GENERAL DYNAMICS
C4 Systems

OPERATION & MAINTENANCE MANUAL
UP/DN CONVERTER
L-BAND
LT-3600 SERIES

Vertex RSI®

1915 Harrison Road
Longview, Texas 75604

WARRANTY

VertexRSI warrants its products for a period of two (2) years from the date of shipment to be free from defects caused by faulty materials or poor workmanship.

The terms and conditions of this warranty are as follows

- The purchaser must notify VertexRSI promptly upon discovery of such defect.

- The purchaser must return the defective product, postpaid, to:

  VertexRSI
  1915 Harrison Road
  Longview, Texas 75604 USA

- Evaluation of the defective product at VertexRSI shall disclose that such defects exist and have not been caused by misuse, neglect, improper handling, alteration or accident.

VertexRSI reserves the right to make product improvements and/or design changes in any of its products without incurring any obligation or liability to make the same changes in units previously shipped.

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SECTION 1	General Information

1.0 INTRODUCTION

This manual contains installation, operation, and maintenance information for the Integrated L-Band Up/Dn Converter manufactured by VertexRSI, Longview, Tx.   Information is organized according to section. Within each section the pages, figures and tables are numbered by section and by order of appearance within the section. Unless otherwise noted, any information about the unit applies to the LT-3600, Base Part Number 201667.

1.1 SAFETY INFORMATION

This equipment has been designed to minimize exposure of personnel to hazards.

WARNING

A continuous safety earth ground must be provided from the main power source through the main power cord. This is provided in the power cable shipped with the unit. If this power cord is damaged, it should be replaced with cord of equal or better specifications. This cord can be obtained from VertexRSI.

Servicing instructions are for use by trained personnel only. To avoid dangerous electric shock, do not perform any servicing unless qualified to do so. Do not replace components with the power cord connected to the equipment.

WARNING

Some of the adjustments described in this manual are performed with power applied while protective covers are removed. Always be careful not to come on contact with dangerous voltages while performing these procedures, and never work alone. With power applied to the unit and the cover removed, be aware that a rotating fan is operating.

1.2 GENERAL INTRODUCTION

This manual provides operation and service instructions for the Integrated L-Band Up/Dn Converter. The unit consists of a power supply, forced-air cooling system, microprocessor-based CCA (circuit card assembly) and control circuitry and the modules required for up and down conversion. It incorporates extensive monitor and control functions that are accessible from the front panel as well as through a remote serial bus. A general description of the front and rear panels is given in Sections 1.5 and 1.6. A description of the Keypad and Display can be found in Section 3.

The Integrated L-Band Up/Dn Converter is housed in an enclosure destined for mounting in a standard EIA 19-inch rack, requiring a 1.75-inch high vertical space.

1.3 PURPOSE OF EQUIPMENT

The Integrated L-Band Up/Dn Converter is a fully synthesized up and down converter covering 575 or 1000 MHz bandwidth receiving RF frequencies in up to 125 kHz steps. The unit incorporates extensive monitor and control functions that are accessible from the front panel as well as through a remote RS-232/422/485 bus.

The LT-3600 can be configured to accommodate various requirements involving an IF of 70 or 140 MHz, non-inverted or inverted spectrum, with standard or high-stability 10 MHz reference oscillator or any combination the user desires. Combined with jumper selectable and user programmable options, the LT-3600 is flexible to user requirements.

1.4 SPECIFICATIONS
The specifications for the Integrated L-Band Up/Dn Converter are listed in Table 1-1, along with the mechanical dimensions.

1.5 FRONT PANEL
All the operating controls and indicators for the Integrated L-Band Up/Dn Converter are located on the front panel. The front panel is depicted in Figure 1-1. Alarm and level monitoring of the L-Band Up/Dn Converter CCA, an external LNB, and SSPB modules is accomplished through the front panel display and keboard interface.

1.6 REAR PANEL
The rear panel is depicted in Figure 1-2. It incorporates, from left to right, Grounding Lug (GND), Power Connector, Optional 10MHz high stability reference output (J1), 10 MHz reference input (J2), IF Out (J3), L-Band In (J4), On/Off Switch for Dc output on J4 (SW2), Cooling Fans, Down Converter StarSwitch Interface (Opt.) (J5), SSPB monitor and control (J6),   Remote Serial Interface (J7), Up Converter StarSwitch Interface (Opt.) (J8), IF In (J9), On/Off Switch for Dc output on J10 (SW3), L-Band Out (J10).

In the lower right hand side of the rear panel is a label that refers to the operation and maintenance manual and revision level that applies to this converter.

1.7 COOLING
Cooling of the equipment is achieved by pulling in cool air through the two side inlet grills. The heated air exits the equipment through the two rear panel mounted exhaust fans.
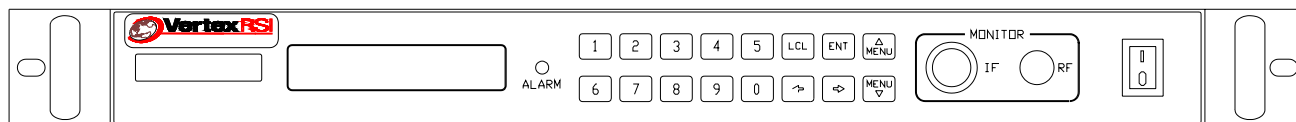
Figure 1-1   Front Panel w/Keypad and LCD Display
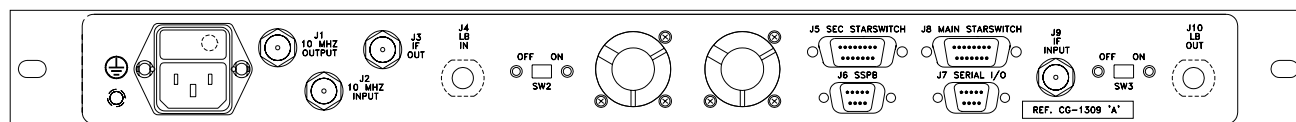
Figure 1-2   Rear Panel

1.8 Part Number Configuration

The Part Number Selection Chart shows configuration options that are set at the factory prior to shipment.   The voltage output to J4 and J10 may be changed as required by the customer, however this requires removal of the cover and resetting internal jumper connections. This should be performed by qualified personnel.

Base Number		1st Digit IF Operation		2nd Digit L-Band		3rd Digit Bias Voltage		4th Digit Ref. Oscillator	
201667	-	1	70 MHZ	1	Std.	0	None	0	Std 10Mhz
		2	140 MHz	2	Extend	1	D/C-22VDC U/C-22VDC	1	Hi Accuracy 10 MHz
						2	D/C-22VDC U/C-15VDC		

5th Digit L-Band Ports		6th Digit 10 MHZ Ref. Out		7th Digit StarSwitch Ready	
0	SMA Female	0	No Output	0	No
1	N-Type Female	1	U/C & D/C	1	Yes
		2	U/C Only		
		3	D/C Only		

Note: If connected to a StarSwitch, No Bias Voltage Output is allowed.

Option Descriptions:
1st Digit – IF Frequency, Options 3 and 4 are set for inverted spectrum.
2nd Digit – Standard – 950 to 1525 MHz, Extended – 950 to 1950 MHz
3rd Digit – Bias voltage outputs are switchable in rear panel, if selected.
4th Digit – A reference oscilator is built in to the main board. The high accuracy unit is optional.
5th Digit – D/C Input and U/C Output Port Type (J4 & J10)
6th Digit – The output from the 10 MHz reference oscilator may be connected to either or both.
7th Digit – StarSwitch Ready includes output connections to J5 and J8 for control between the
              Starswitch and the LT3600.

Table 1-1   Integrated L-Band Specifications

UPCONVERTER	
Input Frequency Range	50 to 90 MHz
Input Impedance	50 Ohms
Input Level Range	-20 to -40 dBm
Output Frequency Range	950 to 1525 MHz 950 to 1950 MHz (Optional)
Output Impedance	50 Ohms
Output Return Loss	18dB
Conversion Gain	10 to 30 dB (0.5 dB steps)
Gain Linearity (over 10 dB)	$\pm$0.5 dB
Gain Linearity (over 20 dB)	$\pm$1.0 dB
Gain Stability (0 to +50 °C)	$\pm$0.75 dB
Amplitude Response (over any 36 MHz)	$\pm$0.75 dB
Amplitude Response (over 875 MHz)	$\pm$1.0 dB
Output Power (1 dB GCP)	+10 dBm (minimum)
3rd Order Intermodulation (for 2 car. each at 0 dBm o/p)	-40 dBc
Spurious (at 0 dBm output)	-55 dBc
Non-Carrier	-60 dBm
Transmit Spectrum Sense	Non-Inverting or Inverting
Noise Power Density	-125 dBm/Hz
DOWNCONVERTER	
Input Frequency Range	950 to 1950 MHz
Input Impedance	50 Ohms
Input Level Range	-75 to -35 dBm
Output Frequency Range	50 to 90 MHz
Output Impedance	50 Ohms
Input Return Loss	18dB
Conversion Gain	25 to 45 dB (0.5dB steps)
Gain Linearity (over 10 dB)	$\pm$0.5 dB
Gain Linearity (over 20 dB)	$\pm$1 dB
Gain Stability (0 to +50 °C)	$\pm$1 dB
Frequency Response (over 36 MHz)	$\pm$0.75 dB
Frequency Response (over 575 MHz)	$\pm$1 dB
Output Power (1 dB GCP)	$\pm$10 dBm
Non-Carrier	-55 dBm
Spurious Over 52 to 88 MHz (at 0 dBm output)	-50 dBc
Receive Spectrum Sense	Inverting or Non-Inverting
Noise Figure	15 dB max

Table 1-1   Integrated L-Band Specifications

OPTIONAL INTERNAL REFERENCE	
Reference Frequency	10.000 MHz
Stability (0 to +50 °C)	$\pm$ 2 x 10^{-8}
Aging per Day	$\pm$ 1 x 10^{-9}
Output Level (rear panel)	+ 12 dBm $\pm$2 dB
Phase Noise @ 10 Hz	-115 dBc/Hz
100 Hz	-135 dBc/Hz
1 kHz	-145 dBc/Hz
10 kHz	< -150 dBc/Hz

UPCONVERTER and DOWNCONVERTER	
Synthesizer Configuration	Dual U/C and D/C with Independent Programmability
Tx Synthesizer and Rx Synthesizer Step Size	125 kHz
Parameter Memory Storage	Non-Volatile EEPROM
L-Band Output Phase Noise:	
at 100 Hz Offset	-66 dBc/Hz
at 1 kHz Offset	-76 dBc/Hz
at 10 kHz Offset	-86 dBc/Hz
at 100 kHz Offset	-96 dBc/Hz
at 1 MHz Offset	-106 dBc/Hz

INTERNAL REFERENCE	
Reference Frequency	10.000 MHz
Stability (0 to+50 °C)	$\pm$1 PPM
Reference Output Calibration	$\pm$10 Hz
Reference Programmable Control	$\pm$20 Hz
Output Level (10 MHz on LB IN J4 coax)	-2 dBm $\pm$2 dB
Output Level (10 MHz on LB OUT J10 coax)	-2 dBm $\pm$2 dB
Output 2nd Harmonic	-40 dBc

EXTERNAL REFERENCE INPUT	
Input Frequency	10.000 MHz
Input Level	0 to +13 dBm
Frequency Stability	As Required

CHASSIS PHYSICAL SIZE	
Height	1.75 inches
Depth	18 inches
Width	19 inches
Weight	12 lbs. max.

Table 1-1   Integrated L-Band Specifications

INTERFACE AND CONNECTORS	
Voltage (auto-ranging)	115/230 VAC $\pm$15%
Internal Electronics (Power)	25 watts
StarSwitch Interface Connectors (Options)	DB-15 (Female)
Remote Serial Interface: Standard: RS-422/RS-485 (J7)	DB-9 (Male)
External SSPB Monitor and Control (J6)	DB-9 (Female)
DC Output to LNB on J4 (coaxial) (Options)	22 VDC @ 0.5 amps (max)
DC Output to SSPB on J10 (coaxial) (Options)	22 or 15VDC @ 2.0 amps (max)
Operational Temperature Range	0 to 50 °C

SECTION 2   Installation

2.0 INTRODUCTION
This section defines the installation require-ments by which the Integrated L-Band Up/Dn Converter will meet the published specifications.

2.1 UNPACKING AND INSPECTION
Remove the unit from its shipping container and inspect for any damage sustained during shipment. Save the packing material for reshipment back to the factory or to another site. Report any damage to the shipping forwarder in accordance with required procedures.

2.2 INSTALLATION REQUIREMENTS
The LT-3600 is designed for mounting in a standard EIA 19-inch rack. The unit must be supported on the sides and space must be allowed at the side of the unit to permit the flow of cooling air. The unit should be installed in an environment that is within the environ-mental envelope described in Table 1-1. Primary power must be made available that is within the specified limits.

2.3 MECHANICAL INSTALLATION
The chassis is equipped with threaded inserts on either side for the installation of slides. Slides are not provided with the unit. The front panel is equipped with slots to accommodate user-supplied retaining screws.

CAUTION
MOUNTING THE UNIT BY ONLY THE FRONT PANEL WILL CAUSE EXTENSIVE DAMAGE.

2.4 ELECTRICAL CONNECTIONS
All electrical connections are made to the rear panel of the unit. The following describes the rear panel connectors and its interface requirements. The chassis ground is a #10-32 lug on the back panel.

2.4.1 Power Input
This connector is an IEC 320-C14 male and will accept any compatible mating connector. The power cord supplied as standard with the unit is equipped with a NEMA 5-15P male plug at the opposite end and is compatible with most 115 VAC supplies. The unit is manufact-ured with a Universal Input Power supply that will accept voltages in the range of 115 or 230 +/-15% VAC.

CAUTION
DAMAGE MAY RESULT IF THE INCORRECT VOLTAGE IS APPLIED TO THE UNIT.

2.4.2 L-Band Output (J10)
This connector is selectable as an SMA or N-Type female. The mate (not supplied) should be compatible with the 50-ohm coax used to connect to the system.

CAUTION
DC OUTPUT CURRENT MAY BE PRESENT ON J4 AND J10 DEPENDING ON POWER OPTIONS SUPPLIED FOR THE SSPB AND LNB.

2.4.3 IF Input (J9)
This connector is a BNC female. The male mate (not supplied) should be compatible with the 50-ohm coax used to connect to the system.

2.4.4 IF Output (J3)
This connector is a BNC female. The male mate (not supplied) should be compatible with the 50-ohm coax used to connect to the system.

2.4.5 L-Band Input (J4)
This connector is selectable as an SMA or N-Type female. The male mate (not supplied) should be compatible with the 50-ohm coax used to connect to the system.

2.4.6 External 10 MHz Input (J2)

This connector is a BNC female. The male mate (not supplied) should be compatible with the 50-ohm coax used to connect to the system.

2.4.7 SSPB Interface (J6)

This connector is a 9-pin female miniature type "D" connector with standard #4-40 female screw-lock hardware mounting. The mating shell, pins, and strain relief are not supplied. Outputs are open collector and inputs have internal 1K full PS to +5V. The pin-out is as follows:

Pin 1   SSPB Band Control Output -
         (Low = Lo Band)
Pin 2   Amplifier Fault - Open (Hi) = ALM
Pin 3   Thermal Alarm Input –
         Open (Hi) = ALM
Pin 4   Lock Alarm Input - Open (Hi) = ALM
Pin 5   Up/Dn Converter Ground
Pin 6   SSPB Attenuator/Enable Control –
         (Lo = Enable)
Pin 7   Not Used
Pin 8   SSPB Detector Input + Analog 0-5V
Pin 9   SSPB Detector Input – Analog 0-5V

2.4.8 Remote Serial I/O Interface (J7)

This connector is a 9-pin male miniature type "D" connector with standard #4-40 female screw-lock hardware mounting. The mating shell, pins, and strain relief are not supplied. The electrical interface to this connector is for a standard RS-422/485 bus. This port may be reconfigured for RS-232 as shown below. For bus protocol requirements, refer to Section 3-3. The convention used for the signals is a logic Hi for Mark (Rest) and a logic Lo for Space. The pin-out is as follows for RS-422/485:

Pin 1   Rx -
Pin 2   Rx +
Pin 3   Tx +
Pin 4   Tx -
Pin 5   Ground
Pin 6   Alarm Relay: Common
Pin 7   Alarm Relay: Normally Closed
Pin 8   Not Used
Pin 9   Alarm Relay: Normally Open

Port J7 may be reconfigured for RS-232 interface by changing the following jumpers locations on the main board inside the converter:

Serial Port	RS-422/485	RS-232
JP3 TXD SER 0 RXD SER 1 (Standard)	Jumpers On 1-2 5-6 7-8 9-10 11-12 17-18	Jumpers On 13-14 15-16
JP3 TXD SER 1 RXD SER 0	3-4 5-6 7-8 9-10 11-12 19-20	13-15 14-16
JP2	Remove	Install

The pinout for RS-232 is as follows:

Pin 1   Not Used
Pin 2   Rx +
Pin 3   Tx +
Pin 4   Not Used
Pin 5   Ground
Pin 6   Alarm Relay: Common
Pin 7   Alarm Relay: Normally Closed
Pin 8   Not Used
Pin 9   Alarm Relay: Normally Open

2.4.9 High Stability 10 MHz Reference Output (J1) (Optional Connector)

This connector is a BNC female. BNC jumper cable is supplied with this option for connection to J2.

2.5 OPERATIONAL CHECK

To verify that the basic functions of the unit are operational, it is recommended that the following check-out procedure be followed prior to final system integration. If there are any questions regarding performing the indicated operations, refer to Section 3-3.

2.5.1 Setup

Connect the unit to a primary power source and turn on the power switch at the front of the unit. Verify that the power led is illuminated. If the power led is not illuminated, check the power cord and fuse. A spare 3.15 A fuse is provided inside the power connector.

Switch the primary power off and connect the IF out, LB in, IF in and the LB out at the rear of the chassis to J3, J4, J9 and J10 respectively. Re-establish the primary source of power. The Front display will light and status will be displayed.

SECTION 3   Operation

3.0 INTRODUCTION
The Up/Down Converter can be controlled from the front panel or remotely via a serial bus located on the rear panel of the converter. Various menus are available for **EDIT** and **DISPLAY** purposes.

See Figure 3-2 for a listing of the menus. Section 4 gives a complete description of the bus commands and conventions for operating the converter remotely.

Red LED illuminates when any of the monitor functions in the converter are not within pre-defined parameters.

PLUGGED; NOT USED

THE DISPLAY WINDOW SHOWS THE VARIOUS SETTINGS FOR THE UNIT. CONTROL AND STATUS MENUS CAN BE VIEWED BY USING THE UP AND DOWN MENUS KEYS.

USED TO MAKE FUNCTIONAL SELECTIONS WHEN IN ANY OF THE SET MENUS. THESE KEYS MOVE A CURSER UNDERLINE LEFT OR RIGHT TO ENTER NUMERICAL DATA FROM THE 0-9 KEYS.

USED TO SCROLL THE MENU DISPLAY UP AND DOWN.

ENT PRESSING THIS BUTTON CHANGES THE PARAMETERS ENTERED WHEN IN ANY OF THE EDIT MENUS. IF THE PARAMETERS ARE CHANGED WITH THE NUMERICAL KEYPAD, BUT IF THIS BUTTON IS NOT PRESSED, THE PARAMETER UNDERLINED WILL NOT CHANGE.

USED FOR ENTERING NUMERICAL DATA FOR VARIOUS PARAMETER SETTINGS. THE APPLICABLE NUMBER IS ENTERED AT THE CURSER UNDERLINE AND THEN ENT IS PRESSED TO ACCEPT THE CHANGE.

LCL PRESSING THIS BUTTON TOGGLES BETWEEN EDIT DISPLAY MODE.

Figure 3-1   Front Panel Controls and Indicators

DISPLAY   **EDIT**

DISPLAY		EDIT	Description
RefOsc: OK Ofst:127 Slope Factor: 0 dB	LCL	RefOsc: OK Ofst: 127 Slope Factor: 0 dB	REFERENCE STATUS AND CONTROL/ SLOPE FACTOR SET
Unit Address: xx xx = 422 Mode	LCL	Unit Address: xx xx = 422 Mode	RS 485 ADDRESS AND STATUS
Brd SN 1234 20/12/04 S/W:v7.70 Temp: 32 C			BOARD STATUS
Front Panel SW v5.20 FP Alarm Tone: On	LCL	Front Panel SW v5.20 FP Alarm Tone: Muted	SOFTWARE VERSION AND ALARM CONTROL
STARSW: OK ON MODE: Auto	LCL	STARSW: OK OFF MODE: STBY	STARswitch MODE, AND ALARM CONTROL
UC 1200.000 +25.0 dB DC 1300.000 +35.0 dB	LCL	UC 1000.250 +15.0 dB DC 1500.625 +30.0 dB	<u>DEFAULT MENU</u> FREQUENCY AND GAIN SETTINGS
UC: Ovr State: On DC: Low State: Muted	LCL	UC: Ovr State: On DC: OK State: On	UP/DN CONVERTER STATUS AND MUTE CONTROL
UC Lvl: +1 dBm DC Lvl: -25 dBm			DETECTOR LEVELS
SSPB: Muted Lck: Bad Amp: OK Therm: N/A	LCL	SSPB: Muted Lck: Bad Amp: OK Therm: Act	SSPB STATUS AND ALARM MASK CONTROL
LNB: OK Lvl: 380 mA UC: Normal DC: Normal	LCL	LNB: Act Lvl: 000 mA UC: Invert DC: Normal	LNB AND CONVERTER STATUS

MENU

MENU

MENU BUTTONS TOGGLE ALARMS FROM ACTIVE TO MUTED STATES WHEN IN EDIT MODE

MENU

SSPB: Muted   Lck: Bad
Amp: OK   Therm: Act

MENU

Figure 3-2   Menu Listing

MENU ▲

ENTER KEY RECALLS MEMORY TO ACTIVE

MENU ▼

| UC   0950.000   +10.0 dB |
| DC   1525.000   +30.0 dB |

ENT ←

| Make Satellite: 0 |
| Active? (Yes/No)   No |

0

HIT ANY KEY (0-9) Example (KEY 0)

EDIT

MENU ▲

MENU ▼

| UC0 1200.000   +20.0 dB |
| DC0 1200.000   +30.0 dB |

ENT

LCL

| UC0 1200.000   +20.0 dB |
| DC0 1200.000   +30.0 dB |

MENU ▲

MENU ▼

MENU ▲

MENU ▼

ESCAPES TO ADJACENT MENU WITHOUT RECALL

1

ENT

CONFIRM AND STORE CHANGE TO EACH FIELD AND LEAVE EDIT MODE AFTER LAST FIELD

SELECT MENU ARROWS UP OR DOWN TO SCROLL 125 KHZ STEP SIZE WHEN CURSOR IS ACTIVE AT .000

| UC1 1000.125   +30.0 dB |
| DC1 1500.125   +45.0 dB |

● ● ● ● ● ● ●

SELECT MENU ARROW UP FOR POSITIVE GAIN AND MENU ARROW DOWN FOR NEGATIVE GAIN WHEN CURSOR IS ACTIVE AT GAIN SIGN

| UC9 1500.875   +25.0 dB |
| DC9 1300.875   +35.0 dB |

Figure 3-3   Satellite Memory

3.1 StarSwitch Operation

The LT3600 UP/DOWN Converter may be used in conjunction with the StarSwitch to provide redundancy switch over operations if configured as StarSwitch Ready. The following modes of operation may be selected.

3.1.1 Auto Mode

Upon reaching the StarSwitch Menu the information shown in Figure 3-4 will be displayed. The Information Window can have three selections, AUTO, STBY, or ON. The converter's default is AUTO. Any of the three selections stated previously can be made, and will be activated when the ENTER key is pressed.
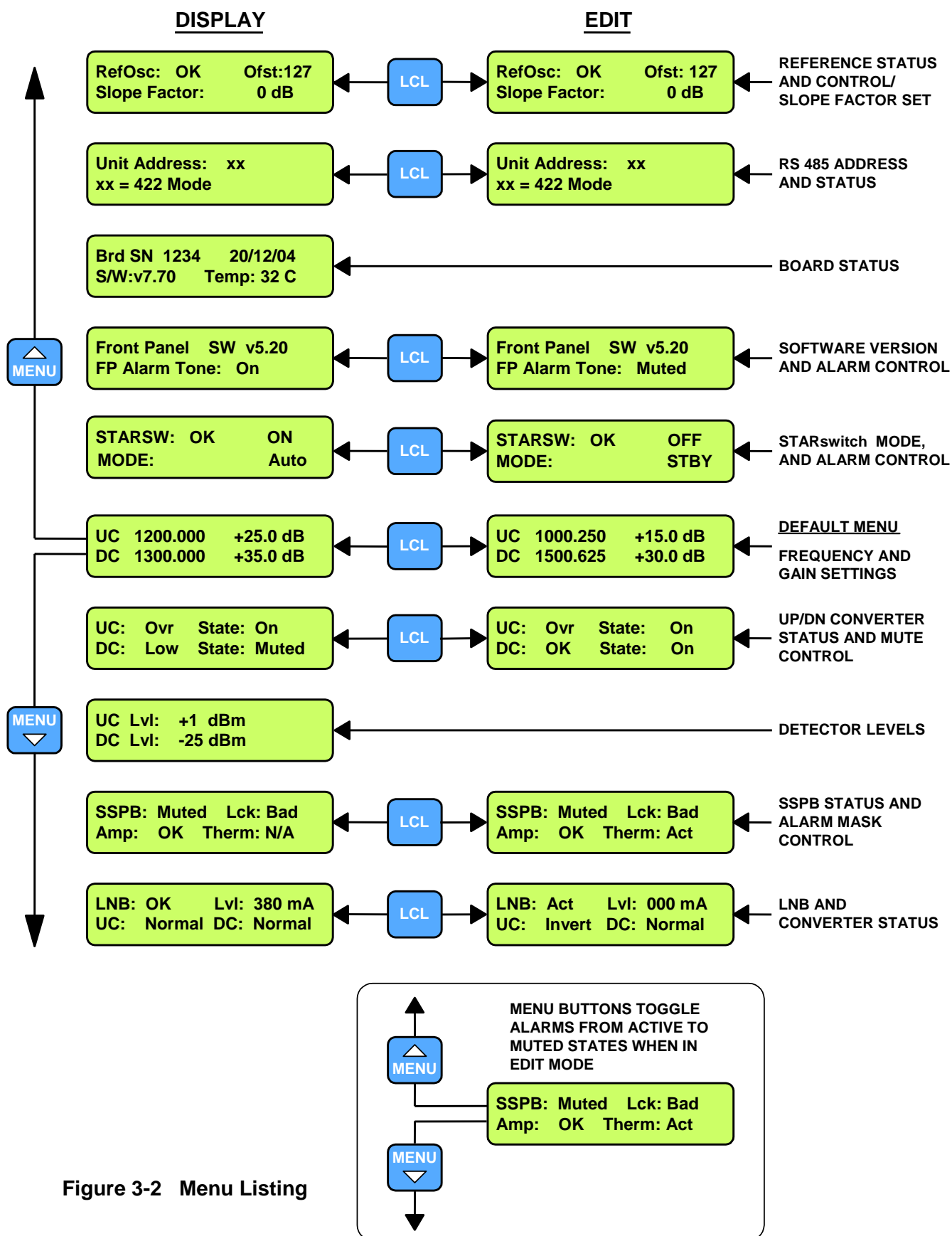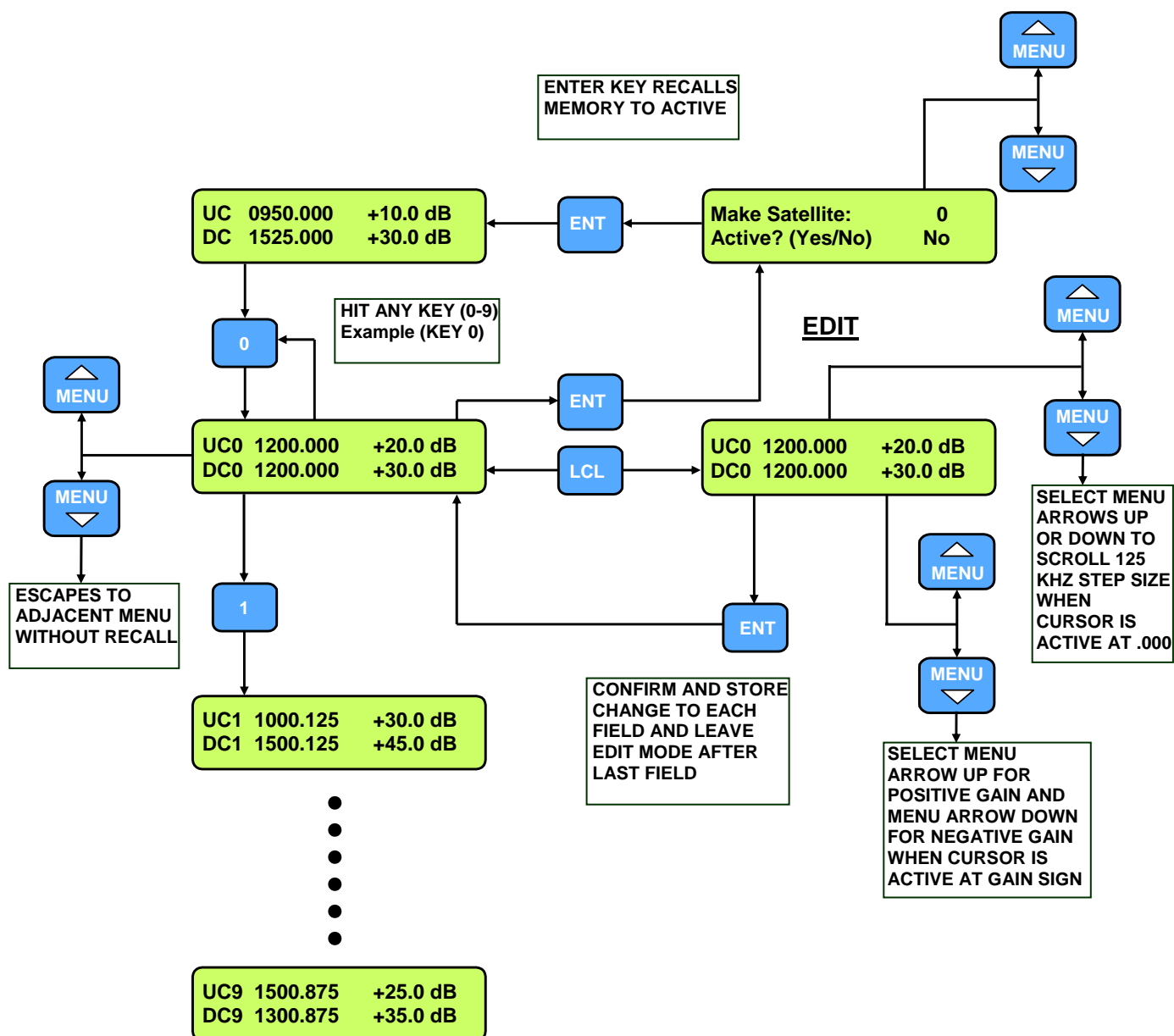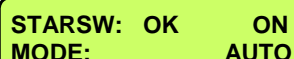
If a particular converter is in the AUTO mode, and an alarm is activated, it will be backed up by the backup converter if there are no other alarms in the system. REMEMBER: ONE AND ONLY ONE ALARM IN THE SYSTEM CAUSES A SWITCHOVER.
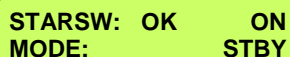
```
STARSW:  OK        ON
MODE:            AUTO
```
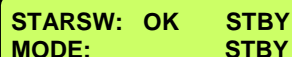
Figure 3-4 StarSwitch Display – Auto Selection

3.1.2 StandBy Mode

When STBY has been selected, the display will change to the display shown in Figure 3-5a. In this mode the converter with this selection will be backed up if there are no other alarms in the system. Upon switchover to the backup converter, the display will change to Figure 3-5b indicating STBY in the Activity Window. Under normal operation the Summary Alarm would only be ON if there were another alarm activated on the converter, however in this case, the Summary Alarm is forced to be ON regardless of the state of the other alarms. The operator can still view the state of alarms via the other menus, i.e. if an alarm has been activated it will be displayed, however the Summary Alarm will always be ON.

```
STARSW:  OK        ON          STARSW:  OK      STBY
MODE:            STBY          MODE:            STBY
```
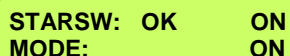
Figure 3-5 StarSwitch Display – STBY Selection

3.1.3   ON Mode

When ON Mode has been selected, the display will change to the display shown in Figure 3-6. This mode is the opposite to the STBY mode, in that the Summary Alarm is turned OFF, so even if there was a valid alarm, the converter would not show a Summary Alarm. As in the STBY mode the operator can still view the state of the alarms via the other menus, i.e. if an alarm has been activated it will be displayed, however the Summary Alarm will be OFF.

NOTE: If the converter is already in STBY mode, a change to the ON mode will not occur, unless there is no alarm in the system.

```
STARSW:  OK        ON
MODE:              ON
```

Figure 3-6 StarSwitch Display – ON Selection

3.1.4   Backup Converter Operation

The Backup Converter must be programmed to store all of the Converter Frequencies and Gains in the system, in its Satellite Memory Locations, corresponding to the Converter Number (1 to 8) labeled on the StarSwitch Interface cables. Figure 3-7 shows the Backup Converter in Auto Mode ready to Backup any converter in the system and after backing up Converter 2.

```
STARSW:  OK     STBY        STARSW:  OK     ON 2
MODE:           Auto        MODE:           Auto
```
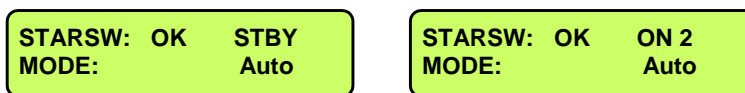
Figure 3-7 StarSwitch Display – Backup Converter

3.1.5 StarSwitch Alarm

The StarSwitch Alarm is displayed as "Fault" in the StarSwitch Menu Window on the Backup Converter only. A fault indicates either an internal StarSwitch Unit failure or a Power Off condition detected on any one of the Converters in the system. The StarSwitch Alarm however, does not activate the Summary Alarms, and the Backup Converter will still backup an Online Converter when it is powered down. Figure 3-8 shows the Backup Converter display after Converter 1 has been powered off and the Backup has taken over.

```
STARSW:  Fault   ON 1
MODE:            Auto
```

Figure 3-8 StarSwitch Display – Fault Indication

3.1.6   Dual StarSwitch Operation

Each LT3600 Converter has two StarSwitch Interface connectors (J8, Main and J5, Secondary) to control two StarSwitch Units, for systems where switching for both Up and Down Converter sections is required. The two interfaces are not independent as an alarm in either Up or Down Converter system will cause both to switch to the backup converter. This is necessary since a failed unit, including both Up and Down Converter sections, will need to be removed for service. Ensure that J8, Main Interface, is used if only one StarSwitch Unit is configured in the system.

3.2 Front Panel Alarm Settings

	Menu Page	**Active Modes**	**Mask (Default)**	**Comment**
1)	Starswitch	Auto ON STBY	Auto	Must select "Auto" Mode when Starswitch is not present. Forces summary alarm to OFF (see Starswitch operation). Forces summary alarm to ON (see Starswitch operation).
2)	Front Panel Alarm Tone	Muted On	Muted	Mutes audio tone when in alarm. (has no effect on Summary Alarm condition). Audio Tone will indicate an Alarm.
3)	Reference Oscillator	N/A Act OK Bad	N/A	Disable Alarm if External Reference Oscillator is not present. Activate for External Reference Alarm (select in Edit Mode). External Reference is detected (Active Mode) External Reference is not detected (Active Mode).
4)	LNB	N/A Act OK Bad	N/A	Disable Alarm if LNB (or BDC) is not present. Activate for LNB supply current Alarm (select in Edit Mode). LNB supply current is within acceptable range (Active Mode) LNB supply current is not within acceptable range (Active Mode)
5)	SSPB	Lck · N/A Act OK Bad	N/A	Disable Alarm if SSPB (or BUC) is not present. Activate for SSPB, PLL Alarm (select in Edit Mode). SSPB, PLL is Locked (Active Mode) SSPB, PLL is not Locked (Active Mode)
		Amp · N/A Act OK Bad	N/A	Disable Alarm if SSPB (or BUC) is not present. Activate for SSPB, Amplifier Summary Alarm (select in Edit Mode). SSPB, Amplifier Summary Alarm is OFF (Active Mode) SSPB, Amplifier Summary Alarm is ON (Active Mode)
		Therm · N/A Act OK Bad	N/A	Disable Alarm if SSPB (or BUC) is not present. Activate for SSPB, Thermal Alarm (select in Edit Mode). SSPB, Thermal Alarm is OFF (Active Mode) SSPB, Thermal Alarm is ON (Active Mode)

SECTION 4   Serial Command Set

4.0 GENERAL
The standard Up/Dn Converter is controlled via a rear panel serial link (RS-422/485)(Reconfigurable to RS-232). With the front panel control, a user can operate the L-Band Up/Dn Converter from its front panel as well as from the serial link. This section describes the format for the ASCII serial control as well as front panel operation.

Note: Some commands and status strings have been changed as of Software Release v7.70 (main board) and v5.20 (front panel). Units marked with "Rev A" on the rear panel support the new protocol.

4.1 LT-3600 SERIAL INTERFACE
The serial interface format to the Up/Dn Converter for RS-422 is identical to the RS-485 format except that under RS-485, the format includes an address field (aa in the format below).

4.2 COMMUNICATION PROTOCOL

Baud Rate: 9600
Parity: None
Data Bits: Eight
Start Bits: One
Stop Bits: One

4.2.1 General Data Format
{aaCND…}

Where:
> {   = Start byte
> aa   = 2 character address (00 to 50, remote interface only)
> C   = 1 character, either C (Command) or S (Status)
> N   = 1 number 0 to 9, A,B,C Command or Status Number
> D   = 1 or more Data characters (depending on command)
> }   = Stop byte

Note: The address is only used in the RS-485 mode when having several addressable units communicating with one station.

4.3 COMMANDS

4.3.1 Set UP/Converter Frequency
{aaC1xxxxx} Where xxxx(x) = First 4 numeric data characters
      Range: 0950 to 1525   (MHz) for Std. Band units
      Range: 0950 to 1950   (MHz) for Extended Band units
   Where (xxxx)x = Fifth character is fractional MHz as follows
      0 = 0.0 MHz
      1 = +0.125 MHz
      2 = +0.250 MHz
      3 = +0.375 MHz
      4 = +0.500 MHz
      5 = +0.625 MHz
      6 = +0.750 MHz
      7 = +0.875 MHz
   Note: If only four charactors entered, 0 is assumed as fifth digit.

4.3.2 Set DOWN/Converter Frequency
{aaC2xxxxx} Where xxxx(x) = First 4 numeric data characters
      Range: 0950 to 1950   (MHz) for Std and Extended Band units
   Where (xxxx)x = Fifth character is fractional MHz as follows
      0 = 0.0 MHz
      1 = +0.125 MHz
      2 = +0.250 MHz
      3 = +0.375 MHz
      4 = +0.500 MHz
      5 = +0.625 MHz
      6 = +0.750 MHz
      7 = +0.875 MHz
   Note: If only four charactors entered, 0 is assumed as fifth digit.

4.3.3 Set UP/Converter Gain
{aaC3xxxx}   Where xxxx = 4 numeric data characters
      Range: +100 to +300 (+10.0 dB to +30.0 dB)
      in 0.5 dB steps

4.3.4 Set DOWN/Converter Gain
{aaC4xxxx}   Where xxxx = 4 numeric data characters
      Range: +250 to +450 (+25.0 dB to +45.0 dB)
      in 0.5 dB steps

4.3.5 Set Internal 10 MHz Ref Oscillator Offset
{aaC5xxx}   Where xxx = 3 numeric data characters
      Range: 000 to 255 (0 through 10 volts)

4.3.6 Enable SSPB
{aaC6x}   Where x = 0 to disable SSPB control
      and x = 1 to enable SSPB control

4.3.7 DOWN/Converter (LNB) Spectrum Control

{aaC7x}   Where x = 0 for Non-Inverting spectrum
                                            and x = 1 for Inverting spectrum

4.3.8 UP/Converter Spectrum Control

{aaC7TXz}   Where z = 0 for Non-Inverting spectrum
                                            and z = 1 for Inverting spectrum

4.3.9 SSPB Band Control

{aaC8x}   Where x = 0 for SSPB Std.Band control
                                            and x = 1 for SSPB Extended Band control

4.3.10 Set SSPB Gain (Attenuation)

{aaC9xx)   Where xx = 2 data characters (sign and number)
                                            Range: –8 to –0 (-8 to 0 dB) or ++ for full on.

4.3.11 Enable UP/Converter

{aaCAx}   Where x = 0 to disable or mute the transmitter
                                            and x = 1 to enable or un-mute the transmitter

4.3.12 Enable DOWN Converter

{aaCBx}   Where x = 0 to disable or mute the DOWN/Converter
                                            and x = 1 to enable or un-mute the DOWN/Converter

4.3.13 Satellite Memory Store

{aaCSSxyyyyyyyyyy} Where   x = Number from 0 to 9 (memory position)
                                            y = ASCII character making up to a 10 character name for the satellite

                                            Stores current UP and DOWN Converter Frequencies and Gains to
                                            storage position specified along with a Text name
                                            for that satellite is so desired.

4.3.14 Satellite Memory Recall

{aaCSRx}   Where   x = Number from 0 to 9 (memory position)
                                            Recalls saved satellite settings of Frequencies and
                                            Gains to the current set-up.

4.3.15 StarSwitch Mode Select

{aaCWx}   Where x = A – Auto Mode
                                                         x = S – Standby Mode
                                                         x = O – ON Mode

4.4 STATUS REQUESTS

4.4.1 Command Status
{aaS1}
Returns: {aaS1bbbbccccddddeeeefffUL}

              Where   bbbb = Up/Converter Frequency (as above)
                               cccc = Down/Converter Frequency (as above)
                               dddd = Up/Converter Gain
                               eeee = Down/Converter Gain
                               fff = Ref. Osc. Offset
                               U = 0 for Non-Inverting Up/Converter, 1 for Inverting
                               L = 0 for Non-Inverting LNB, 1 for inverting

4.4.2 Fractional Frequency Status
{aaSF}
Returns: {aaSFxy}

              Where: x = U/C Fractional Frequency (0 to 7, in 125 kHz increments)
              Where: y = D/C Fractional Frequency (0 to 7, in 125 kHz increments)

4.4.3 Level Status
{aaS2}
Returns: {S2MLffppeett}

              Where: M = ASCII-hex Char. MSN of bitmapped status
                               F   indicates no alarm in group
                               D7 – Low = SSPB Lock Alarm
                               D6 – Low = SSPB Thermal Alarm
                               D5 – Low = SSPB Amp Alarm
                               D4 – Low = LNB Alarm
              Where: L = ASCII-hex Char. LSN of bitmapped status
                               F indicates no alarm in group
                               D3 – Low = Ext. 10 MHz Ref. Osc. Alarm
                               D2 – Low = Down/Converter Synthesizer Alarm
                               D1 – Low = Up/Converter Synthesizer Alarm
                               D0 – Low = Summary Alarm
              Where: ff =   2 Chars., Forward SSPB Power Detection
                                     Range: 00 or 16 to 40 (dBm) (00 = No SSPB)
              Where: pp =   2 Chars., L-Band Output Level Detection
                                     Range: 25 to +5 (-25 to +5 dBm)
              Where: rr =   2 Chars., IF Output Level Detection
                                       Range: 25 to +5 (-25 to +5 dBm)
              Where: tt =   2 Chars., on board Temperature Monitor
                                     Range: 00 to 70 (0 to 70°C)

4.4.4 L-Band Status
{aaS3}
Returns: {S3bbCddTReeN}

Where: bb = 2 Chars., LNB current Detection
                          Range: 00 to 99 (0 - 990 mA)
                C = 1 Character, SSPB Band Control
                          Range: 0 = low band, 1 = high band
                dd = 2 Characters, SSPB Gain
                          Range: –8 to –0 or ++ (dB) ++ = Full On
                T = 1 Character, Up/Converter enable
                          Range: 0 = disable, 1 = enable
                R = 1 Character, Down/Converter enable
                          Range: 0 = disable, 1 = enable
                ee = 2 Character, SSPB current detection
                          Range: 00 to 30 (0 – 3.0 A)
                N = 0 for SSPB Disable, 1 SSPB Enable

4.4.5 Set Cable Slope Factor
{aaFx}   Where: x = numeric character
                                Range: 0 to 5 (dB/500 MHz)

4.4.6 Query Cable Slope Factor
{aaF}
Returns: {F = x}

Where: x = numeric character
                                Range: 0 to 5 (dB/500 MHz)

4.4.7 Serial Number Read
{aaID}
Returns: {aaIDyymmddxxxx}

Where :   yy = last 2 digits of year
                mm = month
                dd = day
                xxxx = 4 digit sequence number

4.4.8 Query Software Version
{aaV}
Returns: {aaVr.ii}

Where: r = Software Release number (1 – 9)
                ii = Software Issue number (00 – 99)

4.4.9 Query Card Type

{aaZ}

Returns: {aaZxx}

Where: xx = L-Band Card Type (1 – 8)
                          10 = 70 MHz IF, Std. Band Unit (SBU)
                          20 = 140 MHz IF, SBU
                          11 = 70 MHz IF, Ext Band Unit (EBU)
                          21 = 140 MHz IF, EBU
                          50 = 70 MHz IF, SBU with Inv. Up/Converter Spectrum
                          60 = 140 MHz IF, SBU with Inv. Up/Converter Spectrum
                          51 = 70 MHz IF, EBU with Inv. Up/Converter Spectrum
                          61 = 140 MHz IF, EBU with Inv. Up/Converter Spectrum

4.4.10 Satellite Memory Status Query

{aaSSx}

Where   x = Number from 0 to 9 (memory position)

Returns: {aaSSxbbbbccccddddeeee}{aayyyyyyyyyy}

Where: x = The number of the Satellite Memory location
                          bbbb = Frequency for the Up/Converter
                          cccc = Frequency for the Down/Converter
                          dddd = Gain for the Up/Converter
                          eeee = Gain for the Down/Converter
                          y = ASCII character making up to a 10 character
                               name for the satellite

4.4.11 Satellite Fractional Frequency Status

{aaSGn}

Where: n = Number from 0 to 9 (memory position)

Returns: {aaSGnxy}

Where: n = The number of the Satellite Memory position.
                          x = U/C Fractional Frequency (0 to 7, in 125 kHz increments)
                          y = D/C Fractional Frequency (0 to 7, in 125 kHz increments)

4.4.12 StarSwitch Status

{aaSW}

Returns: {aaSWxnyz}

Where: x = O – ON (Current Status)
                          X = S – STBY (Current Status)
                          n =   – No Converter Backed Up, (Space)
                          n = 1 – Converter 1 Backed Up, (1 to 8)
                          y = A – Auto Mode
                          y = S – STBY Mode
                          y = O – ON Mode
                          z = G – SW ALM Green (Normal)
                          z = R – SW ALM Red (Fault)

Appendix A   Manual Revision History

Rev. No/change	Revised By	Date	Approved By	Date	ECO#
C – Add Starsw menu	M. Neely	2-03-05	D. Snyder	2-03-05	6323
B – Add Satellite Menu Info	M. Neely	10-14-05	D. Snyder	10-5-05	6129
A – Gain signs	M. Neely	8-15-05	D. Snyder	8-15-05	6020
- Original Release	M. Neely	11-5-04	D. Snyder	11-5-04	5442

Appendix B   CCA Software Revision History

7.72   StarSwitch Menu and Status Update
7.71   Added RS-485 address to Fractional Frequency Status
7.70   High/Low gains with signs, M&C changes (July 05)
7.56   1950 MHz limit, invert ref. osc. alarm (May 05)
7.55   Freq. and gain limits, fixed starswitch 485 address (Feb. 05)
7.54   Original (Jan. 05)

Appendix C   Display Panel Software Revision History

5.22   StarSwitch Alarm display message is now "Fault" was "Bad".
5.21   Reversed Relay Alarm - now energized in no alarm condition.
5.20   Gain signs added, U/C Spectrum invert (July 05)
5.03   Fix Display errors (Jan. 05)
5.01   Original (Dec. 04)