Berkeley's own dual band receiver...

Companion

Manual Version 2.0

CONTENTS PAGE

TRADEMARKS

IBM PC is a trademark (tm) of IBM Corporation.
MS-DOS is a trademark (tm) of Microsoft Corporation.
Excel is a trademark (tm) of Microsoft Corporation.

CAUTIONS

GPS POWER SWITCH

This switch (located to the left of the power on switch) should ONLY be switched when the unit's main power is OFF. NEVER turn the GPS ON or OFF while the COMPANION is running.

IMPORTANT NOTE WHEN USING THE PC SERIAL PORT TO COLLECT DATA

If the computer used to collect serial data boots up in Windows (3.1 or 95), do the following BEFORE attempting to save serial binary data in a disk file:

a) Enter WINDOWS
b) Select the MAIN menu (win 95 "Mycomputer")
c) Select CONTROL PANEL, when in, select PORTS
(win 95 system\device manager)
d) Set COM 1 or COM 2 (depending on which is to be used) FLOW CONTROL to "HARDWARE" or "OFF". The normal setting for this option is "XON-XOFF". Flow Control MUST be set to the "HARDWARE" or "OFF" option for binary data collection to work reliably.

Also note that when using laptops, POWER MANAGEMENT control MUST be turned OFF. This feature is usually found in the CONTROL PANEL, set it to OFF. If the power management control software puts the laptop in low power mode DURING data collection, data WILL be lost.

INTRODUCTION

The COMPANION is equipped with an 8 channel GPS receiver whose data is both displayed on the LCD and included in the serial output for post processing.

The Companion is a dual RF receiver that measures RF in one of two modes:

SINGLE FREQUENCY MODE

Each receiver independently measures signal strength (in dBm) 200 times per second for the selected frequency of both receivers. The data is output simultaneously on the local back lit LCD display and through the serial port for collection on a PC for post processing.
The demodulated FM signal of both receivers can be listened to using the built in speaker or headphone jack using the supplied headphone.

The supplied MSDOS PC software is used to collect and save the RF data in a PC disk file. While the data is being collected, it can be viewed on the PC screen either in a text or graphic format. In order to use the graphic features of the PC software, the computer must be equipped with a VGA (color) display. The post process outputs of the PC software include:

1) Conversion of data to ASCII for import into EXCEL or MAP INFO.

2) Graph of either receivers data vs. position (LAT-LON).

3) Graph of either or both receivers dBm values vs. time.

SCAN FREQUENCY MODE

Each receiver can be programmed using the supplied PC software to scan and record signal strength of up to 80 frequencies for each receiver. The strongest frequency encountered at each scan is displayed on the LCD. In addition, all data for each scan is sent through the serial port for collection on a PC for post processing.

The supplied MSDOS PC software is used to collect and save the RF data in a PC disk file. While the data is being collected, it can be viewed on the PC screen in a text format. In addition, the PC software contains a frequency/channel editor that is used to create receiver scan tables and to download the tables to the COMPANION. The SCAN mode is started and stopped via the PC serial port, the top panel controls (KNOB and all keys) are inactive when the unit is in the scan mode.

SPECIFICATIONS

Input Power MIN..... 12 VDC
Input Power MAX ..... 15 VDC
DC Current..... 1.5 AMP

Receivers

Standard Frequency Ranges (MHz)

1930-1995,1850-1910(PCS)
935-960, 890-915(ETACS)
928-941(PAGING)
900-930(ISM)
850-870(SMR)
869-893, 824-848(EAMPS)

Other ranges available upon request.

Measurement Speed (Single Frequency Model)... 200 dBm per second
(Both receivers)
Sensitivity..... -118 to -30 dBm +- 1db
First IF..... 83 MHz
Second IF..... 455 KHz
Channel Step - Depends on type of receiver 12.5Khz to 50Khz
Modulation..... FM

INPUT, OUTPUTS and CONTROLS

TOP PANEL

MAIN POWER switch - Use to turn COMPANION on and off.

GPS POWER switch - Use to turn on and off the GPS receiver. Use this switch only when the MAIN POWER switch is OFF. GPS antenna MUST be connected to the back panel GPS antenna input BEFORE the MAIN POWER switch is turned on.

The GPS POWER switch is used to conserve power in situations where GPS is not required
and the COMPANION is being powered by an external battery.

Both the MAIN POWER and GPS POWER switch have a built in indicator lamp that is lit when the switch in question is on.

SELECTION KNOB -The selection knob is used in conjunction with the display to adjust the currently selection parameter. The knob can be used to:
Adjust receiver 1 or 2 frequency
Adjust receiver 1 or 2 volume

There is also a 'LOCK' selection which disables the knob from changing any parameter.

KEYPAD -The 20 key keypad is used to enter frequencies and to enter setup information.

CONTRAST -Use to adjust the contrast (viewing angle) of the LCD display.

HEADPHONE -Connect the supplied headphones to this jack to listen to the demodulated signal of either receiver. Before using the headphones, adjust the volume using the built in speaker to a low level. Then plug in the headphone and adjust the volume to a comfortable level.

BACK PANEL

INPUT-OUTPUT CONNECTOR

RF INPUT - RECEIVER 1TNC +13dBm MAX
RF INPUT - RECEIVER 2TNC +13dBm MAX

GPS ANTENNA INPUTSMA (see note below)

RS232 SERIAL DATA IN\OUTDB9 Female

DC POWER INPUT4 PIN Male

Note: GPS ANTENNA INPUT

This connector supplies 5 Volt power to the supplied GPS antenna. ONLY CONNECT the supplied GPS antenna to this connector when the MAIN POWER SWITCH is in the OFF position. DO NOT connect any other antenna but the supplied GPS ANTENNA to this connector. Connection of other than the supplied GSP ANTENNA to this input MAY damage the GPS receiver.

UNIT OPERATION

TURN ON - If using the GPS receiver, connect the supplied GPS antenna to the back panel GPS antenna input and turn on the GPS POWER switch, making sure the MAIN POWER switch is OFF.

Turn on the MAIN POWER switch, the display will turn on and the power up screen will be displayed:

POWER UP SCREEN

The unit will exit this screen in 15 seconds unless a key is pressed before this time elapses. Use this screen to determine ROM firmware revision # (the number to the right of the letter 'V' on the top line) receiver types (frequency), serial number and last calibration
date (mmddyy).

After the POWER UP SCREEN is displayed, the unit will begin measuring the last two frequencies the unit had been set to when the MAIN POWER switch was last turned off in the SINGLE FREQUENCY MODE. If the unit was last used in the SCAN MODE, the Companion will start measuring the strongest frequency last scanned by both receivers
in the SINGLE FREQUENCY MODE. To resume the SCAN MODE, the PC must be used to re-start scanning the receiver scan tables.

SINGLE FREQUENCY MEASUREMENT SCREEN

Whenever this display screen is active, the COMPANION is measuring the indicated frequencies and data is being output from the RS232 serial connector.

SINGLE FREQUENCY MODE DISPLAY SCREEN

Measurement Data Display:

1 888.3000 -93
Receiver 1 is measuring -93dbm at 888.30MHz

2 1930.2500 -115
Receiver 2 is measuring -115dbm at 1930.25MHz

07-03-97 11:21:11 MARKER 1001
Current date is June 3, 1997
Current time is 9:21:11 am (time is displayed in 24 hour format)
Marker value is currently 1001

LA 40 42.793N LO 074 22.792W LOCKED 4
Current latitude is 40 deg 32.811 min North
Current longitude is 74 deg 22.833 min West
The GPS receiver is locked and tracking 5 satellites

Current Selection Knob Parameter (active option is highlighted):

FREQ1 - if highlighted, KNOB adjusts receiver 1 frequency, ENTER key changes receiver 1 Frequency, SEEK UP/DOWN keys cause receiver 1 to seek up or down

VOL1 - if highlighted, KNOB adjusts receiver 1 volume

FREQ2 - if highlighted, KNOB adjusts receiver 2 frequency ENTER key changes receiver 2 Frequency, SEEK UP/DOWN keys cause receiver 2 to seek up or down

VOL2 - if highlighted, KNOB adjusts receiver 2 volume

LOCK - if highlighted, KNOB locked, turning the KNOB has no effect

UP and DOWN ARROW keys are used to change the highlighted KNOB parameter while in the measurement screen.

For AMPS and ETAC receivers, the channel number to frequency conversion is as defined by the AMPS and TACS specification. For all other receivers, channel number 1 corresponds to the receiver base frequency (as displayed on the POWER UP screen). Each successive channel number to frequency uses the following formulas:

Freq = ((Chan# - 1) * ChanStep (KHz)) + Base Frequency

Chan # = ((Frequency - Base Frequency) / Chan Step) + 1

SINGLE FREQUENCY MODE DISPLAY EXAMPLE

CHANNEL NUMBER DISPLAY EXAMPLE

KEYPAD

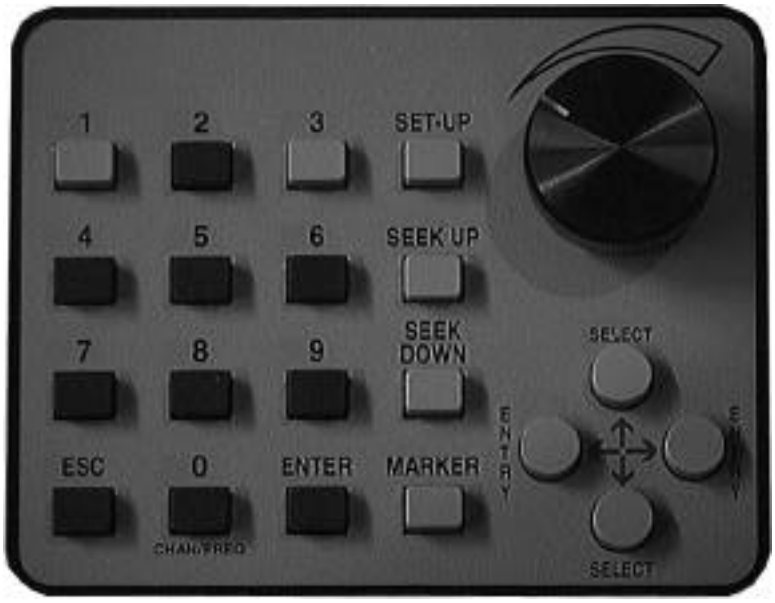
Keys Usage

1-9 & 0 Entry of frequencies, channel numbers and setups.

0 Pressing the 0 key while displaying the measurement screen will change between channel number and frequency for both receiver 1 and 2.

SETUP- Enter COMPANION SETUP SCREENS

SEEK UP- Current Selected receiver SEEKS UP in frequency until a frequency is found that is >= the SEEK dBm threshold. (FREQ1 or FREQ2 must be highlighted)



SEEK DOWN- Current Selected receiver SEEKS DOWN in frequency until a frequency is found that is >= the SEEK dBm threshold. (FREQ1 or FREQ2 must be highlighted)

The SEEK db threshold is set in the SETUP screen. When SEEKing UP or DOWN, the receivers step up or down by single increments of the fixed channel step.

MARKER- Press to increment the measurement marker number. Use to mark areas of interest during measurement.

ESC- Use to exit setups, has no effect during measurement.

ENTER- If FREQ1 or FREQ2 is highlighted, pressing the enter key allows entry of either RX 1

or RX 2 measurement frequency (using the numeric keys rather than the KNOB).

SELECT UP ARROW - Change the KNOB select highlight.
SELECT DOWN ARROW - Change the KNOB select highlight.

ENTRY RIGHT ARROW - No effect in measurement screen. When in setup or chan-freq entry, move input highlight right.

ENTRY LEFT ARROW - No effect in measurement screen. When in setup or chan-freq entry, move input highlight left.

SCAN FREQUENCY MEASUREMENT SCREEN EXAMPLE

Whenever this display screen is active, the COMPANION is in the SCAN FREQUENCY mode and data is being output from the RS232 serial connector. The frequencies and dBm values displayed are the strongest found during each scan through the receiver scan tables.

SCAN FREQUENCY TABLE DISPLAY SCREEN

When in the SCAN MODE, the COMPANION is under the control of the PC. The keys and KNOB are inactive.

```
1 881.5200  -93 SCAN  MODE

2 836.5200  -115

02-19-97 12:04:52 MARKER  27
LA 40 42.793N LO 074 22.792W LOCKED 4
```

Measurement Data Display:
1 881.5200 -93
The strongest frequency encountered during the previous scan of Receiver 1 scan table was -93dbm at 881.52MHz

2 836.5200 -115
The strongest frequency encountered during the previous scan of Receiver 2 scan table was -115dbm at 836.52MHz

02-19-97 17:04:52 MARKER 27
Current date is February 19, 1997
Current time is 5:04:52 pm (time is displayed in 24 hour format)
Marker value is currently 27

LA 40 42.793N LO 074 22.792W LOCKED 4
Current latitude is 40 deg 42.793 min North
Current longitude is 74 deg 22.792 min West
The GPS receiver is locked and tracking 4 satellites

SETUP
Pressing the SET-UP key causes the COMPANION to enter the setup screen.

SETUP SCREEN

Highlight item using UP/DOWN arrows
Press ENTER to change Highlighted item
Press ESC to return from setup

To change DATE/TIME, SEEK THRESHOLD or MARKER, highlight the selection using the up and down arrow key and press ENTER.

SET DATE/TIME SCREEN

Enter the 2 digit (leading zero if < 10) month, 2 digit (leading zero if < 10) day, and 2 digit (leading zero if < 10) year.
Enter the 2 digit (leading zero if < 10) hour, 2 digit (leading zero if < 10) minute, and 2 digit (leading zero if < 10) seconds. Time MUST be entered in 24 hour format (example, enter 17 for 5 pm). Press ENTER to set DATE/TIME as entered.

SET SEEK THRESHOLD SCREEN

Enter the 3 digit (leading zero if < 100) dBm threshold used by SEEK UP and SEEK DOWN keys.

Press ENTER to set the entered threshold.

SET MARKER SCREEN

Enter the 4 digit (leading zero's required) MARKER #. Press ENTER to use the entered MARKER number.

PC SOFTWARE

INSTALLATION

Create a directory on the PC that will be used to collect and post process the COMPANION serial data. Change to that directory and copy all files from the supplied disk to this directory.

EXAMPLE

TYPE:EFFECT

md compan<ENTER>Make directory "COMPAN"
cd compan<ENTER>Change to directory "COMPAN"
copy a:*.*<ENTER>Copy all files from the supplied disk in drive A to the directory "COMPAN"

USING THE PC SOFTWARE

Connect the COMPANION to the PC serial port COM 1 or COM 2 using
the supplied RS232 serial cable.

Run the supplied MSDOS program COMPAN.EXE, type COMPAN<ENTER>

The program will prompt:

Use COM Port 1 or 2 ?

Press 1 if using PC COM port 1, press 2 if using PC COM port 2.

The program will now display the MAIN MENU:

BVS COMPANION SERIAL PORT Interface V1.01
Copyright (c) 1997
Berkeley Varitronics Systems, Inc.,Metuchen, N.J. 08840
732-548-3737

SINGLE FREQUENCY MEASUREMENT MENU

Press: T text display of COM 1 Single Frequency data and save on disk
G graph display of COM 1 Single Frequency data and save on disk

C display Single Frequency file data and convert to ASCII

P to plot Single Frequency file vs. Lat-Lon
D to plot Single Frequency file vs. dBm

F for Frequency Scan Menu

Esc to return to DOS

SINGLE FREQUENCY MEASUREMENT MENU OPTIONS

T - Display (and save to disk) COMPANION data in a text format.
G - Display (and save to disk) COMPANION data as a graph of dBm vs. time.

Press 'T' or 'G' depending on the display desired, the program will prompt:

Save Single Frequency DATA to File:

Enter an MSDOS file name to save the binary data in for further post processing. If it is not desired to save the serial data, just press ENTER.

The TEXT or GRAPHIC screen will be displayed, and within one second, data will be displayed. IF no data is displayed within one second, check that the cable is connected to the COMPANION and that the COMPANION is in the measurement screen.

To stop the PC display (and close the binary save file), press the PC ESC key. The PC will return to the MAIN MENU.

NOTE: To use ANY of the graphics options, the PC used to run the supplied software must be equipped with a color VGA display system. MONOCHROME VGA will work, but it will be difficult to view the graphs since many items are color coded.

Receiver 1 dBm is plotted in BLUE, receiver 2 dBm in GREEN, X axis is time, Y axis is dBm.

SPECIAL PC KEYS WHILE IN THE SINGLE FREQUENCY TEXT DISPLAY

F1 - change Receiver 1 frequency

F2 - change Receiver 2 frequency

F3 - Scan receiver 1 table and resume measuring on the strongest frequency.

F4 - Scan receiver 2 table and resume measuring on the strongest frequency.

F5 - Scan both receiver tables, resume measuring on the strongest frequencies.

C - current receiver frequencies displayed as Channel #'s
F - current receiver frequencies displayed as Frequency (MHz)
M - increment Marker #

SPECIAL PC KEYS (GRAPHIC or TEXT) DISPLAY

ESC - Stop display of data, CLOSE save binary file (if it had been specified) and return to the SINGLE FREQUENCY MENU.

C - Display Single Frequency file data (saved using option 'T' or 'G') in text and convert to ASCII format. To create ASCII files for import into EXCEL or MAP INFO, option 'C' MUST be used.

Press 'C', the program will prompt:

Name of Single Frequency binary file to Display and Convert:

Enter the name given to the binary file saved in the 'T' or 'G' option screen.

The program will now prompt:

MAPINFO,PLANET,EXCEL or RAW DATA Tab delimited OUTPUT
Enter FILE NAME for disk file output
Or press ENTER for output to terminal only:

If it is not desired to create an ASCII file, press ENTER.

If the ASCII file is destined to be imported into EXCEL, enter a file name for the ASCII data with an extension 'XL'.

EXAMPLE EXCEL ASCII FILE NAME: DRIVE.XL

If the ASCII file is destined to be imported into MAP INFO, enter a file name for the ASCII data with an extension 'TXT'.

EXAMPLE MAP INFO ASCII FILE NAME: DRIVE.TXT

The program will now prompt:

Press M for Mapinfo-Planet format
E for EXCEL format
R for RAW DATA format ?

If the ASCII file is destined to be imported into MAP INFO, press 'M', press 'E' for EXCEL format. To convert ALL dBm data into ascii, press 'R' for RAW DATA format.

The program will display the data in the binary file and create the ASCII file. The MAIN MENU will be displayed when the conversion is complete.

P - Use to plot Binary Data file saved with the 'G' or 'T' option, dBm vs. Position (Latitude-Longitude). This Plot will display either Receiver 1 or 2 dBm vs. position. If using this plot, make sure that while the data is collected, the frequency of the receiver to be plotted is not changed.

Press 'P'
The program will prompt:

Name of Disk File to plot:

Enter the name given to the binary file saved in the 'T' or 'G' option screen such as "DRIVE.BIN".

The program will now prompt:

Press 1 to plot RX 1, 2 to plot RX 2

Press 1 to display receiver 1 dBm vs. position, press 2 to display receiver 2 dBm vs. position.

The program will respond:

Scanning File Drive.bin

Wait while the program scan's all of the data to determine the range of LAT-LON and dBm for the selected receiver. When the scan is complete, the program will display the requested receiver dBm vs. position. To the left of the Y axis, the frequency, date and color coded dBm scale is displayed. The Y axis is LATITUDE, the X axis is LONGITUDE. When the plot is complete, the program will display:

Done...
Press Any Key

in the lower left hand corner of the display. Press any key to return to the main menu.

D - Use to plot Binary Data file saved with the 'G' or 'T' option, dBm vs. Time. This Plot will display either Receiver 1 or 2 or both dBm vs. time.

Press 'D'
The program will prompt:

Name of Disk File to plot:

Enter the name given to the binary file saved in the 'T' or 'G' option screen such as "DRIVE.BIN".

The program will now prompt:

Press 1 to plot RX 1, 2 to plot RX 2, B to plot Both

Press 1 to display receiver 1 dBm vs. time, press 2 to display receiver 2 dBm vs. time, press 'B' to display both receiver 1 and 2 dBm vs. time.

The program will display the first two second's worth of data in the following format:

Y axis is dBm
X axis is time

The max fade for the two seconds of data is marked for either or both receiver by RED dotted lines on the graph and in text to the left of the Y axis. When viewing both receivers data, receiver 1 is plotted in BLUE, receiver 2 in GREEN. To the left of the Y
axis the LAT-LON, Date, Marker and frequency(s) are displayed. After the first 2 seconds of data is displayed, the screen will pause.

To continue single stepping, press the SPACE BAR, to stop the display and return to the MAIN MENU, press ESC. To display the data without pausing (FREE RUN), press the 'F' key. To resume single stepping, press the SPACE BAR to stop free running. To step backward, press the 'L' key to display the previous 2 seconds of data. Press the 'M' key to move forward to the point in the file where the MARKER value changes.

When the end of data in the disk file is reached, the program will display:

Done...
Press Any Key

in the lower left hand corner of the display. Press any key to return to the main menu.

F - Enter the FREQUENCY SCAN MENU

FREQUENCY SCAN MENU

Press: T text display of COM 1 RF SCAN data and save on disk
C convert RF SCAN file data to ASCII

E for FREQUENCY SCAN EDIT Menu

Esc to return to SINGLE FREQUENCY MENU ?

FREQUENCY SCAN MENU OPTIONS

T - Start SCANNING the receiver 1 and 2 scan tables and save data in a disk file for later post processing. Data is displayed in text as received. During the display of the data the following PC keys are used to change the data displayed:

F1 - display Receiver 1 data
F2 - display Receiver 2 data
C - current receiver frequencies displayed as Channel #'s
F - current receiver frequencies displayed as Frequency (MHz)
ESC - Stop scanning measurement, close the binary disk file and return to the FREQUENCY SCAN MENU.

Press 'T', the program will prompt:

Save SCAN FREQUENCY DATA to File:

Enter an MSDOS file name to save the binary data in for further post processing. If it is not desired to save the serial data, just press ENTER. As soon as the results of the first scan of both receivers is available, it will be

displayed in text. Do NOT turn off the COMPANION until the SCAN MODE is stopped by the PC or some setups could be lost.

C - Convert saved binary scan file to ASCII TAB Delimited format for import into EXCEL or MAP INFO.

Press 'C', the program will prompt:

Name of SCAN FREQUENCY binary file to Convert:

Enter the name given to the binary scan file saved in the 'T' option.

The program will now prompt:

MAPINFO,PLANET or EXCEL Tab delimited OUTPUT
Enter FILE NAME for disk file output:

If the ASCII file is destined to be imported into EXCEL, enter a file name for the ASCII data with an extension 'XL'.

EXAMPLE EXCEL ASCII FILE NAME: DRIVE.XL

If the ASCII file is destined to be imported into MAP INFO, enter a file name for the ASCII data with an extension 'TXT'.

EXAMPLE MAP INFO ASCII FILE NAME: DRIVE.TXT

The program will now prompt:

Press M for Mapinfo-Planet format
E for EXCEL format

If the ASCII file is destined to be imported into MAP INFO, press 'M', press 'E' for EXCEL format.

The program will now prompt:

Convert Receiver 1, 2 or Both
Press 1 for Receiver 1, 2 for Receiver 2, B for Both ?

Press 1 - Only receiver 1 data is converted to ascii.
2 - Only receiver 2 data is converted to ascii.
B - Both receivers data is converted to ascii.

The program will now prompt (for receiver 1, 2 or both):

Save RX1 Frequency or Channel #
Press F for Frequency, C for Channel # ?

Press F if the frequencies scanned should be saved in row one in MHz, press C if the frequencies scanned should be saved in row one as channel #'s.

The program will now convert the binary file to ascii and return to the FREQUENCY SCAN MENU when the conversion is complete.

E - Enter the FREQUENCY SCAN EDIT MENU

FREQUENCY SCAN EDIT MENU

Press: R to Read SCAN TABLE disk file
W to write SCAN TABLE to disk file

V to view SCAN TABLE

D to DOWNLOAD Scan Tables to COMPANION

E to EDIT Frequency Scan Tables
I to list EDIT Frequency Table Instructions

Esc to return to FREQUENCY SCAN MENU ?

FREQUENCY SCAN EDIT MENU OPTIONS

R - Read in a previously saved SCAN TABLE disk file for editing or downloading to COMPANION.

Press 'R', the program will prompt:

Name of Frequency Table file to read:

Enter the name of a previously saved Frequency Table file.

V - To view the contents of a SCAN TABLE

Press 'V', the program will prompt:

Press 1 for Receiver 1, 2 for Receiver 2 ?

Press 1 to view receiver 1 portion of the table, press 2 to view receiver 2 portion of the table. Press any key after the table is displayed to return to the FREQUENCY SCAN EDIT MENU.

FREQUENCY SCAN EDIT MENU OPTIONS

W - Write the current SCAN TABLE to disk file for future use.

Press 'W', the program will prompt:

Save Frequency Table to File:

Enter an MSDOS file name for the Frequency Scan Table file. Use this same name with the 'R' option to reload the SCAN TABLE in the future.

D - Download the current SCAN TABLE to the COMPANION battery backed memory.

To Download the current table to the COMPANION, do the following.

Step:

1) Connect the COMPANION to the PC serial port COM 1 or COM 2 using the supplied RS232 serial cable.
2) Make sure the COMPANION is in the SINGLE FREQUENCY MODE (see page 7).
3) Press 'D', when the download is complete, the program will return to the FREQUENCY SCAN EDIT MENU.

Verify the DOWNLOAD by using the FREQUENCY SCAN MENU 'T' option BEFORE collecting data.

FREQUENCY SCAN EDIT MENU OPTIONS

E - to enter the Frequency Scan Table EDITOR
I - list EDITOR Instructions

Press 'I', the program will display the EDITOR instructions, press any key to return to the FREQUENCY SCAN EDIT MENU.

Press 'E', the program will prompt:

Press 1 for Receiver 1, 2 for Receiver 2 ?

Press 1 to edit receiver 1 portion of the table, press 2 to edit receiver 2 portion of the table.

FREQUENCY SCAN TABLE EDITOR

NOTE - Make sure the PC Num Lock is off before using the editor. If the Num Lock is ON, the arrow keys will not work.

The current entry position is marked by the > character, to the left of either the frequency or the channel number. To enter frequency, press F (which moves > to the left of the current frequency), to enter channel numbers press C (which moves > to the left of the current channel number).

Use the ARROW (UP,DOWN,RIGHT,LEFT) keys to move the position of the current entry marker.

To erase the current entry, press the DEL key. Both channel number and frequency will be set to zero. The Companion does not measure any entry in the table that is set to zero.

To enter either current frequency or channel number, type the first digit of the new frequency or channel number. Use the BACKSPACE key to erase incorrectly entered digits.

FREQUENCY SCAN TABLE EDITOR - CONTINUED

Press ENTER to save the entered frequency or channel number in the current table position. The marker will be automatically moved down to the next position in the table.

Press ESC to return to the FREQUENCY SCAN EDIT MENU. Always remember to SAVE edited tables with the 'W' option BEFORE returning to MSDOS, or the edited data will be lost and have to be re-entered.

DATA SAVE FORMAT - SINGLE FREQUENCY BINARY

```
/*Single Frequency structure*/
/*header - follows trigger and int count*/

structpcs_head {

byte pcssec;/* real time  sec */
byte pcsmin;/* min */
byte pcshr;/* hour */
byte pcsday;/* day */
byte pcsmon;/* mon */
byte pcsyr;/* year */

byte pcsnavs;/* navigation status */
byte gpslat[5];/* gps position - lat */
byte gpslon[5];/* lon */
byte gpstim[3];/* gps time */

word pcsmrk;/* current user marker # */
};

/*DATA record - follows header, pcs_head.pcsndr records*/

structpcs_data {
```

```
word pcsch;/* chan # */
byte pcsgif;/* GHz flag, is54 (amps) flags */
word pcs_bmh;/* base F Mhz */
word pcs_bkh;/* Khz */
word pcs_stp;/* chan step in khz */
byte pcssat;/* sat */
word pcs_drsv;/* reserved */
byte pcs_ndb;/* number of rssi in buffer (200) */
byte pcs_dbb[200];/* rssi buffer */
};


structpcs_buf {
structpcs_head ph;/* header */
structpcs_data prec[2];/* record array */
};
```

SINGLE FREQUENCY ASCII DATA SAVE FORMATS

EXCEL FORMAT

col	1	2	3	4	5	6	7	8	9	10	11
ascii	0001	12:12:30	01-12-97	0001	OK	74.3345	32.5678	881.52	87	1950.00	95

columnascii data

1row
2time
3date
4marker
5gps status
6lat
7lon
8Rx 1 frequency
9Rx 1 dBm (average of 200 dBm readings)
10Rx 2 frequency
11Rx 2 dBm (average of 200 dBm readings)

MAP INFO FORMAT

col	1	2	3	4	5	6
ascii	74.3345	32.5678	881.52	87	1950.00	95

columnascii data

1lat
2lon
3Rx 1 frequency

4Rx 1 dBm (average of 200 dBm readings)
5Rx 2 frequency
6Rx 2 dBm (average of 200 dBm readings)

In both ASCII formats, each column field is seperated by a single TAB (09H) character. Each line ends with a CR LF (0DH,0AH).

RAW DATA FORMAT

col1 2 3

ascii0001 -80-90
0002 -81-91
0003 -80-90
0004 -83-92
. . .
. . .
0200 -86-100
. . .
. . .
. . .

columnascii data

1sample #
2receiver 1 dBm
3receiver 2 dBm

The time between each consecutive sample # is 5 milli seconds so that each one seconds worth of data contains 200 dBm values. This output format provides the un-averaged data that could be used to analyze RF fading.

BINARY DATA SAVE FORMAT - SCAN FREQUENCY MODE

```
/* infromation about receiver */

struct rx_info {
byte gif;/* GHz flag, is54 (amps) flags */
word bmh;/* base F Mhz */
word bkh;/* Khz */
word stp;/* chan step in khz */
};

/* scan table structure that is downloaded to receiver */

struct scan_table {

struct rx_info rx1_info;
struct rx_info rx2_info;
```

```
word scan_list_rx1[80];/* rx1 chan list */
word scan_list_rx2[80];/* rx2 chan list */
};
```

note: CHAN # 0 is skipped by receivers (not scanned).

```
struct scan_data {
word schan;/* channel */
byte srssi;/* rssi (dBm) */
};


/* scan data sent by receiver to PC */

structpcs_scan_data {

struct pcs_head ph;/* header (pg. 27) */
struct rx_info scn1_info;/* rx1 info */
struct rx_info scn2_info;/* rx2 info */

struct scan_data rx1_sd[80];/* rx1 chan, rssi data */
struct scan_data rx2_sd[80];/* rx2 chan, rssi data */
};
```

ASCII SCAN DATA FORMATS

For both EXCEL and MAP INFO ASCII formats, ROW 1 is a header that contains an ASCII string that describes the data in each column. This includes the frequencies (or channel numbers). The dBm readings for each frequency are in the column under the frequency or channel number in ROW 1.

SCAN DATA - EXCEL FORMAT

```
col       1         2             3          4      5     6           7          8
row 1  Meas    #Time         Date      Marker  GPS    Lat         LON      881.52
row 2  0001   12:12:30   01-12-97   0001    OK   74.3345   32.5678   -80
```

Row 1 is an ascii header containing:

```
columnascii data

1Meas (row) #
2time
3date
4marker
5gps status
```

6lat
7lon
8frequency/chan 1
9frequency/chan 2
..
..

Following the Longitude, starting at column 8, is the list of frequencies or channel numbers measured. Receiver 1 frequencies or channel numbers are first followed by receiver 2 if BOTH receivers are included in the ascii file. Skipped channels are not listed.

Row 2 through end of file.

Following row 1 is the scan data in the columns as shown above. dBm for each frequency is in the column under the ascii frequency or channel # in row 1.

SCAN DATA - MAP INFO FORMAT

col	1	2	3	4	5
row 1	Lat	LON	881.52	869.04	893.97 .....
row 2	74.3345	32.5678	-80	-120	-120

Row 1 is an ascii header containing:

columnascii data

1lat
2lon
3frequency/chan 1
4frequency/chan 2
..
..

Following the Longitude, starting at column 3, is the list of frequencies or channel numbers measured. Receiver 1 frequencies or channel numbers are first followed by receiver 2 if BOTH receivers are included in the ascii file. Skipped channels are not listed.

Row 2 through end of file.

Following row 1 is the scan data in the columns as shown above. dBm for each frequency is in the column under the ascii frequency or channel # in row 1.

dBm to Watts CONVERSION

dBm	microwatts
0	1000
-3	500
-6	250
-9	125
-12	62.5
-15	31.25
-18	15.625
-21	7.813
-24	3.906
-27	1.953

dBm	nanowatts
-30	976.563
-33	488.281
-36	244.141
-39	122.070
-42	61.035
-45	30.518
-48	15.259
-51	7.629
-54	3.815
-57	1.907

dBm	picowatts
-60	953.674
-63	476.837
-66	238.419
-69	119.209
-72	59.605
-75	29.802
-78	14.901
-81	7.451
-84	3.725
-87	1.823
-90	.931
-93	.466
-96	.233
-99	.116
-102	.0582
-105	.0291
-108	.0146
-111	.00728
-114	.00364
-117	.00182
-120	.000909

Glossary of Acronyms

AC	alternating current
A/D or ADC	analog to digital converter
AGC	automatic gain control
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	geographical 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
kw-hr	kilowatt-hour
LCD	liquid crystal display
LO	local oscillator
ma	milliampere
Mbits	megabits
MHz	megahertz
modem	acronym for modulator/demodulator
mw	milliwatt
PCMCIA	personal computer memory card international association
PC	personal computer
PCS	personal communications service (1.8 to 2.1 GHz)
PN	pseudo noise
QPSK	quaternary phase shift keying, 4-level PSK
RF	radio frequency
RSSI	receiver signal strength indicator
UTC	universal coordinated time
µ	micro (10^6)
VAC	volts alternating current
VGA	video graphic
VSWR	voltage standing wave ratio
X	horizontal axis
Y	vertical axis

If you require technical assistance, or service to your Companion , please contact:

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

Tel:(732) 548-3737
Fax:(732) 548-3404
www.bvsystems.com
E-mail: info@bvsystems.com

8:00am - 6:00pm Eastern Time