



# MANUAL OF TELEMETRY USING VHF EQUIPMENT

Dear Customer,

Thank you for your purchase and the best wishes in your research.

VHF telemetry has been used at least since the 1970's and nowadays is widely accepted as an essential tool for wildlife research. However, we know that there is still too much lack of knowledge about it and in many occasions the researcher is eager to use it but he has no experience and nobody is there to help him/her in the learning process. This is why we have written this manual, to help you get the most out of your new equipment.

It really is very simple. Turn on the receiver, connect it to the antenna, get ready for listening for the beeps and take notes. Nevertheless, there are many details that even if they may seem insignificant in the beginning, they can mean the difference between finding the transmitter at only a few meters or at several kilometers or miles away.

Above all, we want you to never forget one single thing:

**Practice as much as you can with your telemetry equipment before attaching the transmitters to your study animals.**

And if possible, practice in the same place where your research will be held.

This will allow you to get experience under controlled situations. This way, once the transmitters are deployed you will have a lot of experience that will help you avoid potential problems and get the most out of your equipment.

The telemetry equipment is divided in:

- > Transmitter
- > Receiving Yagi Antenna
- > Antenna-Receiver Cable
- > Receiver

## TRANSMITTER

Your new transmitters will generally arrive with a magnet located over a label that contains the frequency (e.g. 148.100), and a code (e.g. A100).



Figure 1: Sample labels included on each transmitter.

If the transmitter is small, the label is a circle and the magnet goes right on it; if the transmitter is big then it will most likely have a larger label and the magnet will go above or close to the gray dot.

The transmitter will turn on as soon as you remove the magnet and will start transmitting a pulse train. This means, an uninterrupted series of beeps that can be listened with the receiver.

Considerations:

### TURNING OFF:

1.-Whenever you want to turn off the transmitter is very important to verify that the transmitter is really turned off. **The label indicates you the nearby area where the magnet has to be put on.** However it is not always the exact place.

2.-If you are going to store the transmitters for a long period of time you have to keep them **separated at a distance of at least 10 cm from each other**. The magnet field can nullify if you have another magnet close by, then the transmitters could turn on even if the magnet is in position.

### **TURNING ON:**

The transmitters contain a microprocessor. It turns on when you remove the magnet. Sometimes such microprocessor starts working erratically when the magnet is not removed quickly enough. This is because the magnet turns the microprocessor on and off several times in just tenths of a second. When this happens the microprocessor may work erratically or not work at all and this can only be detected if you have a receiver listening to the beeps. Typically, you will hear the transmitter in mortality mode or making weird noises, or not working at all.

1.- When removing the magnet, remove it quickly and take the magnet away so it will not get close to the transmitter by accident.

2.- Whenever you turn on any transmitter to be attached to the animal, **have a receiver in hand to listen to the signal so you can be sure that it is working properly**. Move the transmitter and verify that the activity and inactivity modes are working.

If you detect something strange please put the magnet back on so the transmitter turns off and wait at least 10 seconds. Remove the magnet again and the transmitter should be working fine.

### **YAGI ANTENNA**

The most widely used antennas are 3 element Yagi antennas. It is very important that you follow the assembly instructions since any error may cause your antenna to lose tuning and then the detecting range could decrease (could decrease by 50% or more)

Once you have assembled your antenna take note of the following tips:

1.- The higher above the ground the better for the antenna reception.

2.- Always try to hold the antenna by its handle. It might be more comfortable to hold it by its center but this will not help for the signal detection since you will cause interference. The best is to be behind the Reflector element. Once the signal is detected you can hold it by the center if this does not affect the signal reception in a significant way.

2.- It is usually better to have the antenna in a vertical position rather than horizontal. This has to be verified every time you are tracking.

3.- When you find the signal for the first time always turn around 360 degrees to find the strongest signal.

## ANTENNA-RECEIVER CABLE

- 1.- Verify that the connections are tight and that the cable is in good condition.
- 2.- The shorter the cable, the better. The Standard is 1.5 to 2 meters (4 to 6 feet)
- 3.- If the cable is in bad condition you can buy another one with us or at any good electronics store. Ask for it as BNC-BNC cable.

## RECEIVER

The Receiver has two very important parameters that we can manipulate in order to increase our chances of detecting the signals. These are GAIN and TUNING.

Your RX-TLNx has 3 buttons, DIAL, GAIN and VOL.

VOL: You got it right, it's the Volume. Turn it freely so it won't hurt your ears but so you can listen to the signals.

DIAL: This is the button that controls the TUNING.

GAIN: Controls the GAIN.



Figure 2: Buttons located in the upper part of your RX-TLNx

### TUNING (DIAL):

TUNING is the parameter that allows you to find the frequency to which the transmitter is best heard. By turning the DIAL we increase or decrease the frequency that can be heard in the receiver and it can be read in the LCD screen. To take the most out of it take into consideration:

- 1.- Find the summit of the emitted signal:

In theory the transmitters would be heard in one single frequency. But in reality they send beeps in several nearby frequencies with more or less strength. The figure shows a signal emitted by any transmitter. Notice how the signal is not located in one single frequency, but that it goes from zero strength and starts rising slowly until it gets to the summit and then starts going down.

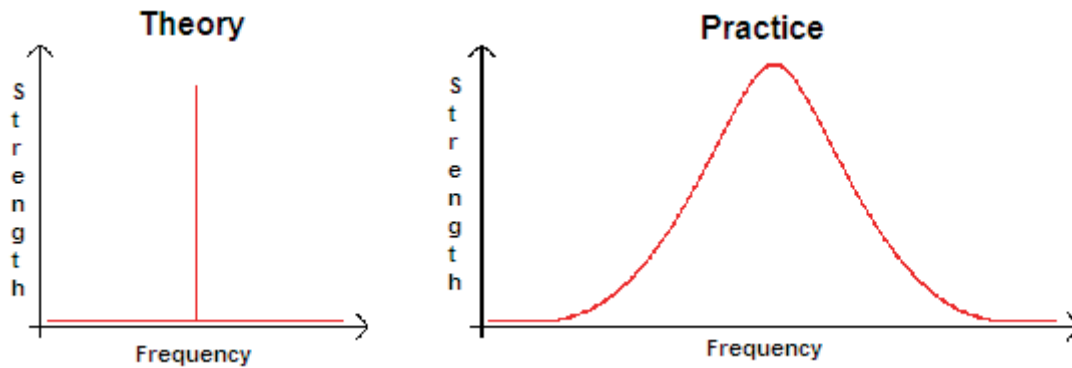


Figure 3: Strength vs Frequency of any transmitter

This is the reason why the beeps can be listened to in a certain frequency and in its nearby frequencies. The goal is to find the frequency where the summit is located in order to get the best distance between you and the transmitter.

How to do this? Once the beep has been detected you have to turn the DIAL and you will notice that the signal is best heard in some frequencies. You will very likely notice that the signal strength starts rising and then starts going down, so you can find the summit.

NOTE: It is important to verify the DIAL's sensitivity. If it is too low you will not have the resolution needed to find the summit. On the RX-TLNX, press [ENT] for 5 seconds. Then press [▼←] once to move the cursor one step down and rotate DIAL to .1KHz. Finally press [ENT] again. This will allow you to have the best resolution to find the signal's summit.

2.- Take into consideration the drift in frequency:

Once again, in theory the transmitters should always transmit in the same frequency but this is not always like that. Different factors, mainly the aging and climate such as temperature will affect the signal causing it to move a little higher or lower in frequency. For this reason, many times the frequency in the label does not match with the best frequency in the receiver. This is why is best to have a guide to start looking for the summit based in your last tracking experience on that particular transmitter, as the summit may not always be in the same frequency.

In the practice and as a rule of thumb the higher temperatures tend to lower the frequency and lower temperatures tend to increase the frequency. This is not a law but it can be an initial parameter.

This does not happen in an instant, so once you have found the summit you don't have to look for it until the next week or so. Most likely you will always find the summit in the same place or very close.

On the other hand, and even if it happens very rarely, you may not find the signal if it moved to a far frequency. This drift could be of up to 5KHz up or down. For instance, if the label in your transmitter indicates 151.655, the frequency could move from 151.650 to 151.660 MHz, or if it indicates 148.100, it could move from 148.095 to 148.105 MHz.

It is uncommon that the frequency drifts more than 1 KHz, so just take the time to search through the 5KHz up or down if you are definitely having problems finding the signal.

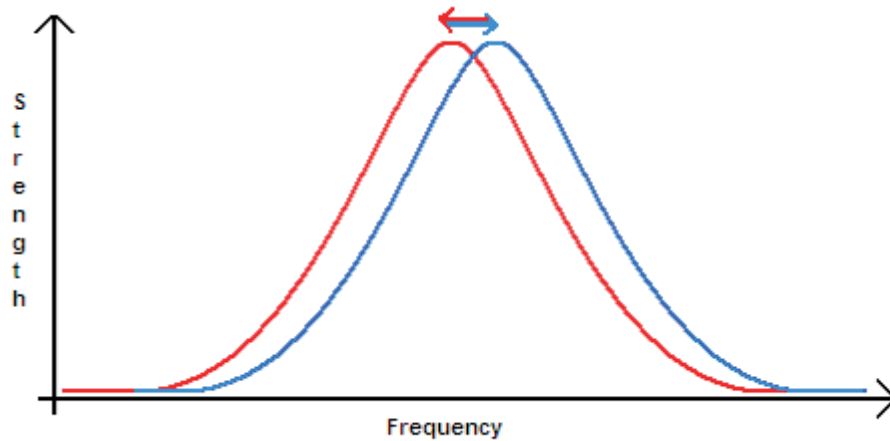


Figure 4: The frequency may drift a little because of different factors

### GAIN:

The GAIN controls how much signal strength you allow to come into the receiver at the tuned frequency. In many receivers there is not such a button, or it is linked to the volume as one single button, but it is of great help to have it separated.

As you increase or decrease the gain you will notice that it sounds just like if you increased or decreased the volume. Don't let this confuse you; the volume and gain are very different.

Volume only controls how loud the signals are heard but it depends entirely on how much strength the Gain is letting in. For example, if the Gain is at the minimum then no signals come into the receiver, no matter if you have the volume to the maximum and then you will hear nothing. On the contrary, if the Gain is at a certain level so you can hear a beep coming from a transmitter, even if you turn the volume to the minimum you will still be able to see that there is signal detected by the receiver by checking out the bars in the LCD screen.

Increasing the gain allows you to let the signals from the transmitters to come in, but you will also let noise in. By decreasing the gain you decrease how much noise comes in, but also the incoming transmitter's signal decreases. Then, what good does it do?

- If it is set to the maximum or close to maximum it helps to locate the transmitters at the greatest distance.
- Once the transmitter is found, to decrease the gain allows you to:
  - o Reduce the noise that besides being bothering, many times doesn't allow you to hear the beeps
  - o Make the antenna more directive and therefore to be able to punctuate the direction where the signal comes from
- To discriminate parasitic signals

Explaining:

1.-When you start to track the transmitter's signal:

**When you start to track it is advisable that you set the gain to the maximum, so you will let the most minimum amount of signal to come in.**

**There are sometimes, or some places where there is too much noise (like in a city) and it doesn't allow you to hear the signal because the noise is louder. In these cases you can decrease the gain a little.**

If you decrease the gain to less than one third you will not hear the transmitter unless you are right above it, regardless of the volume.

2.- Fine adjustment to find the direction from the signal:

Once the signal and best frequency have been found is time to find the direction of the signal. It is here where the Gain is best used. When not allowing much signal strength to come in, the antenna's detecting angle gets narrower and therefore you can determine with more accuracy the direction of the signal. Besides, it gets more comfortable to listen to the signal as you also decrease the annoying noise.

Slowly decrease the Gain by turning the Gain button. You will realize that the less gain you have the more accurate the pointing has to be. Sometimes you can help yourself by using the bars in the LCD screen, as they indicate the incoming signal strength.

3.- What it means when the gain has to be very loud:

If the gain has to be set very high then the transmitter is either very far away, or there are many obstacles between the transmitter and the receiving antenna (could be trees, when the animal is in a den, etc)

4.- When the transmitters are very close:

When the transmitters are very close to the receivers, for instance, when you are in the office, the receiver can detect parasitic signals that are generated by the transmitters. These are very weak but when you are very close the receiver can detect them and there is the possibility that this parasitic signal is the same that one from another transmitter, causing an error since you could think that you are listening to a transmitter that really is not. Or it can happen that you listen to two or more beeps overlapped since you are really listening to several transmitters in the same frequency.

For this reason, when the transmitter is at less than 100 meters, there are no obstacles and you use a 3 element Yagi antenna, the gain should be adjusted to the minimum possible so you can be sure that you are listening to the right transmitter. If you are using the omni directional antenna the distance is reduced to about 20 meters. If there are obstacles between then the distance gets shorter.

Experimentally the RX-TLNX has proven that when the transmitters are at a few meters you can set the gain to the 4th dot (1/3). This way you are sure that you are detecting the summit of each transmitter, no matter if you are using the Yagi or the omni directional antenna.

The following figure shows why this happens:

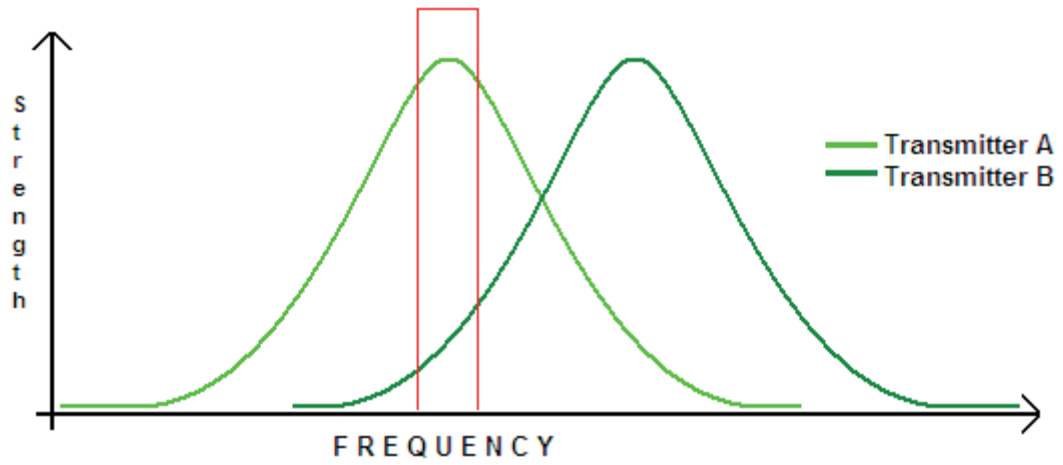


Figure 5: Both transmitters are very close and the low strength emitted by transmitter B can be detected at the frequency where the summit of transmitter A is found.



## FIELD GUIDE

- 1.- Verify that the antenna is assembled correctly
  - 2.- Verify the cable, connectors must be tightly connected and cable must be in good condition.
  - 3.- Turn on the receiver and tune it to the previous summit.
  - 4.- Turn GAIN to the maximum
  - 5.- Decrease or increase VOL so it is comfortable to your ears but so you can hear well and loud
- As soon as you detect the signal go to number 10**
- 6.- Raise the antenna and put it in a vertical position and make a whole 360 degrees turn, searching for the signal.
  - 7.- Turn the antenna to a horizontal position and make a 360 degrees turn again.
  - 8.- Decrease the gain 2 or 3 dots (up to 1/3) and go back repeat steps 6 and 7.
  - 9.- Move to another place, at least about 100 meters from where you were and go back to step 4.
  - 10.- Once the signal has been found point to where it is best heard
  - 11.- Tune with the DIAL so you can find (tune) the summit of the signal.
  - 12.- Decrease the gain little by little with the GAIN so you can still hear the signal and the noise gets to the minimum.
  - 13.- The less Gain you have the smaller the error when finding the direction of the signal.
  - 14.- If the gain has to be very high then it means that the transmitter is very far away or that there are many obstacles between.

### Note from the author:

My experience in this field includes Telecommunications Engineering; my thesis was "Monitoring of endangered species using the Global Positioning System (GPS)"; I also performed as an employee of Telemetry Solutions for almost 4 years; the first year in charge of Latin American sales and after that as Telemetry Specialist in charge of giving customer support of VHF equipment manufactured by Telemetry Solutions as well as GPS equipment manufactured by Televilt. Since May 2005 I am president and partner of Telenax.

All of this is 100% related to Wildlife Telemetry. This manual has been written based in my experience and theoretical acknowledgement. However, since this is a much reduced field with very particular characteristics, there is not enough literature or studies about the affecting parameters. Therefore I ask you to accept this manual as a supporting guide but not as if it had 100% accurate and irrevocable information.

Any information or suggestions about this manual please don't hesitate to send them to [alexcampos@telenax.com](mailto:alexcampos@telenax.com).

Thank you,  
Alex Campos