Advanced Telemetry Systems

R4500S

(Models: R4500SD or R4500SLD)

**Receiver/Datalogger, 12 table version
for use with ATS Coded Transmitters**

User Manual

Introduction:

The R4500S is a receiver - data logger combination with built in GPS. (An optional GPS antenna is required to use the GPS feature)

Operationally, the R4500S works by acting as a filter to select a very narrow window in the frequency spectrum. The position of this filter in the frequency spectrum is determined by the frequency selection (tuning). The receiver rejects signals and noise outside the filtered window, and passes signals and noise within the window. Additionally, the receiver translates the signal to a frequency within hearing range that can be heard from the speaker.

The R4500S can store 98304 Stationary data blocks, or 49152 Aerial data blocks or data blocks recorded in the Manual mode. For Aerial Data, and data recorded in the Manual mode, an extra data block is needed for GPS information. The data is stored to memory using a looping format. If the data set is maxed out, the newest data will overwrite the oldest data block. Data blocks consist of the time stamp, frequency, transmitter data, and GPS location if GPS is used.

The Receiver uses DSP (Digital Signal Processing) technology to achieve better sensitivity, and to help filter out noise. The DSP digitally samples the audio signal from the R4500S. When the signal has been digitized, the DSP processor uses internal mathematical calculations to identify signals.

The S suffix indicates the software in this receiver is programmed to detect non coded transmitters.

A non coded transmitter transmits a single pulse which is repeated at a specific pulse rate.

The R4500S can be used for fixed pulse rate transmitters, and for variable pulse rate transmitters.

For fixed pulse rate transmitters, the R4500S uses a pattern matching algorithm to detect up to 3 user entered pulse rates. To verify a pulse rate, the pattern matching algorithm uses 4 pulses from the transmitter to verify the pulse rate which helps separate a transmitter signal from a noise pulses. This is important to know for setting the correct scan time for detecting pulse rates as described in sections 13.0 . 15.0.

For variable rate transmitters (temperature, depth, altitude), the R4500S uses a pattern matching algorithm to identify transmitter pulse periods, and converts the period to the actual measurement using 2nd order regression coefficients required to be entered for each transmitter.

Class B Device Statement: (Section 15.105 (b) of the FCC Rules)

%Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-    Reorient or relocate the receiving antenna.

-    Increase the separation between the equipment and receiver.

   o   Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
   o   Consult the dealer or an experienced radio/TV technician for help.+

Contents

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Getting Started:

When you first turn on the power, the receiver will display Advanced Telemetry Systems, the receiver model and the version number of the receiver software. The display will then proceed to the Main Menu:

```
Main Menu:           GPS        (Flashing GPS / OFF)
MANUAL
AERIAL          PC
STATIONARY      CLONE
```
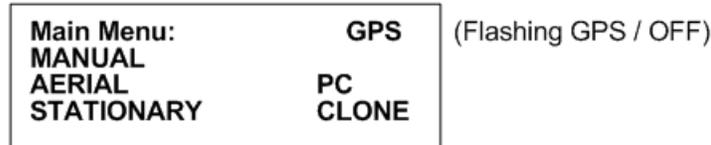
Main Menu Items:

GPS indicator: The status of the GPS is displayed in the upper right corner of the screen. The messages indicate the following:

GPS (non flashing) . The GPS is on, and there is a valid GPS fix.
GPS / **OFF** . The GPS is turned OFF.
NO / **FIX** . The GPS is attempting to acquire a valid GPS fix.
GPS / **ERR** . The GPS has not been able to get a valid GPS fix within 5 minutes.
NO / **GPS** . The GPS has not been able to get a valid GPS fix after 15 minutes.

If a valid GPS fix is found during NO /FIX, GPS / ERR, or NO / GPS the indicator will change to a non flashing GPS indicator.

MANUAL: This mode is used to detect transmitters on an individual frequency. Frequency scanning is not available in this mode. The manual mode does not use pattern matching. The actual pulse rate between any two pulses will be displayed. Without any pattern matching, the manual mode is helpful to identify a transmitter pulse rate if it is not known. To save a target in the manual mode, **Record** would need to be activated. When **Record** is activated, GPS locations are also recorded along with the transmitter data if GPS is activated. An optional GPS antenna is required to use the GPS feature.

AERIAL: Designed for transmitter location using aircraft, but can easily be used in any other vehicle. While scanning a table usually a small scan time is used to cycle through the frequency table quickly, and does not allow enough time for the R4500S to identify a pulse rate on each frequency. To remain on a specific frequency for a longer period of time to allow the R4500S to identify the pulse rate, **Hold** will need to be activated. When **Hold** is activated, the scanning of the frequencies in the frequency table stops and is held for the frequency shown in the screen until **Hold** is pressed again. While in **Hold**, all available information will be continually stored. The transmitter pulse rate, frequency, signal strength and time are stored to memory when the operator exits **Hold** or activates **Record**. While In **Hold**, **Record** needs to be activated when no pulse rate is detected but a transmitter can still be heard. GPS locations are also recorded along with the transmitter data if GPS is activated. An optional GPS antenna is required to use the GPS feature.

STATIONARY: This mode is used to monitor transmitters passing a site or presence/absence of transmitters. The time, frequency, signal strength, transmitter pulse rate, and the number of valid transmitter detections per store period are stored. Scanning is enabled, GPS is disabled.

PC: Used to off load data, send/receive frequency tables and to send/receive receiver programming parameters. The supplied ATSWinRec software and serial cable must be used with this option.

CLONE: Using the optional blue cable, frequency tables and default settings may be cloned from one receiver to another receiver.

Receiver Controls:

Receiver controls are shown in the figure below. Most are self explanatory. The RF Gain control is normally set to full clockwise for maximum sensitivity. RF Gain may be reduced for close in searching or while direction finding. The Audio control should be set for a comfortable level. Its setting does not affect detection sensitivity. Any monaural headset with a 0.25 inch jack may be used. Most users prefer headsets with muffs to reduce external noise from wind or aircraft. Inserting the headset jack disables the internal speaker.

The AUX connector is used to interface antenna switches or other controlled devices.

The SIG LED will light for every valid pulse detected. See specifications for valid pulse detections.
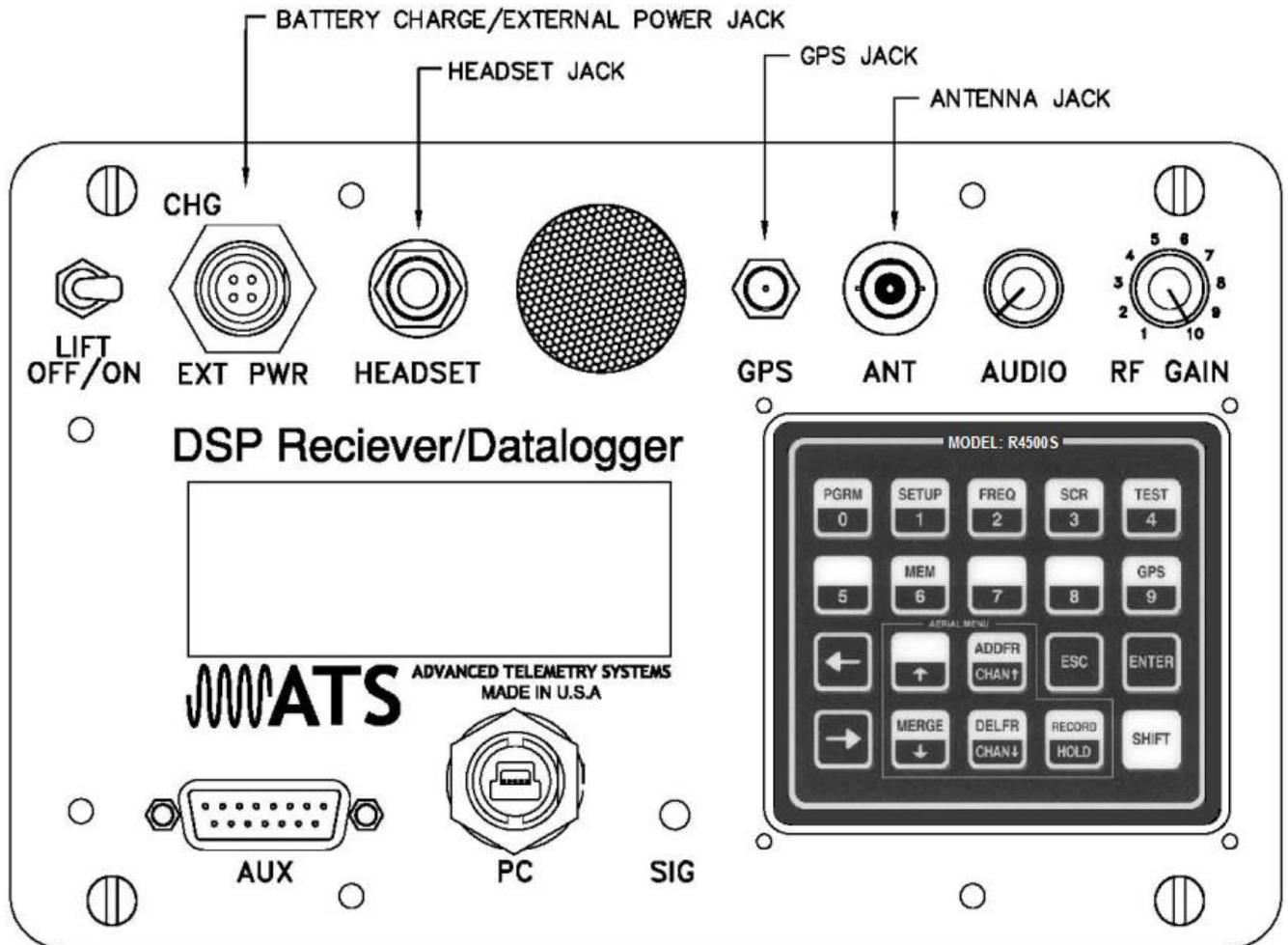
Most input and control of the receiver is done through the keypad. The keypad is shown below:
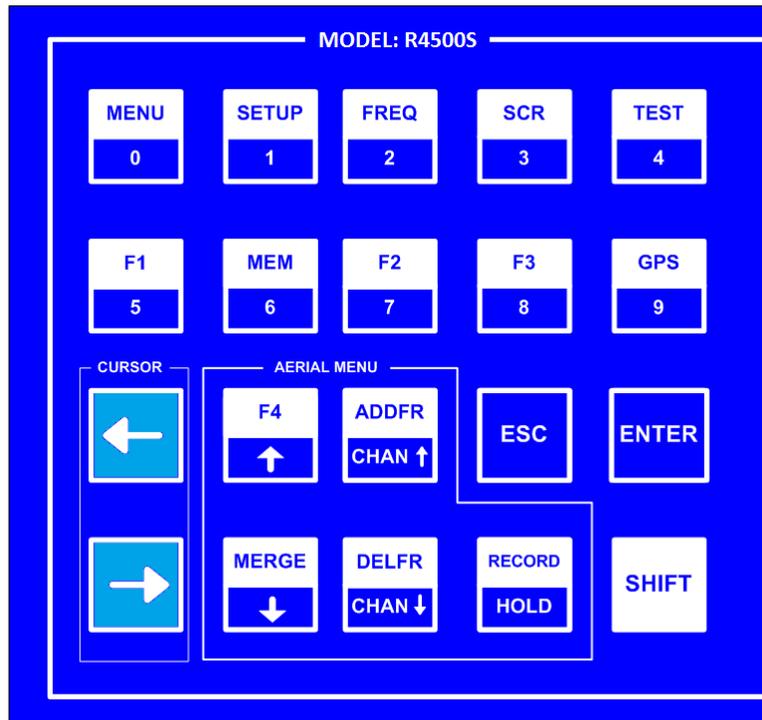
Navigation of the Cursor:

At startup in the Main Menu, the cursor will be positioned on the MANUAL menu item.

To maneuver through the menu items, use the ➡️or the ⬅️keys to move the cursor to the desired menu item.

Both keys will move the cursor. One key moves the cursor in a forward direction➡️, and the other ⬅️ in a reverse direction. Once the cursor is on the desired menu item, pressing *"ENTER"* will activate that item.

To access the upper functions on the keypad, first press the *"SHIFT"* key followed by the desired upper function key sequentially.

Note: The *"SHIFT"* key will not be activated if pressed simultaneously with another key.

To stop a scan (Aerial or Stationary), stop a setup sequence, or to return the previous menu, press the *"ESC"* key.

Pressing the wrong key or entering invalid data will produce the response:

> **NOT an Option**
> or
> **Out of Range**

Upper Keypad Functions:

To access the upper keypad functions, first press **"SHIFT"** and then press the *"upper function"* key sequentially.

MENU . Enters the Main Menu

SETUP . Enters the Setup Menu

FREQ . Enters the Frequency Menu

SCR . Toggles the display backlight on and off

TEST . Test internal Battery Voltage Level or External Power Supply Voltage Level

MEM . Enters the Memory Menu

GPS . Enters the GPS Menu

MERGE . Merges frequency tables for Aerial or Stationary Scanning

ADDFR . Adds a frequency while Aerial Scanning

DELFR . Deletes a frequency while Aerial Scanning

RECORD . Used to manually record information

F1, F2, F3, F4 . Currently not in use

1.0 Frequency Entry Mode

Stationary Mode and Aerial Mode will not function if there are no frequencies in the table selected to scan. The frequencies should be entered into the frequency table or tables first.

Frequency Entry Mode – Fixed Rate Transmitter

The frequencies entered in the R4500S are 6 digit numbers. For frequencies below 100 MHz, the frequencies are entered as 5 digit numbers. For example, a frequency of 151.183 MHz will be entered as 151183. A frequency of 48.655 MHz will be entered as 48655.

From the Main Menu screen, press the *"SHIFT"* key followed by pressing the *"FREQ"* key sequentially. To change the numeric value, use the numeric digits on the keypad. For the R4500S to accept a value, press *"ENTER"*.

Screen 1

```
Freq Entry Mode:
Table #          1
Chan Qty         1
```
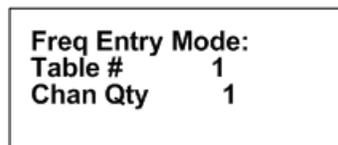
Table # :   Selects the frequency table that you will be storing your transmitters' frequencies. There are twelve tables available. Table 1, 2, 3 … or 12.

Chan Qty :   The number of frequency entries you will be using for the transmitters in this table. Note the first channel is Channel (00). There are 50 channels available for each frequency table.

After entering the Chan Qty, the screen will change to entering the frequencies.

Screen 2

```
FR 1(00) : 1640000
```
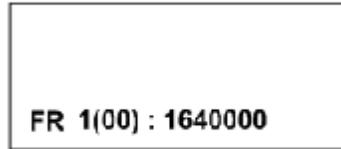
(The default frequency will be the lowest frequency of the receiver)

FR 1 indicates frequency table 1.

(00) represents the first frequency in the list. The next frequency will be FR 1(01), and so on.

The cursor defaults to the 1 MHz position. Use the [→] or the [←] keys to move the cursor to the digit that needs changing. When a number is entered in one location, the cursor will move to the right by one. Pressing *"ENTER"* will store the frequency, and move to the next frequency position in the table. When all the frequencies are entered, the screen will jump back to the start of the Frequency Entry Menu.

If you have overlapping frequencies (i.e. 148.000-151.999) move the cursor to the 10 MHz position and then enter the desired numeric value.

You may use the CHAN up [ADDFR / CHAN↑] and CHAN down [DELFR / CHAN↓] keys at any time to scroll through the channels. These keys can be used to make corrections or change an individual channel frequency.

Frequency Entry Mode – Variable Rate Transmitter

The R4500S uses a second order regression to convert the incoming pulse rate to the specified measurement (i.e. temperature, altitude, and depth). Each transmitter will behave uniquely and should have its own associated equation. This information should be included in the calibration data we send out with the transmitters. The values to be entered will be highlighted on the transmitter paperwork.

The following is an example for a Temperature transmitter:

Temperature = Ax^2 + Bx + C

1.	x is the transmitter period.

2.	A, B and C are calibration constants, an example set is listed below:

   a.	A = 0.000012897 => value entered is 1290
   b.	B = -0.09435789 => value entered is . 9436
   c.	C = 111.99245 => value entered is 11199

This data for the transmitter types: temperature, depth, or altitude will be entered along with each transmitter frequency. When entering frequency data for variable pulse rate transmitters the prompts will automatically appear for ±Aq¢Bqand £Cq

Because each one of these calibration constants will take up the space used for entering one frequency the maximum number of frequencies that each table can store will now be 25.

This calibration data will also be requested in the defaults menu when setting up your reference frequency if a reference transmitter is used.

The frequencies entered in the R4500S are 6 digit numbers. For frequencies below 100 MHz, the frequencies are entered as 5 digit numbers. For example, a frequency of 151.183 MHz will be entered as 151183. A frequency of 48.655 MHz will be entered as 48655.

From the Program menu screen, press the *"SHIFT"* key followed by pressing the *"FREQ"* key sequentially. To change the numeric value, use the numeric digits on the keypad. For the R4500S to accept a value, press *"ENTER"*.

Screen 1

```
Freq Entry Mode:
Table #        1
Chan Qty       1
```

Table # :   Selects the frequency table that you will be storing your transmittersqfrequencies. There are twelve tables available. Table 1, 2, 3 õ .. or 12.

Chan Qty :   The number of frequency entries you will be using for the transmitters in this table. Note the first channel is Channel (00). There are 25 channels available for each frequency table.

After entering the Chan Qty, the screen will change to instruction needed for entering required information for the coefficient, and how to scroll through the frequencies in the frequency table. Pressing *"ENTER"* is required to move to the next screen. If Screen 1 is needed at any time during the following screens, pressing *"ESC"* will bring the Frequency Entry Mode back to the first screen %Freq Entry Mode:+

Screen 2

```
Use the tune arrows
to change the sign
of the coefficient.
Press enter…
```

Screen 3

```
Use the Channel keys
to scroll through
the frequencies
Press enter…
```

After the instructions, the screen will change for entering the frequency and coefficients. The calibration data for each transmitter will be unique, and each frequency entered will have different coefficients to enter.

Screen 4

```
FR  1(00)  150123
A: +01290
B: -09436
C: +11199
```

FR 1 indicates frequency table 1.

(00) represents the first frequency in the list. The next frequency will be FR 1(01), and so on.

A, B, and C represent values for the second order regression equation mentioned earlier.

The cursor defaults to the 1 MHz position for entering the frequency. Use the ➡️ and the ⬅️ keys to move the cursor to the digit that needs changing. When a number is entered in one location, the cursor will move to the right by one. Pressing enter will store the frequency, and move to the next frequency position in the table. When all the frequencies are entered, the screen will jump back to the start of the Frequency Entry Menu.

If you have overlapping frequencies (i.e. 148.000-151.999), move the cursor to the 10 MHz position and then enter the desired numeric value.

You may use the CHAN up **ADDFR CHAN↑** and CHAN down **DELFR CHAN↓** keys at any time to scroll through the channels. These keys can be used to make corrections or change an individual channel frequency.

After entering the frequency, press *"ENTER"*. Then the coefficients can be entered. Entering the coefficients will be in order from A to B to C. To change to the next coefficient, press *"ENTER"*.

To change the sign for the coefficient use the tune up **F4 ↑** or the tune down key **MERGE ↓**, a number other than 00000 will need to be first entered before either key can change the sign.

2.0 Setup Menu

The Setup Menu is used to set the clock, select transmitter type, default settings and delay times for the screen, stationary hold, the channel delay and set the external data transfer settings. Setting the defaults first will make starting Aerial or Stationary scans much easier and also reduce potential for errors.

To get into the "Setup Menu", press the *"SHIFT"* key followed by pressing the "*SETUP*" key sequentially.

Again, to maneuver through the menu items, use the ➡️ or the ⬅️ keys.

This is the view of the "Setup Menu"

```
Setup Menu:
Clock          Stat Hold
Defaults       Chan Delay
TX Type        Ext Data
```
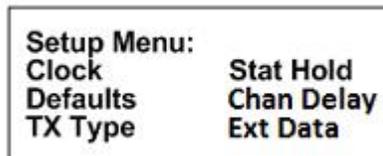
To return to the Main Menu from the Setup Menu, press *"ESC"*.

2.1 Clock

To access the clock, position the cursor on **Clock** and press *"ENTER"*.

Here is an example of the Clock Menu:

```
Year          03
Julian Day    056
Hour          11
Minutes       16
```

You can press *"ENTER"* to go through each setting, or use the ➡ and the ⬅ keys to move forward or backwards to a specific setting.

To change the numeric value, use the numeric digits on the keypad, or you can use the ⬆[F4] and ⬇[MERGE] keys to increment the numeric value, up or down. For the R4500S to accept a value, press *"ENTER"*. After the Minutes have been entered, the menu will return to the "Setup Menu". If no changes are needed in the Clock Menu, pressing "ESC" will return you to the "Setup Menu". If a numeric number has been changed and *"ENTER"* has not been pressed, pressing *"ESC"* will return the value to its original value.

2.2 Defaults

```
Defaults Menu:

Aerial Defaults
Stationary Defaults
```

This selection allows you to set **Aerial Defaults** or **Stationary Defaults**. Move the cursor to select either Aerial or Stationary Defaults and press *"ENTER"*.

2.2.1 Aerial Defaults

This menu option sets the default options for aerial tracking, setting the defaults in this option helps reduce unwanted changes or mistakes in having to set the parameters during the tracking survey.

Aerial Defaults – Fixed Pulse Rate

To change the numeric value, use the numeric digits on the keypad, or you can use the ⬆[F4] and ⬇[MERGE] keys to increment the numeric value, up or down or to toggle between YES / NO selections. For the R4500S to accept a value, press *"ENTER"*.

Moving the cursor with the ➡ or the ⬅ will allow movement between screens or by pressing *"ENTER"* for the last item in the window to proceed to the next window.

Screen 1

```
Aerial Defaults:
Table #               1
Scan Rate        003.5
GPS                  YES
```

Table #:   Selects the frequency table used for scanning. Twelve tables are available. Multiple tables are used to optimize Aerial surveys in multiple locations.

Scan Rate: Sets the amount of time the R4500S will stop on each frequency before changing to the next frequency in the frequency table while attempting to detect transmitters. (Range = 001 . 300 seconds)

GPS: Sets whether the GPS receiver is used (**YES**) or not used (**NO**) when an Aerial Scan starts. An optional GPS antenna must be connected to the R4500S for GPS option to work.

Screen 2

```
Aerial Defaults:
Auto Record:    YES
```

The option of Auto Recording data can be selected as **YES** or **NO** for an Aerial Scan.

When Auto record is selected as **YES** for an Aerial Scan, a data point will be stored for every valid pulse rate detected. The time stamp, frequency, pulse rate, signal strength and GPS location will be saved to memory for every valid pulse rate detected. An optional GPS antenna must be connected to the R4500S for the GPS location option to work. **HOLD** is used in an Aerial Scan to stop the scanning of frequencies to allow the required time needed to identify a valid pulse rate for a specific frequency.

When Auto Record is selected as **NO** for an Aerial Scan, no pulse rate information will be displayed or recorded. To manually save a data point, **Hold** must be activated and pressing *"SHIFT"* and then *"RECORD"* sequentially will save a data point. The time stamp, frequency, signal strength and GPS location for each data point recorded will be stored to memory. An optional GPS antenna must be connected to the R4500S for the GPS location option to work.

If *"SHIFT"* and then *"RECORD"* is pressed while not in **Hold**, the frequency will not be recorded, but the time stamp, and GPS location will be stored to memory. An optional GPS antenna must be connected to the R4500S for the GPS location option to work.

Screen 3

```
Number of Different
Pulserates to Scan
(1-4): 4
```

The number entered here should represent the total number of pulse rates you are using in your study. There should not be more than one transmitter per frequency. If you need to use multiple transmitters per frequency you should consider using a coded receiver and coded transmitters.

Screen 4

```
PR1: 055 +/-  00 ppm
PR2: 045 +/-  01 ppm
PR3: 072 +/-  02 ppm
PR4: 030 +/-  00 ppm
```

PR1-PR4: The pulse rates of your transmitters in pulses per minute. (Range = 020ppm . 250ppm)

ppm : The ppm adjustment (tolerance) is a +/- pulse rate range in ppm used to filter the incoming signal. The tolerance may be set in the range of 00ppm to 10ppm. There is always a +/- 10ms buffer added to the tolerance setting. A tolerance of 1 for PR2: 045 would indicate the R4500S should accept signals coming in that range from 44ppm (1364ms) to 46ppm (1304ms) +/- 10ms = 1374ms to 1294ms. A tolerance of zero indicates the R4500S should accept only signals that are the specified range +/- 10ms (i.e. PR1:055 should always be 55ppm (1091ms) +/- 10ms = 1081ms to 1101ms). You can use a zero tolerance when using ATS microprocessor transmitters. A larger tolerance will be needed on transmitters that have a pulse rates that can drift with temperature or age.

Aerial Defaults – Variable Pulse Rate

To change the numeric value, use the numeric digits on the keypad, or you can use the [F4 ↑] and [MERGE ↓] keys to increment the numeric value, up or down or to toggle between YES / NO selections. For the R4500S to accept a value, press *"ENTER"*.

Moving the cursor with the [→] or the [←] will allow movement between screens or by pressing *"ENTER"* for the last item in the window to proceed to the next window.

Screen 1

```
Aerial Defaults:
Table #              1
Scan Rate        003.5
GPS                YES
```

Table #: Selects the frequency table used for scanning. Twelve tables are available. Multiple tables are used to optimize Aerial surveys in multiple locations.

Scan Rate: Sets the amount of time the R4500S will stop on each frequency before changing to the next frequency in the frequency table while attempting to detect transmitters. (Range = 001 . 300 seconds)

GPS: Sets whether the GPS receiver is used (**YES**) or not used (**NO**) when an Aerial Scan starts. An optional GPS antenna must be connected to the R4500S for GPS option to work.

Screen 2

```
Aerial Defaults:
Auto Record:    YES
```

The option of Auto Recording data can be selected **YES** or **NO** for an Aerial Scan.

When Auto record is selected as **YES** for an Aerial Scan, a data point will be stored for every valid pulse rate detected. The time stamp, frequency, pulse rate, signal strength and GPS location will be saved to memory for every valid pulse rate detected. An optional GPS antenna must be connected to the R4500S for the GPS location option to work. **HOLD** is used in an Aerial Scan to stop the scanning of frequencies to allow the required time needed to identify a valid pulse rate for a specific frequency.

When Auto Record is selected as **NO** for an Aerial Scan, no pulse rate information will be displayed or recorded. To manually save a data point, **Hold** must be activated and pressing *"SHIFT"* and then *"RECORD"* sequentially will save a data point. The time stamp, frequency, signal strength and GPS location for each data point recorded will be stored to memory. An optional GPS antenna must be connected to the R4500S for the GPS location option to work.

If *"SHIFT"* and then *"RECORD"* is pressed while not in **HOLD**, the frequency will not be recorded, but the time stamp, and GPS location will be stored to memory. An optional GPS antenna must be connected to the R4500S for the GPS location option to work.

Screen 3

```
Enter the valid
Period Range:
Min:  0800 ms
Max: 1200 ms
```

The number entered here should represent the range of pulse rates you are using in your study. The available period range allowed to be entered is between 400ms to 6000ms. The periods measured from signals that are outside the entered range will be thrown out.

2.2.2 Stationary Defaults

Stationary Defaults – Fixed Pulse Rate

Move the cursor to the Stationary Default item and press *"ENTER"*. There will be multiple windows to go through.

To change the numeric value, use the numeric digits on the keypad, or you can use the **F4** ↑ and **MERGE** ↓ keys to increment the numeric value, up or down or to toggle between YES / NO selections. For the R4500S to accept a value, press *"ENTER"*.

Moving the cursor with the → or the ← will allow movement between screens or by pressing *"ENTER"* for the last item in the window to proceed to the next window.
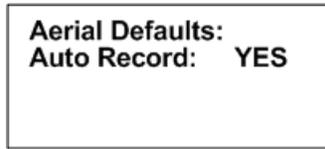

Screen 1

```
1:Continual
2:Periodic

Type of Logging: 1
```

Continual: The R4500S will continually scan through the selected frequency table.

Periodic: The R4500S will scan through the selected frequency table only once and wait to scan the frequency table once again until an entered amount of time has elapsed. The amount of time entered between scans (Log Period) is entered when starting a Stationary Scan.

Screen 2

```
Number of Different
Pulserates to Scan
(1-4): 4
```

The number entered here should represent the total number of pulse rates you are using in your study. There should not be more than one transmitter per frequency. If you need to use multiple transmitters per frequency you should consider using a coded receiver and coded transmitters.

Screen 3

```
PR1: 055 +/- 00 ppm
PR2: 045 +/- 01 ppm
PR3: 072 +/- 02 ppm
PR4: 030 +/- 00 ppm
```

PR1-PR4: The pulse rate of your transmitter in pulses per minute. (Range = 20ppm . 250ppm)

ppm : The ppm adjustment (tolerance) is a +/- pulse rate range in ppm used to filter the incoming signal. The tolerance may be set in the range of 00ppm to 10ppm. There is always a +/- 10ms buffer added to the tolerance setting. A tolerance of 1 for PR2: 045 would indicate the R4500S should accept signals coming in that range from 44ppm (1364ms) to 46ppm (1304ms) +/- 10ms = 1374ms to 1294ms. A tolerance of zero indicates the R4500S should accept only signals that are the specified range +/- 10ms (i.e. PR1:055 should always be 55ppm (1091ms) +/- 10ms = 1081ms to 1101ms). You can use a zero tolerance when using ATS microprocessor transmitters. A larger tolerance will be needed on transmitters that have a pulse rates that can drift with temperature or age.

Screen 4

```
Stationary Defaults:

Time Out    003    sec
Scan Time   010    sec
A           0010   min
```

(A = Store Rate or Log Period, see below**)**

Time Out: The amount of time the receiver will stay on a Frequency while attempting to detect a transmitter. If no transmitter is detected in the Time Out period, the

receiver will advance to the next frequency in its frequency table. This feature allows faster scanning by truncating the scan time if no transmitter is detected in the Time Out period. The user defines the parameter (Range = 001 . 300 seconds). Refer to section **14.0** for information on setting the Time Out value.

Scan Time: The amount of time to hold on a frequency and attempt to detect transmitters. The Scan time will override the Time Out time, if a pulse has been detected during the Time Out period. The Scan Time is set to whatever you need this set at (Range = 001 . 300 seconds). Refer to section **15.0** for information on setting the Scan Time value.

A: If Continual (1) was selected in screen 1 this will read ➔ **Store Rate**
If Periodic (2) was selected in screen 1 this will read ➔ **Log Period**

Store Rate: This defines how often a transmitters detection will be stored for each antenna (Range = 0000 . 1440 minutes). For example if the Store Rate is set to 10 minutes and a scan time of 15 seconds, its presence will only be recorded once during that 10 minute period. The data stored will include the time stamp of the strongest signal strength measured in one 15 second scan time during the 10 minute scan period. Stored with it will be a total number of pulses that the receiver determined to be pulse rates during the 10 minute store period along with the total number of pulses detected during the Store Period.

Log Period: This defines the time interval between the receiver cycles where the R4500S performs one scan of the frequency table.
(Range = 0000 . 1440 minutes). If the scan of the frequency table takes the entire log period, the receiver will never pause between the end of a frequency table scan, and the start of the next one.

Screen 5

```
Stationary Defaults:
Tables(1-12):  1,
   ,  ,  ,  ,  ,  ,
   ,  ,
```

Tables(1-12): The frequency tables you want to scan. There are twelve tables available.

Screen 6

```
Stationary Defaults:
Antenna #(1-8):      1
EXT Data XFER:   NO
```

Antenna # : The number of antennas the receiver will sample. This feature requires an external antenna switchbox connected to the AUX port of the R4500S if using more than 1 antenna. If using a 2-way switchbox, this would be set to 2.

EXT Data XFER: When this is enabled the receiver will dump the logged data out a serial port once an hour. To change this options settings use the "Ext Data" choice in the "Setup Menu".

To activate the EXT Data XFER feature, use the [F4 ↑] or the [MERGE ↓] key. These two keys are used to toggle between the two choices.

Screen 7

```
Stationary Defaults:
Reference Freq:   NO
```

Reference Freq: Pressing *"ENTER"* while the cursor is on NO will bring the screen back to the Default Menu.

To activate the Reference transmitter feature, use the [F4 ↑] or the [MERGE ↓] key. These two keys are used to toggle between the two choices.

If you entered **YES** for the reference transmitter, you will be prompted to enter the reference transmitter frequency, and the store rate of the reference transmitter.

Screen 8

```
Default Ref Tag:
Reference Freq:
150000
Store Rate: 0060 min
```

Reference Freq: This is the frequency of a transmitter set up within range of your station used as a check on the system. Since you will not need the same quantity of data you can set up a longer store period to use up less memory. Instead of the strongest signal strength being stored within the storage period, it will be the time of the first valid pulse rate detected.

Store Rate: This defines how frequently the data from the reference transmitter will be stored. A count of the number of detected pulse rates will be stored for the entire store rate. (Range = 0005 . 1440 minutes)

Note: The data are not stored until the storage period has expired. For example with storage period set up for once an hour the time the first data are collected might be at 6:00 am. Although the data recorded will reflect 6:00 they will not be committed to memory until 7:00 am. This means when the data are offloaded you may have the data for the actual transmitters appearing before the reference transmitter. This is true even if the animal data were collected at 6:30 am and the reference data were collected at 6:00 am.

Stationary Defaults – Variable Pulse Rate

Move the cursor to the Stationary Default item and press *"ENTER"*. There will be multiple windows to go through.

To change the numeric value, use the numeric digits on the keypad, or you can use the [↑] (F4) and [↓] (MERGE) keys to increment the numeric value, up or down or to toggle between YES / NO selections. For the R4500S to accept a value, press *"ENTER"*.

Moving the cursor with the [→] or the [←] will allow movement between screens or by pressing *"ENTER"* for the last item in the window to proceed to the next window.

Screen 1

```
1:Continual
2:Periodic

Type of Logging: 1
```

Continual: The R4500S will continually scan through the selected frequency table.

Periodic: The R4500S will scan through the selected frequency table only once and wait to scan the frequency table once again until an entered amount of time has elapsed. The amount of time entered between scans (Log Period) is entered when starting a Stationary Scan.

Screen 2

```
Enter the valid
Period Range:
Min: 0800 ms
Max: 1200 ms
```

The number entered here should represent the range of pulse rates you are using in your study. The available period range allowed to be entered is between 400ms to 6000ms.

The periods measured from signals that are outside the entered range will be thrown out.

Screen 3

```
Stationary Defaults:
Time Out     003    sec
Scan Time    010    sec
A            0010   min
```

(A = Store Rate or Log Period, see below**)**

Time Out: The amount of time the receiver will stay on a Frequency while attempting to detect a transmitter. If no transmitter is detected in the Time Out period, the receiver will advance to the next frequency in its frequency table. This feature allows faster scanning by truncating the scan time if no transmitter is detected in the Time Out period. The user defines the parameter (Range = 001 . 300 seconds). Refer to section **14.0** for information on setting the Time Out value.

Scan Time: The amount of time to hold on a frequency and attempt to detect transmitters. The Scan time will override the Time Out time, if a pulse has been detected during the Time Out period. The Scan Time is set to whatever you need this set at (Range =

0000 . 1440 seconds). Refer to section **15.0** for information on setting the Scan Time value.

A: If Continual (1) was selected in screen 1 this will read ➔ **Store Rate**
If Periodic (2) was selected in screen 1 this will read ➔ **Log Period**

Store Rate: This defines how often a transmitters detection will be stored for each antenna (Range = 0000 . 1440 minutes). For example if the Store Rate is set to 10 minutes and a scan time of 15 seconds, its presence will only be recorded once during that 10 minute period. The data stored will include the time stamp of the strongest signal strength measured in one 15 second scan time during the 10 minute scan period. Stored with it will be a total number of pulses that the receiver determined to be pulse rates during the 10 minute store period along with the total number of pulses detected during the Store Period.

Log Period: This defines the time interval between the receiver cycles where the R4500S performs one scan of the frequency table. (Range = 0000 . 1440 minutes). If the scan of the frequency table takes the entire log period, the receiver will never pause between the end of a frequency table scan, and the start of the next one.

Screen 5

```
Stationary Defaults:
Tables(1-12):  1,
    ,  ,  ,  ,  ,  ,
    ,  ,
```

Tables(1-12): The frequency tables you want to scan. There are twelve tables available.

Screen 6

```
Stationary Defaults:
Antenna #(1-8):    1
EXT Data XFER:   NO
```

Antenna # : The number of antennas the receiver will sample. This feature requires an external antenna switchbox connected to the AUX port of the R4500S if using more than 1 antenna. If using a 2-way switchbox, this would be set to 2.

EXT Data XFER: When this is enabled the receiver will dump the logged data out a serial port once an hour. To change this options settings use the %Ext Data+ choice in the %Setup Menu+.

To activate the EXT Data XFER feature, use the [F4 ↑] or the [MERGE ↓] key. These two keys are used to toggle between the two choices.

Screen 7

```
Stationary Defaults:
Reference Freq:   NO
```

Reference Freq: Pressing *"ENTER"* while the cursor is on NO will bring the screen back to the Default Menu.

To activate the Reference transmitter feature, use the [F4 ↑] or the [MERGE ↓] key. These two keys are used to toggle between the two choices.

If you entered **YES** for the reference transmitter, you will be prompted to enter the reference transmitter frequency, and the store rate of the reference transmitter.

Screen 8

```
Default Ref Tag:
Reference Freq:
150000
Store Rate: 0060 min
```

Reference Freq: This is the frequency of a transmitter set up within range of your station used as a check on the system. Since you will not need the same quantity of data you can set up a longer store period to use up less memory. Instead of the strongest signal strength being stored within the storage period, it will be the time of the first valid pulse rate detected.

Store Rate: This defines how frequently the data from the reference transmitter will be stored (Range = 0005 . 1440 minutes). A count of the number of detected pulse rates will be stored for the entire store rate.

Screen 9

```
Use the tune arrows
to change the sign
of the coefficient.
Press enter…
```

Screen 10

```
FR  1(00)  150123
A:  +01290
B:  -09436
C:  +11199
```

The frequency cannot be changed in screen 8. Only the coefficients are to be entered here. Entering the coefficients will be in order from A to B to C. To change to the next coefficient, press *"ENTER"*.

To change the sign for the coefficient with the tune up **F4** ⬆ or the tune down key **MERGE** ⬇, a number other than 00000 will need to be first entered.

2.3 Tx Type

This is used to select what type of transmitters you want to monitor.

```
Transmitter Type:
1:Fixed PulseRate
2:Variable PulseRate
Pulse Rate: 1
```

Enter a 1 or 2 for the type of transmitter and press *"ENTER"*.

2.3.1 Fixed pulse rate

Most transmitters will have a pulse rate that does not change. This is the default setting. After choosing the Fixed PulseRate, a new screen will appear to select the default type of scan.

Screen 2
```
1:Pattern Matching
2:PulsesPerScan Time

Type of Scan:  1
```

Pattern Matching: Pattern Matching is the default type of scan. With Pattern matching, 4 consecutive pulses are needed to determine if the pulse rate is valid, given the information entered for the pulse rates before starting an Aerial Scan or a Stationary Scan. Also the R4500S will check to see if the incoming pulse rates are within the tolerances entered for each pulse rate. If the pulse rates do not match the entered information, the pulse rate will be thrown out. This Pattern Matching method helps to filter out noise pulses. A noise pulse is defined as any pulse that is not wanted to be received.

PulsesPerScan Time: Pulses per Scan Time will count all pulses detected during each scan time, and stored during the scan period. No noise filtering is used, and no pulse rate information is available.

Enter a 1 or 2 for the type of scan and press *"ENTER"*. The screen will return to the "Setup Menu".

2.3.2 Variable PulseRate

```
Select Type of Scan:
Temperature    Period
Altitude
Depth
```
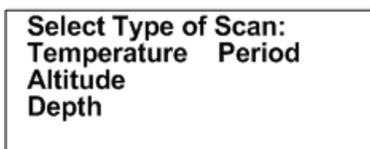
A variable pulse rate transmitter has an added sensor that will vary the pulse rate to indicate an external measurement: temperature, altitude, depth, and period.

A period type scan does not use coefficients when entering frequencies and the actual period will be stored.

When using temperature, altitude, or depth, the converted measurement will be displayed using the entered coefficients for each frequency.

The R4500S uses a second order regression to convert the incoming pulse rate to the specified measurement (i.e. temperature, altitude, and depth). Each transmitter will behave uniquely and should have its own associated equation. This should be included in the calibration data we send out with the transmitters. The values to be entered will be highlighted on the transmitter paperwork.

The following is a second order regression example for a Temperature transmitter:

Temperature = Ax^2 + Bx + C

x is the transmitter period.

A, B and C are calibration constants and need to be entered for the to display converted data.

Move the cursor with the ➡ or the ⬅ to choose what type of measurement data you want to collect and store and press *"ENTER"*.

2.4 Stat Hold

(This time setting is only used only for a Stationary Scan and is not used for **Hold** during Aerial Scanning)

Stat Hold is abbreviated for Stationary Hold time (Range = 00005 to 65535 seconds). The Stationary Hold time is the number of seconds the *"HOLD"* feature can remain in the **Hold** position when activated during a Stationary Scan. Pressing *"HOLD"* before the **Stat Hold** time has expired will resume the stationary scan. The *"HOLD"*

feature may be used to monitor a transmitter for a period of time longer than the Scan Time during a Stationary Scan. If the user does not exit the *"HOLD"* mode, the R4500S will automatically resume scanning after the number of seconds has been reached. This is a safety feature added to prevent the possibility of a stationary scan remaining in Hold at a remote location.

Pressing *"ENTER"* or *"ESC"* from the "Stat Hold" menu will bring you back to the "Setup Menu".

2.5 Channel Delay

During a stationary scan, when switching to a new frequency the "Channel Delay" will be activated. The available delay time is 0-5000 milliseconds. The default Channel Delay time is 1000 milliseconds (1 second). The purpose of the Channel Delay is to filter out unwanted noise pulses when switching frequencies. The R4500S filters out unwanted noise pulses during the Channel Delay time by ignoring all pulses detected during the entered time, 0 . 5000 milliseconds. The scan time of each frequency does not start until the Channel Delay time has expired.

This adjust is available for cases where the noise level changes significantly when frequency channels are changed. The R4500S measures the average background noise level and adjusts the detection level accordingly. If the background noise level changes dramatically between channels, more time is needed to adjust to the new threshold level. When using multiple antennas the system monitors all antennas for the first two seconds (Time Out setting), if there are no pulses present, the search on all antennas is terminated and any other antennas are skipped. This saves scan time and allows all channels to be searched more often.

To determine if extra delay is needed, cycle through the frequency table with no transmitters present to determine if noise pulses cause the receiver to cycle through the multiple antenna sequence. If the receiver scans through all antennas on several or all frequency channels even with no signal present; you may want to increase the Channel Delay time. If noise pulses are present, and the multiple antenna scanning sequence does not start, the Channel Delay time is set correctly.

Setting the Channel Delay time longer gives more time for the R4500S to set a new threshold and optimize sensitivity while at the same time ignoring noise. Setting it longer than necessary means the additional delay will be added to every frequency channel scanned also increasing the time for all channels to be scanned. Thus the goal is to set the delay so most, but not necessarily all noise pulses on every channel are ignored. Occasionally high level noise will still pass no matter how long the delay is made.

Example of scan times with no transmitters present: Number of antennas used = 2. Time out = 3 seconds. Scan time = 10 seconds. Number of frequencies used in table scanned = 10.

If the noise level is higher than the noise threshold level the R4500S has set, the noise will produce signal pulses and the receiver will think transmitters are present and then cycle through the individual antennas. With no transmitters in the area, but with noise pulses indicating possible presence of transmitters, the time for a scan of the complete frequency table will be: Scan Time of antenna 0 + Time Out of antenna 1 + Time Out of antenna 2 = 10 + 3 + 3 = 16 seconds. For the10 frequencies in the table, the total scan time will be 160 seconds. (When an individual antenna is selected, the noise level decreases and there should not be any noise pulses produced)

When using the default Channel Delay of 1000 milliseconds and there are no noise pulses above the threshold nor are any transmitters present; the time of the frequency table scan will be: Channel Delay time + Time Out of antenna 0 = 1 + 3 = 4 seconds. For the10 frequencies the total scan time would be 40 seconds. With the Channel Delay set correctly, scan times can be reduced by allowing time for the R4500S to set the correct noise threshold level.

```
New Channel Delay
1000 Milliseconds
```

Enter a numeric number from 0 to 5000 and press *"ENTER"*.
Pressing *"ENTER"* or *"ESC"* will return the screen back to the "Setup Menu".

2.6 Ext Data

This optional feature is used when you want to dump data out hourly through the **AUX** serial port to another device. This screen is used to select the type of device you want to dump to. For this feature to be activated it will need to have been selected for in screen 6 of the Stationary Setup.

```
Ext Data XFER:
1: RDP
2: Goes
Format:    1
```

Enter a 1 or 2 for the type of device and press **"ENTER".**

2.6.1 RDP – Remote Data Platform

With this setting selected all the data collected during the hour will be dumped out the **AUX** serial port as binary compressed data.

Screen 2

```
RDP Tx baud:
1:9600
2:57600
Tx Rate:   1
```

| 9600 : | Sets the serial communication settings for the R4500S's data output to "baud: 9600, no parity, 8 data bits, 1 stop bit". |
| 57600: | Sets the serial communication settings for the R4500S's data output to "baud: 57600, no parity, 8 data bits, 1 stop bit". |

Enter a 1 or 2 for the desired serial port settings and press "ENTER". The screen will return to the "Setup Menu"

2.6.2 Goes – Geostationary Operational Environmental Satellites

With this setting selected, limited amounts of data collected during the hour will be dumped out the **AUX** serial ports as binary compressed data.

The GOES functionality enables the receiver to send data to a geostationary satellite so that the user can retrieve it later from another location. This system has the advantage of working in remote locations not typically covered by standard cell phone service providers.

To use GOES you first need an account with NESDIS (National Environmental Satellite, Data and Information Service). You also need a GOES Transmitter. Both the SAT HDR GOES and TX312 models sold by Campbell Scientific, Inc are compatible with the data protocol being sent out the **AUX** serial port. The data coming out the **AUX** port is standard RS232 with settings: "baud: 9600, no parity, 8 data bits, 1 stop bit".

> **Screen 2**

```
GOES Tx baud:
1: 1200      2: 300
3: N/A
Tx Rate:    1
```

1200: Informs the R4500S that the GOES satellite will be transmitting data back to Earth at 1200 baud. This value is assigned by NESDIS (National Environmental Satellite, Data and Information Service).

300: Informs the R4500S that the GOES satellite will be transmitting data back to Earth at 300 baud. This value is assigned by NESDIS (National Environmental Satellite, Data and Information Service).

N/A: Informs the R4500S that it doesn't need to worry about the GOES transmission rate. You would select this if you wanted to take advantage of the GOES data format without actually using the GOES transmitter and setup.

Enter a 3 to finish or a 1 or 2 to continue to the next screen and press "**ENTER**".

> **Screen 3**

```
Size in Seconds
of the GOES
transmission
window:  020
```

Enter the value of the transmit window size assigned by NESDIS and press "**ENTER**".

Screens 2 and 3 are used to limit the amount of data dumped out the serial port. The data size will be a size that can be handled by hourly satellite transmissions. Data that doesn't get sent to the GOES transmitter this hour will be saved for the next hours dump. If you anticipate having intervals where you collect more data than can be sent by a satellite transmission, you will need to make sure you have intervals where you collect limited data so the system can catch up.
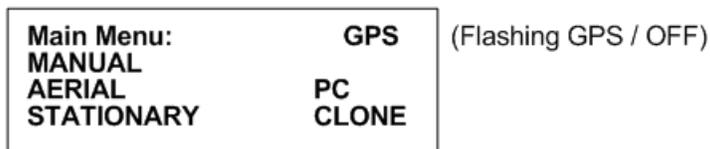
> **Screen 4**

```
Maximum number of
noise pulses
allowed for
Ext Data XFER    255
```

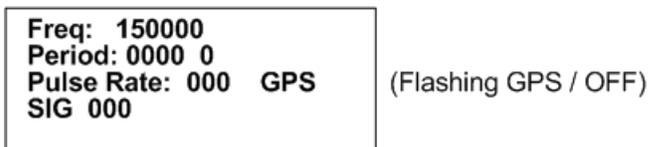Enter a numeric number from 1 to 255 and press *"ENTER"*.

When using pattern matching, pulses are expected to be received at a certain fixed rate. Those pulses occurring at that rate are considered matches. Any pulses that are received in addition to the matches are considered noise. It is normal for noise to be present during any scan. If too much noise is present your system may store data for frequencies when no transmitters are within range. This is referred to as a false positive. The amount of information that can be sent each hour to GOES is limited by the transmission baud rate and your transmission window. If your system is prone to detecting false positives you may want to filter out data where a lot of noise pulses occurred. Data with a certain amount of extra noise pulses would remain in the R4500S for later retrieval but would not be sent to the GOES. The default for this feature is 255 and is the same as having the filter deactivated. It is recommended that you do not change this value unless you have positively confirmed the presence of false positives and you are not able to transmit all your logged data. When you do change it, use your existing data set as a guide and keep this number as high as possible while still eliminating your false positives.

3.0 Main Menu

```
Main Menu:              GPS      (Flashing GPS / OFF)
MANUAL
AERIAL            PC
STATIONARY        CLONE
```

3.1 MANUAL MODE

With the cursor in the MANUAL position, press *"ENTER"*.

```
Freq:  150000
Period: 0000  0
Pulse Rate:  000    GPS      (Flashing GPS / OFF)
SIG  000
```

The manual mode does not use pattern matching as the Stationary Mode and Aerial Mode use to detect incoming pulse rates. In the Manual mode screen, the Period and the Pulse Rate are displayed for any two pulses detected. There is a 0-9 single digit counter located after the 4 digit Period. This counter will increment every time a pulse has been detected and will keep incrementing and looping from 0-9 for every duplicate pulse rate. A new pulse rate will clear the count.

The GPS is normally OFF for the Manual Mode. If the GPS has been turned on previously from the GPS Menu, or an Aerial Scan, the GPS will remain on when entering the Manual Mode.

The Manual mode does not automatically store the data. To store data in the Manual mode the **RECORD** feature can be used. All information in the display will be stored when pressing *"SHIFT"* and then *"RECORD"* sequentially. The latest time stamp and an accumulative count of the detected pulses and consecutive pulse rates will be stored. When the **RECORD** feature is activated, "**Saving targets**" will flash in the display

To change the frequency

The cursor defaults to the 1 MHz position. From here you can enter whatever frequency you are looking for.

You may use the ➡ or the ⬅ keys to change the cursor position. More likely you will enter transmitter frequencies using the keypad. Each time you enter a digit the cursor will move one place to the right. If the cursor is in the 1 kHz position (least significant digit), then it will just remain in that location. Receiver frequency is also updated after each key is entered.

Pressing *"ENTER"* will move the cursor to the default location of the 1 MHz position. It does not change the last entered frequency. You may also use the left and right arrow keys to move the cursor around and change the frequency by entering a new digit.

The [F4 ↑] and the [MERGE ↓] keys can be used to increment or decrement a numeric value while keeping the cursor in the same location.

If the enter frequency that is not within the receiver's range, "**Out of range**" error will be displayed.

To exit the Manual mode, press the *"ESC"* key.

3.2 AERIAL MODE

The Aerial Mode has a Low Battery indicator. The LOW / BAT indicator will show in the display when the internal battery voltage is below 11.5V. If external power is connected to the receiver, the internal batteries are not used, and the low battery indicator would be for the external power supply. The R4500S checks the battery voltage level each time the frequency table has been scanned through.

3.2.1 Starting an Aerial Scan - Fixed Pulse Rate Transmitter

Use the [→] or the [←] key to move the cursor to the AERIAL position and press *"ENTER"*.

To change the numeric value, use the numeric digits on the keypad, or you can use the [F4 ↑] and [MERGE ↓] keys to increment the numeric value, up or down or to toggle between YES / NO selections. For the R4500S to accept a value, press *"ENTER"*.

Moving the cursor with the [→] or the [←] will allow movement between screens or by pressing *"ENTER"* for the last item in the window to proceed to the next window.

Screen 1

```
Aerial Scan Mode:
Table #              1
Scan Rate        003.0
Auto Record      YES
```

Table #:   Selects the frequency table used for scanning. Twelve tables are available. Multiple tables are used to optimize Aerial surveys in multiple locations.

Scan Rate: Sets the amount of time the R4500S will stop on each frequency while attempting to detect transmitters. (Range = 001 . 300 seconds) For setting Scan Rate time, see section **13.0**.

Auto Record: Selects if transmitter pulse rates will be detected and automatically recorded by the R4500S.

The option of Auto Recording data can be selected **YES** or **NO** for an Aerial Scan.
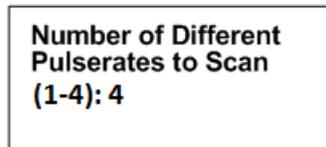
When Auto record is selected as **YES** for an Aerial Scan, a data point will be stored for every valid pulse rate detected. The time stamp, frequency, pulse rate, signal strength and GPS location will be saved to memory for every valid pulse rate detected. An optional GPS antenna must be connected to the R4500S for the GPS location

option to work. **HOLD** is used in an Aerial Scan to stop the scanning of frequencies to allow the required time needed to identify a valid pulse rate for a specific frequency.

When Auto Record is selected as **NO** for an Aerial Scan, no pulse rate information will be displayed or recorded. To manually save a data point, **Hold** must be activated and pressing *"SHIFT"* and then *"RECORD"* sequentially will save a data point. The time stamp, frequency, signal strength and GPS location for each data point recorded will be stored to memory. An optional GPS antenna must be connected to the R4500S for the GPS location option to work.

If *"SHIFT"* and then *"RECORD"* is pressed while not in **HOLD**, the frequency will not be recorded, but the time stamp, and GPS location will be stored to memory. An optional GPS antenna must be connected to the R4500S for the GPS location option to work.
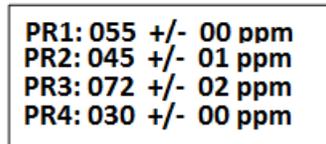
Screen 2

```
Number of Different
Pulserates to Scan
(1-4): 4
```

The number entered here should represent the total number of pulse rates you are using in your study. There should not be more than one transmitter per frequency. If you need to use multiple transmitters per frequency you should consider using a coded receiver and coded transmitters. Enter the number f puserates used and press *"ENTER"*.

Screen 3

```
PR1: 055 +/- 00 ppm
PR2: 045 +/- 01 ppm
PR3: 072 +/- 02 ppm
PR4: 030 +/- 00 ppm
```

PR1-PR4: The pulse rate of your transmitter in pulses per minute. (Range = 20ppm . 250ppm)

ppm : The ppm adjustment (tolerance) is a +/- pulse rate range in ppm used to filter the incoming signal. The tolerance may be set in the range of 00ppm to 10ppm. There is always a +/- 10ms buffer added to the tolerance setting. A tolerance of 1 for PR2: 045 would indicate the R4500S should accept signals coming in that range from 44ppm (1364ms) to 46ppm (1304ms) +/- 10ms = 1374ms to 1294ms. A tolerance of zero indicates the R4500S should accept only signals that are the specified range +/- 10ms (i.e. PR1:055 should always be 55ppm (1091ms) +/- 10ms = 1081ms to 1101ms). You can use a zero tolerance when using ATS microprocessor transmitters. A larger tolerance will be needed on transmitters that have a pulse rates that can drift with temperature or age.

If the defaults were set up correctly, just press enter for each item listed, and the cursor will move through each setting in the Aerial Setup windows. When all settings have been entered, the Aerial scan will start.

The default settings are used to pre - enter the values for each item listed for the Aerial Setup. Pressing *"ENTER"* on these values stores them into memory. If there needs to be any changes made to any of the items, pressing *"ENTER"* will store the changed value into memory, and that changed value will be used in the Aerial scan.

If the defaults settings are not used and a different value is entered, the new value entered will be used for that Aerial Scan until the scan has been terminated. If a new scan is started by starting an Aerial Scan from the Main

Menu, the default values will be returned to the listed items. If a new value is needed other than the default values, selecting a new scan will be needed to enter the new values.

When an Aerial Scan has started, the R4500S will start scanning the frequencies in the table at the entered scan rate time. When a transmitter is heard on a frequency, pressing *"HOLD"* will stop the scan rate and remain on that frequency until *"HOLD"* is pressed again. When Hold is pressed the second time, the R4500S will resume scanning through the frequencies in the table at the scan rate time.

You may use the CHAN up $\boxed{\text{CHAN↑}}$ and CHAN down $\boxed{\text{CHAN↓}}$ keys at any time to scroll through the channels. When the R4500S is scanning through the frequencies, pressing the chan up or chan down keys will override the scan rate time, and advance forward or backwards through the frequency table. While in **Hold**, pressing the chan up or chan down keys will advance forward or backwards through the frequency table and remain in the **Hold** state, recording any available information when detected.

While in **Hold**, the tune up $\boxed{\text{↑}}$ and the tune down $\boxed{\text{↓}}$ keys can be used to increment or decrement the frequency.

The Aerial Scan screen, while in **Hold**, will look like the following:

```
FR1(00) 151234    Hold
Period:  0000  0
Pulse Rate:  000      GPS
SIG  000
```

Hold :   Pressing the *"HOLD"* key will cause the aerial scan time to stop on the current frequency and store data continually whenever a valid pulse rate is detected. While in the **Hold** mode, the %**Hold**+text will appear on the screen. Use this key when you want to store data (i.e.. time, frequency, signal strength, GPS location, and pulse rate, temperature etc) for the displayed frequency. If the signal is not being decoded and you still want to save GPS data ,frequency and time press *"SHIFT"* then *"RECORD"*. Pressing the *"HOLD"* key again will cause the R4500S to resume scanning. Note: GPS data will only be stored if an optional antenna is connected to the receiver, the GPS functionality is turned on and a valid GPS fix has been acquired.

Period: The Period will be displayed when a valid pulse rate has been detected. The single digit number displayed after the period is a counter that loops from 0-9. The counter will increment when valid pulse rates have been detected.

Pulse Rate: The Pulse rate will be displayed when a valid pulse rate has been detected.

GPS: This flashing message will indicate the status of the GPS functionality.

SIG: The signal strength reading will display for any pulse detected. A valid pulse rate is not needed to display the signal strength for an incoming pulse.

To stop the Aerial Scan, press *"ESC"*. This will return the screen to the Main Menu

If you desire to start the aerial scan after stopping the scan, a new window will appear when entering the Aerial Menu.

Screen 1

```
Aerial Scan Mode:
Resume Last Scan
Scan Using Defaults
New Scan
```

Pressing *"ENTER"* while the cursor is on **Scan Using Defaults**, the Aerial Scan will start up with the values entered in the Aerial Default Menu.

If any of the scan protocol values need to be changed, you will need to move the cursor to **New Scan** and press *"ENTER"*. The values in the list will show the default values. Change and enter the value you want to use for this one time scan only. If you want the values to be remembered for future scans go back to the default menu and make the changes there.

Pressing *"ENTER"* while the cursor is on **Resume Last Scan** will start up your last scan using your last scan settings.

Screen 2

```
Aerial Scan Mode:
Table #            1
```

Table #:   Typing a new table number and pressing *"ENTER"* will resume the last scan using just the frequencies from that specific table. Just pressing *"ENTER"* without typing in a new table number will resume the last scan with all the tables last used. Twelve tables are available.

3.2.2 Starting an Aerial Scan - Variable Pulse Rate Transmitter

Use the → or the ← key to move the cursor to the **AERIAL** position and press *"ENTER"*.

To change the numeric value, use the numeric digits on the keypad, or you can use the [F4] ↑ and [MERGE] ↓ keys to increment the numeric value, up or down or to toggle between YES / NO selections. For the R4500S to accept a value, press *"ENTER"*.

Moving the cursor with the → or the ← will allow movement between screens or by pressing *"ENTER"* for the last item in the window to proceed to the next window.

Screen 1

```
Aerial Scan Mode:
Table #            1
Scan Rate       003.0
Auto Record      YES
```

Table #:   Selects the frequency table used for scanning. Twelve tables are available. Multiple tables are used to optimize Aerial surveys in multiple locations.

Scan Rate: Sets the amount of time the R4500S will stop on each frequency while attempting to detect transmitters. (Range = 001 . 300 seconds) For setting Scan Rate time, see section **13.0**.

Auto Record: Selects if transmitter pulse rates will be detected and automatically recorded by the R4500S.

The option of Auto Recording data can be selected **YES** or **NO** for an Aerial Scan.

When Auto record is selected as **YES** for an Aerial Scan, a data point will be stored for every valid pulse rate detected. The time stamp, frequency, pulse rate, signa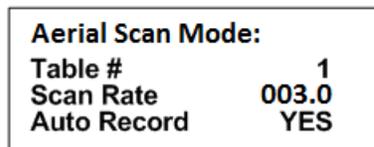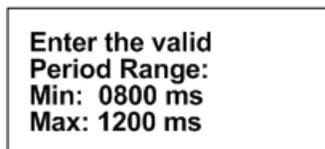l strength and GPS location will be saved to memory for every valid pulse rate detected. An optional GPS antenna must be connected to the R4500S for the GPS location option to work. **HOLD** is used in an Aerial Scan to stop the scanning of frequencies to allow the required time needed to identify a valid pulse rate for a specific frequency.

When Auto Record is selected as **NO** for an Aerial Scan, no pulse rate information will be displayed or recorded. To manually save a data point, **Hold** must be activated and pressing *"SHIFT"* and then *"RECORD"* sequentially will save a data point. The time stamp, frequency, signal strength and GPS location for each data point recorded will be stored to memory. An optional GPS antenna must be connected to the R4500S for the GPS location option to work.

If *"SHIFT"* and then *"RECORD"* is pressed while not in **HOLD**, the frequency will not be recorded, but the time stamp, and GPS location will be stored to memory. An optional GPS antenna must be connected to the R4500S for the GPS location option to work.

Screen 2

```
Enter the valid
Period Range:
Min:  0800 ms
Max: 1200 ms
```

The number entered here should represent the range of pulse rates you are using in your study. The available period range allowed to be entered is between 400ms to 6000ms. The periods measured from signals that are outside the entered range will be thrown out.

If the defaults were set up correctly, just press enter for each item listed, and the cursor will move through each setting in the Aerial Setup windows. When all settings have been entered, the Aerial scan will start.

The default settings are used to pre - enter the values for each item listed for the Aerial Setup. Pressing *"ENTER"* on these values stores them into memory. If there needs to be any changes made to any of the items, pressing *"ENTER"* will store the changed value into memory, and that changed value will be used in the Aerial scan.

If the defaults settings are not used and a different value is entered, the new value entered will be used for that Aerial Scan until the scan has been terminated. If a new scan is started by starting an Aerial Scan from the Main Menu, the default values will be returned to the listed items. If a new value is needed other than the default values, selecting a new scan will be needed to enter the new values.

When an Aerial Scan has started, the R4500S will start scanning the frequencies in the table at the entered scan rate time. When a transmitter is heard on a frequency, pressing *"HOLD"* will stop the scan rate and remain on that frequency until *"HOLD"* is pressed again. When Hold is pressed the second time, the R4500S will resume scanning through the frequencies in the table at the scan rate time.

You may use the CHAN up [ADDFR / CHAN↑] and CHAN down [DELFR / CHAN↓] keys at any time to scroll through the channels. When the is scanning through the frequencies, pressing the chan up or chan down keys will override the scan rate time, and advance forward or backwards through the frequency table. While in **Hold**, pressing the chan up or chan down keys will advance forward or backwards through the frequency table and remain in the **Hold** state, recording any available information when detected.

While in **Hold**, the tune up [F4 / ↑] and the tune down [MERGE / ↓] keys can be used to increment or decrement the frequency.

Example of Aerial Scan Windows using variable transmitters (example = temperature transmitter):

Scanning through frequency table:

```
FR1(00) 151234
Temperature Tags
                        GPS
SIG  000
```

While scanning through the frequencies, the signal strength is available.

When Hold is pressed:

```
FR1(03) 151280          Hold
Temperature Tags
+ 31.45-6                GPS
```

While in **Hold**, the signal strength is not available in the screen, but is recorded to memory with all other available transmitter data. The display will show the converted data, using the entered coefficients for the frequency currently in the display.

Hold :   Pressing the *"HOLD"* key will cause the aerial scanning to stop on the current frequency and store data continually. When this has occurred the %**Hold**+text will appear on the screen. Use this key when you want to store data (i.e. time, frequency, signal strength, GPS location, and pulse rate, temperature etc) for the displayed frequency. If the signal is not being decoded and you still want to save GPS data, frequency and time press *"SHIFT"* then *"RECORD"*. Pressing the *"HOLD"* key again will cause the R4500S to resume scanning. Note: GPS data will only be stored if an optional antenna is connected to the receiver, the GPS functionality is turned on and a valid GPS fix has been acquired.

Variable Tag Format: The display will show the converted data while in **Hold**.

GPS: This flashing message will indicate the status of the GPS functionality.

To stop the Aerial Scan, press *"ESC"*. This will return the screen to the Program Menu

If you desire to start the aerial scan after stopping the scan, a new window will appear when entering the Aerial Menu.

Screen 1

```
Aerial Scan Mode:
Resume Last Scan
Scan Using Defaults
New Scan
```

Pressing *"ENTER"* while the cursor is on **Scan Using Defaults**, the Aerial Scan will start up with the values entered in the Aerial Default Menu.

If any of the scan protocol values need to be changed, you will need to move the cursor to **New Scan** and press *"ENTER"*. The values in the list will show the default values. Change and enter the value you want to use for this one time scan only. If you want the values to be remembered for future scans go back to the default menu and make the changes there.

Pressing %ENTER+ while the cursor is on **Resume Last Scan** will start up your last scan using your last scan settings.

Screen 2

```
Aerial Scan Mode:
Table #          1
```

Table #:   Typing a new table number and pressing %ENTER+will resume the last scan using just the frequencies from that specific table. Just pressing %ENTER+without typing in a new table number will resume the last scan with all the tables last used. Twelve tables are available.

3.3 STATIONARY MODE

See section **3.3.3** for viewing the stationary flowchart. The stationary mode has a low battery indicator. The LOW / BAT indicator will show in the display when the internal battery voltage is below 11.5V. If external power is connected to the receiver, the internal batteries are not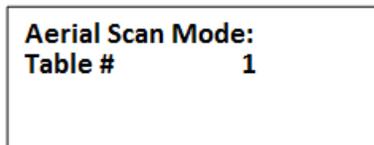 used, and the low battery indicator would be for the external power supply. The R4500S checks the battery voltage level each time the frequency table has been scanned through.

If power is interrupted during a Stationary Scan, the R4500S will remember it was in Stationary Scan mode and will automatically resume the Stationary Scan when power is restored. The values used for the Stationary Setup will still be stored in memory and they will be the values used when resuming the stationary scan.

3.3.1 Starting a Stationary Scan - Fixed Pulse Rate Transmitter

From the Main Menu, use the ➡️ or the ⬅️ key to move the cursor to the STATIONARY position and press *"ENTER"*.

To change the numeric value, use the numeric digits on the keypad, or you can use the ⬆️ and ⬇️ keys to increment the numeric value, up or down or to toggle between YES / NO selections. For the R4500S to accept a value, press *"ENTER"*.

Moving the cursor with the ➡️ or the ⬅️ will allow movement between screens or by pressing *"ENTER"* for the last item in the window to proceed to the next window.

Screen 1

```
1:Continual
2:Periodic

Type of Logging:   1
```

Continual: The R4500S will continually scan through the selected frequency table.

Periodic: The R4500S will scan through the selected frequency table and shut the power off for a period of time.

Screen 2

```
Number of Different
Pulserates to Scan
(1-4): 4
```

The number entered here should represent the total number of pulse rates you are using in your study. There should not be more than one transmitter per frequency. If you need to use multiple transmitters per frequency you should consider using a coded receiver and coded transmitters.

Screen 3

```
PR1: 055 +/- 00 ppm
PR2: 045 +/- 01 ppm
PR3: 072 +/- 02 ppm
PR4: 030 +/- 00 ppm
```

PR1-PR4:   The pulse rate of your transmitter in pulses per minute. (Range = 20ppm . 250ppm)

ppm :   The ppm adjustment (tolerance) is a +/- pulse rate range in ppm used to filter the incoming signal. The tolerance may be set in the range of 00ppm to 10ppm. There is always a +/- 10ms buffer added to the tolerance setting. A tolerance of 1 for PR2: 045 would indicate the R4500S should accept signals coming in that range from 44ppm (1364ms) to 46ppm (1304ms) +/- 10ms = 1374ms to 1294ms. A tolerance of zero indicates the R4500S should accept only signals that are the specified range +/- 10ms (i.e. PR1:055 should always be 55ppm (1091ms) +/- 10ms = 1081ms to 1101ms). You can use a zero tolerance when using ATS microprocessor transmitters. A larger tolerance will be needed on transmitters that have a pulse rates that can drift with temperature or age.

Screen 4

```
Stationary Setup:
Time Out:          002  sec
Scan Time:         012  sec
A:                 0010  min
```
(A = Store Rate or **Log Period**, see below**)**

Time Out: The amount of time the receiver will stay on a Frequency while attempting to detect a transmitter. If no transmitter is detected in the Time Out period, the receiver will advance to the next frequency in its frequency table. This feature allows faster scanning by truncating the scan time if no transmitter is detected in the Time Out period. The user defines the parameter (Range = 001 . 300 seconds). Refer to section **14.0** for information on setting the Time Out value.

Scan Time: The amount of time to hold on a frequency and attempt to detect transmitters. The Scan time will override the Time Out time, if a pulse has been detected during the Time Out period. The Scan Time is set to whatever you need this set at (Range = 001 . 300 seconds). Refer to section **15.0** for information on setting the Scan Time value.

A: If Continual (1) was selected in screen 1 this will read ➔ **Store Rate**
              If Periodic (2) was selected in screen 1 this will read ➔ **Log Period**

       Store Rate: This defines how often a transmitters detection will be stored for each antenna (Range = 0000 . 1440 minutes). For example if the Store Rate is set to 10 minutes and a scan time of 15 seconds, its presence will only be recorded once during that 10 minute period. The data stored will include the time stamp of the strongest signal strength measured in one 15 second scan time during the 10 minute scan period. Stored with it will be a total number of pulses that the receiver determined to be pulse rates during the 10 minute store period along with the total number of pulses detected during the Store Period.

       Log Period: This defines the time interval between the receiver cycles where the R4500S performs one scan of the frequency table (Range =

0000 . 1440 minutes). If the scan of the frequency table takes the entire log period, the receiver will never pause between the end of a frequency table scan, and the start of the next one.

Screen 5

Stationary Defaults:
Tables(1-12): 1,
  , , , , , ,
  , ,

Tables(1-12):   The frequency tables you want to scan. There are twelve tables available.

Screen 6

Stationary Defaults:
Antenna #(1-8):   1
EXT Data XFER: NO

Antenna # :   The number of antennas the receiver will sample. This feature requires an external antenna switchbox connected to the AUX port of the R4500S if using more than 1 antenna. If using a 2-way switchbox, this would be set to 2.

EXT Data XFER: When this is enabled the receiver will dump the logged data out a serial port once an hour. To change this option<U+2019>s settings use the <U+201C>Ext Data<U+201D> choice in the <U+201C>Setup Menu<U+201D>.

To activate the EXT Data XFER feature, use the [F4 ↑] or the [MERGE ↓] key. These two keys are used to toggle between the two choices.

Screen 7

Stationary Defaults:
Reference Freq: NO

Reference Freq: Pressing *"ENTER"* while the cursor is on **NO** will the Stationary Scan start.

To activate the Reference transmitter feature, use the [F4 ↑] or the [MERGE ↓] key. These two keys are used to toggle between the two choices.

If you entered **YES** for the reference transmitter, you will be prompted to enter the reference transmitter frequency, and the store rate of the reference transmitter. After entering the reference frequency transmitter information, the Stationary Scan will start.

Screen 8

```
Reference Tag Setup:
Reference Freq:
150000
Store Rate: 0060 min
```

Reference Freq: This is the frequency of a transmitter set up within range of your station used as a check on the system. Since you will not need the same quantity of data you can set up a longer store period to use up less memory. Instead of the strongest signal strength being stored within the storage period, it will be the time of the first valid pulse rate.

Store Rate: This defines how frequently the data from the reference transmitter will be stored. A count of the number of detected pulse rates will be stored for the entire store rate. (Range = 0005 . 1440 minutes)

Note: The data are not stored until the storage period has expired. For example with storage period set up for once an hour the time the first data are collected might be at 6:00 am. Although the data recorded will reflect 6:00 they will not be committed to memory until 7:00 am. This means when the data are offloaded you may have the data for the actual transmitters appearing before the reference transmitter. This is true even if the animal data were collected at 6:30 am and the reference data were collected at 6:00 am.

Stationary Scan Window (Fixed pulse rate transmitter)

```
FR 1(00) 151234
Time 339 09:50 Ant 1

Tx Data  SIG 077
```

FRXX(XX)   This represents the frequency table, (1=table 1), the frequency channel number (o3) = 4th channel number in table 1, and the 6 digit number following is the frequency the receiver is tuned to.

Time   This is the Julian date, and the hourly time.

Ant: This Antenna number represents the current antenna being monitored.

Tx Data: This is the transmitter pulse rate along with a counter looping from %0+ to %0+ for each valid pulse rate detected during the scan.
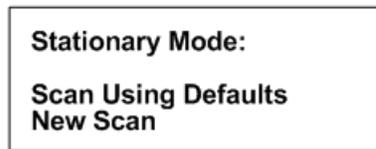
SIG: The signal strength of the incoming signal.

"HOLD" can be pressed during a Stationary Scan to stop on a particular frequency. The screen will change to showing the Pulse Rate and Period along with the time and signal strength. No information will be stored while in **Hold**. To resume the stationary scan, press *"HOLD"* again. As a precaution, the **Stat Hold** time entered in the Setup Menu prevents the possibility of accidentally leaving a remote site while in the Hold mode during a stationary scan. After the Stat Hold time has expired, the stationary scan will resume.

If power is interrupted during a Stationary Scan, the R4500S will remember it was in Stationary Scan mode and will automatically resume the Stationary Scan when power is restored. The values used for the Stationary Setup will still be stored in memory and they will be the values used when resuming the stationary scan.

To stop the Stationary Scan, press *"ESC"*. This will return the screen to the Program Menu.

If you desire to start the stationary scan after stopping the scan, a new window will appear when entering the Stationary Menu.

```
Stationary Mode:

Scan Using Defaults
New Scan
```

Pressing *"ENTER"* while the cursor is on Scan Using Defaults Scan, the Stationary Scan will start up with the values entered in the Stationary Default Menu.

If any of the scan protocol values need to be changed, you will need to move the cursor to New Scan and press *"ENTER"*. The values in the list will show the default values. Change and enter the value you want to use for this one time scan only. If you want the values to be remembered for future scans go back to the default menu and make the changes there.

3.3.2 Starting a Stationary Scan - Variable Pulse Rate Transmitter

From the Main Menu, use the ➡ or the ⬅ key to move the cursor to the **STATIONARY** position and press *"ENTER"*.

To change the numeric value, use the numeric digits on the keypad, or you can use the [F4 ⬆] and [MERGE ⬇] keys to increment the numeric value, up or down or to toggle between YES / NO selections. For the R4500S to accept a value, press *"ENTER"*.

Moving the cursor with the ➡ or the ⬅ will allow movement between screens or by pressing *"ENTER"* for the last item in the window to proceed to the next window.

Screen 1

```
1:Continual
2:Periodic

Type of Logging:    1
```

Continual: The R4500S will continually scan through the selected frequency table.

Periodic: The R4500S will scan through the selected frequency table and shut the power off for a period of time.

Screen 2

```
Enter the valid
Period Range:
Min:  0800 ms
Max: 1200 ms
```

The number entered here should represent the range of pulse rates you are using in your study. The available period range allowed to be entered is between 400ms to 6000ms. The periods measured from signals that are outside the entered range will be thrown out.

Screen 3

```
Stationary Setup:
Time Out:      002  sec
Scan Time:     012  sec
A:             0010  min
```
(A = Store Rate or **Log Period**, see below)

Time Out: The amount of time the receiver will stay on a Frequency while attempting to detect a transmitter. If no transmitter is detected in the Time Out period, the receiver will advance to the next frequency in its frequency table. This feature allows faster scanning by truncating the scan time if no transmitter is detected in the Time Out period. The user defines the parameter (Range = 001 . 300 seconds). Refer to section **14.0** for information on setting the Time Out value.

| Scan Time: | The amount of time to hold on a frequency and attempt to detect transmitters. The Scan time will override the Time Out time, if a pulse has been detected during the Time Out period. The Scan Time is set to whatever you need this set at (Range = 001 . 300 seconds). Refer to section **15.0** for information on setting the Scan Time value. |

A: If Continual (1) was selected in screen 1 this will read ➔ **Store Rate**
            If Periodic (2) was selected in screen 1 this will read ➔ **Log Period**

| Store Rate: | This defines how often a transmitters detection will be stored for each antenna (Range = 0000 . 1440 minutes). For example if the Store Rate is set to 10 minutes and a scan time of 15 seconds, its presence will only be recorded once during that 10 minute period. The data stored will include the time stamp of the strongest signal strength measured in one 15 second scan time during the 10 minute scan period. Stored with it will be a total number of pulses that the receiver determined to be pulse rates during the 10 minute store period along with the total number of pulses detected during the Store Period. |

| Log Period: | This defines the time interval between the receiver cycles where the R4500S performs one scan of the frequency table. If the scan of the frequency table takes the entire log period, the receiver will never pause between the end of a frequency table scan, and the start of the next one. (Range = 0000 . 1440 minutes) |

Screen 5

```
Stationary Defaults:
Tables(1-12):  1,
  ,  ,  ,  ,  ,  ,
  ,  ,
```

Tables(1-12):   The frequency tables you want to scan. There are twelve tables available.

Screen 6

```
Stationary Defaults:
Antenna #(1-8):     1
EXT Data XFER:   NO
```

| Antenna # : | The number of antennas the receiver will sample. This feature requires an external antenna switchbox connected to the AUX port of the R4500S if using more than 1 antenna. If using a 2-way switchbox, this would be set to 2. |

| EXT Data XFER: | When this is enabled the receiver will dump the logged data out a serial port once an hour. To change this options settings use the Ext Data choice in the Setup Menu. |

To activate the EXT Data XFER feature, use the [F4 ↑] or the [MERGE ↓] key. These two keys are used to toggle between the two choices.

Screen 7

```
Stationary Defaults:
Reference Freq:   NO
```

Reference Freq: Pressing *"**ENTER**"* while the cursor is on **NO** will the Stationary Scan start.

To activate the Reference transmitter feature, use the [F4 ↑] or the [MERGE ↓] key. These two keys are used to toggle between the two choices.

If you entered **YES** for the reference transmitter, you will be prompted to enter the reference transmitter frequency, and the store rate of the reference transmitter. After entering the reference frequency transmitter information, the Stationary Scan will start.

Screen 8

```
Reference Tag Setup:
Reference Freq:
150000
Store Rate: 0060 min
```

Reference Freq: This is the frequency of a transmitter set up within range of your station used as a check on the system. Since you will not need the same quantity of data you can set up a longer store period to use up less memory. Instead of the strongest signal strength being stored within the storage period, it will be the time of the first valid pulse rate.

Store Rate: This defines how frequently the data from the reference transmitter will be stored. A count of the number of detected pulse rates will be stored for the entire store rate. (Range = 0005 . 1440 minutes)

Screen 9

```
Use the tune arrows
to change the sign
of the coefficient.
Press enter...
```

Screen 10

```
Ref Freq: 151183
A: +01320
B: -09357
C: +12405
```

The frequency cannot be changed in screen 10. Only the coefficients are to be entered here. Entering the coefficients will be in order from A to B to C. To change to the next coefficient, press *"ENTER"*.

To change the sign for the coefficient with the tune up [F4 ↑] or the tune down key [MERGE ↓], a number other than 00000 will need to be first entered.

If the defaults were set up correctly, just press enter for each item listed, and the cursor will move through each setting in the Stationary Setup windows. When all settings are entered, the stationary scan will start.

The default settings are used to pre - enter the values for each item listed for the Stationary Setup. Pressing *"ENTER"* on these values stores them into memory. If there needs to be any changes made to any of the items, pressing *"ENTER"* will store the changed value in memory, and that changed value will be used in the stationary scan. The defaults settings are not changed and these default settings will be the settings used when the R4500S is turned back on after having been turned off.

Stationary Scan Window (Variable Transmitter)

```
FR 1(03) 151455
TIME 321 15:32 Ant:1
Tag Type
Tx Data  SIG 077
```

FRXX(XX)	This represents the frequency table, (1=table 1), the frequency channel number (o3) = 4th channel number in table 1, and the 6 digit number following is the frequency the receiver is tuned to.
Time	This is the Julian date, and the hourly time.
Ant:	This Antenna number represents the current antenna being monitored.
Tag Type:	If a variable pulse rate transmitter was chosen, a label will appear here indicating the transmitter measurement being made.
Tx Data:	This is the transmitter data currently being collected. The data will be the converted data, using the entered coefficients. The count will also be included going from %0+to %9+and rolling over to %0+again.
SIG:	The signal strength of the incoming signal.

If power is interrupted during a Stationary Scan, the R4500S will remember it was in Stationary Scan mode and will automatically resume the Stationary Scan when power is restored. The values used for the Stationary Setup will still be stored in memory and they will be the values used when resuming the stationary scan.

To stop the Stationary Scan, press *"ESC"*. This will return the screen to the Program Menu.

If you desire to start the stationary scan after stopping the scan, a new window will appear when entering the Stationary Menu.

Stationary Mode:

Scan Using Defaults Scan
New Scan

Pressing *"ENTER"* while the cursor is on **Scan Using Defaults Scan**, the Stationary Scan will start up with the values entered in the Stationary Default Menu.

If any of the scan protocol values need to be changed, you will need to move the cursor to **New Scan** and press *"ENTER"*. The values in the list will show the default values. Change and enter the value you want to use for this one time scan only. If you want the values to be remembered for future scans go back to the default menu and make the changes there.

3.3.3 The Stationary Logging Flowchart
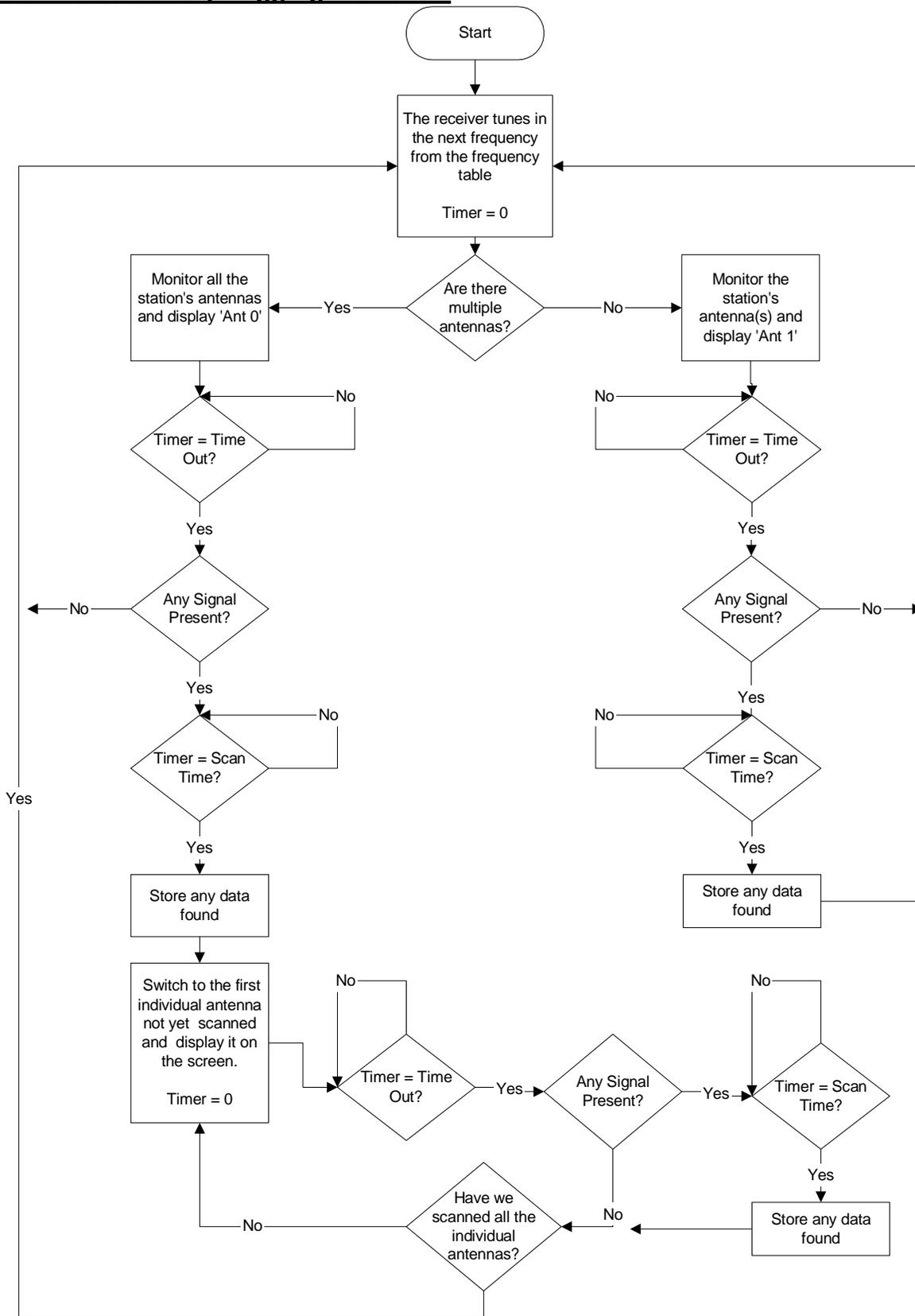
3.4 PC MODE

This Mode is used when communicating with a personal computer (PC). The R4500S needs to be connected to a PC using the supplied cable. The PC must currently be running the ATS supplied ATSWinRec communication software. For more information see the sections of this manual covering "Downloading Data" and "ATSWinRec".

3.5 CLONE

The Clone feature is used to transfer frequency tables and default settings from one receiver to another. The optional blue clone cable with male DB15 connectors on both ends is required to use this function. Use the following procedure:

1. Connect the Clone cable between the two receivers.
2. Turn both receivers on.
3. Select **CLONE** on the receiver you want to be the recipient of the data, press *"ENTER"*.

The receiver should respond with:
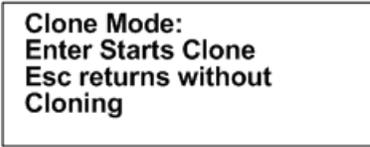
```
Clone Mode:
Enter Starts Clone
Esc returns without
Cloning
```

If a connection cannot be made the receiver will respond with:
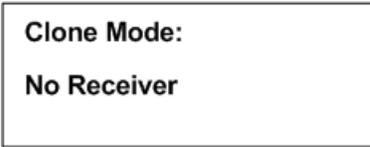
```
Clone Mode:

No Receiver
```

If a connection is not made, turn both receivers off and repeat the steps outlined above.

Remember to select **CLONE**, and then press "*ENTER*" on the receiver you want to clone the information to.

4.0   SCR – Turning the Screen Backlight On and Off or Enabling Real Time Serial Data Output

Pressing the *"SHIFT"* key followed by pressing the *"SCR"* key sequentially will turn the backlight on or off. If in Stationary Mode it will also toggle the option to send the real time screen output to the **AUX** serial port. What it does will depend on its current state. If it is enabling the real time serial output you will see the following screen appear.

```
**Output redirected
to   AUX    port.
Press Shift-SCR to
return. ***
```

This screen will remain for several seconds before resuming the normal display. With this feature enabled the information appearing on the screen will also be mirrored in the Output along with the display line number. The serial settings will be: "baud: 9600, no parity, 8 data bits, 1 stop bit".

5.0   TEST - View of the "Battery" Voltage

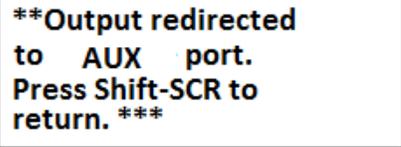Pressing the *"SHIFT"* key followed by pressing the *"TEST"* key sequentially will display the receiver's power source voltage. If the power source is the internal battery it will be the internal battery voltage. If it is an external power source it will be the voltage of the external power source.

```
Battery Test
12.1 Volts
```

6.0   MEM - View of the "Memory Menu"

The Memory Menu is used to view the amount of data storage you have left, look at your stored data and reset your data pointer.

To get to the "Memory Menu" press the *"SHIFT"* key followed by the *"MEM"* key sequentially.

Again to maneuver through the menu items, use the [→] or the [←] keys to choose Memory Remaining, View Memory, or Delete Memory.

This is the view of the "Memory Menu"

```
Memory Menu:
Memory Remaining
View Data
Delete Data
```

6.1 Memory Remaining

This screen displays the number of data blocks the R4500S can still write before the memory is full. It list two numbers, one for Aerial data and one for Stationary data. The number of Aerial data blocks will always be half as much as the number of Stationary data blocks. The maximum number of data blocks available for storage is shown below.

```
Memory Remaining:
98304 Stationary
        OR
49152 Aerial
```

6.2 View Data

This series of screens allows you to view all your previously stored data block by block. The format of the data to be viewed will depend on the selected ‰X Type+and whether it was Aerial or Stationary Logging.

Screen 1

```
View Data at
  Block: 000000
Valid Data Block
Range: 0 to 000010
```

Block: The number of the first data block you want to view. The first data block is zero.
Range: This is the number of data blocks you want to scroll through.

Screen 2

```
Block Num: 000000
Scan Parameter Block
```

This represents a block of saved parameter data that was used during the following data block saves. It is not viewable here but can be viewed when offloaded from the PC.

To scroll through the screens displaying the blocks of data, use the ➡ *or the* ⬅ *keys.*

Screen 3

```
Block Num: 000001
04  030  15:57  Ant: 00
150255  SS:091  PR:060
#Pulses:011  #M:011
```

After the Block Number, the next row has the Year, Julian Day, Time, and Antenna used.
Next row: Frequency, Signal Strength, Pulse Rate.
Next row: # of detected pulses, # of valid pulses detected for the pulse rate listed.

For Aerial Data only:

(A block number is not shown for the 2nd screen of Aerial Data)

Lat: 45 29.7200 N
Lon: 093 14.8300 W
GPS Age (sec): 001

GPS Age: The amount of time in seconds that have passed since this GPS data had been recorded.

This sequence of screens will repeat until you have viewed all the data blocks listed in your range or you press the *"ESC"* key.

6.3 Delete Data

This instructs the R4500S to reset the data pointer back to the beginning of memory effectively deleting all the stored data blocks.

Screen 1

Are you sure you
Want to delete?
Press ENTER
To confirm

Screen 2

Press ENTER to clear
Memory or ESC to
return without
clearing memory.

Screen 3

Deleting Memory

This message flashes momentarily then returns you back to the "Memory Menu".

7.0   GPS –   Viewing / Activating GPS Data

Pressing the *"SHIFT"* key followed by pressing the *"GPS"* key sequentially allows you to view the GPS data as the data are collected and it allows you to turn the GPS functionality on or off.

The optional GPS antenna needs to be connected to the R4500S to use the GPS feature.

Note: The GPS functionality uses a lot of power. Make sure to turn off the GPS when you are not using it in order to extend your battery life.

The [F4 ↑] and the [MERGE ↓] keys are used to turn GPS on or off. The coordinates are displayed as Degrees . Decimal Minutes. **DD MM.MMMM.** The GPS locations saved in memory are stored as Decimal Degrees, or converted to UTM (NAD83) when using the ATSWinRec software.

```
Lat:   45 29.7200 N
Lon:  093 14.8300 W
                        GPS
GPS ON
```

GPS (non flashing) . The GPS is on, and there is a valid GPS fix.
GPS / **OFF** . The GPS is turned OFF.
NO / **FIX** . The GPS is attempting to acquire a valid GPS fix.
GPS / **ERR** . The GPS has not been able to get a valid GPS fix within 5 minutes.
NO / **GPS** . The GPS has not been able to get a valid GPS fix after 15 minutes.

If a valid GPS fix is found during NO /FIX, GPS / ERR, or NO / GPS the indicator will change to a non flashing GPS indicator.

The GPS requires a current Almanac to obtain a GPS fix (a current almanac is within 6 months). If a current almanac is needed to be downloaded, this process may take longer than 15 minutes and a fix will not be obtainable until a current almanac is downloaded.

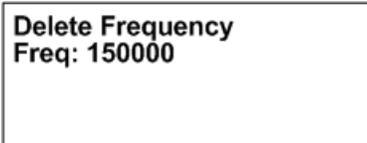# 8.0   ADDFR – Adding a Frequency to the Scan Table

(Used only in Aerial Mode)

Pressing the *"SHIFT"* key followed by pressing the *"ADDFR"* key sequentially activates the add frequency feature. This allows you to append frequencies to your current scan table. Changes will be maintained if you exit Aerial Mode and return to the Aerial Scan using the Resume Last Scan option.

```
Add Frequency
Freq: 150000
```

9.0   DELFR - Deleting Frequencies

(Used only in Aerial Mode)

Pressing the *"SHIFT"* key followed by pressing the *"DELFR"* key sequentially activates the delete frequency feature. This allows you to delete frequencies from your current scan table. Changes will be maintained if you exit Aerial Mode and return to the Aerial Scan using the Resume Last Scan option.

```
Delete Frequency
Freq: 150000
```

10.0   MERGE –   Merging Frequency Tables

(Used in Stationary and Aerial Modes)

Pressing the *"SHIFT"* key followed by pressing the *"MERGE"* key sequentially activates the merge frequency feature. This allows you to merge an additional frequency table into to your current scan table. Changes will be lost once you exit the Stationary scan but maintained if you exit Aerial Mode and return to the Aerial Scan using the Resume Last Scan option.

```
Merge Table 2
```
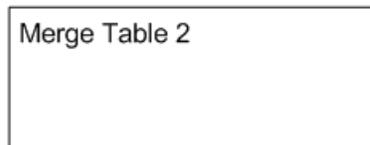
11.0   RECORD –   Recording Data

(Used only in Aerial and Manual Modes)

Pressing the *"SHIFT"* key followed by pressing the *"RECORD"* key sequentially activates the record feature. This forces a save to be preformed when a save would not ordinarily be done. The R4500S will save the data it has currently available.

12.0   PC - Downloading Data

12.1 Establish communication between the R4500S and the Computer

First install the provided software, ATSWinRec, onto your computer. This program needs to be operating on the computer first, for the R4500S to recognize a PC connection.

The setup should start automatically, if it does not, select START, RUN, BROWSE to find the SETUP file on the CD, then OPEN and OK. Run the setup to install the ATSWinRec program. It will install a short cut icon on your desktop.

## 12.2 Com Port (Settings Menu)

This is the communications port (Com Port) that you have selected to communicate from your personnel computer to the R4500S. You will need to use a standard USB A Male to USB Mini communication offload cable which is provided to you by ATS. The first time you start ATSWinRec after installation you'll be asked to select a Com port from a provided list. This is a list of communication ports currently residing on your computer. After the selection is made it will be the default Com port selected during subsequent sessions using ATSWinRec. The Com Port can be changed by selecting "Com Port" from the "Settings" menu and selecting a new Com Port from the list provided. This selection will then be the new default selection.

Connect the provided USB Serial Cable to a USB port on the computer, and to the PC connector on the R4500.

With the ATSWinRec program running on the computer, move the R4500S cursor to the PC position while in the R4500S Program Menu. Presses "*ENTER*" on the R4500S.

The R4500S display will change to:
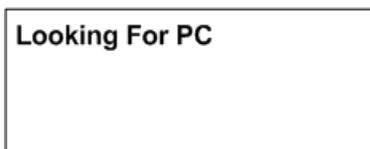
```
Looking For PC

```

And then to:
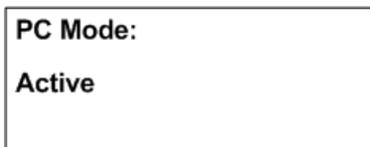
```
PC Mode:

Active

```

 If communication is not successful :

> 1. Check that both ends of the offload cable are plugged in. The male end of your cable plugs into a USB port of your computer and the USB Mini end plugs into the R4500's USB connector labeled "PC".
>
> 2. Verify that the selected Com Port matches the PC Com Port that is currently assigned to your USB serial convertor. This can be done by going into your Device Manager and looking under the Ports (COM & LPT) directory.
>
> 3. Make sure that the R4500S is powered up.
>
> 4. Make sure that you are in the R4500S's "PC Mode" and that the screen reads "Active". Choose "PC Mode" by selecting "PC" from the "Program Menu" of the R4500S. This needs to be done while you are connected to your PC and after you have booted up the ATSWinRec program.

12.3 ATSWinRec

The main screen of the ATSWinRec program has the following command box that will appear in the center of the screen:
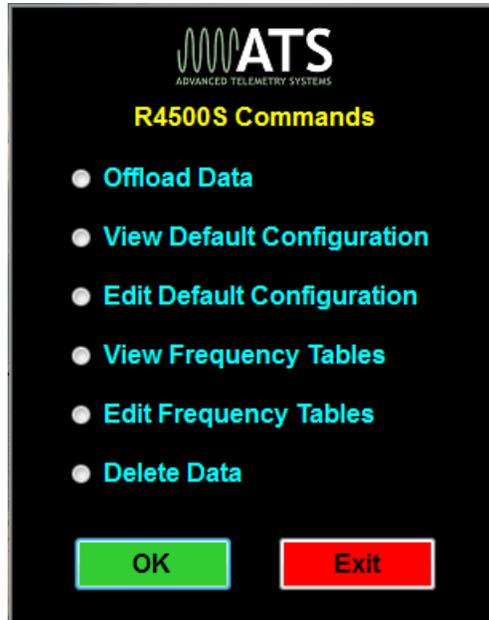
12.3.1 First Time Start Up

When starting the ATSWinRec program for the first time you will be prompted for a com port with the following dialog box:
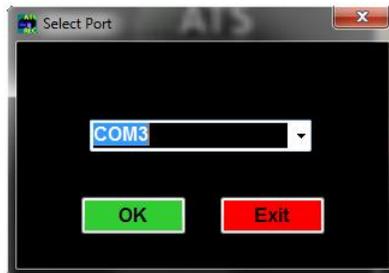
It is also possible that you may also get the following dialog box:
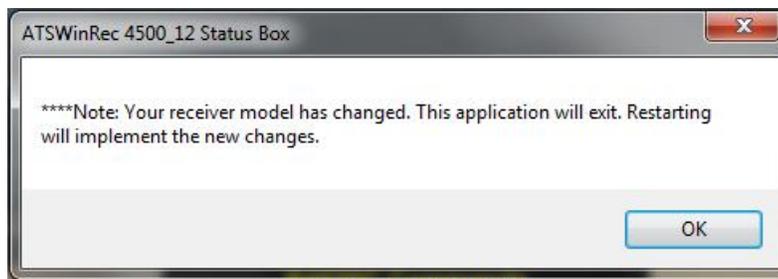
This is a notification that the software has readjusted to the R4500S receiver model.

12.3.2 Offloading Data

If you select **Offload Stored Data** followed by **OK**, the following screen then appears:
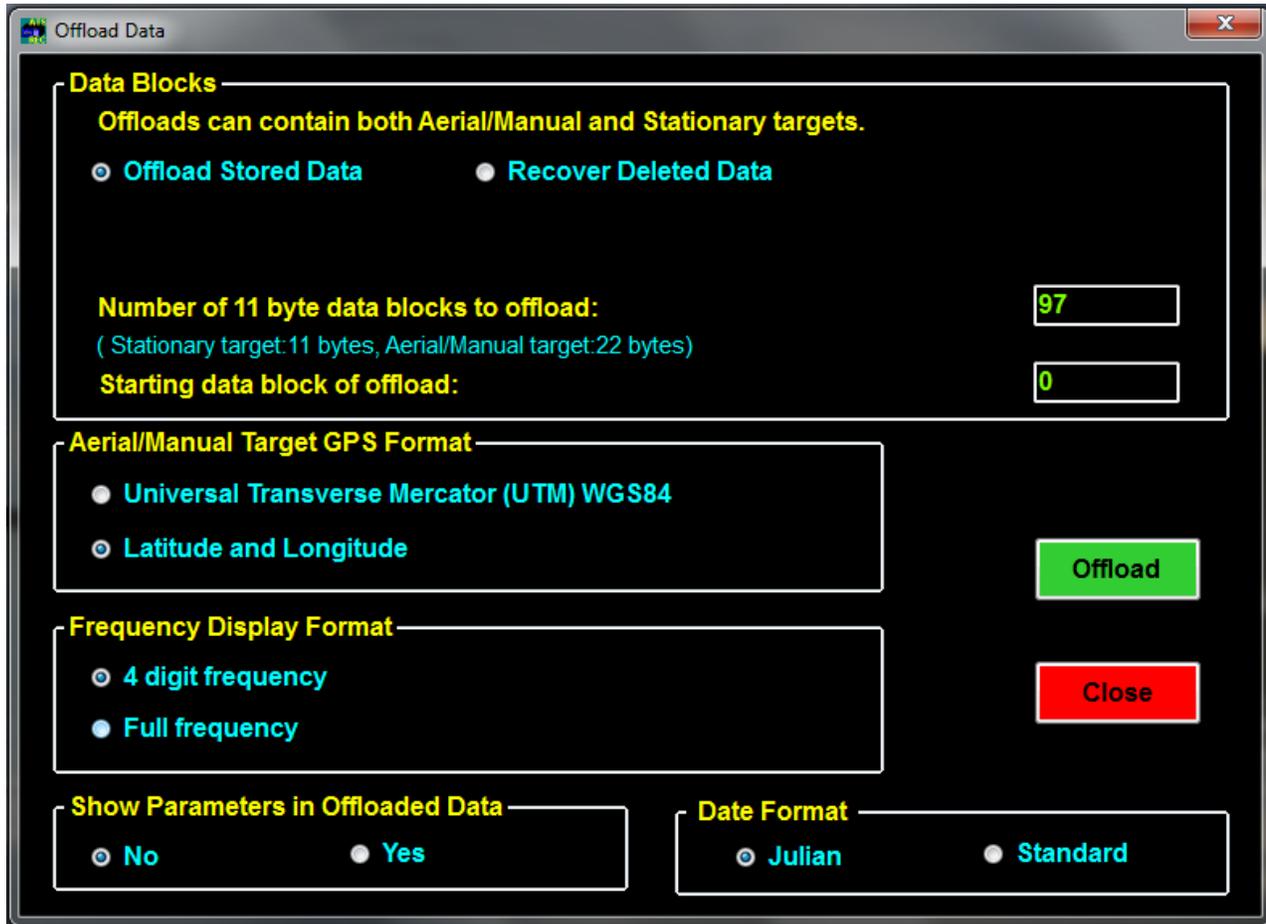
You can select some of the offload parameters. Most are self explanatory.

Recover Deleted Data allows you to recover deleted data. When deleting data, a data pointer that is used to store memory in the R4500S is reset, and when recovering deleted data, the data pointer can be returned to the previous location. Thus data can be recovered if the data has not been overwritten by resetting the pointer. When the R4500S memory is maxed out, the newest data will start writing over the oldest data blocks. Recovering deleted data will only work for the last data set deleted.

You may also set the starting data block to be greater than zero. For example you may only want to check the most recent data.

You can select the coordinate for the GPS data.

You can select the frequency data displayed with all six digits or with the two most significant digits suppressed.

Showing parameters in the offloaded data, will add scanning information for Aerial, Stationary, and Manual modes. All scan parameters will be available for viewing at the end of the downloaded file when selected. The scan parameters are index from the PrmNum column. Every time the scan parameters are changed the PrmNum will be incremented and there will be a corresponding parameter description line added to the PrmNum Key appearing at the bottom of your offload file.

The figure below shows downloaded data with first a Manual Scan, then an Aerial Scan, then a Stationary Scan.

Steps for Offloading:

1. To offload the data, make sure the **Offload Stored Data** button is checked (default position on start up). Select any other format options and select "OK".

2. Selecting the "OK" button will start the data download. Another window will pop up showing the progress of the download.

3. When the Data Download is complete, a window will appear asking if you would like the data deleted from the receiver. If you do delete the data, and later realize that you did not want to delete the data, the "**Recover Deleted Data**" tab can be used to recover the last data set deleted. The deleted data is only retrievable as a downloaded file using ATSWinRec.

4. Next will be a window that prompts the user for a file name. The default file name is a date stamped file name. The file is stored in a Data folder. The location will be where the ATSWinRec was installed to. The default location is:

    C:\Program Files\Advanced Telemetry Systems, Inc\ATSWinRec_4500_12\Data

5. After saving the file, a new window will appear displaying the downloaded data. A spreadsheet program can be used to display the downloaded data. When viewing offloaded data with the ATSWinRec software, sorting data or filtering data is not available and printing is not available. Using a spreadsheet program (e.g. Excel) will allow sorting and filtering of data.

12.3.3 View / Edit Default Configuration
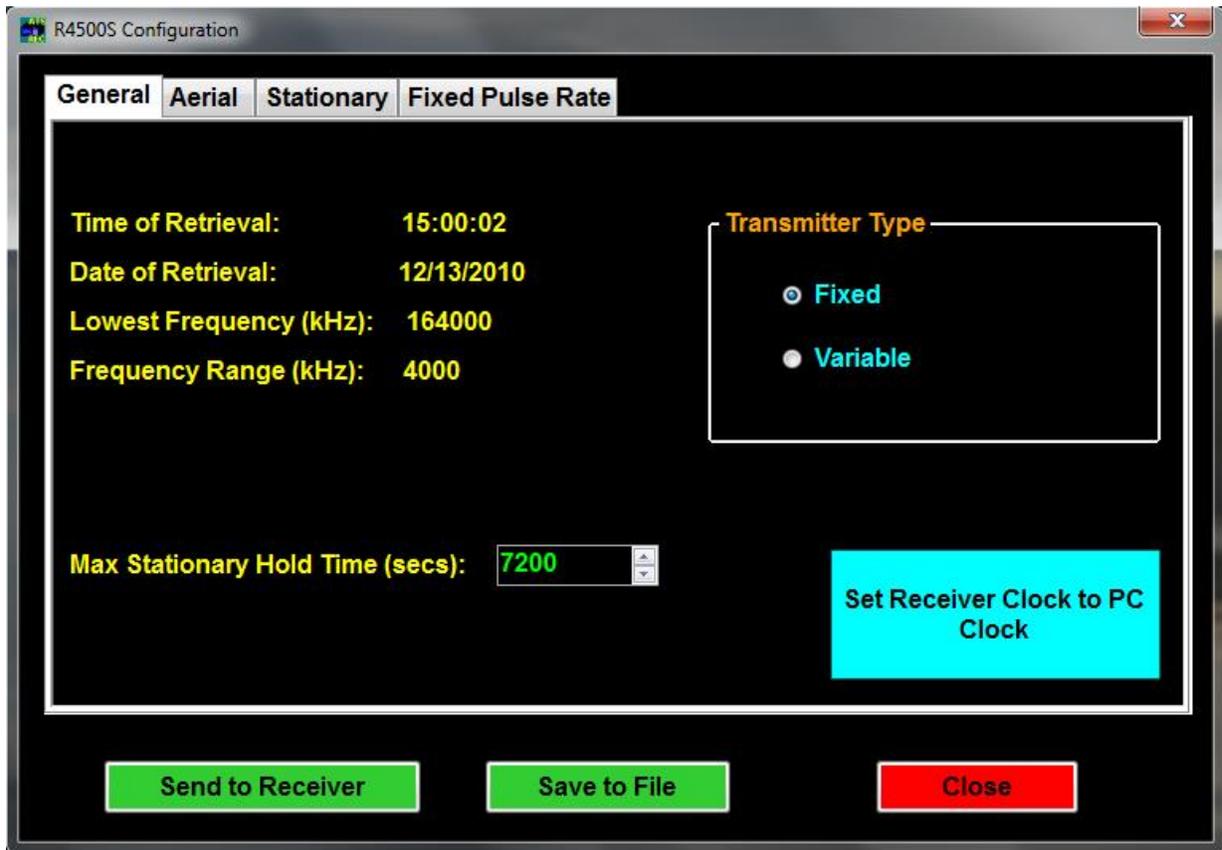
The screens will be the same for viewing or editing the default configuration. In the *View Default Configuration* mode, no parameters can be modified.

Only the selections in blue and the numeric entries in green can be modified. No information will be saved, unless the green or blue buttons are selected; *Save to File, Send to Receiver* or *Set Receiver Clock to PC Clock*. See section **2.3 Defaults** for information on each configuration parameter.

All default configurations can be retrieved from the receiver or from a file, and sent to the receiver or saved to a file.

If no configuration was sent to the receiver or saved to a file, selecting *Close* will not save any changed values.

When selecting the **Set Receiver Clock to PC Clock** button, the PC time is sent to the R4500S and is converted to: Year, Julian Day, and 24 hour time format.

12.3.4 View / Edit Frequency Tables

The screens will be the same for viewing a frequency table or editing a frequency table. In the **View Frequency Tables** mode, no parameters can be modified.

When editing a frequency table the source can be; from a file, from a receiver connected the PC, or a new frequency table can be created using ATSWinRec. A group of twelve tables can be entered for editing, or a single table can be entered for editing.

The frequency files are saved as a group (12 tables) . FileName_grp.csv or as a single table . Filename_tbl.csv.

Group Frequency Tables

When opening a file of 12 frequency tables, ATSWinRec will be looking for a file with the extension *_grp.csv. A single frequency table file (file name with extension *_tbl.csv) will not be allowed to be opened.

When sending a group (12 tables) of frequency tables to the receiver only tables with frequencies will be sent. Also, the option to only send selected tables to the R4500S is available by deselecting any frequency table tabs not wanting to be sent.

Single Table Frequencies

When opening a file for a single frequency table, ATSWinRec will be looking for a file with the extension *_tbl.csv. A group table file (file name with extension *_grp.csv) will not be allowed to be opened.

If a file is saved as a single table, the file can be loaded to any selected frequency table and sent to the receiver by selecting the corresponding frequency table checkbox. When loading a single table from a file or saving a single frequency table to a file, each table selected to be loaded or saved, will have a %Windows+open file dialog box for each file. The figure below is selecting the frequency tables 1 and 3 to be handled as single tables.
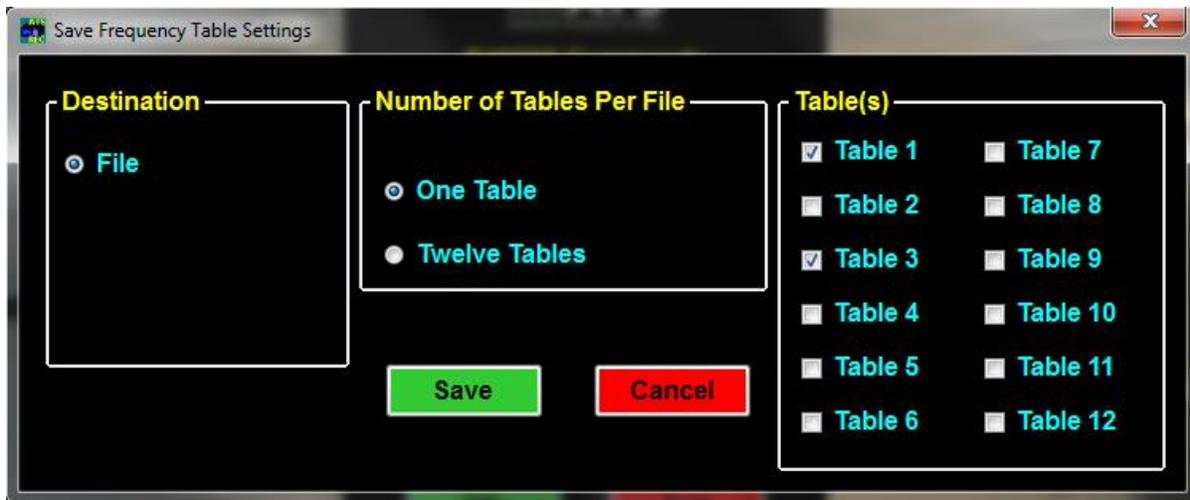
If a receiver is not connected to the PC when a new frequency table is created, the lowest frequency of the receiver will need to be entered. If the wrong lowest frequency is entered when creating a new frequency table, the table will not be sent to the receiver and an error message will appear indicating that the lowest frequencies do not match.

12.3.5 Delete Data

Selecting *Delete Data* will delete the data in the receiver. Warning messages will appear in case if the tab was accidentally selected.

12.3.6 EXIT

To exit from the ATSWinRec program select:

Exit, then *OK*

13.0 Setting Aerial Scan Rate

The minimum Aerial Scan Rate should be set to allow for a single pulse from the transmitter with the longest pulse repetition period to be heard.

$$\text{Period length in seconds} = \frac{1}{(\text{Pulse rate}/60)} \text{ seconds.} \quad \text{Example: a 45 ppm transmitter} = \frac{1}{(45/60)} = 1.33 \text{ seconds}$$

So, for a 45ppm transmitter, the minimum scan rate should be set for 2 seconds so at least one pulse will be heard.

You may use the CHAN up **ADDFR CHAN↑** and CHAN down **DELFR CHAN↓** keys at any time to scroll through the channels while scanning or while in **Hold**. The Chan up and Chan down keys override the Scan Rate time.

The SIG LED should not be used to detect pulses while in the Aerial Mode. The DSP requires 2 pulses to verify a signal. The first pulse heard will not be shown with a flashing LED, only the second pulse and all other consecutive pulses will have an LED flash corresponding to a detected pulse. While Aerial scanning, usually there is not enough time for 2 pulses to appear when scanning. Only when **Hold** is used or a long enough scan rate is used, will there be enough time for multiple pulses and for the SIG LED to flash for every detected pulse.

14.0 Setting Stationary Time Out

The DSP needs two pulses to verify 1 pulse, therefore the minimum stationary Time Out time must be set to allow for at least 2 pulses from the transmitter with the longest pulse repetition period to be detected. Using the example above, a 45 ppm transmitter will have a period length of 2.66 seconds for two consecutive pulses.

Thus, for the 45 ppm transmitter, the minimum Time Out time will need to be set for 3 seconds for the R4500S to detect the presence of a transmitter. Once a pulse is verified, a signal is sent to the R4500S indicating a pulse is present. This will also correspond with the SIG LED flashing for every valid pulse detected. Once a valid pulse is present, the Scan Time will override the Time Out. If two consecutive pulses are not allowed to be detected, the first pulse could be heard but no signal will be sent to indicate a valid pulse has been detected. The Time Out will expire and the next frequency in the table will be scanned.

The Time Out can be set for longer than the recommended minimum setting. Setting the right Time Out will depend on the size of the frequency table, and how quickly the table should be cycled through.

15.0 Setting Stationary Scan Time

The minimum stationary Scan Time should be set to allow for at least 5 pulses from the transmitter with the longest pulse repetition period to be detected.

Once a valid signal has been detected during a Time Out period, the Time Out time is overridden by the Scan Time. The Scan Time is the length of time to attempt to detect a valid pulse rate. The R4500S uses a pattern matching algorithm to verify a pulse rate. The pattern matching algorithm uses 4 valid consecutive pulses and the entered pulse rate information to verify a pulse rate. A setting for 5 consecutive pulses is needed because the first pulse is not used. The Scan Time should be greater than the minimum setting to help allow for filtering out false detections. Noise can trigger a false pulse rate. With a longer Scan Time, the number of detected pulses for a transmitter located in the area will be greater, and separating a valid pulse rate stored to memory from a noise generated pulse rate stored to memory will be easier.

Example for minimum times for Time Out and Scan Time for a 45 ppm Transmitter

Number of pulses stored to memory for detected pulse rate	4	5	6	7	8	9	10
Detected Pulse Rate	45ppm	45ppm	45ppm	45ppm	45ppm	45ppm	45ppm

(4 valid pulses are needed for detecting a valid pulse rate using pattern matching)

SIG LED flashing on faceplate

Speaker Audio

Transmitter Signal

Pulse rate

Minimum Time Out time.
2 Pulses are needed.

Minimum Scan Time.
5 Pulses are needed
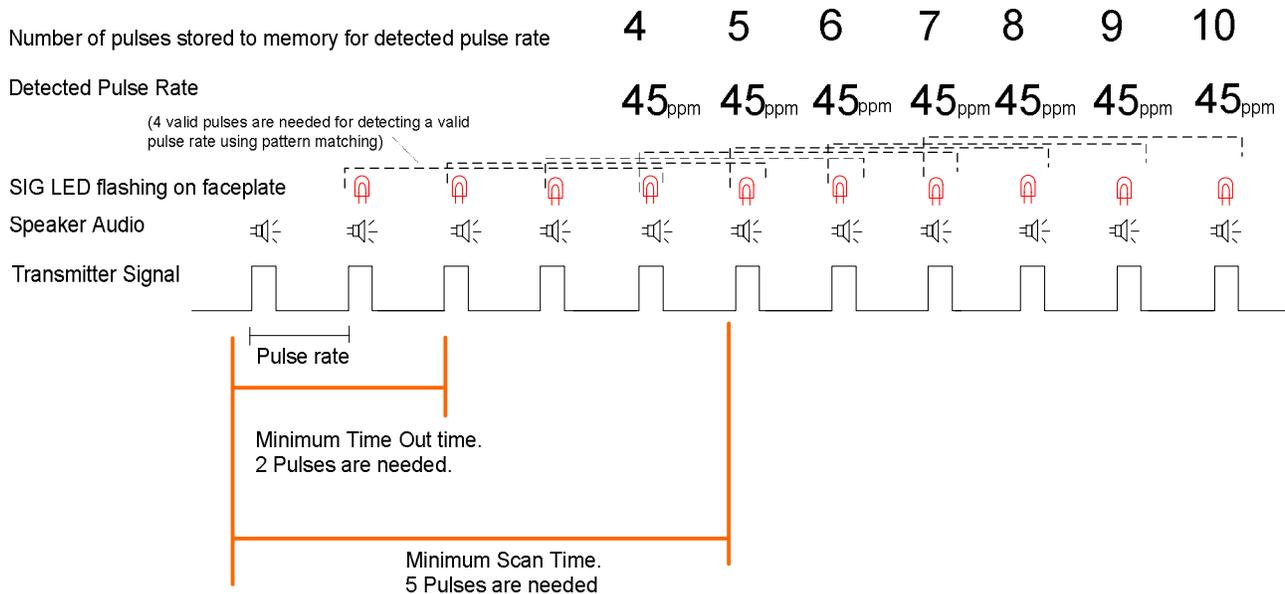
Example: Stationary Scan using two antennas. 3 Frequencies are scanned in Frequency Table 1.
Time Out = 3 seconds, Scan Time = 15 seconds, Antenna 0 Delay = 1 second.
The first example, a tag is present on frequency FR(00) in area Antenna 2 is covering.

	Ant 0 FR1(00)	Ant 1 FR1(00)	Ant 2 FR1(00)		Ant 0 FR1(01)		Ant 0 FR1(02)

Pulse Detected
Scan Time = 15
seconds

Pulse Not
Detected
Time Out = 3
seconds

Pulse Detected
Scan Time = 15
seconds

Pulse Not
Detected
Time Out = 3
seconds

Pulse Not
Detected
Time Out = 3
seconds

Antenna 0 Delay
= 1 second

Antenna 0 Delay
= 1 second

Antenna 0 Delay
= 1 second
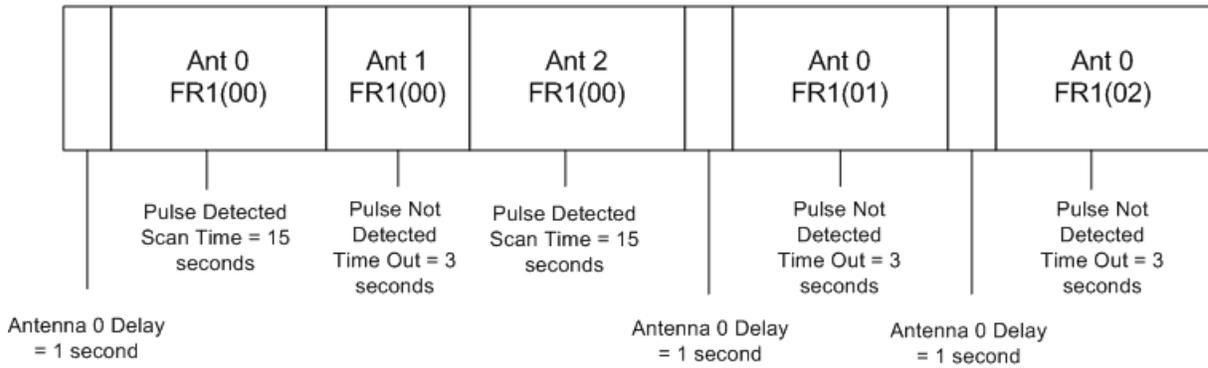
16.0 Offloaded Data Format

Heading . The offloaded file heading identifies the file

Model: The model of the receiver that was offloaded.
Filename: The name of the file with the personal computer drive and folders included.
Date: The date the file was originally created.
Version: The version of ATSWinRec used to create this file.

Column Headers . Lists the name of each column field.

Date . The date each point was recorder.

YY,JJJ,HH,mm,   The offload used the Julian Date Format.
or
MM/DD/YYYY HH:mm,   The offload used the Standard Date Format.

YY: A number from 0-99 representing the last two digits of the year.
YYYY: A number from 0-9999 representing the year.
JJJ: A number from 1-366 representing the Julian day (1-366 for a leap year, otherwise 1-365).
MM: A number from 1-12 representing the month.
DD: A number from 1-31 representing the day of the month.
HH: A number from 0-23 representing the hour.
mm: A number from 0-59 representing the minute.

Stationary Data . The data stored while the R4500S was logging data in Stationary Mode.

A: A number from 0-8 representing the antenna being used. A 0 indicates all antennas were turned on.
(FF)FFFF: A number representing the transmitters frequency. Either it will be 6 digits representing the entire frequency or it will be a number from 0-9999 representing the last four digits of the frequency.
TTT: A number from 40-154 representing the signal strength.
NNN: A number from 1-255 representing the number of pulses received during the recorded scan.
PPP: A number representing the recorded pulse rate of the detected transmitter
MMM: A number from 1-255 representing the number of valid pulses during the store period. Note: This excludes estimated noise pulses and may include data calculated over several scans.
CCC: The calculated measurement taken from variable rate transmitters using entered coefficients.

Aerial Data . The data stored while the R4500S was logging in either Aerial or Manual Mode.

SS: A number from 0-59 representing the second.
(FF)FFFF: A number representing the transmitters frequency. Either it will be 6 digits representing the entire frequency or it will be a number from 0-9999 representing the last four digits of the frequency.
TTT: A number from 40-154 representing the signal strength.
NNN: A number from 1-255 representing the number of pulses received during the recorded scan.
PPP: A number representing the recorded pulse rate of the detected transmitter
MMM: A number from 1-255 representing the number of valid pulses during the scan.
CCC: The calculated measurement taken from variable rate transmitters using entered coefficients.

(-)LL.LLLLLLLL: A number representing either Latitude or the X coordinate for UTMs (Universal Transverse Mercator).
or
XXXXXXX.X:

(-)lll.llllll: A number representing either Longitude or the Y coordinate for UTMs (Universal Transverse Mercator).
or
YYYYYYYY.Y:

ZZZ: This will appear only if UTMs were selected and represents the UTM zone.
AA: A number in seconds from 0-119 representing how long ago the GPS coordinates were recorded.

When offloading data and showing parameters in the offloaded data, there will be a parameter number appearing in the last column. Find that number under the ‰**PrmNum Key ***+ appearing at the bottom of the offload. Cross referencing this will let you know what parameters was used for each data point that was recorded. Each column has a short descriptive header. Expand the columns to read what each parameter field is.

Below are the column headers followed by some examples:

Column Headers:

PrmNum, Block_Type, Scan_Type, TimeOut, Scan, Tables, GPS, StoreRate, Antennas, ExtData,   Reference_Frequency

Parameter Examples:

0, Aerial, Fixed PR - Pattern Matching - PR1:55 Tol:1 PR2:0 Tol:2 PR3:0 Tol:0 PR4:0 Tol:0, NA, 1, 2, Yes, NA, NA, NA, NA

1, Stationary, Fixed PR - Pattern Matching - PR1: 55 Tol:1 PR2:62 Tol:4 PR3:50 Tol:1 PR4:0 Tol:0, 2 ,12, 1, NA, 0, 1, No, No

2, Stationary, Variable PR - Temperature Period Range (Min-Max): 400-1500, 3, 12, 2 3, NA, 10, 1, Yes, No

17.0 Charging the Batteries

The R4500S is using NiMH (Nickel Metal Hydride) batteries. The capacity of the battery pack is 4.0 Amp hours. The R4500S will operate from internal batteries for approximately 18 hours for stationary mode, and approximately 11 hours for manual and aerial modes while using the GPS.

The batteries can self drain to 80% capacity during a 6 month shelf life.

It is recommended to maintain a charge cycle when storing the receiver for long periods of time. If the charge capacity of the batteries does not seem to be at full capacity, a couple charge cycles can bring the battery pack back to full capacity (discharge . charge . discharge . charge)

The charger supplied with the R4500S is a "smart charger". There is a thermal sensor to detect a full charge, and to shutdown the charge process if the battery pack overheats.

Turn OFF the power to the R4500S when charging the batteries.

When the charger is connected to the R4500S, the charging sequence will start.

A fully depleted battery pack should be charged to full capacity within 5 hours.

18.0 EXT – External Data Output

If the EXT option has been selected the R4500S will send data once an hour out the **AUX** port while stationary logging. If using GOES (Geostationary Operational Environmental Satellites) option, the data will be sent to the GOES transmitter's buffer thru a cable attached via the **AUX** port. While the R4500S is sending data out its serial ports one or two status screens will be displayed.

Screen 1

```
Preforming EXT
Data Transfer
Total blocks
to process: 8
```

This screen indicates the R4500S is starting to send data out. The example above has 8 data blocks in memory to process. Only valid data blocks will be sent. The number of blocks the R4500S sends may actually be less than 8. For example there could be informational blocks that contain programming information for your R4500S that would not be sent.

Screen 2 (GOES option only)

```
Total Verified
 106
Total Possible
 106
```

This screen indicates the number of bytes that were sent over versus the number of bytes that the GOES transmitter sent acknowledges for. If these numbers do not match a "CHECK" will flash on the screen indicating a probable system problem. If this happens check your connections. Also make sure your GOES transmitter is turned on and operating correctly. The GOES transmitter should display the same number of bytes in its buffer.

If the R4500S determines there were more bytes of data to be sent over to the GOES buffer than the GOES transmitter can transmit, it will save this data for the next hour's transmission cycle. You should try to set up your system so that it does not log more data than it can transmit in a 24 hour period. For fixed period logging each data point will use 11 bytes. For variable period logging each data point will use 11-12 bytes depending on the type of data being transmitted. Assume an extra 29 bytes overhead for the header and footer of the transmission block. Check with NESDIS to determine how many bytes your transmission assignment will allow.

Note: When using the GOES option and as long as the R4500S has not filled up it will not lose the data. It will always try to catch up. In order to save transmission space, the day the data is collected is attached to the transmission and not to the individual data point. If the back log becomes too large the date information will not match the day the data was collected.

When using the RDP (Remote Data Platform) option the R4500S will always dump all the data recorded during the previous hour's logging.

Even after the R4500S has filled up it will continuing logging. The newest data will be written over the oldest data.

In order for data to actually be lost the data back log would have to be the entire capacity of the data logger which is over 90,000 data blocks.

You can connect to the **AUX** port from your PC using the R4500 Serial Download cable (14314). By using a communication software such as Microsoft ® HyperTerminal or Symantec's Procomm Plus and the serial settings "baud: 9600, no parity, 8 data bits, 1 stop bit" or "baud: 57600, no parity, 8 data bits, 1 stop bit" you can monitor the data that is sent out. This data comes out in a compressed format that if using GOES is the same as that you will see when downloading your data from NESDIS or if using the RDP is a compressed format that when uncompressed is the same as your normal offloaded data.

18.1 Data Format and Translation

18.1.1 BINARY DATA

To maximize the amount of data you can send in a transmission, your data has been compressed into binary data. The binary data is sent as ASCII text that is viewable in a text editor. The downloaded data will appear in the same form that it was sent.

Some example GOES data:

138/13:00 137GC?
D@r}HPPK@
D@r}h@hKG
D@b~H`tkA
D@b}hAXkE
D@r~GpTLj
D@b~H@tLE
D@r}iPtoy
D@r~IPPOz
D@b}iQ@Oy
D@b~Ipdo{
D@r}ij]pD
000 END

Some example RDP data:

```
349/15:00 129 RDP_S Dump
Cym{EUtOAIDIMpI
Cym{EUtOyIDIMpI
Cym{EUtOyHDHMpH
Cym{EUtOyHDHMpH
Cym{EUtOzHDHMpH
Cym{EUtOzIDIMpI
Cym{EUtOzIDIMpI
Cym{EUtOzIDIMpI
Cym{EUtOzIDIMpH
Cym{EUtO{HDHMpH
Cym{EUtO{IDIMpI
Cym{EUtO{IDIMpI
Cym{EUtO{IDIMpH
Cym{EUtO{HDHMpG
Cym{EUtO{HDHMpH
000 END
```

To view this as more meaningful data you need to run translator program that is provided by ATS on request. The translated data for the RDP style dump is the same as a normal offloaded data file.

18.1.2 GOES Translated Output Format

153056A205132132921G51+0NN180W0000101`

Day/Hr:Min	Volts	Log Type	Freq	Pulse Rate	Ant#	Signal	#Matches	Noise Ind.	Hr:Min
132/07:00	12.5	Fixed-35	15	54	1	90	62	2	7:01
132/07:00	12.5	Fixed-35	15	55	1	88	62	3	7:18
132/07:00	12.5	Fixed-35	731	71	1	154	17	0	7:06
132/07:00	12.5	Fixed-35	15	55	0	89	30	2	7:42
132/07:00	12.5	Fixed-35	15	54	0	87	14	1	7:22
132/07:00	12.5	Fixed-35	731	71	0	154	21	0	7:38

000 END

Day: A number from 1-366 representing the Julian day (1-366 for a leap year, otherwise 1-365). This appears in the transmission header of R4500S and it indicates the day the data was processed for transmission.

Hr: A number from 0-23 representing the hour. This appears in the transmission header of the R4500S and it indicates the hour the data was processed for transmission. The data is sent from the R4500S at the top of the hour over to the GOES transmitter. This hour represents the hour previous to the hour the data is sent. If the transmissions are keeping up with the data collection this will be the same hour as the hour the data was collected.

Volts: Voltage to the tenths of volts representing the system voltage at the time the data was sent over to the GOES transmitter. This appears in the transmission header of R4500S.

Log Type: Indicates what type of logging is being done.

Fixed-NN : The pulse rate is fixed and the noise multiplier is NN. The noise multiplier is

applied to the noise indicator to determine the range of noise pulses being received. The noise multiplier used is determined by the maximum number of noise pulses allowed for a data point to be transmitted to GOES.

Noise Multiplier	Range of Maximum Noise Pulses
35	211-255
30	176-210
25	141-175
20	140-71
10	36-70
5	15-35
2	8-14

The default noise multiplier is 35. In this case the noise multipliers indicate the following:

Noise Indicator	Noise Pulses
0	0
1	1-35
2	36-70
3	71-105
4	106-140
5	141-175
6	176-210
7	211-255

Temperature: The pulse rate is variable and the data represents temperature.

Depth: The pulse rate is variable and the data represents depth.

Altitude: The pulse rate is variable and the data represents altitude.

Period: The pulse rate is variable and the data represents pulse period.

Freq: A number representing the transmitter's frequency. It will be a number from 0-9999 representing the last four digits of the frequency.

Pulse Rate (Temperature, Depth, Altitude, or Period (ms)): The number representing the measured data.

Ant#: A number from 0-8 representing the antenna being used. A "0" indicates all antennas were turned on.

#Matches: A number from 1-255 representing the number of valid pulses during the scan.

Noise Ind.: Only used during fixed pulse rate logging. It indicates level of noise. See Log Type for further explanation.

Hr: Min: A number representing the hour and minute this data point was saved to memory.

000 END: The END appears at the end of the data sent to the GOES. If it does not appear you know the data transmission was incomplete and some data was lost. The ### proceeding the END indicates the number of data blocks skipped over for this transmission. This number can be nonzero only if you choose not to send data that had noise pulses exceeding a preset limit.

JULIAN DATE CALENDAR

(PERPETUAL)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Day
1	001	032	060	091	121	152	182	213	244	274	305	335	1
2	002	033	061	092	122	153	183	214	245	275	306	336	2
3	003	034	062	093	123	154	184	215	246	276	307	337	3
4	004	035	063	094	124	155	185	216	247	277	308	338	4
5	005	036	064	095	125	156	186	217	248	278	309	339	5
6	006	037	065	096	126	157	187	218	249	279	310	340	6
7	007	038	066	097	127	158	188	219	250	280	311	341	7
8	008	039	067	098	128	159	189	220	251	281	312	342	8
9	009	040	068	099	129	160	190	221	252	282	313	343	9
10	010	041	069	100	130	161	191	222	253	283	314	344	10
11	011	042	070	101	131	162	192	223	254	284	315	345	11
12	012	043	071	102	132	163	193	224	255	285	316	346	12
13	013	044	072	103	133	164	194	225	256	286	317	347	13
14	014	045	073	104	134	165	195	226	257	287	318	348	14
15	015	046	074	105	135	166	196	227	258	288	319	349	15
16	016	047	075	106	136	167	197	228	259	289	320	350	16
17	017	048	076	107	137	168	198	229	260	290	321	351	17
18	018	049	077	108	138	169	199	230	261	291	322	352	18
19	019	050	078	109	139	170	200	231	262	292	323	353	19
20	020	051	079	110	140	171	201	232	263	293	324	354	20
21	021	052	080	111	141	172	202	233	264	294	325	355	21
22	022	053	081	112	142	173	203	234	265	295	326	356	22
23	023	054	082	113	143	174	204	235	266	296	327	357	23
24	024	055	083	114	144	175	205	236	267	297	328	358	24
25	025	056	084	115	145	176	206	237	268	298	329	359	25
26	026	057	085	116	146	177	207	238	269	299	330	360	26
27	027	058	086	117	147	178	208	239	270	300	331	361	27
28	028	059	087	118	148	179	209	240	271	301	332	362	28
29	029		088	119	149	180	210	241	272	302	333	363	29
30	030		089	120	150	181	211	242	273	303	334	364	30
31	031		090		151		212	243		304		365	31

FOR LEAP YEAR USE OTHER CHART

JULIAN DATE CALENDAR

(FOR LEAP YEARS ONLY)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Day
1	001	032	061	092	122	153	183	214	245	275	306	336	1
2	002	033	062	093	123	154	184	215	246	276	307	337	2
3	003	034	063	094	124	155	185	216	247	277	308	338	3
4	004	035	064	095	125	156	186	217	248	278	309	339	4
5	005	036	065	096	126	157	187	218	249	279	310	340	5
6	006	037	066	097	127	158	188	219	250	280	311	341	6
7	007	038	067	098	128	159	189	220	251	281	312	342	7
8	008	039	068	099	129	160	190	221	252	282	313	343	8
9	009	040	069	100	130	161	191	222	253	283	314	344	9
10	010	041	070	101	131	162	192	223	254	284	315	345	10
11	011	042	071	102	132	163	193	224	255	285	316	346	11
12	012	043	072	103	133	164	194	225	256	286	317	347	12
13	013	044	073	104	134	165	195	226	257	287	318	348	13
14	014	045	074	105	135	166	196	227	258	288	319	349	14
15	015	046	075	106	136	167	197	228	259	289	320	350	15
16	016	047	076	107	137	168	198	229	260	290	321	351	16
17	017	048	077	108	138	169	199	230	261	291	322	352	17
18	018	049	078	109	139	170	200	231	262	292	323	353	18
19	019	050	079	110	140	171	201	232	263	293	324	354	19
20	020	051	080	111	141	172	202	233	264	294	325	355	20
21	021	052	081	112	142	173	203	234	265	295	326	356	21
22	022	053	082	113	143	174	204	235	266	296	327	357	22
23	023	054	083	114	144	175	205	236	267	297	328	358	23
24	024	055	084	115	145	176	206	237	268	298	329	359	24
25	025	056	085	116	146	177	207	238	269	299	330	360	25
26	026	057	086	117	147	178	208	239	270	300	331	361	26
27	027	058	087	118	148	179	209	240	271	301	332	362	27
28	028	059	088	119	149	180	210	241	272	302	333	363	28
29	029	060	089	120	150	181	211	242	273	303	334	364	29
30	030		090	121	151	182	212	243	274	304	335	365	30
31	031		091		152		213	244		305		366	31

(USE IN 2008, 2012, 2016, 2020, ETC.)