



# In This Issue

February 2016

Volume 100 Number 2

**Harold Kramer, WJ1B**  
Publisher

**Steve Ford, WB8IMY**  
Editor

**Becky R. Schoenfeld, W1BXY**  
Managing Editor

**Larry D. Wolfgang, WR1B**  
Senior Assistant Technical Editor

**Steve Sant Andrea, AG1YK**  
Assistant Editor

**Rick Lindquist, WW1ME**  
*Happenings*

**Bob Allison, WB1GCM**  
*Product Review Lab Testing*

**Paul L. Rinaldo, W4RI**  
**Mark J. Wilson, K1RO**  
**Al Brogdon, W1AB**  
**Bernie McClenny, W3UR**  
**H. Ward Silver, N0AX**  
**Paul Wade, W1GHZ**  
**Jon Jones, N0JK**  
**Rick Palm, K1CE**  
**Joel R. Hallas, W1ZR**  
**Barry Shackelford, W6YE**  
**Kai Siwiak, KE4PT**  
**Bruce Draper, AA5B**  
Contributing Editors

**Michelle Bloom, WB1ENT**  
Production Supervisor

**Jodi Morin, KA1JPA**  
Asst Production Supervisor

**Maty Weinberg, KB1EIB**  
Production Coordinator

**Sue Fagan, KB1OKW**  
Graphic Design Supervisor

**David Pingree, N1NAS**  
Senior Technical Illustrator

**Jennifer Glifort**  
Copy Editor

**Debra Jahnke, K1DAJ**  
Business Services Manager  
*QST Advertising*

**Bob Inderbitzen, NQ1R**  
Marketing Manager

**Yvette Vinci, KC1AIM**  
Circulation Manager

**Diane Szlachetka, KB1OKV**  
Advertising Graphics Designer

**Steve Ewald, WV1X**  
Field Organization Supervisor

**Gail Iannone**  
Convention Program Manager

**Allison Barbieri, KC1ARQ**  
Digital *QST* Coordinator

## Technical

### Understanding Controlled Envelope Single Sideband 30

**Dave Hershberger, W9GR**  
CESSB increases your average transmitted power without making you sound more “processed.”

### Radio Wave Propagation: How Waves Attenuate with Distance 37

**Kazimierz “Kai” Siwiak, KE4PT**  
Inverse square law attenuation holds for free space — but attenuation can be stronger in many environments.

### Meter Bands and Megahertz — Why We Use Both 41

**John Stanley, K4ERO**  
New hams are often confused about the different ways we refer to the amateur bands. Here’s how to make sense of them.

### An Introduction to Coaxial Cable for RF Applications 43

**Joel R. Hallas, W1ZR**  
Coax cable is probably the most popular Amateur Radio transmission line — but how do we choose the best one?

### Done in One: Software Oscilloscopes 47

**Paul Danzer, N1II**  
A brief overview of software scopes — they are capable and free!

### Product Review 49

**Mark Wilson, K1RO**  
Yaesu FTM-100DR and FT2DR Dual-Band Transceivers, Signal Hound USB-SA44B 4.4 GHz Spectrum Analyzer and USB-TG44A Tracking Generator, RT Systems Radio Programming Software Kit

Page  
49



## News and Features

### It Seems to Us 9

**David Sumner, K1ZZ**  
Small Satellites of the Non-Amateur Kind

### Inside HQ 13

**Harold Kramer, WJ1B**  
The ARRL Foundation

### An Aerial Foxhunt 70

**George DeMartini, KG7JEB**  
A training exercise for pilots and radio operators alike.

### National Parks on the Air — February 2016 73

**Sean Kutzko, KX9X**  
Photo contest announcement and tips for National Park photography.

### A Grid Expedition to DM02 75

**Jim Price, K6ZH**  
A boat trip to a rare grid square for the 2015 June VHF contest.

### A Hundred Kids a Day 78

**Steve Warford, WB4ZSC**  
W7ASC brings ham radio to life at Arizona Science Center.

### Goata SOTA 80

**Steve Sant Andrea, AG1YK**  
In the high Rockies, one ham’s four-hooved companions are a big help in putting the summit in SOTA.

### Make the Most of 10 Meters 83

**Steve Ford, WB8IMY**  
Sunspots may be declining, but the 10 meter band is far from “dead.”

### Philip J. McGan Memorial Silver Antenna Award 85

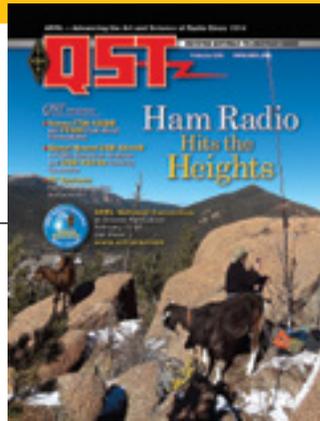
**Sean Kutzko, KX9X**  
Honor a ham’s PR efforts within the non-amateur community.

### Happenings 86

**Rick Lindquist, WW1ME**  
US Representative Greg Walden, W7EQI, cosponsors the Amateur Radio Parity Act, IARU news, ARRL Lab acquires two Keysight signal generators; more.

## Our Cover

Steve Galchutt, WG0AT, activates Knights Peak, a 10,459-foot (3188 meter) mountain near Manitou Springs, Colorado. With him are Peanut (standing guard on the left), and Boo, his pack goat companions. The antenna is a custom setup consisting of a Buddipole VersaTee, Mini Coil, and two whip sections. On this sloped rock pinnacle there was no room for wires, and supporting a loop in the wind was not possible, so this custom Buddipole vertical was assembled, and netted many SOTA contacts. [Photo courtesy Steve Galchutt, WG0AT]



February 2016  
Volume 100 Number 2

QST (ISSN:0033-4812) is published monthly as its official journal by the American Radio Relay League, Inc., 225 Main Street, Newington, CT 06111-1494, USA. Periodicals postage paid at Hartford, CT, USA and at additional mailing offices.

POSTMASTER: Send address changes to: QST, 225 Main St, Newington, CT 06111-1494, USA. Canada Post: Publications Mail Agreement #90-0901437. Canada returns to be sent to IMEX Global Solutions, 1501 Morse Ave, Elk Grove Village, IL 60007.

**US & Possessions:** Membership in the ARRL, including a 1-year subscription to QST, is available to individuals at \$49. Licensed radio amateurs age 21 and under and the eldest licensee in the household may qualify for the rate of \$25. Life Membership, including a subscription to QST is available at \$1225.\* Membership includes \$21 per year for subscription to QST. Membership and QST cannot be separated. Libraries and institutions, \$49 per year. Single copies \$6.95.

**International**  
To compensate for additional postage for mailing outside the US, the following rates apply:

**Canada:** Membership in the ARRL, including a 1-year subscription to QST, \$62, payable in US funds. Life Membership, including a subscription to QST is available at \$1550.\* Libraries and institutions, \$62 per year.

**All Other Countries:** Membership in the ARRL, including a 1-year subscription to QST, \$76, payable in US funds. Life Membership, including a subscription to QST, is available at \$1900.\* Libraries and institutions, \$76 per year.

Membership without QST is available to the immediate family of a member living at the same address, and to anyone who is legally blind, for \$10 per year.

Foreign remittances should be by international postal or express money order or bank draft negotiable in the US and for an equivalent amount in US funds.

Membership in the ARRL, including a 1-year subscription to Digital QST only, is available to Canadian and International members at \$49.

Copyright © 2016 by the American Radio Relay League Inc. Title registered at the US Patent Office. International copyright secured. All rights reserved. Quedan reservados todos los derechos. Printed in the USA.

QST®, DXCC®, VUCC®, DX Century Club®, ARES®, Amateur Radio Emergency Service®, Logbook of The World®, LoTW®, and ARRL, the national association for Amateur Radio® are registered trademarks of the American Radio Relay League, Inc.

The ARRL and QST in no way warrant the products described or reviewed herein.

QST is available to blind and physically handicapped individuals from the Library of Congress, National Library Service for the Blind and Physically Handicapped. Call 1-800-424-8567 or go to [www.loc.gov/nls/](http://www.loc.gov/nls/).

Indexed by Applied Science and Technology Index, Library of Congress Catalog Card No: 21-9421.

\*Payment arrangements available. Please write for details.

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 at [circulation@arrrl.org](mailto:circulation@arrrl.org) or 860-594-0200 immediately. Thank you for your assistance.

Reprints and permissions: [permission@arrrl.org](mailto:permission@arrrl.org)

Details of our Online Privacy Policy can be found at [www.arrrl.org/online-privacy-policy](http://www.arrrl.org/online-privacy-policy).

Telephone: 860-594-0200  
Fax: 860-594-0259

# Radiosport

## Contest Corral 92

Bruce Draper, AA5B

## 2015 ARRL 10 GHz and Up Contest Results 93

Bruce Richardson, W9FZ

Most microwavers operate while exposed to the elements.

Page  
75



Page  
78

# Columns

Classic Radio.....	100
Correspondence .....	24
The Doctor is In .....	62
Eclectic Technology.....	64
Hands-On Radio .....	65
Hints & Kinks.....	67
How's DX? .....	94
Op-Ed .....	102
Public Service.....	90
Up Front .....	20
The World Above 50 MHz .....	96
100/50/25 Years Ago .....	105

# Departments

ARRL Member Services .....	14
ARRL Section Managers.....	16
Convention and Hamfest Calendar .....	103
Feedback.....	40
Field Organization Reports.....	105
Ham Ads.....	154, 155
Index of Advertisers.....	156, 157
New Products .....	40
Officers, Division Directors, and Staff.....	15
QuickStats.....	138
Silent Keys .....	106
Strays .....	63, 72, 104
Special Event Stations.....	99
W1AW Qualifying Runs .....	99
W1AW Schedule .....	104

## Digital and Mobile Editions

ARRL members can access the digital edition via a link at [www.arrrl.org/qst](http://www.arrrl.org/qst), download our iOS app from the iTunes Store, and download our Android app from the Google Play Store.

## Interested in Writing for QST?

[www.arrrl.org/qst-author-guide](http://www.arrrl.org/qst-author-guide)

e-mail: [qst@arrrl.org](mailto:qst@arrrl.org)