
CHAMP ULTRA-LITE
CHAN
MHz
-dBm
manual version 1.4
EAMPS model
-110 -100 -90 -80 -70 -60 -50 -40
ENTER
ON
SELECT
OFF

## Ultra-Lite 1.4 AMPS Table of Contents

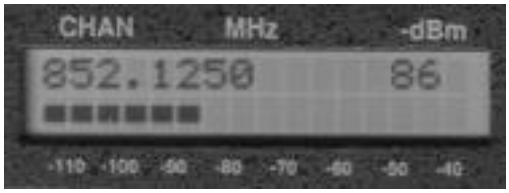
## INTRODUCTION

The CHAMP ULTRA-LITE is a hand held RF meter used for measuring RF signal strength. The unit is equipped with a 2 line, 16 character LCD for readout and setups. Three two-way push buttons are used to control the operation of the meter and its functions. The Ultra-Lite is powered with either a standard 9V transistor radio battery or may be powered through use of an optional Dragonfly™ battery pack also available from BVS and your local BVS reseller. Between measurement sessions, all setups and the last frequency measured are saved so that the unit will return to these settings whenever power is switched on again. While the Ultra-Lite does retain its measurement settings when power is switched off, it does not retain the actual measurements nor does it have a storage device for this data.


Ultra-Lite is an ideal tool for locating and measuring RF “hotspots” and “shadows” both indoors and outdoors. It’s lightweight packaging and power make Ultra-Lite the ultimate portable receiver for propagation analysis studies that must stay on the move. However, the Ultra-Lite does come complete with a power transformer for charging the external power supply which may also be used as the sole power source for the unit. While many Ultra-Lite models exist supporting the more popular frequency bands and channel spacing, customers sometimes require modifications to the basic Ultra-Lite instrument. In these cases, we suggest that you speak to us directly to provide us with the necessary data to optimize the Ultra-Lite specifically for your needs. For other more advanced receiver and stimulus transmitter solutions, contact BVS or your local reseller.

The complete Ultra-Lite package should include the Champ Ultra-Lite, Dragonfly™ battery, battery charger/AC adaptor, battery cable, RS-232 serial upload cable, antenna (corresponding to frequency of unit), wall mount adaptor, latest Ultra-Lite software 3 1/2” diskette, latest manual for Ultra-Lite, official BVS calibration certificate (signed and dated), BVS general data packet and a checklist containing all of the aforementioned items.

## DISPLAY




LCD - The 2 line by 16 character alpha-numeric LCD display is used for both display of the RF measurement and to set various ULTRA-LITE parameters.
While the unit is measuring a selected frequency:
Line 1 - displays the frequency in MHz and to the right, RSSI in dBm. (ø dBm=1 milliwatt into 50 ohms)

Line 2 - displays a bar graph representation of the RSSI of -110 dBm to the left, -40 dBm to the far right. (The RSSI scale actually extends beyond the print on the exterior casing of the Ultra-Lite from -120 dBm (no signal) to -32 dBm (strongest signal)). The RSSI LCD indication on line 1 does display this full range of dBm.

Each solid block is 5 dBm. A block in the display is represented by 5 segments. Each segment is equal to 1 dB.


**CONTROL BUTTONS**

There are just three buttons on the front panel used to control the instrument.


ON/OFF
This button turns the meter On and Off.

UP/DOWN ARROWS
These buttons are used to increase (UP ARROW) or decrease (DOWN ARROW) the frequency being measured (INC/DEC mode) or to seek up (UP ARROW) or seek down (DOWN ARROW) from the current frequency displayed to the first frequency encountered at or above a set threshold. Each incremental/decremental step is equal to 30 kHz (Cellular) or 1 channel.


ENTER/SELECT
This button works in two ways:
1) When the unit is measuring, pressing the SELECT button will cause the select menu (first selection which is BEST A/B CONTROL) to be displayed.

2) While in the "SELECT MENU", pressing the ENTER button again will cause the displayed selection or value to be input to the instrument.

**POWERING UP**


When you first power up the Ultra-Lite, you should see the startup screen as shown:


LINE 1 displays the model and version number of the model

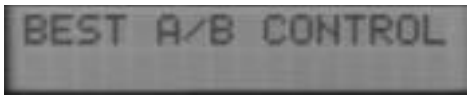
LINE 2 displays the serial number of the unit as assigned by the Berkeley Varitronics Factory.

The unit may be powered on or off at any time the user chooses to do so. Remember that the last settings will be the only thing saved. Immediately after the startup screen, the unit goes into the menu selections starting with BEST or BEST A/B CONTROL (depending upon the frequency of the model).

**SELECTING MENUS**

Press SELECT when the measurement is displaying and the first menu selection will display on LCD Line 1. Press UP/DOWN to scroll through the menu choices. Press ENTER to select the displayed menu selection.

**BEST A/B CONTROL** (not supported in version 1.4)




Scroll through the menu selections until BEST A/B CONTROL appears. Press ENTER and the unit will scan all 42 A/B control channels (313-354). After the scan, the strongest frequency encountered will be measured, and results will be displayed.

**BEST A CONTROL** (not supported in version 1.4)


Scroll through the menu selections until BEST A CONTROL appears. Press ENTER and the unit will scan all 22 A band control channels (313-333). After the scan, the strongest frequency encountered will be measured and displayed.

**BEST B CONTROL** (not supported in version 1.4)


Scroll through the menu selections until BEST B CONTROL appears. Press ENTER and the unit will scan all 22 B band control channels (334-354). After the scan, the strongest frequency encountered will be measured and displayed.

**BEST**


Scroll through the menu selections until BEST appears. Press ENTER and the unit will scan all channels in the receiver band. After the scan, the strongest frequency encountered will be measured and displayed. ULTRA-LITE can scan up to 832 channels. If no frequency is found, then

try entering the channel number directly.

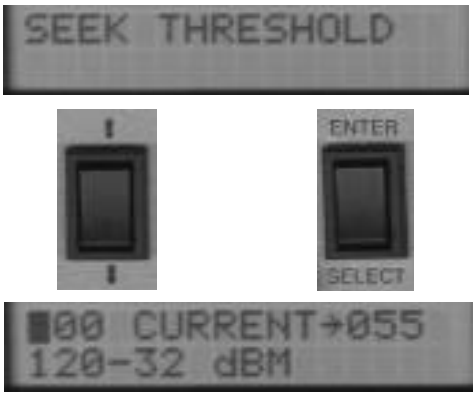
### INC/DEC FREQ


Scroll through the menu selections until INC/DEC FREQ appears. Press ENTER and the INC/DEC mode is selected. When the unit is measuring, pressing the UP ARROW button will increase the displayed measurement frequency by 30 kHz. Pressing the DOWN ARROW button will decrease the measurement frequency by 30 kHz.

### SEEK UP/DOWN


Scroll through the menu selections until SEEK UP/DOWN appears. Pressing ENTER and the SEEK UP/DOWN mode is selected. When the unit is measuring, pressing the UP ARROW button will cause the unit to seek the next highest frequency (from the currently measured frequency) that is equal to or greater than the SEEK THRESHOLD. Pressing the DOWN ARROW button will cause the unit to seek the next lowest frequency (from the currently measured frequency) that is equal to or greater than the SEEK THRESHOLD. If no frequency is found that is $\geq$ to the threshold, the measurement returns to the frequency that was being being measured before the UP/DOWN Arrow button was pressed.

### SEEK THRESHOLD




Scroll through the menu selections until SEEK THRESHOLD appears. Press ENTER and the SEEK THRESHOLD DISPLAY is shown:

Line 1 is used to enter a new seek threshold (the field of 000); the current value for the seek threshold is displayed to the right (055).

Line 2 displays the range of valid seek threshold values.

The first zero of Line 1 will blink (left most, hundreds place). To change this digit displayed, press UP ARROW to increase by one, DOWN ARROW to decrease by one. Press ENTER to move to the next digit (move right one place). Pressing ENTER while the right-most digit is blinking (ones place) will cause the number displayed to be used for the seek threshold. If the number is out of the range, the message "INVALID

ENTRY" is displayed and the entry is ignored.

To use the SEEK THRESHOLD selected, the unit must be in the SEEK UP/DOWN mode. Setting the seek threshold to 120 will cause the SEEK to select the next strongest frequency (up or down). If set to other than 120 dBm, pressing the UP/DOWN ARROW button during measurement will cause the unit to seek the next frequency that is equal to or greater than the threshold set in signal strength. This function is similar to your AM/FM car radio 'seek station' function and shown by the following example:

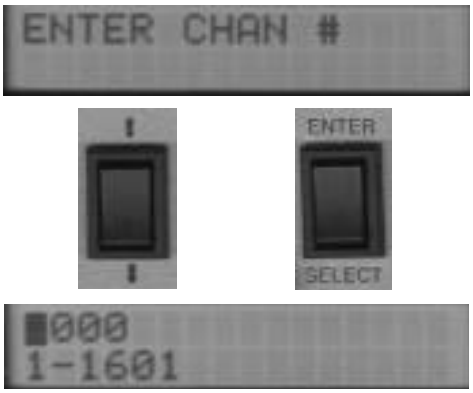
1) Set the SEEK THRESHOLD to -80 dBm.

2) Select SEEK UP/DOWN mode .

3) If you press the UP button during a measurement, it will seek UP and change measurement frequency to the next highest frequency (from that of the current frequency) that was ≥ -80 dBm.

4) Conversely, pressing the DOWN button during measurement will seek and change measurement frequency to the next lowest frequency from the current value that was ≥ -80 dBm.

**ENTER CHANNEL #**



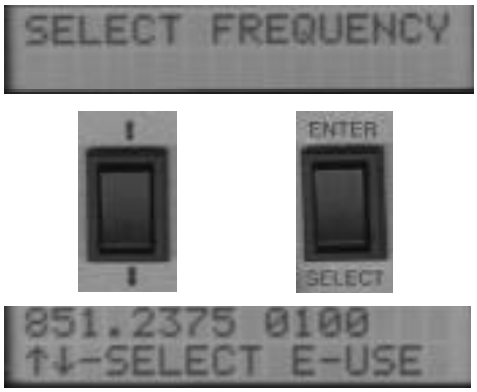

Scroll through the menu selections until ENTER CHANNEL# appears. Press ENTER and the ENTER CHANNEL# display is shown:

Line 1 is used to enter a new channel number.

Line 2 displays the range of valid channel numbers.

The first zero of line 1 will blink (left most, the hundreds place). To change the digit displayed, press the UP ARROW button to increase by one, or the DOWN ARROW button to decrease by one. Pressing ENTER while the rightmost digit is blinking (ones place) will cause the number displayed to be taken as the channel number for measurement. If the number is out of range, the message INVALID ENTRY is displayed and the entry will be ignored.

## SELECT FREQUENCY



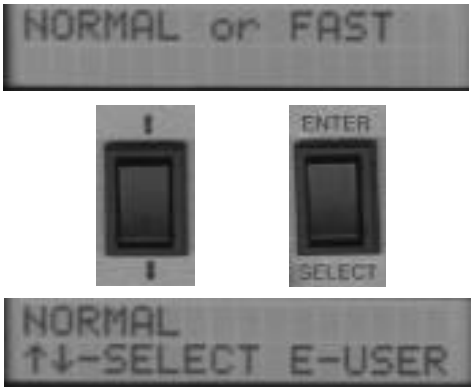

Scroll through the menu selections until SELECT FREQUENCY appears. Press ENTER and the SELECT FREQUENCY display is shown:

Line 1 displays the current channel number (left) followed by the current measurement frequency.

Line 2 instructs the user to select a frequency using the UP/DOWN ARROW button.

Press the UP/DOWN arrow button to change the frequency on line one until the desired frequency is shown. Notice that the channel number will also update with the frequency update. The longer an arrow key is held down, the faster the frequency on line 1 is increased or decreased. Release the arrow buttons to slow down and stop the display from scrolling. Once the desired frequency is shown on line 1, press ENTER (E) to input this value as the measurement frequency.

## NORMAL or FAST (not supported in version 1.4)




NORMAL and FAST modes simply allow the user to decide the speed at which they wish to take measurements. In the NORMAL mode, the Ultra-Lite takes approximately 13 measurements per second. In FAST mode, the Ultra-Lite takes 40 measurements per second. Besides the obvious speed advantages, the primary difference between these two modes is the power consumption. Expect FAST mode to cut operation time by about one third of the NORMAL time.

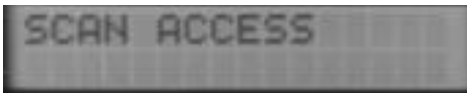
## SCAN MAX


Scroll through the menu selections until SCAN MAX appears. Press the ENTER button and the unit will scan the current group (up to 8 channels).

## SCAN MIN

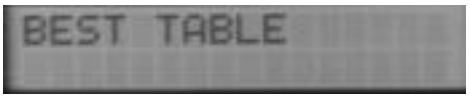

Scroll through the menu selections until SCAN MIN appears.Press the ENTER button and the unit will scan the current group and returns to weakest channel.

## SCAN ACCESS



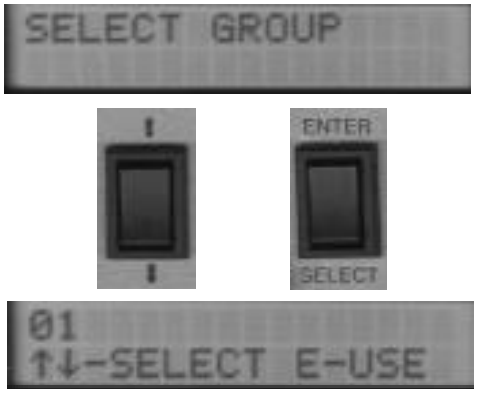

Scroll through the menu selections until SCAN ACCESS appears.Press ENTER and unit scans access channels and returns to strongest. The group is changed to the group # of the strongest access channel so that a SCAN MAX or SCAN MIN following SCAN ACCESS will scan the group with the strongest access channel.

## BEST TABLE




Scroll through the menu selections until BEST TABLE appears.This feature scans all channels in the upload table and returns to the strongest channel. The group number is set to the group that contains the strongest channel.

## SELECT GROUP




Scroll through the menu selections until SELECT GROUP appears. Press ENTER and the ENTER CHANNEL# display is shown:

Line 1 is the current group number.

Line 2 instructs the user to select a group number using the UP/DOWN ARROW button.

Select 1 of 21 uploaded groups. Use the UP/DOWN ARROW button to increment or decrement the group number. When you have reached the desired group number, press the ENTER button and the group will be selected and displayed on the Ultra-Lite.

## UPLOAD GROUP


Use this function to load the Ultra-Lite with a channel plan created with the LITE PC program. Connect the audio plug end of the supplied cable to the Ultra-Lite connector labeled “LOAD” on the bottom of the display portion of the Ultra-Lite. Connect the DB9 female end of the cable to the PC COM 1 or 2.

**DOWNLOAD PROCEDURE** (AMPS models only)

1) Run LITE.EXE program by typing “LITE.EXE”

2) Load saved freq plan (using “R” option)

3) Verify plan (inspect via “L” option)

4) Plug cable to PC COM PORT

5) Connect to ULTRA-LITE

6) Turn on ULTRA-LITE and plug in cable

7) Select ULTRA-LITE “UPLOAD GROUP”

8) Press ULTRA-LITE ENTER

9) press “D” key on PC for download

10) After pressing “D” on PC keyboard, ULTRA-LITE will display channels as they are received.
note: ULTRA-LITE must be connected to a PC via serial port before pressing enter to “Upload Group”. If not connected to a PC, ULTRA-LITE senses no connection and ignores request.

11) After upload, scan access channels so that an uploaded group is selected.

12) Use SCAN MAX/MIN to verify group selected by SCAN ACCESS. This completes upload verify.

**ULTRA-LITE PC SOFTWARE V1.02**

Copy the program “lite.exe” from the supplied disk to your hard drive. Also copy the file “TABLE.BIN”, a sample channel plan file. To run the program, type “lite” followed by enter. At the prompt, press 1 or 2 to select which PC COM port will be used for downloading groups.

**PC MENU SELECTIONS**

E-To edit a new or disk saved channel plan.

The “>” character marks the current channel to enter. To the

right of the PC screen, the information about the Ultra-Lite unit is displayed (base and top channel numbers, base and top frequency). In addition, the current number (marked by ">") is displayed in frequency.

Use the RIGHT ARROW key to move the marker one channel right.

Use the LEFT ARROW key to move the marker one channel left.

Use the UP ARROW key to move the marker up one row.

Use the DOWN ARROW key to move the marker down one row.

Press the DEL key to clear the current channel. Do this before entering digits.

Digit Keys (0, 1, 2...9) to enter the channel number digits after pressing DEL to clear.

Channels under the text "Access Channels" are the access channels for the group. These channels are measured by "SCAN ACCESS". If there are less than 21 groups, start entry from the left to the right, filling unused access channels with "0".

Channels under the text "Voice Channels" are the group's voice channels. Fill the column from the top to the bottom, including unused positions with 0's. The scanning of a group stops at the first 0 encountered.

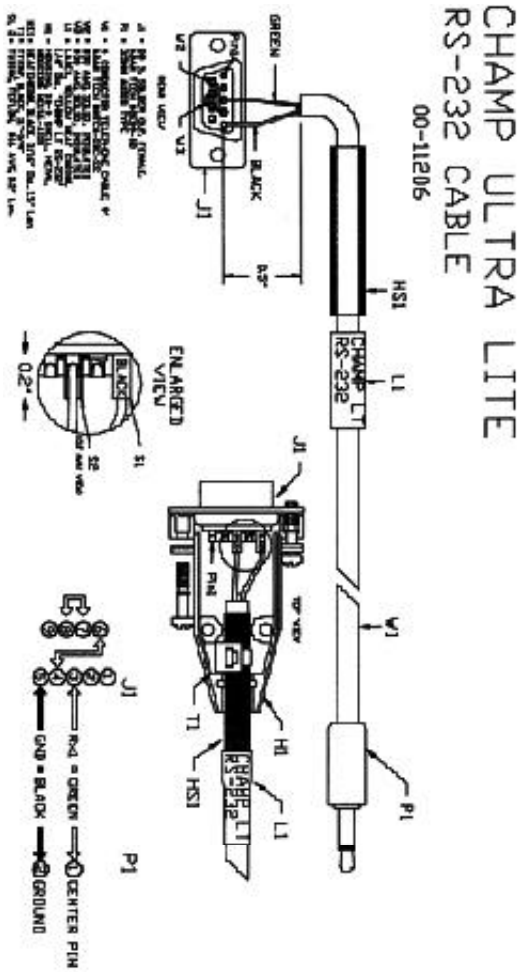
Run the LITE program on the PC and press "1" if the cable is connected to COM 1 or "2" if connected to COM 2 when prompted.

Use the LITE program to create a channel plan (using EDIT mode) or load a previously saved plan (using R.)

Select UPLOAD GROUP on the ULTRA-LITE screen and press the ENTER button. Press "D" on the PC to begin downloading (the screen of the ULTRA-LITE will display channels and frequencies during the download.)

Remove the cable from the ULTRA LITE.

Select SCAN ACCESS to verify that the download was suc-



cessful.

## LITE.EXE MENU SELECTIONS

L-To list current channel plan. To the right of the list is information about the Ultra-Lite (base and top channel numbers, base and top frequency).

W-To write the current channel plan to disk. Use a standard DOS format file name (name.ext) when specifying the name of the file to save the channel plan in.

R-To read a channel plan saved with the W function above. The current channel plan is overwritten, so be careful to save the current plan before using “R”. Use the supplied file “test.bin” as an example of using the “R” feature.

D-See page 1, upload group. The current channel plan is sent via the selected COM port to the ULTRA-LITE.

SPECIAL CHANNEL TABLE FILE “C_TO_F.TXT”

A text table of channel numbers vs. frequency is included on the supplied disk. This ASCII text file is called “C_TO_F.TXT”.

A-Reset the ULTRA-LITE to the AMPS mode (Scan A, Scan B, Scan A/B).

E-edit or create a download channel table

ESC-To return to DOS

## CHANNEL GROUPING EXAMPLE

The Ultra-lite includes the ability to upload channels (optional) to its internal EEROM storage circuits. The organization is 8 channels per group and up to 21 groups. The following is an example of such organization:

| Group | Access | Voice | Voice | Voice | Voice | Voice | Voice | Voice |
|---|---|---|---|---|---|---|---|---|
| 01 | 0313 | 0001 | 0002 | 0003 | 0004 | 0005 | 0006 | 0007 |
| 02 | 0314 | 0022 | 0023 | 0024 | 0025 | 0026 | 0027 | 0028 |
| 03 | 0315 | 0043 | 0044 | 0045 | 0046 | 0047 | 0048 | 0049 |
| 04 | 0316 | 0064 | 0065 | 0066 | 0067 | 0068 | 0069 | 0070 |
| 05 | 0317 | 0085 | 0085 | 0000 | 0000 | 0000 | 0000 | 0000 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 06 | 0318 | 0106 | 0107 | 0000 | 0000 | 0000 | 0000 | 0000 |
| 07 | 0319 | 0127 | 0128 | 0000 | 0000 | 0000 | 0000 | 0000 |
| 08 | 0320 | 0148 | 0149 | 0000 | 0000 | 0000 | 0000 | 0000 |
| 09 | 0321 | 0169 | 0170 | 0000 | 0000 | 0000 | 0000 | 0000 |
| 10 | 0322 | 0190 | 0191 | 0000 | 0000 | 0000 | 0000 | 0000 |
| 11 | 0323 | 0211 | 0212 | 0000 | 0000 | 0000 | 0000 | 0000 |
| 12 | 0324 | 0232 | 0233 | 0000 | 0000 | 0000 | 0000 | 0000 |
| 13 | 0325 | 0253 | 0254 | 0000 | 0000 | 0000 | 0000 | 0000 |
| 14 | 0326 | 0274 | 0275 | 0000 | 0000 | 0000 | 0000 | 0000 |
| 15 | 0327 | 0295 | 0196 | 0000 | 0000 | 0000 | 0000 | 0000 |
| 16 | 0328 | 0498 | 0499 | 0000 | 0000 | 0000 | 0000 | 0000 |
| 17 | 0329 | 0519 | 0520 | 0000 | 0000 | 0000 | 0000 | 0000 |
| 18 | 0330 | 0540 | 0541 | 0000 | 0000 | 0000 | 0000 | 0000 |
| 19 | 0331 | 0561 | 0562 | 0000 | 0000 | 0000 | 0000 | 0000 |
| 20 | 0332 | 0582 | 0583 | 0000 | 0000 | 0000 | 0000 | 0000 |
| 21 | 0333 | 0793 | 0794 | 0795 | 0796 | 0797 | 0798 | 0799 |

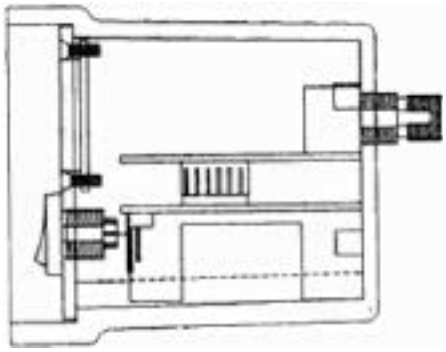

Channel number can be converted over to carrier frequency by multiplying the channel number (N) X .050 + 900.0 MHz.


**BATTERY LOW**

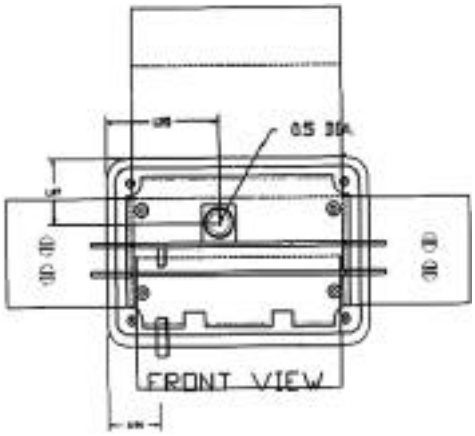
When the battery is detected to be less than 7.25 volts, the message BATTERY LOW will flash on the display. All measurements are suspended. Turn the unit OFF to change the battery. To change the battery, remove the four screws holding the Ultra-Lite's hand grip to the base of the display and then remove the old 9 volt battery, replacing it with a fresh alkaline battery respecting the polarity and then re-install the hand grip.

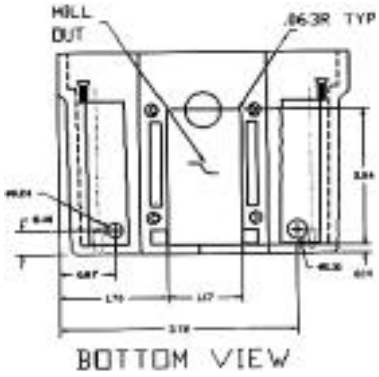
This process only applies to Ultra-Lites not equipped to run from an external DC power source. When power from the Dragonfly™ battery pack runs low, simply disconnect the supplied cable from the Output jack on the Dragonfly™ and recharge it fully by inserting the supplied DC transformer jack into the 12 VDC Input on the Dragonfly™ to charge the battery.

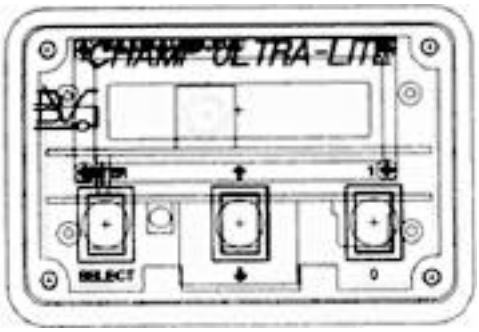
## RECEIVER SPECIFICATIONS



| | |
|---|---|
| LCD Display | 2 x 16 alphanumeric STN |
| Tuning Range | 20-40 MHz of band |
| Bands Supported | |
| ISM: | 2.4-2.485 GHz |
| ISM: | 900-930 MHz |
| Paging: | 450-465, 928-941 MHz (12.5 or 25 kHz steps) |
| PCS: | 1850-1910, 1930-1995 MHz |
| LMR: | 805-825, 850-870 MHz |
| Cellular: | 824-848, 868-896 MHz (30kHz steps) |
| ETACS: | 872-905, 915-950 MHz (25 kHz steps) |
| IVDS: | 218-219 MHz |
| Sensitivity | -110 to -35 dB ± 1.5 dB 30 kHz IF Bandwidth for -12 dB SINAD |
| Adj. Chan Rejection | > 50 dB @ 30 kHz |
| Measurement Accuracy | ± 1.5dB |
| Speed of Measurements | 20/second (averaged) 32 samples/measurement |
| Channel Scan Rate | 20 channels/sec (normal) |
| Channel Step Size | 12.5 kHz or 25 kHz |
| Download Rate | 9600 BAUD, 8 data bits, start, 1 Stop bit and with out parity via mini phone jack |
| Charging | 10 ma hours rate via 2.5mm slip jack, center positive |



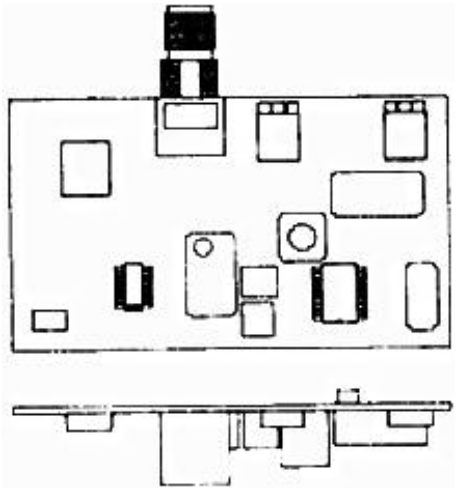



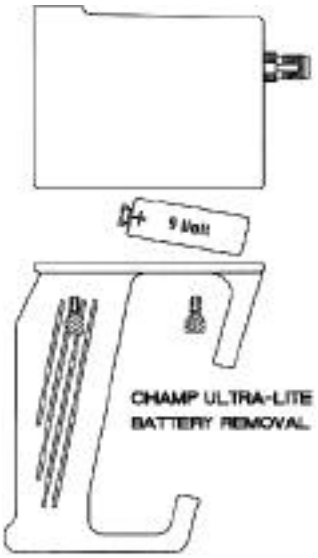



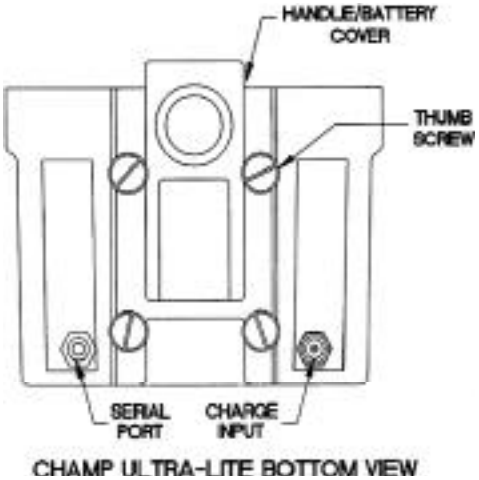

Note: 868-896 MHz ULTRA-LITEs (DAMPS Cellular) are calibrated at the factory with π/4DQPSK modulated signals centered on 30 kHz steps. All measured values are related to dBm

## GENERAL SPECIFICATIONS

| | |
|---|---|
| Dual Conversion | 83 MHz first IF<br>455 kHz second IF |
| IF Bandwidth | 12.5 kHz (standard) |
| Stability | ± 2.5 PPM from 32° to 120° F |
| Phase Noise | > 80 dBc @ 1 kHz offset |
| Antenna | TNC right angle 50 Ω whip |
| Controls | 3 button keypad |
| Warm Up Time | < 1 minute |
| Power | Internal 9 Volt battery Alkaline 560 mAH or external 12 volt high capacity Ni-Cad (>12 hours use) |
| Running time | > 12 hours, typical (with BVS external battery) |
| Weight | 1.5 pounds |
| Dimensions | 6” L x 4” W x 3”D |
| Unit includes: | |
| Antenna | Right angle TNC 50 Ω whip |
| Case | Yellow ABS plastic |
| Manual | 16 page guide |
| Cable | RS-232 Serial Cable |
| Dragonfly™ battery | 12V High capacity NiCad |
| Battery charger | 12V 120V AC-DC transformer |
| Wall mount adaptor | Yellow ABS plastic |
| 3 1/2” diskette | Ultra-Lite PC software |
| Calibration Certificate | Official BVS laminated document |
| Options:IF Bandwidth | (4, 10, 25, 30 kHz available) |





CHAMP ULTRA-LITE BOTTOM VIEW

# 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 |

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