

# INSTALLATION

## TYPICAL ANTENNA INSTALLATIONS FOR THE ATU 8250

"A STATION IS ONLY AS EFFECTIVE AS ITS ANTENNA SYSTEM".

As with any antenna system, only proper installation will give top performance. SKANTI cannot overstate the importance of RF grounding. The RF ground is one half of the antenna, and no radio will give top performance with only the half of an antenna.

When installing the ATU itself, give a great deal of consideration to its placement in relationship to both the antenna and the RF grounding system.

The Antenna Tuning Unit may be mounted up to 100 metres from the Transmitter using RG-213/U (RG-8A/U) coaxial cable and a screened 16 x 0.5 mm sq. multi-wire cable for interconnection. The unit should be installed near the antenna feed point. Fig. 4.1 shows mounting details.

Some precautions should be taken when installing the ATU :

1. Mount the antenna above and clear of rigging, towers and all metal objects.
2. The feed wire to the antenna should be of good quality with high voltage insulation.
3. Keep in mind that the wire connected to the ATU is also part of the antenna and does radiate, so it must be kept clear of metal objects.

## TYPICAL VESSEL INSTALLATIONS

The ATU 8250 is a versatile unit, and will conform to virtually all types of marine antenna systems on a variety of vessels.

## RF GROUNDING

Direct electrical contact with seawater is not really as necessary as to provide that the maximum possible conducting surface area creates a ground plane or counterpoise for the antenna to work against. The counterpoise is especially important at high frequencies. At frequencies below 4 MHz, it is important to get a good connection to the water. However, at higher frequencies, the water becomes less effective. At frequencies above 4 MHz, the water connection is only a help. Thus, we are talking of two different types of RF grounding: a good connection to the water and a good ground plane close to the ATU. The ground plane may be placed a distance above the water.

Starting with the low frequency RF ground, bond together any sizeable through-hull fittings, engines, fuel and water tanks, etc. Propeller shafts should be outfitted with wipers. The commercially available ground plates have usually insufficient area to be effective by themselves and are not recommended for use as the only RF ground.

A wide ground strap "ground bus" where all the bonding are connected should be run to the ATU. SKANTI recommends at least 5 cm wide strap for short runs up to 1 m and 10 cm wide copper strap for runs up to 5 m. The ground strap carries large RF currents, and the surface area is important, the more the better. The copper strap may be only 0.5 mm in thickness.

The RF ground or ground plane for frequencies above 4 MHz will consist of bonding metal rails, sail tracks, metal trim, etc., and connected to the ATU with the 5 cm wide copper strap.

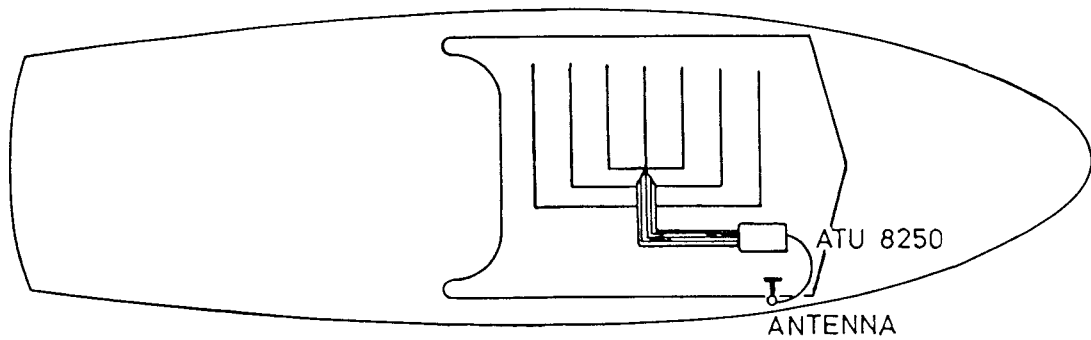
Also, in most installations, it will be necessary to lay in some kind of a radial system. Ideally, the radial system would resemble the spokes of a wheel without the rim, the hub being the antenna and ATU position. The radials may be copper wire of 10 AWG, but preferably 5 cm wide copper strap. It is not necessary to run a radial in a straight line. It may run around the bridge, go down the side of the bridge, etc. (see figure 4.2). The object is to put in as much as possible.

Another type of excellent RF ground is copper screen. The screen may cover a cabin top and be spot soldered and fiberglassed in place, placed under salon carpeting, etc. Again, the more the better.

After the ground plane is in place, a 5 cm wide copper strap is run to the ATU ground terminal and the connection coated with waterproofing.

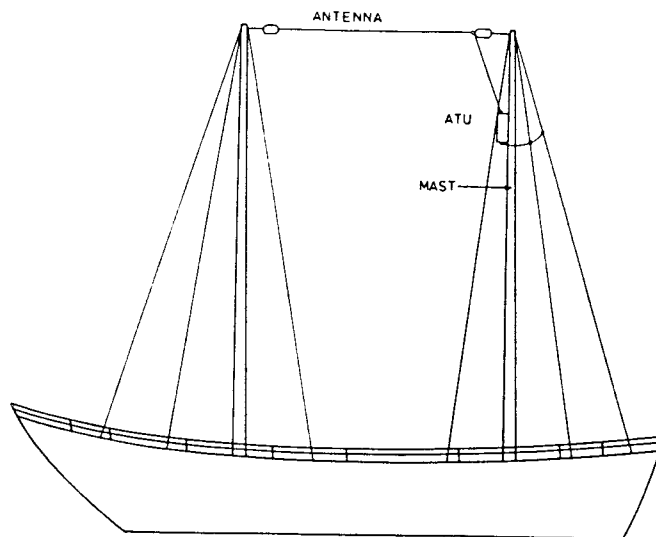
Typical ATU Installations

Fig. 4.2. Radial ground plane installation showing typical installation of radials on a cabin top.



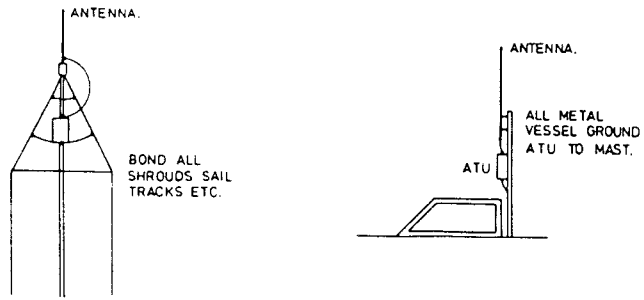
Bond in all rails and run wide copper strap from low frequency water grounds to ATU base.

Fig. 4.3.



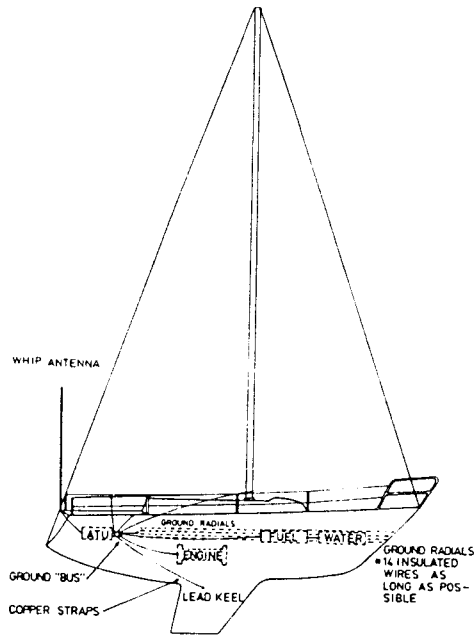
Bond all shrouds and connect to ATU, this applies to sail track too.

Fig. 4.4.



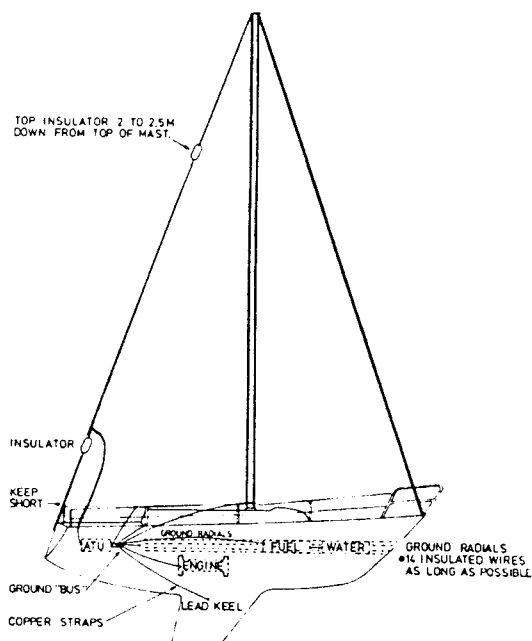
Whip Antenna Installation

Fig. 4.5.



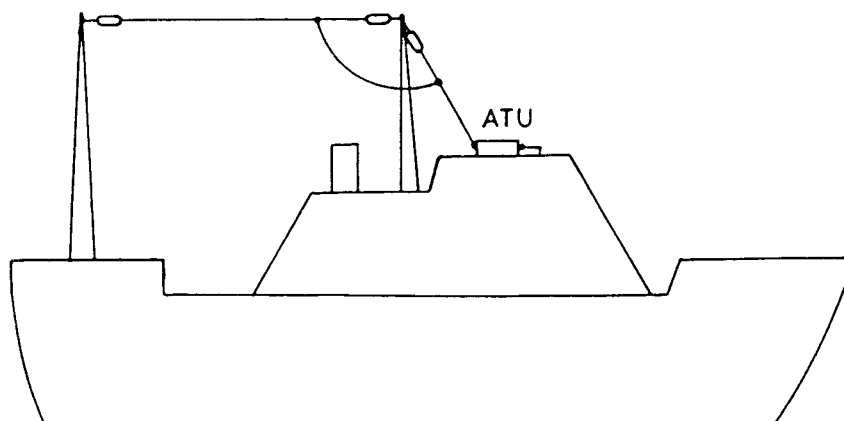
## Backstay Antenna Installation

Fig. 4.6.



## Long Wire Installation for Metal Vessels

Fig. 4.7.



The ATU may be mounted inside or outside of wheel house. Locate insulators at a distance of 1 m from mast. Connect ground to hull.

## THE GROUNDLESS ANTENNA SYSTEM

Fig. 4.8. and Fig. 4.9. show some typically groundless antenna systems. These types of systems have been found to give excellent performance, and are recommended when the installation of an adequate RF ground is not possible.

The groundless antenna is basically a dipol configuration and therefore balanced. The ATU is not balanced and when connected to the dipol the radiating diagram will not be symmetrical, because the outer side of the coax will be part of the radiating system. The antenna should be as long as possible to give adequate performance at low frequencies.

## Groundless System

Fig. 4.8.

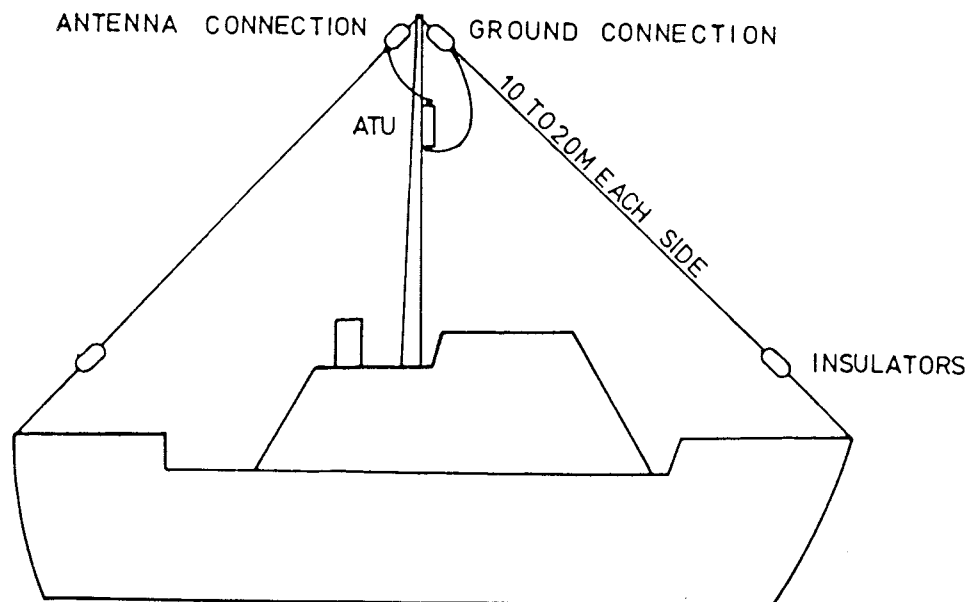
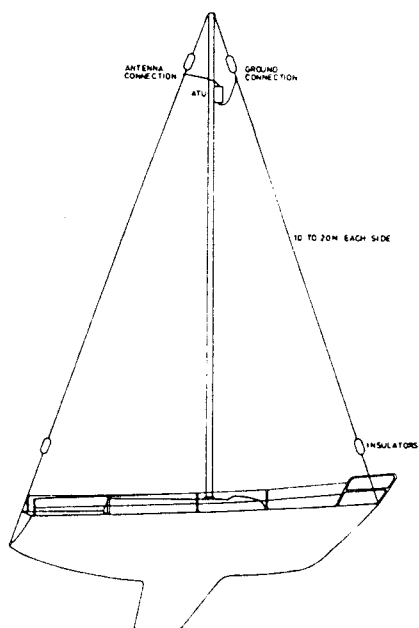


Fig. 4.9.



## ANTENNA INSTALLATIONS FOR LAND STATION

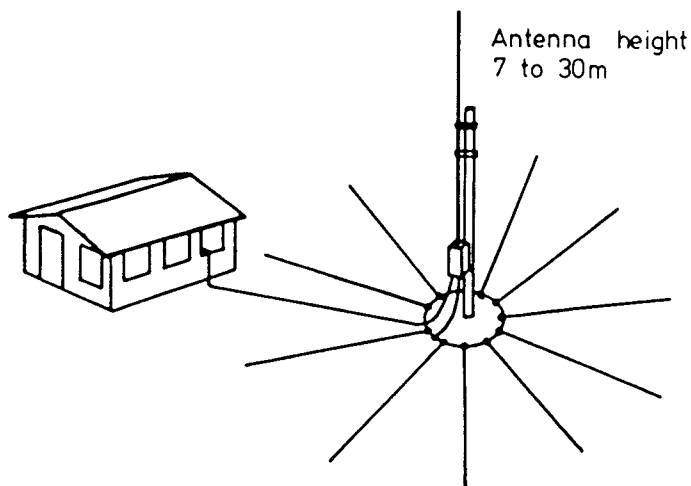
Here will be shown some examples of antenna installations for land stations using the ATU 8250. But remember that these are not the limits of the ATU 8250. You could do almost everything you want with it, like driving a metal rod into the soil for the RF ground and throw a wire up in a tree; the ATU will tune the system and deliver a good load to the transmitter and will put as much power as possible into the antenna. The amount of radiated power will depend on the value of the radiating resistance in proportion to the loss resistance in the antenna and ground system. So if you want some power to be radiated we will recommend a more efficient ground and antenna system.

To reach that the following precautions and helpful hints should be observed.

1. Don't make the antenna too short. Some times it is not possible to erect a full  $1/4$  wave antenna on, say 2 MHz. It would be 37.5 m long for a  $1/4$  wave or 75 m end to end for a dipole. But, put up as much antenna as possible for the lowest frequency to be used. Don't be concerned that it is too long at the higher frequencies, the ATU 8250 will tune to a long antenna properly. The antenna will also exhibit some gain. So there is a definite advantage. If it is too short, the low frequencies will suffer. It is like putting a 10 horsepower motor into a Mercedes.
2. As in vessel installations, a good RF ground is a must for a vertical or long wire antenna. The better the ground, the stronger the signal.
3. Use good, high quality insulators.
4. Use good, high quality wire for the radiator. AWG 10 stranded is ideal, (D=3 mm).
5. Use good, high voltage insulation on the feed wire. Remember that it is also part of the antenna and does radiate, so keep it clear of metal objects. Don't tape or clamp it to a metal mast.
6. Vertical antennas are excellent for long distance communications, but due to their high angle of radiation, they tend to "shoot" the signal above close-in stations.
7. A long wire antenna radiates maximum signal from its end and is excellent for both short and long range communications. It should be considered for point-to-point communications.
8. The dipole, "V", or inverted "V" is an excellent antenna for long, short and point-to-point communications.

## VERTICAL ANTENNA INSTALLATION

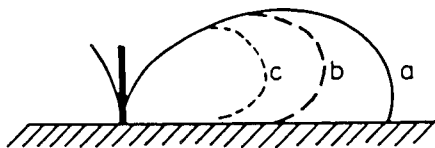
Antenna may be whip on mast, metal pole, wood pole with wire or pipe for radiator, etc.



Antenna height 7 to 30 m.  
The minimum antenna height would vary somewhat, depending on the number of the radials and their length.

Counterpoise radials should be 1.5 times the length of the antenna radiator or at least 0.1 wavelength at the lowest used frequency. The number of radials should be as many as possible but at least 18 pieces. Diameter of each radial 3-5 mm. It should be kept in mind that the loss resistance should be as low as economically feasible. A good approach to the ideal ground is one with 120 radials and 1/2 wavelength long. The conductivity of the ground has considerable influence on the properties of an aerial excited with respect to ground. In order to avoid too large current density within the proximity zone of the radiator, ground networks are necessary.

The more the ground network differs from the ideal case of an infinitely large conductive plane, the greater the difference between the actual and the theoretically expected vertical radiation pattern (to raise the beam of the vertical diagram).



Vertical radiation pattern for a 1/4 wave antenna with different ground loss:

- a. Ideal case, with no ground loss.
- b. Good ground conductivity.
- c. Bad ground conductivity.

Ground networks should be buried at a depth of 25 to 30 cm or, if the soil is cultivated, 60 cm. In case of stony soil they might be put directly on the surface.

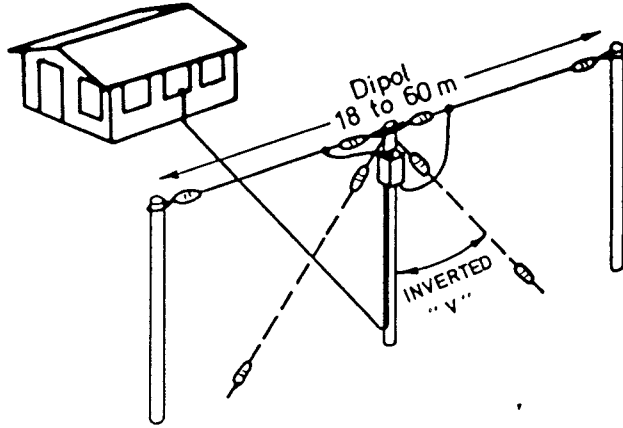


Dipole or Inverted "V" Antenna Installation

Radiation direction pattern:

- a. Dipole, broadside.
- b. Inverted "V", end fire.

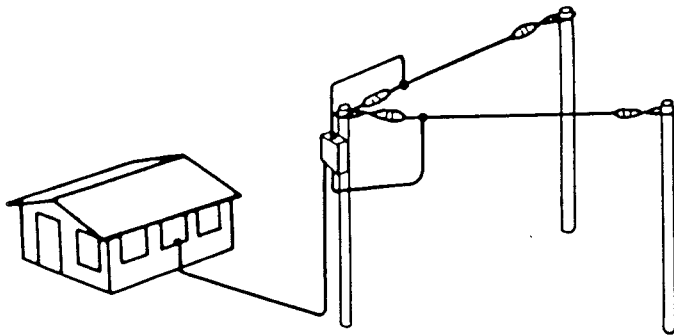
Because of the ATU 8250 not being symmetrical, the radiation pattern may differ somewhat from the ideal symmetrical pattern.



Mast should be high enough to achieve a 45 deg. angle on each leg of an inverted "V" antenna.

Many people have reported that the dipole in the form of an inverted "V" is more effective than the horizontal antenna, especially at frequencies below 7 MHz.

"V" Antenna Installation



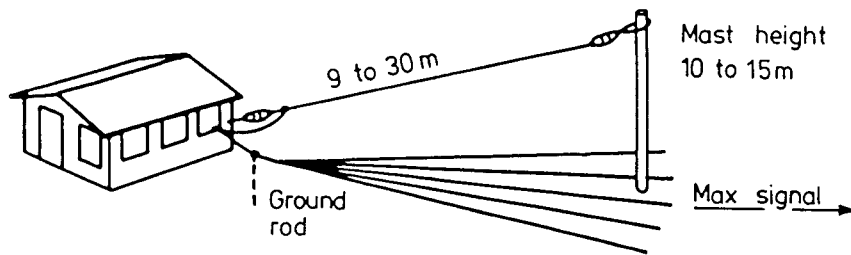
For both antennas, the antenna terminal should be connected to the one leg and the ground terminal to the other leg.

Optimum Apex angle  $\theta$

| Leg Length ( $\lambda$ ) | Gain (dB) | $\theta$ |
|--------------------------|-----------|----------|
| 1                        | 3         | 108      |
| 2                        | 4.5       | 70       |
| 3                        | 5.5       | 57       |
| 4                        | 6.5       | 47       |
| 5                        | 7.5       | 43       |
| 6                        | 8.5       | 37       |
| 7                        | 9.3       | 34       |
| 8                        | 10        | 32       |

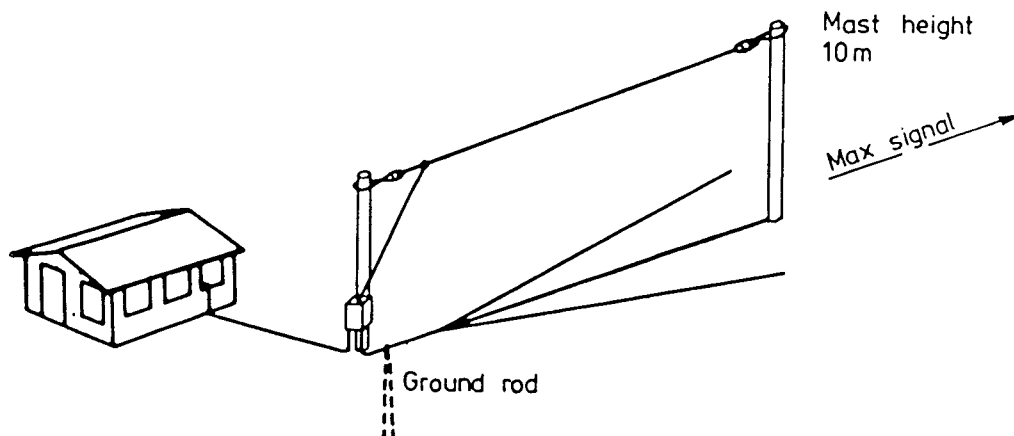
## END FEED WIRE ANTENNA INSTALLATION

The ATU may be mounted inside or outside of building.



## LONG WIRE ANTENNA INSTALLATION

The length should be 9 to 30 m or any convenient length as long as the length is more than  $1/2$  wavelength at the lowest used frequency.



Radials must be at least as long as the antenna. Use as many radials as possible, they may be buried. There should be used a 3 m metal (porous bronze) ground rod tied to radial system.

## Final Installation Check

The Antenna Tuning Unit will tune automatically to the transmitter antenna when the equipment is keyed or the TUNE button is pressed. The standing wave ratio (SWR) at the input of the tuning unit is automatically measured after the tuning sequence. If the SWR exceeds approx. 3, correct tuning has not been obtained. In this case, investigate the antenna installation and control that the antenna length is within the boundaries.