Single-Operator Contesting with Two Radios

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The Fundamental Concept

If you're not CQing,
you're *LOSING!*

Why Use Two Radios?

- Boost score—maximize productivity

- Stay competitive—the bar is higher than ever

- Increase the fun of operating

- Skill-building

- Reduce boredom

- The technical challenge and rewards of developing an effective contest station

Two-Radio Techniques

- Listen to both rigs at the same time, one in each ear.
  - The original technique
  - Hard to master; highly distracting and fatiguing
  - Some top operators do this very well.

- Listen to one rig whenever you're transmitting on the other
  - Use an output from your contest software to control the receive audio/CW switching.
  - Very effective technique (more later)

The Challenges

- Achieving <u>zero</u> interstation interference
  - Antenna separation—difficult for most of us
  - Coaxial stubs—good, especially with monobanders
  - Band-pass filters—better
- Synchronizing all the switching
  - CW key line and/or mike audio
  - Receiver audio
  - PTT and/or amplifier key line
  - Switch, by band:
    - Radio frequency
    - Selected antenna, band-pass filter, and/or coaxial stub

Use the Tools

- Use PC software that you like

  - Interface both rigs to one PC

  - Use all the control outputs available to you

    - Frequency control (serial interface)
    - CW output (serial or parallel) and paddles (parallel)
    - Use PTT output to key amplifier(s)
    - Radio A/B select output for switching RX audio/CW/voice
    - Parallel port band data for antenna and filter selection

Where it Works, Where it Doesn't

- **Two-radio operating works best when you have:**
  - Good station, set up for efficient band-changing
  - No self-interference
  - Lots of antenna choices
  - With QSO rates up to about 140/hour on the run radio (in CW DX contests with short exchanges)
  - Low power—very productive at raising your rate
- **SO2R is least effective:**
  - On DXpeditions or other very high-rate situations.
  - When you're too weak to hold a good run frequency.

Details

See N6TR's 1997 Dayton Contest Forum presentation for examples

http://web.jzap.com/n6tr/tworadio.html

Two-Radio Mechanics

- **Receiver Audio**
  - Listen on one rig whenever transmitting on the other.
    - Automatically switch audio to receiving radio when sending from the computer (CW or DVK/DVP voice messages).
    - Listen to second rig when sending with paddles, but also listen to keyer audio (acoustically coupled).
  - Use amplifier key line or PC PTT output to drive switching circuit (ie, simple control box as in Sep/Oct 1990 *NCJ*).

- **Transmitter Key Line**
  - Switch under automatic control (PC A/B output) or under manual control as a backup (switch with a big knob).
  - Isolate amplifier key lines from each other with relays.

How Do You Do It?

- *Call CQ!*

- **When transmitting, dial the second rig's VFO!**
  - Look for multipliers
  - Look for QSOs (best use of time in low-rate situations)
  - Check for band openings
    - Put stations you find in the band map
    - Bag a whole bunch of them quickly if your CQ freq goes bad
    - Spot them on packet if you're operating Single Op Assisted
  - With sufficient filtering or antenna separation, look on the same band for QSOs and multipliers. (Hard to do.)

- **You quickly get used to not hearing your own sidetone on CW. But pay attention to CW speed!**

Getting Started

- **Add a second radio! A basic rig is a good start.**

- **Set goals for yourself.**

- **Think about how to switch your existing antennas for maximum flexibility.**

- **Add more antennas, particularly multiband ones.**

- **Minimal setup:**
  - Two inexpensive radios, two multiband antennas.
  - Manually switch the CW key line and RX audio between rigs.
  - Ensure that you cannot transmit on both rigs at the same time; this is illegal in almost all contests.

- **Start operating—this takes practice!**

Low Power/QRP Tips

- **Make best use of low power by CQing a lot.**

- **It's possible to *double* your rate, especially during slow times.**

- **SO2R is very effective with a small lot and close-spaced antennas for LP/QRP entrants.**
  - You can get by without much filtering or antenna separation

- **You can do well with simple antennas.**
  - Tribander for the CQ rig
  - Wires, such as parallel dipoles with single feed point, for second radio

Efficiency

- The key point of SO2R is to increase your efficiency, so:

    - Don't lose your run frequency!

    - Make smart decisions about who you call on the second radio

        - Snappy operators with good signals are best

        - Be loud enough to work whomever you call

    - Don't be an SO2R lid

        - Use frequencies wisely and be courteous; SO2R is not an excuse to become a toad

        - Most people listening to you on the air should not be able to tell that you're doing SO2R

Software Choices

- **CT, NA, TR Log and Writelog have two-radio features. These are the big names.**

- **All support radio A/B output, CW keying and band information for two rigs on LPT1 and LPT2.**

- **From my experience, TR Log and Writelog have the best-integrated two-radio features.**
  - Ability to check dupes on second rig without interrupting CQ-rig activities
  - Working stations on second rig with minimum keystrokes; smallest chance of losing your run frequency.

Software (2)

- **For more information on contest software:**
  - TR Log: *www.qth.com/tr ($60—free eval ver.)*
  - Writelog: *www.writelog.com ($75)*
  - CT: *www.k1ea.com ($79.95)*
  - NA: *http://datom.contesting.com ($64.50)*
- The second-best investment you can make for improving your contest scores, general logging, QSLing and tracking QSOs for awards.
- What's the best investment? *Operate more!*

Software (3)

- **What about RTTY and Windows?**
  - *WriteLog* is excellent Windows software. See Mar/Apr 1999 *NCJ* review by K5ZD. $75.
    - Includes two-radio features almost identical to TR Log.
    - Uses sound card for SSB, and to simultaneously demodulate RTTY streams from two radios
    - Interesting configurations possible, including the option of using two monitors—one for each radio. (Requires Win 98+)
  - WF1B's RTTY software.
    - Limited two-radio features; requires two computers
    - Now freeware
  - For good info on two-radio RTTY operating, see the presentations at: *www.megalink.net/~n1rct/wlindex.html.*

Hardware Options

- **Home-brew band decoding and antenna switching**
  - A major project; involved to build. Requires good RF isolation and careful construction.
  - Customizable, relatively inexpensive, expandable

- **Commercial controllers**
  - W9XT band decoders, two at $20 (board-level solution).
  - Top Ten band decoders, two at $125 each.
  - Top Ten two-way relays ($390 for 6 bands) and two six-way relays ($125 each).
  - Array Solutions/RF Applications IBS-1 decoder, two at $199 each.
  - Array Solutions SixPak antenna switch, $300. (Supports Top Ten and W9XT band decoders)

Hardware Options (2)

- Cost analysis: six-band switching solutions
  - Top Ten Band Decoders plus Top Ten relays: $864 ($680 using W9XT decoders).
  - SixPak plus two Top Ten band decoders: $615 ($340 using W9XT decoders).
  - SixPak and two IBS-1 decoders with relay drivers: $897 ($340 using W9XT decoders).
    - More highly integrated solutions
  - Home-brew RF relay box
    - $100-$200 in parts, depending on source of relays.
  - With any complete six-band solution, count on at least $100 for interconnecting cables.
  - Requires external switches for >6 feed lines

Hardware Options (3)

- Between the Rigs (CW, audio, related switching)
  - Top Ten DX Doubler, $195
  - Array Solutions SO2R Master, $275
  - Home-brew solution, <$100 depending on features and parts used. I spent about $85.
  - Extras (must-have):
    - Band-pass filters (~$300 each)
    - Stubs—a less expensive alternative that trades labor for cost; appropriate only for monobander stations.

- Bottom line: Home-brewing is a great opportunity for substantial savings

K2UA SO2R Setup

- Rigs interfaced to one 486-66 PC. Either can be CQ rig.

- FT-1000MP/AL-1500, TS-850S/SB-220.

- DuneStar 600 6-band band-pass filters on both rigs

- One box decodes band information; drives band-pass filters and relay box that switches 10 separate antennas. Can be operated manually (by rotary switches).

- Any antenna to either radio; selected rig has priority.

  - Automatic lockout keeps both rigs from selecting the same antenna.

- Alternative antenna selections available

  - Tribander at 35 ft on Caribbean
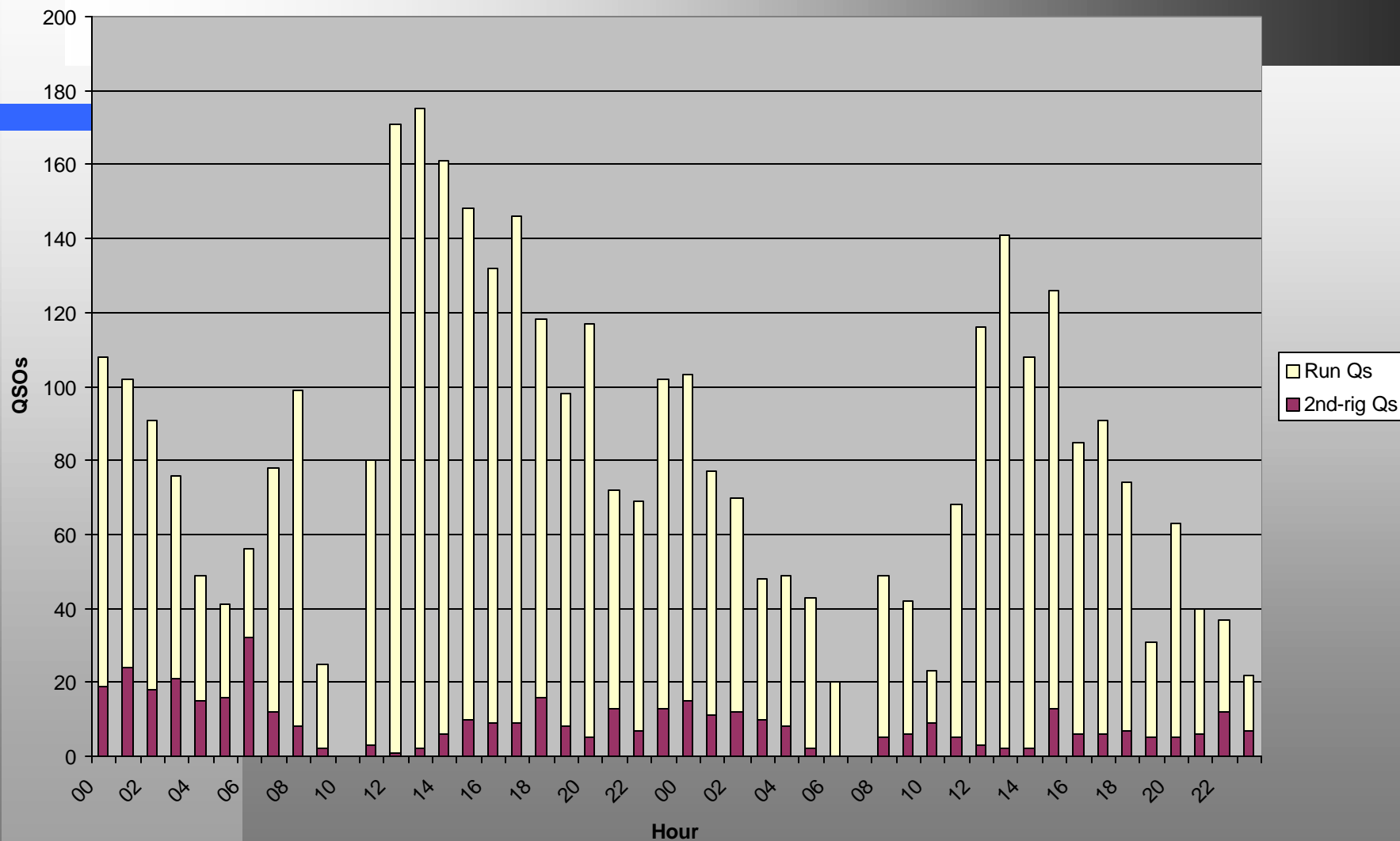 - Two antennas for 80 meters

Outside

- **Two 100-foot Rohn 25 towers, 150 feet apart**
  - Tower 1:
    - Top 50 feet rotates (K5IU/RTS hardware)
    - 2-element Cushcraft 40-meter beam at 96 feet
    - 4/4/4/4 stack for 10 meters, every 25 feet
    - Low tribander on swinging-gate side-mount
  - Tower 2:
    - 4/4 20-meter stack, U/L/B switchable
    - 5/5/5 15-meter stack, top/all/bottom-two switchable
    - 80-meter inverted V
  - Other Antennas
    - 160 sloping vertical; 3 Beverages; 80-meter groundplane

Bottom Line SO2R Benefits

- 2000 CQWW CW, SOAB
  - 3846 QSOs
  - 426 second-radio QSOs
  - Average rate boosted by 10 QSOs/hour by second radio
  - Personal best by 650 Qs in any CW contest

- 2001 ARRL DX CW, SOAB
  - 4089 QSOs
  - 362 second-radio QSOs
  - Average rate boosted by 9 QSOs/hour by second radio

Main and Second-Radio Rates, K2UA 2000 CQWW CW

Run Qs
2nd-rig Qs

QSOs

Hour

Summary

N6TR's 1997 Dayton presentation encapsulates the benefits of two-radio operating nicely:

"Two radios—puts the operator back into the equation."