APPLIED INSTRUMENTS, INC.

TELECOMMUNICATIONS INSTRUMENTATION

Super Buddy
Operation Manual

Revision	1.5
Date	11/17/2006

1. <u>Introduction</u>

The Super Buddy embodies a new standard in satellite identification capability. Rather than loading a limited set of satellites or a large number of channels plans to select from, the Super Buddy holds all of the satellite transponder information for the entire continent.

You just tell it where you are and what type of system you are connected to, and the Super Buddy accesses all satellite transponders visible to that system. The basic operation becomes extremely simple:

> Left arrow – goes to next orbit east
> Right arrow – goes to next orbit west
> Up arrow- next higher transponder
> Down arrow – next lower transponder

Connections

1) SIGNAL IN - connects to the LNB or receiver side of a multi-switch
2) IRD   - connects to the IRD (receiver) – NOT REQUIRED
3) A/C   - mini A/C cord to 50/60 Hz 120 to 240 VAC power for battery charging only
4) DC   - 12 VDC at least 1 amp for battery charging (cigarette adapter)
5) PC   - serial connection to PC for updating with Service Packs, etc.

IRD Connection

The IRD connector has two functions:
- Measures voltage supplied by the IRD.
- Allows voltage supplied by IRD to power the LNB extending the battery life.

However, the meter itself is always powered by the battery.

PC Connection

The Super Buddy can be connected to a serial port (RS232) of a PC via the supplied cable. This cable has a 9 pin D-sub connector for the PC and a mini stereo headphone jack on the Super Buddy side.

PC software is available on our website (www.appliedin.com) for updating the instrument with the latest Field Guides (satellite data) and firmware.

2. Run Screen

The main "run" screen displays all information used when pointing a dish or testing an L-Band network.
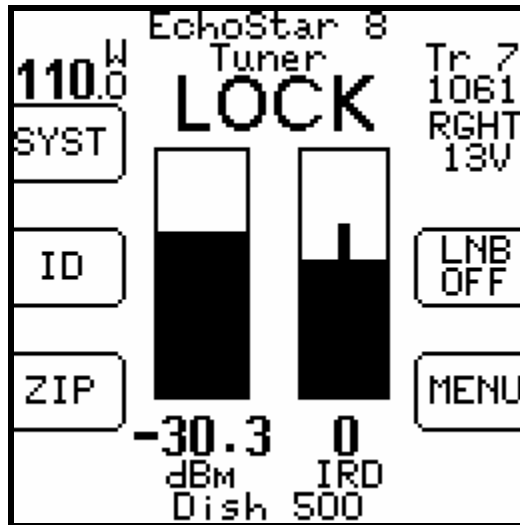
Displayed Data

1) Selected satellite
   a) Change with left and right arrows (or the LNB soft key, see Multi-LNB Systems below)
   b) Satellite name is on the top line
   c) Orbital position is shown at upper left
2) Lock status
   a) Search – when searching for a matching signal
   b) LOCK – when signal lock obtained, this indicates you MIGHT be pointed at the selected satellite, but you must use the ID button to confirm the satellite.
3) Transponder information (upper right)
   a) Transponder label
   b) Frequency (L band or down-converted)
   c) Polarity (RGHT, LEFT, HZ or VT)
   d) Voltage provided to LNB (13 or 18V)
4) Signal Level
   a) left bar graph (with peak center line)
   b) Numeric value in dBm
   c) Scale: -10 to –70 dBm

5) Signal Quality
    a) right bar graph (with peak center line)
    b) Numeric value as IRD equivalent or C/N, Eb/N0 or Es/N0 in dB
    c) Scale: 0 to 20 dB C/N
6) Selected LNB type (bottom line)

Soft Keys

1) SYST   - transfers to system setup screen
2) ID   - starts satellite identification verification function
3) ZIP   - transfers to zip code lookup screen
4) Polarity   - displays or selects polarity and LNB voltage
5) ON/OFF   - Turns LNB power on or off (displays present state) and selects switch ports
6) MENU   - transfers to menu screen
7) Left and Right Arrows – change satellite
8) Up and Down arrows – change transponder

Changing Satellites

The left and right arrows switch to the next east or west satellite visible to the selected LNB. If
the LNB polarity can be switched, the first priority id transponder will be used and the polarity may
switch if needed. If the polarity cannot be switched, the selected polarity will be maintained.

If you have selected a multi-LNB, the selected satellite will also change when you use the LNB
soft-key to switch between LNBs. (See Multi-LNB Systems below.)

Changing Transponders

The up and down arrows take you to the next or previous transponder in the same satellite
(actually in the same orbital slot). If the polarity is locked (via LNB type) then you get the next
transponder of the selected polarity. Only transponders visible to your region are used.

Polarity

If the LNB supports polarity switching or is stacked, the polarity key is disabled (as shown above)
and the transponder selection determines the polarity.

If the LNB is of the single polarity variety, then the polarity must be selected using the polarity key
and the transponder selection is limited to the selected polarity. See figure below.
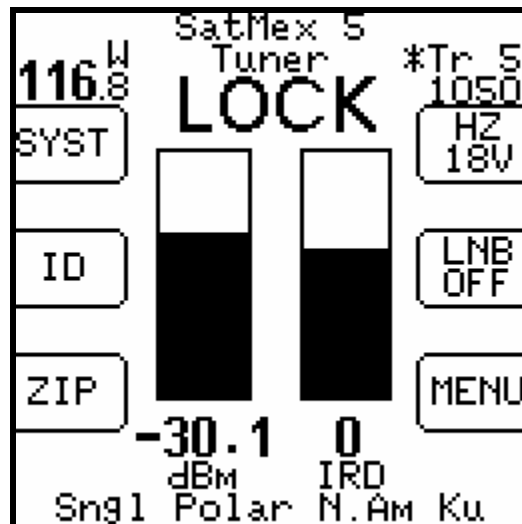
Multi-LNB Systems

When the selected LNB system supports multiple LNBs or multi-head LNBs via the switch setting, the LNB ON/OFF button also controls the switch setting. When you switch the LNB, the satellite is automatically changed to the one normally used for that system

```
           EchoStar 6
    W                    *Tr 7
110.0    LOCK            1061
                         RGHT
SYST                      18V

 ID                      LNB1

ZIP                      MENU
         -37.5  110
          dBм    IRD
         Dish Pro Plus
```

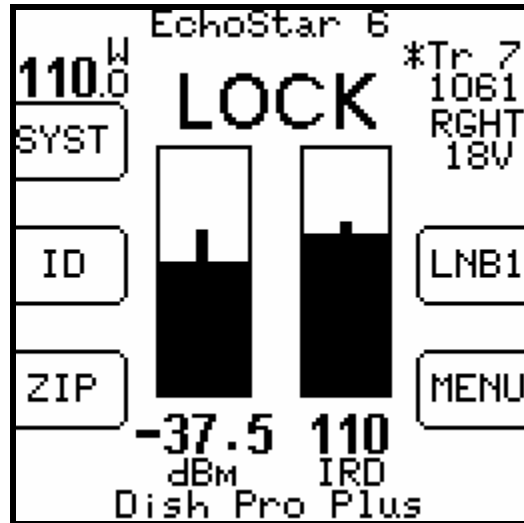For example, the Dish Pro Plus system is typically used with the 110 and 119 satellites and possibly an additional dish pointed at 61.5. When you push the button to select LNB1, the meter automatically selects the 110 satellite. Push it again to select LNB2 and the 119 bird is selected. The third push gets you to LNB3 and the 61.5 bird.

```
           EchoStar 7
    W                    *Tr 13
119.0    LOCK            1149
                         RGHT
SYST                      18V

 ID                      LNB2

ZIP                      MENU
         -38.0   96
          dBм    IRD
         Dish Pro Plus
```
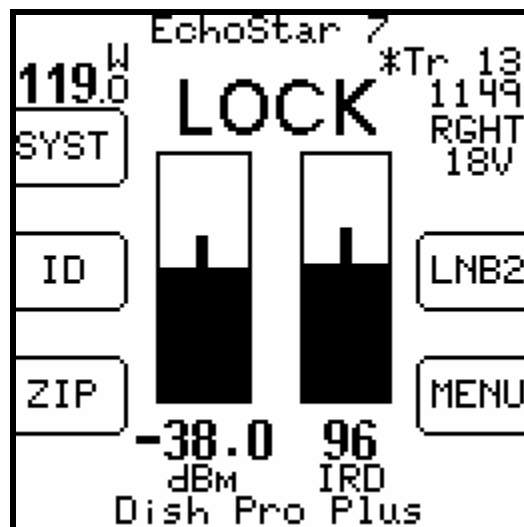
3. <u>Main Menu</u>

The MENU button takes you to a menu of all of the Super Buddy screens. Some of these screens are also available via soft keys from the run screen.
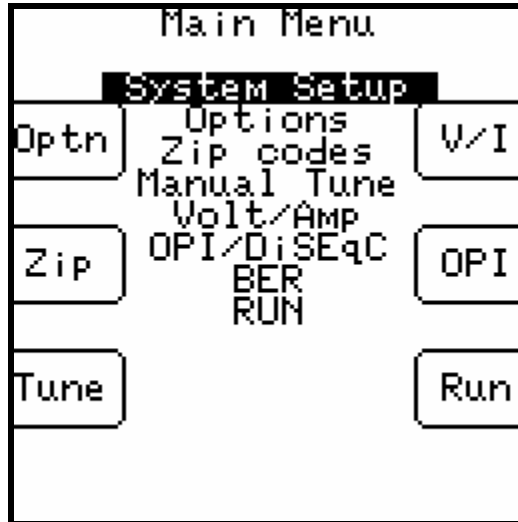
All of the functions are available on the central menu using the up/down and enter keys. Some functions are also available via soft keys as a shortcut.

The functions are described in the sections that follow.

4. <u>System Setup</u>

You must use this screen to identify the type of system you are connected to and where you are. **This step is essential**: the Super Buddy calculates all frequencies based on this information and displays only the transponders that can actually be received by the selected system in the selected location.

This screen is a simple menu selection. Use the up/down arrows to highlight the selection you want to change and press ENTER.

The system selection actually selects three items:
1)   Region
2)   LNB system
3)   Switch type

Due to the large variety of LNB systems in use, the LNB system selection is divided into three levels:
1)   Service
2)   System
3)   LNB model

Because you will not need to change the region very often (if ever), the second option is highlighted by default. You will need to use the up arrow to change the region.

The LNB system also defines a default switch type, so this selection is also normally skipped.

Regions

When the unit is shipped from the factory, it will have the latest information for all of North America loaded into it.   You must select a region within this set that better identifies the area where you will be using the meter.

```
         Select Region

   NE Continental US
   NW Continental US
   SE Continental US
   SW Continental US
        Alaska
    Eastern Canada
    Western Canada
       Caribean
        Mexico
                      ┌─────┐
                      │EXIT │
                      └─────┘
```

If you are not sure of which region you are in, it probably doesn't matter because there is significant overlap in the regions. For example, the NE Continental US region extends as far south as South Carolina and the SE Continental US region extends as far north as New Jersey.

The region selection is necessary because transponders are pointed only at certain parts of the globe and the Super Buddy will use just the transponders that are pointed at your selected region.

Services

The service selection groups the LNB/antenna systems into a small sets of choices. The available services may change with Field Guide updates.

```
           Select Service

        ███Dish Network███
            DIRECTV
        Bell ExpressVu
            Tachyon
        Other Providers
        Generic C Band
        Generic Ku Band


                      ┌────┐
                      │EXIT│
                      └────┘
```

Systems

The system selection lets you pick the type of system within the selected service. In some cases this is the final LNB model selection. In other cases, the system will be broken down further by the LNB model selection below.

```
           Select System

          ███Dish 1000███
          Dish Pro Plus
            Dish Pro
            Dish 500+
            Dish 1000+
           Dish 1000.2
         Dish500 Legacy
           Super Dish
            DP Single
           FSS Single ┌────┐
         Legacy Single│EXIT│
                      └────┘
```
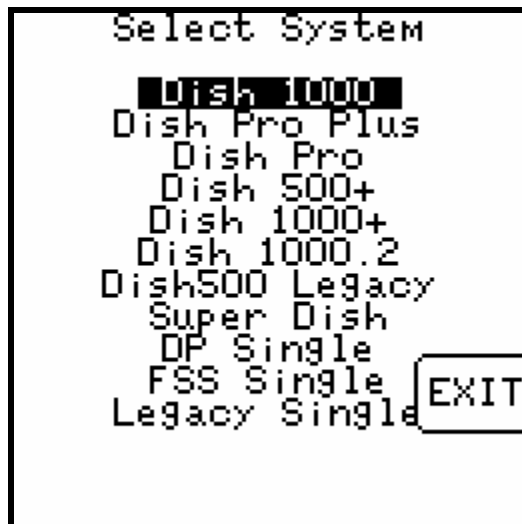
LNB Model

The models listed will depend on the system selected above. For example:

```
        Select LNB

        ██Dish 1K██
        Dish 1K/61.5
        Dish 1K/148




                              ┌──────┐
                              │ EXIT │
                              └──────┘
```

Switch Type

The switch type may be automatically selected when you pick an LNB Model, but you may wish to change it or to identify a switch that is external to the LNB. If you are installing a system that does not have a switch, you may need to select "none".

```
       Select Switch

          ██none██
           22kHz
           SW21
          SW42/44
           SW64
           Twin
           Quad
          DiSEqC
          DpTwin
          DpPlus    ┌──────┐
           Dp34     │ EXIT │
          DPP44     └──────┘
```
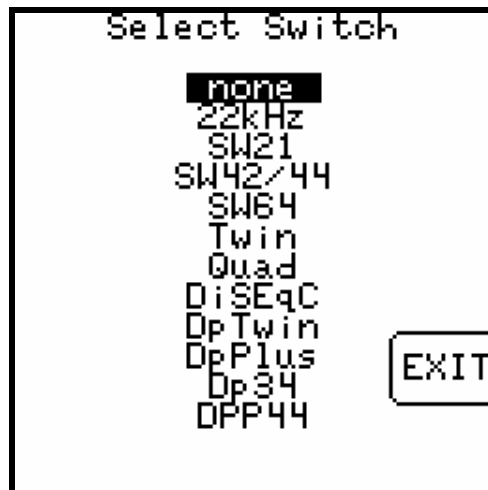
5. <u>Options</u>

There are several options you may select to personalize the operation of your meter.

```
        OPTIONS

     Level: ▊dBm▊
   Quality: IRD#
 Frequency: L-band
   Sounder: Lock Tone
  Shutdown: None



                      ┌─────┐
                      │EXIT │
                      └─────┘

   (arrows select)
```
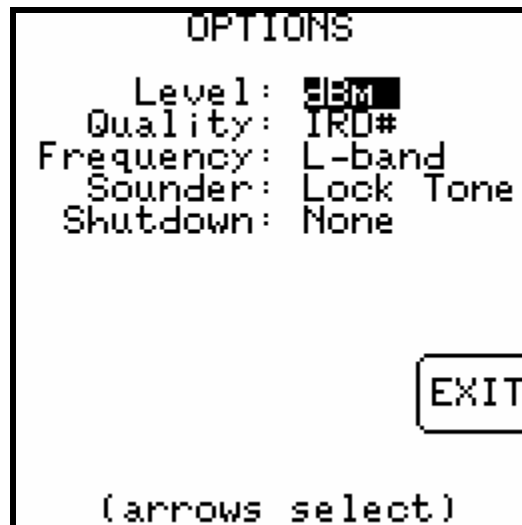
To use this screen, highlight the option you want to change with the up/down arrows and select the value you want with the left/right arrows (or ENTER key). Press EXIT when done.

Signal Level

The signal level may be displayed in either dBm, dBmV or dBuV.

Signal Quality

The signal quality number may be displayed as one of the following:
> C/N (carrier to noise ratio) in dB
> IRD equivalent number
> Eb/N0 – Energy per bit over noise energy per hertz
> Es/N0 – Energy per symbol over noise energy per hertz

IRD numbers range from 0 to 100 for DIRECTV™ or 0 to 125 for Dish Network™.

Frequency

The frequency may be displayed as either the L-band frequency, which the meter is tuned to, or the downlink frequency transmitted by the satellite. Both are displayed in MHz.

Sounder Option

Peaking via the audible tone can be done in two ways: "tone-on-lock" and "peak-o-matic". The "tone-on-lock" method uses the following:

1) Slow beep - the function is on
2) Fast beep – the signal is locked
3) Solid – the signal is locked and at the highest level yet seen

This method works well when the dish is close enough to obtain a signal lock. If you have trouble finding a lock however, you may want to use the "peak-o-matic" method:

1) Slow beep – the function is on

2)   Fast beep – the signal is at least 5 dB higher than the lowest level seen
3)   Solid – the signal is higher and at the highest level seen so far

Note that the peak-o-matic method does not indicate a lock. It allows you to peak the azimuth and elevation even before a peak is obtained.
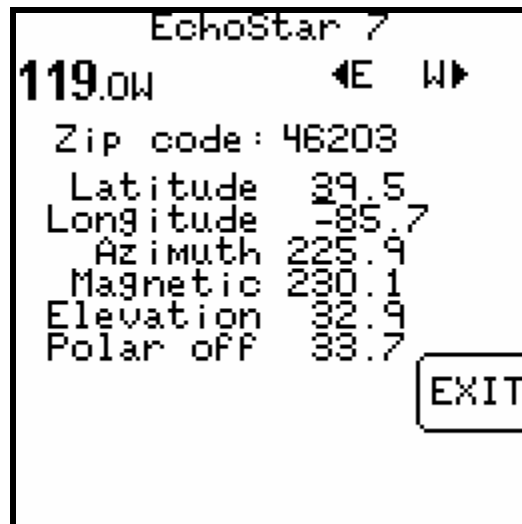
In both methods to fully peak the dish, you must move it in one direction until the signal is found, and continue moving it until you move past the peak, then move back to the solid tone.

Shutdown Timer

The unit can be set to automatically shut off after 5, 10, or 15 minutes with no buttons being pressed. This timeout can be disabled by setting the option to "none".

6. <u>Zip Code Lookup</u>

Enter any zip code in the United States and this screen will look up the latitude and longitude for that location and calculate the azimuth and elevation angles for the selected satellite. The azimuth is given in true north and in magnetic north degrees.

```
         EchoStar 7
119.0W          ◄E   W►

   Zip code: 46203
   Latitude   39.5
  Longitude  -85.7
    Azimuth  225.9
   Magnetic  230.1
  Elevation   32.9
  Polar off   33.7
                      ┌─────┐
                      │EXIT │
                      └─────┘
```

Type in the zip code using the numeric keypad and press ENTER.
If a postal code table is not available for your area, you may enter the latitude and longitude directly and the same azimuth and elevation calculations will be made.
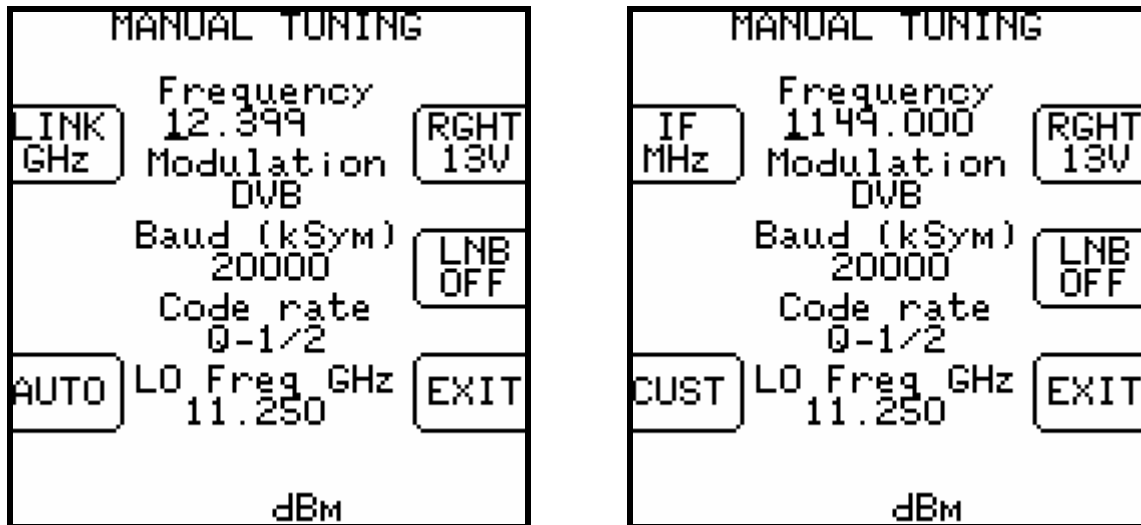
You may change the selected satellite using the left and right arrows.

The "Polar off" is the polarization offset degrees used for FSS LNBs. If the value is negative, turn the LNB clockwise, if positive turn it counter-clockwise when viewed from behind the antenna looking towards the satellite. Note: this is different from the skew setting used for Dish Network or DIRECTV multi-satellite dishes.

Note: if the Wild Blue™ system is selected, some additional information pertaining to Wild Blue installations is displayed at the bottom of this screen. See the Application Note "How to install Wild Blue with a Super Buddy" for more information.

7. <u>Manual Tuning</u>

The manual tuning screen may be useful when looking for a signal that has not yet been added to our database and loaded into the instrument. You can manually enter the tuning parameters. The screen will display the locking status at the bottom of the screen (not shown in example below) and will keep these parameters when you return to the run screen.

```
     MANUAL TUNING              MANUAL TUNING
        Frequency                 Frequency
┌────┐   12.399    ┌────┐    ┌────┐  1149.000   ┌────┐
│LINK│  Modulation │RGHT│    │ IF │ Modulation  │RGHT│
│GHz │     DVB     │13V │    │MHz │     DVB      │13V │
└────┘             └────┘    └────┘              └────┘
       Baud (kSym)  ┌────┐          Baud (kSym)  ┌────┐
          20000     │LNB │             20000     │LNB │
       Code rate    │OFF │          Code rate    │OFF │
          Q-1/2     └────┘             Q-1/2     └────┘
┌────┐LO Freq GHz┌────┐    ┌────┐LO Freq GHz┌────┐
│AUTO│  11.250   │EXIT│    │CUST│  11.250   │EXIT│
└────┘           └────┘    └────┘           └────┘

        dBm                       dBm
```

Frequency
You may specify the frequency as either the L-band frequency to tune to or as the downlink satellite frequency. Press the upper left soft-key to change the frequency type. This soft key also changes the display format on the run screen and alters the frequency display option set up in the Options screen.

Modulation
Use the arrows to select the modulation format:
    DSS   for legacy DIRECTV™ signals
    DVB   for DVB-S standard signals (Dish Network and most others)
    DC2   for Digicipher 2 signals (Star Choice and some others)
    Turbo for Dish Networks high-def 8PSK signals

Baud Rate
Use the keypad to enter the baud rate (symbol rate) in kiloSymbols per second

Code Rate
For Turbo modulation only, select the desired code rate (not needed for other modulations)

LO Frequency
Normally, the LO frequency of the LNB is obtained from the system type selection and may change with different switch settings and polarities. This is the "AUTO" mode of operation. In rare circumstances, you may want to use the lower left key to change to "CUST" or custom mode and specify an LNB LO frequency directly. The LO frequency is the difference between the downlink frequency and the L-band tuner frequency. High-side LO frequencies like those used in C-band LNBs and some stacking LNBs may be specified using a negative number.

LNB Control

You may use the right side soft keys to change the LNB voltage and turn the LNB on or off or change switch settings.

8. <u>Voltage / Current</u>

The V/I or "Voltage / Current" screen displays the LNB voltage and current draw, the battery voltage, and the voltage on the IRD connection.

```
VOLTAGE/CURRENT
        LNB
     17.4 Volts
     120 mAMPs
 13V    IRD
        17.6V
 ON    Battery    EXIT
        7.9V
```
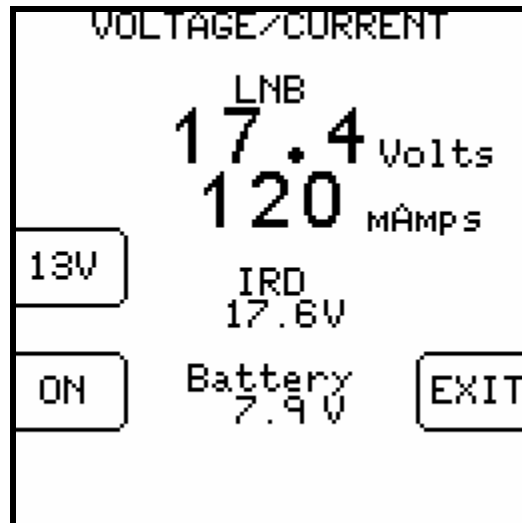
You may change the LNB voltage and turn it on or off using the soft keys.

9. OPI Simulation

The OPI screen simulates the DiRECWAY™ Outdoor Pointing Interface used to check cross-pole alignment of the DiRECWAY transmitters. It is used exactly like the OPI device.
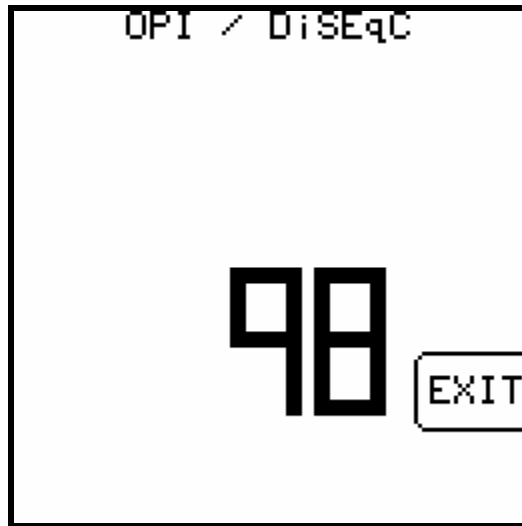
Procedure for performing cross-pole check:

1) Align the dish using the receiving LNB just as you would a normal Ku band dish using the Super Buddy run screen.
2) Connect the modem and PC to the transmit and receive cables and run the DirecWay software. Go to the DirecWay screen used for checking the cross-pole.
3) Return to the dish and connect the Super Buddy into the receiver cable. The Super Buddy's LNB port should be connected to the LNB and the IRD port to the receiver modem.
4) Go to the Super Buddy OPI screen. This screen displays the numbers transmitted from the modem just like the OPI device.
5) Adjust the dish to peak the transmitter cross pole quality number.

10.   <u>Satellite Identification</u>

Satellites are identified by obtaining locks on one or more transponders. To obtain a lock, the frequency, modulation and symbol rate of the transponder must be known to the instrument. These combinations vary enough between the satellites that they can be used to identify the satellite. Unfortunately, one transponder is not always enough; there may be another satellite using the same combination.

ID Verification

Unlike other meters, the Super Buddy has the ability to check one or more transponders looking for a match on a combination that is unique to each satellite. This is what we call the "ID Verification" feature. It is initiated when you press the ID button on the Run Screen.

When you change satellites with the left/right arrows, the transponder shown will be one of the transponders used in ID Verification. Once you get a lock and peak the dish on this transponder, press the ID button and the unit will check any other transponders needed to confirm the identification and display either "VERIFIED" or "ID FAILED".

Satellite Scan

If you have peaked up the meter on a satellite signal, but either don't have a lock or get an "ID FAILED" message when performing the ID Verification, the Super Buddy can try to determine what satellite you are pointed at by performing the ID Verification on different satellites sequentially. This is called the "Satellite Scan" feature.

To run a Satellite Scan, press the ID button to verify the selected satellite. If that succeeds, there is no reason to run the Satellite scan. If that fails, there will be a "SCAN" button on the "ID FAILED" error screen, press that and the scan begins.

The scan will start from the selected satellite, presumably the one you are looking for and look to the east and west one satellite at a time until a positive ID is found or the horizon is reached, or you abort the scan.
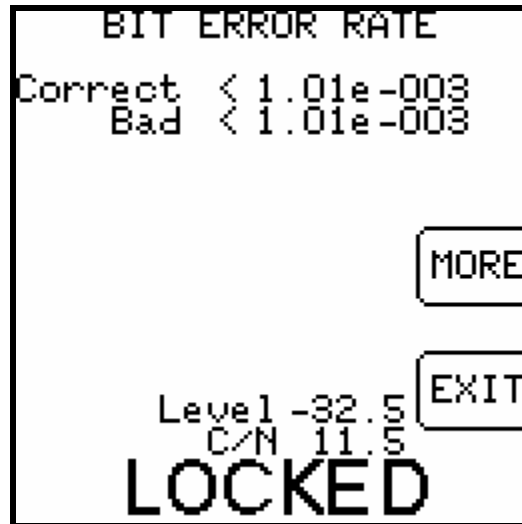
Field Guide Updates

Unfortunately, the satellite identification process is only as good as the transponder definitions that are used. And these change often enough to make the job challenging. That's where Field Guide updates come into play. As we update our database we post the revisions on our web site which you can download into your instrument. See the section on "Updating".

Our database is updated from information gathered from other web sites and information obtained from our customers. If you know of any omissions or errors in our database, please contact us so that we may pass on what you have learned.

11.   <u>Bit Error Rate</u>

The Bit Error Rate screen (BER on the main menu) displays the bit error rate of the signal as detected by the demodulator within the Super Buddy.

```
       BIT ERROR RATE

Correct < 1.01e-003
     Bad < 1.01e-003



                        ┌──────┐
                        │ MORE │
                        └──────┘

                        ┌──────┐
                        │ EXIT │
      Level -32.5 └──────┘
        C/N 11.5
      LOCKED
```

There are two rates displayed:

Corrected   This is the rate of errors detected and corrected by the Reed-Solomon portion of the Forward Error Correction routine.
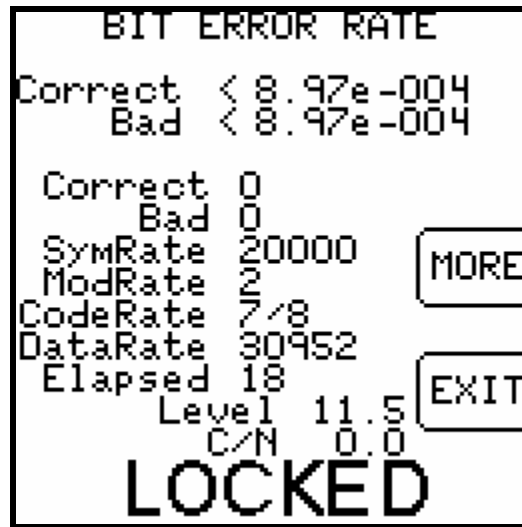
Bad   This is the rate of errors detected that the Reed-Solomon decoder was unable to correct. These are the errors which cause tiling or other problems visible to the customer. This is sometimes referred to as the "post-FEC" error rate.

The errors that are corrected by the first stage in the decode process, the Viturbi or Turbo trellis decoder, are not available from the demodulator and are not displayed. This rate is sometimes referred to as the "pre-FEC" error rate.

If the error rate is preceded by a less than sign (<) as in the example above, it indicates that no errors have yet been detected and so the bit error is not known but is less than the number given.

The BER screen accumulates errors as long as the screen is active. To reset the counters, exit and restart the screen.

The MORE button can be used to display additional information about the signal:

```
      BIT ERROR RATE

Correct < 8.97e-004
    Bad < 8.97e-004

  Correct 0
      Bad 0
  SymRate 20000      ┌──────┐
  ModRate 2          │ MORE │
 CodeRate 7/8        └──────┘
 DataRate 30952
  Elapsed 18         ┌──────┐
      Level 11.5     │ EXIT │
       C/N  0.0      └──────┘
      LOCKED
```

This displays the following additional information:

1) Corrected error count
2) Uncorrected (bad) error count
3) Symbol rate in kilo-symbols/second
4) Modulation rate or bits per symbol (2 for QPSK, 3 for 8PSK)
5) Code rate or bit puncture rate
6) Data Rate – calculated rate of payload kilo-bits per second (post FEC data rate)
7) Elapsed time counter (1/2 seconds)

12.   Updating

Updates to the Field Guide and to the instrument firmware are available from the Applied Instruments website.

Requirements

1)   A PC running Windows 95, 98, 2000, NT, or XP.
2)   An RS232 serial port (COM port, 9 pin D-sub connector)
3)   An internet connection
4)   The special serial cable provided with the instrument

Note: if your PC does not have an RS232 serial port, a USB to serial adapter may be used.

Installation

Before you can update your instrument, you must obtain and install the FlashUpdate software onto your PC:

1)   Go to the Applied Instruments website (www.appliedin.com) and follow the links to download the Super Buddy upgrade program or use one of the following links directly:
    a)   For Windows 95 or 98:   www.appliedin.com/downloads/flashupdate9x.exe
    b)   For Windows XP: www.appliedin.com/downloads/flashupdatexp.exe
2)   This is a self-extracting archive file. You may choose to open or run the file directly from the website or may save it to your disk and then open or run it. Either way, when you open this file, it will unzip several files onto your PC in a folder C:\FlashUpdate\ and will install an icon on your desktop to start up the FlashUpdate.exe application. You must unzip these files.
3)   If the icon does not appear on your desktop, you can use "My Computer" or Windows Explorer to navigate to the C:\FlashUpdate\ folder and open FlashUpdate.exe from there.

Updating

1)   Ensure you have an active internet connection.
2)   Plug your Super Buddy into the AC outlet to prevent any problems due to a low battery.
3)   Connect the Super Buddy to your PC using the supplied cable and turn it on.
4)   Double click the icon or start the application.
5)   If the connection is working, the top portion of the following screen should be filled in with data obtained from the instrument.
6)   If the connection is not working, you will get an error message after a delay. In this case, check to be sure the instrument is on and the cable is fully seated. Click "Connect" to retry the connection. If it still fails, verify that the selected COM port is correct. You can try all available ports, if you don't know the com port number.
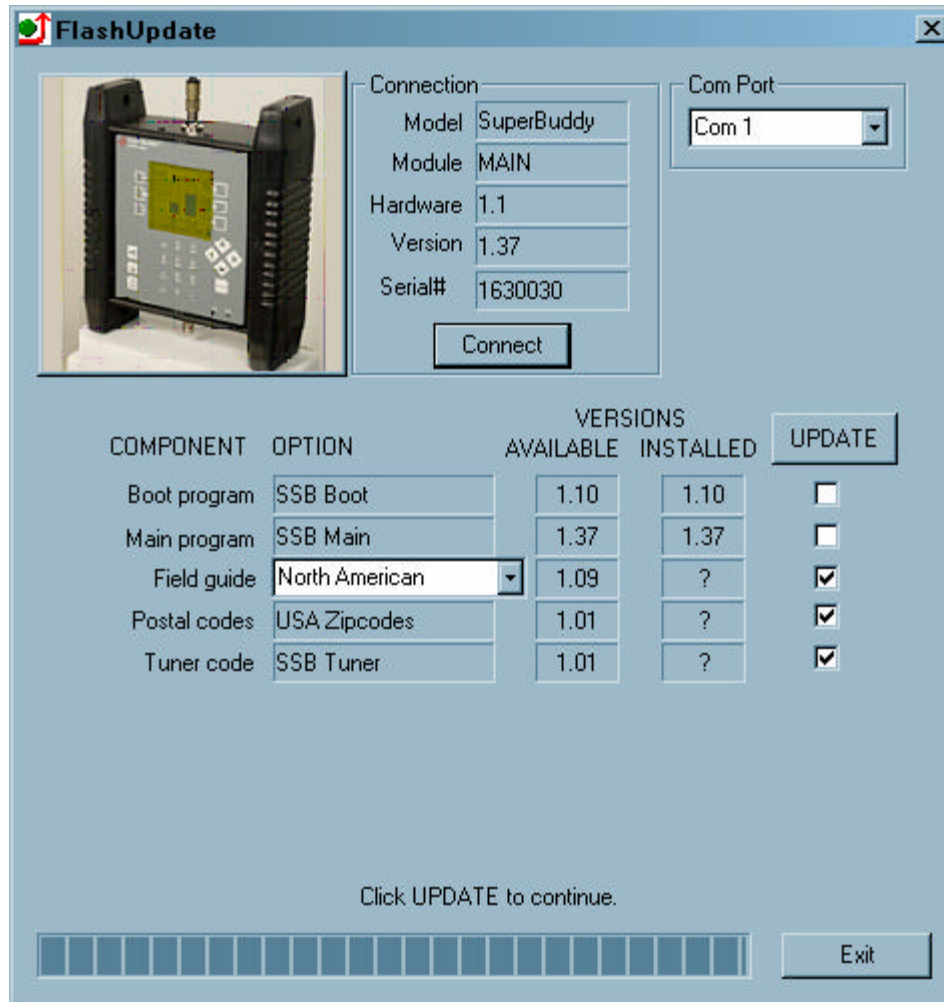
7) As soon as the connection is established, the application will access the website and obtain the latest available versions for the various components. These will be compared with the versions installed on your instrument. Any component with a newer version available will be checked.

8) Click "UPDATE" to start updating the instrument. This process is rather slow. The progress bar at the bottom will show the progress of each component.

9) When finished, click "Exit" to close the application.

Field Guides

There are several Field Guides available now and more may be added in the future. The different Field Guides cover different parts of the world. You can select the Field Guide you need using the pull down list.

If you simply want to change Field Guides even though no new versions are available, you may need to also put a check in the box before clicking "UPDATE". Only components that are checked will be updated.

WARRANTY

The Applied Instruments Super Buddy is warranted against defects in materials and workmanship for a period of twelve months. Applied Instruments agrees to repair or replace any assembly or component found to be defective under normal use during this period. Our obligation under this warranty is limited solely to repairing the instrument proven to be defective within the scope of the warranty when returned to the factory. Transportation to the factory is to be prepaid by the customer. Authorization (RMA#) by Applied Instruments is required prior to shipment.

Applied Instruments assumes no liability for secondary charges or consequential damages and, in any event, Applied Instruments' liability for breach of warranty under any contract shall not exceed the purchase price of the instrument shipped, and against which a claim is made.

Any application recommendation made by Applied Instruments for the use of its products is based upon tests believed to be reliable, but Applied Instruments makes no guarantee of the results to be obtained. This warranty is in lieu of all other warranties, expressed or implied, and no representative or person is authorized to represent or assume for Applied Instruments any liability in connection with the sale of our products other than that set forth herein.

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