Panther

manual version 2.4

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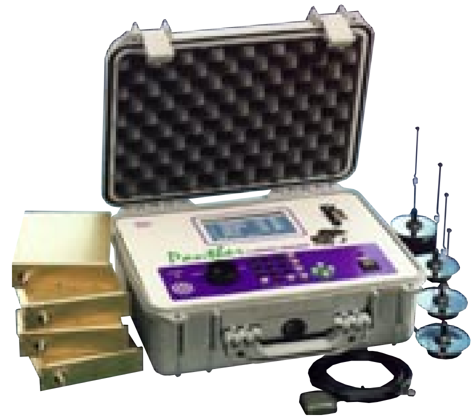
OVERVIEW

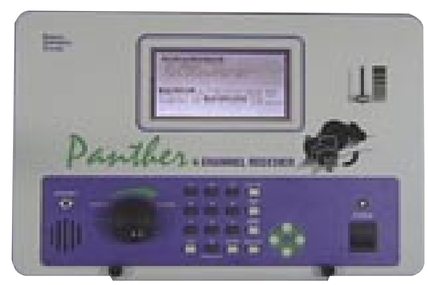


The PANTHER™ RF measurement system operates in three modes, SINGLE FREQUENCY, FREQUENCY SCAN and SETUP . When turned on, the PANTHER enters SINGLE FREQUENCY mode. In this mode, the received signal strength (RSSI) is measured 512 times per second for each installed receiver. The dBm data for each receiver plus time,date,marker and GPS position are provided via the RS-232 serial port each second for data logging. The average of the 512 dBm readings for each receiver is displayed on the lcd display along with system status. The frequency for any of the receivers can be changed in this mode using the keypad, inc-dec knob or serial port command.

The FREQUENCY SCAN mode is controlled via the RS-232 serial port. When in this mode, channel tables provided by the user are scanned (up to 80 per receiver) or the receivers can be set to sequentially scan frequencies. The measurement data is sent via the RS-232 port after each scan (all frequencies and dBm's plus time,date,marker and GPS position). Up to 200 frequencies per second (50 per receiver) can be measured using this mode. The lcd display in this mode displays the strongest frequency encountered for each receiver along with the system status.

A command sent by the PC is used to return to the SINGLE FREQUENCY measurement.

The SETUP mode is used to enter system parameters such as date, time, seek threshold, marker and MIN. The SETUP mode is only available when the unit is in the SINGLE FREQUENCY mode.



PANTHER TOP PANEL

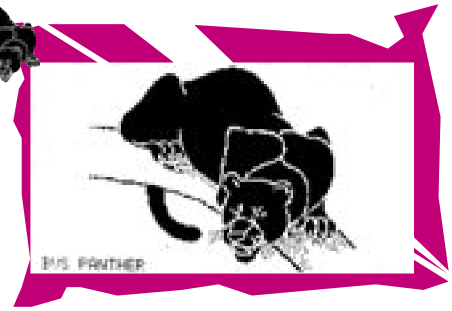
The screen below is from a laptop PC screen. BVS supplies an application program with the Panther receiver that will display and run all of PANTHER's primary functions via a serial port from a laptop PC.

The display, keypad and knob take on different functions depending on which mode the instrument is in. See the sections for the SINGLE FREQUENCY, FREQUENCY SCAN and SETUP modes for a description of display and key pad usage.

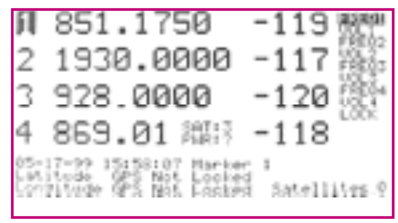
PANTHER BACK PANEL

1 Receiver 1 input TNC female, +13db max RF input
2 Receiver 1 input TNC female, +13db max RF input
3 Receiver 1 input TNC female, +13db max RF input
4 Receiver 1 input TNC female, +13db max RF input
5 Serial connection to PC
6 GPS input SMA active (5V DC)
Note: connect only to supplied GPS antenna.
7 4 pin keyed, pin 1 +12 to +15v MAX, pin 4 ground
8 fuse GMA 4.0 amp fast blow

STARTUP SCREEN

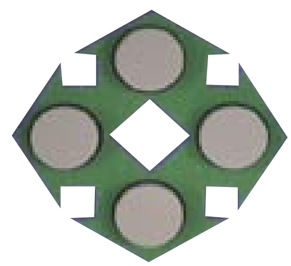


Upon powering up your Panther a graphic of a panther will appear followed by a receiver status check. This startup screen indicates firmware version and serial number of the unit. This screen also runs a check on any receiver modules installed and displays their calibration date(s). Once the user pushes any key to continue, the Panther displays the main scanning screen.

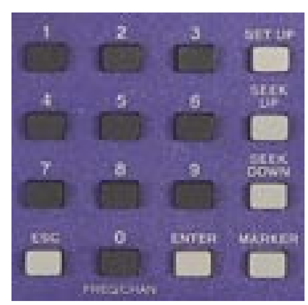


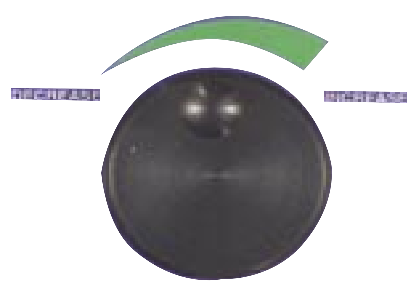
SINGLE FREQUENCY MODE DISPLAY AND KEYPAD FUNCTIONS

Display Frequency or channel # and dBm of each receiver (avg. of 512 measurements), status and select menu.



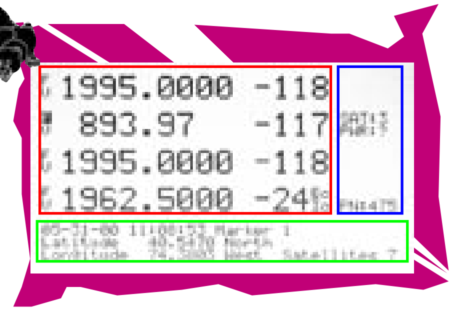
Key(s)	Function
0	Toggle between Frequency and Channel Number display.
1-9,0	Use to change frequency or channel number.
Enter	Use to enter frequency or channel number edit mode.
Right, Left Arrows	Move the edit cursor right or left 1 digit.
Up, Down Arrows	Change menu item.
Esc	Exit edit and setup mode.
Setup	Enter the SETUP mode.
Seek Up	Selected receiver seeks up from the current frequency to the first frequency that is equal to or greater than the seek threshold dBm.
Seek Down	Selected receiver seeks down from the current frequency to the first frequency that is equal to or greater than the seek threshold dBm.
Marker	Increment the marker number.





KNOB	Adjust selected receiver audio volume or frequency up and down.

MAIN DISPLAY



The following is the display layout while in SINGLE FREQUENCY MODE:

Display Line Interpretation:

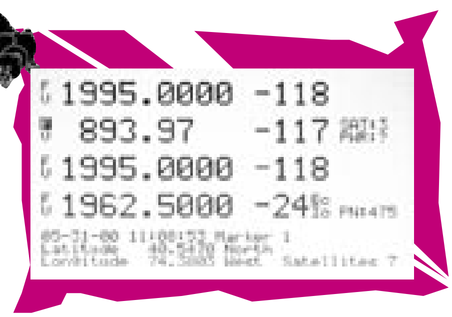
Rx Line 1 Receiver 1 frequency is 851.1750 MHz, RSSI is -119 dBm
2 Receiver 2 frequency is 1930.0000 MHz, RSSI is -117 dBm
3 Receiver 3 frequency is 928.0000 MHz, RSSI is -120 dBm
4 Receiver 4 frequency is 869.0100 MHz, RSSI is -118 dBm

Status Line 1 Date is 5/17/99, Time is 3:58:07 pm, Marker value is 1
2 no GPS lock
3 no GPS lock, 0 satellites in view

Menu Line 1 When highlighted, SEEK, KNOB and enter RX 1 frequency
2 When highlighted, KNOB controls RX 1 volume
3 When highlighted, SEEK, KNOB and enter RX 2 frequency
4 When highlighted, KNOB controls RX 2 volume
5 When highlighted, SEEK, KNOB and enter RX 3 frequency
6 When highlighted, KNOB controls RX 3 volume
7 When highlighted, SEEK, KNOB and enter RX 4 frequency
8 When highlighted, KNOB controls RX 4 volume
9 When highlighted, KNOB is locked (off)

NOTE: Volume controls are disabled for any Finch CDMA modules.

FREQUENCY DISPLAY



SINGLE FREQUENCY MODE

The SINGLE FREQUENCY MODE is used to continually monitor frequencies at a high sample rate (512 measurements per second). In this mode, the receivers are set to the frequency indicated by the LCD display and the dBm is measured every 1/512th of a second. Once 512 individual dBm measurements have been collected, the resulting data plus time, date, marker and GPS data are sent out the serial port and a new sequence is started. To change the frequency being monitored by a receiver, use the UP-DOWN arrow keys to highlight the FREQ item for the receiver in the menu. When this item is highlighted:

1) Pressing the ENTER key allows changing frequency via the edit mode.

2) Turning the inc-dec knob will increase or decrease frequency.

3) Pressing SEEK UP or DOWN will cause the selected receiver to seek up or down to the frequency whose dBm is >= to the SEEK threshold.

The dBm value reported on the PANTHER display in this mode is the average of the last 512 dBm readings. Time, date, marker and GPS status is also displayed.

To adjust the volume of a receiver's audio, use the UP-DOWN arrow keys to highlight the VOL item for the receiver in the menu. When this item is highlighted, turning the inc-dec knob will increase or decrease the audio of the selected receiver.

In addition, the frequency or volume of any or all receivers can be changed via PC serial commands. The ONLY way to exit the SINGLE FREQUENCY mode and enter the FREQUENCY SCAN mode is via PC serial command.

EAMPS RECEIVERS

Whenever EAMPS receivers are started in the SINGLE FREQUENCY MODE, they will function as follows:

When started on a control channel (313-354) they will begin the CONTROL FOLLOW function. When in this mode, the receiver will continually monitor control channel data, measure BER and report DCC. This data (A and B stream words) is provided in raw binary form along with the 512 dBm readings. If a voice channel assignment command is encountered with the MIN entered in SETUP, the receiver will enter the VOICE CHANNEL FOLLOW function. To prevent EAMPS receivers from entering VOICE CHANNEL FOLLOW, enter a MIN of 0000000000. When a receiver is in the VOICE FOLLOW mode, any voice channel assignment command from the cell site will cause the receiver to jump (hand-off) to the specified voice channel. In addition, SAT and VMAC (power control) are reported both on the screen and in the serial data.

When started on a voice channel (1-312, 355-799, 991-1023) the receiver will stay on the requested channel (will ignore voice channel assignment messages). However, SAT and VMAC will be reported on the screen and in the serial data.

Note that changing the channel from voice to control or from control to control (either via the top panel or PC command), will force the receiver into the CONTROL FOLLOW mode.

The MIN can be set via the serial port or the top panel (SETUP mode). For any MIN to be used, however, it must be set BEFORE any of the EAMPS receivers enters the CONTROL channel follow mode.

FREQUENCY SCAN MODE

The FREQUENCY SCAN MODE is used to scan either channel lists (up to 80 per receiver) or to sequentially step through a range of frequencies. The SCAN MODE is started via a command from the serial port. If a receiver is to scan a table, it is assumed that the table has been loaded via the serial port prior to starting the scan mode. It is only required to load a table once since it is saved in battery backed ram and thus held even when no power is applied to the instrument. Once the SCAN MODE is started, the only way to return to the SINGLE FREQUENCY mode is via a command from the serial port. While in the scan mode, scanning receivers will (not call following) report the strongest channel (frequency and dBm) encountered during the last scan (either table scan or incremental) on the display (and SAT if EAMPS).

EAMPS RECEIVERS

If an EAMPS receiver is commanded to follow rather than scan, it will behave as it would in the SINGLE FREQUENCY mode. In place of scan data, the current channel, dBm and follow data (DCC and BER if control, SAT and PWR if voice) will be returned in addition to raw control channel A and B stream words (if a control channel). When EAMPS receivers are in the FOLLOW mode, DCC and BER (control), SAT and PWR (voice) are reported on the screen. If the EAMPS receiver is not in the FOLLOW mode (scanning), both the strongest frequency and SAT are reported on the screen (and in the serial data).

The measurement can be setup in any combination of follow, table or sequential scan via the serial port.

Once the PANTHER is in the frequency scan mode, the following sequence is repeated until the scan mode stop command is issued:

1) Receiver frequency 1 through 4 are set to the next frequency. The next frequency is either taken from the downloaded channel scan table or is incremented by the user supplied step.

Note: If the receiver is in EAMPS FOLLOW mode, frequency is not changed in step 1. Handoff's are reported along with SAT and PWR, but the change of frequency (hand-off) is controlled by the receiver.

2) Wait for the synthesizer's to settle. The largest channel step (based on the previous channel measured) for all of the receivers is computed and this step is used to determine the settle time based on the table below.

channel step	settle time (msec)
<= 8	10
<= 16	16
<= 32	22
<= 100	28
<= 500	34
> 500	40

3) 16 samples of RSSI are taken and averaged for each receiver's dBm reading. This takes 10msec total.

4) Repeat step 1-3 until all frequencies are scanned.

5) Send data via the serial port and display results of scan and status.

6) Repeat starting at step 1 until stopped by PC command.

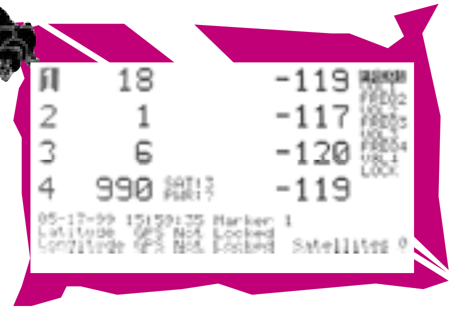
FREQUENCY SCAN MODE DISPLAY AND KEYPAD FUNCTIONS

Display Frequency or channel # and dBm of the
strongest signal for each receiver, status and
select menu.

Key(s)	Function
0	Toggle display between Frequency and Channel Number display.
Up, Down Arrows	Select Audio Source
Marker	Increment the marker number.
1-9	Not used
Esc	Not used
Enter	Not used

Right,Left Arrows	Not used
Setup	Not used
Seek Up	Not used
Seek Down	Not used
KNOB	Adjust selected audio volume up or down.

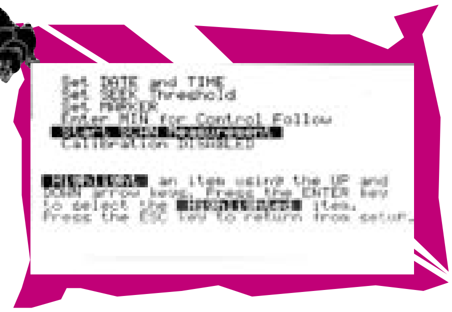
CHANNEL DISPLAY



CHANNEL DISPLAY

This screen indicates the channel number associated with the receiver frequencies. using the arrow keys and the numbers on the keypad, the user may scan through all of the channels in each frequency.

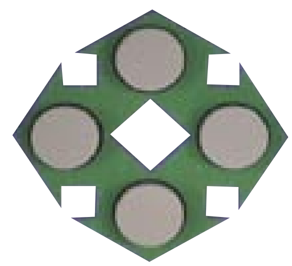
SETUP MENU

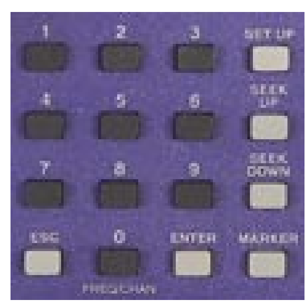


ENTER SETUP MODE

SETUP MODE DISPLAY AND KEYPAD FUNCTIONS

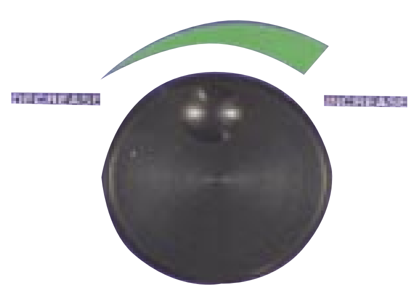
Key(s)	Function
1-9,0	Use to make numeric entries.
Enter	Use to enter save numeric entries
Right, Left Arrows	Move the edit cursor right or left 1 digit.
Up, Down Arrows	Change menu item.
Esc	Exit setup mode (return to SINGLE FREQUENCY MODE).
Setup	Not used.
Seek Up	Not used.
Seek Down	Not used.
Marker	Not used.
KNOB	Not used.



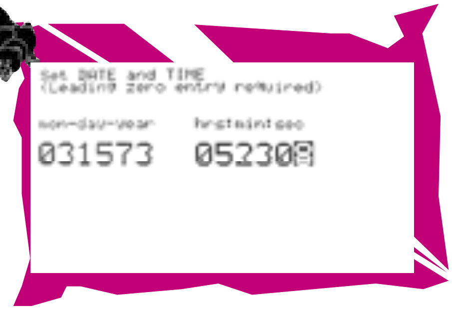


Use the UP-DOWN arrow keys to change which menu line is highlighted.

Menu Line
1 Highlight and press ENTER to set system date and time.
2 Highlight and press ENTER to set seek dBm threshold.
3 Highlight and press ENTER to set the marker value.
4 Highlight and press ENTER to set control follow MIN.
5 Highlight and press ENTER for calibration and selftest menu.



DATE and TIME



SET DATE AND TIME

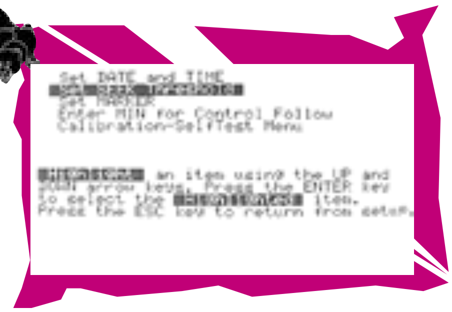
Use the 0-9 keys to enter the date (with leading zeroes), use the right and left arrow keys to move the cursor. Press ENTER when the date is correct, the cursor will move to time entry (hrs). Use the 0-9 keys to enter the time (with leading zeroes), use the right and left arrow keys to move the cursor. Press ENTER when the time is correct. The entered date and time will be set and the display will return to the setup menu.

Note that the time is displayed in 24 hour format and must be entered as such. Example, set date to March 15, 1973, time to 5:23:08 pm.

Enter date by pressing 031573 then ENTER, the cursor will move to hrs.

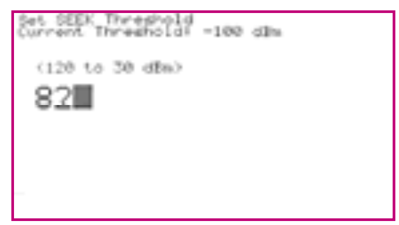
Enter time by pressing 052308, then press ENTER.

SEEK THRESHOLD



SET SEEK THRESHOLD

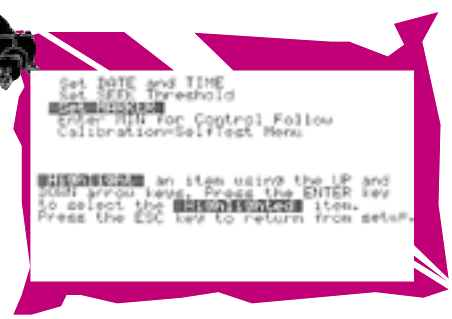
Use the 0-9 keys to enter the SEEK Threshold, use the right and left arrow keys to move the cursor. Press ENTER when the threshold as desired. The entered threshold will be set and the display will return to the setup menu.



Example, change the SEEK Threshold from the current value of -100 to -80 dBm:

Press 80 followed by Enter. (note: leading zeroes not required)

SET MARKER NUMBER



SET THE MARKER NUMBER

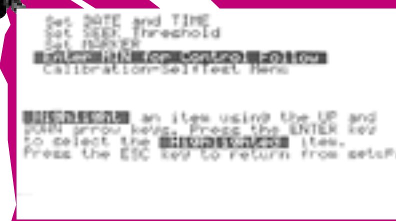
Use the 0-9 keys to enter the MARKER number, use the right and left arrow keys to move the cursor. Press ENTER when the marker is as desired. The entered marker number will be set and the display will return to the setup menu.

Example, change the Marker from the current value of 0 to 9999:

Press 56 followed by Enter. (note: leading zeroes not required)

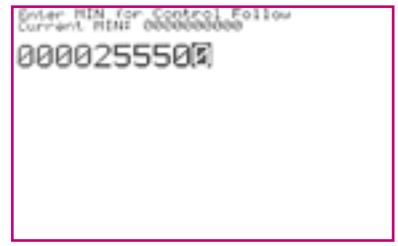
The MARKER number is used along with a notebook to indicate an area of interest. If an area of low signal strength is encountered for example, a note is made along with the current marker number. Then the marker number is incremented by pressing the MARKER key. In this way it is easy to find areas of interest in the post process data by comparing the marker number in the data with the notebook entries.

CONTROL FOLLOW MIN



SET CONTROL FOLLOW MIN SCREEN

Use the 0-9 keys to enter the 10 digit follow MIN, use the right and left arrow keys to move the cursor. Press ENTER when the MIN is as desired. The entered MIN will be set and the display will return to the setup menu.

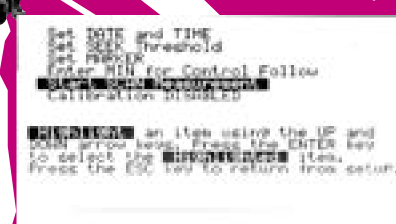


Example, change the MIN from the current value of 0000000000 to 0000255500:

Press 0000255500 followed by Enter.

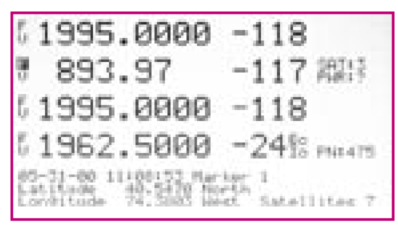
NOTE: Newly entered MIN is used by ALL EAMPS receivers installed whenever they enter CONTROL FOLLOW mode. The MIN is not used by non-EAMPS receivers.

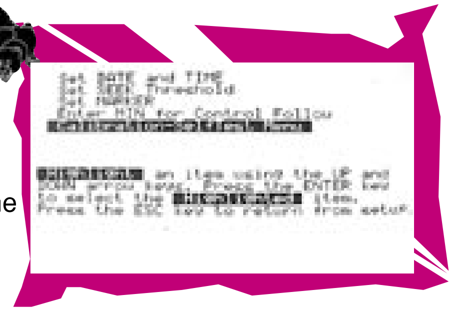
SCAN MEASUREMENT



START SCAN MEASUREMENT (CW receivers only)

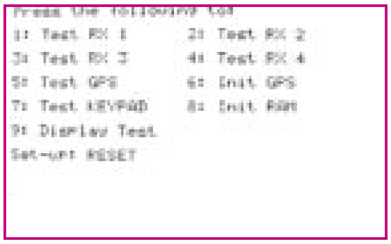
This selection allows the user to begin scanning the CW receivers without using a connected PCand Panther Data Logger. Scan parameters must be initially set via the software but once settings are created, this selection will activate the scanning mode. Press the **ESC** key at any time to return to the single frequency mode.

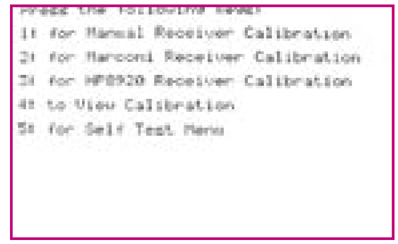


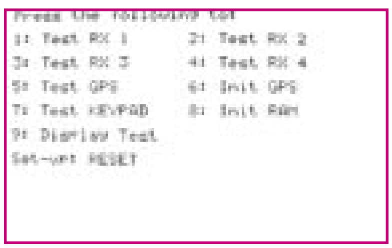


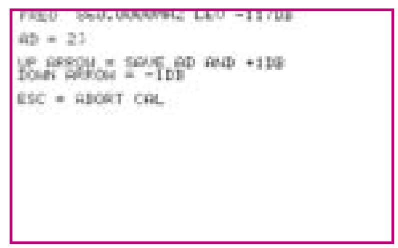
VIEW BVS CALIBRATION SCREENS

These screens are used for factory testing and should NOT be accessed by the user. Contact BVS for further information.









PANTHER PC SERIAL COMMANDS

Note: numbers followed by the letter ‘h’ are in hex (base 16), otherwise numbers are decimal (base 10). A byte is an 8 bit unsigned number (00h to FFh). A word is a 16 bit unsigned number (0000h to FFFFh). All 16 bit data sent to the PANTHER and returned by the PANTHER are words. Words are always sent/received in the INTEL format (low byte followed by high byte).

The following is a list of the commands that may be used to control the PANTHER via the serial port:

Command #	Page	Function
2	20	Set MIN to follow
4	20	Restart SINGLE FREQUENCY measurement
16	20	Load scan table
17	21	Scan RX1 table
18	21	Scan RX2 table
20	21	Set RX1 Frequency
21	21	Set RX2 Frequency
22	21	Inc marker
24	22	Exit scan mode
25	21	Set RX3 Frequency
26	21	Set RX4 Frequency
27	21	Scan RX3 table
28	21	Scan RX4 table
29	23	Start scan mode
30	22	Set volume

Commands not listed are RESERVED and should NEVER be used.

SENDING SERIAL COMMANDS TO PANTHER

Commands are sent to the PANTHER as 8 bit binary packets at 38k baud as follows:

Name	Value
----	-----
Sync	AAh
Size	# of bytes following (1 to N)
Command #	See command list
Data	depends on command

Note: the value of N in Size depends on the command as does the number of data bytes.

When the complete command has been received by the PANTHER, the PANTHER will STOP the SINGLE FREQUENCY measurement (if currently in the SINGLE FREQUENCY measurement) and process the command. After the command has been processed, the PANTHER will acknowledge the command with the following sequence:

Name	Value
‘$’	24h
Sync	AAh
ACK	06h

Do not send commands to PANTHER until the previous command has been acknowledged. To restart the SINGLE FREQUENCY measurement, send command 4 to resume the SINGLE FREQUENCY MODE. If the command is sent while the PANTHER is in the SCAN MODE, the command will be processed when received and the SCAN MODE will continue after the command has been acknowledged. To stop the SCAN MODE, send command 24.

COMMAND 4 - RESUME SINGLE FREQUENCY MODE

If the PANTHER was in the SINGLE FREQUENCY MODE, this command MUST be sent following any other command. This command is ignored if the PANTHER is in the CHAN SCAN MODE. There is no data required by this command.

COMMAND 2 - PANTHER SET FOLLOW MIN COMMAND

This command is used to enter the MIN used by all AMPS downlink receivers to call follow from a control channel. The command (2) if followed by the ten ascii digits of the MIN to follow:

Size	Command	Data (example)
11	2	9081234567

COMMAND 16 - PANTHER LOAD CHANNEL TABLE COMMAND

This command is used to load the channel scan tables used by the scan mode. The command (16) is followed by the receiver id (0-3), the table entry index (0-79) and the channel number to place into the table at the indicated index.

Rx id	Receiver
0	1
1	2
2	3
3	4

Example: Load chan # 1000 into receiver 2 table position 10

Size	Command	RX id	Index	Chan Low byte	High byte
5	16	1	9	E8h	03h

In order to load the entire table for any receiver, this command must be sent 80 times. If less than 80 channels are to be scanned, send channel # 0 for the unused table locations. Channel # 0 is skipped when scanning a table.

COMMAND 17 - SCAN RECEIVER 1 TABLE
COMMAND 18 - SCAN RECEIVER 2 TABLE
COMMAND 27 - SCAN RECEIVER 3 TABLE
COMMAND 28 - SCAN RECEIVER 4 TABLE

These commands require no data and will scan the requested receiver's scan table and set the requested receiver to the strongest frequency encountered during the scan.

If this command is received while in the SCAN MODE, it will be ignored unless the requested receiver is in the EAMPS follow mode (control or voice), in which case it will work as described above.

COMMAND 20 - SET RECEIVER 1 FREQUENCY
COMMAND 21 - SET RECEIVER 2 FREQUENCY
COMMAND 25 - SET RECEIVER 3 FREQUENCY
COMMAND 26 - SET RECEIVER 4 FREQUENCY

Use to set any of the receivers to a new frequency.

If this command is received while in the SCAN MODE, it will be ignored unless the requested receiver is in the EAMPS follow mode (control or voice), in which case it will set the requested receiver to the chan # received.

Example: Load chan # 256 into receiver 3

Size	Command	Chan Low byte	High byte
3	25	00h	01h

COMMAND 22 - INCREMENT MARKER

This command requires no data and will add 1 to the current marker value.

COMMAND 30 - SET RECEIVER AUDIO VOLUME

This command requires 2 data bytes, the receiver id followed by a code that indicates whether to increase or decrease the volume and by how much.

Rx id	Receiver
0	1
1	2
2	3
3	4

The second byte works as follows:

bit 7 set	- increase volume
bit 6 set	- decrease volume
bit 5-0	- inc/dec count (0-63)

Example: increase receiver 2 volume by 5

Size	Command	RX id	control
3	30	1	85h

Example: decrease receiver 1 volume by 1

Size	Command	RX id	control
3	30	0	41h

Note: An inc/dec count of 0 will mute the selected receiver.

Example: mute receiver 3

Size	Command	RX id	control
3	30	2	40h or 80h

COMMAND 24 - EXIT CHANNEL SCAN MODE (RESTART SINGLE FREQUENCY MODE)

This command requires no data, and will restart the SINGLE FREQUENCY mode if the PANTHER was in the SCAN MODE. This command is ignored if the PANTHER is in the SINGLE FREQUENCY already.

COMMAND 29 - START CHANNEL SCAN MODE

Use command 29 to start the SCAN FREQUENCY mode. The first byte after the command, the ‘scan mode’ function byte, determines how each receiver will operate during the scan mode. Each receiver can follow calls (EAMPS) or scan the downloaded channel table or do an incremental scan, depending on the bits in the scan mode byte. Following the scan mode byte are 4 sets of 16 bit unsigned integers. Each set determines the START,END channel and STEP for the incremental scan, one set for each receiver. These should always be sent, even if the receiver is not doing an incremental scan. If a receiver is not doing an incremental scan, set the START,END and STEP to zero.

‘scan mode’ byte (a copy of this byte is included in the header, called ‘mode’.

bit	function
7	if 1, rx 4 incremental scan, if 0, rx 4 table scan
6	if 1, rx 3 incremental scan, if 0, rx 3 table scan
5	if 1, rx 2 incremental scan, if 0, rx 2 table scan
4	if 1, rx 1 incremental scan, if 0, rx 1 table scan
3	if 1, follow rx 4, 0, scan rx 4
2	if 1, follow rx 3, 0, scan rx 3
1	if 1, follow rx 2, 0, scan rx 2
0	if 1, follow rx 1, 0, scan rx 1

notes: 1) non-EAMPS receivers IGNORE the follow bits (3-0) and default to table scan mode.
2) if BOTH the follow bit AND incremental scan bit are set for an EAMPS receiver, the receiver will call follow.

Size	26	
Command	29	
Scan Mode	xx	see above
Rx1 Start	lo,hi	RX1 incremental mode start chan
Rx1 End	lo,hi	RX1 incremental mode end chan
Rx1 Step	lo,hi	RX1 incremental mode step
Rx2 Start	lo,hi	RX2 incremental mode start chan
Rx2 End	lo,hi	RX2 incremental mode end chan
Rx2 Step	lo,hi	RX2 incremental mode step
Rx3 Start	lo,hi	RX3 incremental mode start chan
Rx3 End	lo,hi	RX3 incremental mode end chan
Rx3 Step	lo,hi	RX3 incremental mode step
Rx4 Start	lo,hi	RX4 incremental mode start chan
Rx4 End	lo,hi	RX4 incremental mode end chan
Rx4 Step	lo,hi	RX4 incremental mode step

Panther Command Format*

All commands to the Panther have the same format< Trigger >< Size >< Command> < Data > ... < Data >
where

Trigger Constant byte OAAH
Size Size of Command and Data in bytes
Command Byte (table follows)

Data	Data bytes for command

The Panther acknowledges each command with the following structure.
< $ >< Trigger >< Acknowledge >
where

$	Constant ASC II
Trigger	Constant byte OAAH
Command	Constant byte 006h

List of Commands

Measurement Data

Measurement data is sent from the Panther in blocks (referred to as sections below) once a second. Acknowledgements to commands will only come between sections.

Section
Section
...

Section:

ID	:two bytes (0A5h, 03Ch)
Length	:Integer (2 bytes)
Data Block	:Size given by Length in bytes

Data Block

The first byte the Data Block identifies the type of the Data Block. There are three valid identifier values for the Panther.

Each of these Data Blocks is described in the following sections.

Fast Measurement Block

The fast measurement block is returned by the normal single channel measurement on the Panther.

Header Block	:23 bytes - Common to both Fast Measurement and Scan Frequency blocks. Structure follows.
Reserved	:5 bytes
Fast Data Block	:532 bytes - Data for receiver 1
Fast Data Block	:532 bytes - Data for receiver 2
Fast Data Block	:532 bytes - Data for receiver 3
Fast Data Block	:532 bytes - Data for receiver 4

Header Block

Type	1 byte - Id byte ‘F’ for’S’ to define block type (this is the first byte of the Fast Measurement Block or the Scan Frequency Block)
Seconds	1 byte - Seconds from the real time clock
Minutes	1 byte - Minutes from the real time clock
Hours	1 byte - Hours from the real time clock
Day	1 byte - Day from the real time clock
Month	1 byte - Month from the real time clock
Year	1 byte - Year from the real time clock

Navigation Status	1 byte - Bit flags for Positioning status (given below)
GPS Latitude	5 bytes - format follows
GPS Longitude	5 bytes - format follows
GPS Time	3 bytes - format below

Marker Value 2 bytes - user settable tag.

Fast Data Block
Channel 2 bytes - channel number (used to determine RF Frequency).
TypeFlag 1 byte Additional receiver info flags
BaseMegaHertz2 bytes - MegaHertz portion of base frequency.
BaseKiloHertz 2 bytes - kilohertz portion of the base frequency.
Step 2 bytes - frequency step for each channel.
LowChannel 2 bytes - lowest channel number
HighChannel 2 bytes - highest channel number

DemodFlags 1 byte - Demodulation Flags
SAT/DCC 1 byte - SAT or DCC for AMPS only
PWR/BER 1 byte - SAT Power or BER for AMPS only

Reserved 2 bytes

NRSSI 2 byte - number of RSSI values returned

RSSIValues :512 bytes - Array of 1 byte RSSI values (magnitude)

Navigation Status
The following masks indicate the positioning status

TypeFlags
The following masks indicate the meaning of bits in the TypeFlags field

DemodFlags
The following masks indicate the meaning of the bits in the DemodFlags field:

How to determine the RF Frequency for a receiver:

$$Base = BaseMegaHertz + \frac{BaseKiloHertz}{1000}$$

if GIGA flag is set
Base = Base + 1000

if AMPS flag is set
Base = Base + 0.01

$$Frequency = Base + \frac{Step}{10000} (Channel - 1)$$

How to interpret the GPS data:
Latitude and longitude are encoded as four byte BCD values plus a 1 byte hemisphere character:

DD DM Mm mm HH

Where D is a degree digit, M is a minutes digit, m is a fractional minutes digit (right of decimal point), and HH is the hemisphere character'N', 'S', 'E', or'W'

The GPS time is BCD encoded hours, minutes, and seconds:
HH MM SS

Scan Frequency Block

The Scan Frequency Block is returned by Scan Mode on the Companion receiver. It contains the RSSI data for up to 80 frequencies for each receiver that were selected by the user at measurement time. Channel zero indicated that no frequency was selected. Valid Channel numbers are always greater than zero. If a receiver is set to follow during scan mode, it will return with only one pair of frequency/RSSI values for the channel

Scan Frequency Block	
Header Block	23 Bytes (see Fast Measurement block for details)
Reserved	9 bytes
Scan Data Info Block	11 bytes - Receiver 1 Information
Scan Data Info Block	11 bytes - Receiver 2 Information
Scan Data Info Block	11 bytes - Receiver 3 Information
Scan Data Info Block	11 bytes - Receiver 4 Information
Scan Data Block	320 bytes - Receiver 1 RSSI and Channel Data
Scan Data Block	320 bytes - Receiver 2 RSSI and Channel Data
Scan Data Block	320 bytes - Receiver 3 RSSI and Channel Data
Scan Data Block	320 bytes - Receiver 4 RSSI and Channel Data

Scan Info Block

TypeFlag	1 byte - see Fast Data Block
BaseMegaHertz	2 bytes - see Fast Data Block
BaseKiloHertz	2 bytes - see Fast Data Block
Step	2 bytes - see Fast Data Block
LowChannel	2 bytes - see Fast Data Block
HighChannel	2 bytes - see Fast Data Block

Scan Data Block	
ScanDataItems[80]	Array of 80 pairs of channel, RSSI and Aux values.
Channel	2 bytes - channel number for this item
RSSI	1 byte - RSSI for this item
Aux	1 byte - SAT if TypeFlag has AMPS bit set.

PANTHER OUTPUT DATA - GENERAL*

Data is sent from the PANTHER in binary packets at 38k baud. Each packet begins with a 16 bit sync word used by the PC to identify the start of a packet. Following the sync word is a 16 bit word indicating the total number of bytes that follow to complete the packet.

Name	Value
Sync word (lo)	A5h
Sync word (hi)	3Ch
Size	16 bit count of bytes following
Data	SINGLE FREQUENCY or SCAN MODE DATA

The data sent for both modes (SINGLE and SCAN FREQUENCY) starts with a header that contains system information (type of measurement,date, time,GPS data,marker and firmware version). Following the header is the measurement specific data. To collect data packets, use the following procedure:

1) read a word.
2) if the word is not equal to SYNC, goto step 1
3) read the count word
4) if the count word does not contain valid size, goto step 1
5) input the number of bytes indicated by the value of count
6) process the data
7) goto step 1

Note: Valid size (step 4) is the size of the header + the size of a single frequency data block OR the size of the header

+ the size of a scan data block.

PANTHER OUTPUT DATA - SINGLE FREQUENCY MODE*

Every second, the PANTHER sends 1 packet of data that contains the result of the latest SINGLE FREQUENCY mode measurement. A header is followed by 4 fixed sized data blocks (1 for each receiver, even if the receiver is not installed).

The header contains the time and date of the measurement, GPS time and position, and the value of the marker. A type code (set to 'F') indicates that the data following the header is SINGLE FREQUENCY type.

The data that follows the header contains (for each receiver):

1) Information that defines the frequency range and modes of operation of the receiver. If the base frequency of the receiver is 0, the receiver is not installed.

2) Flags that indicates EAMPS follow status.

3) EAMPS specific data - sat,pwr or dcc,ber,control A-B stream data, up to 174 bytes.

4) 512 dBm values (each taken at 2 msec intervals), saved in the sequence measured.

To determine if the receiver data contains EAMPS data, a byte is provided ('demod_flag' - see DATA STRUCTURES). If this byte is 0, the EAMPS data fields contain no data and should be ignored.

If the 'demod_flag' has the value of 40h, the receiver is on an EAMPS voice channel and the byte 'sat_dcc' contains SAT, the byte 'pwr_ber' contains the VMAC power code.

If the 'demod_flag' has the value of 80h, the receiver is on an EAMPS control channel and the byte 'sat_dcc' contains DCC, the byte 'pwr_ber' contains BER %. In addition, the word 'nrdb' contains the value of the number of bytes in the control channel raw data buffer 'rdb', up to 174 bytes of data.

The data in the 'rdb' buffer is the raw A and B stream words (the12 bit parity is not included). This data is saved in the same sequence as it was demodulated by the receiver, (A word followed by B word, followed by A word...), each word being 4 bytes long (32 bits). The first 28 bits contain the message word, the last 4 bits should be ignored. All words demodulated, including the filler messages, are saved in this buffer.

RAW DATA BUFFER

The following shows how control channel data is saved in the raw data buffer. The first word is always an A word.

Offset	Data
------	----
0	First 8 bits of A word
1	Second 8 bits of A word
2	Third 8 bits of A word
3	Last 4 bits of A word, ignore low 4 bits
4	First 8 bits of B word
5	Second 8 bits of B word
6	Third 8 bits of B word
7	Last 4 bits of B word, ignore low 4 bits
8	First 8 bits of A word
9	Second 8 bits of A word
10	Third 8 bits of A word
11	Last 4 bits of A word, ignore low 4 bits
12	First 8 bits of B word
.	.
16	First 8 bits of A word

. .
20 First 8 bits of B word
. .
. .
. .

DECODING EXAMPLE

Assume the first A word in the buffer is a System Parameter Overhead Message:

Byte at Offset	Bit	Contains
0	7------	T1
	6------	T2
	5------	DCC bit 1
	4------	DCC bit 0
	3------	SID1 bit 13
	2------	SID1 bit 12
	1------	SID1 bit 11
	0------	SID1 bit 10
1	7------	SID1 bit 9
	6------	SID1 bit 8
	5------	SID1 bit 7
	4------	SID1 bit 6
	3------	SID1 bit 5
	2------	SID1 bit 4
	1------	SID1 bit 3
	0------	SID1 bit 2
2	7------	SID1 bit 1
	6------	SID1 bit 0
	5------	RSVD
	4------	RSVD
	3------	RSVD
	2------	NAWC bit 3
	1------	NAWC bit 2
	0------	NAWC bit 1
3	7------	NAWC bit 0
	6------	OHD bit 3
	5------	OHD bit 2
	4------	OHD bit 1
	3------	ignore
	2------	ignore
	1------	ignore
	0------	ignore

When in the SCAN MODE, the PANTHER scans up to 80 frequencies per measurement per receiver. After this measurement is complete, PANTHER sends a packet of data with the results of this latest scan. This cycle continues until stopped by a serial command

Each packet of scan mode data contains:

1) A Header (same as single frequency mode)
2) A receiver information block for each receiver.
3) A data block for each receiver.

There are three possible modes a receiver can be in while the PANTHER is in the SCAN MODE

1) EAMPS Call Follow

2) Incremental Frequency Scan
3) Table Scan

The information block for each receiver contains a flag called 'sflag' used to determine the status of receivers in the SCAN mode.

An 'sflag' value of 00h indicates a non-EAMPS receiver, all scan data is contained in the scan data block for that receiver. The 'satmsc' in each data block and the rx_info 'ssat', 'spwr' should be ignored.

An 'sflag' value of 80h indicates an EAMPS receiver in the control channel follow mode. When a receiver is in this mode during scan, the first scan_data block for the receiver contains the current channel number and dBm. The 'satmsc' data in this block should be ignored. The second block channel # contains the count of bytes of A-B stream data that follow in data blocks 2-79.

Example: RX1 'rx_info.sflag' = 80h

rx_info.ssat; contains DCC
rx_info.spwr; contains BER

scan_data rx1_sd[0] contains the follow chan #, dbm
scan_data rx1_sd[1] contains the # of unsigned chars of control chan data.

scan_data rx1_sd[2-79] contains the control chan data (saved in the same way as the SINGLE FREQUENCY mode. Treat the rx1_sd[2-79] as a buffer of 312 bytes (78*4) and decode just as in SINGLE FREQUENCY

An 'sflag' value of 40h indicates an EAMPS receiver in the voice channel follow mode. When a receiver is in this mode
during scan, the first scan_data block for the receiver contains the current channel number and dBm. The 'satmsc' data in this block should be ignored. The data blocks 1-79 that follow contain no data and should be ignored.

Example: RX1 'rx_info.sflag' = 40h (voice chan follow)

rx_info.ssat; contains SAT
rx_info.spwr; contains PWR (VMAC)

scan_data rx1_sd[0] contains the follow chan #, dbm
scan_data rx1_sd[1-79] empty (ignore)

An 'sflag' value of 01h indicates an EAMPS receiver in the scan mode. When an EAMPS receiver is in this mode during scan, the 'satmsc' data in each data block contains the SAT measured.

Example: RX1 'rx_info.sflag' = 01h (EAMPS scan)

rx_info.ssat; ignore
rx_info.spwr; ignore

scan_data rx1_sd[0-79] contains the follow chan #, dbm and SAT

PANTHER OUTPUT DATA - SCAN FREQUENCY MODE INCREMENTAL SCAN*

The 'mode' byte in the header is a copy of the code used to start the scan mode (see pg. 23). If bits 7-4 are set as follows,

mode bit	function
7	if 1, rx 4 incremental scan
6	if 1, rx 3 incremental scan
5	if 1, rx 2 incremental scan
4	if 1, rx 1 incremental scan

the receiver is in incremental scan mode. In this case, the scan data block for the receiver will contain the data for the last 80 channels scanned (both channel #'s, dBm and SAT if sflag = 01h).

Note that if more than 80 frequencies are to be scanned, it will require more than 1 complete scan data packet to collect ALL of the frequencies requested to be scanned. If less than 80 channels are to be scanned, some channels will appear in the data block more than once.

Example: Receiver 1 started in incremental mode as follows:

Start Chan - 1
End Chan - 200
Step - 1

For each Packet, receiver 1 scan data will contain:

Packet #	Data for channel:
1	1 - 80
2	81 - 161
3	162 - 200, 1 - 42
4	43 - 123
.	.
.	.

and so on until the SCAN MODE is stopped.

EXAMPLE C LANGUAGE DATA STRUCTURES

PANTHER SERIAL DATA structures
The 'header' contains status data and it follows the sync and count words.

```
struct header {

unsigned char typ;      // 'F' - single frequency data
                        // 'S' - scan data
unsigned char mode;     // measurement mode - 0 if single freq mode
                        // or copy of 'scan mode' byte if scan mode
                        // (see pg 23)
unsigned char sec;      // real time seconds (0-59)
unsigned char min;      // minutes (0-59)
unsigned char hr;       // hours (1-23)
unsigned char day;      // day (1-31)
unsigned char mon;      // month (1-12)
unsigned char yr;       // year

// navigation status
// bit 7 set, gps ok and locked, bit 7 clear, gps NOT locked
// bits 4-0 contain the # of visible satellites
unsigned char navs;             // navigation status

unsigned char gpslat[5];        // gps position (bcd)
unsigned char gpslon[5];
unsigned char gpstim[3];        // gps time (bcd)
```

```
    unsigned int mrk;                 // current user marker #

    unsigned int ver;                 // rom version x 100 (v1.10 == 110)
    unsigned char rsv[2];             // reserved for future
};
```

Size of the header is 28 bytes.

```
// SINGLE FREQUENCY DATA record, follows header, one for each receiver
// this block defines the frequency range and other receiver specific
// information and contains the latest measurement results

struct sf_data {

    unsigned int ch;                          // current chan #
    unsigned char gif;                // GHz flag, is54 (amps) flags
    unsigned int bmh;                 // base F Mhz
    unsigned int bkh;                 // Khz (divided by 100)
    unsigned int stp;                 // chan step in khz (divided by 100)
    unsigned int chlo;                // chan # low
    unsigned int chhi;                // chan # high

    unsigned char demod_flag;         // 0x00 == no demod
                                      // 0x80 == amps control chan demod
                                      // 0x40 == amps voice chan demod

    unsigned char sat_dcc;            // sat-dcc
    unsigned char pwr_ber;                    // pwr-ber
    unsigned int drsv2;               // reserved

    unsigned int nrdb;                // # of unsigned chars in raw data buffer
    unsigned int ndb;                 // number of rssi in buffer
    unsigned char dbb[512];                   // rssi buffer
    unsigned char rdb[174];                   // raw data buffer
};
```

Size of the single receiver data block (above) is 708 bytes.

```
// A complete single frequency mode data structure, one sent per second
// could be defined as follows. Note it contains a header plus 4 data
// records.

struct single_freq_data {

    struct header sfh;                        // header
    struct sf_data sf_receiver_data1;         // data - receiver 1
    struct sf_data sf_receiver_data2;         // data - receiver 2
    struct sf_data sf_receiver_data3;         // data - receiver 3
    struct sf_data sf_receiver_data4;         // data - receiver 4
};
```

Size of a complete single freq data block = 28 + (708*4) = 2860 bytes.

```
// rx info block defines the frequency range and other receiver
// specific information

struct rx_info {

    unsigned char gif;                // GHz flag, is54 (amps) flags
```

```
	unsigned int bmh;		// base F Mhz
	unsigned int bkh;		// Khz (divided by 100)
	unsigned int stp;		// chan step in khz (divided by 100)
	unsigned int chan_lo;		// chan # low
	unsigned int chan_hi;		// chan # high

	unsigned char sflag;		// 0x00 == no demod (non EAMPS)
					// 0x80 == amps control chan demod
					// 0x40 == amps voice chan demod
					// 0x01 == scan mode sat valid

	unsigned char ssat;		// follow sat-dcc
	unsigned char spwr;		// follow pwr-ber

	unsigned int srsv;		// reserved
};
```

Size of a receiver info block is 16 bytes.

```
// the measurement data for each scanned frequency is contained in the
// scan data block. 80 of these are sent for each receiver.

struct scan_data {
	unsigned int schan;		// channel
	unsigned char srssi;		// rssi (dBm)
	unsigned char satmsc;		// sat or misc.
};
```

Size of a scan data block is 4 bytes.

```
// complete scan mode mode data structure, one sent per 80 channel scan
// could be defined as follows. Note it contains a header plus 4 radio
// 'info' blocks plus 4 data blocks

struct pcs_scan_data {

	struct header smh;		// header

	struct rx_info scn1_info;	// rx1 info
	struct rx_info scn2_info;	// rx2 info
	struct rx_info scn3_info;	// rx3 info
	struct rx_info scn4_info;	// rx4 info

	struct scan_data rx1_sd[80];	// rx1 data
	struct scan_data rx2_sd[80];	// rx2 data
	struct scan_data rx3_sd[80];	// rx3 data
	struct scan_data rx4_sd[80];	// rx4 data
};
```

Size of a complete scan data block is:
The header, 4 receiver info blocks, 4 receiver data blocks
28 + 4*16 + 4*(80*4) = 1372 bytes

Panther 40 Lambda Averaging in Chameleon CW

Introduction

In some instances it is desirable to reduce the effect of fading in the analysis of transmitted signal propagation. The 40 Lambda averaging technique is a known scheme for accomplishing this goal.

Berkeley Varitronics Systems, Inc. has support for this type of averaging in "Chameleon CW", the universal data conversion tool, starting with version 1.53. This tool converts data that has been collected using Berkeley's CW line of receiver equipment.

Background

It has been concluded that the sampling rate needed to suppress the Rayleigh fading of a propagated signal is:
36-50 samples/ 40 wavelengths

An explanation of this theory can be found in the book titled "Mobile Cellular Telecommunications Systems" by William C. Y. Lee. Therefore, assuming that the sampling rate of the receiving equipment is greater than the number of samples required by the 40 Lambda theory, the samples maybe reduced to the needed number of samples per second through averaging.

Example: Signal frequency = 800MHz.
Drive-study speed = 100KM/H.
l = Wavelength of signal
v = Velocity of signal
f = frequency of signal

Therefore, l=v/f. l=(300000000m/s)/(800000000/s).

l = .375 meters

Now,we will take 40 samples per 40 wavelengths. Therefore, we need the time duration for 1 wavelength.

T = time duration to drive 1 wavelength.
V = Velocity of vehicle.

V = (100km/h)(1000m/km)/(3600s/h) = 27.78 m/s
T = (l) / V = (.375m) / (27.78m/s)
T = .0135 seconds

S = Sampling rate needed.

S = 1 / .0135 s = 74.08 samples / second

Chameleon CW 40 Lambda Conversion

The BVS Chameleon CW data conversion tool has an option for averaging based on the 40 Lambda theory. This option is available for data collected via the BVS Panther 4-channel receiver.

In the FAST mode of each piece of equipment, 512 samples per second are taken. The BVS Chameleon CW then reduces this data to the appropriate amount of samples required by the 40 Lambda criteria. The user only has to input the average drive speed of the vehicle.

ONCORE INTERNAL GPS RECEIVER

Refer to this text for: interface protocol descriptions
operational modes of your ONCORE receiver
additional customizing ca pabilities/operation

OVERVIEW

The Motorola ONCORE Receiver is an intelligent GPS sensor intended to be used as a component in a precision navigation system. The ONCORE Receiver is capable of providing autonomous position, velocity, and time information over a serial RS232 port. The minimum usable system combines the ONCORE Receiver and an intelligent system controller device.

INTERFACE PROTOCOL

The Motorola ONCORE Receiver is provided with one RS232 serial data port. The port is configured as o t L) ta communications equipment (DCE) port and provides the main control and data path between the ONCORE Receiver and the system controller. The user can customize the 1/0 protocol on the BASIC and XT RS-232 port to be one of three different formats. In order to support differential applications, the Basic and XT ONCORE receivers support various degrees of differential capabilities dependent on the selected protocol. The table below summarizes the built-in DGPS features as a function of the user-selected 1/0 protocol. The VP ONCORE 1/0 port provides a TTL interface.

Available Interface Protocols

FORMAT	TYPE	BAUD	BITS	START	PARITY	FEATURES	DIFFERENTIAL CAPABILITY
Motorola	Binary	9600	8	1/1	no	full control/all data	RTCM SC-104*
NMEA	ASCII	4800	8	1/1	no	partial control selected messages	RTCM SC-10411
LORAN	ASCII	1200	8	1/1	no	little control/1 output message	none

Notes: * RTCM SC-104 decoding of Message Type #1 exists in deoptioned units. It is available to all users at no additional cost.

Once you select a format type, the ONCORE Receiver operates in the selected protocol. The ONCORE Receiver remembers the protocol when the power is removed and initializes itself to the previous state when power is reapplied. You can switch to an alternate 1/0 protocol by issuing the valid Switch Format" input command in the currently selected format. All parameters set in one format are remembered and applied in the alternate format. The 1/0 port operates under interrupt control. Incoming data is stored in a buffer that is serviced by the ONCORE Receiver's operating program. In the Position Fix mode, this buffer is serviced every 1.0 seconds.

Motorola Binary Format

The binary data messages used by the ONCORE Receiver consist of a variable number of binary characters. These binary messages begin with the ASCII @@ characters and are terminated with the ASCII carriage return and line feed <CR><LF>. The first two bytes after the @@ characters are two ASCII message ID bytes that identify the particular structure and format of the remaining binary data. The last three bytes of all messages contain a single byte checksurn (the exclusive-or of all message bytes after the @@ and before the checksum), and a message terminating ASCII carriage return line feed character sequence.

Message Start:
@@ - (two hex 40s) denotes start of binary message.

Message ID:
(AZ)(az, AZ, 09) - ASCII upper-case letter, followed by an ASCII lower-case or upper case letter, or digit. These two characters identify the message type, and implies the correct message length and format.

Binary Data Sequence: Variable number of bytes of binary data dependent on the command type.

Checksum:

C - The exclusive-or of all bytes after the @@ and prior to the checksum.

Message Terminator:

<CR><LF> - carriage return line feed denoting end of the binary message.

Every ONCORE Receiver input command has a corresponding response message so you can verify that the input commands have been accepted or rejected by the ONCORE Receiver. The message format descriptions detail the input command and response message formats. Information contained in the data fields normally is numeric. The interface design assumes that the operator display is under control of an extemal system data processor and that display format and text messages reside in its memory. This approach gives you complete control of display format and language. The ONCORE Receiver reads the input command string on the input buffer once per second. If a full command has been received, then it operates on that command and performs the indicated function. The following logic relates to the i nput character string checks that are performed on the input commands:

A binary message is considered to be received if:

(1) It began with @@ and is terminated with a carriage return and a line feed

(2) The message is the correct length for its type

(3) The checksum validates

You must take care in correctly formatting the input command. Pay particular attention to the number of parameters and their valid range. An invalid message could be interpreted as a valid unintended message. A beginning @@, a valid checksum, a terminating carriage return line feed, the correct message length and valid parameter ranges are the only indicators of a valid input command to the ONCORE Receiver. For multiparameter input commands, the ONCORE Receiver will reject the entire command if one of the input parameters is out of range. Input and output data fields contain binary data that can be interpreted as scaled floating point or integer data. The field width and appropriate scale factors for each parameter are described in the individual 1/0 message format descriptions. Polarity of the data (positive or negative) is described via two's complement presentation.
Once the input command is detected, the ONCORE Receiver validates the message by checking the checksurn byte in the message. Input command messages can be stacked into the ONCORE Receiver input buffer, up to the depth of the message buffer (2048 characters long). The ONCORE Receiver will operate on all full messages received during the previous 1 second interval and will process them in the order they are received. Every input command has a corresponding output response message. This enables you to verify that the ONCORE Receiver accepted the input com-mand. The ONCORE Receiver response message to properly formatted commands with at least one out-of-range parameter is to return the original nonchanged value of the parameter(s). Input commands may be of the type that change a particular configuration parameter of the ONCORE Receiver. Examples of these input conunand types include commands to change the initial position, the ONCORE Receiver internal time and date, satellite mask angle, satellite almanac, etc. These input commands, when received by the ONCORE Receiver, change the indicated parameter and result in a response message to show the new value of the particular parameter. If the new value shows no change, then the input command was either formatted improperly, or the parameter Was Out of its valid range.

Input commands may be of the type that enable or disable the output of data or status messages. These output status messages include those that the external controller will use for measuring position, velocity, time, pseudorange, and satellite ephemeris data. Status messages are output at the selected update rate (typically, once per second) for those messages that contain position, velocity, time, or range data, or can be commanded to output the data one time upon request. Those messages that include slowly changing data, such as satellite ephemeris data, satellite visibility tables, xDOP tables, etc., are output once when the ONCORE Receiver detects a change in the data from the previous output data. For example, if the user enables the ONCORE Receiver to output ephemeris data, the ONCORE Receiver will output the ephemeris data once upon receipt of the input command, and then once upon detection of the change of the ephemeris (typically once per hour).

All of the Position/ Status/Da ta message types can be selected independently to be output in a continuous fashion (at the selected update rate), or once each time the data is requested (polled). The rate at which the data is output in the continuous output mode is dependent on the type of data in the message. The Data Message Output Rates table shows the rates at which the data messages are output for each type of message, depending on the setting of the continuous/ one-time option that is part of the input command.

Data Message Output Rates

OUTPUT MESSAGE TYPE	CONTINUOUS (m=1 255)	ONE TIME (m=O)
Position/Channel Status	At selected update rate	When requested
Satellite Range Data Output	At selected update rate	When requested
Pseudorange Correction Output	At selected update rate	When requested
Ephemeris Data Output	When Eph data changes	When requested
Satellite Broadcast Data Msg	Once every six seconds*	One time**
Visible Satellite Status	When Vis data changes	When requested
DOP Table Status	When DOP data changes	When requested
Almanac Status	When Alm status changes	When requested
Leap Second Pending	When Requested	

*The message is sent 1 second after word 10 of the current subframe is collected.
**One time after the current subframe (word 10) of data has been collected.

For the case where more thin one output message is scheduled during the same I second interval, the GPS Receiver will output all scheduled messages but will attempt to limit the total number of bvtes transmitted each second to 750 bytes. For the case of multiple output messages, if the next message to be sent fits around the 750 byte length goal, then the message will be output. For example, if messages totaling 718 bytes are scheduled to be sent, and the user requests another 58 byte message, then 776 bytes will actually be sent. If the user requests Vet another 86 byte message, then its output will be left pending and will be scheduled when the total number of output bytes allows. The order shown in the Data Message Output Rates table is the priority order for transmitting messages. Below this priority list, the ONCORE Receiver Control Parameters response messages and the Utilities response messages have the lowest priority. You can select each of the output data messages as either one-time output (polled), or output continuously (continuous) at a selected update rate. The polled or continuous option of each output message is remembered during the power-off state in the ONCORE Receiver nonvolatile memory

NOTE: Every change-para meter type" input command has a corresponding response message showing the configuration parameter change. To request the current status of the ONCORE Receiver, enter an input command with at least one out-of-range parameter. The response message to properly formatted commands with outof-range parameters is to output the original unchanged value of the parameter.

The ONCORE Receiver is capable of supporting the following optional capability via the Motorola Binary 1/0 Format. Receivers with no options installed will not respond to, nor create, the following input/output messages listed below. In addition, the 1 PPS hardware output of the receiver 1/0 port is deactivated. You can install these options independently at any time. Contact your Motorola P. N. S. B. customer repersentative for information about option installation.

Options

Option: Thning1l PPS Capability
- Position I lold Position
- Position Hold Enable/Disable
- Measurement Epoch Offset
- 1 PPS Time Offset
- 1 PPS Cable Delay

Option: Real-Time Differential Capability (is now a standard feature)
- Position Hold Position
- Position Hold Enable/Disable
- Output Pseudorange Correction (Master Station)
- Input Pseudorange Correction (Remote Mobile)

Available Motorola

Options: Satellite Pseudorange/Carrier Phase Data Capability
Satellite Range Data Output Message

There are three components of data in the satellite range data messagv (Carrier Phase Data, Smoothed Satellite Time data, and RAW Code Phaseand Code Discriminator Data) shown in the following table.

Three Components of Satellite Range Data Message

DATA CONTAINED IN SAT RANGE MSG	OPTION	OPTION	OPTION
Raw Code Phase & Disc Data	yes	yes	yes
Smooth Sat Time Data	yes	yes	yes
Carrier Phase Data	yes	no	no

The same format for the satellite range data message applies to all three options. The data fields that are not available in the Options are zero filled.

Input/Output Processing Time

The receiver operates in two modes: idle and position fix. When the receiver is in the idle mode, no satellites are being tracked, and only the last known receiver position is available. When the receiver is in the position fix mode, satellites are being tracked, and the current receiver position is available. In the idle mode, the receiver processes input buffer data as soon as a full command has been detected. In the position fix mode, the input buffer data is serviced once a second.

The message response time will be the time from the transmission of the first byte of input data to the transmission of the last byte of output data. For the idle mode, assuming 1 ms per transmission of a data byte, and assuming 50 ms command processing, the best case and worst case scenarios follow.

Best Case (Idle): Delete all waypoints

Thci= shortest command input + command processing + shortest command output

= 7ms + 50 ms + 7 ms

= 64 ms

Worst Case (Idle): Output route

Twci= longest command input + command processing + longest command output

= 21 ms + 50 ms + 377 ms

= 448 ms

Input/Output Processing Time(Cont) In the position fix mode, the command processing time will be skewed since the time will be dependent on when the input message buffer is processed. For best case processing, the input command would have to arrive just before the input buffer data is processed, and the output response would have to be the first (or oniv) receiver output. For worst case processing, the input command would have to arrive just after the input buffer data had been processed, and the output response would have to be the last receiver output. Assuming 1 ms per transmission of a data byte, assuming 50 ms command processing, and assuming a uniform distribution for time of input command data entry, the best case, typical case, and worst case scenarios are shown below.

Best Case (Position Fix): Delete all waypoints

Tbcf= shortest command input + command processing + shortest command output
= 7 ms + 50 ms + 7 ms
= 64 ms

Typical Case (Position Fix): Any command

Ttcf= input anywhere across one second period
+ command processing + output anywhere across
one second period following command processing
= 0.5 s + 0.05s + 0.475 s
= 1.025s

Worst Case (Position Fix): Any command

Twcf= input beginning of one second period + output end
of one second period
= 1 s + 1 s
= 2s

NMEA-0183 Format Description
Output of data in NMEA-0183 standard format allows interface via the RS232 port to an electronic navigation instrument that supports the specific messages that are transmitted. The ONCORE Receiver will support the following NMEA output messages per the NMEA-0183 Revision 2.0
Specification:

GPGGA	CPS Fix Data
GPGLL	Geographic Position - Latitude/ Longitude
GPGSA	GPS DOP and Active Satellites
GPGSV	GPS Satellites in View
GPRMC	Recommended Minimum Specific GPS/ TRANSIT Data
GPVTG	Track Made Good and Ground Speed
GPZDA	Time and Date

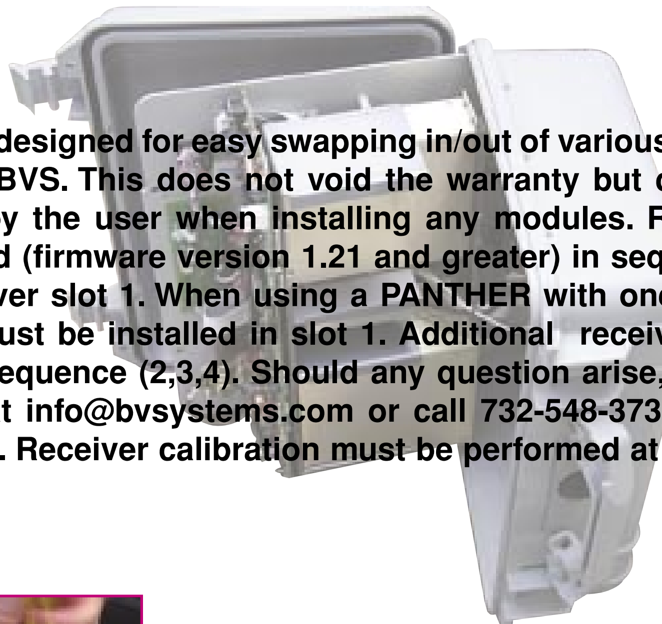
You can enable or disable each message output independently and control the update rate at which the information is output. Once enabled to output a particular message at a pirticular rate, the GI'S Receiver remembers the settings when powered off and reconfigures itself to the same state when powered up again. All NMEA messages are formatted in sentences that begin with ASCII $ (hex 24) and end with ASCII <CR><[.F> (hex OD and hex OA). A five-character address occurs after the ASCII $. The first two characters are the talker ID (which is GP for GPS equipment), and the last three characters are the sentence formatter or message ID from the table above. Any number of fields and an optional checksum can occur in the sentence as long as the total number of characters does not exceed 79. Fields within the message are delimited by the ASCII comma. The checksum is calculated by XORing the 8 data bits of each character in the sentence between, but excluding, the $ and the optional (*) or (CS) checksum. The high and low nibbles of the checksum byte are sent as ASCII characters. You control the output of the above listed messages with Motorola NMEA format messages. Input messages are allowed in the NMEA specification, and take the form $PMOTG *CS<CR><LF>. All input parameters are separated with comma delimiters. The P character identifies the message as Proprietary format, and the MOT is the manufacturer designator for Motorola Inc.

For the case where more than one output message is scheduled during the same 1 second interval, the GPS Receiver will output all scheduled messages but will attempt to limit the number of bytes transmitted each second to 375 bytes. For the case of multiple output messages, if the next message to be,sent fits around the 375 byte length goal, then the message will be output. For example, if messages totaling 334 bytes are scheduled to be sent, and the user requests another 80 byte message, then 414 bytes will actuafly be sent. If the user requests yet another 70 byte message, then its output will not be generated. The order for priority for transmitting messages is simply alphabetical.

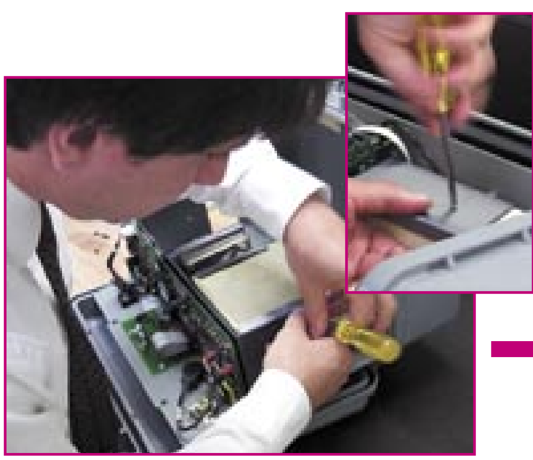
LORAN Emulation Format Description
This particular Output message format is intended to emulate the position status message string from a LORAN receiver. This allows you to use the GPS receiver to replace the LORAN receiver in embedded positioning system applications. You can request the LORAN position status message string to be output at any update rate (from 1 second to 1 hour in 1 second increments) and can operate it in a polled mode where the host can request the receiver to output the position status message upon request. The selected rate of the output message is remembered between power on-off-on sequences.

Begin by loosening the thumbscrews located at the bottom of the top panel

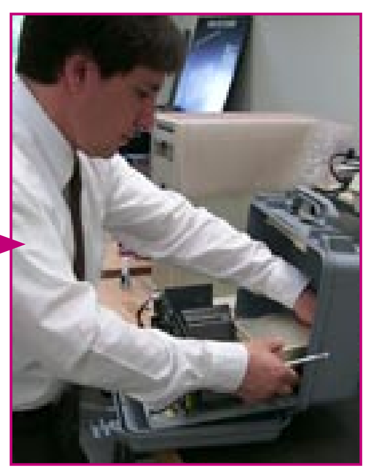
Carefully lift top to reveal internal receivers



Panther is designed for easy swapping in/out of various receiver modules from BVS. This does not void the warranty but caution should be taken by the user when installing any modules. Receivers must be installed (firmware version 1.21 and greater) in sequence starting from receiver slot 1. When using a PANTHER with one receiver, that receiver must be installed in slot 1. Additional receivers should be added in sequence (2,3,4). Should any question arise, you may contact BVS at info@bvsystems.com or call 732-548-3737 for technical assistance. Receiver calibration must be performed at BVS labs.



Unscrew the receiver from its mounting brackets



Unattach any cables and slide out receiver modules

Slide new module back into bracket

BVS Panther Data Logger
User Manual
(For versions 4.00 and later)

Introduction
The BVS Panther Data Logger (PDL) is the PC application that stores data collected using the BVS Panther 4-channel receiver. This data is displayed visually as well as stored in a log file for later conversion via the "Chameleon" conversion software provided by BVS.

The PDL also allows you to modify certain settings on the Panther. Scan tables may be uploaded and downloaded for each of the four receivers. Incremental scanning options may also be transferred. Scan tables may also be saved to and restored from disk.

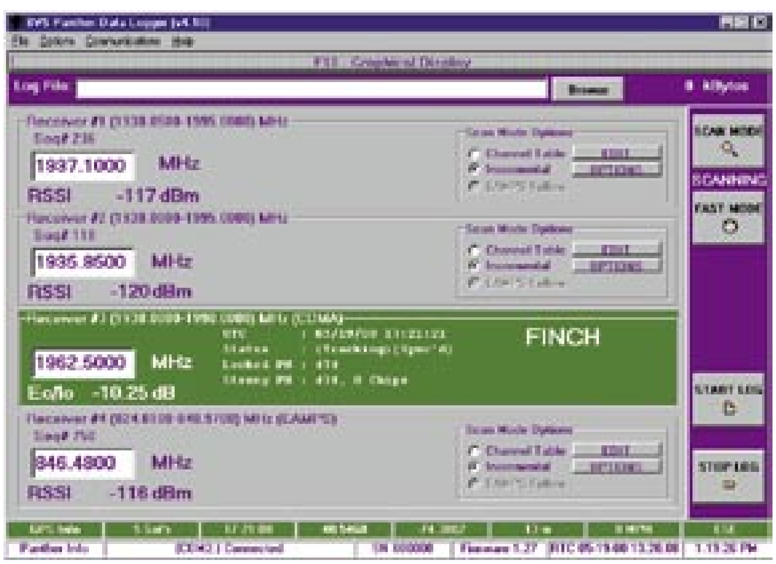
System Requirements
Pentium II
500 MHz
64MB RAM
100MB free on Hard Drive
Operating System: Windows 95/98/Me
free serial port between COM1: and COM4:Windows® 95, 98 or ME operating system

Getting Started
To begin using the PDL software:

1. Connect the Panther to the PC or laptop via the serial cable provided.
2. Turn on the Panther.
3. Start the PDL by double-clicking on the icon.
4. Choose the communications port to which the Panther is connected.
5. A message will appear in the status bar on the bottom of the PDL stating that it has connected to the Panther.

Quick Tour
Now that you have the PDL up and running, let's look at the features of the application.

The PDL consists of a main menu. Beneath the min menu is the log file selection bar. Along the right side of the application is the action bar, where the Panther and logging modes are selected.



Panther Data Logger

On the bottom of the screen are the two status bars. The top status bar is the GPS Information bar.

Current information from the GPS receiver is displayed including, from left to right:

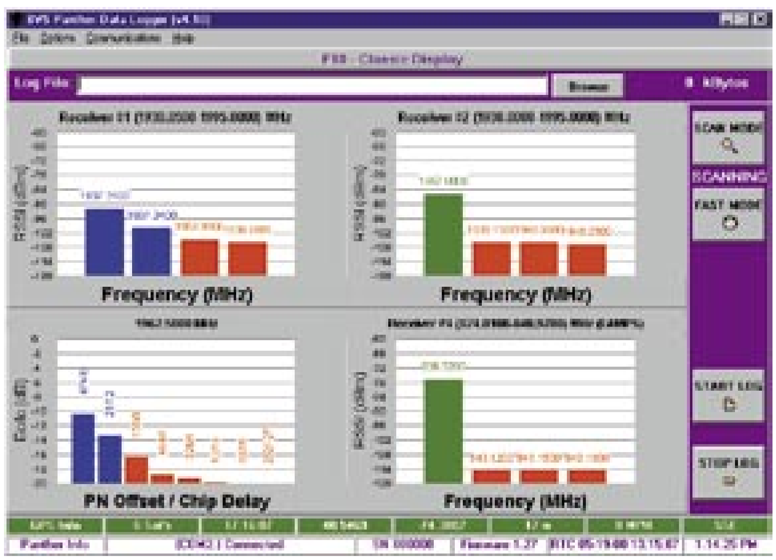
1. Number of satellites being tracked.
2. Time
3. Latitude in decimal degrees.
4. Longitude in decimal degrees.
5. Height in meters.
6. Speed in miles per hour.
7. Heading (e.g. N is North)

The bottom bar is information concerning the Panther itself. It contains:
1. Connection status.
2. Unit serial number.
3. Firmware version.
4. Internal real-time clock date and time.
5. PC system time.

The center of the screen can be switched between two different information screens by use of the F10 key or by clicking on the button located between the main menu and the log file selection bar.

The first screen is the classic screen. This displays information similar to the LCD on the Panther as well as provide options for scan modes.

The second screen is the graphical display screen. This screen shows bar charts representing different frequencies (or PN's for a FINCH module).



PDL Graphical Screen

Logging Data
Logging data from the Panther is straightforward. Choose a filename from the log file selection bar. Then, click on the "START LOG" button in the action bar. Click "STOP LOG" to stop logging.

You will notice the size of the current log file incrementing when log mode is "ON". You will also notice the message "LOGGING" appear between log mode buttons.

Single Frequency Mode
Single Frequency Mode is the standard mode for the Panther. It monitors a single frequency for each receiver within the Panther.

Frequencies may be changed from the PDL by selecting the frequency and setting it to a corresponding new frequency for the appropriate receiver.

Scan Mode
Scan Mode may be started from the PDL by clicking on the "SCAN MODE" button in the action bar. The mode

selected for each receiver will then commence. Note the sequence number on the classic screen. This is a notification of where the Panther is in its search. When the sequence number reverts back to #1, a cycle has completed.

There are three different types of scan modes. Scanning can be accomplished through a scan table, an incremental approach, or call follow mode (EAMPS only). Each of these may be selected by choosing the appropriate radio button in the classic screen.

The graphical screen will display the top frequencies for each receiver.

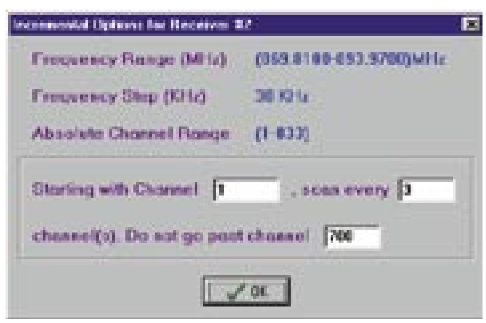
Scan Table Options

The scan table for each receiver may hold up to 1600 channels. The table may be uploaded to or downloaded from the Panther. The table may also be saved to disk. When entering channels for the table, you may enter in channels or frequencies. The appropriate channel/frequency will adjust to the other field being entered.

Scan Table Option Screen

Incremental Scan Options

Incremental mode allows you to set a starting channel, ending channel, and channel step for the appropriate receiver.



Incremental Scan Option Screen

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.

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.

Introduction

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

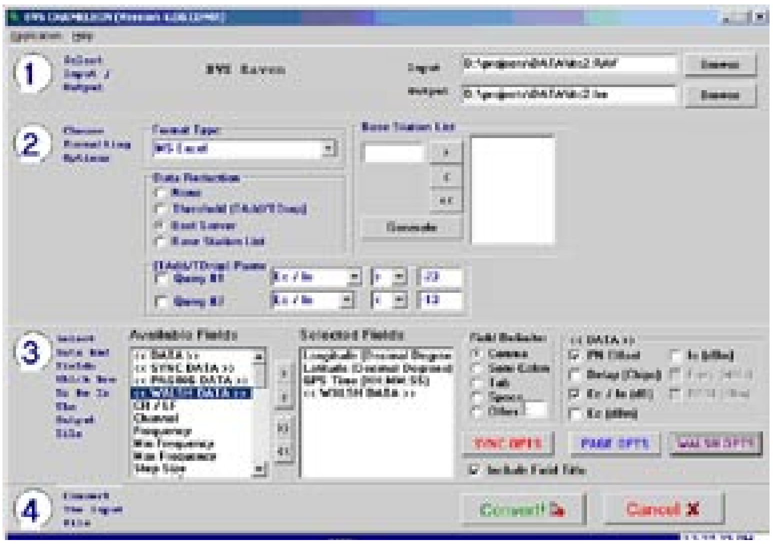

FIGURE 1 – Chameleon Main Screen

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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.

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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.

Panther Receiver Removal/Installation Procedure

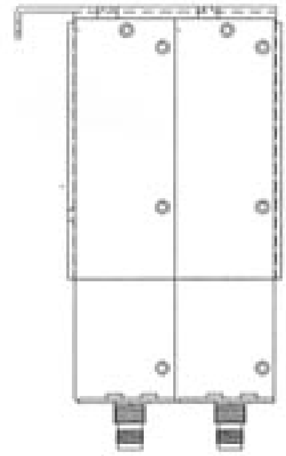
Undo two thumbscrews on top panel, pull panel forward slightly and up.

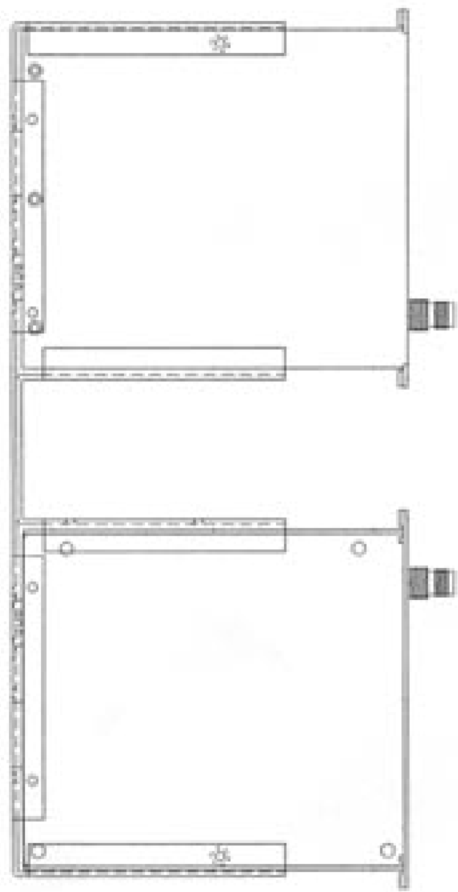
With top panel open turn Panther on its side, with receiver to be changed top most.

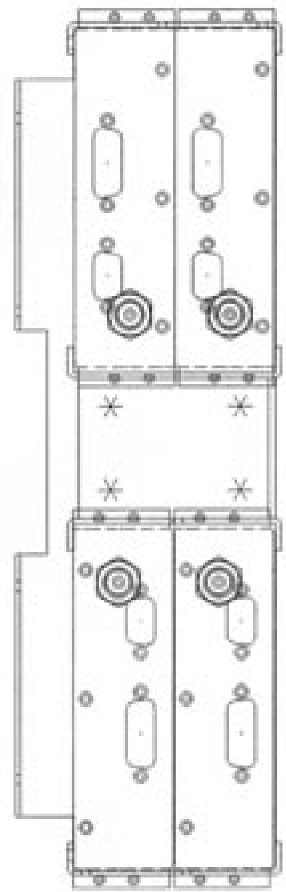
Remove screw securing receiver to partition. Rock and pull receiver toward bottom of case and remove.

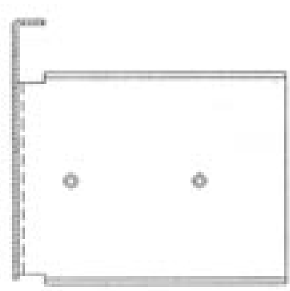
Push replacement receiver into desired slot. Install securing screw.

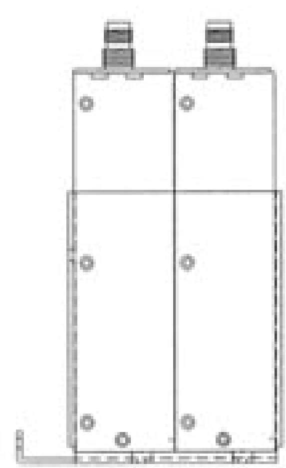
Turn Panther back on its bottom. Carefully close top panel insuring receiver's TNC aligns with rear inset panel ports. Push down on top panel firmly by thumbscrews,









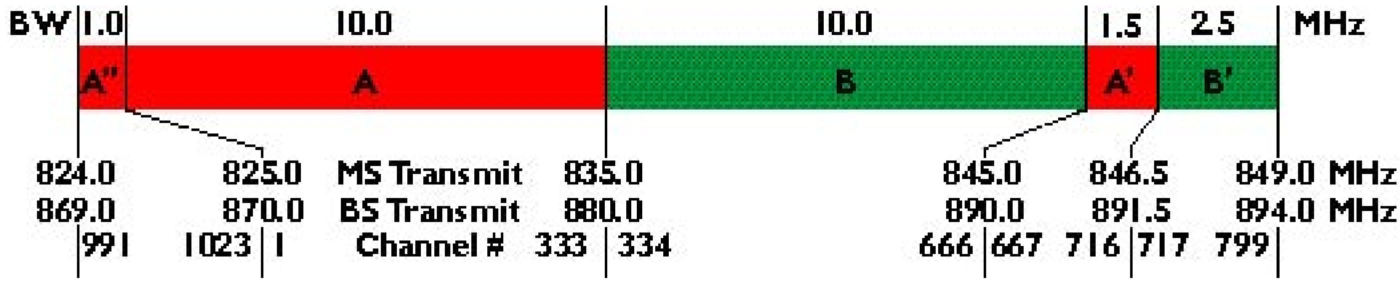


and turn thumbscrews to secure top panel.

Frequency Plans

Cellular (IS-95A)

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

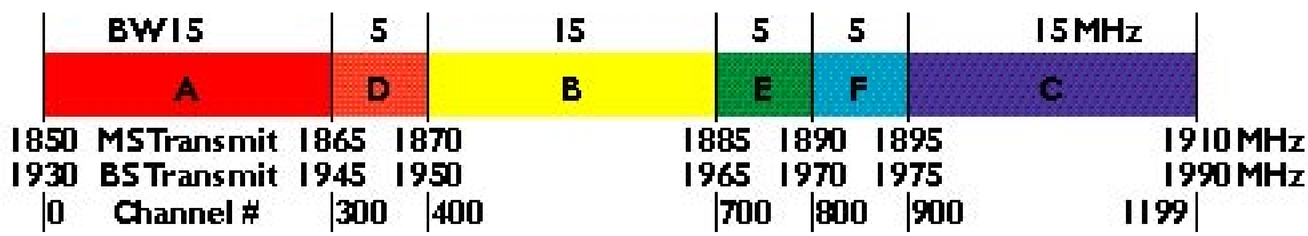


Consecutive AMPS channels are spaced by 30 kHz. CDMA stations are permitted to operate on any AMPS channel, except for guard bands at the edges of the allocations. CDMA stations, of course, would normally be assigned channel at least 1.25 MHz apart (about 42 channels). The mobile station transmit frequency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

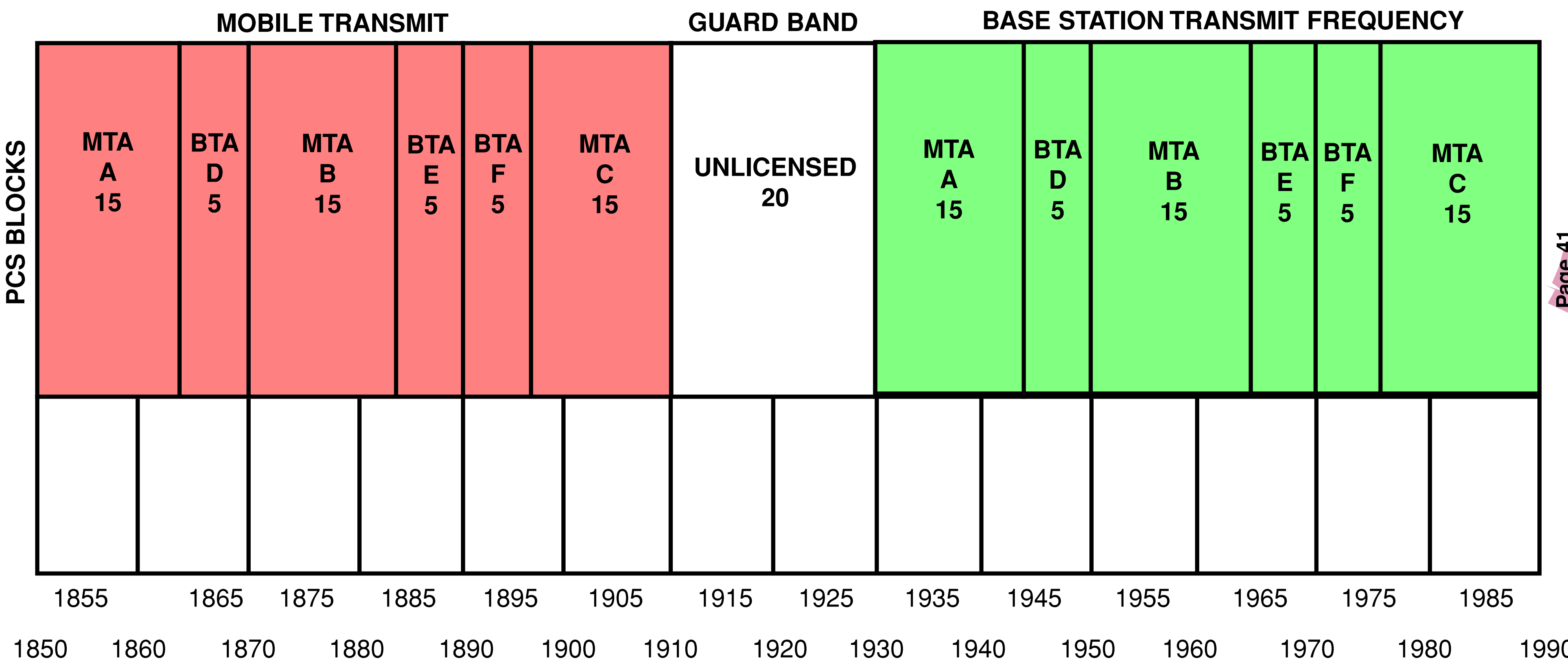
CDMA Preferred Frequency Assignments

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

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

PCS ALLOCATION TABLE



GPS-MM Active Mobile (Magnetic Mount) GPS Antenna

General Description:

The GPS-MM is a high performance GPS patch antenna combing a state-of-the-art low noise amplifier with a low profile, compact, fully water-proof enclosure. When connected to a GPS receiver with 3-5 VDC antenna power, the GPS-MM provides excellent signal amplification in addition to out-of-band filtering & rejection.

This data sheet specifies the basic operational characteristics of the active GPS antenna module GPS-MM under a standard test condition of 3V DC at 25°C and 50% relative humidity.

Specifications:

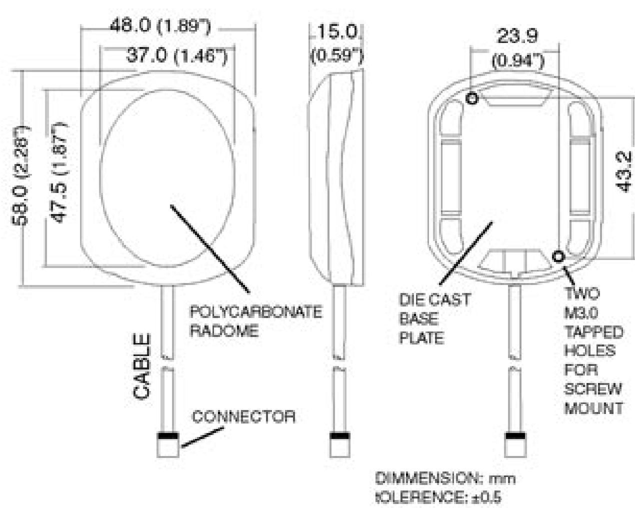
PHYSICAL	
Construction:	Dark gray Polycarbonate-radome at top, die-cast shell at bottom/ rubber gasket for water seal in between
Dimension:	58mm (L) x 48mm (W) x 14mm (H)
Weight:	65 grams (excluding cable & connector)
Standard Mounting:	Magnet mount with two magnets
ANTENNA ELEMENT	
Center Frequency:	1575.42 MHz +/- 1.023 MHz
Polarization:	R.H.C.P. (Right Hand Circular Polarization)
Absolute Gain at Zenith:	+5 dBi typically
Gain at 10o Elevation:	-1 dBi typically
Axial Ratio:	3 dB max.
Output VSWR:	1.5 max.
Output Impedance:	50 ohm
OVERALL PERFORMANCE (Antenna Element, LNA & Cable)	
Center Frequency:	1575.42 MHz
Gain:	25 dB min.
Noise Figure:	2.6 max.
Band Width:	2 MHz
Axial Ratio:	3 dB max.
VSWR:	2.0 max
Output Impedance:	50 ohm

Specifications (Continued):

LOW NOISE AMPLIFIER	
Center Frequency:	1575.42 MHz ±1.023 MHz
Gain:	25 dB typically
Band Width:	2 MHz min.
Noise Figure:	2.6 max.
Out Band Attenuation:	12dB min. @F0 ±140MHz
Supply Voltage:	3.0~5.0V DC
Current Consumption:	12 mA +/- 2 mA
VSWR:	2.0 max.
Output Impedance:	50 ohm

ENVIRONMENTAL	
Operating Temperature	-30oC~+85oC
Storage Temperature:	-40oC~+90oC
Relative Humidity:	95% non-condensing
Waterproof:	100% waterproof

Dimensional Drawing:



Ordering Information:

Model Number	Part Number
BVS-MM	10001268 with 5 m cable & R/A MMCX Plug
BVS-MMB	10001273 with 5 m cable & ST BNC Plug

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.)

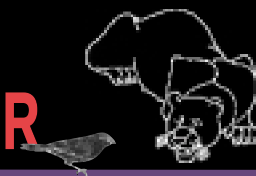
8. When inserting batteries into this product, the proper polarity or direction must be observed. Reverse insertion of batteries can cause charging, and that may result in leakage or explosion. (Applies to product employing more than one separately replaceable primary battery.)

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.

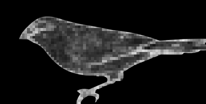
The Panther™ 4 CHANNEL RECEIVER



FINCH CDMA RECEIVER MODULE

The Panther™ is a high performance, modular receiver system providing precision, four channel signal strength measurements using four independent receivers. Panther provides a high speed, unfiltered data output, including time, GPS, marker frequency of measurement followed by 512 measurements per channel.

With the Finch™ CDMA module, Panther becomes a powerful 4-channel receiver system able to measure and report both analog and digitally modulated signals simultaneously. Finch measures all 512 base stations and measures true CDMA (Ec/Io) correlated signal strength $\pm$ 1.0 dB in less than one second.



Optional Finch™ CDMA module shown

FEATURES:

- **Now** supports simultaneous **CDMA** and Analog receiver modules for verification of neighbor lists, PN assignments, handoff thresholds, pilot pollution and analysis of coverage areas
- Modular construction allows any combination of analog & digital receiver pairs, i.e. Cellular, PCS, Paging, SMR/iDEN and LMR, in any combination of forward and/or reverse bands with up to four receivers
- High speed scanning ability supports **40 Lambda Data Averaging**
- Precise navigation using an internal 8-channel Global Positioning System (GPS)
- Super bright display using 240 x 128 pixel graphic supertwist LCD (VF backlighted)
- 12 volt DC operation via supplied transformer or vehicle power
- Total system weight under 17 lbs., encased in a durable water resistant case
- Internal speaker and headset audio output
- Measurements exceed sampling rate requirements for 40 λ at vehicle speeds >80 MPH
- High speed interface to PC via 38,400 bps serial port

The Panther with Finch CDMA module 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
E-mail: info@bvsystems.com

wireless products

BERKELEY VARITRONICS SYSTEMS

The Panther™ 4 CHANNEL RECEIVER

SPECIFICATIONS

FINCH MODULE RF PERFORMANCE:

IF BANDWIDTH	1.25 MHz
MEASUREMENT ACCURACY	Ec/Io ± 1 dB@ 25C deg ± 2 dB@ 0-50C deg
RECEIVER NOISE FIGURE	< 7.5 dB
ANTENNA INPUT SENSITIVITY	> -90 dBm
MAXIMUM SAFE INPUT	+ 10 dBm

FINCH MODULE 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

PANTHER QUAD RECEIVER SYSTEM:

DISPLAY	128x240 pixel Graphic Backlighted VF LCD (Super Twist)
TUNING RANGE	20-40 MHz synthesized tuning covering any band
BANDS SUPPORTED	ISM: 2.400-2.485 GHz
	ISM: 900-930 MHz
	LMR: 805-825, 850-870 MHz
	SMR / iDEN: 851.0125-870 MHz
	Paging: 145-165, 450-465, 928-941 MHz tunable in either 12.5 kHz or 25 kHz steps
CDMA and Analog:	*PCS: 1850-1910, 1930-1995 MHz (A,B and C Blocks)
CDMA and Analog:	*Cellular: 824-848, 868-896 MHz tunable in 30 kHz steps
ANALOG RSSI MEASUREMENTS	
Fast Scan: (For Each Receiver):	512 measurement/second
Scan Mode(10 bit precision A/D convertor):	up to 80 Freq/Rec

GENERAL SPECIFICATIONS
(For each Receiver Module)

Dual Conversion:	83 MHz first IF, 455 kHz second IF
IF Bandwidth:	4 kHz, 10 kHz, 25 kHz or 30 kHz available (@ 5dB)
Stability:	± 2.5 PPM from freezing to 120 degrees F
Phase Noise:	> 80 DBC @ 1 kHz
Antenna:	TNC 50 ohms
Controls:	20 button keypad
Warm Up Time:	< 3 minutes
Power:	External car cigarette lighter 12-16 VDC @ 200 mA External DC transformer 16V @500 mA, 120 or 240 VAC auto switching
Serial Port:	RS-232, 38,400 baud, 8 bit. no parity, 1 stop bit
Weight:	17 lbs.
Dimensions:	7" H x 13" W x 16" L
Approvals:	UL, CSA external supply

All Panthers include internal 8-channel differential GPS with antenna, cigarette car adapter for mobile power and Windows 95 compatible software. Ask for optional IF Bandwidths and BER Demodulation.

Berkeley Varitronics Systems, Liberty Corporate Park, 255 Liberty Street, Metuchen, NJ 08840
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