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# SOFTWARE DEFINED RADIO RECEIVER (SDR)

## Introducing RF Receivers for Argos Transmitting Tags

If your tagging application involves recovering Wildlife Computers tags that transmit on the Argos satellite system, you will need to acquire specialized RF (radio frequency) equipment capable of detecting the Argos transmitter frequency of 401.678 MHz.

## Legacy Handheld RF Receivers

In the past, Wildlife Computers offered handheld RF receivers that could effectively pick up both the high-powered Argos transmissions and the lower-power "ping" signals emitted by some of our product lines. However, most radio manufacturers have discontinued production of receivers compatible with these lower-powered signal or Argos transmissions, making it challenging to source suitable receivers.

## Alternative Solution: Software Defined Radio (SDR)

An alternative solution is to use a standard USB SDR in conjunction with an Android phone or tablet. This document will try to illustrate the details of this approach, providing you with a cost-effective and reliable way to detect and recover your Argos transmitting Wildlife Computers tags.

By following the guidelines outlined, you will be equipped with the necessary knowledge and tools to successfully receive and process signals from your Argos transmitting tags.

## Materials

### Items You Can Source From Wildlife Computers

- Yagi Kit—the kit comes with the Yagi antenna and SMA-BNC cable=USD 200
- 20 dB Attenuator=USD 20

### Mandatory Items You Must Source Elsewhere

- Nooelec NESDR
- Adapter—a flexible adapter (important so it doesn't put too much strain on the connection port) to connect the SDR to the phone.



Yagi Kit

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Nooelec RTL-SDR v5 SDR - NESDR Smart HF/VHF/UHF (100kHz-1.75GHz) Software Defined Radio. Premium RTLSDR w/ 0.5PPM TCXO, SMA Input & Aluminum Enclosure. RTL2832U & R820T2 (R860)-Based Radio

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- Turn your computer, phone or tablet into a radio scanner/ham radio receiver that can receive nearly all RF signals! Compatible with Windows, Mac OS, Linux, and Android
- NESDR Smart RTL-SDR v5 can be used for the reception of broadcast AM radio, broadcast FM radio, shortwave radio, CB radio, public security radio, trunked radio, air traffic control, ACARS (plane-ground communications), ADS-B (plane tracking), AIS (ship tracking), POCGAG (papers), NOAA and GOES weather satellites (weather images), weather balloons, radiosondes, DAB radio, DVB-T video, Inmarsat, Iridium, and so much more!
- The best-performing low-cost RTL-SDR available anywhere! Compared with RTL-SDR v3, HF SNR is improved by up to 15dB, VHF & UHF SNR is improved by up to 6dB, tuning accuracy is improved by an average of 4x, and the frequency range is expanded all the way down to 100kHz

Roll over image to zoom in

Back to results



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Compatible Devices Cellular Phones

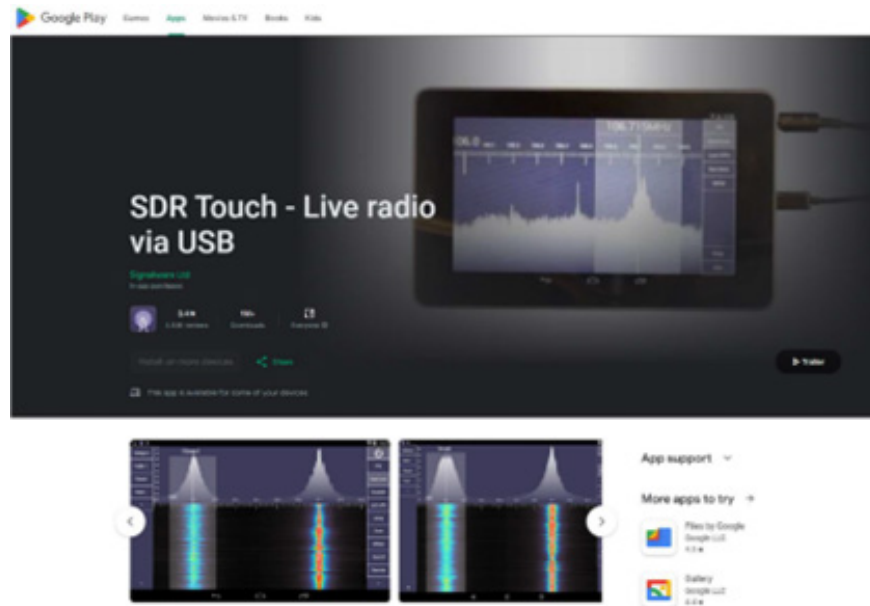
Roll over image to zoom in

# SOFTWARE DEFINED RADIO RECEIVER (SDR) - CONTINUED

## SDR Software

The most suitable software to use with the SDR is SDR Touch. SDR Touch is available in the Google Play Store.

- SDR Driver—download and install the SDR driver: [https://play.google.com/store/apps/details?id=marto.rtl\\_tcp\\_andro&hl=en&gl=US](https://play.google.com/store/apps/details?id=marto.rtl_tcp_andro&hl=en&gl=US)
- SDR Touch—download and install SDR Touch: <https://play.google.com/store/apps/details?id=marto.androsdr2&hl=en&gl=US>



- SDR Touch Key—download for full operational functionality (USD 12): <https://play.google.com/store/apps/details?id=marto.androsdr.key&hl=en&gl=US>

## Additional Materials

The following materials will help support the SDR and reduce the strain on the connectors.

- Phone Case
- Velcro



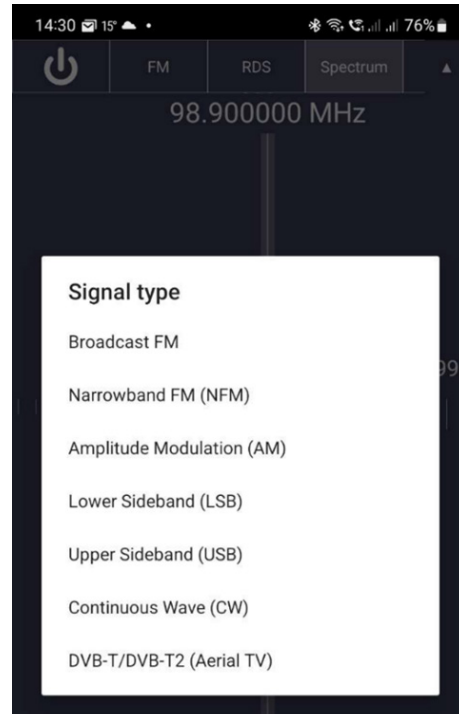
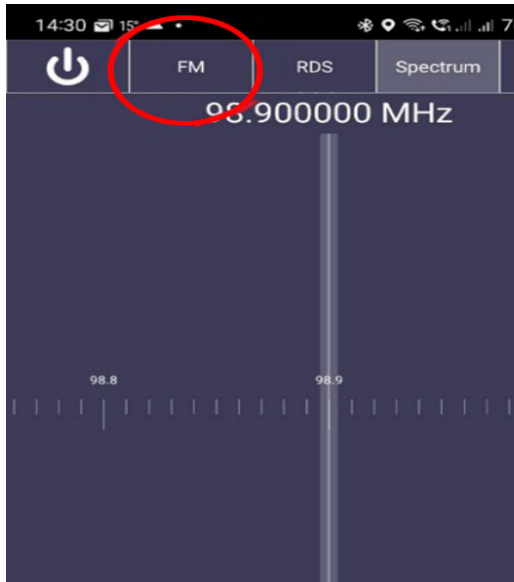
# SOFTWARE DEFINED RADIO RECEIVER (SDR) - CONTINUED

## Software Setup

### Step One: Selecting the Mode

After the required software is installed, plug in the SDR device to the Android phone. The application should start automatically and a welcome screen will appear.

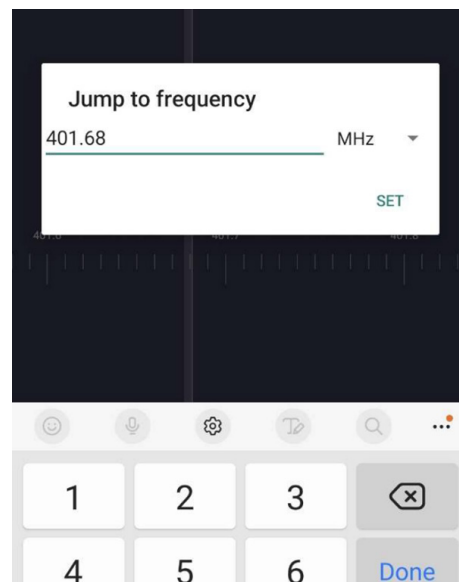
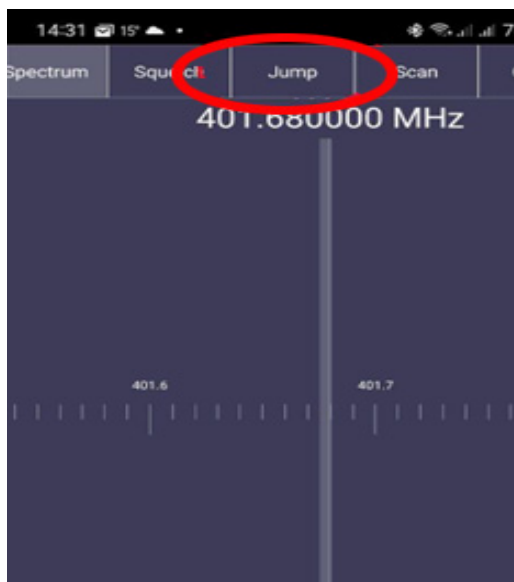
- If the receiver can be heard, **turn it OFF** by pressing the Power button on the top left of the screen.
- Press the FM tab to the right of the Power button and change Signal Type to **Lower Sideband (LSB)**.



### Step Two: Setting the Frequency

To set the correct frequency, use the Jump tab. To find this tab, scroll to the top menu bar. Scroll until you see Jump. Select this tab.

- Set the frequency to **401.68** MHz. Click **SET**. This is offset from the tag frequency of 401.768 so you can hear the transmission clearly in the lower sideband.

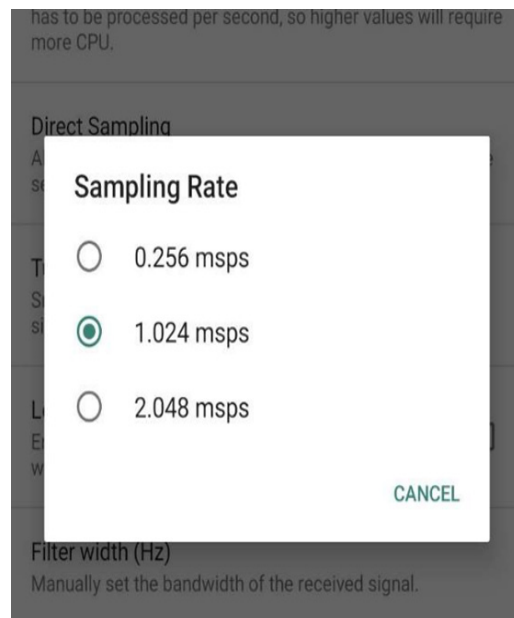
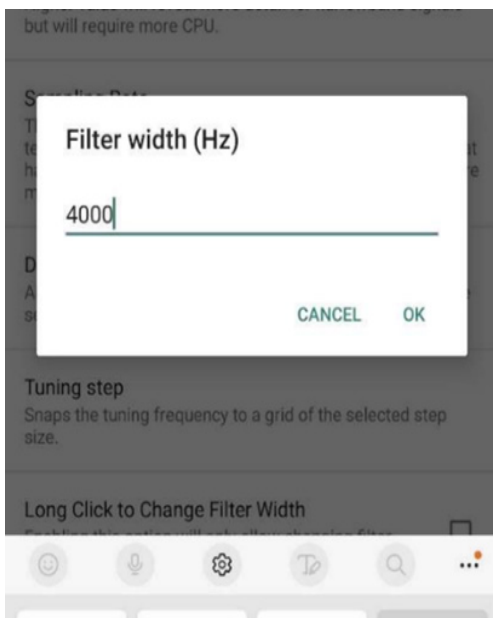
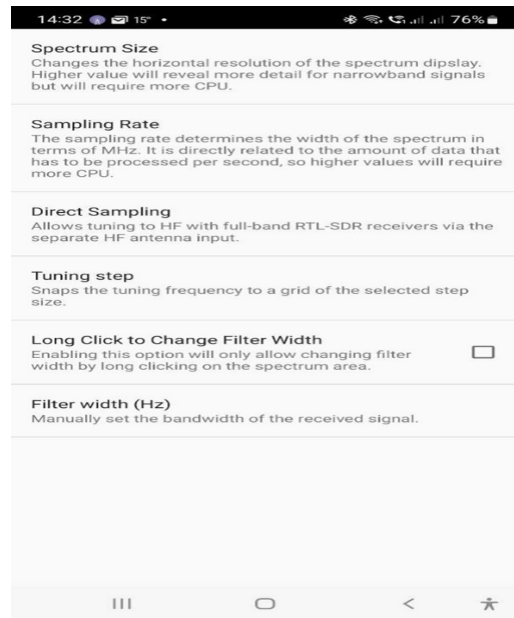
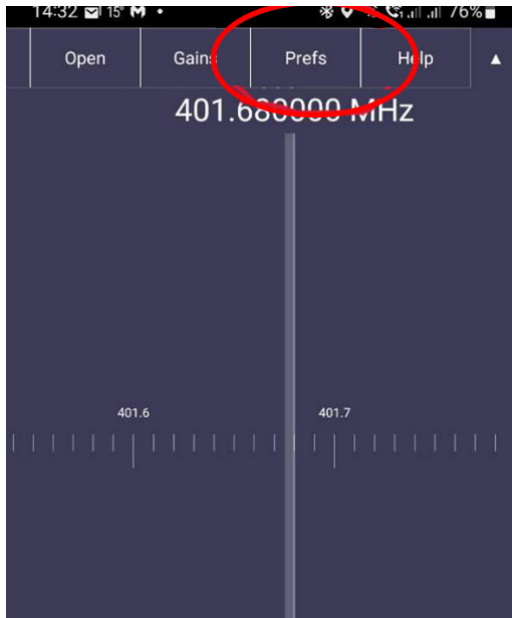


# SOFTWARE DEFINED RADIO RECEIVER (SDR) - CONTINUED

## Step Three: Setting Preferences

Set the sampling rate to 1.024 msp/s and filter the width to 4000 Hz.

1. Click **Prefs** tab.
2. Select **Sampling Rate**. Then select **1.024 msp/s**. Click off the window. *You cannot change the sampling rate when the device is on.*
3. Select **Filter Width** (Hz). Then enter **4000**. Click **OK**.

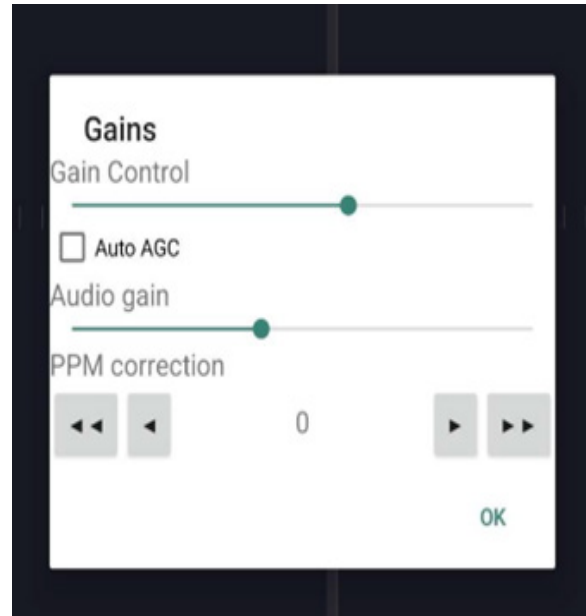
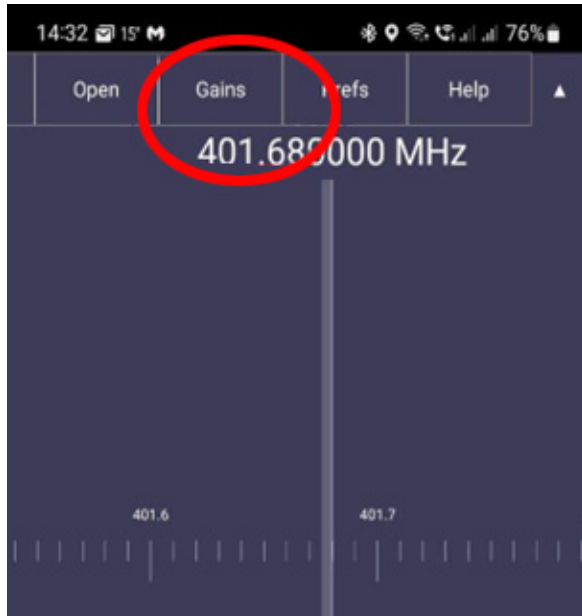


# SOFTWARE DEFINED RADIO RECEIVER (SDR) - CONTINUED

## Step Four: Setting the Receiver Gain

AGC must be disabled on the receiver and a manual gain setting added. To start, set the controls as in the image below. Increase or decrease the gain depending on the strength of the PTT transmission.

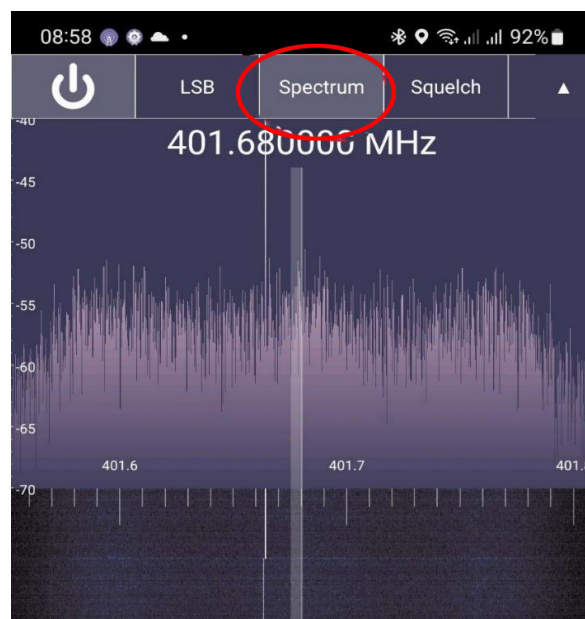
- Adjust **Gains** while looking/listening for the tag.
- As the tag gets closer, toggle the gain to the **right** or **left**.



## Step Five: Turn on the Receiver

Scroll the top menu bar tabs to the right until you see Power icon and select it to turn the receiver **ON**.

- If there is no spectrum displayed, use the **Spectrum** tab to turn it **ON**.

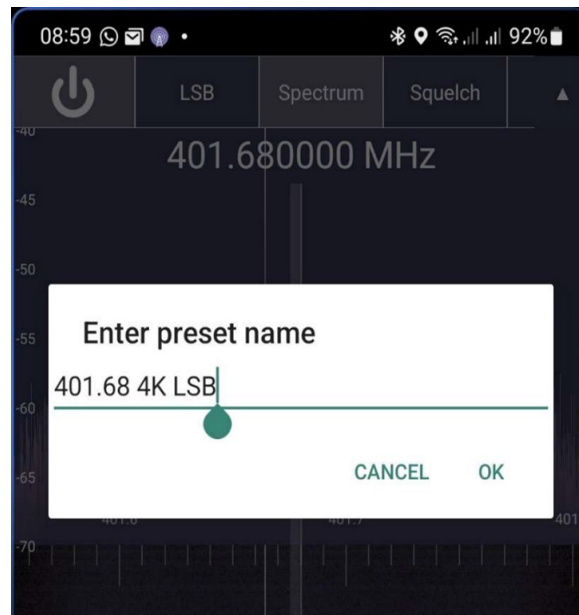


# SOFTWARE DEFINED RADIO RECEIVER (SDR) - CONTINUED

## Step Six: Create a Saved Setting

Create a saved setting to capture your setting preferences and enable simple start up next time.

1. Create a saved setup by pressing the **+ tab** at the bottom of the screen (to the right of the new category).
2. Create a save name that identifies the settings. Click Ok.

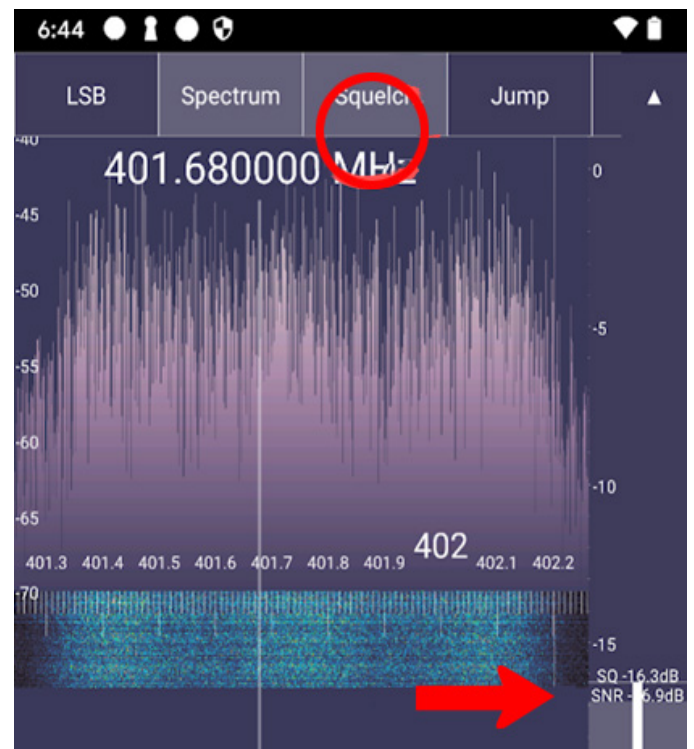


The next time you start up the application you can select the preset name and all the saved settings will return.

## Step Seven: Utilizing Squelch

You can utilize the **Squelch** feature to help filter the noise.

1. Scroll through the top menu and find **Squelch**. Press it.
2. A secondary chart will appear on the right side of the screen. Use your finger to slide the bar just above most of the noise, such that (ideally) only a transmission from the tag breaks through this floor. This helps limit the amount of noise you hear while listening for the tone.



# SOFTWARE DEFINED RADIO RECEIVER (SDR) - CONTINUED

## General Use

- Make sure that **Battery Optimization** is removed for the SDR Touch software.
  - Your phone/tablet may give you the option when you first run the software. If not, go into your device's **Settings > Apps > SDR Touch > Battery** and select **Unrestricted**. This allows the software to run when the screen is off.
  - This is important so that the settings aren't accidentally changed when using the device in the field.
- **Do NOT attach an antenna directly to the SDR, it will pick up too much noise from the phone/tablet. Always use an antenna connected via a coaxial cable.**
- For ease of use and comfort, utilize Bluetooth earbuds and control the volume with the phone volume controls.
- The spectrum view can be zoomed in or out using two fingers.
- Frequency can be changed by sliding the spectrum or by tapping on a point in the spectrum. If zoomed in, the frequency will not slide.
- Make sure your phone is fully charged before you begin. You cannot charge your phone while using the SDR connector as the connector is plugged into the USB-C charging port on the phone,

## Dealing with In-band Noise

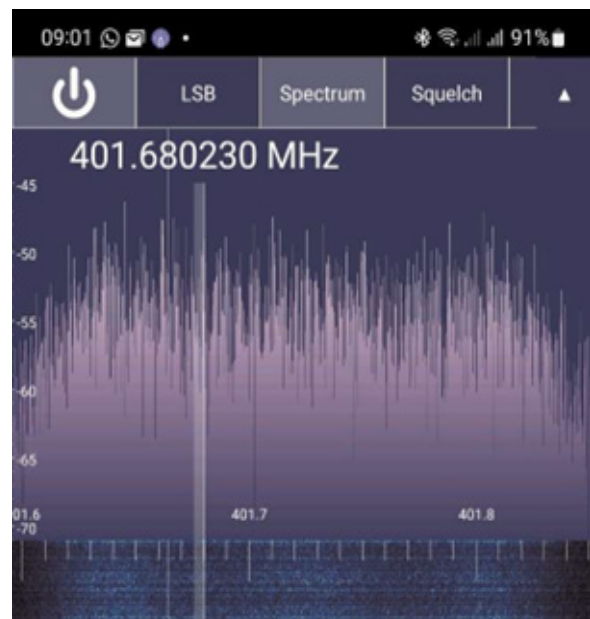
Once you are set up and receiving, you may notice a constant tone and see an increased noise level in the center of the spectrum. This can be caused by an IQ imbalance which this software does not correct. In this case, you can adjust where you listen within the spectrum to avoid the noise.

Identify an area in the spectrum where there is lower noise and select it by touching the screen.

- You will see your frequency marker change to this location.
- You will notice that the frequency has changed and can shift the bar back to your chosen frequency (or close it) by sliding the spectrum to the left or right until the frequency readout is correct and, hopefully, no tones are heard.

Note that the frequency will return to the center and be noisy again if some menus are selected or the screen is rotated. You will need to switch the device screen off to lock this offset setting while monitoring.

You can also utilize the Squelch feature to help filter noise and create a noise floor for transmissions to be heard through.



# SOFTWARE DEFINED RADIO RECEIVER (SDR) - CONTINUED

## Tracking Tips

Radio tracking and locating a tag requires a level of skill that comes with experience. Tracking a stationary tag on land is quite different from tracking a drifting tag from a boat. For this reason, **Wildlife Computers highly recommends practicing these tracking techniques before attempting them in a real-life scenario.** This will ensure familiarity with the receiver, demonstrating what to listen for, and how to change the settings such as RF Gain, Squelch, Attenuation, and Volume as you get closer to the tag.

The receiver has RF Gain and Volume controls that are distinctively different. Think of RF Gain as the sensitivity of the receiver and Volume as the loudness. Use a 400 MHz UHF directional Yagi antenna connected to the receiver. We also recommend using Bluetooth headphones or earphones to reduce external noise and increase the chances of hearing a weak signal.

When searching for a lost tag, if you have GPS or Fastloc® quality locations, start around the last known location. If you have Argos-quality locations, filter all of the Class 3 (or best) quality locations from the past 24 hours, plot them on a map and start at an average location between those points. Search in a slow 360° sweep with the Yagi antenna horizontal to the ground while listening for the bearing with the strongest signal. Rotate the antenna 90° (perpendicular to the ground) and repeat the 360° search. Continue until you can determine a definite direction with the strongest signal. Ideally, narrow the search arc from 360° to between 60° and 90° and still maintain directionality of the strongest signal, all while moving towards it.

Be aware that if a signal reflects off a physical structure like a building or a cliff, you may receive a false bearing. Change your position by moving several meters and continue tracking to reduce reflected signals.

Directionality will become difficult to determine as the signal strength “swamps” the receiver. There are a few ways to regain directionality. First, insert the in-line coaxial cable attenuator. Next, reduce the **Gain**. These steps may need to be implemented in stages as the tag signal becomes stronger.

You may want to spend some time scanning 360° while adjusting the **Gain**. Often the signal strength on one particular step will provide the best directionality. If the Gain is set to the minimum and all the attenuation is added but the tag directionality still cannot be determined, try unplugging the coaxial cable completely and searching with just the receiver to listen for the strongest signal to help pinpoint the tag with the last ~10 meters.

## Contact Us

If, at any time, you have any questions, feel free to contact us.

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