Radio Configuration – Shorelines

Introduction

The performance of a radio system is highly dependent on the environment that the radio is used within. Elements such as base frequency, ground clutter, water, foliage, antennas height, gain and style, insertion loss, and other factors each impact aspects of radio performance.

This document provides a baseline configuration for radio deployment between a shoreline and an unmanned surface vessel (USV). For optimal radio performance, modifications should be made based on site-specific conditions.

Kairos Radio Options

Kairos Aetheric radio products are our simplest and most cost effective approach to radio communications between an OCU and our Pronto4 agnostic autonomy products. Aetheric radios are multi-frequency and operate point-to-point on one frequency at a time. They are usually shipped with two frequencies: 2.4 GHz and 900 MHz. During installation, the best frequency to use is determined by throughput and utilization testing (for more information, review the "Aetheric Radio Data Collection Procedure" and "Aetheric Radio Data Collection Form", both available at http://kairosautonomi.com/bulletins/). Either 2.4 GHz or 900 MHz is selected depending upon radio environment concerns and application requirements. This is the most inexpensive radio that Kairos recommends for shoreline operations.

Rajant radios are multi-frequency radios that are used primarily for mesh connections between multiple nodes. Rajant radios do not work well in point-to-point environments. The more nodes that are added to a Rajant Radio system, the better the system can perform. It is common to add multiple repeater nodes to a Rajant radio system to increase range and increase robustness. Kairos does not recommend Rajant systems for shoreline operations.

Silvus radios perform well in both point-to-point and mesh environments. Their waveform and routing software perform well without the caching found in Rajant point-to-point solutions and without the switching delays in Microtik mesh solutions. Silvus radio systems are more expensive than the other Kairos solutions, but their performance is superior, in even the most demanding radio environments. This is the radio system that Kairos recommends for optimal performance in any unmanned operational area.

Typical Radios and Antennas

Kairos most often provides radio packages that include the following equipment:

- One (1) 2.4 GHz ISM Band, 120 degree Sector Antenna (Kairos p/n KA200-21; OEM p/n HG2414SP-120)
- Two (2) 2.4 GHz Omni Directional Antennas (Kairos p/n KA200-22; OEM p/n OD24M-5)
- Two (2) 900 MHz Omni Directional Antennas (Kairos p/n KA200-23; OEM p/n OD9-5-ANT)
- Two (2) Aetheric Multi-Band Radios 2.4Ghz and 900Mhz (Kairos p/n KA200-09)

The reminder of this document refers to these specific radios. *Adjust the configuration as appropriate for each installation.*

Physical Configuration

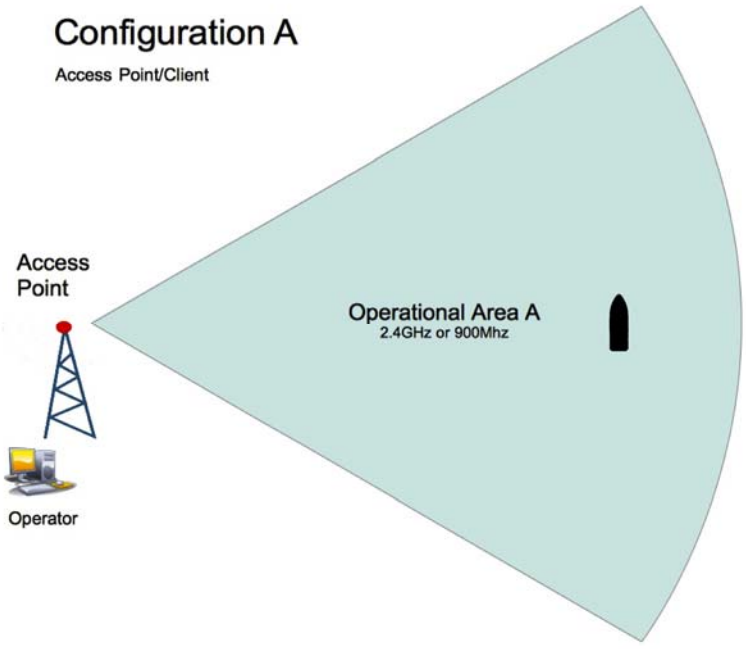
The 120 degree, 2.4GHz sector antenna should be mounted on the OCU tower and pointed directly toward the operational area. In a shoreline environment, this should result in a non-obstructed Line of Sight (LOS). The functional radio distance increases as the antenna is mounted at greater heights. For example, to support operations up to 15 miles from the tower, the base station antenna should be positioned approximately 100 feet above the shoreline.

There must be an Aetheric radio mounted at the top of each USV with both the 900 MHz and 2.4GHz OMNI antennas. The antennas should have no obstructions in a 360 degree radius. The antennas should be mounted to the highest structure on the USV. Kairos sells a tri-pod that can accommodate up to a 30ft mast. Based on sea state, it may be possible to install this tri-pod on an USV. Like the base tower, the functional radio distance increases as the antenna is mounted at greater heights. For example, to support operations up to 15 miles from the tower, the USV antenna should be positioned approximately 10 feet above the waterline.

Radio propagation and tuning/alignment have to be done by manually aligning the 2.4 sector antenna on the base station tower, by aiming it toward the operational area. If the area is saturated with other 2.4 GHz frequencies then the 900 MHz might be a better option. If the site chooses to run at 900MHz, contact Kairos for more information on options, prices, and availability of 900MHz sector antennas.

A radio should be mounted close to its antenna; this reduces the length of the Coax cable needed; which, in turn, reduces the amount of signal loss. Run an Ethernet cable between the radio and the OCU to ensure the highest quality link connection.

For additional information, review the “Radio Assembly and Set-Up” bulletin, available at http://kairosautonomi.com/bulletins/.



Radio Configuration

The Aetheric Multi-Band dual frequency (900MHz and 2.4GHz) runs a single frequency at a time; Kairos recommends running it at 2.4GHz. It is very easy to troubleshoot with a laptop because it can be connected wirelessly with 2.4GHz.

When running 2.4GHz the 900MHz must be disabled on the Operator Control Unit (OCU) radio, this is done through the Winbox application (Note that to maintain control through Winbox, at least one frequency must always be turned on. Therefore, the new frequency must be turned on prior to turning off the old frequency; For more information, review the "Winbox Tools for Aetheric Radio: Network Traffic Tools" bulletin, which is available at http://kairosautonomi.com/bulletins/)).

In Winbox, both frequencies (2.4GHz and 900MHz) should be running for each USV radio.

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