

Remote Control and Operation of DDF6000 Direction Finders via DataRadio Modems

A Technical Application Note from Doppler Systems Inc.

3 June 2005

Introduction

Doppler RDF6001 (RDF6000) direction finders can be networked in a variety of ways. Telephone modems, radio modems, or Ethernet connections are the most common ways. This technical note describes how to network direction finders using the [DataRadio](#) Integra radio modems. Version 3.x or later of the DDF firmware and version 4.x of the BearingTrack software require that the radio modems operate in the “data activation” mode at 9600 baud. The latest version of the BearingTrack software can be downloaded at <http://www.dopsys.com/software.htm>. Contact the [factory](#) or your [local distributor](#) for a firmware upgrade.

Configuration

A radio modem is required at each remote site and at the control site. All radio modems must be set to the same frequency for both transmission and reception. The master modem is located at the control site. This modem transmits and receives data from each of the remote site radio modems.

A single remote site can be controlled by BearingTrack using two radio modems as depicted in Figure 1, or multiple sites may be connected as shown in Figure 2. Additionally, using a serial expander, a site at the control site can be controlled while controlling the remote sites (see Figure 3). Any number of remote sites can be connected. However, it takes approximately 170 ms for BearingTrack to sample each radio modem site, so the response time of the system becomes slower when more than three sites are remotely connected (BearingTrack typically samples every 0.564 second).

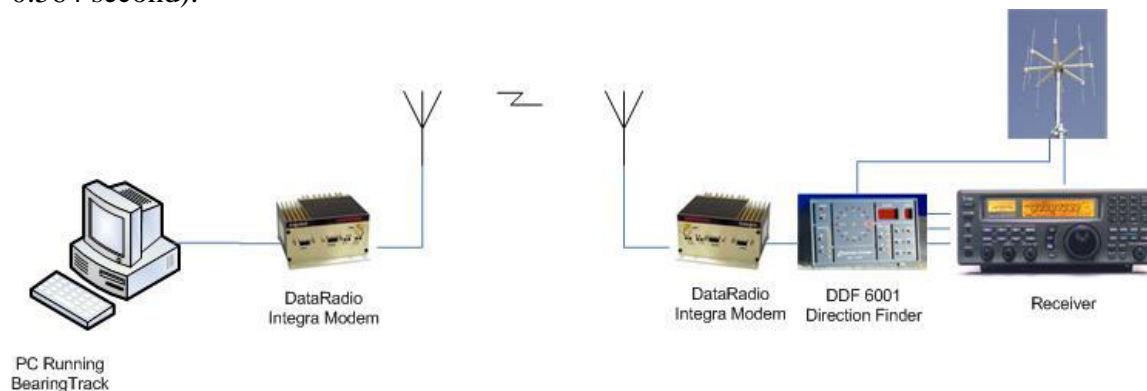


Figure 1: A Single Direction Finder Site Controlled by a Radio Modem

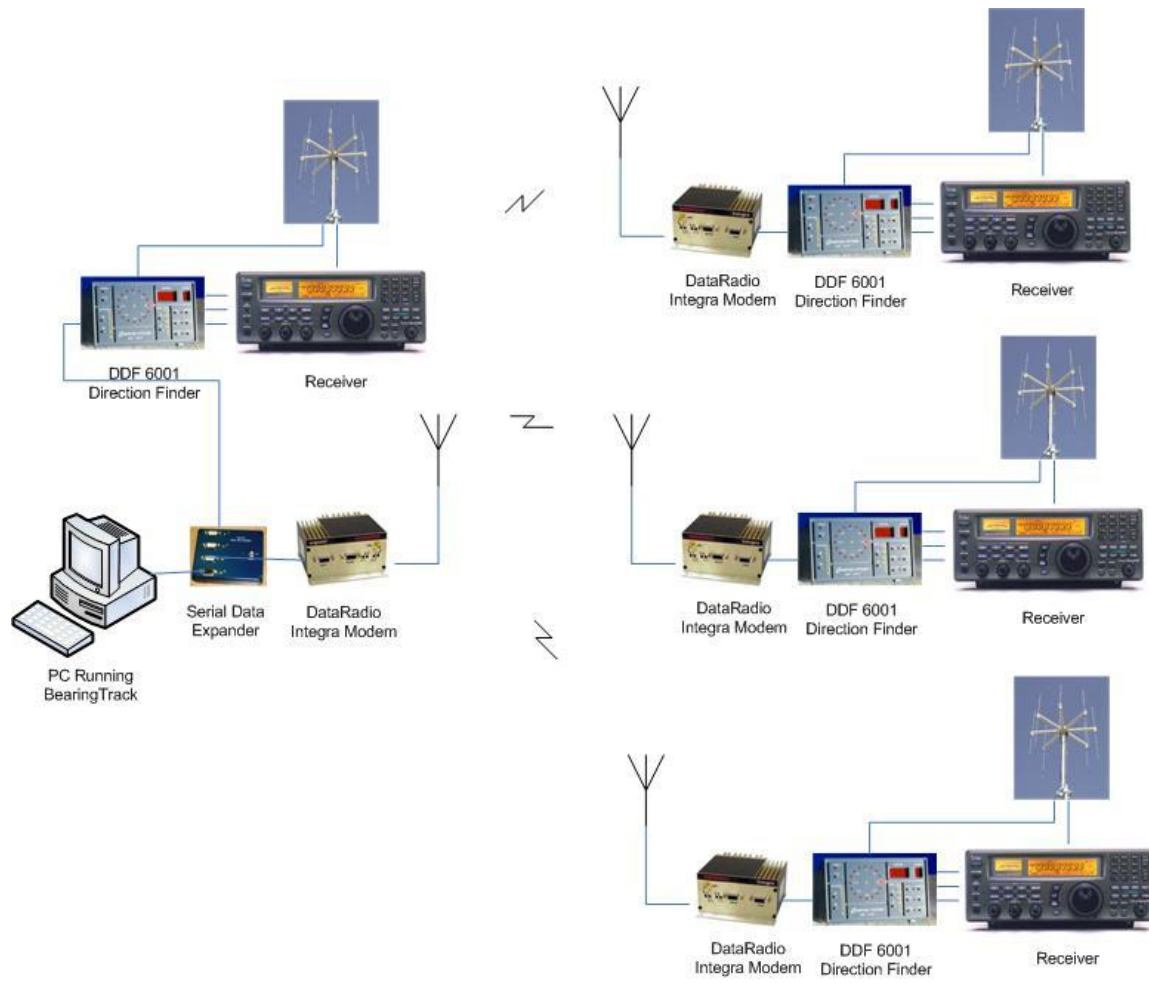


Figure 2: Multiple Direction Finders Controlled by Radio Modem

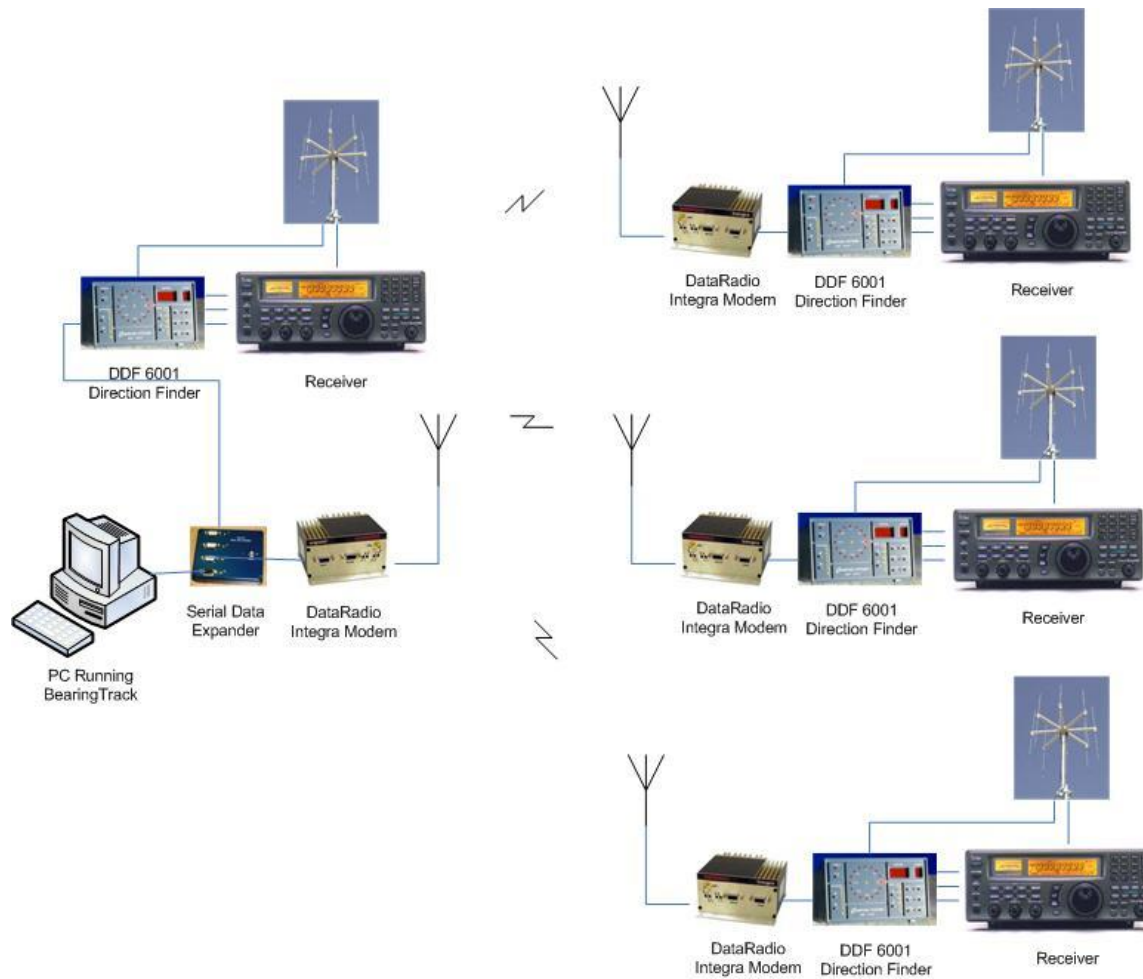


Figure 3: Multiple Remote DF Sites Controlled by Radio Modem, Local Site Controlled Serially

Master Radio Modem Setup

Note: The DataRadio Integra modem requires special software to interface with it. You can download it from <http://www.dataradio.com/downloadlibrary.html>. Version 4.00 or later is required.

Connect a serial cable from a PC to the setup port on the Integra radio modem. The serial cable used to program the modems must have a full complement of pins. Apply power to the radio modem. Launch the Integra TR application. Press the Read button and verify that the program is communicating with the radio modem. Next press the Parms button. A dialog box will appear that will allow you to program the modem. On the first tab, (Figure 4) the radio modem parameters are set. Select an ID number you would like to assign the modem. Change the Data Delivery parameter to **Selective**. Make sure the **Master** radio button is checked. If the radio modem is being used where a license is required, enter the license ID in the Station ID (CWID) field and set the interval you want the station to identify itself.

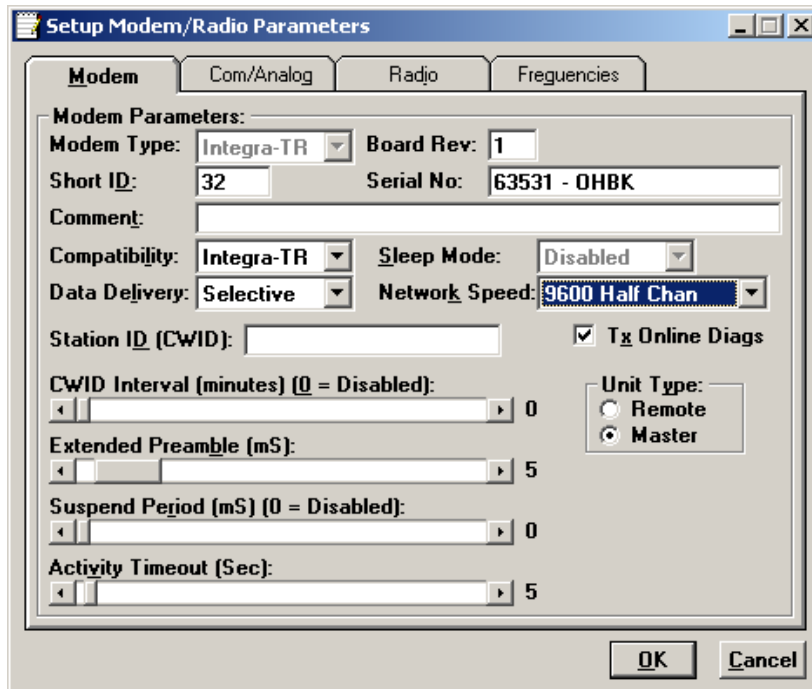


Figure 4: Radio Modem Parameters

Next select the Com/Analog tab (Figure 5). Set the DTE baud rate to **2400**. Make sure the TX protocol is set to **DOX** and the DCD control set to **Active**.

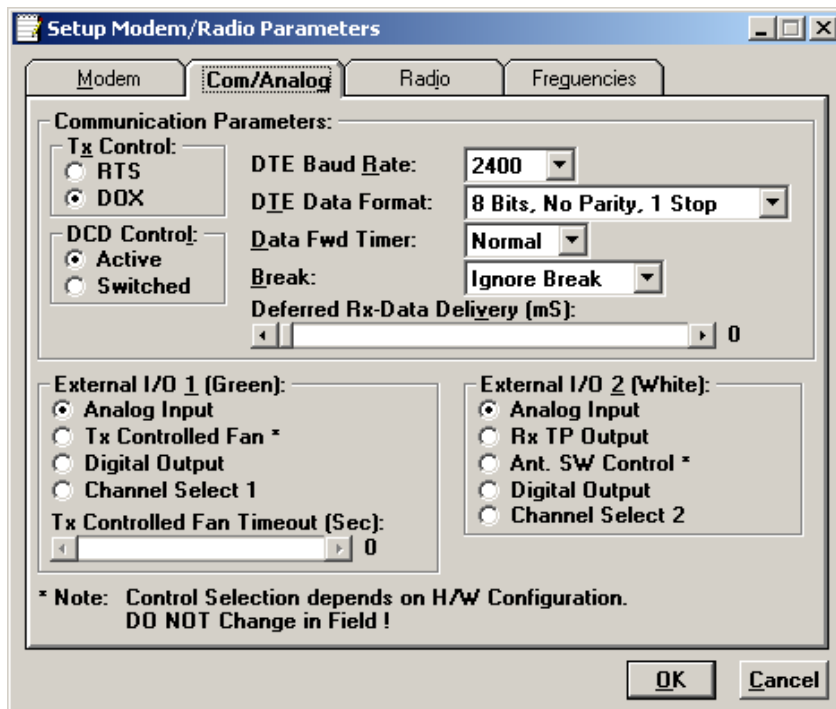


Figure 5: Com/Analog Parameters

Now select the Radio tab (Figure 6) and check the **Transceiver** radio button and the **Enabled – Buffer Data** button. For weak signals, the Carrier Sense control may have to be adjusted downward, or in a noisy environment it may be necessary to adjust it higher. The Tx Timeout parameter establishes the maximum time a transmitter can transmit before timing out. This parameter can be set quite low since all the system transmissions are quite short.

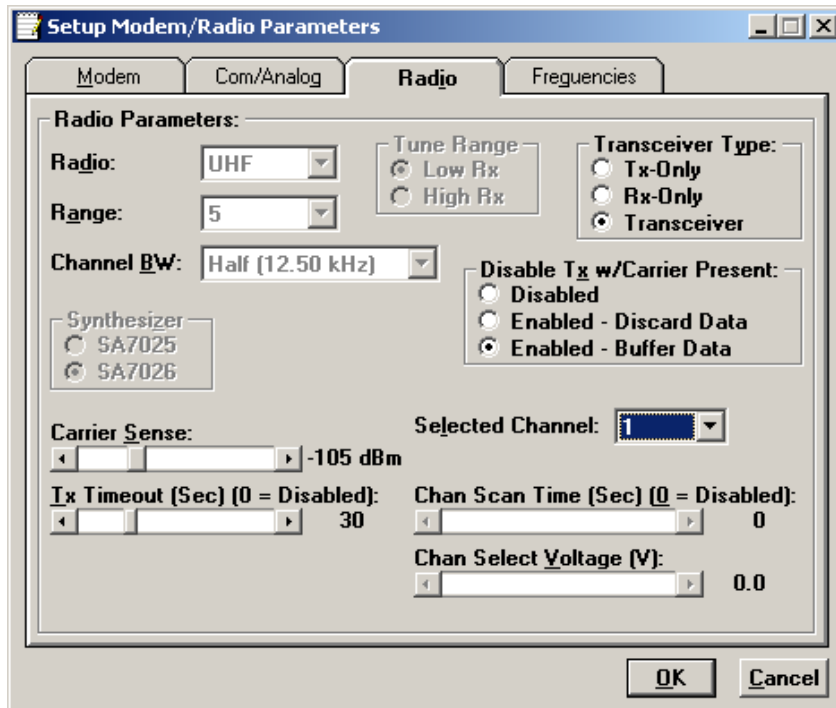


Figure 6: Radio Tab Settings

Next press the Frequencies tab. In the Channel 1 edit box, type in the frequency you want to use. Make sure the RX and TX frequencies are the same. You can also set the output power of the transmitter. This may not be necessary at the control site but if you are using a battery at the remote sites you may want to reduce the power to the minimum required to achieve reliable communications.

Once you've set all the parameters to the correct value, press **Program** to download the parameters from the software into the modem.

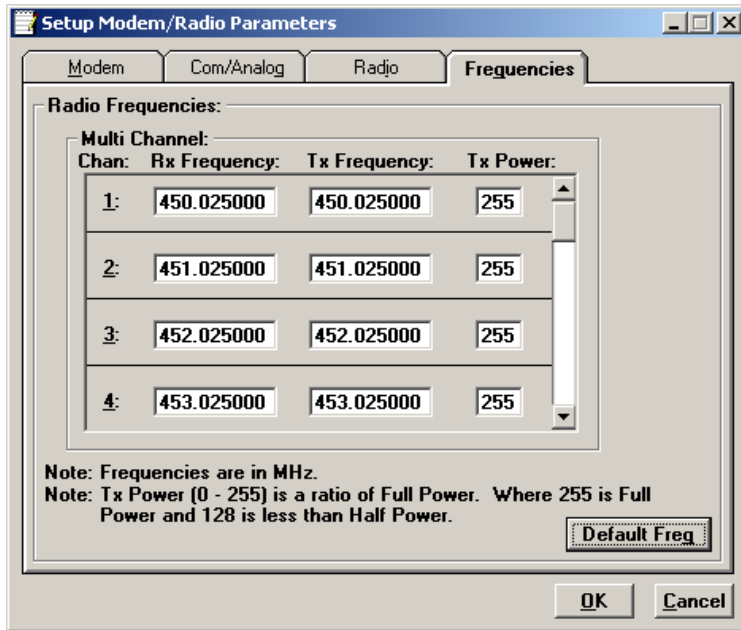


Figure 7: Frequency Tab Settings

Remote Site Radio Modem Setup

The remote site modems are set up exactly like the master, except the **Remote** radio button is checked and no Station ID should be entered. A unique Short ID number must be set from each remote modem. We suggest using the same number as you will assign to Direction finder in BearingTrack. See the BearingTrack manual or help file for more information on setting the Direction Finder address.

Modem Checkout

Apply power to the master modem and connect a serial cable from the PC to the setup port on the Integra modem. Under the Utilities menu, select **Diagnostic IDs and Alarms**. Enter an ID of a remote modem and hit the **Add New** button. Do this for all the ID numbers you used for the remote modems. Next, power up one of the remote modems and connect an antenna to the master and remote modem. Under the Utilities menu, select **Offline Link Test**. Use the drop down box to select the ID of the remote modem and then press start. The modems should communicate and the packets sent and received should match. Do this for each modem.

Setting Up BearingTrack

Follow the instructions for setting up the sites as instructed in the BearingTrack manual or help files. Select the **Option** menu item from the Setup menu and set the Time to Wait For Direction Finder Response to 200 ms.

RS232 Cabling

Host Modem to PC Cable

You can use any standard direct connection RS 232 cable. However, all that is required is a 3 wire shielded cable that connects the host modem to the COM port on the PC.

Signal	PC DE9 (female) pin	Master modem DE9 (male) pin
TXD	3	3
RXD	2	2
Ground	5	5

Remote Modem to DDF6000 Cable.

A null modem 3-wire shielded cable is required that connects the following signals on the remote modem to J1 on the DDF6001/6000.

Signal	Remote modem DE9 (male) pin	DDF6001 DE9 (male) pin
TXD	2	3
RXD	3	2
Ground	5	5

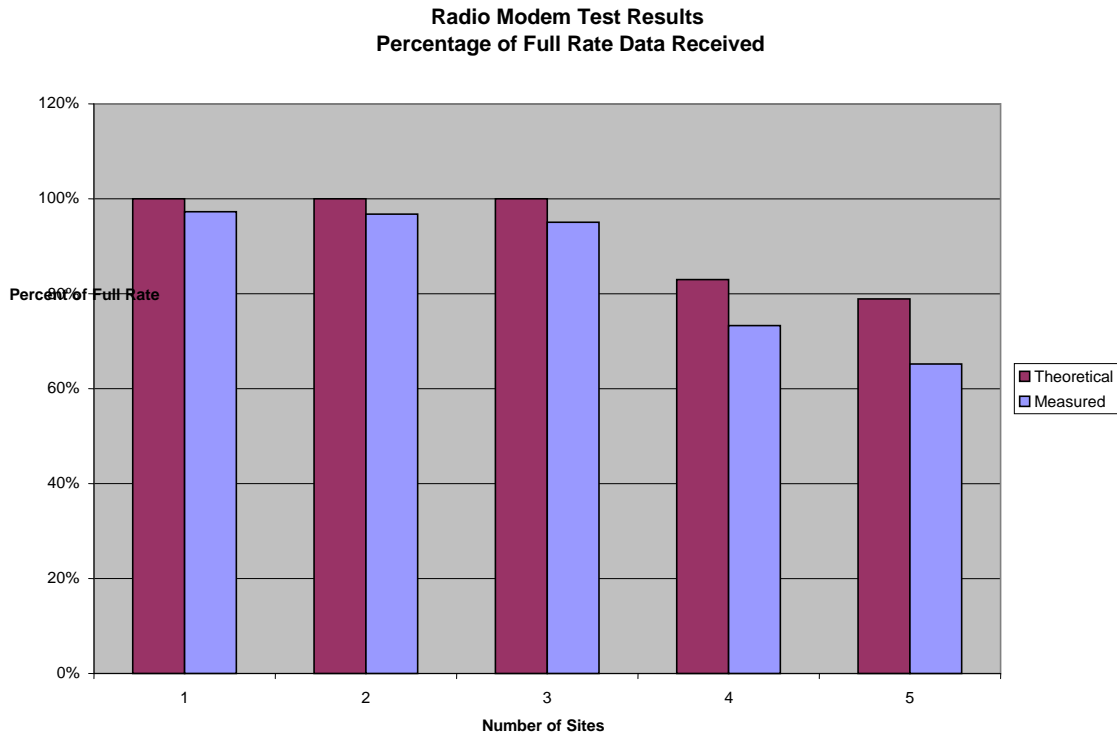
Test

We strongly recommend that you set up all the remote sites' direction finders, receivers, radio modems, and the control site computer all in the same room and test the system prior to deploying the system. Antennas on the radio modems can be simple whips or dummy loads. The direction finders can be placed in a self test mode to allow for a bearing display on BearingTrack. A CIV plug must be inserted into the CIV socket prior to powering the direction finder. If frequency control of the receiver is not required, this plug can be simply a "dummy" plug.

Test Results

To test the performance of the system we connected four remote sites via radio modems on one site directly to the PC, similar to the configuration depicted in Figure 3. Using BearingTrack we enabled the sites in a sequential manner to determine the system throughput. In a telephone modem or direct connected DF network, BearingTrack polls each direction finder once every 0.564 second. The direction finder responds very fast allowing a large number of direction finders to be polled every 0.564 seconds. The radio modems take approximately 135 ms to respond and BearingTrack takes about 35 ms to process the data. As a result a single poll sample in the radio modem network takes approximately 170 ms. The chart shows the throughput as a

function of the number of enabled sites. Notice that the actual throughput is somewhat below the predicted throughput. This is due to the fact that there are occasional transmission errors associated with the radio modems and some data is lost. This loss of data is not important since the network is sampled so frequently.



Final Installation

When all of the modems, direction finders, receivers and the PC are operating reliably in the same room using dummy loads on the RF outputs, you are ready to relocate the remote modems, direction finders and receivers to the remote sites and connect them to the radio modem antennas. Be sure to note the CIV addresses of the direction finders and the receivers so that they are installed at the correct site location. Also, be sure not to mix up the master and remote modems. Remember to switch off the self test mode on the direction finders.