various configurations, including:

- Output power levels.
- Input power (AC/DC).
- Step sizes. For example, 125 kHz step size. The 125 kHz step size option allows the transmit and receive frequencies to be adjusted within 125 kHz. The higher resolution step size of 125 kHz requires replacing the synthesizer modules and upgrading the software on the M&C board.
- LNA gain.
- Redundant LNA mounting plates.
- Custom logos.
- Wider bandwidths. The 140 MHz IF option enables the user to double the available bandwidth. Specifically, instead of the standard 70 MHz, ± 18 MHz, this option allows 140 MHz, ± 36 MHz. For more information, refer to Appendix A.
- Multi-carrier system. The multi-carrier option allows external separation of the up converter and SSPA for possible multiple carrier inputs. For more information, refer to Appendix A.

1.2.2 Equipment

The following items are available:

- KP-10 hand-held keypad. The KP-10 provides portable, external access for controlling the RFT. For information, refer to the *KP-10 External Keypad Installation and Operation Manual*.
- Front panel display/keypad. The optional front panel provides the local user interface, which can be used to configure and monitor the status of the terminal. For information, refer to Chapter 4.
- High-power amplifiers:
  - Traveling Wave Tube Amplifier (TWTA).
  - SSPA. For more information, refer to the *EFData High-Power SSPA Satellite Terminals Installation and Operation Manual*.
- High-performance LNAs.
- Phase-locked Low-Noise Block-converters (LNBs).
- LNBs (Non-Phase-locked).

1.3 Specifications

Table 1-1 lists the specifications for the CST-5000 system, Table 1-2 lists the specifications for the RFT-500, and Table 1-3 lists the specifications for the LNA.

Notes:

1. For specifications on the RSU-503, refer to the *RSU-503 Redundancy Switch Unit Installation and Operation Manual*.
2. For more information pertaining to CST-5000 specifications, refer to *EFData Specification SP/2578*.

Table 1-1. CST-5000 System Specifications

Prime Power	95 to 230 VAC, 47 to 63 Hz, or 48 VDC
Power Consumption: +8 dBm Output 5W Output 10W Output 20W Output 40W Output	 90W 140W 210W 340W 600W
Size	23 H x 10.5 W x 9 D inches (58.4 x 26.7 x 22.8 cm)
Weight	40 lbs. (18 kg)
Sealing	Weatherproof
Ground	#10 AWG ground lug
Environmental: Temperature Humidity Altitude	 -40 to +55° C (-104 to +131° F) Operational -50 to +80° C (-122 to 176° F) Storage 0 to 100% RH 0 to 15,000 ft. (0 to 4.6 km) Operational 0 to 50,000 ft. (0 to 15.2 km) Storage

Table 1-2. RFT-500 Specifications

Transmit	
Output Frequency (No Inversion)	5.845 to 6.425 GHz
Input Frequency	70 MHz, ± 18 MHz (optional 140 MHz, ± 36 MHz)
Output Power: at 1 dB compression	 +8 dBm or 5W (+37 dBm) or 10W (+40 dBm) or 20W (+43 dBm) or 40W (+46 dBm)
Third Order Intercept	+18 dBm (for +8 dBm) or +46 dBm (for 5W) or +49 dBm (for 10W) or +52 dBm (for 20W) or +55 dBm (for 40W)
Nominal Small Signal Gain	26 dB (for +8 dBm) or 68 dB (for 5W) or 71 dB (for 10W) or 74 dB (for 20W) or 77 dB (for 40W)
Gain Adjust Range	0 to 25 dB, in 0.5 dB steps
Gain Variation: Over 36 MHz Over 36 MHz, Temperature, and Aging	 ± 1 dB maximum ± 2 dB maximum
Noise Figure: Maximum Attenuation Minimum Attenuation	 23 dB maximum 15 dB maximum
Group Delay	25 ns/36 MHz
Synthesizer Step Size	2.5 MHz (optional 125 kHz)
Synthesizer Phase Noise	-60 dBc/Hz at 100 Hz -70 dBc/Hz at 1 kHz -75 dBc/Hz at 10 kHz -80 dBc/Hz at 100 kHz
Frequency Stability: At Shipment Daily at 23°C Annual at 23°C Over Temperature After 30 Minutes Warm-up Electrical Adjustment	 $\pm 1 \times 10^{-8}$ $\pm 1 \times 10^{-8}$ $\pm 1 \times 10^{-7}$ $\pm 1 \times 10^{-8}$ (-40 to +55° C) (-104 to +131° F) $\pm 1 \times 10^{-8}$ 0.5×10^{-7}
Isolation on Fault Shutdown	-60 dBc
Spurious: < 250 kHz Carrier Offset > 250 kHz Carrier Offset	 -35 dBc maximum -58 dBc maximum
HPA Harmonics	-50 dBc maximum
RF Output VSWR	1.5:1 at 50Ω
RF Output Connector	Type N female
IF Input VSWR	1.5:1 at 50Ω
IF Input Connector	Type TNC female

Table 1-2. RFT-500 Specifications (Continued)

Receive	
Input Frequency (No Inversion)	3.620 to 4.200 GHz
Output Frequency	70 MHz, ± 18 MHz (optional 140 MHz, ± 36 MHz)
Output Power at 1 dB Compression	+15 dBm
Third Order Intercept	+25 dBm
Gain Adjust Range (Typical, with LNA)	87 to 98 dB
Gain Variation (with LNA): Over 36 MHz Over 36 MHz, Temperature and Aging	 ± 1.5 dB maximum ± 4 dB maximum
Noise Temperature (with LNA)	LNA specification
Group Delay	25 ns/36 MHz
Synthesizer Step Size	2.5 MHz (optional 125 kHz)
Synthesizer Phase Noise	-60 dBc/Hz at 100 Hz -70 dBc/Hz at 1 kHz -75 dBc/Hz at 10 kHz -80 dBc/Hz at 100 kHz
Frequency Stability: At Shipment Daily at 23° C (73° F) Annually at 23° C (73° F) Over Temperature After 30 Minutes Warm-up Electrical Adjustment	 $\pm 1 \times 10^{-8}$ $\pm 1 \times 10^{-8}$ $\pm 1 \times 10^{-7}$ $\pm 1 \times 10^{-8}$ (-40 to +55° C) (-104 to +131° F) $\pm 1 \times 10^{-8}$ 0.5×10^{-7}
Spurious Non-Signal Related	-60 dBm maximum
Image Rejection (All Conversions)	> 35 dB
Linearity	Intermods < -35 dBc for two tones at -89 dBm at 95 dB gain
RF Input VSWR	1.25:1 at 50Ω
RF Input Connector	Type N female
IF Output VSWR	1.5:1 at 50Ω
IF Output Connector	Type TNC female

Table 1-2. RFT-500 Specifications (Continued)

Monitor and Control		
Control Interface	EIA-232, EIA-485, or optional keyboard	
Control Functions	SELECT RF OUTPUT U/C FREQ D/C FREQ U/C ATTN D/C ATTN PROGRAM BAUD ADDRESS	PARITY LNA PWR LNA FLT CALIB. REF ADJ XFLT EN RSW MODE LOCK MODE
Monitor Functions	U/C TEMP D/C TEMP HPA TEMP	TUV TDV TIV
Fault Detect Functions	RESTART UPLINK DOWNLINK 5V PWR 12V PWR HPA LNA	U/C LOCK U/C TUN D/C LOCK D/C TUN IF LOCK IF TUN

Table 1-3. LNA Specifications

LNA Dimensions	Refer to Figure 1-5 or 1-6, respectively
Frequency	3.620 to 4.200 GHz
Noise Temperature (with TRF)	65°K maximum (lower temperatures optional)
Gain	50 dB minimum, 54 dB nominal (optional 60 db)
Gain Flatness	± 1 dB/575 MHz
Gain vs. Temperature	± 3 dB maximum
1 dB Compression Point	+10 dBm minimum
Third Order Intercept	+20 dBm minimum
Group Delay: Linear Parabolic Ripple	 ± 0.01 ns/MHz maximum 0.001 ns/MHz^2 maximum 0.1 ns P-P
Input VSWR	1.25:1
Output VSWR	1.25:1
Input Connector	CPR229G (hold pressure to 0.5 PSIG)
Output Connector	Type N
Spurious	Below thermal noise/100 kHz
TRF Rejection	60 dB

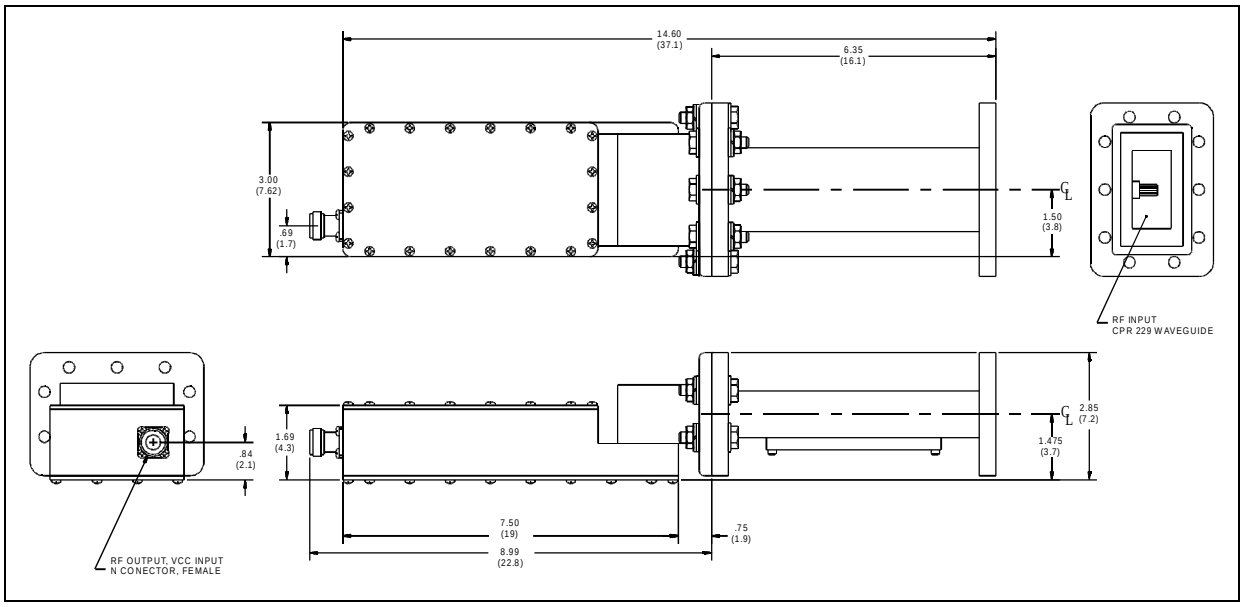

Figure 1-5. Dimensions for Single Thread LNA

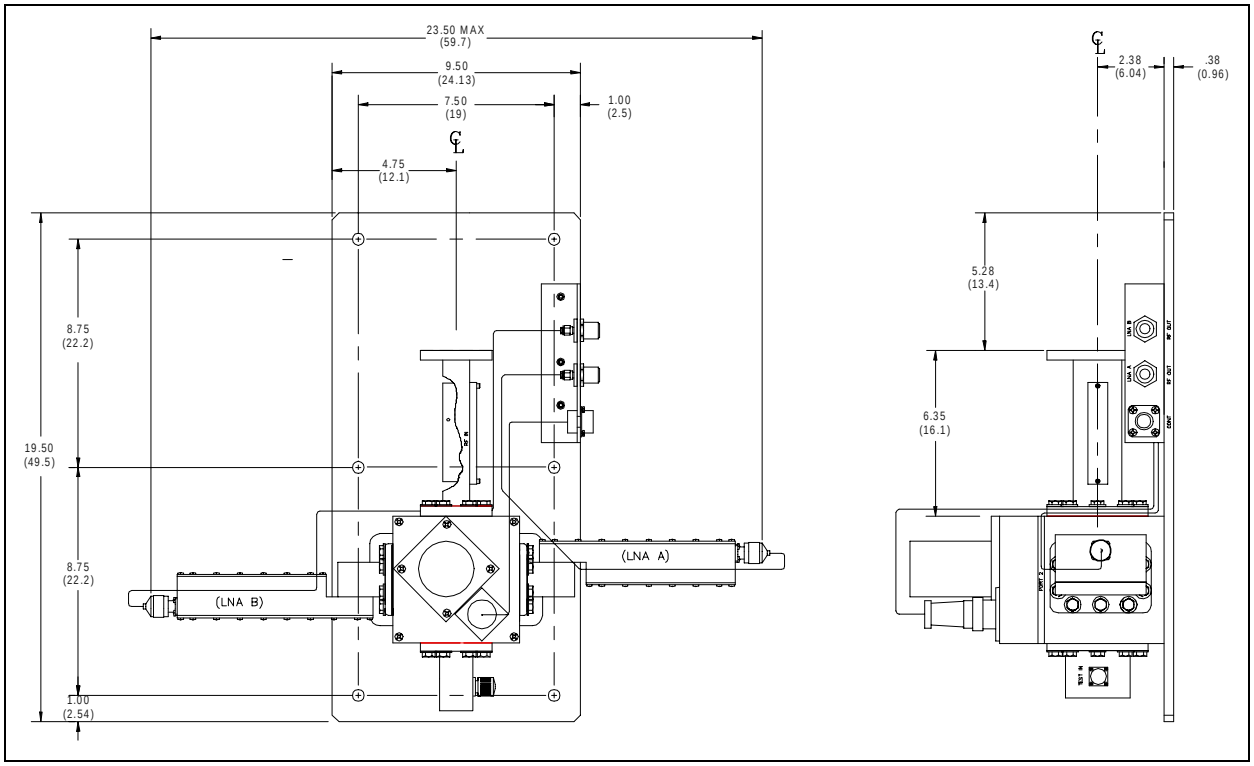

Figure 1-6. Dimensions for 1:1 Redundant LNA Plate