Ultra-Lite

manual version 2.1 General Model

ULTRA-LITE 2.0 Table of Contents

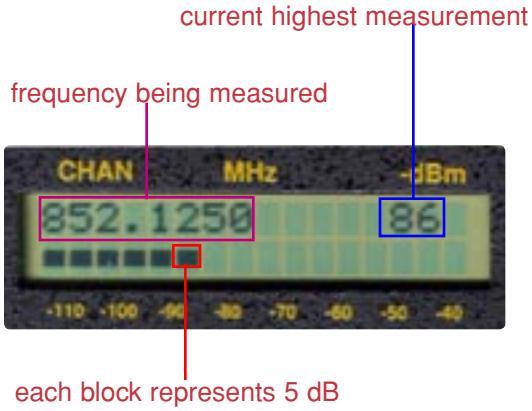
INTRODUCTION

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 the Dragonfly™ battery pack supplied. 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, please contact BVS directly.

The complete Ultra-Lite package should include the Champ ULTRA-LITE, Dragonfly™ battery, battery charger/AC adaptor, battery cable, antenna (corresponding to frequency of unit), wall mount adaptor, 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



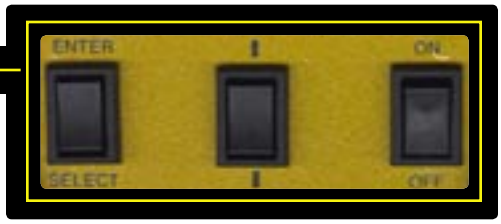
LCD - The 2 line by 16 character alpha-numeric LCD display is used for both display of the RF measurement and to set various ULTRA-LITE parameters.
While the unit is measuring a selected frequency:
Line 1 - displays the frequency in MHz and to the right, RSSI in dBm. (ø dBm=1 milliwatt into 50 ohms)

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.

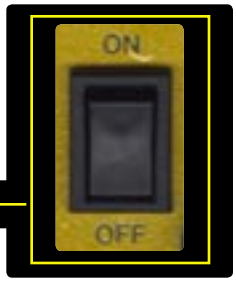
Each solid block is 5 dBm. A block in the display is represented by 5 segments. Each segment is equal to 1 dB.

CONTROL BUTTONS



There are just three buttons on the front panel used to control the instrument. The ENTER/SELECT switch and UP/DOWN ARROW switchs are both rocker switches that spring back to the middle but the ON/OFF switch locks ensuring the ULTRA-LITE remains in the power state that the user wishes.

ON/OFF



This switch simply turns the ULTRA-LITE On and Off. Under normal conditions, the Ultra-Lite has enough power t run all day (over 12 hours with a Hummingbird external battery pack). Be sure to keep the power cord unplugged from the external battery source when the ULTRA-LITE is not in operation as the battery will be depleted slowly over time.

UP/DOWN ARROWS

This switch is 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 the channel step for your particular model.

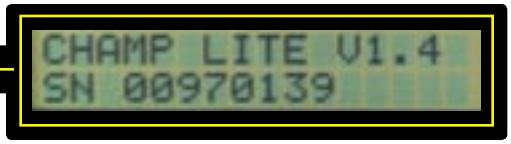
ENTER/SELECT

This switch works in two ways:

1) When the unit is measuring, pressing SELECT on the switch will cause the select menu (first selection which is BEST or BEST A/B CONTROL depending on model) to be displayed.

2) While in the “SELECT MENU”, pressing ENTER on the switch 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

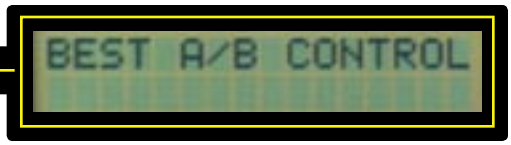
LINE 2 displays the serial number of the unit as assigned by the Berkeley Varitronics Factory.

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



(only on cellular band models)

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

(only on cellular band models)

Scroll through the menu selections until BEST A CONTROL appears. Press ENTER and the unit will scan all 21 A band control channels (313-333). After the scan, the strongest frequency encountered will be measured and displayed.

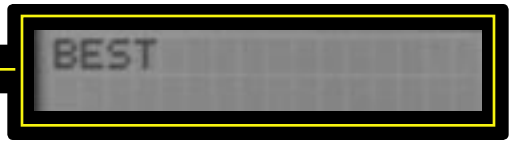
BEST B CONTROL

(only on cellular band models)

Scroll through the menu selections until BEST B CONTROL appears. Press ENTER and the unit will scan all 21 B band

control channels (334-354). After the scan, the strongest frequency encountered will be measured and displayed.

BEST

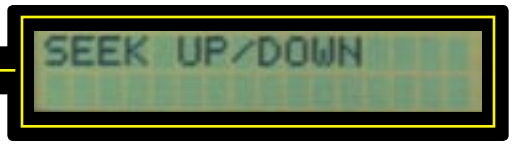


Scroll through the menu selections until BEST appears. Press ENTER and the unit will scan all channels in the receiver band. After the scan, the strongest frequency encountered will be measured and displayed. If no frequency is found, then try entering the channel number directly.

INC/DEC FREQ

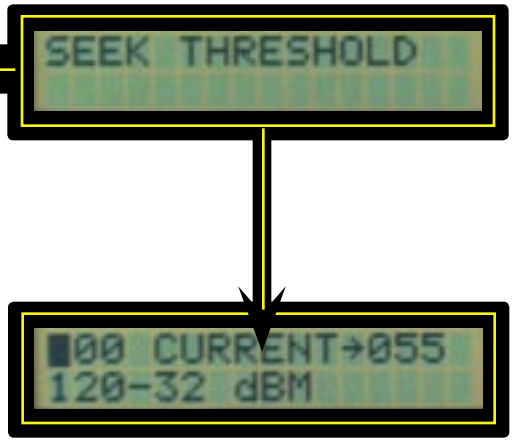
Scroll through the menu selections until INC/DEC FREQ appears. Press ENTER and the INC/DEC mode is selected. When the unit is measuring, pressing the UP ARROW button will increase the displayed measurement frequency by the channel step for your particular model. Pressing the DOWN ARROW button will decrease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

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:

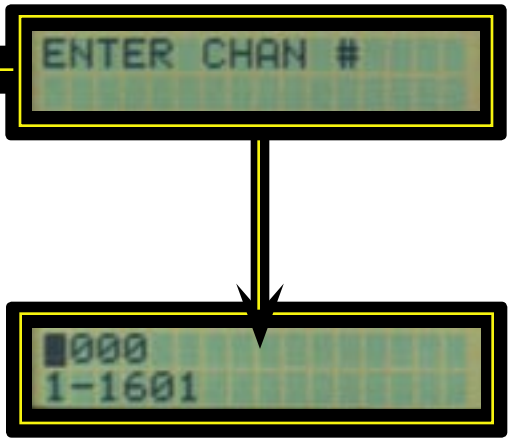
1) Set the SEEK THRESHOLD to -80 dBm.

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:

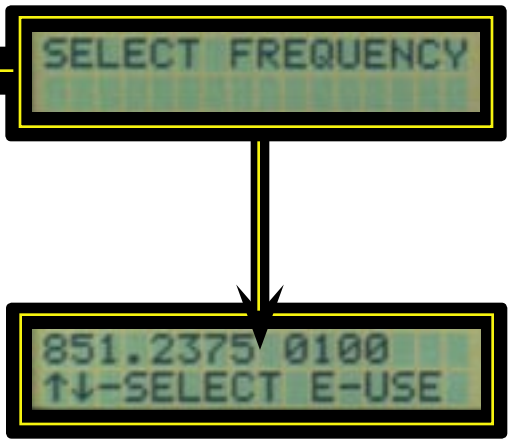
Line 1 is used to enter a new channel number.

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



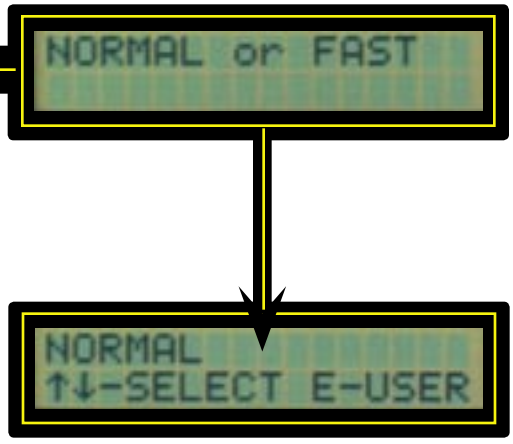
Scroll through the menu selections until SELECT FREQUENCY appears. Press ENTER and the SELECT FREQUENCY display is shown:

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

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.

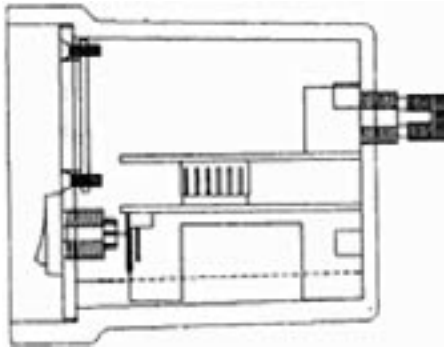
BATTERY LOW

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 reinstall the hand grip.

This process only applies to **ULTRA-LITES** not equipped to run from an external DC power source. These units do not have any input for power on the bottom of the handle as shown in the image on the right. 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.

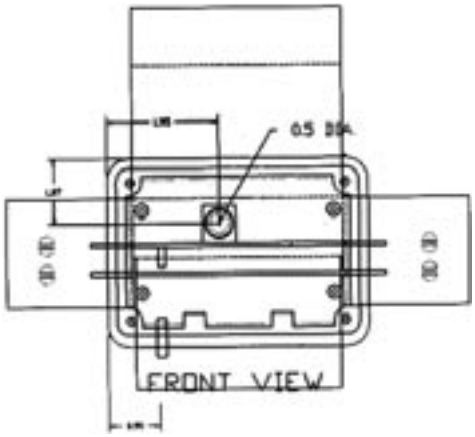
External power input (Dragonfly) is found on the bottom of the Ultra-Lite.

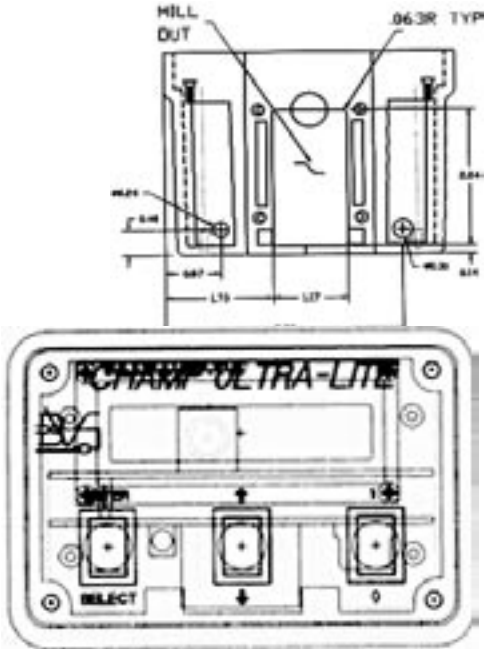
Be sure to ask for Dragonfly.



RECEIVER SPECIFICATIONS

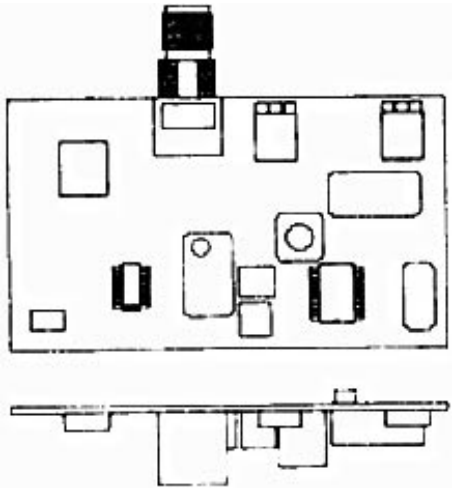
LCD Display	2 x 16 alphanumeric STN
Tuning Range	20-40 MHz of band
Bands Supported	
ISM:	2.4-2.485 GHz
ISM:	900-930 MHz
Paging:	450-465, 928-941 MHz (12.5 or 25 kHz steps)
PCS:	1850-1910, 1930-1995 MHz
LMR:	805-825, 850-870 MHz
Cellular:	824-848, 868-896 MHz (30kHz steps)
ETACS:	872-905, 915-950 MHz (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
Charging	10 ma hours rate via 2.5mm slip jack, center positive



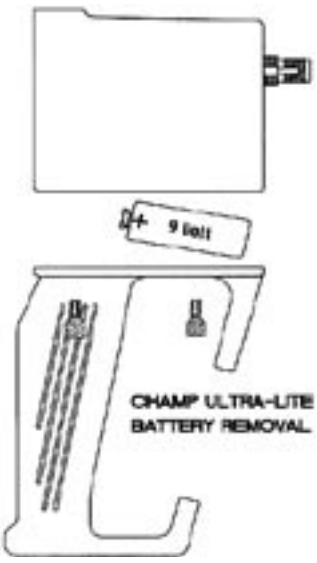


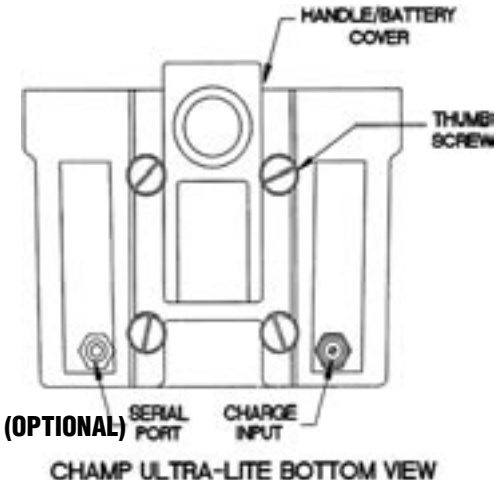
Note: 868-896 MHz ULTRA-LITEs (DAMPS Cellular) are calibrated at the factory with π/4DQPSK modulated signals centered on 30 kHz steps. All measured values are related to dBm

GENERAL SPECIFICATIONS



Dual Conversion	83 MHz first IF 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	13 page guide
Dragonfly™ battery	12V High capacity NiCad
Battery charger	12V 120V AC-DC transformer
Wall mount adaptor	Yellow ABS plastic
Calibration Certificate	Official BVS document
Options:IF Bandwidth	(4, 10, 25, 30 kHz available) Serial Port





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

Convert channel number to frequency in PCS Ultra-Lite:
example: Ultra-Lite frequency range 1930 to 1990 MHz with channel step 50 kHz

base frequency=1930
base channel=1 (channel 1=1930 MHz)
step=50 kHz (.05 MHz)
example:chan=90

frequency=base frequency+(channel-base channel) * step

frequency=1930+(90-1) * .05

frequency=1934.45

Convert frequency to channel number in PCS Ultra-Lite:
example:frequency=1960 MHz

channel=((frequency-base frequency) / step)+1

channel=((1960-1930) / .05)+1

channel=601

Convert channel number to frequency:
example: Ultra-Lite frequency range 928 to 941 MHz with channel step 12.5 kHz

base frequency=928
base channel=1 (channel 1=928 MHz)
step=12.5 kHz (.0125 MHz)
example:chan=90

frequency=base frequency+(channel-base channel) * step

frequency=928+(90-1) * .0125

frequency=929.1125

Convert frequency to channel number:
example:frequency=933 MHz

channel=((frequency-base frequency) / step)+1

channel=((933-928) / .0125)+1

channel=401

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

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.