

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:

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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 or by e-mail to 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.

Ron Diehl, NQ8W

Perspectives

At the forefront of innovation, *QEX* remains committed to exploring the ever-expanding frontier of amateur radio science. In this issue, we present a dynamic mix of engineering challenges, cutting-edge technologies, and theoretical insights that reflect the vibrant and evolving landscape of RF experimentation.

As analog and digital RF designs continue to shrink in size while growing in precision, the need for accurate measurement of low-value surface mount components becomes increasingly critical. You can build a practical, workshop-ready method that delivers lab-grade accuracy—an invaluable resource for anyone looking to push the performance limits of their circuits.

Transitioning from hardware to digital modes, dive into a detailed examination of the Icom IC-9700's Digital Data functionality. With its SDR architecture and D-STAR capabilities, this popular VHF/UHF rig continues to generate excitement. Real-world testing puts its digital features through their paces to assess both strengths and limitations.

Artificial Intelligence is no longer just a buzzword in the RF world—it's becoming an active design partner. In this issue, you'll discover how AI can assist in iteratively optimizing circuit designs and opening new possibilities for adaptive, efficient experimentation.

On the propagation front, learn to analyze five key factors affecting HF performance using WSPR data from the WSJT-X software suite. By tapping into real-time, crowdsourced transmission reports and applying modern data visualization, you can reveal ionospheric trends and anomalies that can help you make informed and improved operating strategies.

Strong theoretical foundations are still essential. Examine a clear and accessible guide to real and complex signals—concepts every serious RF experimenter must understand, especially as digital modulation techniques grow in sophistication.

We hope this issue encourages fresh ideas, new experiments, and a deeper understanding of the principles that make amateur radio so rewarding. As always, *QEX* is your platform—keep building, keep testing, and keep sharing.

Writing for QEX

QEX is a forum for the free exchange of ideas among communications experimenters. *QEX* is published bimonthly.

Please send full-length *QEX* manuscripts, or share a Technical Note of several hundred words in length plus a figure or two, to qex@arrl.org. 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. 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.