RC3000 User's Manual additions for the Positive Identification feature.

1.2 Software Configuration

The positive identification feature requires the presence of three navigation sensors: 1) GPS receiver, 2) compass and 3) integrated DVB receiver. Software to support this option will have the designation letter "A" for the navigation sensor category.

For example, the software configuration RC3K-Z1-ATR will support the positive identification feature ("A") along with the tracking ("T") and remote control ("R") options.

1.3.x Theory of "Positive Identification"

In order to overcome small errors inherent with a magnetic compass, an optional "positive identification" feature is available. This feature is mechanized by integrating a Digital Video Broadcasting (DVB) compatible receiver with the RC3000.

When the positive identification feature is enabled, the LOCATE function will scan the sky looking for an identifiable satellite which will be called a "signpost". The signpost satellite will be identified via the DVB receiver locking onto the frequency/symbol rate/forward error correction code pattern stored in the RC3000 for that satellite. A positive identification of the satellite will be accomplished by recognizing a unique identification string encoded in the DVB data stream.

After peaking up on the identified signpost satellite, the RC3000 can perform a "fix" of the original heading estimate obtained from the compass. After establishing the heading fix, the mount may then be moved with confidence to any satellite selected by the user.

2.1.5 DVB Receiver mounting

In RC3000s with updated hardware, the DVB receiver will be mounted internally.

The DVB receiver may also be mounted externally to RC3000s containing the original hardware configuration. The external DVB receiver may be mounted anywhere that will allow the coax and communication connections (see 2.2.8) to be made. There will be no user interaction to the external DVB receiver, so it may be placed behind the rack that contains the RC3000.

2.2.8 RF connection

If the DVB receiver is housed internally in the RC3000, the connection to the coax from the LNB will be made at the J11 F connector. Internally this connection will be split to the DVB receiver and the L-band power detector.

NOTE: if you wish to power the LNB from the RC3000, the DVB receiver may supply up to 300 mA. at 13 or 18 VDC. To supply LNB power, the coax from the DVB Receiver must be connected to the DC passing side of the internal splitter.

2.4.x DVB receiver checkout

To confirm that the DVB receiver is able to lock onto signpost satellites use the DVB maintenance screen described in 3.3.2.11. Position the antenna onto known signposts and observe that the DVB receiver obtains lock and that the anticipated identification string is recognized.

The user may want to edit the DVB signpost list (3.3.1.1.x) based on the antenna system's characteristics (LNB LO, etc) and the systems intended area of use.

Factors:
- signpost frequency within LNB range
- signpost beam pointing vs. system's area of use
- stability of signpost data

The following table may be used to log observations.

NAME	LON	POL	FREQ	SYMBR	FEC	ID

3.2.2.3.x Additional LOCATE steps for positive identification

When the positive identification feature is enabled, additional steps will be added to the normal LOCATE sequence.   Initiate the LOCATE mode as usual and select the satellite that you want to locate. As always lat/lon from the GPS and a heading "estimate" from the compass will be obtained and the estimated pointing angles to the selected satellite will be displayed. Press <ENTER> to proceed and then select the desired polarization as usual.

The following steps will then automatically occur to perform the positive identification feature:

1) the list of signpost satellites/transponders (3.3.1.1.x) will be sorted to decide which are the best signposts to first look for. NOTE: the satellite the user wants to eventually go to doesn't have to be one of the signpost satellites.

2) the dish is moved in azimuth 90 degrees in order to characterize the pitch and roll of the platform. This tilt information will later be used to make a final adjustment on the polarization.

NOTE: the platform tilt characterization will be skipped if it is disabled via the TILT configuration item in the AUTOPEAK configuration screen.

3) a scan is performed looking for lock on the frequency/symbol rate/FEC of the highest priority signpost calculated in step # 2.

"SP:119.0W" will be displayed to show the longitude of the signpost that is being scanned.

"Additional messages" showing the sequence of events will be appended to the SP: string.

"MOVING TO START OF SCAN"

The RF value is sampled above and below the elevation of the arc of satellites in order to determine an average noise floor.

"DETERMINING RF NOISE"

Elevation set for the signpost.

"MOVING TO SIGNPOST ELEVATION"

The DVB receiver is programmed with the frequency / symbol rate / FEC pattern for the signpost.

"INITIALIZING DVB RCVR"

Polarization is adjusted for the signpost.

"ADJUSTING POLARIZATION"

Azimuth scan begins.

"SCANNING AZIMUTH"

Starts out in fast until it sees a RF value above "noise_floor to threshold". Switches to slow and starts looking for a lock.

4) after scanning through a lock condition, the dish is returned to the place of highest RF (with lock)

- will go 3 degrees beyond last indication of lock to make sure we didn't see a lock from a sidelobe.

"RETURNING TO LOCK PEAK"

After returning, lock is confirmed. If no lock scan will start again.

"NO LOCK FOUND – CONTINUING SCAN"

5) a local peak up of RF is performed in order to place the dish as well as possible on the signpost satellite. This peak up requires high resolution sensors (such as pulses) on the azimuth and elevation axes.

"PERFORMING PEAK UP"

NOTE: this peak up will not occur if the positive identification feature is "enabled without lock" in the DVB ID configuration screen (3.3.1.1.x).

6) a "positive identification" of the signpost is then confirmed. Using the PRODIG, this positive id is done by comparing the orbital slot value parsed from the bottom line of the PRODIG with a string that had been placed in the signpost list (along with lon/frequency/symbol rate/FEC).

"CHECKING FOR POSITIVE ID"

7a) if a positive id of the signpost is not confirmed, the scan for that signpost will be completed in case we had come across a satellite using the same freq/symbol rate/FEC combination. If no positive id happens, then a scan looking for the next signpost from the list sorted in step #2 will be done.

7b) if no positive identification of any signpost is accomplished, the LOCATE will stop and display a message indicating something like "NO POSITIVE IDENTIFICATION". The hpa disable signal will remain to prevent transmission. I feel that no answer is better than a potential wrong answer.

7c) if a positive id is confirmed, an azimuth delta will be computed and used to fix the original heading estimate. We then go to step 8.

"SIGNPOST FOUND- GO TO SELECTED SATELLITE"

8) with the heading fixed, we can then move to the selected satellite with confidence.

9) the polarization angle is adjusted according to which direction the satellite is with respect to the tilt of the platform. Hopefully this will leave the pol axis positioned to achieve 30 db isolation.

"ADJUST POL TO COMPENSATE FOR TILT"

10) a final RF peakup is performed to put the dish on the selected satellite as well as possible.

NOTE: this peak up will not occur if the positive identification feature is "enabled without lock" in the DVB ID configuration screen (3.3.1.1.x).

3.3.1.1.x DVB Signpost

This group allows the user to customize a list of 10 "signpost" satellites. The LOCATE mode's positive identification feature will prioritize from this list.

```
SP#: 1                    CONFIG-DVBR
LON: 121.0W FRQ:11724 FEC:1
POL:2        SYM:20000 PRI:1 ID:121W
<SCR> THRU LIST, <ENTER> TO SELECT
```

SP#:   **<SCR> THRU LIST, <ENTER> TO MODIFY DATA**
This field identifies the list number (1-10) that is currently being displayed. When in this field, the Scroll Up or Scroll Dn keys will move through the list.
To modify the data press the Enter key. The cursor will move to the LON field.

LON: **ENTER LON IN <DDD.TT> FORMAT**
This field allows a user to enter a signpost satellite's longitude in decimal format. See section 3.1.4 for instructions on how to enter satellite longitude. After the longitude is entered, the cursor will move to the POL field.
If you do not wish to change the current longitude, pressing the Scroll Up key will move to the POL field. Scroll Dn will move back to the SP field.

POL: **POLARIZATION<1-H 2-V 3-R 4-L>**
This field allows the user to specify the polarization associated with this signpost. This data is used by the positive identification feature to orient the polarization axis correctly for receiving the DVB data.

FRQ: **FREQUENCY<10000 – 13000> MHZ**
This field allows the user to specify the frequency associated with this signpost. This data is used by the positive identification feature to tune the DVB receiver.

SYM: **SYMBOL RATE <1000 – 30000> kS/sec**
This field allows the user to specify the symbol rate associated with this signpost. This data is used by the positive identification feature to tune the DVB receiver.

FEC: **FEC <1-3, 5-7> ex. 3=3/4>**
This field allows the user to specify the forward error correction code associated with this signpost. This data is used by the positive identification feature to tune the DVB receiver.

Enter the first number of the FEC scheme. Example: to select 5/6, enter 5.

PRI: **PRIORITY <0-DISABLE, 1-TOP>**
This field allows the user to specify the priority to be placed on this signpost. This data is used by the positive identification feature to sort which signposts to search for first.

ID: SIGNPOST ID STRING <6 CHARACTERS MAX>
This field allows the user to specify the (orbital slot) associated with this signpost. This data is used by the positive identification feature to confirm the signpost.

*** *make sure there is a space following last character of id string* ****

NOTE: the signpost list only contains data about a DVB transport stream to be used as a "signpost". With respect to the RC3000 there is sometimes confusion between the preset list and the list of STOREd satellite data (3.2.2.4). STOREd data contains both satellite and mount (azimuth, elevation, polarization) position data. The signpost list is an additional list that should not be confused with the other lists mentioned.

The following table shows a typical list of signpost that might be used for a system operating in North America.

SP#	LON	POL	FRQ	SYM	FEC	ID	PRI
1	119.0W	R	12224	20000	5/6	119W	2
2	79.0W	V	11742	11110	3/4	0W	1
3	95.0W	H	11780	20760	3/4	191E	1
4	148.0W	R	12224	20000	5/6	148W	1
5	121.0W	V	11724	20000	1/2	121W	1
6	110.0W	R	12224	20000	5/6	110W	1
7	105.0W	V	11720	26000	2/3	15W	2
8	61.5W	R	12224	22000	5/6		2
9	119W	R	12239	20000	5/6	119W	1
10	103.0W	H	11840	26,670	7/8	23W	2

Notes:
SP #1 is given priority 2 since it is actual used by multiple spot beams that may not be visible in various areas of North America.
SP #8 does not have a ID string associated with it as its identification string has not been observed to be consistently available. It is given priority 2 since its FREQ/SYMBR/FEC pattern is the same as many other potential signpost satellites.
SP #10 is given priority 2 as it is only used occasionally for uplinks.

3.3.1.1.x DVB ID

This group allows the user to customize parameters associated with the positive identification feature.

```
ENABLED:1              CONFIG-DVB ID
LO FREQ:10750
  RANGE:30      TH: 15
DVB IDENT <0>DISABLED <1>ENABLED
```

ENABLED: **<0>DISABLED <1>WITH PEAK <2>W/O PEAK**

This field allows the positive identification feature to be disabled (0).

If the feature is enabled, it may be specified whether or not an automatic peakup on the signpost and selected satellites will be performed. If high resolution sensors are available for the azimuth and elevation axes, it is recommended that the automatic peakup (1) option be chosen. If high resolution sensors are not available, automatic peakups cannot be performed and option 2 should be chosen.

LO FREQ: **LNB LO FREQENCY <10000 – 12000>**

This field allows the frequency of the LNB's local oscillator to be specified.

This value will be automatically be subtracted from a signpost's downlink frequency in order to describe the intermediate frequency that the DVB receiver will receive.

RANGE: **DVB SCAN RANGE +/- <10 -90> DEGREES**

This field specifies the number of degrees on either side of the estimated signpost position that will be scanned.

This number should be somewhat larger than the worst case error that can be obtained from the compass. Example: if you have confidence that the compass will never have more than a 15 degree error, then the scan range could be set to a value of 20.

TH: **DVB SCAN THRESHOLD <10 -500>**

This field specifies at what value above the open-sky noise floor that the scan for a signpost will transition from high speed to low speed.

This value should be set low enough that slow speed will be triggered quickly as the scan approaches a satellite. Conversely, it should be set at a high enough value that the transition won't be fooled by noise in the open-sky value.

3.3.2.11 DVB Receiver Maintenance

This mode allows the user to test the DVB receiver's ability to lock onto a signpost satellite. When the mode is entered, the parameters for signpost # 1 are automatically loaded into the DVB receiver.

```
   0.0 STOW    SP:1    FRQ:12224    DVB
  43.7          FAST    SYM:20000 FEC:5
 -14.5          RF:452  LK:LOCK ID:119W
<5>SP <7>FRQ <9>SYM <BKSP>FEC
```

Manual Antenna Control

Azimuth, elevation and polarization angles and limit status on shown in the two left columns of the display. The antenna may be moved as it is in the MANUAL mode. The azimuth may be manually jogged via the 4 and 6 keys, elevation via the 2 and 8 keys, and polarization via the 1 and 3 keys. Speed may be toggled via the 0 key.

Other keys will be used to program the DVB receiver.

RF:

The signal level seen by the L-band (RF) power detector is shown in this field.

<5>SP: ENTER SIGNPOST # 1-10

This key allows the user to select another signpost from the stored list of DVB signposts. The index of the signpost will be displayed. If individual signpost parameters are entered as described below, a "*" will be shown to indicate that the current set of parameters does not necessarily come from the stored signpost list.

<7> FRQ: ENTER FREQUENCY <10000 – 13000> MHz

The frequency for a potential signpost may be individually entered. After entering the frequency, the new frequency along with the current symbol rate and FEC will be programmed into the DVB receiver.

<9>SYM: ENTER SYMBOL RATE <1000 – 30000> kS/sec

The symbol rate for a potential signpost may be individually entered. After entering the symbol rate, the new symbol rate along with the current frequency and FEC will be programmed into the DVB receiver.

<BKSP>FEC: ENTER FEC <1-3, 5-7> ex. 3 = 3/4

The FEC for a potential signpost may be individually entered. After entering the FEC, the new FEC along with the current frequency and symbol rate will be programmed into the DVB receiver.

LK: ----, lock, LOCK

This field indicates the current lock status from the DVB receiver. "----" indicates that the DVB receiver currently has not established a lock on the programmed parameters. "lock" indicates that the DVB receiver has initial lock on the data stream. "LOCK" indicates that it has established a better lock indicating that it is able to estimate a bit error rate from the data stream.

ID:

This field indicates the current text that the DVB receiver has pulled off of a data stream.

Prior to establishing a lock, the string "RCIx" will appear indicating that the DVB receiver is trying to lock on the parameters defined by signpost # x. If any of the parameters have been individually programmed the string will be "RCI;".

When a lock is initially established, text such as "MPEG-2" may appear. This indicates that the DVB receiver recognizes a data stream but has not pulled the orbital data information from the stream.

A few seconds after lock is established, a string indicating orbital slot data should appear. For example, "119W" will be extracted from data stream coming off of the EchoStar satellite located at 119.0 West longitude.

NOTE: not all uplinkers will faithfully multiplex the orbital slot information into the data stream. One of the main reasons this maintenance screen exists is to monitor if the orbital slot information is being sent from a potential signpost.