




Setting up SDR and the Antenna

Software-defined radio (SDR) is a radio communication system where information is received and decoded on a personal computer. This chapter contains instructions for the foundational SDR software and hardware set up.

Hardware Setup

<ol style="list-style-type: none">1.2.	<p>Assemble the antenna by screwing the telescoping monopole onto the threaded base (Figure 1).</p> <p>Remove the protective covers from the connectors on the SDR dongle</p>	 <p>Figure 1 The telescoping antenna (above) and threaded base (below)</p>
<ol style="list-style-type: none">3.	<p>Screw the connector at the end of the antenna cable to the matching threaded connector on the dongle (Figure 2).</p>	 <p>Figure 2: The ends of the antenna (left) and dongle (right) to be connected.</p>
<ol style="list-style-type: none">4.	<p>The completed assembly can be seen in figure 3.</p>	 <p>Figure 3 The completed assembly.</p>

Installing Supporting Software

1. Download the most recent version of the .NET redistributable (currently 5.0) should be downloaded or installed before installing SDR# from <https://dotnet.microsoft.com/download/dotnet/5.0/runtime> (last accessed August 15, 2022)
2. From the “Run desktop apps” selection, click the “Download x86” version (Figure 4). As SDR# is a 32 bit application, there have been problems with the 64 bit version of .NET; the 32 bit “x86” version has been more reliable.

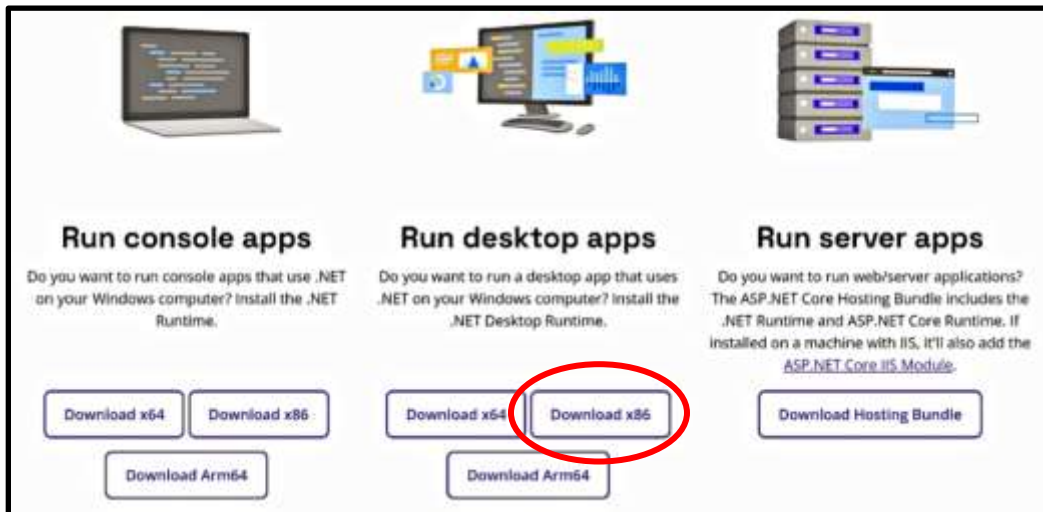


Figure 4 The .Net download screen. For best results select x86

3. Once the file has downloaded, double click to run the installation.

Installing SDR#

1. Go to <https://airspy.com/download/> and click on the “download” button.
2. Extract (unzip) sdrsharp-x86.zip onto the computer.
3. Double click on install-rtlsdr.bat from within the extracted folder (Figure 5). This will start a command prompt used to download all required drivers. The command prompt will automatically close.
4. Plug in the dongle and wait for any plug and play pop up to complete installation.
5. In the folder where the sdrsharp files were extracted to, find the file called zadig.exe. Right click the .exe file and select “Run as administrator”.
6. In the Zadig application, in the menu bar navigate to Options
7. In the pop up that appears: Ensure that “List All Devices” is checked.

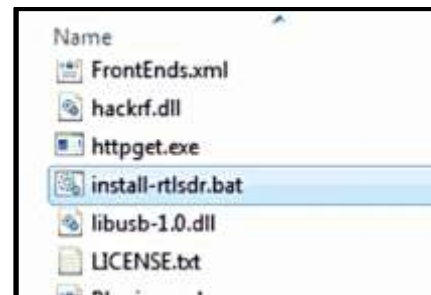


Figure 5 To install SDR# double click on "install-rtlsdr.bat"

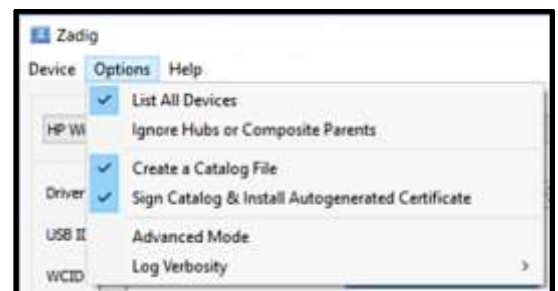


Figure 6 Correct configuration within the options menu.

Ensure that “Ignore Hubs or Composite Parents” is unchecked. (This is necessary to run the RTLSDR Scanner used in later steps.) (Figure 6)

8. Select RTL2832UHIDIR or RTL2832U from the drop down list in the center of the Zadig dialog box. Do NOT select “Bulk-In, Interface (Interface 0)”, “Bulk-In, Interface (Interface 1) ” or “USB Receiver (Interface 0)”. Also, ensure that WinUSB is selected in the box next to where it says driver. (Figure 7).

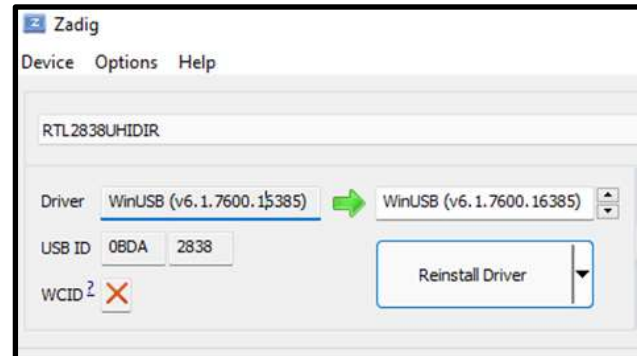


Figure 7 Correct configuration for driver selection.

9. Click Install Driver or Replace Driver. A warning may appear saying that the publisher cannot be verified, but click “Install this driver software anyway”. IMPORTANT: This driver has only been installed onto the USB port that the dongle is plugged into. Note which USB port has the dongle plugged into. If the dongle is moved to another port, or an additional dongle is used, zadig.exe will need to be installed for any USB port used.
10. Open SDRSharp by clicking on the SDRSharp application icon which is in the same folder as Zadig (Figure 8).

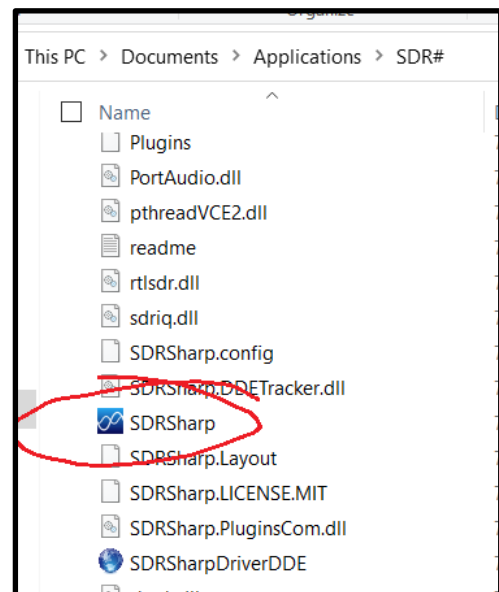


Figure 8 Doubleclick on the SDRSharp Application

11. When SDR# opens, find the “Source” partition and from the drop down menu select RTL-SDR USB (Figure 9).

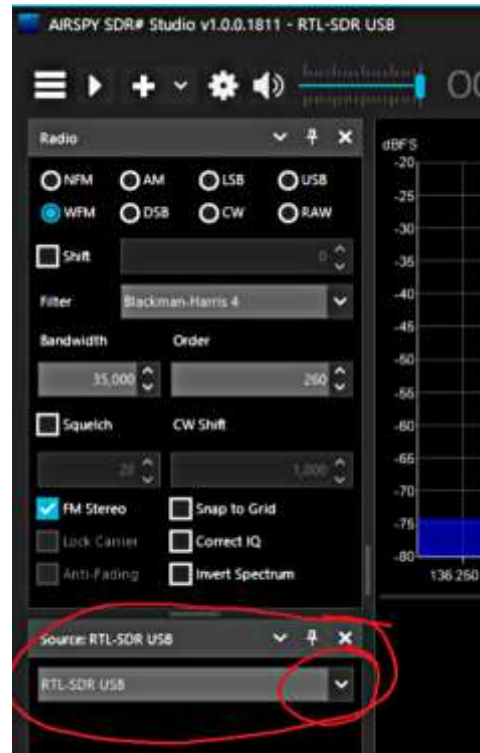



Figure 9 Select RTL-SDR USB from the drop down menu.

12. Click on the Configure button  (shaped like a gear) at the top of the SDR# window to bring up the configure menu (Figure 10). By default the RTL-SDR's gain is set to zero. Increase this gain by moving the RF Gain slider up. Gain is an amplification factor—it is increasing the strength of signal so that the software can detect it. Gain values of around 40 are commonly used. Alternatively, the AGC (automatic gain control) option can be enabled.

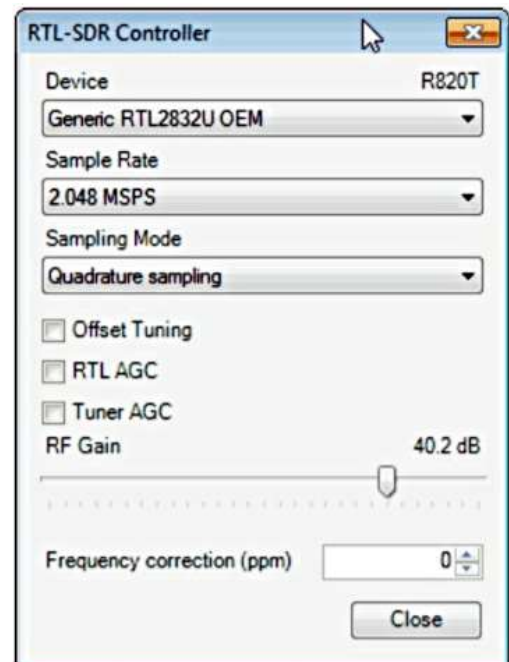


Figure 10 The SDR# configure menu. The RF Gain is circled

Press the Play button. The RTL-SDR software radio should now be playing some static and showing an RF spectrum and waterfall display (Figure 11). Using the frequency range at the top of the program window, tune to different broadcast signals.

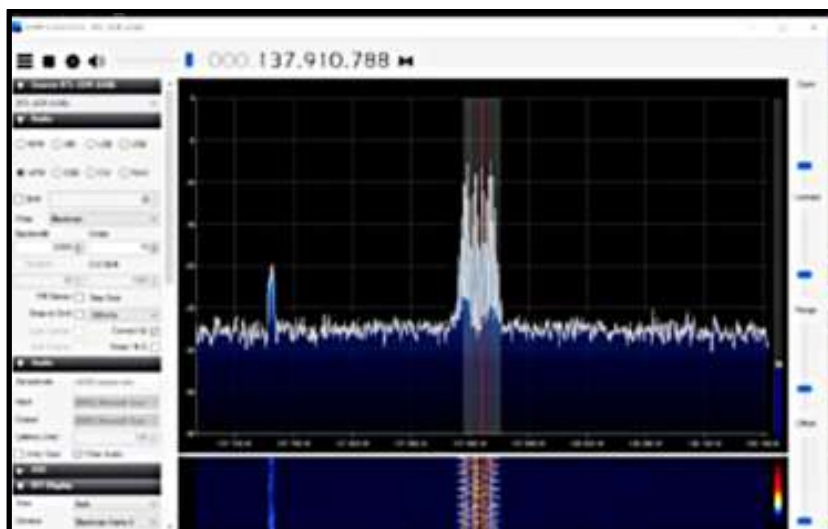


Figure 11 RTL-SDR RF spectrum and waterfall display

See the SDR# users guide at <https://www.rtl-sdr.com/sdrsharp-users-guide/> for more information on the use of SDR# and its various settings.

Improving Reception

Ground Plane

The performance of the monopole antenna can be improved by placing it on a flat metallic surface that has a radius similar to or larger than the length of the antenna (Figure 12). Even if the metal disc has a smaller radius, it will help in most cases to improve reception. The metallic surface could be anything - most easily it could be something like the lid from a coffee tin, or the tin cover of a metal cookie or chocolate box. Placing it on a metallic surface completes the antenna as a quarter wave ground plane.



Figure 12 An example of a ground plate made from a cookie sheet.

Coax Choke

Another improvement that can improve performance is to create a common mode coax choke. A choke will stop unwanted currents in the coax shield. This helps to remove the effect of the coax cabling becoming a part of the antenna and undesirably skewing the radiation pattern. To create

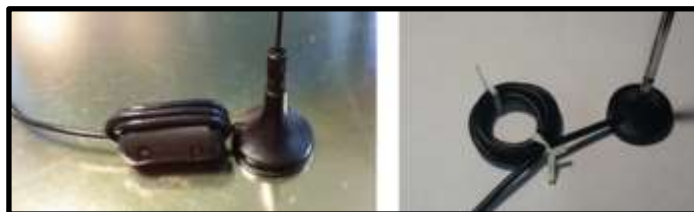


Figure 13 Examples of a simple coax choke. The image on the left uses a ferrite core while the one on the right is a simple coil.

a coax choke find cylindrical object about 2 - 3 cm in diameter, like a marker pen and create about 5 - 10 turns of coax cabling around it. A ferrite core can be used it as the winding center for even better performance. With a ferrite core there are fewer turns required for the same effect as with a non-ferrite core. Make the winding as close to the antenna base as possible. Below are examples of winding with and without a ferrite (Figure 13). This simple modification significantly lowers the noise floor.