Ten things to do, with a handheld radio

July 2018
K Barnsdale ZL3KB

This series of articles are intended to give the newcomer to ham radio an insight into some of the things you can do with a handheld dual band radio.

2: An external antenna for your handheld radio

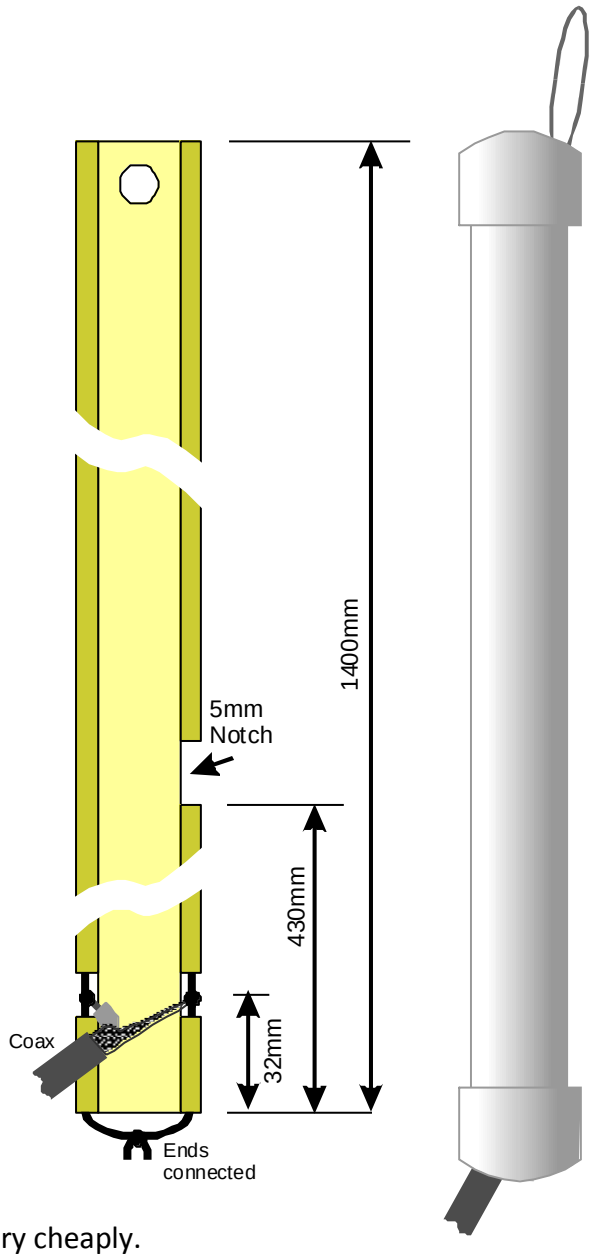
The average stubby antenna supplied with your handheld radio is usually a compromise between performance and size. If better performance is required, for longer range contacts, you will need to build or buy a larger antenna that can be mounted outside the house, or car.
An external antenna can be bought off the shelf from various retailers, such as http://comcentre.co.nz/ https://www.strictlyham.com.au/ http://www.cushcraftamateur.com/

No gain? Some pain

You will see most commercial antennas have a gain parameter. This gives an indication on how efficient and how directional they are. As a reference, a simple dipole antenna would have a gain of approx +2dBi. This is its performance relative to a theoretical point source radiator.
Your handheld antenna at VHF would be around -4dBi, which is approx one quarter of a dipole power gain. In contrast, a Yagi antenna may have a gain of approx +8dBi which is around four times better than a dipole; this is mainly due to its focussed beam.

DIY antenna for 2m band.

You can make a simple antenna for fitting outside the house, and will give a five times improvement in signal strength over the stubby antenna on the radio.
This design is one of the simplest you can make, yet has a performance equal to many commercial antennas.



Parts required

1.4m of 300ohm TV antenna ribbon cable
2m of RG58 or RG174 coax cable
Coax connector to suit your radio antenna socket
1.5m of 15mm diameter plastic water pipe

Suppliers

Jaycar does not stock the TV ribbon any more, but they do sell an cheap FM antenna that contains enough wire to make this antenna.
https://www.jaycar.co.nz/fm-indoor-antenna-300ohm/p/LT3002
If you find fitting the connector to the coax is too difficult, a ready made cable can be bought from Jaycar with an SMA plug already fitted,
https://www.jaycar.co.nz/3m-sma-coaxial-cable/p/WC7802
or these can be bought from Internet suppliers very cheaply.

Construction

1. Strip both wires at one end, twist and solder them together.
2. Measure and cut the overall length, and mark the cuts shown in the diagram with a pen.
3. Cut the 5mm notch all the way through the wire.
4. Strip the coax connection points back to the wire ready for soldering.
5. Strip the coax and solder the braid to the short leg of the antenna, and the centre to the long leg.
6. Slide the whole antenna into the water pipe, attaching the top with some nylon cord to a hole in the pipe. It is probably a good idea to add a cap at each end to keep out the moisture.
7. Suspend the whole antenna from a tree, or high point above the spouting level. Clamps can be added to the lower area near the coax connection.

Yagi antennas

To get even better performance a directional antenna is needed. This concentrates the radio signal, like a hose jet being more powerful than a spray. A signal improvement of twenty times can be had over a handheld radio stubby antenna. The simplest directional antenna is a Yagi beam, a typical three element example is shown below. The more elements, the narrower the beam and the more “gain” you will get, but it then will be more difficult to keep aligned with the station you are receiving.

Figure 1 A three element Yagi antenna

DIY Yagi antenna

A three element Yagi consists of a central driven element, a longer reflector behind and a shorter director in front. The boom is not an electrical part of the antenna and is only to hold it all together. The driven element is very similar to a dipole with two insulated rods and, in the simplest case, the radio feed in the middle.
It is possible to build your own Yagi antenna from wood and aluminium tubing, and there are lots of designs on the web to show you how. You will find a huge variety of designs with different element lengths and spacing, which give various advantages in forward gain, side lobe rejection or improved front to back ratio.
Quite often, the driven element is a folded dipole, where the ends are folded back to the centre boom to from a flat loop. This gives better gain and wider frequency bandwidth.

Checking the impedance of an antenna

To achieve maximum power transfer from your transmitter to the antenna, the impedances have to be matched, so the antenna should have an impedance of 50ohms.

The simplest instrument to check this is a Voltage Standing Wave Ratio (VSWR) meter, as shown below. This will indicate the forward power, relative reflected power and VSWR. The closer the VSWR gets to 1:1 the better the impedance match to 50ohm, and the more power you will get from your radio transmitter.
A VSWR meter should be fitted in the feeder between the radio transmitter and antenna.

Figure 2 A VSWR meter

To find out the tuned frequency of the antenna, measure the VSWR at many places in the band. The lowest VSWR reading will indicate the "tuned frequency". If this frequency is lower than your requirements, remove small lengths from the driven element. If the tuned frequency is too high, you will need to add small lengths.

Further info

Many websites show how to make antennas, including Yagis, and if they are not for the radio band you need, you can generally scale them up in frequency. However, avoid scaling from some of the WiFi Yagi designs as they are a little special!
A wide range of DIY antennas can be found at a Dutch amateurs PG1N site
www.pg1n.nl/index.php?lng=en
A standard three element design can be found at
https://everydayready.wordpress.com/2015/10/19/diy-2m-tape-measure-yagi-antenna/
This is a typical design which is build for portability
https://m0ukd.com/homebrew/antennas/144mhz-2m-portable-yagi-vhf-beam-antenna/