

# AMATEUR RADIO DIRECTION FINDING: A NEW CLUB ACTIVITY

## INCREASING PARTICIPATION AND INTEREST

This article describes how, by means of a low-cost kit for an 80 metre direction finding receiver, a number of clubs were able to add an activity to their schedule that combined technical interests (kit building), a new radio activity (radio direction finding) and associated social opportunities (picnics, kit building sessions and training events) while adding a useful RFI finding capability. Amateur Radio Direction Finding (ARDF) is also a great opportunity to introduce non-Amateurs, including youth groups, to the hobby as an Amateur Radio Operator Certificate is not required to participate in ARDF. A follow-up article in an upcoming issue of *The Canadian Amateur* will describe the equipment development in greater detail. Stay tuned.

Amateur Radio Direction Finding, as defined by the International Amateur Radio Union (IARU), is a widely appreciated Amateur Radio activity in most of the world except here in IARU Region 2 (North and South America). There has been a gradual increase in this radio sport in the US in recent years, but it remains difficult to field a Canadian team to participate in IARU international competitions.

After several years of organizing ARDF events where simple 2 metre equipment was employed, several deficiencies of this approach as a way of engendering enthusiasm for ARDF have become evident:

- 2 metre propagation makes for difficult direction finding so beginners often fail
- The “simple” 2 metre setup is not so simple – attenuators, offset attenuators, FM handhelds, portable antennas, etc.
- Frustration is the enemy of enthusiastic participation

It was thought that using 80 metre ARDF equipment could be a solution to these shortcomings because at 80 metres:

- Bearings are easy to obtain and mostly reliable
- Equipment can be simple to operate

## PROMOTION PROGRAM

One of our members (BCRadioSports), Les Tocko, VA7OM, had developed a simple 80 metre receiver so we set out to turn this into a reproducible kit, with the assistance of several other local Amateurs. We then used this kit and the associated low power transmitter to act as the basis for a 30- to 60-minute presentation to clubs in the lower mainland and Vancouver Island of British Columbia. These presentations were well received and resulted in the initial run of kits being sold out. The intention was not to sell kits but to use the kits as a means of encouraging the clubs and their members to participate in ARDF. The presentations were given in the first quarter of the year, the kits were available in March and assistance was provided to clubs in organizing events throughout the summer.

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The Surrey Amateur Radio Club Annual ARDF picnic at Crescent Park, South Surrey.



The First North Shore Amateur Radio Club ARDF picnic at Princess Park, North Vancouver.

We were gratified, not only at the acceptance of the kits, but also with the increase in the number of clubs offering events and with the turnout. A side benefit was the additional social activities by the club as several events were combined with a picnic style social.

The most recent IARU international ARDF competitions have included two additional 80 metre events: the Sprint and FoxOring. A description of these events is provided below. These new events feature short-range setups, low-power transmitters and faster-cycling or continuous transmissions. Consequently, the new events have most of the features that will assist beginners to succeed in learning to find hidden transmitters.

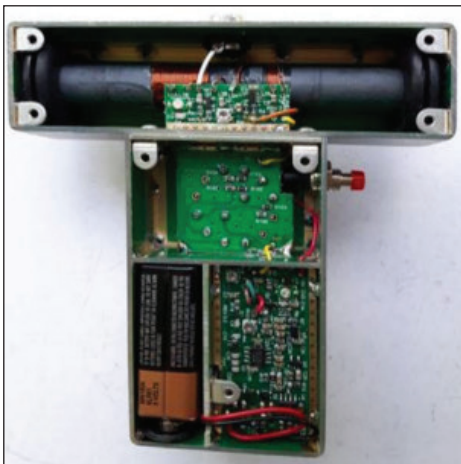
## RECEIVER

The receiver is a direct-conversion, limited tuning range, low-power, ferrite rod loop antenna, handheld design specialized for direction finding. While developed as “beginner” equipment, the receiver sensitivity and directionality performance is nevertheless comparable to more sophisticated receivers (such as the DF1FO FJR80).

The receiver enclosure is fabricated from single-sided printed circuit board material. The least expensive version 2 enclosure begins with a piece of PCB stock and all pieces are cut by hand. The version 3 kits used the PCB fabrication process to pre-cut the enclosure pieces for much less assembly work, but this greatly increased the cost of the kits.



The completed receiver



The receiver with the covers removed

To make the receiver small, it employs surface mount components so some skill with handling these tiny parts is needed. For the kits used in the promotion program, the surface-mount boards were supplied assembled and tested. Thank you Les!

The receiver has a front-end section located within the ferrite rod electrostatic shield part of the enclosure, followed by a 4-step attenuator and then the main board. The main board signal chain has a preamp, an SA602 mixer/oscillator integrated circuit (IC), an op-amp active low-pass filter and an LM386 audio output stage. The main power comes from a 9V battery regulated to 5V with low-dropout regulators for the oscillator-mixer and for the front-end board. The specializations for ARDF are the attenuator and a switchable sense antenna. More detailed description can be found in the references at the end of this article and in our next article.

## TRANSMITTER

The transmitter consists of a crystal oscillator, class C emitter keyed amplifier, and microprocessor controller, all powered with a pair of AA cells. Key-down current is around 10 mA or more depending on the output transistor and antenna.

The Sprint contest employs two groups of 5 transmitters deployed in two physically separated groups. Each group of 5 transmits in a fixed sequence where transmitter 1 starts at an even minute, runs for 12 seconds and stays off for the next 48 seconds. The second transmitter starts at 12 seconds after the even minute, runs for 12 seconds, then off for 48 seconds. Similarly for transmitters 3, 4 and 5.

The second group behaves the same way, but each transmitter identifies itself with a faster Morse code speed.

The transmitter identification consists of sending a unique Morse code: transmitter 1 sends "MOE", transmitter 2 sends "MOI", transmitter 3 "MOS", transmitter 4 "MOH" and transmitter 5 "MOS". That is, the pattern "MO" followed by one, two, ..., five dots.

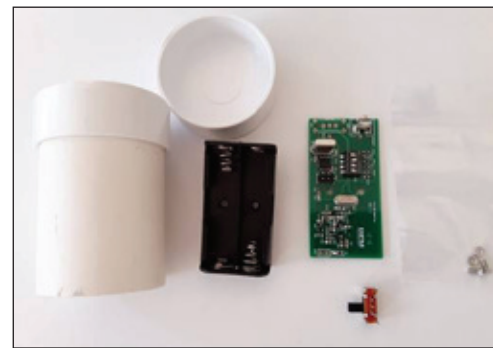


An example of a transmitter setup

The foxOring contest is a combination of fox hunting and orienteering. The low-power transmitters cannot be heard until the searcher has navigated using orienteering techniques to within about 100 metres of the transmitter, then the continuously-transmitting transmitter can be located using direction finding receiver.

The microcontroller is capable of generating the On-Off Keying of the transmitter for all of these timing modes plus the conventional 1 minute on 4 minutes off ARDF mode. These low-power, simple transmitters then allow for small area setups in local parks, or for individual builders to test and learn to use their receivers on their own.

More technical details about the transmitter can be found in the references at the end of this article and will follow in our next article.



The transmitter kit

## ACKNOWLEDGEMENTS

In addition to the authors, several others contributed significantly to the success of this project. Printed circuit boards: Dave Miller, VE7PKE. Chief evangelist: Amel Krdzalic, VA7KBA.

Participating clubs: NSARC (Northshore), SARC (Surrey), AARC (Abbotsford), CARESS (Coquitlam), WARA (Victoria), FARSC (Victoria), MRARC (Maple Ridge), BARC (Burnaby), DARS (Delta), LARA (Langley), RARC (Richmond)

## RESOURCES AND REFERENCES

Version 2 Rx manual, construction tips and general ARDF event information  
<https://ardf.whyjustrun.ca/>

IARU Region 2: links to IARU rules and other ARDF sites: <http://www.ardf-r2.org/>

2016 ARDF 80m Receiver Project  
<https://ardf.whyjustrun.ca/pages/71>

Receiver manual (both versions)  
<http://islandnet.com/~jyoung/>

Transmitter and controller manuals (see "Arduino programs")  
<http://islandnet.com/~jyoung/>

**Les Tocko:** First licensed in 1967 as OK3ZAX, he became VE4AMW in 1981, then VE6AWA and finally VA7OM. A retired electrical engineer, Les likes designing various electronic circuits, mostly RF receivers and transmitters. He likes HF DXing and contesting. His preferred mode is CW. Between 1967 and 1975 Les was an active fox-hunter attending many international ARDF competitions.

**Keith Witney:** First licensed in 1964 as VE4EI, Keith holds VE7MID and VE7KW and has operated in a number of DX countries. Keith is a multi-mode Radiosport operator, but prefers CW. A retired electrical engineer, Keith likes designing HF antenna systems and messing with technology in general.

**G. D. (Joe) Young:** First licensed in 1960, Joe has held call VE7BFK since then. He was active on HF, mostly CW, in earlier years, but his recent activity is mostly ARDF. He is a retired electrical engineer who enjoys messing about with various electronic projects.