

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 Street, 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.

Kazimierz "Kai" Siwiak, KE4PT

Perspectives

Mentors

My Amateur Radio mantra is, "Please do your part to lower the average age of hams: Elmer youngsters!" Elmer was personified by David P. Newkirk, W9BRD, in his "How's DX" *QST* column of March, 1971, as a local ham who, "though busy with his own operating, building, arduous studies, chronic family illness, and full social calendar ... miraculously found time to be the big brother to any local youngster or oldster groping uncertainly towards hamdom." Elmer is both a proper noun and an action verb, but the term itself is anachronistic jargon. Times change, and we now prefer *Mentor*!

Consider this. The *QEX* family of hams is aging dramatically. A very recent survey of *QEX* subscribers reveals that about 90% of you, dear readers, are older than 61 years of age, and half of those are over 70. An additional 9% are between 51 and 60 years of age. More than 95% have been licensed for more than 30 years, and nearly two-thirds are retired. What, then, of the future of *QEX*? We need an influx of younger blood — especially between the ages of 40 and 60 — to grow our journal into the near future.

The *QEX* mission is to provide a medium for the exchange of ideas and information among Amateur Radio experimenters, to document advanced technical work in the Amateur Radio field, and to support efforts in advancing the state of the Amateur Radio art. When most of you were at the onset of your ham careers, your main search parameter was "Radio" in your neighborhood library. *QEX* was in its infancy. In contrast, today's generation is immersed in an internet and social media culture. But, you won't find *QEX* there — yet!

Many of your clubs already sponsor ham radio classes and volunteer examiner testing. Please don't stop there. Actively reach out and take the next step. Mentor your newly licensed hams into our fold as *radio-active* hams who can help fulfill the *QEX* mission.

We'd like to hear from you (qex@arrl.org), the sages, elders and mentors of Amateur Radio. How can we make the *QEX* mission relevant to the next generations? What can we do to lower the average age of hams? And especially, what can we do to lower the average age of the *QEX* readership?

In This Issue

Our *QEX* authors contributed to the communications experimental arts in diverse Amateur Radio topics.

Ulrich L. Rohde, N1UL and Ajay K. Poddar, AC2KG, study the phase noise and frequency stability in an optimized grounded-base VHF and UHF oscillators.

Matthew H. Reilly, KB1VC, introduces the Arduino ecosystem, which includes a wide variety of easy-to-use integrated hardware components, and software development environment.

Bob Larkin, W7PUA, reveals an impedance measuring system based on the Teensy Arduino microprocessor, that also measures amplitude and phase in transmission mode.

John Stensby, N5DF, describes how to make a better RF voltmeter probe.

Keep the full-length *QEX* articles flowing in, but if brevity is your forte, share a brief **Technical Notes** of perhaps several hundred words in length plus a figure or two. Expand on another author's work and add to the Amateur Radio *institutional memory* with your technical observation. Let us know that your submission is intended as a **Note**.

QEX is edited by Kazimierz "Kai" Siwiak, KE4PT, (ksiwia@arrl.org) and is published bimonthly. *QEX* is a forum for the free exchange of ideas among communications experimenters. The content is driven by you, the reader and prospective author. The subscription rate (6 issues per year in the United States is \$29. First Class delivery in the US is available at an annual rate of \$40. For international subscribers, including those in Canada and Mexico, *QEX* can be delivered by airmail for \$35 annually. Subscribe today at www.arrl.org/qex.

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