

## The American Radio Relay League

The American Radio Relay League, Inc., is a noncommercial association of radio amateurs, organized for the promotion of interest in Amateur Radio communication and experimentation, for the establishment of networks to provide communications in the event of disasters or other emergencies, for the advancement of the radio art and of the public welfare, for the representation of the radio amateur in legislative matters, and for the maintenance of fraternalism and a high standard of conduct.



ARRL is an incorporated association without capital stock chartered under the laws of the state of Connecticut, and is an exempt organization under Section 501(c)(3) of the Internal Revenue Code of 1986. Its affairs are governed by a Board of Directors, whose voting members are elected every three years by the general membership. The officers are elected or appointed by the Directors. The League is noncommercial, and no one who could gain financially from the shaping of its affairs is eligible for membership on its Board.

"Of, by, and for the radio amateur," ARRL numbers within its ranks the vast majority of active amateurs in the nation and has a proud history of achievement as the standard-bearer in amateur affairs.

A *bona fide* interest in Amateur Radio is the only essential qualification of membership; an Amateur Radio license is not a prerequisite, although full voting membership is granted only to licensed amateurs in the US.

Membership inquiries and general correspondence should be addressed to the administrative headquarters:

ARRL  
225 Main St.  
Newington, CT 06111 USA  
Telephone: 860-594-0200  
FAX: 860-594-0259 (24-hour direct line)

### Officers

**President:** Rick Roderick, K5UR  
P.O. Box 1463, Little Rock, AR 72203

The purpose of *QEX* is to:

- 1) provide a medium for the exchange of ideas and information among Amateur Radio experimenters,
- 2) document advanced technical work in the Amateur Radio field, and
- 3) support efforts to advance the state of the Amateur Radio art.

All correspondence concerning *QEX* should be addressed to the American Radio Relay League, 225 Main St., Newington, CT 06111 USA. Envelopes containing manuscripts and letters for publication in *QEX* should be marked Editor, *QEX*.

Both theoretical and practical technical articles are welcomed. Manuscripts should be submitted in word-processor format, if possible. We can redraw any figures as long as their content is clear. Photos should be glossy, color or black-and-white prints of at least the size they are to appear in *QEX* or high-resolution digital images (300 dots per inch or higher at the printed size). Further information for authors can be found on the Web at [www.arrl.org/qex/](http://www.arrl.org/qex/) or by e-mail to [qex@arrl.org](mailto:qex@arrl.org).

Any opinions expressed in *QEX* are those of the authors, not necessarily those of the Editor or the League. While we strive to ensure all material is technically correct, authors are expected to defend their own assertions. Products mentioned are included for your information only; no endorsement is implied. Readers are cautioned to verify the availability of products before sending money to vendors.

Kazimierz "Kai" Siwiak, KE4PT

## Perspectives

### Solar Cycle 25 Plus Digital Modes

New Solar Cycle 25 sunspots began to appear in earnest November of 2020, signaling the onset of improved propagation for the upper HF ham bands. Many long-time *QEX* readers are familiar with these solar cycle trends. A rule of thumb is that during the low sunspot activity portion of the cycle, set your sights on the 160 m through 40 m ham bands, and during high sunspot activity expect gratifying results on 30 m through 10 m. That's what institutional memory suggests. But institutional memory over past decades is biased toward the performance of traditional ham modes such as Morse CW, SSB phone, and Baudot RTTY that have been available historically. According to Club Log's latest activity report compiled by Michael Wells, G7VJR, however, FT8 in the *WSJT-X* suite of digital protocols now accounts for 60% of HF operations. Our collective memory is being nudged to digital mode performance.

The ionosphere does not vanish for the upper HF bands during low sunspot periods. It just gets "darker," which is felt more acutely by operators using the traditional modes. Today's digital modes users "see" dozens of decibels deeper into the ionosphere than users of the traditional modes. That means you can expect *Solar Cycle 25 Plus Digital Mode* performance to appear better sooner and last longer in the cycle than for users of the traditional modes. If SSB phone can't get through, turn your "range knob" to CW, or better yet, to a modern digital mode.

Keep your expectations high!

### In This Issue

Bill Dzurilla, NZ5N/OM9AJK (formerly OM3BD), works QO-100, the first amateur radio satellite in geostationary orbit.

Joe Purden, W6AYC, uses a classic matching technique for adding 80 m to a 160 m receiving array.

John E. Post, KA5GSQ, investigates the SA602A Hartley oscillator circuits.

Maynard A. Wright, W6PAP, discusses transmitter output impedance.

Brian R. Callahan, AD2BA, sends arbitrary binary data using a novel CW record protocol.

Carl Luetzelschwab, K9LA, describes the effect of a tree near a vertical 80 m antenna.

Eric Nichols, KL7AJ, in his essay series, Kirchhoff's current and voltage laws.

Eric Nichols, KL7AJ, the Versatile Double Balanced Mixer – Part 3.

### Writing for *QEX*

Please keep the full-length *QEX* articles flowing in, or share a **Technical Note** of several hundred words in length plus a figure or two. *QEX* is edited by Kazimierz "Kai" Siwiak, KE4PT, ([ksiwiak@arrl.org](mailto:ksiwiak@arrl.org)) and is published bimonthly. *QEX* is a forum for the free exchange of ideas among communications experimenters. All members can access digital editions of all four ARRL magazines: *QST*, *On the Air*, *QEX*, and *NCJ* as a member benefit. The *QEX printed edition* annual subscription rate (6 issues per year) for members and non-members is \$29 in the United States. First Class mail delivery in the US is available at an annual rate of \$40. For international subscribers, including those in Canada and Mexico, *QEX* printed edition can be delivered by airmail for \$35 annually, see [www.arrl.org/qex](http://www.arrl.org/qex).

Would you like to write for *QEX*? We pay \$50 per published page for full articles and *QEX* Technical Notes. Get more information and an Author Guide at [www.arrl.org/qex-author-guide](http://www.arrl.org/qex-author-guide). If you prefer postal mail, send a business-size self-addressed, stamped (US postage) envelope to: *QEX* Author Guide, c/o Maty Weinberg, ARRL, 225 Main St, Newington, CT 06111.

Very kindest regards,  
Kazimierz "Kai" Siwiak, KE4PT  
*QEX* Editor