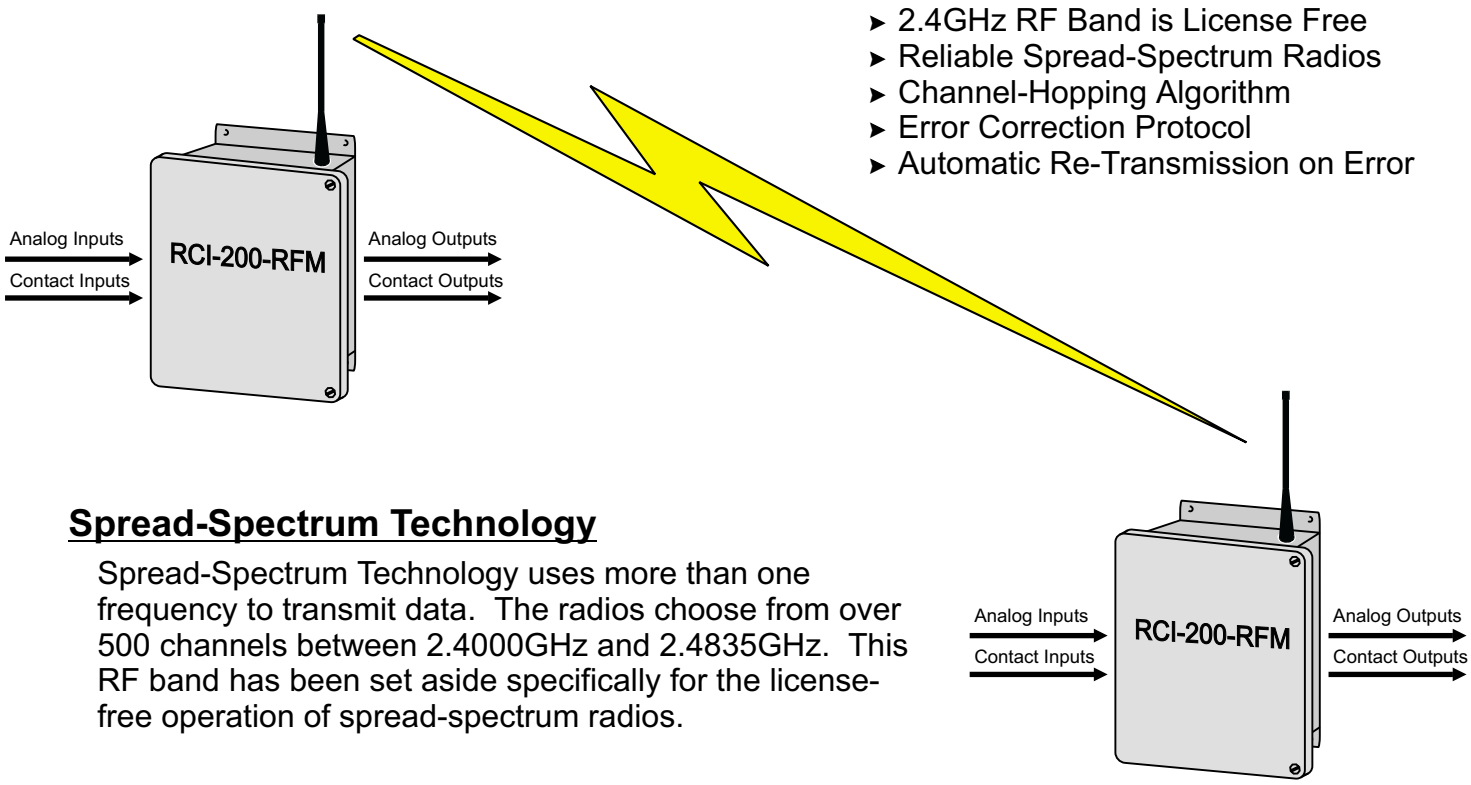
Pribusin Inc.

Section 6

Remote Telemetry

Wireless Telemetry - The Invisible Connection

Wireless Radio Frequency (RF) telemetry offers a great advantage over other telemetry methods by making use of a cheap and easily accessible transmission medium - AIR. When properly installed, wireless systems are very reliable and require little, if any maintenance. Using a license-free RF band eliminates the need for obtaining a site license from the FCC.



- 2.4GHz RF Band is License Free
- Reliable Spread-Spectrum Radios
- Channel-Hopping Algorithm
- Error Correction Protocol
- Automatic Re-Transmission on Error

Spread-Spectrum Technology

Spread-Spectrum Technology uses more than one frequency to transmit data. The radios choose from over 500 channels between 2.4000GHz and 2.4835GHz. This RF band has been set aside specifically for the license-free operation of spread-spectrum radios.

Channel-Hopping

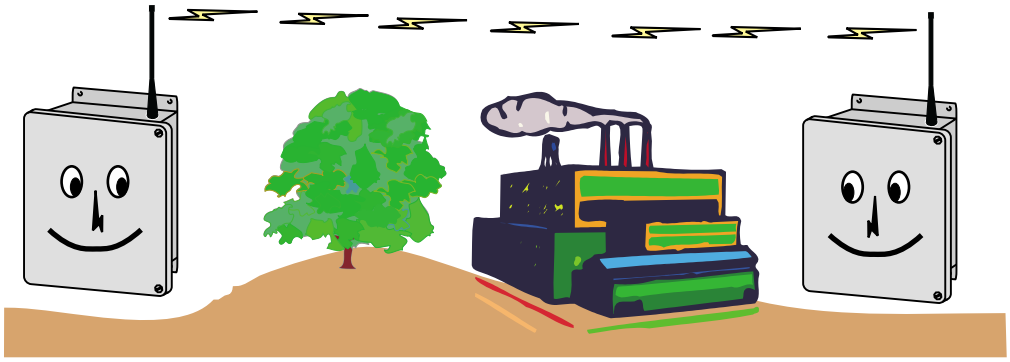
Spread-spectrum radios use channel-hopping technology to make use of the many available channels. Radios will use one channel for only ¼ of a second before jumping to another channel. This ensures that no one channel is ever occupied by one radio preventing another from using the channel. Each radio may use a different channel-hop-table thus allowing many radios to share the same RF band without interfering with one another. If two foreign radios should happen to make use of the same channel, a collision will be detected by both radios and they will each move onto a different channel and re-send their data.

Error-Correction & Re-Transmission

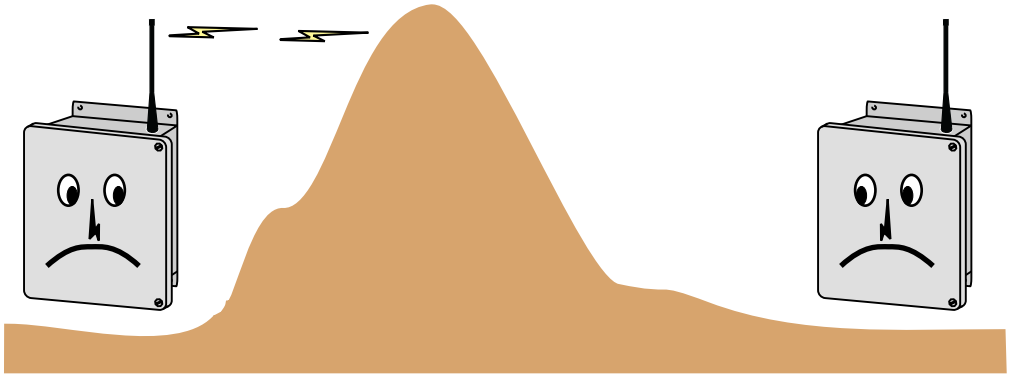
The radios use a comprehensive error checking algorithm to ensure that the transmitted data is indeed correct. If incorrect data was received, the receiver will instruct the sender to re-send the data until it has been received correctly. Since all data is transmitted in digital form there is no degradation in analog values when signal strength decreases. Forward error correction algorithms ‘repair’ any questionable data on the fly.

Wireless Telemetry - To see or not to see ...

As with any Radio Frequency (RF) system, the radio waves propagate best through the air. Obstruction such as buildings, walls, hills, trees etc. pose a potential hindrance to radio wave propagation (imagine your car radio going silent inside a tunnel). The ideal system is one where all radio antennas are in direct line-of-sight with one another. Although, radio waves may reflect off hard surfaces and find an alternate path that is not line-of-sight.



In the ideal system setup, both antennas can 'see' each other without any obstructions. This yields the greatest transmission distance and the most reliable signal conditions. This is called line-of-sight transmission.



If there is a large physical obstruction between the two antennas, the radio waves will be blocked. No transmission is possible in this case.

In many cases where there is no direct line-of-sight path between antennas, the RF signal may still get through by 'bouncing' off buildings or other solid structures. Signal strength must be taken into consideration here to determine if there is enough signal available for reliable transmission.

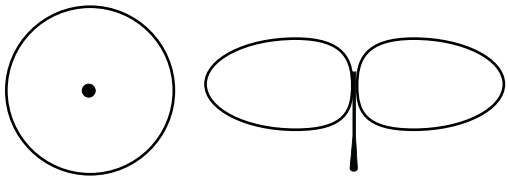
Wireless Telemetry - Antennas & Cable

One of the most important components of any RF system is the antenna. This is where the radio waves are sent on their way to the other radio. There are many different types of antennas for different applications. Ideally antennas are located outdoors and typically on a mast that clears all surrounding obstructions. Besides transmitting the radio waves, antennas can also act as 'radio wave amplifiers'.

The cable that connects the antenna with the radio is equally important. Unfortunately, all cable poses a 'resistance' to the RF signal thereby limiting the amount of signal being transmitted by the antenna. Using low-loss coaxial cable and keeping this cable length short are two important considerations.

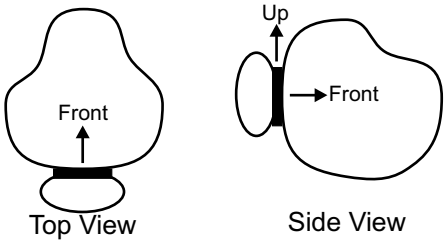
Omni-Directional Antenna

An Omni-Directional antenna is a non-directional antenna. It radiates equal amounts of radio wave energy in a spherical pattern. Higher gain antennas radiate in a 360° pattern that is flattened on top and bottom and looks more like a donut. These antennas are ideal for a host site that has several remote sites located in various directions.



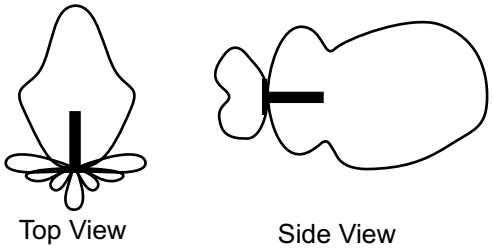
Panel Antenna

A panel antenna is a directional antenna that 'focuses' the radio wave energy into a beam which is aimed out the front of the antenna. Panel antennas have a high gain for greater distance transmissions and are great for a point-to-point RF system.



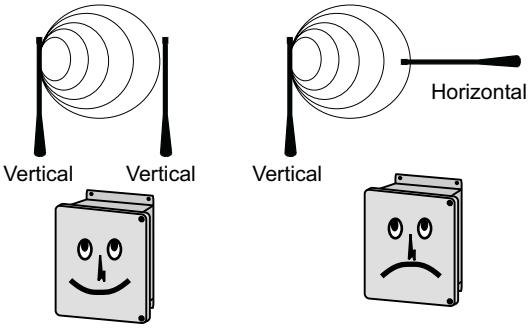
YAGI Antenna

A Yagi antenna is a highly directional antenna that produces a very narrow beam of radio waves. These antennas provide the greatest distance transmission and obstruction penetration capability . Because of the narrow RF beam they are more difficult to align.



Antenna Polarization

All antennas have a direction of polarization. This means that radio waves leaving an antenna are 'oriented' by the polarization of the antenna. Radio waves can only be received by an antenna of equal polarization. Directional antennas have a polarization marking (vertical or horizontal) and a direction arrow to indicate which way is UP. Omni-directional antennas can be mounted in any orientation so long as ALL antennas in the system are mounted the same way.



Wireless Telemetry - May I be Your Host ?

A simple telemetry system consists of just two devices: a local unit and a remote unit. However, many times there may be several remote sites that have data to be exchanged with a single local site. This setup is referred to as a host-to-multipoint system. An 8-channel RCI-800-RFM can act as a host for up to four 2-channel RCI-200-RFMs. If the RCI-200-RFMs are configured as single channel units, one RCI-800-RFM can host up to eight remotes.

Signals can be exchanged with all remotes in both directions just like in a point-to-point system.