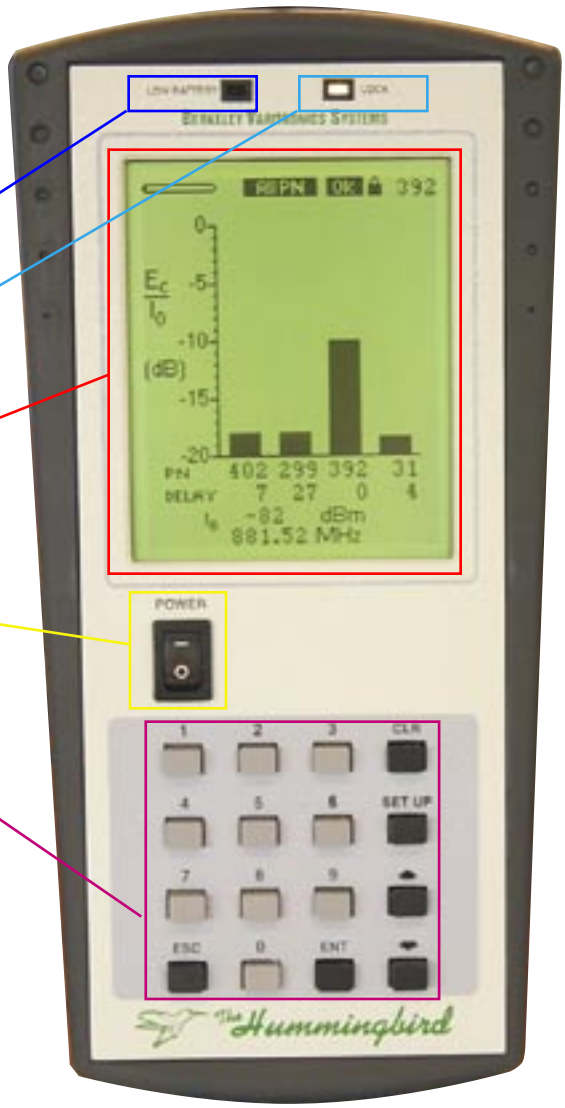
The Hummingbird

manual version 3.0

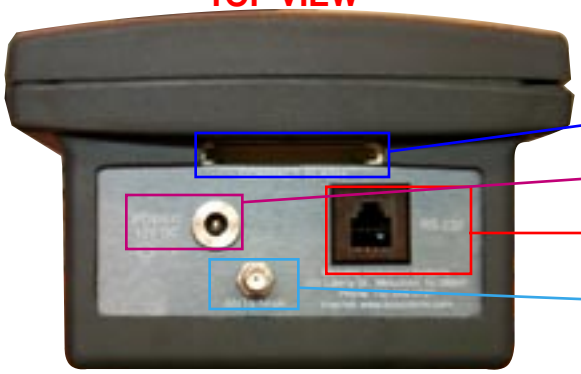
All PCS and Cellular Hummingbird models

Contents

FRONT VIEW



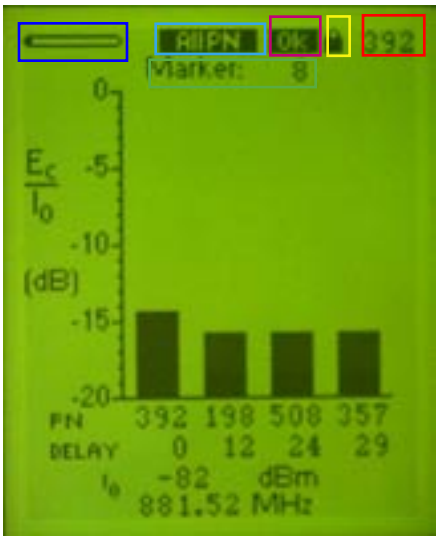
TOP VIEW



BOTTOM VIEW

Simply turn knob the spring-loaded knob counterclock-wise to release the Li-Ion battery. Charging time on each battery is approximately 1 hour. Run time varies from ≥8 (backlight on) to ≥12 hours. Hummingbird is powered from generic laptop (Toshiba) batteries that may be purchased at most computer outlets.

BATTERY REMOVAL & CHARGING

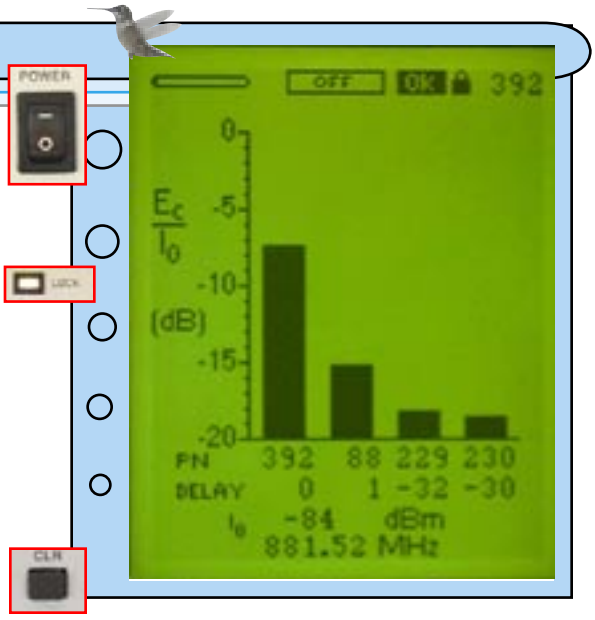


MAIN SCREEN ICONS

indicates remaining space left on compact flash card
indicates current logging mode (All PN or Top 4)
indicates compact flash card status as OK or bad
indicates status of sync channel "LOCK"
indicates current strongest basestation channel number
indicates current user marker number

- No GPS required
- Backlit graphic LCD
- Sync channel demodulation
- Removable lithium-ion battery
- Removable PCMCIA flash card for data storage (16MB capacity)
- Scans and displays all 512 base stations in 800ms
- Measures CDMA correlated signal strength (Ec/Io) ±1.0 dB
- "Playback" allows engineer to review problem spots with markers
- Serial-port (RS-232C) for PC control and downloading measurements

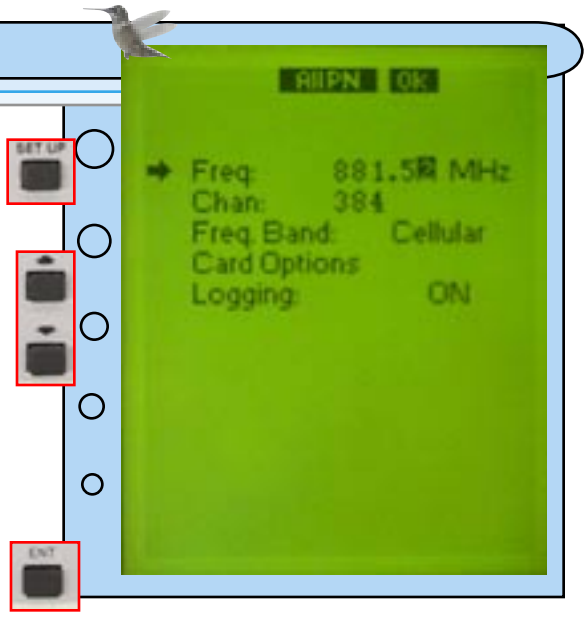
POWER ON



Upon powering up the **HUMMINGBIRD**®, the user must verify that the scanner is set to a carrier frequency for an active network. The current frequency (in MHz) is displayed at the bottom of the Hummmingbird's main screen. Use the Frequency Select or Channel Select options in the SETUP Menu to change this value. The Hummingbird will store the value of the carrier frequency even if it is turned off or if the battery is removed. The user will notice that the Hummingbird finds the strongest basestation (PN) and locks within a few seconds to this signal when tuned to an active network. The yellow "LOCK" LED indicates this lock status and only turns off should the signal become too weak or in extreme cases of multipath signal fading. The user may begin taking measurements immediately but should first familiarize themselves with **HUMMINGBIRD**'s basic menu features. The Backlight is only controlled through the CLR key on the **HUMMINGBIRD** keypad. Push to turn ON. Push again to turn OFF the backlight.

Note: While the **HUMMINGBIRD** does provide up to 12 hours using the supplied single lithium-ion battery, using the backlight substantially decreases battery life (approximately 8 hours of operation) so it is recommended to use the backlight only if necessary.

SETUP MENU



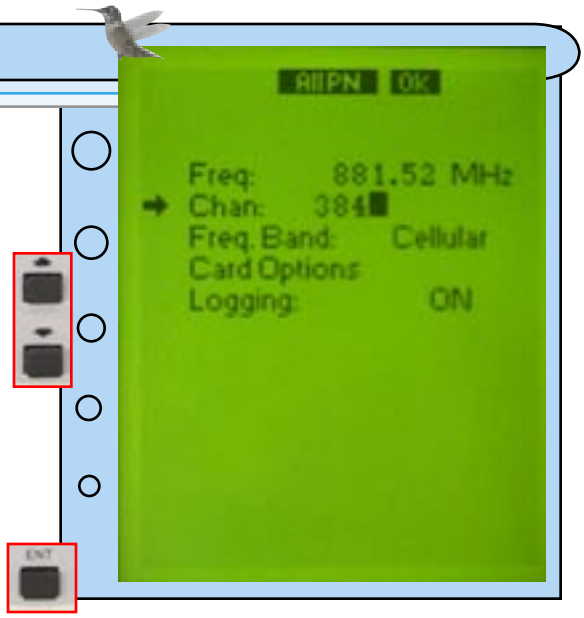
While in the main screen, press the SETUP button to enter the SETUP menu. Use the entire keypad here to navigate through this menu. ARROW keys move from between options, keypad numbers enter frequency and channel number, ENT key executes the selection and ESC takes the user back to the main scanning screen.

FREQUENCY SELECT

Users that know what basestation frequency they wish to scan must first enter the frequency number in the SETUP MENU. Use the keypad and hit ENT when finished.

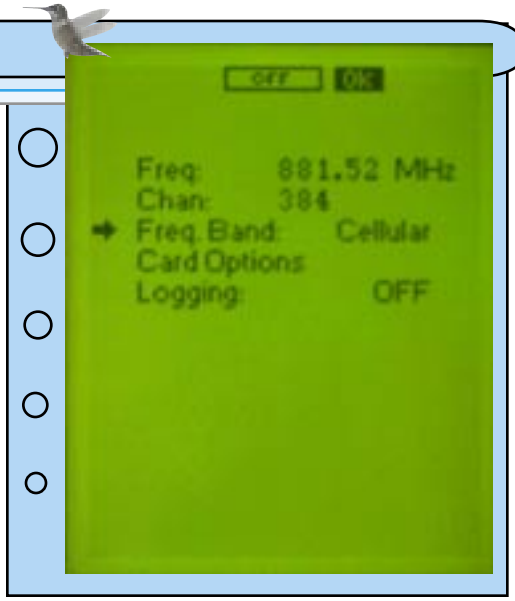
CHANNEL SELECT

Users that know what basestation channel they wish to scan must first enter the channel number in the SETUP MENU. Use the keypad and hit ENT when finished.



FREQUENCY BAND

This menu option indicates the receiver band supported by your **HUMMINGBIRD**. Cellular and PCS frequencies are the only two bands currently supported. This option is just a display and may not be altered.

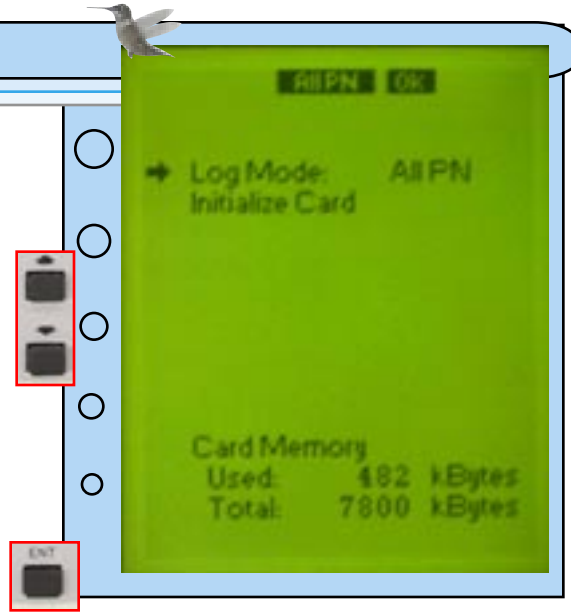


CARD OPTIONS

This menu option takes the user into a submenu indicating the compact flash card options available.

All PN:
This mode allows the user to switch between two different modes of receiving. The screen example here shows All PN has been selected. In this mode, the **HUMMINGBIRD** scans all 512 basestations (regardless of Ec/Io) and logs them to the compact flash card.

Note: In this mode, the average size compact flash card will fill up much more quickly than in the other mode.

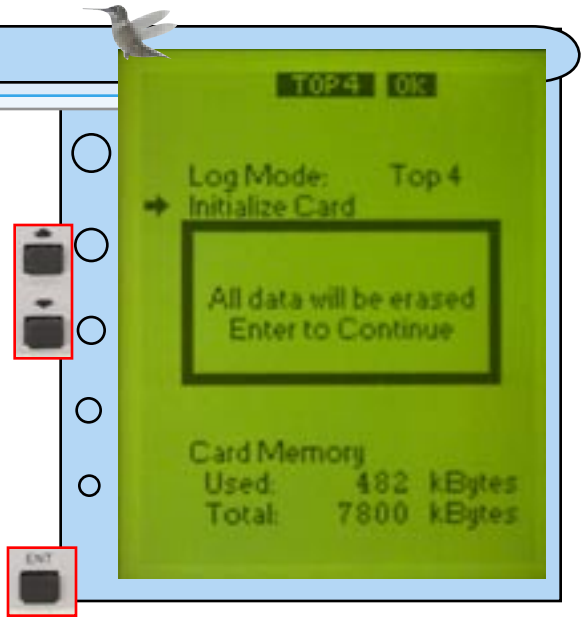


Be sure to keep watch of the remaining card space at the bottom of this menu. Larger compact flash cards are becoming increasingly cheaper and more available. The **HUMMINGBIRD** is currently shipping with a 16MB card. Should the user need further storage space, the **HUMMINGBIRD** is also equipped to spool out data from its serial port to any PC. See the Logging menu selection on the next page.

Top 4:
This mode allows the user to view and log the top four basestations and their Ec/Io measurements. The main screen will show the top four measurements regardless of the mode that is selected for storage.

INITIALIZE CARD

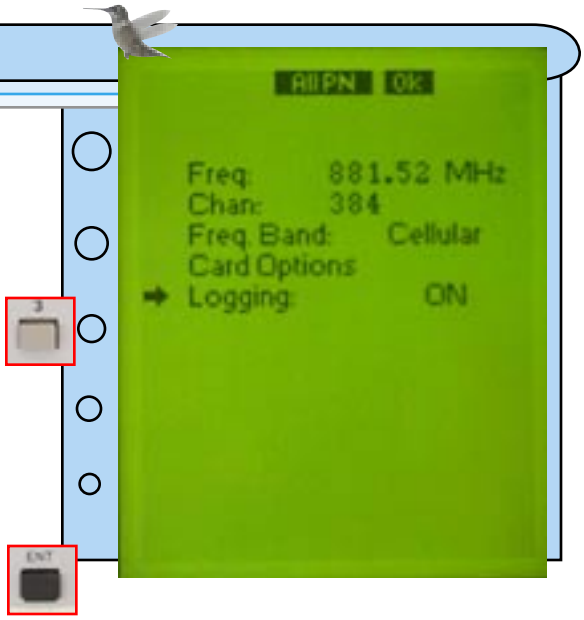
This menu option allows the user to initialize the PCMCIA compact flash card for use in the **HUMMINGBIRD**. This option must be chosen in order to proceed with recording to the compact flash card. Press the ENT key to continue with initialization after prompted with a message box.



LOGGING

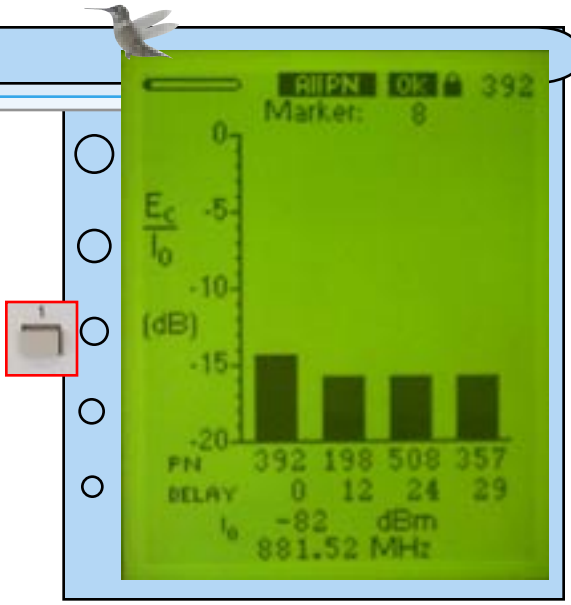
This menu option allows the user to toggle between recording and not recording to the compact flash card. Simply push the ENT key to turn ON (begin logging) or turn OFF (stop logging) this option. Thsi option can also be toggled ON or OFF at any time in the main signal strength screen by pressing the number 3 key on the keypad.

Note: The serial port is always outputting data regardless of the logging option setting. This allows the user to collect all data directly to a PC for virtually unlimited storage of data limited only by the size of the hard drive.



MARKER

This feature allows the user to set incremental markers simply by pressing the number 1 key on the keypad. The marker number increases by one each time the marker key is pressed. The marker number will disappear from the screen after about three seconds of being displayed. Initialization of the card will destroy all data as well as the marker data.



HUMMINGBIRD SOFTWARE

The Hummingbird includes two separate pieces of software; the Hummingbird Data Logger™ (HDL) application and Chameleon CDMA™ application. HDL collects data from the Hummingbird and displays the data. The HDL also logs the data to binary files. Chameleon software is the universal data conversion and filtering tool for BVS Receivers. Be sure to visit the Berkeley website to obtain the latest verison of these freely distributed applications <www.bvsystems.com>

System Requirements

Pentium II
500 MHz
64MB RAM
100MB free on Hard Drive
Operating System: Windows 95/98/Me
Hummingbird interface: 1 free serial port between COM1: and COM4:

Introduction

The Hummingbird Data Logger (HDL) is the PC interface to the Hummingbird. This application collects data from the Hummingbird and displays the data. The HDL also logs the data to binary files.

The binary data files, that are created, may then be used as input into BVS's Chameleon application. This application formats and filters these data so that they may be used with a variety of popular post-processing packages such as MapInfo or MSI Planet.

Installation

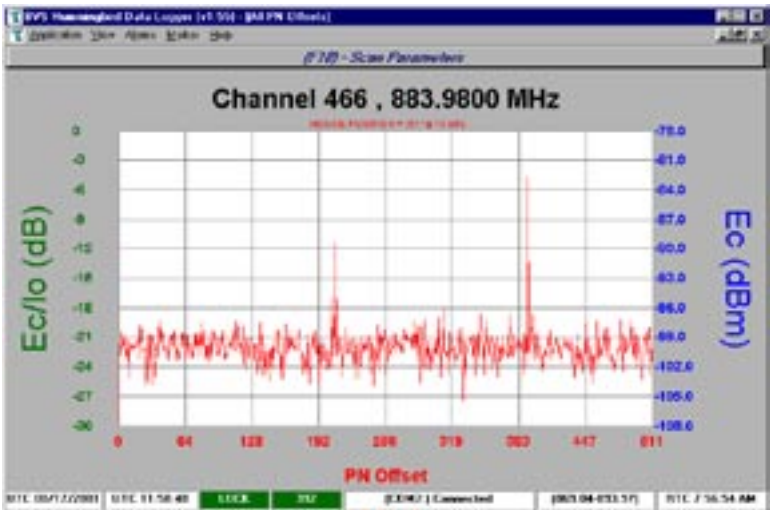


Figure 1 – Hummingbird Data Logger

The installation of HDL can be completed in a few minutes. Place the included software installation CD into an available CD-ROM drive. Wait a few seconds for the software installation window to appear.

Click on the "Install Windows Software/Drivers" button. Then choose Hummingbird from the drop down list by the message "I want to install a…". The applications available for use with a Hummingbird are highlighted. Choose the Hummingbird DL button.

You will be prompted through the InstallShield installation process. After this process has been completed, an icon will be created in the folder that has been specified. This icon will launch the HDL application.

Application Overview

HDL was designed to allow users to display and log scan data with relative ease. All of the controls are located in the parameter panel. A status bar is provided at the bottom of the main screen to provide important system status information.

Figure 2 – Parameter Screen

Data being received from the Hummingbird includes statuses as well as the latest information for each of the 512 PN offsets.

Quick Start

1. Connect serial cable from Hummingbird to available serial (DB9) port.
2. Turn on Hummingbird.
3. Start Hummingbird Data Logger.
4. Choose communications port (usually COM1:).
5. Choose screen, logging, and other options.
6. Press F10 to view data on the screen real-time.

Parameter Screen

Log File Information

Clicking on the SELECT button in the Log File Information group box brings up a dialog box to choose a filename for logging data and/or alerts. After a file is chosen, it will appear next to the “Data:” or “Alerts:” caption. Checking the “Log Data” checkbox begins the logging of information from the Hummingbird. Unchecking this box stops the logging process. The size of the file is displayed next to the “Size:” caption. NOTE: Data being logged contains all 512 PN offsets, the logging mode of the unit does not affect the PC logging.

Data Averaging

The data averaging group box allows for the averaging of data coming into the serial port. The rolling averages will average the last N values, N being either 4 or 16. The weighted sum average places a higher weight on the current point. “None” simply displays the latest point. NOTE: The averaged data is not stored to the data file. The original data is stored.

Display Selections

The “Display Selections” group allows the user to select the data to be displayed on the screen. It is broken down to 5 different screens, each of which is described later in this document. Some screens have an associated option button that allows the user to select different ways to display the data for tat particular screen.

Checking the particular screen tells the HDL to display it when in display screen mode. Any or all of the screens may be displayed at the same time. Multiple screens will be tiled into the available area. Press F10 from the parameter screen to access the display screen mode.

Display Screens

PN Temporal Screen (All 512)

This screen will display all 512 PN offsets. Ec/Io is shown on the left and Ec is shown on the right. There are no options for this screen.

Top PN Offsets

This screen displays the top PN offsets based on the current averaging scheme. 1 to 20 PN offsets can be chosen from the options screen. The colors of the bars may also be chosen, based on selections of TAdd and TDrop.

Among the other options is the reuse bucket, which will mark a bar with the chosen color if the PN is not in the specified reuse bucket. For example, if the reuse bucket is 4 and the PN offset is 6, then the bar would be the reuse color. If the PN offset is 8, then the bar would be colored based on the Tadd/Tdrop colors.

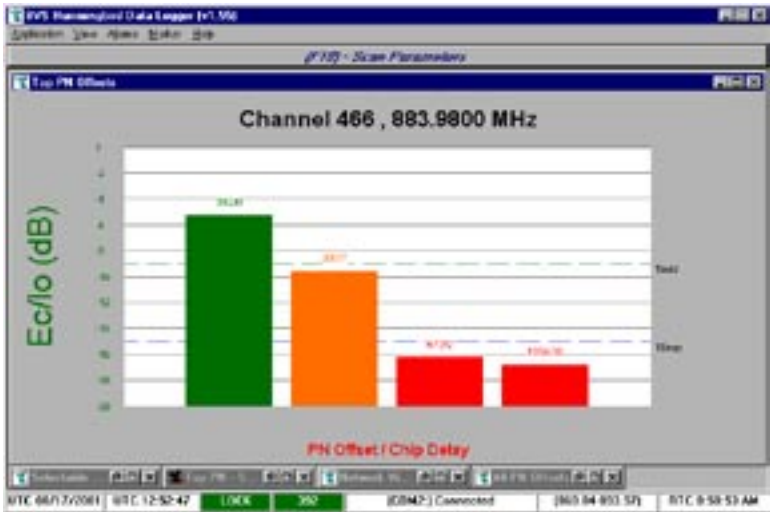


Figure 3 – Top PN Offsets

Figure 4 - Top PN Offset Option Dialog

The user may also choose how to order the displayed bars. The order can be by Ec/Io, by Base Station, or by the last position the PN was seen on the screen.

Selectable PN Offsets

This screen allows the user to select PN offsets to display, so as to monitor particular offsets. The options dialog for this screen let the user choose three offsets to watch. The fourth bar will always be the PN offsets to which the Hummingbird is locked.

Figure 5 – Selectable PN Offset Option Dialog

Top PN Offsets (Search Window)

This screen shows the top PN offsets in a search window view. Using the options screen, the user can set a search window. This window will be displayed around the locked PN offsets. This screen is useful in that it will show PN offsets and whether or not a phone will find them based on whether they are in or out of the search window.

An accumulation of data is shown on this screen as a history plot, to show general trends in the search window.

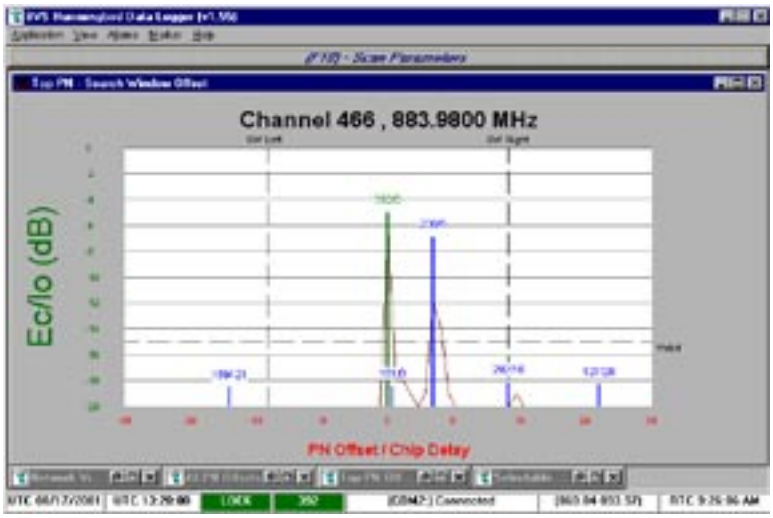


Figure 6 – Search Window Screen

Network Violations Alert Data

The network violation screen lists possible network problems based on options selected. These options include reuse bucket violations, search window violations, and network holes based on no pilots above Tadd.

Status Bar

The status bar on the bottom of the main screen contains the UTC Time and Date received from the locked PN. The status on whether the unit is locked and/or sync'd is also displayed. If the unit is locked, the lock box will be green. Otherwise, the box will be red. The same can be said for the SYNC box. However, if the unit is sync'd, the PN offset being tracked is displayed.

Connection status is also displayed. The frequency range of the unit and the real-time clock round out the status bar.

Menu Options

Application Menu

The user may exit the application from the application menu.

View Menu

The view menu allows the user to toggle between the display screens and the parameter screen. F10 and the button bar also accomplish this task.

Alarms Menu

The alarm alerts the user if communication has been lost with the Hummingbird.
The alarms may be set to be audible, visible, or both. These options may be selected from the Alarms menu. If the audible alarm is checked, then a system beep will repeat for as long as the

condition remains present. A visible alarm will pop up a message box stating the alarm condition.

Marker Menu

The marker menu as well as F7 will place a data marker in the log file for use during conversion.

Help Menu

The help menu contains the on-line version of this manual as well as the application “about box” which will display version information and disclaimer(s).

Introduction

The Chameleon application software is the universal data conversion and filtering tool for BVS Receivers. The Chameleon was designed to greatly simplify the transfer of receiver data to many popular post-processing applications such as MapInfo and MSI Planet. In addition to the ability of this application to convert data into custom formats, different filtering capabilities are available to facilitate the extraction of useful data needed for network analysis.

The following sections of this document outline the various features of the Chameleon software.

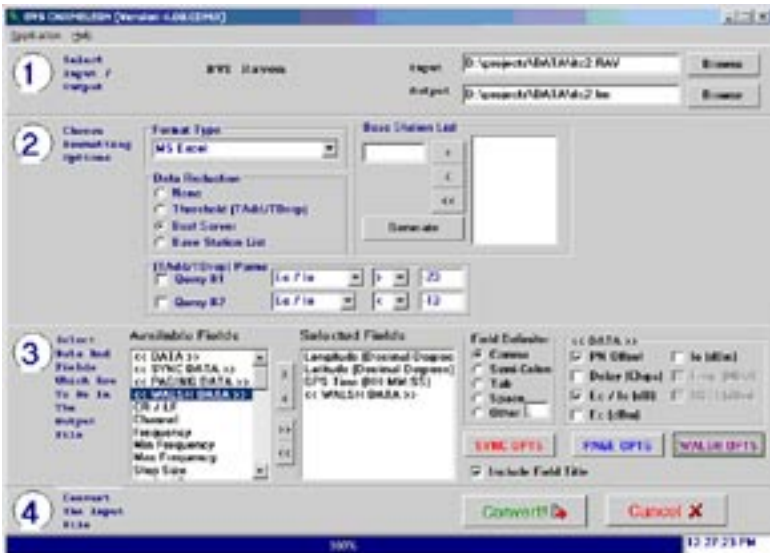


FIGURE 1 – Chameleon Main Screen

Installation

Installation of Chameleon is straightforward. Insert the CD provided with the product purchased into the computer. Wait a few seconds for the auto-run program on the CD to boot up. Choose Chameleon CW from the list of applications to install. This will load the installation program. Next, follow the steps outlined by this application. After the installation has been completed, an icon will be placed in the chosen folder (default is “BVS”).

Running the Application

After starting the application, the main screen will appear. There are four steps to conversion which are outlined in the following sections.

Main Menu

The main menu contains options to save and retrieve configurations. The “Save Configuration” option under the APPLICATION menu will save information stored in all fields on all notebook pages. This allows the user to save custom configurations for use on a number of different files. Any saved configuration can be restored using the “Open Configuration” option in the APPLICATION menu. The configuration files are stored in ASCII form. DO NOT modify these configurations manually! Any manual change to the configuration files may result in the loss of configuration information.

Step 1 – Select Input / Output

Choose the data file that is to be converted. Chameleon will automatically determine which product

created the file. Chameleon will display the product type next to the filename. A default output filename will be chosen with the .OUT extension. This may be modified to suit the users needs.

Step 2 – Choose Formatting Options
This step enables the user to specify which data is to be converted. This section also contains various filters that can be used to reduce the amount of information being converted into the output file.

Choose which receivers are to be converted. Different CW products have a different amount of receivers. Chameleon will only convert data from the receivers which are selected here.

Choose the Data Reduction Type. Either all of the data will be converted or just the data for the strongest server (RSSI), depending on the choice chosen here.

Choose the Average Type. Depending on the product, different options will be available here. Certain products will have the choice of 40 lambda averaging (Panther for example).

One of the powerful features of Chameleon is its ability to convert data into a large number of formats. By selecting the appropriate post-processing application, the correct fields will be selected and placed in the selected field box in the appropriate order. If the format selected requires information that is not ASCII-delimited, no fields will show as selected in the selected field box. The data for these non-ASCII formats is fixed thus the user will not be able to adjust the order or the number of fields to be converted.

The user may also choose a custom ASCII format of a type that is not represented by any of the supported post-processing applications. This is accomplished by choosing “Custom Configuration”. As stated above, these configurations can be saved in configuration files by using the “Save Configuration” option found in the APPLICATION menu.

Step 3 – Select Data and Fields Which Are To Be In The Output File
Select the fields that are to be placed in the output file. The delimiting character may also be chosen. Field titles may be placed in the output file by checking the appropriate box. To include data fields as specified by the “Output Filter” page, be sure to have the “<<DATA>>” field in the selected box.

When a particular post-processing format type has been chosen, fields will be displayed in the selected box. If the format chosen is a non-ASCII delimited custom format, the selection boxes will be inactive.

Step 4 – Convert The Input File
Press the CONVERT button. The progress bar will be updated as the file is being processed. The speed of conversion will vary based on the data filter chosen.

After the message appears stating that the conversion has been completed, the converted file will be ready for import into the specific post-processing application that you have chosen.

CELLULAR CHANNEL SPACING AND DESIGNATION

The Primary CDMA Channel shall be channel number 283 for System A and channel number 384 for System B.

The Secondary CDMA Channel shall be channel number 691 for System A and channel number 777 for System B.

JCDMA FREQUENCIES / CHANNEL NUMBERS

Band A device #141

Channels 1-799 f_T=860+N(0.0125) MHz
Channels 801-1039 f_T=843+(N-800)(0.0125) MHz

Band B device#142

Channels 801-1039 f_T=843+(N-800)(0.0125) MHz
Channels 1041-1199 f_T=832+(N-1040)(0.0125) MHz

JCDMA phones must operate on even channels between 51-749, 851-989 and 1091-1149

HUMMINGBIRD BINARY FILE FORMAT

Data collected from the BVS Hummingbird is stored either on the PC or on the PC Card inserted in the Hummingbird unit. The formats of files in both locations is the same.

The first 3 words (2 bytes) contained in the data file are:

Sector
Offset
Marker

A PC file will store 0's in these 3 words. A PC Card file will populate these 3 fields so that the number of bytes of data may be determined. This is useful due to the fact that ALL PC Card files are 8MB even though the amount of data will vary from file to file.

The number of data bytes can be determined from the following formula:

Total Bytes = Sector*512 + Offset ^

^ Unless otherwise noted, all words are in Intel reverse order, low order byte first.

The marker value is the marker on the Hummingbird when the log file was created.

All other records in the data file contain the following header:

Marker Information
<Marker Number>

Marker Number = Current marker number.

See sample data file for an example of valid Hummingbird data.
Sample Data File

The following file contains Top 4 PN information:

4D 01 B2 00 07 00 05 00 04 00 28 71 67 74 1E 00
C8 72 07 00 01 00 0D BC CC 24 00 03 E2 FF 88 01
0D 00 0D 00 02 00 AC F2 00 00 88 01 00 80 00 80
58 00 00 80 00 80 D0 00 00 80 00 80 A8 01

WORD #	DESCRIPTION	VALUE
1	Sector	333
2	Offset (total=170674 bytes)	178
2	Marker	7
3	Record Length	5 (words)
4	Record ID	4 (RF Header)
5	Minimum Frequency	28968 (869.04MHz)
6	Maximum Frequency	29799 (893.97MHz)
7	Step Size	30 (KHz)
8	Current Frequency	29384 (881.52MHz)
9	Record Length	7
10	Record ID	1 (Information)
11	UTC Time	617397261 seconds
12	UTC Time (cont.)	7/30/99 19:14:21
13	E Scale	768
14	Io Value	-30
15	Locked PN	392
16	Flags	0x000D (Tracking)
17	Record Length	13
18	Record ID	2 (Top 4 PN)
19	Ec/Io	(-3413/256)-13.33
20	Chip Delay	0
21	PN Offset	392
22	Ec/Io	0x8000 (N/A)
23	Chip Delay	0x8000 (N/A)
24	PN Offset	88
25	Ec/Io	0x8000 (N/A)
26	Chip Delay	0x8000 (N/A)
27	PN Offset	208
28	Ec/Io	0x8000 (N/A)
29	Chip Delay	0x8000 (N/A)
30	PN Offset	424

<Record Length><ID>
where
<> denotes a word.
[] denotes a byte value.
{} denotes a double word (4 bytes) value.

Record Length = Length of record in words.
ID = Identifier of current record type.

The following record types are available:

ID	Description
0x0001	Unit Information
0x0002	Top 4 PN Data
0x0003	All PN Data
0x0004	Header Information
0x0005	Marker Information

UNIT INFORMATION
{ UTC Time}<EScale><Io><Locked PN><Flags>

UTC Time = Time in seconds since 1/6/1980.
EScale = Offset Factor used to calculate Ec/Io.

where
Ec/Io = 20xlog(Count/0x4000) + EScale/256

See data records for description of count.

Io = Current Io value.
Locked PN = PN to which the Hummingbird is locked (0 511).
Flags = Bit flags

where
Bit 0 = SET:Tracking CLEAR:Not Tracking
Bit 1 = SET:Sync'd CLEAR: Not Sync'd

Top 4 PN Data
<EcIo><Chip Delay><PN Offset> * 4

Repeated for 4 PN Offsets

EcIo = Ec/Io (signed whole number (e.g. –3413/256 = -13.33))
  Divide number by 256 for correct value.
Chip Delay = Delay in chips from locked PN (-32 to 32).
PN Offset = From 0 511.

NOTE: If Ec/Io is 0x8000, then there is no valid PN Offset in this block. This would happen when there is less than 4 PN Offsets above the noise threshold.

All PN Data
<Count><Chip Delay> * 512

Repeated for 512 PN Offsets

Count = Counts to be used in above formula to calculate Ec/Io.
Chip Delay = Delay in chips from locked PN (-32 to 32).

The order of the PN Offsets in this record are as follows. The first PN Offset is the locked PN. Therefore, if the locked PN is 208, then the first block would be for PN 208, the second would be for 209, etc.

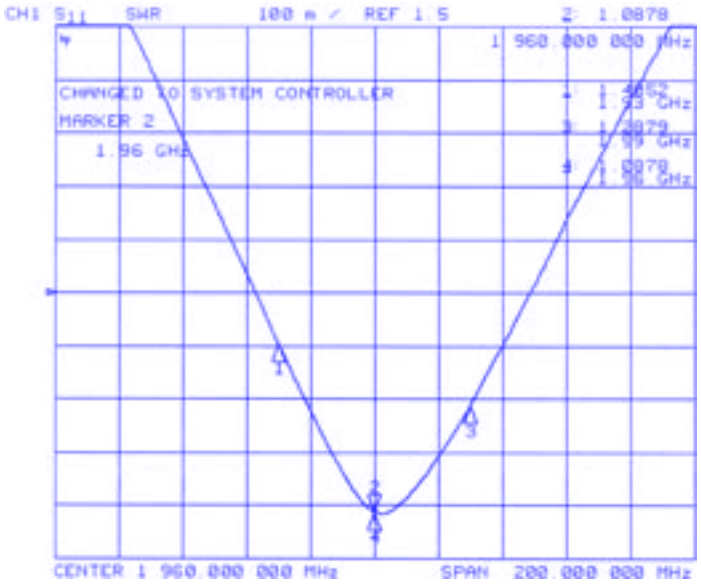
Header Information
<Min Frequency><Max Frequency><Step Size><Current Frequency>

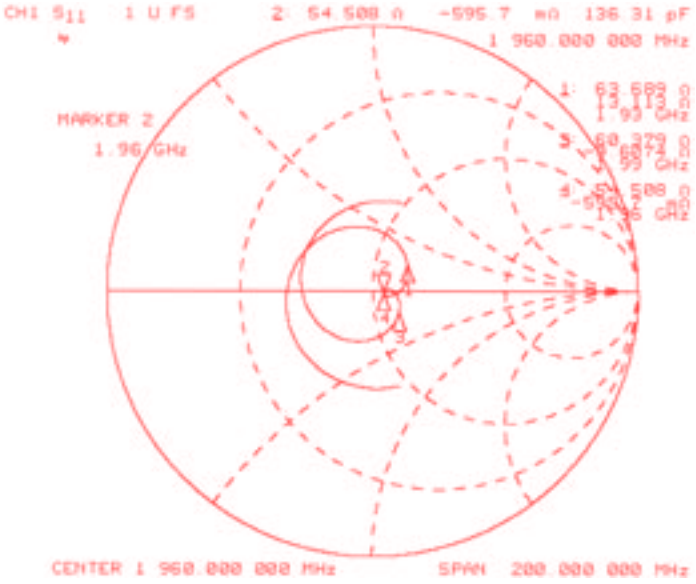
Contains RF header information

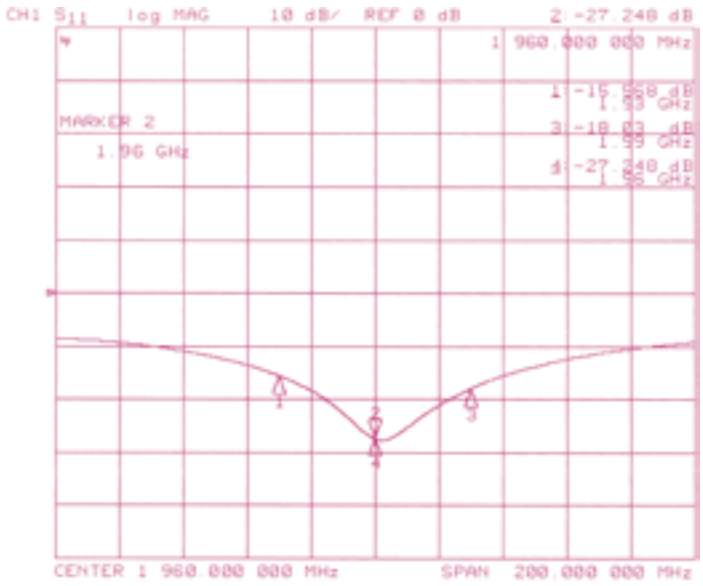
Min Frequency = Minimum frequency for this unit in step size units.
Max Frequency = Maximum frequency for this unit in step size units.
Step Size = Step Size in KHz. (e.g. 30 for cellular)
Current Freq. = Currently set frequency.

where
current frequency = (current frequency)x(step size) (in KHz)
same for min and max frequencies.

PCS SMA ANTENNA SPECIFICATIONS







BATTERY SYSTEM

Hummingbird includes the PA2488U Battery Charger provides a convenient way to charge main battery packs without requiring use of your computer. The battery charger holds up to two Lithium-Ion battery packs, which it charges one after the other in succession.

Charge time is about 2 to 3 hours per battery. The actual times may vary according to the condition of the battery and other factors such as variations in battery capacitance. For example, a battery that has not been used for a long time might take longer to charge, because batteries tend to self-discharge.

The battery charger comes with its own Universal AC Adapter. Be sure to use only this adapter with your battery charger.

CAUTION

Use of the w rong AC adapter could damage your equipment. please read this instruction manual carefully to assure proper operation and care oJ your battery charger and AC adapter.

PRECAUTIONS

• Use only the AC adapter that came with the Battery Charger.

• Do not leave batteries in the Battery Charger unless they are being recharged.

• Remove the battery pack from the Battery Charger when it is not connected to a power source.

• Do not attempt to charge a fully charged battery pack.

• Observe temperature and humidity specifications:
5° to 35°C (41° to 95°F), 20% to 80% humidity

• Avoid sudden or extreme temperature changes and exposure to high temperatures such as close proximity to heaters or inside cars in warm weather.

• Avoid exposure to direct sunlight, dust and moisture.

• Do not spill liquids or put metal objects in the Battery Charger's sockets.

• Do not place objects on the Battery Charger or AC adapter.

• Do not drop, bump or otherwise subject the Battery Charger or AC adapter to undue shock.

• Do not pull or twist power cables.

• Do not attempt to disassemble the Battery Charger or AC adapter.

• Use a slightly damp cloth to clean the Battery Charger and AC adapter. If extremely dirty, use a neutral detergent.

WARNING

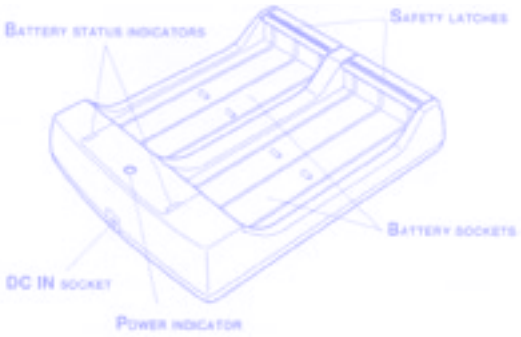
Always disconnect the Battery Charger and AC adapter from all power sources before cleaning. Cleaning these devices while they are connected to a power source can cause electric shock.

Battery Charger Parts

The Battery Charger has sockets for two batteries. LUD indicators let you monitor the charge status of' the batteries and the power status (it the battery charger.

• Battery sockets
Each of the two sockets, 1 and 2, in the Battery Charger accomodates one battery pack. Insert a battery into either socket for recharging.

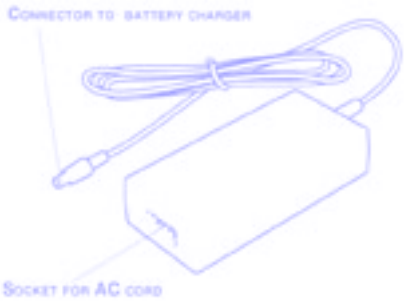
• Indicator lights (for details see the Indicator Lights section) An indicator at each socket shows the status of the battery. A power indicator shows the status of input power.



• **DC IN** socket
The AC adapter plugs into this socket located at the back of the Battery Charger.

• Safety latches
A safety latch secures the battery pack, in place to protect it front accidental dislodging.

AC Adapter Parts
The universal AC adapter supplies 15 volt DC power to the battery charger.
Since it is universal, it can receive a range of AC voltage between 100 and 240 volts.



Recharging a Battery Pack
This section describes handling precautions, powering on the charger. inserting a battery. removing a charged battery and the indicator lights.

Handling precautions
When a battery pack is installed, observe the following to prevent the battery pack from accidentally detaching or falling out of the charger.

• Make sure the battery is fully seated and secured by the safety latch.
(See Inserting the Battery Pack.)

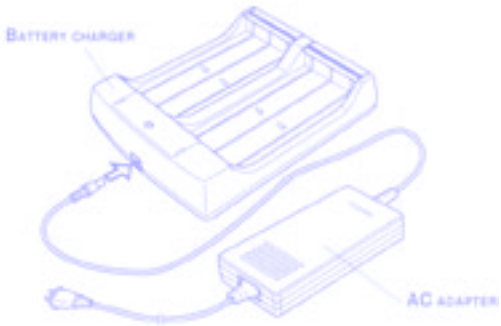
• Before you connect the battery charger to a power source, make sure it is on a flat, level surface.

• Do not set it on an incline.

• Do not move the battery charger while it is charging a battery.

• Do not tilt or turn over the battery charger.

• Do not apply excessive pressure or impact to the battery charger.



Powering on the Battery Charger
To use the Battery Charger, you must first attach the AC adapter.

BATTERY CHARGING
1 . Connect the power cord to the AC adapter.

2. Plug, the AC adapter's round connector into the DC IN socket on the back of the Battery Charger.

3. Plug, the AC adapter's power cord into a wall OLHIC1. The power indicator should glow green.

Inserting the Battery Pack
To insert a battery pack, follow the steps below:

1. Set the terminal end of the battery pack into the connectors on the battery charger.

2. Pull back the safety latch and lay the battery pack in the charger.

3. Release the safety latch so it covers the end of the battery.

Quick charge begins when the AC adapter is connected. 11 takes about 2 to 3 hours to fully charge a battery pack. When the battery status indicator lows green, the battery is fully charged.

If you first connect the AC adapter to the battery charger and a power source then insert two batteries, the battery

inserted first is charged first. If you insert the batteries before you connect the AC adapter, the battery in slot 1 is charged first.

When a battery becomes fully charged, the Battery Charger automatically begins charging the other battery. Also, when a battery is fully charged, the Battery Charger tops quick charge and begins trickle charge so the batteries will not overcharge even if left in the Battery Charger. It is best, however. to remove batteries when they become fully charged.

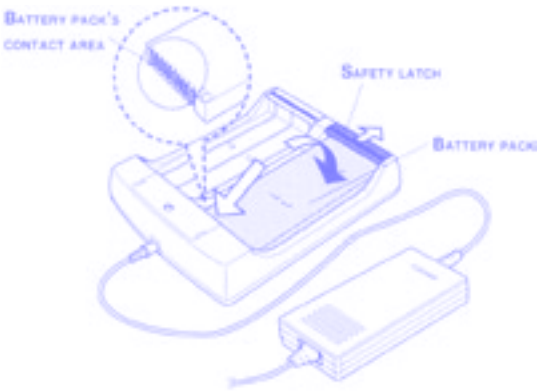
Battery charging notice
The battery may not charge right away under the following conditions:

1. The battery is extremely hot or cold. To assure the battery charges to its full capacity, charge the battery at room temperature from 10' to 301C (501 to 881F).

2. The battery is nearly completely discharged. Leave the AC adapter connected for a few minutes and the battery should begin charging.

Removing the Battery Pack

To remove a battery pack:



1. Pull back the safety latch.
2. Lift out the battery pack.

Indicator Lights

Battery Status Indicators

No light	No battery pack is inserted.
Glows orange	Battery pack is being quick charged.
Glows green	Battery pack is fully charged or being trickle charged.
Blinks orange	Battery pack is waiting for charge.
Blinks red	Fault condition. (For example, the battery pack may be too hot or malfunctioning.)

Power Status Indicator

No light	Not connected to power source.
Glows green	Battery charger is connected to a power source and is operating normally.
Blinks red	Battery Charger or AC adapter is malfunctioning or the wrong AC adapter is connected.

The Power Status indicator might blink red if power to the unit is cut off and restored, for example, by a power outage. If the indicator blinks red, disconnect the AC adapter and remove the battery. Make sure the AC adapter is the correct model, then try again to charge the battery. If the indicator continues to blink red, contact your BVS.

Troubleshooting
If Your Battery Charger or AC adapter does not operate as it should, review the procedures in this manual. Then:

• Check all cable for firm connections.

• Check that the batteries are firmly seated in Battery Charger sockets.

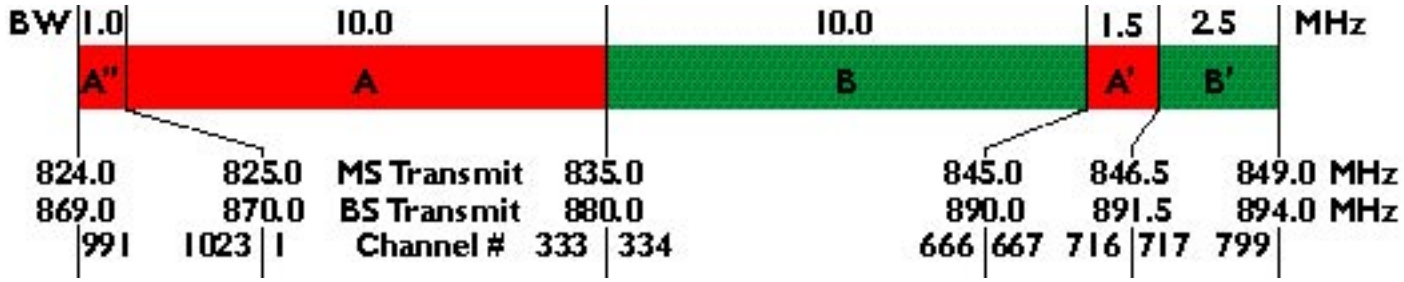
• If a battery status light blinks red. (he battery may be malfunctioning, or hot. It you have a spare battery pack, try to charge it. If it charges properly, the problem is with the first battery pack. If the indicator continues to blink red, the problem may be with the Battery Charger. Contact your dealer.

• It the power indicator blinks red, the Battery Charger or AC adapter may be malfunctioning. Contact your dealer.

Frequency Plans

Cellular (IS-95A)

CDMA cellular service is intended to share the existing AMPS spectral allocation, shown below.

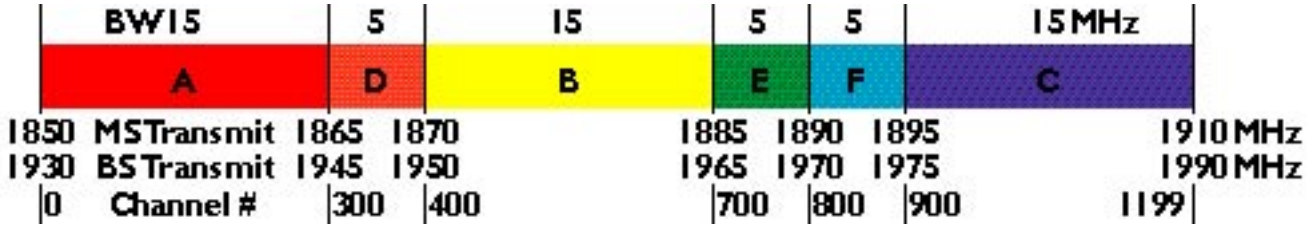


Consecutive AMPS channels are spaced by 30 kHz. CDMA stations are permitted to operate on any AMPS channel, except for guard bands at the edges of the allocations. CDMA stations, of course, would normally be assigned channel at least 1.25 MHz apart (about 42 channels). The mobile station transmit frequency is always 45 MHz lower than the base station transmit frequency.

Both A and B operators have 12.5 MHz of spectrum in each direction. Each allocation, however, is split, and the splits are not the same for the two operators, as shown in the figure. Note that the A' and B' allocations present problems, both for the RF hardware design, and for the allocation of CDMA channels. The B' band, in particular, accommodates two CDMA channels only if they are overlapped slightly, at some small loss of capacity.

PCS (J-STD-008)

PCS is allocated 60 MHz total in each direction, as three 15 MHz bands plus three 5 MHz bands, shown below.



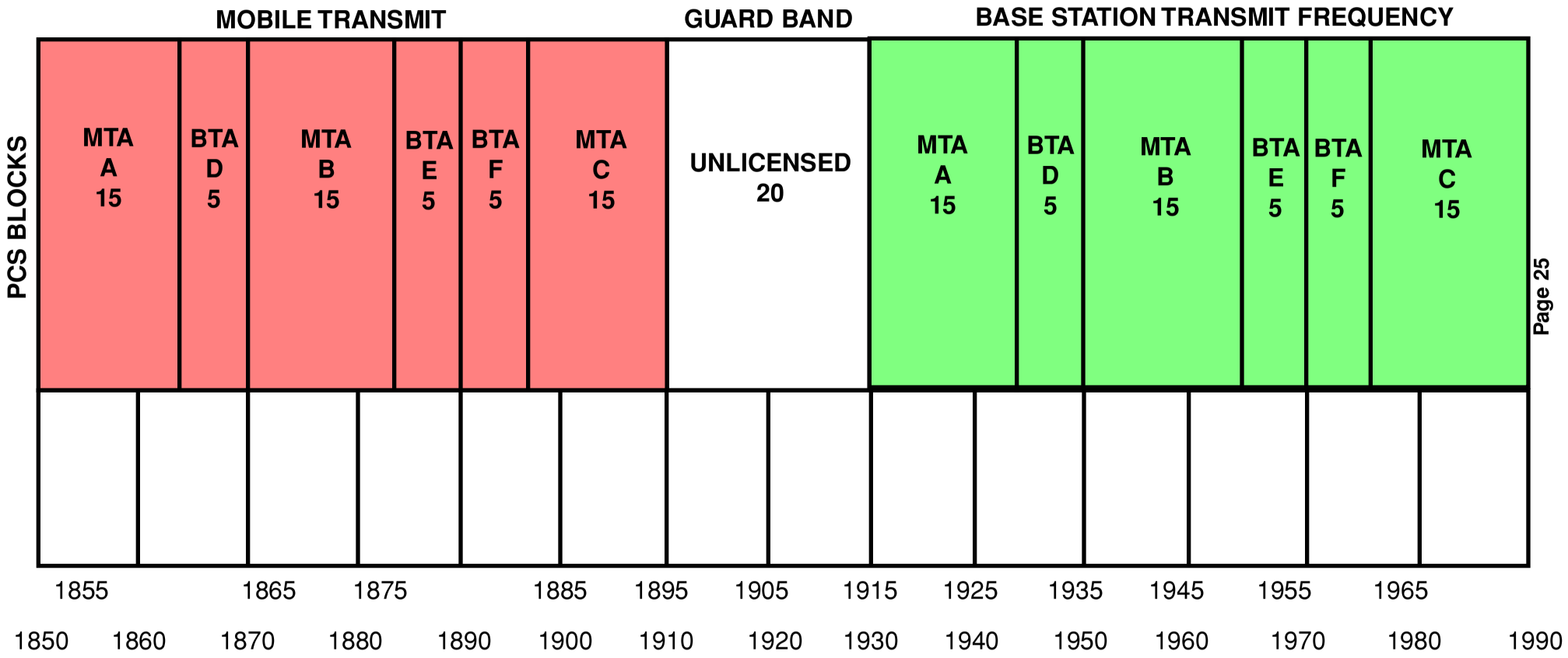
Consecutive frequency assignments are spaced by 50 kHz. Assignments near band edges are conditional, depending on whether the neighboring bands are held by the same operator. Operation near the edges of the service is forbidden in 1.2 MHz guard bands.

In contrast to the cellular service, the standard suggests particular channel numbers as preferred CDMA frequency assignments as follows.

CDMA Preferred Frequency Assignments

Band	Preferred Channels
A	25, 50, 75, 100, 125, 150, 175, 200, 225, 250, 275
D	325, 350, 375
B	425, 450, 475, 500, 525, 550, 575, 600, 625, 650, 675
E	725, 750, 775
F	825, 850, 875
C	925, 950, 975, 1000, 1025, 1050, 1075, 1100, 1125, 1150, 1175

PCS ALLOCATION TABLE



Glossary of Acronyms

AC	Alternating Current
A/D	Analog to Digital converter
AGC	Automatic Gain Control
Applet	a small Application
BER	Bit Error Rate
BPSK	Binary Phase Shift Keying
BW	Band Width
CDMA	Code Division Multiple Access (spread spectrum modulation)
DC	Direct Current
D/A	Digital to Analog
dB	decibel
dBm	decibels referenced to 1 milliwatt
DOS	Digital Operating System
DSP	Digital Signal Processing
FIR	Finite Impulse Response
GHz	GigaHertz
GPS	Global Positioning System (satellite based)
GPS diff.	GPS error correction signal which enhances GPS accuracy
IF	intermediate frequency
I and Q	In phase and Quadrature
kHz	kiloHertz
LCD	Liquid Crystal Display
LO	Local Oscillator
Mbits	Megabits
MHz	MegaHertz
modem	modulator/demodulator
PC	Personal Computer
PCS	Personal Communications Service (1.8 to 2.1 GHz frequency band)
PN	Pseudo Noise
QPSK	Quaternary Phase Shift Keying, 4-level PSK
RF	Radio Frequency
RSSI	Receiver Signal Strength Indicator
UCT	Universal Coordinated Time
VAC	Volts Alternating Current
VGA	Video graphic

IMPORTANT SAFETY INSTRUCTIONS

When using your telephone equipment, basic safety precautions should always be followed to reduce the risk of fire, electric shock and injury to persons, including the following:

1)Read and understand all instructions.

2)Follow all warnings and instructions marked on the product.

3)Unplug this product from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.

4)Do not use this product near water, for example, near a bath tub, wash bowl, kitchen sink, or laundry tub, in a wet basement, or near a swimming pool.

5)Do not place this product on an unstable cart, stand, or table. The product may fall, causing serious damage to the product.

6)Slots and openings in the cabinet and the back or bottom are provided for ventilation, to protect it from overheating these openings must not be blocked or covered The openings should never be blocked by placing the product on the bed, sofa, rug or other similar surface. This product should never be placed near or over a radiator or heat register. This product should not be placed in a built-in installation unless proper ventilation is provided.

7) This product should be operated only from the type of power source indicated on the appliance. If you are not sure of the type of power supply to your home, consult your dealer or local power company.

8)Do not allow anything to rest on the power cord. Do not locate this product where the cord will be abused by persons walking on it.

9)Do not overload wall outlets and extension cords as this can result in the risk of fire or electric shock.

10)Never push objects of any kind into this product through cabinet slots as they may touch dangerous voltage points or short out parts that could result in a risk of fire or electric shock. Never spill liquid of any kind on the product.

11) To reduce the risk of electric shock, do not disassemble this product, but take it to a qualified service facil4 when some service or repair work is required. Opening or removing covers may expose you to dangerous voltages or other risks. Incorrect reassembly can cause electric shock when the appliance is subsequently used.

12)Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:

A) When the power supply cord or plug is damaged or frayed. B) If liquid has been spilled into the product.

C)If the product has been exposed to rain or water.

D) If the product does not operate normally by following the operating instructions. Adjust only those controls, that are covered by the operating instructions because improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to normal operation.

E) If the product has been dropped or the cabinet has been damaged. F) If the product exhibits a distinct change in performance.

13)Avoid using the product during an electrical storm. There may be a remote risk of electric shock from lightning.

14)Do not use the telephone to report a gas leak in the vicinity of the leak.

INSTALLATION INSTRUCTIONS

1. Never install telephone wiring during a lightning storm.

2. Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.

3. Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.

4. Use caution when installing or modifying telephone lines.

INSTRUCTION FOR BATTERIES

CAUTION: To Reduce the Risk of Fire or Injury to Persons, Read and Follow these Instructions:

1. Use only the type and size of batteries mentioned in owner's manual.

2. Do not dispose of the batteries in a fire. The cells may explode. Check with local codes for possible special disposal instructions.

3. Do not open or mutilate the batteries. Released electrolyte is corrosive and may cause damage to the eyes or skin. It may be toxic if swallowed.

4. Exercise care in handling batteries in order not to short the battery with conducting materials such as rings, bracelets, and keys. The battery or conductor may overheat and cause burns.

5. Do not attempt to recharge the batteries provided with or identified for use with this product. The batteries may leak corrosive electrolyte or explode.

6. Do not attempt to rejuvenate the batteries provided with or identified for use with this product by heating them. Sudden release of the battery electrolyte may occur causing burns or irritation to eyes or skin.

7. When replacing batteries, all batteries should be replaced at the same time. Mixing fresh and discharged batteries could increase internal cell pressure and rupture the discharged batteries. (Applies to products employing more than one separately replaceable primary battery.)

8. When inserting batteries into this product, the proper polarity or direction must be observed. Reverse insertion of batteries can cause charging, and that may result in leakage or explosion. (Applies to product employing more than one separately replaceable primary battery.)

9. Remove the batteries from this product if the product will not be used for a long period of time (several months or more) since during this time the battery could leak in the product.

10. Discard "dead" batteries as soon as possible since "dead" batteries are more likely to leak in a product.

11. Do not store this product, or the batteries provided with or identified for use with this product, in high-temperature areas. Batteries that are stored in a freezer or refrigerator for the purpose of extending shelf life should be protected from condensation during storage and defrosting. Batteries should be stabilized at room temperature prior to use after cold storage.

Product Information Sheet

Product: ***ENERGY+*** **Brand Lithium-Ion (Li-ion) Battery Packs – All Models and Sizes**

Because all of our battery packs are defined as "articles", they are exempt from the requirements of the Hazard Communication Standard, hence an MSDS is not required. This sheet is provided as a service to our customers.

MSDS:
Material Safety Data Sheets (MSDS) are a sub-requirement of the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard, 29 CFR Subpart 1910.1200. This Hazard Communication Standard does not apply to various sub categories including anything defined by OSHA as an "article". OSHA has defined "article" as a manufactured item other that a fluid or particle: (i) which is formed to a specific shape or design during manufacture; (ii) which has. end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which under normal conditions of use does not release more than very small quantities, e.g. minute or trace amounts, of a hazardous chemical, and does not pose a physical hazard or health risk to employees.

The major components used in Fedco Electronics, Inc. ***ENERGY+*** brand Lithium Ion (Li-Ion) battery packs are Lithium-Ion cells made by various manufacturers, and contain the following:

Chemical Name	Weight by %	Formula	Component
Lithium Cobalt Oxide	10 - 25%	$LiCoO_2$	Positive Electrode
Graphite (Carbon)	5 - 15%	C	Negative Electrode
Ethylene Carbonate-Solvent	0 - 14%	$C_3H_4O_3$	Electrolyte
Diethyl Carbonate-Solvent	"	$C_5H_{10}O_3$	Electrolyte
Lithium Hexaflurophasphate-Salt	"	$LiPF_6$	Electrolyte
Nickel-plated steel	15 - 25%	N/A	Case
Other metal & fiber items	10 - 20%	N/A	Separators, gaskets, etc.

The overall reaction is: $Li_xC + Li_{1-x}CoO_2 \Longleftrightarrow C + LiCoO_2$

Potential Health Hazards:
Lithium-Ion batteries do not contain any free liquid electrolyte, and do not leak electrolyte under normal usage conditions. Overcharged or abused batteries may leak small amounts of electrolyte. In the case of skin exposure, wash any exposed skin with soap and copious amounts of water. It is advisable to wear gloves when handling leaking batteries.

Disposal:
Lithium Ion batteries are not defined by the federal government as hazardous waste and are safe for disposal in the normal municipal waste stream. These batteries, however, do contain recyclable materials and are accepted for recycling at the Inmetco facility in Ellwood City, PA. For more information, call Inmetco at 1-724-758-2800, or go to their web site at www.inmetco.com.

Transport:
Fedco Electronics Lithium Ion battery packs are considered to contain "dry cell" batteries and are unregulated for purposes of transportation by the U.S. Department of Transportation (DOT), International Civil Aviation Administration (ICAO), International Air Transport Association (IATA) and the International Maritime Dangerous Goods regulations (IMDG). The only DOT requirement for shipping these batteries is Special Provision 130 which states: "Batteries, dry are not subject to the requirements of this subchapter only when they are offered for transportation in a manner that prevents the dangerous evolution of heat (for example, by the effective insulation of exposed terminals)". IATA requires that batteries being transported by air must be protected from short-circuiting and protected from movement that could lead to short-circuiting.

NOTICE: The information and recommendations set forth are made in good faith and are believed to be accurate at the date of preparation. Fedco Electronics, Inc. makes no warranty expressed or implied.

The Hummingbird™

PORTABLE PILOT SCANNER

KEY APPLICATIONS:

- Measures correlated signal strength (Ec/Io) of IS-95 base stations
- Verification of neighbor lists
- Optimization of Cell sites
- Verifies PN assignments
- Confirms handoff thresholds
- Analysis of coverage areas
- Measures pilot pollution

FEATURES:

- Scans all 512 base stations in less than one (1) second
- Measures CDMA correlated signal strength (Ec/Io) ±1.0 dB
- Derives Base Station ID's via internal Sync Channel demodulation
- Reports Base Station System Time
- Internal Lithium Ion rechargeable battery
- Graphic LCD display with backlighting
- Serial Port (RS-232C) connection for external control and downloading measurements
- Removable ATA Flash Card for data storage
- "Playback" allows engineer to review problem spots with markers
- Portable instrument for both indoor and outdoor applications
- Does not require GPS reception

Fast

Sensitive

Lightweight

Low Cost

Self-contained

Removable Data Storage

The Hummingbird™ is just one of many exceptional design solutions from Berkeley Varitronics. Call us today for more information:

(732) 548-3737 / Fax: (732) 548-3404

Internet: www.bvsystems.com

Email: info@bvsystems.com

BERKELEY VARITRONICS SYSTEMS

The Hummingbird™

PORTABLE CDMA SCANNER

SPECIFICATIONS

HUMMINGBIRD™ RF PERFORMANCE:

FREQUENCY RANGE	PCS model Cellular model	1930-1990 MHz (Bands A through F) 865-897 MHz
IF BANDWIDTH	1.25 MHz	
MEASUREMENT ACCURACY	Ec/Io	± 1 dB@ 25C°) ± 2 dB (0-50C°)
RECEIVER NOISE FIGURE	< 7.5 dB	
ANTENNA INPUT SENSITIVITY	> -90 dBm	
MAXIMUM SAFE INPUT	+10 dBm	

CDMA PROCESSING:

PN GENERATOR SEQUENCES	IS-95 I and Q Pilot
MINIMUM Ec/Io	-20 dB
CORRELATION LENGTH	1024 chips (for both I and Q)
MINIMUM PILOT POWER DETECTABLE	-20 dB
BASE STATIONS SCAN RATE	< 1 sec.
DISPLAY UPDATE RATE	< 1 sec.
BASE STATION IDENTIFICATION	Direct IS-95 BS ID demodulation
TIMING ACCURACY	Absolute (derived from the signal)
TIMING JITTER	± 200 ns

GENERAL SPECIFICATIONS:

SOFTWARE	CDMA Chameleon included (Windows 95/98)
DATA RETENTION	Removable ATA Flash
OPERATING TEMPERATURE RANGE	0-50C°
STORAGE TEMPERATURE RANGE	-40-50C°
DIMENSIONS	W = 5.5” L = 11” H = 3.5” High
WEIGHT	4 pounds
POWER	Internal battery External +12VDC @ 0.5A
CHARGER	External dual battery fast charger for Li-Ion batteries

DUAL BATTERY CHARGER

Berkeley Varitronics Systems, Liberty Corporate Park, 255 Liberty Street, Metuchen, NJ 08840 USA
Phone 732-548-3737 • Fax 732-548-3404 • Internet: www.bvsystems.com • E-mail: info@bvsystems.com

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