

SPOT User Guide

This user guide will give you all the essential information needed to interact with, configure, and deploy a Wildlife Computers SPOT tag.

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Before you Begin



The information contained in this guide is designed to help you get the most from your deployment. In the guide, you will see the yellow icon highlighting information where special attention should be paid.

The list below shows what is required to configure and deploy a SPOT tag:

- A Wildlife Computers Data Portal Account.
- A Windows® computer with Tag Agent and our USB driver installed.
- A Wildlife Computers communications cable.
- A magnet.

Visit wildlifecomputers.com to download the required software (Tag Agent and the USB communications cable driver) and setup an account. At the end of this document, there is a list of key terms and concepts for reference. We recommend inexperienced users review this list as well as the [Deployment Checklist](#).

About the SPOT

The Wildlife Computers SPOT tag is an Argos transmitter that includes temperature and wet/dry sensors.

SPOT tags transmit to the Argos satellite system. Consecutive transmissions received in a single satellite pass are used to calculate the location of the tag and its host animal. See <http://www.argos-system.org> for more information on Doppler locations.

SPOT tags have an on-board clock that keeps track of when a transmission should be made. When it is time to make a transmission, the SPOT monitors its wet/dry sensors. As soon as the sensors indicate a dry condition, transmission is initiated.



Anatomy of a SPOT

Wildlife Computers offers SPOT tags in different shapes to suit a variety of applications. While the shapes may differ, all SPOT tags have many elements in common (Figure 1).

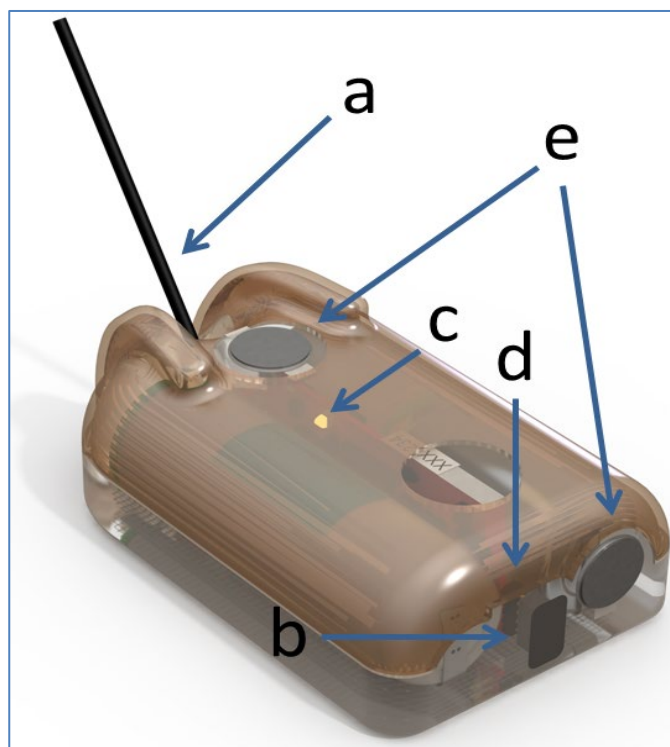


Figure 1—typical backmount SPOT showing: (a) Argos antenna, (b) communications port with plug, (c) LED indicator light, (d) magnetic switch, and (e) wet/dry sensors.

Note: the magnetic switch is not visible. It is located near the base of the communication port. Swiping a magnet across the communication port will activate the switch.



The wet/dry sensor is composed of two or more metal discs on the surface of the tag. **Do not cover any of the metal discs** with anything including antifouling substances and/or attachment adhesives (e.g., epoxy). Seawater contact is essential for normal function of the tag.

The communications port is where the Wildlife Computers Communications Cable connects to the tag. Prior to a deployment, this port should be sealed with the plug provided. Smear a small amount of the silicone grease supplied onto the sides and bottom of the plug, align the plug and pins, and carefully push the plug into the port. If it does not align easily with the pins, rotate it 180° and try again. The plug prevents corrosion of the pins during the deployment; however, the plug is not required for the tag to function normally.

Tag States

SPOT tags have three states—Auto-Start, Start and Stop.

Auto-Start—when in Auto-Start mode, the SPOT tag will automatically deploy when submerged in seawater.

Start—when in Start mode, a SPOT tag is running and will transmit to Argos satellites. When first deployed, the tag's LED will blink every second. This "heartbeat" blink provides visual confirmation that a tag switched from Auto-Start to Start and is meant to prevent deployment of deactivated tags. Additionally, the LED will blink brightly whenever the SPOT tag transmits to the satellite. The duration of both the heartbeat blinks and transmission blinks is user-programmable (see [Miscellaneous Settings](#) section). For some applications, it may be best to disable the blinks as they can draw unwanted attention to the tagged animal.

Stop—Stop mode is used for storing and shipping tags. In Stop mode, the tag will remain unresponsive until the tag is communicated with via Tag Agent. If storing tags, keep them in a cold place such as a refrigerator or freezer. [See Tag Storage and Battery Maintenance.](#)

Display a Tag's State Using a Magnet

Passing a magnet near the communications port will cause the tag to reveal its current state using the LED.

- Two blinks and a pause repeated three times means the tag is in Auto-Start mode.
- Ten rapid blinks indicate the tag is Started.
- No blinks indicate the tag is Stopped.

Change a Tag's State Using a Magnet

A timed magnet swipe can be used to change the state of a SPOT between Auto-Start and Start modes.

First, swipe the magnet and wait for the tag to indicate its current state. At the end of the blinking pattern, the indicator light will remain on for several seconds. If the magnet is swiped a second time during the extended light-on stretch, the state will toggle. The second swipe needs to happen in the window when the light is on (Figure 2).

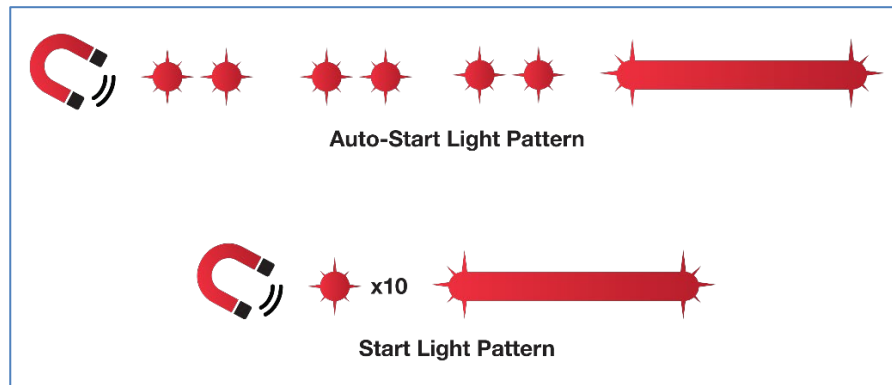


Figure 2—sample of the indicating light pattern.

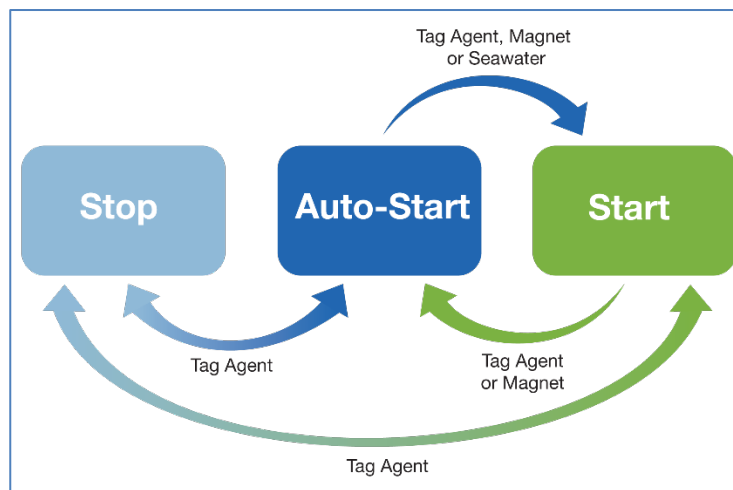


Figure 3—methods for changing states in a SPOT tag. Tag Agent can be used to put a SPOT in any state.

Interacting with a Tag

Tag Agent

Tag Agent is used to communicate with SPOT tags. A local copy of Tag Agent must be downloaded the first time you use it. Once installed, all updates to the tag's setup are done directly through the local copy on your machine. More information on how to use Tag Agent is be found in the [Wildlife Computers Data Portal & Tag Agent User Guide](#).



The USB driver must be installed, and a Wildlife Computers Data Portal account must be created prior to opening and using Tag Agent.

Each time Tag Agent is launched, you will be greeted by a welcome screen (Figure 4). Along the bottom the Tag Status, USB Status, and Cloud Status are displayed.



Figure 4—Tag Agent welcome screen.

Connecting a Tag to Your PC



To communicate with a tag, open Tag Agent and use the USB communication cable to plug the tag into your PC. **Make sure to align the pins properly.** Once plugged in, swipe a magnet near the tag's communication port to establish a connection. The Tag Agent home screen will appear with tag information on the left and sensor readings on the right (Figure 5).

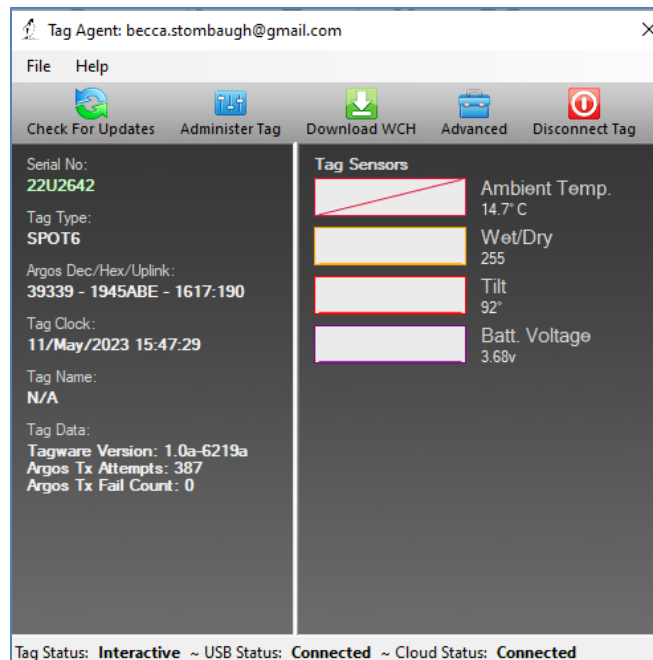


Figure 5—Tag Agent home screen.

If this is the first time you are communicating with a tag, a pop-up box will ask if you would like to become the tag administrator. Selecting 'yes' will allow you to select and publish tag settings.

Configuring Tag Settings

Use the Administer Tag button in the upper menu of Tag Agent to configure tag settings.

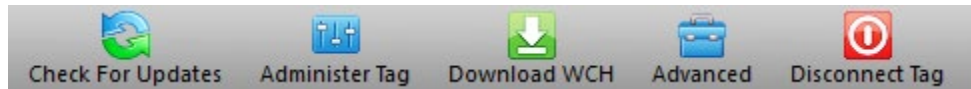


Figure 6—Tag Agent menu bar. Select Administer Tag to edit tag settings.

A new window will open revealing three categories—Tag Information, Data Product Settings, and Transmission Settings.

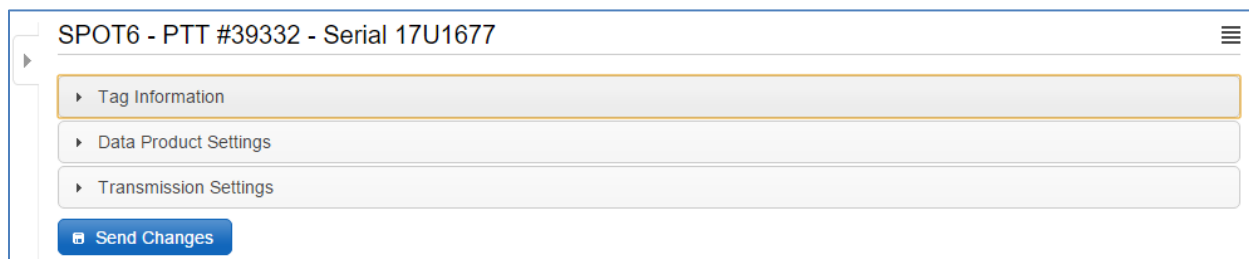


Figure 7—collapsed version of SPOT tag programming categories.

Tag Information

Tag Details

This tab includes information on tag administrators and the Tagware version. A friendly name can be assigned to the tag if desired. This can make it easier to search and filter for the tag within the portal.

Argos Settings

The PTT decimal and hexadecimal numbers as well as the Argos uplink ID are listed here. PTT numbers are a manufacturer's setting. Contact Wildlife Computers if a change is needed.

Miscellaneous Setting

SPOT tags are equipped with an LED that flashes for a specified duration when deployment begins, serving as a visual confirmation that the tag has transitioned from Auto-Start to Start mode. If the flashing LED could potentially harm your animal, it may be advisable to deactivate the LED flashes.

Tag Information

Tag Details | Argos Settings | Miscellaneous Settings

Administrator(s): Example@wctags.com
 Tagware Version: 1.0a-6219a
 Tag Type: SPOT6
 Tag Name:

▸ Data Product Settings
 ▸ Transmission Settings

Figure 8—expanded view of Tag Details tab.

Data Product Settings

In addition to providing locations, the SPOT tag can optionally transmit two data products. These are Time-at-Temperature histograms and Percent Dry Timelines.



Enabling SPOT data products will generate larger messages which require more power to transmit. The more data product messages created, the greater the impact on battery life.

Summary Period Data

Time-at-Temperature Histograms (TAT)

The Time-at-Temperature histogram reports the amount of time that an animal spent within each temperature bin. The amount of time is reported as a percentage of the histogram summary period.

Select the high temperature limit for each bin. Next choose the summary period. The summary period can range from one hour to 24 hours, but the chosen period must divide the day evenly. The summary period begins immediately after midnight UTC by default and runs to the end of the UTC Day.

Selecting a six-hour summary period will cause the tag to generate four histograms. One from 00:00 hrs. to 06:00 hrs.; one from 06:00 hrs. to 12:00 hrs.; one from 12:00 hrs. to 18:00 hrs.; and one from 18:00 hrs. to 24:00 hrs. This pattern repeats on the next UTC Day.

To measure behavior associated with local time, you can delay the start of each summary period by setting a summary period offset. Choosing an offset of three hours will shift the example summary periods as follows: 03:00 hrs. to 09:00 hrs.; 09:00 hrs. to 15:00 hrs.; 15:00 hrs. to 21:00 hrs.; and one from 21:00 hrs. to 03:00 hrs.



Choosing a one-hour summary period will cause twenty-four times more data to be generated than choosing a 24-hour summary period.

Be aware that the temperature sensor is buried in the tag and has a response time of approximately 30 minutes.

Data Product Settings

Summary Period Data

Daily Data

Classic Histograms: Time-at-Temperature

ON

Temperature is sampled at a rate of (seconds): 3

Set the high temperature limit for each histogram bin. The tag can measure temperatures from -40°C to 60°C.

Bin #	1	2	3	4	5	6	7	8	9	10	11	12
High °C	3 °C	12 °C	16 °C	20 °C	25 °C	27 °C	30 °C	33 °C	35 °C	37 °C	40 °C	60.0 °C
Low °C	-40.0 °C	3.1 °C	12.1 °C	16.1 °C	20.1 °C	25.1 °C	27.1 °C	30.1 °C	33.1 °C	35.1 °C	37.1 °C	40.1 °C

Choose the histogram summary period (hours): 6

Choose the summary period start delay (hours): 3 UTC

Figure 9—example of Time-at-Temperature histogram with six-hour summary periods and a three-hour start delay.

Daily Data

Percent-Dry Timelines

This timeline reports the amount of time the tag is dry. The amount of time is reported as a percentage of each hour in the day. Choosing the Low-Resolution option will cause the tag to report to the nearest 10%. The Low-Resolution timeline will also indicate when the tag was wet for the entire hour and when the tag was completely dry for the entire hour. The High-Resolution option reports to the nearest 1%.

Tag Information

Data Product Settings

Summary Period Data

Daily Data

The wet/dry sensor is sampled at a rate of (seconds): 3

Percent Dry Timelines

Off

Low Resolution

High Resolution

Figure 10—low resolution percent dry timeline enabled.

The percentages are as follows:

% reported in DAP spreadsheet	Amount of time during hour
0	0% (no readings were dry)
3	0% < dry < 5%
10	5% <= dry < 15%
20	15% <= dry < 25%
30	25% <= dry < 35%
40	35% <= dry < 45%
50	45% <= dry < 55%
60	55% <= dry < 65%
70	65% <= dry < 75%
80	75% <= dry < 85%
90	85% <= dry < 95%
98	95% <= dry < 100%
100	100% (every sample was dry)

Transmission Settings

Data Uplinks

Argos uplinks serve two purposes—generation of Argos locations and data transmission.

Location Messages—SPOT tags send short, three-byte messages for the purpose of generating locations. The location uplink scheduler is used to set hourly or daily transmission limits. The scheduler is highly flexible. See [At-Sea Mode versus Haul-Out Mode](#) section for more information.

Data Messages—the tag uses a separate itinerary to transmit data messages. Data throughput is optimized by sending each data message multiple times (approximately 10). Resent messages are separated in time by at least 40 minutes to maximize the odds of reception. Data messages are only combined with location messages when timing coincides.



In summary, SPOT tags transmit two types of messages—short, location-only messages which transmit at a user determined uplink schedule and longer, data-filled messages which transmit according to a preset agenda. Data messages are independent of the location transmit count. A tag programmed to send 250-location transmissions per day and generate 10-data messages could attempt 350 uplinks (assuming each data message is sent ten times). This is important to keep in mind for power budgeting.

Transmission Modes

At-Sea Mode versus Haul-Out Mode

Independent transmission regimes can be set for when an animal is At-Sea versus Haul-Out.

The Haul-Out mode entry and exit conditions are user defined. When haul out is achieved the tag switches to its slower repetition rate (usually 90 seconds).

If tagging an animal that never hauls out, set Haul-Out mode to DISABLED to ensure transmissions always occur at the faster repetition rate.

Transmission Patterns

Both transmission modes have a schedule that can have one or more patterns.

Patterns can start on a specific calendar date or after a fixed number of days. This allows the tag to modify its behavior to accommodate changing requirements during the deployment. When an interval is used, the number of days is timed from the deployment start for the At-Sea Schedule. For the Haulout Schedule, the interval is timed from the start of haulout rather than the start of the deployment.

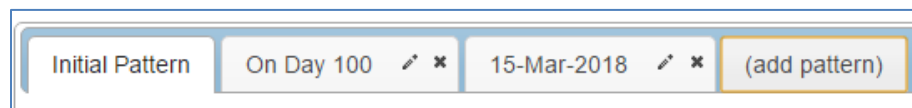


Figure 11—example of a deployment with three transmission patterns.

Transmission Steps

Each pattern is made up of sequential steps and a loop. The pattern will run to the last step, then revert to the step designated by the loop and repeat. This can be any step in the pattern. The loop allows steps in a schedule to be used only once or for all the steps to be repeated.

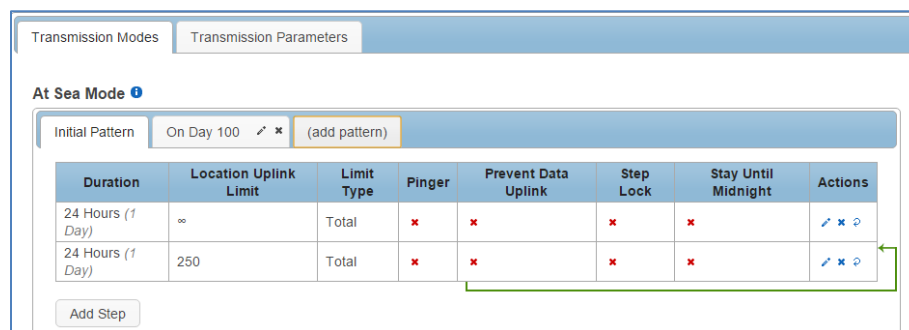


Figure 12—transmission schedule example with an initial pattern of 2 looping steps. Step 1 lasts for 1 day with an unlimited number of transmissions. Step 2 lasts for 24 hours with a limit of 250 uplinks per day. On day 100, the next pattern begins.

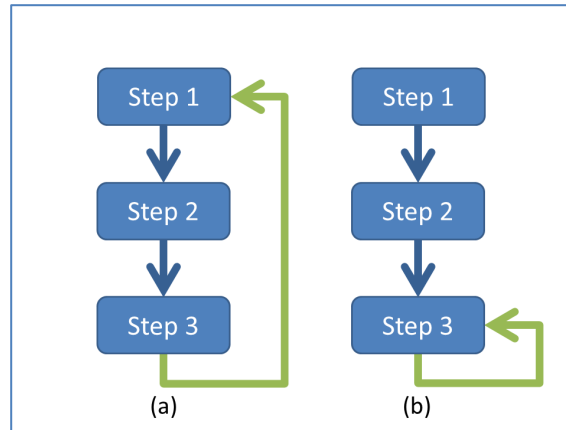


Figure 13—a pattern which repeats all steps (a), and a pattern which uses steps one and two once and then repeats the last step (b).

To configure steps within a pattern, select the pencil icon under the Actions column on the far right.

1. Select the duration of the step.
2. Select the options for the step.
 - Set the Location Uplink Limit—the limit can be either hourly or for the entirety of the step.
 - Enable/Disable the Pinger—the pinger is used for radio tracking recovery.
 - Prevent Data Uplink—this will disable data transmissions for this step. This has significant power savings for some applications.
 - Lock the Step—overrides the At-Sea and Haul-Out mode definitions for the duration of the step.
 - Stay Until Midnight—locks the step until the UTC midnight after the step was set to expire. It is used to synchronize subsequent steps to UTC midnight.

The info button next to each option offers additional information.

Edit Transmission Setting Step

Select the duration for this step.

Year(s): 0 Day(s): 1 Hour(s): 0

Select the options for the step duration above:

Hourly Location Transmission Limit: 60 (unlimited)

Make Limit(s) Hourly: ☒

Pinger Enabled: ☒

Prevent Data Uplink: ☐ [i](#)

Step Lock: ☐ [i](#)

Stay Until Midnight: ☐ [i](#)

Argos transmissions for this step: 1440.0/day or 60.0/hour

Save **Cancel**

Figure 14—example of a step lasting one day with an uplink limit of sixty attempts per hour and the pinger enabled.

The daily and hourly transmit settings are displayed at the bottom of the box. A caution symbol appears if fewer than fifty transmits per day are scheduled. Achieving locations from so few uplinks can be a challenge.



The Location Uplink Limit is the maximum number of transmissions for the duration of that step. It is not a daily transmission limit unless the duration is set to 24 hours.

If numerous steps have been set, the spiral arrow icon under the Actions column can be used to create loops.







Duration	Location Uplink Limit	Limit Type	Pinger	Actions
24 Hours (1 Day)	25	Hourly	×	  
144 Hours (6 Days)	0	Hourly	×	  

Figure 15—two looping steps created using the arrow icon.

Considerations for Setting Location Uplink Limits

1. *Hourly limits can be used to distribute transmissions evenly throughout a step.* By default, when a step begins, transmissions occur as fast as possible (at the set Argos repetition rate and when a dry environment is detected). Once the uplink limit is achieved, transmissions are suspended until the next step begins. If a long step duration is set the allowable transmissions may be used before the step is complete. This can result in recurring gaps in location data. For example, in the case of a 24-hour step with a total transmit limit of four hundred, and a repetition period of 30 seconds, the tag could run through its allowance in the first four hours after UTC midnight. Alternatively, a limit of sixteen uplinks per hour could be set and locations achieved throughout the day.
2. *Only a fraction of transmissions sent result in locations.* Argos locations require a perfect combination of events.
 - a. A satellite must be overhead (near the equator satellites are overhead roughly 20% of the time).
 - b. The tag and animal must be at the surface.
 - c. The tag must be allowed to transmit (the uplink limit must not have been met, and no mask must be on).
 - d. Multiple uplinks must be received during a single satellite pass (ideally 3+).
 - e. When the transmit limit is too conservative it can be difficult to achieve these conditions.
3. *Consider battery capacity and your target mission duration.* SPOT tags can send a finite number of transmissions. Limiting the number of transmissions allowed per step can save battery life and extend the deployment. This is especially important for animals that spend ample time at the surface or haul out. For animals that surface infrequently (such as turtles and sharks) animal behavior tends to restrict transmits more than the set limit.

[Contact Wildlife Computers](#) to discuss the battery capacity of your tag, your target deployment length and how frequently locations are required.

Transmission Parameters

Argos Uplink Mask

In each location there are known, consistent gaps in Argos satellite coverage. The Mask feature can be used to save battery power by preventing a tag from transmitting during hours with few or no satellite passes.



Figure 16—Argos Uplink Mask with UTC hour ten disabled.

By default, all transmitting hours are enabled (blue). Hours which you choose to disable will turn red and appear with an 'X.'

The best and worst satellite coverage hours can be determined using the Argos Pass Prediction Program. See [Argos Satellite Pass Prediction](#) section for instructions on how to use the program.



If you expect your animal to move more than 500 km East or West, leave all hours enabled as satellite coverage will change drastically enough that masking is not advised. Alternatively, you may run satellite pass predictions for the expected new locations and determine if there are appropriate transmission hours for the animals' entire migration. The Uplink Mask does not impact data collection or the pinger. The schedule only impacts when Argos transmissions are allowed.

Argos Uplink Settings

The minimum uplink interval (or repetition rate) is displayed for At-Sea and Haul-Out modes.

The typical rate for pinnipeds is 45 and 90 seconds, respectively. Turtles and sharks tend to have faster At-Sea rates (15-30 seconds) to increase the probability of multiple transmissions reaching the satellites.



The repetition rate is a manufacturer setting. [Contact Wildlife Computers](#) before deployment if you wish to change the interval.

Argos uplinks can be delayed by fractions of a second once the tag is ready to transmit and becomes dry. This is typically used for large cetaceans to make sure the animal is well clear of the water and not likely to be splashed or re-submerged during an uplink. ***Note: the dry readings are attempted at 0.25 second intervals.***



To maximize the probability of receiving data messages, it is recommended that each unique message be sent ten times. Changing the number of times a message is re-sent will impact what data are received.

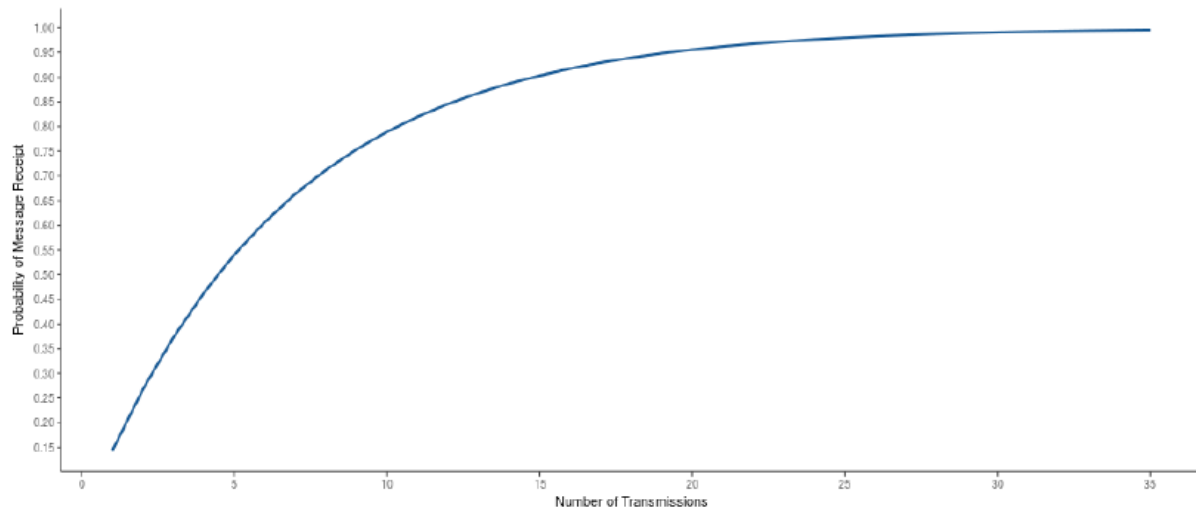


Figure 17—graph showing the probability of successful data transmission with an increasing number of re-transmits for a specific location. A per message corruption rate of 10% is assumed.

Loading Settings into a Tag

Once settings have been chosen, use the blue Send Changes button to load settings into the tag. Tag Agent g Templates

A template can be saved so the same settings may be applied to multiple tags. To save settings as a template, click the four horizontal lines in the shape of a square ≡ visible in the top right corner of the screen. You have the option of creating an online template or a local template file of the current settings selected. Local templates are used when no Internet connection is available.

Viewing Configuration History

You can review a tag's programming history using the arrow icon on the left-hand sidebar menu. Clicking the arrow exposes the tag history. Previous tag settings can be viewed by clicking on each date listed. The blue check mark indicates settings were applied. A date without a check mark indicates settings were proposed but not applied to a tag.

Check Sensor Readings

The sensor values displayed on the Tag Agent home screen are continuously updated from the tag. Sensor functionality can be validated by manipulating the sensors as follows:

- Internal Temperature—this will change slowly as the entire tag changes temperature. Leaving a tag in a refrigerator for a while will change the value.
- Wet/Dry—connecting a wire between a ground and active wet/dry sensor disc should change the value from 255 to less than 20.

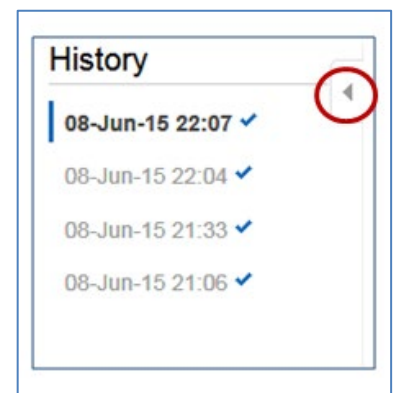


Figure 18—arrow icon exposes tag programming history.

Perform Battery Tests

Prior to deploying your tags, check that the batteries are functioning optimally.

Sending Test Transmissions

Sending Test Transmissions gives a quick view of the current battery voltage and power output of the tag.

Tips to Optimize this Test

To optimize the Sending Test Transmissions Test, consider the following:

- **Antenna angle should point UP.** The angle of the antenna should mimic how the tag will orient while transmitting in the field. Never touch the antenna to anything.
- **Some SPOT tags should be held ~15cm above the desk for this test.** Think of the desk as the surface of the water. You should hold the tag in a way that imitates the height of the instrument when the animal comes out of the water. For [finmount](#) applications, tags should be held higher (~15-30 cm above the desk). For backmount and towed tag applications, tags should lie flat or nearer to the desk (antenna up). See the photos below.

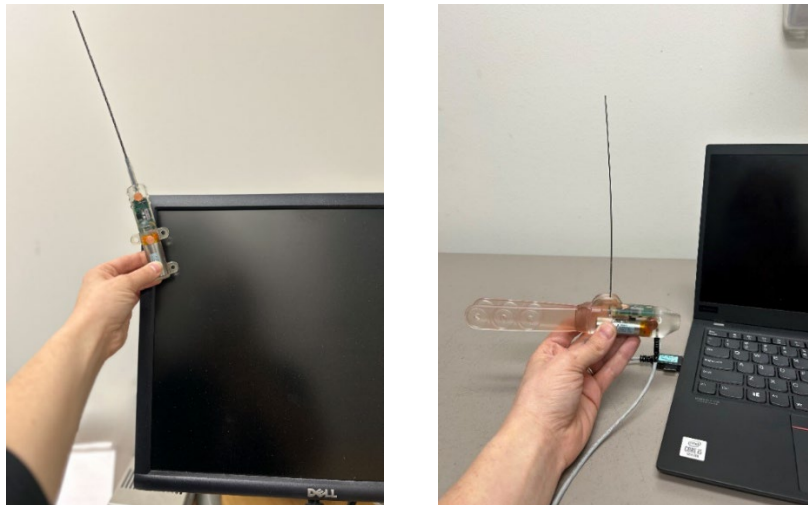


Figure 19—example of finmount orientation (left) and single-point finmount (right) for Test Transmission test.

Connect your USB cable to each SPOT tag and log into Tag Agent. In the menu at the top, click the “Advanced” tab. Scroll down to “Send Test Transmission” and follow the prompts.

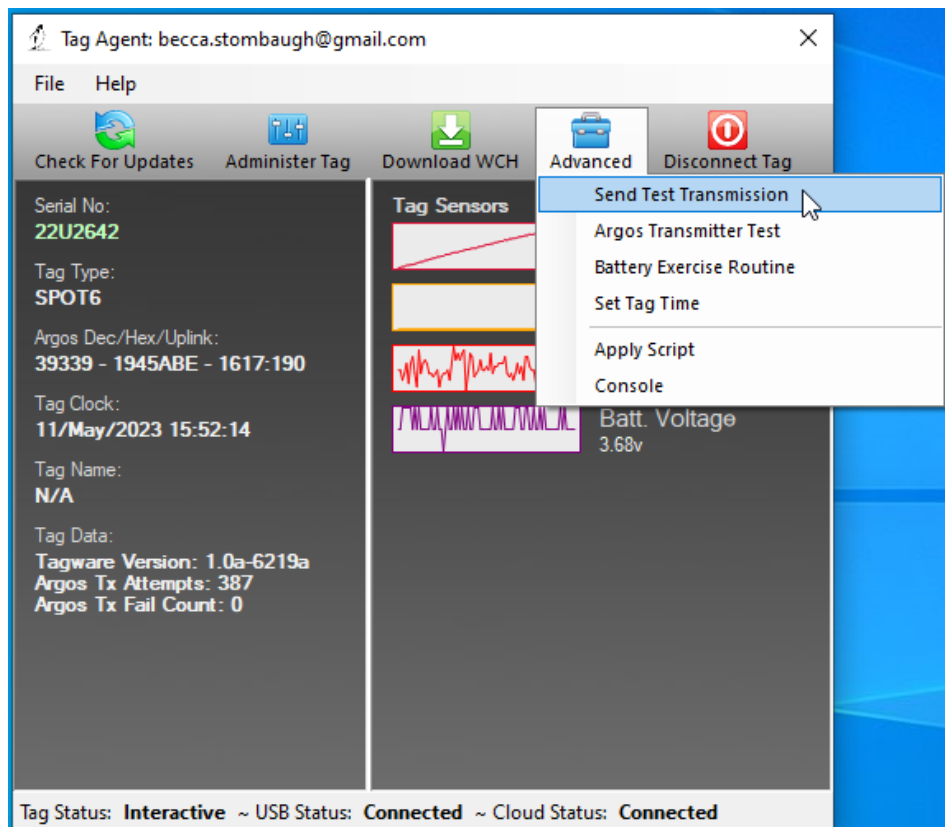


Figure 20—example of Send Test Transmission.

The test transmission voltage should read 3.3V or higher and the battery voltage displayed on the main sensor screen should be around 3.5V.

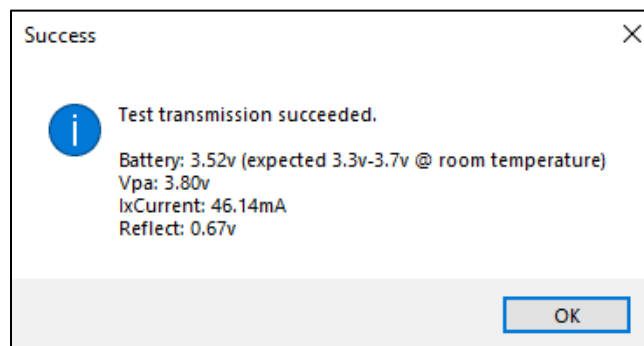


Figure 21—example of acceptable transmit battery voltage and acceptable transmit current.

If the output values of three consecutive test transmissions are all within the expected range(s), and all sensors on the main sensor screen are within the normal range, the tag is ready to continue storing, or it is ready to deploy.

- To continue storing; Disconnect the tag in “Stop” mode.

- To prepare for deployment (<1 month); Disconnect the tag in “Auto-Start” mode.

If you see a lower than acceptable voltage, it may be due to passivation forming during storage. We recommend taking additional steps to dislodge passivation by performing the [Battery Exercise Routine](#) in Tag Agent.

Argos Transmitter Test

The Argos Transmitter test allows for a full system test to confirm that the tag is successfully sending messages to the Argos satellites. Click on the Advanced Tab then Argos Transmitter Test.

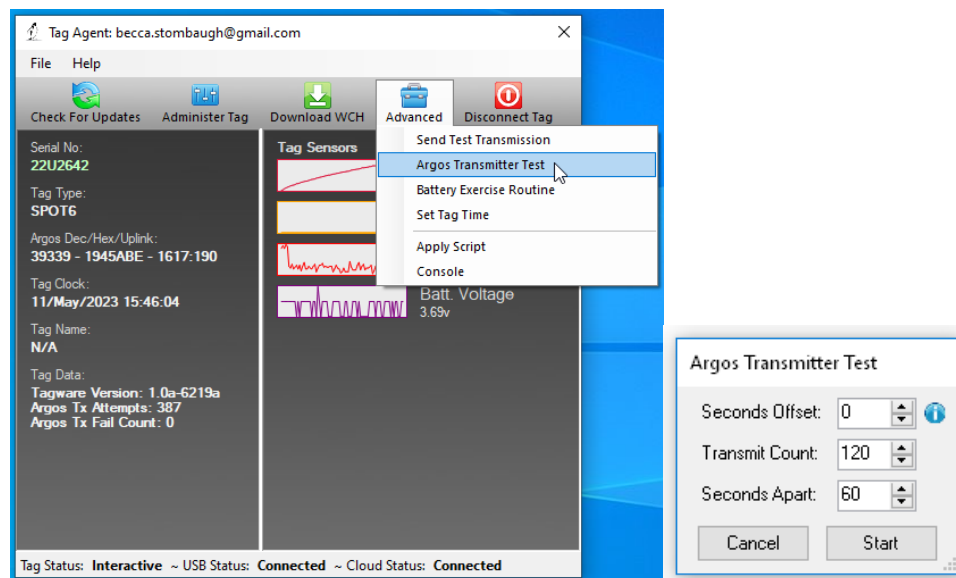


Figure 22—Argos Transmitter Test.

- Seconds Offset: If you will be testing multiple tags at one time, you can use this parameter to offset transmissions so the tags will not transmit at the same time.
- Transmit Count: How many times you want the tag to transmit. 120 transmissions at a sixty second interval will provide a 2-hour test, which is usually enough to coincide with a couple of satellite passes. Check the satellite passes in your area prior to beginning the test.
- Seconds Apart: The time between each transmission. 60 seconds is standard.

When all the tags are set up and deployed, take them outside where they have a full view of the sky.



Upon completion of the Argos Transmitter Test, the tag will be in STOP mode. You must communicate with it again prior to deploying it. When the test is complete, verify that the LED light is not on. If the LED light is on, you MUST communicate with the tag using Tag Agent and manually place the tag in Auto-Start or Stop mode.

Disconnect from SPOT

Use the Disconnect button on the upper right of the Tag Agent home screen menu to select the tag state before unplugging. If you are planning to deploy soon, select Auto-Start. The tag will then auto deploy upon submersion in saltwater.



Always disconnect the tag using the Disconnect button. Unplugging without setting the tag state could leave the tag in a state that will rapidly deplete the battery.

Using Tag Portal to Select Settings Remotely

Tag Portal is the cloud-based service offered by Wildlife Computers for remotely selecting tag settings. Configuring can be done without connecting to your tag. This enables project coordinators to review and select settings for their associates and programming to be done while tags are in transit before arrival. More information on using Tag Portal can be found in the [Wildlife Computers Data Portal & Tag Agent User Guide](#).

When logged into your portal account, a list of the tags for which you have administration rights can be viewed under the My Tags tab. To select settings, click on the serial number of the tag you wish to configure or use the pencil icon.

This will open a new window with setting selections. The same programming options are available whether settings are configured via Tag Portal or from within Tag Agent.

Once settings have been selected in Tag Portal, click the blue Propose Changes link. This will save the settings into the Cloud. The next time the tag communicates with Tag Agent (no matter who plugs in the tag), a notification will appear stating that new settings are awaiting upload.

Multiple set-ups can be published resulting in a queue of configurations awaiting upload. In this case, a dialog box will reveal a list of the configurations, when they were selected, and which administrator chose the settings.

Tag Portal maintains a historical record of tag settings each time changes are uploaded into a tag. The record is instantly updated so long as an Internet connection is available.

If tags are programmed offline using Tag Agent, the next time an Internet connection is established and Tag Agent software is open, the record automatically updates.

Offline Mode

Before programming can be done offline, Tag Agent must be downloaded and opened with valid credentials entered while connected to the Internet. Credentials are your Wildlife Computers Data Portal login username and password.

If the software has been opened once and credentials entered, programming offline is possible. To program settings, select Administer Tag from Tag Agent's top navigation bar, configure the tag, and click Send Changes. A dialog box will confirm when settings are loaded into the tag.



The next time an Internet connection is established, and Tag Agent software is open, the historical record will be updated in Tag Portal.

Online templates are not accessible when working offline. To program a group of tags with the same settings when working without an Internet connection, you need to create a local template. A file of the selected tag settings will be saved onto your local machine. Local templates can be created and applied in the Template Manager. Expose the Template Manager with the icon in the upper right corner of the screen.

The Internet connection status is displayed at the bottom of the Tag Agent home screen.

Tag Storage and Battery Maintenance

Proper tag storage is important to minimize passivation and keep the batteries charged. When stored correctly, the amount of battery life lost per year is only 1-2 percent. Battery passivation may cause low voltage readings, and in extreme cases, may compromise the battery. For this reason, batteries must be stored and then exercised.



Care must be taken with tags containing 1 AA battery only to avoid battery passivation. [Read the Addendum at the end of this User Guide for Special Storage and Testing Guidelines.](#)

As a standard, SPOT tags ship in “Auto-Start” mode for immediate deployment, unless otherwise specified.

SPOT Storage—Less Than One Month

Not much needs to be done as you will be deploying them soon. Store the tags in “Auto-Start” mode. The optimal storage temperature range is 0° to 5° C. Tags must not be stored at temperatures warmer than 5° C or colder than -20° C. Remember to read the [pre- and post-deployment checklists](#) to optimize your deployment.

SPOT Storage—Longer Than One Month

If you are storing SPOT tags for longer than one month, place your tag in “Stop” mode using Tag Agent and exercise the batteries at least 3 months* prior to your deployment to confirm the battery voltage is 3.3-3.7 volts.

To change the Tag State from “Auto-Start,” connect to each tag and log in to Tag Agent. In the menu at the top, you will see the “Disconnect Tag” tab. Scroll down to “Stop.” The optimal storage temperature range is 0° to 5° C. For long-term storage, tags must not be stored at temperatures warmer than 5° C or colder than -20° C. Remember to read the [pre- and post-deployment checklists](#) to optimize your deployment.

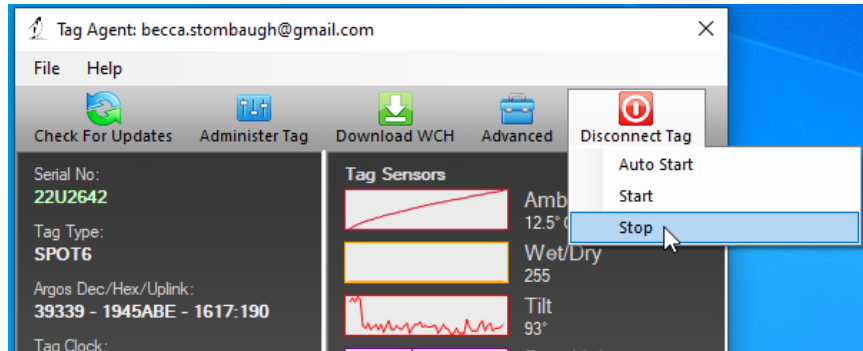


Figure 23—example of how to put tag in Stop Mode in Tag Agent.

Ideally, every few months we suggest exercising the tag's batteries by sending several test transmissions. This can be done in Tag Agent. Select Advanced and then Send Test Transmission. The transmission voltage should read approximately 3.3v and the battery voltage level displayed on the main sensor screen should be around 3.5v. It may take several transmissions for the tag voltage to build up after storage.

If you receive a low voltage reading, it may be due to passivation. Turn the tag on and leave it outside for several hours according to the [Argos Transmitter Test](#) instructions. When the unattended Argos test concludes, reconnect to Tag Agent and perform three more [Test Transmissions](#) to see if the transmission voltage level has increased.

Technical Specifications

Below are general physical specifications of SPOT tags.

Pressure rating	2000 m for most shapes
Operating frequency	401.678 MHz
Sensors	Temperature, Wet/Dry
Temperature	Range: -40° C to 60° C / Resolution: 0.05° C
Conductivity operational limits	0.1 to 5 S/m
Communication	Via USB port using Wildlife Computers USB communications cable

Additional Information

Glossary of Terms

- Administrator—someone who has the authority to publish tag settings.
- Argos ID—uniquely identifies a transmitter for the Argos system. The ID comprises a decimal number and a hexadecimal (base 16) number.
- Argos Location—a location generated by the Argos system from uplinks received during a satellite pass. Get more information about how the Argos system works here: <http://www.argos-system.org/web/en/391-faq-general-questions.php>
- Argos Uplink—a radio transmission intended for the Argos satellite system.
- At-Sea and Haul-Out—tag states controlled by wet/dry readings.
- Daily Data—generated from sensors over a fixed 24-hour period.
- Data Message—created by the tag to transmit data through the Argos system. Each data message is transmitted as payload in an Argos uplink. To increase the likelihood of its reception by the Argos system, each message is sent a fixed number of times.
- Data Products—the various types of data available from Wildlife Computer tags.
- Deployment—the period when a tag is associated with an animal and actively collecting and sending telemetry data.
- Location Uplink—a transmission intended to generate an Argos location. These uplinks can also carry a data message payload. Multiple uplinks are required to generate an Argos location.
- Pinger—a UHF radio tracking beacon.
- Start/Auto-Start/Stop—tag states. When started, the tag will generate locations and/or collect sensor data. Auto-Start will allow the tag to Start using a magnet or when reading wet. Stop causes the tag to do nothing until reconnected to Tag Agent.
- Summary Period Data—generated from sensors during a defined number of hours.



- Tag Agent Software—the program used to change tag states, select tag settings, and connect a tag to the Wildlife Computers Tag Portal.
- Tagware—the software running on a tag.
- Wildlife Computers Communication Cable—the Wildlife Computers communication cable required by Tag Agent.
- Tag Portal—the cloud-based service offered by Wildlife Computers for remote tag setup. A historic record of tag settings and templates is maintained within the Tag Portal.
- Wet and Dry—the state of the tag as determined by the wet/dry sensor which measures conductivity.

Argos Satellite Pass Prediction

CLS offers a satellite pass prediction program to help forecast satellite coverage at a given location. Additionally, Wildlife Computers offers a tool to graph the results and display the best hours for tags to transmit data for up to six months. The Wildlife Computers tool will display satellite pass histograms in both UTC/GMT for tag programming, and in local time for tag initialization and testing.

The following instructions outline the two-step process:

To determine when satellites will be in view, log onto the CLS website at <http://www.argos-system.org> and select "DATA ACCESS." Log in with your Argos username and password. Ensure that the time settings next to the login username are set to UTC. If not, then change them using the settings icon.

To run a simulation, select "Satellite Pass Prediction" on the right side of the dashboard.

- To run a simulation, select "Satellite Pass Prediction" on the right side of the dashboard.
- Set your simulation period—select today's date as the "Start Date." Then select "End Date." Use the calendar box on the right-hand side to select an end date that is six months out from today's date (the calendar will be grayed-out after six months). A shorter period can be selected for initialization testing or shorter deployments.
- Select satellites—ensure all satellites are selected.
- Enter location—select "Latitude/Longitude/Altitude." Input your deployment location coordinates. The location will display on the world map on the right-hand side. Altitude must also be set to "0" for marine applications.
- Click "Simulate"—the results spreadsheet will now appear.
- Click "Export"—select to save as a .CSV file and to save it in an easy-to-access location on your computer.
- Exit the Argos website.

Plotting the Results

- Use a web browser to navigate to the following link: <http://bit.ly/argospassprediction>. Adjust the UTC/GMT slider to the UTC/GMT offset of your current location, including possible daylight-saving time.
- Upload the Argos file—browse and import the pass prediction file saved from Argos. The program will display the pass prediction data for the next six months which will assist in selecting the best hours to activate the tag.



Tags must always be set and programmed in UTC/GMT time. The “Local Time” histogram is only used for identifying the best hours for tag initialization and testing.

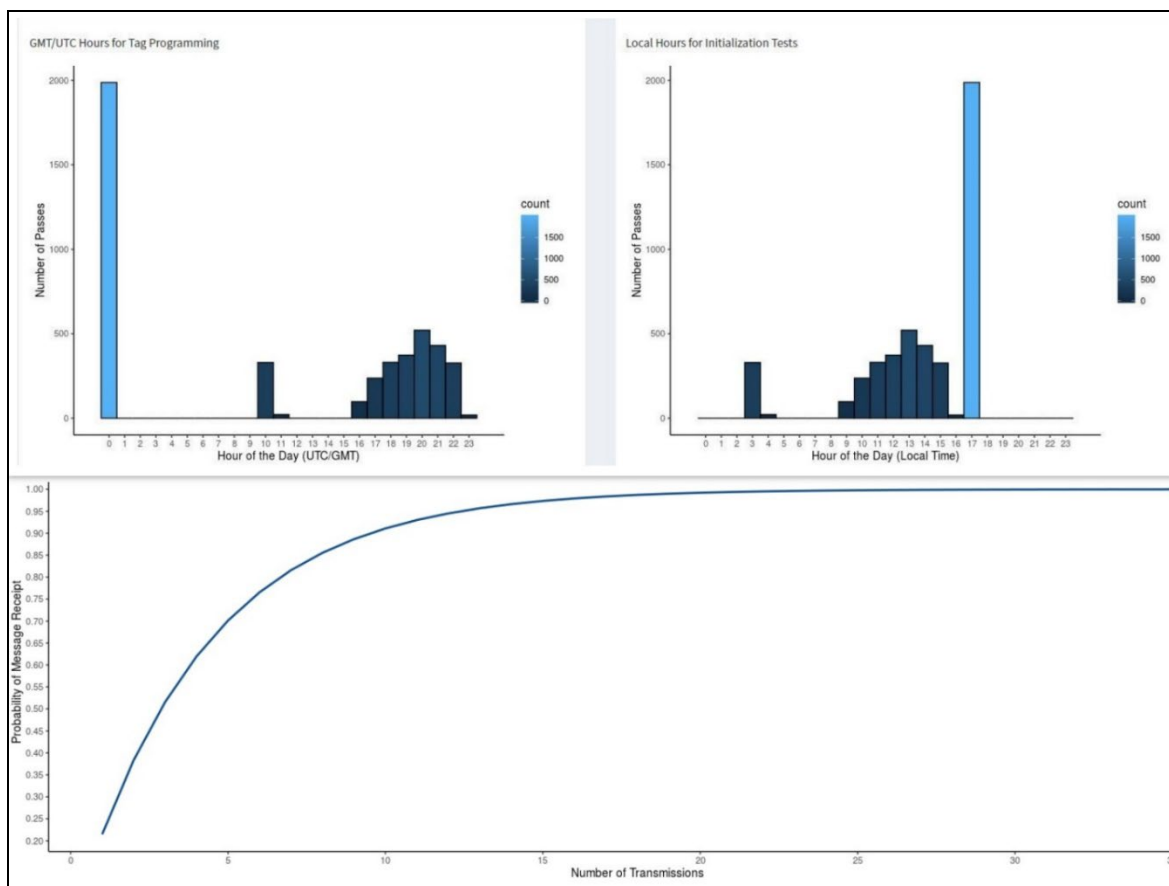


Figure 24—satellite coverage is best in UTC hours 2-4 and worst in hours 7-10 with no passes at all in hours 8 and 9.



If you expect your animal to move East or West more than 500 km, leave all hours enabled as satellite coverage varies significantly East to West so the mask will not be effective.

Initializing Tags Prior to Deployment

Before deploying a SPOT tag, it is recommended to conduct a trial mission. Activating tags prior to deployment has several benefits. It provides exposure to the software and data, it allows you to

evaluate the performance of the tag, and, most importantly, it enables Argos to secure a quality location at your field site prior to the animal being released. This is significant because the Kalman filtering algorithm not only uses measurements from the current satellite pass but also from prior satellite passes to calculate positions from just one or two Argos messages.

Run the trial mission for four to six hours, leaving the tag outside with a clear view of the sky. It can be beneficial to run a pass prediction via the Argos website to ensure multiple satellite passes are scheduled during the mission window.

If the primary purpose of the trial is to hit the Argos satellites and generate locations, the recommended settings are one step with a 250-uplink limit and no data products enabled. If data product testing is desired, ensure the summary periods fit within your six-hour testing time.

At Sea Mode ⓘ

Initial Pattern (add pattern)

Duration	Location Uplink Limit	Limit Type	Pinger	Prevent Data Uplink	Step Lock	Actions
6 Hours (6 Hours)	250	Total	×	✓	×	✎ ✕ ↺

Add Step

Hauled Out Mode ⓘ **DISABLED** ⏻

Figure 25—settings for priming Argos locations; a single six-hour step with a 250-uplink limit and no data uplinks.

When testing multiple tags, it is important to space out the transmissions, so they do not interfere with one another. This is easily accomplished by using a magnet to activate tags ten-seconds apart. Alternatively, it can be accomplished by starting tags using Tag Agent, placing tags in a bucket of salt water, and then pulling each tag out of the bucket, ten seconds apart. Wildlife Computers recommends only testing four to five tags at a time to avoid signal collisions. You could alternatively run an [Argos Transmitter Test](#) as described above.

After the trial, review your results in the data portal. Use Tag Agent to change the tag settings and switch the state to Auto-Start or Stop.

The Pinger

The pinger is used for radio tracking recovery. When enabled, a SPOT tag sends out low-power pings every two seconds while at the surface. With an appropriate receiver and directional antenna, the tag can be located. Excess power drawn from the pinger is negligible.

Battery Isolator Screw

Certain SPOT tags with ample battery power (>2g lithium metal) include a battery isolator screw. The isolator keeps batteries disconnected during shipment. Once tags arrive at their destination, the screw must be inserted to connect the batteries.

Tag Agent displays the SPOT tag battery status on the lower left.

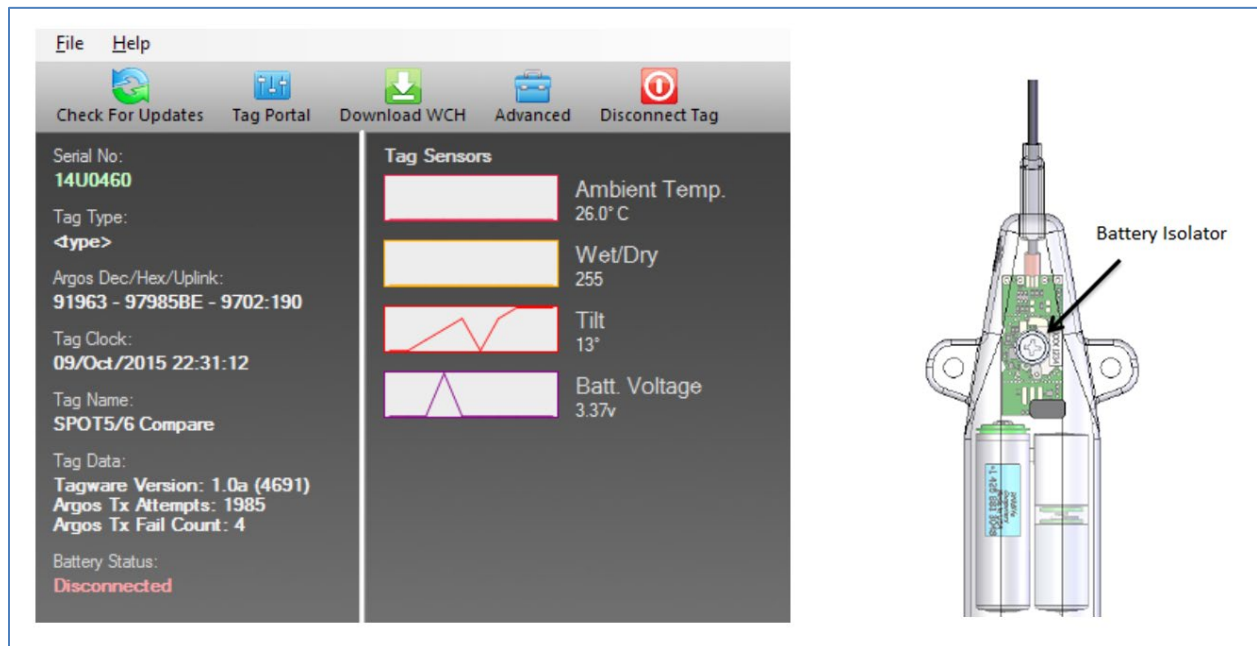


Figure 26—Tag Agent showing the Battery Status as disconnected and the placement of the battery isolator screw on a SPOT-257 tag.

What is Antifouling Paint and Why You Should Apply It

Heavily fouled tags can be hugely detrimental to tagging studies as fouling growth over critical sensors impedes the tag's transmitting performance. Especially for deployments in tropical waters, it is imperative that tags be protected against marine growth.

Wildlife Computers leaves the decision to apply antifoul coating after manufacturing and before deployment entirely to the researcher's discretion. Excluding animals that regularly haul-out, ***we strongly recommend that tags be treated with some antifouling coating to ensure the best possible chance of a successful deployment as Wildlife Computers does not provide warranty against biofouling.***

Wildlife Computers endorses two antifouling coatings: Micron and PropSpeed.

Micron is a range of copper-based antifouling paints, many with a biocide that repels barnacles. For optimal protection, it is critical to use [International Paints' Interprotect primer](#) in addition to the paint. Micron66* is a great choice for slow movers like sea turtles and whale sharks. Other Micron saltwater paint options are available and should work well. Proven choices are Micron 66, 77, 99, CSC, and Extra SPC. If Micron paint is unavailable in your area, find an alternative copper-based ablative antifouling paint with a suitable primer. Wildlife Computers does not currently apply Micron antifouling paint.

**Micron66 has been discontinued but can still be found in some stores. Wildlife Computers has been testing Micron CSC and Micron Extra SPC as a replacement. SPOT tags on species such as sea turtles should be painted with one coat of primer and three coats of any Micron paint. When using SPOT versions of the [Wildlife](#)*



[Computers towed tags](#), Wildlife Computers recommends performing a float test once antifouling paint and tethers are applied.



Tags painted with Micron must only be handled with gloves as Micron contains copper and biocides.

Store the tags in a Ziploc® bag as Micron gives off a strong odor. Store the tags in a cool place optimally between 0° C and 5° C.

Propspeed is a foul release silicon coating, not an antifoul, that impedes biofouling adhesion. PropSpeed is non-toxic and widely available. PropSpeed relies on movement for its effectiveness—the more water moves over its surface, the better it performs, as marine growth cannot get a grip to grow. PropSpeed can last up to a year and is mostly non-toxic according to the manufacturer.

Wildlife Computers offers an optional service to sand, mask, and paint tags with PropSpeed antifouling and coat the wet/dry sensors with conductive polymer. Wildlife Computers offers PropSpeed antifouling painting at a charge of \$100 per tag prior to shipping.

For instructions on how to apply antifouling coatings, videos, and more:

<https://wildlifecomputers.com/our-tags/extras/anti-fouling/>



SPOT tag wet/dry sensors should never be covered or coated with antifouling paint. Seawater contact is essential to these sensors for correct operation. Use masking tape to protect the wet/dry sensors when painting.

Antifouling Tests

Wildlife Computers have been undertaking tests on antifouling paint in various parts of the world.

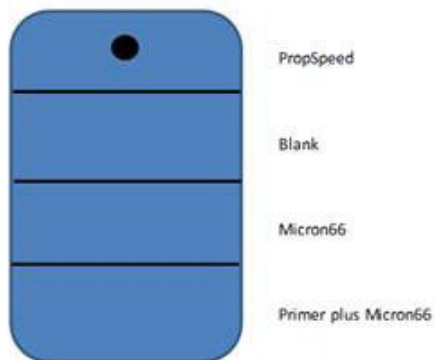
Below is an image of submerged polyurethane and epoxy test plates after two months on a wharf pile in New Zealand.

Propspeed is at the top and has done a reasonable job but has started to fail. Next is a placebo blank area with no protection that has fouled badly. The next strip down had Micron without a primer and the Micron has nearly worn away completely.

The Micron at the bottom has one coat of Interprotect primer and three coats of Micron—it is pristine. We recommend this set up for a successful project.



The plates are as follows:



Resources

Peel Ply Instructions

Backmount SPOT tags are shipped with a sheet of heavy-duty white polyester peel ply. When the peel ply is removed, the tags have a contamination-free, bondable surface that requires no additional preparation.

Attachment instructions

- Immediately prior to attachment, peel off the peel ply fabric
- Apply epoxy to the tag bottom.
- Attach tag to the animal.

Recommendations

- If your application process includes sterilizing the tag, do so with the peel ply fabric in place.
- Do not touch the exposed tag bottom surface with anything other than your epoxy.
- Surfaces with peel ply should not be sanded.

Additional Advice

Once a SPOT is deployed, keep all magnets away from the reset position. Even though it takes two specifically timed swipes of the magnet to change modes, it is still a good idea to keep magnets away just in case.

Fine-grade sandpaper can be used to clean wet/dry sensors. Before deploying, ensure the wet/dry sensors are clean and free of any residual epoxy, tape residue or other contaminants. If the wet/dry sensors are covered, it will reduce the SPOT ability to determine wet and dry.

1. If traveling on a commercial carrier with your SPOT tags:
 - a. We recommend you place the tags in Stop Mode, so they are not transmitting.
 - b. We suggest carrying a copy of your invoice or our product literature identifying the tag as a scientific research instrument.
2. We highly recommend that a laptop with Tag Agent and USB driver installed and a Wildlife Computers USB communications cable are brought to the field location so that communication with the tag is possible onsite if necessary.

Contacting Wildlife Computers

U.S. and International

Members of the Wildlife Computers technical sales and support team are in Redmond, WA, USA, and Havelock North, New Zealand, allowing us to cover promptly a wide range of time zones.

Mailing and Shipping

Wildlife Computers
8310 154th Avenue NE, Suite 150
Redmond, WA 98052 USA

Email

Sales, Quotes, and Inquiries: tags@wildlifecomputers.com
Technical Support: support@wildlifecomputers.com

Phone

+1 (425) 881 3048

Website

WildlifeComputers.com

For Asian Clients

While we welcome your direct correspondence, we recommend that you contact our colleague, Yong Huang, for assistance. Mr. Huang understands the special purchase processes for your countries and will provide you with the best service for the best price. He also is fluent in Japanese, Chinese, and English.

Mailing Address — Please ship tags to our main office in Redmond, WA

Yong Huang
Enfotran Corporation
816 Evergreen Point Road, #217
Medina, WA 98039 USA

Email

yong.huang@enfo.us

Phone

+1 (425) 456 0101

Fax

+1 (425) 456 0303



Addendum

Battery Storage and Testing Guidelines for AA-Battery Tags

The following SPOT tags contain one AA battery. This battery configuration is susceptible to passivation *if the batteries are not properly exercised every month.*

SPOT-177

- AM-S177Q-00
- AM-S177R-00
- AM-S177S-00

SPOT-196

- AM-S196I
- AM-S196J

SPOT-253

- AM-S253G-00

SPOT-258

- AM-S258G-00
- AM-S258H-00
- AM-S258I-00

SPOT-364

- AM-S364A-00
- AM-S364B-00
- AM-S364C-00

SPOT-386

- AM-S386A-00
- AM-S386B-00

SPOT-F-398

- AM-S398A-F-00

SPOT-399

- AM-S399A-00

SPOT-405

- AM-S405A-00

SPOT-413

- AM-S413A-00

To minimize passivation, follow the special storage and battery maintenance guidelines below.

Proper tag storage and battery maintenance are important to minimize passivation, maintain optimal battery voltage, and prepare the tags for deployment. When stored correctly, tags may experience battery life loss of one to two percent for every year of non-use.

As a standard, SPOT tags ship in “Auto-Start” mode for immediate deployment, unless otherwise specified.

Storing SPOT Tags with One AA Battery for Less Than One Month

If your deployment date is less than one month from receipt, simply store the tags in “Auto-Start” mode in a cool, dry environment—optimally between 0° C and 5° C. Tags must not be stored at temperatures warmer than 5° C or colder than -20° C. Remember to read the [pre- and post-deployment checklists](#) to optimize your deployment.

Storing SPOT Tags with One AA Battery for Longer Than One Month

If your deployment date is greater than one month from receipt, place the tags in “Stop” mode before storing in a cool, dry environment— The optimal storage temperature range is 0° to 5° C. For long-term storage, tags must not be stored at temperatures warmer than 5° C or colder than -20° C. [Refer to the Tag Storage and Battery Maintenance section of this User Guide.](#)

SPOT tags can be stored longer than a month, but care must be taken for tags with one AA battery to avoid battery passivation. After storing your tags, you must **connect to each tag monthly** and exercise the batteries. Send Test Transmissions in Tag Agent to confirm the battery voltage is within the acceptable range (3.3V-3.7V). [See the Sending Test Transmission section of this user guide.](#)





Battery Exercise Routine

Only applicable to tags containing one AA Battery. You must be connected to the Internet to run the Battery Exercise Routine.

Run the Battery Exercise Routine in Tag Agent if a tag shows a low voltage reading after three consecutive low Test Transmission results. Refer to the [Tips to Optimize Transmitting Tests](#).

To start the test, in the top menu, select the “Advanced” tab and click “Battery Exercise Routine.”

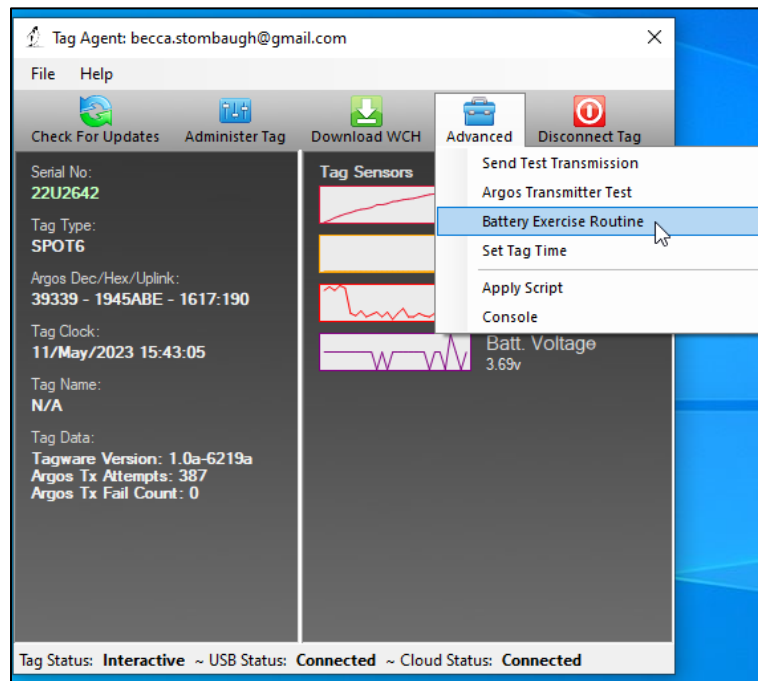


Figure 27—Battery Exercise Routine location in Tag Agent.

The following box will appear:

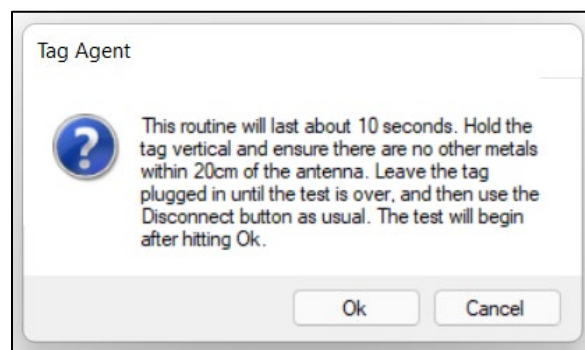


Figure 28—Battery Exercise Routine prompt.

- To run the test, click “OK” to exercise the battery. The test will perform ten transmissions very quickly.
- To exit test, click “Cancel.”

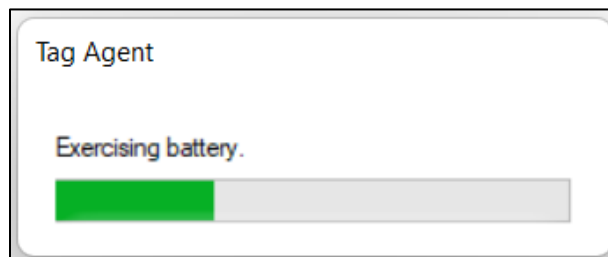


Figure 29—example view of ongoing Battery Exercise Routine test.

After the test’s initial run, if the battery voltage is *below* the recommended threshold, Tag Agent will prompt you to run the test again. Click Ok.

- *You will see the prompt up to nine more times if the battery voltage continues to read below the recommended threshold.*

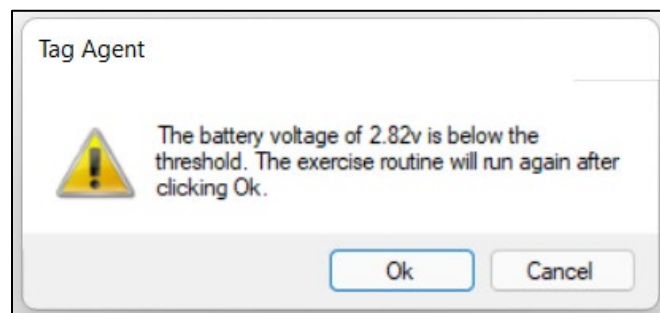


Figure 30—low voltage output. Prompt to rerun test.

If the battery voltage is still below the threshold after ten runs of the test, contact your Technical Sales Consultant (tags@wildlifecomputers.com).

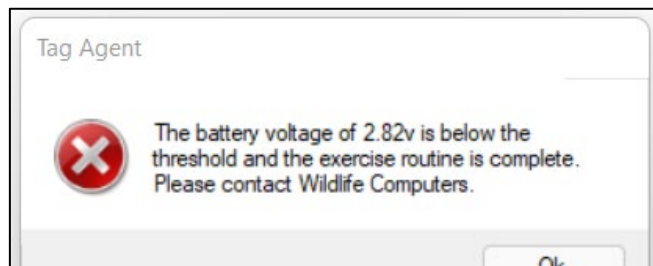


Figure 31—low voltage output. Contact Wildlife Computers.

If the battery voltage is *above* the threshold during any part of the Battery Exercise Routine, Tag Agent will display the following message:

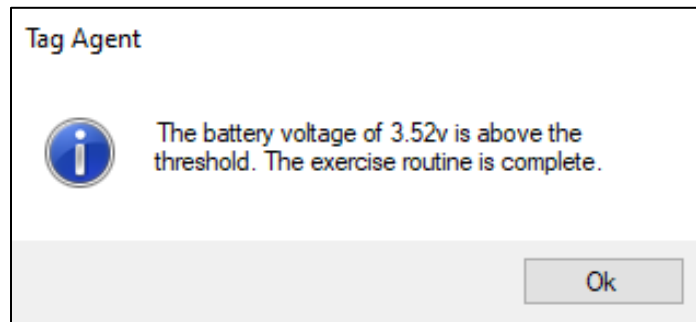


Figure 32—acceptable voltage output prompt.

When you see the battery voltage is above the threshold prompt, the tag is ready for either storage or deployment.

- To continue storing; Disconnect the tag in “Stop” mode.
- To prepare for deployment (<1 month); Disconnect the tag in “Auto-Start” mode.

The outcome of each test will save to the TagLog for each tag within the Tag Portal. Depending on which test you perform (Test Transmission or Battery Exercise Routine), the name of the test will appear in the column.

05-May-2023 22:40:38	teddy@wildlifecomputers.com	Test Transmission (2.2.44.0)	~txs 05/05/2023 22:40:38 PTTHEX [REDACTED] PTTDEC [REDACTED] Test ~txd 127 153 139 041 120 001 085 028 063 095 039 000 000 088 103 015 ~txd 016 017 018 019 020 021 022 023 024 025 026 027 028 029 030 ~txe Battery:3.48 Vpa:3.83 IxCurr:103.27 Reflect:0.23 Vpll:2.76 TxVco:1.58 TxLock:1 TxCnt:383 Accel:1.04:tilt:85 PWR Tx:78 Png:00 MOD L:1C M:3F H:5F PLL:50 mS UT>
05-May-2023 22:40:40	teddy@wildlifecomputers.com	Test Transmission (2.2.44.0)	~txs 05/05/2023 22:40:40 PTTHEX [REDACTED] PTTDEC [REDACTED] Test ~txd 128 153 140 041 120 001 085 028 063 095 039 000 000 022 237 ~txe Battery:3.49 Vpa:3.81 IxCurr:103.52 Reflect:0.23 Vpll:2.76 TxVco:1.58 TxLock:1 TxCnt:384 Accel:1.06:tilt:85 PWR Tx:78 Png:00 MOD L:1C M:3F H:5F PLL:50 mS UT>
05-May-2023 22:40:42	teddy@wildlifecomputers.com	Test Transmission (2.2.44.0)	~txs 05/05/2023 22:40:42 PTTHEX [REDACTED] PTTDEC [REDACTED] Test ~txd 129 153 140 042 120 001 085 028 063 095 040 000 000 212 096 015 ~txd 016 ~txe Battery:3.49 Vpa:3.82 IxCurr:103.76 Reflect:0.23 Vpll:2.75 TxVco:1.57 TxLock:1 TxCnt:385 Accel:1.06:tilt:85 PWR Tx:78 Png:00 MOD L:1C M:3F H:5F PLL:50 mS UT>
05-May-2023 22:40:59	teddy@wildlifecomputers.com	Disconnected (2.2.44.0)	Tag Disconnected in 'Auto Start' mode.
05-May-2023 22:40:59	teddy@wildlifecomputers.com	Control Closed (2.2.44.0)	
05-May-2023 22:46:06	teddy@wildlifecomputers.com	Control Closed (2.2.44.0)	

Figure 33—Tag Portal's TagLog view of Test Transmission test results.

Contacting Wildlife Computers

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Mailing Address—Please ship tags to our head office in Redmond, WA

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