
VEMCO Acoustic Telemetry New User Guide

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Section 1: What Is VEMCO Acoustic Telemetry All About?

1.1 Acoustic Telemetry Defined

Acoustic telemetry is the transmission in water of ultrasonic energy or sound signals at frequencies generally above our hearing range of 20-500 kHz (20,000-500,000 cycles/sec). Ultrasonic frequencies are generally used for transmitting data underwater because, compared to radio frequencies (100-200 MHz – millions of cycles/sec), acoustic frequencies are absorbed much less. However, acoustic signals, due to their lower frequencies, experience more distortion than radio and cannot transmit as much information per unit time. Our acoustic systems are designed to maximum data transmission and minimize errors due to many physical limitations on the transmission. We use frequencies between 50 and 84 kHz and 180 kHz to maximize transmission range in fresh to salt water.

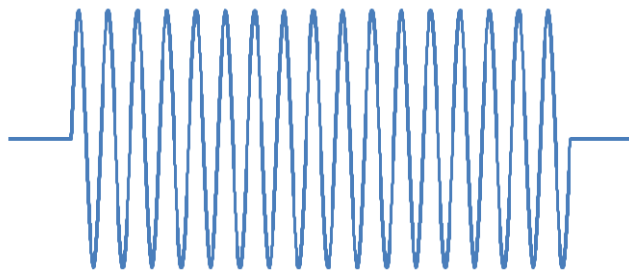


Figure 1-1: Generalized Acoustic Signal

1.2 What is a Transmitter?

A transmitter, or tag (see Figure 1-2), is an electronic device usually implanted or externally attached to a fish that transmits ultrasonic signals. Our tags transmit very short pings of ultrasound (typical frequency = 69 kHz) either at very regular intervals (e.g. 1 second) or as a series of several pings (6-10) that contain a digital ID (identifier) code and sometimes physical data (e.g. temperature) that a VEMCO receiver detects, decodes and stores in memory.

We have two basic types of tags with unique data transmission, **continuous** and **coded**. VEMCO's transmitters range from 6mm diameter up to 16 mm diameter and of various lengths from 16 to 98 mm. Please visit the [transmitter section](#) of our website to see all the available models.

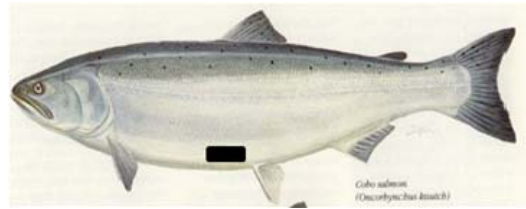


Figure 1-2: VEMCO Transmitters

Continuous Transmitters

A **continuous** tag transmits sequential pings with a precise interval or a varying interval that is correlated to a physical variable such as temperature or depth (see Figure 1-3). Continuous tags are restricted to one frequency each. For example, if you have five tags, each tag transmits its pings on a different frequency (e.g. 51, 54, 60, 78, 81 kHz). Continuous tags are an excellent choice if you are tracking individual fish from a vessel in real time or conducting VRAP positioning studies. To monitor and track animals with continuous tags, you must use a multi-frequency acoustic receiver such as a VR100 (see Figure 1-7).

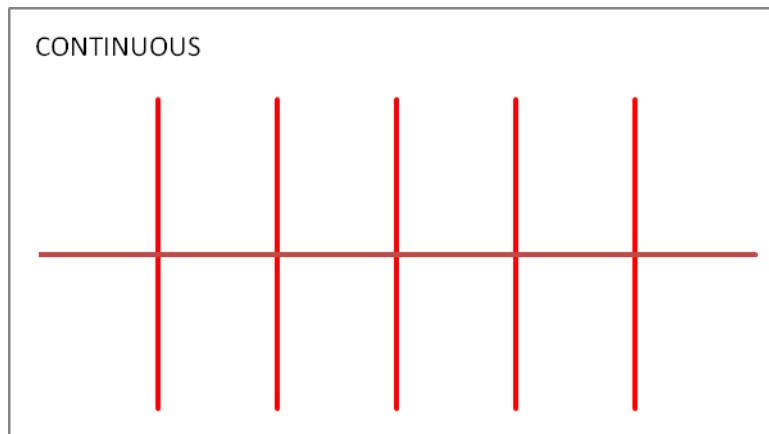


Figure 1-3: Diagram of a Continuous Tag Transmission

Coded Transmitters

A **coded** transmitter transmits a series of pings we define as a burst or code burst. Each burst contains a digital ID (identifier) code and sometimes physical data (e.g. temperature, depth or acceleration) (see Figure 1-4). The code burst usually occurs over a few seconds followed by a delay which is usually determined by your particular study design. It also often depends on such factors as number of tagged animals, swimming speed, detection range, etc. Delay is randomized to minimize the chance that the pings from any two tags will overlap or collide repeatedly. For example, a typical coded tag might have a delay that ranges between 30 and 90 seconds which means the tag will transmit a series of pings every 30 to 90 seconds. This type of transmission scheme allows many tags to transmit on the same frequency enabling researchers to conduct large scale population studies.

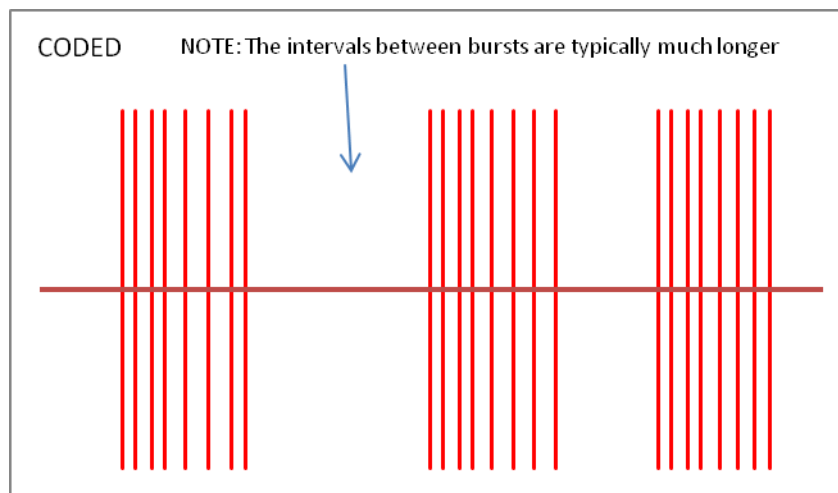


Figure 1-4: Diagram of a Coded Tag Transmission

Coded ID Tag vs Coded Sensor and ID Tag

Within the coded tag family there are two types: tags that transmit an ID code only (referred to as a **pinger**) and tags that transmit both an ID code and sensor data such as temperature, depth or acceleration (referred to as a **sensor transmitter**). Sensor transmitters provide a “view” into the behaviour of animals by transmitting physical or physiological data of an animal’s natural environment. Sensor data can often be used to explain “why” animals behave the way they do and not just “where” they go! The V9AP (see Figure 1-5) is an example of a **coded sensor transmitter**. It transmits a unique ID code along with depth and acceleration data.

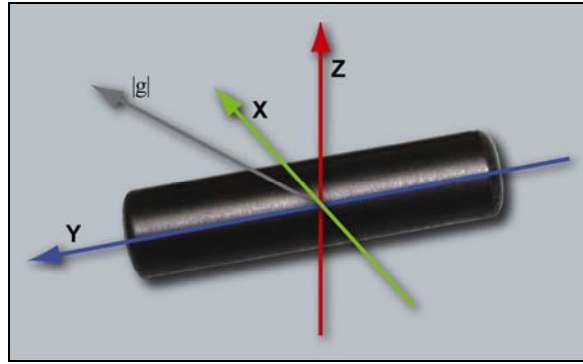


Figure 1-5: V9AP Coded Sensor Transmitter

What is a Code Map?

A **coding technique** involves the details of how the tag ID and data are encoded. VEMCO has several types of coding techniques. Users will be familiar with names such as R256, S256, R64K and more.

A **code space** is comprised of the coding technique and fixed parameters that provide detailed instructions for a receiver. Parameters include such things as the length of the first interval and the frequency of operation. Code spaces in current use include A69-1105 (sensor tags) and A69-1303 (pingers). The unique code space nomenclature is all a receiver needs to fully decode any VEMCO tag transmission.

Finally, a **code map** is a collection of code spaces that determines the type of tags a receiver can decode. VR2s, for example, can have up to four code spaces whereas VR2Ws can have up to eight. More code spaces means that a receiver can detect a greater number of unique tag IDs.

In 2009 VEMCO released a new global code map, MAP-112. All VR2W, VR3 and VR4 receivers should be configured with MAP-112. VR2 receivers should be configured with MAP-110.

1.3 What is an Acoustic Receiver?

An acoustic receiver detects and decodes transmissions from acoustic tags. Our receivers are categorized as **passive** or **active** which define how the receivers are used. Passive receivers like our VR2W (see Figure 1-6.), VR3, and VR4 (where VR = VEMCO Receiver) are designed to be moored in a fixed location to detect the presence/absence of coded tags. These receivers are single or dual frequency, have plenty of data storage and are designed to last for greater than one to five years on a single battery. Active receivers such as our VR100 (see Figure 1-7) are used for actively tracking animals.

1.4 Passive Monitoring with Fixed Listening Receivers

Passive monitoring is used for investigating population responses over large areas and time such as migration routes, home range, spawning and feeding areas identification, survival estimates, etc. VR2Ws, VR3s and VR4s are most commonly used for this purpose. These receivers are usually setup as “curtains” or “gates” across shorelines or in arrays to quantify the amount of time animals spend in an area. They record the presence of coded transmitters only.



Figure 1-6: VR2W Acoustic Receiver

Batteries

The VR2W is powered by a TADIRAN lithium 3.6 volt industrial D-cell battery. A new battery will provide service for approximately 12 to 15 months. We recommend that you record the amount of time usage if you are frequently swapping batteries in and out of your receivers. Always ensure your batteries are reasonably fresh and have not been shelved for long periods of time prior to use. The manufacturer date code indicates when the battery was built.

Mooring

VR2Ws are moored in many configurations often reflecting the bathymetry and oceanographic/weather conditions. A simple mooring design generally works well. However, in rougher conditions, heavier weights and mooring lines are usually required. If a bottom mooring is desired, the VR2W should be positioned above the floor such that it has an unobstructed “view” of tagged animals within their expected acoustic range. Ensure the VR2W’s hydrophone is unblocked (e.g. do not position an air filled buoy directly above the hydrophone) and free of any biofouling. In high flow locations, you may consider using hydro dynamically shaped buoys and low profile anchors.

Spacing

Receiver spacing is generally determined based on range testing and historical acoustic data. Our position is that you should try to space receivers such that you achieve good detection probability in most or all weather conditions. It is not always necessary to have 100% coverage if you have several other locations where you know the animals will be passing through. However, if you wish to accurately quantify the passing of animals through receiver locations then you should strive for 100% detection probability. Typical spacing is usually between 100 and 1,000 meters.

Data Uploading

VR2 and VR2W receivers store detection data in memory along with status and health information. VR2s can store up to 300,000 detection events and VR2Ws can store approximately 1,000,000 detections. Uploading data from older VR2s can take considerable time – sometimes up to two hours. Therefore, you should have replacement receivers ready to put in place if you cannot afford the time to stay on station. The VR2W has wireless *Bluetooth*® capability and can upload all data within minutes. Using VUE, VEMCO’s PC software, you can store data in files, view detections and setup your receiver for its next deployment within a few minutes.

Data Analysis and Detections

Detection data is easy to manage. Each detection event is recorded with date, time and sensor information if the transmitter is equipped with a sensor. Most researchers use VUE or use their own custom database to store their data. There are also statistical and GIS packages available that facilitate movement animations, home range analysis, and advanced statistical tests.

1.5 Active Tracking with Mobile Listening Receivers

Active tracking entails following tagged animals from a vessel using an acoustic receiver and directional or omni-directional hydrophone and is very useful for investigating animal behaviour, such as mating, predation, feeding, diving over short periods of time.

Our active tracking receivers include the VR100, VR28, and VR60. The VR100 (see Figure 1-7) is the newest member of the family since 2006. This is a multi-frequency, digital signal processing (DSP) receiver that digitally samples acoustic sound and provides output that can be heard by the human ear and data that can be stored in its memory.



Figure 1-7: VR100 Receiver, Omni-directional (VH165) and Directional (VH110) Hydrophones

Electrical Hookup

The VR100 can last for several hours on a full charge of its internal battery. If you need to track for longer periods of time, you can connect the VR100 directly to an external DC (auto/marine) battery or to an AC source (wall socket or DC-AC inverter). However, care must be taken to select an inverter that provides a “clean” sine AC signal. Inverters can create electrical feedback noise that may significantly impair a receiver and reduce range. Please contact us for advice.

How Do I Track and Position a Tag?

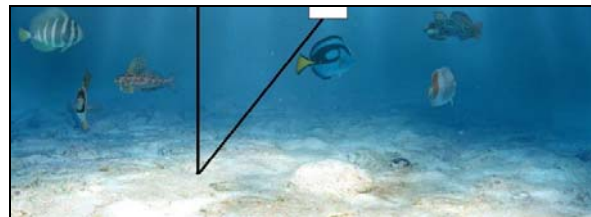
*“Experience is that marvelous thing that enables you
to recognize a mistake when you make it again.”*

(F.P. Jones)

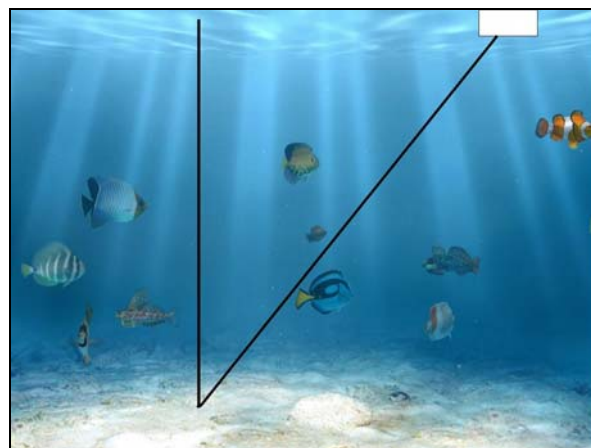
Active tracking gets better with experience and requires high level understanding of how a receiver and hydrophone function together in an ever changing aquatic environment. When tracking, remember that the equipment may seem to perform widely within a day, between days and in different areas. This is usually a result of changes in weather, waves, bathymetry, etc. and not a problem with the equipment. Following is a list of basic tips to keep in mind when tracking:

1. Use your ears! Recognize subtle changes in the receiver speaker output. You will notice that pings can vary in strength from ping to ping but you will learn to recognize when you are getting closer or moving away by detecting average changes over time and by monitoring the receiver data on the panel.
2. Turn off your depth sounder if possible. Depth sounders can negatively impact the performance of your receiver.
3. Use the Manual Gain setting on your receiver (see VR100 Hardware Manual). Auto gain is usually best for unattended monitoring or times when you have located your animal and are collecting sensor data (e.g. depth or temperature).
4. As you approach your tagged animal, lower the Gain so that the signal is still audible but not very strong. You will find it easier to determine an accurate bearing to the tag with the directional hydrophone. With experience, you will be able to determine the bearing very precisely by slowly sweeping the hydrophone back and forth and watching the signal strength values. Maximum signal strength will indicate the bearing. Occasionally, point the hydrophone from 180 to 90 and 270 degrees to rule out the possibility that you are listening to echoes or moving past the tag. Depending on depth, you should be able to hear a loud signal at very low gain when you are very close to the tag.

5. Some researchers position by triangulating based on the bearing from different locations. This is time consuming and is prone to positioning inaccuracies. However, this procedure is sometimes necessary especially if the animal's behaviour is influenced by your activity.
6. Be aware that your tracking activity may influence the behaviour of the animals you are tracking. If you are in shallow depths and/or tracking pelagic animals, you may be influencing their movements and depth patterns when you are in close proximity.
7. When you think you are on top of the tag or animal, the directional hydrophone should give you a strong signal in 360 degrees. Rotate the hydrophone and listen. You can also orientate the hydrophone to point down into the water column. This should produce a very strong signal when you are above the tag.
8. Positioning accuracy will depend on depth (see Figure 1-8). In deep water, positioning accuracy will be less simply due to geometry. The horizontal distance to the actual position is greater for the same angle to the animal in deep water.



(shallow)



(deep)

Figure 1-8: Impact of Depth on Positioning Accuracy

9. The accuracy and resolution of sensor data from continuous sensor tags depends on the quality of the acoustic signal. The time interval between pings is correlated to the sensor value and the receiver settings for the tag should be set according to the tag specifications that are sent by VEMCO.

1.6 Study Design

Choosing the Transmitter Model

The model of transmitter that you choose depends on:

- size range of the animals in your study
- battery life you expect to achieve
- transmission frequency of the transmitters
- acoustic power output of the transmitter model

With regard to transmitter size, there are no regulations that govern how large an animal must be to be implanted with a transmitter. Many fish biologists adhere to the 2% guideline where the transmitter weight in air should be 2% or less of the fish weight in air. Table 1-1 provides calculated fish weights based on the 2% guideline for VEMCO's non-sensor transmitter models.

Tag Model	Tag Weight in Air (g)	Fish Weight (g)
V6	1	50
V7	1.4-1.8	70-90
V8	2	100
V9	2.9-4.7	145-235
V13	11	550
V16	20-36	1-1.8 kg

Table 1-1: Fish Weight in Air as 2% of Tag Weight in Air

The ratio you choose may be different depending on your study design and chosen species:

- Some researchers use higher ratios for salmon smolt studies because research has shown that smolts can accept heavier tags
- Sharks can often handle large tags because they generally heal quickly and have large body cavities.
- Laterally compressed fish (many reef fish) may have small body cavities where smaller tags are more appropriate.
- Some species are more sensitive to surgery and recovery and may require smaller tags.
- Researchers who conduct studies in small areas that do not require large and powerful transmitters often use smaller tags in larger fish.
- Researchers who wish to minimize tagging effects often choose to use smaller tags.

The major husbandry issues are healing time, short and long term survival, growth and energetic costs associated with carrying the tags and behavioural changes.

VEMCO's sales personnel are highly experienced at providing advice on tag size but ultimately you will make the final decision after weighing all the issues. Keep in mind that if you have the aquatic facilities available then you may wish to consider conducting your own tests. VEMCO provides dummy tags (identical to a functioning transmitter in diameter, length and weight) for anyone who wishes to investigate transmitter size on tag retention, growth and survival in fish and other aquatic animals.

Please call us if you have any questions.

Tag Programming

Coded transmitters can be programmed with different transmission sequences to accommodate the many unique study designs employed by telemetry researchers. We can vary the transmission frequency and acoustic power output over the life of a transmitter:

- a transmitter could transmit every 10-30 seconds for two hours at low power,
- then shut down for two weeks while the animal recovers from surgery,
- then transmit for one month at high power every 45-70 seconds while the fish swims down a river, and
- finally it could transmit every 60-180 seconds at low power when the fish is expected to be in the ocean where acoustic range is typically higher than in rivers and estuaries.

The programming options that you choose will depend on:

- expected behaviour of your fish
- environment or location where the fish will be
- number of fish (residency) that are expected to be within range of your receivers
- available energy budget of the transmitter

Continuous transmitters have fewer programming options available. Simple continuous pingers transmit pings after precise short intervals of time. They are usually programmed to transmit between 1000-2000 milliseconds. Typically, there are two transmission ranges available for sensor tags where the magnitude of the sensor determines the frequency of transmissions between 2000-1200 msec. or 1000-500 msec.

Please contact our sales personnel for advice.

Passive Telemetry Designs

At VEMCO, we consult with customers and give advice regarding the capabilities of our products within their objectives and designs. I have categorized most studies that use our passive receivers as gates and grid studies. However, I am certain that you may have more categories.

Gate studies are generally conducted to monitor the passage of animals through VR2W lines and are evident in lakes, rivers, estuaries and along marine coasts. They are usually used to define migration routes for populations and survival of juvenile fish (smolts) when it is possible to monitor several points along a route.

Grid studies encompass a huge group that consists of laying receivers as mesh to collect as much data as possible in areas where populations are known to inhabit for a portion of its life history. Examples of studies are:

- monitoring behaviour on natural and artificial reefs (home range and movements related to sex and age within a reef)
- fish homing and relocation
- predator/prey behavior
- activity level (nocturnal-diurnal)
- pollutant exposure
- chemical exposure
- electromagnetic exposure (wind farm cables)
- effects of wind farms on residency
- spawning and mating behavior
- stock mixing
- cage studies
- distribution in lakes and rivers
- behaviour with thermoclines, haloclines, dive behaviour, etc.

Figure 1-9 provides an example of a typical receiver layout for a river migration study.

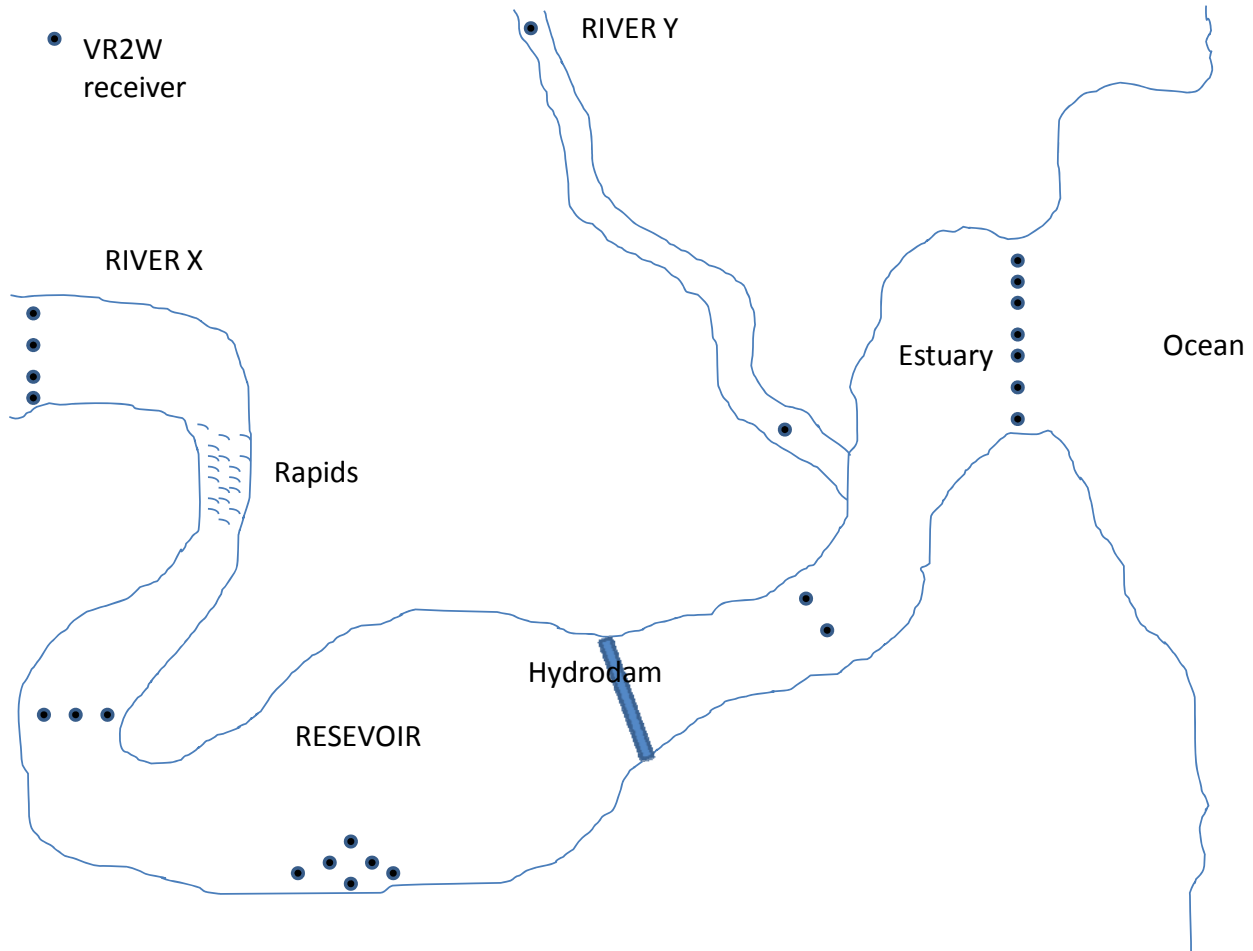


Figure 1-9: Example of a Typical Receiver Layout for a River Migration Study

Active Tracking Designs:

Active tracking studies are often intermittent in nature and are designed to provide more detailed information on animal behaviour and physiology. Active tracking is usually employed when researchers are interested in:

- short-term behavioural movements
- diving behavior
- mating,
- responses of animals to environmental perturbations, etc.

Also, many researchers use both passive and active telemetry within the same study.

Continuous transmitters are better suited for active tracking studies as animals are more easily located and the tags provide more frequent updates of data. Continuous transmitters are usually programmed to transmit between 0.5 and 2 seconds but it is possible to program shorter and longer intervals. However, intervals too short can be an issue with regard to echoes and intervals too long are problematic when tracking fast moving animals.

Coded transmitters are sometimes better suited for active tracking applications when researchers need to track many animals at once however, care must be taken when determining tag programming. Contact our sales team at VEMCO for advice.

1.7 Managing Data

VUE software

VUE or **V**EMCO **U**ser **E**nvironment software manages data for passive monitoring receivers. VUE is a database application used for managing data that is recorded on all your VR2, VR2W, and VR3 receivers. VUE can upload and download from receivers, time correct, filter, query, convert sensor data and graphically display data and export data for other applications.

Detections of transmitters are listed by VUE in order of date and can be viewed by receiver or ID code as well (see Figure 1-10 and Figure 1-11). VUE is an excellent platform for maintaining your data. However, data should be exported into other GIS, statistical or spreadsheet applications for further analysis. The VUE software and manual can be uploaded from the [VUE support page](#) of our website.

Vemco User Environment - CollisionTest.vdb

File Search Receiver Transmitter Station Tools Help

All Detections

All Events

Receivers (1)

- VR2W-100041

Transmitters (28)

- A69-1303-15610
- A69-1303-15613
- A69-1303-15615
- A69-1303-19637
- A69-1303-20488
- A69-1303-23705
- A69-1303-30934
- A69-1303-48246
- A69-1303-49354
- A69-1303-51130
- A69-1303-51610
- A69-1303-51850
- A69-1303-52071
- A69-1303-52084
- A69-1303-52085
- A69-1303-52086
- A69-1303-52087
- A69-1303-52088
- A69-1303-52089
- A69-1303-52090
- A69-1303-52091
- A69-1303-52092
- A69-1303-52093
- A69-1303-52094
- A69-1303-52095
- A69-1303-52096
- A69-1303-52097
- A69-1303-52098

Stations (0)

Imported Log Files (1)

Detection Filters (0)

Detections: 13566

Date	Time	Code Space	ID	Transmitter	Receiver	Station	Data
2009-03-13	21:10:05	A69-1303	52094	A69-1303-52094	VR2W-100041		
2009-03-13	21:10:11	A69-1303	52094	A69-1303-52094	VR2W-100041		
2009-03-13	21:10:18	A69-1303	52094	A69-1303-52094	VR2W-100041		
2009-03-13	21:10:24	A69-1303	52094	A69-1303-52094	VR2W-100041		
2009-03-13	21:10:50	A69-1303	52095	A69-1303-52095	VR2W-100041		
2009-03-13	21:16:38	A69-1303	52088	A69-1303-52088	VR2W-100041		
2009-03-13	21:16:57	A69-1303	52097	A69-1303-52097	VR2W-100041		
2009-03-13	21:17:05	A69-1303	52085	A69-1303-52085	VR2W-100041		
2009-03-13	21:17:24	A69-1303	52086	A69-1303-52086	VR2W-100041		
2009-03-13	21:17:36	A69-1303	52090	A69-1303-52090	VR2W-100041		
2009-03-13	21:17:53	A69-1303	52087	A69-1303-52087	VR2W-100041		
2009-03-13	21:18:26	A69-1303	52098	A69-1303-52098	VR2W-100041		
2009-03-13	21:18:41	A69-1303	52086	A69-1303-52086	VR2W-100041		
2009-03-13	21:19:15	A69-1303	52087	A69-1303-52087	VR2W-100041		
2009-03-13	21:20:00	A69-1303	52096	A69-1303-52096	VR2W-100041		
2009-03-13	21:20:18	A69-1303	52092	A69-1303-52092	VR2W-100041		
2009-03-13	21:20:34	A69-1303	52097	A69-1303-52097	VR2W-100041		
2009-03-13	21:20:50	A69-1303	52098	A69-1303-52098	VR2W-100041		
2009-03-13	21:20:59	A69-1303	52095	A69-1303-52095	VR2W-100041		
2009-03-13	21:21:24	A69-1303	52084	A69-1303-52084	VR2W-100041		
2009-03-13	21:21:32	A69-1303	52097	A69-1303-52097	VR2W-100041		
2009-03-13	21:21:43	A69-1303	52088	A69-1303-52088	VR2W-100041		
2009-03-13	21:22:02	A69-1303	52094	A69-1303-52094	VR2W-100041		
2009-03-13	21:22:25	A69-1303	52089	A69-1303-52089	VR2W-100041		
2009-03-13	21:22:39	A69-1303	52085	A69-1303-52085	VR2W-100041		
2009-03-13	21:22:43	A69-1303	52096	A69-1303-52096	VR2W-100041		
2009-03-13	21:23:02	A69-1303	52098	A69-1303-52098	VR2W-100041		
2009-03-13	21:23:13	A69-1303	52090	A69-1303-52090	VR2W-100041		
2009-03-13	21:23:23	A69-1303	52094	A69-1303-52094	VR2W-100041		
2009-03-13	21:23:38	A69-1303	52096	A69-1303-52096	VR2W-100041		
2009-03-13	21:23:52	A69-1303	52085	A69-1303-52085	VR2W-100041		

Plot Export

19:37:04 UTC

Figure 1-10: Window Display of Detections in VUE



Figure 1-11: Graphic Display of Detections in VUE

What Is a False ID and How Do I Determine If a Detection is False:

A false ID is an ID code detection that does not actually exist and is recorded when a receiver is detecting many tags near the same time or from noise signals. False codes are usually very easy to recognize and discard and account for a very small percentage of your total dataset. We have [FAQs](#) and [Application Notes](#) on our website that fully explain false ID codes and how to recognize them.

1.8 Range Tests

A range test is a procedure that can help you determine the detection range capabilities of your system and mostly apply to the following:

- studies that use passive receivers moored as “acoustic curtains” or “gates” to detect passing fish
- VPS and VRAP positioning studies
- studies that require near or 100% coverage (e.g. spawning area, reef, feeding area, etc.)

If VR2Ws are too far apart and animals swim through gates without being detected then survival estimates may be in question. Also, acoustic range can vary significantly for any location within hours, days and seasons. Therefore, we recommend that you perform range tests in a few different environmental conditions and at different times of the year. VEMCO's [Range Test Guide](#) can provide valuable assistance when performing range tests.

Are Range Tests Useful for Me:

It is generally important to perform a range test for a number of reasons:

- calculating the survival of fish through gates
- understanding the performance of your system
- highlighting problems associated with mooring design, location or tag power

If nearby receiver ranges overlap (e.g. a tag placed at VR2W#1 can be heard by VR2W#2) then you probably have a tight line. If a tag in the middle between two receivers is not detected all the time then your gate is leaky and you should conduct more tests and bring your receivers closer together.

Suggested Range Test Procedures:

The most basic and short term test is as follows:

- moor one VR2W receiver and position one range test tag (see Figure 1-12) at several ranges from the VR2W for a period long enough so that the tag transmits many times at each location (i.e. 100+ transmissions)
- calculate the percent # of transmissions recorded by the VR2W at each tag location and plot % detects against range.

Our preference is to conduct a longer term test (months) using several receivers and a tag:

- calculate the % detects over a six hour period and plot a time series of % detections over the study period at each range (see Figure 1-13)
- this test allows you to analyze the effects of weather and oceanographic changes on range.



Figure 1-12: Range Test Transmitter

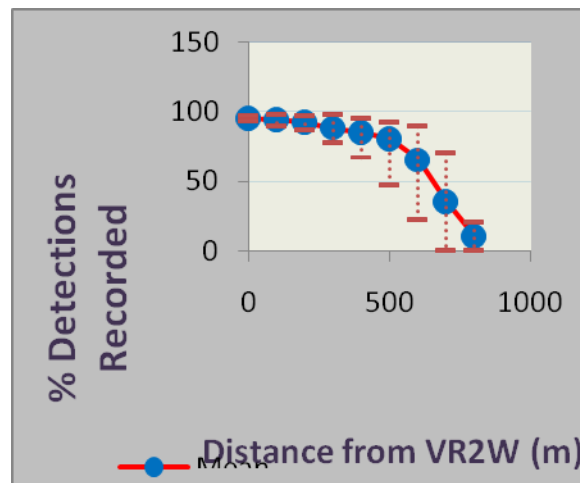


Figure 1-13: Typical Range Test Graph

Section 2: What To Do The Day Before I Release My Tags

2.1 Verify Receivers and Tags (in Air Tests)

Check Your Order:

When you receive your order:

- Check to ensure your order is correct.
- Photocopy the tag specification sheets that come with your order and store the original for future reference.
- Visually inspect all tags and make sure that each tag has a magnet attached.
- Review the tag specifications on the data sheets (e.g. Tag Model, Code Space, ID Codes, Tag Programming, Battery Life).

Verify Tag Activation:

To verify tag activation for coded tags:

- Connect the omni-directional (VH165) or directional hydrophone (VH110) to your VR100.
- Turn on your VR100 and select the Channel (1-8) that is programmed to detect a 69 kHz coded tag.
- Ensure the channel has been programmed with the appropriate Map (see the [VR100 manual](#)).
- Set GAIN to MANUAL and choose a value of 0 db.
- Position the transmitter approximately 2-3 cm in air from the hydrophone, remove the magnet and read the ID code on the VR100 screen.
- If the signal is weak move the tag closer to the hydrophone and further away if the signal is so strong that the transmitter ping is not crisp.
- Each tag transmits a series of pings (≤ 10) depending on the code space and the VR100 receiver will decode the ID.
- If an incorrect Map is programmed in the VR100 then the ID will not be displayed (refer to your tag specifications to determine the appropriate Map if this occurs). For example, if you are activating an A69-1303 coded pinger, you should hear 8 pings for each transmission burst. If the VR2W or VR100 has the correct code map (MAP-110 or MAP-112), the ID will be displayed when the last ping is transmitted.
- Repeat this procedure for all your transmitters

You can also use a VR2W to test your tags:

- Place the transmitter close to a working VR2W and the red LED will flash each time a ping is detected.
- On the last ping of each ID burst, the LED will light up for a longer duration. This indicates that the VR2W successfully decoded and stored the ID code in memory.
- If desired, you can also upload the data into VUE and see the ID code.

The VR60 and VR28 receiver systems can also be programmed to detect your transmitters.

Check Your Receivers:

- First setup a PC with the latest version of VUE installed and set the correct time zone and clock settings on your PC.
- Use an accurate time base to set the PC clock (internet source or GPS).
- Run VUE.
- Confirm that the LED is flashing
- Activate the VR2W by inserting the activation key into the larger hole in the head of the VR2W (communication is through Bluetooth® wireless technology).
- Use VUE to communicate with the receiver.
- Place the transmitter close to the hydrophone on the top of the VR2W and watch the red LED.
- Make sure that the Map corresponds to the Map listed with your transmitter and receiver specifications sheet. If the LED flashes when the tag transmits and the ID code is stored in the receiver memory, then your Map configuration is correct.
- If you are starting a new study, you should initialize the VR2W. This clears the memory and sets the VR2W clock time.
- If you are using an older model VR2, you should follow these same steps. The VR2 does not use Bluetooth but the VR2PC interface can be used with VUE to communicate with the VR2. The [VUE software manual](#), available on-line, covers many of these topics.

Always check your VR2s and VR2Ws for physical damage from previous use:

- On older style grey VR2s check the orange hydrophone tip for cracks or chips.
- Ensure you have sufficient battery life left. If the red LED does not flash then connect a new battery to your receiver.
- Always check the condition of the O-Rings that create the seal between the receiver head and body. O-Rings must be clean, free of nicks and tears and must have a thin coating of O-Ring lubricant.

If you are starting a new study:

- Place your receivers in your locations at least a few days in advance of releasing your tagged animals.
- Place a transmitter at a few locations within range of the VR2W. This test gives you confidence that you have selected good receiver locations. A thorough range test does the same thing except that it is usually impractical to conduct a range test at every VR2W location.
- If you use a tag with a very short delay (e.g. 5 seconds), then you can quickly lower the tag in various locations to make sure that your receivers are detecting the tag.

Call Us!

We recommend that you contact us for advice before you start your study.

Section 3: What To Do The Day I Upload Data

3.1 Equipment I need to take on board

When uploading data you should have:

- A charged PC (Windows XP or higher) with the latest VUE installed and with an accurate time clock - the PC can be set to your local time and the Daylight Savings Time box should be selected
- One or two Bluetooth Belkin USB devices (model)
- GPS (handheld or VR100) for station position and time synching
- Optional are: VR100 to listen to tags, extra zip ties for the VR2Ws, a spare VR2W. Make sure that the VR100 battery is charged.

3.2 Time Syncing

If your PC time is accurate then the detection times will be more accurate when you correct for time drift in VUE. An accurate detection time may be more important when interpreting sensor data from more than one VR2W. Note that your receiver time is set based on your PC clock. If your PC time is not accurate then your receiver clock will be inaccurate as well. Minutes and seconds can make a big difference when correcting for time skew later so always update your PC just before communicating with a receiver.

3.3 Using a Test Tag

When you retrieve your VR2W:

- Place the test tag near the hydrophone.
- Allow the receiver to record two to three detections before you upload the receiver.
- Before you lower the receiver back in the water, place the test tag near the hydrophone and watch for the short flashes followed by the long flash. This ensures that the VR2/VR2W is detecting and decoding the tag. In VUE, you will see the detections of the test tag after the data is uploaded.

3.4 Upload and Post Upload Tips

- Ensure that the laptop, VUE and Bluetooth interface function properly before the trip.
- If a VR2W is initialized after data is uploaded you will not be able to recover your data if the PC fails.
- Use your best judgment when deciding to initialize the VR2 or VR2W. A VR2W can store approximately 1,000,000 detections. A VR2 can store approximately 300,000 detections.
- If you have plenty of memory left until the end of your study then you may wish to not initialize.
- If several months have passed since the study was started, you may wish to initialize the receiver in order to reset the VR2 start time.
- Initialization clears the memory but also resets the VR2W clock to the PC time.
- When you upload a VR2 or VR2W, check the start and stop times and quickly look at the detection data in the graph to make sure that all looks normal.
- Very few or no detections may indicate a faulty receiver or an incorrect receiver map.
- Check the receiver case for damage.
- If you change the battery, ensure that you insert a new or renewed desiccant pack.
- Check the case O-Rings before re-assembling the case.