

Getting Started with Single-Operator, Two-Radio (SO2R) Operation — Part 1

Single-operator, two-radio (SO2R) operation has been around for a while now. Skill with SO2R can clearly give those using it an advantage. In fact, some believe SO2R should be a separate category. I disagree with that notion, though, and once was taken to task when I was *NCJ* editor. A reader wrote to assert that SO2R was only for the Big Guns who could afford big stations, massive antenna arrays, and expensive switching devices. In my opinion, nothing could be farther from the truth. In fact, I would even say that SO2R is a skill that can give the Little Pistols a way to help close the gap between their modest stations and those of the contest superstations. Yes, a modest investment is required, but I believe the main impediment to SO2R is simply the willingness to make the investment in time and practice to do it well (see Figures 1 and 2).

We'll tackle this topic in two parts. Part 1 will address specific hardware and software needed to operate SO2R. The equipment needed to operate SO2R is not that unreasonable, and many contesters may have many of the required items already.

Part 2, in the next issue of *NCJ*, will discuss in some detail the various SO2R

operating techniques. As you will see, you can start very simply and, after you become more comfortable, you can reach a point where you are expertly interweaving QSOs on two different radios.

A key factor in successful SO2R operation is how effectively you can reduce cross-band interference as you are receiving on one band while transmitting on another. Four major factors affecting this are (1) the quality of the radios you are using; (2) the proximity of the antennas to each other; (3) the effectiveness of your band-pass filters, and (4) how much power you are running. Taking the last one first, it stands to reason that running less power is going to cause fewer problems on the second band. Operating SO2R with low power or QRP is going to be a *lot* less challenging than running high power on each band. With that in mind, let's take a look at the other three factors.

Radios for SO2R

I have used a variety of Icom, Yaesu, Kenwood, and Flex radios for SO2R. Just about any recent-vintage transceiver will work fine. Of course, the two radios you select should be in good operating condition. If your con-

testing station is built around one primary HF transceiver, you can certainly get started by picking up a used HF transceiver for the second radio. For many years, I used a Yaesu FT-2000D and an Icom IC-7600. Radios with superior dynamic range specs will perform best, as they will be better at suppressing cross-band interference — a fact of life when you are transmitting on one band and listening on another simultaneously. Some SO2R operators prefer to have identical radios on both sides of their SO2R setup. This is not necessary, but it may reduce some confusion in the heat of battle, if the controls for tuning, filters, gain, band changes, etc. are the same for both radios.

Many radios have a second VFO, allowing you to look for multipliers on a second radio while either running or searching and pouncing on the main VFO. This is a great feature in many modern transceivers but it does *not* mean that you can operate SO2R with that single radio. To truly operate SO2R, you need to be able to listen on one band *while transmitting* on a second band. The only single radio that I am aware of that can currently do this is the Flex 6600 (see my review of the Flex 6600M in November/December 2018 issue of *NCJ*).

Single Op HP							
Call	SO2R	Remote	QSOs	Mults	Op Time	Score	Club
K3WW	x		186	169	1	31,434	FRC
AA3B	x		181	171	1	30,951	FRC
N1LN	x		171	154	1	26,334	PVRC
N4AF	x		159	147		23,373	PVRC
N3RD			163	143	1	23,309	FRC
K4RO	x		150	142	1	21,300	TCG
NT6Q(N5Z0)	x		137	136	1	18,632	SCCC
VE7DZ0			135	135	1	18,225	DpDxCC
W2GD(@KU2C)		x	135	132	:52	17,820	FRC
K3WJV	x		135	127	1	17,145	FRC
K9MA			135	124	1	16,740	
NA8V	x		133	122	1	16,226	MRRRC
W6SX			130	124	1	16,120	NCCC
KØWA			130	122	1	15,860	DpDxCC
K2WK			127	122	1	15,494	PVRC
N3JT		x	128	120		15,360	
K5AX			129	116	1	14,964	DFWCG
K1GU			117	117	1	13,689	TCG
K6DAJ(@N6RO)	x	x	117	115	1	13,455	NCCC
K4QS			114	111	1	12,654	PVRC

Figure 1 — Nine of 12 total SO2R users in a recent 1-hour CWT Mini Contest event (high power) were in Top 20 (out of 104 participants). (From www.830scores.com)

Single Op LP							
Call	SO2R	Remote	QSOs	Mults	Op Time	Score	Club
K7SV	x		129	120	1	15,480	PVRC
KØAD	x		126	116	1	14,616	MWA
N4ZZ	x		109	106	1	11,554	TCG
KE8G			105	105	1	11,025	TDXS
K4FN	x		101	100	1	10,100	KCG
KØVBU			93	90	:55	8,370	KCCC
W9ILY			91	88	1	8,008	Metro DX
K1VUT	x		88	84	1	7,392	YCCC
K4IU			87	82	1	7,134	MWA
K1EBY			84	83	1	6,972	YCCC
KØPK	x		83	82	1	6,806	MWA
N4ETC(@AA4LS)			81	81		6,561	
W1QK			81	80	1	6,480	YCCC
N5EE			82	79	0:55	6,478	DpDxCC
K1DW			83	77	1	6,391	Lou CC
KG9X			79	79	1	6,241	SMC
W7OM			77	75		5,775	WWDXC
NØAC			75	74		5,550	IaDXCC
W8BG			73	73		5,329	FH
N8AA			73	70	1	5,110	

Figure 2 — Five out of a total of eight SO2R users in a recent 1-hour CWT event (low power) were in the Top 20 (out of 152 participants). (From www.830scores.com)

Antennas for SO2R

The design of your station's antenna system will go a long way toward determining how effective you will be operating SO2R. The ideal situation would be one in which you could have dedicated antennas for each band *and* have them located at some distance from each other. For most of us, that is simply not feasible. For contesters on a city lot or with a lot less space, a more reasonable antenna system might consist of a tri-band beam, perhaps dipoles for 40 and 80, and an inverted L or vertical for 160. When I first started doing SO2R, I had separate inverted Vs for 20, 40, and 80 on the roof and a ground-mounted R5 vertical in the backyard for 10, 15, and 20. This worked fairly well, as the antennas radiated in different planes. When planning your antenna system for SO2R, it is a good time to think about the band combinations you will want to work at the same time. Then, try to have antennas for those band combinations as far apart as possible. For example, during a North American QSO Party, my SO2R band combinations might be something like this:

- ◆ Start using 20/15 or 20/10 meters based on propagation
- ◆ In late afternoon, use 20/40
- ◆ During the evening, use 40/80
- ◆ During late evening use 80/160

If you have separate antennas and feed lines for each band, as well as a 6 × 2 antenna switch, this becomes a moot point. You are able to use any combination you desire. If, however, you wish to have certain bands permanently assigned to either Radio 1 or Radio 2, you need to think about this.

Most radios today allow you to switch between two antennas. Let's say you have a tribander, dipoles on 40 and 80, and an inverted L or vertical on 160. You could connect the beam and the 80-meter dipole to one radio, and the 40-meter dipole and 160 inverted L to the other one. This would allow you to operate all the above band combinations with the exception of 20/10 assuming you could use the 40-meter antenna on 15. This is just one of many possible scenarios. Ultimately, investing in a good 6 × 2 antenna switch (such as the popular Array Solutions Six Pak) is the most effective and flexible solution for switching antennas for SO2R operation. They do show up on the used market from time to time.

One very useful device I have added to my SO2R antenna system is a triplexer. In effect, this effectively has turned my tri-band Yagi into separate beams for 10, 15, and 20 meters. Prior to using a triplexer, I used a compromise antenna, such as a vertical or a dipole, on the second radio while using the beam on my primary band.

With the triplexer, I can take advantage of the gain and directivity on two bands at the same time, even though I have just a single tribander. My first triplexer was an Inrad HF Triplexer. It worked fine but was only rated for 200 W. I had to bypass it whenever I wanted to use my 500 W amplifier. I replaced it with a Low Band Solutions PerfoBox-500 unit, which is rated for 500 W. It also works well. Operating 20 and 15 at the same time was absolutely no problem. Operating 20 and 10 required making sure I stayed away from harmonically related frequencies.

Band-Pass Filters

In the Twin City area, we have a fellow who repairs radios. He works out of his basement, does great work, and charges a fair price. When SO2R operation started becoming popular a while back, he once told me that it caused a real spike in his business. Lots and lots of radios were coming into his shop with their front ends smoked. Although some SO2R operators with good antenna separation have told me they are able to operate SO2R without band-pass filters, I do not recommend doing this. Band-pass filters do two things for the SO2R operator. Most important, they protect the front end of each radio from voltages induced when the other radio is transmitting. They also filter out possible spurious signals being generated from the other radio when it is transmitting. Although band-pass filters are not a cure all, they can definitely make SO2R easier and reduce the possibility of damage to your radios. Evaluating the effectiveness of band-pass filters is beyond the scope of this article.

Switchable filters, such as the DuneStar D600, have the advantage of being able to be positioned between the radio and the amplifier, meaning that low-power filters can be used even if you are running an amplifier. Single band-bandpass filters, which would simply be inserted in the feed line of each antenna, will also work. If you are running an amplifier, however, the non-switchable single-band filters will have to be inserted at the output of the amplifier in the individual antenna's feed line. This means having to use more costly high-power filters.

In reality, band-pass filters are not a silver bullet for getting rid of cross-band interference. If antennas are in very close proximity and in the same plane, band-pass filters will be much less effective at reducing this cross-band interference, especially on harmonic frequencies. [A number of commercially available high-power band-pass filter units are available, including the Low Band Systems models, the 4O3A models, and the VA6AM units. The availability of these on the used market is less certain. — Ed]

Switching Devices

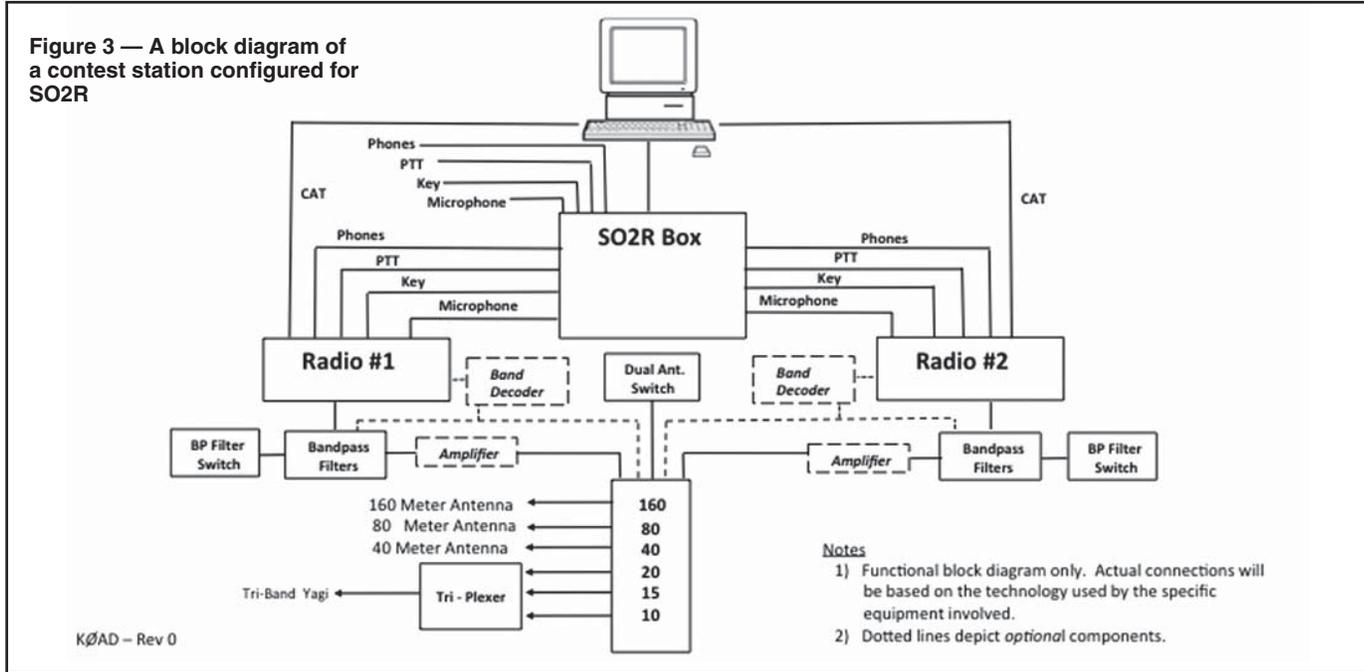
The final piece of hardware needed for SO2R is a means to switch such things as headphones, microphone, keying line, and PTT line between the two radios. In most cases, you will want your logging program to take care of this, but it is useful to be able to do this manually, especially when you are using your radios outside of a contest. For many years, the DX Doubler made by Top Ten Systems was a popular box for performing these functions. One drawback of the DX Doubler was that it used a LPT interface to the computer which is no longer available on most computers today. Another popular SO2R box was available from the Yankee Clipper Contest Club in kit form. According to their website, this kit is also no longer available. Perhaps the most popular boxes used by SO2R operators today are those manufactured by MicroHAM. The MicroHAM micro2R is available in the \$300 – \$400 range and performs well. The top of the line MicroHAM MK2R+ is popular with many SO2R operators but may be overkill for a beginner. It is priced in the \$900 – \$1,000 range. Both MicroHAM devices use USB interfaces to the computer.

Another device that is useful but not absolutely necessary for SO2R is some kind of band decoder that will detect which band you are on and automatically switch to the correct antenna when you change bands. You will need two of them (one for each radio). Band decoders are available from a number of suppliers and can even be homebrewed if you feel ambitious. I won an Array Solutions Bandmaster III band decoder at the Dayton contest dinner one year. It worked well, so I purchased another one. One feature that I liked with the Bandmasters is that they have two contact outputs for each band. This makes it possible to switch in both the correct antenna and correct band-pass filter when you switch bands. In the heat of battle with SO2R operation, it is nice not to have to worry about switching in the correct antenna and filter. It is an easy thing to forget.

Computer and Software

With the latest transceivers and interfaces, a USB interface to your computer may be all you need. Depending on the vintage of the computer and operating system, as well as the type of interfaces you use, you may also need some serial ports. It is recommended that you use as large a display as possible — perhaps even two screens — with the ability to navigate seamlessly across both with the mouse. This is especially true when you are operating SO2R in an RTTY contest. Besides the windows you would normally have open on CW and SSB, you would also need to have print windows and tuning scopes open for both radios. Some RTTY contesters like to

Figure 3 — A block diagram of a contest station configured for SO2R



have multiple print windows, with different decoders, open for each radio to improve the possibility of printing marginally readable signals. The screen real estate adds up quickly. I still use one screen but do reduce the font size to fit everything when doing SO2R on RTTY.

Finally, I should mention that some SO2R operators use separate computers (including monitors, keyboards, and mice) for each radio. This is essentially configuring your station for Multi-Two operation but with just one operator. I will not address this approach, as I believe that the vast majority of SO2R operators use a single computer.

Most major contest logging programs accommodate SO2R operation. Most of my experience has been with *N1MM Logger+* and *WriteLog*. The examples of SO2R operation I've given in this article will reference those two programs.

Putting It All Together

Figure 3 offers a general block diagram showing how a station configured for SO2R might look. The connection details will vary widely, depending on what radios, interfaces, and computer is used. Many of these connections with today's radios will be via USB or Ethernet. Some items are optional, depending on the level of automation you desire. In general, the more automation the better. Like many things, though there is always a tradeoff between how much money you want to spend and how automated you want to be.

In Part 2, I will dive into the various techniques and strategies that you can use to operate SO2R effectively. I'll also touch on some SO2R etiquette.