

### 3.10 Antenna Installation & Alignment



**INSTALLER CAUTION:** Antennas used for this device must be fix-mounted on permanent outdoor structures to provide 5 feet or more separation from all persons during device operation to comply with FCC RF exposure requirements. Installers should contact manufacturer for applicable gain and type restrictions to ensure compliance.

The antenna installation consists of permanently mounting the antenna outdoors on a tower, building roof, or other location that provides line-of-sight path clearance to the far-end location. In general, antennas smaller than 2 feet diameter are not recommended for urban areas due to their wider beamwidths, which results in higher interference susceptibility.

Antennas should be ordered with a suitable mounting kit specific to the site requirements. For example, specifying round or angle tower leg adapters, or a roof tripod as necessary.

The antenna must be very rigidly mounted, with adequate room for azimuth and elevation adjustment from the rear.

The antenna polarization must be the same at both ends of the link, either vertical or horizontal.

In general, antenna mountings require a support pipe to which upper and lower support brackets are attached with "U" bolts. The antenna and optional elevation and azimuth adjustment rods are then mounted onto the support brackets. The whole structure must be adequately grounded for lightning protection. The antenna system must always be installed according to the manufacturer's instructions.

Unless special test equipment is available, two operating *Tsunami* terminals are required to align the antennas. Alternatively, a CW generator may be used to transmit a signal toward the end under alignment.

The antenna is coarse aligned using visual sighting and then fine aligned using the receive signal level (RSL) voltage of the *Tsunami*.



*The RSL voltage reading can still be used to peak antennas even if the radios have not synchronized, however far-end RSL cannot be measured from the near-end terminal until radios are synchronized.*

To coarse align the antenna, first set it for flat elevation (no up or down tilt) using a spirit level. Then point it at a heading marker obtained using a compass back-bearing from an adjacent location, (ideally, 100 feet or more away from the antenna).

If a heading marker cannot be set sufficiently far away (for example when on a city building roof or looking through a window) then a rough azimuth setting can be obtained by sighting along the antenna feed.



*It should be verified that both antennas are on the same polarization by using the manufacturer's instructions. Otherwise the RSL will be approximately 25 to 30 dB below the calculated level.*

Most antennas will also need fine alignment obtained using an operating link because it is very important to maximize the receive RF signal level at each end of the radio link.



*Read Section 3.7 before applying DC power to the Tsunami radio.*

Once the coarse alignment has been set-up at both ends, then the link can be powered and some level of reliable communication established. The voltage at the *Tsunami* front panel RSL test point should be measured with a DVM to determine the relative receive RF signal level.

For the fine alignment, adjusting first the azimuth and then the elevation of the local antenna will maximize the RSL voltage. Then, the far antenna is aligned in the same way, using the RSL voltage of its local *Tsunami* radio.

When aligning antennas it may be convenient to run two wires from the RSL and ground test points to the antenna so that the voltmeter reading is directly visible to the technicians aligning the antenna. Also, a cellular telephone or two-way radio may be useful for coordinating alignment activities between both ends of the link. Once the radios are coarse aligned and synchronized, the built-in orderwire phone service can also be used to coordinate alignment between both ends of the link.



*An orderwire telephone will provide end-to-end voice communications once radios are synchronized. Synchronization usually can be accomplished by coarse alignment only. After synchronization, the orderwire phones can be used to communicate between radio sites for antenna fine alignment. The phone interconnect cable can be extended to the antenna when desired.*

The larger the antenna size, the more critical alignment becomes: for example, with a 2 foot dish, the antenna can be moved  $\pm 3$  degrees off the correct heading before the receive signal level drops by 3 dB. This compares with a 6-foot dish which may only be moved  $\pm 1$  degree for the same degradation.

The graph shown in Figure 3-6 shows the typical variation of RSL voltage as the receive signal level is increased from threshold to a higher level. There is some variation between *Tsunami* receivers, but an approximate estimate of the potential RSL value may be made using this figure.