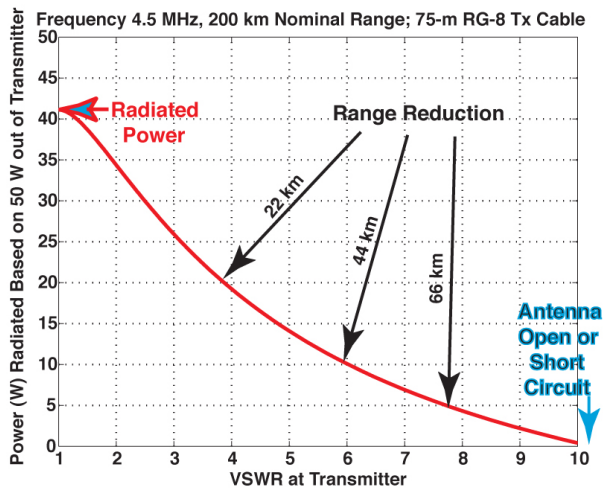


How does high VSWR affect range?

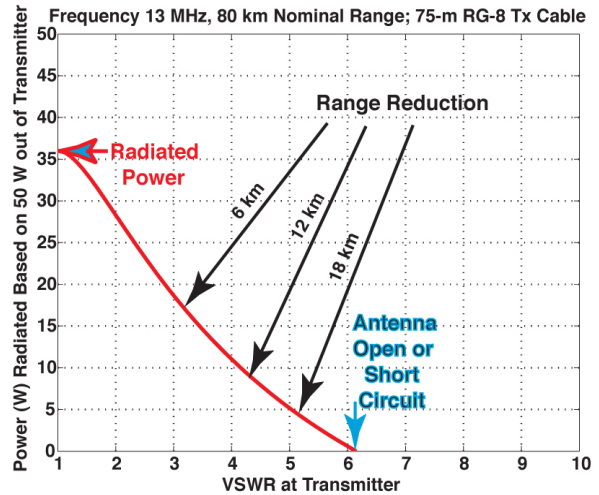
by Don Barrick

In the figure examples below, it is assumed that 50 watts is being outputted (not radiated) from the transmitter and that a CODAR standard 75m length RG-8 cable connects the Tx antenna to the Tx output. The difference between the 50 watts output and the radiated power at a VSWR of 1 is due to cable losses in the RG-8 cable. This varies with frequency.

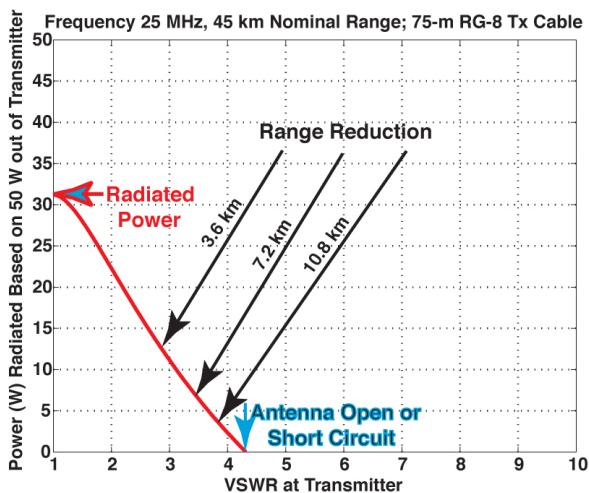
5MHz SeaSonde



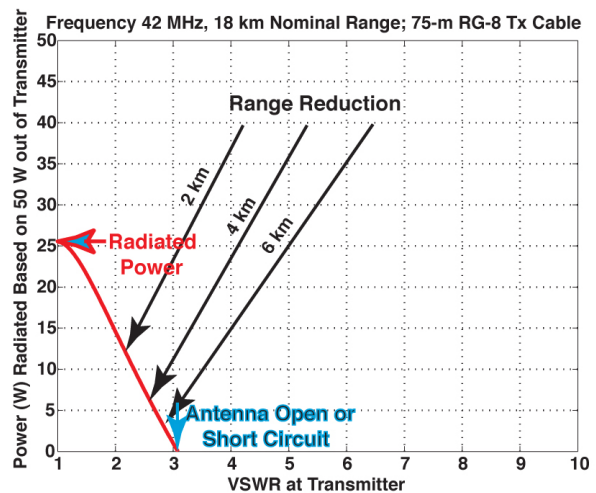
12MHz SeaSonde



25MHz SeaSonde



42MHz SeaSonde



Interpreting the graphs:

1. The vertical axis in each plot shows how much power is being **radiated**, for a given measured VSWR seen on the Tx power meter.
2. The red arrow on the left side shows how much power is being radiated for a **theoretical** perfect match, i.e., $VSWR = 1$. CODAR engineers state that the transmitter supplies ~ 50 watts at 0dB attenuation when tuned at the factory and that the antenna **radiates** about 40 watts of this. The graphical plots show that this is true only in the case of a 4.5MHz SeaSonde and when there is absolutely no mismatch. In all other cases, radiated power is even lower than 40 watts, for 50 watts available.
3. The nominal range one might expect under typical conditions is shown in the graph title at the top for the four frequency bands most commonly used by SeaSondes. The black arrows in the figures pointing to VSWR positions on the curve tell how much this range will be reduced if you see that VSWR at the back of the transmitter. So if you ask yourself, "can I live with this XX value of VSWR that I am observing?" you can refer to the curve to determine the loss of range associated with the VSWR value XX.
4. The aqua blue arrow to the right indicates the VSWR value where **radiated** power goes to zero. This is an important number. It means, if you observe this VSWR (for example, $VSWR \approx 6$ for 13MHz), this means no power is being radiated, i.e., there is an open or short circuit at the Tx antenna or its connector.
5. For cable lengths other than the standard 75m CODAR-supplied cable, this figure no longer applies. However, you can get an idea of how things will go from this. Longer cables are worse. Also, lower VSWRs will be observed for longer cables than the VSWR for 75m, for the same mismatch at the antenna.
6. The curve for 42MHz shows that even a 75m cable is too long. Only half the power available gets radiated even when there is a perfect match. Any $VSWR > 1$ causes even less radiated power. It is therefore prudent to remove (cut off) the excess RG-8 transmit cable on a 42MHz SeaSonde rather than just coil it up. When scouting for a new 42MHz site it is a good idea to keep the transmit cable run as short as possible between the transmitter and antenna (with a minimum 7-8m clearance around the antenna).
7. Of course these curves **do not apply** if the VSWR measurement is made with a hand-held power meter at the base of the Tx antenna. The VSWR at the base of the antenna will always be higher than that at the transmitter output, because the cable attenuation mutes the reflected power seen further back.