Appendix BCN

Integrated Beacon Receiver Option

Revision: 19 June 2007, software version 1.59

This appendix describes the additional functions provided by the RC3000's integrated Beacon receiver option.

1.1 Appendix Organization

This appendix is provided as a supplement to the baseline RC3000 manual. The corresponding paragraphs in the baseline RC3000 manual are referred to when data specific to the Integrated Beacon Receiver option is described.

1.2 Features

This option provides the ability to manually and automatically tune an integrated beacon receiver for use during LOCATE and TRACK modes.

Software Configuration

RC3000 software configuration is presented in the form RC3K-ab-wxyz where ab-wxyz represents: (Mount manufacturer/Model #)-(Nav Sensor Option)(Tracking Option)(Remote Option)(Receiver Option)

This feature is categorized as one of the RECEIVER options of the RC3000.

OPTION CATEGORY	DESIGNATOR	DESCRIPTION
Integrated Receiver	N	No integrated receiver supported
	B	Integrated Beacon Receiver
	D	Integrated DVB Receiver
	C	Integrated DVB and Beacon Receivers

Software supporting the integrated beacon receiver would therefore be designated as either RC3K-ab-wxy**B** or RC3K-ab-wxy**C**.

1.3.10 Integrated Beacon Receiver Overview

For many tracking applications, it is desirable to monitor the satellite's beacon as an indication of received signal strength. Due to the relatively low power and narrow bandwidth of satellite beacons, specialized receiving equipment is required. This option allows the RC3000 ACU to internally house and control a high performance L-band beacon tracking receiver manufactured by Novella Satcoms.

The beacon receiver is designed to lock to and measure the level of conventional continuous wave beacons as well as BPSK modulated beacons. High immunity against false lock to telemetry subcarriers is achieved by the use of a universal anti-sideband device that is capable of identifying any sideband located between 2.5 kHz to 75 kHz away from the carrier.

The L-band (940 to 2,150 MHz) beacon signal is input to the beacon receiver from the backpanel of the RC3000. Via user programming, beacon frequency may be selected to a resolution of 10 kHz. The receiver is capable of automatically locking to a satellite beacon through a search band of +/- 100 kHz about the selected frequency. Therefore accurate centering of the satellite beacon frequency is achieved despite the 10 kHz granularity of frequency selection.

The beacon receiver tracks the beacon signal's frequency drifts and measures its power level. The receiver generates a DC voltage output which represents, in logarithmic scale, the beacon power at the receiver's input. The output voltage to input power log-conformity is better than 0.1 dB over a 40 dB measuring range. The RC3000 monitors this DC voltage during tracking operations in order to keep the antenna peaked on the satellite.

1.4 Beacon Receiver Specifications

Input Range	940 to 2,150 MHz
Input Impedance	50 ohm
Input Level	-70dBm to -110dBm
Signal Strength Output Range	+/- 10 VDC
Signal Strength Output Scale	Logarithmic
Signal Strength Output Slope	2dB/V (=> 40 dB) (0.5, 1.0, 4.0 optional)
Signal Strength Output Resolution	0.04 dBm (10 / 1024) 3k 10 A/D @ 2dB/V
PLL Noise Bandwidth	2 kHz
PLL Damping Factor	0.7
Post-detection Time Constant	100 ms
Threshold for Reacquisition of Lock	< 43dBHz
Search Range	+/- 200 kHz
Average Search Time	< 1 s
Frequency Resolution (synthesizer selection?)	10 kHz

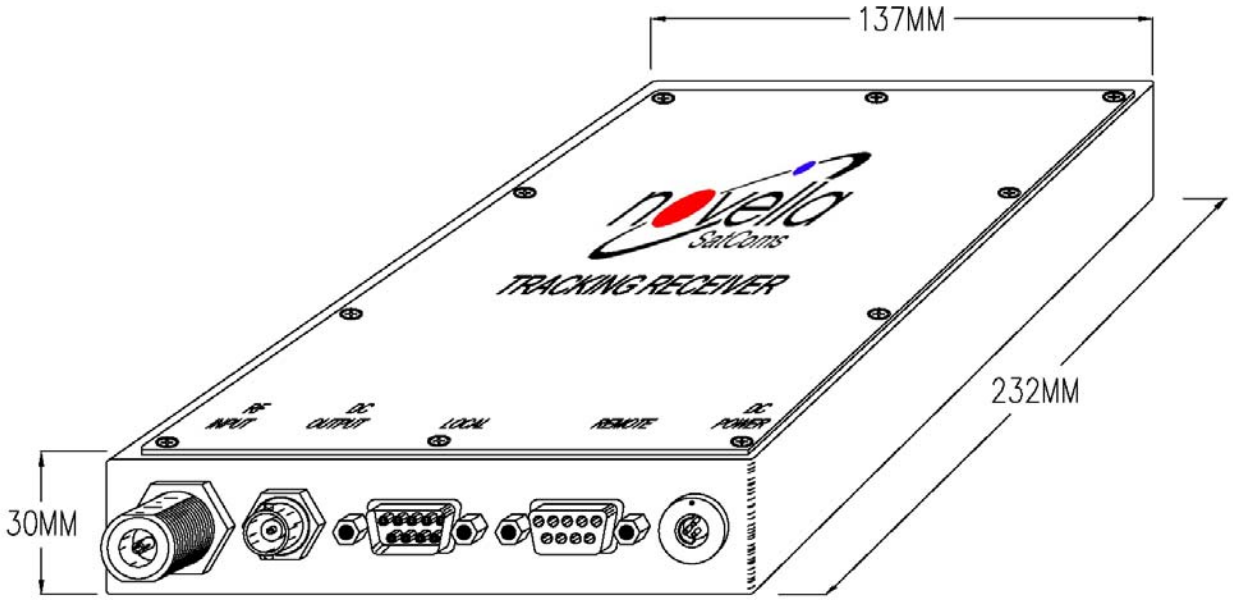
2.0 INSTALLATION

In order for this option to work properly, all other normal calibration steps described in the baseline manual must be performed correctly.

2.1.5 Beacon Receiver mounting

When only the beacon receiver is present, the 8 inch x 5 inch beacon receiver card will be factory mounted internally above the RC3000's analog board.

When both the integrated DVB and beacon receiver are present, the beacon receiver card will be housed in a small enclosure and mounted externally to the RC3000.



2.2.5 Signal Strength

The RC3000 monitors the input power level signal and lock status from the beacon receiver via the AGC2 circuitry.

When mounted internally, these connections are made inside the RC3000. The AGC2 and LOCK2 inputs via the J2 backpanel connector will therefore be inactive.

NOTE: any other receiving equipment must therefore be connected via the J2 AGC1 inputs.

2.2.8 RF connection

When mounted internally, the J11 L-Band RF input will be split internally to the beacon receiver and the RC3000's L-Band power detector.

2.4.8 Beacon receiver checkout

To confirm that the beacon receiver is able to lock onto the beacons from satellites of interest, use the beacon receiver maintenance screen described in 3.3.2.11 of this appendix. Position the antenna onto candidate satellites and observe that the beacon receiver is able to tune to the beacon obtain lock.

NOTE: when initially looking for beacons, set the beacon receiver's attenuation to 0 in order to provide the most sensitivity to signals. If the receiver's attenuation has to be increased to 40 dB in order to bring the observe signal strength to values less than 700, then separate attenuation on the input line may be needed.

The user may want to edit the preset satellite list (3.3.1.1.3) to include beacon frequencies for satellites of interest.

The following table may be used to log observations from multiple satellites.

SAT NAME	LONGITUDE	POLARIZATION	BEACON FREQUENCY	DEMOD. (CW / BPSK)	LOCK STATUS	SIGNAL STRENGTH

The user should also manually scan in azimuth across beacons in SLOW speed. If a lock does not appear, it indicates that the mount's azimuth slow speed is too fast and the automatic scan function may not recognize the lock indication. Adjust the azimuth's slow speed (2.3.5 of baseline manual) to a point where a lock indication is apparent for at least one second as the antenna moves across the satellite.

NOTE: make sure that the LO frequency of the system's LNB has been programmed in the Beacon Maintenance screen (3.3.2.11).

2.4.7 Mechanizing Automatic Locates

The integrated beacon receiver will be interfaced to the baseline RC3000 via the SS2 lock and signal strength inputs.

3.0 DETAILED OPERATION

3.2.2.3.7 Unique LOCATE mode steps using the Integrated Beacon Receiver

When the beacon receiver option is present, 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.

If the selected satellite is from the user preset list and a beacon frequency has been programmed for the selected polarization, the beacon receiver will be automatically tuned before any LOCATE movements begin. The input power level and lock status from the beacon receiver will then be available as the SS2 inputs. Normal locate and autopeak operations will then proceed using the SS2 inputs as their source.

CAUTION: Many satellites utilize the same frequencies for beacons. If the beacon frequency for the satellite of interest is not unique, the Autopeak scan function could lock onto the wrong satellite.

TRACK MODE

The inclusion of the integrated beacon receiver is basically transparent to the functionality of TRACK mode. TRACKing as described in appendix TRK will proceed as if an external receiver is providing signal strength to the SS2 input.

Prior to entering Track mode, the beacon should either be manually tuned via the beacon receiver maintenance screen or automatically tuned as part of prior LOCATE.

Within the TRACK FACTORS configuration screen, the signal source should be programmed to SS2.

When the beacon receiver loses lock, its AGC output also drops to a minimum value. Therefore, loss of lock will manifest itself as a "loss of signal" situation.

3.3.1.1.3 Preset Satellites

In addition to the normal preset satellite data (see baseline manual), this option allows programming of two beacon frequencies (H and V) per satellite. The formatting of the preset satellite list screen has been modified slightly to accommodate the unique beacon receiver data items.

```
SAT#: 1   NAME:TELSTAR 12    CONFIG-SATS
 LON:121.0W PO:-26.0          H:12198.90
INCL: 3 BAND:1 EPH:0      D:0 V:11701.03
<SCR> THRU LIST, <ENTER> TO MODIFY DATA
```

H: HORIZONTAL BEACON <xxxxx.yy>MHz
V: VERTICAL BEACON <xxxxx.yy>MHz

The H: and V: fields allow the user to program the beacon frequency for both polarizations.

NOTE: program the actual beacon frequency, not the IF frequency beyond the LNB. The RC3000 will automatically adjust according to the LO of the LNB.

If you do not want the RC3000 to automatically tune and use a beacon for a particular satellite, program 0.00 into H and V for that satellite.

If the system has a circularly polarized feed, describe the one beacon frequency in the H: field.

D: BEACON DEMODULATION <0-CW 1-BPSK>

This field allows the user to describe whether the satellite's beacon has BPSK modulated telemetry present or is just of the continuous wave (CW) type.

The following table shows an example list of North American Ku-band satellites and their published beacon frequencies.

SAT NAME	LON	Horizontal Frequency	Vertical Frequency
Nahuel 1	71.8 W	11700.00	11701.00
AMC-6	72.0 W	11702.00	12198.00
AMC-5	79.0 W	11701.00 11702.00	
AMC-9	83.0 W	11702.00	12198.00
IA-6	93.0 W	11702.00	12198.00
IA-5	97.0 W	11702.00	12198.00
AMC-4	101.0 W	11702.00	12198.00
AMC-1	103.0 W	12198.00	
AMC-15	105.0 W	11702.00	12198.00

3.3.2.11 Beacon Receiver Maintenance

When the integrated beacon receiver option is present, the MAINTENANCE menu allows the user to select Beacon Receiver maintenance by pressing the ENTER key (symbolized by <>).

```
1-VOLTS   2-DRIVE   3-TIME   4-SIG MAINT
5-LIMITS  6-GPS COM 7-FG COM 8-MOVETO
9-FG CAL  0-SHAKE            .-CI RECORD
                    <>-BCN   Z1-GTRB1.59
```

This mode allows the user to manually tune and test the Beacon Receiver's ability to lock onto a satellite's beacon. When the mode is entered, the current IF frequency that the receiver is tuned to is displayed. Also displayed is the current attenuation (AN:) setting from the receiver.

```
-208.3  CCW   SS:623        .-AN:32   BCN
  43.7        LK:LOCK <>CW 5-RF:
 -14.5        SP:SLOW      7-LO:10750.00
TUNE BEACON RECEIVER       9-IF: 1448.90
```

Manual Antenna Control
Azimuth, elevation and polarization angles and limit status are 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 tune the beacon receiver.

5-RF: FREQUENCY<xxxxx.yy>MHz

This field allows the user to enter the actual frequency of the satellite's beacon. When the frequency is entered, the IF frequency will be derived from the LO frequency. The resulting IF frequency is displayed in the IF field. The beacon receiver will then be tuned to that IF frequency.

NOTE: upon entering this screen the RF field will be blank.

7- LO: LO FREQ<0-30000>MHz

The LO frequency of the LNB must be programmed here in order for the actual frequency of beacons to be described in the satellite preset list.

9- IF: I FREQ<940.0 - 2150.0>MHz

The intermediate frequency to program the beacon receiver to may be entered via this field.

After entering the IF frequency, a tuning command will be sent to the beacon receiver. The success of the programming is then confirmed by a status check of the receiver. During the time of tuning and status checking the IF field will show "TUNING". If the status check shows that the receiver is now tuned to the entered IF frequency then the IF value will be displayed in the field. If the status check does not confirm the programming then the field will be filled with "*****.**".

NOTE: as described above (5-RF:), the IF field may also be derived by entering a RF value. After entering the RF value, the IF field will display "TUNING" just as if the IF value had been entered directly.

.-AN: ATTENUATION <0-40>dB

This field allows the user to change the input attenuation of the beacon receiver. Press the STOP (.) key to enter this field.

<>CW/BP

The ENTER key may be pushed to toggle the beacon receiver's demodulation mode between continuous wave (CW) or BPSK (BP) settings.

LK:----, LOCK

This field indicates the current lock status from the beacon receiver. "----" indicates that the beacon receiver currently has not established a lock on the tuned frequency. "LOCK" indicates that a lock has been established.

RF: / SS: / AD:

The signal level seen by the L-band (RF) power detector, the beacon receiver's AGC (SS) or a level internal to the beacon receiver (AD) is shown in this field. The Scroll Down key will scroll between RF, SS and AD.

Upon entering this screen the beacon receiver's AGC (SS) value will be displayed. The SS value will probably be of most use for determining the functionality of the beacon receiver.

The RF value is an indication of total L-band power. This may be useful for finding a satellite while jogging the antenna from this screen.

The AD value is an internal beacon receiver signal level value that will probably only be useful for debugging purposes by RCI personnel.

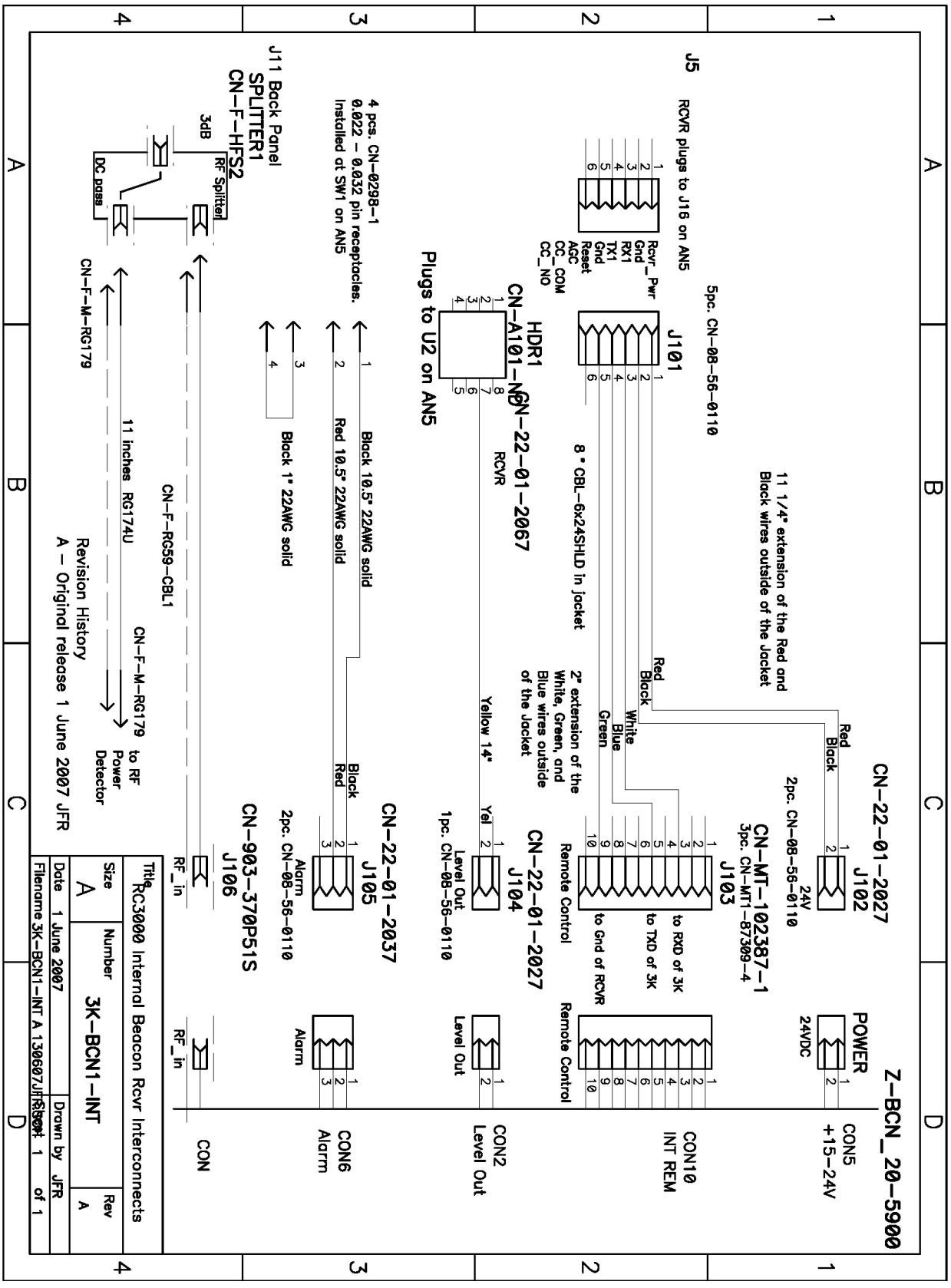
4.0 TROUBLESHOOTING

If the functionality of the beacon receiver is in question, first go to the maintenance screen and confirm communication with the receiver. If the receiver cannot be tuned, check the internal cabling between the beacon receiver and the rest of the RC3000.

If a LOCATE to a satellite does not work, manually position onto the satellite and confirm (via the maintenance screen) that a lock can be obtained at that frequency.

The inability to obtain lock may be due to low signal level reaching the beacon receiver. From the maintenance screen, set the attenuation to 0 to make the receiver as sensitive as possible.

5.0 DRAWINGS & SCHEMATICS


Z-BCN_20-5900
POWER
24VDC
CON5
+15-24V
CN-MT-102387-1
3pc. CN-MT1-87309-4
J103
CON10
INT REM
to RXD of 3K
to TXD of 3K
to Gnd of RCVR
Remote Control
CN-22-01-2027
J104
CON2
Level Out
Level Out
1pc. CN-08-56-0110
CN-22-01-2037
J105
CON6
Alarm
Alarm
2pc. CN-08-56-0110
CN-903-370P51S
J106
CON
RF_in
CN-22-01-2027
J102
24V
2pc. CN-08-56-0110
Red
Black
11 1/4" extension of the Red and Black wires outside of the Jacket
J5
RCVR plugs to J16 on AN5
5pc. CN-08-56-0110
Rcvr_Pwr
Gnd
RX1
TX1
Gnd
Reset
AGC
CC_COM
CC_NO
J101
8 " CBL-6x24SHLD in jacket
Red
Black
White
Blue
Green
2" extension of the White, Green, and Blue wires outside of the Jacket
HDR1
CN-A101-NON
CN-22-01-2067
RCVR
Yellow 14"
Plugs to U2 on AN5
4 pcs. CN-0298-1
0.022 - 0.032 pin receptacles.
Installed at SW1 on AN5
Black 10.5" 22AWG solid
Red 10.5" 22AWG solid
Black 1" 22AWG solid
J11 Back Panel
SPLITTER1
CN-F-HFS2
3dB
RF Splitter
DC pass
CN-F-RG59-CBL1
11 inches RG174U
CN-F-M-RG179
CN-F-M-RG179
to RF Power Detector
Revision History
A - Original release 1 June 2007 JFR
Title RC3000 Internal Beacon Rcvr Interconnects
Size A
Number 3K-BCN1-INT
Rev A
Date 1 June 2007
Drawn by JFR
Filename 3K-BCN1-INT A 130607JFR.SchDoc
Sheet 1 of 1