LinkStar®
RCST Installation Guide

Version E

June 2005

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General Safety Precautions

Avoid Personal Injury from Electricity

DANGER:

Do not short circuits when using metal tools. Some circuits have high current capability which, when shorted, will flash and may cause burns and/or eye injury.

Remove all jewelry and exposed metal objects from body and from clothing before performing maintenance, adjustments, and/or troubleshooting. Before working inside the equipment, remove all power, unless power is required to perform procedures. Do not replace parts with power on.

Equipment maintenance may require working with protective covers removed and AC power connected. Exercise **extreme** caution during these procedures!

Death or severe injury may result if personnel fail to observe safety precautions.

Replace Fuses with Identical Types

DANGER:

Replace fuses with identical types and ratings. Substitution of non-identical fuses may cause safety and fire hazards. Do not replace fuses with the power on. Failure to do this may result in electrical damage and/or personal injury.

Do Not Disconnect Power Cable from Plug-in Terminal

DANGER:

Do not disconnect the power cable or IF cables from the terminal. First turn off the power source at the nearest breaker, if possible, then remove plug and attached cable from the chassis. Failure to do this may result in electrical damage and/or personal injury.

Electrostatic Discharge (ESD) Procedures

You should only handle printed wiring circuit boards when you are grounded or have taken other precautions against the discharge of static electricity to avoid damaging the equipment. The icon below will appear next to procedures involving an electrostatic discharge (ESD) risk to warn you to protect the equipment.

Fire and Electric Shock Warning

WARNING:

To prevent fire or electric shock:

- Do not expose this apparatus to rain or moisture.
- Avoid spilling liquids on or near this apparatus.
- Do not open the top cover of this apparatus.

- Do not push objects through openings in this apparatus.
- Refer servicing to qualified personnel only. Contact your cable operator for service.

Resuscitation

Technicians working with or near hazardous chemicals or voltages should be familiar with CPR (cardiopulmonary resuscitation).

Use Safety-approved Equipment

You should clean the LinkStar chassis **only** with a damp cloth or vacuum cleaner (for ventilation slots). When applying cleaners to other areas, use approved explosion-proof lights, blowers, and other equipment. Ensure that fire-fighting equipment is readily available and in working order. Keep cleaners in special polyethylene bottles or in safety cans and in minimum quantities. Discard soiled cloths into safety cans.

Emergency Plan

Have an emergency plan. Know the procedures for obtaining first-aid and fire-fighting assistance. Plan your work and maintain good housekeeping; the safety and quality of the product are at stake.

Additional Precautions

CAUTION

- To protect this apparatus against damage from lightning storms and power-line surges, or when you are not using this apparatus for a long period of time, disconnect the power cord from the AC outlet.
- To disconnect the cord, pull it out by grasping the plug. Never pull the cord itself. Additionally, never walk on, place objects on, or pinch the power cord.
- The front and rear of this apparatus have openings for ventilation to protect it from overheating. To ensure reliable operation, do not block or cover these openings in any manner.
- Never place this apparatus near or over a radiator or heat register, or in a built-in installation, such as a bookcase or rack, unless the installation provides proper ventilation.
- Locate this apparatus on a stable, vibration-free surface capable of supporting its weight and size.

1. Introduction

This document provides instructions on installing, verifying operation, and troubleshooting the LinkStar® remote system. If an installation problem cannot be resolved after following the troubleshooting procedures in this document, please contact our 24/7 ViaSat Product Customer Support line at +1 (888) 272-7232 (U.S.), +1 (760) 476-2600 (international), or send an e-mail to noc-support@viasat.com.

Figure 1 illustrates a LinkStar remote system. Note that a typical installation will have the BUC directly attached to the feed assembly, versus what is shown, which is an arm-mounted BUC connected via flex waveguide. A PC and Ethernet switch are not part of the LinkStar remote site equipment, but they are included here to illustrate IP connectivity.

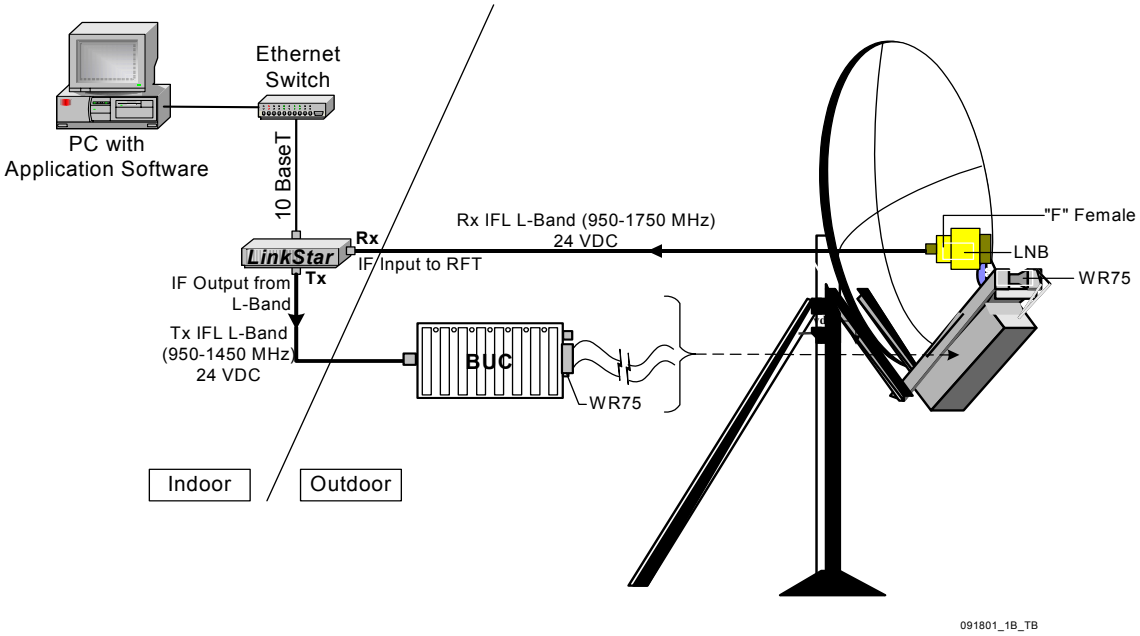

Figure 1: LinkStar Remote Site Diagram

2. Reference Documents

[1] LinkStar User's Manual, USR00091_A, June 21, 2002.

3. System Diagrams

Figure 2 and Figure 3 illustrate system diagrams, including cable length, connectors, and signal level information for Ku-band and C-band systems, respectively. Refer to Appendix A, "RCST Specifications," for more operational specifications for the RCST.

Ku-Band

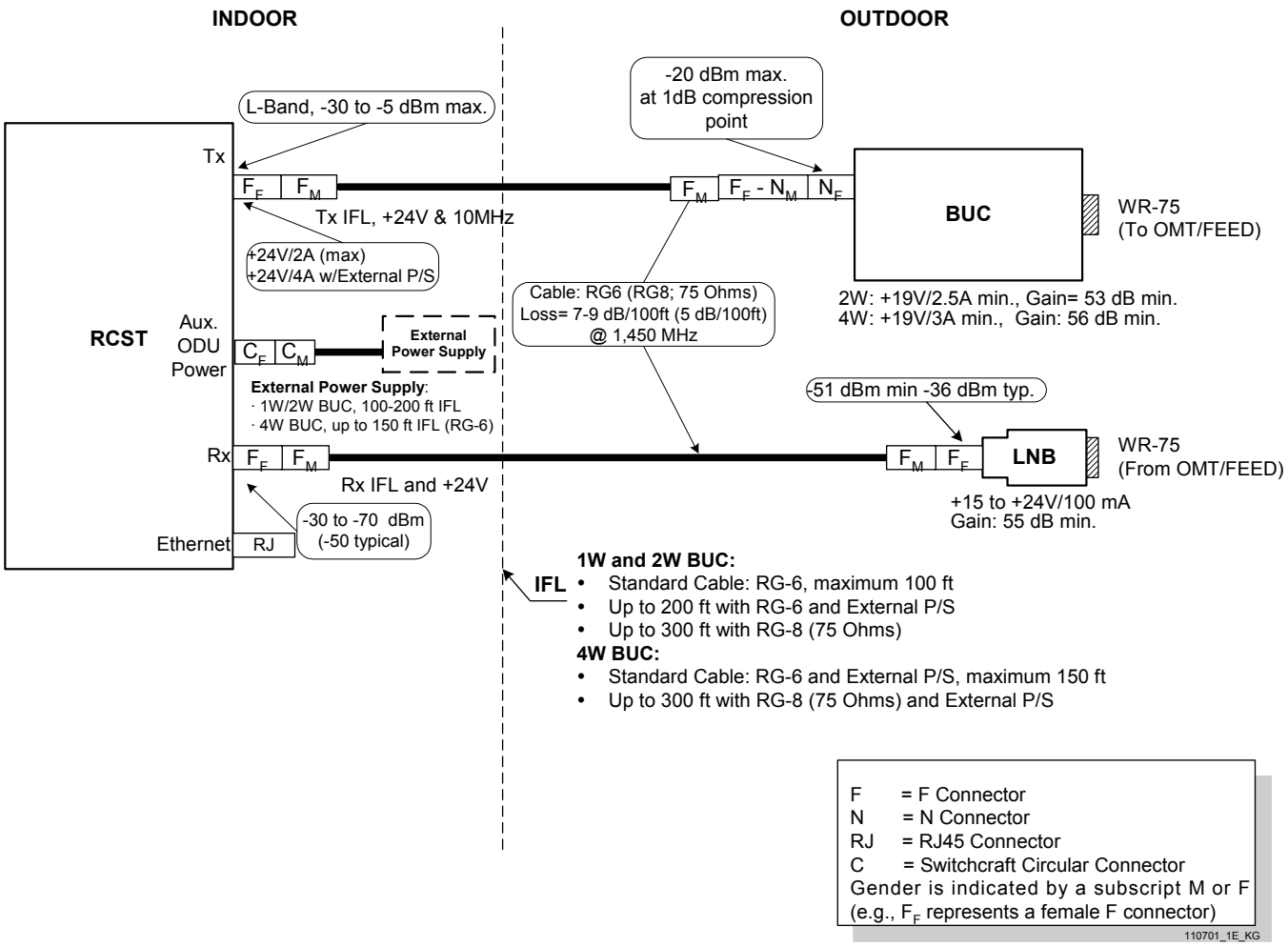

Figure 2: Ku-band System Diagram

C-Band

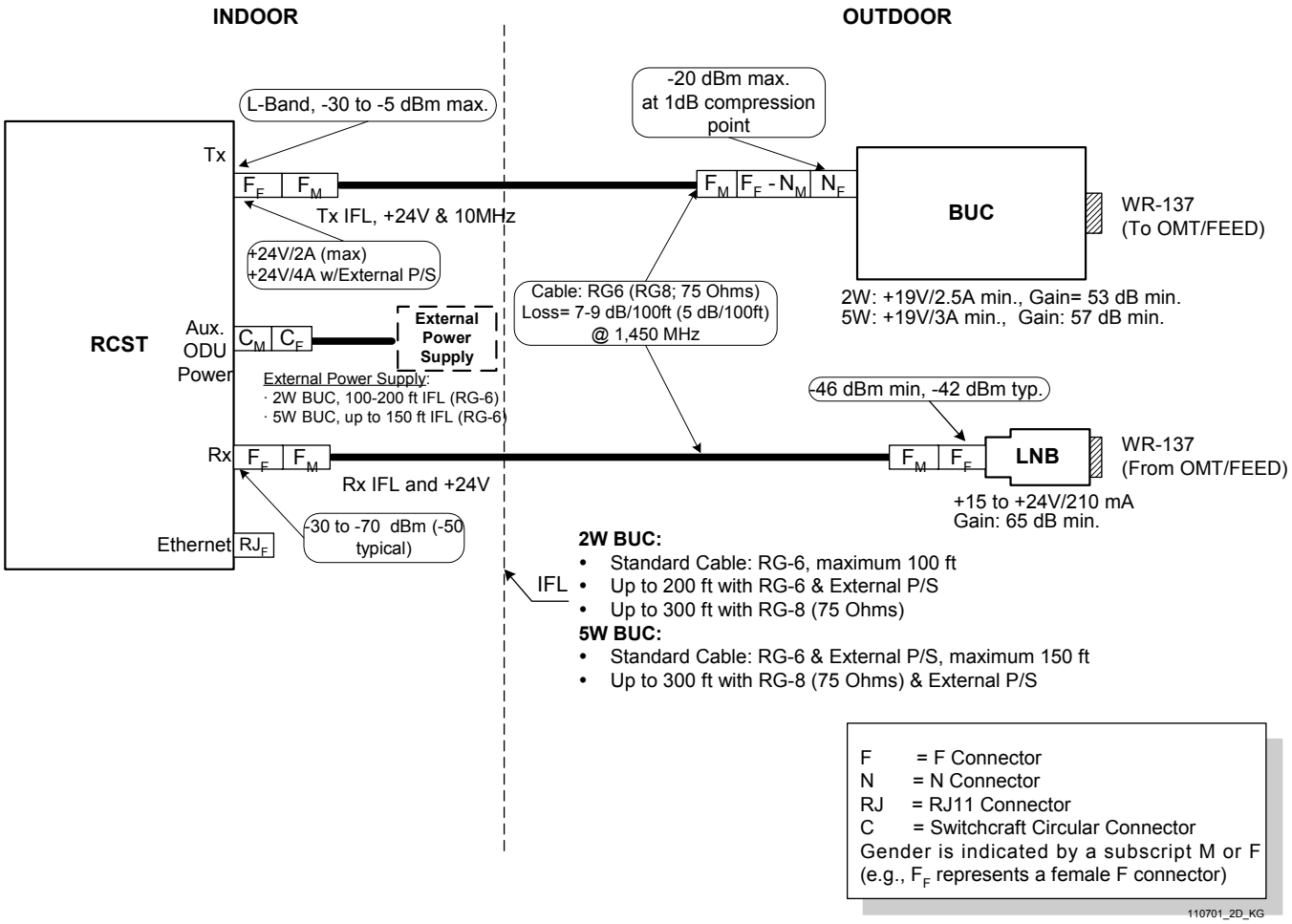

Figure 3: C-band System Diagram

4. LinkStar Remote Site Components

Table 1 lists LinkStar remote site components available from ViaSat, Inc. Typical quantities are listed in parentheses, (), next to the component listing. The installer should write in the quantity of each part in the "Qty" column in this table.

Component	Part #	Qty
1. Antenna (1)		
0.96M Ku-Band, WR-75, X-Pol, 2 7/8" – 3.0" mast	CL0004538-01	
1.2M Ku-Band, WR-75, CO-Pol, Prime Focus, 2 7/8" – 3.0" mast	CL0006681-01	
1.2M Ku-Band, WR-75, X-Pol , Prime Focus, M-D, Class II	CL0006626-01	
1.2M Ku-Band, WR-75, X-Pol, L-D, Class I	CL0006628-01	
1.8M C-Band, WR-137, CO-Pol, H-D, Class III **(NOTE**: w/BUC mounting shelf. BUC mounting bracket kit must also be ordered separately to attach feed and BUC.)	CL0006699-01	
1.8M C-Band, WR-137, TX-LHCP, 4.5" mast, H-D, Class III	CL0006700-01	
1.8M C-Band, WR-75, X-Pol, H-D, Class III	CL0006697-01	
1.8M Ku-Band, WR-75, CO-Pol, Prime Focus, 4.5" mast, H-D, Class III	CL0006682-01	
1.8M Ku-Band, WR-75, X-Pol, Dual Optic	CL0004560-01	
1.8M Ku-Band, WR-75, X-Pol, Prime Focus, Offset	CL0004561-01	
1.8M Ku-Band, WR-75, X-Pol, 4.5" mast, L-D, Class I	CL0006710-01	
1.0M Ku-Band, WR-75, X-Pol, L-D, Class I	CL0006627-01	
2.4M C-Band, WR-137, CO-Pol, 6 5/8 " mast, H-D, Class III	CL0006702-01	
2.4M C-Band, WR-137, TX-LHCP, 6 5/8 " mast, H-D, Class III	CL0006703-01	
2.4M C-Band, Wr-137, X-Pol, 6 5/8 " mast, H-D, Class III **NOTE**: w/BUC mounting shelf. BUC mounting bracket kit must also be ordered separately to attach feed and BUC.	CL0006701-01	
2.4M Ku-Band CO-Pol, 6 5/8 " mast	CL0006592-01	
2.4M Ku-Band, WR-75, X-Pol, Dual Optic	CL0004636-01	
2.4M Ku-Band, WR-75, X-Pol, 6 5/8 " mast	CL0004562-01	
2. Non-Penetrating Mount (1)		
1.2M King Post 2 7/8 in Mast	CL0006435-01	
90CM -1.2M NPRM 3.0 in Mast	CL0006058-01	
.96M & 1.2M Ground Pole 3.00 in Mast	CL0006421-01	
90CM - 1.2M Wall Attachment 3.00 in Mast	CL0006638-01	
1.8M King Post 4.5 in Mast	CL0006649-01	
1.8M NPRM 4.5 in Mast	CL0004634-01	
2.4M King Post 6 5/8 in Mast	CL0006422-01	
2.4M NPRM 6 5/8 in Mast	CL0006423-01	
3. RCST (1) – LinkStar Terminal		
4. BUC (1)		
1W Ku-Band 14.0-14.5 GHz F-In/WR-75 Out	CL0006683-01	
1W (Min) Ku-Band 14.0-14.5 GHz F-In/WR-75 Out	CL0006688-01	
2W (Min) Ku-Band 14.0-14.5 GHz F-In/WR-75 Out	CL0006712-01	
2W Ku-Band 14.0-14.5 GHz F-In/WR-75 Out	CL0006684-01	
4W Ku-Band	CL0006046-01	
2W C-Band	CL0006011-01	
5W C-Band	CL0006047-01	

Component	Part #	Qty
5. LNB (1)		
Ku-Band 10.95-11.7 GHz DRO	CL0005553-01	
Ku-Band 10.95-11.7 GHz Int. Ref.	CL0006586-01	
11.2-11.7 GHz DRO	CL0006048-01	
Ku-Band 11.2-11.7, 90K	CL0002236-01	
Ku-Band 11.7-12.2 DRO	CL0005554-01	
Ku-Band 11.70-12.20 GHz, Int. Ref.	CL0006587-01	
Ku-Band 12.20-12.75 GHz, DRO	CL0005555-01	
Ku-Band 12.25-12.75 GHz, Int. Ref.	CL0006588-01	
C-Band Extnd 3.400-4.200 GHz, DRO	CL0005556-01	
C-Band 3.4-4.2 GHz, Int. Ref.	CL0006589-01	
C-Band 3.700-4.200 GHz, DRO	CL0005901-01	
C-Band 3.625-4.200 GHz, Int. Ref.	CL0006590-01	
C-Band 4.5-4.8 GHz, Int. Ref.	CL0006591-01	
6. IFL Cables (2 each of either item below)		
Type - F, RG-6	CL0006573-01	
Low Power 150M	CL0006570-06	
7. IFL Cable Installation Kit (2)		
IFL-2 Low Power	CL0006575-01	
8. Adapter(s)		
RG6 cable run (F female to N male)		
RG8 cable run (F male to N female *qty*: 3)		
9. Tape, self-fusing 6" *(not supplied)*		1*
10. Grounding wire 8 AWG *(not supplied)*		1*
11. Installation Kit, Indoor Unit, for rack mount *(optional)*		1**
12. DC power supply *(optional)*	CL0006035-01	1**

* Quantity is one per line item. Installer supplied.

** Optional requirement

Table 1: LinkStar Remote Site Components

5. Recommended Installation Tools and Test Equipment

Table 2 is a list of recommended tools and test equipment for installing a remote LinkStar terminal system.

Description
☐ Electronic Installer's Tool Kit
☐ Cable Termination Tool Kit
☐ Hacksaw
☐ Hacksaw Blades, 12 inch
☐ Magnetic Compass
☐ Inclinometer
☐ Socket Set, 3/8" drive, to 3/4", with 3-inch extension
☐ Combination Wrench Set
☐ Set, Allen, Ball-End
☐ Tape Measure, 25 foot
☐ Fish Tape, 100 foot
☐ Pull Rope, 1/2 inch, 200 foot, polyester
☐ Cable Pull Grip, for cable diameter of 0.37-0.49 inch
☐ Pipe Wrench, 18 inch
☐ Test Equipment: Analog or digital Volt-Ohm Meter 2-way splitter w/ one DC pass **Adapters:** ▪ Type F female to N male ▪ Type F female to BNC male ▪ Type BNC female to N male Two (2) 3' test coaxial cables, RG6 male/male Spectrum analyzer 950 to 1750 MHz or Peaking Meter GPS radio for LAT/LONG
☐ Laptop PC for use in terminal configuration or troubleshooting, running telnet sessions. Minimum PC requirements: 1GB hard drive 32 MB RAM 10/100 Ethernet Card Win98 or higher Pentium processor
☐ Standard LAN crossover cable
☐ Two Ethernet Cables
☐ Console Cable (only if unit has console port)

Table 2: Installation Tools

6. IFL Requirements

This section identifies the type of IFL cable recommended for a given cable length and specifies when an external power supply will be required for the BUC. The required specifications are below; Table 3 and Table 4 provide a reference for cable length, cable type, and external power supplies based on requirements for low-power and high-power BUCs, respectively.

External Power Supply:

Required for IFL runs over 100 ft and for 4W or 5W BUCs.

Specifications

- Desktop model, universal input (90-264V AC) and single output (24V DC and 4A minimum).
- Over-voltage and short-circuit protection.
- DC power plug on RCST is barrel type, 2.5 mm interior diameter, center positive.

Note: Turn on the external power supply only when RCST is OFF. If the RCST is ON, it will reset the RCST.

IFL Cables and Connectors (available from ViaSat):

RG-6 type

- Connector used: type F (male).
- Impedance: 75 Ohm
- Recommended for IFL lengths up to 100 ft.
- Maximum length is 200 ft with external power supply and 2W C-band or 1W/2W Ku-band BUC.
- Maximum length is 150 ft with external power supply and 5W C-band or 4W Ku-band BUC.

RG-11 type

- Connector used: type F (male).
- Impedance: 75 Ohm
- Recommended for IFL lengths between 100 – 250 ft.
- Maximum length is 250 ft with 2W C-band or 1W/2W Ku-band BUC.
- Maximum length is 250 ft with external power supply and 5W C-band / 4W KU-band BUC.

RG-8 (75 Ohm) Low Loss Cable

- Connector used: type F (male).
- Impedance: 75 Ohm
- Recommended for IFL lengths between 200 – 300 ft.
- Maximum length is 300 ft with 2W C-band or 1W/2W Ku-band BUC.

- Maximum length is 300 ft with external power supply and 5W C-band / 4W KU-band BUC.

IFL Length	Cable	Connector	External Power Supply Required	DC Resistance/ 1000 ft. (cond. dc res. + ½ shield dc res.)	Attenuation/ 100 ft (between 950 and 1450 MHz)
<100 ft	RG-6 type	F-type	No	11.1 ohms	6.0 to7.5 dB
100 - 200 ft	RG-6 type	F-type	Yes	11.1 ohms	6.0 to 7.5 dB
100 - 250 ft	RG-11 type	F-type	No	4.1 ohms	3.9 to 5.2 dB
200 - 300 ft	RG-8 (75 Ohm)	F-type	No	3.3 ohms	3.7 to 4.9 dB

Table 3: Cabling Specifications for 2W C-band or 1W/2W KU-band BUC

IFL Length	Cable	Connector	External Power Supply Required	DC Resistance/ 1000 ft. (cond. dc res. + ½ shield dc res.)	Attenuation/ 100 ft (between 950 and 1450 MHz)
<100 ft	RG-6 type	F-type	Yes	11.1 ohms	6.0 to7.5 dB
100 - 150 ft	RG-6 type	F-type	Yes	11.1 ohms	6.0 to7.5 dB
100 - 250 ft	RG-11 type	F-type	Yes	4.1 ohms	3.9 to 5.2 dB
200 - 300 ft	RG-8 (75 Ohm)	F-type	Yes	3.3 ohms	3.7 to 4.9 dB

Table 4: Cabling Specifications for 5W C-band or 4W KU-band BUC

NOTE: If the IFL cables used for the RCST installation exceed the lengths or attenuation specifications shown in the tables above, the power supply may fail due to a current draw exceeding the maximum specified (2.25 amperes for internal supply; 4 amperes for external supply).

These cables meet the Underwriters Laboratory (UL) and CL2 requirements for normal installation and may be installed without using conduit within buildings. The cable is **not** designed for direct burial and must be installed in conduit at least 2.5 cm (1 inch) in diameter with 13 cm (5-inch) minimum radius bends for buried cable applications. Pull-wire must be in place in conduit before beginning installation.

7. Installation Procedure

Before starting an RCST installation, verify a *Remote Site Installation Data Sheet* is available, and that the Site Information, Outdoor Equipment Information, and RCST Parameters sections are complete (for an example of information contained in an installation data sheet, refer to Appendix B).

A completed *Remote Site Installation Data Sheet* will contain the information required to install the RCST system and verify its operation. In addition, notes regarding installation are recorded on this sheet.

8. IFL Installation

Important Cautions:

Note the following precautions to prevent destroying the RCST or its power supply.

- **The RCST must be powered OFF until the Rx IFL cable is connected to BOTH the RCST and the LNB!**

  If the center pin of the RX IN connector on the back of the RCST is shorted to ground, it will burn the printed circuit (PC) tracks on the RCST circuit board. This renders the RCST inoperable.

- **Do not connect the Tx IFL cable to the BUC until Rx synchronization is established!**

  If the transmit cable to the BUC is mistakenly connected to the RCST RX IN connector, excessive current will be immediately drawn from the unit, possibly damaging the RCST power supply.

1. Ensure installation meets all applicable cable codes, including National Electrical Code (NEC) and local requirements.
2. Do not pull IFL cables using the center conductor of the coax. The cable insulation on the cables is made of foam and pulling by the center conductor will damage electrical performance. Pull on the outside of the cable only.
3. Pull the IFL cables, using good installation practices. Leave 6 meters (15 to 20 feet) of cable beyond the antenna post for adequate service loops. At the indoor end, allow an adequate service loop for easy access and service of the RCST.
4. At the outdoor end, dress the IFL cables from the bottom to the top of the antenna mounting post using tie wraps (included in the installation kit) positioned 20 cm (~8 inches) apart.
5. Terminate cable ends with proper connectors. The connectors must mate to the connectors on the antenna feed assembly and RCST. Use tie wraps to dress cable to the support arm.
6. Use standard self-fusing tape on all outdoor connections to ensure a water-tight system. Approximately 3” of tape is required per connection.

9. Antenna Pointing

This procedure for antenna pointing requires a compass and a spectrum analyzer. A peaking meter can also be used to peak the signal strength of the satellite beacon, after the signal has been found with the spectrum analyzer. If desired, instructions shipped with the antenna may be used in place of the procedure included here.

Record the site parameters from the *Remote Site Installation Data Sheet* onto Table 5 below. The site parameters can also be determined at the hub using the NMS map, or by using a GPS system at the remote site.

Parameter	Value
Satellite Elevation	
Satellite Azimuth	
Uplink and Downlink Polarization	
Satellite Beacon Frequency or plot of satellite signature	
Magnetic Declination	

Table 5: Satellite Parameters

It is assumed that the antenna has been properly mounted, facing the correct direction, and that the installer has a known beacon frequency or a plot of the satellite "signature" to complete installation.

1. Set up the spectrum analyzer as shown in Figure 4. **Make sure the 2-way splitter blocks the DC voltage from reaching the spectrum analyzer!**
2. Tune the spectrum analyzer to the beacon frequency.
3. Adjust the antenna to an approximate azimuth and elevation using a compass for the azimuth and an inclinometer for the elevation. Set the azimuth to the magnetic azimuth recorded on the *Remote Site Installation Data Sheet*.

   Magnetic Azimuth = Azimuth – Magnetic Declination
4. Using the supplied polarization setting, rotate the feed to the appropriate position. If a cross polarization measurement is performed, a final polarization adjustment will be made in coordination with the Hub operator.
5. Adjust the azimuth slowly, in 2 to 3 degree increments, while observing the spectrum analyzer for the beacon signal. Span up to 15 degrees on each side of the supplied azimuth heading. If no signal is observed, raise the elevation 2 degrees and repeat the azimuth sweep. Repeat this process to a maximum of 6 degrees above supplied elevation value.
6. If no signal is observed, repeat Step 5 after adjusting 2 degrees lower on the elevation.
7. Once a signal is found, confirm it is the proper satellite using the supplied beacon frequency or signature. If a beacon signal cannot be found, refer to the appropriate troubleshooting section in this document.
8. Fine adjust the azimuth to attain maximum signal level on the spectrum analyzer, then secure the azimuth adjustments. Verify the beacon signal strength remains the same after securing the adjustment.

9. Now fine adjust the elevation for maximum signal on the Spectrum Analyzer and secure the elevation adjustment. Verify the beacon signal strength remains the same after securing the adjustment.

10. After acquiring the satellite, disconnect the spectrum analyzer and connect the LNB to the RCST. If the RCST is receive synchronized and enabled at the hub, the +24 volts to the BUC will be enabled.

    Note: More specific instructions for antenna pointing and setting polarization are supplied with the antenna.

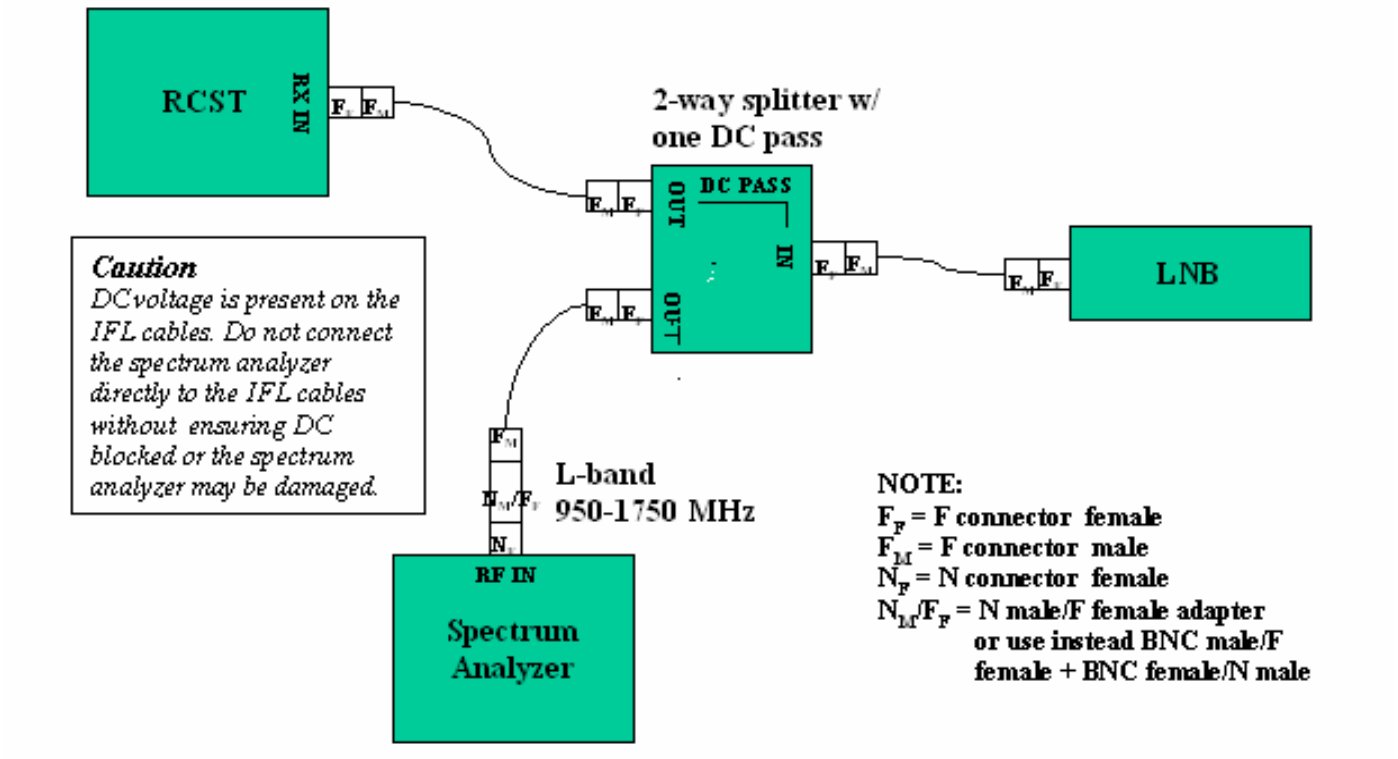

Figure 4: Setup for Antenna Pointing

10. RCST Installation

A rack-mounted RCST must occupy a minimum 3U space, with the top 2U space left empty to ensure adequate cooling. Less space can cause overheating and subsequent failure of the terminal.

Similarly, a tabletop-mounted RCST also requires proper ventilation. To ensure adequate cooling, no other items may be resting on top of the unit.

1. Turn RCST power ON at the back of the unit. When power is ON, verify PWR LED is ON. See Appendix C for front panel LED definitions.

2. Using the example in Table 6, determine the RCST's default IP address and enter it into the table. Establish a Telnet session with the RCST using the default IP address (alternatively, for units with console ports, plug directly into that port using a console cable). See Appendix D for a more detailed description of IP addresses and telnetting to the RCST.

Address	Value	Description
MAC Address	___.___.___.___.___.___	Ethernet address label is on the back of the RCST.
Default IP Address	10. ____.____.____	The RCST's default IP address is based on its MAC address, where the last three hex bytes are the decimal equivalent. **Example:** MAC=0E.00.01.***01.72.bd*** Default IP=10.**1.114.189** …where ***01*** (hex) = **1** (dec), ***72*** (hex) = **114** (dec) and ***bd*** (hex) = **189** (dec)
Network IP Address	____.____.____.____	NOC provides or as part of *Remote Site Installation Data Sheet*.

Table 6: IP Addresses

The default IP address is only effective until the RCST becomes Transmit Acquired. Once the RCST is Tx Synced, it receives its Network IP Address from the RNCC and the default address is no longer valid. To re-establish the default address, remove the Tx/Rx cables from the back of the terminal, and it will automatically reset to default.

3. Contact the Hub operator.

- Tell the operator the coordinates of the remote site based on the values recorded in the *Remote Site Installation Data Sheet*.
- Check the software/firmware version executing in the RCST by entering the following command:

  lmep

  Two lines will display, indicating the files loaded into the two banks for both the software (SW) and firmware (FW):

  ```
  0x7285 SW rcst-1.0.6.term.exe () rcst-1.0.7.term.exe (PE)

  0x7285 FW rcst.021314.altera.dat () rcst.060416.altera.dat (PE)
  ```

  [A set of parentheses will display next to each file. An "E" designates that file as "executing," and a "P" indicates "primary." If an executable is primary, it will load

in the RCST the next time it is rebooted. In this example, software version 1.0.7 is executing (as indicated by the "E") and the "P" indicates that software version 1.0.7 will execute when that RCST is rebooted. Similarly for the firmware, in this example, firmware version 060416 is executing and on an RCST reboot, version 060416 will execute.]

Determine with the Hub operator if the RCST requires a new software version. If new software is required, then verify a software download process is running at the Hub.

4. Enter the boot parameters in the RCST by using the dbpr command shown below. RCST parameters can be found on the *Remote Site Installation Data Sheet*. The definitions for the boot parameters are in Appendix E.

dbpr bootconf [An example of values displayed is in Figure 5.]

termid	0x730b	**popid**	**0x11e0004**
ctlPID	**0x1029**	**pcrPID**	**0x365**
TDMCarrierFreq	**1250000**	**SymbolRate**	**27500000**
Latitude	0	Longitude	0
TxPower	**-30**	**ODUStatus**	**EXTERNAL**
VCXOParl	0x1321*	VCXOPar2*	0x1331
TimingLoopBW	0x10*	Signature*	0xfa

Figure 5: Example of RCST Boot Parameters

VCXOPar1, VCXOPar2, TimingLoopBW, and Signature, are set in the software. DO NOT make any changes to these parameters.

5. If any parameters need to be changed, enter the new values using the **save** command.

save -t <*TxPower(0.5 dB steps)*> -f <*TDMCarrierFreq*> -pop <*popID*> -s <*SymbolRate*> -c <*ctlPID*> -pcr <*pcrPID*> -o <*ODUStatus*> -lnbv <*0|12|13|18|20*> -lnbi <*0|1*>

LNB settings are as follows:
-lnbv <0|12|13|18|20> (0 = off; otherwise, value is in volts)
-lnbi <0|1> (0 = off, 1 = on(increments lnbv value by 1))

The terminal ID (termid) is set at the factory. The Latitude and Longitude parameters are not used by the RCST. See Appendix E for a definition of boot parameters and data formats.

Example:

-t -60 -f 125000 -pop 0x11e0004 -s 27500000-c 0x1029 -pcr 0x365 -o 2 -lnbv 20 -lnbi 1

The signal level at the input of the BUC is determined based on the Tx Power in the RCST parameters and the attenuation in the Tx IFL cable. The cable attenuation is provided in Table 7. **Using the cable type and length, set the TxPower to provide the correct signal level at the input of the BUC.**

Cable Type	Cable Loss dB/100ft
RG-6	~11.1 @ 950 to 1450 MHz
RG-11	~4.1 @ 950 to 1450 MHz
RG-8 (75 Ohm)	~3.3 @ 950 to 1450 MHz

Table 7: LinkStar Cable Loss Specifications

6. Reboot the terminal.
7. The SAT LED in the terminal should start blinking after approximately 20 seconds, indicating receive synchronization. Leave the terminal running in this state for 5 minutes.
8. If the RCST requires a new software version, the RCST should receive the new software within approximately five minutes. The RCST will reboot after the software download.
9. After reboot, all the lights in the front of the terminal will become solid for a second and the satellite light will start blinking afterwards.

10. Power the RCST off and connect the transmit cable from the RCST Tx connector to the input of the BUC. After cable is connected, power on the RCST. Receive acquisition will automatically start.
11. When the RCST is transmit synchronized, the SAT LED will become solid after approximately 5 minutes.
12. Telnet to the RCST using the Network IP address recorded in the *Remote Site Installation Data Sheet*.

11. Verifying RCST Operation

11.1. TDM BER

1. Enter **tcmp**. Receive parameters will display (Figure 6 is an example—certain values will vary). Verify **CarrierPhase** and **RSVit** are LOCKED. The **RSUncorrectedErrorCount** should be 0 and should not increase. If the value is not zero, enter **tcmreset** and reenter **tcmp** to check that the value is zero.

RSCorrectedErrorCount	0	RSUncorrectedErrorCount	0
QPSK BER	0.001349059	I2CErrorCount	0
LostSyncCount	0	TimeSynced	0
MaxTimeSynced	146867	Synced	1
TimeUnSynced	155	NCODeviation	187
CarrDeviation	-0.01642432	CodeRate	2/3
CarrierPhase	LOCKED	RSVit	LOCKED
USActive	RUNNING	Rs	27.50000
Fs	85	frequency	1250
UCLoaded	1		

Figure 6: Receive Parameters

2. Let the RCST run in transmit synchronization for at least half an hour and record values from the **tcmp** file into the *Remote Site Installation Data Sheet*.

11.2. TDMA BER

1. Contact the Hub operator for the following data: TDMA BER, CRC Errors, Turbo Errors, Power, Fr ER, UW detects and UW misses for traffic burst. Record this information in the *Remote Site Installation Data Sheet*.

2. Request that the Hub operator issue the **showrcst <*termID*>** command to view the RCST status and verify that the Terminal Commands are incrementing. The increasing number of Terminal Commands indicates that the RNCC is sending command messages to the RCST.

11.3. IP Ping

1. Request that the Hub operator start a repetitive ping to the RCST. Verify with the Hub operator that the ping is running successfully. To verify at the remote site:

   Enter: **e**

   Figure 7 illustrates an example of the values displayed after issuing the **e** command during a repetitive ping to the PC from the hub:

```
ETHER: RxProc=IFMGR RxFunc=1415c RxProcCOSMOS=0
EthAddr=00.a0.94.00.73.f3

Loopback=Disabled Promiscuous=Disabled Broadcast=Enabled

Interface UP at 100 Mbps Full-Duplex


NodeId           0x0         LinkId                 0
PortId           0           OutUcastPkts           4230
OutNUcastPkts    8           OutDiscards            0
OutErrors        0           OutOLen                0
OutOctets        3074983     OutKbps                0
InUcastPkts      2789        InUcastPkts            82804
InBcastPkts      1078        InMcastPkts            81726
InDiscards       0           InErrors               0
InOctets         7090835     InKbps                 0
AlignmentErrors  0           FCSErrors              0
SQETestErrors    0           DeferredTransmissions  0
LateCollisions   0           ExcessiveCollisions    0
OutUnderruns     0           CarrierSenseErrors     0
FrameTooLongs    0           InOverruns             0
```

Figure 7: IP Performance

2. Verify that the values in **InUcastPkts** and **OutUcastPkts** are increasing incrementally. Also verify that the following parameters are zero: InErrors, FCSErrors, DeferredTransmissions, ExcessiveCollisions, CarrierSenseErrors, InOverruns, InDiscards, AlignmentErrors, SQETestErrors, LateCollisions, OutUnderruns, and FrameTooLong.

   Note: This screen does not update automatically, it must be closed and reopened to update.

12. Cross Polarization

This procedure is for enabling the RCST to transmit a CW carrier from the remote site.

1. The cross pole interference is measured at the Hub, provided the antenna has a dual feed.

   For this measurement, the RCST must transmit a CW signal over the satellite. The transmit frequency is specified by the Hub operator.

DO NOT TRANSMIT A CW CARRIER UNLESS TRANSMIT AUTHORIZATION IS GIVEN BY THE HUB OPERATOR!

2. Before transmitting the CW signal, the RCST must establish receive synchronization. After receive synchronization is established:

   Enter: **disable termexec**

3. Enable RCST to transmit a CW signal.

   Enter: **cacsetcw -power<(**0.5 dB steps**)> -freq<(**MHZ**)> -time<(**seconds**)>**

   The default for **time** is 300,000 seconds (5,000 minutes); be sure to enter a value to control the duration of the CW signal.

   Set the power to the TxPower specified in the boot parameters. The Hub operator specifies the frequency. An example of a CW signal is shown in Figure 8.

4. The transmission of the CW carrier will terminate after the Time has expired. To immediately stop transmission of the CW signal, enter **hw**. This will reboot the RCST.

5. The RCST will restart acquisition and synchronization after entering the hardware reset command, **hw**.

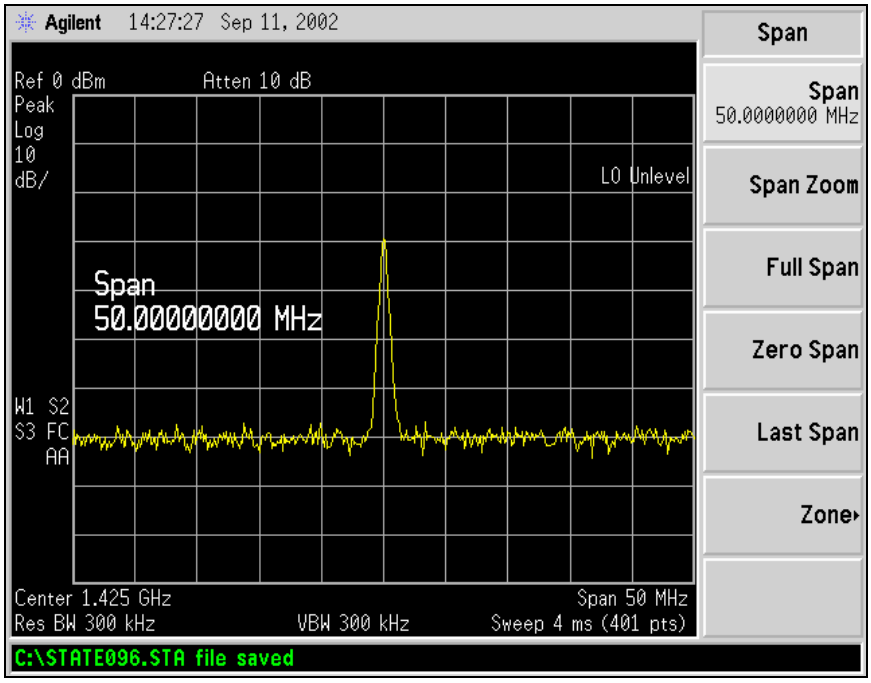

Figure 8: RCST CW Signal

13. Troubleshooting

13.1. Recommended Troubleshooting Equipment

The list below identifies the recommended equipment for troubleshooting an RCST remote installation.

- Spectrum Analyzer
- Two-way splitter with DC block on one port
- Voltmeter or oscilloscope
- Personal computer (desktop or laptop) with Ethernet Interface
- Ethernet crossover cable or Ethernet hub

A personal computer, usually a laptop, is connected to the RCST via an Ethernet crossover cable or hub. All commands identified in this document are entered using this PC.

13.2. Identifying the Problem

Table 8 provides a listing of problems that may occur during RCST installation, and includes the corresponding alarm indication and a list of probable causes. Each probable cause has one ore more sections that provide a procedure to verify the potential cause and resolution of the problem.

The first step in troubleshooting is to identify the problem at the site, either by examining the RCST front panel LED display or by viewing configuration and operational parameters in the RCST. For example, the Acquisition and Synchronization operation of the RCST can be checked by observing the SAT LED (see *Appendix C* for descriptions of LEDs).

Problem	Alarm Indication	Probable Causes/Related Sections
RCST does not power ON	PWR LED – OFF	13.3 RCST Power ON Failure
Cannot find Satellite Beacon Signal	No signal on Spectrum Analyzer	13.4 No Satellite Beacon Signal
No Receive Synchronization	SAT LED – OFF	13.5 Receive Synchronization 13.5.1 Receive TDM Signal 13.5.2 LNB 13.5.3 Receive IFL Cable 13.5.4 Antenna 13.5.5 TDM Frequency and Symbol Rate 13.5.5.1 RCST boot parameters
High Receive BER	QPSK BER read from RCST file - tcmp	13.6 Receive TDM BER

Problem	Alarm Indication	Probable Causes/Related Sections
No Transmit Synchronization	SAT LED - Blinking	13.7 Transmit Synchronization 13.7.1 RCST Transmission 13.7.2 RCST Boot Parameters 13.7.3 PCR Distribution 13.7.4 TMDA Transmit Level 13.7.4.1 CW carrier 13.7.4.2 Transmit Cable 13.7.4.3 BUC Power 13.7.4.4 BUC Output
High RCST Transmit BER	Transmit BER measured at Hub GCU	13.8 RCST Transmit BER
No IP Traffic	IP Ping test fails	13.9 IP Traffic Test 13.9.1 Allocated Bandwidth 13.9.2 Allocated CIR 13.9.3 IP Status

Table 8: RCST Installation Problems

13.3. *RCST Power ON Failure*

When the AC power switch is set to the ON position, the PWR LED should be ON. If this LED is not ON, then power the RCST OFF and back ON. All LEDs should be ON for approximately one second.

If all LEDs come ON, except the PWR LED, then the PWR LED has failed.

If none of the LEDs are ON momentarily during power up, then check the following:

1. AC power wired to 110/220 VAC
2. Blown fuse
3. Bad AC power cable

If no problems are found and the RCST still does not power ON, then replace the RCST.

13.4. *No Satellite Beacon Signal*

If the frequency is not found using the Antenna Pointing procedure (Section 9) in this document, check the following:

- Using the spectrum analyzer, sweep across the frequency range to see if any signals are received. If *any* signals are received, the LNB is working properly.

  If signals are not received, then the LNB is not working as expected, and the following details should be checked:

- Before connecting or disconnecting the IFL cable from the RCST to the LNB, power off the RCST.

  Disconnect the Rx IFL cable from the LNB, then use a voltmeter to verify that 15 to 24 VDC is present on the cable at the input to the LNB. If DC voltage is not present, measure the DC voltage at the RX IN port on the RCST. If there is no DC voltage at the RX IN port of the RCST, replace the RCST. If DC voltage is present at the RX IN port and not at the LNB, then the problem is in the receive IFL cable. Inspect the cables and connectors (Section 13.5.3) and replace if necessary.

- Verify with the Hub operator that the beacon frequency, magnetic azimuth, and inclination given in the *Remote Site Installation Data Sheet* are correct.
- Verify that the spectrum analyzer is set to the correct frequency.
- Verify the correct frequency range for the LNB.
- Verify voltage settings are correct using dbpr bootconf.

  If after checking the above, signals are still not seen at the spectrum analyzer, replace the LNB.

13.5. *Receive Synchronization*

If the SAT LED is off, the RCST is not receive synchronized. The RCST will reboot every five (5) minutes until receive synchronization is established.

The following will affect RCST receive synchronization:

- TDM Signal Level
- TDM E_{cb}/N_o
- TDM Frequency
- TDM Symbol Rate

If these four parameters are correct, the RCST SAT LED should be blinking, indicating receive carrier synchronization.

13.5.1. Receive TDM Signal

A troubleshooting chart for the receive TDM signal is shown in Figure 9. First check the receive TDM signal with a spectrum analyzer to determine the signal level at the input of the RCST and the E_{cb}/N_o value. Use the spectrum analyzer to estimate E_{cb}/N_o.

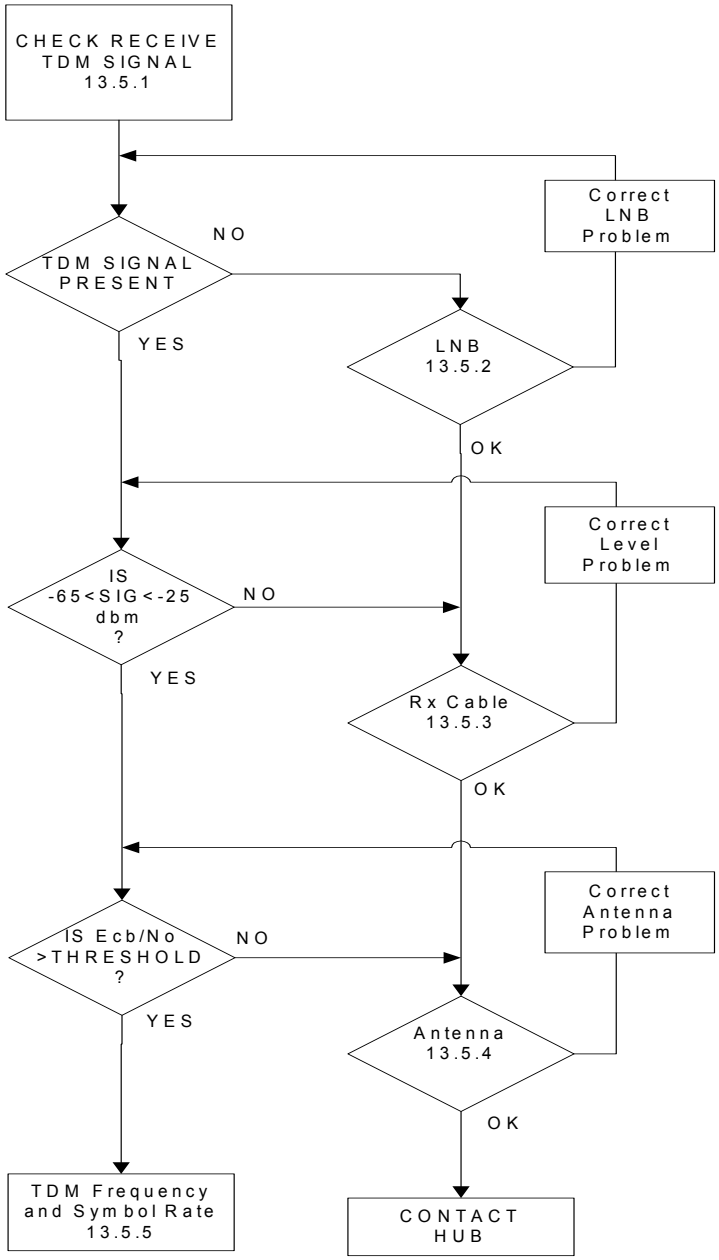

Figure 9: Check Receive TDM Signal Flow Chart

Connect the spectrum analyzer to measure the receive signal as shown in Figure 10.

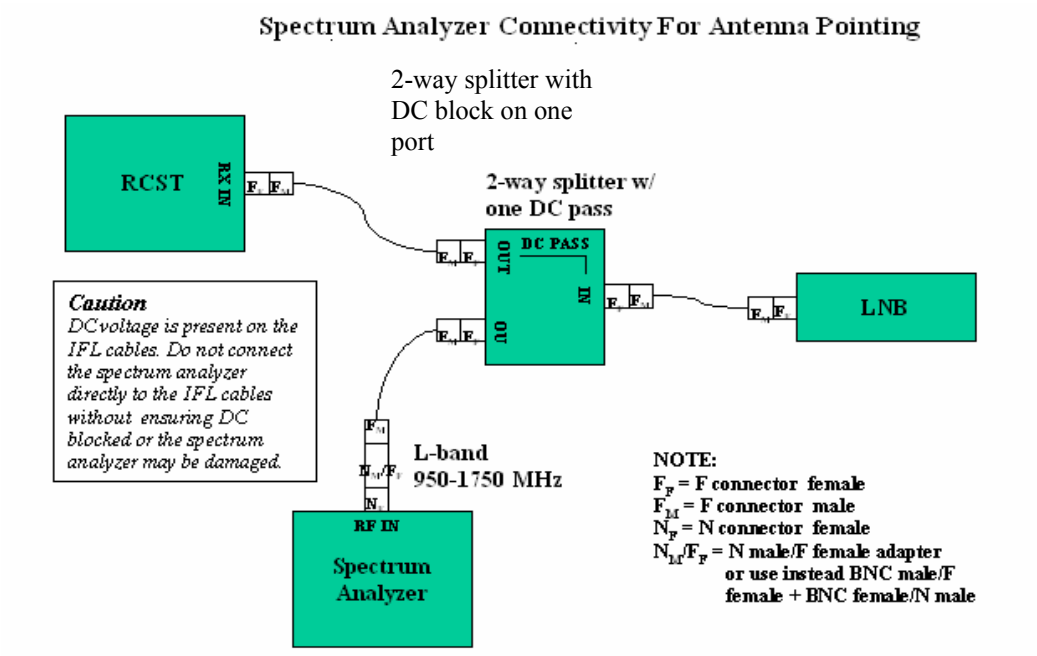

Figure 10: Spectrum Analyzer Connection to Downlink

Connect the spectrum analyzer to the LNB output. Use a 2-way splitter between the RCST and LNB with a DC-through path to RCST and a DC-block path to the spectrum analyzer. The DC-through path from the RCST to the LNB provides the DC voltage to power the LNB.

Terminate the cable to the spectrum analyzer with the impedance of the cable (50 or 75 ohms).

If a TDM signal is present, check the level and $E_{cb}/N_{o.}$

- Total carrier power should be between –25 dBm and –65 dBm.

  Carrier power is the cursor reading at approximately the center of the carrier + 10log10[(carrier symbol rate)/resolution bandwidth)].

  If the TDM carrier power is > -25 dBm, notify the Hub operator.

- E_{cb}/N_o (energy per channel bit) can be approximated by C_o/N_o – 3dB (distance between top of modulated carrier and noise floor, minus 3 dB).

  E_{cb}/N_o should be at least 4 to 8 dB, depending on coding.

13.5.2. LNB

If the beacon signal is received, the LNB is operating. If the beacon frequency is received and the TDM signal is not received, as seen on the spectrum analyzer, then check the following:

- Verify the LNB is the correct model with the correct frequency range, as shown in Table 9: LNB Frequency Range.

Ku-Band Receive Requirement	Range
European	**10.95 to 11.7 GHz**
North American	**11.7 to 12.2 GHz**
Intelsat	**12.2 to 12.75 GHz**

C-Band Receive Requirement	Range
Global	**3.7 to 4.2 GHz**
Extended	**3.4 to 4.2 GHz**

Table 9: LNB Frequency Range

- Verify the frequency of the TDM outbound signal with the Hub operator.

13.5.3. Receive IFL Cable

If no signal or a low-signal level is seen at the spectrum analyzer, check cables and connectors as follows:

- Type-F center conductor:
  - Check that the conductor is not bent (it can be damaged when connecting).
  - Check that the conductor is at least flush with end of the connector and does not exceed 1/8 inch (3 mm) beyond the end of the connector.

Verify the cable loss using Table 10 below and check against the length of cable recorded in the *Remote Site Installation Data Sheet*.

Cable Type	Cable Loss dB/100ft
RG-6	~11.1 @ 950 to 1450 MHz
RG-11	~4.1 @ 950 to 1450 MHz
RG-8 (75 Ohm)	~3.3 @ 950 to 1450 MHz

Table 10: LinkStar Cable Specifications

13.5.4. Antenna

If no signal or a low-signal level is seen at the spectrum analyzer, check the antenna's pointing, polarization, and ground.

- Use a spectrum analyzer to verify that the frequency and signal strength of the satellite beacon agrees with the data in the *Remote Site Installation Data Sheet*.
- Verify that the polarization of the antenna agrees with the data in the *Remote Site Installation Data Sheet*.

- Verify no interfering signals are present.

If the E_{cb}/N_o is low and signal strength is correct, then check the following:

- Obstruction at the antenna feed.
- Alignment of the feed assembly.
- An interfering signal on the spectrum analyzer.
- Noise level on spectrum analyzer.

13.5.5. TDM Frequency and Symbol Rate

Verify that the frequency and symbol rate of the TDM signal measured on the spectrum analyzer is consistent with values specified in the boot parameters (symbol rate is 3 dB bandwidth of carrier).

13.5.5.1. RCST Boot Parameters

Verify the frequency and symbol rate in the RCST boot parameters.

Enter: **dbpr bootconf** (Figure 11 displays an output of this command.)

termid	0x730b	popid	0x11e0004
ctlPID	0x1029	pcrPID	0x365
TDMCarrierFreq	**1250000**	**SymbolRate**	**27500000**
Latitude	0	Longitude	0
TxPower	-30	ODUStatus	EXTERNAL
VCXOParl	0x1321*	VCXOPar2*	0x1331
TimingLoopBW	0x10*	Signature*	0xfa

Figure 11: RCST Boot Parameters

*** Do not attempt any changes to the following parameters: VCXOPar1, VCXOPar2, TimingLoopBW, or Signature!** They are set at the factory.

If TDMCarrierFreq (L-Band) or SymbolRate are incorrect, then confirm values with HUB operator.

Note: TDMCarrierFreq = Satellite Downlink Frequency – LNB LO Frequency

If the boot parameters are consistent with the measurements on the spectrum analyzer, and the signal level is correct at the RCST input, then the RCST may be at fault.

13.6. Receive TDM BER

Check BER on the receive TDM signal only when the RCST is in receive synchronization. Note that the BER may be affected by signal level and/or E_{cb}/N_o. Antenna pointing, polarization, cable attenuation, interference, and weather can also contribute to degrade BER performance.

Enter: **tcmp** (Figure 12 displays an output of this command.)

RSCorrectedErrorCount	0	RSUncorrectedErrorCount	0
QPSK BER	0.001349059	I2CErrorCount	0
LostSyncCount	0	TimeSynced	0
MaxTimeSynced	146867	Synced	1
TimeUnSynced	155	NCODeviation	187
CarrDeviation	-0.01642432	CodeRate	2/3
CarrierPhase	LOCKED	RSVit	LOCKED
USActive	RUNNING	Rs	27.50000
Fs	85	frequency	1250
UCLoaded	1		

Figure 12: Receive Parameters

If RSUuncorrectedErrorCount is not zero, enter **tcmreset** to set that value to zero.

The RSUncorrectedErrorCount should then remain at zero. If this count is incrementing, verify the receive signal level and E_{cb}/N_o at the RCST. If the signal level and E_{cb}/N_o are out of specification, then refer to Section 13.5.1, "Receive TDM Signal."

13.7. *Transmit Synchronization*

Once the RCST is transmit synchronized, the telnet, or console, session must switch from the default address to the network IP address supplied in the *Remote Site Installation Data Sheet*. See *Appendix D* for the Telnet procedure.

The SAT LED will continue blinking when in receive synchronization. At the point that transmit synchronization is established, the SAT LED will change from blinking to continuous ON.

Incorrect values on the following items can affect RCST transmit synchronization:

- RCST not enabled at the NMS
- Terminal ID
- Population ID
- Control PID
- PCR PID
- TDMA transmit signal level
- BUC

A transmit synchronization troubleshooting flowchart is shown in Figure 13. This flowchart includes references to tests to check the RCST's transmission, and to verify that the terminal is enabled, and that data are correct for the bootconf parameters, PCR distribution, and transmit signal level.

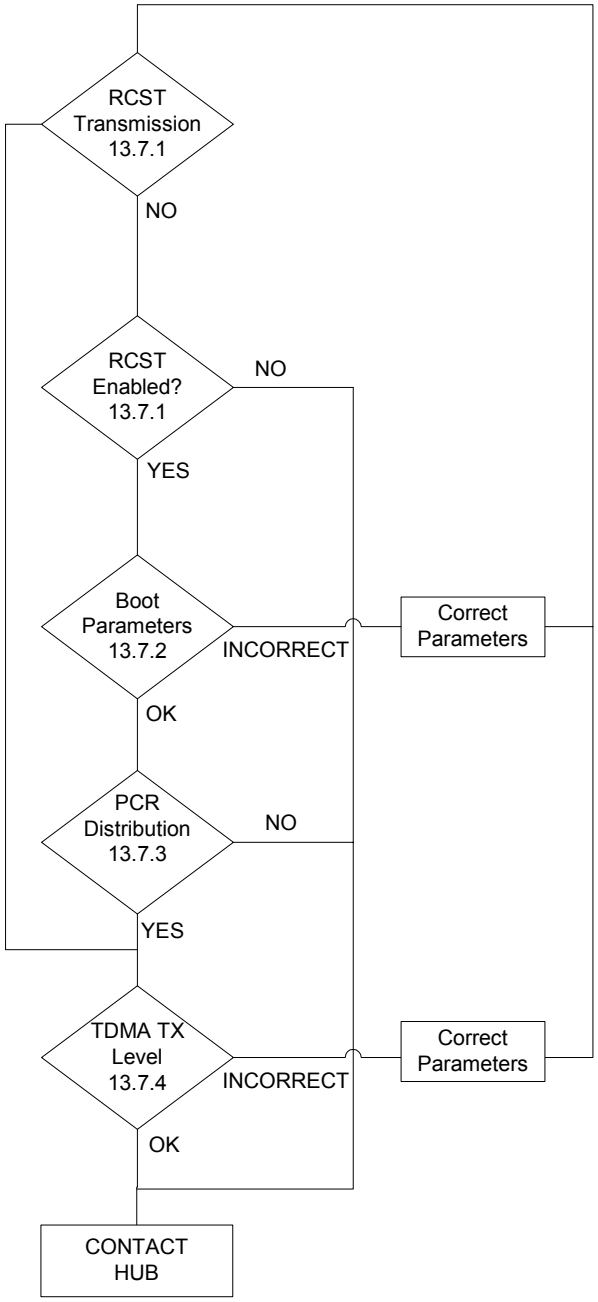

Figure 13: Transmit Synchronization Flow Chart

13.7.1. RCST Transmission

The **repeat** command will indicate if the RCST is transmitting continuously, intermittently, or not at all. Enter the repeat command as shown below.

Enter: **repeat –t 1000 tb** (Figure 14 displays an output of this command.)

ID	TxPower (dB)	Chan	TX segs
100	-14.94	2	15585
1000	-14.94	4	3621

Figure 14: Transmit Burst(s) Table

If the RCST is transmitting, the above display will be shown. If the RCST is not transmitting, there will be no display. The above display should repeat continuously and the SAT LED should be ON continuously. However, if this display stops and restarts periodically, then the TDMA signal is not received or is not being processed properly at the HUB; in that case, the SAT LED will remain blinking.

Contact the Hub operator for assistance if the RCST is transmitting continuously and the SAT LED is still blinking, or if the RCST is transmitting intermittently. If the RCST is not transmitting, then check if the RCST is enabled using the command below:

Enter: **prt termexec** (Figure 15 displays an output of this command.)

```
TmExCB(@ 0xa65c0):
terminal:            0x73f3
Population           0x11e0001
Region               0x1e
Regional NCC         0x21e
State                Operational
Event                Null
Enabled              TRUE
Rx synced            TRUE
NCR synced           TRUE
Tx synced            FALSE
Watchdog enabled     TRUE
RxSetTErmModelMsgs   0
RxnvalidMsgs         0
TxTermReportMsgs     0
```

Figure 15: Termexec Data

Verify that “Enabled” is TRUE. If it is not TRUE, contact the Hub operator.

13.7.2. RCST Boot Parameters

The boot parameters that affect RCST transmission are:

- Terminal ID (Set at factory)
- Population ID
- Control PID
- PCR PID
- TxPower

To display the boot parameters, enter the command below:

Enter: **dbpr bootconf** (Figure 16 displays an output of this command.)

termid	0x730b	**popid**	0x11e0004
ctlPID	0x1029	**pcrPID**	0x365
TDMCarrierFreq	1250000	SymbolRate	27500000
Latitude	0	Longitude	0
TxPower	-30	ODUStatus	OFF
VCXOParl	0x1321	VCXOPar2	0x1331
TimingLoopBW	0x10	Signature	0xfa

Figure 16: RCST Boot Parameters

Verify that the following parameters agree with the data in the *Remote Site Installation Data Sheet.*

- termid (Set at factory; cannot be changed)
- popid
- ctlPID
- pcrPID
- Tx Power

If any of these parameters are incorrect, make changes using the **save** command:

save -t <*TxPower(0.5 dB steps)*> -f <*TDMCarrierFreq*> -pop <*popID*> -s <*SymbolRate*> -c <*ctlPID*> -pcr <*pcrPID*> -o <*ODUStatus*>

[See *Appendix E* for descriptions of each parameter.]

Do not attempt any changes to the following parameters: VCXOPar1, VCXOPar2, TimingLoopBW, Signature, or termid! They are set at the factory.

The termid is the hex equivalent of the last two (2) bytes of the default MAC address given on the back panel of the RCST.

13.7.3. PCR Distribution

Verify PCR distribution.

Enter: **tclgets** (Figure 17 displays an output of this command.)

```
PCRReceived   TRUE            state             NCR Sync
LastError     99              LastConnection    299
FreqError     -9.523809
```

Figure 17: PCR Status

Verify **PCRReceived** is TRUE and **state** is NCR Sync. If pcrPID is correct in the RCST boot parameters, PCRReceived is FALSE in the PCR status, and the RCST is receive synchronized, contact the Hub operator.

13.7.4. TDMA Transmit Level

The TDMA transmit signal level specified in the *Remote Installation Data Sheet* depends on the specified transmit power (Ku- or C- band) based on the link budget, BUC gain, and cable loss. The transmit power is given in the *Remote Site Installation Data Sheet*. Given this power setting, verify the correct input level to the BUC based on cable type and length (see Table 3 or Table 4 to verify cable type). Verify that the level into the BUC is at least 3 dB below the saturation point, or, if the operating range for the input level is given, use that level, but do not exceed the maximum.

Set the RCST transmit level:

Enter: **dbpr bootconf** (Figure 18 displays an output of this command.)

```
termid                0x730b      popid            0x11e0004
ctlPID                0x1029      pcrPID               0x365
TDMCarrierFreq       1250000      SymbolRate        27500000
Latitude                   0      Longitude                0
TxPower                  -30      ODUStatus              OFF
VCXOParl              0x1321      VCXOar2           0x1331
TimingLoopBW             0x0      Signature            0xfa
```

Figure 18: RCST Boot Parameters

Verify that the TxPower in the boot parameters agrees with that given in the *Remote Site Installation Data Sheet*. Power is set in 0.5 dB steps (e.g., you would enter -20 to set the power to -10dBm (-20 x 0.5 = -10 dBm)).

13.7.4.1. CW Carrier

The following items are checked by transmitting a CW carrier from the RCST:

- Signal level going into the BUC (measured by the spectrum analyzer), and
- Cross polarization (can be measured at the Hub if the antenna has a dual feed).

Measure Signal Level

Before connecting or disconnecting the IFL cable from the RCST to the BUC, power off the RCST.

Disconnect the input cable to the BUC and connect the cable to the properly terminated spectrum analyzer with a DC block in line, as shown in Figure 7.

1. The RCST will transmit a CW signal only when the RCST is in receive synchronization. When the RCST is received synchronized, then:

   Enter: **disable termexec**

4. Enter: **cacsetcw -power <(**0.5 dB steps**)> -freq <(**MHZ**)> -time (**seconds**)>**

The default for time is 300,000 seconds (5,000 minutes); be sure to enter a value there to control the duration of the CW signal.

Set the power to the same power specified in the boot parameters. The Hub operator specifies this frequency.

The CW begins transmission once the **cacsetcw** command is entered. The CW signal ends when the **time** has expired or when the RCST is reset (by entering the hardware reset command, **hw**). The RCST automatically restarts receive and transmit acquisition only after **hw** is entered.

VERIFY CW TRANSMISSION HAS ENDED AND POWER OFF THE RCST BEFORE RECONNECTING THE TxIFL CABLE TO THE BUC.

Cross Polarization

Connect the input cable to the BUC. For this measurement, the RCST must transmit a CW signal over the satellite. The transmit frequency is specified by the Hub operator.

DO NOT TRANSMIT A CW CARRIER UNLESS TRANSMIT AUTHORIZATION IS GIVEN BY THE HUB OPERATOR!

Enable the RCST to transmit a CW signal using the **cacsetcw** command. The cross-polarization measurement is made at the Hub site. The Hub operator will specify the transmit frequency.

13.7.4.2. Transmit Cable

If the L-band signal measured at the BUC input is low (measured using the CW signal), there may be too much attenuation in the cable.

Using the spectrum analyzer with a **DC block**, measure the level of the L-band signal at the RCST output. Then use this level value, the cable type, and the cable length to compute the signal level at the BUC. The loss in signal level due to transmit IFL cable, based on cable type and length, is given in Table 3. If the computed signal level and the measured signal level at the input to the BUC are different by more that 1 or 2 db, inspect the cable connectors (see Section 13.5.3) and the cable. Otherwise, enter a value of TxPower in the boot parameters so that the correct signal level can be measured at the input to the BUC.

13.7.4.3. BUC Power

Check to determine if the BUC is internally powered, externally powered, or OFF.

Enter: **dbpr bootconf** (Figure 19 displays an output of this command.)

termid	0x730b	popid	0x11e0004
ctlPID	0x1029	pcrPID	0x365
TDMCarrierFreq	1250000	SymbolRate	27500000
Latitude	0	Longitude	0
TxPower	-30	**ODUStatus**	**INTERNAL**
VCXOParl	0x1321	VCXOar2	0x1331
TimingLoopBW	0x10	Signature	0xfa

Figure 19: RCST Boot Parameters

When INTERNAL or EXTERNAL is selected, the 24V DC is supplied with the L-Band signal to the BUC. If INTERNAL is selected, the DC voltage is supplied from the RCST power supply. If EXTERNAL is selected, the DC voltage is supplied from an external power supply connected to the AUX ODU PWR connector on the back of the RCST as shown in Figure 20.

Verify the ODU power status in the *Remote Site Installation Data Sheet*. The ODU power is based on the BUC type, cable type, and cable length.

Figure 20: RCST Rear Panel

13.7.4.4. BUC Output

If power to the BUC is correct and the Hub is not receiving the TDMA burst, connect the spectrum analyzer to the output of the BUC with the appropriate adapters and pads.

If no TDMA burst is seen at the output, and the L-band input signal and 24 VDC is present, the BUC should be replaced.

If the TDMA burst is seen at the output, check the transmit feed assembly.

NOTE: Terminate transmission from the RCST before checking the feed assembly.

13.8. *RCST Transmit BER*

At the GCU (Hub location), check the BER and attenuation values while the RCST is in transmit synchronization. Both these values can be affected by the RCST transmit signal level, receive polarization, and weather.

If the TDMA BER is high or the GCU attenuation is low, as specified at the Hub, check the following:

- TDMA signal level
- BUC Output

- Antenna Polarization
- Weather conditions at Hub site and RCST site.

Have the Hub operator verify that the terminal reports counter is increasing incrementally (this can be checked by entering **ps** at the RNCC). If the RCST is transmit synchronized and this counter is not incrementing, check with the Hub operator.

The Hub operator can verify the GCU receive attenuation, Unique Word misses, CRC errors, and other statistics at the GCU console. An increase in the number of CRC errors or UW misses on the TB indicates a problem such as rain fade, transmit power, frequency, or timing.

13.9. *IP Traffic Test*

IP traffic can be verified by pinging the remote PC from the Hub, or by pinging the GCU from the PC at the remote site. Request the IP address of the GCU from the Hub operator.

If the ping does not work, check the IP status by the following command:

Enter: **prt ipctest** (Figure 21 displays an output of this command.)

```
pkts received 549737

bytes received 48254096

rate bits/second 3008

mcbs run out 0
```

Figure 21: ipctest

The **pkts received** and **bytes received** should increment each time the command is entered. This indicates that the ping is being received from the hub. If the ping is not being received, then verify the following:

13.9.1. Allocated Bandwidth

Verify that there is enough allocated bandwidth on the return link.

Enter: **tbtp** (Figure 22 displays the output of this command.)

Id Type	Type	TxTerm	RxTerm	Carr	Fec	Mod	Offset	Aper	Chan	Octets	CheckB
100	SB	11e0001	400609f	1	2/3	QPSK	1674	NORMAL	2	114	0
1001	TB	73f3	400609f	1	2/3	QPSK	113354	NORMAL	4	228	0

Figure 22: tbtp – Burst Time Plan

Verify traffic burst (TB) with at least one channel (1 channel = 8.6kbps). If no TB is assigned, traffic will not be transmitted. Check if the CIR is allocated.

13.9.2. Allocated CIR

Verify if there is a CIR in kbps assigned to the rcst.

Enter: **dbpr iprcconf** (Figure 23 displays an output of this command.)

```
KSET IPRCConf
```

```
  Item 1. Addr e9b60, Key 0x73f3 ItemMark 1 ArrayPos 5
Rcsttermid       0x73f3        Qosqprofnum    0
Cirtohub         34            Isdisabled     0
Sendroutestohub  0                            0
```

Figure 23: iprcconf – CIR

The iprcconf command and the accompanying parameters indicate the following:

- If a CIR has not been submitted at the Hub, a CIR table will not display. Only a KSET IPRCCONF line is displayed. Notify the Hub operator.
- A CIR greater than zero may result in not enough bandwidth. Notify the Hub operator.
- A CIR value of 0 (zero) indicates bandwidth-on-demand (BOD). Wait a couple of minutes and check for a traffic burst using the **tbtp** command. If after approximately 10 minutes, there is still no traffic burst, notify the Hub operator.

13.9.3. IP Status

The status of the Ethernet interface is monitored as follows:

Enter: **e**

Figure 24 is an example of the **e** display when continually pinging the PC from the hub.

```
ETHER: RxProc=IFMGR RxFunc=1415c RxProcCOSMOS=0
EthAddr=00.a0.94.00.73.f3
Loopback=Disabled Promiscuous=Disabled Broadcast=Enabled
Interface UP at 100 Mbps Full-Duplex

NodeId           0x0          LinkId                 0
PortId           0            OutUcastPkts           4230
OutNUcastPkts    8            OutDiscards            0
OutErrors        0            OutOLen                0
OutOctets        3074983      OutKbps                0
InUcastPkts      2789         InUcastPkts            82804
InBcastPkts      1078         InMcastPkts            81726
InDiscards       0            InErrors               0
InOctets         7090835      InKbps                 0
AlignmentErrors  0            FCSErrors              0
SQETestErrors    0            DeferredTransmissions  0
LateCollisions   0            ExcessiveCollisions    0
OutUnderruns     0            CarrierSenseErrors     0
FrameTooLongs    0            InOverruns             0
```

Figure 24: IP Parameters

Verify that In and Out Pkts are incrementing increasing. Verify that the following parameters are zero: AlignmentErrors, SQETestErrors, LateCollisions, OutUnderruns, FrameTooLongs, FCSErrors, DeferredTransmissions, ExcessiveCollisions, CarrierSenseErrors, and InOverruns .

Appendix A: RCST Specifications

RCST Specifications Table

Dimensions	1U (1.75") High, 13.08" Width, 7.53" Depth
Power	110/220 VAC Auto-sensing, Auto-ranging
Temperature	0° to 40°C Operating; -20° to 70°C Storage
Humidity	95% relative humidity non-condensing at 0° to 40° operating; 90% relative humidity non-condensing at 65°C non-operating
Susceptibility	EN50082-1; 1997
EMI	FCC Part 15, EN50022, CE
Safety	UL/cUL 1950; EN60950; TUV; VDE
Power Consumption	125 VA

Table A-1: RCST Specifications

RCST Rear Panel Functions

Function	Rear Panel Label	Specification
Power supply	***100-240V~ 60Hz/50Hz 2.0A/1.0A***	• **50/60 Hz** • **Auto-range**—100 VAC to 240 VAC, IEC 320
ODU IF connections	***Tx OUT*** ***Rx IN***	• **Tx**—950-1450 MHz (L band), 75 Ohm, Type F female • **Rx**—950-1750 MHz (L band), 75 Ohm, Type F female
LAN Interface	***10/100BaseT***	• **8-Pin RJ-45 Jack**—IEEE 802.3 compatible. 10/100 BaseT physical interface
Console Port	***Console***	• **RJ-11**
Auxiliary ODU Power (future)	***AUX. ODU PWR***	• **+24 VDC, 4A Max., Barrel Pin Jack (Switchcraft 712RA)**

Table A-2: RCST Rear Panel Ports and Specifications

LinkStar Modulator and Demodulator Table

	Modulator Output	Demodulator Input
GCU	N/A	–35 to –70 dBm
RCST	–5 to –30 dBm in 0.5 dBm steps	–30 to –70 dBm

Table A-3: LinkStar GCU and RCST Modulator and Demodulator Table

Appendix B: Remote Site Installation Data Sheet Example

Site Information

Customer:		Site Longitude:	
Location Name:		Site Latitude:	
City:		Azimuth:	
State:		Elevation:	
Country:		Polarization:	
Contact:		Azimuth:	
Phone Number:		Mag Declination:	
Satellite ID:		Mag Azimuth:	
Satellite Beacon Freq:			

Satellite Information

Satellite ID:		Magnetic Declination:	
Satellite Beacon Freq.:		Magnetic Azimuth:	
Azimuth:		Elevation Angle:	
Polarization:			

Outdoor Equipment Information

Antenna Size:		Rx IFL Cable Length:	
BUC Power:		Cable Type:	
BUC Freq. Range:		LNB Freq Range:	
Foundation:		IFL Connectors:	
Tx IFL Cable Length:		External Power Supply:	

RCST Parameters

Ethernet Address:		Popid:	
Termid:		PcrPID:	
CtlPID:		SymbolRate:	
TxPower:		TDMCarrierFreq:	

RCST Software and Firmware Versions

Software Version:	(P or E)	Firmware Version:	(P or E)
Bank 1 –		Bank 1 –	
Bank 2 –		Bank 2 –	

TDM Performance

RSCorrectedErrorCount:		RSUncorrectedErrorCount:	
QPSK BER:		12CerrorCount:	
LostSyncCount:		TimeSynched:	
TimeUnSynced:		NCODeviation:	
Carrier Deviation:		Code Rate:	

TDMA Performance

TDMA BER:		Power:	
CRC Errors:		Fr ER:	
Turbo Errors:		UW Detects (traffic burst):	
UW Detects (Sig Burst):		UW misses (traffic burst):	
UW Misses (Sig Burst):			

Installation Notes

Installation Sign-off

Installation date:	
Installer's name:	
Installer's signature:	

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Appendix C: RCST LED Display

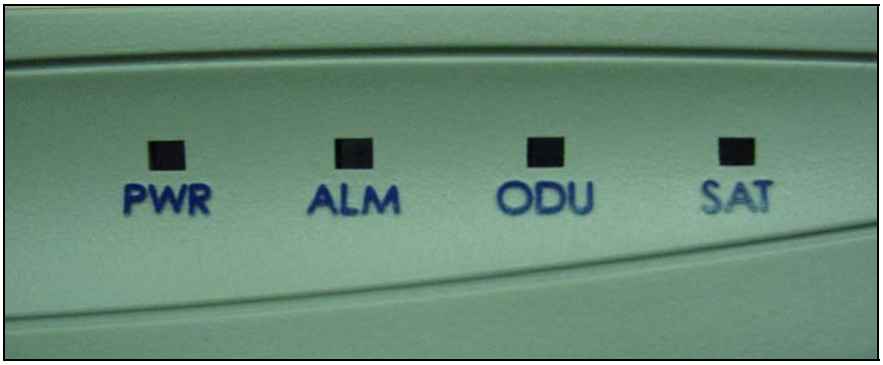

Figure C-1: RCST Front Display

PWR – ON indicates the AC power switch is turned on. The AC power switch is located on the back of the RCST. The AC voltage should be 100 to 240 VAC, 60/50 Hz, 2.0/1.0 Amps.

ALM – ON indicates the RAM used by the firmware to implement the two extra PIDs has failed a critical test for software version 1.0.7. The unit must be returned to the factory for repair before it will operate with 1.0.7.

ODU – ON indicates the RCST is supplying voltage to ODU.

SAT – OFF indicates no receive synchronization.

BLINKING indicates receive synchronization.

ON indicates receive and transmit synchronization.

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Appendix D: Telnetting to the RCST

Default Address

Note: The default address is only effective until the RCST becomes transmit acquired. Once the RCST is transmit synchronized, it receives its Network IP Address from the RNCC and the default address is no longer valid.

1. Connect the PC to the RCST 10/100 Base-T connector on the back panel of the RCST using an Ethernet crossover cable or an Ethernet hub. Alternatively, use a console cable if the unit has a console port.
2. Note the Ethernet (MAC) address in hex located on the back panel of the RCST.

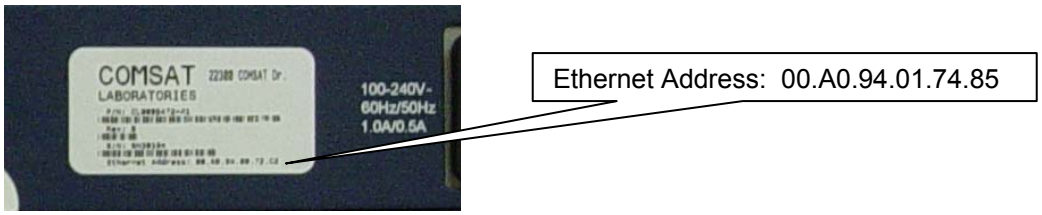

Figure C-1: RCST Rear Display – Ethernet (MAC) Address

The default IP address is always "10." plus the last three hex octets converted to decimal. Therefore, since 01.74.85 hex is 1.116.133 decimal, the default IP address for this terminal will 10.1.116.133. The subnet is 255.255.255.0.

Configuring an IP Address on the PC

To establish a telnet session with the RCST, configure a PC on the same subnet as the RCST by assigning an appropriate IP address.

The following steps are for the Windows 2000 operating system (other operating systems will be similar):

1. Right-click on **My Network Places** on the desktop and select **Properties**.
2. Right-click on the **Local Area Connection** icon and select **Properties**.
3. In the **General** tab, select **Internet Protocol (TCP/IP)**, then click on **Properties**.
4. Select the **Use the Following IP Address** radio button, then fill out the address section below. You may also click on **Advanced**, then click **Add** in the next window if maintaining multiple IP addresses on the PC.

   Make sure the IP address that is on the same subnet as RCST. For example, for the default RCST address of 10.1.116.133, you would enter 10.1.116.*x* (where *x* is not 133 and is a host number available in the network).
5. Click OK on the Internet Protocol Properties and Local Area Connection Properties screens.

You should now be able to start a telnet session to the default IP address of the RCST.

Establishing a Telnet Session

1. From the Start menu, select Run. Enter **cmd**, then click OK. A DOS console window appears.

2. Enter **telnet *RCSTDefaultIPAddress*** (in this example, 10.1.116.133).
3. Verify a connection to the RCST by entering **e** at the console. Ethernet information displays.

Network IP Address

Note: The network IP address is only effective after the RCST becomes transmit acquired.

1. In this example, the network IP address is 10.254.11.1 and the subnet is 255.255.255.0.
2. Set the IP address of the PC to the same subnet as the Network IP address of the RCST, using the procedure given in the "Configuring an IP Address on the PC" section.
3. To check that the RCST has the proper IP address, from the Start menu, select Run. Enter cmd, then click OK. A DOS console window appears.
4. Enter telnet RCSTNetworkIPAddress (in this example, it would be 10.254.11.1).
5. Verify connection to RCST by entering e at the console. Ethernet information displays.

Appendix E: RCST Boot Parameters for Installation

Command Format

The format of the savebootparms command (alias **save**) is below:

save -t <*TxPower(0.5 dB steps)* > -f <*TDMCarrierFreq*> -pop <*popID*> -s <*SymbolRate*> -c <*ctlPID*> -pcr <*pcrPID*> -o <*ODUStatus*> -lnbv <*0|12|13|18|20*> -lnbi <*0|1*> -poi <*0|1*>

Parameter Descriptions

-pop (Population ID)

Identifies the population to which the RCST belongs. The form of the population ID is 0x*RRePPPP* where *RR* is the region and *PPPP* is the population within that region. All Population IDs start with the numbers "*01*."

Population IDs are assigned by the NMS, and should be taken from the NMS screens once the population is configured.

-c (Control PID)

The RCST looks for this PID to receive configuration and control information. All RCSTs in the network listen to the same Control PID. The number normally assigned to a control PID is 0x1029.

-pcr (PCR PID)

Specifies the PID on which the RCST receives the PCR generated by the TDU. The number normally assigned is 0x365.

-f (L-Band TDM Carrier Frequency in KHz)

Specifies the L-Band frequency of the TDM Carrier so that the RCST can program the tuner.

-s (Symbol Rate of the TDM Carrier in Symbols/second)

Specifies the symbol rate of the TDM Carrier so that the RCST can program the tuner.

-lat [*degreesEast*]

This is the latitudinal position of the RCST and is only required when in "Self-Directed" Acquisition mode. The value does not need to be entered when in "RNCC-Directed" Acquisition mode.

-lon [*degreesNorth*]

This is the longitudinal position of the RCST and is only required when in "Self-Directed" Acquisition mode. The value does not need to be entered when in "RNCC-Directed" Acquisition mode.

-o [0 or 1 or 2] (ODU Status)

Use the **save** command to enter the ODU Status as **0** (none), **1** (internal), or **2** (external). The display in the **bootconf** file will be "none," "internal," or "external," respectively.

-t (Transmit Power in half-dB steps)

Specify the transmit power in 0.5 dB steps (e.g., you would enter **-20** to set the power to **-10dBm** (-20 x 0.5 = -10 dBm)). The transmit power level is set to provide the correct signal level at the input to the BUC, based on the loss in the TxIFL cable.

-lnbv [0|12|13|18|20] (0 = off)

-lnbi [0|1] (0 = off, 1 = on (increments lnbv value by 1 when turned on))

For example:

save -lnbv 20 **-lnbi** 0 (=20 volts)

save -lnbv 20 **-lnbi** 1 (=21 volts). The recommended initial setting is 21 volts.

-poi <*0*|*1*>

Values of zero (0) for disabled and one (1) for enabled. This entry allows use of the pointing tool mode when enabled.

14. Appendix F: RCST Commands

Command	Description
dbpr bootconf	Displays RCST boot file.
tcmp	Displays RCST receive performance parameters.
tcmreset	Clears counts in tcmp.
repeat –t 1000 tb	Displays RCST transmit parameters. Display repeats as long as the RCST is transmitting. No display indicates the RCST is not transmitting.
tclgets	Displays PCR status.
prt ipctest	Displays receive IP information: packets received, bytes received, rate, and MCBs.
tbtp	Displays transmit burst time plan – information about signaling burst and transmit bursts.
dbpr iprcconf	Displays CIR to hub.
e	Displays IP statistics.
disable termexec	Disables the terminal executive. Use before enabling CW transmission.
save –pop<*popid*> **-c**<*ctlPID*> **-pcr**<*pcrPID*> **-f**<*freq*> **- s**<*SymbolRate*> **-o**<*ODU Status*> **– t**<*TxPower*> **[save** is an alias for **savebootparms.]**	Saves boot parameters: ▪ freq in Khz ▪ SymbolRate in Msps ▪ ODUStatus: 0 – None, 1- Internal, 2-External ▪ TxPower: 0.5 dbm steps
cacsetcw –p<*power*> **-f**<*freq*> **-t**<*time*>	Enables RCST to transmit a CW signal: ▪ power in 0.5 dbm steps Example: Enter –60 to set the power to –30dbm. [60 x 0.5 = -30 dbm] ▪ freq in Mhz ▪ time in seconds (default 300000 (5000 mins))
showrcst <*terminalID*>	Displays comprehensive information for RCST. This command displays the following RCST information: ◆ Name, address, and configuration of the RCST and population, current status of the RCST (down, operational, etc.), burst ID of the AB or SB allocated to the RCST. ◆ Acquisition-related statistics, such as how many times the RCST acquired and how many times the hub has received terminal reports from the RCST.

	◆ Carrier- and GCU-related status, such as configuration of the carrier being used, including carrier ID and symbol rate, name, terminal ID and IP address of the GCU, L-Band frequencies at the transmit at the RCST and receive at the GCU, and symbol rate constraints (as configured by the operator), if any, on the RCST. ◆ IP address and subnet mask of the RCST as configured via the NMS and the default address of the RCST if it does not receive configuration from the Hub (e.g., if it does not transmit acquire). IP PIDs configured to be received by the RCST, status of the return channel of the RCST (down, return channel enabled, return channel disabled, bandwidth allocated), constraints on the bandwidth that can be allocated by the Hub, and total amount of CIR + BoD bandwidth that has been allocated to the RCST.