Choose the Best Mode for Your HF Contact With the Help of Free Software Page 32

QST

DIGITAL EDITION

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April 2020 www.arrl.org
DEVOTED ENTIRELY TO AMATEUR RADIO

Doing Good in the Galapagos

QST Reviews

Yaesu FT3DR Dual-Band Analog and Digital Handheld Transceiver

MFJ-1234 *RigPi* Station Server

Phase Dock WorkBench Project Development Kit

DX Engineering Ultra-Grip 2 Crimp Connector Hand Tool Kit

DIGITAL FEATURE

45| See our Video Review of the **Yaesu FT3DR** Dual-Band Analog and Digital Handheld Transceiver

The radio... YAESU

FTDX101 TECHNICAL HIGHLIGHT-#5

MPVD (Multi-Purpose VFO Outer Dial)

ABI (Active Band Indicator)

Yaesu's accumulated HF Knowledge & Experience delivers Superior User Operability

Important Operational functions such as VC-Tune can be viewed on the large 7" Display and adjusted using the high-grade aluminum MPVD knob's outer ring, without taking your hand off the VFO dial. Other important RX function keys and controls are conveniently arranged around the VFO dial, making adjustments on the fly whilst searching for weak signals during pile-up operations entirely possible.

Band Selector keys with Active Band Indicator (ABI) LED for both Main and Sub band selection are arranged in horizontal rows above the main VFO dial allowing instant identification of the current band and selection for a desired band change.

HF/50MHz TRANSCEIVER
FTDX101MP 200W

HF/50MHz TRANSCEIVER
FTDX101D 100W

* Microphone M-1: Optional

YAESU
The radio

YAESU USA
6125 Phyllis Drive, Cypress,
CA 90630 (714) 827-7600

For the latest Yaesu news, visit us on the Internet: **http://www.yaesu.com**

C4FM/FM 144/430 MHz
Dual Band 5W
Digital Transceiver

FT-70DR

《 700 mW Loud and Clear audio,
Commercial Grade Specifications 》

WIRES-X
Portable Digital Node
Available

C4FM/FM 144/430 MHz
Dual Band 5 W
Digital Transceiver

FT3DR

《 Improved 66 ch GPS receiver included,
Built-in Bluetooth® Unit 》

System Fusion II

C4FM Digital
Pursuing Advanced Communications

C4FM/FM 144/430 MHz
Dual Band Dual Receive Digital Repeater

DR-2X

WIRES-X
Portable Digital Node
Available

C4FM/FM
144/430 MHz Dual Band 50 W
Digital Transceiver

FTM-100DR

《 Improved 66 ch GPS receiver included 》

WIRES-X
Amateur Radio Internet Linking Kit

HRI-200

WIRES-X
Portable Digital Node
Available

C4FM/FM
144/430 MHz Dual Band 50 W
Digital Transceiver

FTM-400XDR

《 Improved 66 ch GPS receiver included 》

C4FM/FM 144/430 MHz Dual Band 50 W
Digital Transceiver

FTM-7250DR

《 Heavy Duty 50 Watts High Power 》

C4FM/FM 144 MHz 65 W
Digital Transceiver

FTM-3200DR

《 Genuine 65 Watts High Power 》

C4FM/FM 430 MHz 55 W
Digital Transceiver

FTM-3207DR

《 Heavy Duty 55 Watts High Power 》

CW/SSB/AM/FM/C4FM
HF/50/144/430 MHz Wide-Coverage
100 W All Mode Transceiver (144/430 MHz: 50 W)

FT-991A

《 Real-Time Spectrum Scope included 》

System Fusion II Supports All C4FM Portables and Mobiles

YAESU
The radio

YAESU USA
6125 Phyllis Drive, Cypress,
CA 90630 (714) 827-7600

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Cushcraft...Keeping You in Touch Around the Globe

MA-6B 6-Band Beam

Small Footprint – Big Signal

2-Elements on 20/17/15/12/10/6 Meters!!!

Cushcraft's latest MA-6B gives you *2-elements on six bands!* You get solid *signal-boosting directivity* in a bantam-size and weight.

It mounts on your roof or mast using standard TV hardware. It's perfect for exploring exciting DX without the high cost and heavy lifting of installing a large tower and a full-sized array. Its 7 foot 3-inch boom has less than 9 feet of turning radius. Contest tough – handles 1500 Watts.

The unique MA-6B is a *two-element Yagi* on 20/17/15/12/10/6 Meters. It delivers solid power-multiplying gain over a dipole on *all* bands. You get automatic band switching and a super easy installation in a compact 26-pound package.

When working DX, what really matters are the interfering signals and noise you *don't hear*. That's where the MA-6B's impressive side rejection and front-to-back ratio really shines.

MA-5B, $579.95. Like MA-6B but five bands: 20/17/15/12/10 Meters. 12 and 17 Meters is a single element trapped dipole.
See cushcraftamateur.com *for gain figures.*

Cushcraft 10, 15 & 20 Meter Tribander Beams

Only the best tri-band antennas become DX classics, which is why the Cushcraft World-Ranger A4S, A3S, and A3WS go to the head of the class. For more than 30 years, these pace-setting performers have taken on the world's most demanding operating conditions and proven themselves every time. The key to success comes from attention to basics. For example, element length and spacing has been carefully refined over time, and high-power traps are still hand-made and individually tuned using laboratory-grade instruments. All this attention to detail means low SWR, wide bandwidth, optimum directivity, and high efficiency – important performance characteristics you rely on to maintain regular schedules, rack up impressive contest scores, and grow your collection of rare QSLs!

It goes without saying that the World-Ranger lineup is also famous for its rugged construction. In fact, the majority of these antennas sold years ago are still in service today! Conservative mechanical design, rugged over-sized components, stainless-steel hardware, and aircraft-grade 6063 make all the difference.

The 3-element A3S/A3WS and 4-element A4S are world-famous for powerhouse gain and super performance. **A-3WS, $529.95,** 12/17 M. **30/40 Meter** *add-on kits* available.

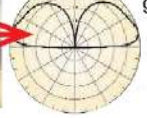
Cushcraft R9...80-6 Meters 80 Meters...No Radials...1500W

Cushcraft's world famous R8 now has a big brother!

Big Brother R9 now includes 75/80 Meters for local ragchewing and worldwide low band DX *without radials!*

Its omni-directional low angle radiation gives you exciting and easy DX on all 9 bands: 75/80, 40, 30, 20, 17, 15, 12, 10 and 6 Meters with low SWR. QSY instantly – no antenna tuner needed.

Use full 1500 Watts SSB/CW when the going gets tough to break through pileups/ poor band conditions.



The R9 is super easy to assemble, installs just about anywhere, and its low profile blends inconspicuously into the background in urban and country settings alike.

Compact Footprint: Installs in an area about the size of a child's sandbox – no ground radials to bury with all RF-energized surfaces safely out of reach.

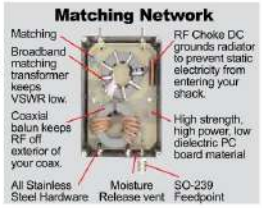
Rugged Construction: Thick fiberglass insulators, all stainless steel hardware and 6063 aircraft-aluminum tubing is double or triple walled at key stress points to handle anything Mother Nature can dish out.

31.5 feet tall, 25 lbs. Mounting mast 1.25 to 2 inches. Wind surface area is 4 square feet.

R8, $569.95. Like R9 antenna but less 75/80 Meters.

R-8TB, $99.95. Tilt-base lets you tilt your antenna up/down easily by yourself to work on.

R-8GK, $79.95. Three-point guy kit for high winds.



Cushcraft Dual-Band Yagis

One Yagi for Dual-Band FM Radios

Dual-bander VHF rigs are the norm these days, so why not complement your FM base station with a dual-band Yagi? Not only will you eliminate a costly feed line, you'll realize extra gain for digital modes like high-speed packet and D-Star! Cushcraft's A270-6S provides three elements per band and the A270-10S provides five for solid point-to-point performance. They're both pre-tuned and assembly is a snap using the fully illustrated manual.

Cushcraft Famous Ringos Compact FM Verticals

W1BX's famous Ringo antenna has been around for a long time and remains unbeaten for solid reliability. The Ringo is broad-banded, lightning protected, extremely rugged, economical, electrically bullet-proof, low-angle, and more – but mainly, it just plain works! To discover why hams and commercial two-way installers around the world still love this antenna, order yours now!

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140 Pages of MFJ, Ameritron, Hygain, Cushcraft, Mirage and Vectronics Products! Visit **www.cushcraftamateur.com** to download your copy!

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❶ ❷ ❸ ❹ ❺ ❻ ❼

Base Antennas

❶ COMET CHA-250B BROADBAND 80M THROUGH 6M VERTICAL ANTENNA

A newly designed broadband vertical with NO GROUND RADIALS. EXTREMELY easy to assemble, requires no tuning or adjustments and VSWR is under 1.5:1 from 3.5-57MHz! • TX: 3.5MHz – 57MHz • RX: 2.0– 90MHz • VSWR is 1.5:1 or less, continuous • Max Power: 250W SSB/125W FM• Impedance: 50 Ohm • Length: 23' 5" • Weight: 7 lbs. 1 oz. • Conn: SO-239 • Mast Req'd: 1" – 2" dia. • Max wind speed: 67MPH

❷ Maldol HVU-8 ULTRA-COMPACT 8 BAND HF/VHF/UHF VERTICAL ANTENNA

80/40/20/15/10/6/2M/70cm Only 1/2 the traditional size and weight of vertical HF antennas, and it includes 2M/70cm! Unique radial system rotates for balcony installations, the radials can all be rotated to one side. • Wavelength: HF and 6M: 1/4 wave • 2M: 1/2 wave • 70cm: Two 5/8waves in phase • Impedance: 50 Ohm • Max Power: HF 200W SSB • 6M–70cm: 150W FM• Conn: SO-239 • Height: Only 8'6" • Weight: 5lbs. 7ozs.

❸ COMET GP-3 DUAL-BAND 146/446MHZ BASE REPEATER ANTENNA

Wavelength: 146MHz 6/8 wave • 446MHz 5/8 wave x 3 • Max Pwr: 200W • Length: 5'11"• Weight: 2lbs. 9ozs. • Conn: Gold-plated SO-239 • Construction: Single-piece fiberglass

❹ COMET GP-6 DUAL-BAND 146/446MHZ BASE REPEATER ANTENNA

Wavelength: 146MHz 5/8 wave x 2 • 446MHz 5/8 wave x 5 • Max Pwr: 200W • Length: 10'2"• Weight: 3lbs. 8ozs. • Conn: Gold-plated SO-239 • Construction: Fiberglass, 2 Sections

❺ COMET GP-9 / GP-9N DUAL-BAND 146/446MHZ BASE REPEATER ANTENNA

BEST SELLER! • Wavelength: 146MHz 5/8 wave x 3 • 446MHz 5/8 wave x 8 • Max Pwr: 200W• Length: 16' 9"" • Weight: 5lbs. 11ozs. • Conn: GP-9 Gold-plated SO-239 • GP-9N Gold-plated N-type female • Construction: Fiberglass, 3 Sections

❻ COMET CX-333 TRI-BAND 146/220/446MHZ BASE REPEATER ANTENNA

Wavelength: 146MHz 5/8 wave x 2 • 220MHz 5/8 wave x 3• 446MHz 5/8 wave x 5 • Max Pwr: 120W • Length: 10'2" • Weight: 3lbs. 1oz.• Conn: Gold-plated SO-239 • Construction: Fiberglass, 2 Sections

❼ COMET GP-15 TRI-BAND 52/146/446MHZ BASE REPEATER ANTENNA

Wavelength: 52MHz 5/8 wave • 146MHz 5/8 wave x 2 • 446MHz 5/8 wave x 4 • Max Pwr: 150W • Length: 7'11" • Weight: 3lbs. 1oz. • Conn: Gold-plated SO-239• 2MHz band-width after tuning (6M) • Construction: Single-piece fiberglass

NEW CAA-500MarkII

1.8-500MHz Antenna analyzer

The CAA-500MarkII combines the simplicity and accuracy of an analog instrument, PLUS...a full color LCD graphic display • Resistive (R) and Reactive (X) components of impedance graphed and displayed numerically • SWR readings in both graphic and numerical results.

Operates on 8-16VDC external power, 6 AA Alkaline or NiMH rechargeable cells • Trickle charger built in (only when using NiMH batteries) • Typical battery life: 9 hours of continuous operation • Battery level indicator • Selectable auto power-off time limit preserves battery capacity • SO-239 connector for 1.8-300MHz range • N-female connector for 300-500MHz range

The perfect combination of analog and graphic information, designed in particular for antenna diagnostics and adjustments while on the roof, tower or in the field!

CAA-5SC

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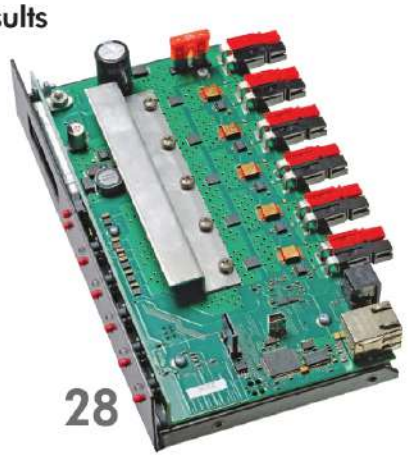
Contents

April 2020 ♦ Volume 104 ♦ Number 4

Includes video
Includes audio
Additional content



Columns

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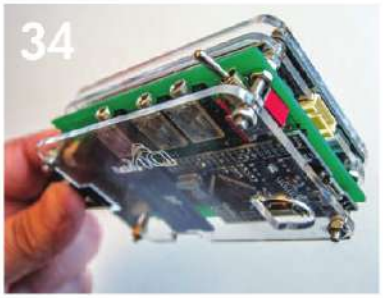
Write for *QST*

www.arrl.org/qst-author-guide
email: **qst@arrl.org**

Our Cover

The blue-footed booby is one of many unique species found on the Galapagos Islands. The HD8M DXpedition team was so impressed with the work being done to preserve the rare species they encountered during their operation that they contributed a sizeable donation to the Galapagos Conservancy. Read more about it in Jim Millner's, WB2REM, article, "HD8M DXpedition to the Galapagos Islands," on page 59 of this issue. [Kate Chapman, photo]



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The SteppIR Advantage

PROBLEM SOLVED!

Yagi antennas are basically single frequency devices that work well only over a very narrow range, typically 0.5% change in frequency. Fixed length yagis compensate by using a variety of techniques, all of which result in serious degradation of performance, especially in Front to Rear rejection, and added complexity, size, and weight. Dipoles have a much broader bandwidth but still cannot cover the entire 80m and 40m bands and maintain a low SWR (<1.5:1). Our patented solution is to simply adjust all of the antenna elements to the optimal length for the desired frequency with none of the compromises in performance that all fixed antennas require. This is accomplished remotely using an electronic controller that can automatically follow the radios' frequency. SteppIR antennas enjoy optimal performance on all frequencies within their specified frequency range (varies by model), and that includes non-ham radio frequencies as well!

THE INHERENT ADVANTAGES OF A STEPPIR:

Create/Modify Mode

The create modify mode allows the user to change the length of each individual antenna element on all bands of operation -and frequencies outside the ham bands as well – and then save the new antennas to memory. This can be incredibly useful to "tune" out potential objects that may be causing interaction with the SteppIR antenna, or to create your own custom antenna designs.

180 Degree Mode

The 180 degree mode feature is one of the most popular among SteppIR owners. For our Yagi antennas, this feature allows a user to electrically "rotate" the antenna from the forward beam heading, to the reverse (180 degrees) beam heading, with a click of a button – the entire process takes approximately 2 seconds.

Bi-Directional Mode

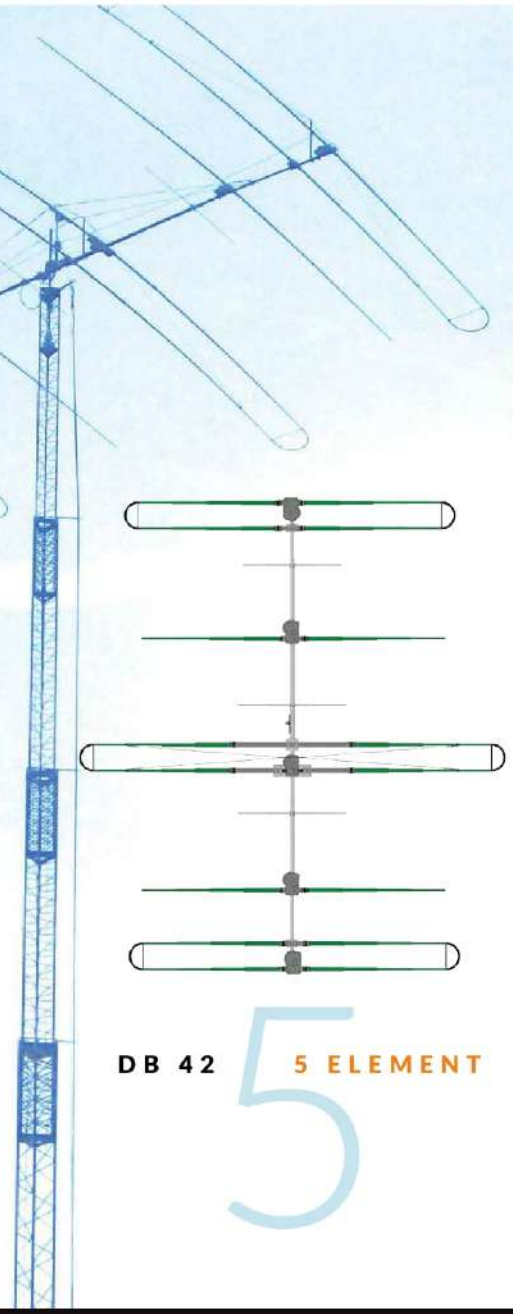
The bi-directional mode works similarly to the 180 function, except when enabled, the Yagi antenna will now be operating with gain in both directions – forward and backwards, simultaneously!

Retract Elements

With a touch of a button, SteppIR antennas can be fully retracted into their housing, which helps to protect the most valuable part of the antenna during extreme weather events.

Emergency Communications

Many times, emergency communications occur outside the standard amateur radio allocated bands of operation. All SteppIR antennas are optimal within the entire scope of their specified frequency range.



DB 42 5 ELEMENT

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DIAMOND ANTENNA

diamondantenna.net

X700HNA Special Features:

- Heavy duty fiberglass radomes
- Four section assembly
- Overlapping outer shells for added strength
- Stainless steel mounting hardware & radials
- Strong waterproof joint couplings
- Type-N cable connection
- Wideband performance
- Highest gain Dual-band Base Antenna!

When it comes to quality and performance, DIAMOND ANTENNA is the worldwide leader in VHF/UHF base and mobile antennas.

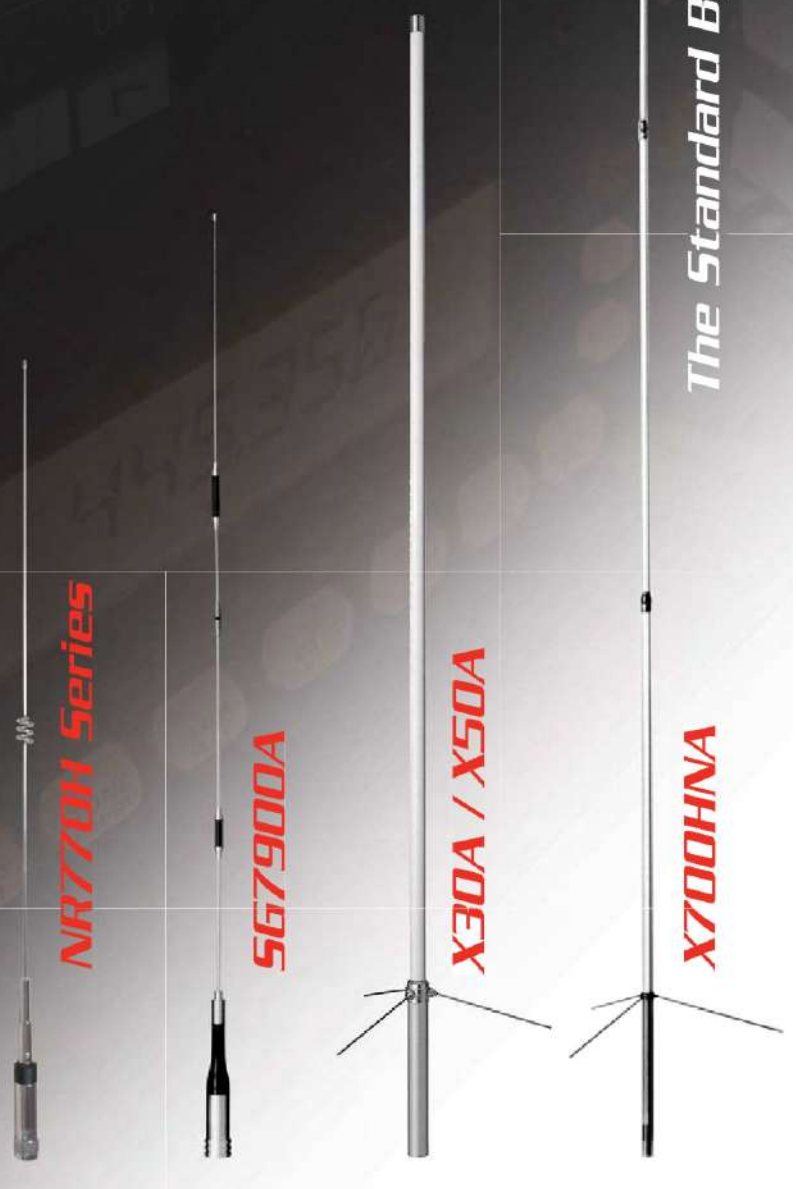
DIAMOND ANTENNAS help you get the most out of your on-air experience.

For all your base station and repeater needs, DIAMOND has an antenna that will work for you.

You've tried the rest, now own the best!

Here is a small sample of our wide variety of antennas

Model	Bands	Length Ft.	Max Pwr. Rating	Conn.
Dualband Base Station/Repeater Antennas				
X700HNA (4 section)	2m/70cm	24	200	N
X510HD (3 Section)	2m/70cm	17.2	330/250	UHF or N
X300A (2 Section)	2m/70cm	10	200	UHF or N
X200A (2 Section)	2m/70cm	8.3	200	UHF
X50A (1 Section)	2m/70cm	5.6	200	UHF or N
X30A (1 Section)	2m/70cm	4.5	150	UHF
Monoband Base Station/Repeater Antennas				
F23H (3 Section)	144-174 MHz (W/ Cut Chart)	15	350	UHF
F22A (2 Section)	2m	10.5	200	UHF
CP22E (Aluminum)	2m	8.9	200	UHF
F718A (Coax Element)	70cm	15	250	N
Dualband Mobile Antennas				
SG7900A	2m/70cm	62.2 in.	150	UHF or NMO
SG7500A	2m/70cm	40.6 in.	150	UHF or NMO
NR770H Series	2m/70cm	38.2 in.	200	UHF or NMO
MR77 Series	2m/70cm	20 in.	70	Mag Combo
AZ504FXH	2m/70cm	15.5 in.	50	UHF
AZ504SP	2m/70cm	15.5 in.	50	UHF
NR7900A	2m/70cm	57 in.	300/250	UHF
Monoband Mobile Antennas				
NR22L	2m	96.8 in.	100	UHF
M285	2m	52.4 in.	200	UHF or NMO



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Second Century

A Future Beyond Our Imaginations

This column has always served as a forum for the CEO of ARRL to provide commentary on the organization and its future. Having just been elected as the Interim CEO with an uncertain term of office, I thought it would be more valuable for the membership to hear from other members of the ARRL management team, the ones working to shape ARRL's future.

For the next several months, there will be a rotating lineup of guest columnists providing their perspective on the organization and amateur radio. First up is ARRL Director of Operations Norm Fusaro, W3IZ, with others to follow in the coming months.

You may still reach out to me directly at **ceo@arrl.org**.

— Barry J. Shelley, N1VXY, Interim Chief Executive Officer

I took my Novice-class license exam at someone's kitchen table about 36 years ago, when I was in my mid-twenties. I never imagined that one day I'd be working at ARRL, let alone overseeing the DXCC program, playing a role in the ARRL Centennial celebration, co-producing the National Parks on the Air event, or eventually becoming the Director of Operations. No one knows the future. But no matter what, the future eventually arrives, and when it does, it may not be the future you imagined — sometimes it can be even better.

The same can be said for amateur radio. Modern technology makes it possible for today's radio amateurs to operate their station (or someone else's) from a remote location anywhere in the world. This is the future that was envisioned in 1934, in a *QST* article titled "Automatic DX Relay Work for the Ham," and it's turned out even better than the author, D. A. Griffin, W2AOE, imagined. More than a decade before the invention of the transistor and years before the DXCC program was created, hams contemplated the idea of using remote relay stations for "international round-table nets and globe circling relays."

Griffin proposed the notion of W1MK (ARRL's call sign at the time) broadcasting bulletins simultaneously in all 48 states, or being able to hear your own signal coming back to you "via the 'round the world relay." I'm sure this all sounded far-fetched at the time, but today remote operating is easily accomplished with off-the-shelf components. We employ remote receivers at W1AW so the station can be used for making two-way contacts while the bulletins are being broadcast. This is all part of amateur radio today.

When the League was founded, Hiram Percy Maxim, W1AW, saw amateur radio as a valuable way to serve the public. Public service is still a crucial element of the value ham radio provides. However, when it comes to moving traffic, our partners and served agencies expect to see high-speed digital methods using modern communications equipment. This was demonstrated at a joint meeting of top officials with the American Red Cross and FEMA in May 2019. ARRL used W1AW to collect messages digitally from 13 field stations, then relayed the messages to the meeting location in Baltimore, Maryland. Red Cross and FEMA officials were very impressed when they saw high-speed digital messages being printed on a computer screen, configured in the format they were used to seeing.

I'm not advocating for one operating mode over another. Ham radio has many facets, and I enjoy quite a lot of them. Most of my operating time is spent hunting DX in the CW bands. I also use digital modes and participate in the annual AM Rally. Ham radio is an art and, like all art, needs to be appreciated in the context of its medium. Each mode, band, and piece of gear has its own purpose.

High-speed digital communications have been developed to supplement older technology. What's in the future is anyone's guess, but I can assure you that what is state of the art today will eventually be replaced with something new. Agility, not complacency, is going to keep ham radio relevant and ensure our future.

Norm Fusaro, W3IZ
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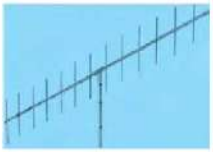

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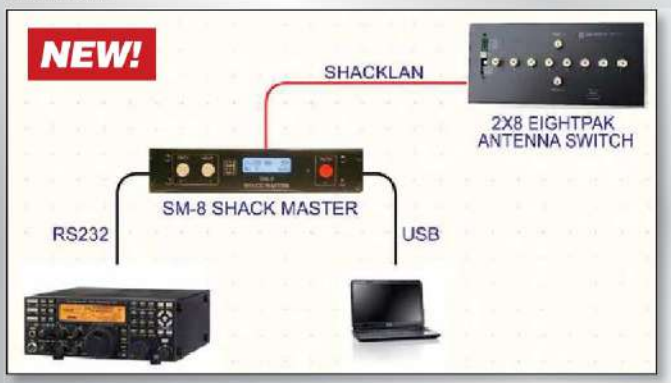

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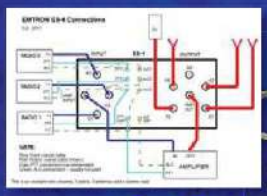

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Steve Ford, WB8IMY, wb8imy@arrl.org

Member Spotlight

Scott Avery, KA4ZZQ

Scott Avery's parents were both amateur radio operators. In fact, they met at a transmitter hunt! Scott grew up in his South Carolina home surrounded by the sights and sounds of ham radio.

"Dad would be on the Military Auxiliary Radio System (MARS) net and I would be hanging out listening," Scott recalled. "His station was in the only room in the house with an air conditioner, so that was an extra benefit. Dad was a self-employed electronics wizard and even had the WWV station playing as background noise in his work shed."

Despite the ham influences at home, Scott didn't obtain his Novice license until he was a freshman in college in 1982. Although he had the license, he wasn't on the air much until he happened to meet an avid VHF/UHF contester at his job. Scott said, "He really got me motivated to earn my General license and get on the air."

Scott explored different activities, including transmitter hunting, amateur television, contesting, CW, and public service, but he eventually fell in love with 6 meters. "Living in Nebraska, when the band opened up, I would find myself working pileups. What a hoot!"

Parenthood

Like many amateurs, Scott found that parenthood took him off the air for several years. In fact, his daughter's athletic activities brought him to a different hobby. "When my daughter became a gymnast, I decided to procure the necessary gear to photograph her. This led to bigger and fancier stuff and I found there were a whole lot of opportunities to share my talents with the local newspaper and other parents," he said. "I've been shooting high school sports for 11 years at my daughter's alma mater. I started with football, then I picked up basketball, volleyball, baseball, soccer, wrestling, swimming, and cross country."

Amateur Radio Returns

Scott and his wife recently moved to a new home in a development with a strict homeowners association (HOA). Outdoor antennas are out of the question, but Scott's house has a large attic with enough room to string some antennas, allowing him to return to his amateur radio roots. "I've retained my original call sign as I intended to return to 4 land when I retired, but that may not happen," he said.

His current ham interests are operating Field Day with his local club, trying new HF digital modes, and assisting SATERN — the Salvation Army Team Emergency Radio Network.

Computers and "Flying"

Computer technology plays a large role in Scott's life. For the last 33 years he has worked as a programmer, primarily with mainframes running COBOL/JCL.

When Scott isn't working with computers at his day job, he's flying World War II-era aircraft in a multiplayer online simulation known as *Aces High*. All aircraft are modeled to simulate the flight characteristics of the real thing, and each is flown by pilots like Scott from around the world. Every pilot has a "call sign" and Scott is known in *Aces High* as "AP Drone." Like Scott, I am also an *Aces High* bomber pilot and have flown with him on several missions.

"While they do have arenas where hundreds of people duke it out in the air, I prefer the historical matchups between two countries such as the US 8th Air Force B17s and B24s being escorted into clouds of German fighters protecting their industrial complexes," he said. "I'll often act as the commander of many other bomber pilots. I'm busy designating targets, coordinating coverage with the fighter commanders, setting routes, and managing my own plane's defensive arsenal."

When Scott Avery, KA4ZZQ, isn't working or enjoying amateur radio, he is commanding missions in the multiplayer online simulation *Aces High*.

Going Forward

Scott plans to expand his attic antenna farm and eventually configure his station to operate remotely — from many miles away or just from the other side of the house, where his office is located. He also plans to explore VHF digital with Digital Smart Technologies for Amateur Radio (D-STAR).

"My hopes are high for the return of sunspots and abundant activity on 15 meters, one of my favorite bands. In the meantime, I'm active with FT8," Scott said.

With a long career in computer programming, Scott is particularly excited to see the rapid development of digital operating in amateur radio. "There is enormous potential for the hobby, and it is only just now being tapped."

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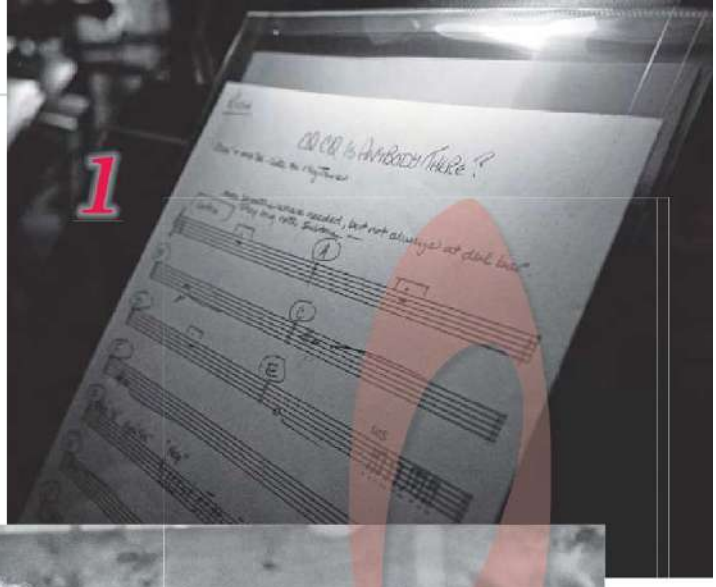
Up Front

Morse Code Becomes Focus of New Jazz Composition

Paul Schreier, AA1MI/HB9DST

CW has often been integrated into music in some form, but rarely has it been the major focus of a song — until now. Maria Schneider, a five-time Grammy Award-winning jazz composer and National Endowment for the Arts (NEA) Jazz Master, has released a piece entitled "CQ, CQ Is Anybody There?" on her album, *Data Lords*.



I love jazz and have been a fan of the Maria Schneider Orchestra for quite some time. She finances her recordings through ArtistShare (**artistshare.com**), a crowdfunding site for musicians. Earlier this year, I became a participant in her latest project, *Data Lords*, by paying up front for the dual CD set (scheduled for release in April 2020). As a participant, I have access to a series of videos she filmed during the conception and realization of her new CDs. In one of the videos, she held up a photo of her childhood homestead in rural Minnesota to mention that her dad was a ham, pointing out the two huge antenna towers that he built himself. I wrote her a short email asking for her father's call sign. She responded almost immediately with "WØABF," and this started a fascinating exchange of emails. At one point, I sheepishly suggested that she add Morse code into a piece as homage to her father. The idea took root, grew, and eventually blossomed into the piece, "CQ, CQ Is Anybody There?"

According to Maria, "This piece uses Morse code for all of its rhythms except for a recurring unison sax line in the second half. The opening is a search for connection, and the messages being transmitted start with 'CQ.' You'll have to decode the rest of the Morse code messages for yourself or search out someone to help, but I also talk about them in our ArtistShare videos."

I know Maria would love to have one of her dad's QSL cards. I've checked into every avenue I could think of and turned up empty handed. If any readers have a QSL card from WØABF, please get in touch with Maria at **support@artistshare.com**.

1 The first page of the score for a new jazz composition dedicated to Morse code. [Briene Lermitte, photo]
2 Five-time Grammy Award-winning composer and NEA Jazz Master Maria Schneider conducting her orchestra. [Dina Regine, photo]
3 Maria Schneider composing in the recording studio. [Briene Lermitte, photo]

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Correspondence

Letters from Our Members

Kindness Knows No Bounds

To honor my late brother, Donald, WB2UQP, I requested and received his call sign from the FCC so that it could live on. Having heard "WB2UQP" on the air since I was 5 years old, it was sentimental to me.

On his birthday, I got on 20 meters SSB and held a personal "special event," calling CQ. I told responders my reason for transmitting was my late brother's birthday, and that I now had his call sign.

Eighteen hams from all over the United States and Canada responded to my CQs with heartwarming sentiments. One particularly comforting sentiment shared with me was that my brother's original signals still travel the Earth, causing him to smile when our signals meet.

Hams spotted me on the DX Summit website, allowing more responses. The kindness from hams in our huge community knows no bounds.

Susan A. Bloomfield, WB2UQP
West Kennebunk, Maine

Through-the-Earth Communications

After reading "Eclectic Technology" in the January 2020 issue, I think the idea of RF traveling around and through the Earth should be explored. I wonder what amateur radio will be like in 2025 and beyond. Imagine the transformation if instead of depending on sunspots and spaceweather we could reliably send RF signals "through" the Earth!

It would be nice to have reliable communications day or night, regardless of the sunspot cycle or grayline. Not only would through-the-Earth communications transform amateur radio, but all of our communications. There would be a reduced need for undersea cables and satellites.

I hope someone sees the benefit of looking into this concept. Who knows? It could conceivably become our future.

William J. Andress, AC5WT
Silsbee, Texas

More SK Estate Planning Tips

Dino Papas', KLØS, estate planning guide, published in the September 2019 issue, is one of the most informative and useful articles I've read in a long time. We should not underestimate its value and relevance.

In the course of our ham careers, it's easy to say that long hours of preparation, work, and the expenditure of large sums of money have gone into making us the ham radio hobbyists we are today. We must work equally hard to prepare for the day when we become Silent Keys (SKs).

I have two recommendations to add to Dino's excellent article. My first recommendation is to make your ham radio estate planning documents available. You would be surprised how many wills and estate planning documents become lost or forgotten. Ensure the executor of your estate knows where to find your "SK file" or binder, as Dino suggests.

Additionally, consider taping 3 × 5 cards on your prominent equipment, directing them to the SK file.

My second recommendation is to do your part. Preparing your executor to handle your estate saves your heirs money, assuming the involvement of an attorney. Estate attorneys are accustomed to settling estates of various complexities, however, it's safe to say many seldom distribute property and manage assets of ham radio operators. You may save your heirs thousands of dollars by following Dino's suggestions on building an SK binder.

Perhaps the most important task for you is valuating all your equipment. You can either do it yourself or your estate will have to pay an estate attorney to learn the nuances and portals for ham radio sales.

Danny Jamison, AH6FX
Nokesville, Virginia

A New Level of Content

The December issue of *QST* hit a home run. Starting with the cover with Joel Hallas, W1ZR, (aka "The Doctor"), the "Member Spotlight," "A Look Back: October 1969" (I missed that year's magazine issues while serving in Vietnam), "Celebrating Our Legacy," "Classic Radio," and "100, 50, and 25 Years Ago" — wow! You have set a new level of great content. Thanks to all the skilled authors.

Jeff Blackmon, W8YI
Eaton, Ohio

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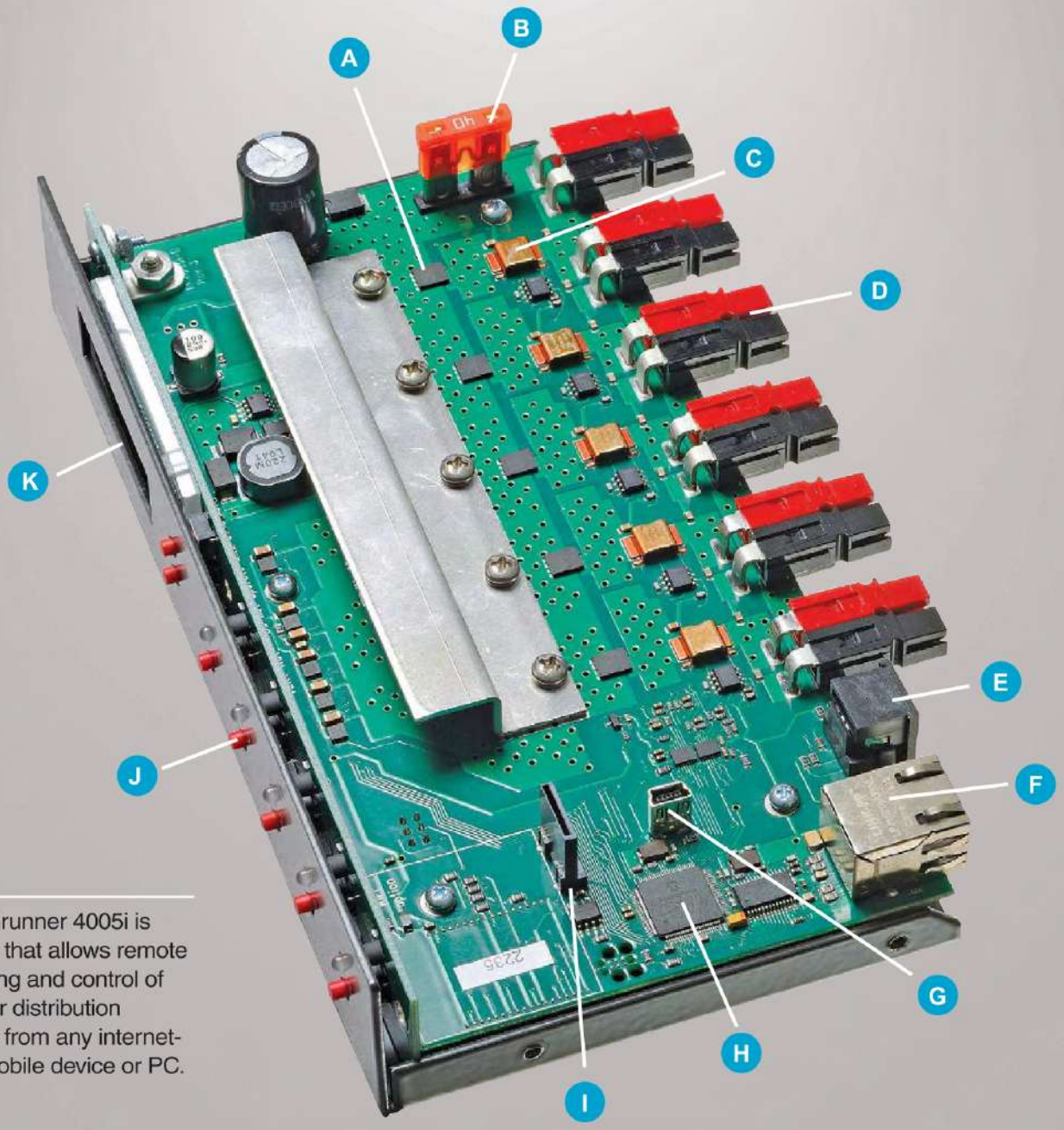

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A Quick-Disconnect Balanced Line Antenna Connector

Protect your station from bad weather and lightning strikes with this simple solution.

Charlie Liberto, W4MEC

I once had an 80-meter dipole about 50 feet off the ground, suspended by two trees. It was fed with window line that used white plastic spacers about every 8 inches. Two holes drilled in a glass pane of a double-hung window brought the ladder line to my homebrew balanced tuner. I thought the 80 – 100 foot tall trees would protect my antenna from any lightning strikes, but that was not the case.

The antenna was hit by lightning, resulting in my backyard being strewn with plastic spacers. Most of the copper in the 130-foot antenna was vaporized. My station equipment was grounded via a length of #6 solid copper wire connected to an 8-foot ground rod outside my window. The ground rod is also connected to the ac entrance ground rod with #4 copper wire on one side of the house — not all the way around, as recommended by the National Electrical Code. However, no damage occurred to my station equipment or any other electronic devices in my home.

Constructing the Connector

After that experience, I wanted to ensure that my station equipment was further protected by disconnecting and grounding any antenna feed lines when not in use. I recently installed a 160-meter antenna fed with 450 Ω window line, and realized that the common two-wire ac plug and receptacle were roughly 450 Ω ladder line width. Here's how to build your own quick-disconnect to protect your antennas.

Hamspeak

Ground
Low-impedance electrical connection to the Earth. Also, a common reference point in electronic circuits.

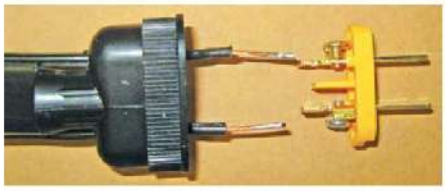
Ladder Line
Another name for air dielectric, parallel conductor, open wire transmission line with occasional insulating spacers.

Window Line
Window line is a balanced transmission line with part polyethylene and part windows of air dielectric. These transmission line types have less loss than coaxial cable, especially when not matched to the load.

Step 1
Buy a two-wire ac plug and socket.

Step 2
Drill two holes in the plastic covers to allow the wires access to reach the terminals.

Step 3
Slide the cover on the individual leads of the line.



Step 4
Wrap the window line solid copper wire clockwise around the screws, tighten the screws, and reassemble the connectors. If your window line wire is stranded, it would be best to tin the wires first. You may also want to use some anti-oxidant compound on the connections.

Step 5


Finally, slide the covers back on and reattach them to the plug/socket bodies. Put the socket on the station end and the plug on the antenna end of the feed line. I also have a large alligator clip/jumper wire connected to my station ground rod, which I clip across the antenna connector blades to eliminate static buildup when the antenna is not in use. You might also consider purchasing a second ac socket, shorting both terminals together, and connecting these shorted terminals to your station ground. When the antenna is not in use, unplug the antenna from the station feed socket and plug it into the ground socket.

Now I have a quick disconnect for my window line to further protect my station (see the lead photo). And as reassurance, a recent ice storm caused a large branch to fall across the feed line and all it did was pull the line apart at the plug. There was no damage to my house attachment point or to the antenna.

All photos by the author.

Charlie Liberto, W4MEC, was first licensed in 1968 as WN4MEC/WB4MEC, though his electronic career started at age 9 when he shocked himself with a homemade Jacob's Ladder. His ham radio interest led to 38 years in aviation-related electronics. Now retired, Charlie enjoys restoring vintage and military AM/CW/SSB and RTTY equipment, as well as restoring the radio gear for the B-17F "Lucky Thirteen" aircraft being rebuilt in Asheville, North Carolina (**www.hangarthirteen.org**). You can contact Charlie at **w4mec@arrl.net**.

For updates to this article, see the *QST* Feedback page at www.arrl.org/feedback.

New Products

The QHtenna VHF/UHF Combiner/Diplexer

The new QHtenna combiner/diplexer combines and isolates 2-meter and 70-centimenter antenna feed lines to a single feed line for transceivers that provide only one coaxial connector. Isolation is typically greater than 25 dB. The unit is rated for 300 W maximum and is housed in a diecast aluminum enclosure with SO-239 connectors. A 12-inch jumper cable is included. It costs $58, plus $7.90 shipping from QHtenna, 101 Collins Rd, Toccoa, GA 30577; tel. 706-491-6490; **lylen4qh@aol.com**.

Choosing the Best Mode for Your HF Operation

When it comes to HF operating, some modes allow you to communicate farther than others. Free software can help predict which ones are likely to be most effective.

Kai Siwiak, KE4PT

Have you ever wondered how the various *WSJT-X* modes stack up against each other — and modes like CW and SSB — in terms of range and coverage on the HF bands? You can easily find out by using the free *HamCAP* software (created by Alex Shovkoplyas, VE3NEA), along with the information in Table 1, which charts the sensitivity thresholds of the modes.

Relative Range Using *HamCAP*

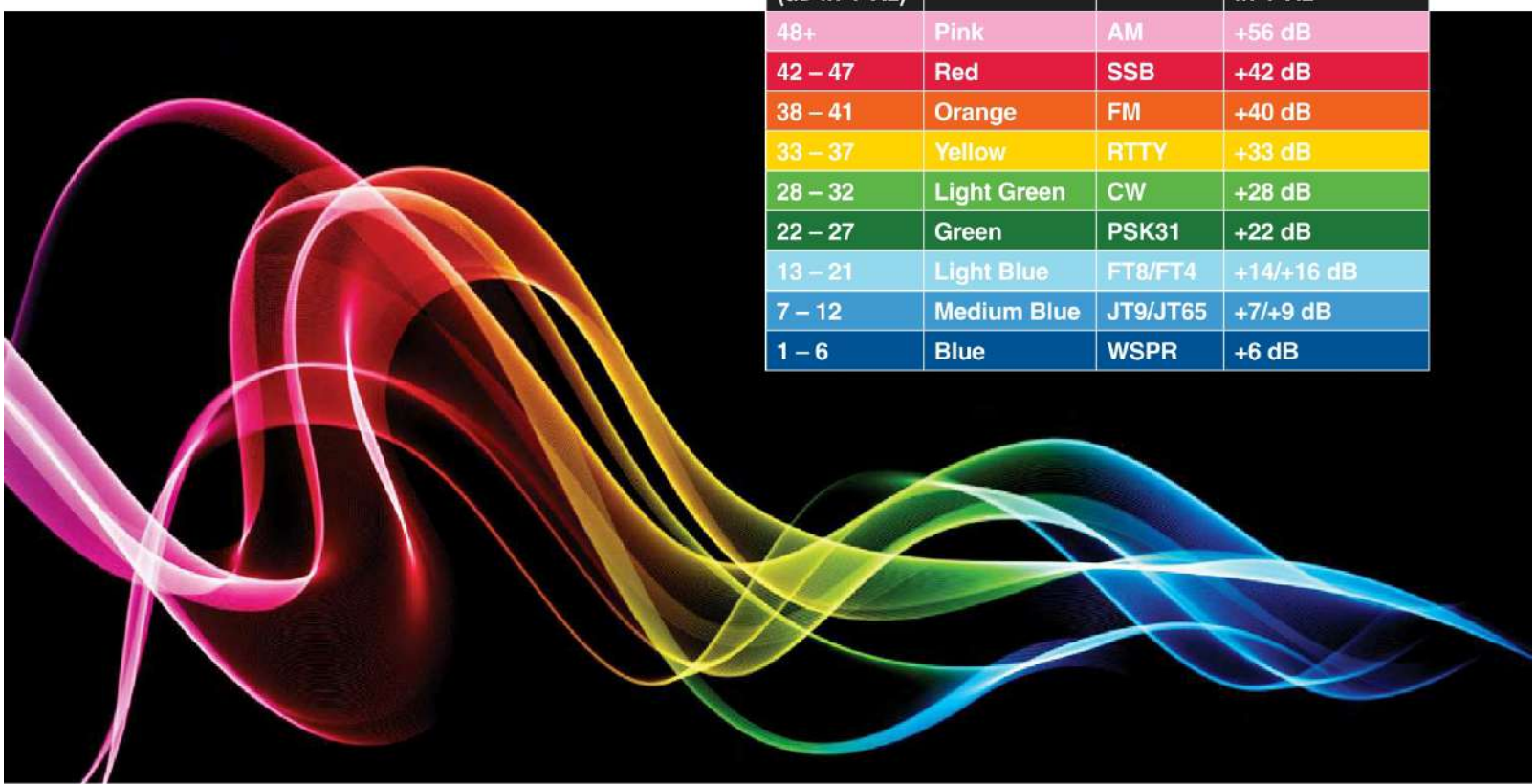
The relative signaling range by mode is approximated on the example *HamCAP* area coverage map (see Figure 1) in colors using the signal-to-noise ratio (SNR) approximations in Table 1. *HamCAP* shows the SNR in a 1 Hz bandwidth whenever you hover your cursor over the colors in the map display. The first column of Table 1 shows the SNR span in a 1 Hz bandwidth that approximately corresponds to the color in the second column. The corresponding modes in column three have threshold sensitivities listed in column four.

For example, the threshold SNR in the standard 2500 Hz bandwidth for FT8 is –20 dB.[1] So, we first convert the SNR in 2500 Hz to SNR in 1 Hz by adding 10log(2500/1) = 34 dB to get the SNR in a 1 Hz bandwidth of +14 dB, shown in column four of the table. That threshold sensitivity extends to the light blue color range of the table. FT8 range coverage therefore includes anything in the light blue through pink range on the map. The same goes for each of the other listed modes.

[1]J. Taylor, K1JT; S. Franke, K9AN, and B. Somerville, G4WJS, "Work the World with *WSJT-X*, Part 2: Codes, Modes, and Cooperative Software Development," *QST*, Nov. 2017, pp. 34.

Table 1
How *HamCAP* Map Colors Correspond to Mode SNRs

SNR span (dB in 1 Hz)	Color	Mode	Threshold SNR in 1 Hz
48+	Pink	AM	+56 dB
42 – 47	Red	SSB	+42 dB
38 – 41	Orange	FM	+40 dB
33 – 37	Yellow	RTTY	+33 dB
28 – 32	Light Green	CW	+28 dB
22 – 27	Green	PSK31	+22 dB
13 – 21	Light Blue	FT8/FT4	+14/+16 dB
7 – 12	Medium Blue	JT9/JT65	+7/+9 dB
1 – 6	Blue	WSPR	+6 dB



In the sample map in Figure 1, SSB voice is limited to pink and red only, while the subsequent mode colors in Table 1 include all previous colors. FT4 coverage, for example, includes light blue through pink, and WSPR coverage includes the whole color map, blue through pink. Remember that the color correspondence is approximate and depends on further mode specifics.

You can generate your own *HamCAP* pseudo-color map specific to your chosen *HamCAP* propagation parameters, and then refer to Table 1 for your relative coverage by mode. This can be extremely handy when you're trying to decide which mode to use for a particular location you're trying to reach.

Generate Your Own *HamCAP* Coverage Map

This is not meant to be a tutorial on using *HamCAP*. For that, please refer to the Installation and Configuration instructions, and third-party tutorials listed at **www.dxatlas.com/hamcap**. *HamCAP* is free software, but I also found the companion program, *IonoProbe*, very useful. If you also purchase and install *IonoProbe*, go to the **SETTINGS** tab in *HamCAP* and press the **IonoProbe** button. *IonoProbe* will then provide real-time ionospheric indices to *HamCAP* to make its predictions even more accurate.

Install *HamCap*, which acts like a graphical user interface (GUI) for the underlying free *VOACAP* propagation prediction software. Start *HamCAP* and fill in the boxes with your station details, including transmitter power. If you don't want to use *IonoProbe*, you need to enter the current sunspot number (SSN) and Kp number for current conditions. You'll find this information at **www.spaceweather.com** (look in the left-hand column).

Now click the **PARAMS** tab and fill in your choices for the input parameters. On the **SETTINGS** tab, I filled in my home latitude and longitude and chose the **PSEUDO** map style and **HIGH** map resolution. The **ANT** tab lets you select antenna patterns from the drop-down menu for both the transmit and receive ends of the propagation path. Double click the **FREQUENCY** button to see the antenna pattern. I chose **ISOTROPE** antennas for both ends of the link to get the most conservative propagation map.

Click on the **MAP** tab and select a frequency button and UTC time. *HamCAP* will generate a color-coded map after a few seconds. You can then refer to Table 1 to estimate the approximate range and coverage from your location using the listed modes.

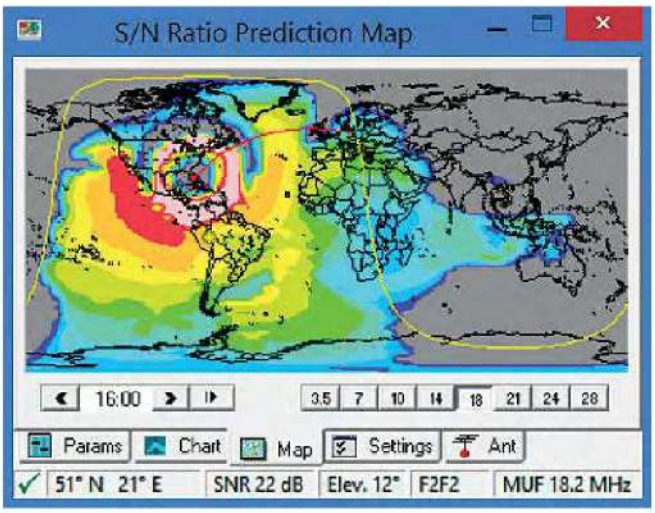


Figure 1 — An example *HamCAP* pseudo-color map for propagation from my home in Florida. The colors correspond to the SNR spans in Table 1. [Kai Siwiak, KE4PT, image]

Mousing over the map reveals latitude/longitude, SNR (in 1 Hz bandwidth), antenna pattern elevation, propagation mode, and Maximum Usable Frequency at the mouse pointer location relative to your home location, on the bottom bar of the map display. Wherever the SNR on the map exceeds the threshold value for your desired mode, it is fair to say that you probably have usable coverage using that mode!

A Technological Approach to Working HF

The coverage map relies on propagation prediction software (*VOACAP* here, built into the *HamCAP* GUI) that displays propagation SNR in a 1 Hz bandwidth. Conveniently, *HamCAP* displays SNR per 1 Hz bandwidth with color transitions that can be correlated to mode threshold sensitivities, as in the table. Armed with this capability, you can "dial up" a propagation range and coverage from your station by choosing a mode that works for that range and coverage.

Kazimierz (Kai) Siwiak, KE4PT, holds an Amateur Extra-class license, is a life member of AMSAT, and member of ARRL, where he serves on the RF Safety Committee and as a Technical Advisor. He is a *QST* Contributing Editor, and Editor of *QEX*. He earned his PhD from Florida Atlantic University, specializing in antennas and propagation. He is a registered Professional Engineer and Life Senior Member of IEEE. Dr. Siwiak holds 41 US patents, has authored many peer-reviewed papers, several textbooks, and has contributed chapters to other books. Kai is a dedicated DXer and enjoys portable operating. His interests include flying (instrument and multiengine commercial pilot), hiking, and camping. You can reach Kai at **k.siwiak@ieee.org**.

For updates to this article, see the *QST* Feedback page at www.arrl.org/feedback.

Using a Nextion Display to Update a Classic Keyer

An exploration of new technology modernizes a keyer design.

Rick Dubbs, WW9JD

Kit building is one of my favorite ham radio activities. In 1984, I purchased the Heathkit SA5010 µMatic Memory Keyer. It's pictured in the splash screen of my updated keyer in the lead photo. The µMatic had a "huge" 240-character command memory and a 22-key membrane keypad. It could use up to 10 variable-length memories and generated repeatable random CW for code practice. Its main flaw was its capacitive touch paddles, which seemingly worked well for only a few hams.

I've been wanting to build an updated keyer with more memory, a physical iambic paddle, and a touch-sensitive LCD screen. I recently found the Nextion NX4832K035 enhanced 3.5-inch HMI touch display LCD Module (available from **www.nextion.tech**). It connects to an Arduino or Raspberry Pi with just a pair of serial wires, and provides a user interface (UI) design environment that is independent from the main program code (known as the Arduino *sketch*). This was the basis for my keyer. Figure 1 shows my updated µMatic2 keyer, with paddles attached, next to the µMatic keyer with its capacitive paddles.

The original µMatic Keyer had 10 memories. My updated version has 110 memories. The Nextion display can have as many as 256 controls on each screen, and as many as 256 screens. This project doesn't need to have a large enclosure to accommodate buttons, switches, dials, and displays. The single Nextion display touchscreen will suffice (see Figure 2).

Nextion Editor

Use the *Nextion Editor* software to create the different screens, or *Pages*, and populate them with controls. The display has the ability to move between the different Pages on its own, or the Pages can be selected under Arduino sketch control. The same goes for the controls themselves. They can get or send their information from or to the sketch. If the **SEND COMPONENT ID** box is checked for a particular control's action (like **TOUCH PRESS** or **TOUCH RELEASE**), then your sketch will be able to make use of that event to perform some sketch function.

I've also created a Page to enable several Pages for reference information. There's a Page with Q signals, a Page with a US call areas map, and some Pages with keyer instructions.

Building Nextion Pages

The *Nextion Editor* is made up of multiple panes (see Figure 3). Start by clicking on the **NEW** icon (or **FILE|NEW**) on the quick access bar. Give your project a name, select which model you're using, and choose the direction in which the display will be oriented.

I recommend you start with the pane in the lower left-hand side. It's a tabbed pane, so its name changes depending on which tab is active. Click on the **FONTS** tab. If you click on the + sign to add a font, you'll be presented with an empty **OPEN FILE** dialog box). Click the **TOOLS** menu, and then the **FONT GENERATOR** item. You may create several fonts, but start with one right now. I used a 16-point Arial anti-aliasing font and named it Arial16AA. Click **GENERATE FONT**, name it again, click **OK**, and then **YES** to actually add it to the **FONTS** pane. You can now close the **FONT GENERATOR**.

To add functionality, click on the control you want from the **TOOLBOX** pane. Position it on the Page, resize it as needed, and then adjust its attributes and/or write any needed code to use the control within the display itself.

To try this out, click on the **BUTTON** control and drag it away from the upper left-hand corner. That's where all new controls start. Next, click on the **TEXT** control. Left-click and hold on the right-hand border of the rectangle and drag it over to the other side of the Page. In the **t0(Text) Attribute** pane, scroll down to the **tst_maxl** attribute, then click on the 10 and change it to 50. Now, click on the button you previously added, click on its **txt_maxl** attribute and change it to 30, then click on the **txt attribute** and change **newtxt** to **My Button**. In the **EVENT** pane, be sure that the **BUTTON TOUCH PRESS EVENT** is selected, then in the text box underneath enter: **t0.txt="The button is pressed"**. Select and copy that line, select the **TOUCH RELEASE EVENT**, and paste the line into the text box. Change the word **PRESSED** to **RELEASED**.

Generally, if you want to use a control in your sketch, you just need to be sure the **SEND COMPONENT ID** box is checked for the Event you want to use. A **PUSH** Event is triggered when you first tap a control (**TOUCH PRESS EVENT**), and a **POP** Event triggers when you release a control (**TOUCH RELEASE EVENT**). Different attributes of a control — like size, location, color, min/max, and value — are usually available to customize from the sketch itself. You will also need to hook the control into your sketch, if you are going to make use of **PUSH/POP** Events. The sketch identifies your control based on its Page and ID numbers. All controls on the first Page have a Page number of "0." Each control has an ID number based on the order in which it was added to the Page, or its arrangement in layers. This last feature caused me some trouble when I moved a control to an upper layer and the editor then re-indexed (re-numbered) several controls. The re-numbered controls then no longer responded as expected in the sketch. You can give each Page a name, which the display can use, but the sketch can refer to each Page only by its number. If you reorder the pages, their numbers change accordingly.

Figure 1 — The WW9JD Arduino-based µMatic2 Memory Keyer next to the original Heathkit SA-5010 µMatic Memory Keyer.

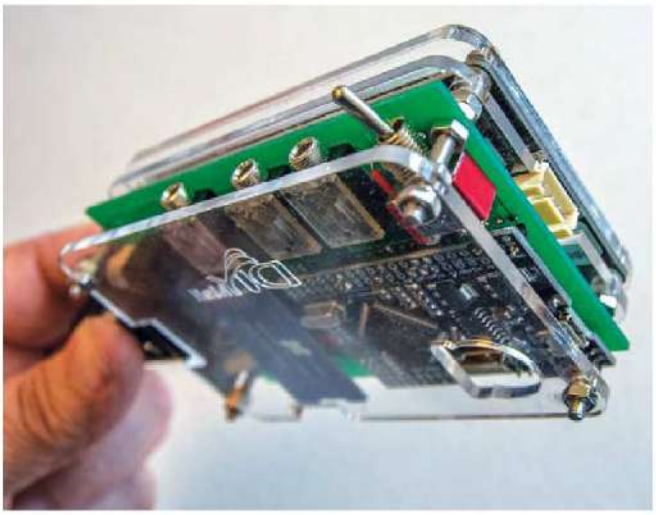


Figure 2 — The keyer board is mounted behind the Nextion display and is sandwiched by the acrylic case.

To add a new Page to the display, click on the **ADD PAGE** icon at the top-left of the Page pane. The Editor will display a list of the Pages that have been created. Initially, each Page is named with the consecutive number of its creation, but you may rename Pages to something more meaningful. The other controls at the top of the Page pane let you delete, insert, reorder, copy, import/export, and delete all the pages at once. After you have created a Page, click on it in order to

view it in the **DISPLAY** pane and begin working with controls.

After populating your Pages with controls, you can compile and test your design right in the Editor. Granted, it knows nothing of input from your sketch, but you can test location and operation of controls, the size of text, and the commands you've programmed to be used by the display itself before taking the time to load it on the display. Click **COMPILE** on the quick access bar, then click **DEBUG** and click on your button to your heart's content.

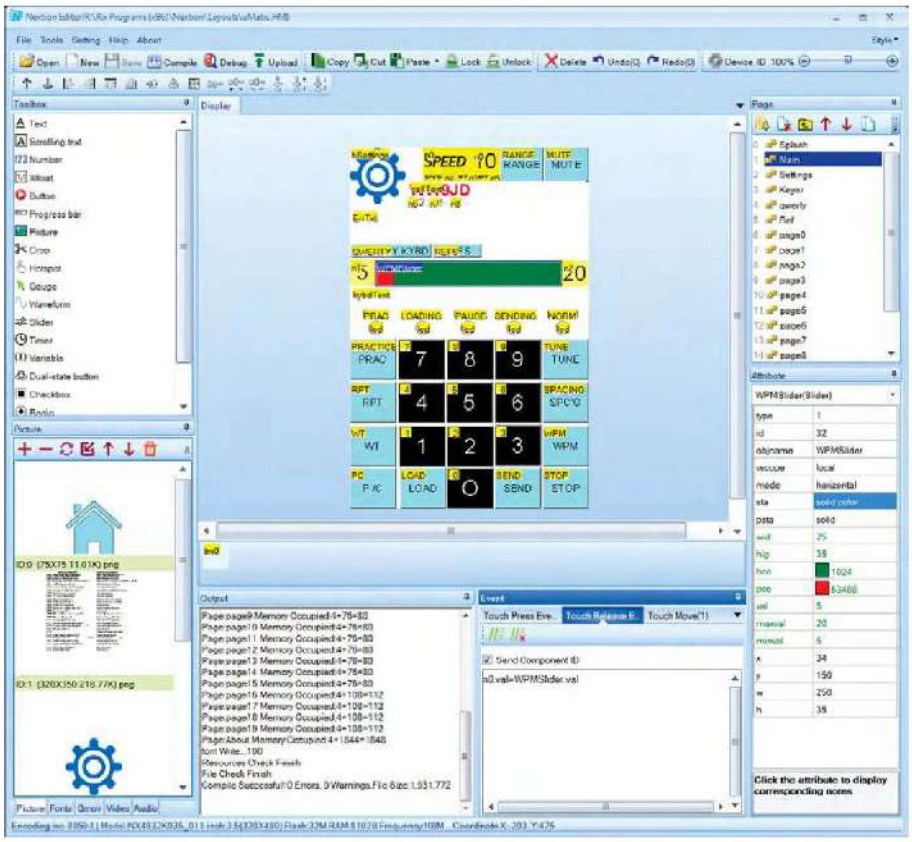


Figure 3 — *Nextion Editor* showing the keyer **MAIN PAGE**.

You will need a microSD card to load your design to the display itself. Use **File|TFT file output** to compile and save the design to the card. When the destination folder is displayed, you can turn off power to the display and insert the card in the slot on the display. When you supply power to the display, it will look for the design file and try to load it. The display screen will show that the upload was successful. Power down, remove the card, and power up to see your design or design changes. As far as I know, the microSD card reader on the display can be used only to upload display designs.

Details about using the display in the sketch are on the **www.arrl.org/qst-in-depth** web page. More project resources, including code and PCB layouts, are available from the author at **www.ww9jd.net**.

Microprocessor Board Selection and PCB Design

One of my goals was to make a smaller, lighter device than the Heathkit original. I wanted to use an Arduino Nano board, but my sketch exceeded its memory limits. I ended up doing much of my prototyping work on a breadboard using an Arduino Mega. I settled on the RobotDyn Mega 2560 PRO CH340G/ ATmega2560-16AU perfboard for my final design.

I wanted the keyer board to be installed behind the display. The Nextion included an acrylic case that is just a frame for the display: a flat back with cutouts for the display connector, microSD card, and the real-time clock battery, some plastic spacers, and hardware.

I ordered another case to use for mounting the keyer board behind the display.

There are several PCB manufacturers that will produce a small run of boards quickly, and at low cost. I used KiCad (**www.kicad-pcb.org**) to design the PCB, and PCBWay (**www.pcbway.com**) to make the actual boards. The total cost was about $30.

My final version includes provisions for attaching the QRPGuys paddle (**https://qrpguys.com/kx-iambic-mini-paddle-kit**), shown in Figure 1. I used epoxy putty to attach a pair of 6-32 standoffs directly to the PCB, placed by using the paddle itself for the proper locations. I also use the µMatic2 keyer with Vibroplex iambic paddles (see the lead photo).

The keyer program, or sketch, mostly replicates the functions of the original µMatic, and then extends that functionality.

Keyer Operation

The Fritzing diagram in Figure 4 includes a microSD memory card that can store gigabytes of data, compared to the 240 characters of memory in the Heathkit original. The Nextion board is in the upper right. The keyer program, or sketch, mostly replicates the functions of the original μMatic and then extends that functionality. The sketch is open source, and I expect others to add features.

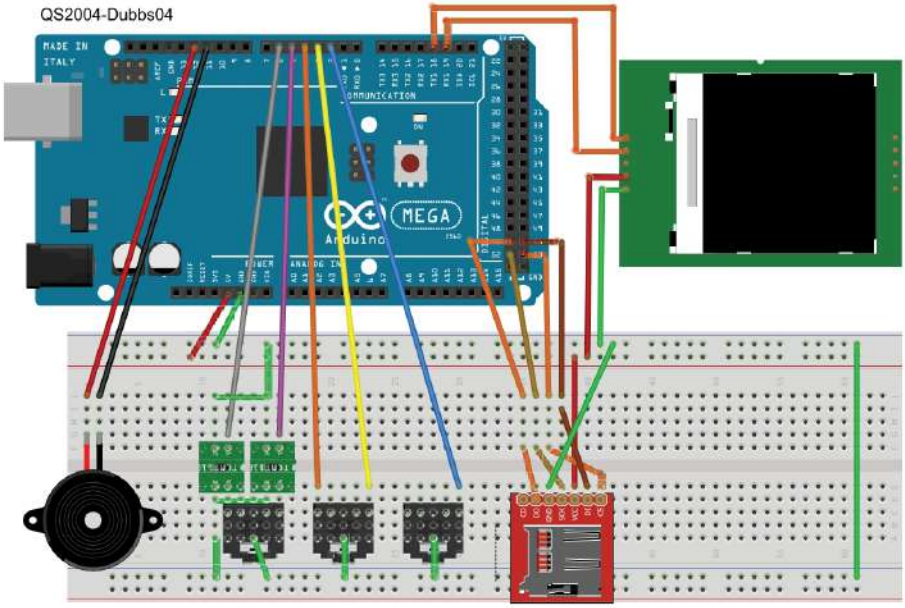


Figure 4 — The diagram for the μMatic2 Memory Keyer shows the Nextion display on the top right and the microSD card on the bottom right.

When you turn the keyer on, you first see a splash (opening) Page that shows the time and has access to an **ABOUT** button that credits some of the folks who posted material online that helped me with this project. The splash Page clears itself after about 5 seconds, or you can tap it to clear it, and then it displays the **MAIN PAGE** seen in Figure 1. The bottom half of the main screen duplicates the keypad layout of the Heathkit original. Most of the function keys work after you have pressed one or two number keys. The function keys on the right-hand side perform the same as the originals. However, both the **WPM** and **SPC'G** may be further modified.

I created several different files with the word "Paris" repeated 5, 10, 13, 16, 18, 20, 25, 30, and 35 times. Use the **TIMING CONSTANT** slider on the Keyer Setup Page to assure that the words per minute (WPM) and Farnsworth settings are accurate. On the left-hand side, the **WT** (weight) control and the **P/C** (pause/continue) work the same, but get used differently. **RPT** (repeat) sets the number of times a file is sent. **LOAD** is used to load or save characters to a file, but not with the paddles. **PRAC** (practice) merely stops the keyer from operating the transmitter. There is no current function in the sketch that produces random CW for practice, but you can copy any text to a file and run it with the keyer.

On the top of the **MAIN PAGE**, there is a large display area that shows you which of the number buttons you have pressed. It displays **OFF** whenever it's not showing recent number button presses. Tapping that display (with or without **OFF** showing) puts the Nextion and the microprocessor board to sleep. Tap the dit paddle to wake it up. There is a display area that will show error conditions, as well as display the name of the file currently being sent. Tap the **MUTE** button in the upper right-hand corner to mute the sidetone, and again to unmute it. The WPM, Farnsworth WPM, weight (if any), and repeat count are shown at the top. The upper left-hand corner has a settings button that gets you to the Nextion settings page. There are two more keys just above the status LEDs to open the QWERTY keyboard Page and the References Index Page.

Conclusion

I now have the μMatic2 update I've wanted for so long. Not only was it well worth the wait, but the process of bringing it to fruition was more enjoyable and educational than I would have imagined. I hope that you will be able to put some of what I learned to use in your next project.

All photos by the author.

ARRL Life Member Rick Dubbs, WW9JD, earned his Novice- and Technician-class licenses in 1977 while in the US Navy nuclear propulsion program. He earned his Advanced-class license in 1987. Rick graduated Ball State University in 1988 with a BS in Middle School Math/Science Education and became a teacher. In 1994, he graduated from Indiana Wesleyan University with an MA in Education, and began teaching in the graduate education program. He retired from teaching in 2017, and currently works part-time with woodworking tools and supplies. Rick also has a photography business (**www.soaringeagle.photography**). You can reach Rick at **umatic2@ww9jd.net**.

For updates to this article, see the *QST* Feedback page at www.arrl.org/feedback.

Mark J. Wilson, K1RO, k1ro@arrl.org

Product Review

Yaesu FT3DR Dual-Band Analog and Digital Handheld Transceiver

Reviewed by Dan Wall, W1ZFG
w1zfg@arrl.org

Yaesu's FT3DR handheld transceiver transmits on the 2-meter and 70-centimeter amateur bands using the Yaesu System Fusion (C4FM) digital modes as well as standard analog FM. Its A band wideband receiver covers most of 500 kHz to 999.995 MHz in 11 bands. The B band receives 108 to 580 MHz in six bands.

The receiver also comes with preset memory channels — 10 for NOAA Weather Radio broadcasts, 57 for VHF marine radio, and 89 for international shortwave broadcasts. A GPS receiver and Automatic Packet Reporting System (APRS) functionality are built in.

With the supplied battery pack or a 13.8 V dc external supply and E-DC-6 cable, power output ranges from 300 mW to 5 W in four steps. With the optional FBA-39 alkaline battery case, the power output is about 0.9 W on **LOW2** and about 0.3 W on **LOW1**.

Bottom Line

Yaesu's FT3DR handheld seamlessly integrates analog FM and C4FM digital voice and data in one package through Yaesu's System Fusion technology. The color touchscreen and standard Bluetooth features are nice upgrades from the FT2DR.

The radio is supplied with the SBR-14LI 7.2 V, 2,200 mAh rechargeable lithium-ion battery pack, a SAD-25B battery charger, a flexible antenna, a belt clip, a USB cable, and a battery pack protective cap (if you choose to not attach the battery clip). Also included is an *Operating Manual* for the radio and instructions for the battery. Additional manuals covering specific features are available for free download from the Yaesu website. Yaesu offers optional accessories, including speaker/microphones, battery packs and chargers, and power and data cables.

Features

The FT3DR has a long list of features in common with its predecessor, the FT2DR. The most notable changes are an improved color display and Bluetooth capabilities.

The FT3DR has a full-color, 320 × 240 pixel high-resolution LCD touchscreen (see Figure 1). It is slightly smaller than the monochrome display on the FT2DR, but I found it more readable in all lighting conditions, even outside on a sunny day.

In the dual-band receive mode, the selected frequency is displayed in a larger font than the frequency of the unselected band. The size of the displayed frequencies reverses when the other band is selected, making it easier to see which band is currently in use.

In the digital modes, the FT3DR displays both the TX and RX numbers used in the Group Monitor functions, whereas the FT2DR only displays the TX number. The display also has the usual indicators for volume, signal strength, VFO/memory mode, FM/digital modes, GPS and Bluetooth signal status, and battery level. There is also an indicator to show if a microSD card is inserted.

The FT3DR has built-in Bluetooth functionality. I tested the review unit with both the optional Yaesu SSM-BT10 Bluetooth headset and a BlueParrott B250-XT Bluetooth headset. (Note that Yaesu does not guarantee that any third-party products will be compatible with their transceivers.) Both headsets paired easily with the FT3DR and performed well. Once paired to a Bluetooth headset, the transmitter in the FT3DR is keyed by pressing the headset multifunction button (or whatever it is called on your particular headset). The radio will remain in transmit mode until you press the multifunction button again. This is a slight departure from the traditional push-and-release PTT button found on hand microphones, and it took a little getting used to.

If you turn on the VOX function in the FT3DR, you can operate totally hands-free through the headset. The radio has high and low settings for VOX gain, and an adjustment for the transmit/receive delay time between 0.5 and 3.0 seconds. Yaesu also offers an optional SSM-63A VOX wired headset in addition to the Bluetooth version.

The list of standard features continues with the AMS (Automatic Mode Select) function, which automatically selects analog FM and C4FM digital modes, based on the signal received from the other station. The DG-ID (Digital Group ID) and GM (Group Monitor) features enable you to automatically locate and communicate with other stations within range if they have a matching DG-ID number. Also DP-ID (Digital Personal ID) features are included. (More on these topics later.) Additional features include:

- Simultaneous reception of two separate frequencies on different bands or on the same band.
- Water-resistant design.
- Memory tags of up to 16 alphanumeric characters.
- Band scope that displays up to 79 channels.
- Continuous Tone Coded Squelch System (CTCSS), Digital Coded Squelch (DCS), and Enhanced Paging and Code Squelch (EPCS) functions.
- Support for WIRES-X internet connections and WIRES-X portable digital node functions.
- Compatible with microSD memory cards for transferring settings and memory contents between the radio and optional programming software.
- Recording of transmitted and received audio on the microSD card for playback on the FT3DR or another device.
- Snapshot function with the optional MH-85A11U camera/microphone.

Knobs and Switches

In both the FT3DR and its predecessor, the FT2DR, there are two main knobs on the top of the unit. The **DIAL** knob is used to change the frequency or select a memory channel. The **VOL** knob is used to adjust the audio volume level. These are the default settings, but the knob functions can be swapped by changing a setting in the **CONFIG** menu.

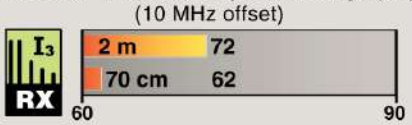
The squelch level can be set by changing a setting in the **SIGNALING** menu, but it's quicker to use the **SQL** button on the left side of the radio. In the FT2DR, pressing the **SQL** button causes the main display to disappear completely, and you are taken directly to the **SIGNALING** menu to adjust the squelch level with

Figure 1 — The FT3DR color touchscreen is easy to read under various conditions.

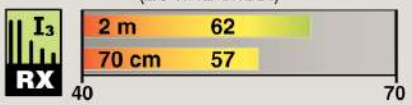
Yaesu FT3DR Key Measurements Summary

Receiver Sensitivity (12dB SINAD, µV)

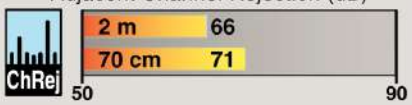
Receiver Third-Order Dynamic Range (dB) (10 MHz offset)



Receiver Third-Order Dynamic Range (dB) (20 kHz offset)

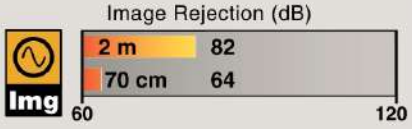


Adjacent Channel Rejection (dB)



IF Rejection (dB)

Image Rejection (dB)



Audio Output (mW)

KEY: QS2003-PR143

Values shown are for Receiver B. See Table 1 and expanded test results at **www.arrl.org/qst_in_depth** for additional measurements.

Bars off the graph indicate values over/under scale.

Table 1
Yaesu FT3DR, serial number 9J030005

Additional ARRL Lab measurements are available at **www.arrl.org/qst_in_depth**.

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receiver A, 0.5 – 999.995 MHz (cellular blocked); Receiver B, 108 – 580 MHz. Transmit: 144 – 148 and 430 – 450 MHz.	Receive and transmit, as specified. (824 – 849, 869 – 894, 940 – 965.1, and 985 – 999.995 MHz blocked).
Modes: FM, Data, C4FM; AM and WFM (receive only).	Receiver A, 0.52 – 50.5, 108 – 137, and 300 – 336 MHz are AM only. 76 – 108 MHz is WFM only. 50.5 – 75.995, 174 – 300, 336 – 420, 470 – 824, 849 – 869, 894 – 940, and 965.1 – 985 MHz are FM only.
Power requirements, 7.2 V dc battery power: Receive, 140 mA (mono band receive), 170 mA (dual band receive), 67 mA, standby (battery saver on). GPS on, additional 18 mA. Digital mode, additional 6 mA. Transmit, 1.6 A (5 W, 144 MHz),1.9 A (5 W, 430 MHz). Auto power off, 990 µA.†	Battery power, at 8.3 V (full charge): Receive, 410 mA (mono or dual-band receive, max volume, backlight on), 87 mA standby, battery saver on). GPS on, add 18 mA. Digital mode, add 16 mA. Transmit (Hi/L3/L2/L1): 146 MHz, 1.34/0.94/0.61/0.45 A 440 MHz, 1.79/1.16/0.73/0.53 A Power off: <1 mA.
Receiver	**Receiver Dynamic Testing***
Sensitivity: AM, 10 dB SN: 3 µV (0.5 – 30 MHz), 1.5 µV (108 – 137 MHz). WFM, 1.5 µV (76 – 108 MHz). FM, 0.35 µV (30 – 54 MHz), 1 µV (54 – 76 MHz), 0.2 µV (137 – 140 MHz), 0.16 µV (140 – 150 MHz), 0.2 µV (150 – 174 MHz), 1 µV (174 – 222 MHz), 0.5 µV (222 – 350 MHz), 0.2 µV (350 – 400 MHz), 0.18 µV (400 – 470 MHz), 1.5 µV (470 – 580 MHz), 3 µV (580 – 800 MHz), 1.5 µV (800 – 999 MHz).	Receiver A: AM, 10 dB S+N/N, 0.54 µV (1 MHz), 1.49 µV (3.8 MHz), 1.53 µV (15 MHz), 1.26 µV (29 MHz), 0.67 µV (50.4 MHz) 0.71 µV (120 MHz). WFM, 12 dB SINAD, 1.41 µV (100 MHz). FM, 12 dB SINAD, 0.18 µV (52 MHz), 0.17 µV (146 MHz), 0.21 µV (162.4 MHz), 0.24 µV (222 MHz), 0.13 µV (440 MHz), 0.64 µV, (902 MHz). Receiver B: AM 10 dB S+N/N, 0.61 µV (120 MHz). FM, 12 dB SINAD, 0.17 µV (146 MHz), 0.16 µV (162.4 MHz), 0.20 µV (223 MHz), 0.15 µV (440 MHz).
Adjacent-channel rejection: Not specified.	20 kHz offset: Receiver A, 68 dB (146 MHz), 69 dB (440 MHz). Receiver B, 66 dB (146 MHz), 71 dB (440 MHz)
Spurious response: Not specified.	IF rejection, Receiver A: 90 dB (146 MHz), 130 dB (440 MHz). Receiver B: 130 dB (146 MHz), >133 dB (440 MHz). Image rejection, Receiver A: 82 dB (146 MHz), 64 dB (440 MHz). Receiver B: 78 dB (146 MHz), 61 dB (440 MHz).
Squelch sensitivity: Not specified. S-meter sensitivity: Not specified.	At threshold, ≈0.12 – 0.26 µV. S-9 indication, Receiver A: 2.26 µV (146 MHz), 2.19 µV (440 MHz). Receiver B: 2.60 µV (146 MHz), 2.06 µV (440 MHz).
Audio output: at 10% THD, 300 mW with 8 Ω load at 7.4 V dc (external speaker).	303 mW, total (either Receiver A or B, or both).
Transmitter	**Transmitter Dynamic Testing**
Power output (Hi/L3/L2/L1): 5.0/2.5/1.0/0.3 W at 13.8 V dc external input.	Battery power, 8.3 V dc (full charge): 146 MHz: 4.8/2.3/0.8/0.32 W 440 MHz: 4.7/2.3/0.79/0.28 W External 13.8 V dc input: 146 MHz: 5.2/2.5/0.96/0.33 W 440 MHz: 5.0/2.7/0.79/0.28 W At minimum battery voltage (5.5 V dc): 146 MHz, 2.8/2.2/0.96/0.45 W 440 MHz, 2.4/2.0/0.86/0.39 W
Spurious signal and harmonic suppression: ≥60 dB (Hi/L3), ≥50 dB (L2/L1).	As specified. Meets FCC requirements.

Size (height, width, depth): 4.7 × 2.7 × 1.1 inches (including protrusions). Antenna length: 7 inches. Weight: 10 ounces (with battery and antenna).

†SBR-14LI 7.2 V, 2,200 mAh Li-ion battery supplied. Replacement SB-14LI, $80. FNB-101LI 7.4 V, 1,100 mAh Li-ion battery, $53. FBA-39 AA-cell holder, $32. CD-41 rapid charger cradle, $38.

*DV not tested; C4FM FDMA signal generator was not available.

the **DIAL** knob. In the FT3DR, pressing the **SQL** button leaves the main display present, but the **VOL** slider changes to a **SQL** slider and the squelch level is adjusted with the **VOL** knob. Pressing the **SQL** button again returns the **SQL** slider to a **VOL** slider.

Also on the left side of the unit is an ample PTT button and a **MONI** button. Pressing and holding the **MONI** button opens the squelch to listen for weak signals. The right side of the unit has the microSD memory card slot, a **DATA TERMINAL** jack, a **MIC/SP** jack, and an **EXT DC IN** jack.

Communication Modes

The FT3DR communicates in the same analog and digital modes as the FT2DR. Standard analog FM mode is indicated by the **FM** icon. In the V/D (voice/data) mode, voice and data are transmitted simultaneously. This is the standard Yaesu System Fusion digital mode and is indicated by the **DN** icon. The Voice FR (voice full-rate) mode uses the entire 12.5 kHz bandwidth for high-quality voice communications, and is indicated by the **VW** icon. The DW (data full-rate) mode for high-speed data communication is automatic with image data reception and is indicated by a **DW** icon. It is not a user selectable function.

There is also a receive-only AM mode, which is automatically selected in the 520 kHz to 50.5 MHz range to listen to the AM broadcast band, shortwave broadcasts, and other services. AM reception is also available from 108 to 137 MHz, (including the popular aircraft band) and 300 to 335.9 MHz. Wideband FM reception includes the FM broadcast band.

The quality of the received audio is good on all bands, but especially good in the C4FM modes. I thought there was plenty of audio from the internal speaker, even when operating outdoors on a windy day or in a moving vehicle.

Memory Channels and Scanning

The transceiver includes 900 memory channels for storing operating frequencies and other parameters, 99 skip-search memory channels, 50 sets of programmable memory scan channel pairs (to set lower and upper scanning limits), and 11 home channels (one per band) that can be reprogrammed by the user. The memory channels can be broken down into 24 memory banks with up to 100 memory channels in each bank. Also included are the preset memory channels mentioned earlier for NOAA Weather Radio and other services.

The radio supports a number of scanning modes, including various options for scanning selected VFO frequencies or memory channels. Details on the scanning modes can be found in the *Operating Manual* and *Advanced Manual*, which are available for download from the Yaesu website.

GPS and APRS Functions

The FT3DR is equipped with a standard Global Positioning System (GPS) receiver. The GPS display screen shows a circular display of the satellites captured with their azimuths and elevations, as well as a bar graph showing relative signal strength and satellite number. Also displayed is your latitude and longitude (within a tolerance of several meters), your current altitude and speed, and the date and time.

When an APRS signal is received from another station, the direction, distance, speed, and other information from the other station is shown on the transceiver display. APRS can only be set up on the B band. More information on APRS operation with the FT3DR is available from the *APRS Manual* available for download from Yaesu's website.

Group Monitor Function

To use the Group Monitor (GM) function in Yaesu System Fusion, each radio (and each DR-2X System Fusion repeater) is set for a two-digit Digital Group ID (DG-ID) number. Separate TX and RX numbers can be programmed. This feature allows only group members who have set their radios to the same DG-ID numbers to communicate. This feature can be expanded in a multi-repeater system to allow selective access to individual repeaters in the system. The GM function monitors the frequency for any other stations with the GM function turned on (or operating in the V/D mode) within communication range. If the DG-ID number is set to **00**, then communication with all radios can take place. If the DG-ID number is set to anything but **00**, the GM function will check for partner stations set to the same DG-ID numbers.

There is also a screen for automatic position locating (APL), which indicates the positions of the group members, centered on your location. The position, distance, and direction of travel for up to four stations can be displayed. GM functions can be used to send messages and images to your group members.

Every C4FM digital transmission includes the individual ID information (radio ID) of each transceiver. With the Digital Personal ID (DP-ID) feature enabled, the speaker audio opens only when a C4FM signal is set to the same DP-ID.

WIRES-X Function

WIRES-X (Wide-coverage Internet Repeater Enhancement System) is an internet-based system that allows you to communicate with stations worldwide. Just contact a local WIRES-X node station, and select from the multitude of "rooms" to talk to whoever is present in that room. When connected to a WIRES-X node station, the node name, room name, call sign of the other station, distance, and direction are all displayed on the radio screen.

The FT3DR can also be set up as a WIRES-X portable digital node by connecting your radio to a computer and running the required software. The optional HRI-200 internet interface is not needed, and no fixed or dynamic global IP address is required. There is a large amount of information available from the Yaesu website about these interesting modes.

Final Thoughts

The FT3DR has something for everyone. It is easy enough to program and use for a first-time venture into the world of Yaesu System Fusion digital communication, but it also has enough advanced features to keep an experienced veteran interested for a long time. Of course, it's a very fine analog FM radio as well.

Special thanks to Steve Paradis, KB1RRR; Ron Lavoie, KC1CWN, and Rick Castrogiovanni, N1JGR, for their valuable assistance with the on-the-air testing done in preparation of this review.

Manufacturer: Yaesu USA, 6125 Phyllis Dr., Cypress, CA 90630; **www.yaesu.com**. Price: FT3DR, $390.

MFJ-1234 *RigPi* Station Server

Reviewed by Pascal Villeneuve, VA2PV
va2pv@arrl.net

The MFJ-1234 *RigPi* Station Server is a standalone, mini PC based on the popular Raspberry Pi. It's also a web server, a bidirectional audio server, an audio interface, an electronic keyer, and an amateur station computer. It is advertised as a computer system that controls your station and handles on-the-air activities, and it allows multiple users and radios to interact simultaneously using any internet browser.

You can operate your transceiver remotely over your home network or from anywhere via the internet. You can operate digital modes, such as FT8 and RTTY, using preinstalled software, and then log your contacts and upload them to your Logbook of The World (LoTW) account. You can browse the internet, send and receive emails, or look up call signs online.

MFJ packaged the hardware and software in one box to get the most out of the excellent Raspberry Pi software called *RigPi*. This combination makes it possible for almost any computer-controllable radio to be operated remotely using any web browser on any mobile phone, tablet, laptop, or desktop computer.

With the MFJ-1234, you can control more than 200 radios and 30 rotators supported by the Hamlib library. You can update the software when new radios and rotators are added, and you can customize CAT (computer-aided transceiver) radio control commands for your transceiver.

Bottom Line

The MFJ-1234 *RigPi* Station Server offers a complete remote station solution and also works as a station computer. Although it is easiest to set up with newer transceivers that have CAT and audio features available over a single USB connection, it can be used with older radios with separate connections as well.

The Software Packages

The *RigPi* Station Server was first demonstrated by Howard Nurse, W6HN (the *RigPi* software author), at the MFJ booth at the 2019 Dayton Hamvention. The *RigPi* software is open source and can be modified. When you buy the MFJ-1234, all the needed software is installed and just a few settings are required to be operational.

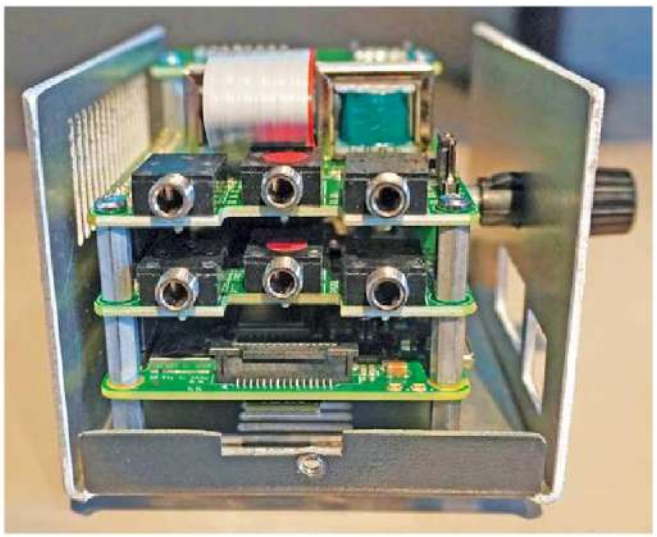


Figure 2 — The inside of the MFJ-1234. The Raspberry Pi board is at the bottom, with *RigPi* keyer and audio boards above.

In the **HAMRADIO** menu, you will find software including *flarq*, *fldigi*, *flrig* (**www.w1hkj.com**); *js8call* (**js8call.com**); *TrustedQSL* (for LoTW, **www.arrl.org/lotw**), and *WSJT-X* (**www.physics.princeton.edu/pulsar/K1JT/**). On the desktop, there is a shortcut for *RigPi*, and an application for auto starting the *Mumble* VoIP server when *RigPi* boots.

Another application, *USB ID*, allows *RigPi* to identify your radio's USB port on the MFJ-1234. On a Raspberry Pi, finding the correct USB port is not simple — your port will look like this: **/dev/ttyUSB0**. The USB device can be mapped to a name, and *USB ID* does it for you.

The Raspberry Pi platform reliability depends heavily upon the quality of the software image and the quality of the SD card it's on. With the MFJ-1234, the software image is secure because the SD card is inaccessible without removing the cover, and there's no chance of removing the card by accident.

After using the MFJ-1234 for several months, I have found the software to be very reliable. The hardware and software integration are very well done. For more information about *RigPi*, visit **rigpi.net**.

The Hardware

The MFJ-1234 hardware is shown in Figure 2. The bottom board is the Raspberry Pi 3 Model B+. In the middle is the *RigPi* keyer, and at the top is the *RigPi* audio board that also includes an I/Q input for SDR radios. If you have a recent transceiver with a USB port that can be used for audio and CAT control, just connect the radio to any of the USB ports on the MFJ-1234 to be fully operational without additional cables.

If your transceiver doesn't have a USB port that can be used for the audio interface, you can use separate cables to connect to an accessory (ACC) port on your transceiver. On the left, Figure 3 shows the 3.5-millimeter jacks for the inputs and outputs for the keyer and audio boards. On the right, Figure 3 shows the other side of the unit with the Raspberry Pi ethernet and USB ports. There's also an RJ-45 jack that you can use for the audio interface.

To power the unit, you will have to provide an external 5 V power supply with a micro USB cable. The MFJ-1234 requires a 2.5 A supply, more than many typical USB power cubes. MFJ offers an optional MFJ-1305RP supply intended to power this device.

Setting Up the Device

The day I received the unit, I was very excited and wanted to test it right away. An hour later, I was controlling my Icom IC-7300 with my iPhone. I only needed to run a USB cable between the radio and MFJ-1234.

I connected one of my station computer monitors directly to the MFJ-1234 using an HDMI cable, along with a wireless mouse and keyboard. There is no power switch on the Raspberry Pi. It will start automatically when you connect power, and it will boot directly in a Windows-type interface (*Raspbian*). Using the mouse and keyboard, I configured my Wi-Fi network (it's best to use a wired ethernet cable). After you are connected to your home network, you can do all the settings remotely or continue directly on the device.

Figure 3 — The MFJ-1234 inputs and outputs.

Figure 4 — The MFJ-1234 *RigPi* interface on the Raspberry Pi with customized macros for my transceiver and operating preferences.

With the MFJ-1234 connected to my home network, I was able to connect to the *RigPi* server by simply typing the *RigPi* IP address in my cell phone's internet browser. I entered the default user and password (from the MFJ-1234 manual) and I was in. Then I selected my radio in the **SETTINGS** tab and was able to power it on.

I noticed there was no audio and found out that another server was running on the Raspberry Pi, *Mumble* (for VoIP applications). I went to Apple's App Store on my iPhone and downloaded the *Mumble* app. After it was installed, I chose a unique username and used the default password and connected to it. There was still no audio, so I went into the *Mumble* settings on the *RigPi* computer, selected the USB audio connections (the *RigPi* automatically detected the sound card interface built into the IC-7300), and it worked. For Android devices, I used the *Plumble* VoIP application available in the Google Play Store.

To access the *RigPi* server from the internet (outside your home network), you will need to do some port forwarding in your home router. Then you need to use your public IP address to connect from an outside network.

Keep in mind that even if the unit is preconfigured, you will need some computer and networking skills in order to make it work. It's not exactly plug-and-play, but it's pretty close if you know what you're doing. A good online support forum is available, as discussed later.

On-Air Operation

The *RigPi* interface is pretty simple to use. Load the web interface on your browser, log in, and turn on the radio using a macro (the **PWR ON** button). Click on **CONNECT RADIO**, open the *Mumble* app on your remote device, and connect to the audio server.

Now that you are connected, you can use the on-screen VFO to change frequencies and the on-screen PTT to transmit while talking on your phone. You need to test everything while you're in your station to ensure that everything works fine and that you will not damage anything. At one point, I was operating remotely from another room in my house, and when I got back into the station, I noticed that my transceiver was stuck in transmit. Fortunately, I had not been transmitting for very long. It was not because of a malfunction, but because I had touched the **T/R** button on my iPhone screen. As soon as you remove your finger from the PTT button, the radio stops transmitting, but the **T/R** button locks the PTT until you touch it again. To be safe, I deleted the **T/R** macro from my interface screen, as shown in Figure 4.

Another thing to consider is your country's regulations about remote operations. In Canada, you need an Advanced license to operate a remote station.

I wanted to set up the system to be able to monitor the IC-7300's SWR meter while transmitting. By default, I couldn't see my SWR when I was transmitting. This worried me because my antenna switch is manual, so I need to set everything correctly before I leave the station if I want to operate remotely. Fortunately, using the online *RigPi* support forum, I was able to learn how to set up SWR monitoring for my transceiver using the **ADVANCED RADIO** settings. I had to go through a calibration process, but it works.

The software package includes everything you need to operate using FT8 and other digital modes. After selecting the correct audio interface for your radio in the *WSJT-X* software, everything works going through the *RigPi* radio control interface, and the application looks and works just like it does on a locally connected desktop computer. If you encounter audio connection problems, confirm that the correct audio device is selected by right-clicking the speaker icon on the Raspberry Pi desktop along with checking the audio device settings in *WSJT-X*.

Figure 5 — The *RigPi* web interface running on my iPhone XS MAX.

I was able to operate remotely using both Android and iOS mobile devices (see Figure 5). You can also use any desktop or laptop computer with a web browser. Another cool thing about the software image is that it includes a VNC (virtual network computing) server. This allows you to connect remotely to the Raspberry Pi interface as if you were connected directly to the device.

Support

There's a well-organized community for the *RigPi* users. You can find help and a lot of useful information on the *RigPi* forum (**groups.io/g/RigPi**). *RigPi* developer Howard Nurse, W6HN, is active on the forum, and he's answered many questions.

Here's an example of support I got from the group. When you select your transceiver in the **SETTINGS** tab of the *RigPi* interface, most macros will work, but many radio functions are not included in the default setup. So, I went on the support forum and got a list of macros for my radio, and I customized my interface (see Figure 4).

Conclusion

I've had a lot of fun with the MFJ-1234. I can now monitor my favorite HF frequencies from any room in my home, and from anywhere away from home, as long as I have internet access. I can also transmit if I want to, instead of just listening.

I had never tried FT8 before I got the MFJ-1234. It works so easily that I'm now addicted, and I made quite a few DX contacts in just a few days using this mini station computer. I imported my Logbook of The World certificate and uploaded my *WSJT-X* log (.adi) to LoTW using the *TQSL* application on the MFJ-1234 as well.

The MFJ-1234 is a very good addition to my station. It's a compact, multifunctional PC that combines practicality with many fun features. Because the software is open source, I expect even more functionality will be available in the future when it becomes available on **www.github.com**.

Manufacturer: MFJ Enterprises, 300 Industrial Park Rd., Starkville, MS 39759; **www.mfjenterprises.com**. Price: $319.95; MFJ-1305RP power supply, $24.95. *RigPi*™ is a trademark of Howard Nurse, W6HN. More information is available at **rigpi.net**.

Visit https://youtu.be/Hoc4213UOmE to see our review of the MFJ-1234 *RigPi* Station Server on YouTube.

Phase Dock WorkBench Project Development Kit

Reviewed by Glen Popiel, KW5GP
kw5gp@arrl.net

The Phase Dock WorkBench Project Development Kit (PDK) is an innovative approach to the old breadboard system of developing projects. This review pertains to the WorkBench 1007 PDK, but the other members of the WorkBench series share many of the same features and accessories.

For years, I've done much of my project development and testing using the traditional breadboard method of mounting everything to a wooden board, with a 400- or 800-pin solderless plastic breadboard to mount the smaller components, and then connecting everything together using jumper wires. Switching out any of the larger components, such as an Arduino Uno microcontroller for an Arduino Mega or a Raspberry Pi, would involve dismounting the old circuit board and mounting the new one in its place.

In the Box

The WorkBench 1007 PDK, shown in Figure 6, comes with a 13.75 × 7.75 inch base (including handles) that provides about 54 square inches of work area. The base consists of a 10 × 7 primary matrix of holes, along with a 9 × 6 secondary matrix of smaller holes. The larger primary holes are used for mounting the boards that contain your components.

The boards that mount to the base are called *clicks*. The click is designed to snap into place on the base and is available in two sizes. The 1007 PDK comes with four 2 × 3 inch clicks and one 1 × 3 inch click. A direct-mount hardware kit with standoffs and screws is included, and it allows you to custom mount your own components, breadboards, and other assemblies to the clicks. The Phase Dock website also shows components mounted with cable ties or double-sided tape.

The 1007 PDK also includes three *slides* designed to mount to the top of the clicks. One slide has mounting holes pre-drilled for attaching an Arduino Uno (or any Arduino-type board that has the same mounting configuration, such as the Arduino MEGA). Another slide matches the Raspberry Pi 2, 3, or 4, and the last slide matches the Adafruit Feather series/Particle Argon, Boron, or Xenon.

To test the flexibility of the WorkBench slide concept, I mounted an Arduino Nano and an I/O pin breakout board to the 1 × 3 Feather click and slide. One interesting idea I saw on the Phase Dock website is to mount a USB battery power source to power your project. I chose to mount a 2.2-inch color TFT display module on one click and a 400-pin solderless breadboard on another. Additional clicks and slides are available separately.

Bottom Line

Phase Dock's WorkBench series is an innovative approach to the breadboarding method of project development.

Figure 6 — The Phase Dock WorkBench 1007 Project Development Kit includes the base, with clicks and slides to mount electronic components and microprocessor boards. There's also a clear cover (not shown) and hardware packet.

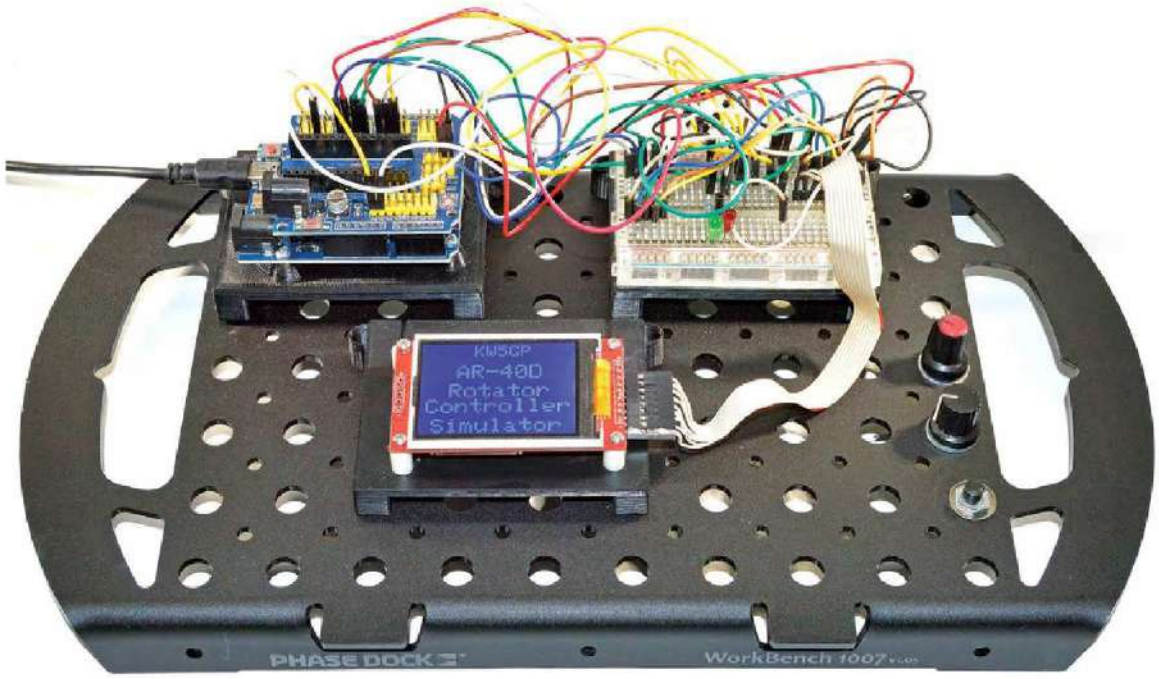


Figure 7 — An antenna rotator controller and simulator project in development. The Arduino Uno with an I/O shield are mounted on a click at the upper left. Other components are on a breadboard mounted to a click at the upper right, and the 2.2-inch display is on another click.

The 1007 PDK kit comes with a snap-on clear plastic cover to protect your project in between development sessions. It even comes with several tie-wrap bases for cable management, allowing you to run cables on the underside of the base and helping to keep the top side uncluttered.

Initial Assembly

Assembling a slide to a click was the most difficult part of getting the WorkBench ready to use — if you could call any part of it difficult. You have to insert mounting nuts for the screws that will secure the microcontroller board and then glue the bottom of the slide to the top of the click. The instructions call for making a small jig (essentially two small pieces of wood and some clamps) to ensure the proper placement of the slide to the top of the click. A video on the Phase Dock website shows exactly how to do the assembly.

With its unique click and slide design, you can quickly rearrange and swap out major components as you switch between projects or designs during development. The Phase Dock website has an excellent series of tutorial and support videos to help you get started assembling and using the system.

Building a Project

In order to see just how much of an improvement the Phase Dock WorkBench was over my traditional breadboard method, I used the WorkBench to create a prototype of an MFJ AR-40 rotator controller, as shown in Figure 7.

I used holes in the WorkBench base to mount a potentiometer and a switch on the right edge to simulate the antenna direction dial and start switch on the controller, and an additional potentiometer to simulate the rotator position sensor. I mounted an I/O shield to the top of the Arduino Uno in its click and slide assembly, allowing for quick and easy access to the Arduino's I/O pins for connecting to another click with a breadboard mounted on top.

The prototyping went quickly and smoothly. I really liked the flexibility the click and slide units gave me in project component selection and their placement on the base. The ability to rearrange the project on the base made for quick and easy wiring between modules. I could easily swap out the Arduino Uno click for an Arduino Nano click in just a matter of minutes.

Manufacturer: Phase Dock, **www.phasedock.com**. Price: Phase Dock 1007 Project Development Kit, $69.95 with a black base. Other colors are available for $79.95. Other versions and additional clicks, slides, and hardware kits are available.

DX Engineering Ultra-Grip 2 Crimp Connector Hand Tool Kit

Reviewed by Mark Wilson, K1RO
k1ro@arrl.org

A recurring debate in the ham radio world is the best way to install PL-259 coax connectors. We won't be declaring a "best way," but DX Engineering (DXE) offers a system of installing crimp/solder connectors that does a fine job. For this review, we ordered the Ultra-Grip 2 Crimp Connector Tool Kit, some DX Engineering brand coaxial cable, and several types of compatible DXE Next Generation and Amphenol Crimp/Solder PL-259s. We also ordered DXE coaxial cable prep tools for RG-8 and RG-8X size cables.

The tool kit includes the crimping tool, coaxial cable shears, and diagonal cutters for trimming braid — all packaged in a padded carrying case. The centerpiece of the tool kit is the crimping tool and various dies, which are shown in Figure 8. The dies are easily changed by removing two screws with an included Allen wrench.

Figure 8 — The DX Engineering crimp tool and dies. The die for the Anderson Powerpole connectors is installed. The other dies (left to right) are used for RG-8 size coax, RG-8X and RG-58 size coax, and three sizes of insulated wire terminals. Another die for uninsulated terminals is included but not shown.

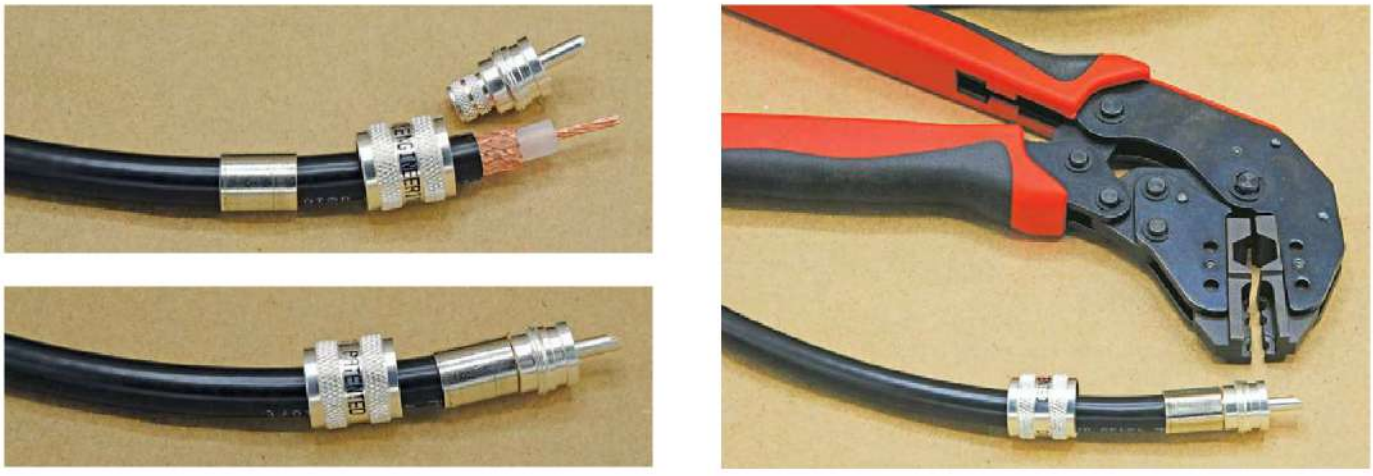


Figure 9 — Installing DXE Next Generation connectors on DXE-213 coax.

Figure 10 — Installing DXE Next Generation connectors on DXE-400MAX. The red object is the cable prep tool.

Figure 11 — A DXE Next Generation PL-259 installed on DXE-8X (top) and Amphenol 182100 PL-259 installed on DXE-58AU.

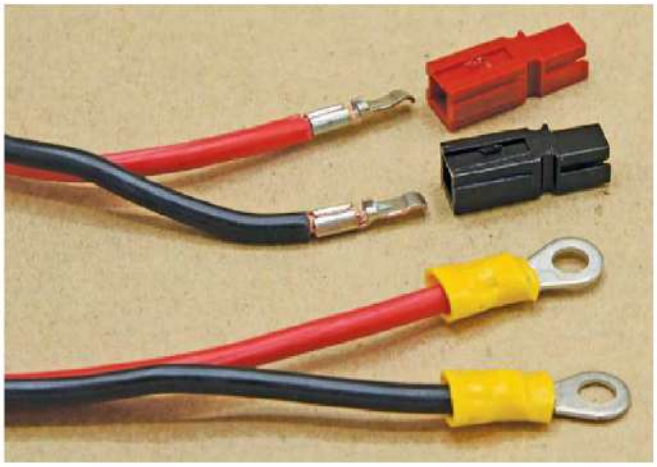


Figure 12 — Anderson Powerpole connectors and insulated ring terminals installed on a power cable using the Ultra-Grip 2 tool and dies.

The manual includes a chart showing the types of cable and connectors that are compatible with this tool kit. Figure 9 shows the installation of a DXE Next Generation PL-259 on DXE-213U cable. First, cut the desired length of cable and cut the ends square. The cable shears cut the DXE-213 like butter and made a very clean cut. Slide the ferrule and connector collar onto the cable so you don't forget.

Using the dimensions in the manual, remove the outer jacket and trim the braid and dielectric (center insulation) to length. Although I could do this with a razor knife and pliers, it was a lot faster and neater to use the DXE cable prep tool. Just clamp the tool over the cable, give it a few twists, and pull the discarded pieces off. I had to use the diagonal cutters to trim a few errant strands of braid, but the tool did a remarkably nice job.

Next, slide the prepared cable end into the connector body (it slides under the braid). Then slide the ferrule over the exposed shield until it is against the connector body, and then crimp the ferrule. The tool ratchets as you squeeze — keep going until the ratchet releases. Solder the center pin, and you're done.

I had similar success using Amphenol 182102 crimp/solder PL-259s plugs on the DXE-213 cable, and also DXE connectors on the DXE-400MAX cable (see Figure 11). Figure 10 shows DXE and Amphenol connectors installed on RG-8X and RG-58 size cables.

The crimp tool includes dies for Anderson Powerpole connectors and crimp-style wire terminals, so I made a power cable with some #12 AWG wire (see Figure 12). The crimp tool did a fine job with both connector styles, and the ratcheting mechanism was easier to close than the simple crimping pliers I normally use.

The DX Engineering Ultra-Grip 2 Crimp Connector is worth a look if you have a lot of connectors to install. Instructions and a helpful video showing how to use the cable prep tool are available on the DX Engineering website.

Manufacturer: DX Engineering, 1200 Southeast Ave., Tallmadge, OH 44278; **www.dxengineering.com**. Price: UT-KIT-CRMP2, $182.99. UT-405C-P1 and UT-240C-P1 cable prep tools, $39.99 each. Connectors are available in a variety of styles, and tools in the kit are available separately.

Feedback

In the March 2020 *QST* "Product Review," column we failed to mention that the Xiegu G90 transceiver is also sold by Connect Systems at **www.connectsystems.com**; tel. 818-889-0503, and Radioddity at **www.radioddity.com**.

Joel R. Hallas, W1ZR, w1zr@arrl.org

The Doctor is In

Height Above Ground Makes a Big Difference

Q Adrian, VE7NZ, asks: While selecting a new triband HF Yagi for my station, I noticed that one antenna manufacturer's specification sheet has a footnote that the published gain figures include the effect of the ground at 1 wavelength above ground for each band. Is this normal and is the statement omitted on other manufacturers' specification sheets?

How is the gain figure changed by including this and does it decrease if you go higher than 1 wavelength? I'm installing my new antenna 43 feet above ground. This of course is more than 1 wavelength on 10 meters, less on 15 meters, and quite a bit less on 20 meters. If it's easy to calculate, I would like to know how much the ground effect is part of the gain for each band at 43 feet.

A I'm not aware of a standard height, but note that while the gain above typical ground is around 5 – 6 dB higher at some angles than it would be in free space, the gain is not very different at various heights. Because of the higher gain over ground, most manufacturers specify their gain above ground at some height.

The actual height above ground mainly affects the peak elevation angle, which is pretty much the same for all antennas of similar design at the same height in fractions of a wavelength. Note that the free-space pattern, while sometimes useful for comparisons, doesn't apply directly to HF antennas mounted at typical heights above ground.

Table 1
Gain (dBi) and Angle of First Elevation Peak of Typical Three-Element Yagi Over "Medium" Ground at Different Heights Compared to Free Space

20-meter Yagi	**Free space**	**43 feet (0.62 WL)**	**½ wavelength**	**1 wavelength**
	6.9 dBi at 0°	11.8 at 21°	11.2 at 26°	12.2 at 14°
15-meter Yagi	**Free space**	**43 feet (0.93 WL)**	**½ wavelength**	**1 wavelength**
	7.4 dBi at 0°	12.6 at 15°	11.8 at 26°	12.8 at 14°
10-meter Yagi	**Free space**	**43 feet (1.2 WL)**	**½ wavelength**	**1 wavelength**
	6.8 dBi at 0°	12.2 at 11°	11.2 at 26°	12.2 at 14°

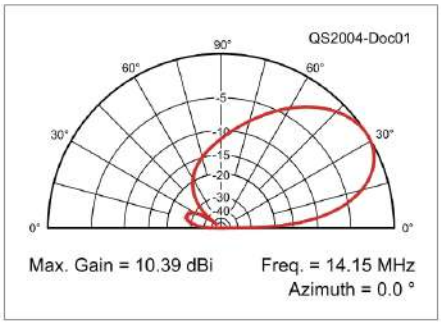


Figure 1 — *EZNEC* elevation plot of a three-element Yagi ⅜ wavelength above *EZNEC* medium ground (conductivity 0.005 S/m, dielectric constant 13).

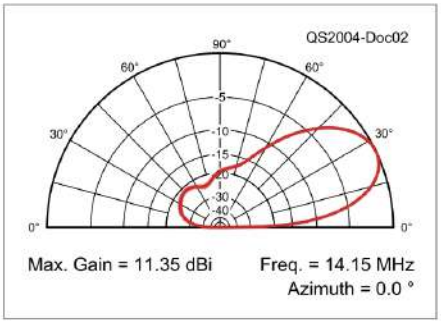


Figure 2 — Elevation plot of the antenna of Figure 1 at ½ wavelength above ground. Note the narrowing of the elevation pattern and the lowering of the angle of the peak of the lobe by 6°, as well as the increase in the peak gain by almost 1 dB.

The ground has a significant effect on all earthbound HF antennas. Not only is the height above ground important, but so is the ground conductivity. The gain of a horizontal antenna above ground at the peak elevation angle is often called "ground reflection gain." This gain is real, and is an advantage of a horizontal antenna over a vertical antenna on typical ground at or near the peak elevation angles.

The peak gain doesn't change as much with height as does the angle of the peak. For example, at a height of ½ wavelength, the peak gain over "medium" ground occurs at an angle of about 26°. I have run *EZNEC* models of three-element 20-, 15-, and 10-meter Yagis over different kinds of ground at a height of ½ wavelength, and then also at 43 feet and full-wave over medium ground as shown in Table 1. Some observations:

- The three antennas are of somewhat different design that I had models of at hand, so don't draw any conclusions about the small differences for similar situations.
- The height is more important than the ground type. As the antenna goes higher, the (first) elevation peak goes lower, so more power is deliv-

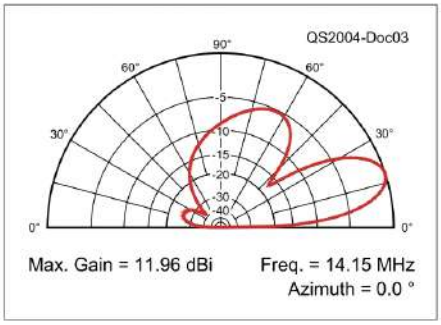


Figure 3 — Elevation plot of the antenna of Figure 1 at ¾ wavelength above ground. Note the further narrowing of the main elevation beam, the further lowering of the angle of the peak of the lobe, and the smaller increase in the peak gain. The gap in the elevation pattern centered at 42° won't have much impact on long-distance communications, however, the higher lobe will add interference from close-in stations, which will likely be stronger than those from stations at a longer distance.

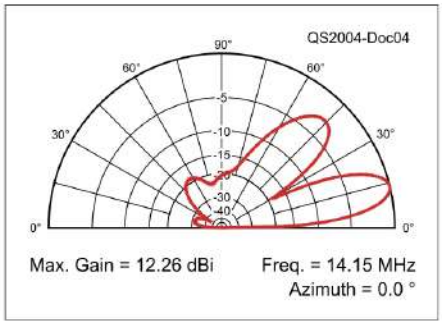


Figure 4 — Elevation plot of the antenna of Figure 1 at 1 wavelength above ground. The null now centered at 29° may be an issue for medium-distance stations, otherwise the trends are similar.

ered at the desired low angles (useful for DX), but notice as the antenna gets higher than about ¾ wavelength, the elevation pattern starts to break up into a narrower first beam with multiple lobes and nulls between. If the station you want to work is in one of the nulls, you might as well not be so high. Figures 1 – 4 show the elevation pattern of a three-element Yagi over typical ground at ⅜, ½, ¾, and 1 wavelength.

■ The most serious DX/contest stations with the very tall towers tend to have multiple Yagis at different heights. For most work, they feed them in phase to have higher gain at a height equivalent to the height in between, but they can also select either one separately, or even feed them out of phase for very high angle work. As Kai Siwiak, KE4PT, explains in, "Is There an Optimum Height for an HF Antenna?" from the June 2011 issue of *QST*, us mere mortals usually have to select a compromise height, and 43 feet is in the optimum range as considered by some.

Q Mike, W9KY, asks: I saw a recent catalog offering some type of spacer to space coax a few inches away from my Yagi's boom. Since getting into the hobby in 1977 and installing a tower a few years later, I've always taped the coax directly to the boom and then a tower leg. Have I been doing the coax installation wrong all these years?

For my Yagi, I usually have some type of balun or a series of ferrite cores located directly at the feed point. Once past the balun or the cores, out comes the tape. Likewise, the tower has the coax secured top-to-bottom with plastic electrical tape. What are your thoughts?

A Properly terminated coax results in the signal being entirely within the coax — between the outside of the inner conductor and inside of the outer conductor or shield. That's what shielded cable is all about — so whether it's coiled up, buried, or taped to the boom or tower, it shouldn't make a difference to the desired signal. With your balun or choke, you should be forcing all the RF inside the cable where it's supposed to be. Using the spacers certainly won't hurt anything and will avoid any problems from possible tape failure due to extreme temperatures or other conditions, but isn't necessary for proper operation.

That's the short answer, but since you're considering routing of your coax, there is more to the story. Most lightning gets brought into the station on cables that come down from the antenna — not only coax, but also rotator and lightning cables, if needed. How these cables are routed can make a big difference in what fraction of any induced lightning current reaches the station.

First, any lightning current will be coupled to the tower and antenna system and tend to run toward ground from there. The best place for it to find ground is at the bottom of the tower legs where there should be a solid grounding arrangement with multiple ground rods at each leg, interconnected with buried cables. Unfortunately, this path can be degraded through improper cable routing. Current coming down the tower will follow skin effect by trying to be on the outer surface. This will be the tower itself if all the cables are routed inside of it. This means that taping your coax on the inside of a tower leg is preferable to taping it to the outside of a leg.

Still, some fraction of the current will try to come down the outside of your coax shield (as well as your rotator cable). If the shields are terminated at the bottom of the tower leg by a connection to ground, that will remove much of the lightning current at that point. DX Engineering (**www.dxengineering.com**) does make a handy product called "coax grounding brackets." These can be clamped to the tower leg and have holes that can accept UHF bulkhead or feed-through coax connectors, providing a clean way to ground the shields at the bottom of the tower leg.

It's important that the coax go all the way to the bottom of the tower to avoid tapping off at a higher lightning voltage point.

Do you have a question? Ask the Doctor! Send your questions to "The Doctor," ARRL, 225 Main St., Newington, CT 06111, or email your question to: **doctor@arrl.org**.

Also listen to the archives of episodes of the *ARRL The Doctor is In* podcast, sponsored by DX Engineering, on iTunes, Blubrry, Stitcher, or on the ARRL website at **www.arrl.org/doctor**.

Paul Wade, W1GHZ, w1ghz@arrl.org

Microwavelengths

Operating in Less Than Ideal Conditions

Weather forecasts in northern New England for the first day of the 2019 ARRL 10 GHz and Up Contest were not promising — showers and thunderstorms. Most operators were deterred from attempting mountaintop operation, but some got creative. Ray Perrin, VE3FN, arranged to operate from the 10th-floor balcony of a ham friend, Robert Cherry, VA3AOD, in downtown Ottawa, Canada. Chip Taylor, W1AIM, and I set up under my back deck, with a reasonably unobstructed view in that direction. We were able to make CW contacts between FN34uj and FN25ej — my fifth grid from home.

Later in the day, we went to local hilltops with partially obstructed horizons and made good contacts (up to 368 kilometers), in the unobstructed directions. We did even better from a mountaintop the next day, making contacts of up to 579 kilometers from Maine to Ontario, some with rain scatter.

Operating in Winter

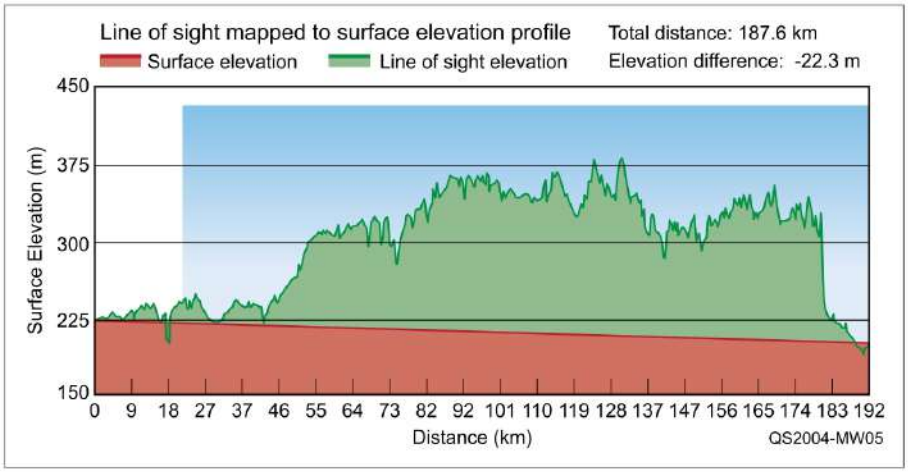
While mountaintops may provide better DX, they aren't essential for making microwave contacts (so don't put away your microwave gear once contest season ends). I recently received the following note from Rus Healy, K2UA:

> There's a lot of energy around keeping the microwave bands hopping in the northeast and other regions. We're fortunate to have passionate Canadian hams and the corresponding level of energy on the US side of the Great Lakes when it comes to activating the bands — especially 10 GHz.
>
> Hugh Duff, VA3TO, doesn't live in a great neighborhood for getting on 10 GHz. He can't put up a tower and his views are obstructed in most directions. Therefore, he has adopted a roadside spot on the Niagara Escarpment in FN03an. Since deciding to focus his efforts on that spot, Hugh worked 19 grids from there on 10 GHz in 2019, as well as six grids on 24 GHz. One of my contacts with him got him to the five-grid mark for ARRL's VHF/UHF Century Club (VUCC). His goal for 2019 was to make 20 grids on 10 GHz from that location.
>
> Peter Prabucki, VA3ELE, and Hugh usually go out together, or at least at the same time, for 10 GHz operations. In many cases, one or the other has driven quite a way to work the other from a needed spot. I've also given them both new grids on 10 GHz including FN01, FN11, FN22, FN23, and FN24.
>
> The forecast for December 14

Hugh Duff's, VA3TO, setup at FN03cn on a railroad overpass. [Peter Prabucki, VA3ELE, photo]

Peter Prabucki, VA3ELE, operating 10 GHz at EN82xx. [Hugh Duff, VA3TO, photo]

Andy Flowers, KØSM, in contact on 10 GHz with Peter Prabucki, VA3ELE, from inside Andy's garage. [Hugh Duff, VA3TO, photo]



An obstructed path profile between FN03cn and EN82xx at a distance of 187 kilometers.

called for rain and snow from east to west. It was a large system. Rain and snow both scatter 10 GHz signals nicely, unblocking paths and significantly extending distances under summertime conditions (not so much in winter). Peter drove 2½ hours west to work Hugh in grids #20 and #21. Andy Flowers, KØSM; Mark Wasserbauer, N2YB, and I also got on to join them (even though Mark's 10 GHz station wasn't completely assembled yet).

Andy and I operated from a spot inside his garage, which has a great view to the west, with a 30-mile visual horizon. Graham Stratford, VE3FHM, also operated. Tony Emanuele, K8ZR, got on from northeast Ohio and made the 1-hour drive from his home up to the shore of Lake Erie to work Andy and me after the attempt from his house didn't work. These events gave me an opportunity to work five grids on 10 GHz (FN03, EN82, EN83, EN91, and EN92). I've worked VUCC on 10 GHz in one day before from several hilltop locations, but never from anyone's garage. It was a lot of fun.

Here's a link to a YouTube playlist I put together showing clips from four of the five grids I worked: **www.youtube.com/playlist?list=PLp_6XO98qEV-YcCGhCs67wV9t46PMXoBB**.

Hugh and I have worked many times on 10 GHz from FN12 so I didn't record that one, but he was the strongest signal of the day at just about 200 kilometers. He averages S-9 over that path, but was more like S-7. The videos show what signals were like from the other operators and locations.

Hugh Duff, VA3TO, added:

This has been an incredible year of microwave activity in and around the lower Great Lakes. "The things you'll do for a new grid on 10 GHz" is one of my favorite quotes of the year. Once the wet snow started coming down harder, I took off my "toque" (Canadian for hat) to put it over the rig in an attempt to keep it dry.

These hams try to get out once a month for microwave operating, and they set new 10 GHz Canadian distance records in 2019. I missed the December operation, but have tried to work them from home on other occasions — no success yet, only partial contacts. We're all monitoring 10 GHz beacons, hoping for enhanced conditions.

Roving in a Blizzard

VA3ELE and VA3TO roved in blizzard conditions during the ARRL January VHF Contest. I was able to work them in FN25ma, 222 kilometers away, and FN24lx, 227 kilometers away, taking advantage of snow scatter by using the *RainScatter* program by Andy Flowers, KØSM, to find an area of heavy snow.

If we can do all-season operation in the north, microwaves in the US should be easier. Don't wait for a contest. Get out more often and have fun!

Microwave Update 2020

Microwave Update, the premier microwave conference, will be held October 15 – 18, 2020, in Sterling, Virginia. Visit **www.microwaveupdate.org** for more information.

Steve Ford, WB8IMY, wb8imy@arrl.org

Eclectic Technology

Listening to the Sun at 20 MHz

Our nearest star is constantly active throughout the electromagnetic spectrum, even during the current solar minimum. In addition to the occasional sunspots (which have been scarce recently), the sun emits bursts of radio noise at unpredictable intervals. With little more than an HF station, you can eavesdrop on these occasional solar hiccups.

The "magic" frequency for solar radio noise observations on the HF bands is 20 MHz. That's a problem, however, because the National Institute of Standards and Technology (NIST) station, WWV, has been camped on that frequency for many years and is unlikely to move any time soon. The good news is that you don't need to listen exactly at 20 MHz. I've had good results listening at about 10 kHz above or below.

Any antenna can serve as your "solar telescope." Some people do very well with 15-meter wire dipole antennas placed just a few feet off the ground. After all, for this application you're not transmitting, and you're certainly not trying to achieve low angles of signal reception; straight up is fine.

As far as a solar receiver is concerned, your existing HF transceiver is ideal for the job. Place it in the USB or LSB mode. If your rig has a receive preamplifier, turn it on. Also switch off any noise-reduction functions. You want as much noise as you can get!

What You're Listening For

When the sun cuts loose, you'll hear a strong increase in the noise level that will rise quickly, stabilize, and then decay slowly. A burst typically lasts about 30 seconds or even longer.

Obviously, the best time to listen is during the daytime, specifically about 2 hours before and after noon, when the sun is at its highest point in your local sky.

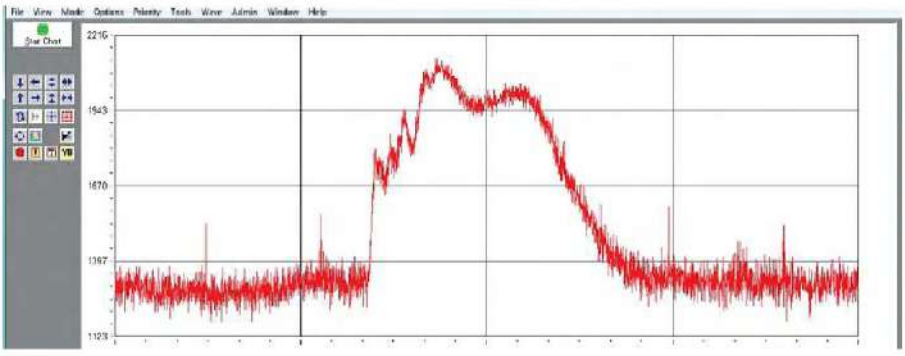
Radio-SkyPipe

The only serious issue with observing solar radio noise at 20 MHz is the unpredictable nature of the activity. Parking yourself in front of a radio for 4 hours, listening to nothing but the hiss of the cosmos, is a formula for madness.

You could record the audio output and then do a fast-forward listening session later, but that's far from ideal. My solution was found in a software application called *Radio-SkyPipe* for Windows. The software acts as a sophisticated strip-chart recorder.

You simply connect a cable between your radio's audio output jack and the sound card input on your computer. (If you're already using HF digital modes such as FT8, you already have everything in place.) *Radio-SkyPipe* turns the analog audio signal into data and displays the result on a continuously scrolling chart. You can easily review the results at your convenience, noting how the noise levels changed (and when). A solar radio burst usually appears as a "shark fin" pattern with a rapid rise and gradual decay.

You'll find *Radio-SkyPipe* at **radiosky.com/skypipeishere.html**. I'd recommend the $49.95 home version if you want to take advantage of the full array of features.



A solar radio burst captured by *Radio-SkyPipe* at 20 MHz. Notice the sharp onset followed by the gradual decay.

Hints & Hacks

Make Your Own Antenna Launcher; Use Camouflage to Deter Theft

A Homebrew Antenna Launcher

One challenge that most hams are faced with is figuring out how to get their wire antenna up in the air.

Here's a homebrewed slingshot that uses a fishing reel (see Figure 1). If you want to try this yourself, please note that some states and municipalities regulate the ownership and sale of slingshots. It would be a good idea to check ahead of time.

▲ **Figure 1** — The finished slingshot launcher. [Steve Allen, KZ4TN, photo]

▶ **Figure 2** — The press-in nut and knob screw. [Steve Allen, KZ4TN, photo]

▼ **Figure 3** — The attachment of the reel to the aluminum channel. [Steve Allen, KZ4TN, photo]

The three major components to this device are the slingshot, the fishing reel, and the method to connect the two. I drilled out the bottom of the slingshot handle to accommodate a ¼ × 20 press-in nut (see Figure 2). These nuts have a shank that is meant to be inserted into sheet metal or other sheet materials. I ordered these from an industrial supply house (McMaster-Carr at **www.mcmaster.com**), but you may be able to find them at a local hardware store. I used epoxy adhesive to hold the nut in place. I found the ¼ × 20 knob screw at my nearby hardware store.

The reel was sourced at a local discount department store and came with 10-pound test fishing line already spooled. I taped the foot of the reel to a piece of tubing that I found in my junk box (see Figure 3).

To complete the assembly, I used a piece of C channel aluminum (ordered from the same industrial supply house) that was the same width as the base of the slingshot. I used two U-bolts to hold the tubing to the C channel aluminum. To finish the project, I purchased some ¾-ounce and 1-ounce sinkers and painted them fluorescent orange and green to denote the weights.

If you choose to use this method, place the weight in the slingshot cup and press the button on the reel to release the line, take aim, and let it fly. Make sure the fishing line is free to unspool from the reel. It's best to do a dozen or so dry runs with small rocks, so you get a feel for how far to pull back the slingshot and how to aim. I have found that the ¾-ounce weight is enough to have the line freely fall back to earth and is relatively easy to find due to the bright color. I've been able to shoot lines up as high as 60 feet.

Once you have the line over your target branch and the sinker on the ground, remove the sinker and attach a long piece of chalk line. This step requires attention to detail because you must keep the knot small so it doesn't hang up in the crotch of a branch, yet it must be strong enough to not come untied while pulling it up and over the branch. It helps to tape over the knot

to smooth the surface of the knot junction.

Once the chalk line is over the tree, you can attach the antenna halyard to the chalk line and pull it back over the branch, again paying close attention to the knotting method. — *Steve Allen, KZ4TN,* **kk1vt@arrl.net**

Concealing Radios Deters Theft

As a retired chief of police, I always encourage people to do three simple things to help prevent thefts from their vehicles:

1) Lock the car.

2) Remove items of value from the vehicle.

3) Park in a lighted area (if possible).

Still, I am amazed at the items people leave in plain sight within their unlocked cars — wallets, purses, laptops, and even full sets of golf clubs.

A transceiver in a car is like a beacon to thieves (see Figure 4), but taking it in and out every day is usually impractical. If the rig must remain in your vehicle, you need to reduce its visual profile. Some transceivers feature designs that allow their control heads to be mounted in the open while the rest of the radio is under a seat or in the trunk. This is useful because only the control head is visible, so it is the only thing that would need to be replaced in the event of theft.

If this transceiver arrangement isn't an option for you, consider at least concealing the entire radio. In my truck, the radios are close to the floor and the carpet is black. My wife made a cover for my transceiver out of black denim (see Figure 5). It's very easy to remove and put back on. In many instances, simply hiding the rig is sufficient to prevent it being stolen.

Another clever bit of camouflage is to take an old power cord and a piece of coax with a PL-259 connector on it and sew it to the bottom of the fabric cover to make it look as if the radio has been removed.

Be sure to write down the makes, models, and serial numbers of everything in your mobile installation. Take photos of your equipment as well.

▶ **Figure 4** — A set of radios in plain sight is a burglary waiting to happen. [Mike Burg, N8QQN, photo]

▼ **Figure 5** — Something as simple as a piece of black denim may be all it takes to make a potential thief less interested in the contents of your vehicle. [Mike Burg, N8QQN, photo]

This information will be helpful to law enforcement in the identification and recovery of your equipment if it's taken, and your insurance company will appreciate it as well. And, of course, a car alarm is always a worthwhile investment. — *Mike Burg, N8QQN,* **mburg@neo.rr.com**

"Hints and Hacks" items have not been tested by *QST* or ARRL unless otherwise stated. Although we can't guarantee that a given hint will work for your situation, we make every effort to screen out harmful information. Send technical questions directly to the hint's author.

QST invites you to share your hints with fellow hams. Send them to "Attn: Hints and Hacks" at ARRL Headquarters, 225 Main St., Newington, CT 06111, or via email to **hh@arrl.org**. Please include your name, call sign, complete mailing address, daytime telephone number, and email address on all correspondence. Whether you are praising or criticizing an item, please send the author(s) a copy of your comments.

Rebuilding West Point's Cadet Amateur Radio Club, W2KGY

Checking in on the resurgence of amateur radio at the US military academy.

Stephen Hamilton, KJ5HY; Nolan Pearce, KE8JCT, and Matt Sherburne, KF4WZB

The Cadet Amateur Radio Club is one of West Point's oldest cadet clubs, starting in 1936. The club only updates its equipment every couple of decades, and a 2012 renovation of the science building, Bartlett Hall, halted the club's ability to grow, with all radio equipment being removed.

Constructing the New Station

In the summer of 2015, Major (then Captain) Matt Sherburne, KF4WZB, began the process of designing a new station and antenna configuration. The original club room was accessed through a janitor's closet. The renovation plans forced the radio club to move to the second floor. The new room was more convenient in terms of member access, and Matt ensured that the renovation plan included upgrading the power to the club room to support two HF operating positions with amplifiers, one VHF/UHF position, one vintage HF radio station with an amplifier, and a satellite mission control station. However, the move presented an engineering challenge in accounting for the longer feed line runs to the roof.

Joe Barkley, KI4TZ, and Cadet Nolan Pearce, KE8JCT, begin assembling the satellite array with the help of other volunteer cadets.

Volunteer cadets, led by Don Daso, K4ZA, and Joe Barkley, KI4TZ, assemble the Yagi elements in a very tight space before tramming it across the roof and up to the tower.

Matt, along with LTC Michael Lanham, navigated the complicated antenna installation process, with the help of Don Daso, K4ZA, of Tower Works. Due to various levels of approvals, paperwork, and bad weather, the installation did not start until May 2019.

◀Cadet Nolan Pearce and Cadet Paul Shorkey-Chacon operated at West Point's US Army Military Auxiliary Radio System (MARS) station.

▼With the fully assembled Yagi and satellite array, W2KGY is fully operational on HF, VHF, and UHF.

Installing the Equipment

One of the challenges with this installation was moving all of the equipment and antennas to the roof. The primary components were a Rohn tower (two 10-foot sections), a non-penetrating roof mount for an M2 satellite antenna array, and a JK Antenna Mid-Tri-40 Yagi beam.

The satellite antenna array was moved first. Without ballast weights, the non-penetrating mount was about 800 pounds. Cadets disassembled it on the ground and moved it up to the roof, along with the JK Mid-Tri-40 antenna.

A few options were discussed on how to install the JK Mid-Tri-40. Bartlett Hall presents a challenge to antenna installation; the roof is not flat and provides little space to build the beam. We decided to build it on the roof, and tram it up to the tower. This was difficult because the antenna was on a separate roof structure than the tower.

Joe Barkley, KI4TZ, assembled the beam in the area where the satellite non-penetrating mount would eventually be built. There was enough room to assemble it, but parts of it dangled over the edge of the roof. Once it was assembled, Don used a tram to move it across the roof up to the tower. Multiple cadets volunteered to help prevent the antenna from hitting other parts of the roof while it was being trammed up.

Once the antenna was in place, Joe built the M2 satellite antenna array system, and club members ran the heliax coax and control lines from the roof down to the second floor. This was challenging due to the conduit being inconsistently placed between floors. Cadets with their ham license utilized 2-meter radios on each floor to help guide the heliax lines between each floor.

Acknowledgments

This project took 10 (mostly rainy) days to complete, and now W2KGY is fully operational on HF, VHF, and UHF. We would like to thank Don Daso, K4ZA; Joe Barkley, KI4TZ; Ken Garg, W3JK, and Wyatt Lyzenga, KF6ZMW, of M2 Systems, for all the help in getting our final antenna installation completed. We also thank all donors to W2KGY, including the East Tennessee DX Association; Donald Backys, K9UQN; John Ulmer, WB4AVX, and 1958 club members. Specifically, we thank and remember Hugh Morgan, W4VAB (SK), Class of 1958.

The West Point Amateur Radio club will make great use of these installations in the upcoming year. Colonel Drew Morgan, Class of 1998, spoke to the cadets aboard the ISS using the satellite array. W2KGY also plans on competing in School Club Roundup and other national contests. The club remains dedicated to using ham radio not only as a hobby, but an important communication skill for cadets and future army officers.

All photos by Stephen Hamilton, KJ5HY.

Stephen Hamilton, KJ5HY, has a BS and PhD in computer science, and an MS in software engineering. He is the Technical Director of the Army Cyber Institute and the Officer-in-Charge of the Cadet Amateur Radio Club, W2KGY.

Nolan Pearce, KE8JCT, holds an Amateur Extra-class license and is the president of the Cadet Amateur Radio Club, W2KGY.

Matt G. Sherburne, KF4WZB, holds an Amateur Extra-class license and has a BS and an MS in electrical engineering. He was the Officer-in-Charge for the Cadet Amateur Radio Club, W2KGY, and is now involved with the Fort Gordon Amateur Radio Club.

For updates to this article, see the *QST* Feedback page at www.arrl.org/feedback.

HD8M DXpedition to the Galapagos Islands

This DXpedition managed to make a sizable donation toward the preservation of this precious ecosystem. Here's how they did it.

Jim Millner, WB2REM

The Galapagos Islands are located on the equator off the coast of Ecuador and consist of 17 larger islands, and hundreds of smaller islets and rocks. The HD8M team visited two of the islands — Santa Cruz and Isabela. The archipelago was formed by underwater volcanic activity three to five million years ago. In geological terms, these islands are considered relatively new.

In 1835, Charles Darwin was one of the first naturalists to observe the unique nature of the Galapagos wildlife. The animals are not afraid of humans because they evolved in isolation from them or other large predators, so had no reason to fear them. After a couple of the tortoise species were hunted to near extinction, 97% of the land and surrounding water was designated a national park to protect the Galapagos wildlife and flora.

The group of amateur radio operators that participated in the HD8M 2017 and 2019 DXpeditions traveled to the Galapagos for different reasons. Ellis, N1MWJ (SK), a retired park ranger, had a keen interest in wildlife. Mark, WY1G, a birdwatcher, was excited about observing new avian species. Bill, W2WCM, was on his first DXpedition. The rest of us, including Nancy, KGØYL, ARRL Section Manager for North Dakota, were amateur photographers and world travelers. Ham radio was the glue that bound us together, and the adventure is what excited us.

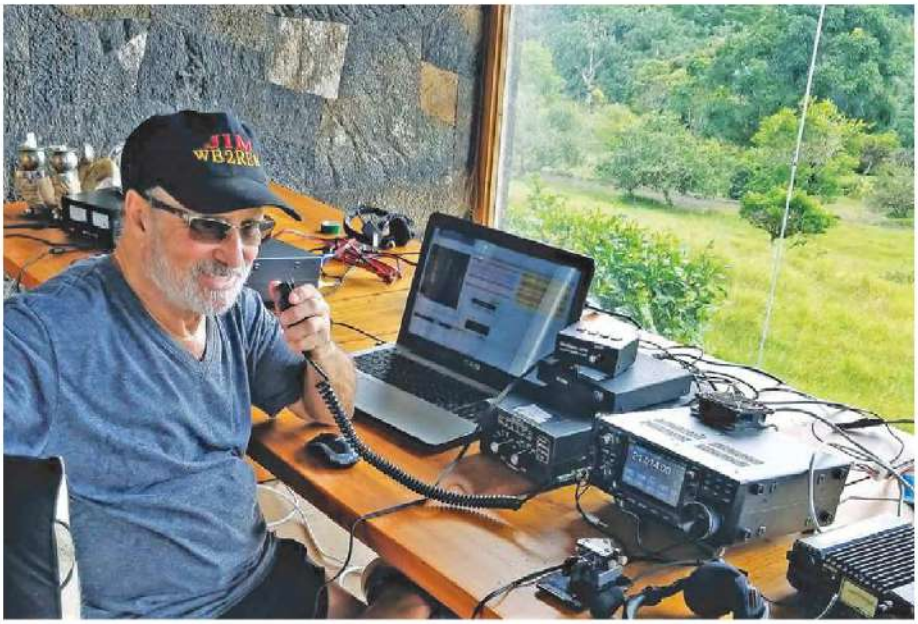
Isabela

The HD8M team traveled to Isabela Island in 2017. Isabela is the largest of the Galapagos Islands. It is easily reachable by small twin-engine prop planes, which fly daily from Baltra Island Airport. It is also possible to get to most major islands by ferry.

Isabela Island was chosen because of its beautiful volcanoes, abundance of wildlife, and limited develop-

The hexagonal beam antenna that was used for the HD8M operation on Isabela Island. [Jim Millner, WB2REM, photo]

ment. In our free time, we explored the island's nature trails, walked the rim of a volcano, and swam with marine iguanas. We stayed in the quaint village of Puerto Villamil on the southern end of the island. It had unpaved sand roads, a few restaurants that lined the main street, and a friendly atmosphere. On the beach in front of the house, sea lions frolicked in the water, bright red Sally Lightfoot crabs crawled over lava rocks, and blue-footed boobies dove into the water for fish. In the wetlands behind the house, flamingos gracefully played in the water while giant Galapagos tortoises slowly traversed the landscape.



Jim Millner's, WB2REM, operating position in Santa Cruz. [Bill Mims, W2WCM, photo]

Santa Cruz

The 2019 HD8M DXpedition took place on Santa Cruz Island. The most populated island of the group, Santa Cruz is close in proximity to the Baltra Island Airport, just across the Itabaca Canal. Operation took place in a modern two-bedroom house located on the side of the Cerro Crocker volcano at an elevation of 1,500 feet. The numerous full-length windows in each room gave us a panoramic view of the ocean, distant islands, and the surrounding environment. As we operated the radios, it was easy to spot giant Galapagos tortoises roaming the property and numerous Galapagos finches flying by our windows. In our spare time, we walked through a mile-long lava tube, toured the Charles Darwin Research Station, and visited Puerto Ayora, its main city.

Galapagos Conservancy

On both islands, we operated from enchanting environments. We were keenly aware that the flora and fauna that surrounded us — which we greatly loved — wouldn't have been there if there wasn't an active effort to protect the islands' fragile ecosystems.

The Galapagos Conservancy (**https://www.galapagos.org**) is a United States-based organization that aims to preserve, protect, and restore the Galapagos ecosystem. They have a record of successfully restoring existing tortoise populations, repopulating tortoises on islands where they had gone extinct, and helping to mitigate damage to both flora and fauna. In addition to the Galapagos National Park and Charles Darwin Research Station, we visited the Isabela Island Tortoise Breeding and Rearing Center, where we saw firsthand the work that the Galapagos National Park Directorate was doing in rearing and releasing tortoises back to the islands. The Directorate was even able to close their tortoise breeding center on San Cristóbal Island, because their goal of tortoise repopulation had been met. The Galapagos Conservancy has also been actively involved in educating and training volunteers to help further protect the ecosystems of the Galapagos.

The HD8M team felt compelled to find a way to help. Given more time, volunteering for one of the numerous island preservation projects would have been considered. We decided to donate a portion of our QSL card funds to the Galapagos Conservancy that would have normally reimbursed our expedition costs.

Prior to the 2017 DXpedition, we contacted Johannah Barry, President of the Galapagos Conservancy. She was excited to hear about our unique approach to fundraising. Through her connection, the Galapagos Conservancy's services department created a link for donations to be placed through our website, **www.hd8m.com**. (For clarity, no donations were directly solicited over the radio.) Our DXpedition's success led to a $3,400 donation to the Galapagos Conservancy. Ms. Barry and the Galapagos Conservancy's team were so impressed with our effort that they fea-

A Sally Lightfoot Crab, one of the most common crabs found in the Galapagos Islands. [Jim Millner, WB2REM, photo]

Sea lions sunbathing on the shores of Isabela Island. [Jim Millner, WB2REM, photo]

Conclusion

We, as amateur radio operators, do a lot to help in emergencies and thus bring positive attention to our hobby by doing so. I suggest that we search for other avenues to creatively help the communities in which we live and from where we go on DXpeditions. Although it was exciting to operate from the Galapagos Islands, we felt even more fulfilled by giving back to the islands through our donations to the Galapagos Conservancy. In turn, we challenge you to find a way to do the same in your community or on your next DXpedition.

tured HD8M and amateur radio's approach to fundraising in their Spring/Summer 2019 Galapagos Conservancy Newsletter. We have received many positive comments from hams around the world about our operation and goal to support the Conservancy. Likewise, Ms. Barry reported that members of the Galapagos Conservancy had developed a better appreciation of amateur radio and the generosity of our community.

Jim Millner, WB2REM, has been an amateur radio operator for 56 years. He is an avid DXer, world traveler, and licensed psychologist. He first began experimenting with remote-control linking in the 1980s, and has published several articles on the subject in *QST, 73,* and *CQ* magazines. Jim would like to thank Gene, K5PA, and Mark, WY1G, for their assistance with the article.

For updates to this article, see the *QST* Feedback page at www.arrl.org/feedback.

Coming up in the March/April 2020 and future *QEX* issues are articles and technical notes on a range of amateur radio topics. These are at the top of the queue.

- Joseph M. Haas, KEØFF, adds DTMF capability to popular transceiver microphones.
- Jacek Pawlowski, SP3L, describes a wide range of new broadband wire antennas in this Part 1 of a longer article.
- Ralph J. Crumrine, NØKC, designs a lightweight 3 kW power supply to support state-of-the-art switching MOSFET amplifiers.
- Eric P. Nichols, KL7AJ, in this first of a series, reveals the simplicity and many uses of the double-balanced mixer.
- Michael P. Hasselbeck's, WB2FKO, technical note describes anchors for a 3D-printed lid.
- Wilton C. Helm's, WT6C, technical note explores receiver step attenuators.
- Kai Siwiak's, KE4PT, technical note explains why typical small HF loop antennas are not magnetic loops.
- Steve Stearns, K6OIK, explores the general uniform transmission line having complex characteristic impedance and propagation constant.

QEX is edited by Kazimierz "Kai" Siwiak, KE4PT, (**ksiwiak@arrl.org**) and is published bimonthly. *QEX* is a forum for the free exchange of ideas among communications experimenters. The annual subscription rate (six 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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ARRL Board of Directors Re-Elects President Rick Roderick, K5UR

Meeting January 17 – 18 in Windsor, Connecticut, the ARRL Board of Directors re-elected ARRL President Rick Roderick, K5UR, to a third 2-year term. Roderick outpolled the only other nominee, Pacific Division Director Jim Tiemstra, K6JAT, 8 – 7. New England Division Vice Director Mike Raisbeck, K1TWF, was elected First Vice President, succeeding Greg Widin, KØGW, who did not seek another term. Raisbeck was the sole nominee. A successor will be appointed to fill the Vice Director seat that Raisbeck has vacated. Bob Vallio, W6RGG, was re-elected as Second Vice President as the only nominee.

On a 9 – 6 vote, the Board voted not to re-elect Howard Michel, WB2ITX, as Chief Executive Officer. Michel was in the post for 15 months. Former ARRL Chief Financial Officer and Chief Executive Officer Barry Shelley, N1VXY, has come out of retirement to serve as interim ARRL CEO. He was also elected as Secretary. Shelley was ARRL's CFO for 28 years and served as CEO during 2018 before his retirement, following the departure of former CEO Tom Gallagher, NY2RF. The ARRL Board has appointed a committee to spearhead the search for a new CEO. That panel will screen suitable CEO candidates, presenting three to the Board for consideration.

In other action, former ARRL President and IARU Secretary Rod Stafford, W6ROD, was elected International Affairs Vice President, succeeding Jay Bellows, KØQB, who did not seek another term. Also re-elected by the Board were Treasurer Rick Niswander, K7GM, and Chief Financial Officer Diane Middleton, W2DLM.

Elected as members of the Executive Committee were Atlantic Division Director Tom Abernethy, W3TOM; Central Division Director Kermit Carlson, W9XA; Roanoke Division Director Bud Hippisley, W2RU; New England Division Director Fred Hopengarten, K1VR, and Great Lakes Division Director Dale Williams, WA8EFK. The Executive Committee addresses and makes decisions regarding ARRL business that may arise between scheduled Board meetings.

Hudson Division Director Ria Jairam, N2RJ, was elected as a member of the ARRL Foundation Board for a 3-year term. Tim Duffy, K3LR, and Jim Fenstermaker, K9JF, were elected to the Foundation Board for 3-year terms as non-ARRL Board members.

Outgoing ARRL First Vice President Greg Widin, KØGW (left), and ARRL President Rick Roderick, K5UR, who moderated the Annual Meeting. [Michelle Patnode, W3MVP, photo]

The ARRL Board of Directors held its 2020 Annual Meeting January 17 – 18 in Windsor, Connecticut. [Michelle Patnode, W3MVP, photo]

Relief from Private Land-Use Restrictions

The Ad Hoc Legislative Advocacy Committee provided the Board with drafts outlining three legislative approaches to address relief for radio amateurs facing private land-use restrictions impacting outdoor antennas. The Board signed off on the draft legislative approaches "as presented and possibly modified" and directed the committee "to proceed to obtain congressional sponsorship, employing any of these three approaches and using its best judgment on any alterations or modifications that our advisors or sponsors may require or suggest."

HF Band Planning

Outgoing chair of the HF Band Planning Committee Greg Widin, KØGW, presented the panel's report and entertained questions. Board members noted that staff turnover and funding limitations at the FCC might impact ARRL's efforts to tweak the bands. The Board agreed that ARRL would post the report and solicit comments from members on it.

The Board elected Greg Widin, KØGW, as an Honorary Vice President. [Rick Lindquist, WW1ME, photo]

Contests and Operating Awards

The Board approved raising the maximum number of contacts a Field Day GOTA station can make to 1,000. It amended the ARRL RTTY Roundup rules to add Multi-Two and Multi-Multi categories and to permit multioperator stations to operate for the entire contest period, and it divided entry categories into RTTY only, Digital only (i.e., no RTTY), and Mixed (both RTTY and digital).

Matt Holden, KØBBC, presented the DX Advisory Committee report, telling the Board that the panel engaged in extensive discussion on a proposal to change the 5-Band DXCC award from the current required bands to offer credit for any five bands. The committee unanimously rejected the proposal.

ARRL Elections

The Board revised rules governing ARRL Division and Section Manager elections to clarify some terminology, to extend the campaign period from the call for nominations to the deadline for ballots received, and to make other miscellaneous changes. Revisions will become effective by February 15, 2020.

In the interest of "openness and fairness," the Board also approved a measure that would offer candidates and members an opportunity to be present during the counting of ballots. Candidates may also designate one ARRL member to attend as a surrogate if they're unable to observe ballot counting, or to accompany them at the count. The Board further approved an amendment to permit ARRL members, upon petition, to travel at their own expense to witness the counting of ballots from their Division.

The Board charged the Programs and Services Committee to consider changes to the ARRL by-laws that would give members, upon petition, the opportunity to attend the public portion of the Annual Meeting in January. The number of members permitted to attend would be subject to available space and fire code regulations.

Public Service Enhancement Working Group Chair, Roanoke Division Director Bud Hippisley, W2RU, reported that with field adoption of the 2019 *ARES Plan* now under way, the group is putting increased focus on the National Traffic System, including plans for dialog with representatives of Radio Relay International.

Reduced Dues for Younger Applicants

The Board approved an amendment giving the CEO discretion to raise the eligibility age for reduced full ARRL membership dues from 22 to 26, provided the rate not be less than one-half of the established rate. In addition, the Board approved the establishment of a reduced-rate, revenue-neutral Life Membership for individuals age 70 or older, with cumulative annual membership of 25 years or more, at an initial rate of $750. Headquarters staff will work out the administrative details of the program, subject to approval of the Administration and Finance Committee.

The Board also agreed to allow for a "digital-only" access membership, at the discretion of the CEO, discounted no more than 10% from the established dues rate.

Financial Reports

In his Treasurer's report, Niswander noted that the credit quality of ARRL's investments has risen and that he has been preemptively conservative with bonds after decades of falling interest rates and a concern about credit-quality corporate debt.

In her report as Chief Financial Officer, Middleton noted that ARRL generated a larger-than-expected gain from 2019 operations. ARRL also experienced a $4 million growth in its balance sheet, and cash balances continue to be healthy.

Greetings from Visitors

International Amateur Radio Union (IARU) President Tim Ellam, VE6SH/G4HUA, conveyed greetings from the IARU and its officers and thanked ARRL for its continued support. He noted the exceptional work of ARRL staff, especially Technical Relations Specialist Jon Siverling, WB3ERA. He also mentioned World Radiocommunication Conference 2019, which he attended.

Radio Amateurs of Canada (RAC) President Glenn MacDonell, VE3XRA, conveyed greetings from the RAC. He reported that amateur radio is growing in Canada, as is RAC membership, and said that he shares ARRL's concern with helping new licensees to become active. MacDonell was recently re-elected for a 2-year term.

Other Business

In other business, the Board:

♦ Approved a grant of $500 to the Youth on the Air (YOTA) in the Americas program, which is sponsoring a camp in June for young radio amateurs. Neil Rapp, WB9VPG, a former ARRL Youth Coordinator, is heading the initiative, which is funded through the nonprofit Electronic Applications Radio Service Inc.

♦ Authorized creation of an Emergency Management Director Selection Committee, with its chair and members to be named by the president.

Awards and Recognitions

The Board conferred several honors, awards, and recognitions:

♦ The ARRL President's Award went to David H. Bernstein, AA6YQ, in recognition of "exemplary, outstanding, and continuing service" to ARRL and its members as part of the ARRL Logbook of The World team. Bernstein was a charter member of the ARRL Logbook Committee and a "founding, influential, and devoted member" of the Committee on Communication with ARRL Members.

The ARRL Board presented the ARRL President's Award to Dave Bernstein, AA6YQ, in recognition of "exemplary, outstanding, and continuing service" as part of the ARRL Logbook of The World team. He was the 2008 recipient of the ARRL Technical Innovation Award. [Photo courtesy of Dave Bernstein, AA6YQ]

♦ The 2019 Bill Leonard, W2SKE, Professional Media Award for Audio Reporting was awarded to Roman Battaglia and the associated producer and staff of Jefferson Public Radio in Oregon. Battaglia produced a feature story on amateur radio emergency services in and around the Jefferson Public Radio listening area.

♦ The 2019 Bill Leonard, W2SKE, Professional Media Award for Print Reporting went to Zack Plair and the *Columbus and Starkville Dispatch* in Mississippi. Plair wrote a feature for the paper describing how amateur radio has proven fulfilling to various participants, including new and experienced radio amateurs.

♦ The 2019 Bill Leonard, W2SKE, Professional Media Award for Video Reporting was given to reporter Jim Altman and affiliated producers and staff of FOX 61 News in Hartford, Connecticut. Altman's report, "American Radio Relay League Ready for Hurricane Season," focused on ARRL's participation in a May 2019 emergency drill conducted in association with the American Red Cross.

The Board recognized and thanked the Delaware Valley Radio Association of New Jersey and the Clark County Amateur Radio Club of Vancouver, Washington, for their 90 years of assistance in fulfilling the ARRL mission of, "advancing the art, science, and enjoyment of amateur radio within their community."

The ARRL Board elected Jay Bellows, KØQB, as an Honorary Vice President.

The Board bestowed the honor of Honorary Vice President on John B. "Jay" Bellows, KØQB, and on Greg Widin, KØGW, in recognition of their outstanding contributions to ARRL and amateur radio.

The minutes of the January Annual Meeting of the ARRL Board of Directors are available on the ARRL website, at **www.arrl.org/board-meetings**.

Rick Lindquist, WW1ME, ww1me@arrl.org

Happenings

Relocation Options Limited for 3 GHz Amateur Radio Spectrum

In a December *Notice of Proposed Rulemaking* (*NPRM*) in WT Docket 19-348, the FCC proposed relocating non-federal operations, including amateur radio, to spectrum outside the 3.3 – 3.55 GHz band. Amateur radio has a secondary allocation at 3.3 – 3.5 GHz. The FCC said it anticipates auctioning the spectrum to expand commercial use of 5G cellular and wireless broadband services, if an agreement can be reached on the relocation of — or sharing with — federal incumbents that also operate within this band. Reply comments in the proceeding were due by March 23. ARRL was poised to prepare a strong response to protect amateur access to the 3 GHz spectrum.

The immediately adjacent 3.1 – 3.3 GHz band is also included in the spectrum that Congress identified for similar study, making things more complicated. In a statement accompanying the *NPRM*, FCC Commissioner Michael O'Rielly specifically noted that the lower-portion band may also be considered for non-federal reallocation to 5G and broadband purposes. This would severely limit relocation possibilities in the 3 GHz range for the Amateur Radio Service, since the spectrum above 3.55 GHz has already been reallocated.

Amateurs make substantial use of the 3.3 – 3.5 GHz band that would be hard to replicate elsewhere. Hundreds of comments were filed by the amateur community even before the designated comment period began. Among users who could be affected are those who use this spectrum for Earth-moon-Earth (moonbounce) communication, mesh networks, experiments with communication over long distances, radiosport, and amateur television. A portion of the band is also designated for use by amateur satellites in ITU Regions 2 and 3 (the Americas and Asia/Pacific).

A report was due in March from the National Telecommunications and Information Administration (NTIA) evaluating the feasibility of having federal users share all or part of the 3.1 – 3.55 GHz band with commercial wireless services. In January, an NTIA report concluded that sharing opportunities for federal and commercial uses exist in the 3.45 – 3.55 GHz portion of the band. The results of the new NTIA report covering the entire band will impact how much spectrum ultimately may be reallocated for auction to wireless providers as well as sharing opportunities for amateur radio.

Clayton Coleman, W5PFG, Elected AMSAT President

In February, the AMSAT Board of Directors elected Clayton Coleman, W5PFG, of Granbury, Texas, as AMSAT President. Coleman had served as a member of the Board of Directors and as AMSAT Secretary from 2017 until 2019, and has volunteered in several other capacities for AMSAT, including as chair of the 2016 AMSAT Space Symposium.

Coleman succeeds Joe Spier, K6WAO, who resigned in late January, citing personal reasons, after being in office since October 2017.

Coleman was introduced to amateur radio in space through the SAREX program — the forerunner to ARISS — and the Russian *Mir* space station. His interest in setting up an AX.25 BBS and nodes in the early 1990s led him to try making contacts via the *Mir* Personal Message System (PMS) and digipeater. In 2011, Coleman became interested in OSCAR satellites and began chasing operating awards.

Coleman's focus as president will be working with members to improve organizational processes and aligning them with strategic goals. Professionally, Coleman works in the industrial process control sector both as a consultant and business development manager.

ARRL Expands Its Roster of Online Discussion Groups

ARRL has launched new online discussion forums as part of its ongoing effort to enhance and improve communication between ARRL leadership and members or prospective members. The new forums, which focus on antenna law, regulatory issues, and support for new amateur radio licensees, went live in late January. Another new forum addressing HF band planning was established in early February.

The new forums and their moderators are:

- ARRL New England Division Director and attorney Fred Hopengarten, K1VR, moderates the Antenna Law and Policy Forum (**groups.arrl.org/g/ARRL-Antenna-Law-and-Policy**). Hopengarten is the author of *Antenna Zoning for the Radio Amateur.*

- ARRL Regulatory Affairs Manager Dan Henderson, N1ND, moderates the Regulatory Affairs Forum (**groups.arrl.org/g/ARRL-Regulatory-Affairs**).
- *QST* Editor and ARRL Publications Manager Steve Ford, WB8IMY, moderates the New Hams Forum (**groups.arrl.org/g/ARRL-New-Hams**).
- ARRL First Vice President Mike Raisbeck, K1TWF, moderates the new HF Band Planning Discussion Group (**groups.arrl.org/g/ARRL-HF-Band-Planning**), which will focus on the ARRL HF Band Planning Committee's recommendations and other band-planning activities. In January, the ARRL HF Band Planning Committee invited comments and suggestions from the amateur radio community on its report to the ARRL Board, which can be found at **www.arrl.org/files/file/Bandplanning/25%20HF%20Bandplanning%20Cmte%20FINAL%20(d).pdf**. To view the specific recommendations for each HF band and US license class included in the report, visit **www.arrl.org/files/file/Bandplanning/25%20Appendix%20BP_Committee_recs%20FINAL%20(h).pdf**.

The online discussion program launched last fall with three forums — contesting, awards, and the International Amateur Radio Union (IARU) — all open to the amateur radio community.

Those wishing to subscribe to any ARRL discussion group must use a **Groups.io** username and password, if they have one, or create an account if they don't. All ARRL Group subscribers are automatically subscribed to "ARRL Groups," an administrative feature that allows ARRL to convey routine announcements to subscribers of all ARRL groups, such as planned system outages. — *Thanks to ARRL Communications Manager Dave Isgur, N1RSN*

In Brief...

- **The Northeast HamXposition — formerly known as "Boxboro" — is moving and will take place this year July 24 – 26 in Marlborough, Massachusetts.** The new venue, the Best Western Royal Plaza Hotel and Trade Center, is about 15 miles from Boxboro off Interstate 495 (Exit 24A). The Northeast HamXposition, which had been held in early September in past years, hosts the ARRL New England Division Convention. "The new venue offers us much-needed additional capacity for forums, a larger flea market, and ample parking right in the hotel's main lot," said Event Chairman Bob DeMattia, K1IW.

- **The W9DXCC ARRL Specialty Operating Convention is moving.** The event will take place September 11 – 12 at the Chicago Marriott Hotel in Naperville, Illinois. W9DXCC is sponsored by the Northern Illinois DX Association. This year's event will include a Contest University and DX University. Saturday's events will include forums, QSL card checking, a CW pileup contest, an evening reception, and a banquet. For more information, visit the W9DXCC website at **www.w9dxcc.com**. — *Thanks to Kermit Carlson, W9XA, and* The Daily DX

- **Past ARRL Southeastern Division Director Dale Strieter, W4QM (ex-W4DQS), of Cocoa Beach, Florida, died on January 6.** An ARRL Life Member, he was 92 and a founding member of the Maxim Society. Strieter was ARRL Southeastern Division Director from 1970 until 1973. Following World War II service and college, Strieter moved to Cocoa Beach to work for General Electric. He was also a NASA contractor, and served as the guidance engineer on the Mercury and Gemini manned spaceflight missions. Strieter was a prolific DXpeditioner. After 20 years with GE, he returned to sea in 1979 as a radio officer in the US Merchant Marine on a ship generally anchored at the Chagos Islands. As VQ9QM, Strieter logged more than 200,000 contacts from nearby Diego Garcia Island, between 1986 and 2001. He retired in 2002. — *Thanks to Tom Tenney, W8OJM, and Don Karvonen, K8MFO*

Foundation for Amateur Radio Invites 2020 – 2021 Scholarship Applications

The Foundation for Amateur Radio Inc. (FAR) has invited applications for the 2020 – 2021 academic year for the scholarships it administers. Applications must be submitted online. Several questions ask for essay responses. The deadline for initial submissions is April 30, 2020. Appli-cants may amend their applications until May 7. All applicants must hold a valid amateur radio license and be enrolled or accepted for enrollment at an accredited university, college, or technical school. Applicants attending school outside the US must provide a brochure describing the school. Students do not apply for specific scholarships; each application will be considered for all of the scholarships for which the applicant is qualified. QCWA scholarships and the Chichester Memorial Scholarship all require recommendations to be awarded. An application form and more information are available on the FAR website, **www.farweb.org/scholarship-information**, or you may contact Dave Prestel, W8AJR, at **dave.prestel@gmail.com** or 443-812-4403.

Section Manager Nomination Notice

To all ARRL members in Connecticut, Idaho, Minnesota, North Dakota, Ohio, Oklahoma, Southern Florida, Western New York, Puerto Rico, and the Virgin Islands: You are hereby solicited for nominating petitions pursuant to an election for Section Manager (SM). Incumbents are listed on page 16 of this issue.

To be valid, a petition must contain the signatures of five or more full ARRL members residing in the Sections concerned. It is advisable to have a few more than five signatures on each petition. A sample nomination form is available on the ARRL website at **www.arrl.org/section-terms-nomination-information**. Nominating petitions may be made by facsimile or electronic transmission of images, provided that upon request by the Field Services Manager, the original documents are received by the Manager within 7 days of the request.

We suggest the following format:

(Place and Date)
Field Services Manager, ARRL
225 Main St.
Newington, CT 06111

We, the undersigned full members of the _____ ARRL Section of the _____ Division, hereby nominate _____ as candidate for Section Manager of this Section for the next 2-year term of office.

(Signature____ Call Sign____ City___ ZIP ___)

Any candidate for the office of Section Manager must be a resident of the Section, an amateur radio licensee of Technician class or higher, and a full member of the ARRL for a continuous term of at least 2 years immediately preceding receipt of a nominating petition. Petitions must be received at Headquarters by 4 PM Eastern Time on June 5, 2020. If more than one member is nominated in a single Section, ballots will be mailed from Headquarters no later than July 1, 2020, to full members of record as of June 5, 2020, which is the closing date for nominations. Returns will be counted August 18, 2020. Section Managers elected as a result of the above procedure will take office October 1, 2020.

If only one valid petition is received from a Section, that nominee shall be declared elected without opposition for a 2-year term beginning October 1, 2020. If no petitions are received from a Section by the specified closing date, such Section will be resolicited in the October issue of *QST*. A Section Manager elected through the resolicitation will serve a term of 18 months. A Section Manager vacancy occurring between elections is filled through appointment by the Field Services Manager.
— Bart Jahnke, W9JJ, Field Services & Radiosport Department Manager

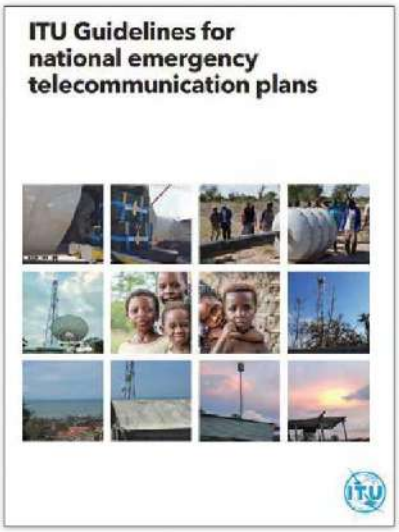
Rick Lindquist, WW1ME, ww1me@arrl.org

Amateur Radio World

ITU Publication Highlights Amateur Radio's Role in Emergency Communication

Amateur radio is featured in the publication, *ITU Guidelines for national emergency telecommunication plans,* published by the International Telecommunication Union (ITU) Development Sector (ITU-D). The publication notes that radio amateurs have supported communication in emergency situations on a voluntary basis since the dawn of radio.

"They are experts in radio communications and have the equipment, skills, and necessary frequencies allocated by ITU to deploy networks in emergency events quickly and efficiently," the publication said. ITU-D noted that amateur radio support offers training programs and exercises that have been developed for emergency communication, "qualified temporary volunteers who provide skills and experience essential for emergency telecommunications," problem-solving skills and an ability to work with "often very limited resources," and the ability to work with alternative power sources.



IARU Debuts Revamped Websites

The International Amateur Radio Union (IARU) has completed the makeover of its main website and the three regional websites, which can be accessed directly from the IARU home page. All of the updated pages are organized to broadly mirror the structure of the Interna-tional Telecommunication Union (ITU) and its related regional telecommunication organizations. The Region 2 web page is available in English or Spanish. — *Thanks to IARU Secretary David Sumner, K1ZZ*

IARU Region 1 Youngsters on the Air Summer Camp 2020 in Croatia

The 10th annual Youngsters on the Air (YOTA) camp will be held this summer in Karlovac, Croatia, announced International Amateur Radio Union (IARU) Region 1 Youth Working Group Chair Lisa Leenders, PA2LS. The Croatian Amateur Radio Association — Croatia's IARU member-society — will host the August 8 – 15 event. Participation is aimed at young radio amateurs living in IARU Region 1 (Europe, Africa, and the Middle East).

"In this YOTA Camp, we will be continuing with our train-the-trainer (TTT) program," Leenders said. "Participants will be working on the future of amateur radio and will be involved in workshops where they gain skills to start similar amateur radio youth events when they are back home. Campers will also be able to enjoy getting on the air as well as building electronic kits."

Each IARU member-society in Region 1 is invited to sponsor teams of up to four camp participants, age 15 to 25.

Tunisia Issues Authorizations to Operate After 64 Years

Tunisia has issued amateur radio Authorizations to Operate to three individuals, the first such licenses since 1956. Hannibal Hamrouni, 3V8HB; Nizar Ben Rejeb, 3V8MN, and Moez Bhira, 3V1MB, will be allowed to operate from home, rather than restricted to operating from a club station. Issuing individual Authorizations to Operate is new in Tunisia and involves a number of stages, including equipment conformity checks. — *IARU Region 1 via Don Beattie, G3BJ*

High Speed Telegraphy Competitions Set

The 17th International Amateur Radio Union (IARU) High Speed Telegraphy (HST) World Championship will take place August 20 – 24 in Ulaanbaatar, Mongolia. Europe's HST Cup and Balkan HST Championships will take place May 8 – 12 in Elbasan, Albania. Although not an IARU-recognized event, this international competition is widely accepted by the HST community as an opportunity for top competitors to check their form before the world championship, for teams to test new candidates for a national team, and for those unable to participate at the World Championship to still enjoy top-level competition. — *Thanks to IARU Region 1*

Regulators in Spain now allow radio amateurs to exchange current call signs for permanent 2 × 1 call signs. To be eligible, applicants must have held a license issued by Spanish authorities without any sanctions and have at least 15 years of experience in "international amateur radio."

Rick Palm, K1CE, k1ce@arrl.net

Public Service

A Solution for Antenna Deployment in the Field

In the May 2019 column, I wrote about my participation in the Florida Amateur Radio Emergency Communications Conference in Gainesville, which featured a full-scale exercise scenario — an epidemic caused by a virus, coupled with a computer virus that took down the internet. The exercise had nearly 60 participants, including radio amateurs and professional emergency managers.

Amateur radio operators deployed to two "evacuation shelters" 6 miles apart, with the mission of establishing communications between them and a command center as soon as possible. HF and VHF radios and antennas were needed to support sundry modes including Winlink, voice, packet, repeater, and simplex.

Radios, antennas, feed lines, masts, support bases, and guy wire rigging were all unloaded onto the field. Some antenna supports were homemade, while others were commercially manufactured. As we set up, I resolved to look into options for future deployments. The following is one option I experimented with and had positive results.

Buying the Supplies

I found **www.GoVerticalUSA.com** online. The prices for new and used equipment were reasonable, and the components appeared to be appropriate for amateur applications. I purchased a few of their products with the goal of putting my three-element vertically polarized 2-meter Yagi antenna up about 20 feet, as might be commonly done on deployments.

Building the Support Base

Some of their products were used at the exercise's command center to support a VHF antenna. I used it as a model to help me get started. I ordered the antenna tower aluminum tripod base ($59) for use with the company's military 4-foot aluminum and fiberglass mast sections. The tripod base accepts one or two mast sections per leg. Two sections (8 feet) per leg yield a larger ground footprint, possibly rendering greater stability. For the legs, I purchased the used surplus 4-foot heavy-duty fiberglass sections with a lip at the male end. The sections are sold in lots of four for $24. On delivery, the pieces showed only slight wear and no chips. I easily fit the three sections into the tripod base leg holes.

Next, to secure the ends of the legs to the ground, I purchased three swivel stakes (see Figure 1) fitted with metal plates ($74.95 each) that are driven into the ground. They fit perfectly into the leg section ends, and are made of heavy-duty, solid steel. (Always check digging laws and use common sense before hammering anything into the ground.) My tripod base was ready for the first mast section to be run through the tripod's center hole.

▶ **Figure 1** — Heavy-duty, solid steel swivel stakes for securing the legs and mast to the ground.

▼ **Figure 2** — The bottom of a portable antenna mast setup for a 2-meter Yagi antenna.

Assembling the Mast

I purchased 16 feet of the used surplus 4-foot heavy-duty fiberglass mast sections (with a ring on the female end). This was close enough for the height I wanted. The company literature suggests cutting off the ring to allow insertion of the section through the center hole of the aluminum tripod base, but I inserted it from the other (non-ring) end without any issues. Once placed through the center hole, I fit the bottom end on the round, 1-foot-diameter base ($12) that sits on the ground (see Figure 2). The company says it can be used as a "base for all 48-inch fiberglass and aluminum mast sections."

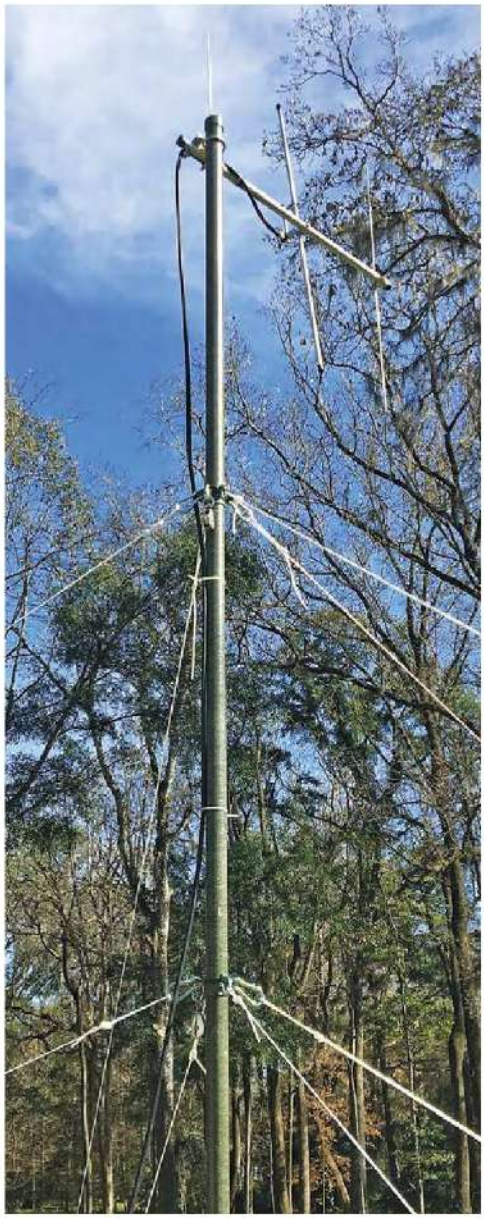


Figure 3 — The top of a portable antenna mast setup for a 2-meter Yagi antenna.

Mounting the Antenna

After setting up the first mast section on the base and through the center hole, I coupled the next section to the top end of the first and installed one of two heavy-duty steel guy rings with four clips and a pulley ($16.99 each) on top. I attached four pieces of ⅛-inch white nylon line (for ease of visibility and safety) to serve as guys, securing the ends to my own makeshift stakes (including two steel pipes). The company does have a wide selection of military-grade stakes available to consider.

Next, the third mast section was slotted on to the second; the second guy ring was slipped on top of it, and guy lines were run again to the same stakes. The fourth section was slotted on top of the third, and I mounted my Yagi antenna to the top (see Figure 3).

Conclusion

These steps may give the impression the installation would take a lot of time at the beginning of a deployment, but with backyard practice, it should go up in less than 30 minutes. Do take the necessary time, however, to ensure a safe installation. I'm happy with mine.

All photos by the author.

Field Organization Reports

January 2020

Public Service Honor Roll

This listing recognizes radio amateurs whose public service performance during the month indicated 70 or more points in six categories. Details on the program can be found at **www.arrl.org/public-service-honor-roll**.

481
WA7PTM

410
N9VC

393
W7PAT

385
KV4LY

306
WM2C

248
KE8BYC

243
WB8RCR

240
KW9EMG

234
WØPZD

228
WA2CCN

225
N5MKY

220
KD2LPM

210
N8SY

208
KT2D

207
N3KRX

200
KK4PUX
WD8MWD

193
KØIBS

185
W3GWM

181
KC8YVF

179
KB8RCR

177
N2WGF

170
W4DNA

169
N2DW

161
WB7OSC

160
WB9WKO

159
W9RGR

158
W4INK

151
WD8USA

150
W2PH
WO2H
ACØKQ

145
KE8KOC

144
WA2BSS

140
K9LGU
K4IWW
KK3F

138
KF4DVF

135
KC8WH
W3YVQ

133
KI4UDZ
K8RDN

130
WB9QPM
N2JBA

KW1U

126
AA7BM

125
AG9G
AD3J

123
K4VWK
W8IM

120
W4NWT
WC4FSU
WA4VGZ
K3JL
WØLAW
W7EES
WA4VGZ

KY2D

118
KY2MMM

115
NX9K
WB8YYS

111
W4CMH

110
W1KX
WB8YLO
KA9MZJ
KA5AZK
KF5IOU
WA3QLW
K3IN
K6HTN
W1RVY
N1IQI
KD2JKV
KD8ZCM

106
KA8ZGY
WV5Q

100
W2PAX
WB4RJW
KZ8Q
NN7H

KN9P
N3SW
AC8RV
WB8SIQ
KD2MDV
KE5YTA
KG5NNA
KB2QO
AA3SB
WB3FTQ
N1LAH
KE1ML
K8ED
WF2Y

99
KB3YRU

97
KV8Z

96
KA2GQQ

95
K3FAZ
K1XFC
KB1NMO

92
AB3WG

91
K6JT
N7PHX

90
KM4WHO
KD4EAQ
K8KRA
N2TSO
NBØZ
KØFBS
KC1HHO
WB8WKQ
WDØBFO

89
KI7TIG
N3RB

87
AC8NP

85
K8AMH
N1TF

84
K1HEJ

83
W5XX
N6IET
KC1KVY

82
KA2HZP

80
KC9FXE
KL7RF
KT4WX
KF7GC

79
KB8HJJ
KAØDBK

78
WB2VUF
WA1LPM

77
KB1NAL
KD2SON

76
W4TTO

75
AF4NC
KD8UUB

74
K8OVO
W2CTG
KBØDTI

73
KA1G

72
KD2MEN
W7MIN

71
WD8DHC
KN4AAG
KC7ASA

70
K6RAU
KB4CAU

The following stations qualified for PSHR in previous months but were not reported in this column: (Dec. 2019) N1LL 160, KA9QWC 140, AB9ZA 114, W9BGJ 105, K9DUR, W9EEU 94.

Section Traffic Manager Reports

The following Section Traffic Managers reported: AL, AR, AZ, CO, CT, DE, EMA, ENY, EPA, IL, KS, LA, LAX, MDC, ME, MI, MN, MS, MT, NC, NE, NFL, NLI, NM, NNJ, NTX, OH, OR, SC, SD, SFL, SJV, TN, VA, WI, WCF, WMA, WPA, WTX, WV, WY.

Section Emergency Coordinator Reports

The following Section Emergency Coordinators reported: AZ, DE, ENY, GA, IA, ID, IL, IN, KY, LA, MDC, ME, MI, MN, MO, MS, MT, ND, NM, NNJ, NV, OH, OR, PAC, SFL, SJV, SNJ, STX, SV, WCF, WPA, WTX, WV.

Brass Pounders League

The BPL is open to all amateurs in the US, Canada, and US possessions who report to their SMs a total of 500 or more points or a sum of 100 or more origination and delivery points for any calendar month. Messages must be handled on amateur radio frequencies within 48 hours of receipt in standard ARRL radiogram format. Call signs of qualifiers and their monthly BPL total points follow.

NX9K 1041, KK3F 858, N1IQI 769, KW1U 768, WB9WKO 708, K6HTN 547.

Bruce Draper, AA5B, aa5b.corral@gmail.com

Contest Corral

April 2020

Check for updates and a downloadable PDF version online at **www.arrl.org/contest-calendar**.
Refer to the contest websites for full rules, scoring information, operating periods or time limits, and log submission information.

Start - Finish Date-Time		Date-Time		Bands	Contest Name	Mode	Exchange	Sponsor's Website
1	2000	1	2100	3.5	UKEICC 80-Meter Contest	Ph	4-char grid square	ukeicc.com/80m-rules.php
2	1700	2	2000	3.5	SARL 80-Meter QSO Party	Ph	RS, serial, grid locator	www.sarl.org.za
2	1700	2	2100	28	NRAU 10-Meter Activity Contest	CW Ph Dig	RS(T), 6-char grid square	nrau.net/activity-contests
2	2000	2	2200	1.8-50	SKCC Sprint Europe	CW	RST, SPC, name, mbr or power	www.skccgroup.com
4	0400	4	0800	7	LZ Open 40-Meter Sprint Contest	CW	Serial, serial received from last QSO	www.lzopen.com/lzocc40
4	1000	5	0400	14	PODXS 070 Club PSK 31 Flavors Contest	Dig	SPC, mbr or name	www.podxs070.com
4	1300	5	0100	1.8-UHF	Nebraska QSO Party	CW Ph Dig	County or SPC (grid square on FT8)	www.arrl.org/sections/view/nebraska
4	1400	5	0200	1.8-144	Louisiana QSO Party	CW Ph Dig	RS(T), Parish or SPC	laqp.louisianacontestclub.org
4	1400	5	0200	3.5-UHF	Mississippi QSO Party	CW Ph Dig	RS(T), county or SPC	www.arrlmiss.org
4	1400	5	2000	1.8-UHF	Missouri QSO Party	CW Ph Dig	RS(T), county or SPC	w0ma.org/index.php/missouri-qso-party
4	1400	5	2200	3.5-28	Florida State Parks on the Air	CW Ph Dig	Park ID or SPC	flspota.org/rules
4	1500	5	1500	1.8-28	SP DX Contest	CW Ph	RS(T), Province or serial	spdxcontest.pzk.org.pl
4	1600	5	1600	3.5-28	EA RTTY Contest	Dig	RSQ, EA province or serial	concursos.ure.es/en/eartty/bases
5	0000	5	0400	3.5-14	North American SSB Sprint Contest	Ph	Other station's call, your call, serial, name, SPC	ssbsprint.com/rules
5	0600	5	1000	50	UBA Spring Contest, 6 Meters	CW Ph	RS(T), serial, UBA Section (if ON)	uba.be/hf/contest-rules
5	1900	5	2030	3.5	RSGB RoLo SSB	Ph	RS, previous 6-char grid square received	www.rsgbcc.org/hf
6	0800	12	2000	All	IQRP Quarterly Marathon	CW Ph Dig	RS(T)	www.arimontebelluna.it
6	1900	6	2030	3.5	RSGB 80-Meter Club Championship, CW	CW	RST, serial	www.rsgbcc.org/hf
6	1900	6	2300	144	144 MHz Spring Sprint	CW Ph Dig	4-char grid square	sites.google.com/site/springvhfupsprints
7	0100	7	0300	3.5-28	ARS Spartan Sprint	CW	RST, SPC, power	arsqrp.blogspot.com
11	0000	11	2359	1.8-28	QRP ARCI Spring QSO Party	CW	RS, SPC, mbr or power	qrparci.org/contests
11	0700	12	1300	1.8-28	JIDX CW Contest	CW	RST, Prefecture number or CQ zone	jidx.org/jidxrule-e.html
11	1200	12	1200	1.8-28	OK/OM DX Contest, SSB	Ph	RS, 3-letter OK/OM county code or serial	okomdx.crk.cz
11	1200	12	1200	3.5-28, 144	F9AA Cup, PSK	Dig	RST, serial	www.site.urc.asso.fr
11	1200	12	1200	3.5-28	FTn DX Contest	Dig	RST, US state or VE province or serial	europeanft8club.wordpress.com
11	1200	12	2359	1.8-50	SKCC Weekend Sprintathon	CW	RST, SPC, name, mbr or "none"	www.skccgroup.com
11	1400	12	0200	1.8-50	New Mexico QSO Party	CW Ph Dig	Name, county or SPC	www.newmexicoqsoparty.org
11	1800	12	1800	1.8-144	North Dakota QSO Party	CW Ph	RS(T), county or SPC	ndarrlsec.com
11	1800	12	2359	1.8-50	Georgia QSO Party	CW Ph	RST, county or SPC	www.georgiaqsoparty.org
11	2100	12	2100	1.8-28, satellites	Yuri Gagarin International DX Contest	CW	RST, ITU zone	gc.qst.ru/en/section/32
12	1000	12	2200	3.5-14	WAB 3.5/7/14 MHz Data Modes	Dig	RS, serial, WAB square or country	wab.intermip.net/Contests.php
12	1200	12	1800	3.5-7	International Vintage Contest HF	CW Ph	RS(T) 4-char grid square	contestvintage.beepworld.it
12	1500	12	1600	3.5	Hungarian Straight Key Contest	CW	RST, serial, power code	hskc.ha8kux.com
13	0000	13	0200	1.8-28	4 States QRP Group Second Sunday Sprint	CW Ph	RS(T), SPC, mbr or power	www.4sqrp.com
14	1900	14	2300	222	222 MHz Spring Sprint	CW Ph Dig	4-char grid square	sites.google.com/site/springvhfupsprints
15	0030	15	0230	3.5-14	NAQCC CW Sprint	CW	RST, SPC, mbr or power	naqcc.info
15	1900	15	2030	3.5	RSGB 80-Meter Club Championship, SSB	Ph	RS, serial	www.rsgbcc.org/hf
17	2100	18	2100	1.8-28	Holyland DX Contest	CW Ph Dig	RS(T), 4X area or serial	iarc.org/iarc/#HolylandContest
18	0500	18	0859	3.5-7	ES Open HF Championship	CW Ph	RS(T), serial	erau.ee/en/es-open-contests
18	0600	19	0559	3.5-28	Worked All Provinces of China DX Contest	CW Ph	RS(T), BY province or serial	www.mulandxc.org
18	0700	19	0659	3.5-28	YU DX Contest	CW Ph	RS(T), YU/YT county or serial	www.yudx.yu1srs.org.rs
18	0800	18	1800	3.5-21	QRP to the Field	CW Ph	RST, SPC, name or SOTA	www.zianet.com/qrp/qrpttf
18	0900	19	2359	3.5-28	CQMM DX Contest	CW	RST, continent, category code	www.cqmmdx.com/rules
18	1400	19	2000	All	Texas State Parks on the Air	CW Ph Dig	RS(T), park or SPC	www.tspota.org/rules
18	1600	19	0400	3.5-28	Michigan QSO Party	CW Ph	Serial, county or SPC	www.miqp.org/Rules.htm
18	1700	19	1300	3.5-28	EA-QRP CW Contest	CW	RST, category code	www.eaqrp.com
18	1800	18	2159	1.8-50	Feld Hell Sprint	Dig	RST, mbr, SPC, grid	sites.google.com/site/feldhellclub
18	1800	19	1800	1.8-144	Ontario QSO Party	CW Ph	RS(T), ON county or SPC	va3cco.com/oqp/rules.htm
19	1800	19	2359	3.5-28	ARRL Rookie Roundup, SSB	Ph	Name, 2-digit year first licensed, state/province/XE area/"DX"	www.arrl.org/rookie-roundup
20	0100	20	0300	1.8-28	Run for the Bacon QRP Contest	CW	RST, SPC, mbr/power	qrpcontest.com/pigrun
22	0000	22	0200	1.8-28	SKCC Sprint	CW	RST, SPC, name, mbr or power	www.skccgroup.com
22	1900	22	2300	432	432 MHz Spring Sprint	CW Ph Dig	4-char grid square	sites.google.com/site/springvhfupsprints
23	1900	23	2030	3.5	RSGB 80-Meter Club Championship, Data	Dig	RST, serial	www.rsgbcc.org/hf
25	0001	26	2359	28	10-10 International Spring Contest, Digital	Dig	Name, mbr or "0," SPC	www.ten-ten.org
25	1200	26	1200	3.5-28	SP DX RTTY Contest	Dig	RST, 2-letter SP province or serial	pkrvg.org/strona,spdxrttyen.html
25	1300	26	1259	1.8-28	Helvetia Contest	CW Ph Dig	RS(T), 2-letter HB canton or serial	www.uska.ch
25	1600	26	2159	7-28	Florida QSO Party	CW Ph	RS(T), county or SPC	floridaqsoparty.org/rules
26	1700	26	2059	3.5-28	BARTG Sprint 75	Dig	Serial	bartg.org.uk
27	1300	28	0400	1.8-28	QCX Challenge	CW	RST, name, SPC, rig	qrp-labs.com/party.html
29	2000	29	2100	3.5	UKEICC 80-Meter Contest	CW	4-char grid square	ukeicc.com/80m-rules.php

April 2020 Frequency Measuring Test

The format of the April Frequency Measuring Test (FMT) will be to measure a single-frequency signal transmitted first on 40 meters then on 80 meters from one station in eastern Oklahoma — K5CM. The FMT will begin at 0200 UTC, April 24 (Thursday evening in North America).

Measure the transmitted frequency and report your results at the ARRL FMT page, **fmt.arrl.org**. Results must be submitted by 0200 UTC on April 27, at which time the results will be published on the website.

To be listed in the "Green Box" of the results, submit a measurement with an accuracy of better than 1 Hz.

Although the "call up" is scheduled to start at a very specific time, K5CM will try to start earlier. Every effort will be made to start the key-down period at the published time.

40-Meter Schedule — Near 7065 kHz

(times are UTC)

02:00	Call up for 3 minutes
02:03	Key down 2 minutes
02:05	End 40-meter run

80-Meter Schedule — Near 3599 kHz

02:20	Call up for 3 minutes
02:23	Key down 2 minutes
02:25	End FMT

Congratulations

January 2020
Cover Plaque Award Winner

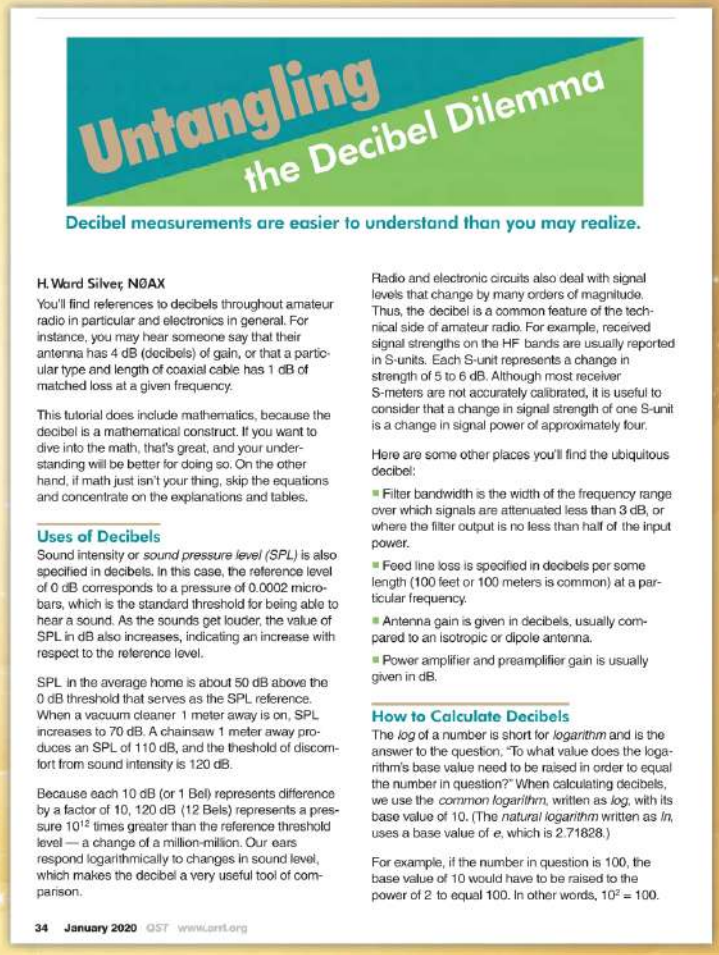
H. Ward Silver
NØAX

"Untangling the Decibel Dilemma" by H. Ward Silver, NØAX, provided a down-to-earth tutorial for a mathematical concept that keeps some amateurs tangled in knots. Many *QST* readers appreciated his helpful explanation and voted accordingly, so Ward will receive a handsome plaque featuring the cover of the January 2020 issue.

QST Cover Plaque Awards are given to the author or authors of the most popular article in each issue. *You* choose the winners by casting your vote online at

www.arrl.org/cover-plaque-poll

Log in now and pick your favorite article in this issue!



Untangling the Decibel Dilemma

Decibel measurements are easier to understand than you may realize.

H. Ward Silver, NØAX

You'll find references to decibels throughout amateur radio in particular and electronics in general. For instance, you may hear someone say that their antenna has 4 dB (decibels) of gain, or that a particular type and length of coaxial cable has 1 dB of matched loss at a given frequency.

This tutorial does include mathematics, because the decibel is a mathematical construct. If you want to dive into the math, that's great, and your understanding will be better for doing so. On the other hand, if math just isn't your thing, skip the equations and concentrate on the explanations and tables.

Uses of Decibels

Sound intensity or *sound pressure level (SPL)* is also specified in decibels. In this case, the reference level of 0 dB corresponds to a pressure of 0.0002 microbars, which is the standard threshold for being able to hear a sound. As the sounds get louder, the value of SPL in dB also increases, indicating an increase with respect to the reference level.

SPL in the average home is about 50 dB above the 0 dB threshold that serves as the SPL reference. When a vacuum cleaner 1 meter away is on, SPL increases to 70 dB. A chainsaw 1 meter away produces an SPL of 110 dB, and the theshold of discomfort from sound intensity is 120 dB.

Because each 10 dB (or 1 Bel) represents difference by a factor of 10, 120 dB (12 Bels) represents a pressure 10^{12} times greater than the reference threshold level — a change of a million-million. Our ears respond logarithmically to changes in sound level, which makes the decibel a very useful tool of comparison.

Radio and electronic circuits also deal with signal levels that change by many orders of magnitude. Thus, the decibel is a common feature of the technical side of amateur radio. For example, received signal strengths on the HF bands are usually reported in S-units. Each S-unit represents a change in strength of 5 to 6 dB. Although most receiver S-meters are not accurately calibrated, it is useful to consider that a change in signal strength of one S-unit is a change in signal power of approximately four.

Here are some other places you'll find the ubiquitous decibel:

- Filter bandwidth is the width of the frequency range over which signals are attenuated less than 3 dB, or where the filter output is no less than half of the input power.
- Feed line loss is specified in decibels per some length (100 feet or 100 meters is common) at a particular frequency.
- Antenna gain is given in decibels, usually compared to an isotropic or dipole antenna.
- Power amplifier and preamplifier gain is usually given in dB.

How to Calculate Decibels

The *log* of a number is short for *logarithm* and is the answer to the question, "To what value does the logarithm's base value need to be raised in order to equal the number in question?" When calculating decibels, we use the *common logarithm*, written as *log*, with its base value of 10. (The *natural logarithm* written as *ln*, uses a base value of *e*, which is 2.71828.)

For example, if the number in question is 100, the base value of 10 would have to be raised to the power of 2 to equal 100. In other words, $10^2 = 100$.

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2019 September VHF Contest Results

Check out the results of the event, held September 14 – 16, 2019.

Ralph "Gator" Bowen, N5RZ, wb5aar@gmail.com

Chuck Kemmer, AC7QN, operated from the summit of Mount Fremont in Washington as part of the Limited Multioperator team of WW7LW, the Mount Rainier Amateur Radio Club, in the 2019 September VHF Contest. Chuck, along with Patricia Wingerter, WT7N; Mike Drorbaugh, W7MKE, and Rich Patrick, KR7W, took the top spot in the Northwestern Division for their category. [Patricia Wingerter, WT7N, photo]

Top Ten

Classic Rover

N6NB/R	162,480
KF2MR/R	120,428
N7GP/R	81,656
VE3OIL/R	70,041
NI6G/R	69,624
WB6HYD/R	69,552
K2TER/R	51,800
NØLNO/R	39,360
KA9VVQ/R	30,940
W9FZ/R	30,240

Limited Rover

NF2RS/R	52,682
VE3SMA/R	43,050
KJ2G/R	16,121
KI5FIQ/R	13,350
N6GP/R	7,744
W1RGA/R	6,142
WB5IDY/R	6,000
N7OW/R	4,888
KA5D/R	3,534
AF1R/R	3,360

Unlimited Rover

K6MI/R	83,760
N2SLN/R	34,680
KA2LIM/R	30,870
NØLD/R	27,920
KCØSKM/R	19,671
AE5P/R	16,616
K1SIG/R	16,000
KT5TE/R	14,670
N6RH/R	14,640
KRØVER/R	11,592

Single Operator, High Power

K1TEO	282,000
K1RZ	154,328
N2YB	97,712
WZ1V	73,320
VA3ELE	67,456
W3IP	65,520
K1KG	47,508
N1AV	46,662
K1TR	43,316
WØUC	37,968

Single Operator, Low Power

AF1T	82,000
WB1GQR (W1SJ, op)	73,988
N2WK	49,344
VE3DS	47,676
W6TV (W6YEP, op)	38,055
K9MU	37,730
WA3EOQ	23,130
N8RA	21,904
N2OA	21,840
N8LRG	19,380

Single Operator, Portable

W4RXR	6,055
WBØLJC	2,240
AA4Q	1,900
K7ATN	1,768
NV4B	1,560
KØNR	1,080
WB2AMU	1,034
WA9STI	792
WK9U	750
N2YTF	644

Single Operator, Three-Band

ACØRA	44,220
KO9A	19,749
N7IR	10,584
VE3WY	5,600
KA2BPP	4,879
K3TEF	4,070
NA2NY	3,220
VE3SST	2,944
N7QOZ	2,860
N7RK	2,575

Single Operator, FM Only

KM6PHB	2,436
WB9WOZ	2,196
W7AIT	598
K7JSG	368
N9VM (N1VM, op)	198
VA2DG	132
WAØKXO	85
N7AKC	60
KA2CGB	42
N1SFE	32

Limited Multioperator

N2NT	126,720
AA4ZZ	113,176
W2LV	64,855
K5QE	60,606
W3SO	53,193
W4IY	46,400
W9VW	23,142
W9RVG	22,698
N4HB	21,590
W1QK	9,200

Unlimited Multioperator

W2SZ	294,345
W2EA	109,434
N8GA	57,512
KD2LGX	47,630
WE1P	35,100
W4NH	17,850
AG4V	14,094
W1XM	8,500
W3RFC	7,693
K3AE	3,306

Division Winners

Classic Rover

Atlantic	KF2MR/R	120,428
Dakota	KA9VVQ/R	30,940
Delta	W5VY/R	9,976
Midwest	NØLNO/R	39,360
Northwestern	KE7MSU/R	5,610
Pacific	N6NB/R	162,480
Southeastern	KF4TPW/R	154
Southwestern	N7GP/R	81,656
West Gulf	KBØYHT/R	3,456
Canada	VE3OIL/R	70,041

Limited Rover

Atlantic	NF2RS/R	52,682
Central	N9GH/R	1,248
Dakota	NØSPN/R	1,000
Great Lakes	AE8AT/R	120
Hudson	KA2YRA/R	832
Midwest	KBØZOM/R	1,562
New England	KJ2G/R	16,121
Northwestern	KC7OOY/R	2,889
Roanoke	K2JB/R	2,646
Rocky Mountain	AA5PR/R	2,166
Southwestern	N6GP/R	7,744
West Gulf	KI5FIQ/R	13,350
Canada	VE3SMA/R	43,050

Unlimited Rover

Atlantic	N2SLN/R	34,680
Midwest	KCØSKM/R	19,671
New England	K1SIG/R	16,000
Pacific	K6MI/R	83,760
Rocky Mountain	KRØVER/R	11,592
Southeastern	N4GLE/R	558
West Gulf	NØLD/R	27,920

Single Operator, High Power

Atlantic	K1RZ	154,328
Central	WØUC	37,968
Dakota	WØGHZ	35,776
Delta	N4QWZ	32,256
Great Lakes	K8ZR	15,879
Hudson	AA2TT	9,568
Midwest	KØTPP	12,936
New England	K1TEO	282,000
Northwestern	K7YDL	15,282
Pacific	ND7M	5,310
Roanoke	W3IP	65,520
Rocky Mountain	W9RM	10,829
Southeastern	KE8FD	20,064
Southwestern	N1AV	46,662
West Gulf	K5LLL	8,960
Canada	VA3ELE	67,456

Single Operator, Low Power

Atlantic	N2WK	49,344
Central	K9MU	37,730
Dakota	WBØHHM	11,220
Delta	AA4DD	2,015
Great Lakes	N8LRG	19,380
Hudson	WB2JAY	8,786
Midwest	WBØNRV	4,949
New England	AF1T	82,000
Northwestern	WZ8T	11,868
Pacific	W6TV (W6YEP, op)	38,055
Roanoke	K4FJW	2,960
Rocky Mountain	WB7CJO	644
Southeastern	AJ6T	4,888
Southwestern	N7VD	13,296
West Gulf	N5ITO	3,445
Canada	VE3DS	47,676

Single Operator, Portable

Central	WK9U	750
Dakota	WBØLJC	2,240
Delta	W4RXR	6,055
Hudson	WB2AMU	1,034
Midwest	NØJK	168
Northwestern	K7ATN	1,768
Pacific	W6KKO	420
Rocky Mountain	KØNR	1,080
Southwestern	AA4Q	1,900
Canada	VA3TO	64

Single Operator, Three-Band

Atlantic	K3TEF	4,070
Central	KO9A	19,749
Dakota	KØVG	1,972
Delta	W4BCG	70
Great Lakes	KV4ZY	1,170
Hudson	KA2BPP	4,879
Midwest	ACØRA	44,220
New England	KA1VMG	420
Northwestern	N7QOZ	2,860
Pacific	K7XC	544
Roanoke	WA4LDU	1,470
Rocky Mountain	KC7QY	224
Southeastern	K4EA	682
Southwestern	N7IR	10,584
West Gulf	W5TRL	2,496
Canada	VE3WY	5,600

Single Operator, FM Only

Atlantic	KA2CGB	42
Central	WB9WOZ	2,196
Delta	K4NRT	30
New England	N1SFE	32
Northwestern	K7JSG	368
Pacific	KM6PHB	2,436
Rocky Mountain	WAØKXO	85
Southwestern	N7AKC	60
West Gulf	KG5UNK	6
Canada	VA2DG	132

Limited Multioperator

Atlantic	W3SO	53,193
Central	W9VW	23,142
Delta	NE5BO	6,572
Hudson	N2NT	126,720
New England	W1QK	9,200
Northwestern	WB7PEK	150
Roanoke	AA4ZZ	113,176
Rocky Mountain	K5LRW	529
Southeastern	WB4WXE	2,044
West Gulf	K5QE	60,606

Unlimited Multioperator

Atlantic	W2EA	109,434
Central	N9UHF	465
Delta	AG4V	14,094
Great Lakes	N8GA	57,512
Hudson	WE1P	35,100
New England	W2SZ	294,345
Northwestern	K7VHF	3,120
Pacific	W6EK	2,898
Southeastern	W4NH	17,850
West Gulf	KC5MVZ	189

Full Results Online

You can read the full results of the contest online at **http://contests.arrl.org** or **www.arrl.org/contest-results-articles**. You'll find detailed analysis and more play-by-play, along with the full line scores. Improve your results by studying your log-checking report, too.

Regional Leaders

Boxes list call sign, score, and class: LM = Limited Multioperator; R = Classic Rover; RL = Limited Rover; RU = Unlimited Rover; SO3B = Single Operator, Three-Band; SOFM = Single Operator, FM Only; SOHP = Single Operator, High Power; SOLP = Single Operator, Low Power; SOP = Single Operator, Portable, and UM = Unlimited Multioperator.

West Coast Region
(Pacific, Northwestern, and Southwestern Divisions; Alberta, British Columbia, and NT Sections)

N6NB/R	162,480	R
N7GP/R	81,656	R
NI6G/R	69,624	R
WB6HYD/R	69,552	R
N6TEB/R	18,432	R
W6AMT/R	18,432	R
N6GP/R	7,744	RL
N7OW/R	4,888	RL
KC7OOY/R	2,889	RL
K6LMN/R	2,070	RL
K7MDL/R	1,134	RL
K6MI/R	83,760	RU
N1AV	46,662	SOHP
WA7XX	17,405	SOHP
K7YDL	15,282	SOHP
KE7SW	12,400	SOHP
N7EPD	11,144	SOHP
W6TV (W6YEP, op)	38,055	SOLP
N7VD	13,296	SOLP
WZ8T	11,868	SOLP
N7KSI	5,986	SOLP
KT7E (K7ZS, op)	5,850	SOLP
AA4Q	1,900	SOP
K7ATN	1,768	SOP
WA9STI	792	SOP
W6KKO	420	SOP
K7IW	189	SOP
N7IR	10,584	SO3B
N7QOZ	2,860	SO3B
N7RK	2,575	SO3B
K7BDB	2,331	SO3B
K7XC	544	SO3B
KM6PHB	2,436	SOFM
W7AIT	598	SOFM
K7JSG	368	SOFM
N9VM (N1VM, op)	198	SOFM
N7AKC	60	SOFM
WB7PEK	150	LM
W7DK	60	LM
K7VHF	3,120	UM
W6EK	2,898	UM
WW7LW	885	UM

Midwest Region
(Dakota, Midwest, Rocky Mountain, and West Gulf Divisions; Manitoba and Saskatchewan Sections)

N0LNO/R	39,360	R
KA9VVQ/R	30,940	R
W9FZ/R	30,240	R
W0ZF/R	18,605	R
K0BBC/R	10,127	R
KI5FIQ/R	13,350	RL
WB5IDY/R	6,000	RL
KA5D/R	3,534	RL
AA5PR/R	2,166	RL
AB0YM/R	2,016	RL
N0LD/R	27,920	RU
KC0SKM/R	19,671	RU
AE5P/R	16,616	RU
KT5TE/R	14,670	RU
N6RH/R	14,640	RU
W0GHZ	35,776	SOHP
K0TPP	12,936	SOHP
W9RM	10,829	SOHP
K0AWU	9,360	SOHP
KF0M	9,009	SOHP
WB0HHM	11,220	SOLP
W0ZQ	7,830	SOLP
WB0NRV	4,949	SOLP
N0LL	4,731	SOLP
N5ITO	3,445	SOLP
WB0LJC	2,240	SOP
K0NR	1,080	SOP
N0SUW	204	SOP
N0JK	168	SOP
NA1KW (N1SPX, op)	120	SOP
AC0RA	44,220	SO3B
W5TRL	2,496	SO3B
K0VG	1,972	SO3B
N0UR	1,650	SO3B
WB0ULX	1,392	SO3B
WA0KXO	85	SOFM
KG5UNK	6	SOFM
K5QE	60,606	LM
K5LRW	529	LM
KC5MVZ	189	UM

Central Region
(Central and Great Lakes Divisions; Ontario East, Ontario North, Ontario South, and Greater Toronto Area Sections)

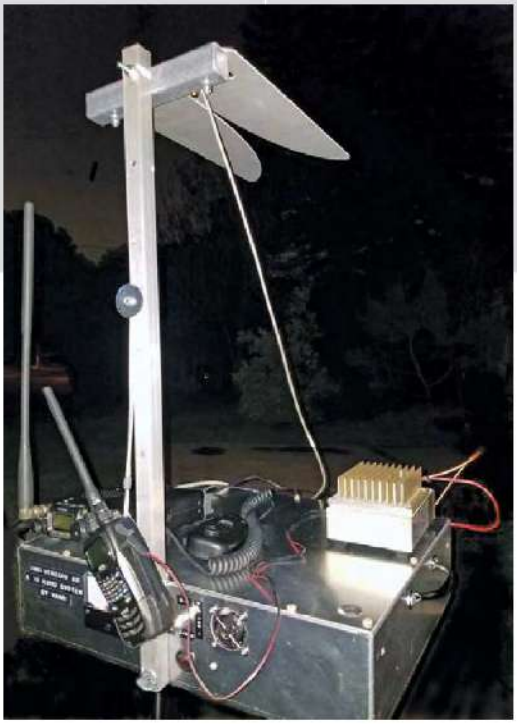
VE3OIL/R	70,041	R
VE3CRU/R	7,486	R
VE3SMA/R	43,050	RL
N9GH/R	1,248	RL
K9JK/R	1,120	RL
AE8AT/R	120	RL
VA3ELE	67,456	SOHP
W0UC	37,968	SOHP
VE3ZV	17,538	SOHP
K8ZR	15,879	SOHP
W9FF	9,512	SOHP
VE3DS	47,676	SOLP
K9MU	37,730	SOLP
N8LRG	19,380	SOLP
W9GA	11,100	SOLP
W9HQ	3,840	SOLP
WK9U	750	SOP
VA3TO	64	SOP
KD9MQV	30	SOP
KO9A	19,749	SO3B
VE3WY	5,600	SO3B
VE3SST	2,944	SO3B
WB9TFH	1,972	SO3B
W9ZB	1,260	SO3B
WB9WOZ	2,196	SOFM
W9VW	23,142	LM
W9RVG	22,698	LM
N8GA	57,512	UM
N9UHF	465	UM

Southeast Region
(Delta, Roanoke, and Southeastern Divisions)

W5VY/R	9,976	R
KF4TPW/R	154	R
K2JB/R	2,646	RL
KM4OZH/R	1,260	RL
W4LJS/R	504	RL
KM4QCH/R	54	RL
N4GLE/R	558	RU
W3IP	65,520	SOHP
N4QWZ	32,256	SOHP
KE8FD	20,064	SOHP
K4XR	10,787	SOHP
KF7NN	6,832	SOHP
AJ6T	4,888	SOLP
K4FJW	2,960	SOLP
AA4DD	2,015	SOLP
W4GO	1,972	SOLP
KA2KQM	1,943	SOLP
W4RXR	6,055	SOP
NV4B	1,560	SOP
WA4LDU	1,470	SO3B
KK4MA	1,392	SO3B
K4EA	682	SO3B
K5OLV	611	SO3B
N1IA	345	SO3B
K4NRT	30	SOFM
AA4ZZ	113,176	LM
W4IY	46,400	LM
N4HB	21,590	LM
NE5BO	6,572	LM
WB4WXE	2,044	LM
W4NH	17,850	UM
AG4V	14,094	UM

Northeast Region
(New England, Hudson, and Atlantic Divisions; Maritime and Quebec Sections)

KF2MR/R	120,428	R
K2TER/R	51,800	R
W3ICC/R	28,288	R
K2ET/R	22,700	R
W2EV/R	19,224	R
NF2RS/R	52,682	RL
KJ2G/R	16,121	RL
W1RGA/R	6,142	RL
AF1R/R	3,360	RL
WA2TMC/R	1,000	RL
N2SLN/R	34,680	RU
KA2LIM/R	30,870	RU
K1SIG/R	16,000	RU
KJ1K/R	2,976	RU
K1TEO	282,000	SOHP
K1RZ	154,328	SOHP
N2YB	97,712	SOHP
WZ1V	73,320	SOHP
K1KG	47,508	SOHP
AF1T	82,000	SOLP
WB1GQR (W1SJ, op)	73,988	SOLP
N2WK	49,344	SOLP
WA3EOQ	23,130	SOLP
N8RA	21,904	SOLP
WB2AMU	1,034	SOP
N2YTF	644	SOP
W2NTN	570	SOP
KQ2RP	28	SOP
KA2BPP	4,879	SO3B
K3TEF	4,070	SO3B
NA2NY	3,220	SO3B
KC3NPK	2,496	SO3B
KG2H	1,680	SO3B
VA2DG	132	SOFM
KA2CGB	42	SOFM
N1SFE	32	SOFM
WA2HOY	10	SOFM
KM2B	4	SOFM
N2NT	126,720	LM
W2LV	64,855	LM
W3SO	53,193	LM
W1QK	9,200	LM
WA3EKL	7,200	LM
W2SZ	294,345	UM
W2EA	109,434	UM
KD2LGX	47,630	UM
WE1P	35,100	UM
W1XM	8,500	UM



Wayne Overbeck, N6NB, built this 10-band Rover station, which covers 50 MHz up to 10 GHz. The wide-band Vivaldi antenna mounted on the unit covers 902 MHz through 10 GHz. Wayne secured the top spot in the Classic Rover category. [Wayne Overbeck, N6NB, photo]

2020 Straight Key Night Results

ARRL's classic New Year's Day event brought together 186 hams from all over the world.

Paul Bourque, N1SFE
ARRL Contest Program Manager

Every year on January 1, the shacks of many amateur radio operators are filled with the sounds of Morse code and the warmth of old tube gear, as Straight Key Night (SKN) takes to the air. During the first 24 hours of the new year, 186 participants made over 1,250 contacts.

Soapbox Comments

Straight Key Night can bring old friends together on the air, as well as foster new friendships. Many participants shared their stories on the ARRL Soapbox page (**www.arrl.org/soapbox**).

Barry Pfeil, K6RM, participated in his first Straight Key Night using vintage gear. He assembled his dream station from his high school days — a Drake 2B receiver that he restored and a Johnson Viking Ranger. [Barry Pfeil, K6RM, photo]

George Kelly, K9WWT, reported that he had a roundtable contact with three Navy buddies of 54 years. George, Carl Young, K5HK, and Robert "Brad" Bradley, AA7CT, all served as cryptologic technicians at the same base in Panama in 1966. Buddy Smith, W4YE, had a lengthy contact with two other hams from Fairfax, Virginia. They all went to the same high school and met on the air by accident.

Other participants reported bringing old gear back to life for the event. Paul Harden, NA5N, operated low power using a World War II-era Navy J-38 key that his father had used as a Navy radioman during the Battle of Peleliu Island.

Gary Hornbuckle, K9MMS, participated in SKN for the first time this year. Gary said that he operated using mostly CW for the past 62 years, and for SKN he enjoyed using a Skillman brass straight key that he purchased from the original RadioShack store in 1958, as well as a 1959 Vibroplex Original Bug key that he'd received as a gift for his 16th birthday.

Jim Cluett, W1PID, had a contact with 97-year-old Don Gagne, W2LID, who has been an amateur for over 81 years! Don was originally licensed with that distinctive call sign in 1937, at the age of 15.

Brennan Price, N4QX, combined SKN with AMSAT CW Activity Day, using a straight key on multiple linear satellites. He reported hearing most of the activity on the CAS-4A and CAS-4B satellites, which passed over North America in the early and final hours of the event. His contact with Scott Richardson, N1AIA, was Scott's first CW contact via satellite.

Jim Zimmerman, N6KZ, contacted Dale Romagnoli, VE7YTB, who was operating maritime mobile on the tugboat *Seahorse* off the coast of British Columbia, Canada. It was Dale's first CW contact.

Best Fist and Most Interesting QSO

Each year, we ask SKN participants to cast their votes for "Best Fist" and "Most Interesting QSO." This year's vote for "Best Fist" is a three-way tie between Tom Billings, AA4TB; Tom Warren, K3TW, and Jim Zimmerman, N6KZ. "Most Interesting QSO" went to Billy Williamson, WB8SJE.

ARRL will hold the next Straight Key Night on January 1, 2021. Remember, you don't have to wait a year to enjoy hand-sent CW. Let's keep the airwaves filled with the sounds of dits and dahs until then!

Participating Stations

AAØQZ, AA4AI, AA4TB, AA7FV, AA8UU, AB8FJ, AB9BZ, ADØKH, AD4E, AE3A, AE7CG, AE8EA, AF3I, AF4O, KØPHP, KØPK, K1APJ, K1EEE, K1LEE, K2AL, K2NPN, K3AFS, K3BVQ, K3KKA, K3MD, K3NP, K3STX, K3SWZ, K3TW, K4DS, K4HJN, K4PMT, K5HK, K5KHK, K5LDA, K5MBA, K5SOH, K5TSK, K6DF, K6GPB, K6KQV, K6LG, K6PBQ, K6RM, K6SK, K6TY, K7COM, K7SU, K7TRF, K7ZX, K7ZY, K8JV, K8NB, K8RAT, K9DJT, K9LA, K9MMS, K9PMV, K9UQN, K9VKY, K9WWT, K9YA, KAØLDG, KA3BPN, KA4WJB, KA8NNY, KB2MN, KB8M, KB8TL, KB8TXZ, KB9STR, KCØPLZ, KC2KWA, KDØGRS, KDØWW, KD2BD, KD6WKY, KEØTT, KE1R, KE7LOY, KF8KS, KG4KGY, KH4GX, KIØG, KJ6CA, KN4QDE, KN5L, KN7NNN, KO8S, KT3A, KW4RM, KW6G, NØEAX, NØIMJ, NØYB, N2KZ, N3HCN, N4CU, N4QR, N4QX, N4RLI, N5PBP, N6KZ, N8GAS, N8JLM, N8LA, N9BOR, NA5N, NC6Q, NF1O, NF8M, NIØR, NN7A, NOØV, NWØM, NW3V, WØCZ, WØEJO, WØESE, WØKIZ, W1AST, W1MJ, W1PDI, W1PID, W1RO, W1TPB, W1TS, W1UJ, W2AAB, W2LID, W2NTN, W2QJH, W4IT, W4KDK, W4RK, W4SGP, W4SQ, W4YE, W5NZ, W5QLF, W6JHQ, W6KN, W7AIT, W7OS, W7UUU, W8DPK, W8WTS, W8WZ, W9KMP, W9XW, WAØJLY, WAØVQY, WA1CFX, WA2CHV, WA2SON, WA3GYN, WA4KFZ, WA4ONV, WA5KBH, WA6ARA, WA6BXV, WA7AXT, WA7OET, WA9PWP, WA9ZBW, WBØB, WBØCJB, WBØCNK, WBØIXI, WB2AWQ, WB3CEG/5, WB3JKQ, WB4YDL, WB6AAJ, WB8CFO, WB8SJE, WB9AYW, WB9HFK, WB9TFF, WD6EGW, and WD8RIF.

DX and VE stations included HP1AC, HP1IBF, VE3CBK, VK6GX, and VO1NA.

W1AW Schedule

PAC	MTN	CENT	EAST	UTC	MON	TUE	WED	THU	FRI
6 AM	7 AM	8 AM	9 AM	1300		FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
7 AM-1 PM	8 AM-2 PM	9 AM-3 PM	10 AM-4 PM	1400-1600 1700-1945	VISITING OPERATOR TIME (12 PM-1 PM CLOSED FOR LUNCH)				
1 PM	2 PM	3 PM	4 PM	2000	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
2 PM	3 PM	4 PM	5 PM	2100	CODE BULLETIN				
3 PM	4 PM	5 PM	6 PM	2200	DIGITAL BULLETIN				
4 PM	5 PM	6 PM	7 PM	2300	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE
5 PM	6 PM	7 PM	8 PM	0000	CODE BULLETIN				
6 PM	7 PM	8 PM	9 PM	0100	DIGITAL BULLETIN				
6:45 PM	7:45 PM	8:45 PM	9:45 PM	0145	VOICE BULLETIN				
7 PM	8 PM	9 PM	10 PM	0200	FAST CODE	SLOW CODE	FAST CODE	SLOW CODE	FAST CODE
8 PM	9 PM	10 PM	11 PM	0300	CODE BULLETIN				

W1AW's schedule is at the same local time throughout the year. From the second Sunday in March to the first Sunday in November, UTC = Eastern US time + 4 hours. For the rest of the year, UTC = Eastern US time + 5 hours.

♦ Morse code transmissions: Frequencies are 1.8025, 3.5815, 7.0475, 14.0475, 18.0975, 21.0675, 28.0675, 50.350, and 147.555 MHz.

Slow Code = practice sent at 5, 7½, 10, 13, and 15 WPM.

Fast Code = practice sent at 35, 30, 25, 20, 15, 13, and 10 WPM.

Code bulletins are sent at 18 WPM.

For more information, visit us at
www.arrl.org/w1aw

♦ W1AW Qualifying Runs are sent on the same frequencies as the Morse code transmissions. West Coast qualifying runs are transmitted by various West Coast stations on CW frequencies that are normally used by W1AW, in addition to 3590 kHz, at various times. Underline 1 minute of the highest speed you copied, certify that your copy was made without aid, and send it to ARRL for grading. Please include your name, call sign (if any), and complete mailing address. Fees: $10 for a certificate, $7.50 for endorsements.

♦ Digital transmissions: Frequencies are 3.5975, 7.095, 14.095, 18.1025, 21.095, 28.095, 50.350, and 147.555 MHz.

Bulletins are sent using 45.45-baud Baudot, PSK31 in BPSK mode, and MFSK16 on a daily revolving schedule.

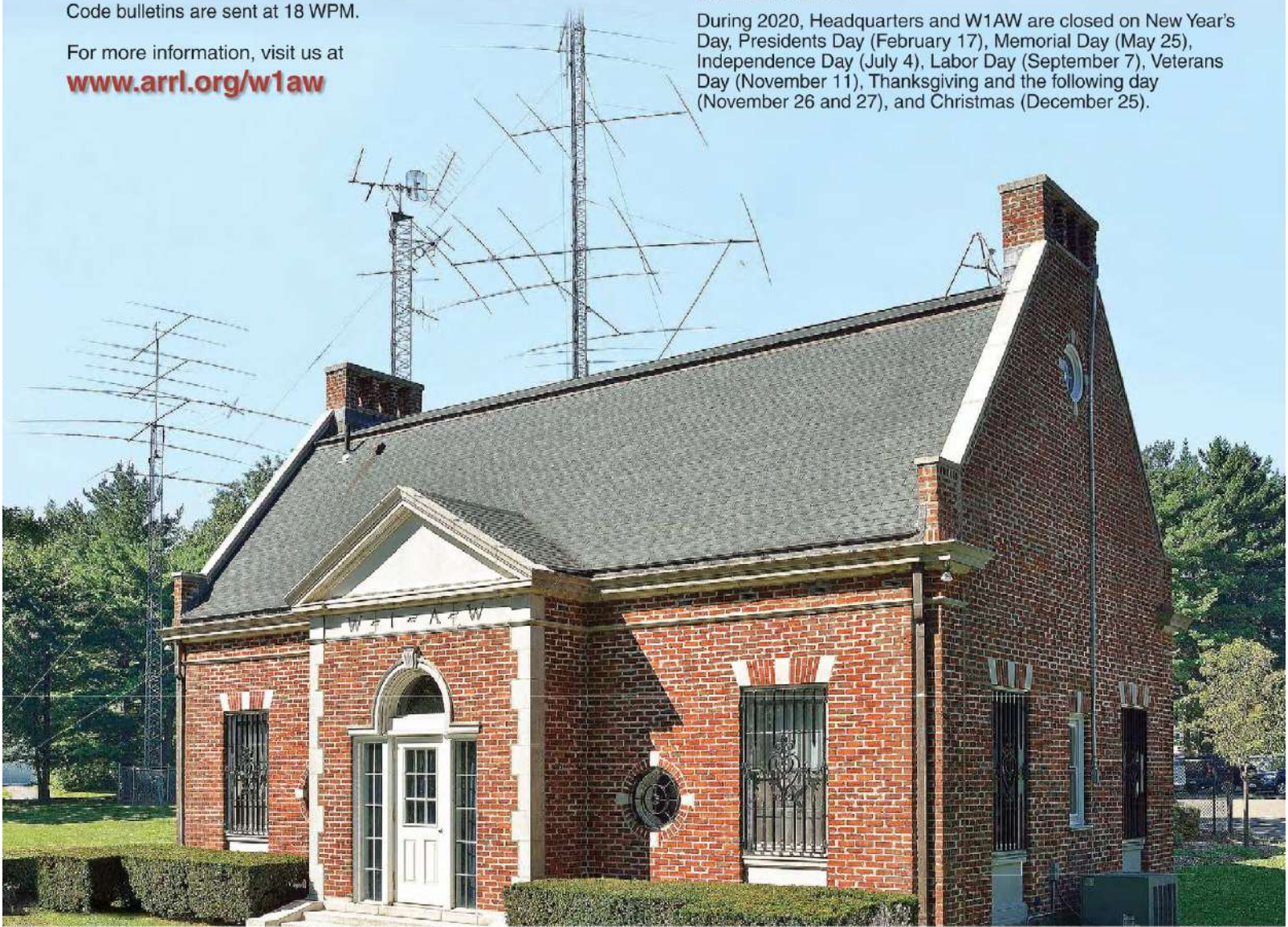
Keplerian elements for many amateur satellites will be sent on the regular digital frequencies on Tuesdays and Fridays at 6:30 PM Eastern time using Baudot and PSK31.

♦ Voice transmissions: Frequencies are 1.855, 3.99, 7.29, 14.29, 18.16, 21.39, 28.59, 50.350, and 147.555 MHz. Voice transmissions on 7.290 MHz are in AM double sideband, full carrier.

♦ Notes: On Fridays, UTC, a DX bulletin replaces the regular bulletins. W1AW is open to visitors 10 AM to noon and 1 PM to 3:45 PM Monday through Friday. FCC-licensed amateurs may operate the station during that time. Be sure to bring your current FCC amateur license or a photocopy. In a communication emergency, monitor W1AW for special bulletins as follows: voice on the hour, teleprinter at 15 minutes past the hour, and CW on the half hour.

W1AW code practice and CW/digital/phone bulletin transmission audio is also available real-time via the *EchoLink Conference Server* W1AWBDCT. The conference server runs concurrently with the regularly scheduled station transmissions. The W1AW Qualifying Run texts can also be copied via the EchoLink Conference Server.

During 2020, Headquarters and W1AW are closed on New Year's Day, Presidents Day (February 17), Memorial Day (May 25), Independence Day (July 4), Labor Day (September 7), Veterans Day (November 11), Thanksgiving and the following day (November 26 and 27), and Christmas (December 25).



Adrian Ciuperca, KO8SCA, ciup@yahoo.com

Bhutan
The Land of the Thunder Dragon

As the plane approached Bhutan after a 3-hour flight from Bangkok, Thailand, I gazed in awe through the airplane window at the snow-capped, majestic peaks of the eastern ridges of the Himalayan Mountains. Although the altitude of the plane was 11,000 meters, it felt as if the wings almost touched the mountain peaks. It was an unforgettable sight.

Prince Dasho Jigyel Ugyen Wangchuck (center) operated using his call sign, A5B, with input from Zorro, JH1AJT (right), while Adrian Ciuperca, KO8SCA, looked on (left). [Max Van-Rymenant, ON5UR, photo]

The Royal Thimphu College Station

Our A5ØBOC DXpedition team included team leader Zorro Miyazawa, JH1AJT; operators Champ Muangamphun, E21EIC; Franz Langner, DJ9ZB; Max Van Rymenant, ON5UR, and myself (Adrian, KO8SCA). We operated from Bhutan between December 11 and 20. Royal Thimphu College (**www.rtc.bt**) was our comfortable home for 10 days. It's the first private college in Bhutan and houses a radio club and a few radio towers with antennas for multiple bands. The club was created to give Bhutanese college students exposure to ham radio.

The noise level on campus was S-7/S-8, so we moved the Beverage antenna a few times (further into the forest) to find a spot that decreased it to about S-2/S-3, which increased our chances of working weak stations.

Although the temperatures outside were low, we were lucky to have had good weather to install the new antennas. A few young Bhutanese men interested in amateur radio helped us tremendously with the antenna installation.

Much of the radio equipment was donated by SEISA Group, founded and run by Zorro. During his visits to Bhutan over the years, Zorro brought additional equipment for the radio club, and built an impressive arsenal of radios and antennas to help overcome the difficulties that arise from trying to make contacts from a country surrounded by the tallest mountains in the world. Together with Zorro, Champ has visited Bhutan 15 times. He knows the details of the location, the antennas, and the radio equipment, which allowed the team to start operating during the first day of our arrival.

Zorro obtained Bhutanese personal amateur radio licenses and call signs for all DXpedition team members, as well as privileges to operate in the 60-meter band for the first time from Bhutan. The team made over 1,000 contacts on 60 meters.

Our Team Leader

In his capacity as the official Olympic Consultant to Bhutan, Zorro had daily meetings with the Bhutanese officials, but he always found time to enjoy operating, especially at night and on the 160-meter band openings to Japan. Zorro has been

visiting Bhutan for many years, and through his position as CEO of SEISA and FGC (the Foundation for Global Children), he's helping them qualify and participate in the Olympic Games, taking place in Tokyo, Japan this year.

Bhutan participated in the 1984 Los Angeles Olympic Games as a wild card, but with Zorro providing access to trainers and infrastructure, one Bhutanese archer was able to qualify for the 2020 Olympic Games in Tokyo.

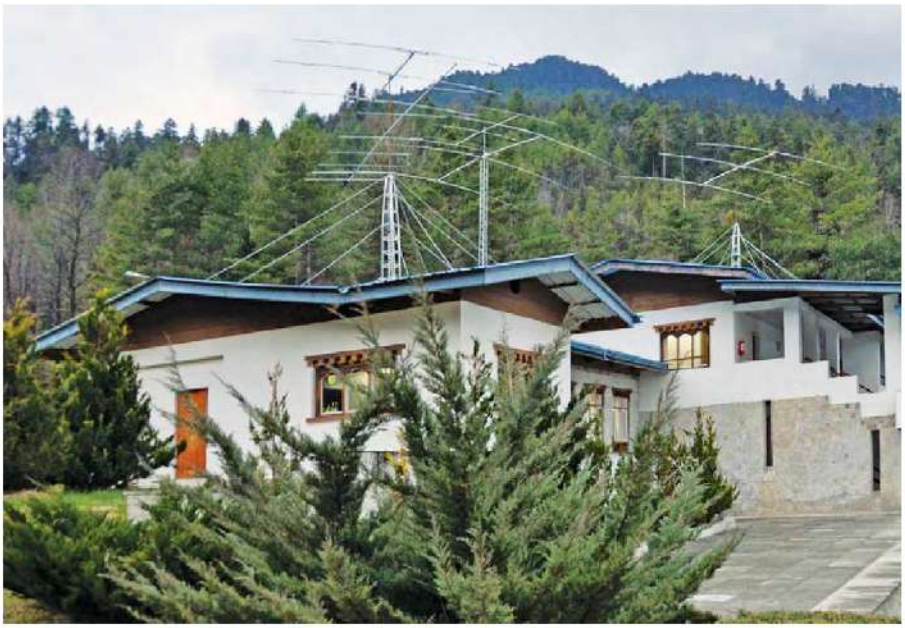
In addition, Zorro has supported the establishment of the Paralympic Committee and development of para-athletes in Bhutan. The Bhutan Paralympic Committee is working on the development of youth participation in the Paralympic Games, which Zorro helped the country compete in for the first time.

Our DXpedition special event call signs were A5ØBOC and A5ØBPC (BOC stands for Bhutan Olympic Committee and BPC stands for Bhutan Paralympic Committee).

A Royal Visit

The highlight of our DXpedition was the visit of Bhutan Prince Dasho Jigyel Ugyen Wangchuck, Princess Ashi Euphelma Choden Wangchuck, and their entourage to the Royal Thimphu College Radio Club station. On December 18, 2019, the prince, who is the half-brother of the King of Bhutan and a good friend of Zorro, spent some time on the radio with Zorro's guidance to make contacts with Thai amateur operators using his own call sign, A5B.

The army personnel and security detail with the prince's entourage were interested in ham radio too, so our team explained how it works and how it differentiates from the radio communication that the army uses.



With Zorro's, JH1AJT, help, the Royal Thimphu College Radio Club now has a few towers and antennas. [Adrian Ciuperca, KO8SCA, photo]

The DXpedition team presented the prince with memorabilia connected to the activation of Bhutan with the call signs A5ØBOC and A5B, as well as a copy of the book *DX World Guide*, written by Franz.

Zorro presented the prince with an impressive gift: a 236-year-old Japanese samurai sword made by a famous Japanese swordsmith. This generosity was partly in response to the gift Zorro received from the prince during his previous visit to Bhutan: a traditional Bhutanese Patang sword, made for the King of Bhutan.

Bhutan on the Air

Our biggest challenge on low bands was the constant RF noise. After much trial and error with our antennas, we overcame this obstacle toward the end of the DXpedition.

Our main goals were achieved: putting all continents (including North America) in the low bands in our log, improving the radio club station with additional equipment and antennas, and operating for the first time in the 60-meter band.

But above all, having fun with radio and making new friends is the best outcome of any DXpedition, and A5ØBOC was no exception to this rule. The club station is still there, and Zorro and his team will continue to visit Bhutan a few times a year, adding this rare entity to many logs.

Strays

Wanted: Vintage Tektronix Gear and Other Items

The vintageTEK museum is looking for the following items:

- 517 oscilloscope
- 570 curve tracer
- T4002, 4006, 4014, and 4081 terminals
- 909 Scientist calculator peripherals
- Tek STS (Semiconductor Test System)
- DuMont 248A oscilloscope
- Eastern Bloc clones of Tektronix oscilloscopes (Russia, Hungary, etc.)

Email Dave Brown at **contactus@vintagetek.org**, or call 503-644-0161.

Jon Jones, NØJK, n0jk@arrl.org

The 2020 Quadrantid Meteor Shower

The New Year started off with the Quadrantid meteor shower. This is one of the major meteor showers of the year, rivaling the Perseids and Geminids with peak rates of over 100 meteors per hour at times. Due to its short peak of less than 6 hours, the "Quads" can be difficult for ping jockeys to use. Often the radiant (the point in the sky where meteors appear to originate from) of this meteor shower is below the horizon at the peak, and therefore it's unusable.

In 2020, the International Meteor Organization predicted the Quadrantids peak would be around 0820Z on January 4. The timing would be favorable, with the radiant above the horizon for both visual observers and those working meteor scatter by reflecting their signals off the ionized meteor trails in Europe and eastern North America. Hope was high for good results.

Figure 1 — Larry, NØLL, operated portable on 50 MHz in grid EN02 for the 2020 Quadrantid meteor shower on January 4. [Larry Lambert, NØLL, photo]

Quadrantid Shower Peak

Larry Lambert, NØLL, was on a grid expedition for this meteor shower, setting up in rare grid EN02 in northern Nebraska (see Figure 1). He planned to be on the air around 0550 CST (1150Z) at Rich Schindler Flying Service Airport in Neligh, Nebraska. His station consisted of a Kenwood TS-690 transceiver with 50 W amplifier, and a three-element Yagi up about 15 feet on a pole.

While Larry was making his preparations, I went to bed early, setting my alarm clock for 0150 CST (0750Z) to catch the peak. When I checked 50.260 MHz, the MSK144 calling frequency, there was no activity. I put out a few CQs. KØTPP (EM48) reported on Ping Jockey (**www.pingjockey.net**) that he had good decodes from me. But there were still no takers.

I thought maybe the peak would be later. At 1200Z, there was good activity on 50.260 MHz, with many decodes on NØLL/P in EN02. I made an MSK144 contact with Larry at 1227Z. Larry made about 20 contacts on 50 MHz MSK144 meteor scatter. He shared his account, saying:

> It was 18 °F at the airport when I got there around 5:10 AM. Rich led me on his private taxiway. My first contact was at 1152Z with KØTPP (EM48). The SWR was too high, but I went with it for a while. A lasting impression I keep thinking about is how much stronger the meteor scatter signals from Minnesota and Wisconsin were in EN02 than in EM09. Just closer to the 8 and 9s, I guess.

But the Quadrantid shower peak remained somewhat of a mystery. The International Meteor Organization analyzed visual observations, and reported that the shower peak occurred around 0400Z at a zenith

hourly rate (ZHR) of 90. This was almost 4 hours before the prediction. Unfortunately, at that time, the shower radiant was below the horizon for North America. By 0800Z, when the shower radiant had climbed above the horizon in North America, the observed ZHR had dropped to 40. And at 1200Z, the ZHR was only 20. But this is still higher than the normal daily random meteor rate, so MSK144 operators were able to do well.

6-Meter Meteor Scatter Grid Expeditions

NØLL, KE7NR, ACØRA, K5ND, W5VY, KG5CCI, W7D/R, and others have done well on meteor scatter operating from rare grids. Six meters is the most popular band, but you can also be successful on meteor scatter on 144 and 222 MHz, while portable. This is a great group activity. The most popular meteor shower for this is the Perseids in August.

Over 25 years ago, John, KFØM, NØFFO, myself, and others operated portable in northeast New Mexico (DM85/DM86) during the Perseids. Using SSB, we completed many meteor scatter contacts on 50, 144, and 222 MHz. Warm weather and a predictable 2-day peak almost guarantee success during the Perseids. If you are interested in trying portable meteor scatter this spring, the Lyrid meteor shower (peaking April 21 – 22 night) and Eta Aquarids, which peak May 4 – 5, are worth trying. Small Yagis on 50 and 144 MHz and 100 W work well on MSK144. For 222 MHz, higher power helps.

Larry concluded, "Portable operating from rare grids is stirring in my blood."

On the Bands

50 MHz. The Winter North America sporadic-E season seemed to take a break from Christmas through the first week of the New Year. Sporadic E came roaring back on January 8 – 10 (see Figure 2). Six meters was open all afternoon from the Midwest to the east coast on through the evening on January 8. At 0032Z on January 9, I (EM19) logged KN4NN (EM70) while running only 10 W to a quarter-wave whip fixed mobile on FT8. Mike, K7ULS (DN41), worked east to Florida. Javan, N8JLM (EM97), reported 23 FT8 contacts, running 100 W on January 8 and 9. WA2GFN made 14 SSB contacts through the Midwest on January 10.

Figure 2 — The best 6-meter sporadic-E opening on 50 MHz on January 9, 2020. It covered the eastern half of North America for hours. [**dxmaps.com**]

On January 14, Lance, W7GJ, worked YB2MDU via JT65 EME for Lance's 219th 6-meter DXCC entity. YB2MDU runs 500 W to a 10-element YU7EF Yagi.

Sporadic-E appeared in the January VHF Contest. KFØM (EM17) worked XE1H (DL80) on Saturday afternoon. There was weak sporadic E on Sunday evening (January 19) to the northeast states, with KR1ST (FN21) going in my log at 2309Z on FT8.

144 MHz. Tropospheric propagation appeared in the Midwest the morning of January 14 with unseasonably warm, foggy weather. From Dallas, K5ND (EM12) logged XE2OR (DL98), KFØM (EM17), KØTPP (EM48), AA9MY (EN50), and KA9CFD (EN41) on 144.174 MHz FT8 with just 90 W to an "eggbeater" antenna. XE2OR worked as far northeast as KØTPP and Illinois. John, KFØM (EM17), worked into Texas as far as N5AG (EM01). He noted most of the activity was on FT8, and the ON4KST chat page helped coordinate contacts. Tropo was present again the next day (January 15) for KFØM to KF4WE (EM56) on SSB.

432 MHz. KFØM (EM17) worked W5LUA (EM13) on FT8 on January 14.

Special Event Stations

Working special event stations is an enjoyable way to help commemorate history. Many provide a special QSL card or certificate!

Through Dec. 31, 0000Z – 2359Z, W5YD, Mississippi State, MS. W5YD Mississippi State University Amateur Radio Club. **W5YD Centennial Celebration**. 80, 40, 20, and 17 meters. QSL. Mississippi State University Amateur Radio Club, Dept. of Physics & Astronomy, P.O. Box 5167, Mississippi State, MS 39762-5167. *Original call sign was 5YD in 1920 when the University was still Mississippi A&M, and ham radio licenses were issued by the Dept. of Commerce. Please be patient, as this is a student-run club.* **www.w5yd.org.msstate.edu**

Through Dec. 31, 0000Z – 2359Z, various call signs, various cities, IA. Great River Amateur Radio Club. **Iowa State Parks On the Air Centennial Celebration**. All bands, all frequencies, as available. Certificate & QSL. IASPOTA-2020, c/o Great River Amateur Radio Club, P.O. Box 1384, Dubuque, IA 52004. *Members will operate with their own call signs from state parks throughout Iowa. Operating as time permits, mostly weekends. QSL for contact; certificate for five parks. See website for complete information.* **www.w0dbq.org/iaspota**

Mar. 13 – Mar. 16, 1800Z – 0600Z, K5B, Las Cruces, NM. Mesilla Valley Radio Club. **Bataan Memorial Death March**. 147.180 +(100) Mega Link talk-in; 147.350 +(100) Mega Link talk; 7.070 USB; PSK31 40-meter night: 20-meter day; 14.250 voice 20-meter day, 40-meter night. QSL. Mesilla Valley Radio Club, P.O. Box 1443, Las Cruces, NM 88004. **www.n5bl.org**

Mar. 16 – Mar. 22, 0000Z – 2359Z, W1L, Boothbay Harbor, ME. Boothbay Harbor Memorial Library. **Maine Bicentennial Special Event**. 14.262 7.262 3.962. Certificate. Via email, **director@bbhlibrary.org**, or from website, **www.bbhlibrary.org**. *W1L will be operating from Boothbay Harbor, ME. Other participating calls include K1B, K1J, K1P, W1C, W1H, W1K, W1L, W1O, W1P, W1S, W1W, and W1Y. Certificate for contact; endorsements for bands, modes, and clean sweep of contact with each of the Maine 200 Special Event call signs. Bicentennial information:* **www.maine200specialevent.com;** *W1L information:* **n1mhc@arrl.net** *or* **www.bbhlibrary.org**

Mar. 28, 1400Z – 2100Z, N4H, Daviston, AL. Lake Martin Amateur Radio Club. **Battle of Horseshoe Bend (Creek Indian War) Anniversary**. 14.250 7.280 3.850. Certificate & QSL. John Philips, P.O. Box 938, Alexander City, AL 35011. *[Note date change from March listing.]* **www.facebook.com/K4YWE/** *or* **www.qrz.com/db/n4h**

Mar. 29, 1630Z – 2130Z, W5KID, Baton Rouge, LA. Baton Rouge Amateur Radio Club. **Vietnam War Veterans Day**. 14.250 14.035 7.225 7.035. QSL. USS *Kidd* Amateur Radio Club, 305 S. River Rd., Baton Rouge, LA 70802.

Mar. 31 – Apr. 5, 1400Z – 2100Z, W4S, Lakeland, FL. Sun-n-Fun. **Sun-n-Fun International Fly-In and Conference**. 14.250. QSL. Tom Ruhlmann, W9IPR, 465 Beechwood Dr., Cedarburg, WI 53012. **www.sun-n-fun.org**

Apr. 8 – Apr. 15, 0000Z – 0000Z, K9L, Springfield, IL. Sangamon Valley Radio Club. **Remembering the Lincoln Assassination — 155th Year**. All modes, all bands. 14.250 14.070 7.270 3.860. QSL. K9L c/o Mitch Hopper, 536 E. Mill St., Rochester, IL 62563. **www.svrc.org/k9l**

Apr. 14 – Apr. 15, 1540Z – 0100Z, AL4US, Pigeon Forge, TN. American Legion Post 104 Amateur Radio Club. **Sinking of the *Titanic* — 108th Anniversary**. 14.280 7.180 14.280. QSL. AL4US, c/o American Legion Post 104, P.O. Box 4242, Sevierville, TN 37864. **www.tnpost104.org**

Apr. 15 – Apr. 30, 0500Z – 0000Z, W4M, Glade Hill, VA. Whiskey 4 Moonshine. **Franklin County Virginia Moonshine Heritage Month**. All standard digital frequencies; phone: 28.400 21.300 14.250 7.215 3.850 1.900; CW: 28.100 21.105 14.050 7.050 3.550. QSL. Bryant Johnson, P.O. Box 103, Glade Hill, VA 24092. **www.facebook.com/groups/2476533519124786**

Apr. 18, 0800Z – 1400Z, W8TFC, Richwood, WV. The Family Center Amateur Radio Club. **2020 Feast of the Ramson**. 147.015 14.220 7.220 3.820. Certificate. W8TFC, 3 Valley Ave., Richwood, WV 26261. Certificates will be provided via email **www.thefamilycenterofrichwoodwv.org/Ham/default.html**

Apr. 18, 1400Z – 1900Z, W4HZL, Gloucester, VA. Middle Peninsula Amateur Radio Club. **Walter Reed Special Event**. 14.260 7.260. QSL. QSL Manager, W4HZL, P.O. Box 1121, Gloucester Point, VA 23062. **www.mparc.net**

Apr. 18, 1500Z – 2000Z, W8PRC, Cleveland, OH. Parma Radio Club. **8th Annual Earth Day**. 145.410 14.245 7.195. QSL. Parma Radio Club, 8111 Laumar Ave., Cleveland, OH 44105. **www.parmaradioclub.com**

Apr. 18, 1600Z – 2100Z, W5BMC, Franklin, LA. Bayouland Emergency Amateur Radio Service. **Franklin, Lousiana Bicentennial, in Conjunction with the Bayou Teche Black Bear Festival and Wooden Boat Show**. 14.250 7.250. QSL. Jackie Price, 708 Front St., Morgan City, LA 70380.

Apr. 18, 1600Z – 2100Z, K7T, Tucson, AZ. Oro Valley Amateur Radio Club. **The Safe Return of *Apollo 13* — 50th Anniversary**. CW 14.040 7.040; USB 14.250; FT8 18.100. Certificate. Send request to **qsl@tucsonhamradio.org**. *No paper QSLs please.* **www.tucsonhamradio.org**

Apr. 18 – Apr. 19, 0900Z – 1700Z, N1M, Westport, CT. Connecticut ARES. **Maker Faire Connecticut**. 14.225. Certificate. NA1RA, P.O. Box 354, New Milford, CT 06776. **www.ctares.org**

Apr. 18 – Apr. 19, 1200Z – 1200Z, W7W, Ogden, UT. Nevada Amateur Radio Repeaters, Inc. **World Amateur Radio Day**. HF frequencies; EchoLink conference *World* 479886 IRLP 9251 VoIP. Certificate & QSL. Thomas Harrington, 636 W. 24th St., Ogden, UT 84401. **wrn-wfn.com**

Apr. 18 – Apr. 19, 1600Z – 0400Z, W2W, Rochester, NY. DoDropin Echolink Conference Node 355800 Allstar Node 47620. **World Amateur Radio Day 2020**. 446.025. Certificate & QSL. John Derycke, W2JLD, 85 Amherst St., Apt. 2, Rochester, NY 14607. **w2jld2@gmail.com**

Apr. 18 – Apr. 20, 1400Z – 0200Z daily, K5LRK, The Colony, TX. Lake Area Amateur Radio Klub. **Activation of State Parks in the State of Texas**. CW bottom of band +40 kHz; phone, general segment +25 kHz and 28.350; VHF, 50.200 and 144.200 MHz. QSL. Ken Rainy, AC3EZ, 529 Kenilworth Ave., Little Elm, TX 75068. **www.k5lrk.com**

Apr. 22, 1500Z – 2100Z, W2NPT, Paterson, NJ. Fair Lawn Amateur Radio Club. **Earth Day at Great Falls National Historical Park**. 14.245 14.045 7.245 7.045. QSL. Fair Lawn

Amateur Radio Club, 10-10 20th St., Fair Lawn, NJ 07410. **www.fairlawnarc.org**

Apr. 24 – Apr. 26, 1800Z – 2359Z, W2P, Brooklyn, NY. James Gallo/Ten Mile River Scout Museum Amateur Radio Club. **West Point Military Academy 58th Annual Scout Camporee.** 21.358 14.258 7.258 3.858. QSL. James Gallo, 149 Marine Ave., Brooklyn, NY 11209.

Apr. 25, 0000Z – 2359Z, W4S, Fernandina Beach, FL. Cornish Radio Amateur Club. **International Marconi Day**. 7.200. Certificate & QSL. Brian Page, 1717 Tidewell Trce., Lawrenceville, GA 30043. *W4S will operate from Fernandina Beach, Florida, site of the 1911 Marconi Company Station MSF, an official Marconi Station. QSL from W4S for single contact. A certificate from the Cornish Radio Amateur Club is offered for operators establishing contact with 15 official IMD stations. Details are on their website.* **www.gx4crc.com/gb4imd**

Apr. 25, 1300Z – 1900Z, W1M, Russell, MA. Western Mass Council Scouting USA. **SCOTA/WHOA**. 14.290 14.060 7.190 7.060. QSL. Tom Barker, 329 Faraway Rd., Whitefield, NH 03598. *Paper logging is used; there will be a delay in sending out QSL cards.*

Apr. 25 – Apr. 26, 1400Z – 2200Z, W8G, Chardon, OH. Geauga Amateur Radio Association. **Chardon Maple Festival**. 14.250. QSL. Larry Shimerka, 965 Primrose Dr., Seven Hills, OH 44131. **www.geaugaara.org**

Apr. 25 – Apr. 26, 1500Z – 2300Z, K5T, Nacogdoches, TX. Nacogdoches Amateur Radio Club. **San Jacinto Day Special Event**. 14.260 14.174 7.220 7.174. QSL. Army Curtis, 167 County Rd. 2093, Nacogdoches, TX 75965. *All contacts will be confirmed via LoTW.* **www.w5nac.com**

Certificates and QSL cards: To obtain a certificate from any of the special event stations offering them, send your QSO information along with a 9 × 12-inch self-addressed, stamped envelope (three units of postage) to the address listed in the announcement. To receive a special event QSL card (when offered), be sure to include a self-addressed, stamped business envelope along with your QSL card and QSO information. *Note: Some clubs may ask for a nominal fee to cover the cost of the certificate or QSL. Request will be made on air during the event or on the club's website.

Special Events Announcements: For items to be listed in this column, use the ARRL Special Events Listing Form at **www.arrl.org/special-events-application**. A plain-text version of the form is available at that site. You may also request a copy by mail or email. Off-line completed forms can be mailed, faxed (Attn: Special Events), or emailed.

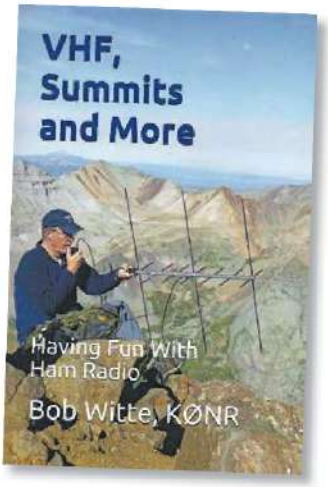
Submissions must be received by ARRL HQ no later than the 1st of the second month preceding the publication date; a special event listing for **July** *QST* would have to be received by **May 1**. In addition to being listed in *QST*, your event will be listed on the ARRL Web Special Events page. Note: All received events are acknowledged. If you do not receive an acknowledgement within a few days, please contact us. ARRL reserves the right to exclude events of a commercial or political nature.

You can view all received Special Events at **www.arrl.org/special-event-stations**.

New Books

VHF, Summits and More — Having Fun with Ham Radio

Bob Witte, KØNR
Reviewed by Rick Lindquist, WW1ME



VHF, Summits and More is an informative and enjoyable read, especially for newcomers to ham radio. Its emphasis leans toward having fun with ham radio. It's an excellent — and lightly humorous — tutorial for someone holding a new Technician-class license who isn't quite sure how to proceed. Witte busts a few myths and misconceptions about how amateur radio should be done. His main point: "The universal purpose of ham radio is to have fun messing around with radios." (Witte does not discount the "serious side" of ham radio — public service communication.)

The book is in essentially three parts — the first chapters cover the basics of getting on the air, VHF and UHF FM and SSB, using repeaters, operating technique, and VHF contesting, while the second half consists of his blog posts that cover a wide range of amateur radio lore, some of it not exclusive to VHF and UHF. The final section focuses on the Summits on the Air (SOTA) program.

Witte tackles what he characterizes as "The Myth of VHF Line of Sight" (and wrote an article for *NCJ*'s January/February 2020 issue on the topic). Beginners are typically told that VHF propagation is line of sight. But, he notes, "exotic" propagation modes can extend a signal's reach considerably. He points out that VHF signals don't just stop at the radio horizon but continue to propagate, albeit at a far weaker signal strength. As he points out several times, citing George E. P. Box, "All models are wrong, but some are useful." With more power and/or better antennas, a VHF operator can be heard at far greater distances, he says.

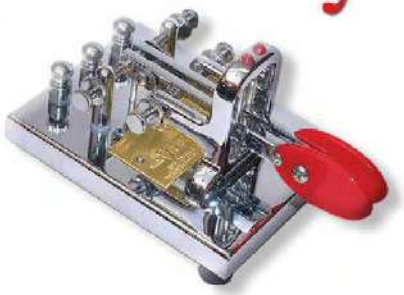
Witte spends the final chapters discussing Summits on the Air and how to carry out a SOTA activation, but the greatest value to his book comes in the form of various hints, tips, and perspectives he offers, peppered with his own philosophy of enjoying ham radio. Newcomers and veterans alike will find something of value in Witte's book.

VHF, Summits and More — Having Fun with Ham Radio, Signal Blue LLC, Monument, Colorado, 2019; ISBN 978-1478298519, softcover, 6 × 9 inches, 352 pp. Available from **Amazon.com**. Softcover, $12.12, Kindle edition, $9.99.

Certificate of Code Proficiency

Recipients

Sponsored by VIBROPLEX
www.vibroplex.com



This month, ARRL and Vibroplex recognize merit and progress in Morse code proficiency on the part of the following individuals, who have achieved proficiency at the following rates, in words per minute.

December 2019

Thomas P. Baxter, W9TPB	10
Benjamin M. Cahill, III, AC2YD	10
James T. Griffin, N4JG	10
Martin Hickey, AJ6CL	10
Steve M. Kuzyszyn, KB2WQ	10
Willis S. Stricklin, KØSMK	10
Gerald E. Trimble, Jr., KG8HZ	10
Philip Burrington, W7ZIP	15
Paul Leon Castonguay, KC1LBL	15
Cesidio DiBenedetto, Jr., KD8OOB	15
Steven G. Fein, KM6VOV	15
Paul A. Miller, W5RES	15
Dennis J. Niles, WV7S	15
Gregory L. Rix, WB7GR	15
Stanford H. Rowe, K6VWE	15
Otto P. Altobelli, K2BY	20
Thomas H. Beebe, W9RY	20
Robert S. Boles, WB4SED	20
Lynn R. Landin, WBØU	20
Dennis M. Markell, N1IMW	20
David J. O'Farrell, WBØIXV	20
Harold E. Fox, K7SAX	30
Gilbert D. Woodside, III, WA1LAD	35
Richard T. Boswell, II, K4CUE	40

January 2020

Floyd E. Cureton, Jr., WO5S	10
John M. Dziedziejko, W9QP	10
David C. Hustvedt, KØDCH	10
Mahlon G. Justice, Jr., WF5J	10
Marlo Montanaro, KA2IRQ	10
Michael A. Penzo, WM4X	10
David P. Shugar, KD8EVN	10
Gerald D. Thomas, AG7GZ	10
Warren D. Zimmer, KC7ND	10
Scott J. Bertrand, AI4TT	15
Michael W. Geoghegan, KX6A	15
James T. Griffin, N4JG	15
Robert L. Heider, WØEJO	15
Ishan Kumaraswami, AC2MX	15
James D. Russ, AB4KA	15
Philip Burrington, W7ZIP	20
Glen S. Johnstone, NK1N	20
Harry McAlister, VE3HMF	20
Peter Van Eenenaam, KD2OMV	20
David W. Rice, AD8WR	20
Carl W. Davis, W8WZ	25
Robert E. Gardner, Jr., WA8PCW	25
Carl J. Sibilski, III, KB9DKR	25
Eugene J. Suslowicz, AD4UB	30

February 2020

Kristopher P. Davis, N5KPD	15
Frank P. Arciuolo, W1ZAH	25
Michael P. Malone, N5WNG	25
Kurt T. Meyers, W8IQ	30
Thadeus H. Niemira, K6TET	40

Congratulations to all the recipients.

April 2020 W1AW Qualifying Runs

W1AW, the Hiram Percy Maxim Memorial Station at ARRL Headquarters in Newington, Connecticut, transmits Morse code Qualifying Runs to assist ham radio operators in increasing and perfecting their proficiency in Morse code. Amateur radio operators can earn a Certificate of Code Proficiency or endorsements by listening to W1AW Qualifying Runs.

April Qualifying Runs will be transmitted by W1AW in Newington, Connecticut at the times shown at 1.802.5, 3.581.5, 7.047.5, 14.047.5, 18.097.5, 21.067.5, 28.067.5, 50.350, and 147.555 MHz. The West Coast Qualifying Runs will be transmitted by KH6TU on Wednesday, April 22 at 6 PM HST (0400 UTC on April 23) on 7047.5 and 14047.5 kHz. Unless indicated otherwise, sending speeds are from 10 to 40 WPM.

Amateur radio operators who participate in Qualifying Runs may submit proof of 1 minute of the highest speed they have copied in the hope of qualifying for the Certificate of Code Proficiency, or an endorsement to their existing certificate.

Legibly copy at least 1 minute of text by hand, and mail the sheet to: W1AW Qualifying Runs, 225 Main St., Newington, CT USA 06111.

Include $10 (check or money order) if this is a submission for your initial Code Proficiency certificate; $7.50 if you are applying for an endorsement (available for speeds up to 40 WPM). Your test will be checked against the actual transmissions to determine if you have qualified.

For more information about Qualifying Runs, please visit **www.arrl.org/qualifying-run-schedule**.

For information about how to qualify for the Certificate of Code Proficiency, please visit **www.arrl.org/code-proficiency-certificate.**

W1AW Code Proficiency Schedule — April 2020
(All times in Eastern Daylight Time, unless otherwise noted.)

Monday	Tuesday	Wednesday	Thursday	Friday
4/6 4 PM – 2000Z 10 – 35 WPM	**4/7** 7 PM – 2300Z 35 – 10 WPM		**4/9** 10 PM – 0200Z **(4/10 – UTC)** 10 – 40 WPM	
	4/14 4 PM – 2000Z 10 – 35 WPM	**4/15** 7 PM – 2300Z 10 – 40 WPM	**4/16** 9 AM – 1300Z 35 – 10 WPM	**4/17** 10 PM – 0200Z **(4/18 – UTC)** 10 – 35 WPM
	4/21 9 AM – 1300Z 10 – 35 WPM	**4/22** 10 PM – 0200Z **(4/23 – UTC)** 35 – 10 WPM	**4/23** 7 PM – 2300Z 10 – 35 WPM	**4/24** 4 PM – 2000Z 10 – 40 WPM
4/27 10 PM – 0200Z **(4/28 – UTC)** 10 – 40 WPM		**4/29** 9 AM – 1300Z 35 – 10 WPM	**4/30** 4 PM – 2000Z 35 – 10 WPM	

Convention and Hamfest Calendar

Abbreviations

Spr = Sponsor
Tl = Talk-in frequency
Adm = Admission

Alabama (Headland) — Apr. 25 T V
8 AM – 12:30 PM. *Spr:* Wiregrass ARC. Headland Town Square, 9 Park St. *Tl:* 145.43 (186.2 Hz). *Adm:* Free.

Alabama (Mobile) — Apr. 25
D H Q R S V
8 AM – 2 PM. *Spr:* Mobile ARC. Abba Shrine Center, 7701 Hitt Rd. *Tl:* 146.82 (203.5 Hz). *Adm:* $5. **www.w4iax.net**

Alabama (Northport) — May 2
D F H Q R S T V
8:30 AM – 2:30 PM. *Spr:* Black Warrior Hamfest Assn. Tuscaloosa County High School, 12500 Wildcat Dr. *Tl:* 145.35 (91.5 Hz). *Adm:* Advanced $8, door $10. **www.blackwarriorhamfest.org**

Arizona (Phoenix) — Apr. 11
D F H Q R T V
7 – 11 AM. *Sprs:* Arizona ARC, Arizona Red Cross Communications Club. DeVry University, 2149 W. Dunlap Ave. *Tl:* 147.06 (162.02 Hz). *Adm:* $2. **www.w7io.org**

ARIZONA STATE CONVENTION

May 8 – 9, Prescott Valley, AZ
D F H Q R S T V
8 – 11 AM. *Spr:* Yavapai ARC. Arizona Downs, 10501 N. State Rte. 89A. *Tl:* 146.88. *Adm:* $5.

Arizona (Sierra Vista) — May 4 D F R T V
7 AM – 2 PM. *Spr:* Cochise ARA. Cara Green Acres, 2756 Moson Rd. *Tl:* 146.76 (162.2 Hz). *Adm:* Free. **www.k7rdg.org**

California (Sonoma) — Apr. 25
D F H R S T V
8 AM – noon. *Spr:* Valley of the Moon ARC. Sonoma Veterans Memorial Hall, 126 First St. W. *Tl:* 145.35 (88.5 Hz). *Adm:* Free. **www.vomarc.org**

INTERNATIONAL DX CONVENTION

April 24 – 26, Visalia, CA
D H Q R S
Fri and Sat 8 AM – 4:30 PM, Sun 8 – 11 AM. *Spr:* Southern California DX Club. Wyndham Visalia, 9000 W. Airport Dr. *Tl:* No talk-in. *Adm:* $25. **www.dxconvention.org**

Connecticut (Gales Ferry) — Apr. 25 H R
10 AM – 2 PM. *Spr:* Radio Amateur Society of Norwich. Gales Ferry Firehouse, 1772 Rte. 12. *Tl:* 146.73 (156.7 Hz). *Adm:* $5. **www.rason.org**

Connecticut (Thompson) — Apr. 26 D F V
8 AM – noon. *Spr:* Eastern Connecticut ARA. Raceway Restaurant at Thompson Speedway, 205 E. Thompson Rd. *Tl:* 147.225 (156.7 Hz). *Adm:* $3. **www.ecara.net**

DELAWARE SECTION CONVENTION

April 18, Georgetown, DE
D F H Q R S T V
7:30 AM – 3 PM. *Spr:* Sussex ARA. Cheer Community Center, 20520 Sand Hill Rd. *Tl:* 147.09 (156.7 Hz). *Adm:* $6. **www.radioelectronicsexpo.com**

Florida (DeLand) — Apr. 18 T
8 AM – 1 PM. *Spr:* West Volusia ARS. Lowes Home Store parking lot, 303 E. International Speedway Blvd. *Tl:* 147.315. *Adm:* Free. **www.westvars.org**

Florida (Tampa) — Apr. 18 F H R V
8 AM – 1 PM. *Spr:* Tampa ARC. 22nd St. Park, 7801 N. 22nd St. *Tl:* 147.105 (146.2 Hz). *Adm:* $5. **www.hamclub.org**

Florida (Waldo) — Apr. 18 D F H R T V
8 AM – 2 PM. *Spr:* Gainesville ARS. First Baptist Church of Waldo, 14370 Kennard St. (SR 24). *Tl:* 146.82 -600. *Adm:* Advance $6, door $8. **www.gars.club/hamfest/hamfest.pdf**

Georgia (Resaca) — Apr. 25 D F H R S T V
8 AM – 2 PM. *Spr:* Cherokee Capital ARS. Hill City Baptist Church, 1411 Hill City Rd. NW. *Tl:* 443.675+, 146.745- (100 Hz) 146.685- (167.9 Hz). *Adm:* $5. **www.k4woc.com**

Georgia (Savannah) — Apr. 25 F R T
8 AM – 1:30 PM. *Spr:* Coastal ARS. Savannah Hilton Head Regional Airport Recreation Building, 250 Crossroads Pkwy. *Tl:* 447.2. *Adm:* Free. **coastalamateurradiosociety.net/wpW4LHSblog/?page_id=871**

Illinois (Galesburg) — Apr. 19 F H R T V
8 AM – 3 PM. *Spr:* Knox County ARC. VFW Post 2257, 1001 Michigan Ave. *Tl:* 147.0-600 (103.5 Hz). *Adm:* Advance $4, door $5. **www.w9gfd.com**

Illinois (Sandwich) — May 3 D F H R T
8 AM – 1 PM. *Spr:* Kishwaukee ARC. Sandwich Fairgrounds, 1401 Suydam Rd. *Tl:* 146.73 (100 Hz). *Adm:* Advance $8, door $10. **www.karc-club.org**

Illinois (Sullivan) — Apr. 25 D F R T V
8 AM – 1 PM. *Spr:* Moultrie Amateur Radio Klub. Sullivan IL American Legion, 8 E. Strain St. *Tl:* 146.655/146.055 (162.2 Hz). *Adm:* $5. **www.qsl.net/mark**

Indiana (Peru) — Apr. 25 D H R S V
8 AM – 1 PM. *Sprs:* Cass County, Grant County, Miami County, and Kokomo ARCs. Miami County 4-H Fairgrounds, 1029 W. 200 N. *Tl:* 147.345 (131.8 Hz). *Adm:* $5. **www.nci-hamfest.net**

Iowa (Des Moines) — Apr. 25 D F H R S V
8 AM – 1 PM. *Spr:* Des Moines RAA. Iowa State Fairgrounds, Walnut Center, 3000 E. Grand Ave. *Tl:* 146.94 (114.8 Hz). *Adm:* $10, ages 12 and under are free. **www.dmraa.com/hamfest**

LOUISIANA SECTION CONVENTION

April 18, West Monroe, LA
D F H Q R S V
8 AM – 2 PM. Northeast Louisiana ARC. West Monroe Convention Center, 901 Ridge Ave. *Tl:* 146.85. *Adm:* $5.

MAINE STATE CONVENTION

April 10 – 11, Lewiston, ME
D F H Q R S V
Fri 7 – 9 PM, Sat 8 AM – noon. Androscoggin ARC. Ramada Conference Center, 490 Pleasant St. *Tl:* 146.61 (88.5 Hz). *Adm:* Advance $8, door $10. **www.w1npp.org**

Maryland (Boonsboro) — May 2
D F H Q R S T V
6 AM – 2 PM. *Spr:* Antietam Radio Association. Washington County Ag-Center, 7313 Sharpsburg Pike. The Great Hagerstown Hamfest. *Tl:* 147.09, 146.940 (100 Hz). *Adm:* $7. **https://www.w3cwc.org/hamfest**

Michigan (Cadillac) — May 2 D F H Q R V
8 AM – noon. *Spr:* Wexaukee ARC. Cadillac Junior High School, 500 Chestnut St. *Tl:* 146.98. *Adm:* $5. **www.wexaukeearc.org**

Michigan (Chassell) — Apr. 18 D F H R
9 AM – 1 PM. *Sprs:* Copper Country RAA, Keweenaw County Repeater Association, Baraga County Repeater Association. Chassell VFW, 42103 Wilson Memorial Dr. (US Rte. 41). *Tl:* 147.315 (100 Hz). *Adm:* $3. **www.kcra-mi.net**

Michigan (Kalamazoo) — Apr. 11
D F H R V
8 AM – noon. *Spr:* Southern Michigan ARS. Wings Event Center, 3600 Vanrick Dr. *Tl:* 147.0+600 (94.8 Hz). *Adm:* $7. **www.w8df.com**

Michigan (Madison Heights) — Apr. 19
D H R V
9 AM – 2 PM. *Spr:* GM ARC. Madison Place Convention Center, 876 Horace Brown Dr. *Tl:* 443.075 (123 Hz). *Adm:* $5. **www.gmarc.org**

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V = VE SESSIONS

Minnesota (Brainerd) — Apr. 18
F H Q R V
9 AM – 1 PM. *Spr:* Brainerd Area ARC. Brainerd High School, 702 S. 5th St. *TI:* 147.225. *Adm:* $6. **www.brainerdham.org**

Minnesota (East Grand Forks) — Apr. 25
F H R S V
8 AM – 2 PM. *Spr:* Forx ARC. Heritage Village, 219 20th St. NE. *TI:* 146.94 (123.0 Hz). *Adm:* $7. **www.facebook.com/events/500083697514759**

AURORA '20 CONFERENCE

April 25, White Bear Lake, MN
H Q S T
9 AM – 5 PM. *Spr:* Northern Lights Radio Society. Community of Grace Lutheran Church, 4000 Linden St. *Adm:* $5. **www.nlrs.org**

Missouri (Kansas City) — Apr. 18
D F H R S V
8 AM – 1 PM. *Spr:* Ararat Shrine ARC. Ararat Shrine, 5100 Ararat Dr. *TI:* 145.13 (151.4 Hz). *Adm:* Advanced $10 for three tickets, door $5. **www.hambash.com**

Nebraska (Bellevue) — Apr. 18 F R
8 AM – 1 PM. *Spr:* Bellevue ARC. Masonic Lodge dining hall, 1908 Franklin St. *TI:* 147.06 (131.8 Hz). *Adm:* $5. **www.bellevuearc.org**

New Hampshire (Center Ossipee) — Apr. 18 F R V
9 AM – 1 PM. *Spr:* Lakes Region Repeater Association. Ossipee NH Town Hall, 55 Main St. *TI:* 147.03 (88.5 Hz). *Adm:* $5. **www.w1bst.org**

New Jersey (Succasunna) — Apr. 19
D F H Q R T V
8 AM. *Spr:* Splitrock ARA. Roxbury Senior Center, 72 Eyeland Ave. *TI:* 146.985 (131.8 Hz). *Adm:* $7. **www.splitrockara.org**

New York (Middletown) — May 3
D F H Q R T V
8 AM – 12:30 PM. *Spr:* Orange County ARC. Town of Wallkill Community Center, 7 Wes Warren Dr. *TI:* 146.76 (100 Hz). *Adm:* $6. **www.ocarcny.org**

New York (Palmyra) — Apr. 18 D F H R T
8 AM – 1 PM. *Spr:* Drumlins ARC. VFW Post 6778, 4306 Rte. 31. *TI:* 146.745 (71.9 Hz). *Adm:* $5. **www.drumlinsarc.us**

New York (Rensselaer) — May 9 D R T
8 AM – 1 PM. *Spr:* East Greenbush ARA. E. Greenbush VFD, 68 Phillips Rd. *TI:* 147.27 (94.8 Hz). *Adm:* $6. **www.egara.club**

North Carolina (Kinston) — Apr. 4
D F H R S V
8 AM – 2 PM. *Spr:* Down East Hamfest Association. Lenoir Community College Gymnasium, 231 NC Hwy. 58. *TI:* 146.685 (88.5 Hz). *Adm:* Advance $5 or $12 for three, door $6 or $15 for three.

North Carolina (Morganton) — Apr. 25
D F H R S T V
8 AM – 1 PM. *Spr:* McDowell ARA. Burke County Fairgrounds, 145 Bost Rd. *TI:* 147.15 (948.8 Hz). *Adm:* Advance $4, door $5. **www.cvhamfest.com**

ROANOKE DIVISION CONVENTION

April 11, Raleigh, NC
D F H Q R S V
8 AM – 3 PM. *Spr:* Raleigh ARS. NC State Fairgrounds, Jim Graham Building, 1025 Blue Ridge Rd. *TI:* 146.64. *Adm:* Advance $9, door $10. **www.rarsfest.org**

North Carolina (Reidsville) — May 9
D F H R T
8 AM – noon. *Spr:* Rockingham County ARC. Community Baptist Church, 509 Triangle Rd. *TI:* 147.345 (103.5 Hz). *Adm:* Donations appreciated. **www.n4iv.org**

Ohio (Athens) — Apr. 26 D F H R T V
8 AM – 1 PM. *Spr:* Athens County ARA. Athens Community Center, 701 E. State St. *TI:* 145.15. *Adm:* Advance $5, door $6. **www.ac-ara.org**

Ohio (Cuyahoga Falls) — Apr. 11
D F H Q R V
8 AM – 1 PM. *Spr:* Cuyahoga Falls ARC. Emidio & Sons Banquet Center, 48 E. Bath Rd. *TI:* 147.27+, 444.85+ (110.9 Hz). *Adm:* Advance $5, door $6. **www.cfarc.org/hamfest.php**

Ohio (Portsmouth) — Apr. 18 D H R T V
8 AM – 1 PM. *Spr:* Portsmouth RC. Former National Guard Armory, 2313 17th St. *TI:* 145.39 (136.5 Hz), 444.6. *Adm:* $2. **www.portsmouthradioclub.com**

OKLAHOMA STATE CONVENTION

April 10 – 11, Claremore, OK
D F H Q R S V
Fri 4 – 9 PM, Sat 8 AM – 3:30 PM. *Spr:* Green Country Hamfest. Claremore Expo Center, 400 Veterans Pkwy. *TI:* 147.09+600 (88.5 Hz). *Adm:* Advance $8, door $10. **www.greencountryhamfest.org**

EASTERN PENNSYLVANIA SECTION CONVENTION

May 3, Bristol, PA
D F H Q R S T V
7 AM – 12:30 PM. *Spr:* Warminster ARC. Bucks County Community College, Lower Bucks Campus, 1304 Veterans Hwy. (Rte. 413). *TI:* 147.09 (131.8 Hz). *Adm:* $7. **www.k3dn.org/hamfest**

Pennsylvania (Spring Grove) — Apr. 25
D F H Q R T V
8 AM – 1 PM. *Spr:* York Hamfest Foundation. Elicker's Grove Park, 511 Roth Church Rd. *TI:* 147.33 (123 Hz), 146.58. *Adm:* $5. **www.yorkhamfest.org**

Tennessee (Bartlett) — Apr. 11
D F H Q R S T V
9 AM – 3 PM. *Spr:* Mid-South ARA. Bartlett Station Municipal Center Auditorium, 5868 Stage Rd. *TI:* 147.03,147.63 (107.2 Hz). *Adm:* Free. **www.maraonline.org/freefest**

Texas (Emory) — Apr. 18 D F H T V
8 AM. *Spr:* Rains ARA. Rains County Courthouse, 167 Quitman St. *TI:* 146.92-(88.5 Hz). *Adm:* Free. **www.w5ent.org**

UTAH STATE CONVENTION

May 8 – 9, Orem, UT
D F H S T
Fri noon – 6 PM, Sat 9 AM – 3 PM. *Spr:* Utah Valley ARC. Utah Valley University UCCU Center, 800 W. University Pkwy. *TI:* 146.78 (100 Hz). *Adm:* $10 per person, $15 per family. **www.utahvalleyhamfest.com**

COMMUNICATIONS ACADEMY 2020

April 24 – 26, Seattle, WA
D H R S
8:30 AM – 5 PM. *Sprs:* Seattle ACS, WWA Medical Services, King County ARES, Bellevue ACS. South Seattle College, 6000 16th Ave. SW. *TI:* 147.08 (103.5 Hz). *Adm:* Advance $45 (1 day), $80 (2 days); door $55 (1 day), $90 (2 days). **www.commacademy.org**

MICRO-HAMS DIGITAL CONFERENCE 2020

May 9, Woodinville, WA
H R S
8 AM – 5 PM. *Spr:* MicroHAMS ARC. Brightwater Center, 22505 State Rte. 9 SE. *TI:* 146.58. *Adm:* Advance $45, door $60. **www.microhams.com**

West Virginia (Ripley) — May 3 D F H R V
8 AM – 2 PM. *Spr:* Jackson County ARC. Ripley Middle School, 1 W. School St. *TI:* 146.67 (107.2 Hz). *Adm:* $5.

Wisconsin (Cedarburg) — May 5 D F H R
8 AM – 1 PM. *Spr:* Ozaukee RC. Columbia St. Mary's Center, W67N866 Washington Ave. *TI:* 146.97 (127.3 Hz). *Adm:* $5. **www.ozaukeeradioclub.org**

Wisconsin (Stoughton) — Apr. 18
D F H Q R S V
8 AM – noon. *Spr:* Madison Area Repeater Association. Mandt Community Center, 400 Mandt Pkwy. *TI:* 147.15 (123 Hz). *Adm:* $7. **www.w9hsy.org**

Wisconsin (Superior) — May 2
D F H Q R V
9 AM – 1 PM. *Spr:* Arrowhead RAC. Head of the Lakes Fairgrounds, 4700 S. Tower Ave. *TI:* 146.94 (103.5 Hz). *Adm:* $7. **www.thearac.org**

Wisconsin (Tomahawk) — Apr. 25 F H R
9 AM – 3 PM. *Sprs:* Rhinelander Repeater Assn., Tomahawk Repeater Assn. Sara Park Center, 900 W. Somo Ave. *TI:* 145.43 (114.8 Hz). *Adm:* $5.

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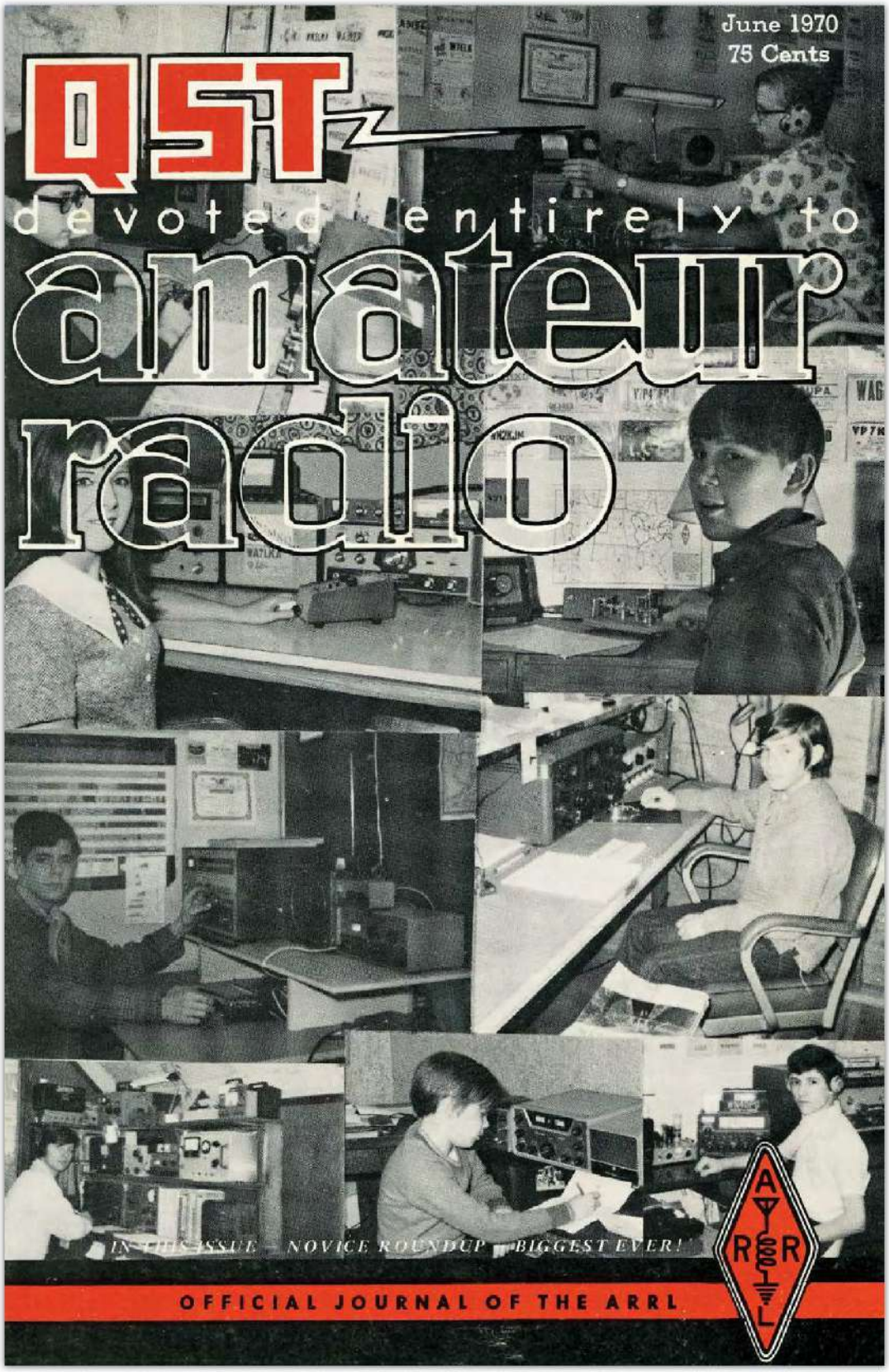
See **www.arrl.org/hamfest-convention-application** for an online registration form and monthly deadlines.

A Look Back


June 1970
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IN THIS ISSUE — NOVICE ROUNDUP — BIGGEST EVER!
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ARRL

A 10-6 Mobile Whip

BY CHARLES A. RANKIN,* WA2HMM

IN the days before our licensing structure set up an arbitrary split between them, the 10-and 6-meter bands made a popular and interesting combination, both for home-station and mobile use. Because it "opens" first for most ionospheric propagation, "10" gives the 6-meter man warning of impending DX, and being able to work both bands conveniently extends the usefulness of a mobile setup tremendously. Designing equipment for both bands is relatively easy, or you can use separate rigs handily in these days of compact solid-state gear —but if you don't solve the mobile antenna problem neatly you may run into family problems in trying to work both bands in the car.

The solution lies in the now-familiar trap approach. A parallel-tuned circuit presents a very high impedance to rf energy at its resonant frequency, but off resonance its series resistance is very low. Thus we can break up a 10-meter whip into two sections, with a tuned circuit in the center, and approximate the performance of a resonant whip for either band.

Details of the trap assembly required are shown in Fig. 1. This is only one way of doing the job; dimensions are not important unless you're interested in duplicating the original. The insulating rod on which the trap is mounted can be any diameter, provided you experiment with coil turns and spacing, or use a variable capacitor in place of the mica 10-pF one shown. The bottom section of the whip is 49 inches long, including the 5-inch spring mount. The upper portion is 46 inches. These lengths could vary slightly, as final adjustment of the trap will take care of some minor differences in materials and the position of the whip on the car.

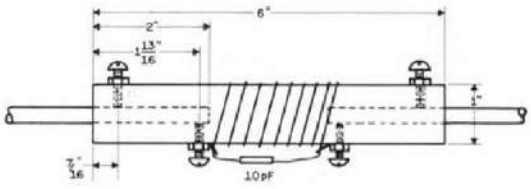


Fig. 1 — Principal details of the trap used in the 10-6 whip. The coil form can be any good insulating material. Weather protection can be provided with a plastic bottle fitted over the coil, once adjustments have been completed. If whip sections of larger diameter than the 7/32-inch original are used, it may be advisable to use a larger-diameter form. Turns information can be modified, so long as resonance at the 50-MHz operating frequency can be obtained.

Adjustment

Before the whip is assembled, the tuned circuit should be adjusted to resonance at the approximate operating frequency used in the 6-meter band. This should be done with a grid-dip meter, with the coil well away from metal surfaces. The turns can be fixed, and a variable capacitor used, or, as was done in this case, the turn spacing can be adjusted to resonance with a 10-pF fixed-value capacitor across the coil.

Now, the whip should be assembled and mounted on the car in the position in which it is to be used. Be careful in tightening the four 6-32 screws, to prevent stripping the threads in the insulation. It may be well to drill a slight depression in the whip elements, at the point where the screws will bear against them, to make the contact more readily maintained without excessive pressure.

The antenna is fed with 50-ohm coax, but this should not be connected until after a further resonance adjustment is made. Use the "dipper" as before. Now connect the coaxial line, and run an SWR check on both bands. If necessary, adjust the length of the top section to get best operation on 10 meters. The writer uses the whip mainly on 28.73 and 50.46 MHz, but it works well over a considerable frequency spread either side. The SWR is under 1.5 to 1 on both bands, a value that is inconsequential in a mobile installation.

Evaluation

The effectiveness of this dual-band setup was checked against single whips, with the aid of WB2FXO. Greg manned the other station, making transmitting tests and taking S-meter readings, while the whips were changed on the mobile. Results with the dual whip were found to be comparable to those with a stainless-steel whip adjusted for either band alone.

The system was also checked to see if the trap was really working as it should, by touching the top section when the antenna was being used on 50 MHz. There was no detuning effect, transmitting or receiving, observed on 50 MHz when this was done. Contact with the lower section made a marked difference in the transmitted or received signal. The whip has been in use with WA2HMM/mobile for several months, and it has given good results on both bands. QST

* No. 8 Corral Lane, East Northport, NY 11731.

Gimmicks and Gadgets

A Simple JFET and MOSFET Tester

WHEN working with transistors it's always nice to know whether or not the semiconductor is good. While there are plenty of available devices to test bipolar transistors, there are no simple checkers for FETs. The unit shown in the photograph is designed to determine if a particular transistor is in proper working order. Although the checker won't test the gain of a transistor, nor indicate *positively* that a transistor is defective, it is quite useful as a "go-no-go" indicator for shorts or opens.

Circuit Details

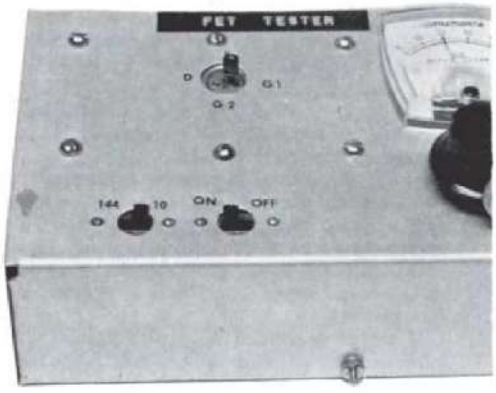
The circuit shown in Fig. 1 consists of a common-gate rf oscillator stage with provision for selecting two oscillator frequencies. A 50-microampere meter, M1, is used to indicate the rectified rf voltage from CR1. S1 permits changing the oscillator frequency by selecting either L1 for 144 MHz, or L2 for 10 MHz. A 9-volt battery supplies the operating voltage.

Construction

A 2 x 3-inch etched-circuit board is used for mounting most of the components. Fig. 2, a full size template, shows the proper placement of the various components on the board. A 2 x 4 x 6-inch aluminum chassis serves as a cabinet for the checker; however, any suitable container may be used.

Using the Checker

It should be mentioned that the checker may be used to determine only if the transistor in question will function as an oscillator. If the circuit won't oscillate, it doesn't necessarily mean that the FET is defective. But, if it does oscillate, it's a good indication the device is at least in working order.



Here is the FET tester in use. The unit being tested is an MPF 103 and the meter reading indicates the transistor is oscillating at 10 MHz.

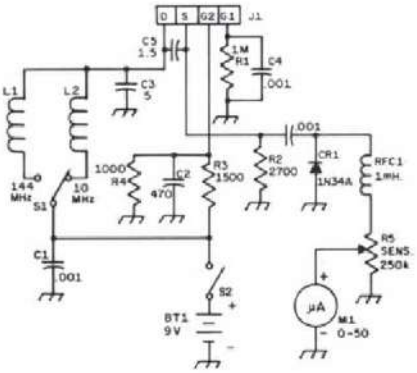
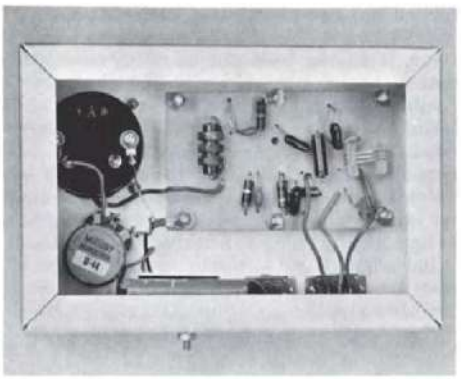


Fig. 1 — Circuit diagram of the transistor checker. All .001-uF capacitors are disk ceramic. Other capacitors are dipped silver micas. All resistors are 1/2 watt. Parts designations not listed below are so labeled for parts placement in Fig. 2.

J1 — Transistor socket.
L1 — 3 turns, 1/2-inch dia., 16 turns per inch, No. 20 (B&W Miniductor 3003).
L2 — 8.2-uH rf choke (Millen 34300-8.2).
M1 — 0 to 50-uA meter.
R5 — 250,000-ohm control, linear taper.



Bottom view of the transistor checker. The circuit board is mounted on 1/2-inch spacers. The 9-volt battery can be seen at the bottom left.

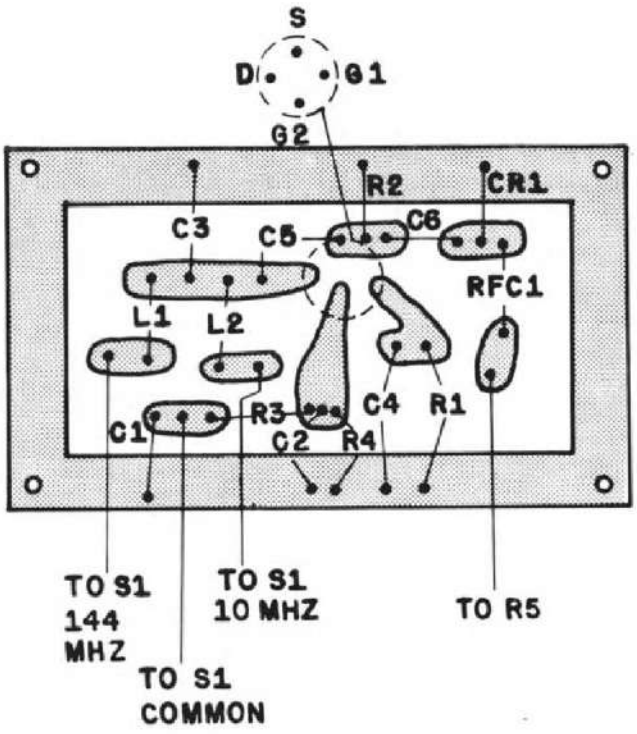


Fig. 2 — Full-size template for the etched-circuit board. A ready-made board is available from Stafford Electronics, Inc., 427 S. Benbow Rd., Greensboro, NC 27401.

Checking a transistor is simple. Plug the FET into the transistor socket, turn S2 on, and adjust R5 for a reading on M1. If the transistor permits oscillation an indication will appear on M1, the amount of the indication being determined by the positioning of R5. If the needle on M1 stays on zero, there is a possibility of a bad transistor. The FET can be checked at either 10 MHz or 144 MHz, depending on the position of S1. Because it is an easy matter to destroy MOSFETs certain precautions should be observed. Static electricity can cause a puncture of the fragile dielectric gate material. It is a good idea to wind some thin, bare wire around the leads of a MOSFET before pulling it from it's shorting collar or socket. The wire should be removed only after placing the MOSFET in the checker. When returning the transistor to the original circuit, the same procedure should be used.

Operation

Several types of transistors can be readily checked. Among the ones we checked were HEP-801s, HEP-802s, and some of the MPF102 through MPF107 series. When checking P-channel types, the battery polarity must be reversed. If it is expected that many P-channel types will be checked, it might be convenient to add a polarity-reversing switch to your checker. — *W1ICP*

Strays

Feedback

In the article, "A Receiver Matcher and Preamplifier," April 1970 *QST*, the coils L1L2 are listed as being made from a single length of coil stock. The stock is no longer available in three-inch lengths so two sections of coil stock are required to make the two coils. The coils should be positioned about 1/8-inch apart in order to obtain the desired coupling.

—···—

The author of "The 2-Meter QRP Mountain Topper," Dick Preiss, W7HCV, (May 1970 *QST*) resides at 7670 S.W. 141st Ave., Beaverton, Oregon 97005. One address number was mistakenly dropped in our footnote.

—···—

The KMC transistors, K5200 and K5500, used in the 1296-MHz preamplifier described by WA2VTR in *QST* for December, 1968, and in the 1970 *Handbook*, are no longer obtainable from the source given in these references. They can be obtained on a similar basis from Bill Ashby, K2TKN, Box 332, Pluckemin, N.J. 07978.

—···—

The Post Office Department promises faster mail service with Zip codes. Use Zip codes.

Celebrating Our Legacy

Sticking With Code Skills

In 1956, my dad and I were intrigued by his Hallicrafters receiver, with its rhythmic mystery of code. At age six, I listened with him, both of us yearning to learn more.

Cub Scout leaders fueled my passion when we made simple buzzers and telegraph keys, giving me the technology to learn more about those vexing radio beeps. My sending developed quickly, using straight keys, flashlights, and flags, along with dot-dash charts — but I couldn't copy.

By 1961, I was a Boy Scout Tenderfoot, eagerly reading my *Boy Scouts of America Handbook*. The chapter on signaling read that Morse code, both receiving and sending, was "...for stickers only." So, I became a focused sticker.

Up through Eagle Scout rank I kept learning, developing a good technique, and sending International and American Morse code via flags, landline sounders, and practice oscillators. Vinyl CW records and World War II paper code machine tapes helped me reach 5 and 13 words per minute (WPM), but I gained no confidence to test.

Teenage years passed into college years and I forgot about Morse code. It wasn't until years later, in 1985, that someone gave my toddler boys an electronics multi-kit with plans for making a code-practice oscillator and sending key. I bucked up, reviewed theory using ARRL books, practiced with CW tapes, and was ready to take my exams.

The Novice and General theory exams went great, but I missed the 13 WPM code test by two characters. A few months later, I passed the Advanced-class written and General-class 13 WPM code. My new FCC Advanced-class license, KD9TT, arrived on my birthday, January 28, in 1986 — the day the space shuttle *Challenger* exploded. Strong emotions of that day further motivated this once too-timid middle-aged sticker.

High-speed code practice became my focus, with my CW copying speed rapidly increasing to 30+ WPM. At the next exam session, I tested for my Extra-class, 20 WPM license. Theory went fine, but not CW. Several tries at code yielded success.

If you're interested in my full Morse code journey, I've shared it in my book, *Neighborhood of Bears*.

Thomas Wayne King, WF9I
Solon Springs, Wisconsin

Junior High Electronics Class

In 1952, I attended electronics class in the seventh grade at Central Junior High School, where Mr. Titus taught us basic wire-splicing techniques and the importance of proper soldering of splices. He had us cut out, bend, and solder a metal box. He also taught us basic electronics theory, and for the final project, he filled the box we made with components and a bare chassis with a schematic for a super regenerative receiver. We were to build and receive a broadcast signal from the receiver. You earned an A for your final grade if you were able to receive a broadcast station — mine received two local stations. The entire class was excited for the eighth grade when we could take the advanced class, but unfortunately the class had been dropped. The school decided that it was too advanced for children of our age group.

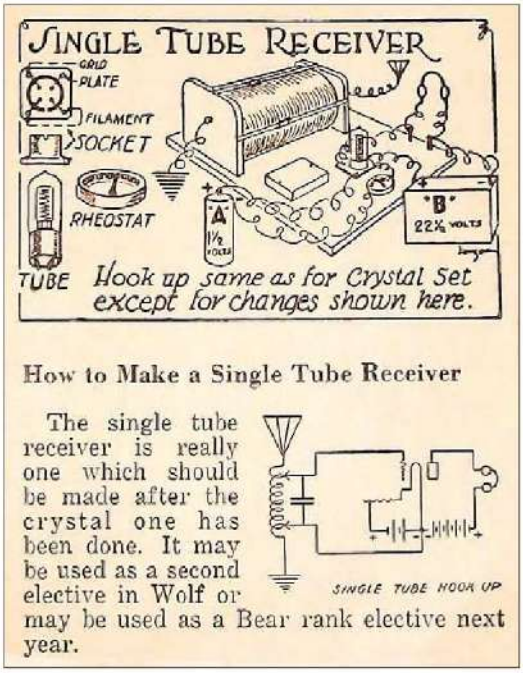
I saw Mr. Titus again 6 years later in my electronics class at Riverside City College, but never forgot the disappointment of the dropped class. How far ahead might we have been if they continued with his curriculum? I spent 35 years in electronics and made a decent living. I loved going to my hobby every day and never worked a day in my life.

Gary Layton, W6VVV
Hesperia, California

My Early Radio Projects

The very first one-tube radio I constructed was a crystal set described in the 1939 issue of the *Wolf Cub Scout Handbook*. The second was a single-tube receiver, also printed in the handbook. I built the crystal set during World War II and built versions of the single-tube receiver in 1949. The following year, I built a one-tube 80-meter crystal-controlled oscillator based on a circuit diagram in the 1941 *ARRL Handbook for Radio Communications* (before I received my amateur radio license in 1951). When I fired it up, with no antenna, I could hear it clearly on my receiver. So did a ham friend who lived about a half-mile away. We agreed to shut it down right away!

John "Jack" Gibson, W4SVH
Hideaway, Texas



The "Single Tube Receiver," from the 1939 *Wolf Cub Scout Handbook*.

Send reminiscences of your early days in radio to "Celebrating Our Legacy," ARRL, 225 Main St., Newington, CT 06111 or **celebrate@arrl.org**. Submissions selected for publication will be edited for space and clarity. Material published in "Celebrating Our Legacy" may also appear in other ARRL media. The publishers of *QST* assume no responsibility for statements made in this column.

George J. Misic, KE8RN, ke8rn@comcast.net

Classic Radio

The All-in-One Swan Cygnet 260 and 270 Transceivers

The Swan Cygnet 260 single sideband transceiver. [Photo courtesy of Cloud City Vintage Audio]

Swan Electronics put out a popular line of SSB/CW transceivers in 1968, starting with the Cygnet 260. This minimalist radio was supplied with a 117 V ac power line and a suitable antenna. All you needed to get on SSB or CW was a telegraph key. A couple years later, Swan put out the Cygnet 270. The Cygnets were a new concept in ham radio transceivers in that they didn't need many accessories to form a complete station. They came on-air ready with a speaker, power supply, and, in some cases, a microphone.

The Cygnet 260

The Swan Cygnet 260 weighed about 25 pounds and was the same size as the Swan 120, 140, and 175 single-band units from 1961. It had a handle that made the radio easy to move and featured a built-in ac power supply with the ability to add a 14A module to convert the power supply to dc operation for mobile use. The Cygnet 260 with ac power supply sold for $395, and the optional dc power supply module sold for $59.95.

The radio came with a built-in speaker and push-to-talk (PTT) microphone wired directly into it. Internally, the final amplifier shielded compartment was reduced in size from previous Swan transceivers, making room for the ac power supply. The 260 had no crystal calibrator, no optional calibrator, and no accommodations for one. Similarly, the usual Swan Electronics voice-operated exchange (VOX) plug-in units did not plug into the model. Lower sideband was provided for reception and transmission on 75 and 40 meters, and upper sideband was supported on 20, 15, and 10 meters, as was the standard at the time. The radio had no means to switch to the opposite sideband.

The Swan 260 didn't have a received signal strength indicator (RSSI), plate, or cathode current. Instead, a magic eye tube was used to indicate output power for tune-up indication. No receive automatic gain control (AGC) was provided; the receive output level control was an RF/IF gain control like it was on the earlier single-band Swan radios.

The Swan 260 ran 260 W peak envelope power (PEP) on SSB, and 180 W on CW from a single 6LQ6/6JE6 color TV horizontal sweep tube. The balance of the vacuum tubes were seven- or nine-pin miniature tubes. When these radios were on the market, a magic eye vacuum tube was much less expensive than a panel meter.

Several decisions were made in the design of the Cygnet 260 to minimize its cost and complexity, allowing the company to sell it for the lowest possible price without requiring extra items to be purchased to get operating. Like all tube-type Swan transceivers, the 260 was a single-conversion design. The 260 was discontinued in 1970, when the basic radio was updated to the Cygnet 270.

The Swan Cygnet 270 single sideband transceiver. [Photo courtesy of **www.rigpix.com**]

The Cygnet 270

The Swan Cygnet 270 was a more convenient transceiver, with more features than its predecessor. It had all the features of the 260 except for the wired-in microphone. The power supply was 117 V ac or 13.8 V dc, and a 100 kHz crystal calibrator could be used by plugging in a 12BA6 tube and a 100 kHz crystal. A VOX accessory could plug into the octal socket, selectable sidebands were provided by means of a front panel switch marked **NORMAL** or **OPPOSITE**, and a ¼-inch microphone jack was provided on the front panel. The carrier balance control allowed the operator to optimize carrier balance and insert some carrier to work AM stations. A microphone gain control was added to the front panel of the 270. It had a **DIAL SET** knob to accurately set the dial frequency readout marks when the 100 kHz calibrator was operational. The deluxe radio featured a front panel meter to serve as a receive S-meter, and a cathode current on transmit in place of the magic eye tube used on the Cygnet 260.

Tube Arrangements

The Swan 260 and 270 have similar tube complements (which were also used in other Swan models such as the 350 and 500 transceivers). Both the 260 and 270 used a 12AU6 as the tuning variable-frequency oscillator (VFO), a 6BZ6 receiver RF amplifier, a 12BE6 as the receiver mixer, two 12BA6s as the first and second IF amplifiers, a 12AX7 as the receive product detector and receive audio amplifier, a 6AQ5 as the audio output tube of the receiver, a 12BA6 microphone amplifier, a 6JH8 balanced modulator, a 12BE6 transmit mixer, a 6GK6 as the transmitter driver, and a 6LQ6/6JE6 transmit RF final amplifier.

The Last of the Cygnets

Four more Cygnet radios were released by Swan Electronics after the 270 in 1969. The Swan Cygnet 270B and 300B tried to appeal to a larger market by lowering the price without bringing back the magic eye tube in place of the meter. The 270B was the first reduced-cost version. It eliminated the dc power supply for mobile use that was included in the original 270 model. The price was reduced by $100 to $429.

In 1974, Swan replaced the 270B with the 300B. The 300B left off the dc power supply, which could be restored by adding the 14A dc module. It used an 8950 tube in the final amplifier to raise the input power to 300 W PEP on sideband and added a CW sidetone function. This Cygnet cost $499 with the power and CW upgrades.

The 300B was revised to the 350B in 1977, which switched to a solid-state balanced modulator and a 6MJ6 output tube. The power rating remained at 300 W PEP SSB and 200 W CW. This version cost $599.95 with no power increase. That same year, the final revisions occurred to the Cygnet with the 350B and 350D. The 350B had the same specifications as the 350A, and the 350D added digital frequency readout, but the same 300 W PEP input on SSB and 200 W input on CW with an ac power supply for $699.95.

Strays

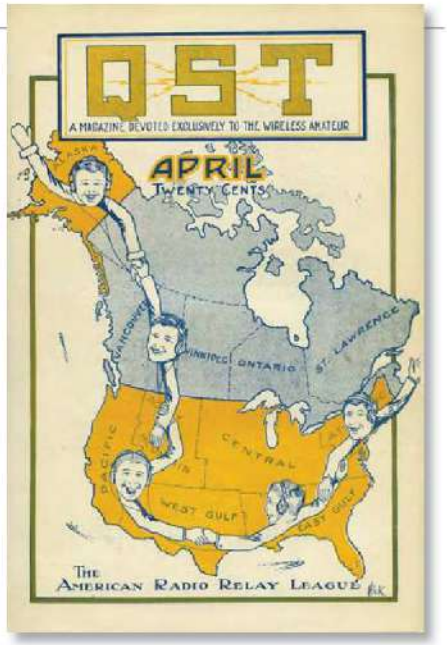
Handiham Readers Needed

The Handiham Program would like to make the new *On the Air* magazine and other ARRL publications available to Handiham members with print disabilities by creating audio versions of the text. To do so, they need volunteers who can read the text aloud and make recordings.

These volunteer positions require you to use your own equipment to record. You need a microphone or headset that can record into your computer, free audio editing software, and a quiet place to make the recordings. The Handiham Program will provide all reading materials.

If you or someone you know would like to record material for the Handiham members, contact Lucinda Moody, Handiham Program Coordinator, for more information on how to submit a demo recording. You can email Lucinda at **lucinda.moody@allina.com**, or call 612-775-2290.

100, 50, and 25 Years Ago



April 1920

- The cover cartoon shows hams linking arms in Alaska, through western Canada, down to California, across the southern US, and back up the eastern seaboard to Maine.
- The editorial details many topics, including "The Power Companies," reporting that many power companies required hams to pay the exorbitant $50 fee of installing a special 2 kW pole transformer for their stations.
- L.M. Clement writes about "The Vacuum Tube as a Detector and Amplifier," which was first presented at a meeting of the Radio Club of America.
- S. Kruse, ex-9LQ, shares a story about "Radio Lighthouse Keeping."
- ARRL Traffic Manager J.O. Smith discusses the "Variation of Strength of Amateur Station Signals," puzzling over why the stations heard by day are different from those heard at night, and discusses places in "dead pockets" of radio reception.
- "The Junior Operator" continues a series of articles written by Guy R. Entwhistle to tutor radio newcomers.

April 1970

- The cover shows the innards of the "Skinnier Linear" built by Doug DeMaw, W1CER, and described in this issue.
- Irvin M. Hoff, W6FFC, describes his latest project, "The Mainline ST-3 RTTY Demodulator."
- Lew McCoy, W1ICP, shares how to build "A Receiver Matcher and Preamplifier" that will improve the performance of low-cost receivers.
- Herman Lukoff, W3HTF, got "Improved 75-Meter Performance for a Mobile Station" by simply hooking a wire to the mobile antenna and getting the wire's other end up high in a tree.
- Part six of "Let's Talk Transistors" by Robert Stoffels, discusses transistor circuit operation.
- K.S. Stone, W7BZ, explains how to use "Clamping Diodes for CW Break-In."
- Dale Covington, K4GSX, uses graphics to show "Radiation Patterns of V Dipoles Over Perfect Ground."

April 1995

- The cover shows Bill Moore's, NC1L, 432 MHz moonbounce antenna array at sunset.
- The editorial discusses the FCC's newly announced "vanity" call sign program.
- "The ARRL Turns Toward Tomorrow," by David Sumner, K1ZZ, and Rick Palm, K1CE, discusses the ARRL's long-range planning efforts, scheduled to begin that year.
- Michael Ardai, N1IST, reports about "Building a Digital Voice Recorder for Less than $15."
- "How to Evaluate Your Antenna Tuner — Part 1," by Frank Witt, AI1H, reveals how you can learn a lot from low-power measurements.
- Lyle R. Williams, KC5KBG, shares his RF detective work in "An HF Hum Interference Mystery Solved!"
- Lew Smith, N7KSB, offers a good weekend QRP project, "A remote-Oscillator High-Frequency VFO."
- Susan Yoder Ackerman shares the unusual DXpedition tale of her husband Robby, 5T5RA, and her son Hans, 5T5DX, in "Wind and Sand: A DXpedition to Tidra Island."

Silent Keys

It is with deep regret that we record the passing of these radio amateurs:

KC1FFF **Edwards**, Steven N., Manchester, CT
•N1FTB **Malloy**, Thomas J., Natick, MA
K1IAO **Saltmarsh**, Hazen J., Westwood, MA
N1IFG **Mancini**, David J., Ashland, NH
K1GTC **Penttila**, Leland G., Charlton, MA
•W1LAK **Forman**, Albert J., Palm City, FL
N1LX **Prewitt**, Glenn M., Eddington, ME
♦WA1M **Tolhurst**, Todd N., South China, ME
K1OTM **Erickson**, Donald H., Plymouth, MA
•W1RQD **Grazik**, Edward J., East Windsor, CT
W1VY1 **Wood**, Robert A. "Woody," Peabody, MA
AB1W **Flumerfelt**, Leonard R., Chelmsford, MA
W1WER **Young**, James A., Holden, MA
AB1ZR **Jones**, James A., Hanover, MA
WA2BZF **Pitts**, James A., Pittstown, NJ
KB2CHY **Allen**, Bradley E., Rochester, NY
W2CYO **Kurtz**, Robert L., Mansfield, OH
WA2FTC **Raso**, Edward, Deltona, FL
KC2ICH **Boughton**, William E., East Islip, NY
♦K2JFK **Kushneir**, John F., III, Clay, NY
•WA2JJM **Dawson**, Roy L., Jupiter, FL
KD2JRU **Keeler**, Timothy J., Marathon, FL
W2KZ **Cameron**, Donald C., Tonawanda, NY
K2MPH **Hoeft**, Michael, Mineola, NY
N2QAQ **Krulik**, Herbert I., Buford, GA
•WB2QEI **Johnson**, Ellsworth L., Kingston, NY
KC2TZV **Williams**, Ray S., Horseheads, NY
WW2ZOW **Clarson**, Michael James, Bloomfield, NJ
K3EE **Moynahan**, Mark A., Rockville, MD
•W3EUN **Tharp**, Nelson B., Ellicott City, MD
♦KA3FBP **Charlton**, Frank W., Jr., The Villages, FL
N3IOD **Hammond**, William A., Jr., Frankford, DE
W3MI **Lukeman**, Edward B., Saylorsburg, PA
W3MJA **Anderson**, Michael, Erie, PA
•K3ND **Steward**, Gale A. "Stew," Quakertown, PA
♦W3PZC **Hecker**, Paul A., Seymour, IN
KQ3R **Rossell**, James H., Jr., Churchill, PA
•KB3RXB **Ruth**, M. Virginia, Chestertown, MD
KB3UQV **Marquardt**, Christopher D., Mars, PA
•N3WQP **Knight**, Alfred R., Erie, PA
N3ZFF **Flickinger**, John W., Hamburg, PA
K4AAF **Davis**, James R., Birmingham, AL
K4AQP **Capehart**, Barney L., Gainesville, FL
♦W4BHD **Seese**, Nelson M., Bridgewater, VA
KE4BZJ **Dennard**, Jimmy O., Pineview, GA
AI4CI **Stevens**, Frank H., Cordova, TN
K4CK **Kelly**, Matt R., Huntsville, AL
WA4DEU **Singletary**, Norman E., Orlando, FL
AF4DH **Harris**, Dianne, Hoschton, GA
KN4DZU **Schober**, David A., Brentwood, TN
K4EPC **Creed**, Jack W., Knoxville, TN
♦W4GCE **Rose**, George D., Jr., Lynchburg, VA
WA4GEF **Grutchfield**, George C., Petersburg, VA
NF4H **Shaw**, Dick, Memphis, TN
KE4HSD **Snell**, Michalene Y. "Mikie," Granite Falls, NC
KD4IBQ **Miller**, Mary R., Port Saint Lucie, FL
W4JCQ **Shortridge**, Edward J., Marshall, NC
K4LQD **Dail**, Lewis Q., Dalzell, SC
KJ4OJQ **Fulford**, Paul C., Huntsville, AL
K4OSM **O'Berry**, Ernie, Citra, FL
KD4OZI **Robinette**, Paul B., Fairview, NC
N4PC **Carr**, Paul D., Jacksonville, AL
N4PGL **Cross**, Harlan E. "Gene," Jr., Oakton, VA
♦W4QM **Strieter**, H. Dale, Cocoa Beach, FL
•WB4S **Kitchens**, Thelma V., Winter Haven, FL
N4SPT **Henley**, Eugene C., Greensboro, NC
KM4SWM **Kuebler**, Herman J., III, Berkeley Lake, GA
KJ4TNA **Dial**, Mary J., Gadsden, AL
WB4VBC **Rosenbalm**, Michael D., Maryville, TN
WB4VQP **McLamb**, Jerry B., Benson, NC
KG4VUL **Bennington**, L. Brock, Chattanooga, TN
•N4WHL **Hatten**, David G., Statesville, NC
•WB4YJW **Hipp**, Harold G., Candler, NC
W4YO **Richmond**, Edmun B., Allendale, SC
KJ4ZAT **Cummins**, Larry, Shelby, NC
AI4ZC **Burttram**, Conway L., Nauvoo, AL
K5BAS **Sanford**, Barbara A., Huntington, TX
W5GPF **Tackett**, Henry A., Dallas, TX
WA5GXH **Locke**, Bertram L., Bossier City, LA
•KZ5H **Schwisow**, Clyde "Ron," Midland, TX
KD5IN **Bray**, Michael, Richardson, TX
AD5J **Murray**, Malcolm P., Starkville, MS
KE5JFU **Tittle**, Tim C., Highland Village, TX
•WB5JWC **McFerrin**, W. H., Texarkana, AR
NN5M **Hunt**, Thomas E., Belton, TX
N5MK **Kontak**, Marv D., Toledo, OH
•W5OSD **Viosca**, Harry L., Jr., Mandeville, LA
WA5PEO **Seitz**, Charles A., Amarillo, TX
N5PY **Williamson**, Gary Beau, Richardson, TX
WA5RSG **Babin**, Michael C., Columbus, OH
KA5SUR **Young**, Milam C. "Lucky," Sulphur, LA
•WA5TWZ **Dunn**, Ivy E., Jr., Albuquerque, NM
WA5UFG **Pickle**, John R., Granbury, TX
KN5W **Tucker**, Joe, Bartlesville, OK
♦AA5WE **Hickman**, Robert E., Copperas Cove, TX
W6BJH **Davis**, Theodore C., Redding, CA
WA6DKO **Holt**, Steven R., Pittsburg, CA
♦WD6EDY **Wendling**, Doug, Corolla, NC
WD6EQS **Meyers**, George L., Fresno, CA
WD6FFF **Durham**, Gerald K., Ripon, CA
N6GBX **Gorman**, Frances G. "Bob," Lomita, CA
K6HEW **Hewitt**, Robert G., Vacaville, CA
KQ6IT **Pawelchak**, Ronald M., Pacheco, CA
WA6KLO **O'Mahoney**, James C., San Francisco, CA
W6MVW **Wheelock**, Richard H., La Jolla, CA
K6RN **McRoberts**, Harold G., La Pine, OR
AA6SF **McElmury**, Peter C., San Francisco, CA
K6SSX **Bishop**, Bernard L., La Mesa, CA
KD6WTY **Balthrope**, Robert J., Elk Grove, CA
AD6XR **Miller**, John W., Newport Beach, CA
♦W7DAJ **Jameson**, D. Allen, Brooksville, MS
•KB7DUT **Zawodniak**, John W., Heber City, UT
•KB7DUU **Zawodniak**, Maxine M., Heber City, UT
WB7EDP **Dumford**, Victor L., Washougal, WA
W7HKW **Mann**, William F., Cambridge, MA
KA7IAC **Winter**, Brian M., Selah, WA
♦KB7KA **Card**, Robert D., Salt Lake City, UT
KB7KEN **Moyes**, Karen A., Layton, UT
•WA7KGX **Forsberg**, Charles A., Portland, OR
N7KKQ **Kesauer**, Mark K., Glendale, AZ
•N7KTY **Jepsen**, Loretta L., Eugene, OR
KD7MMU **Kendall**, William A., Kettle Falls, WA
♦KB7PI **Olmsted**, Lyle D., Chehalis, WA
W7PMT **Tannehill**, Pauline M., Glendale, AZ
K7TTA **Preston**, Karin, Troy, ID
♦WD8CSP **Jones**, Ned A., Lorain, OH
♦W8FDN **Scott**, Richard L., Chesterland, OH
N8FUR **Van Sickel**, David A., Canton, OH
KD8INK **Hardesty**, Stephen B., Columbus, OH
•KC8KQQ **Johnston**, David R., Toledo, OH
K8LEE **McKenzie**, Wayne, Lawrenceburg, IN
KG8MA **Johnson**, William O., Dennison, OH
KB8MAF **Rhodes**, Jerry, Paulding, OH
WD8ODG **Lafevor**, Ruth K., Sanford, MI
KA8PZP **Forster**, Randolph C., Bad Axe, MI
W8SSK **Hassman**, Bret, Cincinnati, OH
KC8UMC **True**, John F., Roscommon, MI
KD8VNW **Goodwin**, Harold R., Portsmouth, OH
W8WGC **Campbell**, Glenn E., Whitehouse, OH
KB8WZK **Schott**, Joseph V., Williamsburg, MI
♦•KC8YY **Moore**, Irad B., South Charleston, WV
K8ZEC **Pollman**, John C., Troy, MI
KB9ASC **Schumacher**, Henry H. "Hank," Wauconda, IL
W9BCK **Yokes**, Ronald R., Grafton, WI
W9DHX **Ward**, James R., Glen Ellyn, IL
K9DJM **Atkinson**, Lowell G., Indianapolis, IN
N9ESO **Kraus**, Charles "Chuck," Bloomington, IN
KD9HIJ **Krzywicki**, Kenneth E., Elk Grove Village, IL
N9UHG **Goodwin**, John H., Machesney Park, IL
K9KGO **McNeal**, Robert E., Tallula, IL
WA9LVB **Pacejka**, Frank M., La Grange Park, IL
KA9MZV **Holderness**, Russell L., Jr., Columbus, IN
KB9NCY **Ranney**, Robert M., Milwaukee, WI
AB9PB **Vanderhoef**, Richard M., Madison, WI
NV9R **Schlotzer**, Robert, Land O' Lakes, FL
KC9RQW **Kuhn**, David E., Syracuse, IN
W9SH **Henke**, Steven P., Noblesville, IN
♦N9UOM **Owen**, Randi W., Byron, WI
♦W9WLS **Gatwood**, John J., Oakland City, IN
•K0ATV **Leslie**, John H., Phoenix, AZ
KB0BB **Bowers**, Don C., Bettendorf, IA
KI0DJ **Van Steenburgh**, Glenn L., Great Bend, KS
WD0EHP **Eberle**, Gene P., Plato, MO
KB0GFC **Olson**, James O., Tyrone, OK
KA0GLP **Sanders**, Mary M., Morrison, MO
AC0H **Stover**, Robert K., Des Moines, IA
AA0HM **Krause**, Alta J., Lehr, ND
KE0HYU **McMillan**, James L., Topeka, KS
WA0JH **Headley**, John W. "Jack," Brookings, SD
WA0KHV **Romig**, Ralph, Kincaid, KS
W0KQ **Blackstad**, Edward M., Sleepy Eye, MN
N0RAB **Barnaby**, Roland E., Wichita, KS
N0UQR **James**, Dale, Sikeston, MO
KB0ZD **Momsen**, Glen C., Quincy, IL
KA0ZDD **Huss**, Todd E., Topeka, KS
♦VE1ANH **Smith**, H. Bruce, Saint John, NB, Canada
VE3AFB **Brown**, Vernon A., Kerwood, ON, Canada
VE3BJJ **Poultney**, Derick, Cambridge, ON, Canada
VE3BYD **Haynes**, Harry W., Dorchester, ON, Canada
VA3CN **Nurnberg**, Charles, Bracebridge, ON, Canada
VE3DFU **Finley**, William F., Sarnia, ON, Canada
VE3EBT **Tilley**, David, Ancaster, ON, Canada
VE3GE **Johnston**, Walter D., Amprior, ON, Canada
VE3GGO **Olsen**, Eric, West Rouge, ON, Canada
VE3HDR **Rock**, Ansil, London, ON, Canada
VE3OVV **Coverley**, James G., Kincardine, ON, Canada
VE3XK **Leach**, Douglas E., Stittsville, ON, Canada
VE6NH **Back**, J. Edwin, Soldotna, AK
DK5DC **Glasmacher**, Peter, Werl, NW, Germany
VK2WN **Fraser**, Ross A., Narromine, NSW, Australia

In February 2020 *QST*, we incorrectly listed Richard B. Rogers, N1URO, as a Silent Key. We regret the error.

♦ Life Member, ARRL
• Former call sign

For information on how to list a Silent Key in *QST*, please visit **www.arrl.org/silent-key-submission-guidelines**.

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Real-time Spectrum Scope with Automatic Scope Control • Multi-color waterfall display • State of the art 32-bit Digital Signal Processing System • 3kHz Roofing Filter for enhanced performance • 3.5 Inch Full Color TFT USB Capable • Internal Automatic Antenna Tuner • High Accuracy TCXO

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Rugged Construction in an Ultra Compact Body • Stable 100 Watt Output with Efficient Dual Internal Fans • 32-Bit IF DSP Provides Effective and Optimized QRM Rejection • Large Dot Matrix LCD Display with Quick Spectrum Scope • USB Port Allows Connection to a PC with a Single Cable • CAT Control, PTT/RTTY Control

FT-857D | *Ultra Compact HF/VHF/UHF*

• 100w HF/6M, 50W 2M, 20W UHF • DSP included • 32 color display • 200 mems • Detachable front panel (YSK-857 required)

FT-2980R | *Heavy-Duty 80W 2M FM Transceiver*

• Massive heatsink guarantees 80 watts of solid RF power • Loud 3 watts of audio output for noisy environments • Large 6 digit backlit LCD display for excellent visibility • 200 memory channels for serious users

FTM-100DR | *C4FM FDMA/FM 144/430 MHz Xcvr*

• Power Packed System Fusion Transceiver • High Audio Output Power • Rugged Powerful Transmitter • Integrated 66ch High Sensitivity GPS • 1200/9600 APRS Data Communications

FTM-400XD | *2M/440 Mobile*

• Color display-green, blue, orange, purple, gray • GPS/APRS • Packet 1200/9600 bd ready • Spectrum scope • Bluetooth • MicroSD slot • 500 memory per band

FT-70DR *C4FM/FM 144/430MHz Xcvr*

• System Fusion Compatible • Large Front Speaker delivers 700 mW of Loud Audio Output • Automatic Mode Select detects C4FM or Fm Analog and Switches Accordingly • Huge 1,105 Channel Memory Capacity • External DC Jack for DC Supply and Battery Charging

FT-3DR *C4FM/FM 144/430 MHz Xcvr*

• High Res Full-Color Touch Screen TFT LCD Display • Easy Hands-Free Operation w/Built-In Bluetooth Unit • Built-In High Precision GPS Antenna • 1200/9600bps APRS Data Communications • Simultaneous C4FM/C4FM Standby • Micro SD Card Slot

FT-65R | *144/430 MHz Transceiver*

Compact Commercial Grade Rugged Design • Large Front Speaker Delivers 1W of Powerful Clear Audio • 5 Watts of Reliable RF Power Within a compact Body • 3.5-Hour Rapid Charger Included • Large White LED Flash-light, Alarm and Quick Home Channel Access

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HAM-IV – $709.95

The Most Popular Rotator in the World!

For medium communications arrays up to 15 square feet wind load area. Has 5-second brake delay, Test/Calibrate function. Low temperature grease permits normal operation down to -30 degrees F. Alloy ring gear gives extra strength up to 100,000 PSI for maximum reliability. *Precision* indicator potentiometer. Ferrite beads reduce RF susceptibility. Cinch plug plus 8-pin plug at control box. Dual 98 ball bearing race for load bearing strength and electric locking steel wedge brake prevents wind induced movement. North/South center of rotation scale on meter, low voltage control, max mast $2^{1}/_{16}$".

HAM-VI – $809.95 with DCU-2
HAM-VII – $959.95 with DCU-3

Specifications	
Wind Load Capacity (inside tower)	15 square feet
Wind Load (w/mast adapter)	**7.5 square feet**
Turning Power	800 in.-lbs.
Brake Power	**5000 in.-lbs.**
Brake Construction	Electric Wedge
Bearing Assembly	**Dual race/96 ball bearings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	26 lbs.
Effective Moment (in tower)	**2800 ft.-lbs**

TAILTWISTER SERIES II – $869.95

For Large Medium Antenna Arrays up to 20 sq. ft. wind load.

Has 5-second brake delay, Test/Calibrate functions. Low temp grease, tough alloy ring gear, indicator potentiometer, ferrite beads on potentiometer wires, weatherproof AMP connectors plus 8-pin plug at control box, triple bearing race with 138 ball bearings for large load bearing, electric locking steel wedge brake, North/South center of rotation scale meter, low voltage control, $2^{1}/_{16}$" max mast. **MSHD, $139.95**. Above tower heavy duty mast support. T2X, HAM-IV, HAM-V, HAM-VI. Accepts $1^{7}/_{8}$-$2^{5}/_{8}$" OD.

T-2XD2 – $979.95 with DCU-2
T-2XD3 – $1039.95 with DCU-3

Specifications	
Wind Load Capacity (inside tower)	20 square feet
Wind Load (w/mast adapter)	**10 square feet**
Turning Power	1000 in.-lbs.
Brake Power	**9000 in.-lbs.**
Brake Construction	Electric Wedge
Bearing Assembly	**Triple race/138 ball bearings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	31 lbs.
Effective Moment (in tower)	**3400 ft.-lbs**

CD-45II – $499.95

For antenna arrays up to 8.5 sq. feet mounted inside tower or 5 sq. ft. with mast adapter.

Low temperature grease good to -30 F degrees. New Test/Calibrate function. Bell rotator design gives total weather protection, dual 58 ball bearing race gives proven support. Die-cast ring gear, stamped steel gear drive, heavy duty, trouble free gear train, North center scale, lighted directional indicator, 8-pin plug/socket on control unit, snap-action control switches, low voltage control, safe operation, takes maximum mast size to $2^{1}/_{16}$ inches. MSLD light duty lower mast support included.

CD-45D2 – $599.95 with DCU-2
CD-45D3 – $659.95 with DCU-3

Wind Load Capacity (inside tower)	8.5 square feet
Wind Load (w/mast adapter)	**5.0 square feet**
Turning Power	600 in.-lbs.
Brake Power	**800 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/48 ball bearings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight	22 lbs.
Effective Moment (in tower)	**1200 ft.-lbs**

New!

Hy-Gain Programmable DCU-3 Digital Rotator Controller

DCU-3 – $499.95

Hy-gain DCU-3 Digital Controller lets you program 6 beam headings! Gives you full automatic or manual control of your hy-gain HAM or Tailtwister Rotators.

Press a memory button or dial in your beam heading or let *Ham Radio Deluxe* (or other) take control. Your antenna auto rotates precisely and safely to your DX.

DCU-3 automatically jogs your antenna free and safely unlocks it before rotating begins (*great for older rotators with "sticky" brakes*) then turns off your motor before reaching its final heading. Your antenna gently coasts to a stop before the brake re-locks -- greatly reducing damaging overshoots and extending rotator life.

Simply press *Left* and *Right* buttons for full manual control and fine tuning.

Bright blue LCD shows current, dialed in and computer controlled beam headings in one degree increments and your call.

Calibrate lets you accurately match your display to your true beam heading. Has USB/RS-232 ports for computer control. Adjustable LCD sleep time. Field upgradeable firmware. 8.5Wx4.3H x9D".

110 VAC. Order DCU-3X for 220 VAC.

DCU-2 Digital Rotator Controller – $459.95
Like DCU-3, but less programmable memories. 110 VAC. Order **DCU-2X**, for 220 VAC.

AR-40 – $399.95

For compact antenna arrays and large FM/TV up to 3.0 square feet wind load area.

Dual 12 ball bearing race. Automatic position sensor never needs resetting. Fully automatic control -- just dial and touch for any desired location. Solid state, low voltage control, safe and silent operation. $2^{1}/_{16}$ inch maximum mast size. MSLD light duty lower mast support included.

AR-40 Rotator Specifications	
Wind Load Capacity (inside tower)	3.0 square feet
Wind Load (w/mast adapter)	**1.5 square feet**
Turning Power	350 in.-lbs.
Brake Power	**450 in.-lbs.**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/12 ball bearings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**5**
Shipping Weight	14 lbs.
Effective Moment (in tower)	**300 ft.-lbs**

Replace your Yaesu Rotator Controller

YRC-1 – $369.95

Hy-gain YRC-1 -- more features, more robust, far less prone to lightning damage. Costs less than repairing!

Easy-to-use -- dial in your beam heading and tap GOTO button. Exclusive 180 degree *AutoReversal*™ for fast longpath operation. All DCU-2 features. Bright blue LCD shows current, dialed-in, computer controlled beam headings, call. USB port for computer control. Extra heavy-duty AC power supply. Fast variable DC motor minimizes overshoot. Intuitive menu. Field upgradeable. For Yaesu G-800/1000/2800/G450/650. AC or DC motors.

YRC-3, $449.95. Like YRC-1 and adds 6 memories.

AR-500 Rotator/Controller – $169.95

UHF/VHF/6-Meter, MFJ-1886 Rotator/Controller and Remote. For use of small VHF/UHF, 6M, TV, FM, the MFJ-1886 wide band receiving loop and other light-weight ham antennas. Rotator is built in a weather-proof one piece cast aluminum housing with precision all metal gears, steel thrust bearings and automatic braking. Includes rotator, controller, remote, clamps, and all hardware.AR-500 remembers up to 12 directions even after a power outage! Use remote control or direct console. Displays location and relative position.

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MFJ Best Sellers!

Dual Band Mag Mount Antennas

MFJ-1724B

2-Meter/440 MHz MFJ-1724B **$29.95**

This antenna is perfect for your dual band mobile or HT. Powerful 3 1/2 inch magnet holds firm at highway speeds, rubber guard, 19" black stainless steel whip, low SWR, excellent gain, 300 Watts PEP, 12 feet coax with PL-259. Free BNC adapter.

MFJ-281 **$13.95**

MFJ-281

Clearest speech you ever heard!
3" speaker, 8W, 8 Ohms, 6' cord, 3.5 mm plug.

MFJ-1729

Power*Gain™ MFJ-1729 **$44.95**

Ham Radio's most powerful dual band antenna gives whopping gain on 440 MHz and 2-Meters! Low SWR. 27 1/2" stainless steel Slimline™ radiator minimizes wind vibration for less SWR flutter for longer range, better readability. 12' coax, PL-259, Heavy duty magnet mount.

MFJ-1728B

5/8 Wave 2/6 Meter Mobile MFJ-1728B **$29.95**

Full 50-inch 5/8 Wave gives you maximum possible gain of any single element antenna on 2-Meters. On 6-Meter "magic band" you get a powerful signal with its high-performance low SWR full 1/4 Wave. 300 Watts PEP, heavy duty magnet, 12 feet coax, stainless steel radiator.

MFJ Super-Strong Magnet Mounts with Coax/PL-259

MFJ 5-inch Magnet

Best Seller!

These jetblack 5-inch super strong magnet mounts have 17' coaxial line terminated with PL-259 connectors. SO-239 (BS) or NMO (BM) for your VHF/UHF antennas or 3/8-24 threaded (BT) for your HF hamstick antennas with a 3/8-24 threaded connector.

$16.95 Each

MFJ-335BS – SO-239
MFJ-335BM – NMO
MFJ-335BT – 3/8 - 24 For HF sticks

MFJ 3-inch Magnet

3-inch Black Magnet Antenna Mounts

17-foot coax is terminated with PL-259 connector. Choose SO-239 (BS) or NMO (BM). For VHF/UHF light-weight antennas.
MFJ-333BS Pictured

$12.95 Each

MFJ SMA/BNC Cables

Release strain on your HT's antenna connector! 3 ft. flexible, mini coax with SO-239 connector.

$16.95 Each

A. **MFJ-5612S** SMA Male.
B. **MFJ-5612SF** SMA Female Wouxun/Baofeng.
C. **MFJ-5612B** BNC Male.

MFJ Triple 5-inch Magnets

Goliath™ – Ultimate Strength Magnet

Three super-strong 5-Inch Magnets make up this MFJ Goliath™ Tri-Magnet Mount. 1/4" thick steel triangle base. 17' coax. Select SO-239, NMO, 3/8-24 antennas.

Caution: once on, it's difficult to get off!

$37.95 Each

MFJ-336S – SO-239
MFJ-336M – NMO
MFJ-336T – 3/8 x 24

HF/VHF/UHF 200 Watt Duplexers

MFJ-916B **$29.95**

Use separate HF/VHF and 440 MHz UHF antennas with single transceiver OR use two separate HF/VHF and 440 MHz UHF transceivers with a single HF/VHF/UHF antenna. Heavy-duty diecast enclosure houses low/high pass networks that separate/combine HF/VHF/UHF signals. Low loss SO-239s. 50 Ohm ports. **MFJ-916BC, $49.95** 3 ft. coax pigtails on 2-port side.

1.8-200 MHz SWR/Wattmeter

Compact 1.8-200 MHz SWR/Wattmeter has HUGE 3" Cross-Needle meter. Read forward/reflected power and SWR simultaneously. Perfect for mobile/portable. 30/300 Watt ranges. Built-in meter light. SO-239s. 3 1/4W x 3 1/4H x 3 1/4D". **MFJ-842, $64.95** covers 140-525 MHz, 15/150 Watts.

MFJ-822 **1.8-200 MHz $64.95** MFJ-842 140-525

VHF/UHF Hi-Gain Antennas

A. MFJ-1402, $34.95.
VHF/UHF RuffRiderJunior™. Premium, short 16 1/2" antenna fits in any garage on any auto. 1/4 Wave on 2 Meters, 1/2 Wave, gain on 440 MHz. 100W. No foldover. B or C.

B. MFJ-1412, $34.95.
VHF/UHF RuffRider High Power™. Just 40" long handles full 200 Watts. Great for high power mobile amp. 1/2 Wave, gain on 2 Meters, 5/8 Wave, great gain on 440 MHz. Black or chrome.

C. MFJ-1422, $34.95.
VHF/UHF RuffRider High Gain™. 41 1/2 inch long antenna gives extra gain with little height increase. Handles 150 Watts. 1/2 wave with good gain on 2 Meters, 5/8 wave, excellent gain on 440 MHz. Black or chrome.

D. MFJ-1432, $59.95.
VHF/UHF RuffRider Hyper Gain™. 62 1/2" brute gives whopping gain on 7/8 Wave 2-Meters, 5/8 Wave and a MONSTER gain on 440 MHz. MFJ will rock your ham radio world! 150 Watts. Use tri-magnet. Black or Chrome.

MFJ Mobile HF Ham Sticks

Each is ruggedly constructed. A heavy duty 4 foot, 3/8 inch diameter fiberglass rod; a nearly indestructible .125 inch diameter PH-17-7 stainless steel whip and chrome plated brass fittings will give you years of service. It's sleek, low profile construction has low wind loading and its semi-rigid fiberglass eliminates the need for springs or guys.

Black anti-static jacket protects loading coil, blends with any vehicle. Stainless steel whip is adjustable for lowest SWR. Push it down to park in the garage or fully extend it for maximum efficiency during mobile operation.

Includes allen wrench and complete tuning and matching instructions. Handle 250 Watts PEP. Whips are 7 feet fully extended, and collapse to about 4 feet for easy storage.

Simply screws into any 3/8 x 24 female mount for quick bandchanging. Get them all for great band coverage!

MFJ-1675T - 75 Meters
MFJ-1660T - 60 Meters
MFJ-1640T - 40 Meters
MFJ-1630T - 30 Meters
MFJ-1620T - 20 Meters
MFJ-1617T - 17 Meters
MFJ-1615T - 15 Meters
MFJ-1612T - 12 Meters
MFJ-1610T - 10 Meters
MFJ-1606T - 6 Meters

$19.95-$21.95 Each

60-75 Meters $29.95 each

— 3/8-24 Ham Stick Mounts —

MFJ-343, $11.95. Tough 3/8-24 hard mount for permanent installation.

MFJ-342T, $11.95. 3/8-24 HF horizontal or vertical 1/4 or 1/2 inch pipe or mirror mount.

MFJ-344, $11.95. Like MFJ-342T, but horizontal pipe mount.

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MFJ-1234 . . . Remotely operate your transceiver from anywhere in the world!

https://www.mfjenterprises.com/Product.php?productid=MFJ-1234

Apple iPhone connected to RigPi Station Server from anywhere via the Internet

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MFJ-1234

$319.95

Use nearly any transceiver with CAT control, old or new.
Operate all modes SSB, CW, FM, digital. WSJT-X, Fldigi are installed.
Control from anywhere via the internet using any browser -- radio, rotor, CW keying, VoIP, digital modes, logging, spot monitoring, callbook lookups, more.
Look-up calls using included FCC database or optional QRZ subscription.
Monitor DX spots for unworked or unconfirmed calls.
Design, maintain multiple logs. Upload ADIF logs to ARRL LoTW server.
Send CW from a mobile device, keyboard or paddle.
32 programmable macros.
Two or more hams from different locations can operate different radios at the same time using one MFJ-1234.

Remotely operate your station! Use any web browser on your mobile phone, iPad, tablet, laptop, desk-top even a Kindle!

Single-click updating, I/Q Input for SDR radios, onboard VoIP server gives outstanding 2-way audio.
Includes email, word processing, spreadsheet programs, 1000's of Linux programs, including many for ham radio. Modify, program RigPi Station Server features using a text editor.

HARDWARE

RSS is a Raspberry PiTM computer running Linux and RigPi Keyer and Audio boards. RigPi Keyer uses K1EL WinKeyer3 integrated circuit for keyboard/paddle input. RigPi Audio is used for VoIP for remote, digital modes and I/Q spectral display (Panadaptor).

RADIO/ROTOR SOFTWARE

RSS radio/rotor control uses Hamlib, a library of over 200 radios, 30 rotors. **MFJ-1305RP, $24.95**. 5V, 3A Pwr Supl.
MFJ-1234SD, $49.95. RigPi operating system on SD card.

TECH HELP

- RigPi forum is *https://rigpi.groups.io*
- RigPi website is *https://rigpi.net*

MFJ CW *Reader and Keyer* Combination

Plug MFJ's CW Reader with Keyer into your transceiver's phone jack and key jack.

Now you're ready to compete with the world's best hi-speed CW operators – *and they won't even know you're still learning the code!* Sends and reads 5-99 WPM.

Automatic speed tracking. Large 2-line LCD shows send/receive messages. Use paddle or computer keyboard.

Easy menu operation. Front panel speed, volume controls. 4 message memories, type ahead buffer, read again buffer, adjustable weight/sidetone, speaker. RFI proof.

MFJ-551, $29.95. RFI suppressed keyboard, a must to avoid RFI problems.

MFJ-464
$239.95
(Keyboard, Paddle Not Included.)

MFJ Pocket-Size *CW Reader*™ and *Code Tutor*

MFJ-461, $109.95. Place this tiny pocket size MFJ Morse Code Reader near your receiver's speaker and watch CW turn into solid text messages as they scroll across an easy-to-read LCD. No cables to hook-up, no computer, no interface, nothing else needed! Practice by copying along with the MFJ-461. Learn the code and increase your speed as you instantly see if you're right or wrong. Eavesdrop on interesting Morse QSOs from hams all over the world MFJ's *AutoTrak*™ automatically locks on, tracks and displays CW to 99 WPM. Serial port lets you display full screen CW text on your computer monitor with your computer and terminal program. Tiny 21/4x31/4x1", 51/2 oz. Fits in your shirt pocket, take it anywhere. Use 9 Volt battery.

MFJ-418, $109.95. Morse Code Tutor. Learn Morse code anywhere! Copy letters, numbers, prosigns or any combina tion or words or QSOs. ARRL/VEC format. Go from zero code speed to a high speed *CW Pro*! High contrast LCD, built-in speaker.

Plug & Play FT-8 and all Digital Modes!

MFJ-1204, $119.95. *Plug&Play* all digital modes! Specify your radio when ordering and just plug USB cable into your computer. Download free software from internet and operate: FT-8, JT4, JT-65, JT6M, FSK441, WSPR, PSK-31, EchoLink, APRS, CW, RTTY, packet, Amtor, more. Easy-to-set transmit/receive levels. Transformer isolated audio, PTT sensing eliminates adjustments. Universal, never obsolete.

MFJ-407E Deluxe CW Keyer $119.95

MFJ Curtis-Keyer has all keyer modes, dot-dash memories, jam-proof spacing, weight, sidetone, built-in speaker. Speed, weight and tone controls and tune, semi-auto and on/off switches are on the front panel.

MFJ-557 Code Oscillator/Key $49.95

Practice sending Morse code. Telegraph key, code oscillator, speaker on heavy non-skid steel base. Volume/tone controls. Use 9V battery.

MFJ-550, $19.95. Key only.

MFJ-561 Tiny Iambic paddle $34.95

Tiny *iambic paddle* is just 1 3/4W x 3/4H x 1 3/4D", just 2 1/2 oz. Precision paddle formed from phosphorous bronze, rugged metal base, non-skid rubber feet, wired.

MFJ-401E *Econo* CW Keyer $94.95

Front-panel volume/speed controls (8-50 wpm), tune switch. Internally adjust weight/tone. Solid state keying. Tiny 4 x 2 x 3 1/2 inches.

MFJ-564 Iambic Paddles $109.95

Deluxe Iambic paddles. Tension/contact spacing adjustments, steel bearings, precision frame, non-skid feet. Chrome (MFJ-564) or Black (MFJ-564B).

MFJ-422E Keyer/Paddle $229.95

MFJ *CW keyer and Iambic Paddle combo* lets you send smooth, easy CW. Front panel volume/speed (8-50 WPM), built-in dot-dash memories, speaker, sidetone.

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MFJ SDR T/R Protection Switch

Turn your SDR into a panadapter to see entire bands on frequency/waterfall displays...

New!

An inexpensive wide-band SDR dongle receiver lets you see entire bands on frequency/waterfall computer displays!

MFJ-1708B-SDR
$119.95

If you want to know where the activity is, who's generating splatter, what's in the DX window, how wide your audio is or what frequencies are clear, it's all right there! While receiving on your transceiver, MFJ-1708B-SDR switches your SDR to your antenna showing the entire band. On transmit your SDR is switched out and grounded to protect your SDR. PTT and a failsafe RF sense switches MFJ-1708B-SDR. For HF/VHF/UHF. Monitor multiple bands with multiple SDRs and a multi-coupler.

MFJ-1708B-SDR-S, $129.95. SMA connector for your SDR.

MFJ-1708SDR, $99.95. Original model for HF/VHF.

New B series improvements...
The original MFJ-1708 series used one relay and wires to connect the SO-239s. The new B-series uses four relays and connectors on a *single* pc board. This gives you > 50 dB isolation at 300 MHz and > 68 dB at 50 MHz. SWR < 1.16:1 at 50 MHz and < 1.75:1 at 450 MHz at the transmit port. Mute output is a selectable short or open to ground. Use "boat anchors" or modern receivers or key a linear amplifier. Receiver input protection prevents overload from nearby high power signals and from receive to transmit. A hybrid splitter on SDR models reduces loading effect and gives > 15 dB isolation between the SDR REC and XCVR ports to reduce interference. The original MFJ-1708 series is still available.

MFJ Low Noise VLF/HF Receiving Loop

Pull weak signals out of static crashes, atmospheric, man-made and power line noise!

Hear signals 500 KHz to 30 MHz cleaner, quieter than ever before! Power line noise disappears. Rotate its figure 8 pattern and its extremely deep null to completely eliminate an interfering signal or greatly peak a desired one. Fully protected state of-the-art Gali MMICs in push-pull gives you a preamp with extremely high dynamic range, low IMD and 25 dB of low noise gain. Excellent performance on strong and weak signals without overload. 36-inch dia. loop. 1-in. OD 6061 aluminum.

MFJ *wideband* SDR *Discone* Antenna

Receives 25-1300 MHz

MFJ ultra wide-band *Discone* Antenna receives 25-1300 MHz. Perfect for all band SDR reception. Covers 10, 6, 2 Meters, 220 and 440 MHz and 33/23 CM ham bands and everything in between. It is excellent for monitoring multiple bands simultaneously using multiple SDRs and a multi-coupler. Also test any transmitter 50-1300 MHz using a single discone and single coax. Handles 200W. Includes 50 feet coax, stainless steel elements and mounting hardware.

MFJ-1866, $59.95. Like MFJ-1868 but transmits 144-1290 MHz. Coax and mounting hardware not included.

Tuned Indoor SDR Active Antenna

MFJ-1020C
$119.95

Make your SDR receiver come alive with HF signals, .3-40 MHz, while rejecting interference with MFJ-1020C *tuneable* indoor active antenna! Gain control, telescoping whip.

Untuned Indoor SDR Active Antenna

MFJ-1022, $79.95. Hear weak, noisy VLF to UHF signals. Noise-less feedback gives excellent low noise reception. Handles strong signals.

Active Outdoor Antenna

MFJ-1024
$179.95

World Radio TV Handbook says "MFJ-1024 is a *first rate, easy-to-operate active antenna, quiet, excellent dynamic range, good gain, very low noise factor, broad frequency coverage, excellent choice...*" **Outdoor** mounted 54-inch whip/pre-amp gives maximum signal and minimum noise. Covers .05-30 MHz. **Indoor** unit: 20 dB attenuator, gain control, 2 receiver and 2 antenna switches.

HF SDR Preselector

MFJ-1040C
$139.95

Tuneable MFJ-1040C lets you copy weak, noisy SDR signals from 1.8 to 54 MHz. Greatly tunes out and reject out-of-band interference. Up to 20 dB gain. Has gain control. Cascode FET/bipolar transistor gives low noise, high gain without overloading. Switches for 2 antennas and 2 receivers. SO-239s. Has 20 dB attenuator. Automatically bypasses when transmitting or use PTT. 6½W x 2½H x 4D inches.

MFJ LW/MW/SW SDR Preselector/Tuner

MFJ-956
$79.95

Highly rated series-tuned MFJ-956 boosts your desired signals while greatly rejecting interference and preventing serious overload. **Greatly** improves reception 0.15 to 30 MHz. Incredibly effective below 2 MHz. **Super** easy to operate, select band and tune! **Bypass** tuner and ground receiver switch positions. **Compact** 2 x 3 x 4 inches. SO-239 connectors.

MFJ-1708B, $119.95.

MFJ RF Sense Transmit/Receive Switch

Switches your antenna from receiver to transmitter using a relay. Shorts your receiver to ground during transmit. Use RF sensing with adjustable delay or PTT line. Has selectable open/short mute.

MFJ-1707B, $119.95.

Auto switch XCVR between 2 antennas

Switches switches separate transmit and receive antennas on transceivers with only one antenna port. *Example*: Efficient 75M dipole for XMIT and MFJ-1708B low noise MFJ loop for receive -- *no static crashes*!

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MFJ Portable Antennas!

Cover HF bands with one single EFHW, no tuner needed!

MFJ-1982MP, $79.95

• **Get on the air** 80-10 Meters with a single wire *EFHW* and one center or end support. Fast, easy set-up/take-down for portable use.

• **End-Fed Half-Waves** (EFHW) resonate on halfwave fundamental frequency and even harmonics. 80-10 Meters -- no traps, stubs, resonators. Broad-band matching transformer gives you low SWR! No tuner usually needed.

• **No long counterpoise**, radials or feedline required

• **Nearly invisible,** no-tangle black *Teflon* insulated radiator wire.

• **Weather** and U/V resistant. Easy storage and transport.

MFJ-1982MP, $79.95. *300 Watts* Restricted space, 80-10M. 132 ft.
MFJ-1984MP, $69.95. *300 Watts* Restricted space, 40-10M. 66 feet.

MFJ-1982HP, $109.95. *800 Watts*, high power, 80-10 Meters. 132 feet.
MFJ-1984HP, $89.95. *800 Watts*, high power, 40-10 Meters. 66 feet.

MFJ-1982LP, $59.95. *30 Watts* QRP, 80-10 Meters. 132 feet.
MFJ-1984LP, $49.95. *30 Watts* QRP, 40-10 Meters. 66 feet.

17' Stainless Steel Telescopic Whip

MFJ-1979, $69.95. Premium stainless steel, 17 feet ext., 27" collapsed. Adjust length for full 1/4 wave antenna on 20-2M. Use MFJ-67 loading coil for 30/40/60/80M. For 3/8-24 standard mounts.

33' Telescopic *Portable* Mast

MFJ-1910, $99.95. Fiberglass. 3¾ ft collapse, 3.3 lbs.

Single-band Rotatable mini Dipoles

MFJ-22XX, $69.95. Lightweight *true balanced* mini-dipoles for portable and space limited use. Choose: 75/60/40/30/20/17/15/12/10/6 Meters. Includes two HF sticks of your choice and dipole mount.

MFJ-347, $24.95. *True isolated balanced* dipole mount only. 1.25" mast size.

MFJ *Walk-About* 80-6M Antenna

MFJ-1899T, $99.95. Operate 80-6 Meters/WARC bands. BNC attaches directly to your Yaesu FT-817, Elecraft KX1/2/3, Icom IC-705, Xiegu G-90, X5105. 12" loading coil with wander lead. 10-section telescopic whip, 52" ext., 7" collapsed. Whip unscrews for easy carry and storage. 25 Watts.

MFJ-7703, $8.95. BNC/PL-259 right angle adapter.

10-band 80-2M *Mobile/Portable*

MFJ-1699T/S, $79.95 HF: 80-10 Meters, VHF: 6 and 2 Meters. Low SWR, 200 Watts. Wander lead changes bands. Maximum height is 49.5 inches. 3/8-24 or PL-259. Whip unscrews at base for quick storage.

Hamsticks! Choose: 75/40/30/20/17/15/12/10/6 Meters. **$19.95-$29.95 each.**

BigEAR™ Dipole

MFJ-2289, $209.95. 7-55 MHz portable, 34' ext., 28" collapsed, balun, 1kW, 30/40M coil.

BigStick™ Vertical

MFJ-2286, $119.95. 7-55 MHz 17' ext., 28" collapsed, mount, counterpoise, 30/40M coil, 1kW.

BigEar™ Combo

MFJ-2289PKG, $339.95. BigEAR, tripod/mast. Canvas carry bag, padding, pockets, handle.

4-Band *Octopus* Antenna *Hub*

MFJ-2100, $109.95. *Turns pairs of hamsticks into four fully balanced dipole antennas in minutes!* Any bands: 80-2M, 440 MHz. Balun, single coax feed, no antenna tuner needed. Perfect for fiberglass pole on tripod at any height. Eight 3/8-24 connectors for antennas.

MFJ *QuickStik™* Mount/Ground

MFJ-1936T, $44.95. Push into ground up to 4 ft., attach any HF/VHF/UHF antenna with 3/8-24 connector like a hamstick or whip, attach coax to SO-239, operate! Use *QuickStik™* as *ground* and/or use included 25 ft. counterpoise wire.

20W Transceiver Xiegu G-90, $449.95

20-W SDR Xcvr, .5-30 MHz, Auto-tuner, SSB/CW/AM/FM/Digital, detachable front panel, IQ out.

5W 160-6M Transceiver Xiegu 5105, $599.95. All modes, DSP, ATU, 3800 mAH battery, microphone.

MFJ 10-40 Meters *Portable* Antenna

MFJ-1621, $119.95. 40-10M, telescoping whip: 54" extended, 22" collapsed. Tuner, field strength meter, 50' coax. 200W SSB/CW.

Box Fan Mag Loop

MFJ-1780, $369.95. Portable 2x2 ft. Carry handle. 14-30 MHz *continuous*. 150W SSB/CW. High efficiency *true mag loop*, no rotating contact *butterfly capacitor*, all welded. Fast/slow tune remote control.

Portable MFJ Tripods and Tripod/Masts

Black *steel* base forms strong braced equilateral triangles on a side. Non-skid feet, strong, mast locks.

MFJ-1919, $109.95. 9¾ lbs. Holds 100 lbs. 1.4" dia. mast extends 7.8 ft. Base spreads to 4.8 ft. 54"x6" dia. collapsed.

MFJ-1919EX, $179.95. Tripod *plus* 18' fiberglass mast. 5' collapsed. 1/8" wall, 3/4" dia. top, 1½" dia. bottom. 15 lbs.

MFJ-1918, $69.95. Tripod: 6' ext. 38" collapsed, 6¾ lbs.

MFJ-1918EX, $109.95. Smaller tripod with 9½' fiberglass mast. 3.8 ft. collapsed. ¾"top, 1" bottom. 6.5 lbs.

MFJ *QRPocket™* *Loop Tuner*

MFJ-9232, $69.95. Drape a wire around a bookcase, window, tree or other and attach to this MFJ QRP Loop Antenna Tuner. It becomes a 25 Watt multi-band transmitting magnetic loop! 40-10 Meters with included flexible wire loop. No ground, radials or needed.

QRP Antenna Tuner

MFJ-9201, $59.95. *Tunes any antenna* 80-10 Meters, 25 W. 12-position hi-Q inductor, tune/bypass, antenna and transmitting matching variable capacitors, BNC connectors. Tiny 4Wx2⅝Hx1½D inches -- MFJ-9201, rig and antennas easily fit into a backpack or briefcase for vacation, SOTA, hikes, etc.

MFJ Manual Tuner

MFJ-945E, $159.95. 1.8- 60 MHz, 300 Watts PEP. Tunes coax-fed antennas and random wires. Lighted cross-needle SWR/forward and reflected Wattmeter. Bypass switch bypasses tuner. SO-239, wing nut post for ground. Efficient, low loss airwound inductor. Small, 8Wx2Hx6D inches.

200W Auto Tuner

MFJ-939, $159.95. Plug and play auto tuner for Icom, Yaesu, Kenwood and others. Automatically tunes any antenna ultra-fast! 20,000 Virtual antenna memories, matches 6-1600 Ohms, 1.8-30 MHz, 2 to 200 Watts SSB/CW. Radio interface cable included, 2-year MFJ warranty. 6½Wx1⅝Hx7½D".

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Be witness to the evolution of KENWOOD's pride and joy - the TS-590S HF transceiver - pushing performance and technology to its utmost limit, with the receiver configured to capitalize on roofing filter performance and IF AGC controlled through advanced DSP technology. Enter the TS-590SG. A new generation of high performance transceiver, with the type of high level response to meet DX'ers needs.

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Choose Lightweight-Light-Duty or Super-Strong Thick-Wall models -- 10 to 50 feet long. Each collapses to an easy-to-carry size for true portability.

For quick put-up and take-down, light-duty models have Twist & Lock sections and heavy-duty thick wall models use military style *QuickClamps*™ or stainless steel hose clamps.

Use them for traveling, camping, at hotels, hamfests, field day, DX-peditions. Put up full size full performance inverted Vee, dipole or vertical antenna in minutes at heights that will snag you real DX.

Use multiple telescoping masts to make loops, quads, rotatable dipoles even beams.

← *Light Duty Lightweight Fiberglass Masts*

So lightweight you can take them anywhere!

MFJ's most popular MFJ-1910 is 33 feet long, 3.3 lbs.

MFJ-1910, $99.95. 33 ft., light duty w/top tie ring.
MFJ-1911, $109.95. 20 ft., light duty w/top tie ring.
MFJ-1913, $109.95. 28 ft., lightweight w/top tie ring.
MFJ-1915, $159.95. 25 ft., for heavier duty use.
MFJ-1916, $179.95. 34 ft., for heavier duty use.
MFJ-1917, $189.95. 43 ft., heavier duty w/top tie ring.

Super-strong .125" Thick-Wall Fiberglass Masts

Use for temporary or permanent wire antennas, small beams or verticals. **Best seller** is 50 ft. long, just 26 lbs.

Heavy Duty Models: All have QuickClamps™ →

MFJ-1908HD, $289.95 is 48 ext., 7.75-ft. collapsed, has $2^1/_2$" OD bottom, 1" OD top, seven 7.75-ft. sections, 24 lbs.
MFJ-1906HD, $249.95 is 38' extended, 6 feet collapsed, has $2^1/_2$" OD bottom, 1" OD top, seven 6-foot sections, 24 lbs.
MFJ-1904HD, $179.95 is 25' extended, 4 feet collapsed, has $2^1/_2$" OD bottom, 1" OD top, seven 4-foot sections, 14 lbs.
MFJ-1904H, $159.95. 22' ext., 5' collapsed, 9 lbs. $2^1/_2$" OD.
MFJ-1902H, $139.95, 10' ext., 38" collapsed, 5 lbs. $2^1/_2$" OD

Standard Models: H models have QuickClamps™

MFJ-1906, $159.95/MFJ-1906H, $219.95, 33 feet, ext., 6 ft. collapsed, six 6-ft. sections, 13 lbs. 2" bottom, $^3/_4$" top OD.
MFJ-1908, $199.95/MFJ-1908H, $259.95, 41' ext., 7.75 ft. collapsed, six 7.75-ft. sect., 16 lbs. 2" bottom, $^3/_4$" top OD.

Mast Accessories

MFJ-1900, $79.95. Mount clamps mast to mounting pipe.
MFJ-13S, $69.95. 5 Military *QuickClamps*™. Fit $^3/_4$" to 2" OD.
MFJ-13HD, $69.95. Extra set clamps, 1- $2^1/_2$" masts.

Mast Guy Ring Sets

Fits masts $^3/_4$" to $1^1/_4$" dia OD. **MFJ-2830X, $9.95,** *fiberglass*; **MFJ-2840X, $12.95,** *aluminum.*

Left: *Stainless Steel Hose Clamps* recommended for permanent installations. Fiberglass is slotted.

Right: UV protected Military grade *QuickClamps*. Guy 2 levels when fully extended.

18' Telescopic Mast & Tripod

MFJ-1919EX, $179.95.
Put your antennas up high anywhere with this super-strong* 18 foot telescoping fiberglass mast and MFJ-1919 heavy duty steel tripod. *QuickClamps™ lower mast to 5 feet. Mast has thick 1/8 in. wall, .75" top, 1.5" bottom dia. 15 lbs. Steel tripod has braced triangle base, non-skid feet, mast lock.

MFJ-1918EX, $109.95.
MFJ-1918 tripod has super strong 9.5 foot telescoping fiberglass mast. 3.8 feet collapsed. *QuickClamps*™. Thick 1/8 inch wall, .75" top, 1" bottom diameters. 6.5 lbs.

Tripods Only

MFJ-1921, $199.95, Giant tripod base spreads to 8 feet! Supports massive antennas. Adjustable length non-skid legs accommodates uneven ground surfaces. Optional foot anchors **MFJ-1905, $34.95**, see **Tripod Anchors** bottom right. 5.75Hx7D feet collapsed. 14 lbs.

MFJ-1919, $109.95, *Large tripod* base spreads to 4.8 feet. Supports 100 pounds. 7.8 feet, 1.4 inch diameter mast. 4.5H x .5D feet collapsed. 9.75 lbs.

MFJ-1918, $69.95, Smaller tripod base spreads to 2.75 ft. Support 66 lbs. 6 foot, 1" dia. mast. 3.2H x .3D ft. collapsed. 6.75 lbs.

80-6 Meter Antenna

3.8 foot fiberglass mast telescopes to a 31 foot self-supporting high performance 80-6 Meter vertical antenna in minutes!

MFJ-2980
$115.95
40-6 Meters

MFJ-2982
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80-6 Meters

Quarter wave performance on 40 Meters, halfwave on 20M. High-Q air wound loading coil. Use antenna tuner for 30, 20, 15, 12, 10, 6 Meters. 600 Watts SSB/CW.

Use as temporary, portable or permanent antenna for home, RVs, camping, field day, hamfest, DX-pedition.

Includes four 12 foot radials. Current balun reduces feedline radiation and pattern distortion.

MFJ "HamStick" Isolated Dipole

Build your own 80-6 Meter *mini*-dipole using two HF mobile whips! Only MFJ-347 mount *isolates* dipole elements and lets you use a balun to give a true *balanced dipole*. Prevents pattern distortion, noise pickup and RFI radiation from RF on coax shield. Solid aluminum. Use mast up to $1^1/_4$" OD.

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3/8-24 Hamstick

MFJ-342T
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Mount 3/8-24 HF/VHF hamsticks vertically or horizontally on masts up to 1 inch. Built-in SO239 connector.

MFJ Balcony Mount

MFJ-1907
$49.95

Mount *multiple* HF/VHF hamsticks, verticals, dipoles vertically and/or horizontally on your apartment/condo balcony. High-strength aircraft aluminum extends out 14". Two U-bolts mount up to $1^1/_2$" diameter.

Tripod Anchors

Securely anchor tripod to ground with these 3 stainless steel foot braces and your stakes. For high winds, unlevel ground, tall antennas. Fits legs to $1^1/_2$"OD.

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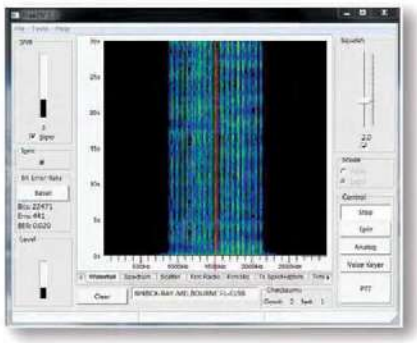

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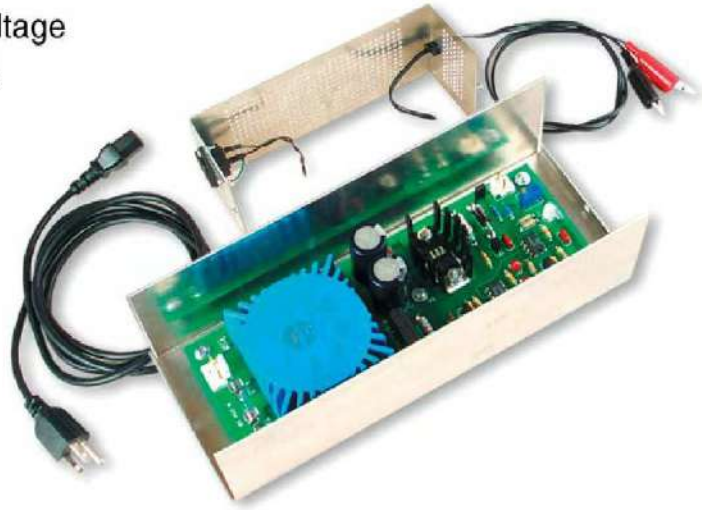

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Read SWR, return loss, reflection coefficient, match efficiency at any frequency simultaneously.

Read Complex Impedance (280 KHz to 230 MHz plus 2200 Meters) as series equivalent resistance and reactance (Rs+jXs) or as magnitude (Z) and phase (degrees). Also reads parallel equivalent resistance and reactance (Rp+jXp).

Determine velocity factor, coax loss in dB, length of coax and distance to short or open in feet (it's like a built-in TDR).

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Super easy-to-use – Read antenna SWR, complex impedance, return loss, reflection coefficient. Determine velocity factor, coax cable loss in dB, length of coax and distance to short or open in feet. Read inductance in uH, capacitance in pF at RF frequencies. Large easy-to-see two line LCD screen and side-by-side meters clearly display your information. Built-in frequency counter, signal generator, Ni-Cad charger circuit, battery saver, low battery warning and smooth reduction drive tuning. More!

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MFJ-223
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This *pocket-sized* wonder breaks the mold for analyzer design with user-friendly convenience, top notch accuracy, and a vivid TFT multi-color display. Don't let the size fool you, MFJ-223 is packed with all the VNA features and performance you need!

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MFJ-225
$339.95

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MFJ-249D, $279.95

If digital display is all you need MFJ-249D does everything MFJ-259D does without analog meters.

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MFJ VNA Antenna Analyzer covers 1 to 230 MHz, 1Hz resolution.

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MFJ-226
$379.95

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B. **MFJ-92AA10, $39.95.** 10-Pack 2500 mAh Ni-MH Supercells.

C. **MFJ-66D, $39.95.** Dip coils, set of two covers 1.8-230 MHz.

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F. **MFJ-5510D, $15.95.** 12VDC cigarette lighter adapter.

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MFJ-998RT
$869.95

Bottom Chassis

Inside View

Tune your antenna at your antenna

Get greatly reduced losses and high efficiencies with long coax runs and high SWR antennas with this new MFJ-998RT 1.5 kW Remote Antenna Tuner.

Weather-Sealed

A tough, durable weather-sealed ABS cabinet with over-lapping lips, sealing gasket and stainless steel chassis protects the MFJ-998RT from all kinds of weather.

No Power Cable Needed!

No power cable needed -- remotely powered through coax. Includes MFJ-4117 Bias-Tee with on/off switch for station end of coax. Has 12 VDC jack for power cable, if desired.

Fully Protected

MFJ exclusive algorithms protect your tuner, radio and RF power amplifier from damage.

Automatic inductor and capacitor limiting prevents tuning extreme loads which can destroy your tuner.

Your tuner will not tune if more than 75 Watts with SWR greater than 3:1 is applied or if more than 125 Watts is applied.

Tuner output is static electricity and lightning induced surge protected.

MFJ exclusive StickyTune™

Very high SWR can fold back transmitter power and prevent tuning caused by extreme differences in loads (example: changing bands and other conditions).

But MFJ exclusive StickyTune™ always tunes with a simple on/off power cycle and re-transmit.

Tunes Coax fed and Wire Antennas

Tunes both coax fed and wire antennas. Has ceramic feed-through insulator for wire antennas. 2 kV Teflon® insulated SO-239 – prevents arcing from high SWR.

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A highly efficient L-network matches 6-1600 Ohms at full 1500 Watts legal limit SSB/CW 1.8 to 30 MHz with Hi-Q Ls, Cs.

MFJ-998RT Learns as you Operate

As you operate, the MFJ-998RT automatically tunes for minimum SWR and remembers your frequency and tuner settings. The next time you operate on that frequency and antenna, its tuner solution is restored in milliseconds and you're ready to operate!

Highly Intelligent, Ultra-fast Tuning

MFJ InstantRecall™ recalls stored tuning solutions from 10,000 memories. For new frequencies, MFJ Intelli-Tune™ measures your antenna impedance and instantly determines the correct matching components. If antenna impedances cannot be measured, MFJ AdaptiveSearch™ searches only the relevant components that can match your antenna giving you ultra-fast tuning.

Field upgradeable firmware. Requires 12-15 VDC at 1.4 Amps maximum or 110 VAC with optional **MFJ-1316, $29.95**. Weighs 9.5 lbs. $13\frac{1}{4}$W x $6\frac{3}{4}$H x $17\frac{1}{2}$D inches.

600W Remote IntelliTuner™

MFJ-994BRT – perfect for 600 Watt SSB/CW amplifiers like Ameritron's AL-811/ ALS-600/ALS-500M. Matches 12-800 Ohms. Coax/wire antennas, 1.8-30 MHz. Fully weather-sealed for outdoor use. Remotely powered through coax. Tough, durable, built-to-last cabinet, $9\frac{1}{4}$W x 3H x $14\frac{1}{4}$D inches, 4 lbs. Includes MFJ-4117 BiasTee Power Injector.

MFJ-994BRT
$459.95

300W Remote IntelliTuner™

MFJ-993BRT handles 300 Watts SSB/CW and matches an extra-wide 6-1600 Ohm impedances. Coax/ wire antennas, 1.8-30 MHz. Fully weather-sealed for remote outdoor or marine use. Remotely powered through coax. Tough, durable, built-to-last cabinet measures $9\frac{1}{4}$W x 3H x $14\frac{1}{4}$D inches. Weighs just 4 pounds. Includes MFJ-4117 BiasTee Power Injector.

MFJ-993BRT
$339.95

200W Remote IntelliTuner™

MFJ-926B, 200 Watts SSB/CW, matches 6-1600 Ohms, Coax/wire antennas, 1.8-30 MHz. Includes BiasTee.

MFJ-926B $329.95

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30 Day Money Back Guarentee
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160-6 Meters 43 foot Vertical Antenna

Operate all bands 160-6 Meters at full 1500 Watts with this self-supporting, 43 foot high performance vertical! Assembles in less than an hour. Low profile blends in with sky and trees -- barely see it. Entire length radiates. Exceptional low angle DX performance on 160-20 Meters and very good performance on 17-6 Meters. Telescope it shorter for more effective low angle radiation on 17-6 M if desired. One of these wide range MFJ automatic tuners at the antenna easily matches all bands 160-6 Meters. There's no physical tuning adjustments on the antenna -- you simply put it up! Requires ground system, at least one radial, more the better. Includes balun and base mount. **MFJ-1932, $44.95**. All band ground radial system.

MFJ-2990
$399.95

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MFJ Tuners

New, Improved MFJ-989D 1500 Watt legal limit Antenna Tuner

World's most popular 1500 Watt Legal Limit Tuner just got better -- much better -- gives you more for your money!

New, improved MFJ-989D legal limit antenna tuner gives you better efficiency, lower losses and a new true peak reading meter. It easily handles full 1500 Watts SSB/CW, 1.8 to 30 MHz, including MARS/WARC bands.

New, dual 500 pF air variable capacitors give you twice the capacitance for more efficient operation on 160 and 80 Meters.

New, improved AirCore™ Roller Inductor gives you lower losses, higher Q and handles more power more efficiently.

New, TrueActive™ peak reading Cross-Needle SWR/Wattmeter lets you read true peak power on all modes.

MFJ-989D $469.95

Includes six position ceramic antenna switch, 50 Ohm dummy load, indestructible multi-color Lexan front panel with detailed logging scales and legends.

The MFJ-989D uses the superb time-tested T-Network. It has the widest matching range and is the easiest to use of all matching networks. Now with MFJ's new 500 pF air variable capacitors and new low loss roller inductor, it easily handles higher power much more efficiently.

New, high voltage current balun lets you tune balanced lines at high power with no worries.

New, crank knob lets you reset your roller inductor quickly, smoothly and accurately.

New, larger 2-inch diameter capacitor knobs with easy-to-see dials make tuning much easier.

New, cabinet maintains components' high-Q. Generous air vents keep components cool. $12^{7}/_{8}$W x 6H x $11^{5}/_{8}$D inches.

No Matter What™ Warranty

Every MFJ tuner is protected by MFJ's famous one year **No Matter What™** limited warranty. We will repair or replace your MFJ tuner (at our option) for a full year.

More hams use MFJ tuners than all other tuners in the world!

MFJ-986 Two knob Differential-T™

MFJ-986 $419.95

Two knob tuning (differential capacitor and AirCore™ roller inductor) makes tuning foolproof and easier than ever. Gives minimum SWR at only one setting. Handles 3 kW PEP SSB amplifier input power (1.5 KW output). Gear-driven turns counter, lighted peak/average Cross- Needle SWR/Wattmeter, antenna switch, balun. 1.8 to 30 MHz. 15W x $4^{1}/_{2}$H x $10^{3}/_{4}$D in.

MFJ-962D compact kW Tuner

MFJ-962D $359.95

A few more dollars steps you up to a KW tuner for an amp later. Handles 1.5 kW PEP SSB amplifier input power (800W output). Ideal for Ameritron's AL-811H! AirCore™ roller inductor, gear-driven turns counter, pk/avg lighted Cross-Needle SWR/Wattmeter, antenna switch, balun, Lexan front, 1.8-30MHz. $10^{7}/_{8}$W x $10^{3}/_{4}$H x $4^{1}/_{2}$D in.

MFJ-969 300W Roller Inductor Tuner

MFJ-969 $259.95

Superb, AirCore™ Roller Inductor tuning. Covers 6 Meters thru 160 Meters! 300 Watts PEP SSB. Active true peak reading lighted Cross-Needle SWR Wattmeter, QRM-Free PreTune™, antenna switch, dummy load, 4:1 balun, Lexan front panel. $10^{1}/_{2}$W x $3^{1}/_{2}$H x $9^{1}/_{2}$D inches.

MFJ-949E deluxe 300 Watt Tuner

MFJ-949E $219.95

More hams use MFJ-949s than any other antenna tuner in the world! Handles 300 Watts. Full 1.8 to 30 MHz coverage, custom inductor switch, 1000 Volt tuning capacitors, full size peak/average lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, dummy load, QRM-Free PreTune™, scratch proof Lexan front panel. $10^{5}/_{8}$W x $3^{1}/_{2}$H x 7D inches. **MFJ-948, $179.95.** Economy version of MFJ-949E, less dummy load, Lexan front panel.

MFJ-941E Super Value Tuner

MFJ-941E $169.95

Most for your money! 300 Watts PEP, 1.8-30 MHZ, lighted Cross-Needle SWR/Wattmeter, 8 position antenna switch, 4:1 balun, 1000 volt capacitors, Lexan front panel. $10^{1}/_{2}$W x $2^{1}/_{2}$H x 7D in. **MFJ-941EK, $139.95.** Tuner Kit -- Build your own!

MFJ-945E HF/6M mobile Tuner

MFJ-945E $159.95

Extends your mobile antenna bandwidth so you don't have to stop, go outside and adjust your antenna. Tiny 8W x 2H x 6D in. Lighted Cross-Needle SWR/Wattmeter. Lamp and bypass switches. Covers 1.8-30 MHz and 6 Meters. 300 Watts PEP. **MFJ-20, $9.95,** mobile mount.

MFJ-971 portable/QRP Tuner

MFJ-971 $149.95

Tunes coax, balanced lines, random wire 1.8-30 MHz. Cross-Needle Meter. SWR, 30/300 or 6 Watt QRP ranges. Matches popular MFJ transceivers. Tiny $6^{1}/_{2}$W x $2^{1}/_{2}$H x 6D in.

MFJ-901B smallest Versa Tuner

MFJ-901B $119.95

MFJ's smallest (5W x 2H x 6D in.) and most affordable wide range 200 Watt PEP Versa tuner. Covers 1.8 to 30 MHz. Great for matching solid state rigs to linear amps.

MFJ-902B Tiny Travel Tuner

MFJ-902B $129.95

Tiny $4^{1}/_{2}$W x $2^{1}/_{4}$H x 3D inches, full 150 Watts, 80-6 Meters, has tuner bypass switch, for coax/random wire. **MFJ-904H, $169.95.** Same but adds Cross-needle SWR/Wattmeter and 4:1 balun for balanced lines. $7^{1}/_{4}$W x $2^{3}/_{4}$H x $2^{3}/_{4}$D inches.

MFJ-16010 random wire Tuner

Operate all bands anywhere with MFJ's reversible L-network. Turns random wire into powerful transmitting antenna. 1.8-30 MHz. 200 Watts PEP. Tiny 4W x 2H x 3D in.

MFJ-16010 $79.95

MFJ-9201 QRPocket™ Tuner

80-10 Meters, 25 Watts. 12 position inductor, tune/bypass switch, wide-range T-network, BNCs. 4W x $2^{5}/_{8}$H x $1^{1}/_{2}$D inches. **MFJ-9201, $49.95**

MFJ-9201 $54.95

MFJ-921/924 VHF/UHF Tuners

MFJ-921 covers 2 Meters/220 MHz. **MFJ-924** covers 440 MHz. SWR/Wattmeter. 8W x $2^{1}/_{2}$H x 3D in.

MFJ-921/924 $109.95

MFJ-931 Artificial RF Ground

Eliminates RF hot spots, RF feedback, TVI/RFI, weak signals caused by poor RF grounding. Creates artificial RF ground or electrically places far away RF ground directly at rig. **MFJ-934, $249.95,** Artificial ground/300 Watt Tuner/Cross-Needle SWR/Wattmeter.

MFJ-931 $129.95

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Phone: (662) 323-5869 ■ **Tech Help:** (662) 323-0549 ■ **FAX:** (662) 323-6551 8-4:30 CST, Mon.-Fri.

MFJ Cobweb Antenna

6-Bands: 20/17/15/12/10/6 M...Outstanding Performance!

Restricted space spoiling your operating fun? MFJ Cobweb puts your call back on the map!

This six-band (20, 17, 15, 12, 10, 6 Meters) full half-wave *Cobweb Antenna* is perfect for restricted space or portable operation. Sky-gray fiberglass spreaders and *nearly invisible* wire elements (flat 9 x 9 x 1/2 feet square. 8 pounds), blend in with your surroundings while standing tough against nasty weather.

Outstanding performance! Horizontally polarized for less local noise pickup plus solid gain over verticals will allow you to work DX easily – even on QRP. Omni-directional. No radials needed! Works great at low heights. Low SWR is due to MFJ's exclusive *Spider-Match*™ broadband network. Use lightweight TV hardware to mount on your chimney, balcony, mast.

Low in cost, but big on performance. MFJ *Cobweb Antenna* turns your space problem into a stack of QSL cards from far away places.

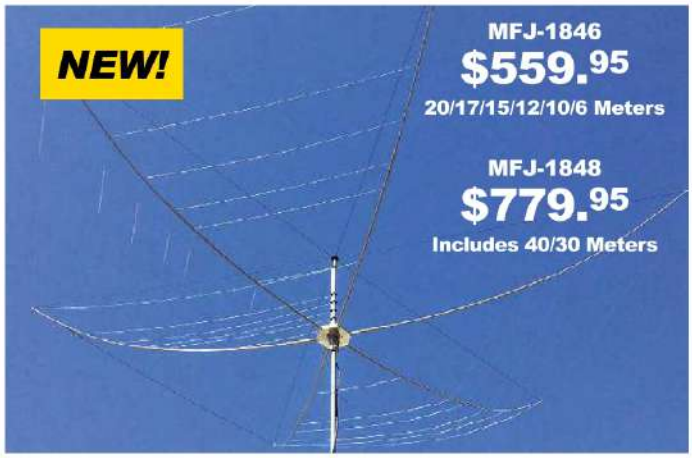
MFJ-1836HK34, $139.95. Add-on kit adds 40/30 Meters to MFJ-1835/1835H and MFJ-1836/MFJ-1836H cobweb antennas.

MFJ-1838
$459.95

40-6 METER Cobweb Super Heavy-Duty, 1.5 kW

New! Super heavy-duty 40-6 Meter Cobweb Antenna. Built to survive harsh northern winters, heavy snow, ice and strong winds – has super-strong large diameter fiberglass and heavy-duty 14 gauge stranded hard copper wire. 8-bands: 40, 30, 20, 17, 15, 12, 10, 6 Meters, 1500 Watts. Turning radius: 12 feet, 23 lbs.

MFJ 20/17/15/12/10/6 Meter *Hexbeam*



New MFJ HexBeams deliver solid gain and directivity on 20/17/15/12/10/6 Meters with two elements on each band.

MFJ uses an updated G3TXQ element configuration for excellent gain, improved bandwidth, superior front-to-back ratio and low SWR!

MFJ takes the HexBeam`s unique balanced-tension framework to a new level with rugged mounting hardware, exceptionally durable spreaders and sliding antenna-wire guides – designed to ensure years of reliable service.

MFJ-1846, $559.95. 6 Bands: 20/17/15/12/10/ 6M, 2-elements per band, full 1500W. 25 lbs. 11 ft.turning radius.

MFJ-1848, $779.95. 8 Bands: 20/17/15/12/10/ 6M, 2-elements per band; 40/30M, single elements, full 1500W. 28 lbs. 14 ft. turning radius.

www.mfjenterprises.com

3-Element Hexbeam

MFJ-1856 is ***six*** individually stacked monoband yagis!

6 Bands: 20/17/15/12/10/6M. Full 1500 Watts.

Three *full-size* elements on each band gives high gain, high front-to-back ratio and wide bandwidth. Works great at 20 feet. 30lbs. 17 feet turning radius. Ideal for a small rotator like hy-gain's CD-45II, $449.95.

MFJ Isolator and 1:1 Balun

MFJ-915, $39.95 Stop *RF* traveling down coax line, painful RF "bites" and erratic operation. 1.5 kW 1.8-60 MHz. 2W x 5H". SO-239s.

MFJ-918, $39.95 True 1:1 Current balun & center insulator forces equal antenna currents in dipole elements.

MFJ Dry Dummy Load

MFJ-260C, $49.95. Air-cooled, 300 Watt dry dummy load with a noninductive resistor in a perforated metal housing. SO-239 connector. Full load 30 seconds. Silk-screened derating curve to 5 minutes. SWR below 1.1:1 to 30 MHz, 1.5:1 from 30 to 650 MHz.

MFJ 2-Pos. Antenna Switch

MFJ-1702C, $49.95. 2-position antenna switch has center ground, auto grounding of unused position, handles 2.5 kW PEP and works to over 500 MHz. Lightning surge protection. Quality SO-239 connectors, heavy duty diecast.

MFJ-1704, $109.95. Like MFJ-1702C but has 4 positions.

MFJ G5RV Antenna

MFJ-1778, $69.95. G5RV antenna covers 160-10 Meters with antenna tuner. 102 ft. long. Inverted vee or sloper. Use on 160 Meters as Marconi. 1500 Watts. Super-strong fiberglass center/feed-point insulators. Glazed ceramic end insulators. Hand-soldered. Add coax, some rope and you're *on the air!*

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MFJ_1836_021417_QST_110819DS

MFJ *Low-Noise Receiving* Loop

Work DX and ragchew through horrendous noise!

Pull weak signals out of static crashes, atmospheric, man-made and power line noise!

Clearly hear signals 50 KHz to 30 MHz you never knew existed. Power line noise and static just disappears.

MFJ-1886 drastically reduces noise and interference by receiving the magnetic field and rejecting the electric field. Rotate MFJ-1886 receiving loop to totally eliminate interfering signals or greatly peak desired signal.

Excellent antenna and preamplifier balance gives deep null.

State-of-the-art push-pull Gali MMICs preamp gives you high dynamic range, low IMD and 25 dB of low noise gain. Gives excellent strong and weak signal performance without overload.

Fully protected preamplifier -- magnetically coupled voltages up to 40V and capacitively coupled voltages up to 20V will not damage preamplifier. Output is protected from transmission line surges induced by distant lightning.

Use anywhere, inside or outside. RF signal and power goes through your 50 Ohm coax.

Ruggedly built to withstand extreme weather. 1-inch OD diameter 6061 aluminum tubing. 36-inch diameter. 2 1/2 lbs. SO-239. Use masts up to 1 3/4 inches.

MFJ-1886, $289.95. Includes receive loop and MFJ-4116 bias-tee to power MFJ-1886 through coax.

MFJ-1886TR, $339.95. Includes MFJ-1886 and MFJ-4113TR Bias-Tee/ Transmit/Receive switch. MFJ-4113TR powers MFJ-1886 through coax and switches between transmitting antenna and receiving loop. For radios with only one antenna connector.

MFJ-4116, $39.95. Bias-Tee provides RF signal and power through coax transmission line. Send up to 1ADC up to 50 Volts.

MFJ-4113TR, $109.95. Bias-Tee with built-in Transmit/Receive switch.

Switches between transmitting and receiving antenna. For radios with only one antenna connector. Provides RF signal and power through coax.

***New!* Multi-coupler/Bias-Tee**

MFJ-1888MC, $219.95. Connect four receivers to one antenna. Receivers are fully isolated. Each receiver port has 1-12 dB adjustable gain. IP3 is +15 dB. 2dB noise figure. Built-in Bias-Tee powers receiving loop through coax. SO-239s. Use 12 VDC or 110 VAC with MFJ-1312D, $19.95. RF tight, 7¼Wx1¼Hx5D inches.

Super High Dynamic Range High Gain Receiving Loop

New! MFJ-1888, $449.95. 32 dB gain from 50 KHz to 30 MHz. 20 dB gain at 80 MHz. IP3 is + 30 dB, 1 dB compression point is 23 dB, noise figure is 1.7 dB. Built-in BCB input filters to reduce overloading. Includes MFJ-1888MC remote multi-coupler. Can be used with MFJ-4113TR BiasTee/T/R switch and/or MFJ-4116 bias tee. 36-inch diameter. 2½ lbs. SO-239. Use masts up to 1¾ inches.

Antenna Rotator

AR-500 $159.95 ***Perfect for MFJ1886/1786/1788 loop, VHF/UHF, small HF beams, TV, FM antennas.***

Weather-proof one piece cast aluminum housing with precision all metal gears, steel thrust bearings and automatic braking. Includes rotator, controller, remote control, clamps, hardware. Memories for 12 directions! Digitally displays position. 110/220 VAC.

Wipe out RFI

MFJ-1026 $239.95

Wipe out RFI, noise, interference from any direction at any frequency with a 60 dB notch before it gets into your receiver!

Eliminate power line noise, fluorescent lamps, light dimmers, computers, TVs, lightning, motors, industrial processes.

Null out QRM on rare DX and work him! Null out local ham or AM station to prevent receiver overload. Works on SSB, AM, CW, FM, digital from BCB to lower VHF.

Plugs between antenna and transceiver. 12 VDC, 110 VAC with **MFJ-1312D, $19.95.**

MFJ *Super High-Q™ Transmitting Loop* Antennas

MFJ 36-inch diameter transmitting loop antenna lets you operate 10-30 MHz continuously including WARC bands!

Ideal for limited space, HOA.

Work DX with low angle radiation and local close-in contacts with high angle radiation when mounted vertically. 150 watts.

Super easy-to-use! MFJ remote control auto tunes to your desired band. Fast/slow tune buttons, Cross-Needle SWR/Watt meter lets you quickly tune to your exact frequency. No control cable needed.

***World's** most efficient small loop antenna has all welded construction, welded butterfly capacitor with no rotating contacts, large 1.050 inch diameter aluminum radiator – gives you highest possible efficiency.*

Every capacitor plate is welded for extremely low loss and polished to prevent high voltage arcing. Nylon bearing, anti-backlash mechanism, limit switches, continuous no-step DC motor gives smooth precision tuning. Heavy-duty ABS plastic housing has ultra-violet inhibitor.

Cover 40-15 Meters. MFJ-1788, $559.95.
Like MFJ-1786 but covers 40-15 Meters continuous. Includes remote control.

Portable Loop

MFJ-1780, $369.95.
Box fan loop with carrying handle, 24 x 24 x 5¾".
20-10 Meters continuous, 150 Watts. Fast/slow tune remote control. Highly efficient all-welded construction

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Ham Shack on Tilghman Island MD. 3 bdrm 2 bath home. Ham, fish, sail, crab, loaf. Antenna Farm 3.5-432 mhz. Call 609-980-8603, W3BFC

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NNY QTH for sale. Four season home overlooking 1,400 acre lake. 2,300 square feet, 3 bedrooms, gourmet kitchen, great room with fireplace. 2 acre lot, no covenants or zoning. 15 KW whole house generator. See Realtor.com listing for photos. 90 foot Rohn 45 tower guyed at 3 levels with Phillystran. 2 runs of hardline. M2 2800 rotor. Tower built to Rohn drawings. Had building permit. Force 12 antennas for 10, 12, 15, 17, 20 and 40 meters. NM2O@outlook.com

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General

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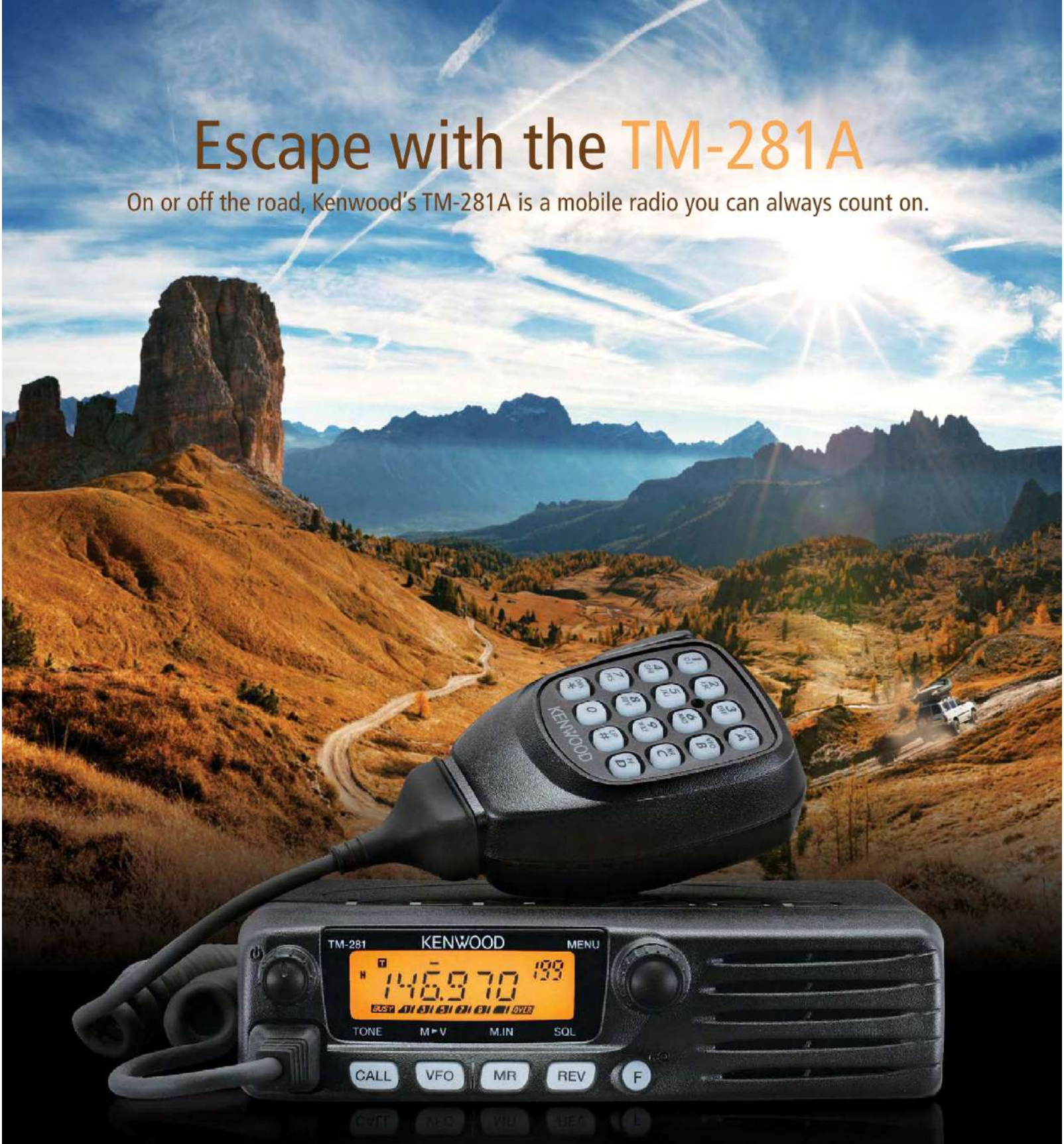

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