



QEX (ISSN: 0886-8093) is published bimonthly in January, March, May, July, September, and November by the American Radio Relay League, 225 Main Street, Newington, CT 06111-1494. Periodicals postage paid at Hartford, CT and at additional mailing offices.

POSTMASTER: Send address changes to: QEX, 225 Main St, Newington, CT 06111-1494 Issue No 257

Harold Kramer, WJ1B  
*Publisher*

Larry Wolfgang, WR1B  
*Editor*

Lori Weinberg, KB1EIB  
*Assistant Editor*

Zack Lau, W1VT  
Ray Mack, W5IFS  
*Contributing Editors*

**Production Department**

Steve Ford, WB8IMY  
*Publications Manager*

Michelle Bloom, WB1ENT  
*Production Supervisor*

Sue Fagan, KB1OKW  
*Graphic Design Supervisor*

David Pingree, N1NAS  
*Senior Technical Illustrator*

**Advertising Information Contact:**

Janet L. Rocco, W1JLR  
*Business Services*  
860-594-0203 – Direct  
800-243-7768 – ARRL  
860-594-4285 – Fax

**Circulation Department**

Cathy Stepina, *QEX Circulation*

**Offices**

225 Main St, Newington, CT 06111-1494 USA  
Telephone: 860-594-0200  
Fax: 860-594-0259 (24 hour direct line)  
e-mail: [qex@arrl.org](mailto:qex@arrl.org)

**Subscription rate for 6 issues:**

In the US: ARRL Member \$24,  
nonmember \$36;

US by First Class Mail:  
ARRL member \$37, nonmember \$49;

International and Canada by Airmail: ARRL member  
\$31, nonmember \$43;

Members are asked to include their membership  
control number or a label from their QST when  
applying.

In order to ensure prompt delivery, we ask that you periodically check the address information on your mailing label. If you find any inaccuracies, please contact the Circulation Department immediately. Thank you for your assistance.



Copyright © 2009 by the American Radio Relay League Inc. For permission to quote or reprint material from QEX or any ARRL publication, send a written request including the issue date (or book title), article, page numbers and a description of where you intend to use the reprinted material. Send the request to the office of the Publications Manager ([permission@arrl.org](mailto:permission@arrl.org)).

**About the Cover**

Jim Koehler, VE5FP, built a 0.1 MHz to 200 MHz signal generator based on the NimbleSig III DDS circuit designed by Tom Allread, VA7TA. He includes a design and construction information, as well as some test application suggestions.



**In This Issue**

**Features**

**3 A DDS-Based Signal Generator**  
By Jim Koehler, VE5FP

**14 Crystal Ladder Filters for All**  
By Horst Steder, DJ6EV and Jack A. Hardcastle, G3JIR

**19 Experimental Determination of Ground System Performance for HF Verticals—Part 6**  
By Rudy Severns, N6LF

**25 Beam Steering on 160 Meters**  
By Victor A. Kean, Jr., K1LT

**40 Waveguide Filters You Can Build—and Tune—Part 1**  
By Paul Wade, W1GHZ

**Columns**

**18 In the Next Issue of QEX**

**44 SDR: Simplified**  
By Ray Mack, W5IFS

**Index of Advertisers**

American Radio Relay League: 13, Cover III  
Down East Microwave Inc: 18  
[hamcity.com](http://hamcity.com): Cover IV  
Kenwood Communications: Cover II

National RF, Inc: 24  
Nemal Electronics International, Inc: 24  
RF Parts: 37, 39  
Tucson Amateur Packet Radio: Cover III