

SSB - UNDERSTANDING THE BASICS

SSB (Single Side Band) radio has been a means for long range communication at sea for decades. Compared to satcom systems the equipment is relatively low cost and is free to use once installed. However, to get the best out of your SSB it is essential that it is installed properly - a good installation can mean the difference between a range of a couple of miles and a couple of thousand miles. You really need to know what you're doing if you want to install an SSB yourself - if you're in any doubt contact the experts, Cactus can supply and install your SSB at a very competitive cost.

What is SSB?

A radio signal comprises of two components - a continuously broadcast *carrier* signal and two audio sidebands that ride on the back of the carrier -



Approximately half of the transmission power is spent on the carrier signal, with the remaining half being divided between the two sidebands. What this means is that with a 100-watt transmitter, 50 watts goes on the empty carrier signal, so you're only getting 25 watts on each audio sideband. That's only 25% of the transmit power!

That's fine for transmissions that need a good audio quality - for example music broadcasts in stereo. But if you just want voice communication over a long range, it's not particularly efficient.

At some stage it was discovered that the audio signal that could be split into its component parts, and more importantly that the carrier signal could be removed so now the 100-watts was divided between the two sidebands -



Radio engineers then found out that one of the sidebands could also be removed so that all the transmitter power was sent through a single sideband -

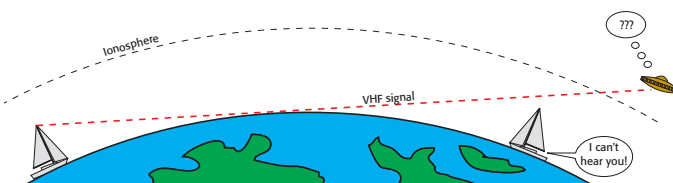


This produces a relatively low-fidelity signal, but since all the transmission power is concentrated into a single sideband, the range is potentially much higher. In fact, an SSB transmission is approximately 16 times more efficient than an equivalent AM transmission.

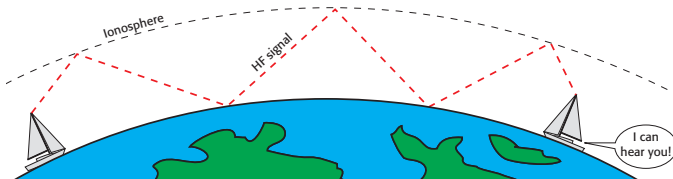
Signal propagation

The power of the transmitter is only part of the story regarding the range that you can expect from your SSB radio - the other factor is the way the signals are propagated.

A VHF signal travels in a straight line - since the earth is curved this means that you will only be able to talk to someone within your line of sight. If the vessel is beyond the horizon, they won't be able to hear you no matter how powerful your transmitter. This limits the range of a VHF radio at sea level to typically around 15 miles -



HF transmissions from an SSB also travel in a straight line, but the difference is that when the wave reaches the ionosphere (a layer of ionised particles in the upper atmosphere) it is refracted, or bent back down towards the earth. When the wave hits the earth it "bounces" back up until it reaches the ionosphere, where the effect is repeated.



Each time this happens the signal loses some strength but as you can see, this dramatically increases the range of a transmission. This is how an SSB user can quite easily talk to someone on the other side of the world.

The equipment

A typical SSB system comprises of a transceiver unit, an antenna, an antenna tuning unit (ATU) and a ground plane. These all have to be installed correctly for the system to work effectively.

The Transceiver

The transceiver unit is the part that you will see - this will have an Rx/Tx module (the part that receives and transmits the HF signals), a control panel and a telephone handset or a fistmike.



The best unit on the market at present is Icom's M802 which has a separate Rx/Tx and control panel - this allows you to tuck the bulky Rx/Tx module out of the way so you only need to have the control panel at the chart table, thus saving space.

SSB - UNDERSTANDING THE BASICS ctd

The Antenna

For the best results from your SSB you need a long antenna - the longer it is, the better. The size of the antenna you can use is normally limited by the size of your vessel. On a power boat a long whip antenna could be used. On a sailboat the best method is to use the boat's backstay, which can be electrically isolated using insulators. This typically costs a few hundred pounds to set up, but is a more complex operation if your boat has rod rigging and can cost in excess of £1000 - give Cactus a call for advice on the best kind of antenna for your particular boat.

The ATU (Antenna Tuning Unit)

An antenna performs best if its length relates to the wavelength of the frequency you are working on. This is fine for VHF which uses a very narrow band of frequencies but HF covers such a broad range it isn't practical to try and set the physical length of the antenna to suit - particularly if you're using an isolated backstay, where the length of the antenna is dictated by the size of the backstay.

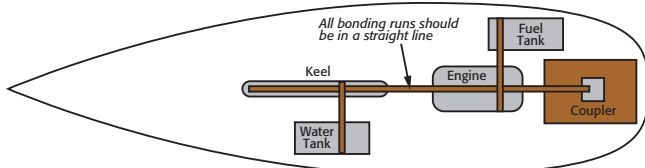
The ATU automatically "tunes" the antenna to best suit the frequency you are transmitting on. This is not to be confused with tuning the *radio* to a particular channel - the ATU tunes the antenna to give the best performance on the frequency you want the radio to operate on.

To use an analogy, the string on a violin is tuned by adjusting its tension. The note played on that string is specified by the position of the violinist's finger on the string, but the accuracy of that note will depend on how well the string has been initially tuned. In the case of an SSB installation, the ATU "tunes" the antenna to suit the channel selected by the operator.

The Groundplane

The groundplane is probably the most important part of the installation to "get right" if your SSB is going to work properly. For the SSB antenna to radiate efficiently, the grounding system area must be larger than that of the antenna. The boat is actually floating on a huge groundplane - the surface of the ocean is ideal, but art is in making an effective low inductance connection to it. The best way (or at least, the one with the most predictable results) is to use an earthing plate attached to the outside of the hull.

Another technique is **bonding**, which involves joining any large metal surfaces like tanks, engine blocks and keels together with a wide copper strip.



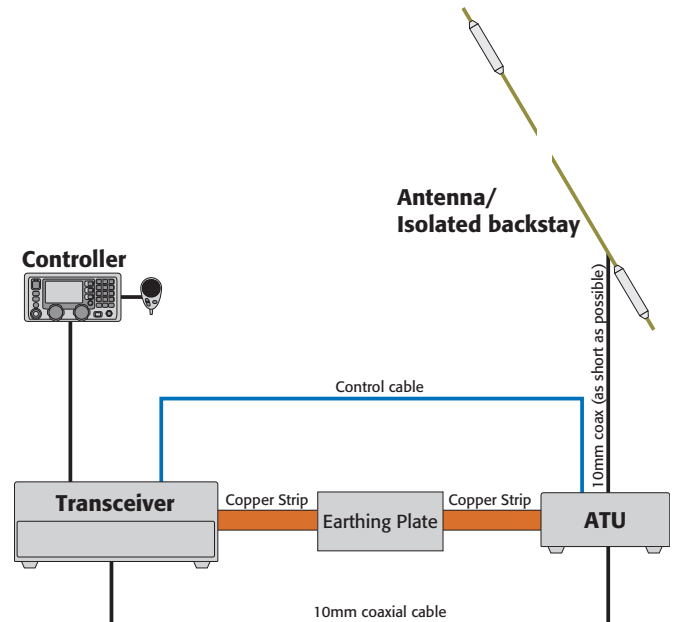
The strip should always run in a straight line to keep all connections direct. If the hull is GRP the inside surface can be lined with a large area of copper foil, and if the hull is less

than 1/2 inch thick, the copper will form a capacitance bond with the water and work as a very effective ground. If the hull is ferrous an excellent ground is almost guaranteed - especially if the boat is sailing in salt water - just by attaching the ground strap to the hull.

A good groundplane will result in a stronger signal and better performance and will also reduce interference with other electronics on the boat.

SSB Installation

An SSB radio is only as good as the quality of the installation, and many aspects of fitting an SSB - isolating the backstay, ensuring a good quality groundplane connection, avoiding interference with other onboard equipment mean that you really need to know what you're doing if you're going to attempt to fit it yourself.



Cactus have over 10 years experience in fitting and commissioning SSB radios, so our advice would be to leave the installation to the experts - each boat has its own characteristics which can affect the performance of your SSB and we can make sure that it's installed and set up to give the maximum performance possible.