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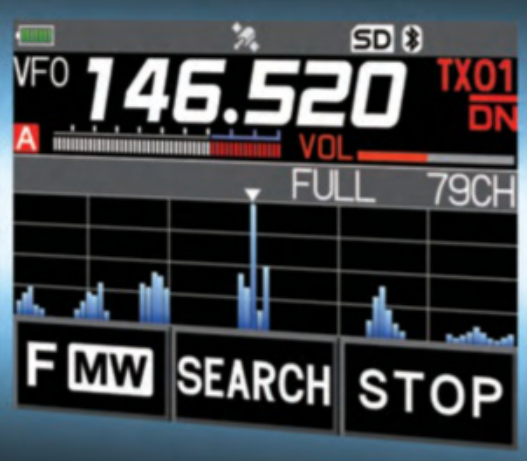
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How Do YOU Work DX? p. 86

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- Can Morse Code Help Prevent Dementia? p. 24



On the Cover: The CQ World Wide DX RTTY Contest team at EA8DED in the Canary Islands. Details on page 68.

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ANNOUNCEMENTS

MARCH 2020

ELYRIA, OHIO — The Northern Ohio Amateur Radio Society will hold the **NOARS Winter Hamfest** from 8 a.m. to noon, Sunday, March 1 at the Lorain County Community College-John A. Spitzer Conference Center, 1005 N. Abbe Road. Contact: Carl Rimmer, W8KRF, (216) 256-9624 (before 9 p.m.). Email: <winterhamfest@noars.net>. Website: <www.noars.net/winterhamfest>. Talk-in 146.70- (PL 110.96).

LINCOLN, NEBRASKA — The Southeast Nebraska Amateur Radio Club will air special event station, **NØN**, from the Nebraska State Capitol Building from 1300-2300 UTC, Sunday, March 1 in honor of Nebraska Statehood Day. Frequencies include 7.180, 14.265, and 18.150 MHz using SSB. QSL to Charles Bennett, SE Nebraska ARC, P.O. Box 67181, Lincoln, NE 68506. Email: <kd0ptk@gmail.com>.

CAVE CITY, KENTUCKY — The Mammoth Cave Amateur Radio Club will hold the **44th Annual Cave City Hamfest** beginning 7:30 a.m., Saturday, March 7 at the Cave City Convention Center, 502 Mammoth Cave Street. Contact: Larry Brumett, KN4IV, (270) 651-2363. Email: <lbrumett@glasgow-ky.com>. Talk-in 146.34+ (PL 114.8). VE exams.

IRVING, TEXAS — The Irving Amateur Radio Club will hold its **Hamfest** from 8 a.m. to 1 p.m., Saturday, March 7 at the Betcha Bingo Hall, 2420 Irving Boulevard. Contact: Ken Hansen, N2VIP, <ken@n2vip.org>. Website: <http://irvingarc.org>. Talk-in 146.720- (PL 110.9). VE exams.

PUYALLUP, WASHINGTON — The Mike & Key Amateur Radio Club will hold the **39th Annual Mike and Key ARC Electronics Show & Swap Meet** beginning 9 a.m., Saturday, March 7 at the Pavilion Exhibition Hall-Puyallup Fair & Events Center, 110 9th Avenue SW. Phone: (253) 631-3756. Email: <ddmdink@gmail.com> or <n7wa@arrl.net>. Talk-in 146.82- (PL 103.5). VE exams.

ROSENBERG, TEXAS — The Greater Houston Hamfest will be held from 8 a.m. to 2 p.m., Saturday, March 7 at the Fort Bend County Fairgrounds, 4310 Texas 36. Phone: (401) 584-4443, (713) 502-5896, or (713) 569-8799. Website: <http://houstonhamfest.org>. Talk-in 146.94 (PL 167.9). VE exams, fox hunt, balloon launch.

ROCK FALLS, ILLINOIS — The Sterling Rock Falls Amateur Radio Society will hold its **60th Annual Hamfest** beginning 7:30 a.m., Sunday, March 8 at 601 W. 10th Street. Contact: Joe Baldwin (815) 526-4766. Email: <w9mep@hotmail.com>. Website: <www.w9mep.com>. Talk-in 146.850 (PL 114.8).

BRAZIL, INDIANA — The Wabash Valley Amateur Radio Association will hold its **2020 Hamfest $ Computer Expo** from 8 a.m. to noon, Saturday, March 14 at the Clay County 4-H Fairgrounds, 6550 North State Road 59. Email: <hamfest@w9uuu.org>. Website: <http://w9uuu.org>. Talk-in 146.685- (PL 151.4). DXCC / VUCC / WAS card checking.

CHARLOTTE, NORTH CAROLINA — The Mecklenburg Amateur Radio Society will hold the **2020 Charlotte Hamfest** from 3-7 p.m., Friday, March 13 and from 8:30 a.m. to 4 p.m., Saturday, March 14 at the Cabarrus Arena & Events Center, 4551 Old Airport Road. Phone: (704) 948-7373. Website: <http://charlottehamfest.org>. Talk-in 146.655 or 146.940 (PL 118.8). VE exams, card checking.

CHARLESTON, WEST VIRGINIA — The 36th Annual Charleston Area Hamfest and **2020 ARRL WV Section Convention** will be held from 9 a.m. to 2 p.m., Saturday, March 14 at the Charleston Coliseum & Convention Center, 200 Civic Center Drive. Contact: Russ Dean, KE8DMB, (304) 988-1373. Email: <ke8dmb@gmail.com>. Website: <http://chaswvhamfest.com>. VE exams, DXCC / CQDX / WAS / VUCC card checking.

LINCOLN, NEBRASKA — The Lincoln Amateur Radio Club will hold the **Lincoln Hamfest** and **2020 ARRL Nebraska State Convention** from 8 a.m. to 3:30 p.m., Saturday, March 14 at the Lancaster Event Center, 4100 N. 84th Street. Website: <www.lincolnhamfest.org>. Talk-in 146.76-. VE exams.

NEW PORT RICHEY, FLORIDA — The Gulf Coast Amateur Radio Club will hold the **GCARC Spring Hamfest** from 7 a.m. to noon, Saturday, March 14 at the Millennium Academy, 10005 Ridge Road. Contact: Barry Kevaney, N2NVP, (727) 277-5794. Email: <keavbv@msn.com>. Website: <http://gulfcoastarc.org>.

TULLAHOMA, TENNESSEE — The Middle Tennessee Amateur Radio Society will hold the **MTARS Tullahoma Hamfest** from 8 a.m., to 2 p.m., Saturday, March 14 at the First United Methodist Church, 208 West Lauderdale Street. Contact: Michael Glennon, KB4JHU, (931) 5888-0302. Email: <kb4jhu@arrl.net>. Website: <www.mtars-ham.org>. Talk-in 146.700- (PL 114.8). VE exams.

PERRYSBURG, OHIO — The Toledo Mobile Radio Association will hold the **TMRRA Hamfest** from 8 a.m. to 2 p.m., Sunday, March 15 at Owens Community College-Student Health and Activity Center, 30335 Oregon Road. Website: <www.tmrahamradio.org>. Talk-in 147.270+.

STATE OF MAINE — The Maine Bicentennial Special Event Group will air special event stations **K1B**, **K1J**, **K1P**, **W1C**, **W1H**, **W1K**, **W1L**, **W1O**, **W1P**, **W1S**, **W1W**, and **W1Y** from 0000 UTC, Tuesday, March 16 through 2359 UTC, Sunday, March 22 to honor Maine's Bicentennial. Activity will be on the 20-, 40-, and 80-meter bands using only SSB and CW. Certificates will be awarded to hams who contact special event stations with endorsements for bands and modes. Contact: Maine 200 Special Event, P.O. Box 6833, Scarborough, ME 04074. Email: <mainehamradio@gmail.com>. Website: <https://maine200specialevent.com>.

FORT WALTON BEACH, FLORIDA — The Playground Amateur Radio Club will hold the **PARC / Fort Walton Beach 2020 Hamfest** from 4-9 p.m., Friday, March 20 and from 8 a.m. to 2 p.m., Saturday, March 21 at the C.H. "Bull" Rigdon Fairgrounds and Recreational Complex, 1958 Lewis Turner Boulevard. Email: <parcfest@w4zbb.org>. Website: <www.w4zbb.org>. Talk-in 146.79- (PL 100). VE exams.

BOONVILLE, MISSOURI — The Boonville Amateur Radio Club will hold its **Hamfest** from 9 a.m. to 3 p.m., Saturday, March 21 at the Cooper County Youth Fairgrounds, 16899 Dunkles Drive. Contact: Dwight (660) 621-1265, Tom (660) 841-5287, or Bob (660) 537-4211. Email: <wa0e@arrl.net>. Website: <http://w0brc.org>. Talk-in 147.360+ (PL 127.3).

BUFFALO, MINNESOTA — KØLTC will hold the **39th Annual Midwinter Madness Hobby Electronics Show** from 8 a.m. to 1 p.m., Saturday, March 21 at the Buffalo Civic Center, 1306 County Road 134. Phone: (763) 537-1722. Website: <www.k0ltc.org>. Talk-in 147.00+ (PL 114.8). VE exams, ARRL card checking.

FORT PAYNE, ALABAMA — The DeKalb County Amateur Radio Club will hold its **20th Annual Hamfest / Tailgate Outing** from 8 a.m. to 1 p.m., Saturday, March 28 at the VFW Fair Grounds, 151 18th Street NE. Contact: Carlton Floyd. W4CTK, (256) 630-4639. Email: <w4ctkk@gmail.com>. Website: <http://w4gbr.org>. Talk-in 147.270+ (PL 100). VE exams.

SEVIERVILLE, TENNESSEE — The Sevier County Amateur Radio Society will hold the **2020 Sevier County Hamfest** from 8 a.m. to 4 p.m., Saturday, March 28 at the Sevier County Fairgrounds, 754 Old Knoxville Highway. Contact: Rick Sawaya, N4JTQ, (865) 888-0555. Fax: (865) 888-0255. Email: <hamfest2020@protomail.com>. Website: <http://seviercountyars.org>. Talk-in 146.34+ (PL 118.8). VE exams.

UNION CITY, TENNESSEE — The Reelfoot Amateur Radio Club will hold the **Ides of March Hamfest** from 8 a.m. to 1 p.m., Saturday, March 28 at the Tennessee National Guard Armory, 2017 E. Reelfoot Avenue. Contact: Bob Miles <greenacres113@charter.net>. Website: <www.reelfootarc.com>. Talk-in 146.70 (PL 100). VE exams.

ANNANDALE, VIRGINIA — The Vienna Wireless Society will hold **Winterfest** and the **2020 ARRL Virginia Section Convention** from 6 a.m. to 1 p.m., Sunday, March 29 at the Northern Virginia Community College-Annandale Campus, 8333 Little River Turnpike. Contact: Mike, WA8AHZ, (703) 870-1730. Email: <tablesales2020@viennawireless.net>. Website: <www.viennawireless.net>. Talk-in 146.91. VE exams, WAS / DXCC / VUCC card checking.

APRIL

FORT SMITH, ARKANSAS — The Fort Smith Area Amateur Radio Club will hold the **Hanging Judge Hamfest** from 8 a.m. to 2 p.m., Saturday, April 4 at the Ben Geren Park-Safe Shelter Building, 7700 South Zero Street. Contact: Jim Weaver, KM5YV, (918) 895-5862 or (918) 730-2569. Email: <kn5yv.jim@gmail.com>. Website: <www.hangingjudgehamfest.com>. VE exams.

LONGMONT, COLORADO — The Longmont Amateur Radio Club will hold its annual **Hamfest** from 8 a.m. to 2 p.m., Saturday, April 4 at the Boulder County Fairgrounds Exhibit Building, 9595 Nelson Road. Email: <larcfest@w0eno.org>. Website: <http://w0eno.org>. Talk-in 147.270+ (PL 100). VE exams.

MILWAUKEE, WISCONSIN — The Milwaukee Radio Amateurs' Club will hold the **9th Annual Interclub SwapFest** from 8 a.m. to noon, Saturday, April 4 at the Elks Lodge, 5555 W. Good Hope Road. Website: <www.w9rh.org>.

SAINT JEROME, QUEBEC, CANADA — The Club Radio-Amateur Laval-Laurentides will hold its **Hamfest 2020** beginning 9 a.m., Saturday, April 4 at the Academie Lafontaine, 2171 Boulevard Maurice. Phone: (514) 708-8033. Website: <www.crall.ca>. Canadian license exams.

BARTLETT, TENNESSEE — The Mid-South Amateur Radio Association will hold the **Memphis FreeFest** from 9 a.m. to 3 p.m., Saturday, April 11 at the Bartlett Station Municipal Center, 5868 Stage Road. Website: <http://sites.google.com/a/maraonline.org>. Talk-in 145.21- (PL 107.2) or 147.03+ (PL 107.2). VE exams.

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HAM RADIO NEWS

ARRL Board Fires its CEO

The ARRL board of directors voted at its January meeting not to renew the contract of CEO Howard Michel, WB2ITX. No official reason was provided. However, Hudson Division Director Ria Jairam, N2RJ, suggested in an email to members that lack of progress in the League's new "lifelong learning project" was a key factor from her perspective, along with a statement that the ARRL doesn't "hire a CEO simply for their 'vision.' Rather, the CEO is the person that manages the League staff at the direction of the Board." Michel had been CEO for just over a year.

Former ARRL Chief Financial Officer Barry Shelley, N1VXY, was named interim CEO while a search committee interviews candidates in preparation for submitting three candidates to the full board for a vote. Shelley had also served as interim CEO in 2018 before Michel was selected for the position.

Change of Leadership at AMSAT

Clayton Coleman, W5PFG, has been elected president of AMSAT, the Radio Amateur Satellite Corporation, following the resignation of Joe Spier, K6WAO, for personal reasons. Spier had served as president since late 2017. Coleman was previously AMSAT secretary and served on the organization's board of directors from 2017 to 2019. He has been involved in amateur satellite activities since 2011.

Amateur Satellite WiFi Network Proposed

Also in the news from AMSAT is a proposal for launching a constellation of nanosatellites that will talk to each other as well as stations on the ground. According to the AMSAT News Service, the goal of the so-called amsatLink project — proposed by AMSAT Vice President of User Services Robert Bankston, KE4AL — is to create an ad-hoc 802.11 wireless network, using amateur frequencies in the 2.4-GHz band, which would support data modes as well as digital voice. The program would use off-the-shelf components to hold down costs. It's estimated that each satellite would cost less than $5,000 and that ground stations could be set up with an investment of about $150.

Did Earthquake in Turkey Rile Up the Ionosphere?

When a magnitude 6.8 earthquake struck an area in eastern Turkey on January 24th, hams from the country's national amateur radio association provided tactical communications in the affected area and, according to the *ARRL Letter*, helped the Ministry of Health get a mountaintop repeater installed and operational.

Half a world away, meanwhile, the earthquake may have been making an impact on the ionosphere. *Newsline* reports that hams operating the North American "Noontime Net" on 40 meters noted "an attenuation of the amateur bands" at nearly the exact time that the quake occurred. It says researchers are studying possible links between earthquakes and propagation, noting that stresses in rocks along a fault line just before a quake cause the release of positive ions into the atmosphere. Those ions then rise into the upper atmosphere, says the report, possibly causing anomalies in the ionosphere.

7X7X DXpedition Highlights Young Operators

If you worked the 7X7X DXpedition in Algeria at the beginning of this year, you were helping motivate young hams as well as working a new country. According to the *ARRL Letter*, the 9-person DXpedition team included four hams in their 20s, three of whom had previously taken part in YOTA (Youngsters on the Air) activities in Europe and Africa. The four young hams included two each from Algeria and Tunisia. Four of the older hams were also from Algeria, with Tunisian team co-leader and well-known DXer Ash Chaabane, 3V8SF / KF5EYY, rounding out the crew.

The station operated on the QO-100 satellite as well as 160 meters and all the HF bands, for a total of 5,800 contacts in four days. "We urge all DXpeditioners to involve youngsters in their future trips," said Chaabane, and to "do their best to make it easy and least costly for them."

Foundation for Amateur Radio Scholarships Available

Speaking of young hams … applications are now being accepted by the Foundation for Amateur Radio for the more than 50 scholarships it administers. Initial applications are due by April 30th, with amendments permitted through May 7th. Amounts vary widely as do requirements for individual scholarships, although a general requirement is to hold a valid amateur radio license and be enrolled in or accepted to an accredited college, university or technical school. According to the ARRL, applicants submit a single application and are considered for any award for which they qualify. Detailed information and application forms are available on the FAR website at <https://tinyurl.com/t5cpmrm>.

ARRL to Strongly Oppose Withdrawal of 3-GHz Band

The ARRL is in the process of preparing a "strong response" in opposition to an FCC proposal to reallocate the current 3.3- to 3.5-GHz amateur band for 5G wireless use. While the band is shared and the current amateur allocation is secondary, hams are making varied uses of the spectrum, according to the *ARRL Letter*. The FCC has asked for comments about current amateur uses and possibilities for relocation. The ARRL response is expected to include uses for EME (moonbounce), terrestrial DXing, satellite communication, mesh networks and amateur television, and that some of these activities cannot be moved to other bands because of the international nature of frequency allocations. Initial comments on WT Docket 19-348 were due on February 21st, with reply comments due by March 23rd.

ITU Publication Spotlights Amateur Radio EmComm

Government administrations are being encouraged by the International Telecommunication Union (ITU) to include amateur radio in their national emergency plans. The *ARRL Letter* reports that the ITU Development Sector's latest *ITU Guidelines for national emergency telecommunication plans* highlights the ongoing contributions of radio amateurs in emergency communications. "They are experts in radio communication and have the equipment, skills, and necessary frequencies … to deploy networks in emergency events quickly and efficiently."

FCC Commissioner Questions Future of ITU

FCC Commissioner Michael O'Rielly has proposed to Congress that the U.S. consider developing an alternative to the International Telecommunication Union, or ITU, for future matters of international spectrum management. O'Rielly told the U.S. Senate Committee on Commerce, Science, and Transportation that the ITU and its quadrennial World Radiocommunication Conferences, or WRCs, may actually be stifling progress in promoting advanced technology. He noted that in the ITU, as an agency of the United Nations, each country has just one vote and that at the last WRC, it seemed that certain countries came with the goal of opposing whatever the U.S. wanted. He proposed creating a separate body of the world's telecommunication leaders — similar to the G7, or Group of Seven major economies — to effectively bypass the ITU in the future.

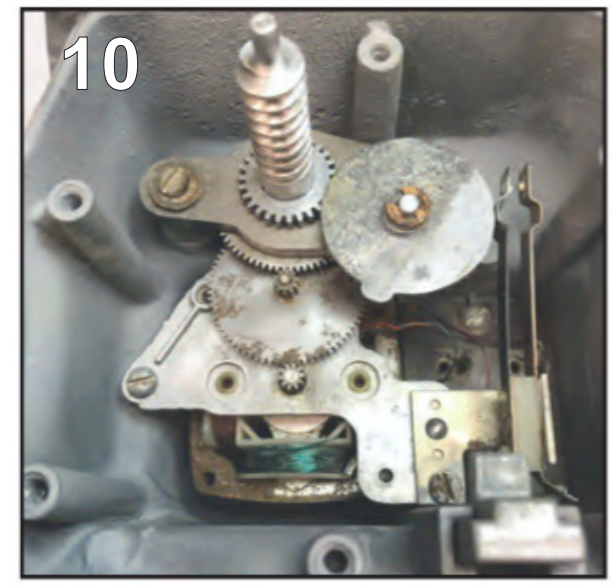
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By Ed Muns, WØYK

Propagation is much better from the tropics than from Scandinavia (not to mention the weather), so members of the Scandinavian Amateur Radio Teleprinter Group operated last fall's CQ World Wide DX RTTY Contest from EA8DED in the Canary Islands. Details on page 68; contest results begin on page 15. (*Cover photo courtesy OH2BP*)





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OUR READERS SAY...

75th Anniversary Issue

Editor, *CQ*:

A comment on your January issue … WOW! The articles from the past issues were absolutely fantastic. The reminiscent articles in *QST* are pale compared to yours. I especially enjoyed the article on propagation during 1955-1959. I missed out on that as I didn't become interested until late 1963 and licensed in 1964.

Keep up the great job on the magazine. I enjoy each and every issue!

– *Jim Kocsis, WA9PYH*

Editor, *CQ*:

Thanks very much for the 75-year anniversary issue of CQ — a masterful work. You brought back a lot of memories: Separates, Heathkits, RTTY, crystal-controlled transmitters, all valuable learning experiences. Have a great New Year.

– *73, John O'Neill, KØVW*

Editor, *CQ*:

Great issue. Thanks for the many years of service to the ham crowd. I miss *WorldRadio* and *Popular Communications*. Let's keep *CQ* going.

– *Bob Brown, W4YFJ*

Editor, *CQ*:

I just wanted to wish you and *CQ* magazine another 75 years together! When I looked through my binder of certificates, I did find two from the 50th year celebration (Challenger and Gold) as well as WPX and WAZ certificates, along with several VHF certificates. Anyway, 73 to you and *CQ* magazine.

– *Bill Hudzik, W2UDT*

December's Technology Special

Editor, *CQ*:

Rich, I want to thank you for the December issue, you have really "hit it out of the park" for me! In fact, the December issue of *CQ* rises above the latest issue of *QST*! Let me explain that comment:

I have been a ham since 1970, and a Life Member of the ARRL for almost that long, which means I have received and enjoyed almost five decades of *QST* magazine. And, unfortunately, I have noticed a gradual but definite decline in the quality of that publication. Early on, every issue of QST was a gold mine of information, a mini-Handbook chock-full of build-it articles and how-tos. Nowadays, not so much.

I will interject here that I have never been, and have yet to be, a contester of any sort, and DX would be nice but not that important. What bakes my cookies and keeps me up happily till the morning light is building things and learning about how things work. I read *CQ* and *QST* for the construction articles and for information that explains the voodoo and physics of radio.

Joe Eisenberg's kits column is a favorite of mine, second only to that amazingly wonderful column whose author and title I do not at the moment remember, who wrote once about substituting a linear pot for an exponential one with the addition of a few external resistors, and another time abut how the NE555 achieves its magic. I love these columns. I have yet to read most of the December issue but already am fascinated by phase-shift oscillators and how to build a homemade remote control for my Yaesu FT-950.

And Irwin, I couldn't agree more with your less-than-rosy reflections on the state of homebrew today. Which brings me back to the latest issue of *QST*. I read the review of the Engineering's little box that connects two radios to two sets of headphones and enables various combinations of same. And it struck me that here I was, reading a review of this passive switchbox that has only some resistors and two switches in it and costs almost 200 dollars, when I SHOULD be reading an article on how to BUILD the very same thing from spare parts for maybe $10!

So, Rich, I look to you to keep the bar high! Be my number-one source for all the information and construction articles that I love! KEEP UP THE GREAT WORK and to all of you at *CQ*, a very Happy New Year!

– *73, Rich Spohn, WB2GXM*
Floral Park, NY

Bad Elmers?

Editor, *CQ*:

To me, it seems that we have gone Elmer-crazy. Everybody should be an Elmer. I disagree. There are lots of really bad Elmers out there. Should we have an Elmer test? Before you can become one you have to pass a test? The following is what is wrong with being an Elmer, in my opinion.

In the spring of 2019 I attended a very small local get-together. There I meet a fellow ham from the adjacent grid square to mine. We recognized each other as we had worked each other multiple times. We talked about how hard it was to work our grid squares. Then the topic turned to antennas. Another gentleman stopped and intently listened to our conversation. I described my 160-meter setup. inverted-V at 30 feet, fed with 75-ohm TV cable. The first ham asked how it does. I said it would get you on 160, but it was not a great DX antenna. It will pass for a very good receive antenna, but it's not high enough to be a great transmit antenna. The gentleman that had walked up and was listening to our conversation said the antenna you are describing will not work. "You can't be using that antenna." I asked him why. "Because my Elmer said it would not work." I asked if he had tried one. "No, because my Elmer said it would not work. I am not going to waste my time, because it will not work." I replied that I have worked 47 states and 25 countries on FT8 running a hundred watts. He replied you can't be using the antenna you described because it will not work, and he walked off.

I admire someone for having this kind of belief in their mentor. But why are you so blind that you will not try something you were told that would work by someone else? This narrow-mindedness will not help amateur radio in any way. It, in my opinion, will only hurt the amateur radio community as a whole.

– *73, Sandy Walker, WB4EVH*

W2VU Responds:

Hi Sandy,

Helping and teaching each other has been a key element of ham radio since its earliest days. And, I'll guess, sharing incorrect or poorly-researched information has been as well. That's why magazines and books continue to be important, because their contents generally have been vetted for accuracy. It doesn't matter if you call someone a mentor or an Elmer or just another ham in the club, there will always be folks who really know what they're talking about and those who don't (but share anyway). It's up to the person on the receiving end of the advice to have a healthy skepticism if the person offering it is not recognized by others as an authority on the subject.

Keeping it Simple

The following letter was directed to "Math's Notes" editor Irwin Math, WA2NDM:

Irwin,

Another interesting article (November 2019 issue)! Your LED illumination article was quite good but I would suggest getting those little full-wave rectifier bridges for your AC version rather than suffering the 60-Hz flicker even with a cap. However, there are times when such a flicker is actually helpful, then better not

(Continued on page 84)

The radio... YAESU

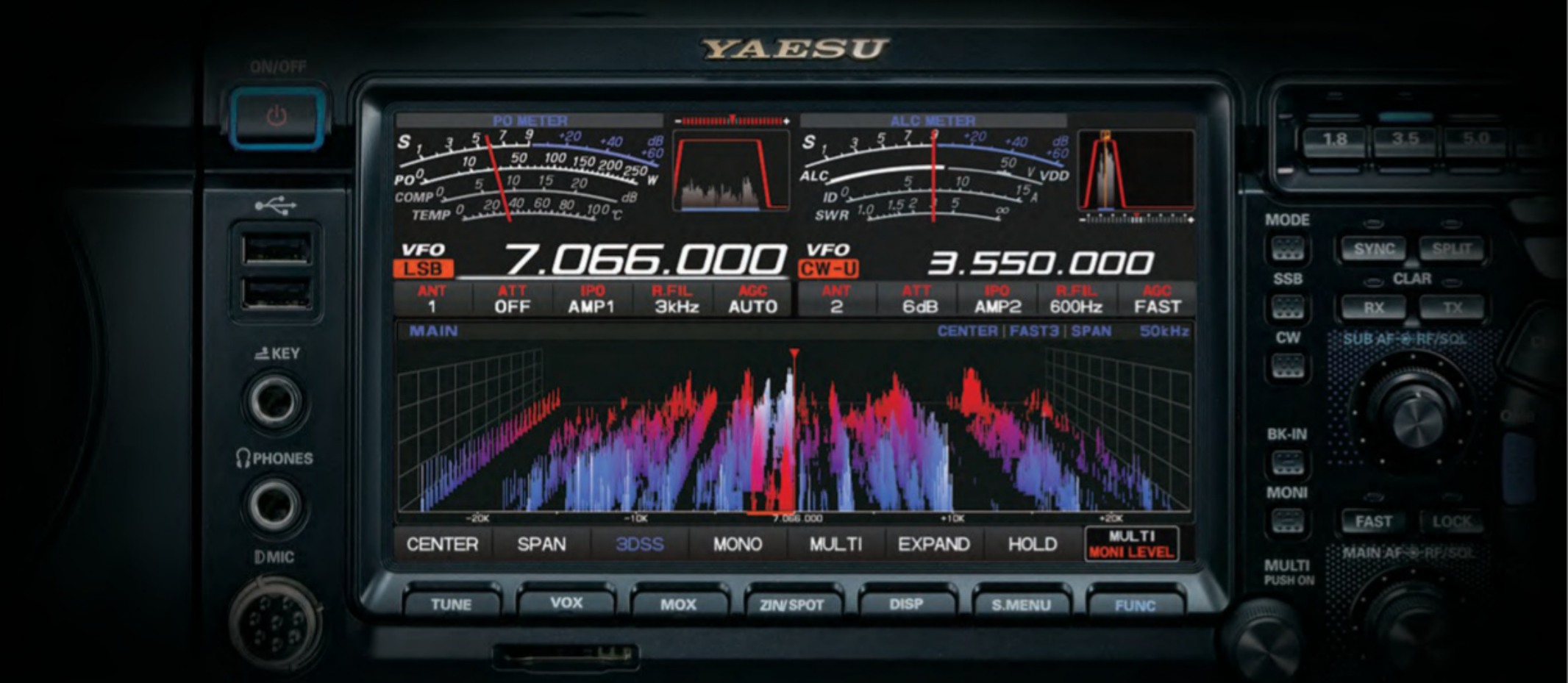
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ZERO BIAS: A CQ Editorial

BY RICH MOSESON,* W2VU

HF Band Plans and the ARRL's "Big IF"

The ARRL's HF Band Planning Committee released a draft in early February of its proposals for realigning both FCC allocations on 80 meters and informal band plan changes on most other HF bands (see details of the plan on page 9). The proposal is really intended to address three separate issues, as well as three pending rule-making proposals the League has filed with the FCC, at least one of which is nearly ready to start collecting Social Security. The committee provided a two-week comment period, which will be expired by the time you read this, but we'll ignore the calendar and comment anyway.

We are generally supportive of two elements of the band plan proposal, have questions about the third and have to wonder if the whole thing is premature, unless part of its intent is to push the FCC to finally take action on the three proposals on which it is based. Those proposals are RM-11708, the so-called baud rate proposal, on which the Commission has been sitting for seven years; RM-11759, which proposes a realignment of the CW / phone segments of 80/75 meters to allow more space for digital modes — awaiting FCC action for four years; and the much more recent RM-11828 — filed one year ago this month — proposing a significant expansion of Technician privileges on HF.

The League's band plan proposals are based on two somewhat shaky assumptions in this regard: 1) that the FCC will actually begin moving on these proposals soon by issuing Notices of Proposed Rulemaking (or perhaps grouping them into a single NPRM, following the committee's lead here); and 2) that the FCC will adopt the proposals essentially unchanged after going through the rule-making process. It is very rare that the Commission does that. In light of these assumptions and the uncertainty of their outcome, this entire exercise may be premature, but then again, the committee needs to start somewhere so it can hit the ground running with a final proposal once the FCC does take action (*if* the FCC does take action).

Timing questions aside, the proposal aims to address several distinct, although occasionally overlapping areas of concern: 1) the need for HF spectrum on which hams may experiment with wide-band digital modes; 2) incompatibility between certain digital modes and resultant interference when they are packed too closely together; 3) expanded frequencies for automatically-controlled digital stations, or ACDS, another term for Winlink over-the-air email; and 4) a desire to encourage more Technician Class licensees — who now make up more than half of the U.S. amateur population — to upgrade to General or Extra by offering them meaningful voice and data privileges on portions of several HF bands.

We'll start with the last one … We enthusiastically support the so-called "Technician Enhancement" proposal. There is nothing better for creating excitement about DXing and other great benefits of HF hamming than providing a taste of it in a meaningful way. And that means a variety of mode privileges, not just CW. Yes, Techs and Novices have voice and data privileges on parts of 10 meters, but we're at the very bottom of a weak sunspot cycle and all indications so far are that the next cycle will be very similar to the one that's ending. That means 10 meters isn't likely to be a hot DX band except maybe around the peak of Cycle 25, in roughly five or six years.

Thirty years ago, Novice Enhancement breathed new life into the HF bands, the amateur radio industry and the ham community overall. Another such boost is needed now, and this proposal will provide it, by offering Technicians not only data privileges on 80, 40, and 15 meters but voice privileges at the top ends of those bands as well. Face it, outside of contest weekends and the FT8 segments, most of the HF bands are pretty quiet right now. Giving access to another 388,000 already-licensed hams to operate phone and data modes such as FT8 will only be good for amateur radio.

The success of FT8 for DXing during the sunspot doldrums proves that digital modes are now permanent fixtures on the HF ham bands. Once limited to VHF and UHF because of wide bandwidths, new narrow-band digital modes have made a huge impact on the HF bands. But hams are supposed to be experimenters and one of the negatives of such modes as FT8 is that they only permit pre-programmed information exchanges and aren't suitable for ragchewing or other activities, such as exchanging photos. Hams are still experimenters and the focus of much experimentation today is on the digital modes. There is a need for designated space within our HF bands to experiment with wider-bandwidth modes that may be capable of transmitting more information or exchanging information more quickly. We don't know what will result but we need to provide space for finding out. Since many digital modes are not compatible with each other, setting aside specific subbands for them in a voluntary band plan is a reasonable approach. Unfortunately, creating enough space for this work on 80 meters will require reallocating half of the current 100-kHz-wide exclusive Extra phone subband. While we never like to see anyone lose any privileges on any band, 50 kHz of Extra-only phone space is still much more than is currently available on most other HF bands. This seems like a reasonable compromise and we support this part of the proposal as well.

Finally, we have the question of ACDS, automatically-controlled digital stations, and we still have as many questions about this facet of ham activity as we have in the past. Two main areas of concern about ACDS are their interference potential when simply starting to transmit at a designated time on a set frequency without knowing if there is already activity there, and questions about message content. The League committee addresses the first issue, by recommending the use of CW IDs for easy station identification as well as implementing a "listen-before-transmitting" protocol to reduce interference potential. Both of these would go a long way toward resolving the first concern. The second is more challenging, and perhaps not within the purview of a band planning committee. There have been — and continue to be — significant concerns that the Winlink radio email system (which is really what ACDS is all about) in many cases is used by sailors to conduct everyday email communications, including business communications, in an effort to avoid the high cost of satellite-based email. This is a problem from two perspectives: 1) As we all know, using amateur radio for business communications is illegal, and 2) international rules specifically prohibit the use of amateur radio as a way to avoid commercial communication services.

Why is significantly more spectrum space needed to accommodate these questionable transmissions? To what extent will the use of Winlink for communications of dubious legality expand once additional frequencies are made available for ACDS? To what extent will that crowd out other uses of our shared frequencies (ACDS stations are not frequency-agile)? And why is the ARRL so invested in expanding the use of ACDS on the HF bands? This last question is one we first asked seven years ago when RM-11708 was filed, and one we are still asking now. What is the benefit to ARRL and/or the broader amateur community? We're not sure there is one or that significant expansion of ACDS band segments is justified. That really is our only quibble here and, again, it is beyond the purview of the band planning committee, which is simply working with the proposals already before the FCC for consideration.

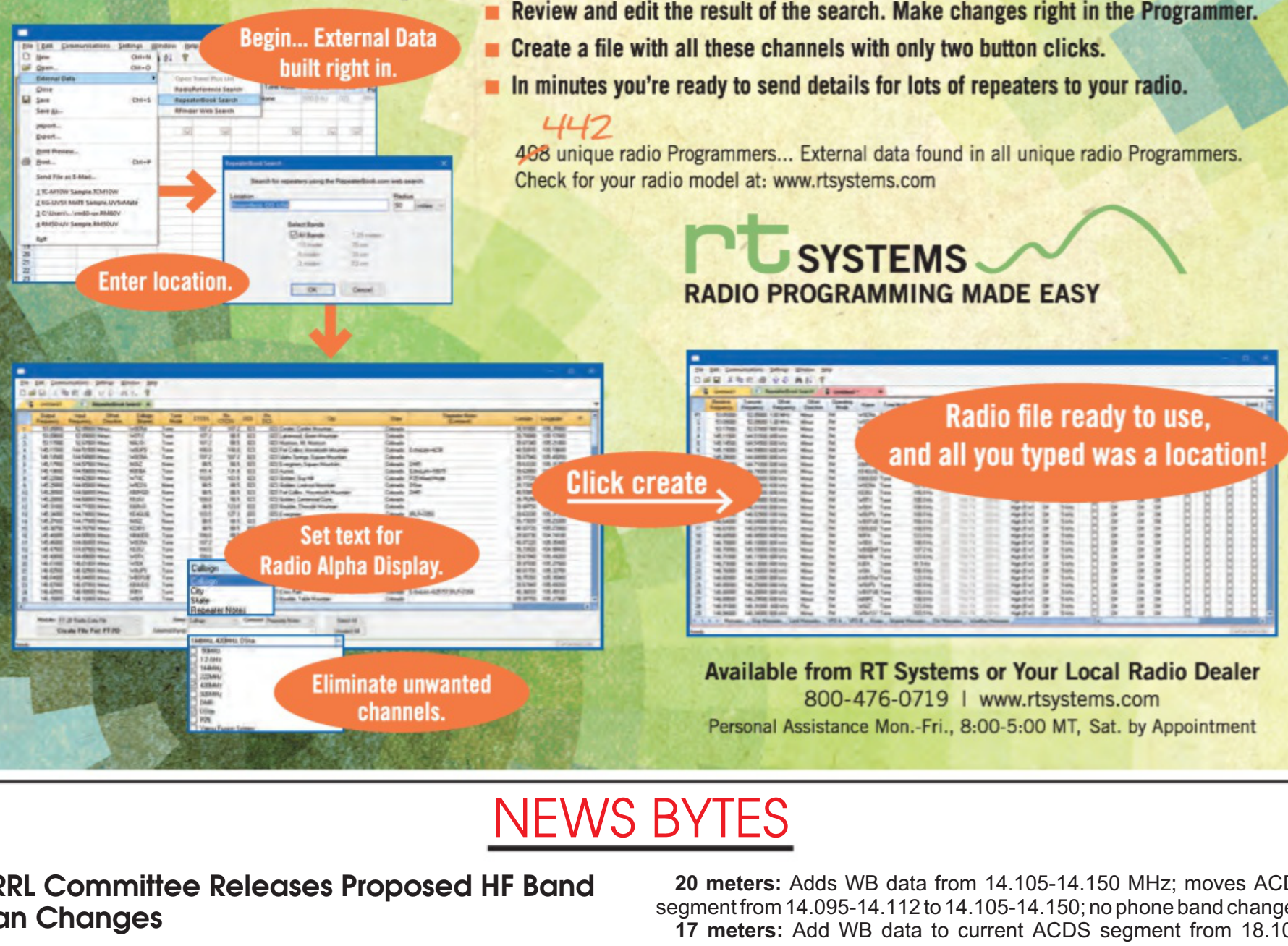
Other than wishing that more time was provided for the amateur community to comment on these proposals, we believe they represent a good start and hope that they help spur the FCC into finally moving on the three proposals wrapped up inside the draft band plans. Using this as a base, final modifications following FCC action should be able to be implemented quickly. *– 73, W2VU*

*Email: <w2vu@cq-amateur-radio.com>

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NEWS BYTES

ARRL Committee Releases Proposed HF Band Plan Changes

The ARRL's HF Band Planning Committee released a draft proposal for comment in early February on its suggestions for a revised HF band plan to accommodate wideband digital modes, greater use of automatically controlled digital stations (ACDS), and proposed enhanced privileges for both Technicians and Novices. The committee is chaired by ARRL First Vice President Greg Widin, KØGW, and it members include four directors and one vice director.

The plan, which was released on February 5th with comments requested by the 19th, assumes that three rulemaking proposals currently pending before the FCC will be adopted essentially as proposed, so is subject to additional change based on the FCC's eventual action on those petitions (RM-11759 / realigning the 80/75-meter allocations to provide more space for digital communications and adding RTTY / data privileges for Techs and Novices, pending before the Commission for four years; RM-11708 / Baud Rate-to-Bandwidth, awaiting FCC action for 7 years; and RM-11828 / Technician Enhancement, pending since last March).

Here are the highlights, broken down first by band and then by license class (no changes are proposed for either the 160-meter or 60-meter bands):

Proposed Band-By-Band Changes

80 meters: Reallocate 3600-3650 kHz from Extra-only phone (currently 3600-3700) to RTTY, narrow-band (NB) and wide-band (WB) data, ACDS, for ALL license classes; change Novice / Tech CW-only subband at 3525-3600 to allow RTTY, NB data as well; add Tech phone and image privileges from 3900-4000.

40 meters: Designate 7100-7125 kHz for NB/WB data including ACDS, for all license classes except Novice (adding data to current Tech privileges), (expanding ACDS segment from 5 kHz to 25 kHz); Novice privileges remain CW only at 7025-7125; Add Tech phone privileges from 7225-7300.

30 meters: Adds WB data between 10.135 and 10.150 MHz; expands ACDS segment by 5 kHz.

20 meters: Adds WB data from 14.105-14.150 MHz; moves ACDS segment from 14.095-14.112 to 14.105-14.150; no phone band changes.

17 meters: Add WB data to current ACDS segment from 18.105-18.110 MHz.

15 meters: Change current Novice / Tech CW-only subband (21.025-21.200 MHz) to CW, NB data (to 21.150), WB data / ACDS (21.150-21.200); move ACDS segment from 21.095-21.100 to 21.150-21.200; add Tech voice / image privileges at 21.350-21.450.

12 meters: Add WB data to current ACDS segment from 24.925-24.930 MHz

10 meters: Add WB data to current ACDS segment from 28.120-28.129 MHz for ALL license classes; add "experimental data" segment with NB / WB and data / ACDS permitted, from 29.200-29.300 for Extra / Advanced / General; no changes to current Novice / Tech phone privileges.

Proposed Changes By License Class:

Novice: Current CW-only privileges on 80 and 15 meters would be expanded to include RTTY and NB/WB data, including ACDS (RTTY/NB data already permitted on 10 meters); 80-meter CW / RTTY / Data band expanded by 50 kHz for WB data / ACDS.

Tech: All current CW-only privileges (80, 40, 15 meters) would be expanded to include RTTY and NB/WB data, including ACDS (RTTY/NB data already permitted on 10 meters); 80-meter CW / RTTY / Data band expanded by 50 kHz for WB data / ACDS; Phone / Image privileges to be added on 75 meters (3900-4000 kHz), 40 meters (7225-7300 kHz) and 15 meters (21.350-21.450 MHz);

General: Access to all new WB data segments plus new "experimental data" segment on 10 meters (29.200-29.300 MHz).

Advanced: Access to all new WB data segments plus new "experimental data" segment on 10 meters (29.200-29.300 MHz)

Extra: Loss of exclusive phone subband from 3600-3650 kHz (3650-3700 would remain exclusive Extra phone); access to all new WB data segments plus new "experimental data" segment on 10 meters (29.200-29.300 MHz)

A graphic presentation of the proposed changes is available on the ARRL website at <https://tinyurl.com/tkxkzg7>.

The University of Michigan Amateur Radio Club was presented with donations and the opportunity to refurbish some old antennas. Here's how they put their ham ingenuity to work in creating a mobile tower and antennas.

Refurbished, Donated and Modified … Putting All the Pieces all Together at W8UM

BY JOHN PALMISANO,* KB8OIS; ROBERT GIULIANO, KB8RCO; ROBERT LAUNDRA,*** N8RGF; AND MICHAEL FLUEGEMANN,**** KE8AQW**

The University of Michigan Amateur Radio Club, W8UM, has benefited greatly from its many members and donors. Through their generosity, both monetary and equipment donations have provided the resources to remain an active club. In recent months, the club has received a 3-element SteppIR antenna (6-20M; SteppIR Communications Systems, Bellevue, WA) without a controller; a 35-foot crank up steel tower; and a single-axle trailer. In addition, due to renovations of the Michigan Union Building, the circularly-polarized 144-MHz and 435-MHz antennas, erected in 1982, were removed from the rooftop and refurbished. This is our experience in assembling these donated, refurbished, and modified items into our new mobile tower.

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* <palmy@umich.edu>
** <kb8rco@arrl.net>
*** <n8rgf@arrl.net>
**** <mfluem@umich.edu>

Trailer

The single-axle trailer and the 35-foot crank-up tower were provided by the Department of Naval Architecture and Marine Engineering. It was not known how this trailer and tower were used in the past. The trailer had been supported off the ground by its four outriggers. This likely prevented any damage to the tires, wheels, bearings, or axle during its time of inactivity. After determining that the frame, axle, bearings, tires, and



Photo 1A. Demonstrating where the winch cable was caught in the tower hinge while elevating the tower.

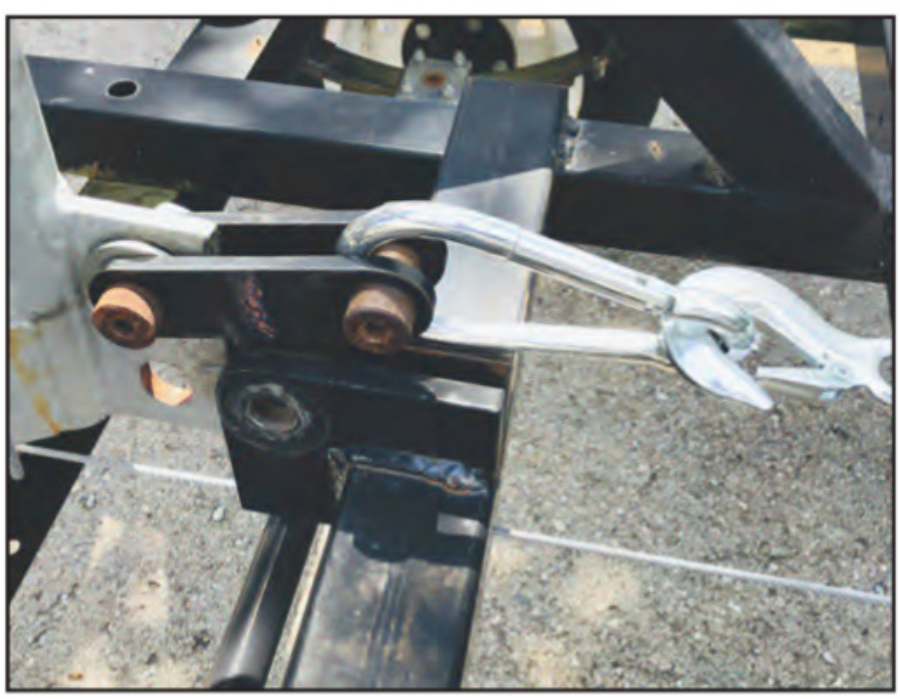


Photo 1B. Elevating the pivot point, on the tower bracket, raises the winch cable above the tower hinge.



Photo 1C. Showing the tower secured into the trailer hinge with a large-diameter bolt.

tire pressure were all safe, attention was then directed to the manual winch and wire cable that elevates the tower from its resting horizontal position to a vertical position.

Noticing that the winch and winch cable were in poor condition, both were replaced with a 1,500-pound capacity electric winch with a remote switch (from Harbor Freight). During our first attempt at raising the tower, the "horseshoe" connection on the winch cable became pinched at the point where the tower base locks into the trailer frame. This prevented the tower from any further movement (*Photo 1A*). By altering the pivot point on the tower base, and adding a washer (*Photo 1B*), the tower base aligned perfectly into the trailer hinge. Once the tower was vertical, the tower base was secured with a 1-inch diameter bolt (*Photo 1C*). The tower was then easily extended to its full height, and then retracted fully, without encountering any difficulties.

Azimuth Rotor and Rotor Bracket

Finding a rotor of the appropriate size to fit into the tower and rotate a "large" antenna proved to be difficult. Of the two rotors available, a Hy-Gain was too large to fit into this tower. An Alliance HD-73-1 rotor (Genie Co.), with controller, donated by KA8POZ, was also slightly too large. However, removing the rotor tower plate (*Photo 2A*), repositioning it beneath the welded supports on the tower and then securing it with right-angle brackets allowed the rotor to fit and rotate freely.



Photo 2A. Rotor plate was originally positioned above the rotor supports on the tower but then re-positioned beneath the rotor plate supports.



Photo 2B. Rotor plate is secured onto the tower with "right-angle" brackets and "U-bolts."

Elevation Rotor

The elevation rotor (Alliance U-100 Tenna Rotor, Alliance Mfg., Alliance, OH) that once held the circularly-polarized satellite antennas for 2 meters and 70 centimeters was taken apart and examined. It was immediately noticed that the worm gear had a significant gouge (*Photo 3A*). This damage may have occurred from uneven balance, improper mounting and / or wind stress over the past 38 years. The rotor was taken apart, thoroughly cleaned and a replacement worm-gear was purchased from Norm's Rotor Service (*Photo 3B*).

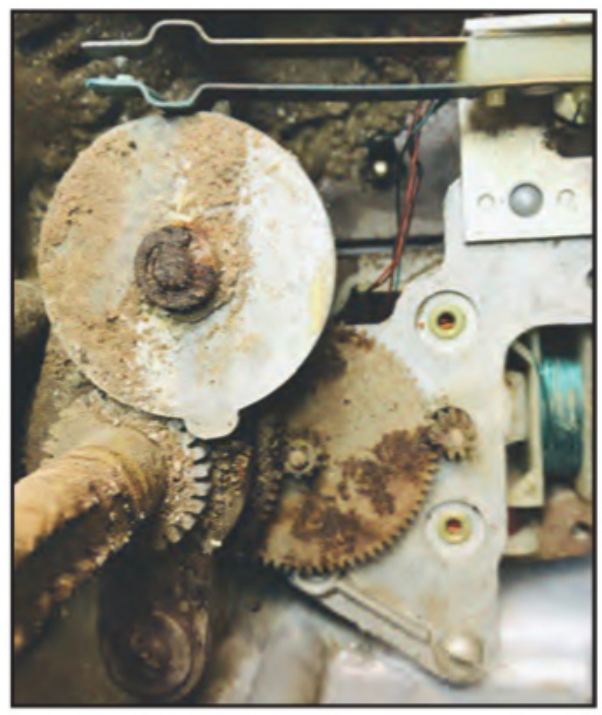


Photo 3A. Alliance U-100 satellite elevation rotor showing the gouged worm gear.

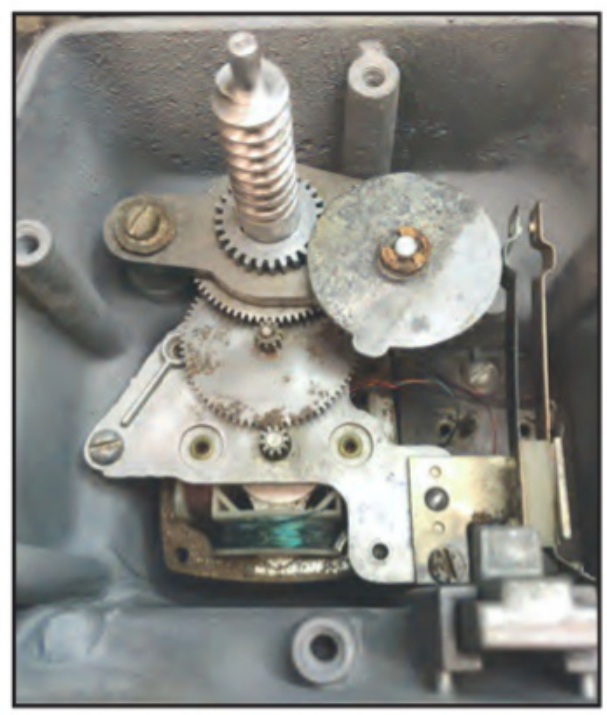


Photo 3B. Worm gear replaced and the inside of the rotor has been cleaned.

Circularly-Polarized Satellite Antennas

Surprisingly, both the 144- and 435-MHZ satellite antennas were in very good condition. While each antenna had bent or broken elements, all coax connections were in excellent condition; like it was put together yesterday. The connections had been thoroughly taped, protected with boot covers, and sufficiently lubricated. All connections were easily undone.

SteppIR Antenna

The family of Evangelo Diamantoni, W8ERN (SK), generously provided our club with a 3-element SteppIR antenna. Since our goal was to limit the use of this antenna to "special event" situations, the shrink-wrap holding the element support tubes (ESTs) in their extended position was cut and removed at each of the four sections of each EST. This allowed the EST sections to collapse and retract to approximately 4-foot sections. A patio umbrella cover was used as a protective carrying case for the ESTs, as well as the element housing units (EHUs) for the director and the reflector.

Element Housing Unit, "Disassembly" Required

The antenna proved to be challenging, especially without a control box to switch bands, i.e., advance and retract the copper conductor tape. The wiring to all three EHUs had been cut and the wire casings had deteriorated, requiring complete rewiring. With an EHU cover removed, we could see the tape-drive gear and the spring-loaded spools. We carefully checked that the copper conductor tape could move — no issue. But what about the motor? Of course, this required additional "disassembly" to access. Unfortunately, during this process, the "loading" spring on one of the spools released (*Photo 4A*). Was this the end of the project? Unaware of any tricks to remedy this, we purposely removed the "molded bullet" that prevents the tape from retracting fully into the EHU. This allowed us to remove both the spool and the remaining unwound tape from the EHU.

Later, after some online research, a video demonstrating how to replace a SteppIR spool was located.

During the process of removing the tape and spool, the contacts of the EHUs were inspected and cleaned (*Photo 4B*). Not knowing any specifics about the SteppIR workings, the tape of each EHU was fully extended to verify and compare their length, sprocket hole diameter and spacing, and tape width.

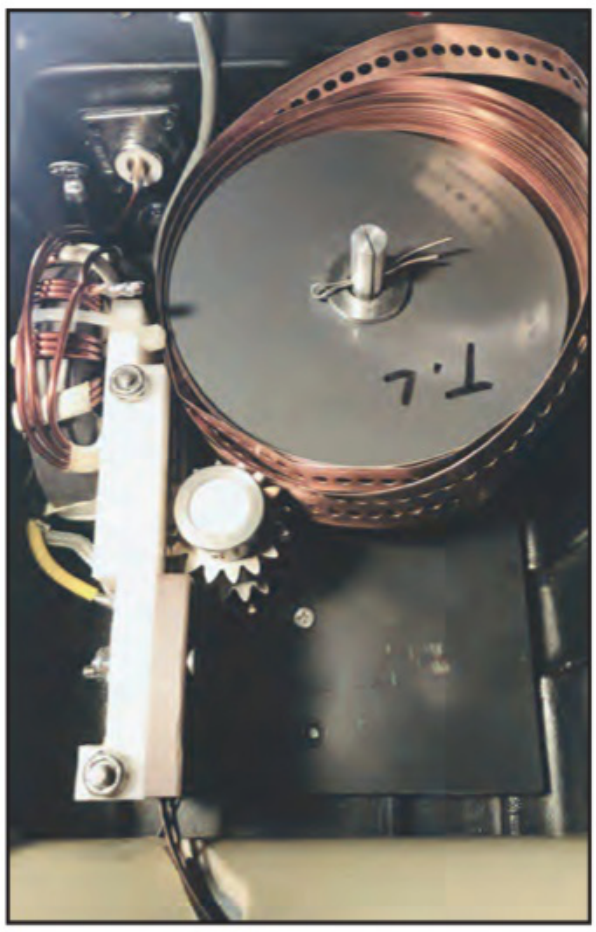


Photo 4A. SteppIR EHU showing the "unwound" copper conductor tape.



Photo 4B. SteppIR contacts and plate. The bullet caps have been removed and the contacts cleaned.

The rewinding of the tape, setting of the spool tension spring, and the proper amount of spool tension initially proved to be frustrating. Our first attempt exceeded 90 minutes. This was reduced to 10 minutes on subsequent EHUs. Perhaps a much easier method to fix an "unwound" tape is to completely unravel the tape without removing the "molded-bullet," remove the small screw on the spool, replace the spool (without attaching the tape), insert the spring, add counter-clockwise tension to the spool, attach the tape and screw and then allow the tension on the spool to fully and slowly retract the tape onto the spool. (*Contacting SteppIR for help might also have been useful, but perhaps this was more educational. –ed*).

Making a Controller for the SteppIR Antenna

Justification: The base controller for the SteppIR antenna costs between $250 and $550 ($250 used on eBay, $550 new from SteppIR). Replacing the controller would be a significant cost for any club, particularly a university club. Having the most expensive part "in hand" — the antenna itself — could the additional expense be justified? What if what we have doesn't even work?

Getting the Stepper Motor to Move: Using an Arduino, EasyDriver (from Sparkfun Electronics) and a stepper motor from an abandoned medical project, test code was written that would move the stepper motor in either a clockwise or counterclockwise direction. A Hewlett-Packard power supply, from an All-In-One printer scanner, with an output of 32 volts (1.65 amps), was used. Our initial code sent 200 pulses with the "DIRection" pin HIGH and the motor turned one full revolution. Next, we set DIR LOW and the motor reversed direction one full turn. By increasing the pulse count, the motor completed "more" revolutions. GREAT! We now had a way to control the SteppIR motor(s).



Photo 4C. Showing the screw that secures the copper tape onto the spool.

Testing the Real Thing

The SteppIR manual mentions use of either a 24-volt or 33-volt power supply, and, the SteppIR website "suggests" using a 33-volt supply. Fortunately, the EasyDriver was rated to 30 volts. Using a 32-volt / 3-amp power supply (purchased from Amazon) we then "wired" in one of the EHUs in place of the "test" stepper motor — it WORKS. The copper conductor tape moved both out and in using our "test" code. The remaining EHUs were then tested individually, with the same results. One important lesson was learned: While exchanging EHUs in the circuit, remember to disconnect the motor winding wires when they are not powered. Otherwise it will result in blue smoke from the driver chip.

While altering the code, we noticed how consistent the tape movement was. Pulse count equates to the length of tape extended from the EHU. So, sending a set number of counts and recording an "approximate" measurement of the tape extension would provide a pulse count per inch.

Determining Element Lengths

Controlling the element lengths, simultaneously, for each of the three EHUs was the next task. From the many websites on Yagi-Uda antennas, the driven element equates to a dipole. The length of the director is 93-95% of the driven element, and the reflector's length is 105% of the driven element. Spacing of the elements on the SteppIR was fixed, so no calculations there were necessary. We decided to use: 0.473 * wavelength for the driven element, 0.93 * driven for the director, and 1.05 * driven for the reflector.

Our crude measurements of pulses per inch were used to set the number of pulses to send to each EHU motor. A spreadsheet was created, including

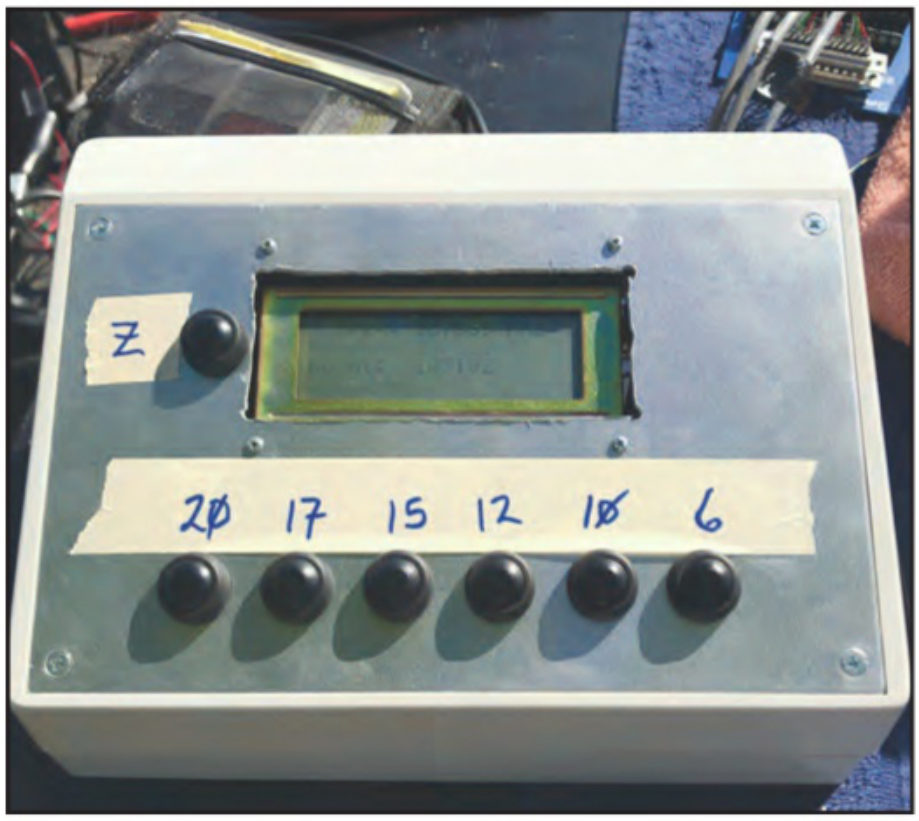


Photo 5. SteppIR control box with Arduino and driver boards inside. LCD panel displays the band, antenna length, pulse counts, frequency, band selector (6-20 meters) and zero reset buttons.

macros to determine pulse count per element per band (at the band center). This would ensure the desired lengths of tape extended, while switching between the bands would be achieved.

On a breadboard were mounted three generic A4988 drivers with an Arduino Nano (with screw terminals). Using the separate power rails for the SteppIR motors (32 volts) and the drivers and Arduino (5 volts), we could now test all three EHU copper tapes at once. As expected, we were not very accurate in predicting the length of copper tape extended. What we needed was a large count-to-distance measurement to improve accuracy. We set the Arduino to output a duration that would advance the copper tape to its near-maximum length of the element support tube (approximately 17 feet 6 inches).

Having recorded the number of pulses per foot, we calculated the pulses required to extend each copper tape, on each band, and updated the Arduino firmware. Now to drive all three elements at once and see what happens. During our first attempt, the tape in two of the EHUs extended to the desired lengths while the remaining EHU stepper motor attempted to retract. After some troubleshooting, a broken wire was located. A second trial resulted in all three EHUs advancing to our pre-set distance on each of the 6-, 10-, 12-, 15-, 17-, and 20-meter bands. Last, we ensured the elements all retracted to zero, or completely into the EHU, by command. To this point, all testing had occurred in a hallway with the tape running on the floor (not in the ESTs).

A project box with band and zero buttons and a 4-line LCD display was added to complete the SteppIR controller (*Photo 5*). The LCD displays the band, antenna length (in feet), pro-



Photo 6A. Attaching the "upper" element support tubes (EST) to the tower.



Photo 6B. Showing both the SteppIR ESTs and satellite antennas in preparation to raise the tower.

grammed counts, and frequency (MHz). This display facilitates with any troubleshooting. The breadboard and Arduino with screw terminals were still inside the box.

Assembly and Tower Crank-Up

With the trailer positioned and leveled, the driven element section of the boom was attached to the mast, the "shorter" director and "longer" reflector sections were added, and the entire boom was positioned parallel to the ground. The "top" 3 ESTs were then secured onto each EHU (*Photo 6A*). Using the electric winch, the tower was raised slightly to allow the "lower" EST support tubes to be secured onto the lower half of each EHU. Again, the tower was raised slightly, which allowed the EST tubes to passively extend downwards. This process was continued until each EST support tube was fully extended (*Photo 6B*). The tower was then raised to its vertical position and secured into the trailer hinge with the large-diameter bolt. What had not been taken into consideration was the effort required to crank the tower to its full height; the additional weight of the azimuth rotor, mast, SteppIR antenna, elevation rotor with boom, 144-MHz and 435-MHz Yagi antennas, and 150 feet of coax and wiring (*Photo 6C*).

On the Air?

With all the connections between the SteppIR antenna and the "new" controller box in place, the coax connected to the radio, power was applied to both, and the "20M" button on our controller was pushed. We could hear the SteppIR motors extending the elements, but when we keyed the radio — HIGH SWR. The radio was disconnected and an MFJ antenna analyzer (MFJ Enterprises Inc.) was inserted into the feedline. A laptop with the programming code was connected to the Arduino to access our "incremental tuning" function. Adjustments were made in the code to adjust the antenna length and obtain a minimum SWR. These new values were then uploaded into the Arduino firmware. Similarly, testing and changes were made to each of the remaining bands. We were fully functional.

Excited that everything worked and satisfied at what we had accomplished, we decided it was time to make the first of 70 contacts for the afternoon.

Acknowledgements

We sincerely appreciate the generous donations from the family of W8ERN, KA8POZ, KE8BZJ and the U-M Department of Naval Architecture and Marine Engineering.



Photo 6C. Tower raised to its maximum height, about 35 feet.



Results of the 2019 CQWW RTTY DX Contest

BY ED MUNS,* WØYK

Every station is DX from the heart of Africa and not many stations expect activity from this part of the world … 5X8C
It is one of my favorite contests! ... LW3DC
RTTY is alive and well! Great fun ... NN4NT

The 33rd annual CQWW RTTY DX Contest attracted 3,103 logs and over 6,100 participants despite continued deterioration of solar conditions that reached a new low for the 2019 event. The daily sunspot numbers for the past four contests are shown in the table below, followed by a table of the QSO breakdown by band.

	2016	2017	2018	2019
Sat	55	12	0	0
Sun	30	23	15	0

Daily sunspot numbers.

	2014	2015	2016	2017	2018	2019
80	7%	7%	10%	10%	14%	16%
40	16%	21%	24%	27%	32%	33%
20	26%	36%	41%	45%	44%	45%
15	33%	33%	23%	17%	9%	7%
10	18%	4%	2%	1%	0.5%	0.5%

Percentage of QSOs by band.

Activity continued the trend toward lower frequency bands with about the same number of total QSOs (1 million) as in recent years. Participation and submitted logs increased slightly, despite the incredible popularity of the new FT digital modes. RTTY contest activity is on par with recent years and current propagation.

There were 156 different countries active and DXCC was worked by several stations on a single band. Single-band 20-meter winner IQ1RY tied with the 20-meter position at Multi-Multi 9A1A with 108 countries. 9A1A topped the other four bands with countries as well. Thirty-seven zones were worked by two stations on 20 meters: IQ4FC and IQ1RY. As in 2018, the highest number of single-band QSOs was achieved by CR3DX on 20 meters with 2,066. The highest number of single-band US/VE QTHs was 58, by HQ9X on 20 meters who also led on 15 with 51; K1SFA and NV9L had the most on 40 meters with 56 each; K9CT topped 80 with 53; and P49X had 28 for the high on 10 meters. Overall, 9A1A had the most QSOs (4,690), down about 100 from their 2018 top number. 9A1A also led with multipliers (713), down from the 748 posted last year. 9A1A had the most countries (401) and zones (118) while P49X had the most US/VE QTHs (234). These numbers are all a bit down from 2018.

Email: w0yk@cqwwrtty.com

	80	40	20	15	10	All
QSOs	970	1589	2066	947	121	4690
Zones	22	32	37	25	13	118
Countries	75	107	108	74	37	401
US/VE QTHs	53	56	58	51	28	234

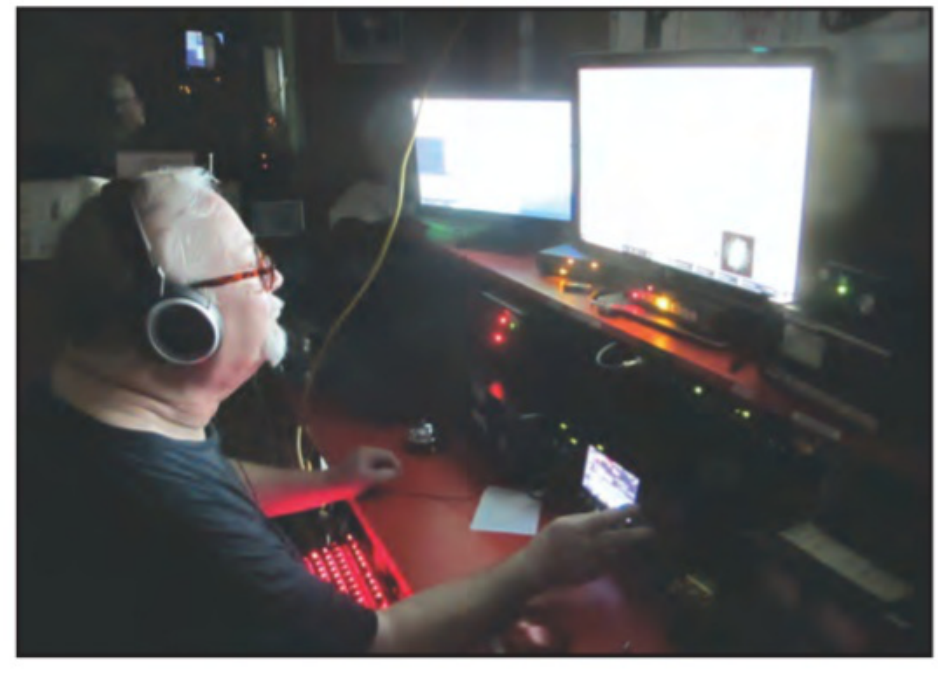
Top statistics.

A number of participants posted videos on YouTube: CE3OP, G0URR, VU2ZMK, WXØV, etc.

First solo attempt at a RTTY contest. It was fun and rewarding! … 4F3BZ
The first time in CQWW RTTY. It was GREAT! Long live RTTY! ... EA7AQ
First time RTTY :-) NICE! ... IK2LFF
My first RTTY contest, and I've had fun, so see you next time! ... IU1DUB
Beautiful contest, my first participation in an RTTY contest ... IZ8GUQ
First RTTY Contest. It was a lot of fun and I look forward to working it again … AE4ED
First RTTY contest! Much fun! ... KA5Z
This is my first contest on my own and was a blast ... KA6PNL
My first CQWW RTTY contest. I had a lot of fun ... KD5ILA
First contest entry other than Field Day and first RTTY contest ... N6OPE
1st CQWW RTTY. FB test ... WC4T
First time using RTTY mode – that was fun ... WT8P

Single-Op High Power (470 logs received)

Single-Op All Band High Power (325): Ed, P49X (WØYK), won with 5.5 million (M) points after winning SOAB LP in



Bob, WC3O, operating Multi-Two station W3GH.

2018. Wanderley, ZZ2T (PY2MNL), took second with 2.2M followed by Ramon, PZ5RA, with 2.1M; Andrius, LY7Z, with 1.9M; Atanas, LZ9R, with 1.6M; and Nick, EMØI (UT2IZ), with 1.5M. Yuri, RG9A, was next and first in Asia with 1.2M. Ken, VK4QH, won Oceania with 1.1M and Randy, K5ZD, topped North America with 1.0M.

Single-Op 80 Meters High Power (21): Toly, UX2X (UT2XQ), won with 186,000 (K).

Single-Op 40 Meters High Power (35): Vinko, S53F, with 590K edged out Tine S50A with 526K.

Single-Op 20 Meters High Power (71): Jan, OL9A (OK2ZAW), won with 586K and Julio, YW1K (YV1KK), took second with 582K.

Single-Op 15 Meters High Power (15): Marcelo, CW4MAX (CX2DK), won with 384K, down again from his 2018 winning score. Antonio, CR6T (CT1ESV), was second with 113K.

Single-Op 10-Meter High Power (3): Chuck, W5PR, won with 7.7K and less than 7 QSOs per hour of perseverance.

Single Operator Low Power (1,217 logs received)

Single-Op All Band Low Power (883): Alex, 3Z9M (SQ9UM), won with 1.2M, barely topping Filipe, CT1ILT, also with 1.2M. Third was, Yuri VE3DZ, with 756K. Fourth was Rich, N1IXF, with 705K and fifth was Helder, CR5O (CT7AJL), with 655K. Next were Schule, 4U1A (HB9RB), with 636, Richard, AA2MF, with 613K; Dirk, ON4CT, with 589K; Matt, W4GO, with 573K; and Jurgis, LY9Y, with 563K.

Single-Op 80-Meter Low Power (32): Gerard, F5BEG, won with 91K followed by Evgeni, 4Z5UN, with 83K and Olivier, F1AKK, with 81K.

Single-Op 40-Meter Low Power (102): Martin, OK6T (OK1WCF), won with 252K and Sam, LY5W, was second with 139K.

Single-Op 20-Meter Low Power (170): Suli, 7Z1SJ, won with 318K followed closely by Vitor, PY2NY, with 300K; Ricardo, EA8PT, with 273K; Amed, CO2AME, with 253K; Vlad, UN6LN, with 202K; and Val, UR2Y (USØYW), with 203K.

Single-Op 15-Meter Low Power (27): Guilherme, PY2UD, won with 131K.

Single-Op 10-Meter Low Power (3): Takeshi, JF1OVA, won with 231 points and 10 QSOs.

Single Operator QRP (84 logs received)

Single-Op All Band QRP Power (34): Rudolf, DK7HA, won again with 282K



Masa, JH4UYB, entered the SOAB Assisted High Power category.

2019 CQWW RTTY TROPHY WINNERS AND DONORS

SINGLE OPERATOR HIGH POWER

World: Sponsored by Yankee Clipper Contest Club, Winner: **P49X (op: Ed Muns, WØYK)**
North America: Sponsored by Dick Wilson, K6LRN & Carolyn Wilson, K6TKD, Winner: **Randy Thompson, K5ZD**
USA: Sponsored by Kevin Rowett, K6TD, Winner: **Stephen Werner, AG4W**
USA – 7th Call Area: Sponsored by Hank Lonberg, KR7X, Winner: **Tom Whitted, N7GP**

SINGLE OPERATOR LOW POWER

World: Sponsored by Rich Cady, N1IXF, Winner: **3Z9M (op: Aleksander Wieczorek, SQ9UM)**
North America: Sponsored by Joseph Young, W6RLL, Winner: **Yuri Onipko, VE3DZ**
USA: Sponsored by Kevin Rowett, K6TD, Winner: **Rich Cady, N1IXF**

SINGLE OPERATOR QRP

World: Sponsored by Kevin der Kinderen, N4TT, Winner: **Rudolf Ruffer, DK7HA**

SINGLE OPERATOR ASSISTED HIGH POWER

World: Sponsored by Lakshman "Lucky" Bijanki, VU2LBW, Winner: **P33W (op: Andrey Sachkov, LZ2HM)**
Europe: Sponsored by Dimitri Cosson, F4DSK, Winner: **SN7Q (op: Krzysztof Sobon, SP7GIQ)**
North America: Sponsored by John Webster, NN1SS, Winner: **Bud Trench, AA3B**
USA: Sponsored by Bud Governale, W3LL, Winner: **Alan Fields, K6DTT/1**

SINGLE OPERATOR ASSISTED LOW POWER

World: Sponsored by Jim Barron, WB5AAA, Winner: **TM3Z (op: Dimitri Cosson, F4DSK)**
Europe: Sponsored by Pat Moyer, W3RGA, Winner: **TM7Y (op: Sebastien Sauvannet, F8BDQ)**

SINGLE OPERATOR SINGLE BAND

World 21 MHz High Power: Sponsored by Steve "Sid" Caesar, NH7C, Winner: **Marcelo Eges, CW4MAX**
North America 14 MHz High Power: Sponsored by Patrick W. Soileau, ND5C, Winner: **Mike Lisenco, N2YBB**
World 7 MHz High Power: Sponsored by John Webster, NN1SS, Winner: **Vinko Gregorcic, S53F**
Europe 7 MHz Low Power: Sponsored by John Webster, NN1SS, Winner: **OK6T (op: Martin Bohadlo, OK1WCF)**

MULTI-OPERATOR, SINGLE-TRANSMITTER HIGH POWER

World: Sponsored by PL259 Contest Club courtesy of K6TD, Winner: **IQ4FC (ops: HB9CAT, I4EWH, I4IFL, IK4DCW, IK4HVR, IK4MGP, IK4WMH, IU4FNO, IW3FVZ, IZ4NIC)**
Europe: Sponsored by EA Contest Club, Winner: **LZ5R (ops: K1LZ, LZ1JZ, LZ1UK, LZ2DF, LZ5DB, OE9GHV, OE9WLJ, S55M, Z36W)**
North America: Sponsored by Steve Jarrett, K4FJ, Winner: **V31VP (ops: V31VP, V31CQ)**
USA: Sponsored by Jack Satterthwaite, K3KG, Winner: **K3LR (ops: K3GP, K3LA, WW3S, K8IV, N8AA, K8RR, K3UA, N8NB, K3LR)**

MULTI-OPERATOR, SINGLE-TRANSMITTER LOW POWER

World: Sponsored by Jamie Tolbert, WW3S, Winner: **IT9BLB (ops: I8UZA, IT9BLB, IT9VDQ, IT9ZMX)**

MULTI-OPERATOR, MULTI-TWO TRANSMITTER

World: Sponsored by Ed Muns, WØYK, Winner: **CR3DX (ops: CT3BD, CT3DZ, CT3EN, CT3FW, IC8SQS, OM2KW, OM3RM, OM7LW)**
Europe: Sponsored by Sandi Spindler, S57K, Winner: **S5ØW (ops: S51DI, S51DD, S51I, S51NM, S52DR, S52SK, S57XZ, S57K)**
USA: Sponsored by John Lockhart, WØDC, Winner: **K9CT (ops: N9CK, N4RR, AI9T, K9NR, K9WX, K9CT)**

MULTI-OPERATOR, MULTI-TRANSMITTER

World: Sponsored by Mike Trowbridge, KA4RRU, Winner: **9A1A (ops: 9A5W, 9A9A, 9A6A, 9A7C, 9A7ROR, 9A8A)**
North America: Sponsored by Kevin Rowett, K6TD, Winner: Not Awarded (No non-USA/Canada MM entrant this contest)
USA: Sponsored by Brian Moran, N9ADG, Winner: **K1SFA @ K1TTT (ops: K1MK, K1NZ, K1SFA, K1TTT, K2IW, W1TO, WA3UVV)**

CLUB COMPETITION

World: Sponsored by Potomac Valley Radio Club, Winner: **Bavarian Contest Club**
North America: Sponsored by Northern California Contest Club, Winner: **Potomac Valley Radio Club**

(Plaque sponsors as of publication date. Additional plaques may be sponsored.)

TOP SCORES

WORLD

SINGLE OPERATOR HIGH POWER ALL BAND

P49X (WØYK) 5,590,480
ZZ2T (PY2MNL) 2,180,996
PZ5RA 2,057,643
LY7Z 1,851,116
LZ9R 1,580,140

28 MHz

W5PR 7,744
K4WI 5,124
NH2DX (KG6DX) 2,912

21 MHz

CW4MAX 384,394
CR6T (CT1ESV) 113,221
LU5VV 84,778

14 MHz

OL9A (OK2ZAW) 586,401
YW1K (YV1KK) 581,664
IZ1PKV 380,000

7 MHz

S53F 590,178
S5ØA 526,384
LY1FW 222,902

3.5 MHz

UX2X (UT2XQ) 186,340
IZØKBR 121,600
SO9I (SQ9ORQ) 107,692

LOW POWER ALL BAND

3Z9M (SQ9UM) 1,177,177
CT1ILT 1,169,754
VE3DZ 1,056,062
N1IXF 705,348
CR5O (CT7AJL) 654,724

28 MHz

JF1OVA 231

21 MHz

PY2UD 131,100
PX2M (PY2XC) 51,243
PU2WDX 32,550

14 MHz

7Z1SJ 318,351
PY2NY 299,744
EA8PT 273,180

7 MHz

OK6T (OK1WCF) 251,518
LY5W 138,780
I3PXN 94,367

3.5 MHz

F5BEG 91,014
4Z5UN 83,214
F1AKK 81,244

ASSISTED HIGH POWER ALL BAND

P33W (LZ2HM) 4,510,000
SN7Q (SP7GIQ) 3,107,940
UW1M (UR5MW) 2,771,055
IQ2CJ (IT9RGY) 2,646,900
AA3B 2,578,576

28 MHz

N6SS 2,604

21 MHz

CV7S (CX7SS) 295,393
LO5D (LU9ESD) 255,500
9A5D (9A3VM) 129,504

14 MHz

IQ1RY (IZ1LBG) 786,111
HA8JV 596,717
WW4LL 408,558

7 MHz

I4AVG 539,240
F4DVX 460,795
Z35T 329,130

3.5 MHz

OK3C (OK2ZC) 181,230
R7AB 127,017
HA8BE 121,432

ASSISTED LOW POWER ALL BAND

TM3Z (F4DSK) 1,969,506
VA3DF 731,688
TM7Y (F8BDQ) 682,660
I2BRT 671,132
DL9YAJ 649,931

21 MHz

CE3CBM 29,273
YC2YSW 19,008
R7DA 12,169

14 MHz

R4IM 168,399
IK3TPP 164,294
WA1FCN 147,686

7 MHz

Z33F 116,207
IK4RVG 100,108
LZ1QV 90,720

3.5 MHz

EB3CW 129,168
LZ5XQ 74,880
G8X (G4FJK) 73,800

SINGLE OPERATOR QRP ALL BAND

DK7HA 282,132
K2YG 143,154
YO9BCM 135,432
W6QU (W8QZA) 122,040
UX2MF 105,357

21 MHz

YO3LW 5,535
JR1NKN 5,148
JR2EKD 2,616

14 MHz

YU1NR 56,180
WE6EZ 20,280
LY5G 13,600

7 MHz

OK2VWB 37,572
ON3DI 31,689
EW8G 21,500

3.5 MHz

YT5YTT 17,342
WD9FTZ 5,265
PAØAWH 3,306

SINGLE OPERATOR QRP ASSISTED ALL BAND

MM3AWD 429,624
IZ8JFL 406,886
YU1LM 194,928
PE2K 72,590
SV9/DJ9XB (DJ9XB) 70,336

21 MHz

R7TU 10,560
HA3JB 9,936
OT6M (ON9CC) 816

14 MHz

OQ4B (ON4BHQ) 34,800
YU1RH 15,060
HA3HX 14,365

7 MHz

IZ7FLP 155,788
LZ3RR 73,508
HG6C (HA6IAM) 24,384

3.5 MHz

OK6K (OK5IM) 24,424
IZ3IBL 19,533
UT8UU 2,072

MULTI-OPERATOR SINGLE TRANSMITTER HIGH POWER

IQ4FC 5,061,250
LZ5R 4,412,550
EM2Q 3,243,230
S53S 3,222,804
K3LR 2,563,484

MULTI-OPERATOR SINGLE TRANSMITTER LOW POWER

IT9BLB 2,189,763
IQ3RK 1,406,784
DD1A 1,240,706
CS5CRE 1,167,790
9A7T 1,079,568

MULTI-OPERATOR TWO TRANSMITTER

CR3DX 7,742,862
S5ØW 3,853,068
LX7I 3,836,308
HQ9X 3,539,646
S51A 3,264,066

MULTI-OPERATOR MULTI-TRANSMITTER

9A1A 7,068,236
CR3W 5,753,769
HG1S 3,630,896
K1SFA 3,557,940
NR4M 2,191,132

ROOKIE SINGLE OPERATOR HIGH POWER ALL BAND

VU2ZMK 245,280
9M2SAF 56,430
HS5XWY 23,985
9M2TDX 6,929
9M2CDX 1,853

ROOKIE SINGLE OPERATOR LOW POWER

YFØTUR 278,160
AA4LS 180,075
PY2FRQ 159,594
YC7YGR 150,535
OD5ZF 146,200

CLASSIC SINGLE OPERATOR HIGH POWER

RG9A 1,197,616
I4JED 838,572
MW2I (GW4FRE) 727,536
YPØC (YO3CZW) 636,225
DJ3NG 410,592

CLASSIC SINGLE OPERATOR LOW POWER

VE3DZ 1,056,062
ON4CT 588,848
TI2OY 557,568
HP3SS 358,743
R7MM 343,294

UNITED STATES

SINGLE OPERATOR HIGH POWER ALL BAND

K5ZD 992,628
AG4W 678,506
WX8C/Ø 599,625
WI9WI 392,980
W3RGA 383,625

28 MHz

W5PR 7,744
K4WI 5,124

21 MHz

K3KG 32,088

14 MHz

N2YBB 70,818
4U1WB (AJ3M) 58,140
AI3Q 30,310

7 MHz

W8TOM 27,927
KG9Z 17,040
W6RKC 10,240

3.5 MHz

K4FJ 28,466
NØOK 7,000

LOW POWER ALL BAND

N1IXF 705,348
AA2MF 612,766
W4GO 572,782
N7IR 406,692
NU4E 304,440

21 MHz

N3GH 3,444
K5ND 2,190

14 MHz

W4LC 90,016
AB1J 64,400
KF6RY (W6ZL) 24,210

7 MHz

AE4ED 61,586
W2VTV 23,630
W9LU 14,616

ASSISTED HIGH POWER ALL BAND

AA3B 2,578,576
K6DTT/1 1,400,100
N3QE 1,372,820
K6LL 1,147,450
W3FIZ 984,192

28 MHz

N6SS 2,604

14 MHz

WW4LL 408,558
W9ILY 208,772
AA5AU 188,635

7 MHz

NN9DD 161,536
WØGJ 112,005
K7WP 74,880

ASSISTED LOW POWER ALL BAND

KS1J 351,833
W3KB 279,300
WØJW 239,652
NY3B 233,230
KØRC 184,260

14 MHz

WA1FCN 147,686
K1JSM 50,467
W5DCC (NK5G) 22,630

7 MHz

AB9YC 23,068

SINGLE OPERATOR QRP ALL BAND

K2YG 143,154
W6QU (W8QZA) 122,040
AA8OY 33,579
NØUR 16,170
N7RCS 12,348

14 MHz

WE6EZ 20,280
N8URE 3,159

7 MHz

KH6KG/W5 15,549

3.5 MHz

WD9FTZ 5,265
K3TW 2,320

SINGLE OPERATOR QRP ASSISTED 7 MHz

W4ER 5,537

MULTI-OPERATOR SINGLE TRANSMITTER HIGH POWER

K3LR 2,563,484
NV9L 1,606,688
W7WW 1,290,210
NA7TB 1,274,898
KU1CW 1,057,968

MULTI-OPERATOR SINGLE TRANSMITTER LOW POWER

NA5NN 697,300
W1QK 449,700
W9JWC 165,536
K2OAK 57,354
AE7K 1,344

MULTI-OPERATOR TWO TRANSMITTER

K9CT 2,199,132
WØLSD 1,416,576
W3GH 1,283,355
KØOO 1,011,528
NW8S 960,514

MULTI-OPERATOR MULTI-TRANSMITTER

K1SFA 3,557,940
NR4M 2,191,132
N6WM 1,606,895

ROOKIE SINGLE OPERATOR LOW POWER

AA4LS 180,075
KK5JD 89,646
W5MMW 46,500
AA8SW 44,998
KN4LKC 41,540

CLASSIC SINGLE OPERATOR HIGH POWER

WI9WI 392,980
W3RGA 383,625
K4ADR 351,260
N6JV 338,640
N3RC 256,486

CLASSIC SINGLE OPERATOR LOW POWER

NU4E 304,440
NN5T 169,120
AE1P 159,570
K9CW 135,876
KF4FC 117,384

EUROPE

SINGLE OPERATOR HIGH POWER ALL BAND

LY7Z 1,851,116
LZ9R 1,580,140
EMØI (UT2IZ) 1,542,378
UV5U (UX1UA) 1,013,446
I4JED 838,572

21 MHz

CR6T (CT1ESV) 113,221
LZ1ND 83,076
YO3VU 31,570

14 MHz

OL9A (OK2ZAW) 586,401
IZ1PKV 380,000
UA6CE 255,045

7 MHz

S53F 590,178
S5ØA 526,384
LY1FW 222,902

3.5 MHz

UX2X (UT2XQ) 186,340
IZØKBR 121,600
SO9I (SQ9ORQ) 107,692

LOW POWER ALL BAND

3Z9M (SQ9UM) 1,177,177
CT1ILT 1,169,754
CR5O (CT7AJL) 654,724
4U1A (HB9RB) 636,260
ON4CT 588,848

21 MHz

YT8A 17,334
IZ7UMS 11,092
DL5PW 5,616

14 MHz

UR2Y (USØYW) 202,750
MIØSAI 118,874
LZ2JA 74,060

7 MHz

OK6T (OK1WCF) 251,518
LY5W 138,780
I3PXN 94,367

3.5 MHz

F5BEG 91,014
F1AKK 81,244
OK2HBR 56,320

ASSISTED HIGH POWER ALL BAND

SN7Q (SP7GIQ) 3,107,940
UW1M (UR5MW) 2,771,055
IQ2CJ (IT9RGY) 2,646,900
S57AW 1,174,716
OH2HAN 1,112,150

21 MHz

9A5D (9A3VM) 129,504
YU5R (YT2AAA) 82,398
UT2G (UR7GO) 74,760

14 MHz

IQ1RY (IZ1LBG) 786,111
HA8JV 596,717
DK3T (DK4EE) 394,914

7 MHz

I4AVG 539,240
F4DVX 460,795
Z35T 329,130

3.5 MHz

OK3C (OK2ZC) 181,230
R7AB 127,017
HA8BE 121,432

ASSISTED LOW POWER ALL BAND

TM3Z (F4DSK) 1,969,506
TM7Y (F8BDQ) 682,660
I2BRT 671,132
DL9YAJ 649,931
UT8EL 573,600

21 MHz

R7DA 12,169

14 MHz

R4IM 168,399
IK3TPP 164,294
RU4SS 132,396

7 MHz

Z33F 116,207
IK4RVG 100,108
LZ1QV 90,720

3.5 MHz

EB3CW 129,168
LZ5XQ 74,880
G8X (G4FJK) 73,800

SINGLE OPERATOR QRP ALL BAND

DK7HA 282,132
YO9BCM 135,432
UX2MF 105,357
OK2FD 91,670
RT4W 86,944

21 MHz

YO3LW 5,535
OK1LV 2,430
UR1YDD 684

14 MHz

YU1NR 56,180
LY5G 13,600
RW3AI 12,137

7 MHz

OK2VWB 37,572
ON3DI 31,689
EW8G 21,500

3.5 MHz

YT5YTT 17,342
PAØAWH 3,306
YT9WW 1,968

SINGLE OPERATOR QRP ASSISTED ALL BAND

MM3AWD 429,624
IZ8JFL 406,886
YU1LM (/QRP) 194,928
PE2K 72,590
SV9/DJ9XB (DJ9XB) 70,336

21 MHz

R7TU 10,560
HA3JB 9,936
OT6M (ON9CC) 816

14 MHz

OQ4B (ON4BHQ) 34,800
YU1RH 15,060
HA3HX 14,365

7 MHz

IZ7FLP 155,788
LZ3RR 73,508
HG6C (HA6IAM) 24,384

3.5 MHz

OK6K (OK5IM) 24,424
IZ3IBL 19,533
UT8UU 2,072

MULTI-OPERATOR SINGLE TRANSMITTER HIGH POWER

IQ4FC 5,061,250
LZ5R 4,412,550
EM2Q 3,243,230
S53S 3,222,804
HG7T 2,175,952

MULTI-OPERATOR SINGLE TRANSMITTER LOW POWER

IT9BLB 2,189,763
IQ3RK 1,406,784
DD1A 1,240,706
CS5CRE 1,167,790
9A7T 1,079,568

MULTI-OPERATOR TWO TRANSMITTER

S5ØW 3,853,068
LX7I 3,836,308
S51A 3,264,066
OMØM 3,030,318
IQ4FA 3,001,185

MULTI-OPERATOR MULTI-TRANSMITTER

9A1A 7,068,236
HG1S 3,630,896
I3VRD 1,038,916

ROOKIE SINGLE OPERATOR HIGH POWER ALL BAND

RA4HL 1,736

ROOKIE SINGLE OPERATOR LOW POWER

SV8OVH 120,733
IU5ICR 119,808
R2PU 72,416
OG8T (OH8TV) 57,132
UB3PDW 52,488

CLASSIC SINGLE OPERATOR HIGH POWER

I4JED 838,572
MW2I (GW4FRE) 727,536
YPØC (YO3CZW) 636,225
DJ3NG 410,592
ES4RD 351,190

CLASSIC SINGLE OPERATOR LOW POWER

ON4CT 588,848
R7MM 343,294
SP9H 304,648
IW2MXY 261,360
IK1RGK 231,081

BAND-BY-BAND BREAKDOWN—TOP ALL BAND SCORES

Number groups indicate: QSOs, Countries, Zones, US/VE on each band

WORLD

TOP SINGLE OPERATOR ALL BAND

Station	80	40	20	15	10
P49X	410/16/43/48	971/24/68/53	1408/24/73/58	564/15/30/51	94/13/16/28
ZZ2T	40/10/19/10	360/19/55/36	637/21/59/50	514/19/61/42	121/13/19/25
PZ5RA	17/4/12/3	326/17/45/44	1043/23/69/49	357/18/39/41	52/8/9/18
LY7Z	567/13/60/3	850/26/83/10	639/31/88/31	97/15/45/0	6/2/5/0
LZ9R	321/12/57/3	560/25/81/19	733/30/82/29	180/17/45/0	8/4/6/0

SINGLE OPERATOR ASSISTED ALL BAND

P33W	472/15/60/6	1046/26/93/34	1358/31/86/40	267/23/58/1	53/5/22/0
SN7Q	557/19/69/15	845/29/89/33	1167/31/98/46	65/16/46/0	24/4/15/0
UW1M	392/15/60/10	1050/28/90/26	1130/29/92/34	203/18/45/0	16/5/11/0
IQ2CJ	525/16/66/12	824/29/94/33	822/33/97/48	174/18/56/2	14/4/11/0
AA3B	396/17/48/45	745/22/76/54	1084/26/92/53	221/17/37/30	21/8/8/6

MULTI-OPERATOR SINGLE TRANSMITTER

IQ4FC	383/19/69/22	1139/32/100/47	1567/37/107/57	284/25/72/7	31/5/26/0
LZ5R	517/22/74/19	1225/29/99/38	1275/32/99/44	379/24/69/2	55/4/20/0
EM2Q	508/15/65/4	1138/29/98/25	1353/33/97/35	204/19/52/0	6/2/4/0
S53S	532/18/70/16	860/29/95/41	1013/34/102/48	152/22/65/5	18/5/16/0
K3LR	281/17/42/47	861/25/74/52	1107/31/90/55	117/17/31/32	30/9/9/8

MULTI-OPERATOR TWO TRANSMITTER

CR3DX	534/19/65/36	1389/29/86/49	2066/32/100/56	475/22/73/28	10/4/7/0
S5ØW	710/15/64/11	1089/30/97/41	1029/32/100/43	295/19/62/7	44/5/21/0
LX7I	793/20/71/15	1129/26/92/35	1082/32/98/50	207/13/49/12	31/3/13/0
HQ9X	357/18/38/51	702/22/55/51	1448/28/80/58	526/20/31/51	39/9/9/10
S51A	790/14/62/11	981/28/92/34	944/33/97/43	221/20/58/8	26/4/18/0

MULTI-OPERATOR MULTI-TRANSMITTER

9A1A	970/20/75/25	1589/31/107/44	1525/36/108/56	500/25/74/14	106/6/37/0
CR3W	526/14/56/23	1293/25/77/39	1858/29/90/51	307/19/55/6	37/4/9/0
HG1S	652/15/66/5	1110/27/94/35	1085/31/88/44	293/22/60/7	23/4/16/0
K1SFA	555/17/53/48	942/24/73/56	1455/28/89/55	250/17/42/34	64/9/11/14
NR4M	370/14/35/46	812/20/67/52	1242/27/80/51	82/14/21/18	23/7/7/7

USA

SINGLE OPERATOR ALL BAND

K5ZD	170/11/27/34	323/15/45/36	786/23/65/44	75/11/21/15	2/1/1/2
*N1IXF	100/6/11/29	418/15/45/42	529/20/63/38	49/11/17/9	2/2/2/1
AG4W	214/12/14/41	460/21/47/46	471/19/54/47	76/10/17/18	0/0/0/0
*AA2MF	197/10/10/39	518/17/44/49	667/17/57/52	32/9/9/9	0/0/0/0
WX8C/Ø	131/8/8/33	261/17/30/39	567/20/63/45	78/12/17/21	7/5/6/1

SINGLE OPERATOR ASSISTED ALL BAND

AA3B	396/17/48/45	745/22/76/54	1084/26/92/53	221/17/37/30	21/8/8/6
K6DTT/1	107/11/28/27	495/22/71/42	908/26/83/43	32/11/18/8	0/0/0/0
N3QE	337/16/35/47	596/21/57/51	775/21/72/51	49/8/12/16	5/2/1/5
K6LL	114/13/13/43	492/25/46/52	868/26/67/56	216/15/22/35	23/6/10/4
W3FIZ	177/11/21/33	433/20/64/39	727/22/73/38	44/9/12/10	0/0/0/0

MULTI-OPERATOR SINGLE TRANSMITTER

K3LR	281/17/42/47	861/25/74/52	1107/31/90/55	117/17/31/32	30/9/9/8
NV9L	295/16/23/47	410/22/52/56	1051/28/83/54	69/16/27/26	13/8/9/5
W7WW	215/17/18/46	753/26/46/55	805/25/63/55	116/17/22/28	14/6/9/2
NA7TB	332/17/23/48	547/23/40/53	859/27/73/54	124/14/19/30	10/4/6/0
KU1CW	177/14/15/40	616/26/40/51	780/25/68/52	55/8/9/17	4/3/3/1

MULTI-OPERATOR TWO TRANSMITTER

K9CT	493/14/17/53	844/24/59/55	1138/26/74/52	252/17/32/38	18/7/7/6
WØLSD	353/13/13/49	718/23/49/52	904/23/72/55	122/13/21/28	28/8/9/6
W3GH	303/13/21/48	520/17/43/52	1042/27/78/52	102/10/16/18	0/0/0/0
KØOO	257/15/35/41	431/21/56/50	536/26/83/46	125/13/20/21	13/8/7/4
NW8S	306/10/15/41	543/20/49/54	677/17/57/50	38/12/17/10	4/3/3/0

MULTI-OPERATOR MULTI-TRANSMITTER

K1SFA	555/17/53/48	942/24/73/56	1455/28/89/55	250/17/42/34	64/9/11/14
NR4M	370/14/35/46	812/20/67/52	1242/27/80/51	82/14/21/18	23/7/7/7
N6WM	363/17/19/50	804/24/43/54	803/27/59/55	264/14/20/38	33/9/11/5

and Dave, K2YG, took second with 143K. Bill, W6QU (W8QZA), was next with 122K; then Virgil, YO9BCM, with 119K; and Serge, UX2MF, with 105K. Virgil, YO9BCM, is very passionate about QRP contesting. He carefully picks the best propagation hours for each band. He mostly concentrated on 80, 40, and 20 meters. Then, he calls in the less crowded portions of the bands and looks for stations without many callers.



Bill, W8QZA, came in 3rd place in SOAP QRP category from W6QU.

Single-Op 80-Meter QRP (9): Aleksandar, YT5YTT, won with 17K.

Single-Op 40-Meter QRP (18): Wieslaw, OK2VWB, won with 38K and Pieter, ON3DI, was second with 32K.

Single-Op 20-Meter QRP (15): Ratko, YU1NR, won again with 56K. Ralf, WE6EZ, was second with 20K and only one state, apparently not realizing U.S. states and VE areas are multipliers in this contest.

Single-Op 15-Meter QRP (8): Cristian, YO3LW, won with 5.5K and Atsushi, JR1NKN, took second with 5.1K.

Single-Op Assisted High Power (597 logs received)

Single-Op Assisted All Band High Power (443): P33W was piloted by Andrey, LZ2HM, to win with 4.5M. Kris, SN7Q (SP7GIQ), was second with 3.1M followed by Victor, UW1M (UR5MW), with 2.8M; Gabry, IQ2CJ (IT9RGY), with 2.6M; and Bud, AA3B, with 2.6M. Masa, JH4UYB, was 7th with 1.4M.

Single-Op Assisted 80M High Power (23): Ludek, OK3C (OK2ZC), won with 181K. Alex, R7AB, was 2nd with 127K followed by Bele, HA8BE, with 121K; Robert, VY2/W5AJ, with 118K; and Uwe, DL3BQA, also with 118K.

Single-Op Assisted 40M High Power (43): G. Franco, I4AVG, won with 539K followed by Bamba, F4DVX, with 457K; Ozren, Z35T, with 329K; Alex, EV1R, with 251K; Tom, GM4FDM, with 248K; Salvatore, IR9K (IT9DSZ), with 233K; and Ivo, S51CK, with 222K.

Single-Op Assisted 20M High Power (72): Filippo, IQ1RY

EUROPE

SINGLE OPERATOR ALL BAND

LY7Z	567/13/60/3	850/26/83/10	639/31/88/31	97/15/45/0	6/2/5/0
LZ9R	321/12/57/3	560/25/81/19	733/30/82/29	180/17/45/0	8/4/6/0
EMØI	323/9/51/0	743/20/70/17	950/27/80/30	98/14/36/0	0/0/0/0
*3Z9M	522/9/52/3	673/19/70/15	379/28/79/26	82/13/33/0	2/1/1/0
*CT1ILT	174/8/38/7	423/11/51/29	768/20/59/42	196/13/31/18	4/2/2/0

SINGLE OPERATOR ASSISTED ALL BAND

SN7Q	557/19/69/15	845/29/89/33	1167/31/98/46	65/16/46/0	24/4/15/0
UW1M	392/15/60/10	1050/28/90/26	1130/29/92/34	203/18/45/0	16/5/11/0
IQ2CJ	525/16/66/12	824/29/94/33	822/33/97/48	174/18/56/2	14/4/11/0
*TM3Z	553/11/58/9	891/27/86/35	516/29/89/41	82/11/32/0	16/3/10/0
S57AW	310/11/58/2	357/24/87/21	425/33/102/41	81/17/40/0	12/3/8/0

MULTI-OPERATOR SINGLE TRANSMITTER

IQ4FC	383/19/69/22	1139/32/100/47	1567/37/107/57	284/25/72/7	31/5/26/0
LZ5R	517/22/74/19	1225/29/99/38	1275/32/99/44	379/24/69/2	55/4/20/0
EM2Q	508/15/65/4	1138/29/98/25	1353/33/97/35	204/19/52/0	6/2/4/0
S53S	532/18/70/16	860/29/95/41	1013/34/102/48	152/22/65/5	18/5/16/0
*IT9BLB	322/12/58/9	480/27/89/36	844/32/92/48	179/21/60/6	100/7/24/0

MULTI-OPERATOR TWO TRANSMITTER

S5ØW	710/15/64/11	1089/30/97/41	1029/32/100/43	295/19/62/7	44/5/21/0
LX7I	793/20/71/15	1129/26/92/35	1082/32/98/50	207/13/49/12	31/3/13/0
S51A	790/14/62/11	981/28/92/34	944/33/97/43	221/20/58/8	26/4/18/0
OMØM	704/14/60/19	1017/29/80/28	1159/33/87/43	187/13/42/0	17/3/8/0
IQ4FA	432/13/60/9	994/29/94/38	1024/30/95/47	248/18/59/6	34/4/15/0

MULTI-OPERATOR MULTI-TRANSMITTER

9A1A	970/20/75/25	1589/31/107/44	1525/36/108/56	500/25/74/14	106/6/37/0
HG1S	652/15/66/5	1110/27/94/35	1085/31/88/44	293/22/60/7	23/4/16/0
I3VRD	309/8/50/2	341/22/61/21	602/28/77/44	93/12/29/0	4/1/3/0

**Low Power*

TOP SCORES IN VERY ACTIVE ZONES

Zone 3

*N7IR 406,692
N7GP 366,482
N6JV 338,640
N3RC 256,486
W7XQ 241,150

Zone 4

*VE3DZ 1,056,062
AG4W 678,506
WX8C/Ø 599,625
VE3TW 424,380
WI9WI 392,980

Zone 5

K5ZD 992,628
*N1IXF 705,348
*AA2MF 612,766
*W4GO 572,782
VE2GSO 478,077

Zone 14

*CT1ILT 1,169,754
HB9ØTOC 814,800
MW2I (GW4FRE) 727,536
*CR5O (CT7AJL) 654,724
*ON4CT 588,848

Zone 15

LY7Z 1,851,116
*3Z9M (SQ9UM) 1,177,177
I4JED 838,572
IT9VCE 768,911
*4U1A (HB9RB) 636,260

Zone 16

EMØI (UT2IZ) 1,542,378
UV5U (UX1UA) 1,013,446
UY5VA 675,880
*UT5EPP 484,191
EW8DX 457,470

Zone 20

LZ9R 1,580,140
YPØC (YO3CZW) 636,225
*YO6HSU 315,432
SV3EXU 150,072
*OD5ZF 146,200

Zone 25

JA7ACM 230,514
JA1AYO 207,756
*7N2UQC 181,300
JA8TR 152,210
JA3HBF 141,600

**Low Power*

(IZ1LBG), took first with 786K, followed by Pal, HA8JV, with 497K; Fred, WW4LL, with 409K; Noel, VE2RYY, with 357K; and Gabriele, IZ3GOM, with 304K.

Single-Op Assisted 15M High Power (13): Eugenio, CX7S (CX7SS), won with 295K; Mariano, LO5D (LU9ESD), was second with 253K; and Matija, 9A5D (9A3VM), was third with 130K.

Single-Op Assisted 10M High Power (3): Pres, N6SS, won with 2.6K.

Single-Op Assisted Low Power (435 logs received)

Single-Op Assisted All Band Low Power (314): Dimitri, TM3Z (F4DSK), took first again with 2.0M (down from his win last year), followed by Doug, VA3DF, with 731K; Sabastien, TM7Y (F8BDQ), with 583K; Rick, I2BRT, with 671K; Bernd, DL9YAJ, with 650K; Yuri, RT9S, with 644K; Oleg, UT8EL, with 574K; Anatoli, EW7BA, with 572K; and Nobuo, JA6GCE, with 488K.

Single-Op Assisted 80M Low Power (19): Axel, EB3CW, won with 129K.

Single-Op Assisted 40M Low Power (38): Zoran, Z33F, won with 116K and Sandro, IK4RVG, was second with 100K.

Single-Op Assisted 20M Low Power (54): Vlad, R4IM, was first with 168K followed closely by Fabio, IK3TPP, with 164K; Robert, WA1FCN, with 148K; Konstantin, RU4SS, with 132K; and Savvas, SV2AEL, with 107K.

Single-Op Assisted 15M Low Power (6): Juan, CE3CBM, won with 29K followed by Amri, YC2YSW, with 19K and Alex, R7DA, with 12K.

Single-Op Assisted 10M Low Power (4): Masa, JE2CPI, won with 75 points and 5 QSOs.

Single-Op Assisted QRP (39 logs received)

Single-Op Assisted All Band QRP (13): Scott, MM3AWD, won with 430K followed closely by Fabio, IZ8JFL, with 407K.

Single-Op Assisted 80M QRP (6): Jiri, OK6K (OK5IM), won with 24K followed by Fabio, IZ3IBL, with 20K.

Single-Op Assisted 40M QRP (5): Giovanni, IZ7FLP, won with 156K.

Single-Op Assisted 20M QRP (6): Wim, OQ4B, won with 35K followed by Rade, YU1RH, with 15K and Ati, HA3HX, with 14K.

Single-Op Assisted 15M QRP (5): Vlad, R7TU, won with 11K and Gabor, HA3JB, was second with 10K.

Single-Op Assisted 10M QRP (4): Mune, JH3DMQ, won with 135 points and 9 QSOs.

Single-Op Overlay (412 logs received)

Rookie (61): Turjiman, YFØTUR, won with 278K followed by Mahendra, VU2ZMK, with 245K; Charles, AA4LS, with 180K; Renan, PY2FRQ, with 160K; and Ibrahim, YC7YGR, with 151K.

Classic (351): Yuri, RG9A, won with 1.2M followed by Alberto, I4JED, with 838K; Yuri, VE3DZ, with 756K; David, MW2I, with 728K; and Marius, YPØC with 636K.

Frederik is 8 years old with an educational callsign. He was supervised by DM9EE. But pushed the buttons and logging himself ... DN5HR
I had fun trying for first time operating with 2 radios ... DL2FQ
Operated remote from Tokyo, Japan ... WA6URY

Multi-Operator (146 logs received)

Multi-Single High Power (51): IQ4FC (ops: HB9CAT, I4EWH, I4IFL, IK4DCW, IK4HVR, IK4MGP, IK4WMH, IU4FNO, IW3FVZ, and IZ4NIC) once again took first place

CLUB SCORES

UNITED STATES

Club	# Entrants	Score
POTOMAC VALLEY RADIO CLUB	60	11,466,317
YANKEE CLIPPER CONTEST CLUB	21	11,200,136
NORTHERN CALIFORNIA CONTEST CLUB	28	10,173,219
FRANKFORD RADIO CLUB	24	7,988,168
SOCIETY OF MIDWEST CONTESTERS	41	7,552,337
ARIZONA OUTLAWS CONTEST CLUB	22	6,856,933
FLORIDA CONTEST GROUP	12	3,017,166
NORTH COAST CONTESTERS	5	2,867,756
WILLAMETTE VALLEY DX CLUB	18	2,651,593
DFW CONTEST GROUP	8	2,616,614
MINNESOTA WIRELESS ASSN	35	2,401,101
TENNESSEE CONTEST GROUP	11	1,917,723
GRAND MESA CONTESTERS OF COLORADO	6	1,868,152
WESTERN WASHINGTON DX CLUB	12	1,656,640
CAROLINA DX ASSOCIATION	8	1,260,887
SWAMP FOX CONTEST GROUP	7	1,204,952
SOUTHERN CALIFORNIA CONTEST CLUB	16	1,172,202
ALABAMA CONTEST GROUP	9	1,149,974
KANSAS CITY CONTEST CLUB	7	1,000,741
CENTRAL TEXAS DX AND CONTEST CLUB	5	898,632
CTRI CONTEST GROUP	6	832,157
KENTUCKY CONTEST GROUP	11	735,121
LOUISIANA CONTEST CLUB	5	574,256
ROCHESTER (NY) DX ASSN	3	567,876
NIAGARA FRONTIER RADIOSPORT	7	482,772
DEEP DIXIE CONTEST CLUB	3	378,150
MAD RIVER RADIO CLUB	5	370,151
BRISTOL (TN/VA) ARC	3	366,226
METRO DX CLUB	5	365,112
NEW PROVIDENCE ARC	4	298,383
SHENANDOAH VALLEY WIRELESS	4	254,014
SOUTH EAST CONTEST CLUB	4	241,686
GEORGIA CONTEST GROUP	5	231,540
MERIDEN ARC	3	186,921
ORDER OF BOILED OWLS OF NEW YORK	4	185,663
THE VILLAGES AMATEUR RADIO CLUB	3	161,107
IDAHO DX ASSOCIATION	3	120,855
TEXAS DX SOCIETY	4	118,696
SPOKANE DX ASSOCIATION	4	103,851

DX

Club	# Entrants	Score
BAVARIAN CONTEST CLUB	94	25,623,620
UKRAINIAN CONTEST CLUB	59	18,380,754
RHEIN RUHR DX ASSOCIATION	50	14,922,136
SLOVENIA CONTEST CLUB	11	9,592,720
CROATIAN CONTEST CLUB	10	8,890,768
HA-DX-CLUB	7	6,612,240
ITALIAN CONTEST CLUB	31	5,430,870
CONTEST CLUB ONTARIO	20	5,302,099
EA CONTEST CLUB	19	5,161,020
ARIPA DX TEAM	6	5,085,368
INTEREST GROUP RTTY	14	4,990,088
ARAUCARIA DX GROUP	10	4,444,133
VYTAUTAS MAGNUS UNIVERSITY RADIO CLUB	9	3,635,098
LU CONTEST GROUP	12	3,482,685
SOUTH URAL CONTEST CLUB	3	1,879,500
RUSSIAN CONTEST CLUB	9	1,795,137
BELARUS CONTEST CLUB	6	1,747,045
KRIVBASS	4	1,358,966
ORCA DX AND CONTEST CLUB	9	1,286,316
CONTEST CLUB FINLAND	12	1,069,080
CATALONIA CONTEST CLUB	4	1,049,883
CONTEST GROUP DU QUEBEC	8	1,049,556
YB LAND DX CLUB	29	929,830
LATVIAN CONTEST CLUB	11	877,398
RSGB CONTEST CLUB	4	828,629
CONTEST CLUB SERBIA	8	700,071
RIIHIMAEN KOLMOSET	3	683,359
BELOKRANJEC CONTEST CLUB	3	666,160
THAILAND DX ASSOCIATION	3	654,272
RIO DX GROUP	9	549,389
RUSSIAN DIGITAL RADIO CLUB	16	534,055
MAUI AMATEUR RADIO CLUB	3	492,880
RADIOCLUBUL RADU BRATU	3	488,605
RTTY CONTESTERS OF JAPAN	7	460,270
SP DX CLUB	7	459,275
CHILTERN DX CLUB	5	428,752
URAL CONTEST GROUP	5	365,634
SK5AA VASTERAS RADIOKLUBB	4	341,994
LA CONTEST CLUB	3	324,748
RU-QRP CLUB	4	320,077
GMDX GROUP	3	269,416
DANISH DX GROUP	6	226,106
NORFOLK AMATEUR RADIO CLUB	3	193,263
GIPANIS CONTEST GROUP	3	182,333
SINGLE FIGHTER DX GROUP	4	169,331
RADIO CLUB VENEZOLANO CARACAS	5	161,647
599 CONTEST CLUB	5	155,111
UA2 CONTEST CLUB	4	150,838
RUSSIAN CW CLUB	4	140,960
VK CONTEST CLUB	3	131,804
SK6AW HISINGENS RADIOKLUBB	4	128,803
TORBAY ARS	4	118,291
ARKTIKA	3	109,618
CDR GROUP	7	108,517
CABREUVADX	4	85,030
VOLYN CONTEST GROUP	3	83,203
ARCK	5	63,845
THE AKITA DX ASSOCIATION	4	63,056
GUARA DX GROUP	5	58,547
KEYMEN'S CLUB OF JAPAN	5	37,734
THRACIAN ROSE CLUB	3	36,719
EUROPEAN PSK CLUB	3	29,399
CS CEAHLAUL PIATRA NEAMT	3	18,014

with 5.1M. LZ5R (ops: K1LZ, LZ1JZ, LZ1UK, LZ2DF, LZ5DB, OE9GHV, OE9WLJ, S55M, and Z36W) was second with 4.4M. EM2Q (ops: UW2QU, UR4QX, N8OO, UT2II, UT2IJ, UT2IV, UT3IZ, URØIM, US1ITU, US2IR, US8ICM, and UY2IF) was third with 3.2M. S53S (ops: S52K, S52X, S53NW, S53X, S55G, S56Y, S57AV, S57NA, and S5ØXX) was nearly tied also with 3.2M. K3LR (K3GP, K3LA, WW3S, K8IV, N8AA, K8RR, K3UA, N8NB, and K3LR) was 5th and first in North America. Tim let the RTTY team run high power RTTY this time.

Multi-Single Low Power (46): IT9BLB (ops: I8UZA, IT9BLB, IT9VDQ, and IT9ZMX) was first with 2.2M, down from their win last year. IQ3RK (ops: I3VUK, I3VWK, IK3VVU, IK3ZGB, IZ3ETC, IZ3KIF, IZ3KSO, IZ3SQW, IZ3ZPO, and IU3MOX) was second with 1.4M. DD1A (ops: HB9BUN, DL3GA, DL1II, DH3GAE, DO5GAR, and DO7JLF) was third with 1.2M. CS5CRE (ops: CT1FKN, CT1CWF, CT1COU, CT1BXE, CT7ABS, CT7ADX, CT2IAG, CT2JYV, and CT5KEK) was fourth also with 1.2M. NA5NN (ops: K2FF and W5UE) was 7th and first in North America with 697K. A61EK (ops: A61ZX, A61BM, and A61EK) was 8th and first in Asia with 660K.

Multi-Two (39): CR3DX (ops: CT3BD, CT3DZ, CT3EN, CT3FW, IC8SQS, OM2KW, OM3RM, and OM7LW) won with 7.7M. S50W (ops: S51DI, S51DD, S51I, S51NM, S52DR, S52SK, S57XZ, and S57K) was second with 3.9M. The new S50W station project started in 2016 with two containers in an idyllic location amidst vineyards with a single 25-meter tower. In the three months leading up to this contest, antennas were moved from the prior location. Only two single radio stations were set up due to lack of time and still only became operational the day before the contest. The live scoreboard provided much competition between S5ØW, S51A, and LX7I with the lead changing over the 48 hours. One of their winning strategies was to work hard to get all available multipliers. The result was very pleasing, especially given the superior amount of aluminum at LX7I.

LX7I (ops: DF7EE, DL6ZBN, DK5ON, DD5ZZ, DJ6GI, DL8LAS, and LX2A) took third with 3.8M, just 17K behind S5ØW. HQ9X (ops: W1UE, N2WQ, LZ5VV, SP4Z, VE3JI, and HR1LEO) was fourth with 3.5M. S51A (ops: S5OLD, S51TC, S51ZJ, S55KZ, S55MZ, S55O, S56B, S56DE, S57PM, S59MZ, and S59VI) was fifth with 3.3M. Sixth and seventh were nearly tied at 3.0M: OMØM (ops: OK2PMU, OM8ADX, OM3CGN, OM7ZZ, OM8AW, and OM3TWM) and IQ4FA (ops: IU4AZC, IU4AOY, IU4HRJ, IZ4AKO, IK4LZH, IU4ICT, IU4JIC, IN3IDQ, IZ4VUS, IK3AES, and IZ4COW).

Multi-Multi (10): 9A1A (ops: 9A5W, 9A9A, 9A6A, 9A7C, 9A7ROR, and 9A8A) continues to dominate this category with 7.1M. CR3W (ops: DK4QT, DJ8NK, DL2AWG, DJ7JC, DG7JB, DM3BJ, DJ9RR, and DL6TK) was second again with 5.8M. HG1S (ops: HA1TJ, HA1DAI, HA1SN, and HA1DAE) was third with 3.6M. K1SFA (ops: K1MK, K1NZ, K1SFA, K1TTT, K2IW, W1TO, and WA3UVV@K1TTT) was fourth, also with 3.6M. NR4M (ops: K3UI, K4MIL, NR4M, K5OF, K4GM, W1IE, KS4Q, and K3NC) was fifth with 2.2M. N6WM

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what's new

Bird's New SignalHawk Handheld Spectrum Analyzers

Bird has expanded its SignalHawk family of rugged, handheld spectrum analyzer products with the addition the SH-60S-AOA (Angle of Arrival) and the SH-60S-TC. The new SignalHawk SH-60S-TC and SH-60S-AOA provide test coverage for all major wireless systems in a fully portable, rugged and weather-resistant test instrument that works on frequencies up to 6 GHz.



A natural integration of digital maps from OpenStreetMap, GPS location, and signal strength vectoring via a two-level internal pre-amplifier, the SignalHawk – AOA provides an easy-to-use interface to not only pinpoint potential in-band interferers and "rogue" or "pirate" broadcast locations, but also perform coverage mapping and "dead spot" identification. This can be very helpful for repeater operators as well as communications professionals.

When paired with an appropriate directional antenna, the small form-factor and extended run-time (up to 5 hours of battery life) of the SignalHawk AOA allows it to be taken to all types of remote locations to accurately pinpoint signal origination. Using a multi-touch, high resolution, TFT display users can change reference level and center of frequency with a touch of a finger and zoom and span just like your smart phone. The display also lets users view the spectrum and trace display, spectrogram display or both.

Multi-task measurements are made easy with the ability to simultaneously review several windows for comparison. The Bird AOA features 8 GB of internal storage so you can screenshot data and transfer via USB/OTG/WIFI/Bluetooth to the cloud and email or upload PC for reference. Additionally, the AOA includes the Bird RF Meter App for interoperability with a wide range of Bird sensors.

SH-60S-TC

Combining easy-to-use intuitive menus with a multi-touch TFT screen that shows a spectrogram / waterfall display that shows intermitted power levels, the SH-60S-TC, RF Analyzer can view RF signals between 9 kHz and 6 GHz. Additional built-in functions include: FM demodulation that allows for rapid verification of communications at the specified frequency, GNSS signal quality, field strength, and spectrum masking.

The SH-60S-AOA RF Analyzer extends the capability of the SH-60S-TC by adding the ability to triangulate the location of an interferer on a map for signals. Triangulation is provided by spectrum analyzers by allowing the user to utilize Bird's interference analysis and triangular functionality to locate the source within three measurements, forming a triangle in the area of the emitter and utilizing a built-in map to find the exact location of the problem.

Both analyzers are available now and include a stylus, AC adapter (12-volt DC output), hard carrying case, instruction manual, soft carrying case, USB drive, USB adapter, and a battery. The SH-60S-AOA has a suggested retail price of $10,150, while the SH-60S-TC has a suggested retail price of $7,730. For more information, call (440) 519-2069 or visit <ww.birdrf.com>

(ops: N6WM, N6RO, NA6O, K6DAJ, and K3EST@N6RO) was sixth with 1.6M. A44A (ops: A45VU, A41ZA, A41RO, A41HA, A45TT, A41CK, A41RF, A41PG, A41LU, A41KB, A41PL, A41QQ, and A41SP) was seventh and first in Asia.

Clubs

Worldwide: Once again, the Bavarian Contest Club (BCC) took top honors with 36M across 97 logs. The Ukrainian Contest Club took second again with 18M in 59 logs. Third place was the Rhein Ruhr DX Association with 15M, and the next three places were from North America, below.

North America: In fourth place worldwide was the Potomac Valley Radio Club (PVRC) with 11M in 60 logs, winning the North America club competition over the Yankee Clipper Contest Club also at 11M from 21 logs and the Northern California Contest Club with 10M from 28 logs.

Logs

Log statistics were similar to recent years, despite log checking itself improving. There were enough logs submitted so that 90% of all QSOs were cross-checked and 97% of those QSOs were deemed good. Approximately 1% of all QSOs had busted (incorrect) callsigns, which was the same as in 2018. Busted exchanges remained the same at 0.5%. Another 1.9% were not found in the other station's log, increasing slightly. Links for individual Log Check Reports (LCRs) were sent out as these results were completed. They are also available upon request to <w0yk@cqwwrtty.com> where you can see how your log stacks up to the overall numbers.

Website

The contest website <www.cqwwrtty.com> is a valuable resource for all aspects of the contest: Rules (including language translations), log format, log submittal, historical statistics, and results database (searchable for any entry and geographical breakdown and all-time records).

Thanks

Thanks to all participants who, together, make this a fun weekend for everyone. Thanks also to the team of volunteers behind the scene who make it all possible:

- Jason, KD2IWM, Managing Editor of *CQ Amateur Radio*.
- Rules translators: Boyan, LZ2BE; Caros, BH4TX; Tapani, OH2LU; Fabi, VA2UP; Steffan, DL6SFR; Kostas, SV1DPI; Joe, IT9BLB; Kazu, JK3GAD / MØCFW; Marcos, PY2WS; Andy, YO3JR; Vlad, VE3IAE; Gerardo, EA1AST; and Mehmet, TA5FA.
- Ken, K1EA, provided the ever-evolving log check software and consulting during log check.
- Randy, K5ZD, for his substantial support on a wide range of issues, including almost all of the log fixes so that the check software ran smoothly and correctly.

I look forward to seeing everyone again in the 34th annual CQWW RTTY DX Contest on 26-27 September 2020.

– *Ed, WØYK*

Great contest as usual ... IW2LLH
Great fun as always to make some Qs in WW RTTY ... KØGEO
Great fun ... KG5U
CQWW RTTY always a lot of fun ... NN2NN
Thanks, had a blast ... WØTUP
Had big fun ... W3GH
Fun contest ... W4EE

(Continued on page 102)

Fifty-nine years ago, in 1961, CQ published an article on transmitter hunting by Helen Signorelli, K6KUP. That article is reprinted in this issue as part of our CQ Classics series. Here, Helen's son, Paul, WØRW, a frequent CQ contributor, brings us full-circle with a short T-hunting article of his own.

LoJack "T" Hunt

BY PAUL SIGNORELLI,* WØRW

During a spectrum search around the shack for noise sources, I came across a big data burst on the LoJack® frequency of 173.075 MHz.[1] It was swamping my HT receiver. I have a sipping chocolate tin that I use as a shield for really strong signals to prevent receiver overload (see photo). My Baofeng UV-5R is poorly shielded, so I put the radio into the can, attached a 60-dB variable attenuator and went outside hunting. I didn't use my beam because it is now tuned to 146 MHz.

The UV-5R doesn't have an S meter, so I just opened the squelch and had lots of hiss noise with which to detect the signal. The LoJack transmission is a data burst (1-2 seconds every 65 seconds). You have probably seen the police cars with the four 17-inch whips on the roof. They do T-hunts automatically to find stolen cars. I don't have one of those.

I walked up and down the block switching from 30- to 40-dB attenuation and the LoJack signal was really strong. There was only one car around … a neighbor's old "spare" car parked next door. I was looking for the Corvette (thinking one might be more likely to be LoJack-equipped). But this was the only car to check out.

I was able to click in 55-dB attenuation and it was still strong at the car. I went over to the passenger's side rear window, set the attenuator to 60 dB and could still hear it. Then I saw the antenna … two little vertical black stripes on the window. It is a FORD.

The police probably get a lot of these false signals, but I don't. In this case, the distance from my shack was 50 feet. Real DX "T Hunting." I arrived with the lowest mileage, HI.

The owner didn't even know what LoJack was. I told him to take it to the dealer and have them reset it, not only to end my QRM, but for his own protection. Driving a car with a pinging LoJack transmitter is very likely to get you pulled over by any police T Hunter — possibly with gun drawn — since the assumption would be that you're driving a stolen vehicle.

Following in my mom's footsteps … another great T-Hunt in the log.

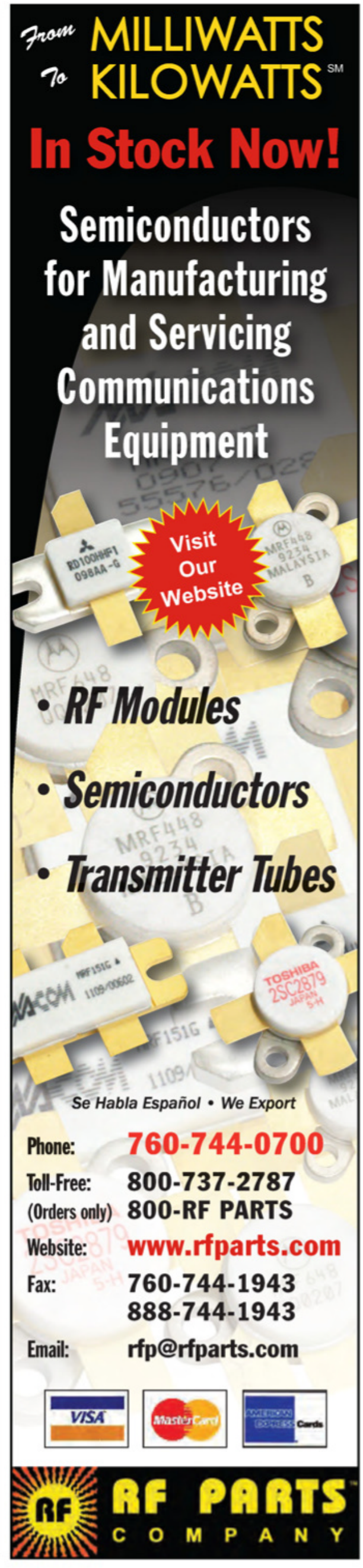


For close-in transmitter-hunting, the author puts his UV-5R handheld inside an empty can of sipping chocolate, which provides extra shielding. He also connects a 60-dB variable attenuator to help him home in on very strong local signals.

Note:

1. LoJack® is a stolen vehicle tracking and recovery system. When a LoJack-equipped vehicle is reported stolen, the company activates a hidden transmitter, which can be tracked by specially-equipped law enforcement vehicles. If you see four closely-spaced VHF whips on the roof of a police car, those are LoJack antennas. For more info, visit <www.lojack.com>.

* *Email: <w0rw1@msn.com>*



There are many good reasons to learn and use Morse code on the air, from working greater distances with less power to operating portable with minimal equipment. But W4DNN has a new reason … it might be good for your health!

How CW Can Protect You From Dementia

BY DENNIS LAZAR,* W4DNN

In May 2018, researchers recruited a few hundred folks between ages 60 and 90 for a study. While some remained nearly as mentally sharp as they had been in their younger days, many were determined to exhibit moderately degraded cognitive skills and some were in the early stages of dementia. All were given a task: Learn the Morse Code.

Published in the journal *Frontiers in Human Neuroscience*, the study was aimed at analyzing the changes in cognitive ability of those seniors, gained through a brain exercise that would take advantage of *neuroplasticity*. Neuroplasticity is a process of *neurogenesis*, the production of new neural pathways and even new brain cells, especially in the hippocampus and cerebral ventricles.

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Until more recent times, most neurologists assumed that the human brain became incapable of growth after a certain age. How could a 90-year-old learn new tricks? But they discovered that the brain has *plasticity*, the ability to change to meet new challenges. Damage to one part of the brain can cause growth and an increase in activity in another part. For example, a person who loses his or her sight will, over time, develop very keen hearing and an enhanced sense of touch.

The Good and the Bad

Neuroplasticity is not all good. It also can affect you negatively. It can contribute to the slow deterioration of your mental and physical abilities, such as memory, problem-solving and balance, as you grow older. One such example is Sam, an 80-year-old who tripped and fell for the first time. From that point on, he feared the possibility of falling again and

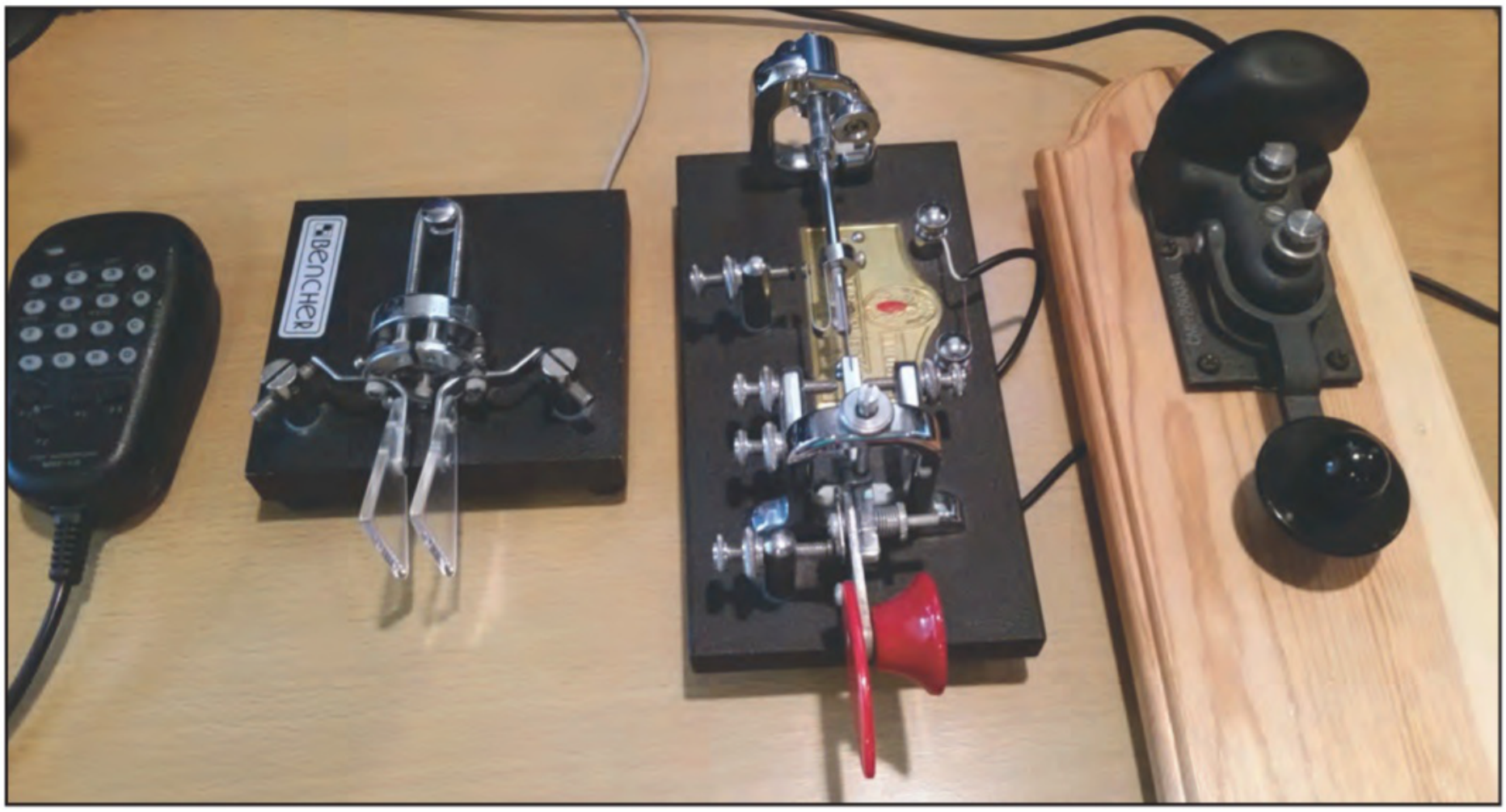


*Photo A. Quiz: Which of these ham radio tools will **not** help you to avoid dementia?*

began to flex his head forward to watch the ground so he would not trip again.

Over his lifetime, Sam, like all of us, had developed a keen ability to balance himself while erect and looking forward. Now, he was looking down with his head bent. His brain began to lose its ability to balance and thus Sam actually increased his chances of falling. The neuroplasticity of his brain had worked against him.

The Dementia Epidemic

For a person living in the U.S. or Europe, there is a nearly 50% chance of being formally identified as senile or demented by the age of 85! Others may have "mild cognitive impairment" that prevents them from living an independent lifestyle. But it doesn't have to be that way. There are changes in lifestyle that can result in prevention of mental decline and even reverse dementia.

Neuroscientists now are devising ways to exercise the brain and the body to take advantage of positive neuroplasticity. One pioneering scientist, Dr. Michael Merzenich, in a recent series on public television, introduced computer-aided exercises which can blaze new neural pathways, reducing the chances of dementia by 35% and even improving cognitive skill of persons already suffering from mild decline. *(Soft-Wired: How the New Science of Brain Plasticity Can Change your Life.)*

Not All Exercise is Created Equal

One key brain exercise technique takes advantage of the brain's ability to multitask cognitive and physical actions at the same time. This type activity seems to work much better than either mental or physical exercise alone. An example is weight training while counting backwards by threes. Another is learning to play the piano, learning to read notes, and use fingers at the same time. Another is, of course, becoming a "know code" ham radio operator.

Learning Morse code employs the cognitive ability to learn a new language as well as the motor skills to be able to operate a key or bug. This is called "Dual Task Training." During the learning process, the senior CW students in the Frontiers study increased gray matter (good stuff) in their left occipitotemporal cortex, which projects to the area involved in language perception. The complex motor skills being learned in sending CW using a hand key induced an increase in gray matter volume in the prefrontal cortex, which is positively correlated with performance improvements over time and a decrease in white matter (bad stuff) volume in the prefrontal cortex.



Photo B. For nearly 60 years, from vacuum-tube boat anchors to tiny solid-state QRP wonders, the author has been enjoying CW. Is it any wonder that he is so intelligent? (And so modest? – ed.)

Exercising different parts of the brain increases neuronal interconnections. As you learn the code, whether via the internet or a code training MP3 on your phone, be sure to tap along with a finger or a toe. When you become proficient enough to get on the air, start sending with your dominant hand, usually the right. Then practice sending with your left hand. (If you're left-handed, reverse the order.) Begin with a straight key. Learn to use an electronic keyer. Learn to use a bug. Increase your speed. Learn to copy words in your head. The more variation in learning and increasing proficiency, the more you are taking advantage or the neuroplasticity of your brain to increase your cognitive ability.

Additional Brain Food

In fairness, I must add that in addition to cognitive training exercises, there are several other important things you can do to ward off mental decline as you age, as detailed in research conducted with 2,765 older adults by the Rush Institute for Healthy Aging at Rush University Medical Center in Chicago. Combining at least partial adherence to the Mind Diet, exercising regularly, engaging in cognitively stimulating activities like a good CW rag chew, and drinking alcohol in moderation resulted in 60% fewer cases of dementia over six years as compared to old lazy, beer-swilling, couch potatoes.

Why You Should Become a "Know Code" Ham

In the past, I have attempted to explain to phone-only hams why I love CW. It's not only because it outperforms anything short of computer-aided modes and can be employed for rag chews in terrible conditions (sorry, FT8). It's not only because I can snag great DX from places where local hams can't afford state-of-the-art rigs. It's not only because I am a QRP enthusiast and like to build and operate simple CW transceivers. No, now I can tell these key-challenged hams that learning CW is one way in which they can improve their brain function and ensure against becoming senile. Ever notice how CW rag chews seem to be conducted at a more sophisticated level, hi hi?

References:

• For an excellent comprehensive article on preventing dementia, you can refer to this *Wall Street Journal* article at <https://tinyurl.com/wet6tck> (You may need a subscription to access the article).

• For information about the Mind Diet, see <https://tinyurl.com/yaez78f7>.

This will be controversial … it has been ever since Alfred Vail developed what we now know as the Morse Code. What's the best way to learn it? That answer depends on each individual learner, as we each have different ways of learning things. If the traditional "learn by listening" approach isn't working for you, you might want to try K4EOR's alternative approach.

Learning Morse Code the Old-Fashioned Way!

BY GEORGE AVERILL,* K4EOR

I have always taken exception to those who say that, when trying to learn code, one should never visualize Morse code characters. They usually advise the use of some type of computer program for sending the sounds of the characters without ever visualizing them. The strange thing is that many hams report that they learned code this "incorrect" way. Note: THEY LEARNED THE CODE! How many language courses would be successful if they never showed you the printed words you were trying to learn?

Today I hear, "I just don't have the time to learn code." What most mean is that they don't have the time to sit in front of a computer and practice or go to a code class. Well, guess what? You don't have to do that. You definitely don't have to lug a computer around with you. You can do exactly what many of us did when first learning code: Look at the symbol for a character. Sound it out as many times as it takes to remember it. Then go on to the next character. Keep this up until you have memorized the code.

After gaining some confidence that you can learn code, concentrate on improving your speed by getting on the air and making contacts, albeit slow ones at first. The best contacts, the ones that help the most, are good old "rag chews" in which you have to combine thinking with sending and receiving code. You will be amazed at how quickly you can improve your speed.

Now before you get on your "high horse" and write that rebuttal to what I'm saying, listen carefully. I'm not saying that this system is the best or most efficient way to learn code. Yes, it may cause some problems later as you try to speed up, but you will be learning code.

Yes, it's much better to learn code in a code class with others if you have the time. Some say that they had great success by having letters flash on a screen while the code was sounded out. Others swear by a computer program they used. You need to do what works best for you and for your style of learning.

So What Do I Propose?

First, I propose that characters should be learned starting with the letter "A" and progressing to the letter "Z," finally adding numbers and common punctuation at the end. Secondly, I propose that the use of a key or paddle wait until the characters are memorized.

Here is how the system works. First, copy the entire Morse code alphabet, numbers, and common punctuation (comma, period, question mark, slash bar, space) on an index card

* <averill@mchsi.com>



The author offers a "key" to successfully learning Morse code if you're having difficulty using more common methods … and this antique telegraph key has a story of its own. George reports that the key once belonged to his wife's uncle, who lived in Milledgeville, Georgia, and became a postal telegraph operator at age 12, riding his bike to and from work every day. (Photo courtesy of the author)

(*we've provided a template – ed.*). Use dots and dashes to represent the characters. Use the front and back of the card if necessary. Next, put the card in your pocket or purse and take it with you wherever you go. Then, throughout the day, as you walk or ride around, begin to learn code by referring to the index card. Keep this card with you at all times. Start by learning the first character and progress down the list. Say "di" or "dit" for a dot and "dah" for a dash, followed by saying the letter. Do this as fast as you can, at least 10 or 20 times for each character, i.e. "di-dah, A; di-dah, A". Repeat this as many times as necessary until saying it fast becomes easy. It's best to do this out loud, but just quietly thinking about it will also do. When you think you know the character, go back to the top of the list and run through each character a couple of times before moving on to the next one.

Start each session beginning with the letter "A" and repeat each character you have learned so far. When you have trouble, consult the card.

Finding the Time and Place is Easy

Here are some common options for learning and practicing:

- When walking around
- When you first go to bed
- While on the potty
- When driving / riding down the road (but don't look at the card while driving!)

Before you know it, you will have memorized the characters and can move on to using a computer program, a key or paddle with an oscillator, or a radio, to practice sending, receiving and increasing your speed. Try it and see what you think. If you have had a hard time finding the time or place to learn code only by listening, this could be the answer to your problem. No more excuses.

A Code Card to Carry With You

Here's an easy reference chart you can print out on two sides of a 3- x 5-inch index card:

A ·–	H ····	O –––	V ···–	3 ···––	0 –––––
B –···	I ··	P ·––·	W ·––	4 ····–	. ·–·–·–
C –·–·	J ·–––	Q ––·–	X –··–	5 ·····	, ––··––
D –··	K –·–	R ·–·	Y –·––	6 –····	? ··––··
E ·	L ·–··	S ···	Z ––··	7 ––···	/ –··–·
F ··–·	M ––	T –	1 ·––––	8 –––··	- –····–
G ––·	N –·	U ··–	2 ··–––	9 ––––·	= –···–

Follow instructions on reverse side of this card.

INSTRUCTIONS FOR LEARNING MORSE CODE USING THIS CARD

- Keep this card with you at all times.
- Start learning the first letter and progress down the list.
- Say dit for a dot and dah for a dash, followed by saying the letter, do all of this as fast as you can at least 10 or 20 times for the letter.
- When you think you know the letter, go back to the top and run through each letter a couple of times before adding another letter.
- Each session start over with the letter "A." and repeat each letter you have learned.
- When you have trouble, consult the card.

GOOD TIMES TO PRACTICE

- When walking around
- When first going to bed
- When on the potty
- When driving / riding down the road (but don't look at the card while driving!)

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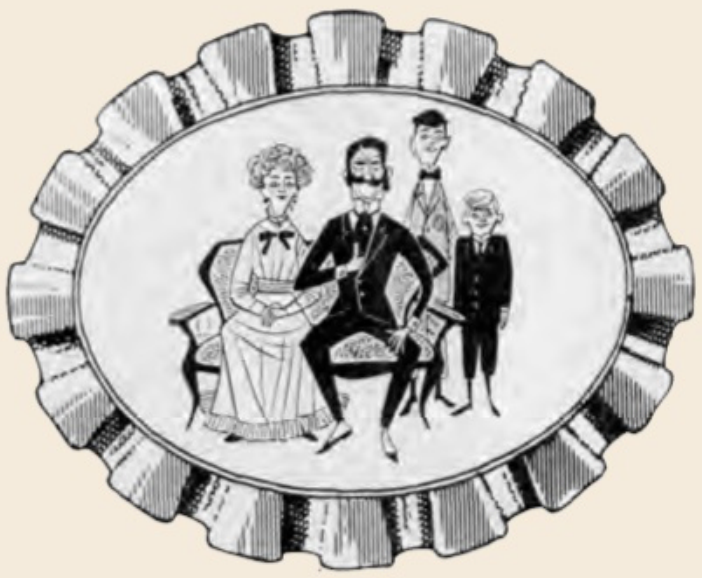
All in the Family …

Over the course of 75 years, and in a hobby like ham radio that tends to run in families, it shouldn't be surprising to occasionally have *CQ* authors from two generations in the same family. But it *is* unusual, in this male-dominated hobby, for one of those authors to be a woman … and especially when it's Mom and son rather than Dad and daughter. We've got two examples for you this month (the only ones of which we're aware; if there are more, please let us know).

Laurie Margolis, G3UML, has contributed to *CQ* many times over the course of five decades. He's also a longtime BBC correspondent and member of the CQ Amateur Radio Hall of Fame. But his mother, Sylvia, who worked for many years for the Radio Society of Great Britain, also penned several humorous articles for *CQ*, mostly about the joys of living in a house full of hams (Laurie's father and brother were also licensed). We share one of those stories with you this month, "Quiet Family Circle," from the September 1966 issue.

Paul Signorelli, WØRW, has contributed many articles to *CQ* on many subjects, both under his own name and sometimes that of an alter-ego (we'll let you figure that one out on your own). But his byline was preceded on our pages by that of his mom, Helen Signorelli, K6KUP. Paul says his mom was licensed around 1955, held a General Class license and enjoyed working CW, copying 30 words-per-minute in longhand! One of Helen's passions was foxhunting, or amateur radio direction finding, and we're happy to reprint her "Transmitter Hunts on VHF" article from the May 1961 issue of *CQ*. Paul has been kind enough to share one of her QSL cards with us as well. And just to close the circle, we have a t-hunting article by Paul in this issue as well.





Quiet Family Circle

BY SYLVIA MARGOLIS

"And the King was so delighted that the beggar had DF'd the wicked bootleggers' QTH that he let him marry his only, beloved daughter, who was not only the most beautiful girl in the world, but who also had 294 countries confirmed. And, for a wedding gift, the King gave them a kingdom of their very own, with a complete rhombic farm, six-element, optimum-spaced beam on all bands and sepa-rate, solid-gold transceivers for every band and, instead of control knobs, the transceivers had huge diamonds and they all lived happily ever after. . . ."

NOT the Best of Spock, but it was the only bedtime story Jonathan understood and the only one he was likely to hear.

He had been three when the dreaded amateur radio virus attacked our home and, like the Plague which had decimated London three centuries ago, struck down the family, one



The G3NMR QSL bears this photo of the author and her husband. Note Maurice's hand over the mike—nobody other than a licensed British amateur may use the trasmitter!



G3UML, Laurie Margolis, the author's eldest son, who obtained his license at the minimum British age, 14 years.

after another. Jonny's elder brother, Laurie, aged eight, could still faintly remember the happy times when a radio was a thing you switched on to hear the news, an antenna waved on the head of a moth and New York was three thousand miles away. But Jonny knew nothing else. This was his world. Daddy studied code and theory with the blinkered concentration of a Pilgrim Father stalking his first Thanksgiving Dinner. Laurie, who must copy everything Daddy did, entered the new element supremely confident that it would hold him up like the Dead Sea. Mother, inured by then to a dozen equally unlikely obsessions into accepting amateur radio as yet another phase in the Hard Day's Night that was her marriage, was uncommitted. This could be no worse than photography, movie-making, wood-turning, model boats, electric trains, rug-making, and the apple-cider-honey cult. Or could it?

Maurice passed the examinations and became G3NMR. Laurie became a fanatical shortwave listener. With a child's astounding memory for statistics, he was soon an authority on DX and a friend high up in the listing once called us to check a knotty point of coral-reef protocol, not with G3NMR, but with Laurie, all of 10 years old, who handled the problem as calmly and capably as U Thant!

So Jonny emerged from infancy into a childhood that seemed normal enough to him. poor mite, if faintly odd to other people. He accepted things, as children will accept the strangest situations, so long as they can call them Home. Some kids get parents who gamble away the grocery money and have to live on Relief, who drink and beat each other up when there's nothing worth watching on TV, who get religion. Our kids got G3NMR and his Ever Loving Wife.

Other children played cowboys and indians. Laurie and Jonny played hams and bootleggers or, better still, hams and FCC Inspectors. Other kids played police cars chasing gangsters. Jonny drove his kiddy-car around saying:— "The name is Jonny. I spell—T.O.M."

Other children annotated car numbers or train or plane numbers. My children competed to see who could hear DXCC quickest from the start of the school vacations. Laurie did it once on 20 meters in 19 hours. Instead of toys for birthdays and Christmas, my children asked for their very own subscriptions to the Radio Society of Great Britain. At nine, Laurie was the youngest member ever, which information, thoughtfully included in his QSL, could reliably melt the heart of the thorniest DX-peditionist and squeeze a card out of him.

Realizing that this thing was bigger than any of us and that it was here to stay, I joined in, too. I listen regularly to a daily B.B.C. nation-wide program called "Woman's Hour," with an audience rating of two million and a consistently high standard of magazine material. A woman talked one day about her sufferings as the wife of a fishing addict.

"I suffer more than that!" I said and wrote them an article about our affliction. British licensing laws forbid anybody except a licensed amateur to use the transmitter under any circumstances whatsoever. So, forbidden to use our British amateur 150-watt power limit, 1 went out on 100 kilowatts.

After I had said my bit, a man came into the studio. "Where is the woman who talked about radio?" he demanded. I confessed.

"You're wanted!" he said.

This was IT. I had committed an obscenity, or fused the B.B.C. transmitters or offended de Gaulle. There would be a quick trial and I would be shot at dawn, or perhaps it might be made to look like an accident, to satisfy the C.I.A. At worst I would have to pay back the 20 dollars they were contracted to pay me.

"Where are we going?" I asked my gaoler.

"Chief Engineer wants to see you."

So it was the transmitters I had blown, not N.A.T.O. 1 tried to figure out how long it would take me to pay back two million dollars, on my dress allowance of twenty dollars a month.

We arrived. The Chief Engineer was a ham. He wanted me to have tea with him.

After this I began to write for British and American amateur radio magazines and *Mobile News* happened. Maurice joined the tiny, newborn Amateur Radio Mobile Society. Following the pattern of all clubs that survive the first three months, A.R.M.S. sought immortality in the printed word. Maurice owned an ancient, hand-operated mimeograph, his wife had a typewriter and her eye on the Editorial chair of the New Yorker, no less.

So *Mobile News* was born, single-sheet, parochial, clumsy. Seven years later it is a bulky, authoritative, printed magazine, with world circulation and enormous prestige and influence, although most of the work is still done voluntarily.



A.4862, the author's younger son, Jonathan, an avid shortwave-listener.

Mobile News week in our home each month is like Spring-cleaning week in others. All extraneous activity stops. Everybody is pressed into helping—proof-reading, checking, composing, plagiarising. Visitors, even ham visitors, are firmly discouraged, unless they are the bearers of good "copy." Sometimes, even, the rig is switched off before the filaments in the tubes glow red, so devoted are we to the production of this zany baby who grew so big and sassy.

The restrictions on their social life disturbed our children not at all. In the Summer they had Hamfests. Rarely a weekend goes by without a couple of these on the program and Britain is so small that there is always an event a few hours' drive from home.

The British Hamfest usually takes the form of a "Mobile Rally," with radio amateurs driving in with their families and friends to picnic, rag-chew and occasionally participate, in leisured and dilettante fashion, in the entertainments provided. Favourite meeting spots are those magnificent estates and palaces owned by deprived aristocrats, who open their gates to the public at 50 cents a head, so that they can afford the vast upkeep of these inherited anachronisms. Here the peasants can gape at hundreds of acres of parkland, millions of dollars' worth of antiques and paintings, all in their original settings, with the chance of being shown round by a real Duke who, to many of them, would look far better hanging from a lamp-post. This is Democracy at work. Woburn, ancestral home of the Duke of Bedford, is the most popular, although Bedford has been hopelessly outclassed by rival Lord Bath who introduced to his estate 50 full-grown lions. All Britain eagerly awaits the news of the first tourist to be eaten. Mobile hams are hoping to be attacked by a lion, so that they can put out a MAYDAY . . .

"You're not going to believe this, Old Man, but.... !"

The Rally organizers need do no more than set up their talk-in stations, arrange a few esoteric contests and sideshows and exploit the status quo.

One of the biggest of these Rallies is the one which the Amateur Radio Mobile Society organizes on a U.S. Air Force Base—coming shortly in CQ—"Quiet Weekend with Uncle Sam."

Their unconventional environment had a spectacular effect on the children's education, which tended sometimes to the startling. The stream of overseas guests who visit us is, on the whole, a splendid influence, apart from the occasional lapse, like the very distinguished VE2 surgeon, who should have known better, who taught the Infant Jonny the words of one of the Tom Lehrer songs (of course it had to be the one about virility) and Jonny taught them to the little girl next door.

But the widening of their suburban, British horizon was indubitable. Thus Laurie would instruct his 7-year-old brother:—"Jonny, what's the capital of Brazil?"

"Brasilia."

"Correct. What's the capital of Venezuela?"

"Caracas."

"Correct. What's the capital of Costa Rica?"

"Don't know."

Bash.

"Now, Jonny, what's the capital of Costa Rica?"



Overseas guests are given the V.I.P. treatment. W9AHR, Bill Carter, was taken to the famous R.S.G.B. Rally at Woburn Abbey, ancestral home of the Duke of Bedford. The silver dollar the author is wearing was given her by K7BGS, Mary Sturkey.

Amid anguished howls Jonny would rapidly be acquiring the trauma that would drive him in later years to hit old ladies over the head and attribute it all to sibling-rivalry.

"Capital of Costa Rica, Jonny?"

"San Jose."

That way you learn fast. When TI2WR has dined in your home and your mother has made a fool of herself demonstrating her perfect coffee, then to find that Walter is a coffee grower— that way you learn very fast all about exotic countries.

You learn the facts of life, too, not all that jazz about birds and bees and hormones, but useful information, vital to a growing boy, like how to fine-tune a receiver, all about digital read-out, the gain a quad has over a yagi, how to get a QSL out of a rare station and where Don Miller is likely to go next.

Some people look at their home as a shelter from the cold and rain, a fortress of privacy protecting them from the outside world, a refuge of peace and family harmony, symbolised by roses round the door, the old rocking chair, the smell of new bread, with a rosy-cheeked, grey-haired mother smiling her welcome.

The roses round our door need pruning because Daddy is busy building his new Heathkit, the smell of new bread is likely to be over-whelmed by the stink of melting transformers, or a Spanish omelette being cooked the way he used to do it on top of a mountain in Afghanistan by K6IWG. The grey-haired mother doesn't exist, period. Rather a black-tressed (Polycolour 'Raven Black") termagant who yells at the kids to get their own supper because she has to meet a *CQ* deadline.

Our home has a dual function, as a radio QTH and an annexe of the London Hilton. In both characters it fails pitifully. As a QTH it is a mere 150 feet above sea level and there is room only for one telescopic tower. The area is densely inhabited by devoted TV fans and there is a factory nearby which uses an r.f. welding process to make furniture. Why can't people make do with sawn logs and buffalo hides for furniture?

As a Hilton-annexe we make a poor show, for we have only one spare bed and can't accommodate more than 50 people for a party. So, when an overseas visitor obeys my husband's burblings on 20 meters to "drop in when he is in London," and the local Boys come to meet him, we have to limit the guest-list to an extent that is frustrating and in direct contravention of the Ham Spirit.

Nevertheless the Guest Book has nearly achieved DXCC and the kids are never surprised at anything or anyone that arrives, whether it be for coffee, a drink, dinner, the night, the weekend, the week or the Summer.

My children are by no means condemned to a life that is entirely bucolic and home-spun. There is sophisticated entertainment for them, like the London SSB Dinners, the R.S.G.B. Golden Jubilee and the time we married off K6IWG, all tales told in CQ. We regretted taking them to the SSB Dinner, because they both had to have new suits, shirts and shoes, which they only wore once afterwards, when we married off K6IWG. Now they properly understand that they prefer outdoor events, where sweaters and jeans are the thing and much cheaper.

With one licensed amateur and two shortwave listeners in the house, life seemed complicated, but it was simple compared with what was to come.

My second ham was born in Geneva. We were there on vacation when we heard over 4U1ITU that Laurie had passed his radio amateur's examination.

This change of status meant a certain amount of re-think in the family. Appointments had to be made to use the rig. Maurice swiftly, and with humility, learnt that he had been doing it all wrong for years, that he lacked application in his quest for DX, that his progress up the Ladder was lamentably slow. He was still permitted, though, to attend to such trivia as paying license fees and supplying equipment and QSL's. In that sphere he remained Dear Old Dad.

The Cordon Bleu of British awards, one which is eagerly sought and prized above all others, is the Commonwealth DX Club Certificate, with its distinctive badge, for which you have to work 50 Commonwealth countries on 20 and 50 more on any other band or bands. It's very difficult. Maurice had waited three years for the last, elusive QSL and counted himself lucky that it arrived in time for him to claim the coveted badge before his son!

I listened, fascinated, as Laurie elegantly handled a sheaf of jostling W's, shuffling them into disciplined order, or stalking an ephemeral, immensely rare station with fierce concentration and patience, pouncing at the precise moment for the kill. I heard him slip naturally into the role of M.C., so that a group of Europeans, who all wanted to work Don Miller, responded gratefully to the ice-cold control of this infant prodigy. Horrified, I heard him tell a UA1 that he was splattering, an Italian that he was calling right on top of Gus Browning. This was my kid, 15 years old, taking his place calmly among his peers, a man among men. I asked a distinguished British DX-er how Laurie was shaping. Was he not arrogant, brash, riding for a fall? No, it seemed he was doing very nicely indeed and had the makings of a creditable DX-peditioner.

But the Old Lion was still to have his uses. Came the TVI complaints. For months we countered them with tried and trusted routines like:

"Do you have a license to receive my transmissions?" with that frosty look that only we British can achieve properly, or:

"What about that gift your dog leaves on my front path every morning?" All techniques guaranteed to help you make friends and influence people.

The neighbors were influenced alright, to the extent of sending a Petition to the G.P.O.

Laurie asked tremulously: "What shall I do, Dad?"

The G.P.O. Inspectors were wonderfully understanding and accepted Maurice's explanation that that 48 hours' solid operation with the linear flat out was only to boost Britain's prestige in a Contest and that never, *never* would it happen again. G3NMR and G3UML are still on the air.

Now the system is simple and infallible. Jonny, aged 10, and proud of the authority vested in him, accepts that he needs little sleep after 6 A.M. As a very special privilege, he is allowed to start monitoring at dawn, when the Pacific and other goodies come in. If anything special is around, he must rush upstairs to wake his father and brother.

Occasionally, trying too hard, maybe, Jonny mistakes an F8 for an FO8, an EA1 for a JA1, and sounds a false alarm. Then he is soundly beaten and the error of his ways explained to him. If he behaves so irresponsibly, he will never grow to be big and strong and a licensed radio amateur like Daddy and Laurie. If he does well and finds them at least one new country a week, and never lets Gus Browning out of his hearing, he is rewarded by being able to log the morsels himself.

Of such is the Kingdom of Heaven.

Transmitter Hunts on V.H.F.

Helen Signorelli, K6KUP

We have been hunting and hiding transmitters on two meters for the past three years. Every other Saturday night, weather or not, the San Fernando Valley gang get out their two meter gear and get on the hunt. Everyone is invited and there are no rules or regulations. It is surprising to see the different ages of people who turn out for these hunts. We have had babies in baskets to the very young at heart. Everyone has fun.

We all meet in the Van Nuys, Sherman Oaks War Memorial Park. At eight P.M. sharp the hidden transmitter calls "CQ The Hunt." After checking in all the cars with the hidden transmitter we record each car's mileage. The winner will have the lowest mileage. This was done to eliminate rat racing and the possibility of someone getting hurt. The traffic here in the San Fernando Valley is very bad, especially on a Saturday night.



Gonset gear being lowered into the manhole.

After three years there didn't seem to be any more good places to hide. We were stumped. So we decided on using strategy. Early one Saturday morning we went out looking, not so much for location, but for the unusual. After scouting around for sometime we found not only the ideal location, but the perfect place for our mad scheme.

At the end of a dead end street we found a gutter fed storm drain. On the sidewalk was a man hole cover. After taking off the man hole cover we found a space about six feet high, five feet wide and about five feet long. Here was a nice room built to order, and large enough for us to get into and set up the gear. The drain pipe leading from this space was about two hundred feet long and emptied into the Los Angeles river. We planned to use the drain pipe for a wave guide but being corrugated it didn't work out.

Three two meter Gonset Communicators were used for this hunt. Two Communicators powered with a large six volt truck battery were lowered into the manhole. These two Communicators were used as repeater receiver and transmitter. The audio from the repeater receiver was piped into the repeater transmitter. We used a nineteen inch whip on the repeater receiver and set it on receive. The repeater transmitter was set on transmit. The antenna for the repeater transmitter was at the end of two hundred feet of coax, which was run through the drain pipe. It took the thin man of the gang to crawl into the drain pipe (which was about three feet around) and two hundred feet over to the river to put up the spring steel center fed dipole. It all worked fine until he got to the end of the drain to install the antenna. Now, how to turn around and come back? Should he crawl backwards two hundred feet? No, that was too slow and uncomfortable. Going up was out of the question, as there is a storm fence six feet high running along the top of the river. So he hung on the edge of the drain pipe, turned himself around and



Helen, K6KUP, bossing the operation.

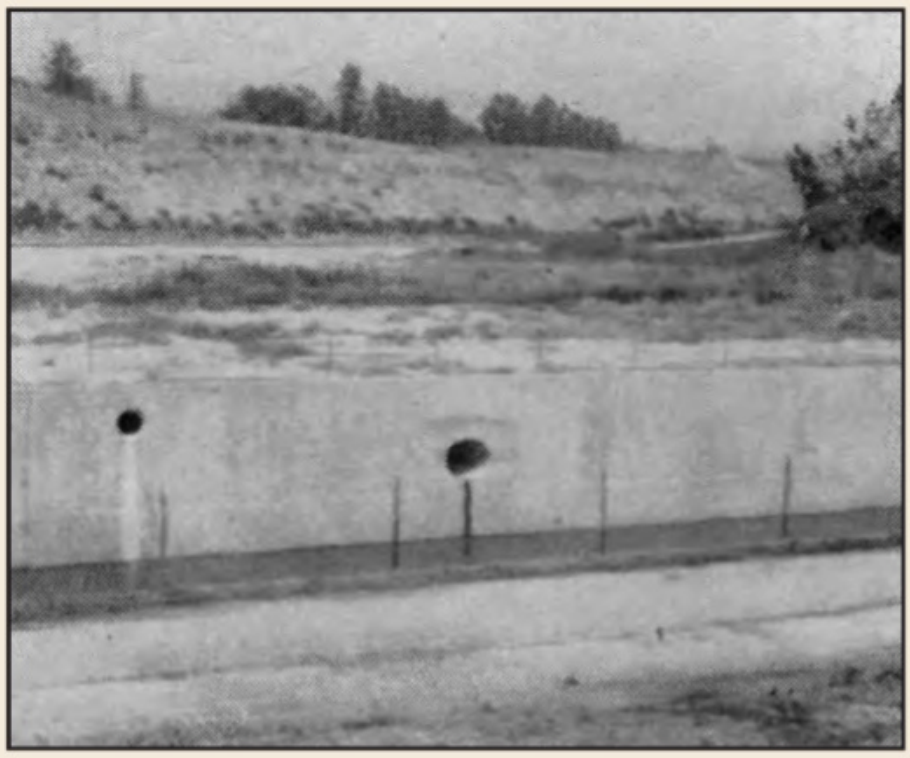
crawled back, leaving behind him a very clean drain pipe. We heard later that we were putting out a five nine plus signal right in the middle of the river.

In the meantime I was lying on the sidewalk very interested in bossing the job and completely unaware of anything other than the activities in the drain. Quite suddenly I heard a gentleman say, “Lady can I be of any help?” Well, I could have fallen through the manhole and floated down the river. I calmly answered, “No, thank you.” As I look back I wonder, “What could this man have thought?” A lady lying on the sidewalk, looking down a drain.

We set the two Communicators into the drain pipe, then carefully laid padding and tumbleweeds on them to deaden the sound and cover up the dial lights. We then proceeded to the next step in our adventure.

The location for the third transmitter (the remote transmitter) was about three hundred feet from the storm drain and over a small hill, hidden from view. This was powered with a six volt battery and used a nineteen inch whip.

A dummy five element beam was put up on the fence



Large drain was where the antenna was installed.

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across the river. The end of the coax was buried in the ground and a note which read, "You've got the antenna — Now What?" We figured the transmitter hunters would come directly to the dummy antenna as it was closest to our antenna in the river.

We started promptly at eight P.M. calling, "CQ The Hunt." The hunters were all gathered at the park and after checking in and being sure all could hear us they started out. From our remote transmitter we would transmit on the high end of the band. The repeater receiver would receive the signal and pipe it into the audio input of the repeater transmitter which was on the low end of the band. The repeater transmitter was licensed under a different call.

In the middle of the hunt our six volt battery on the remote transmitter gave out. So off to the service station to get a new battery. This meant a wild dash on foot, as no cars were parked in this area. Dodging in and out behind bushes and houses and carrying a six volt battery was no easy chore. In the mean time, repeater receiver and repeater transmitter were putting out a fine carrier with no audio. Lucky for us we were close to a service station and it didn't take long to get another battery. We did manage to sign our call a few times before it finally gave up.

From our vantage spot we could see the beams on the hunters cars twisting under the street lights. With their spot lights they promptly discovered the dummy antenna and dug up the coax. They were quite upset at not finding a transmitter at the end of it. Then with a disgusted look they read the note and proceeded looking for the hidden transmitter. They even tried to climb the storm drain fence along the river, but the barbed wire on the top stopped them.

About eleven thirty the seekers decided we were neither in the river or on their side. Finally they came over to our side of the river, but as there was no signal and nothing to see they were lost again. One seeker had a coffee can walkie talkie and a very determined mind. He finally spotted the antenna in the gutter with his spot light. He decided that the antenna didn't go into the river so he figured it just had to go the other way into the pipe. So after scouting around for sometime on foot he heard the vibrators purring in the still of the night. I am sure the walkie talkie didn't help him in locating the transmitter but it did help to find the antenna.

About twelve thirty the remaining hunters finally gave up. They were quite amazed when we told them the story and showed them the three Communicators.Everyone was willing to admit that our mad strategy had really worked.

Now came the clean up work. We didn't think the antenna in the river would be a great loss so with a few yanks we managed to lose the dipole in the river. Our cars were all parked away from the street and it took lots of leg work to get the cars and pick up all the gear. It was a wonderful hunt and we all had lots of fun.

Our reward after a good days work? Off to a midnight snack and lots of discussion about the night's fun.

P.S. Don't go look for our very favorite spot. The Los Angeles City has recently put in a freeway and nothing is left. Well, we can always say we once had fun under the Hollywood Freeway.

CQ CLASSIC

All in the Family …

Elsewhere in this issue, we republished articles by Helen Signorelli, K6KUP; and Sylvia Margolis, both of whose sons became frequent *CQ* contributors as well. We also have a new article by Paul Signorelli, WØRW, and reprise this April 1999 article by Laurie Margolis, G3UML — soon after the passing of Jordan's King Hussein, JY1 — recalling a series of QSOs with the king that were the subject of world headlines and a 1971 *CQ* article by his mom as well.

JY1: SILENT KEY

Memories of JY1

BY LAURIE MARGOLIS, G3UML

In the January 1971 issue of CQ we ran a story by Sylvia Margolis entitled "So Who's Looking After the Store?" which humorously documented the events recounted here. The photos in that article show a young man who, because of his amateur radio avocation, became suddenly catapulted, albeit briefly, to national fame for his contacts with JY1. While Laurie's time in the sun because of this incident might have been relatively brief, his comments here speak measures on the phenomenal and lasting impact King Hussein had on all those he came in contact with. The King, a wise and sagacious leader, will be missed by all. —K2EEK

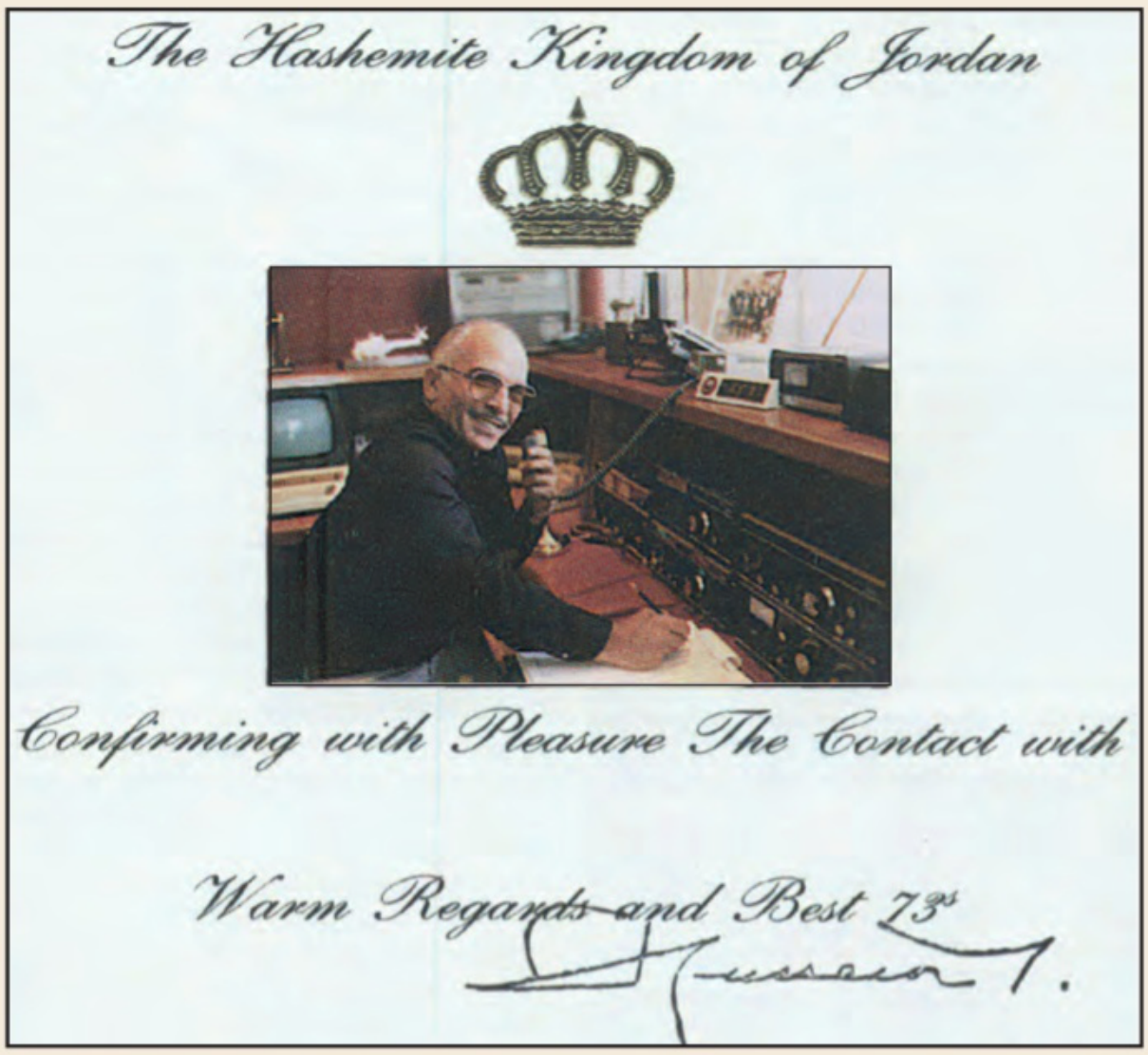
In some ways, 1970 doesn't seem that long ago. Plenty of the things we take for granted already existed. Jet travel was common, with aircraft that wouldn't look all that out of place at modern airports. We had color television, video recorders were starting to appear, and there were push-button phones.

The amateur bands didn't sound that much different either. Single sideband was already the dominant mode. There were plenty of good, small transceivers around, many of them being made by companies such as Yaesu and Kenwood in Japan. I still use an early 1970s Heathkit amplifier. There were contests, pile-ups, split-frequency working, and arguments over DXCC counters.

And yet, in many ways 1970 was a long time ago—29 years ago. Going back yet another 29 years, and the Japanese were planning to bomb Pearl Harbor; the Russians were halting the Nazi tide at Stalingrad; Britain was struggling to survive; and Israel would not exist for seven more years. Much can happen in over a quarter of a century.

More to the point, satellite communication, the Internet, and cellular phones were still a long way off. International communications by telephone were expensive, unreliable, and often collapsed in the face of natural or man-made disaster. And the Middle East was exactly midway between two devastating wars—the Six-Day War of 1967 and the Yom Kippur War of 1973.

King Hussein of Jordan died in February, and was buried amidst possibly the greatest collection of world leaders ever gathered in one place: Britain's Tony Blair with France's President Chirac; Iraqis and Israelis in close proximity; President Assad of Syria; and President Yeltsin of Russia. I don't know why, but I found the shot of four US Presidents—Carter, Ford, Bush, and Clinton—breathtaking, the distillation of a mass of democratic decision-making



A royal QSL confirmation one of the world's most famous statesmen and amateur radio operators, King Hussein, JY1.

CQ 2014, 2015, 2016, 2017, 2018, 2019



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all in one place. All for the Hashemite King of Jordan, King Hussein Ibn Talal. All for a radio amateur, JY1.

Truly great people—US presidents, British monarchs, world leaders—touch many lives, but usually on formal occasions and at a distance. I was just feet from Bill Clinton as he worked the crowds in Northern Ireland. The people who shook his hand, or even stood next to someone who shook his hand, will never forget it—contact with power and success. The difference with King Hussein, a genuinely, truly great man, was that he chatted with many of us radio amateurs, in our homes, through the familiar medium of our radio stations, one on one, as equals. We were G-something or W-someone. He was JY1, another SSB signal in the 20 meter QRM.

A Special Contact

My bit part in this story begins back in March 1970. I was a 19-year-old student, a Jewish student, living with my family in the resolutely ordinary suburb of Ilford in Essex, east of London. Essex's relationship with London equates roughly with New Jersey's with New York City, with all the glamour and style that comparison implies. My father was Maurice, G3NMR; my mother was the well-known CQ contributor of the time, Sylvia Margolis. I'd held my amateur license for almost five years at the time.

Word had gone around the amateur radio world that King Hussein of Jordan, as unlikely as it sounds, had become a radio amateur with the callsign JY1. At that time Jordan, a poor country recently hammered by the Israelis in the Six-Day War, had no amateur radio stations, so the mere suggestion of any operation from Jordan was cause for excitement. I seem to remember that my first reaction to hearing of JY1 's activity was not just that the King of Jordan was on the air, but that I might finally get Jordan for a new one.

On March 20, 1970 I was tuning 20 meters, around 14280, higher than I'd normally listen. I heard a familiar voice. It was JY1, with a huge signal, finishing a contact. I called him, wondering mainly how to address him. He gave his name as "Hussein"; this seemed a bit familiar, so I settled on Your Majesty, pretty odd on the egalitarian amateur airwaves, but I hoped it wouldn't cause offense.

We had a routine contact: weather, rig, 73's. The King of Jordan—and this really took some accepting—was blasting out of my loudspeaker in my living room, calling me Laurie, and telling me he was using a Drake T4/R4 and an L4B amplifier. My father, G3NMR, made a contact immediately afterwards. The King seemed pleased to have worked the father/son combination. No doubt it appealed to the hereditary sensitivities of a monarch.

King Hussein's QSL address was workaday: P.O. Box 1055, Amman. I sent one off immediately, of course, and only a few days later his card dropped onto the doormat. It came in a heavy embossed envelope, resplendent with the Jordanian royal crest and covered with Jordanian stamps. There was a long handwritten message: "It was a pleasure to contact you, my good friend. I hope we will have a future contact soon. Kindly accept my best wishes and regards, Sincerely, Hussein I." I remember thinking at the time that if he made many QSOs, he'd be spending a long time writing QSL cards with messages that length. I think he discovered QSL managers soon afterwards.

Well, the summer of 1970 came and went. As far as I was concerned, I completed my first year at London University, went to America for the summer, had a disastrous time at a summer camp in Pennsylvania, then had a much better time working in a store on Long Island. I discovered I'd made a mess of my end-of- year examinations and had to return to resit them in

early September, wrecking my plans to travel more and come home later that month.

As far as the Middle East was concerned, the summer of 1970 was an ominous time. Palestinian terrorism was at its height, attempting to use Jordanian territory as a base to attack Israeli interests and the west in general. They hijacked three airliners to a remote desert airstrip called Dawson's Field, in Jordan, and blew them up in front of TV cameras. King Hussein realized there was a serious danger that his poor desert domain would be taken over by the Palestinians, and there wouldn't be much resistance from the rest of the Arab world. The very legitimacy of Jordan was questioned by many, who saw it as an artificial state created largely by the British after World War I.

King Hussein decided to fight the Palestinians, to smash the PLO strongholds in his kingdom. The Jordanian civil war developed rapidly and by September 1970 it was raging.

Again, I point out that in 1970 it was inevitable that international communications would collapse under such circumstances. Jordan was no exception. It became a media dead spot. There were no satellited reports. In those days TV film (portable video was still some way off) had to be flown from the scene of a story to someplace where it could be edited and processed, and then flown back to broadcasters such as the BBC or NBC.

Looking at yellowing newspaper cuttings from that time, the press datelines were Nicosia and Beirut. Virtually nothing was coming directly out of Jordan, by now the scene of vicious fighting as King Hussein tried to reimpose control.

There was one voice, however, emerging from Jordan, from the very heart of the kingdom. A few days after I returned from America, I was listening across 20 meters late one night. There, to my considerable surprise, was JY1, King Hussein, chatting to a W0 in Minnesota. Conditions were good; he was loud and I called. To my surprise he remembered our contact six months earlier and described the desperate situation in Amman and his hopes for the way it would turn out.

I have been with the BBC for 24 years now, but at that time I was still some way from becoming a journalist. Indeed, without passing some exams I was some way from being anything at all. But even my still undeveloped news sense recognized that this seemed pretty unusual. There was a country, wartorn and completely cut off, and there was the Arab King giving me, by now a 20-year-old Jewish student, an eyewitness account—the only eyewitness account—of what was going on. All this on 20 meter sideband.

As well as being a writer for CQ, my mother, Sylvia, had become a well-known radio personality in Britain. By now it was about 1 AM, but I woke her and asked if she found this interesting. She did, and rang the "Today" program, then and now the major morning current affairs program on BBC Radio. They were excited by the story and sent around a radio links vehicle the next morning to play my tape of the contact with JY1 and to interview me.

Then began two weeks of mayhem. It is no exaggeration at all to say the world's media descended on our small house in Ilford. I had several more QSOs with King Hussein over the next week, passing on various messages to his family in England and to the Jordanian embassy. There were often several reporters listening (the King always knew this), and the story was big in the British papers, as well as overseas. The King appeared obligingly, S9 plus as usual, as a BBC TV news program did a live report from the house. The story had two strong elements: The only eye-witness accounts from Jordan were coming through its king, and that information was being picked up by a young student in a London suburb. It was a good story. My exam revision wasn't getting far, but I had to admit this was fun.

Then King Hussein, doubtless with better things to do than chatter on 14225, failed to appear for a few days, and my side of the story began to fade. There was still very little coming out of Jordan.

One evening the main BBC TV early-evening news show came to shoot some background material. The King hadn't been heard for a week. The TV team had been working all day and was clearly unenthusiastic about what they saw as an old story. I hadn't heard the King for days and felt we were, in the Cockney vernacular, "flogging a dead horse."

The TV team set up and asked me to make a demonstration contact with anyone. I talked to someone in Lithuania. Then, blasting through the early evening QRM, was JY1, crystal clear: "Good evening, my friend Laurie. This is Juliet Yankee One." It was a startling moment. The TV people loved it, I was pretty stunned, and it made several minutes on the following night's program. I don't think the King revealed anything very much, but he was still the man of the moment, and information from Jordan was very limited.

The war ended with the King victorious, at the cost of a destroyed nation, and Palestinian discontent even deeper than it had been before. The Black September terrorist movement grew out of those days. Some weeks later, a package turned up from the Jordanian embassy. Inside were two watches, engraved with the royal crest, one for me and one for my father. I've worn mine virtually every day since. A note from the embassy thanked us for our help and support.

Later that year the King, exhausted from running the war, spent some time in a hospital in London. To our great delight, he put a beam on the roof and used his reciprocal call, G5ATM. My father and I were invited to meet him. It was just the three of us in a modest hospital room in central London, the small figure of the King lying on his bed in his pajamas and robe. I really can't remember much of the half-hour conversation. I was just astonished to be there. But I do remember looking at the King's bookshelf, with lots of wartime novels and books about the RAF.

This story has two postscripts. The following summer I was in Israel, operating a contest from Kibbutz Sasa, at that time a very active station on a mountaintop in the north of the country. This was years before peace treaties, the Sadat visit to Jerusalem, or any crack in the glacial relations between Israel and the Arab world. I was using a 4Z4 callsign, so there was no mistaking where I was. On the Sunday afternoon, as I worked through a pile of Europeans, suddenly a very loud signal boomed out of the loudspeaker: "Hallo, my friend Laurie. How are you?" Who was that, I asked. "Your very good friend to the east," the familiar deep voice replied. It was the King again, this time talking to me in Israel. The Israelis listening nearby were thunderstruck.

I never met King Hussein again. However, during the first Gulf War, when I was a BBC correspondent in Jordan, I conducted a long interview with Queen Noor, originally the American Lisa Halaby. There was much anti-American feeling in Jordan, and King Hussein had backed Iraq's Saddam Hussein for good internal reasons. I was intrigued by her role as a highly visible American in Jordan. As luck would have it, after I'd been negotiating for the interview for weeks, the summons to the palace came as I was in my hotel bed with flu. I wasn't at my best, but she looked stunning and was very friendly and straightforward.

King Hussein maintained his interest in amateur radio for many years, running top-quality stations from his palaces in Amman and Aqaba. He talked to friends all over the world, including very many in the United States, none of whom will forget the day the King came to call.

Many of us talk about the need to get (or continue getting) more young people involved in amateur radio, but sometimes find it difficult to locate resources to help turn a concept into a functioning program. CQ Contributing Editor Anthony Luscre, K8ZT, is here to help …

Ideas and Resources for Growing Youth Involvement in Amateur Radio

BY ANTHONY LUSCRE,* K8ZT

Looking around at a hamfest or club meeting will give you the definite — and most likely accurate — impression that the ham radio population as a whole is graying. While there are definitely young people getting involved and active in amateur radio, and many of them and their activities are highlighted in these pages, there need to be more. And it's up to us to bring them in.

Unfortunately, two of the most common pathways into ham radio in the past — shortwave listening and scouting — are both in decline for reasons over which we have no control. Also, many of the previous attractions of an amateur radio license — such as the ability to have 24/7 connectivity with friends and family through the local VHF / UHF repeater — has been replaced with today's smartphones. Add to that the ability to make long-distance phone calls for free on the same device. Without these passive incentives, we need to increase the active recruitment of new hams. We also need to do a better job mentoring newly licensed hams to make sure they become and stay active.

There is no silver bullet that will completely solve these issues, but one idea that many believe can help reverse these trends is the increased involvement of youth in amateur radio. For our purposes, I am going to define youth as anyone under 26 years of age. By age 26, most people have completed college, graduate school, military, job training programs, etc. This still covers a wide range of ages and requires multiple plans to address the interests and needs of the many subgroups involved.

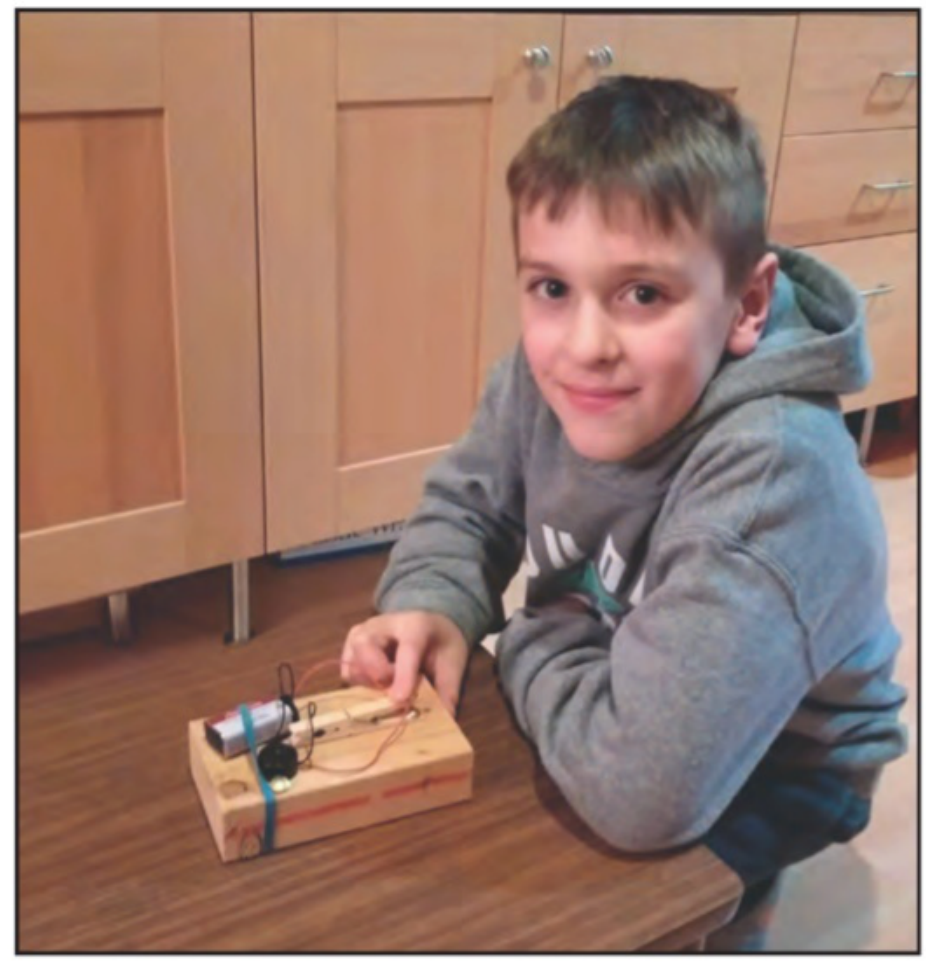
For this article, we will focus on the subgroup of students in grades 4 to 12, as the college, postgraduate and young professional groups need different approaches. The purpose of this article is to provide you and your local radio club with ideas and resources to encourage, instruct and mentor youth involvement in amateur radio. In addition to resources for youth, I have also included a number of resources for you to share with school teachers, scouting and other youth group leaders.

Getting Your Foot in the Door

One of the first problems is getting your foot in the door. One approach to this is piggybacking on the current high interest in STEM or STEAM (Science, Technology, Engineering, [Art], and Mathematics) and DIY (Do It Yourself) movements in education. Many local school districts, public libraries, and scouting groups are looking for STEM activities / programs for their students. I have prepared a tri-fold brochure, **Ham Radio – The Original Maker Movement** <tiny.cc/hr-makers>, for you to use in marketing to these groups. The ARRL also has a flier available along these lines **DIY Magic of Amateur Radio** <https://tinyurl.com/j6domz7>.

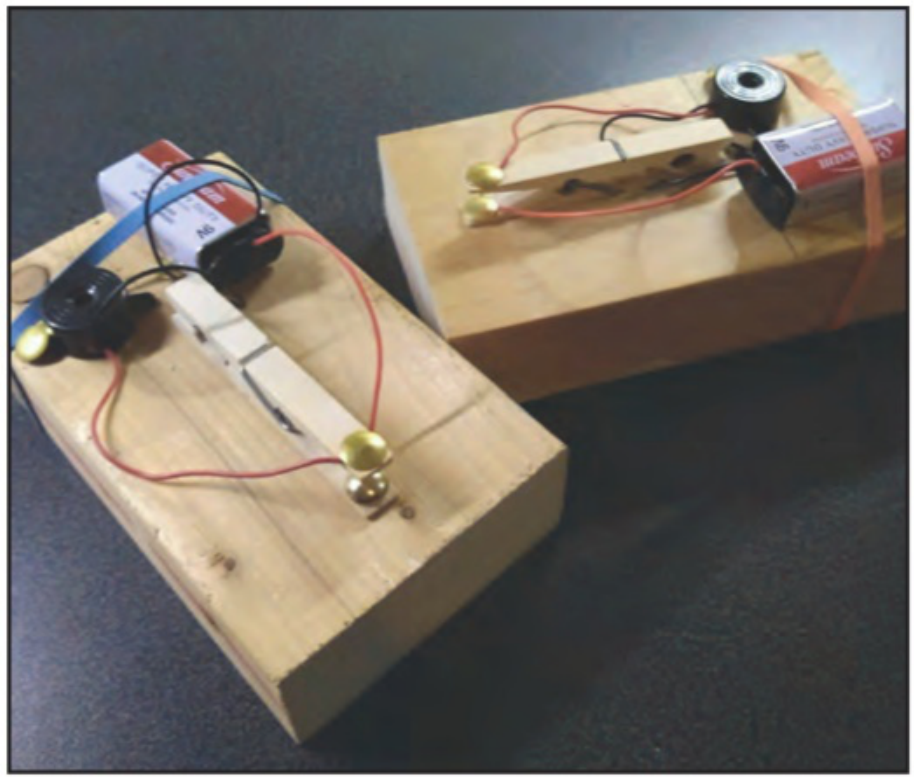
An approach to getting your foot in the door specific to youth in scouting is the annual Jamboree on the Air (JOTA) each October. I recently wrote a column for the *ARRL Ohio Section Journal* on amateur radio and scouting and included a number of ideas for a successful JOTA effort by you and / or your local radio club <https://tinyurl.com/rvlv2bj>.

Working with scouting brings up an issue that needs to be addressed by all hams working with any youth group — youth protection. The Boy Scouts of America, most public schools, and other groups require training and / or background checks for adult volunteers working with youth. The Boy Scouts of



A possible future ham practicing Morse Code using the inexpensive clothespin key that he assembled. (Photos by the author, except as noted)

* *email: <k8zt@cq-amateur-radio.com>*



Closeup of a pair of clothespin keys. For information on building one visit <tiny.cc/cp-key>.

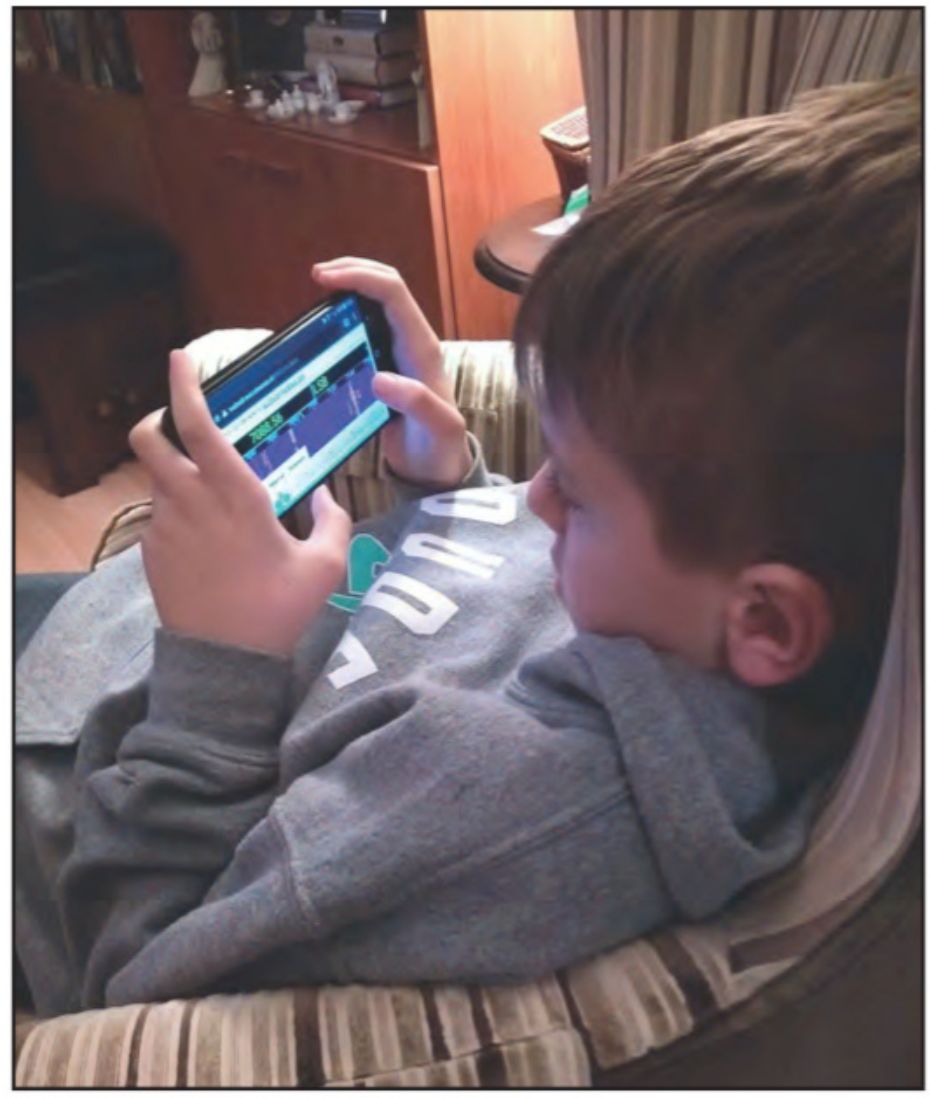
America has a free program that I suggest all adult volunteers take. You will need to register first <https://tinyurl.com/uhcoewd>, but it is free. Check with your local schools or other groups for additional requirements for youth protection.

Fitting In With Current Programs

Whether you are working with scouts or schools, one key is to explain / demonstrate to those in charge how your amateur radio activities can fit into their already existing curriculum, programs, lessons, merit badges, etc. For schools, I have developed a number of sample lesson plans that integrate radio into almost all subject areas. Examples include:

• **Math:** Inverse proportional fractions to calculate wavelength and frequency and metric prefixes (Kilo, Mega, etc.)
• **Science:** The electromagnetic spectrum, atmospheric layers, sunspot cycle, etc. and radio propagation; Space – Satellites, orbits, tracking, and Doppler shift
• **Social Studies:** Polar and other map projections, countries and cultures, governments and international regulations, historical relationships between countries, commonwealths, etc.
• **Language Arts:** Phonetic alphabet, Q-codes and abbreviations, broadcast radio and speech, and radio drama and script writing
• **Music:** Morse code with drums, frequency and pitch, Doppler shift and data rates, compression & digital audio processing
• **Physical Education:** Demonstration of wavelength and frequency with jump ropes
• **World Languages:** Foreign languages, universal communication across different languages, role of world cultures in radio, and listening to native speakers of languages via radio broadcasts

These, along with an introduction to radio and amateur radio, as well as other ideas, are in a slide presentation that I have used at K-12 educational technology conferences, **Radio Technology in the Classroom**, available at <tiny.cc/rtice>. I have a similar presentation I use for local amateur radio clubs that want to get involved with local schools to support amateur radio in K-12 education that you can find here: <tiny.cc/arined>. I also have two documents for a 5th- to 8th-grade level program I call “Radio Day.” They are the Radio Day student Handout <tiny.cc/radio-day-h> and teacher lesson plan (this contains many of the lessons outlined above) <tiny.cc/rdagenda>.



A common pose for a preteen, but look closely at the screen. He is actually listening to an online tunable SDR receiver on 40 meters.

I have also put together a number of ideas for successful demonstrations of amateur radio to youth, whether in a school, at JOTA, or another venue to encourage participation and positive experiences:

• Provide materials to student/youth/scouts and teachers/leaders before the event (videos work well with kids)
* Online resources:
1) What is Amateur Radio <tiny.cc/whats-ar>
2) Amateur Radio Resources for Youth <tiny.cc/hry>
3) Information on the Phonetic Alphabet <tiny.cc/palb-1> and <tiny.cc/palb-2>
* Activities
1) List of SDRs (online tunable software-defined receivers) <www.websdr.org>
2) Instructions on using SDRs <www.websdr.org/faq.html> and <https://tinyurl.com/rw27llx>

• Plan your event including logistics and facilities
* Your place or theirs? There are advantages and disadvantages to each. See *Table 1* (With schools, this is not an issue as you will need to go there).
* Provide a schedule of planned activities for the entire event ahead of time to teachers / leaders
* Have onsite helpers, including other hams to help or even non-hams with experience with managing groups of youth.
* If you can have multiple hams, consider a station-rotation (that is “station” as a learning station, a school term, not to

be confused with a radio operating position) model where small groups of youth move from one activity to another.

• **Plan your radio operations**

* Make things fun and interesting. Make sure your demonstrations of radio contain visual, Internet, social media and / or gaming aspects. Anyone can talk around the world with a simple cell phone today so the lure and magic of doing it with a radio are not there for today's youth. But if we add in a few elements, it suddenly becomes fun and interesting. Adding online displays of your and other hams' radio activities to your demos give it a gaming and / or visual aspect that can attract attention. Show them awards you have won / earned along with interesting QSL cards.

Table 1

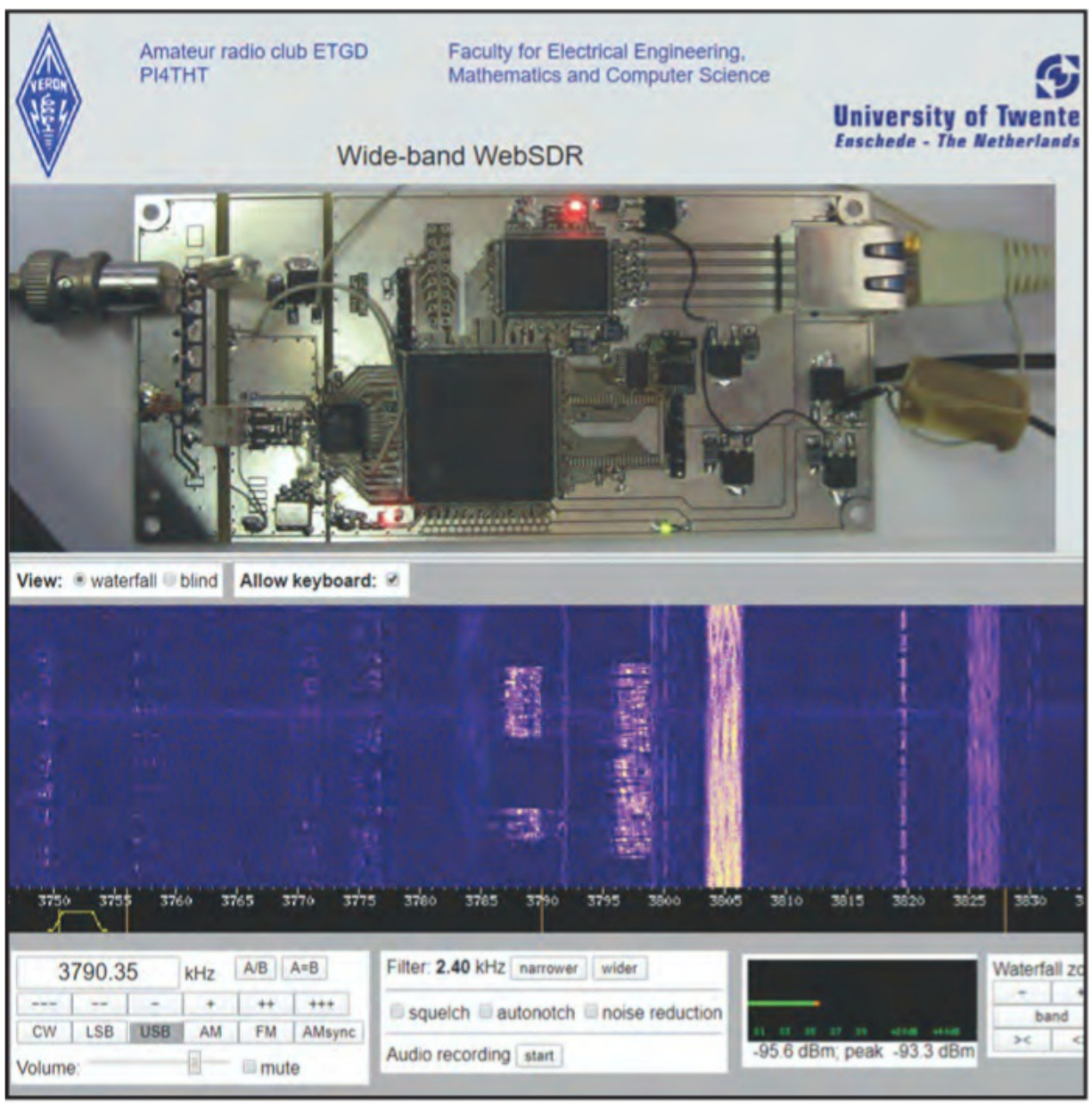
Your Place or Theirs?

Your Place

Advantages	Disadvantages
Installed Antenna & Equipment	Size of room for group
Resources at fingertips	Restroom facilities
Variety of visual items (maps, equipment, QSL cards, etc.)	Not a public space
	Insurance liabilities

Their Location

Advantages	Disadvantages
Public location	Need to bring equipment
Facilities for groups	Need to set up antenna(s)
Parents more comfortable	Possibility of no Internet access
Can have multiple groups of scouts	
Can be part of other Scouting activity	



A screen capture of an online tunable SDR receiver on 80 meters located in the Netherlands. This is one of over 75 free online receivers listed at websdr.org. (Screen capture of <http://websdr.ewi.utwente.nl:8901>)

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Fox hunting is a great activity for visitors to a local club's Field Day site. (Photo by Frank Tompkins, W8EZT)

* Schedule demonstration times and plan bands when propagation will be favorable
* If possible, consider multiple modes of operation
1) Phone contacts
a) Allow easier exchange of information between youth
b) May not impress students used to talking on small handheld devices (cell phones) all the time
c) Discuss understandability ahead of time
i. Phonetics
ii. No single-word answers
iii. Speaking clearly and loud enough into the mic
iv. Explain abbreviations / jargon
v. Have a few off-air practice QSOs
2) Digital Modes
a) Good for mic-shy youths (especially with their experience with texting)
b) The visual display can be appealing to youth
c) Use of PSK Reporter can show worldwide graphic representations of radio station activity
3) CW
a) Will not be understandable by ear to students, although a little pre-instruction may allow them to recognize certain elements (CQ, RR, 73, your callsign, etc.)
b) The addition of a stand-alone, on-screen or in-radio, CW decoder can provide a better understanding of what they are hearing. For more info see **Having Fun with Morse** <tiny.cc/fwm>.
c) Many students like the idea of "secret codes" and find basic Morse code interesting
d) A good hands-on activity would be to build either or both the "Clothespin Key" <tiny.cc/cp-key> or "Thumb Texting Key" <tiny.cc/tt-key>.
* Competition / Gaming Aspect of Amateur Radio
1) If you are doing a demo on a contest weekend
a) The idea of competition can be of interest to many young people
b) Use of an online contest scoreboard can bring visual appeal and a better understanding of contesting. Two examples are at <http://cqcontest.net> and <https://contestonlinescore.com>
2) No contest? You can even run your own eyeball-QSO party <tiny.cc/ebqsop> with a pile of QSL cards and log sheets; no radios required.
3) Here is an article on Gamification (the application of gaming concepts to non-gaming activities) and amateur radio <https://tinyurl.com/yx4tr5ko> (page 17).

• Planning QSOs and having good contacts
* Put together a script for students with suggested ideas on what to say on the air
* Find a good station with which to carry out two-way conversations
1) Strong, clear, and readable signal
2) Preplanned schedules or ask potentially good candidate stations to QSY
3) Make arrangements with other stations for schedules
* Have a backup "plant" station(s)
1) Make arrangements with another operator you know
a) Someone you know will have good propagation to you, and preplan frequencies
b) Someone you know can talk well with youth
i. Ask good questions
ii. Have patience
iii. Have relatable experiences of interest to youths (hobbies, sports, camping, travel, etc.) and avoid "radio talk" of equipment, antennas, etc.
* Prepare and make yourself available to be the person on the other side of the student QSOs … be the "plant"
1) Minimize amateur radio abbreviations and jargon
2) Plan questions to ask. Here are some sample questions for scout groups: <https://tinyurl.com/vg43d29>
3) Offer to QSL and follow up with two cards; one for the station and one for the operator to forward to the scouting group or classroom

• Plan Alternative and Off-Air Activities
* Have a plan B in case of problems (your portable antenna is not cutting it, your radio is acting up, propagation is in the pits, etc.)
1) Have backup equipment
2) Have multiple bands available
3) Have other modes available (CW can sometimes get through poor conditions and FT8 can often work when conditions are extremely poor)
4) Have that pre-scheduled "plant" station (see above)
* One of the ways many of us older hams got interested in radio was by building or borrowing a simple shortwave receiver and listening to stations. SWL was a great activity but it had a few catches — you had to have a radio and you needed to put up an antenna (preferably outside). Today with the major decrease in commercial AM shortwave broadcasting and most of the ham voice activity being SSB you also need a radio capable of receiving SSB. Fortunately, because of internet resources, we now have a way around these obstacles and it is even free. Online SDRs (software-defined radios) are available to anyone with internet access. These SDRs are located around the world and can be tuned remotely by a student to listen to hams with no need for a radio or an antenna. The performance is remarkable compared to my 1970s two-tube Graymark regenerative receiver and basement antenna. Web SDR <www.websdr.org> has a collection of over 170 free open radios around the world waiting to be tuned by an operator with no equipment of their own. I have created a single page help sheet <tiny.cc/sdr-help> to assist students in getting started and it includes a list of suggested ham frequencies.

* Fox hunting <https://tinyurl.com/r54sc7r> and <https://youtu.be/ptP65csLiaw?t=19>

1) A great activity that non-licensed individuals can take part in.

2) In my experience, kids really like it.

3) It is a great outdoor activity after being confined in a small radio shack or classroom with dozens of students or scouts

4) You could also have a building project of tape-measure Yagis <https://tinyurl.com/tna3xdx> and <https://tinyurl.com/r5qvr7j>

5) Give them a follow-up list of Fox hunting activities in your area and invite them along on hunts

* "Clothespin Key" and / or "Thumb Texting Key" (see links above)

1) Kids love building things and making noise and this project does both; plus it provides them with a simple tool to do basic Morse code communications.

2) Using just a wooden clothespin, a 2x4 piece of wood, thumbtacks, a computer piezo buzzer and a 9-volt battery, the project can be built for less than $2 if items are purchased in bulk.



A small sample of radio resources that can be found on Kids Radio Zone webpage. (Screen capture of <www.ztlearn.com/radio-kids>)

3) Although it is not the ideal way to learn CW long term, provide Morse Code visual charts for this simple exercise-<tiny.cc/mcc>

4) Provide follow-up resources for those that would actually like to learn Morse Code. See *"Having Fun with Morse"* <tiny.cc/fwm>.

* Soldering

1) This was a surprise to me, but when we asked our 6th- to 8th-grade school radio club what activities they liked the best over the past year, soldering came in #2 behind #1 fox-hunting.

2) You can put together small soldering projects from your junk box or equipment scavenging or you can pick up $0.99 to $2 kits on eBay for small soldering projects. Just ensure you order early for the long trip from China.

3) Don't forget the safety lecture and adult supervision.

* Satellites

1) Allow you to provide information on yet another merit badge, Space Exploration <https://tinyurl.com/yx5kl56k>

2) You will also find other space resources on my Kid Radio Zone web page <www.ztlearn.com/radio-kids>

* Portable Operation

1) Battery-powered radios, portable antennas, bicycle mobile, pedestrian mobile, etc., are all attractive demonstrations for outdoor-oriented groups like scouts

2) Remember these types of operations may not provide sufficient signal strength for continued scout-to-scout communications, so I treat them as an extra and not the main way of making JOTA contacts

* "Troop Program Feature: Radio" an article on k2bsa.net — <https://tinyurl.com/vzaz6xr> — provides a number of other activities you can do with scouts or students. It includes activities for Aviation, Citizenship In the World, Communications, Electronics, Engineering, Signs, Signals, Codes, and Space Exploration Merit Badges.

* Today's youth love short videos and YouTube can be just the thing to convey information on how radio works, how-tos for operating and more. A great set of videos is from Faith Hannah Lea, KD3Z (a 14-year-old Extra Class ham) and can be found on the channel **Ham Radio (dot) World** at <https://tinyurl.com/qtcxd7n>. You can also easily create your own YouTube videos oriented to youth involvement. One hint for using only portions of YouTube videos and avoiding distracting advertisements and comments is to embed videos in a Google Slides show. For more information on the safe use of YouTube with students, visit the **Control Alt Achieve** blog by Eric Curts at <tiny.cc/safe-yt>.

• Follow-up: Not all the students / scouts will find amateur radio interesting enough to pursue further but hopefully, you will have a few. Make sure these youths are aware of how to continue

* Provide online resources

1) "Ham Radio Intro & Quick Start Guide" <tiny.cc/new-ham>

2) "KB6NU-The No-Nonsense Technician-Class License Study Guide" (both a free PDF and paid book version are available) <https://tinyurl.com/yy6ywgcl>

3) <www.k8zt.com>

* Provide written resources

1) Remember those old books and manuals you have on the shelf

2) How about a few old *QST*s or *CQ* magazines?

* Classes

1) Let them know when there will be licensing classes in your area and make sure you remind them again before they start <https://tinyurl.com/7hnkpdo>

2) Plan a licensing class for them specifically

* Start a school club

1) See my collection of articles on Education Resources in a collection of my Ohio Section Journal Articles <tiny.cc/ar-ed-out>

2) Check with your ARRL Section Youth Coordinator (SYC) for assistance. If your section does not have an SYC contact your Section Manager and let him / her know your section needs one <www.arrl.org/sections>.

* Become a merit badge counselor <https://tinyurl.com/rr88hqt>. In addition to Radio Merit Badge, consider other badges based on your profession, hobbies, and experiences <https://tinyurl.com/yx57569d>.

* Share your experiences and ideas. If you have additional resources, links to resources, or other information to share, please send them to me via email <k8zt@arrl.net> and I will add them to my web pages for the benefit of others.

We have only scratched the surface of ideas for youth involvement so let's close with a few important points. Although having students attain amateur radio licenses might be your end goal, it takes time and lots of patience. Also, realize that not everyone will want to become licensed at the time, but you may be planting future seeds or at least future goodwill toward amateur radio. If you do get students licensed, remember that your immediate goal should expand to mentoring. Mentoring means getting new licensees on the air, teaching them operating skills, and helping them grow as hams. A club station, guest operating opportunities, and / or loaner equipment can be very important in this process as well as a commitment to mentoring by other club members. Ensure that everyone involved in your youth outreach understands the need to always impress school administrators, teachers, and parents with our positive, caring, and impeccable conduct.

Resources & Links

ZT Learn and K8ZT.com:

- The Kids Radio Zone <www.ztlearn.com/radio-kids>
- Teacher Radio Zone <www.ztlearn.com/radio-teachers>
- Ham Radio Youth Resources Handout <tiny.cc/hry>
- Tri-fold STEM brochure **Ham Radio — The Original Maker Movement** <tiny.cc/hr-makers>
- Scouting & Amateur Radio <tiny.cc/ar-scout>
- Ham Radio Quick Start Guide <tiny.cc/new-ham>
- K8ZT Amateur Radio Resources <www.k8zt.com>

The ARRL has a number of youth resources including:

- ETP (Educational Technology Project) Classroom Resources <https://tinyurl.com/rzcfu8w>
- Teachers Institute on Wireless Technology <https://tinyurl.com/3exzpjj>
- Register with ARRL as a Classroom Teacher <https://tinyurl.com/t3lqvxw>
- ARRL Collegiate Amateur Radio Initiative (CARI) <https://tinyurl.com/u3vsdgl>

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MATH'S NOTES

BY IRWIN MATH,* WA2NDM

Some Notes on Upgrading Older "Boat Anchors" From Vacuum Tubes to Transistors

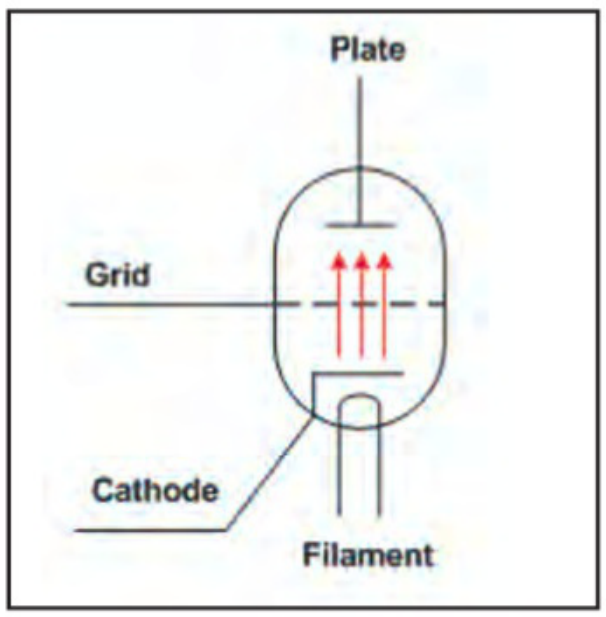


Figure 1. Simple triode vacuum tube

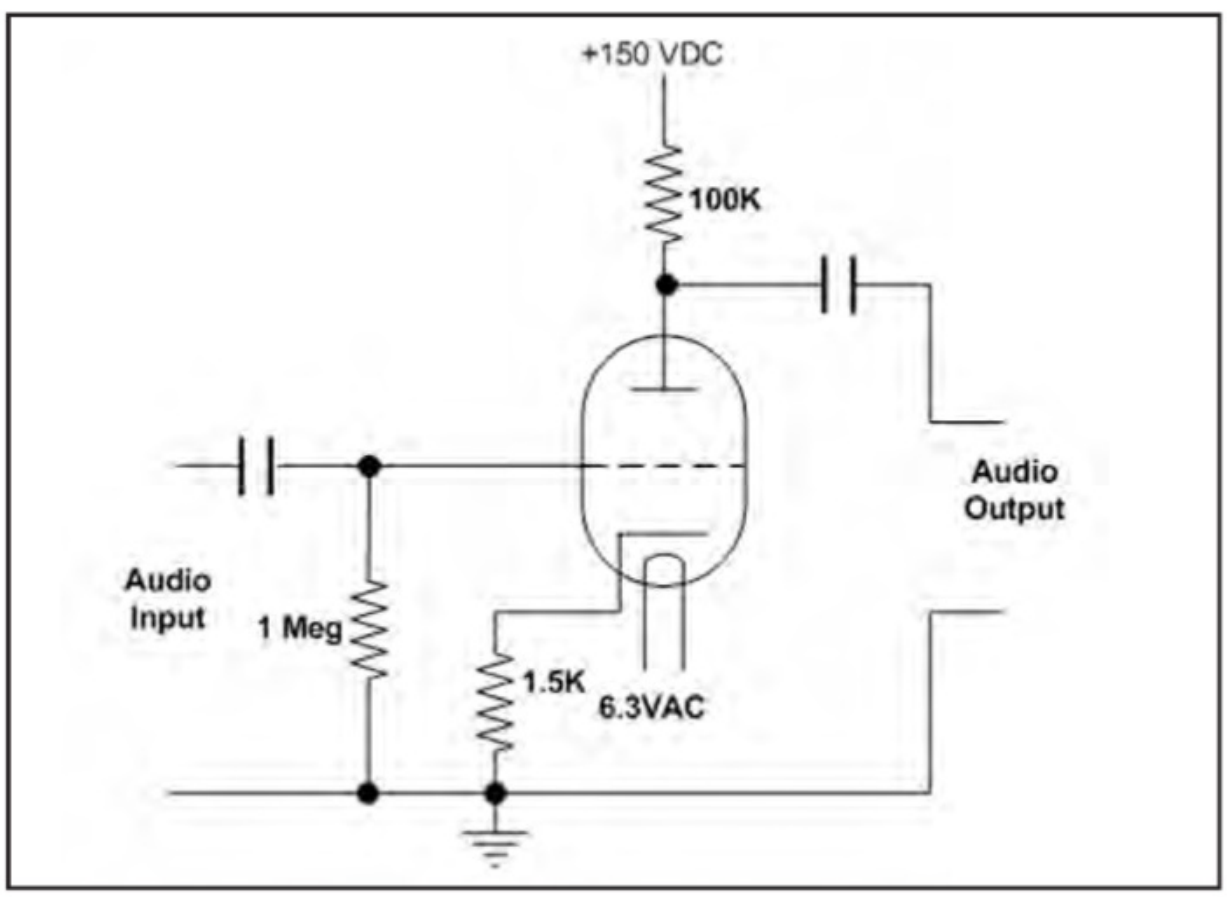


Figure 2. Simple triode vacuum tube amplifier

While researching materials for this column, I came across information indicating how transistors gradually replaced vacuum tubes in electronic gear, but how similar (and different) they are from each other as well as some hybrid attempts. As you all well know, before the transistor, vacuum tubes were the mainstay of radio technology. Amplifiers, oscillators, switches, etc., were all designed with these devices and all of the communications technology of the mid 20th century employed them. At the time that transistors first came on the scene, there were several attempts offered to convert vacuum tube equipment directly with plug-in devices called "solid-state tubes." This got me thinking that perhaps some of you might actually consider "upgrading" older devices. I think this is an interesting topic for the technologically-inclined among us and would like to share some thoughts along those lines with you this month.

Vacuum Tube Basics

To understand the thinking at the time, we must first look at a typical vacuum tube as shown in *Figure 1*. In operation, the filament heats the cathode, which then gives off electrons. The red lines show the path of these electrons from the heated cathode to the positively charged plate. In between the two is the grid, which serves to control the amount of electrons flowing between the two. By varying the voltage on the grid, the electron flow can be varied from maximum to none. Now let us see how this works.

Figure 2 is the schematic of a simple triode audio amplifier stage such as was found in many radios of the early and even middle part of the 20th century. You will note that there is a high-value resistor between the plate and a positive high voltage, and a low-value resistor between the cathode and ground. The grid is also connected to ground through a very high value resistor. With no signal applied to the grid, there is a current flow between cathode and plate which causes a small voltage to appear across the cathode resistor. Since the grid uses the cathode as a reference, the voltage across this resistor appears as a negative voltage at the grid and therefore adjusts the amount of current that can flow. In short, it "biases" the grid. Now if a low-level audio signal is applied between the grid and ground (and across the 1-megohm resistor), the grid voltage will vary in step with the audio signal and the plate circuit current will also vary, producing an amplified output. The two capacitors shown are used to block the voltages within the stage from other stages that may be connected. The gain of such a stage is a function of the construction of the elements within the vacuum tube and is typically in the range of 10 to 100. So much for vacuum tubes.

Comparison With Transistors

Moving on, *Figure 3* is the schematic of a common field-effect transistor, or FET. In addition to early junction transistors, field effect devices were also being studied and manufactured in the early days. When compared with a vacuum tube, you will note that there are similar elements, namely the source, a gate and a drain. The "source" is the source of electrons — comparable to a tube's cathode; the "gate" controls the flow of these electrons, similar to the grid in a tube; and the "drain"

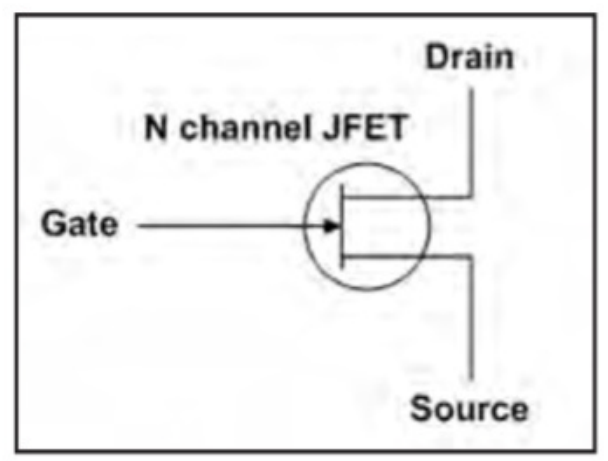


Figure 3. Schematic of an N channel field-effect transistor

*c/o CQ magazine

collects the electrons and drains them off, like the plate in a tube. *Figure 4* is the same audio amplifier as in *Figure 2*, but this time with the FET instead of the tube. As in the case of the vacuum tube amplifier circuit, if a low-level audio signal is applied between the gate and ground (and across the 1-megohm resistor), the gate voltage will vary in step with the audio signal and the drain circuit current will also vary, producing an amplified output. Again the two capacitors shown are used to block the voltages within the stage from other stages that may be connected.

There are two main advantages of the transistor over the vacuum tube in this circuit. A filament voltage is not required (using less power) and the operating voltage is considerably less, eliminating the need for a high-voltage power supply. In addition, the transistor is also much smaller than the vacuum tube. In the same discussion of advantages, keep in mind that the solid-state diode can also replace the vacuum tube diode (or rectifier) with similar savings, reducing the need for the filament voltage and occupying considerably less space.

Updating a "Boat Anchor"

If one wants to experiment with these type of devices, perhaps to "update" an older "boat anchor" radio, there are several ways to go. The first is to consider what you are going to replace. Obviously, the rectifier comes to mind first. The old 5U4, 5Y3 etc., all converted the high-voltage output of a transformer (or the AC line in some cases) to DC, but got quite hot in the process due to both the drop in the tube as well as the load on the power transformer by the 5-volt filament requirement. However, a few 1N4007 diodes, can do the same task and eliminate the transformer filament load. Note that the peak reverse voltage of some rectifier tubes is in the order of 1,500 volts, so the diodes you use must have a similar reverse voltage. Sometimes several diodes in series will be needed.

Figure 5 is a schematic of a suitable replacement that can even be built into an old vacuum tube base from a defective tube (with the correct number of pins) as a plug in device. The voltage drop of a couple of diodes, however, is much less that that of the tube so a resistor has to be added to drop the DC output to a level similar to the original tube so as to not overload the voltage ratings of the filter capacitors. Finding out the correct value of this resistor requires that you first measure the DC voltage at the output of the normally installed tube under actual operation. Then, using a Variac, replace the tube with a diode replacement that you construct along with a 100-ohm 10-watt adjustable resistor, set to maximum resistance. This value will cover the internal voltage drops of most common vacuum tube rectifiers. These components can be temporarily located in a discarded vacuum tube base or under the chassis, whichever is easier. Next, slowly increase the input voltage from 0 to the normal AC line value while measuring the output voltage (after the resistor) with the unit in normal operation. When you get to the same DC voltage as previously measured, measure the value of the resistor and the voltage drop across it. You will have to adjust the 100-ohm resistor until you get the proper voltage. If 100 ohms is not high enough, use another 100-ohm resistor in series with the first one. Now calculate the wattage being dissipated by the resistor ($W=E^2/R$) and select an equivalent resistor with the nearest resistance value and wattage (about 20% to 30% more for safety) and mount it either in the tube base or under the chassis. If the power is high, ensure there is adequate space for cooling the resistor. If you do a neat job, the final plug-in solid-state rectifier can look quite professional. Although you have lightened the load on the transformer, by extending the strain on it you still need to handle the heat from the voltage drop of the resistor.

With regard to diodes, you could also

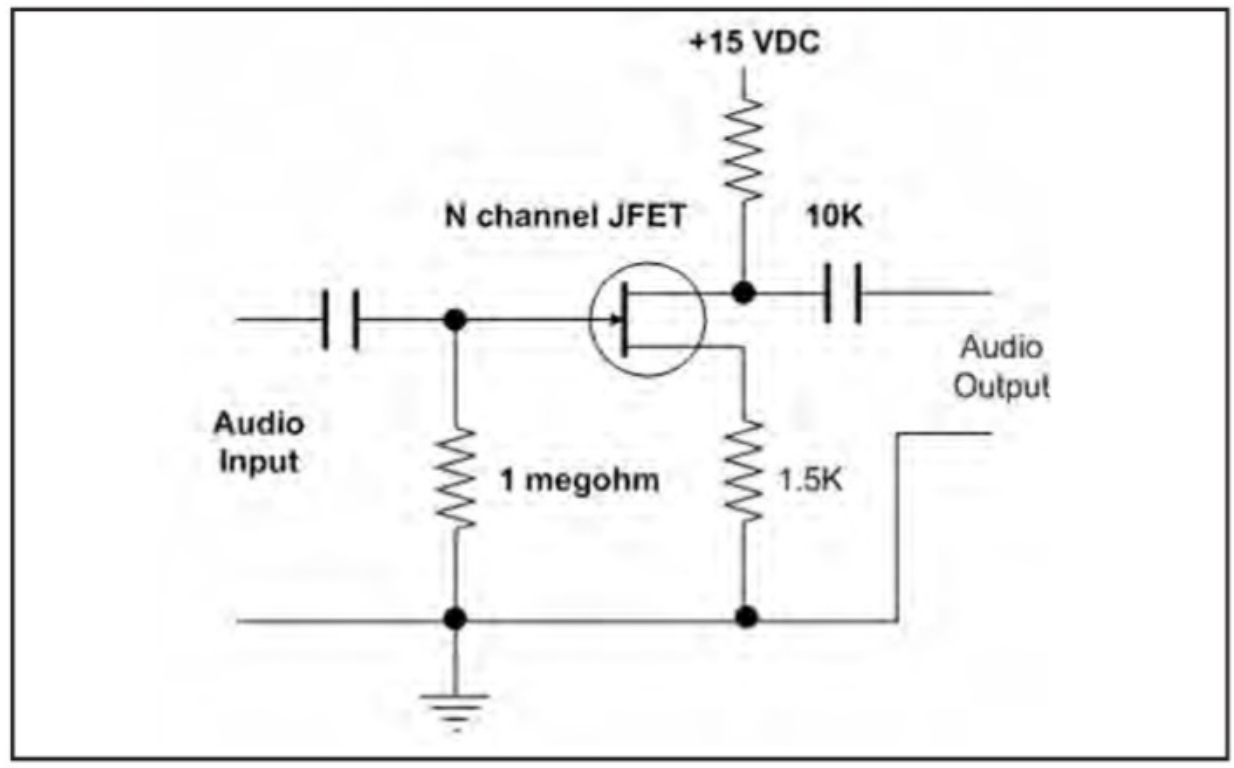


Figure 4. Schematic of an N channel field-effect transistor amplifier

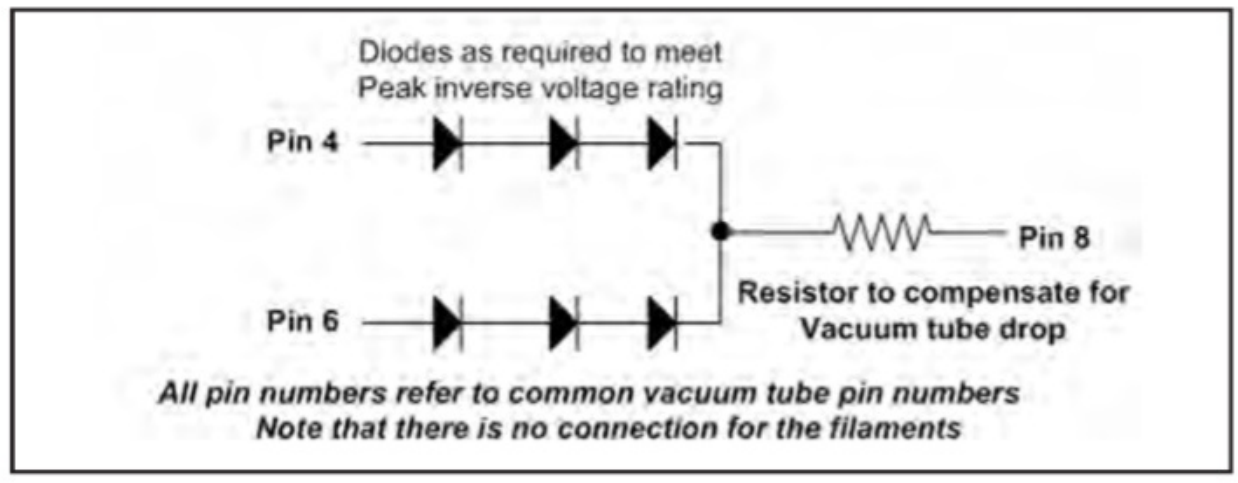


Figure 5. Solid-state replacement for vacuum tube rectifiers

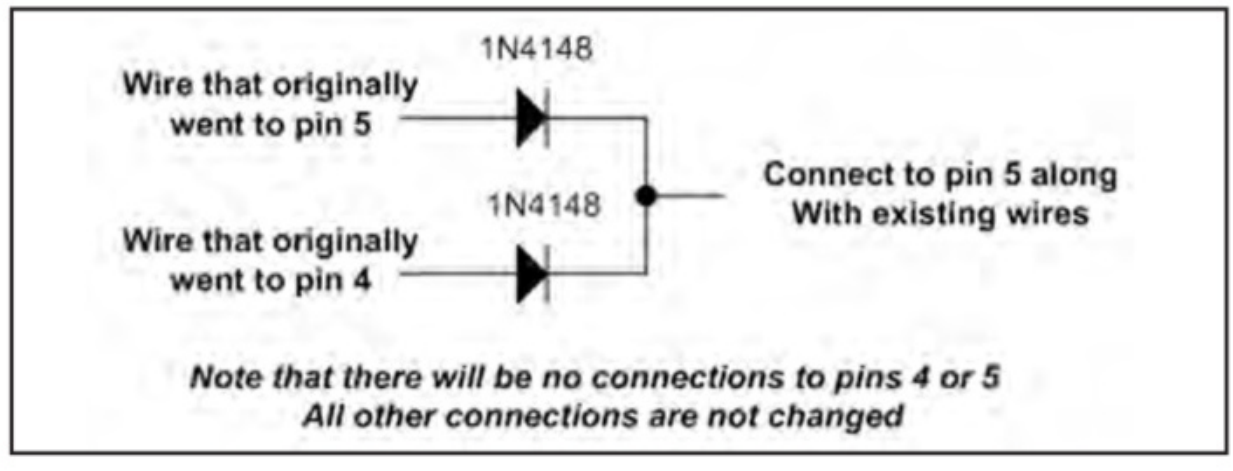


Figure 6. Solid-state replacement for 12SQ7 diodes

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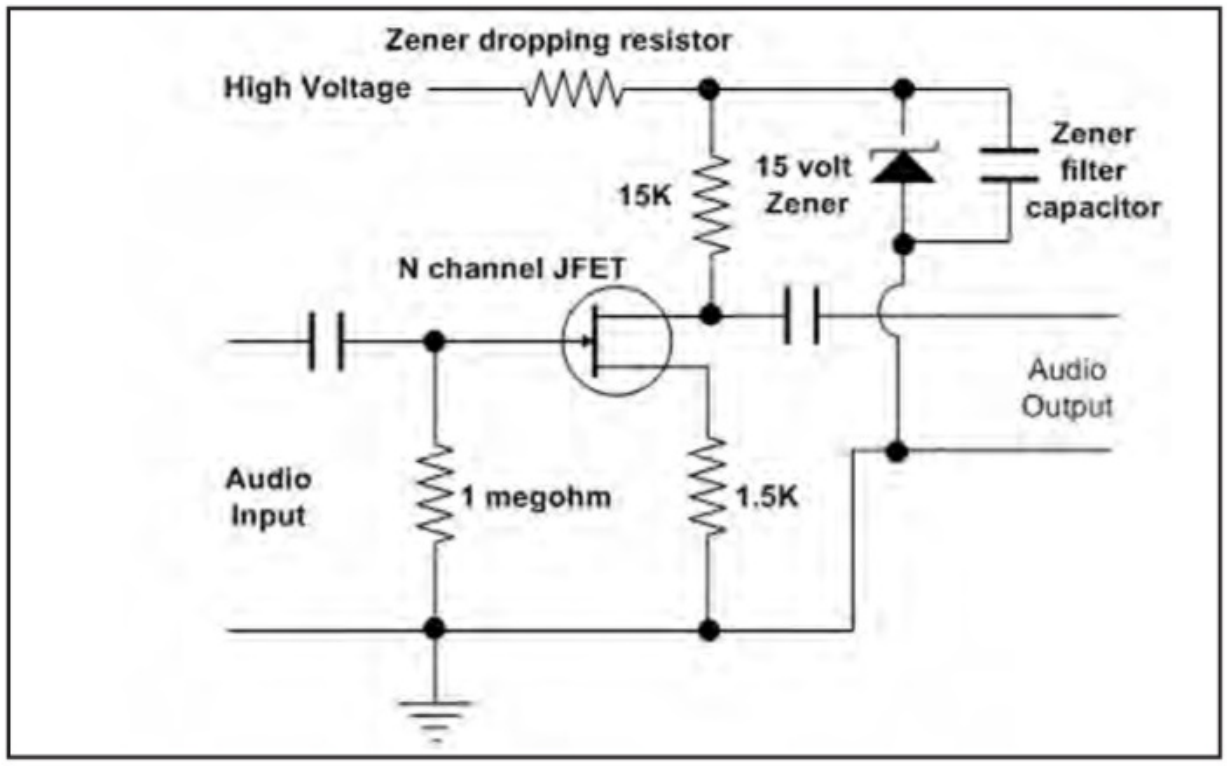


Figure 7. Revised replacement solid-state amplifier

replace the diode section of many vacuum tubes with simple 1N4148 diodes. This will not necessarily reduce power dissipation of the tube but will result in lower drops when needed, perhaps making a rectified signal somewhat higher. *Figure 6* shows how to do this when upgrading the 12SQ7 detector circuit in the so-called "All American 5 Tube Radio." When we speak about amplifiers in the next paragraph, you might be able to configure a completely solid-state tube using the transistor amplifier and solid-state diodes.

Finally we get to the amplifier. Referring to *Figure 4*, you must do several things as shown in *Figure 7*. The triode section must be replaced with an N channel JFET such as the 2N7000, 2N5457, or PN4391 series. Also, the load resistor must be replaced with a lower value resistor in the range of approximately 4.7K to 15K; and the plate voltage dropped with a Zener diode, resistor, and capacitor to 15 to 20 volts as also shown. These will have to be determined experimentally. If the load of the amplifier is an IF transformer winding, then a resistor load is not needed; but the Zener diode and its dropping resistor are still required. When you successfully do this you will find that the power required by the final unit will be much leas than before, as all filament power will now not be needed.

I know this is a project for the technically-inclined but if you have a "boat anchor' that you simply love this may be the answer toward prolonging its life and perhaps even improving its operation. If you do a search for "pictures solid state tubes" on the internet you will see many versions of commercial products from the past as well as homebrew designs.

In conclusion, I want to indicate that this column is really intended to indicate what can be done to upgrade older devices by those so motivated. Obviously, experimentation is required and there is no guarantee that all such modifications will operate properly the first time around but it will be fun to try.

Finally, when working with the high voltages present in such equipment, please be extra cautious! **Safety first!**

– Best luck and best regards, Irwin, WA2NDM

THE LISTENING POST

BY GERRY DEXTER

Stations Reactivated Across the Globe

~ Radio Vanuatu has been reactivated on 5050 kHz (at least temporarily). No word yet on whether the normally used 7260- and 3945-kHz frequencies are still being worked on. Vanuatu's new schedule seems to be 0700-1015 UTC and 1830-0700 UTC, depending on which frequency is active. Radio Vanuatu is being well heard on the West Coast of the U.S. … sometimes even making it into the Midwest.

~ Germany has a new shortwave voice in the form of Radio Se Ta 2, which began using 6070 kHz on Christmas Day. It's no Deutsche Welle, but even so, it's airing from 0900-1100 UTC over Channel 292 from Rohrbach-Wall. I suspect it will also use Channel 292's 10-kilowatt transmitter.

~ All India Radio has reactivated its Aizawl site, which had been silent for a number of years. It's scheduled from 1130-1600 UTC and 0025-0400 UTC on its former 5050-kHz frequency.

~ One of the well-known opposition broadcasters, Echo of Hope, has moved to 4890 kHz, once occupied by Papua New Guinea's NBC Port Moresby. Echo of Hope broadcasts there from South Korea to the North. It's being heard in Korean around 1130 UTC.

~ Radio Santa Cruz in Bolivia has been off the air lately. I'm not privy to the reason, but the gerente (manager) assures its listeners they do intend to return.

~ Back in mid-September, the Danish government suddenly withdrew permission for World Music Radio to operate on out-of-band frequencies, which meant WMR ceased using 5840 kHz and 15805 kHz. The station may return to in-band channels, and notes that it hoped to be back sometime in January.

Logs

Your shortwave broadcast station logs are always welcome. But please ensure to double- or triple-space between the logs, list each log according to the **station's home country** and include your last name and state abbreviation after each. Also needed are spare QSLs (copies), station schedules, brochures, pennants, station or shack photos, and anything else you think might be of interest. The same holds for you amateurs who listen to shortwave broadcasts. I know you're out there. You, too, are most welcome to contribute.

Here are this month's logs. All times are in UTC. If no language is indicated, then English is assumed.

ALGERIA—**Radio Algerienne**, 12060 via France with Qur'an at 2020. (Brossell, WI)

ANGOLA—**Radio Nacional**, 4950, Mulvenos, at 0221 in Portuguese with music and a male announcer. (Sellers, BC)

ASCENSION—**BBC-South Atlantic Relay**, 11810 at 2023 with a profile of a sculptor. (Sellers, BC) 15400 with world news at 1902. (Brossell, WI)

ARGENTINA—**RAE**, 9395 via WRMI carrying "Argentina to the World" program at 0218. (Sellers, BC)

AUSTRALIA—**Reach Beyond**, 9530, Kununurra in Korean at 1530 with a man talking then into woman hosting program of hymns. (Taylor, WI)

BOTSWANA—**VOA Relay**, Mopeng Hill, 4930 with station ID, Yankee Doodle IS repeated and into news at 0300. (Sellers, BC) 11850 at 2048-2059 with woman hosting a program speaking in Hausa. (D'Angelo, PA & Brossell, WI)

BRAZIL – (*All in Portuguese –GLD*)

Radio Nacional Brasilisa, 6180 at 0246-0305 with man talking and program of vocals. In the clear after CRI sign off at 0300. (D'Angelo, PA) 11780 at 2257. (Brossell, WI)

Radio Aparecida, Aparecida, 11855 at 2318 with talks and instrumental music. (Brossell, WI)

CANADA—**CFRX**, Toronto, 6070 at 0228 with ads for home security, CTV News, Walmart Pharmacy, station ID at 0230. (Sellers, BC)

CHINA—**China Radio International**, 7410, Jinhua at 1307 in Japanese; 11860, Kashi in French at 2035; 15600, Beijing in Spanish at 2245. (Brossell, WI) 11640, **Mali** Relay at 2005 beginning "Chinese Theatre" program, 13630 also good. (Sellers, BC)

PBS Xiang, 4820, Baiding in Mandarin at 1303; **PBS Xinjiang**, 4950, Changi in Kazak at 1306; **PBS Yunan FM 99** in Mandarin at 1335; **PBS Quinghai**, 6145 in Mandarin at 1345; **PBS Changi** in Mongolian with an interview; **PBS Scihuan**, 7225 at 2227 in Mandarin.



A new sound comes from Sarawak in the form of Radio Nyawa Sarawak on 11890 kHz in local languages from 1000-1300 UTC.

(Taylor, WI) (*Who notes these were all noted on an exceptional opening to China, and that all were presumed logs. –GLD*)

ENGLAND—**BBC**, 15400, Woofferton with world news at 1802. (Brossell, WI)

ETHIOPIA—**Amhara Radio**, 6090, Addis Ababa at 0352 with frenetic HOA music, chants, and rapid instrumentation. (Perry IL)

Voice of the Tigray Revolution, Addis Ababa, 5950 temporarily in the clear during WRMI's carrier pause at 0342-0344 with wild, crazy music. Tigray could still be heard after WRMI resumed. (Perry, IL)

FRANCE—**Radio France International**, 7380 at 2019 with music and talks in Hausa. (Sellers, BC) 9790 in French at 2012. (Brossell, WI)

GERMANY—**Gruss an Bord**, 6080 possibly via Nauen at 2140 with their annual Christmas program in German. (D'Angelo, PA & Taylor, WI)

GREECE—**Voice of Greece**, 9420, Avlis in Greek at 2147. (Brossell, WI)

GUINEA—**RTV Guinea**, 9650 in French at 2008 with man and woman talking about Guinea, station ID at 2013. (Sellers, BC)

INDIA—9445, Bengaluru at 2045 at 2045 with IS until 2047, English station ID

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Radio Guatapuri in Villavicencio, Colombia, was once one of several HJ stations which used to be on shortwave. Now Colombia is reduced to just two (sometimes).

and frequencies, but this was the only one I could hear. (Sellers, BC) 11560, Bengaluru at 1350 booming in with what sounded like subcontinental disco music. (Perry, IL) 1615 in Russian. (Brossell, WI)

TWR-India, 9300 via **Armenia** at 1335 in Hindi with woman's echo effect, scheduled to 1345. (Perry, IL)

JAPAN—**Radio Japan**, 6155 via **Austria** at 0513-0530 in English with classical music, a feature on Japan then listener letters before closedown. (D'Angelo, PA) Via Nauen (**Germany**) in Russian with talks at 0452. (KB2DMD, PA) 9890 in Japanese at 2208. (Brossell, WI) 11945 at 1709 in Japanese with a Frank Sinatra number. (Sellers, BC)

KUWAIT—**Radio Kuwait**, 17550 in Arabic at 2108. (Brossell, WI & Taylor, WI)

LIBERIA—**ELWA**, Monrovia, with barely audible Christmas music at 2152, station ID, and sign off. (Taylor, WI)

MADAGASCAR—**World Christian Broadcasting**, 6180 in Spanish hosting program of Christmas music at 0305. (D'Angelo, PA)

African Pathways Radio, 11965 at 2000 opening with "Big Yellow Taxi" song, program line-up, website and a couple hosting "Path to a Happy Home" program. (Sellers, BC)

Light of Life / World Christian Radio relay, 9490 in Mandarin at 2226. (Brossell, WI) 11610 at 2100 with lecture by man and woman mixing English and Chinese. (Barton, AZ)

Radiio Feda, 11945 in Arabic at 1940. (Brossell, WI)

MALI—**RTV Mali**, 5995, Bamako, 2345-0004 with French talks, Hi-life music, station ID, man and woman with short music segments. Off suddenly in mid-song, (D'Angelo, PA)

MYANMAR—**Myanma Radio**, 5985, Phin Oo Lwin at 1319 with man and woman alternating talking. (Taylor, WI)

MEXICO—**Radio Educacion**, 6185 Mexico D.F., in Spanish at 0300 with a long string of music genres. (Barton, AZ) 0455 with music bridges and a talk about Nicaragua. (KB2DMD, PA)

NEW ZEALAND—**Radio New Zealand**, 6170 on financial payments to prisoners, station ID at 1600 and into news. A move from 6115? (Sellers, BC)

NIGERIA—**Voice of Nigeria**, 11770 at 1635 with a report on the African Economic Summit, 1712 on forced sterilization as a violation of human rights. (Sellers, BC & D'Angelo, PA)

NORTH KOREA—**Voice of Korea**, 7325 in Mandarin at 0227 with strident woman; 9425, Kujang at 1409 with man and woman alternating talking and fairly long selections. (Taylor, WI) 9665 at 1347 with a DPRK opera. (KB2DMD, PA)

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CQ Reader Needed for Handihams

CQ magazine has a special relationship with the Handiham program, a highly respected non-profit which, since 1967, has provided services for ham operators with visual and other disabilities. The Handiham program's members-only website hosts audio recordings of *CQ* magazine in DAISY format on its server, making them available to Handiham program members with sight disabilities.

The Handiham program has expanded the scope of documents and periodicals available to its members, therefore is always looking for more readers. It **always needs** readers who are knowledgeable of ham radio, as well as those with a background in teaching in STEM-related fields, especially if you have also worked with students requiring accommodations.

Handihams is specifically looking for readers for *CQ* magazine as Jim Perry, longtime reader for the program, would like to retire from this position. To make the burden less on any one person, it would be helpful if multiple readers were available who could each contribute part of the magazine each month.

These volunteer positions require you to use your own equipment to record, but it's simple. You need only a microphone or headset which can record into your computer, some free editing software, and a quiet place to make the recording. Of course, the Handiham Program will provide all reading materials.

If you or someone you know would like to try recording material for the Handiham members, please contact Lucinda Moody, Handiham Program Coordinator, for more information on how to submit a demo recording. Contact her at: <lucinda.moody@allina.com> or (612) 775-2290.



These ladies are not secretaries at opposition broadcaster Denge Walat, nor do they take coffee orders. They merely decorate this e-QSL, received by Ralph Perry.

OPPOSITION—**Radio Ndarason International** (via England to Chad), 9635 at 1620 with talks in Kanuari and instrumental music. (D'Angelo, PA)

Manara Radio International (via France to Nigeria), 15285 in Hausa at 1627. (Brossell, WI)

Echo of Hope (South Korea to North), 3480 in Korean at 1356 with woman talking at length, 4450 probably at 1416 with contemporary Korean music with male announcer. DPRK grind jammer, 6000 at 1424 woman with mellow Korean music, same woman with a harangue. (Taylor, WI)

Fursato No Kaze (Taiwan to North Korea), 9445 with man and woman speaking in Korean. (Taylor, WI)

Shiokaze (Seabreeze) (Japan to North Korea), 6020 at 1600 with man giving Korean monologue, usual theme and sound effects, 6145 at 1300 with woman giving monologue. (Barton, AZ)

National Unity Radio (via Tajikistan to North Korea), 9445 at 1334 with man and woman in possible Q and A format. (Taylor, WI)

Nippon No Kaze (via Taiwan to North Korea), 9940 in Korean at 1319. (Brossell, WI)

Radio Tamazu (via Madagascar to South Sudan), in Sudanese Arabic with an interview at 1338. (Taylor, WI)

Radio Denge Welat (via France to Turkey), 11530 at 1622 with talks in Kurdish. (Brossell, WI)

PERU—**Radio Tarma**, Tarma, 4775 at 1047 with jazzy instrumentals, male announcer but interrupted by CODAR QRM. (Taylor, WI)

PHILIPPINES—**FEBC**, 9920, Bocaue at 1328, man giving monologue in Russian, announcement at the bottom of the hour

then another monologue. (Barton, AZ)

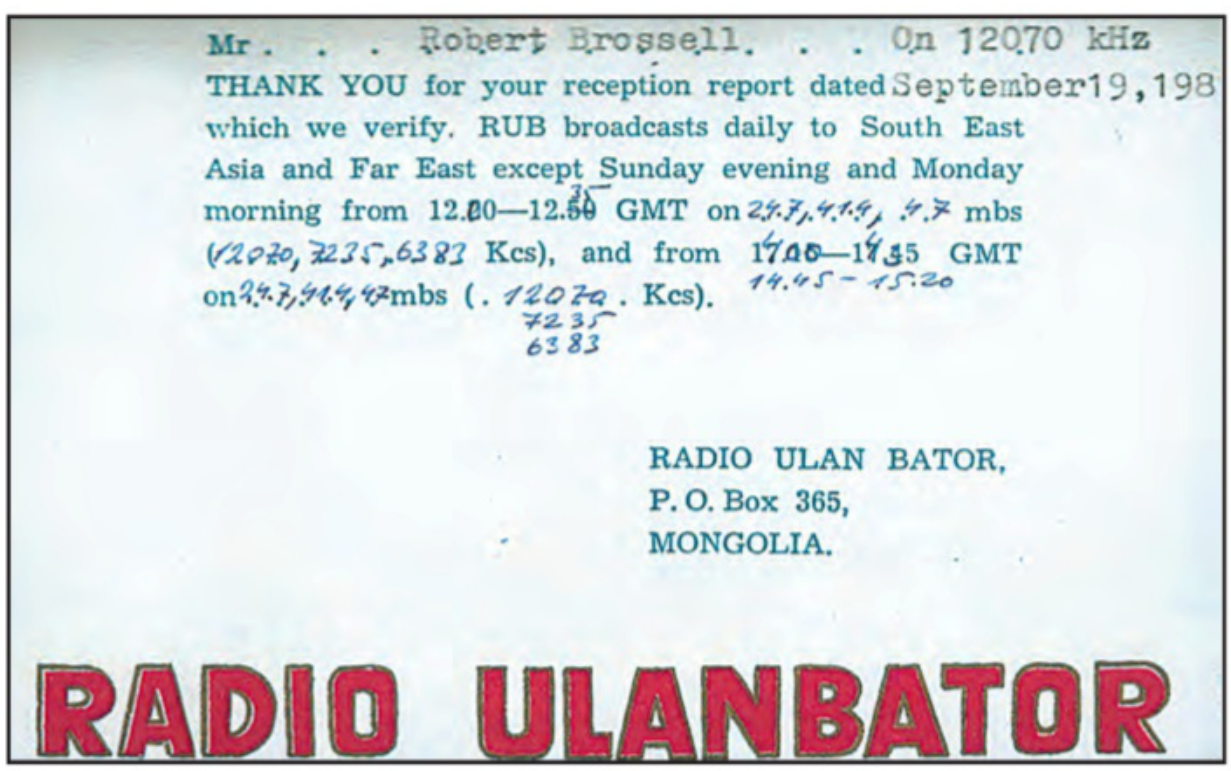
Radio Lisangyou possibly on 9265 via Bocaue at 1326. This is a Christian program in Mandarin, originating in Hong Kong and broadcast over FEBC. (Taylor, WI)

PIRATES – Radio Free Whatever, 4185 at 2201 and "Dick Weed" with non-mainstream rock, some shout outs to HFU. One fake email from Russia. Off at 0317, then back at 0320. **Pesky Radio**, 6925u at 2152 with a song and SSTVs between them. Off at 2245. **Argyle Radio**, 6950 at 2154 with Irish-themed songs, SSTVs. **Radio Humperdoo**, 4185 at 2206 with U.S. NA and rock. **WEAK Radio / Outhouse Radio**, 6955u, weak at 0055. **Classic Radio Pirate Radio Relay Service**, 4085 at 2145, poor with mellow music, station ID from HFU. **WFDR**, 6940u at 2200 with FDRs Pearl Harbor speech, World War II novelty song. **Zeke's Attic**, 4099 at 2313 with big band music and other forms and Zeke talking about them. **Music Power Radio 48**, 4059u at 0253 with chaotic selection of song parts, station ID at 0300, then rock. **Pee Wee**, 6956 at 0232 with remixes of very old pop songs, an SSTV and off. **Robin Hood Radio**, 6930u at 0313 ending Christmas song parodies. **Wild 100**, 4175u at 2335u dance music, ID at 2356. **Wolverine Radio**, 6950u at 0009, later 4015u with old progressive rock, SSTV / FAX, echo station IDs. (Taylor, WI)

Captain Morgan SW, 6934.9 at 2310 weak and fading out. **Radio Free Whatever**, 4015u at 0111 with alternative Christmas tunes, Still going at 0146. **Zeke's Attic**, 6927u at 2210 with various Christmas songs, DJ at 2227, SSTV / FAX, Crosby, Sinatra, more DJ. **WDDR**, 4045u at 0142 with country rock, SSTV / FAX, Grateful Dead, etc. **Mix Radio International**, 4075u at 0053 with alternative rock. (Hassig, IL)



Colorful stamps decorate this envelope, which contained a QSL from the Solomon Islands Broadcasting Corp. received by Bob Brossell. They're still active on 5020 kHz.



Top 'O the World signals from Mongolia arrived at Bob Brossell's Wisconsin QTH, with a QSL confirming his reception of Radio Ulan Bator.

ROMANIA—Radio Romania International, 5920, Tiganesti at 2039-2057, woman speaking in Spanish and light instrumental music, man giving station ID. (D'Angelo, PA) 7330, Tiganesti in German at 1542 with station ID and talk. (Sellers, BC) 9810 with folk things, two women speaking in Romanian; 11975, Galbeni at 1357 with IS, woman speaking in Romanian. (Barton, AZ) 15130 with presumed news in Romanian. (Brossell, WI)

SAO TOME—VOA Relay-Pinheiras, 6080 at 0359 ending program promo with station ID and into news. (Taylor, WI) 0442 with talk about the 2020 election. (KB2DMD, PA) 1900 at 2025 with oldie pops, man speaking in French, 2030 beginning Hausa and possible news. (Sellers, BC) 6195 at 2139-2200 with English pop music, nice closedown station ID. (D'Angelo, PA)

SAUDI ARABIA—BSKSA, 9555 in Arabic at 2017. (Brossell, WI)

SINGAPORE—BBC-Far East Relay, 9630 at 2030 with soccer play by play, 7445 via **Madagascar**. (Sellers, BC)

SOUTH KOREA—KBS World Radio, 9805 at 2230 in Indonesian, man and woman alternating talking. (Taylor, WI) 9630 at 1630 with talks in Koreann. (Barton, AZ) 15575 at 1446 in Korean. (Brossell, WI)

SPAIN—REE, 9690 in Spanish, man talking rapidly almost like play-by-play, but it wasn't. (Sellers, BC)

SWAZILAND—Trans World Radio, Manzani, 4760 at 0333 in N'Debele with man and music bridge, then man and woman talking. (Taylor, WI) 9585 at 1500 in French with brief music bridges between segments. Off before bottom of the hour. (Barton, AZ)

THAILAND—Radio Thailand, 9940 at 1315 ending English and into Mandarin. (Barton, AZ) Introducing another program at 1607. (Sellers, BC)

TURKEY—Voice of Turkey, 6125, Emirler at 0445 in English with dance music and broadcast schedule. (KB2DMD, PA) 9460 in Turkish at 2013. (Brossell, WI)

UNITED STATES – VOA-Philippine Relay, 5880, at 2224 in Khmer, man and woman with a sound bite. (Taylor, WI) 6170 via **Ascension** with two men in discussion in Hausa. (D'Angelo, PA) 15110 **Philippine** Relay in Mandarin at 1434. (Brossell, WI)

Radio Ashna / VOA, 13860 via Woofferton in Dari at 1617 woman reading various items. (Taylor, WI)

Radio Liberty, 15255 at 1443 in Tajik. (Brossell, WI)

Radio Free Asia, 7540 via **Tajikistan** in Tibetan in 1357 with an interview mentioning Cambodia. No jamming from CNR; 7565 via **Kuwait** in Uyghur and apparent news. (Sellers, BC) 15570 **Northern Marianas** Relay at 2310 in Mandarin. (Brossell, WI)

Radio Farda, 7585 via Lampertheim in Persian at 1534 with apparent news with music bridges. (Sellers, BC)

Adventist World Radio, 11955 in Hausa at 1920. (Brossell, WI) 11985 via **Madagascar** at 2053 in Yourba with hymns, woman giving station ID, postal address, and sign off routine. (Taylor, WI)

Trans World Radio, 9800 via Gavar (**Armenia**) at 1327 with mellow South Asian music and woman speaking at length. (Taylor, WI) 15105 in Lingala. (Brossell, WI)

Alameda Bible Fellowship, 13660 via **France** at 1708-1729 with woman speaking in English and long religious talk. No contact info found. (D'Angelo, PA) (*The 2020 World Radio TV Handbook (WRTH) has them based in California, <oneaccordonemouth@gmail.com> –GLD*)

WRNO, 7505, New Orleans at 0338 with religious programs, several nice station IDs. (D'Angelo, PA)

Overcomer Ministry, 11600 via **Bulgaria** at 1405 with Brother Stair preaching. (Taylor, WI)

VATICAN—Vatican Radio, 7230 at 1723 with daily 1715-1730 world news in English; 7365 at 2016 with an African song, then preaching on John the Baptist. (Sellers, BC) 11620 at 1430 opening with man giving station ID, into man speaking in Amharic and choral / flute music. (Barton, AZ)

VIETNAM—Voice of Vietnam, 7220, Sontoy with woman speaking in Mandarin. (Taylor, WI)

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QSL Quests

World's Last Chance Radio, 9330 via WBCQ verified an electronic report with a logo and tower card on a flat earth, which is in tune with their philosophy, reports D'Angelo.

Quien Sabe – (Who Knows)

~ 4955.5 in Spanish at 0312 woman then man talking at some length, woman with contemporary LA music, Radio Cultural Amauta listed here but not at this time. On late for the holiday? (Taylor)

Back in the Day

Radio Clube Mindelo, Sao Vincente, Cape Verde Islands, 4720 at 2148 on Christmas Eve with its Portuguese domestic service.

Just Sayin'

I'm trying something new this month by highlighting in bold relay sites from locations outside the "host" country, but which are separate countries on the NASWA Country List. This should help point out targets that might be passed by otherwise.

Thanks For Your Reports

Back slaps, touchdown signals, and high fives to these good guys who checked in this month: Harold Sellers, Vernon, BC; Ralph Perry, Wheaton, IL; William Hassig, Mt. Pleasant, IL; Art Delibert, North Bethesda, MD; Mark Taylor, Madison, WI; Rick Barton, El Mirage, AZ; Rich Parker, KB2DMD, Pennsburg, PA; Rich D'Angelo, Wyomissing, PA; and Bob Brossell, Pewaukee, WI. Thanks to each of you!

Until next month – Keep on keepin' on! And ... Celebrate Shortwave!

EMERGENCY COMMUNICATIONS

BY WALT PALMER,* W4ALT

CQ – Krakatoa: The Sound Heard 'Round the World'

With the bush fires in Australia, the earthquakes in the Caribbean, and especially the eruption of the Taal volcano in the Philippines (see sidebar), we thought it might be interesting to look back in time at one of the first major natural disasters of the age of electronic communications, Krakatoa.

Indonesia is a group of thousands of small islands in Southeast Asia. Two of the largest islands in this archipelago are Sumatra and Java. Separating them is the busy waterway known as the Sunda Strait. On the southeast flank of the strait is the volcanic island known as Krakatoa. Volcanologists believe the volcano rose from the ocean and exploded in 416 AD, completely destroying the volcano island. Over the next 1,200 years, regular volcanic eruptions reformed and rebuilt the volcano. Over time, the volcano sealed itself, causing a huge collection of gases and magma just waiting to explode.

On May 20th, 1883 a large tremor was felt on the Krakatoa Island and surrounding areas. Eleven days later, volcanic ash and magma began spewing from the rim. By May 27, the volcanic activity abated and calm again came over the mountain.

August 26th, 1883, was a normal Sunday morning along the coast of Sumatra and Java. But at just after 1 p.m., the three craters of the Krakatoa volcano began to violently erupt. Tons of hot ash and magma were suddenly released and blackened the skies. The next morning, the first of three cataclysmic explosions rocked the area and literally tore the volcano apart with the power of 1,000 atomic bombs. The force of the explosion generated a wave of giant tsunamis, some believed to be the largest ever witnessed, with waves over 135 feet high.

On August 27th, a second explosion rocked the area. Giant flows of magma rolled down the volcano and submarined into the ocean, causing another rush of giant tsunamis.

In the Sunda Straits, large waves crested in the ocean. The closest ship to the eruption was the Governor General Ludon, a tourist vessel that was just 12 miles away and was able to maneuver to breach the cresting giant waves. The ocean stripped the sand from all the surrounding beaches and the locals thought it was the end of the world. But several hours later, a third eruption caused Krakatoa to explode so violently the sound could be heard over 1/12th of the earth's surface. The shock wave traveled 2,000 miles south to Perth, Australia and 3,000 miles west to Rodriguez Island in the Indian Ocean. It remains the longest-traveled distance for any airborne sound in recorded history. At least 36,417 deaths were attributed to the 1883 Krakatoa eruption. Over 11 cubic miles of debris, ash, and dust were spewed into the air, causing global climate changes.

Attention from scientists and laymen around the globe began within hours of the eruption, because news of it traveled rapidly via the worldwide network of telegraph lines. "The instantaneity [sic] of the telegraph reports," Richard Hamblyn argues,[1] "create[ed] an entirely new category of disaster: the universal news event, a story followed, in the case of Krakatau, by more than half the world's population." The telegrams themselves are startling and display a "terse eloquence" A telegram sent from Batavia to Singapore on 27 August 1883 reads:

Noon. —Serang in total darkness all morning — stones falling. Village near Anjer washed away.
Batavia now almost quite dark — gas lights extinguished during the night — unable communicate with Anjer — fear calamity there — several bridges destroyed, river having overflowed through rush sea inland. (qtd. in Simkin and Fiske 14)

Calamity had, indeed, struck Anjer: at approximately 9:00 that morning, a large wave had inundated the coastal town (Simkin and Fiske 38). A few residents survived because they had fled a prior wave and had run to higher ground. Amongst them was Anjer's recently appointed Telegraph-master, who was later able to provide a harrowing eyewitness account of events. Despite, or perhaps because of, the horrifying nature of the eruption, some of the telegrams from Batavia are almost poetic in their condensed eloquence and evocative figurative language. A telegram sent around noon on 28 August proclaimed, "Where once Mount Krakatau stood the sea now plays," conveying calm, eerie beauty amid the desolation.

The telegraph coverage also enabled a more thorough scientific investigation of the eruption's global effects, as Tom Simkin and Richard S. Fiske stress in their magisterial centennial review of Krakatoa:

Telegrams bearing news of the Krakatau eruption spread quickly and accounts soon appeared in newspapers around the world. ... Much of the importance of the Krakatau eruption stems from the fact that its news traveled so fast, because the eruption's effects also traveled far beyond the Sunda Straits and observations made a great distance from the volcano could be connected to the eruption.
The late 1880s through to the 1890s saw the discovery and then development of a newly-understood phenomenon into a form of wireless telegraphy, called Hertzian wave wireless telegraphy, radiotelegraphy, or (later) simply "radio". Between 1886 and 1888, Heinrich Rudolf Hertz published the results of his experiments where he was able to transmit electromagnetic waves (radio waves) through the air, proving James Clerk Maxwell's 1873 theory of electromagnetic radiation. Many scientists and inventors experimented with this new phenomenon, but the general consensus was that these new waves (similar to light) would be just as short range as light, and, therefore, useless for long range communication. On 13 May 1897, Marconi, assisted by George Kemp, a Cardiff Post Office engineer, transmitted the first wireless signals over water to Lavernock (near Penarth in Wales) from Flat Holm. The message sent was "ARE YOU READY". From his Fraserburgh base, he transmitted the first long-distance, cross-country wireless signal to Poldhu in Cornwall. His star rising, he was soon sending signals across The English

* email: <w4alt@cq-amateur-radio.com>

Channel (1899), from shore to ship (1899) and finally across the Atlantic (1901). A study of these demonstrations of radio, with scientists trying to work out how a phenomenon predicted to have a short range could transmit "over the horizon", led to the discovery of a radio reflecting layer in the Earth's atmosphere in 1902, later called the ionosphere.

Radiotelegraphy proved effective for rescue work in sea disasters by enabling effective communication between ships and from ship to shore. In 1904, Marconi began the first commercial service to transmit nightly news summaries to subscribing ships, which could incorporate them into their on-board newspapers. A regular transatlantic radio-telegraph service was finally begun on 17 October 1907. Notably, Marconi's apparatus was used to help rescue efforts after the sinking of Titanic. Britain's postmaster-general summed up, referring to the Titanic disaster, "Those who have been saved, have been saved through one man, Mr. Marconi ... and his marvellous invention."

International Morse Code

Morse code has now been in use for more than 160 years — longer than any other electrical coding system. What is called Morse code today is actually somewhat different from what was originally developed by Samuel Morse and his assistant, Alfred Vail. The modern International Morse code, or *continental code*, was created by Friedrich Clemens Gerke in 1848 and initially used for telegraphy between Hamburg and Cuxhaven in Germany. Gerke changed nearly half of the alphabet and all of the numerals, providing the foundation for the modern form of the code. After some minor changes, International Morse Code was standardized at the International Telegraphy Congress in 1865 in Paris and was later made the standard by the International Telecommunication Union (ITU). Morse's original code specification, largely limited to use in the United States and Canada, became known as American Morse code or *railroad code*. American Morse code is now seldom used except in historical re-enactments.

Amateur Radio

International Morse code today is most popular among amateur radio operators, in the mode commonly referred to as "continuous wave" or "CW." This name was chosen to distinguish CW's continuous amplitude waves from the

Ham Radio Activation in Philippines for Taal Volcano Eruption

BY THELMA C. PASCUA, DU1IVT

with the Philippine Amateur Radio Association HERO Network

At approximately 5:45 p.m., 12 January 2020, HERO (Ham Emergency Radio Operations) was activated by Eddie Valdez, DU1EV; and Jojo Vicencio, DU1VHY, to meet the emerging situation over the eruption of the Taal Volcano. At the time of activation, there was no interruption of cellular services and electricity was available, hence HERO activation was mainly a preparatory measure to ensure that HERO operators were on hand should the situation deteriorate. And the situation indeed worsened when commercial electricity was cut in portions of surrounding areas of Tagaytay, Batangas, and small portions of Cavite and Laguna (all DU1).

The proximity of the Taal Volcano to Metro Manila and the surrounding provinces of Cavite, Laguna, and Batangas meant that VHF communications is feasible hence the PARA calling frequency 144.740 FM was utilized and manned by Joji, DU1JR and later on by Lawrence, 4F1SVY. The PARA affili-



Map of the Philippines with circle showing the approximate location of the Taal volcano. (Maps courtesy of Philippine Amateur Radio Association)

ate Cavite Ace (callsign DX1ACE) also activated its own local HERO network sharing an online streaming by Billy, 4I1AFT. Other PARA affiliates also took to the air and monitored their respective areas. PARA affiliate SCAN-I accompanied relief efforts in the Talisay-Agoncillo, Batangas areas launching a caravan on Sunday evening.

On the regional level, IARU Region 3 Disaster Committee Chairman Dani Halim, YB2TJV, has issued precautionary notices to all member associations and social media outlets that the Philippines is using 7.095 MHz (or may have to utilize the regional Center of Activity (COA) at 7.110 LSB should the need arise).

As nightfall came on Sunday, it was evident that ashfall was affecting some parts of Metro Manila, reaching even the northern Quezon City and eastern Marikina as per reports from members on 144.740 MHz. Reports in the HERO VHF net indicated that most southern Metro Manila cities were badly affected by ashfall.

Affiliate club Cavite ACE has signified to launch its own relief effort to alleviate the conditions of targeted evacuees in the Batangas area evacuations centers and were slated to set out January 18th and 19th.

As the various efforts of the different clubs are still ongoing, a full report of those actions will not be available until they have been largely completed. Affiliate clubs have been reminded, as always, to properly document their actions and efforts so that a comprehensive report may be made available to the National Telecommunications Commission (NTC) as the PARA served agency, if necessary.

Should there be a need to issue updates or bulletins to highlight new developments, PARA will send them out as soon as practicable. PARA continues to monitor the 2-meter 144.740 MHz frequency and continues its daily net on 7.095 MHz.

Update: No ashfall in Metro Manila since morning of 13 January 2020 due to change in wind direction.

– 13 January, 2020

Tnx to Dani Hidayat, YB2TJV, IARU Region 3 Emergency Coordinator, for forwarding this information.



Detailed map showing the hazard zones surrounding the Taal volcano.

damped wave emissions from spark transmitters, not because the transmission is continuous. Other keying methods are available in radio telegraphy, such as frequency shift keying.

Early amateur radio operators used Morse code exclusively since voice-capable radio transmitters did not become commonly available until around 1920. Until 2003, the ITU mandated Morse code proficiency as part of the amateur radio licensing procedure worldwide. However, the World Radiocommunication Conference of 2003 made the Morse code requirement for amateur radio licensing optional. Many countries subsequently removed the Morse requirement from their license requirements.

While voice and data transmissions are limited to specific amateur radio bands under U.S. rules, Morse code is permitted on all amateur bands — LF, MF, HF, VHF, and UHF. In some countries, certain portions of the amateur radio bands are reserved for transmission of Morse code signals only.

The relatively limited speed at which Morse code can be sent led to the development of an extensive number of abbreviations to speed communication. These include prosigns, Q codes, and a set of Morse code abbreviations for typical message components. For example, CQ is a general call, looking for a contact. OM (old man), YL (young lady) and XYL ("ex-YL" – wife) are common abbreviations. YL or OM is used by an operator when referring to the other operator, XYL or OM is used by an operator when referring to his or her spouse. QTH is "location" ("My QTH" is "My location"). The use of abbreviations for common terms permits conversation even when the operators speak different languages.

From Krakatoa to Taal, Morse code has been an essential tool in the dissemination of information from areas otherwise cut off from normal communication. While it is no longer required for gaining a ham license in most countries, it is a highly-recommended part of an emergency communicator's toolkit, since it requires only the simplest gear, can get through when voice transmissions can't, and can be sent and received without the need for a computer.

Note/Source:

1. Simkin, Tom and Richard S. Fiske. Krakatau 1883: The Volcanic Eruption and Its Effects. Washington: Smithsonian Institution P, 1983. Print.

KIT-BUILDING

BY JOE EISENBERG,* KØNEB

Don't Be Late For FT8

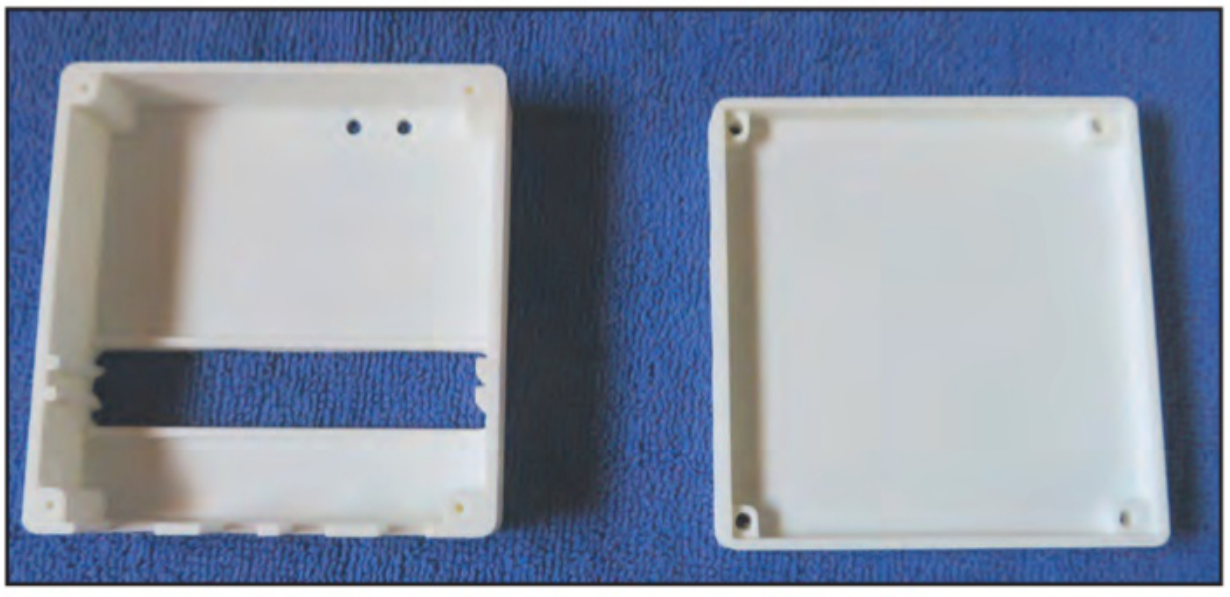


QRPGuys DSB Digital Transceiver kit with parts sorted and ready for assembly.

Who would have thought back in 2017 that a new digital mode would captivate the world of amateur radio in such a way as to revolutionize the way we work DX? When FT8 was first released only a few short days before the 2017 CQ World Wide VHF Contest, nobody had any idea how many CQWW VHF contacts would be made with FT8, especially on the 6-meter band. With its ability to copy signals as low as -24 db below the receiver noise floor, FT8 was a natural fit for VHF contests as well as for making DX more accessible for hams with smaller stations. I started using the mode shortly after hearing about its success on VHF as well as HF.

The ability of FT8 to facilitate QSOs despite very weak signals brought up the question of how long it would be until kits would be available for transceivers with FT8 capability. This void has been filled by at least two new kits that are dedicated specifically to operating FT8. The first, which I'm reviewing this month, comes from the people at QRPGuys.com. QRPGuys.com specializes in very simple and affordable kits and their new DSB digital transceiver kit is no exception.

*7133 Yosemite Drive, Lincoln, NE 68507
e-mail: <k0neb@cq-amateur-radio.com>



The two parts of the 3D printed case ready for assembly.

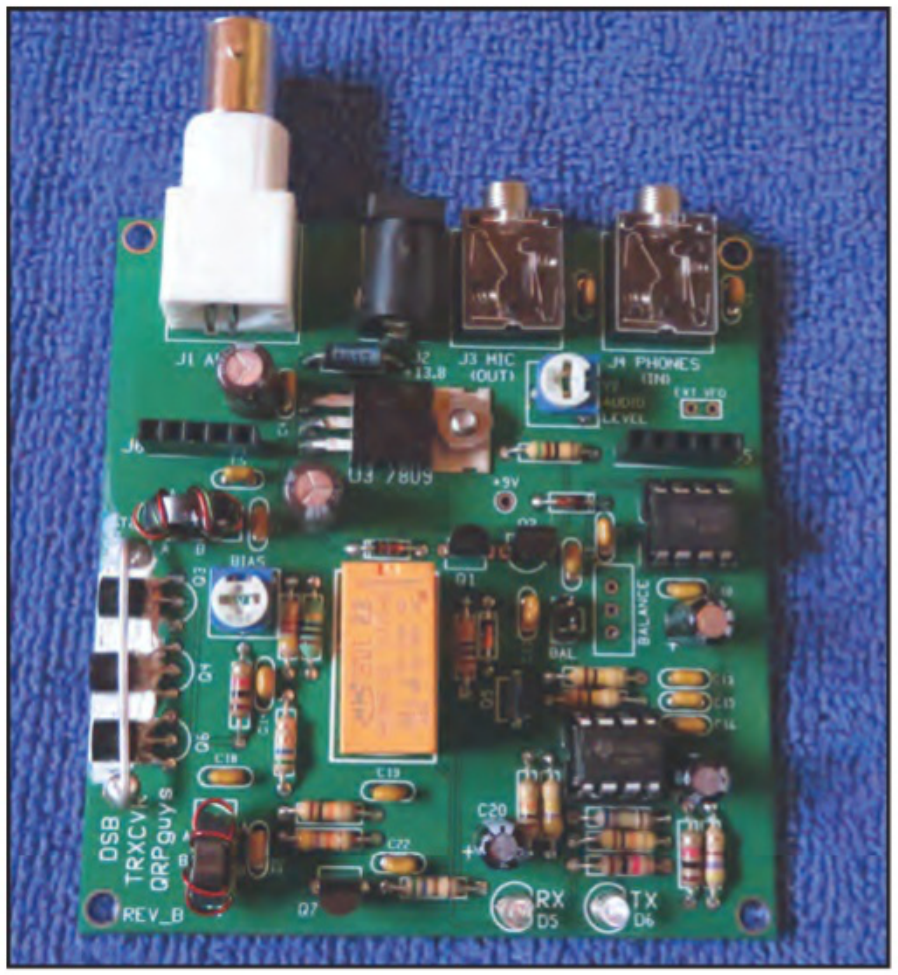
QRPGuys DSB Digital Transceiver

For just $40, The QRPGuys DSB Digital Transceiver kit comes complete with three interchangeable band modules that allow for operation on 40, 30, or 20 meters. The band modules each come with the crystal needed for the recognized FT8 frequency in each band.

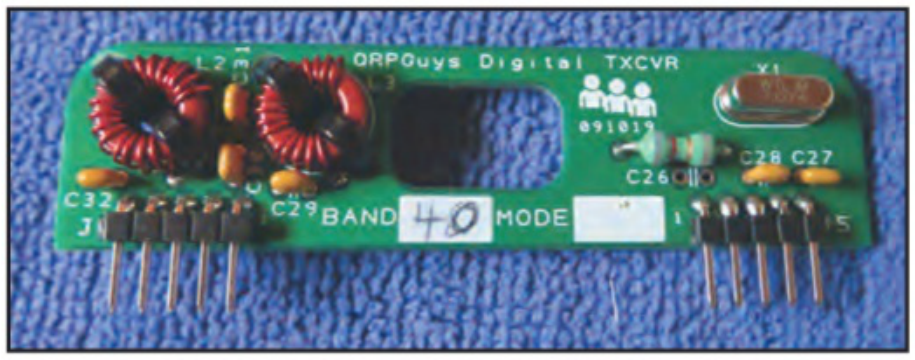
The RF power output varies depending on which band is selected. The 40-meter band module puts out 2 watts, while the 30-meter band is 1.5 watts, and 20 meters is rated for 1 watt of RF output. The main board components are all the same regardless of the band module you wish to use. All the band-specific components are on each pluggable band module. There are two bifilar toroids that need to be wound on the main board, but these are relatively simple and easy to wind, following the very explicit directions. The kit includes both red and green wire to make winding and lead identification on these toroids easier. The PC boards supplied are a good quality as they are double sided and marked well and solder flows easily.

Assembly Tips

In the assembly procedures, there is the need to ensure that the pin connectors are



The finished main board is ready for the band module to be inserted.



The finished 40-meter band module. The band modules contain the crystal and the band-specific parts.

installed so they are exactly straight upright, both on the main board and the band modules. If they are all not straight, the band modules will not plug in correctly. I found that by soldering just one pin, I could reheat it while using a finger (NOT touching the metal pins!) to hold the pins straight and flush. Then, I soldered the rest of the pins. The final output amplifier stage is created by using three parallel MOSFETs laid flat to the board. Using heat sink grease as well as one of a couple of methods given to hold those MOSFETs flat to the heatsink area of the board ensures they do not overheat during the 15-second transmission period. I found the same heatsink grease used for either power transistors or PC CPUs works adequately for this purpose.

The kit can be placed on a table using the sticky rubber feet provided on the bottom of the board, or it can be mounted in a case. There is a case file for 3D printers available on the kit's website along with the assembly manual available for download. The rubber feet can also be used on the 3D printed case. It is always a good idea to download and print out the manual (preferably in color) to see if the kit matches your ability to assemble it. I often look at the manuals in advance to see what things I might need to assemble a kit that I might not always have on hand. In this case, it was heatsink grease and a paper clip.

Assembly of this kit is not done stage by stage. It follows component types, with all the resistors being installed first, followed by



The finished DSB Digital Transceiver kit in the 3D printed case and labeled.

the capacitors and then the other parts that make up the main board. The main board assembly is followed by the band modules, which each hold the crystal and two toroids as well as the other band-specific parts. It is best to test the kit with a good dummy load so you do not risk damaging the output transistors. Once it has been tested, connecting to a good antenna will reveal the sounds of FT8. You can use a headset plugged into the audio output to hear what the transceiver is hearing to be sure you are hearing the desired FT8 signals.

This kit is designed to use two computer audio cables to connect the transceiver to your computer. I used two surplus computer audio cables which worked great. Be sure your computer has separate audio jacks for input and output. I discovered that my newer laptop has a combination audio jack that requires an adapter to break out the audio input and output separately. The T/R switching comes from the use of VOX to trigger the PTT in the kit. When the transceiver sees the data signal input audio, it triggers the T/R relay in the center of the main board to change from receive to transmit. You will be amazed at the number of stations you can work using QRP power levels on FT8.

After assembling and testing the kit, I printed a case using my 3D printer with the files provided on the kit's website. Using white PLA filament, I made a complete case which fit well. I used a Brother P-Touch label maker to print the labels for the inputs and outputs.

I would estimate the building time to be about four hours for this kit, not including case assembly if a case is made with PC material or 3D printed. Ordering the kit is done on the QRPguys.com website and can be paid for by PayPal. Be sure to note when you order the kit as they do not ship every day and have periods surrounding major hamfests when they do not ship for a few days.

On the Road Again…

This month, I'll be presenting at the Lincoln Hamfest right here in Nebraska on March 14th as well as speaking in April at the International DX Convention in Visalia, California. As always, I will also be helping the big group kit-build at Ozarkcon in Branson, Missouri, put on by the Four State QRP Group on April 3rd and 4th. The Four State QRP group always debuts a new kit for the kit-build as well as other new kits as well. Come to Branson and enjoy a great group kit building experience. Ozarkcon is on the web at <www.ozarkcon.com>.

– Until next time, 73 de KØNEB

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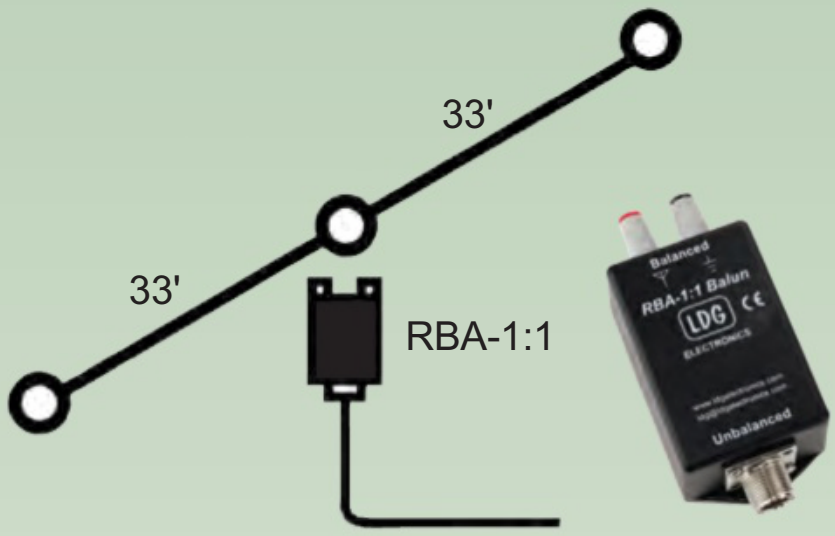
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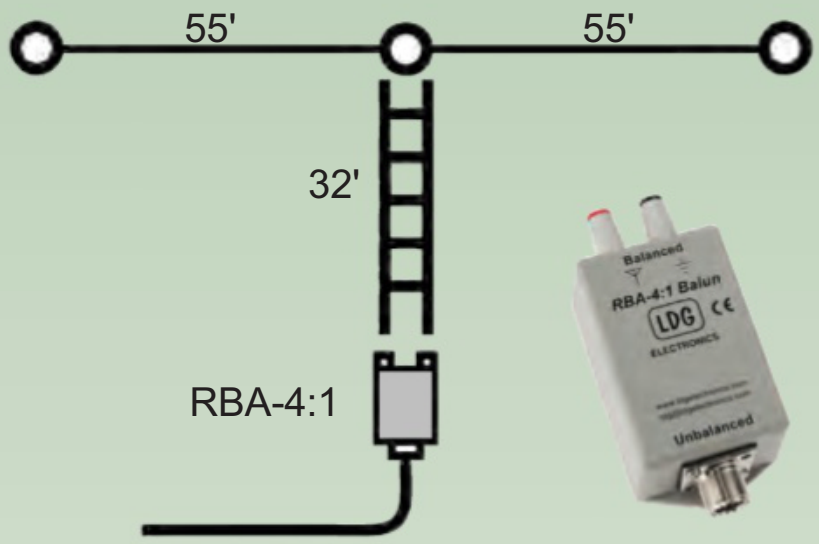
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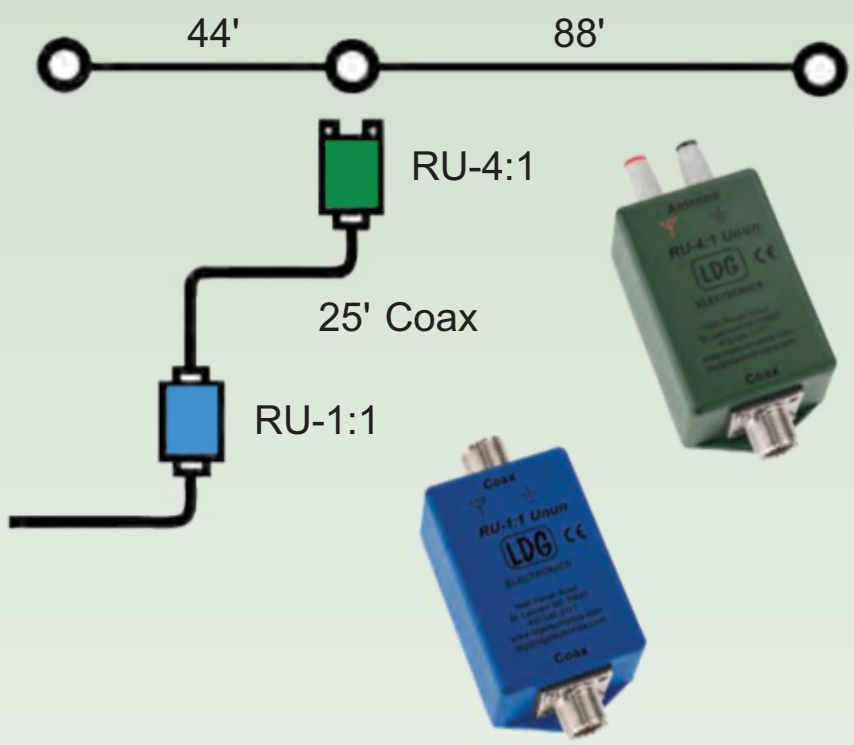
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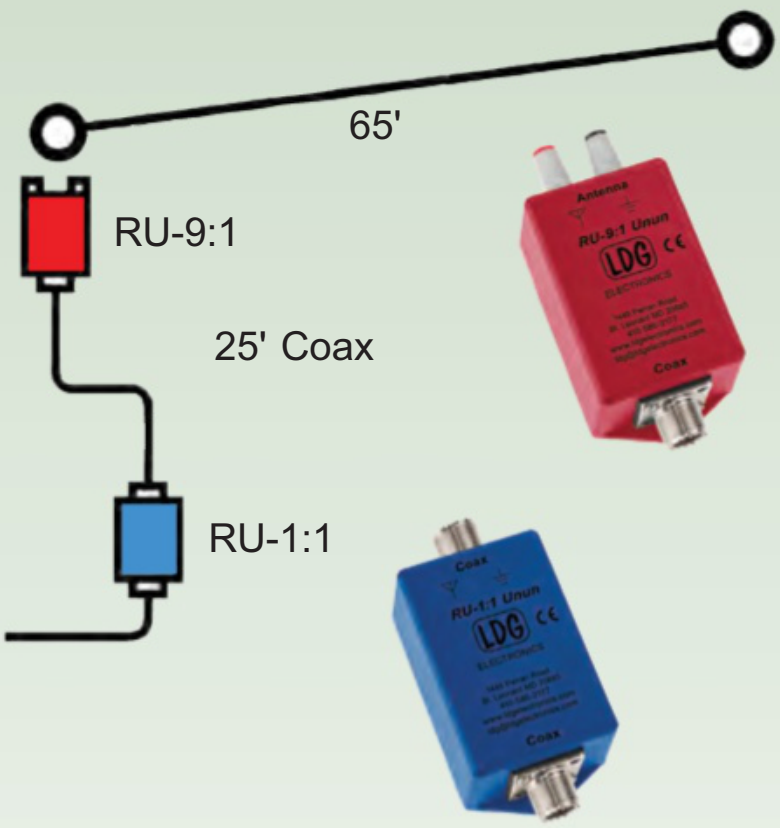
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DIGITAL CONNECTION

BY DON ROTOLO,* N2IRZ

Packet News, Data Radios, and Some Practical Details

Last time, we discussed the hardware and design of a new KISS modem developed by Nino Carrillo, KK4HEJ. Keeping with that theme, this month we'll take a closer look at some of the practical aspects of actually putting a packet link on the air, along with an update on the modem's design progress and expected availability.

TNC-Pi

Before we get into that, just at the end of last year, John Hansen, W2FS, of Coastal Chipworks, announced that his company was ceasing operations. The TARPN network concept <http://tarpn.net> was built around John's TNC-Pi, which is currently sold out and no longer available. Citing the increasing difficulty in sourcing the through-hole components used to assemble these modems, he says he is working on a way for them to be available again "early in the coming year [2020]", but not as kits due to the need for surface-mount components.

Of course, we should all realize that amateur radio is already a niche market, and packet radio modems are a niche of a niche of a niche: It's a challenge to make the financials work in this business; you have to do it for love. I send my sincere thanks to John for the many years of support from Coastal Chipworks and his kindness in making a special TARPN version of the TNC-Pi available at a very reasonable cost.

With that being said, Nino has added 1200-baud (Bell 202) support to his 9k6 KISS TNC, making this a reasonable choice to replace the TNC-Pi (and TNC-Pi9k6). At the time of this writing (early January), testing of this feature, along with a new forward error-correcting scheme, was just starting. I am hoping for a full write-up from Nino later in 2020. Visit <http://tarpn.net/d> for the latest information.

Radio Interface

When we think of digital modes, we often gravitate towards the HF modes such as FT8 and PSK31, which use our computer's sound card to make the noises we want to transmit. Interfacing to the radio is almost a trivial consideration: You can just buy a sound card interface like the West Mountain Radio RIGblaster series <https://bit.ly/2FV8aoG> and be on the air in just a few minutes. But for network operators, a computer and sound card is not the ideal way to send and receive packet signals: It simply costs too much.

To interface a stand-alone TNC to a radio, we only need to build a simple passive cable. Of course, you need both the right connectors and the pinout of each side. But we need only three signals: Transmit audio (TXA), receive audio (RXA), and push-to-talk (PTT) to key the transmitter. Of course a ground (GND) line is also needed.

Over the years, two de-facto standards have emerged for the TNC output connector: The 5-pin male DIN, and the DE-9F. On the radio side, it gets a little more complicated, Depending on the radio, you might need to connect to the microphone jack, speaker jack, a dedicated data jack, or a combination of these. And, different radios use different connector types. As a start, some of the more common connectors are shown in *Photos A*, *C*, and *D*. A check of the radio's operator's manual or an internet search should get you to the exact pin configuration you need.



Photo A. Here is an example of a TNC- to-radio cable, this one built to connect a 5-pin DIN TNC to an ICOM 8-pin mic connector, perfectly fine for 1200 and 2400 baud. The microphone connector doesn't have a received audio (RXA) output, so the 3.5-millimeter phone plug is connected to the speaker output on the back of the radio. Making your own interface cable is quite easy, but you'll need to do some soldering.

To make an interface cable, just find some shielded multi-conductor cable with at least 3 conductors (GND can use the shield) and wire the signals to the correct connector pins. Here, soldering is an important skill, but if you don't know how, you can certainly find someone local who can (or will show you how). Naturally, interface cables and TNCs are not limited to network operators: Anyone wanting to operate packet (including APRS) could do the same thing — indeed, that was all there was 30 years ago. But, with the sound card being the dominant fixture that it is, there's really not a lot of interest today in operating packet with a TNC.

Data Radios

Your choice of radio depends on what you're trying to do: 1200 baud will work with virtually any FM rig, and so we tend to see older (and therefore inexpensive), used radios pressed into service. It isn't that difficult to find a place for the

* *c/o CQ magazine*
Email: <N2IRZ@cq-amateur-radio.com>

signals from the TNC to get into the radio: The microphone plug always has an audio input and PTT, and an external speaker jack is nearly as common. I have used dozens of FM radios for packet, including my trusty ICOM IC-2A handie-talkie, a pair of ICOM IC-45A 440-MHz mobiles, and even my ancient Heathkit SB-102 HF rig (in SSB mode for HF packet), as well as repurposed Motorola and GE business-band FM radios.

Many FM radios of these vintages don't actually generate true FM, which is done with a varactor diode (acting as a voltage-variable capacitor). Instead they pull the frequency of a Phase-Locked Loop (PLL) to generate Phase Modulation (PM). When used for the intended voice operations, your ear can't tell the difference between receiving FM or PM, as they are nearly the same. But they are, in fact, different.

At 1200 or even 2400 baud, these differences don't matter one whit. At 4800 baud, some care lets these PM radios to be used, albeit with some minor modifications to the radio interface. However, at 9600 baud, the differences are too great: One must use a true-FM radio at this speed and higher.

This was one of the reasons so few hams operated 9k6 packet: It was hard to find a usable radio. The other significant reason was that, even with a true-FM radio, you had to open up the radio and interface directly to the modulator and demodulator circuits, bypassing all the microphone and speaker audio processing circuitry. Most hams were either uncomfortable or insufficiently skilled (or both!) in finding and connecting to these normally-inaccessible circuit points.

Photo B shows the modification I had to make to my IC-45A radio in order to use it at 4800 baud. I brought out these signals onto a DE-9 connector so I could interface to the TNC's modem. While it wasn't terribly difficult for me to find the right spots — I have both a schematic diagram and an electrical engineering degree — I can clearly state that others in the club were not anywhere near as comfortable doing this, which I think is understandable.

Today, we have better options. Since the late 20th century, manufacturers have been putting "data ports" on their radios, bringing the necessary interface points to a rear-panel connector. While this was generally good, some radios had abysmal transmit / receive switching times. At 9600 baud, waiting 200 mS for the transmitter to stabilize made no sense when sending a 150-mS data packet. In other words, even a "9600-ready" radio could offer really poor performance if the T/R switch time (TX-Delay) was too long.

Why do we need to tap into these signal points anyway, instead of using the mic connector? 9600 baud G3RUH signals need a flat audio bandwidth response (down to DC) and a linear group delay characteristic. That means that no frequency in the audio passband can be significantly louder or softer than any other, and that the change in phase by frequency needs to be close to a straight line (for both transmit and receive).

Purposely modifying the audio response for certain frequencies — emphasis and, on receive, de-emphasis — significantly improves received audio, and virtually every voice radio does this. Indeed, the emphasis circuitry is one reason why we need to bypass the microphone input, same as the

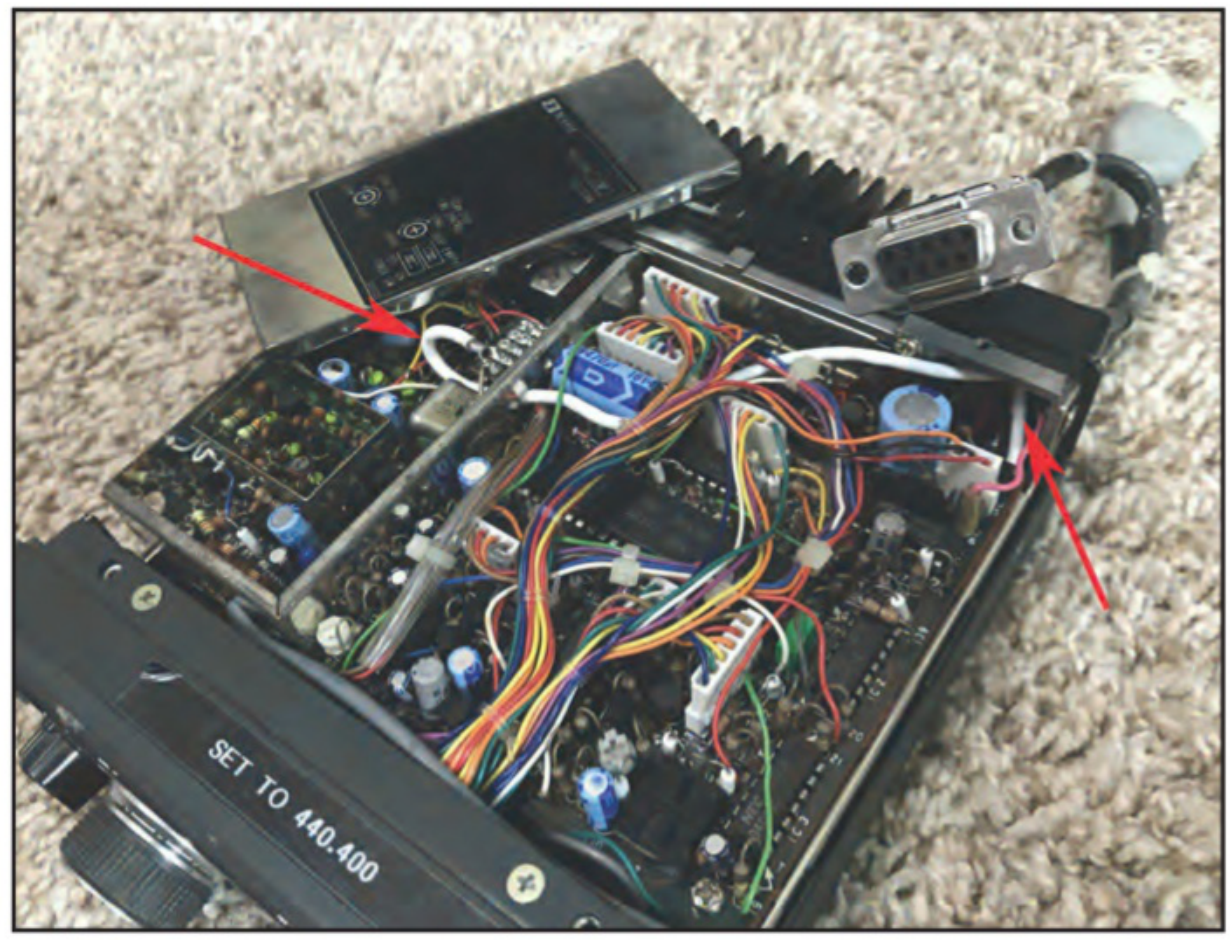


Photo B. This ICOM IC-45A 70-cm radio was modified for 4800-baud operation using a HAPN-T modem — note the white coaxial cables with the red arrows pointed at them. The visible cable is for transmit, with the shield removed for clarity, while receive goes to the bottom board. This is the exact same modification as needed for 9600, but the IC-45A is phase-modulated, which cannot support 9600-baud operation. This durable radio is perfect for network service.



Photo C. The rear panel of a Pac-Comm Micropower-2 TNC. The radio connector is a 5-pin DIN socket. This was the low power variant of the Tiny-2 TNC that was quite popular in the 1990s. Costing about $200 new, less than competitors, many of these operated as part of a ROSE or TheNET network. The relatively high cost to build a network node was just another impediment to far wider adoption.

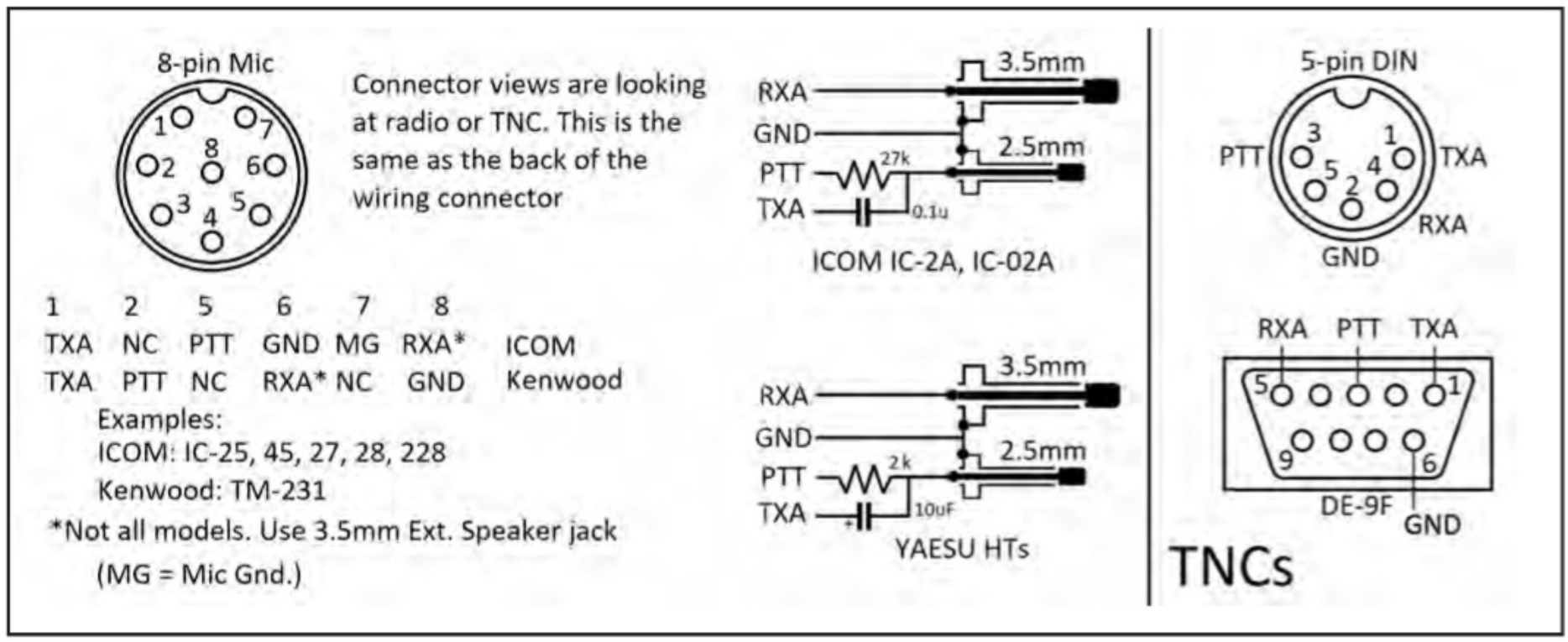


Photo D. Some common TNC and radio pin-outs for 1200-baud operations. You can find what you need in your radio (or TNC) manual, and the internet is rich with resources for this information. Interfacing your TNC to your radio is as simple as building (or buying) a cable. For 1200 baud, the microphone connector is typically used, while for 9600 baud you must use either the dedicated data port on the back panel or modify the radio to bring the needed signal points to an external connector.

receive de-emphasis, both of which introduce distortions unacceptable for 9600 baud.

Radios

Some of the older (and therefore inexpensive) known good radios that operate at 9600 baud without modification include the Alinco data radios (DR-135/235/435); Yaesu FT-5100, 7900 and 8900; Kantronics D4-10, and Kenwood TM-V71A. If you're willing to make some minor modifications, then just about any radio can be made to work — check the internet for older posts of success or failure, there are plenty. Of course, many newer (and more expensive) models are available with 9600-baud ports, but as I had mentioned, beware of TXDelay specifications. I encourage you to visit *CQ* advertisers and see what they have to offer.

Then there are dedicated data radios. These are commercial products that can be tuned to the ham bands (but beware, many cannot!), designed specifically to handle data transmissions. Surplus data radios are neither difficult to find nor expensive. The TARPN folks have found certain Tait TM8105 data radio models to be both available and easy to work with — just ensure the model you get covers the amateur bands, as they offer about a dozen different versions. I saw one on eBay for under $45. Motorola RNET telemetry radios are also said to be 9600-baud capable, and are seen for under $20.

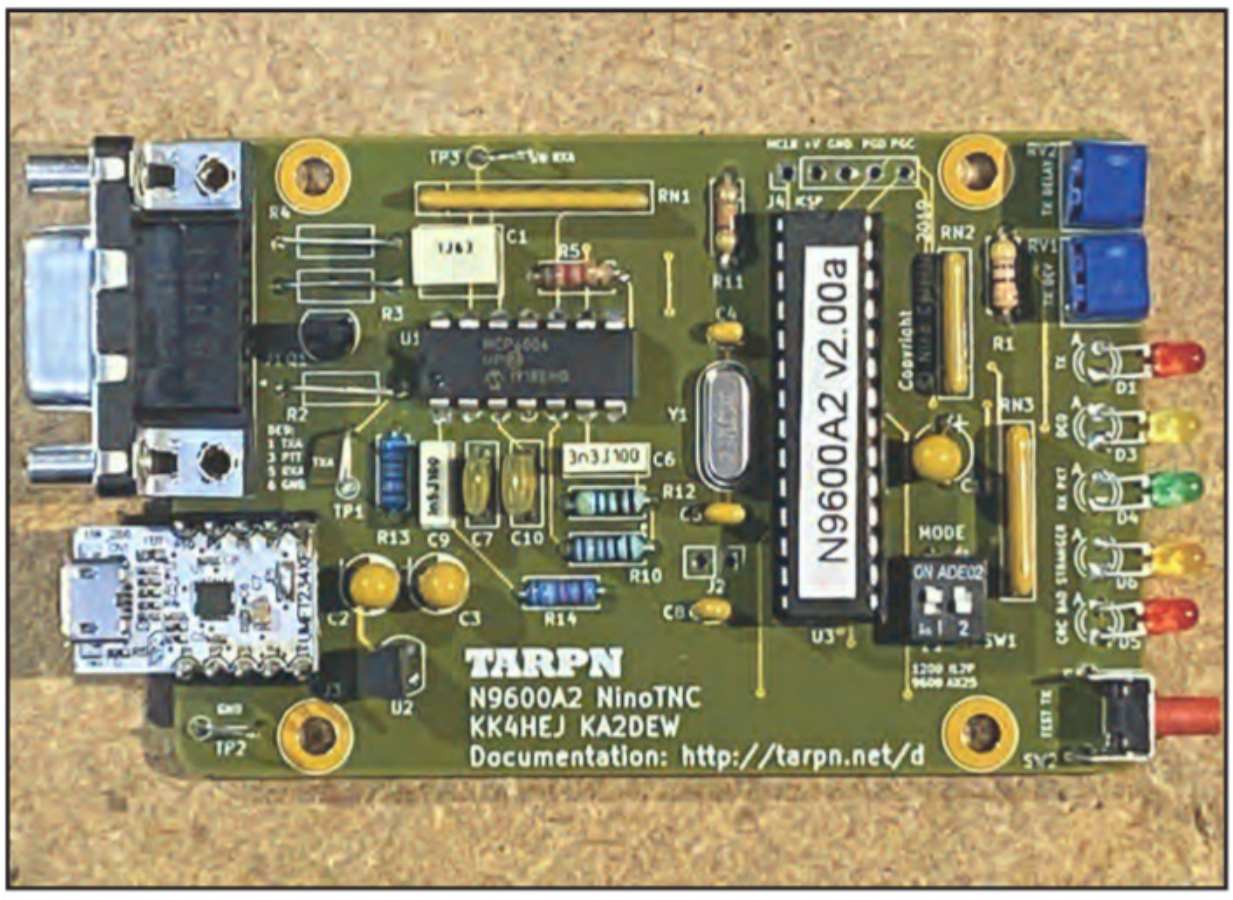


Photo E. The latest version of the NinoTNC, a 1200- / 9600-baud KISS TNC that is expected to cost under $50 as a kit. I covered this topic extensively in the January 2020 issue, and will certainly visit it again later this year. Visit <http://tarpn.net/d> for the latest information.

Radio Surgery

For older (meaning reasonably-priced) VHF and UHF radios with decent (>25W) power levels, you might need to go inside the radio to put wires to the needed signal points. Transmit audio (TXA) needs to go to the modulator, and receive audio (RXA) needs to come directly from the discriminator. These two signals, along with PTT and ground from the microphone jack, all get routed to a DE-9 connector outside the case. Here, for example, are the internal connection points for an ICOM IC-28 radio: RXAudio is obtained from IC1, Pin 9 on the RF unit. TXAudio is deliv-

ered to the side of R45 that isn't connected to trimmer R100. For TXA, use a 33k Ohm, 1/2-watt resistor in series to drop the signal to a suitable range.

The "Pin 9" point is surprisingly common, since popular receiver chips, such as TA7761, LA5006, LC7532M, MC3357, and TK10420 all happen to have their output on pin 9. Not all radios use these, of course, so proceed with caution. Try to find a schematic diagram for your radio to identify where in the circuit you need to connect, then find that spot in the physical circuit. When connecting to internal circuitry, use a small coaxial cable (connect the shields only on the outside of the radio) or short runs of hook-up wire.

In Closing

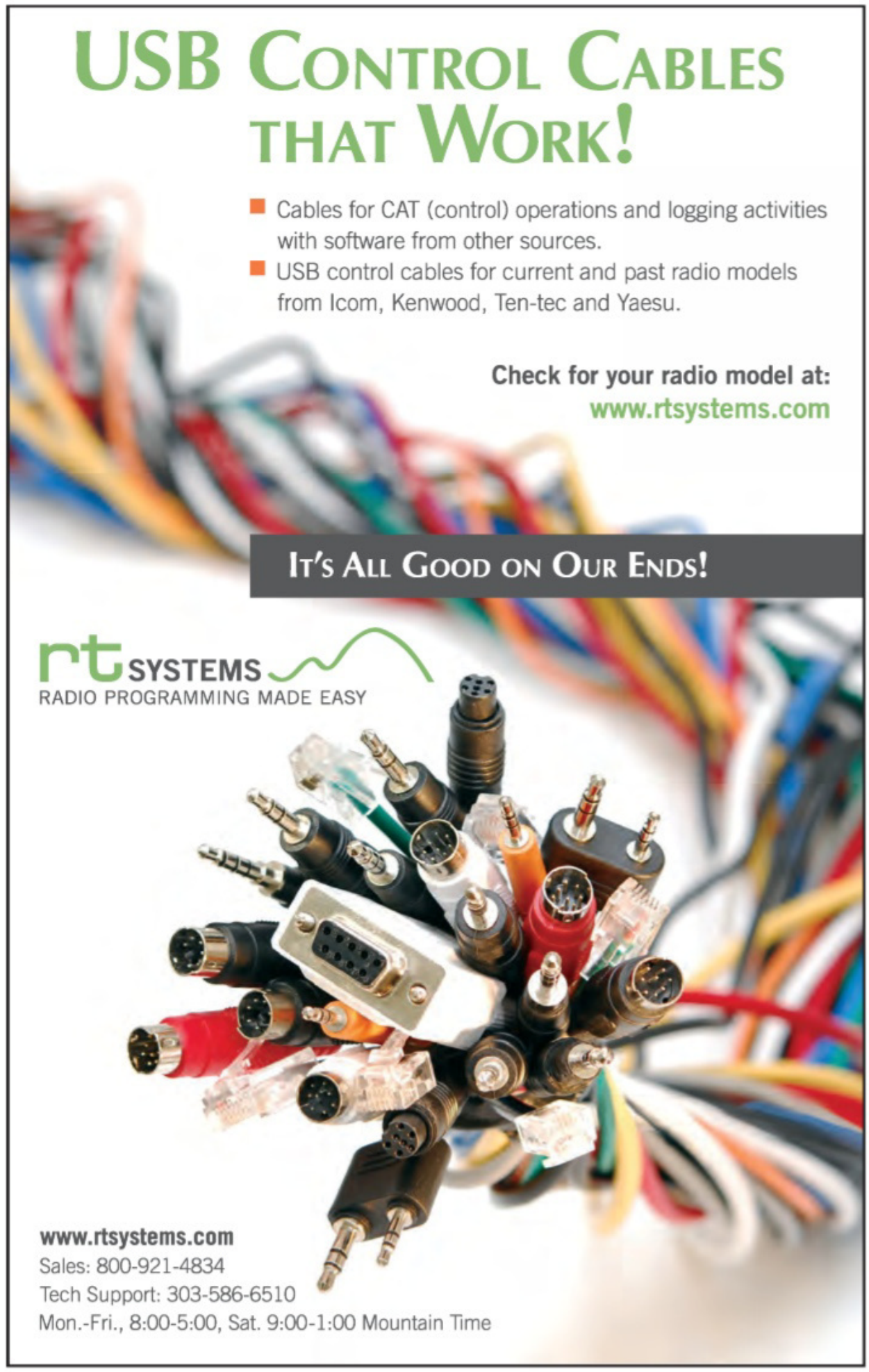
At the risk of repeating myself, all this surgery and solder-anxiety is why 9600-baud operations weren't so popular. But today, you can avoid all of it by buying a surplus commercial data radio. While there is also some effort involved, it's far less. Search the internet for a data radio, then see if it'll do what you expect: Does it tune to the amateur bands? What is needed to change the frequency? Can the radio really handle 9600 baud? Is there any technical documentation available? What are the specifications (power, TXDelay, etc)? As always, do your homework. But, once you find a winner — like the Motorola RNET telemetry data radio models — go for it.

So there you have it, the bare basics of higher speed packet, with an emphasis on network operations. At 1200 baud, nearly any voice radio will work just fine, but at 9600 we need to either modify the (older) radio to bring out the receive and transmit points, buy a newer radio with these points already brought to the rear panel data jack, or find a used commercial data radio and put it on the amateur bands. Connecting the TNC to the radio is done with a simple, passive cable that is easy to make, although you certainly can buy one pre-made.

I could have used most of the pages in this month's issue explaining all this, as there is so much information I can share. To avoid conflict with my fellow columnists, I've shaved it down as usual, but please feel free to write if you have any questions or need some clarification — or if you think packet is all washed up and you want to hear about something else. It's always a good day when I hear from a reader, and complaints are actually my favorite thing to hear. Honest.

– Until next time, 73 de N2IRZ





MICROCONTROLLERS IN AMATEUR RADIO

BY ANTHONY A. LUSCRE*, K8ZT

Two New Projects That Utilize µControllers

This month, we start with another project from Rodrigo Freire, PY2RAF (see Dec 2019 *CQ* for the previous project). This is a great under-$10 project that uses only four items — almost any variety of Arduino board, an OLED display, a pair of resistors, and a few pieces of jumper wire (*Photo A* and *Figures 1-3*). Rodrigo's project is an on-air transmit and receive timer, counting how long you are transmitting or receiving a signal. It is compatible with most Yaesu HF transceivers produced in the last 20+ years. Here is a link to his project: <https://tinyurl.com/urxbhvq>, which now support many ICOM and Kenwood radios.

The name of our next item's creator will be familiar to many involved with microcontroller devices in amateur radio — Jack Purdum, W8TEE. Jack and Al Peter, AC8GY, have teamed up to write a new book titled *Microcontroller Projects for Amateur Radio*. Dr. Purdum is also the author of *Arduino Projects for Amateur Radio*, but explains that the new book is different in that it does not limit itself to the Arduino family of processors, although all of the processors (i.e., STM32, ESP32, and Teensy 4) can be programmed in the familiar Arduino IDE. The Table of Contents for the new book is seen in *Table 1*.

Included in the book is a project I mentioned in my September 2019 *CQ* column — The Morse Code Tutor. This project (*Photo B*) provides tools for learning Morse code individually or in a



Photo A. An OLED-Arduino Timer <https://tinyurl.com/urxbhvq> from PY2RAF. (Photo by Rodrigo Freire, PY2RAF)

*email: k8zt@arrl.net
website: www.k8zt.com

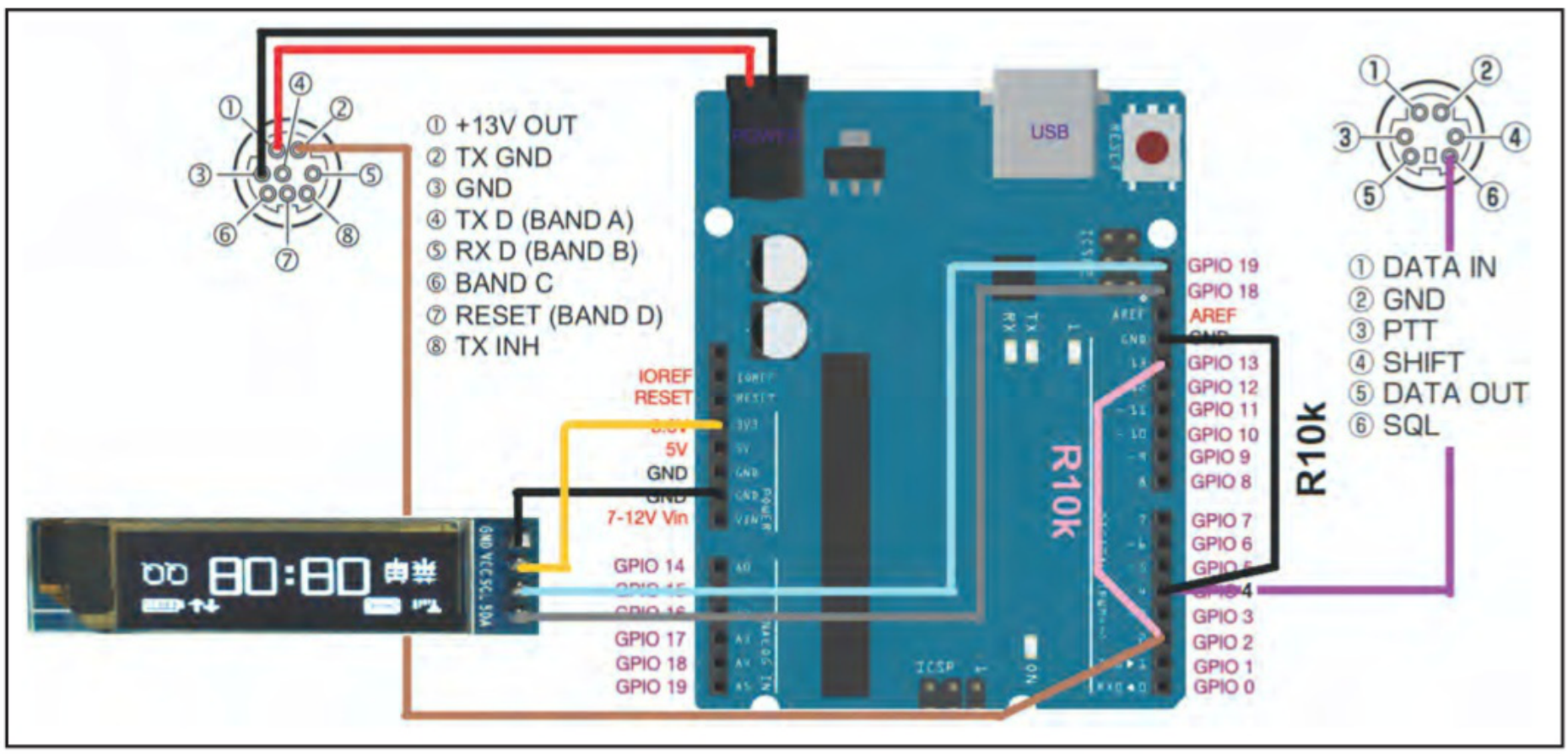


Figure 1. OLED-Arduino Timer simplified schematic. Almost any version of Arduino can be used, but make sure you adjust for different pin-outs in the sketch. Notice the two 10K-ohm resistors between GPIOs 2 and 13 (Illustration by Rodrigo Freire, PY2RAF)

classroom setting. The project covers different sets of Morse letters, numbers, punctuation characters, and words as well as randomly-generated mock QSOs and callsigns. There are also various ways to practice sending Morse. A small 3-watt audio amplifier gives plenty of volume through the speaker for classroom use. A built-in keyer allows the user to set the words per minute between 5 and 60 wpm. The unit is powered by a 9-volt voltage source.

Al and Jack have "modernized" a number of projects to use TFT color displays and provide more information from the projects, as illustrated by their CW Messenger project shown in *Photo C*. The CW Messenger allows the user to send up to 10 different "canned" messages by assigning the messages of interest to the three push-button switches on the top of the case. What is different is that Messenger allows the user to change the messages in the field by using the touch-screen keyboard that is integrated into the Messenger. The Messenger also has a built-in keyer and the output circuit is isolated via a 4N25 optoisolator so it can be used with a variety of keying circuits. PCBs for most of the projects will

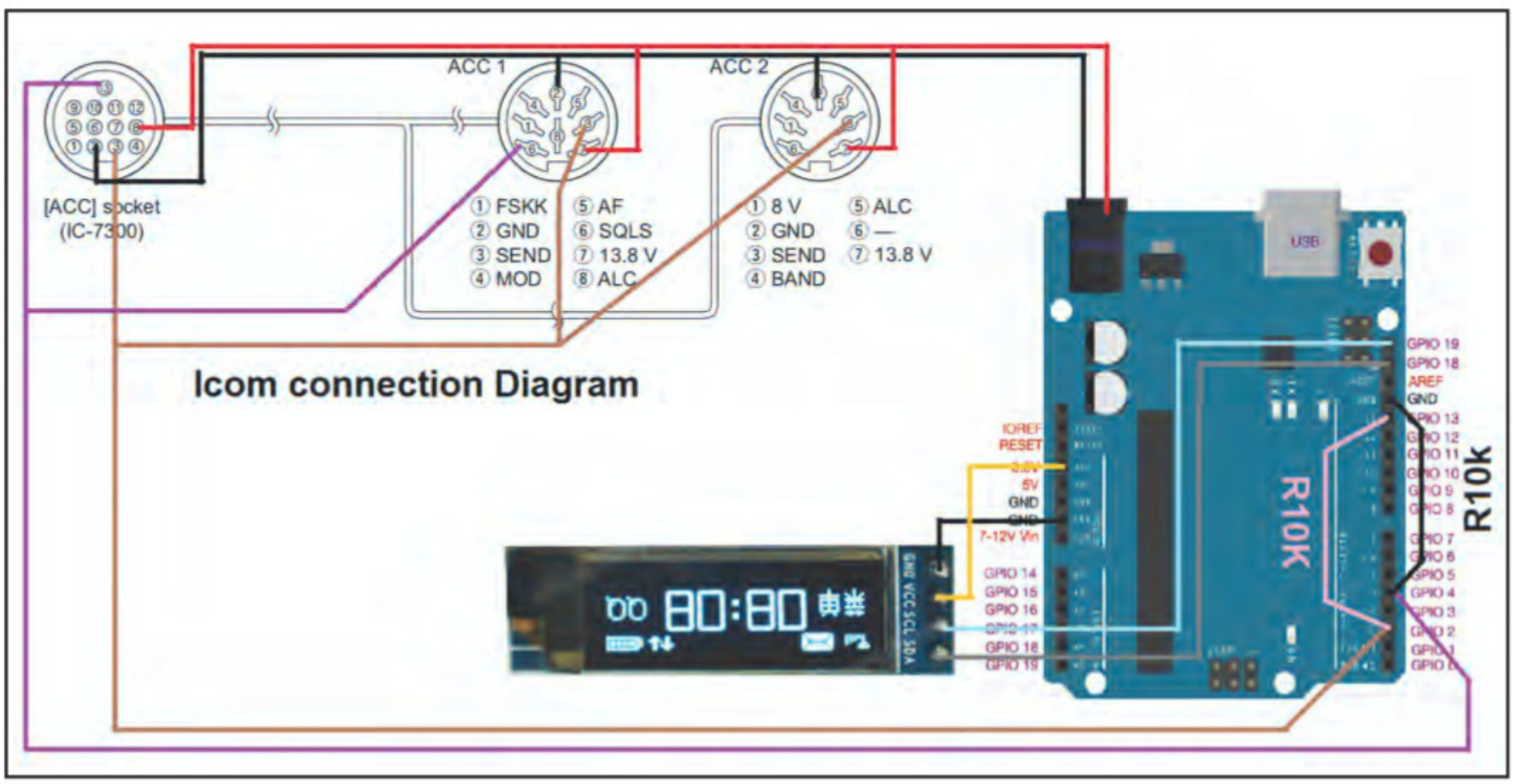


Figure 2. OLED-Arduino Timer project for ICOM radios. (Illustration by Rodrigo Freire, PY2RAF)

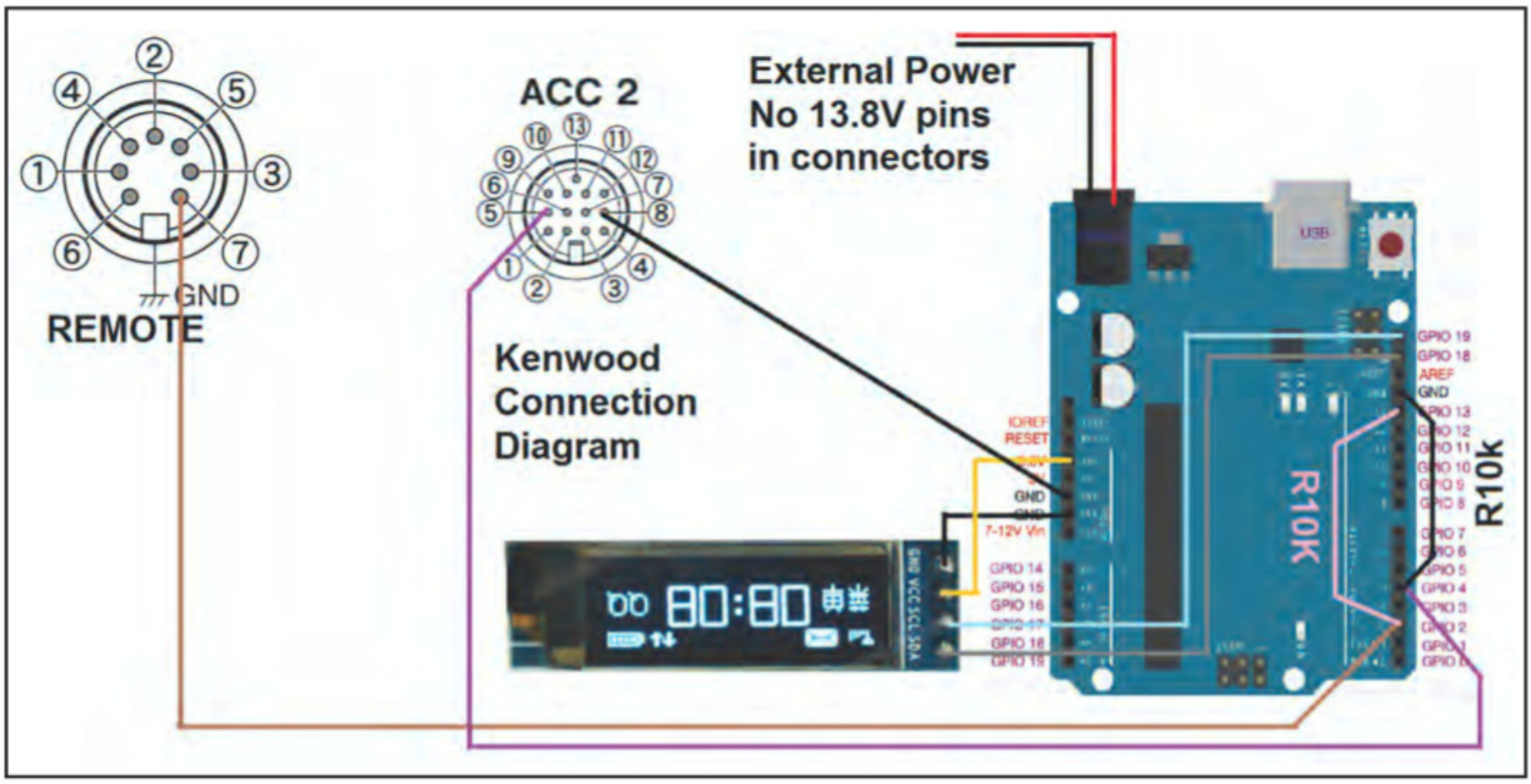


Photo 3. OLED Arduino Timer project for Kenwood radios. (Illustration by Rodrigo Freire, PY2RAF)

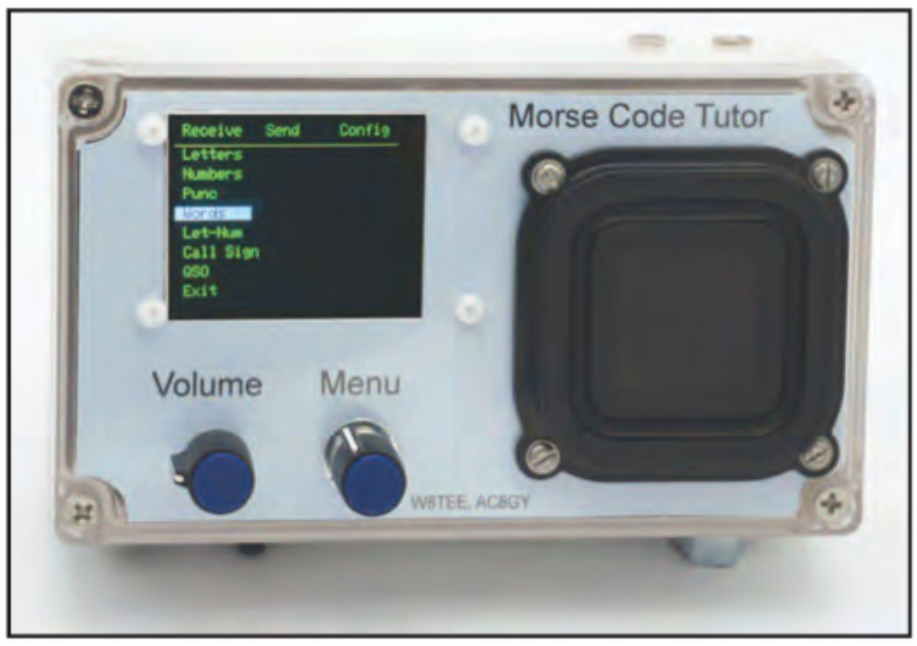


Photo B. The Morse Code Tutor project provides tools for learning Morse code individually or in a classroom setting. (Photo by Jack Purdum, W8TEE)



Photo C. The CW Messenger allows the user to send up to 10 different "canned" messages by assigning the messages of interest to the three push button switches on the top of the case. (Photo by Jack Purdum, W8TEE)

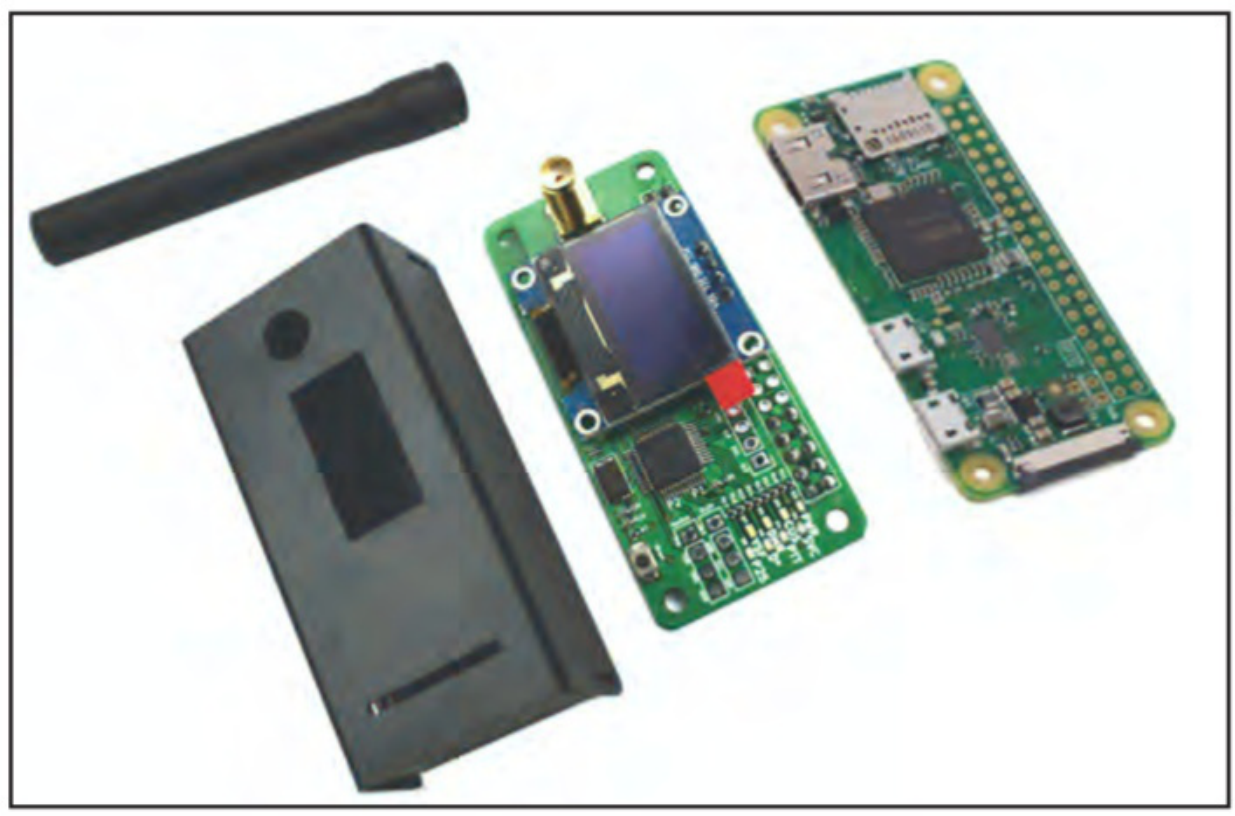
0. Foreword
1. Introduction – Which µC, Installation, and Intro to the IDE
2. An Overview of Arduino-C
3. Libraries and a Gentle Introduction to Object-Oriented Programming
4. Displays – 2x16 LCD, TFT, OLED, Menuing system
5. High-current Utility Power Supply
6. Mini Dummy Load with Power and SWR
7. Morse Code Tutor
8. Programmable Power Supply for the Bench
9. Antenna Tuner
10. CW Messenger
11. DSP Post Processor
12. DSP Mic Processor
13. Signal Generator
14. Constructing the "Luggable Double Double" Magnetic Loop Antenna
15. Remote Control for the Luggable Double-Double Mag Loop
16. How to Make Your Project Look Professional

Table 1. Table of Contents for Microcontroller Projects for Amateur Radio *by Jack Purdum, W8TEE, and Al Peter, AC8GY.*

be available from QRP Guys <https://qrpguys.com>. The book is being published by the ARRL and is expected to be available in June.

During a recent presentation at my local amateur radio club, I heard about a variety of available Hot Spots. One, the Multi-Mode Digital Voice Modem, also known as the MMDVM Hotspot or Jumbo Spot (*Photo D*), was extremely interesting. This tiny (*the term Jumbo is a joke. –AL*) device allows you to connect your UHF DMR radio to DMR repeaters around the world via your home Wi-Fi network (without the use of a nearby repeater). You can choose to put your own Jumbo Spot together via individual modules [a Raspberry Pi-Zero W (WiFi) plus a Jumbo Spot RTQ MMDVM Hotspot expansion board], via a complete kit (with antenna and case), or RTQ (Ready to QSO). Depending on the route you go, the total cost can be between $45 and $200. There are numerous sources online where you can buy your Jumbo Spot. In addition to DMR, Jumbo Spot supports Yaesu's System Fusion, D-Star, and other protocols.

That's it for this month. Remember I am always looking for information on your new microcontroller projects or experiences with any of the projects from this column, so please email me at <k8zt@arrl.net>.



← *Photo D. Jumbo Spot is a hot spot for your DMR, Fusion, or D-Star radio. It's made up of a Raspberry Pi-Zero W (WiFi), a Jumbo Spot RTQ MMDVM Hotspot expansion board, an antenna, and a case. Not shown are assorted jumpers used to connect the boards. (Photo by K8ZT)*

THE HAM NOTEBOOK

TEXT AND PHOTOS BY WAYNE YOSHIDA*, KH6WZ

A "Swap Meet Go Bag" and Other Things Related

Just like being prepared for a communications emergency or drill, a Swap Meet Go Bag is essential for a successful mission.

In this case, the mission is to find and purchase a desired item and transport it home. The mission includes taking steps to avoid disappointment, in several ways.

This Go Bag idea started after I lost money on a bad deal on a big and heavy 1-kilowatt dummy load (*it turned out to be "open" –WY*). I decided I would take steps to avoid buying something that really should have been scrapped by the seller.

First is the bag itself. I use either a big duffel bag or a backpack-style sack. Both bags feature shoulder straps as well as a carrying handle. The shoulder straps free my hands, which makes browsing easier. The handles provide an alternative carrying method to shift the load and avoid fatigue or pain. Sometimes I bring a folding luggage dolly, if I am shopping for something really heavy or big.

Useful Helpers and Supplies

I put a sweater or sweatshirt inside the bag in case I get cold, or if I need to add padding to protect purchased items. On sunny days, I add a hat for protection against the Sun. A magnifying glass or loupe can also be helpful for a close visual inspection.

A pair of gloves is handy when carrying heavy, sharp, or dirty items, such as the vintage Heathkit SB-630 Station Console shown in *Photos A* and *B*. Although quite dirty, I could easily visualize how it would turn out when I completed the restoration.

Heavy-duty trash bags or boxes can be kept in the vehicle to help contain and securely hold the item in the trunk or cargo area. It is also helpful to put items in these containers to protect your vehicle's interior.

Often overlooked items for my Swap Meet Go Bag are snacks and water or some other beverage.

Instruments

Battery-powered, portable test gear can verify if an item is good, or at least, provide a quick preliminary check. For example, the bad dummy load mentioned in my example could have been easily checked with an ohmmeter.

Photo C shows some of the useful testers I take with me on my shopping missions. The test gear I take depends on what I am looking for.

Clockwise in *Photo C* from left to right: Homemade meter tester, pocket-sized multimeter and carrying pouch, gloves, notepad and pen, capacitance and inductance meter made from a kit, Android phone, component tester. In the center, above the phone is a business card-sized gauge for waveguide.

Photo C shows several instruments that are redundant. The component tester on the bottom left can replace all the other instruments in the photo. It is easy to use, and — best of all — it's inexpensive.



Photo A. This Heathkit Station Console was so dirty I didn't want to touch it. Putting on some gloves and placing the item in a large trash bag made me feel better.

Some notes on the testers: I made a useful probe to alligator clip adapter for the portable DMM, shown in *Photo D*. It is a small length of test lead wire with a clip and a pin jack on the other end. This allows the probes to be clipped to the component being tested.

The "Simple Meter Tester" by Wayne J. Stanley, W4RDG, appeared in the March 2000 issue of *QST* (page 40). My version (see *Photos E* and *F*) is built in a plastic electrical box with a cover plate. To make the unit more portable, I mounted a cell phone belt clip to the back of the case. I also mounted the 9-volt battery externally, to make changing the battery easier and to prevent dead battery corrosion inside the unit. It is featured on the cover of *Hints & Kinks for the Radio Amateur, 16th Edition, 2003*. When shopping for analog meters, I clip the tester to my belt so I can do a quick check before buying.

The LC meter kit (from Almost All Digital Electronics) shown in *Photo C* is no longer available, but similar kit or pre-built capacitance / inductance meters may be available, such as units from B&K, Fluke, or Elenco. Search for "LCR meter."

One instrument is quickly becoming my "go-to" tester for everything. I discovered "The Component Tester" from a popular YouTube channel, "EEVblog" (Electronics Engineering Video Blog), hosted by Dave Jones from Sydney Australia. The episode is "EEVblog #1020 - Is A $7 LCR / Component Tester Any Good?"

The Tests

Visual inspection: An easy test is a close look at the item you are thinking about buying. Look for surface rust or corrosion, if variable parts move smoothly, cracked or broken cabinets or parts. A magnifying glass or loupe can be help-

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LinkedIn: www.linkedin.com/in/wayneTyoshida

ful. If your phone or camera has a macro or close-up function, try taking a picture of the detail you want to examine, and take a look.

Regarding visual inspection, some defects may be present, but can be repaired or corrected. For example, air variable capacitors may be corroded or may not move smoothly, but depending on the severity of the defect, it can be easily fixed or cleaned. A good cleaning and lubrication can correct the problem.

Continuity – Shorted or Open: Is an easy test that can prevent purchase disappointment.

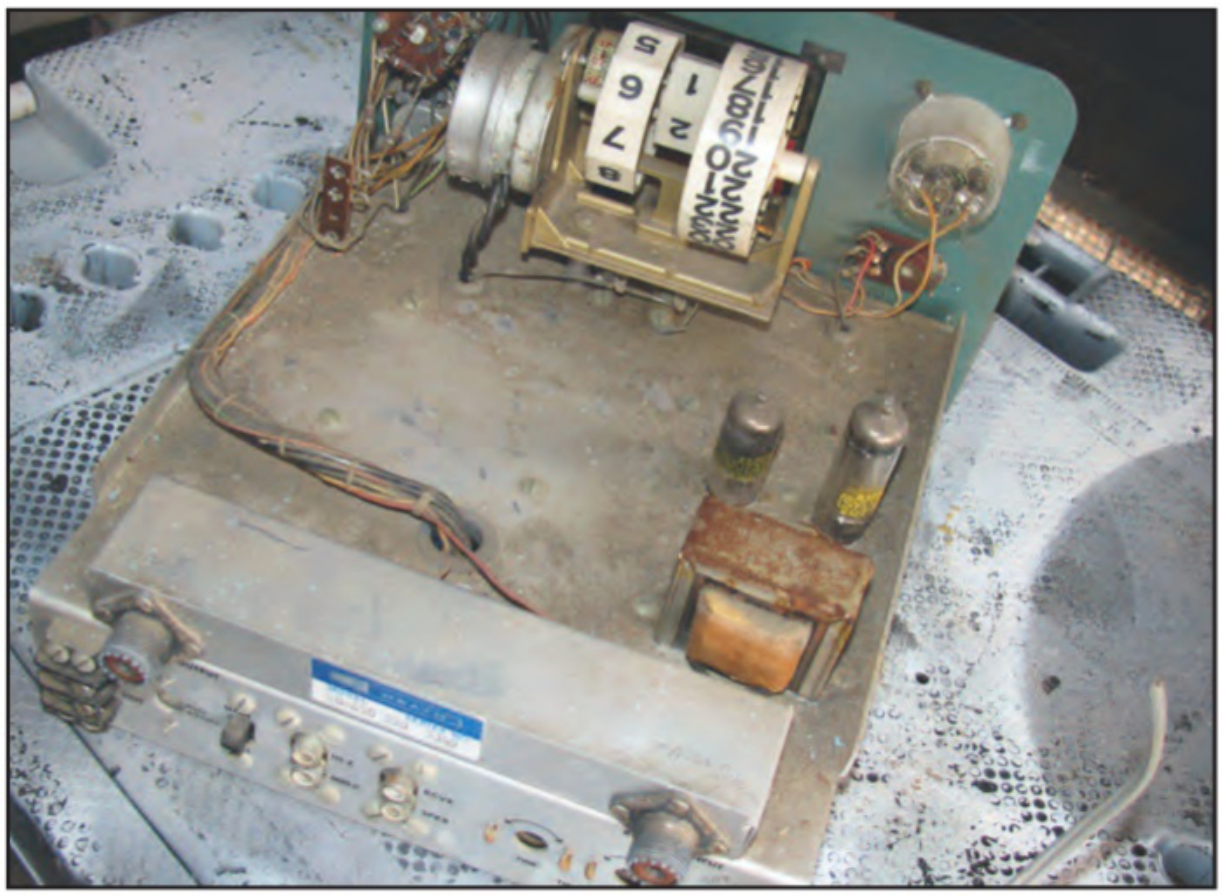


Photo B. Here's a look at the inside. It's really dirty, but I visualized what it would look like after restoration.



Photo C. Simple test gear in the Swap Meet Go Bag.

Resistance: Back to the big dummy load again. A simple resistance check with an ohmmeter would have prevented my buyer's remorse. An antenna dummy load is just a big 50-ohm resistor, an RF connector, and heatsink. I'm still looking for a good kilowatt-rated dummy load for my workbench. I may just make one.

Capacitance and Inductance: Although capacitors and inductors can be bought on faith that they are good, it may be best to test them before buying. This applies to fixed as well as variable versions. Often, these parts found on the surplus market may be unmarked or have some kind of code number. Small inductors may look like resistors, so making sure what's being sold is important. A capacitance / inductance meter will easily verify what's what.

So far, these surplus shopping hints are focused on components. But what about complete products, like station accessories, receivers, transmitters, or transceivers?

Other than taking a close look at the cosmetic aspects, unfortunately there is not too much to examine. I have seen at least one local ham drag around a small generator as he browses the swap meet, but I am not that ambitious.

On the other hand, if the unit is small and battery-operated, such as a VHF / UHF handheld, simply asking for a demonstration should suffice.

For larger items, I recommend asking whether or not there is a guarantee — either money back or trade for something else. If this is not possible, it's best to pass and not take the deal. One more thing I do to help reduce buyer's remorse: Limit the amount of money to spend on any surplus item bought from a stranger (*and sometimes, even friends –WY*).

The Notepad

The notepad is useful for making notes on the items purchased and from whom, and especially any reference information from the seller, such as where the item came from, or its history. It would also be a good idea to note how much you paid for the item, in case you want to sell it later.

Perhaps one of most important things in the notepad is a list of what you are looking for. It is exactly like grocery shopping — do not buy something if it is not on your list. Of course, deviating a little from this can be acceptable, and I often violate my own rule on this.

For example, I have a standing list of vacuum tube types for my Collins, Heathkit, H. H. Scott, and McIntosh

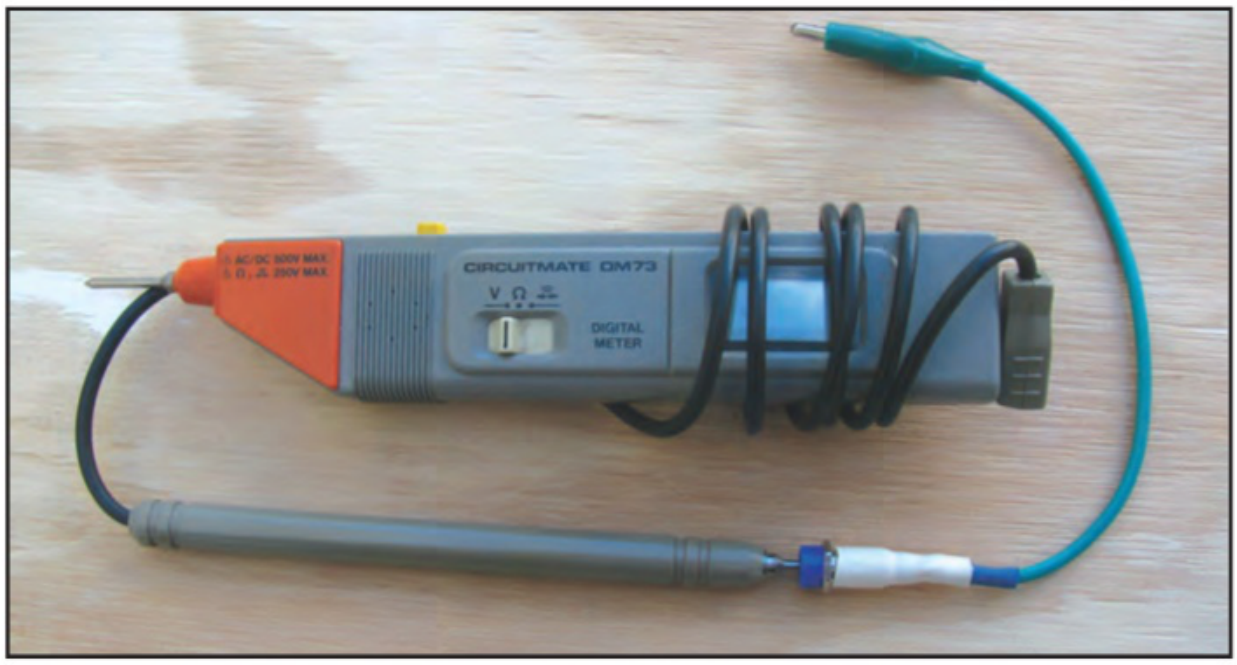


Photo D. A handy probe-to-clip adapter like this enhances the usefulness of any meter.



Photo E. My meter tester is housed in a 99-cent plastic electrical box. The battery is externally mounted.



Photo F. The back of the meter tester has a cellphone belt clip for easy transport.

gear. This helps me focus on tubes I need, rather than finding a "grab bag" of miscellaneous tubes I may never use.

The Best Items are "NOS"

New Old Stock (NOS), is a term often seen on items for sale on eBay. Usually not guaranteed because of the item's age, these items can be risky to buy, but can be a very good value.

Photo G shows an assortment of NOS components I recently bought. I probably have at least 10 lifetimes' worth of passive components in stock, ready for my next project or repair job.

An Etiquette Reminder

When taking steps to avoid disappointments (testing anything), always ask for permission to test the item or items before picking anything up. I have never come across anyone refusing my quick check, but some people may not allow you to test the item. If the seller does not allow you to test the item, respect the answer, and move on.

Next Steps: Cleaning and Verification

In my mind, the mission is not complete until the items are finally verified and either incorporated into a project or put away in storage.

The first thing I do upon returning from the shopping trip is a good cleaning. Since my lab is in my house (spare bedroom), I want to make sure I do not bring unwanted critters, insects, or other vermin into my house.

Similar to a restoration project, I brush and wipe away the dust, inside and out of units or modules or complete prod-

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On the Cover...

Here's why you should always submit a log when you operate in a contest … the Scandinavian Amateur Radio Teleprinter Group (SARTG) team at EA8DED in the Canary Islands had prepared well in advance for last year's CQ World Wide RTTY DX Contest (results article on page 15; complete scores begin on page 102). All the equipment and antennas were working well … and then the power went out across Tenerife Island for 11 of the contest's 48 hours! But the group persevered and ended up winning their category (multi-operator single-transmitter low-power), not only for the Canary Islands but for all of Africa! (Being the only entrant from Africa in that category didn't hurt, either.) Lesson: Send in your log. You just never know when you might win!

The team at EA8DED consisted of five stalwart Scandinavian RTTY enthusiasts, (L-R) Charlie Carlsson, SM4RGD; Ewe Hakansson, SM7BHM; Anders Nordgren, SM7GXR; station owner Kari Hirvonen, OH2BP; and Vaino Isomaa, OH9GIT.

EA8DED is located in Puerto de la Cruz on the island of Tenerife, about 140 meters (460 feet) above sea level. Equipment includes two ICOM transceivers, an IC-7800 and an IC-7300; a Butternut HF-2V vertical for 80 and 40 meters, a SteppIR beam for the lower bands on a 5-meter (16-foot) mast, and an EA8DED Multiple Radio Master. That's a station controller designed and manufactured by Kari that greatly simplifies switching bands, radios, and antennas in a multi-op contest setting and making sure that only one transmitter is on one band at a time. For information, see the EA8DED Facebook page. *(Cover photo courtesy of OH2BP)*



Photo G. An assortment of NOS (new old stock) components for future projects.

Photo H. The Heathkit SB-630 Station Console after refurbishment.



ucts. The Station Console is one of my favorite "bad and dirty" projects. It was so dirty, I left it sealed inside the trash bag and in the garage for a few days before I cleaned the grime out.

Brushes, rags, and a shop vacuum cleaner remove surface dirt, dust, spider webs, and other particles. This is good enough for the preliminary cleaning and assessment.

After a cleaning, I perform additional tests, such as applying power to the unit, or test all vacuum tubes. I use a refurbished Heathkit TC-2 to perform a quick go-no-go test. If a tube is bad, I dispose of it. If it is good on the TC-2, I put it into a storage bin and will later do some more thorough tests with my TV-7 tube tester.

Further cleaning will happen during the refurbishment / restoration of the item. When doing a restoration project, I take the item completely apart, down to the bare chassis. Parts that can be washed are cleaned in an ultrasonic cleaner and detergent.

Remember that dirty Station Console mentioned earlier? The restoration was a success, the renewed version appears in *Photo H*.

Just for fun: Jeri Ellsworth, AI6TK, interviewed me at the Bay Area Maker Faire last year. Her YouTube video is called "Ham Radio at Maker Faire 2019" <https://tinyurl.com/rlrbp4r>. Jeri is an inventor, Maker, entrepreneur — and newly-licensed ham. She took and passed all amateur radio license exams in one sitting. Since the 2019 Bay Area Maker Faire was the last one, the video is an important historical record.

Do you want to see a particular topic in this column? I am always open to suggestions. – *73, Wayne, KH6WZ*

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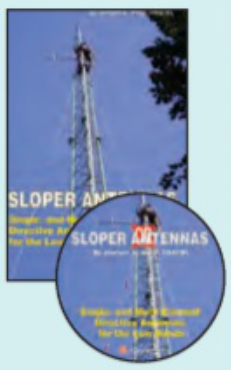
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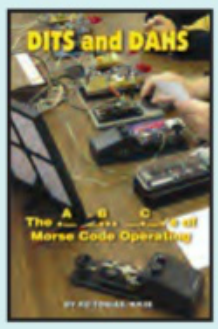
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LEARNING CURVE

BY RON OCHU, KOØZ

Lightning Protection

Lightning. It's a natural phenomenon that "sparks" every ham radio operator's interest. It's not possible to be in our hobby very long before hearing "horror stories" involving ham friends' unfortunate encounters with Mother Nature's electric personality. March is upon us and this month heralds springtime, a time for cold air masses to collide with warmer, humid air masses. These "collisions" result in stormy weather and that means lightning discharges. Lightning is awe-inspiring and fascinating to watch from afar. Not so much when the T-storm is overhead and thunderclaps shake your QTH (location) while you hope you can dodge another bullet.

Personal Interest

For the first 21 years of my ham radio career, I was fortunate. I dodged the lightning bullet every time. I would unplug my coax and even put the PL 259 plug (coax connector) into a glass mason jar whenever I heard thunder, or I knew I would be away from home for an extended time. Orwell is right, "Ignorance is bliss."

But ignorance is a false sense of security. Over the years, as I procured "good ham radio deals," I erected a tower and populated it with aluminum antennas. The tower and antennas tend to act like Benjamin Franklin's lightning rod, thereby increasing the odds of getting struck. Of course, I took the standard precautions in regards to grounding my station. I drove an 8-foot copper clad grounding rod into the ground next to my tower and connected a ground strap to the rod. I was protected! Or so I thought. After all, my 40-foot tower had been up for well over 12 years and numerous thunderstorms later, not a single hit.

My Turn…

I clearly remember the year: July 2000. It was just a little over a week before the Central States VHF Society's annual conference in Winnipeg, Manitoba. I was looking forward to it.

However, some tower maintenance was in order before leaving for Canada from Missouri. Earlier in the afternoon, my neighbor helped me trim my sugar maple tree back from my tower. It was a sunny, hot, and humid day, so afternoon thunderstorms were a possibility. After we finished the tree trimming, it was time for dinner. A nice pasta dish and a "cold one" to wash it all down in air-conditioned comfort was just too inviting. In fact, it was so relaxing, that I barely heard the approaching thunderclaps. Suddenly, there was a bright flash of light outside the dining room window and an immediate explosion overhead.

My neighbor asked, "What was that?"

I already knew the answer. I replied, "It was a lightning strike and way too close for comfort." I looked at my tower, antenna (*Photo A*) and house from my neighbor's window. Nothing seemed amiss, melted, or smoking from the outside. I finished my pasta plate and 10 minutes later went to my QTH to check my shack.

Ozone and Dielectric

As soon as I entered my home, I noticed that all the lights were off. "Hmm … must be the circuit breaker," I thought to myself. I grabbed a flashlight, headed downstairs to the basement. My circuit breaker and ham shack were at the foot of the stairs. Three-fourths of the way down the staircase, I could smell the unmistakable aroma of ozone and melted dielectric. Not a good sign. Just as I suspected, the circuit breaker panel was tripped. I switched all the circuits and my home's lighting and air-conditioning came back on.

I looked in my shack and I noticed that some of my coax connectors had been blown off the cable ends and were now lying on the floor, scarred with burn marks. My computer would not turn on,



Photo A. Author's HF Yagi on top of his tower at his QTH in Missouri. (All photos by KOØZ, unless noted)

**Email: <ko0z@cq-amateur-radio.com>*

my AC (alternating current) to DC (direct current) Astron 35M power supply was useless. None of my rigs were operable. My Peet Brothers weather station computer was out of commission. About the only thing in the shack that worked were the overhead lights. Although none of my equipment was connected to any outside antennas, I had not disconnected any of my equipment from the household AC. I did have surge protectors on each AC outlet.

I had now located the source of the ozone and burnt dielectric smell. As reality began to settle in, I was curious to find out why had my plug-in socket AC surge protectors failed? AC line surge protectors use MOVs (*Photo B*). According to Wikipedia, "A Metal Oxide Varistor or (MOV) is a voltage dependent, nonlinear device that provides excellent transient voltage suppression. The Metal Oxide Varistor is designed to protect various types of electronic devices and semiconductor elements from switching and induced lightning surges."

I am here to tell you that is true, up to a point, but don't be foolish enough (like I was) to bank on it. When I opened the surge protector (*Photo C*) all I found was two, thin, solder leads where the MOV had been. So where was it? The voltage / current surge from the lightning strike vaporized the MOV and I found the entire inside of the enclosure was coated with the former MOV. It valiantly tried to do its job, but it was vaporized in the overpowering process and the lightning surge took it and my precious ham radio gear to oblivion. MOVs are fine for typical electrical line voltage transients caused by voltage demands and load shifts, but don't count on them for lightning protection.

Further Damage

None of my radios, a Kenwood TS-440 and a Kenwood dual-band VHF / UHF rig, were connected to coax at the time of the strike. However, they were connected to my Astron 35M power supply and it was plugged into the household electrical outlet. Anything that was plugged into the shack's household current was fried internally. My rotor control, my radios, my television, and my desktop PC. Although, my antennas were unplugged from the rigs, not all of my rigs were grounded to a single point ground. The lightning surge sought ground. It found ground through my home's electrical system ground.

Not only were my shack's electronics damaged or destroyed, my garage door opener motor's electronic control board was destroyed, and my home stereo system and television needed replacement. I thought I had listed everything damaged for my insurance claim. Not so! When I flew to the CSVHFS 2000 conference in Winnipeg, after we reached cruising altitude, I plugged my headphones into my Sony CD player (remember those?) only to find out it didn't work. I even put in new batteries. Suddenly, it dawned on me that my CD player had been plugged into a wall wart (*Photo D*) in my bedroom and the lighting strike even took that out. It served as a cruel reminder that despite my diligent efforts, I hadn't discovered every casualty. Still, I was lucky. I hadn't suffered a structural fire and my major appliances were still working. But what about my antennas?

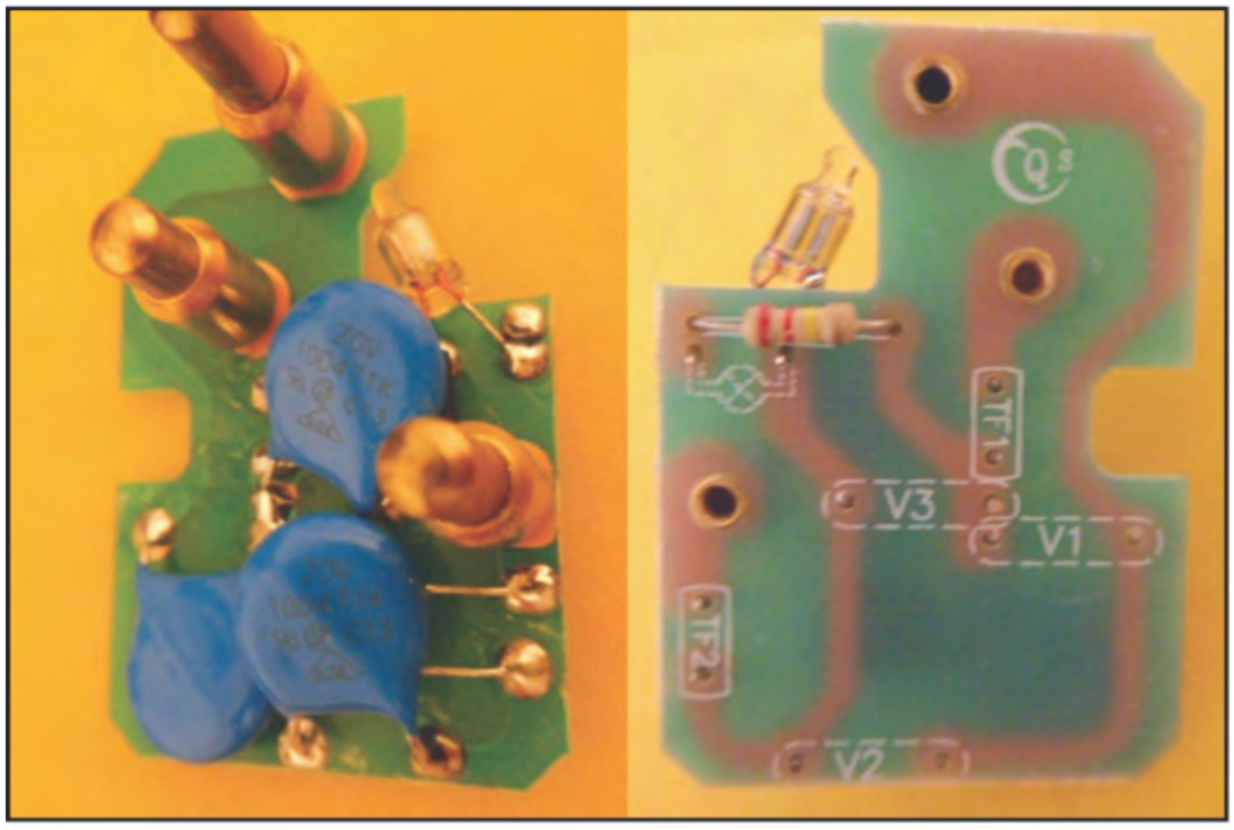


Photo B. The blue discs are metal oxide varistors (MOVs). They are a fine addition to a ham shack, but don't rely on them solely as first-line defense against high voltages induced by lightning. (Courtesy of Wikimedia Commons)



Photo C. A power strip with surge protection. The surge protection is provided by a MOV. Don't be lulled into thinking that your shack's equipment is fully protected against lightning-induced voltage surges. (Courtesy of Wikimedia Commons)

Point of Entry

When I returned from Canada, I lowered my antennas from the tower to test them. My 2-meter and 70-centimeter Yagis were fine. Unfortunately, I couldn't make the same claim regarding my Mosley TA 33 HF Yagi. I could see burn marks and some scoring on the TA 33's driven element that was attached to the coax center conductor. The shield side of the driven element looked fine. But, upon further inspection, I discovered the trap (parallel-tuned circuit that looks like a canister) was vaporized. When I removed the trap's outer, aluminum covering the RF coil was partially gone. The RF coil that remained alternated between being blackened or vaporized. I could tell where the coil started and ended, but everything in the middle was gone. Where did it go? The aluminum sleeve provided the answer. Inside the sleeve, I could see what remained of the coil in its vaporized form coating the interior of the sleeve that once housed the entire RF coil trap. I had now discovered the point of entry. I didn't even bother to check the coax because along

its length I could see holes burned through the outer jacket. All-in-all, I lucked out. My lightning strike could have been more severe.

Assessment

There's nothing like a fried shack to provide the impetus for assessment and improvement. In a word, my shack grounding stunk. I had taken precautions and lulled myself into thinking that I was reasonably protected. No use crying over spilled milk or in my case, fried ham equipment. Consequently, I brought some of my burned parts to share my experience with my local radio club. Since then, I've learned a great deal more regarding lightning strikes and how to mitigate lightning damage. There are several takeaways, but the two most important are:

• First, have a single-point earth ground system (*Figure 1*). *Do not* use a daisy chain ground (*Figure 2*) because each piece of equipment relies on the other piece for grounding and not all them may be at the same ground potential. That's a recipe for a whole host of problems including ground loops.
• Second is to keep lightning induced voltage out of the shack.

Lightning strike damage occurs when there is a significant voltage potential between your shack and an earth ground. If you could instantaneously raise the potential of your shack to that of the lighting strike, then you wouldn't have a problem. Obviously, that's not feasible. Instead, experts recommend building a single point ground for your shack. Each tower leg needs to be attached to the earth ground. Each antenna needs to be attached to the same ground as does your shack and home electrical service. For more information, I highly recommend reading the excellent book, *Grounding and Bonding for the Radio Amateur*, by Ward Silver, NØAX (published by ARRL, see <https://tinyurl.com/uvrr5rr>).

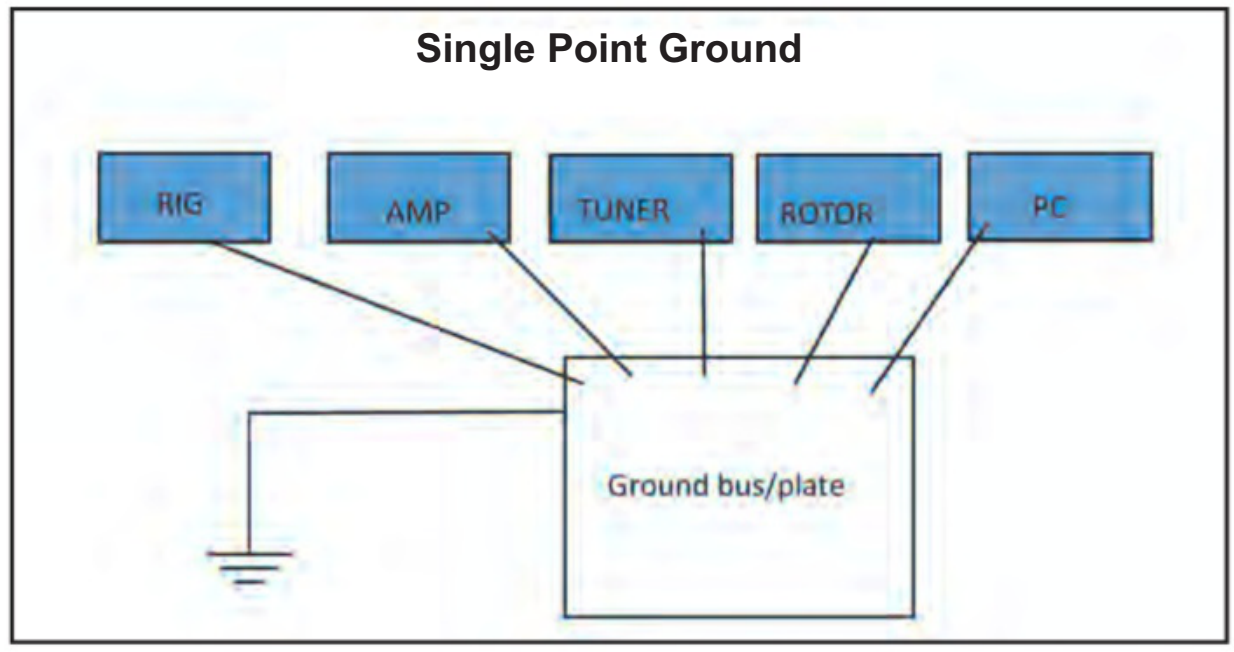


Figure 1. A single-point ground system is the safest and recommended way to ensure all your equipment is at the same potential as earth ground.

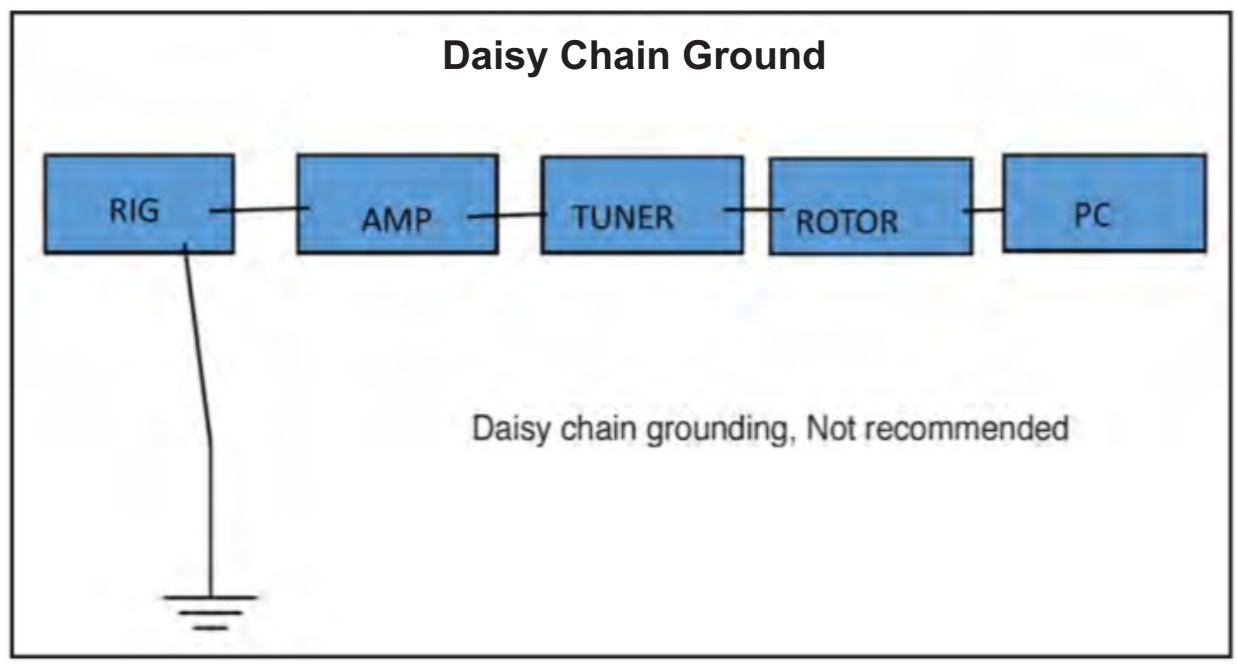


Figure 2. Daisy-chain grounding is not good grounding. Each piece of equipment may be at a different voltage potential that can cause a whole host of problems such as RF feedback, ground loops, and a potentially poor earth ground to all of the equipment.

Shack Entry

Once the ground is in place, the next step is to keep as much of the lightning strike voltage outside of the shack where it belongs. Strange things happen when lightning seeks ground. Consequently, give lightning as direct a path to ground as you can afford. Voltages and current from nearby lightning strikes can be induced into nearby conductors, such as coaxial cables and rotor cables, just to name a few. Although these lightning-induced voltages and currents may not be as strong as a direct hit, they can nonetheless wreak havoc. To increase your chances of rig survival, coaxial "lightning protectors / surge protectors" can help. I dislike the term lightning "protector" because without a good, single-point ground system, any protection it may offer is severely minimized.

Lightning Surge Protectors

The commercial ham radio market offers a lot of lightning / surge protector choices. There are some important criteria to consider when looking at all the available choices. First is how easily and effectively can the lightning protector be attached to ground? My preference is to attach the device directly to ground. Devices that use wires to connect to ground (*Photo E*) can add inductance. If one requiring wire is used, then the conductor (wire / braid strap) needs to be as short as possible. Remember, your lightning protector is only as effective as your single-point ground.

The next criterion to consider is how quickly the device will respond to a lightning strike. Lightning protectors equipped with gas-discharge tubes / pellets react to a lightning hit very quickly, typically 8 to 20 microseconds, and some brands offer tube / pellet replacements. Recently, a PolyPhaser engineer informed me that lightning protectors with inductor-filter protection respond even more quickly (nanoseconds) to lightning strikes than the gas pellet ones.

Another criterion to be aware of is the device's frequency response and RF (radio frequency) wattage rating. What range of RF frequencies will the in-line

coaxial lightning surge protector operate within? For example, an in-line RF lightning protector may only be good to 30 MHz with an RF wattage rating of 300 watts. If you're running an HF amplifier, better to get a protector rated higher than the amplifier's output. Be sure to get a protector that will work on the frequency band you're operating. In addition to HF (high frequency) devices, there are protectors rated for VHF (very high frequency) all the way through to microwaves at various power output levels. Another note, be sure to get the protector with the correct coaxial connectors for your application, e.g. SO-239 female / male, N-type connector female / male, etc.

Lightning Protection Origins

Researching this article, I came across an interesting tidbit of information regarding the origins of lightning protection on the Mouser Electronics website, <https://tinyurl.com/u8t6f3j>. "The earliest reference to experiments involving lightning was Benjamin Franklin's kite experiments in 1752. However, it was in 1859 that Yale University described the use of the first spark gap protection solution. The document uses Franklin's experiment to harness the energy of a lightning storm. The kite was tied to an insulated post where the metallic string going to the kite was connected to a brass ball on the post. A second brass ball was grounded with a 2-inch gap between it and the isolated ball. If the energy on the kite string became too intense, an arc would occur between the two brass balls to conduct the energy to ground." (*Photo F*)



Photo D. Typical "wallwart" found in any ham shack. This one charges a DMR (Digital Mobile Radio) handheld.

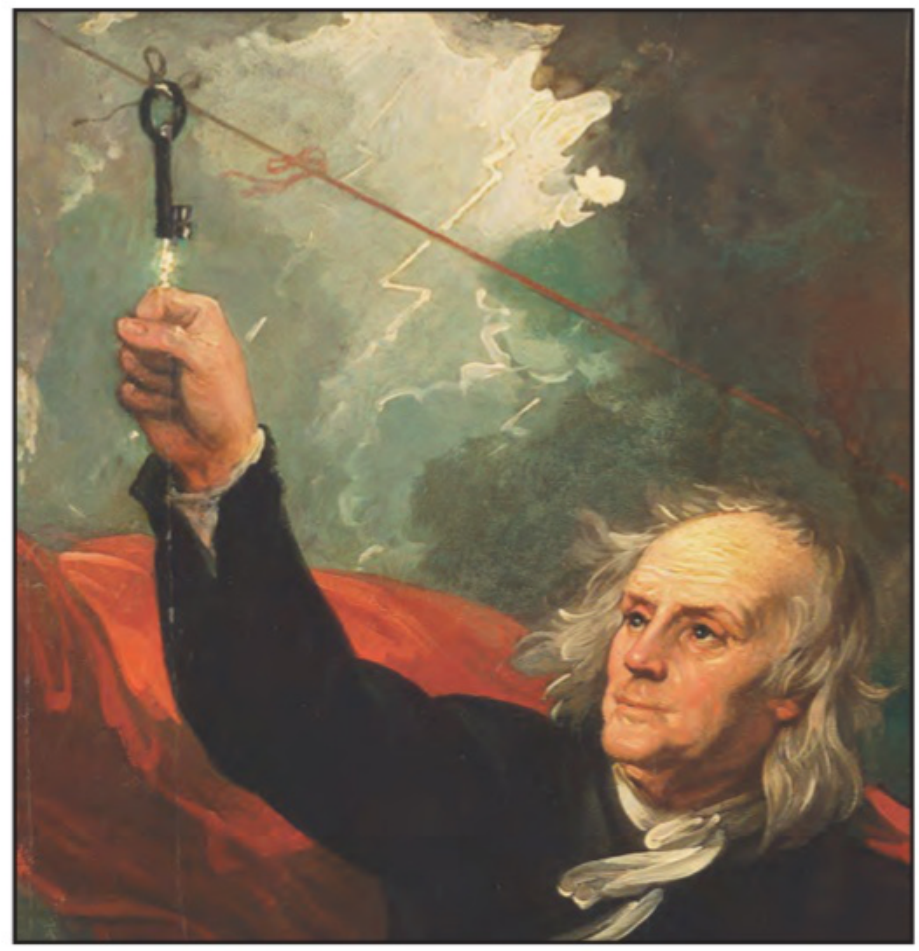


Photo F. Artist's depiction of Benjamin Franklin's famous lightning experiment using a kite and a key. (Courtesy of Wikimedia Commons)



Photo E. MFJ coaxial surge protector. Note the screw and washer to attach a grounding wire. It's highly recommended to keep wire lengths short.



Photo G. PolyPhaser surge protector with a gas discharge tube (GDT). The one pictured is rated 1.5-500 MHz at 2 kilowatts; 50-220 MHz at 375 watts; and 220-700 MHz at 125 watts. This model IS-50UX-CO has female SO-239 coax connectors. Note the flange that can be easily connected to a bus panel, thereby ensuring a good ground connection.

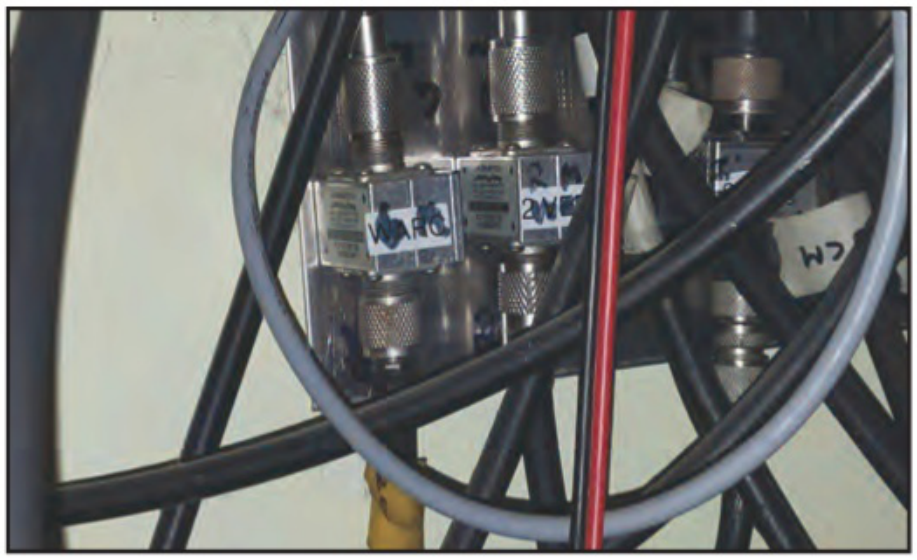


Photo H. I use an aluminum sheet to connect all my PolyPhaser surge protectors. All my PolyPhasers are at the same ground potential. A ground wire to an 8-foot copper grounding rod outside the shack is bonded to the aluminum plate. Another grounding wire connects to a 1/2-inch copper water pipe which serves as a ground bus for all my station equipment.



Photo I. PolyPhaser makes surge protectors for antenna rotor control cables. Don't forget to include the rotor cables in your overall grounding design.

Spark gap discharge is still employed today, but coaxial surge protection now uses GDT (gas-discharge tube) and inductor-filter protection.

GDT

Gas-discharge tubes or pellets have an inert gas enclosure between the coax's center conductor and ground. While transmitting through the lightning / surge GDT protector, the RF is not affected by the gas tube / pellet. However, when a high enough threshold voltage is reached, the gas ionizes and within microseconds, the center conductor will conduct to ground. The gas discharge tubes are designed to withstand many impulses without destruction or loss of the initial characteristics (typical impulse tests are 10 times x 5-kiloamps impulses for each polarity). The second surge protection method uses an inductor-filter system that reacts even more quickly (nanoseconds). PolyPhaser makes lightning surge protectors and the company offers great support (Photo G). I highly recommend their online technical articles for more information <https://tinyurl.com/vu2xnss>.

Lightning Surge Protector Sources

Several ham radio vendors stock commercially-manufactured lightning surge protectors: Alpha-Delta, Diamond, MFJ, PolyPhaser and Times Microwave are some of the well-known manufacturers. Take the time to research your needs. What frequency and output power do you intend to operate? How easy is it for me to ground my lightning surge protector? Some lightning surge protectors offer replaceable gas discharge tubes / pellets. Some are flimsier than others in terms of construction.

For me, I am partial to PolyPhaser. This company has been in the business for quite some time and many commercial radio installations use their products. Although PolyPhaser does not offer replaceable GDTs, they are quite effective and they can withstand some nearby strikes. I especially like that their products come equipped with a flange that readily allows them to be securely fastened to a metal ground plate as part of the single-point grounding system at my shack (*Photo H*). That way, I don't have to rely on a large-gauge wire to connect to ground from my coaxial surge protector. In addition, keep in mind that radio peripherals need surge protection as



Photo J. KC9ULA saw sparks falling from the utility pole between our QTH and our neighbor's. My HF Yagi is about 70 feet away from the pole.

well. Sometimes, we forget about telephone lines and rotor cables (*Photo I*). Surge protectors are made for those items as well.

Surge Protector End of Life

From what I've been able to research, GDT surge protectors without replaceable tubes are not necessarily one-time shots. Sure, if the protector is met with a large inrush of voltage, then the gas discharge tube / pellet will be expended. Otherwise, a GDT surge protector is capable of "surviving" several limited induced voltage surges. So, how will you know if your GDT's life is extinguished? Glad you asked, I have a short story for that.

Several months ago, just before turning into our driveway during a thunderstorm, my wife Debbie, KC9ULA, saw a bright flash, immediately heard a huge thunderclap, and saw sparks raining from a utility pole between our QTH and our neighbor's home (*Photo J*). This utility pole is only about 70 feet from my HF Yagi. When she told me about it, I expected the worst. Now, however, all my antennas and feedlines have PolyPhaser surge protectors connected to a single-point ground. I turned on my radios and everything came to life. All my antennas were working except for my HF Yagi. The SWR (standing wave ratio) was high. I put my antenna analyzer in line, and it confirmed the high SWR. I disconnected the coax from the antenna going to the surge protector and the analyzer indicated a fine SWR. My PolyPhaser had done its job. My HF Yagi antenna induced enough voltage to ionize the gas in my GDT one last time. Sure, surge protectors can be pricey, but so is replacing a shack's equipment, even if it is covered by insurance, not to mention the hassle of replacing the gear and time spent off the air. I view them as inexpensive electronic insurance policies.

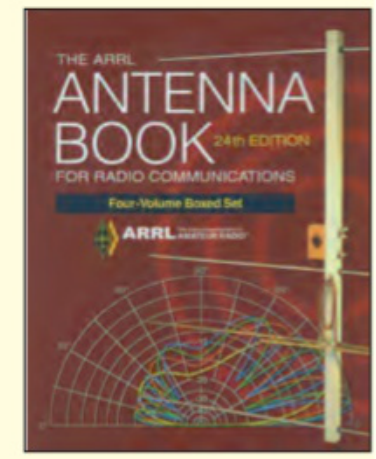
Zapped

Trust me, I know from personal experience that you don't want to experience the aftermath of a zap in the shack due to lightning. Taking the time and going to the expense of building a good, single-point ground with RF surge protectors is well worth the effort and expense. Properly installed RF surge protectors combined with a good ground system won't totally prevent damage from a direct lightning strike, but they'll go a long way toward keeping most of the harmful voltage away from radios.

– Thank you for reading CQ, and very best 73 from Ron, KOØZ

what's new

The ARRL Antenna Book for Radio Communications 24th Edition



Updated and revised for 2020, the Antenna Book packs 80 years of antenna know-how into a four-volume boxed set. The *ARRL Antenna Book* can help you build an entire antenna system for any ham radio application you can think of.

Volume 1 covers antenna fundamentals from monopoles to multi-element arrays. It also delves into propagation and antenna modeling.

Volume 2 covers all types of antennas used for HF / MF / LF, from trail-friendly long wires to a massive tower farm.

Volume 3 covers VHF antennas all the way through microwaves. It also looks into specialty antennas such as stealth antennas for hams stuck in HOA hell and limited space antennas for hams who don't have acres to deploy massive antenna farms. If you like radio direction finding, there is a chapter devoted to the types of antennas used in that activity.

Volume 4 covers constructing your own antenna systems, from selecting the transmission lines, the material and construction techniques, taking line measurements, and antenna system troubleshooting for when Murphy decides to pop in for a visit.

The *ARRL Antenna Book for Radio Communications 24th Edition* is available now and has a suggested retail price of $64.95. For more information, contact the ARRL at 225 Main Street, Newington, CT 06111-1494. Phone (860) 594-0200. Website: <www.arrl.org>.

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GORDO'S SHORT CIRCUITS

BY GORDON WEST, WB6NOA

Non-Resonant No-Where After Winter's Rain and Snow!

(Whaddaya want? Good Grammar or Good Signals? –ed)

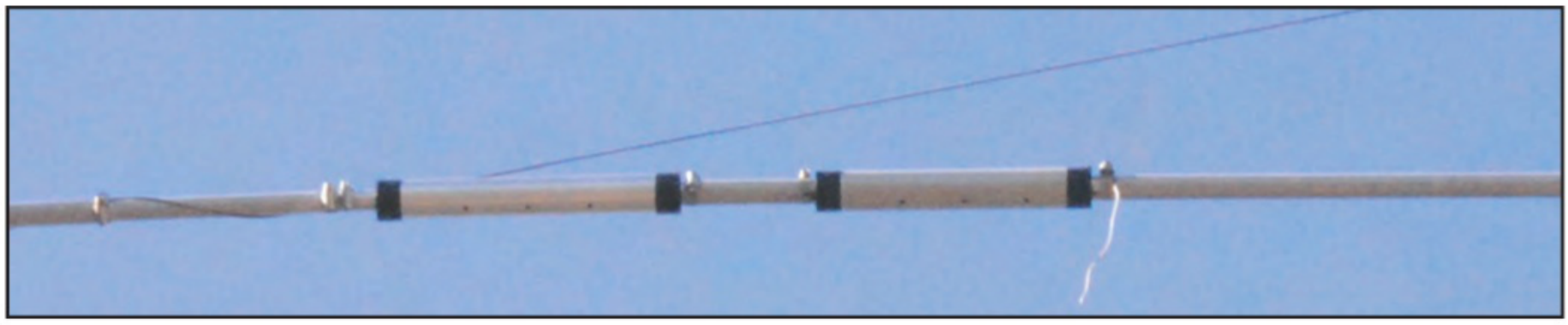


Photo A. Traps need the drain holes to be pointing DOWN.

After all the storms on both the left and right coasts this winter, lots of hams with trap tri-band beams tell me their antennas have gone whacko on being resonant on the 20-, 15-, and 10-meter bands. They are dreading doing the tower climb (see next topic) to take them down, and see what is going on with the antenna.

If your multi-element three-band beam — maybe four bands with 40 meters as an added rotatable dipole — uses traps, the traps likely are NOT BAD! They are probably just waterlogged.

When snow and severe rain get into the trap sections, water starts pooling within the traps, and this added capacitive reactance throws each trap off frequency until the trap dries out completely. This takes lots of warm sun, depending how much water is on the inside of each trap.

The coil within the trap is the tuned inductive reactance (X_L), and just being damp won't usually kill it or affect the X_L. But even a slight amount of rain water clinging to the *inside* of the trap's round *cover* will indeed change the capacitive reactance (X_C), and could change the X_C by hundreds of kHz in each waterlogged trap, especially if the drain holes are not pointing straight down.

Having the drain holes on the trap's outer cover pointing straight down will help get the major water out, but many times they are clogged with dirt, trapping the remaining water INSIDE.

The plastic trap covers on each end are to keep bugs and varmints out, but most covers may allow rainwater inside. Those black trap-end covers are not totally waterproof. That is why there are drain holes. (See *Photos A-D*)

Before climbing the tower, try wiggling the beam a few degrees in each direction to help water escape through the drain holes, hopefully. Or, just let it sit in the sun, and bake the beam for a few days, and then see if resonance is slowly getting closer to where it should be on the three or four HF bands.

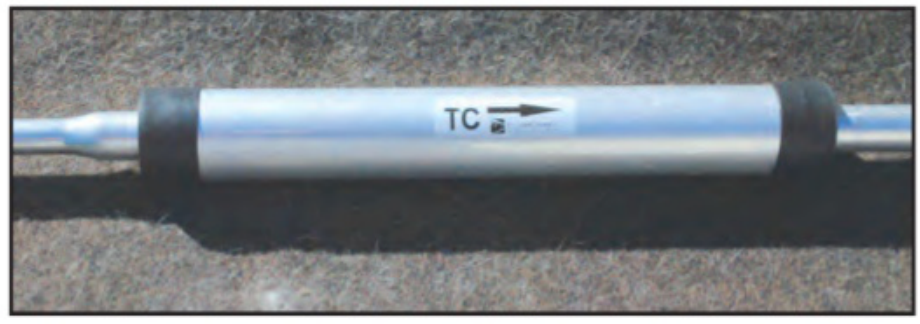


Photo B. Trap cover is grounded to the coil at one end.

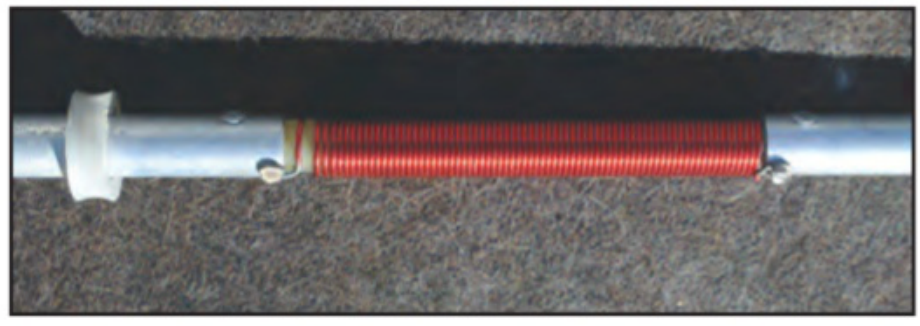


Photo C. Trap coil in great shape after 10 years



Photo D. Get under the plastic cover cap and tighten this self-tapping screw.

**CQ Contributing Editor*
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e-mail: <wb6noa@cq-amateur-radio.com>

Final note: If you can crank down the beam to reachable levels, see if the trap cover TWISTS. If it does, here is an intermittent that MUST be cured. Don't worry, it's easy ... peel back the trap's black plastic cover, locate the self-tapping sheet metal screw purposely shorting the cover at one end to the inner coil, and tighten it.

Traps just don't wear out (unless you were running 1,500 watts in a blinding snowstorm), so let them dry out, and watch the dry-out progression with an SWR analyzer over several sunny days.



Photo E. Low-cost, non-name-brand, two-section VHF / UHF base antenna.



Photo F. Seal this connection outside with weatherproof tape to keep out the water.

VHF, Too…

For those of you with 2-section or 3-section 2-meter / 440-MHz no-name-brand inexpensive white fiberglass collinear base station antennas, they, too, may be waterlogged. (See *Photos E*, *F* and *G*) Water gets into the internal hollow tube screw-joint with the brass elements inside, pools at the base, and unless you get the water out of them fast, they kill the base matching unit.

Water will also get in at the section joints, unless you have them sealed with external self-vulcanizing tape.

Unscrew the sections, and see if water pours out. No water, no problem.

Water? Pour it out, dry out the innards, and see if the VHF / UHF collinear antenna has survived. Hope so.

Climb Your Tower Safely With ZERO FALLS!

The recent escalation of ham operator tower falls to their SK status is a somber reminder about tower-climbing safety. We saw 16 ham operators lose their lives over the last 16 years,

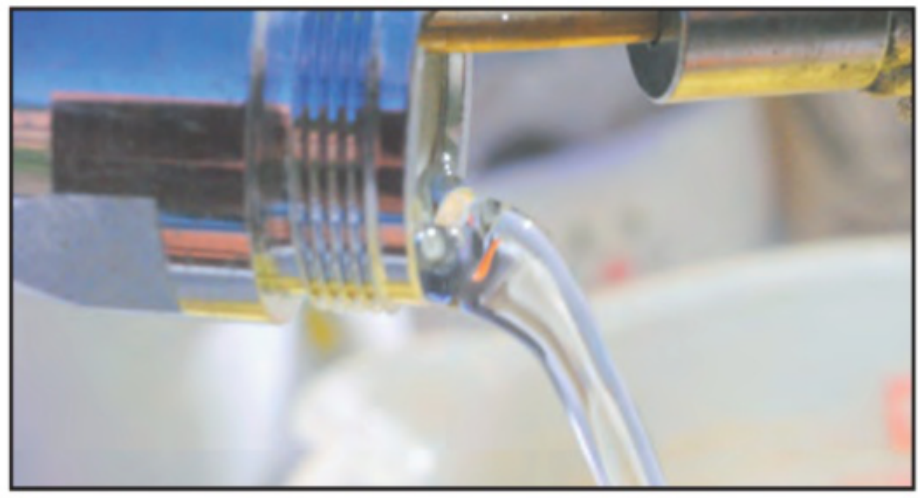


Photo G. After a rainstorm in the South. This antenna is likely inoperable, due to feedpoint being waterlogged.



Photo H. Always use a harness and other safety gear when climbing a tower, and NEVER climb a partially cranked-up tower. Crank it all the way down!

but in the last 5 years, there have been 7 lives lost, four of them in just this last year.

Jim Idelson, K1IR, has launched a new website, ZEROFALLS.ORG, to offer our ham community ways to solve this problem. He has identified root causes of tower accidents, has launched an action call to ACT, and has come up with a zero falls alliance, a non-profit with the purpose of promoting and enabling safety in all amateur tower and radio activities. See his new website, and help spread the word of ZERO FALLS.

Not all ham tower accidents are hapless hams losing their grip and going airborne straight down. Many accidents occur with the ham still strapped to the tower itself, and the TOWER falls with the ham still strapped in.

Before you climb with an approved climbing harness and fall prevention bungee (*Photo H*), put on the hard hat, gloves, and safety glasses, check guy lines, check to ensure you and the tower are far enough away from power lines in the area, and then carefully inspect the BASE of the tower. What? Is the base firmly affixed in the ground?

I have personally seen several well-guyed 60-foot steel crank-up tower base sections on which the bolts securing the base of the tower were so rusted that the base anchor section would soon fail. If the base skeeters out from where it was anchored in the concrete pad, no number of upper supports or guy lines will keep it from falling with ham weight aloft.

Who would have known to check the base mountings — out of sight, out of mind — during the guy wire inspections. That is what Jim, K1IR, is working on with his WWW.ZEROFALLS.ORG website.

You can join him with his campaign by writing him at <jim@k1ir.com>. Watch



Photo I. A great ham radio book from India, available from Amazon.



Photo J. The FABULOUS Italian book on the invention of wireless communications.



Photo K. Italian on the left, English on the right.

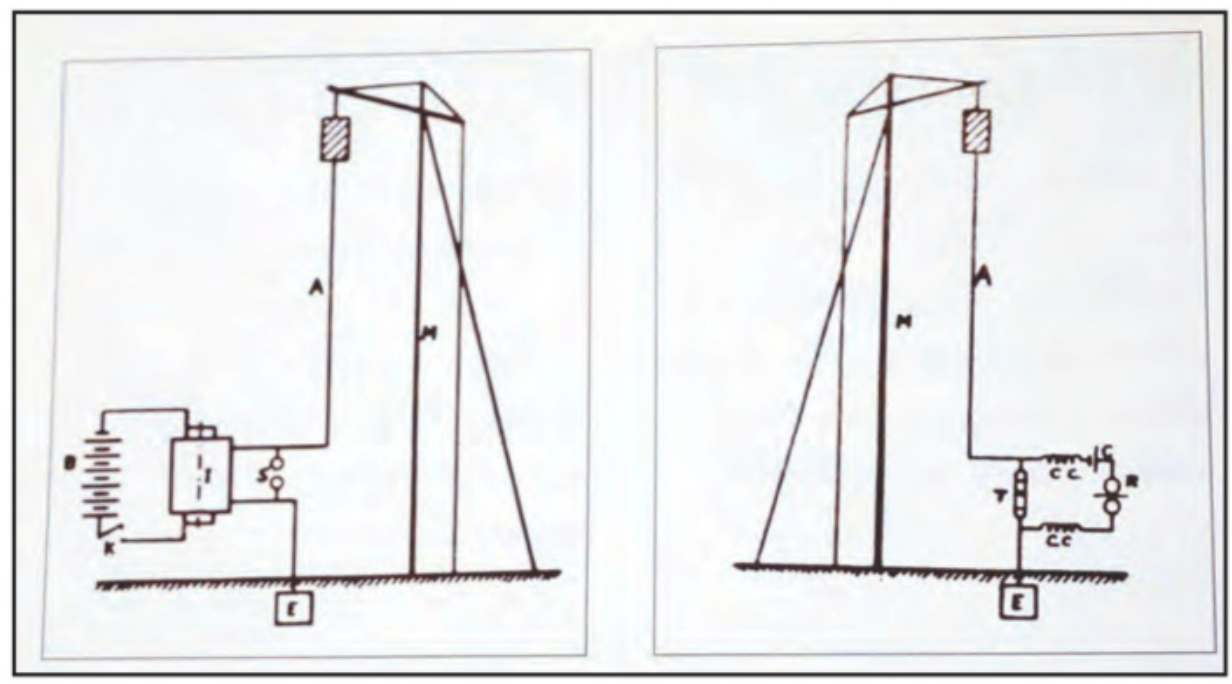


Photo L. Original drawings throughout this book, sent to me by Pietro Begali, the CW key man.



Photo M. Here is where hams hit the hard-packed sand desert floor for a week of training at Quartzfest.

HAM NATION podcasts to see what he is saying about tower safety.

Good Reads About Ham Radio

Two new books arrived for my review from overseas, and neither is a novel. Consider these as books of ham knowledge reference materials.

S. Suri, VU2MY, just released his new book through Amazon, *All About Amateur Radio* (*Photo I*). It is well illustrated, a whopping 400 pages long, and shows how his own country, India, plus all countries of the world, use ham radio for both hobby and emergency communications. S. Suri is a Hamvention® VIP, and his book is an encyclopedia of facts, plus interesting reading ... yes, in English. Amazon has the book. It is very well illustrated. See more at <https://tinyurl.com/r5cbxj4>. It is fascinating reading with lots of photos.

From the Begali telegraph key maker Pietro Begali, I2RTF, I received an autographed *large* hardbound 144-page fully-illustrated book by Franco Sopresini, *Epic Radio History of One Man*. Actually, a lot of men ... Galvani, Volta, Oersted, Ampere, Faraday, Hertz, Marconi, Maxwell, Tesla, and many others.

Every page is side by side languages, with English on the right, and Italian on the left, as well as tons of *original* diagrams of what each of these men added to the development of "wireless." Photos of gear in action, maps of contact distances, antenna photos, technical diagrams of their gear, and more than you would imagine at a wireless museum, but in print (See *Photos J*, *K* and *L*).

You may contact Pietro Begali by writing VIA G.B.BOSIO 22, 25100 BRESCIA BS ITALY.

Quartzfest 2020 Activities

Quartzfest is an annual January ham radio gathering of RVers and tent campers on the desert floor of Arizona



Photo N. The hams may park anywhere they want, usually close to the main fire ring presentation areas.

(*Photo M*). Over 1,000 ham operators attend this gathering — some for all 10 days in their RVs (*Photos N* and *O*), others attending for a day or two by car, and some brave souls doing tent camping on the Quartzfest Bureau of Land Management hard-packed sand (*Photo P*). This is an ARRL sanctioned special event, with lots of seminars (*Photo Q*), along with the special event station, W7Q, that many of you have worked.

This free event is very popular among RVer hams, because the nearby giant RV show which runs concurrently five miles up the road in Quartzite, Arizona. Also, the Gem and Mineral Show is held at the same time, with acres of gorgeous rocks and fascinating quartz crystals.

Quartzfest is in January, so look at the activities that we scored at <www.quartzfest.org>, and join us next year for a day or two, or be a ham "Q" veteran, by attending all week long.

Have a great spring cleaning of your shack, a safety check of the aluminum and wires aloft, and be sure and follow the tower safety tips from the experts.

Happy Spring, and welcome to solar cycle 25!

– 73 de Gordo



Photo O. The Gordo Mobile … ready for training new hams.



Photo P. Tent campers are also welcome … but the ground is awfully hard!



Photo Q. Over 50 seminars are scheduled at the weeklong Quartzfest. Here, Don, N9ZGE, does a technical talk on automatic longwire tuners.

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VHF PLUS

BY TONY EMANUELE,* K8ZR

3.3-GHz Threat Update and HamSCI Workshop to Focus on Auroras

VHF Plus Calendar

DUBUS 3.4-GHz EME contest: March 7th & 8th
HamSCI Workshop - Scranton, PA: March 20th & 21st
144-MHz Spring Sprint: Monday April 6th
222-MHz Spring Sprint: Tuesday April 14th
N.E.W.S VHF Conference: April 16th – 19th Manchester, CT
432-MHz Spring Sprint: April 22nd
Southeastern VHF Conference: April 24th & 25th Gainesville, GA
Microwave Spring Sprint: Saturday May 2nd
VHF / UHF / Microwave Forum at the Hamvention®: May 16th
DUBUS 2.3-GHz EME contest: May 22nd & 23rd

The FCC's Notice of Proposed Rulemaking (NPRM) affecting the amateur allocation at 3.3 to 3.5 GHz became official and was assigned Docket/RM: 19-348, "Facilitating Shared Use in the 3.1-3.55 GHz Band." Since many believe amateurs' loss of the current allocation is a given, some have suggested that our allocation be moved to below 3.3 GHz. Even that is problematic as the adjacent slice of the spectrum at 3.1 to 3.3 GHz is included in the frequency range that Congress has identified for similar consideration. In December, FCC Commissioner Michael O'Rielly referenced the fact that the slice of the spectrum from 3.1 to 3.3 GHz may also be considered as part of the mandate to make additional spectrum available under the MOBILE NOW ACT.[1]

Though the initial comment period concluded on February 21st the deadline for reply comments is March 23rd. As of late January, just under 200 comments had been filed. (*Hmmm … 200 comments vs. 750,000+ licensed amateur radio operators in the U.S. –TE*). Most of those filing comments were amateurs involved with the Amateur Radio Emergency Data Network (AREDN). Formed in 2015, AREDN's focus is to develop and the promote mesh network software for use by amateurs and emergency networks that can be ported to existing commercial hardware on several amateur bands, including 3 GHz. Doing so makes possible inexpensive high speed (up to 144 Mbps) data networks in support of emergency operation centers (EOCs), non-governmental organizations (NGOs) and first responders. Whether it is the result of a wildfire, hurricane, or similar natural disaster, there are times when the existing infrastructure including cell and amateur repeater systems are inoperable. During such times, and where an Amateur Radio Emergency Data Network exists, vital and potentially life-saving emergency communications can continue. This is fundamental to the purpose of the amateur radio service as stated in Part 97.1a, "Recognition and enhancement of the value of the amateur service to the public as a voluntary noncommercial communication service, particularly with respect to providing emergency communications."

It is too late to file comments for or against Docket/RM: 19-348 (there are a few in favor of the NPRM) as the FCC's report on the NPRM is scheduled to be published about the time you read this. However, it does behoove all amateurs who are interested in the bands above 50 MHz to become familiar with the comment filing process as the next threat to one or more of our bands is on the horizon — likely to our allocation at 5.7 GHz. Comments short or long can be filed electronically. See: "How to Comment on FCC Proceedings" section of the FCC website to respond to the next threat.

Auroras and HamSCI

The third annual HamSCI workshop will be held March 20th and 21st at the University of Scranton in Scranton, Pennsylvania. According to a HamSCI announcement, the theme of this year's workshop is "The Auroral Connection: How does the aurora affect amateur radio, and what can we learn about the aurora from radio techniques?" Invited speakers include Dr. Elizabeth MacDonald, NASA scientist and founder of

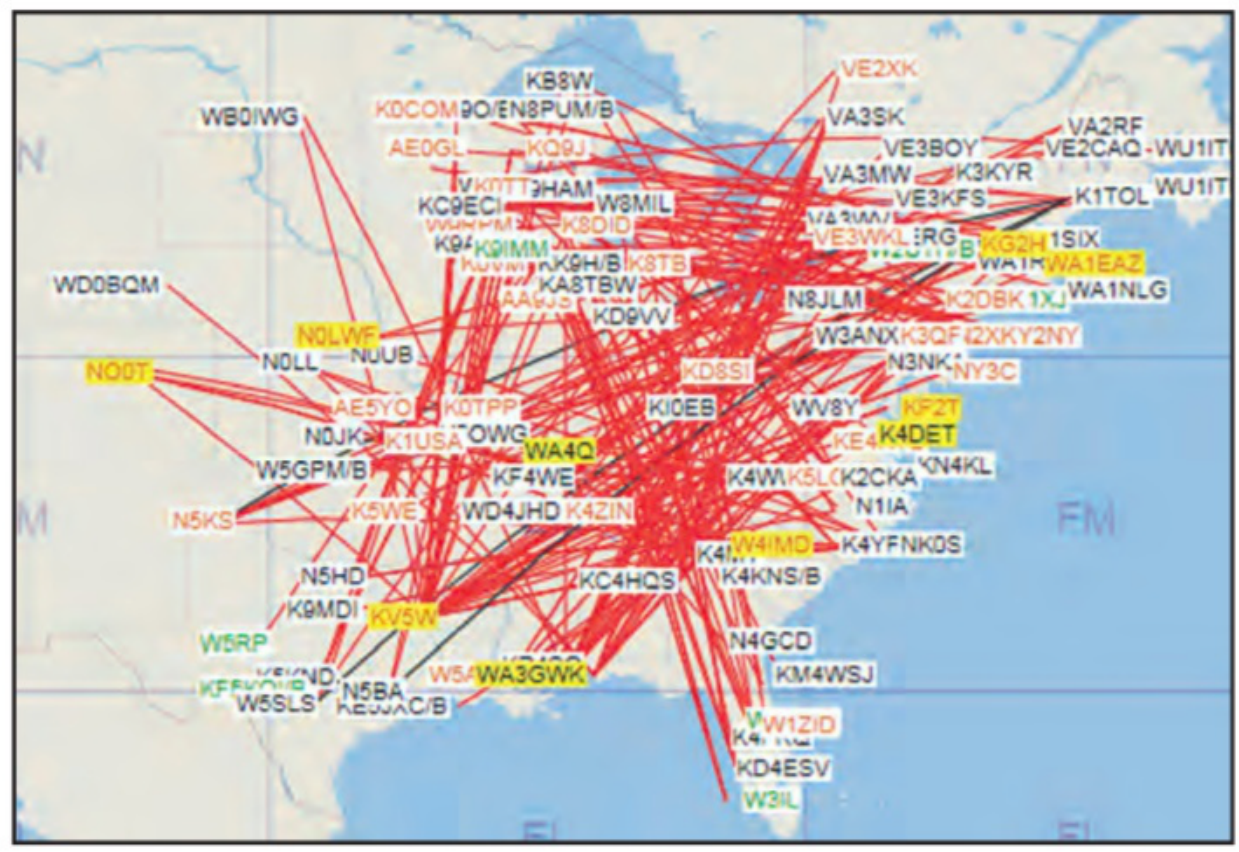


Figure 1. The entire eastern U.S. was able to take advantage of a huge 6-meter band opening on the night of January 7 (Jan. 8 UTC). (Maps courtesy DXMaps)

c/o CQ magazine
email: <k8zr@cq-amateur-radio.com>

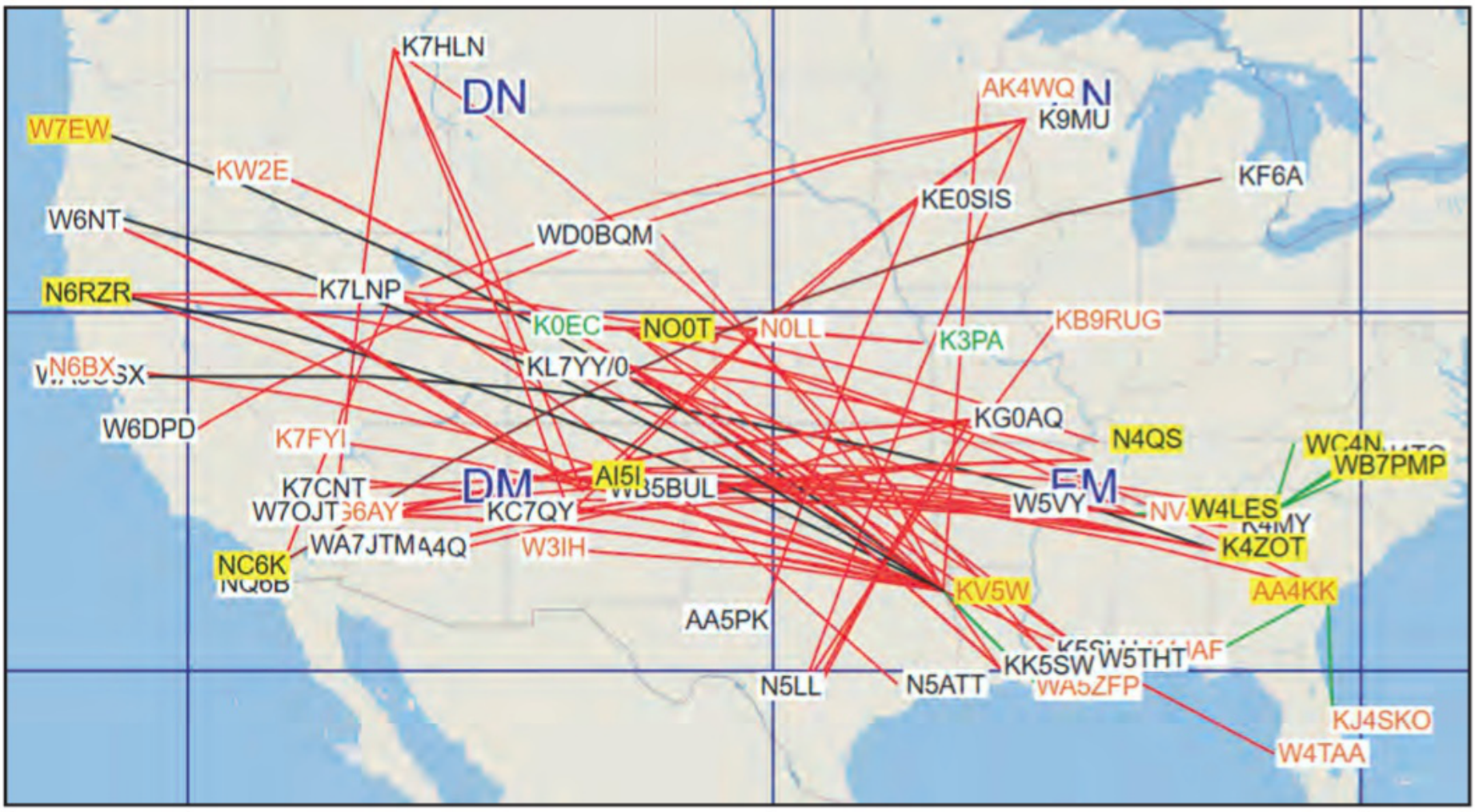


Figure 2. The 6-meter opening on January 9 (1000 UTC) was less intense but more widespread.

Aurorasaurus; Dr. James LaBelle, Dartmouth space scientist expert on radio aurora; and Dave Hallidy, K2DH, veteran amateur radio operator with a wealth of experience in auroral communications. Well-known contester Tim Duffy, K3LR, is the keynote speaker at the Friday night banquet. The annual workshop also serves as a team meeting for the HamSCI Personal Space Weather Station (PSWS) project, funded by the National Science Foundation, its goal is to develop a citizen science instrument for studying space weather from your backyard. The PSWS is led by the University of Scranton, and includes participation from TAPR, Case Western Reserve University / W8EDU, the University of Alabama, the New Jersey Institute of Technology CSTR, MIT Haystack Observatory, Dartmouth College, and the amateur radio community at large.

HamSCI was founded to promote the collaboration of amateur radio operators, as citizen scientists, and the scientific community in an effort to further our expand understanding of radio propagation. See the HamSCI website <https://hamsci.org> for more information.

For those not familiar with aurora and propagation via aurora, it is caused by the interaction of the Earth's magnetic field with the charged particles ejected from the Sun during disturbances such as solar flares. In the aggregate, the charge particles form the solar wind and — if Earth-directed — the particles interact with the Earth's magnetic field, directing them to the magnetic poles. As the particles make their way to the magnetic poles, they interact with oxygen and nitrogen molecules in the atmosphere, creating ions of both elements. When the electrons knocked loose recombine, light is produced — visible aurora.

If the ionization is sufficiently strong it can reflect signals at 6 and 2 meters and, to a much lesser extent on 222 MHz and lesser even still on 432 MHz — radio aurora.[2] The ionization takes place approximately 100 kilometers



Photo A. VE3OIL didn't let a little snow get in the way of a good rover operation in southern Ontario during the ARRL January VHF Contest.

(~62 miles) above the surface of the earth near the E layer and therefore typical communications paths are similar to what one would expect during a single-hop sporadic-E (E_s) opening, i.e. maximum DX of approximately 2,000 kilometers (~1,200 miles.) Typically, distances achieved via aurora are in the neighborhood of 1,000 kilometers or less.

The likelihood that a station will experience an aurora opening varies with geomagnetic latitude, with stations closest to the geomagnetic pole, now located in the Canadian Arctic but on the move,[3] more likely to experience auroras than stations below approximately 40° north latitude. Even in times of high solar activity, stations located south of an arc through South Dakota, Iowa, southern Illinois, southern Indiana, and southern Ohio are unlikely to experience aurora. During the historic aurora in March 1989, aurora was observed as far south as Texas and Florida, but that was an anomaly.



Photo B. The VA3ELE/R team of VA3ELE and VA3TO also covered their planned itinerary despite the weather.



Photo C. The weather was a little better for WA6WDY and N6ZE during their contest rover trip in southern California.

Generally increased solar activity typically found during the peak years of a solar cycle is associated with an increase in auroral activity. However, aurora can happen at any time of year and even during times of low solar activity. The K-index, ranging from 0 to 9, is the go-to indicator for the likelihood of aurora. When the K-index is 5 or higher, aurora is more than likely for stations along the northern border of the U.S. and Canada. K-indexes of 6 or higher are generally recorded only near the peak of the solar cycle. Statistically, auroral events are more frequent around the equinoxes in March and September. The most common explanation is that, at the equinoxes, the earth's tilt is oriented such that it maximizes the interaction of the solar wind and the earth's magnetic field. It would be a bit ironic if during the HamSCI workshop, with its theme of radio aurora, that there was an aurora opening on 6 or 2 meters.

On the Bands

The winter E_s season continued into mid-January with widespread openings on 6 meters on the 8th, 9th, and 10th, with more localized openings on the 12th and 18th (see *Figures 1* and *2*). A lucky few in New England worked YS1RS in El Salvador at approximately 3,500 kilometers (~2,200 miles) on the 12th. In between the E_s openings, decent tropo was experienced on 2 meters and above from the Midwest to Texas and Mexico. A sample of what was worked on 2 meters: K2DRH EN40 and AA5AM EM13 @ ~ 1,000 kilometers, KØTPP EM48 and AA5AM EM13 @ ~800 kilometers, KA9CFD EN40 and K5ND EM12 @ ~1,000 kilometers and KØTPP EM48 and XE2OR DL98 @ ~ 1,400 kilometers. On 432 MHz, using FT8, AA9MY EN50 worked W5LUA EM13 @ ~ 1,000 kilometers.

The ARRL January VHF Contest weekend is not known for great tropo conditions. This year, much of the Midwest and east had to deal with ice, a rain-snow mix or high winds and snow. Though the weather forced many rovers to stay close to home, still others —

BEHIND THE BYLINES...

... a little bit about some of the authors whose articles appear in this issue

John Palmisano, KB8OIS; Robert Giuliano, KB8RCO; Robert Laundra, N8RGF, and Michael Fluegemann, KE8AQW ("Refurbished, Donated and Modified … Putting All the Pieces Together at W8UM," p. 10), are members of the University of Michigan Amateur Radio Club (W8UM) in Ann Arbor. One of the oldest college amateur radio clubs, the station was first licensed in 1913 as 8XA and later held 8AXZ, W8ZUP, and W8AXZ before being issued W8UM by the FCC in 1967 in connection with the university's sesquicentennial. (Tnx W8UM website)

Paul Signorelli, W0RW ("LoJack 'T' Hunt," p. 23), is a regular contributor to *CQ* — but he got that from his mom, **Helen Signorelli, K6KUP (SK)**, who also wrote for *CQ* in the past. Her May 1961, article, "Transmitter Hunts on V.H.F.," is reprinted in this issue on page 31 as part of our ongoing "CQ Classic" series.

Dennis Lazar, W4DNN ("How CW Can Protect You From Dementia," p. 24) is a former *CQ* QRP Editor and a semi-retired doctor of naturopathy specializing in drug-free pain management. He and his wife, Ruthie, K4KLQ (Dennis's former call), enjoy traveling in their RV and operating QRP from wherever it takes them. When they aren't on the road, they live in Port Charlotte, Florida.

George Averill, K4EOR ("Learning Morse Code the Old-Fashioned Way," p. 26), is a frequent contributor to *CQ*, often focusing on topics related to Morse code, including historical articles on American Morse and the use of radio on the battlefields of World War I. He lives in Cataula, Georgia.

Laurie Margolis, G3UML ("CQ Classic: Memories of JY1," p. 34), is a longtime BBC correspondent and member of the CQ Amateur Radio Hall of Fame. His 1999 article just after the passing of Jordan's King Hussein, JY1, is paired in this month's "CQ Classic" series with a 1971 article by his mother, **Sylvia Margolis** ("CQ Classic: Quiet Family Circle," p. 28), who worked for the Radio Society of Great Britain and was a frequent *CQ* contributor herself in the 1960s and '70s.

Anthony Luscre, K8ZT ("Ideas and Resources for Growing Youth Involvement in Amateur Radio," p. 37), is *CQ*'s Microcontrollers Editor, but he has long been involved in promoting ham radio to young people. Anthony is the ARRL Ohio Section Youth and Education Outreach Coordinator and maintains a website with extensive materials and resources for bringing ham radio to youth groups and schools <www.k8zt.com/hry>.

OUR READERS SAY... *(from page 5)*

to use the cap at all or a very small one. This is when you want to catch your eye. I have used this for a light switch left on for an outdoor light not visible from a room unless I look closely through the window to the outside. If I'm moving through the room, or turn my head, my eye is caught a little easier by the LED because of the flickering. This kind of indicator light is best done with a bright amber LED, or at least that's what I like best.

My use of the full-wave bridge was for a five-LED nightlight using around 250 mW. For bigger jobs, I use something similar to your 12-volt design and I have also used inexpensive 120-volt to 12-volt 500-mA-1A switching power supplies / wall-warts. I've made nice 2-watt LED lights this way about as bright as old 20- to 40-watt incandescent lights.

Thanks again and keep 'em coming. I always enjoy your articles even if I think, at times, you oversimplify or don't consider some of the ramifications of your ideas.

– 73 de Phil Karras, KE3FL

WA2NDM responds:

Hi Phil,

Thanks for your email. Your approach is interesting and the flicker approach is a good idea. It is always a pleasure hearing from a technically-oriented reader. Unfortunately, there aren't as many as in the past. When you read my December column, you will see what I mean.

I try to keep the column simple at times because I really want to somehow indicate to the non-technical members of our community that electronics is not a real mystery and if you try to do at least something, maybe somehow the "bug" will bite.

I also hope you enjoy my "think of the future" columns. Considering what amateurs discovered in the past with what they had in hand at the time, who knows what can be discovered by the same "out of the box" thinking of the technically-oriented amateur of today.

– 73, Irwin, WA2NDM

including Russell Beech, VE3OIL/R (*Photo A*) and the team of Peter Prabucki, VA3ELE, and Hugh Duff, VA3TO, as VA3ELE/R (*Photo B*) — managed to execute their plans, albeit with longer travel times between stops, without too much difficulty, i.e. they did not get stuck in the snow. In contrast, the rover team of Woodie Woodward, WA6WDY, and Pete Heins, N6ZE, enjoyed the southern California weather as N6ZE/R (*Photo C*), making just over 250 QSOs on six bands by activating four Ventura and Los Angeles County grids. During their 7-hour stop in the Santa Monica Mountains, DM04qb, the pair managed 150 QSOs.

As was the case in southern California, the weather also cooperated in southern Arizona. VE4MA, N1AV, WA7XX, and N7VD reported a high level of activity on all the bands through 1296 MHz. At least five rovers were active and no less than 11 backpackers participated, hiking to nearby mountaintops to activate the bands to 1296 MHz — many with just with FM handhelds but a surprising number on SSB as well. It seems that the new ICOM IC 9700[4] is having a major impact in the area as at least six were on the air, with a couple of stations making their first QSOs on 1296 MHz during the contest.

Ontario Activity Award

In recognition of its 70th year, the Ontario VHF Association (OVHFA) is sponsoring the Ontario VHF Association 70th Anniversary Activity Award. Open to all radio amateurs, the award requires working 70 Canadian amateur radio stations on 50 MHz and above. Contacts, one per band regardless of mode, must be completed between January 1st and December 31st, 2020. Contact Dana Shtun, VE3DS, at <ve3dss@hotmail.com> for additional details. A handsome certificate, of course suitable for framing, is available for all those who qualify.

73 & CU on the bands, Tony, K8ZR

Notes:

1. MOBILE NOW Act: Making Opportunities for Broadband Investment and Limiting Excessive and Needless Obstacles to Wireless Act.

2. HF DXers know that during times of aurora over the pole paths are subjected to increased absorption generally making HF radio communications, for example North America to Scandinavia, impossible.

3. Fun fact: The north magnetic pole is moving towards Russia at a rate of approximately 50 to 60 kilometers (~30 miles) per year.

4. The ICOM IC-9700 is a multimode transceiver for 144, 432, and 1296 MHz.

AWARDS

BY EDDIE DEYOUNG,* KS4AA

Wallpaper

USA-CA Award Update

500 County Level
DL8OH – Award number 3779 dated December 17th, 2019

1000 County Level
DL8OH – Award number 1921 dated December 17th, 2019

Got a few holes in the wall of your ham shack? Why not cover them with award certificates? Seriously, there are a lot of awards available for just about any style of operating. Some can be earned over a weekend while others can take years or even decades to complete. Are they worth it? Let's take a quick look at some of the possible justifications:

• You learn about the reason for the award. This can be to celebrate a prominent person's life or their achievements; a significant event; anniversaries of the founding of societies, or any number of other interesting reasons.
• You learn a lot of interesting information about the issuing country, such as its history or geography.
• You don't have to patch and paint your shack walls.

A really great source of award information is "The K1BV DX Awards Directory" at <www.dxawards.com>. Ted Melinosky, K1BV, my predecessor as editor of this column, has been working on this project for decades. It is now available online.

Special Event Awards

Many awards are issued for simply participating in an on-air event. Usually, a minimum number of contacts are required to qualify. Some of these events last for a day, while others can last all year. Examples of past events include National Parks On The Air (NPOTA <www.arrl.org/npota>) sponsored by ARRL, and the Canadian National Parks On The Air <https://cnpota.ca>, which each lasted a full calendar year. Then, there are very short-term events that usually run for no more than 48 hours, such as the Famous Museum Ships special event <www.nj2bb.org/museum> taking place June 1-2 this year. Others may last longer, such as the Scouts Jamboree On The Air (JOTA) <www.scouting.org/jota>, which runs for three days each year. Quite often, there will be special callsigns issued which may be your only chance to work it. Commemorative QSLs as well as award certificates often are your reward for participation.

Easy-to Earn Awards

Awards that are somewhat easy to earn: One of the most popular DX awards is also among the easiest to earn. It is Worked All Continents, sponsored by the International Amateur Radio Union (IARU) and administered in the U.S. by the ARRL <www.arrl.org/wac>. Simply work and confirm one valid QSO from each continent on any HF band (except 60 meters). In a DX contest a few decades ago, I worked all continents in 12 minutes from my QTH in Australia. The RSGB (Radio Society of Great Britain) also issues this award <https://tinyurl.com/vuxe3r5> as well as many other harder-to-earn awards.

If you do not chase DX, then another relatively easy award to earn is Worked All States, sponsored by the ARRL <www.arrl.org/was>. Super stations do it routinely in less than a day during contests and QSO parties. A modest station can easily manage it in a few months. QRP might take a little longer.

The Worked All Prefixes (WPX) award is issued by CQ <https://tinyurl.com/yx3vopfb> for working a minimum of 300 prefixes in a single mode or 400 mixed mode. The first hundred prefixes are usually very easy, then the real chase is on to grab the other 200 or 300.

Awards That Take More Effort

Working 100 countries can take anywhere from a few weeks to several years, including getting the confirmations. Logbook of the World (LoTW), ClubLog, and QSL managers have all reduced the time it takes to receive confirmations versus the "traditional" route of exchanging paper cards directly or via QSL bureaus. ARRL issues the DXCC award <www.arrl.org/dxcc> and CQ issues the CQ DX award <https://tinyurl.com/y9rkdrdk>. Many national societies also issue awards for this achievement, such as the Wireless Institute of Australia <https://tinyurl.com/yx5d2g36>. Another CQ award at a similar level of difficulty is the CQ DX Field Award, for confirmed contacts with at least 50 10º x 20º Maidenhead "grid fields." See <https://tinyurl.com/uajfocx>.

Worked All Zones (WAZ) is issued by CQ for confirming a valid QSO with all 40 zones (see map), as defined by the award rules at <https://tinyurl.com/7mlzqhf>. This award usually takes more than a year to earn (*often much more! –ed*). You need to keep an eye on the DX reflectors and DX news channels to learn when some of the rare ones become active, but the fun is in the chase and the reward is a certificate well earned.

Awards that are harder to earn, but definitely worth it, are: The USA-CA award program for working U.S. counties. Currently there are 3,077 of them, and at least 1,200 have regular ham activity at the last survey. The award is sponsored by CQ and was managed for decades by Ted Melinosky, K1BV. The current award custodian is Brian Bird, NXØX. Visit <https://tinyurl.com/3n5dkg6> for the official rules.

The IOTA (Islands On The Air) award, administered in partnership with the RSGB <www.iota-world.org>, can be earned for confirming just 100 official island numbers. Seems easy, but … there are 22 categories for endorsements, which can take decades to earn. Caution: This award can become very addictive.

The topic for the April issue will be lesser-known U.S.-sponsored awards and the May issue will be about lesser-known DX-sponsored awards.

By the way, our award managers are sometimes swamped with applications and endorsement requests, and each certificate is hand-lettered by an artist in New York in her spare time. If you haven't received your award certificate or endorsement, please be patient. Sometimes a polite query will get you an update. Remember, the wait is usually long forgotten after you receive that beautiful award certificate to proudly display in the ham shack. AR

–KS4AA

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Clearwater, FL 33756
<ks4aa@cq-amateur-radio.com>

DX

BY BOB SCHENCK, N2OO

How Do YOU Work DX?

Over my 55 years of chasing DX, my methods for doing so have evolved. In the beginning, I just turned on my radio and tried to work what I could hear. Information was sparse other than what was read in the available monthly magazines at that time, so you never knew just what you may come upon considering the long print lead-time required. In a way, those were the more exciting times of DXing for me. Just turning on the radio and wandering the bands listening for DX forced me to "listen" a whole lot more than I do now. When a new one was found, it truly was more exciting than the current method of finding the pre-announced DX station on a spotting cluster and going to his frequency and start calling. But times have changed.

As I got a bit more serious, I subscribed to the Long Island DX Bulletin which, as I recall, would send out postcards with special announcements. Then came along (for me) Gus Browning's The DXer magazine, Hugh Cassidy's West Coast DX Bulletin, "The DX Bulletin" by Chod Harris (WB2CHO / VP2ML now SK) and later Jim Cain (K1TN), and more recently, Carl Smith's (N4AA now SK) QRZ-DX.

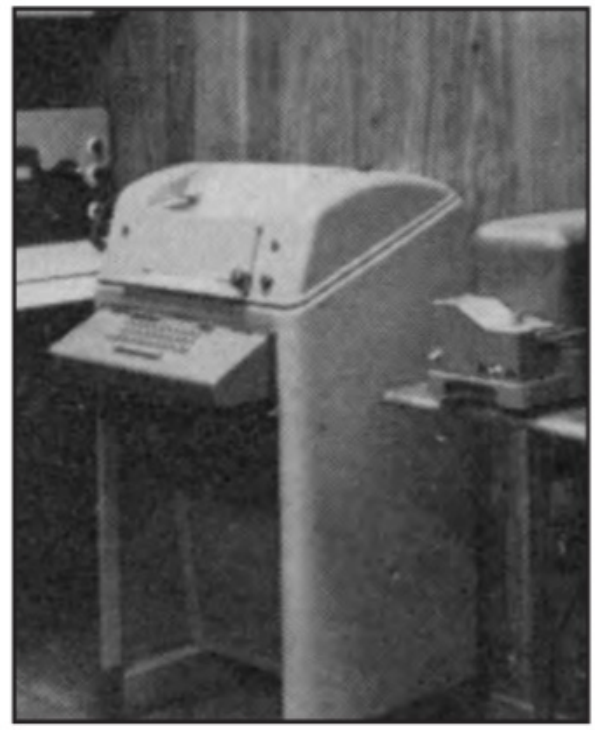
Currently, my information has moved completely online by using the ARRL DX Bulletin service <www.arrl.org/bulletins> as well as the OPDX by Northern Ohio DX Association c/o Tedd Mirgliotta (KB8NW) <www.papays.com/opdx.html>, which are both free weekly services. I complete my incoming information by subscribing to "The Daily DX" by Bernie McClenny, W3UR, which is what it infers — a daily email service providing up-to-date DX information. Bernie even includes additional "as necessary" email bulletins for a complete and timely flow of pertinent DX scoop. <www.daily-dx.com>. There are other sources of online DX news out there, but these are the ones I use here.

Some other DX news sources are "dxnews.com" <https://dxnews.com>, which is run out of Russia, with multiple "editors" from around the world, "DX-world.net" <https://DX-world.net>, which has a worldwide presence; and "425dxn.org" <www.425dxn.org>, which is based in Italy. I avoid online DX blogs. It's just "me." One I am aware of is DX Coffee, which is based on DX-World.net at <https://dx-

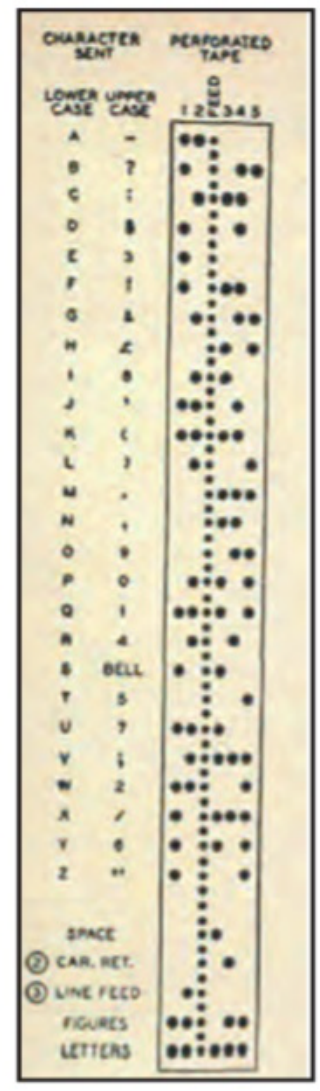
* *Email: <n2oo@comcast.net>*



Since retirement, N2OO has focused on confirming 100+ countries on the 30-, 17-, and 12-meter bands and on finishing off his USA-CA All Counties award (both missions accomplished). He's now focused on working DX on 60 meters.



For those who argue that FT8 isn't "real ham radio," how different is it really from old-time RTTY, in which a big teleprinter (left) – which could be considered a large mechanical computer — decoded and printed the incoming message while outgoing messages were often sent by a tape reader (right)? (CQ file photo)



Reusable perforated paper tape (example above) was used by many RTTY operators "back in the day" to transmit repeating messages. It's not much different from a stored macro for today's computer-based digital modes. (CQ file photo)

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world.net/tag/dx-coffee>. But I welcome information on any and all other online DX-oriented news outlets. I'll gladly include in future columns.

Locally, our DX club, the South Jersey DX Association <www.sjdxa.org> has a "members only" discussion list where we sometimes post current DX station activity. We do this as a miniature version of our own DX spotting network. Of course, we all use DX Summit or one of the many links to DX spotting networks that are available out there. And then there is TEXTING. The methods of being informed seem endless today.

So much for the history of how we "found DX" on the air in the old days, and how we can keep informed in today's DX world. Times have changed quite a bit over the years. What I tell anyone who will listen is to chase DX on your own terms. If you enjoy the old-fashioned way of turning on your radio and blindly wandering the bands to see what you can work, then do it. I will often do that here myself. It is really enjoyable. But when I am seriously looking for band fillers, I use whatever resource I can find. Usually, I let my logging program advise me when a "spotted DX station" is a new one for me. My advice to my DX-chasing friends is to make it a priority to work "All Time New Ones" (ATNOs) first. Especially, do NOT miss any major DXpedition heading to a rare entity. For example, if you need BOUVET, then do NOT miss the next activity from Bouvet. If you miss it, you may be waiting another 10-20 years for the next activity. As you climb the DX ladder and work those ATNOs, you can always expand your horizon towards working DX on perhaps a specific band, or all bands. Maybe concentrate on working and confirming 100 entities on 160? Not easy, especially if you have a modest antenna system, but with CW and FT8, it is now perhaps within reach, and a whole lot of fun to accomplish.

If you enjoy the old-fashioned way of turning on your radio and blindly wandering the bands to see what you can work, then do it. I will often do that here myself. It is really enjoyable. But when I am seriously looking for band fillers, I use whatever resource I can find.

Another challenge that has become very popular recently has been 6-meter DXCC chasing. A bit more challenging, but again, especially with FT8, it has become possible. For me, after I retired, I had two personal challenges that I placed on myself. One was to "work the WARC bands" and confirm 100 plus entities on each. My second challenge was to complete my USA-CA (USA Counties) award. I had worked and confirmed about half of all USA counties up until that time, so I put full energy into accomplishing that feat. Not specifically DX-related, but definitely "contact"-related for sure. Chasing an on-air award is certainly a form of DXing. It took me a couple of years to finish, but I finally got that beautiful certificate, USA-CA #1116.

My current challenge is working DX on FT8, on all bands from 160 to 6 meters. I have heard the nay-sayers out there

what's new

The ARRL Operating Manual for Amateur Radio 12th Edition



While the Handbook and Antenna Book show you how to get on the air, the *ARRL Operating Manual* is geared toward what to do on the air. This handy guide covers every on-air activity you can think of, from simple ragchewing to public service, chasing DX, trying new bands and modes, and working a contest.

It is broken up into three sections: Section 1 covers basic station and operating techniques, Section 2 covers public service activities and the benefits of joining ham radio clubs, and Section 3 covers on-air radiosport from chasing DX to awards and contesting.

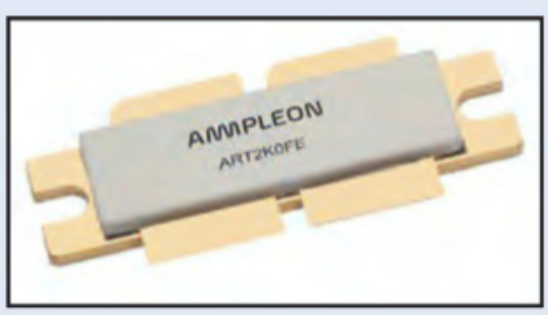
The *ARRL Operating Manual for Amateur Radio 12th Edition* is available now and has a suggested retail price of $24.95. For more information, contact the ARRL at 225 Main Street, Newington, CT 06111-1494. Phone (860) 594-0200. Website: <www.arrl.org>.

what's new

RFMW Now Stocks Ampleon Transistors

RFMW is now offering design and sales support for a high-power transistor from Ampleon. The ART2K0FE power LDMOS transistor provides 2,000 watts of pulsed RF energy for ISM applications in the high-frequency to 400-MHz band High breakdown voltage enables class-E operation up to 50 volts VDS while the ART2K0FE is qualified up to a maximum VDS of 65 volts. Integrated dual sided ESD protection enables class C operation and complete switch off of the transistor.

Ampleon's transistors are available now with pricing varying by model. For more information, contact: RFMW, 188 Martinvale Lane, San Jose, CA 95119. Phone: (408) 414-1450. Email: <info@rfmw.com>.



The WPX Program

CW

3927	JAØDVE	3930	HB9CAT
3928	N7XCZ	3931	K6KZM
3929	SP6OPC	3932	N3OUC

SSB

4251	DL1CZ	4253	K4MVM
4252	N4LKE	4254	HB9CAT

Mixed

3918	EA7IDH	3928	OK1VP
3919	N6DDG	3929	NØBAK
3920	W8EWH	3930	7N4GIB
3921	YB8OBM	3931	F6JSZ
3922	KP4ASG	3932	EU1ADY
3923	DL1CZ	3933	HB9CAT
3924	N1CNG	3934	WO9I
3925	WØZI	3935	UA6AHR
3926	N4DOU	3936	R9JAU
3927	VK5CE	3937	KC7CM

Digital

1149	N6DDG	1159	KD2RWC
1150	SP6OPC	1160	K4MVM
1151	W8EWH	1161	VU2EOJ
1152	YB8OBM	1162	HB9CAT
1153	KP4ASG	1163	K6KZM
1154	WE3J	1164	WO9I
1155	N1CNG	1165	N8URE
1156	ES1RAM	1166	R9JAU
1157	OK1VP	1167	N3OUC
1158	NØBAK	1168	KC7CM

CW: 400: HB9CAT, K6KZM. **450:** KC9UL, N3OUC. **500:** WU1V. **550:** KB8VAO. **700:** N5KAE, DL6JZ, JK1EXO. **800:** JAØDVE. **850:** N3HCN. **1600:** G4FKA. **4950:** W8IQ.

SSB: 350: DL1CZ, N4DOU, HB9CAT. **550:** MIØGTA. **600:** JK1EXO. **700:** K6KZM. **1050:** KB8VAO. **1350:** N5KAE. **1450:** G4FKA. **3200:** UT7DX.

Mixed: 500: N4DOU, KD7HCW, OK1VP, IUØAWH. **550:** EA7IDH, N6DDG, PDØDNA, JG5VFK, WO9I, UA6AHR, KC7CM. **600:** N2WWD. **650:** W5UJ, NØBAK, K1VWJ. **750:** KC5RR. **800:** VE2SYQ, N3DF. **850:** IZØFYW, N7XCZ. **900:** N3HCN. **1050:** KB9DAK, KC9UL. **1100:** K6KZM. **1150:** N1CNG. **1300:** JK1EXO, N3OUC. **1400:** KB8VAO. **1450:** W9HBH. **1750:** DL6JZ, AE4WG. **1800:** N5KAE. **1950:** IZØFUW. **2300:** G4FKA. **2450:** VK5CE. **2950:** HB9BIN.

Digital: 350: N6DDG, PU2GTA. **400:** OH6HSD, OK1VP, IUØAWH, N8URE, N2WWD, R9JAU. **450:** SP6OPC, KD7HCW, HB9CAT, WO9I. **500:** KB9DAK, JG5VFK, VU2EOJ, K6KZM, KC7CM. **550:** EA7IDH, PDØDNA, NØBAK. **650:** KB8VAO, DL6JZ. **700:** KC5RR, W9HBH. **750:** KC9UL. **800:** VE2SYQ. **900:** JK1EXO. **950:** N3OUC. **1100:** IZØFUW. **1150:** N1CNG. **1250:** HB9CAT. **1300:** AA8R, AE4WG. **1350:** G4FKA. **1500:** K2YYY. **1900:** HB9BIN.

160 Meters: N1CNG, DL6JZ, OK1VP, NØBAK, HB9CAT, K6KZM, WO9I, G4FKA
80 Meters: N1CNG, KD7HCW, G4FKA
60 Meters: KB8VAO, DL6JZ
40 Meters: W8EWH, YB8OBM, W5UJ, N1CNG, VE2SYQ, N5KAE, EU1ADY, HB9CAT, JK1EXO, N2WWD, G4FKA, IZØFUW
30 Meters: N1CNG, IZØFYW, DL6JZ, IZØFUW
20 Meters: N6DDG, N1CNG, KB9DAK, JG5VFK, KC5RR, NØBAK, IUØAWH, HB9CAT, K6KZM, JK1EXO, N8URE, G4FKA
17 Meters: N1CNG, KC5RR, IZØFUW
15 Meters: JAØDVE, N1CNG, KB9DAK, K6KZM
10 Meters: DL6JZ, IZØFUW

Asia: JAØDVE, DL6JZ, IWØAWH, VU2EOJ, HB9CAT, UA6AHR, R9JAU, KC7CM
Europe: EA7IDH, SP6OPC, KP4ASG, JAØDVE, DL1CZ, N1CNG, KB9DAK, ES1RAM, JG5VFK, DL6JZ, VK5CE, OK1VP, IWØAWH, F6JSZ, EU1ADY, VU2EOJ, HB9CAT, UA6AHR, N2WWD, R9JAU
Oceania: JAØDVE, JG5VFK
North America: N6DDG, W8EWH, KP4ASG, N1CNG, KB9DAK, N4DOU, NØBAK, N7XCZ, KD2RWC, K4MVM, HB9CAT, K6KZM, WO9I, N8URE, KC7CM
South America: KB8VAO, N5KAE, G4FKA

Complete rules and application forms may be obtained by sending a business-size, self-addressed, stamped envelope (foreign stations send extra postage for airmail) to "CQ WPX Awards," P.O. Box 355, New Carlisle, OH 45344 USA. Note: WPX will now accept prefixes/calls which have been confirmed by eQSL.cc. and the ARRL Logbook of The World (LoTW).

*Please Note: The price of the 160, 30, 17, 12, 6, and Digital bars for the Award of Excellence are $6.50 each.

CQ DX Field Award Honor Roll

The CQ DX Field Award Honor Roll recognizes those DXers who have submitted proof of confirmation with 175 or more grid fields. Honor Roll lisiting is automatic upon approval of an application for 175 or more grid fields. To remain on the CQ DX Field Award Honor Roll, annual updates are required. Updates must be accompanied by an SASE if confirmation is desired. The fee for endorsement stickers is $1.00 each plus SASE. Please make all checks payable to the Award Manager, Keith Gilbertson. Mail all updates to Keith Gilbertson, KØKG, 21688 Sandy Beach Lane, Rochert, MN 56578-9604.

Mixed

K2TQC	288	HA5AGS	228	F6HMJ	206	BA4DW	188
W1CU	267	9A5CY	227	KF8UN	205	HB9DDZ	188
VE7IG	254	K9YC	227	OM2VL	205	K2AU	187
HAØDU	253	WI8A	227	VE7SMP	204	K8YTO	186
OM3JW	253	VE3ZZ	226	RW4NH	203	WO7R	185
W6OAT	249	K8OOK	225	IV3GOW	201	N3RC	184
IK1GPG	245	KØDEQ	221	HB9AAA	200	K2SHZ	182
OK1ADM	244	HA1AG	218	N5KE	200	KJ6P	180
HA5WA	243	JN3SAC	214	W3LL	199	W6XK	180
K8SIX	240	HA9PP	213	K1NU	195	W5ODD	177
HA1RW	239	WA5VGI	213	ON4CAS	194	NØFW	176
VE3XN	239	W4UM	210	NIØC	193	WA9PIE	176
I6T	230	N4MM	208	N4NX	192	HB9BOS	175
N8PR	229	OK1AOV	208	HA1ZH	190	NKØS	175

SSB

W1CU	249	KØDEQ	198	WA5VGI	189	NØFW	176
W4ABW	202	W4UM	198	N4MM	188	DL3DXX	175
VE7SMP	201	JN3SAC	191	W3LL	187		

CW

W1CU	253	JN3SAC	211	OK1AOV	198	N4MM	184
HA5WA	235	DL3DXX	210	WA5VGI	197	OK2PO	184
DL6KVA	233	DL2DXA	209	NIØC	190	N4NX	177
KØDEQ	214	W4UM	200	HB9DZZ	186	N7WO	175

Digital

W1CU	195



The 60-meters-online website offers awards for states and countries worked on the 5-MHz band. See <www.60metersonline.com> for details.

complaining about FT8. But nobody can argue just how popular it has become. When a band is open, the very narrow passband waterfall is usually chock full of stations, and working DX is fairly easy. Sure, the computer is doing a good part of the "work," but not all. The same could be argued about RTTY, which has been around longer than SSB. In the old days, it was a "large mechanical" computer (think about it) that copied the message and printed it on paper, and sending a message would require manually typing the message unless you had a "perforated tape" running a standard message into the TTY machine. Today it is software.

So, here is my advice to DXers everywhere: ENJOY this awesome corner of our great amateur radio hobby. Chasing DX is definitely a multi-faceted pastime that we can all enjoy in our own special ways. I have ALWAYS encouraged DXers to chase the awards, not the "serial numbers" of the awards.

My 60-Meter Update

Since I reported to you in the December 2019 DX column, I had only had ONE QSO on 60 meters (K1N Navassa from a few years ago). Since then, I got myself busy. One evening, I decided to wander down to 60 meters and peek at FT8 channel 3 (5.357 MHz) as suggested by Joe, W8GEX. I was amazed at how busy the FT8 activity was there. I decided to try my available antennas to see if any would "tune" on 60 meters. I found that my 160-meter inverted L worked by using the internal tuner on my K3. I proceeded to call CQ and my first QSO was with I8IGS in Italy. I continued poking around for about an hour, working 19 stations in 11 entities, the furthest being 4X4DK in Israel. As a matter of fact, it wasn't until QSO num-

The WAZ Program

SINGLE BAND WAZ

6 Meter Updates

141 .....DK1FW, 37 Zones
133 .....DK2LO, 27 Zones

10 Meter CW

221 .....NDØN

12 Meter CW

105 .....NDØN
106 .....4Z4DX

15 Meter CW

371 .....NDØN

17 Meter CW

128 .....NDØN

17 Meter Digital

3.....SP6TRX

20 Meter CW

653.....SP6TRX
654 .....KS1J
655 .....NDØN

20 Meter Digital

13.....SP6TRX

20 Meter RTTY

82.....SP5ECC

20 Meter SSB

1256.....JA1GRM

30 Meter CW

159 .....NDØN

30 Meter Digital

7.....SP6TRX

40 Meter CW

329 .....NDØN

160 Meter

606 .....RN1ON, 36 Zones
607 .....RWØLT, 40 Zones
608 .....JO7KMB, 30 Zones
609.....RUØA, 30 Zones
610.....VE3DZ, 33 Zones
611 .....RU6L, 39 Zones
612.....9A6W, 40 Zones
613.....W7CT, 31 Zones
614.....K3PA, 30 Zones

160 Meter Updates

500 .....DK2LO, 36 Zones
547 .....R5DT, 40 Zones
211 .....UA3AB, 40 Zones
199 .....K1UO, 40 Zones
611 .....RU6L, 40 Zones
511.....RL8C, 40 Zones

ALL BAND WAZ

CW

1065 .....JA6GMC
1066 .....SV2DGH
1067 .....DL5MM
1068 .....IK5XCT
1069 .....IZØHTW
1070 .....RL8C

Digital

122 .....JP1LRT
123 .....W7CT
124 .....RL8C

SSB

5461 .....IZ4HTW
5462 .....KF5BA

Mixed

9796.....DK9WI
9797 .....JE4PVC
9798 .....JA6GMC
9799.....UA3FF
9800 .....RK6AH
9801.....NØOJ
9802 .....DL1QQ
9803 .....KF5BA
9804 .....YB1TJ
9805 .....SP3TLJ
9806 .....DK3UA
9807.....UX5XK
9808 .....RL8C
9809.....S6SCC

RTTY

299 .....VE2EBK

Rules and applications for the WAZ program may be obtained by sending a large SAE with two units of postage or an address label and $1.00 to: WAZ Award Manager, John Bergman, KC5LK, 125 Deer Trail, Brandon, MS 39042-9409. The processing fee for all *CQ* awards is $6.00 for subscribers (please include your most recent *CQ* mailing label or a copy) and $12.00 for nonsubscribers. Please make all checks payable to John Bergman. Applicants sending QSL cards to a *CQ* checkpoint or the Award Manager must include return postage. KC5LK may also be reached via e-mail: <kc5lk@cq-amateur-radio.com>.

CQ DX Awards Program

No Update

The basic award fee for subscribers to *CQ* is $6. For non-subscribers, it is $12. In order to qualify for the reduced subscriber rate, please enclose your latest *CQ* mailing label with your application. Endorsement stickers are $1.00 each plus SASE. Updates not involving the issuance of a sticker are free. All updates and correspondence must include an SASE. Rules and application forms for the CQ DX Awards may be found on the <www.cq-amateur-radio.com> website, or may be obtained by sending a business-size, self-addressed, stamped envelope to CQ DX Awards Manager, Please make checks payable to the Award Manager, Keith Gilbertson. Mail all updates to Keith Gilbertson, KØKG, 21688 Sandy Beach Lane, Rochert, MN 56578-9604 USA. We recognize 341 active countries. Please make all checks payable to the award manager. Photocopies of documentation issued by recognized national Amateur Radio associations that sponsor international awards may be acceptable for CQ DX award credit in lieu of having QSL cards checked. Documentation must list (itemize) countries that have been credited to an applicant. Screen printouts from eQSL.cc that list countries confirmed through their system are also acceptable. Screen printouts listing countries credited to an applicant through an electronic logging system offered by a national Amateur Radio organization also may be acceptable. Contact the CQ DX Award Manager for specific details.

The CQ DX Field Award Program

No Update

The basic award fee for subscribers to *CQ* is $6. For non-subscribers, it is $12. In order to qualify for the reduced subscriber rate, please enclose your latest *CQ* mailing label with your application. Endorsement stickers are $1.00 each plus SASE. Updates not involving the issuance of a sticker are free. All updates and correspondence must include an SASE. Rules and application forms for the CQ DX Awards may be found on the <www.cq-amateur-radio. com> website, or may be obtained by sending a business-size, self-addressed, stamped envelope to CQ DX Awards Manager, Keith Gilbertson, KØKG, 21688 Sandy Beach Lane, Rochert, MN 56578-9604 USA. Please make all checks payable to the award manager.

ber 17 that I finally worked my first USA (KG6PH). As of today, after about one full month of part time activity on 60 meters, I have made 276 QSOs, which included 57 DX entities, 31 states, 19 CQ zones, and 6 continents.

The other day, I built a real 60-meter inverted-V antenna and put it up at about 30 feet. It seems to work fine but the inverted L is higher and seems to work just as well, if not a bit better (so far) but it has only been up for a couple of days. I realize that there are no major awards currently offered for 60-meter activity by ARRL or CQ (*CQ's WPX award offers a 60-meter single-band endorsement. –ed*). However, you can work towards DX and WAS awards offered by <60metersonline.com>. Info is located in the header of their web page. I am having FUN on a NEW BAND (for this OLD HAM at least!). I recommend (re)reading the article written by Joe, W8GEX, in the December *CQ* DX Column for more information on 60-meter operation.

– Dit-dit de N2OO

Looking Ahead

Here are some of the articles we're working on for upcoming issues of



• SSB Results: 2019 CQ World Wide DX Contest
• The Magic of the End-Fed Half-Wave Antenna
• A Unique QSL: W8ZZAP

… and of course …

• Professor Heisseluft on Working the Republic of Uzupis

Upcoming Special Issues

June: Take it to the Field
October: Emergency Communications
December: Technology

Do you have a hobby radio story to tell? Personal ham history for our 75th anniversary year? Something for one of our specials? *CQ* now covers the entire radio hobby. See our writers' guidelines on the CQ website at <http://bit.ly/2qBFOdU>.

Dayton DX Dinner

The SouthWest Ohio DX Association (SWODXA) will sponsor the 35th annual DX Dinner, held in conjunction with the 2020 Dayton Hamvention®, on Friday, May 15th, 2020, at the Dayton Marriott, 1414 S. Patterson Blvd., Dayton, OH 45409. We will have another fantastic array of great prizes at the dinner and the forum! There will be a cash bar starting at 5:30 p.m., with dinner served at 7. Following the event, there will be a separate room and cash bar available for more fellowship. This is an excellent opportunity to meet new hams and to renew old acquaintances as well as to learn about past DXpeditions and those in the planning stages.

The Marriott is very accommodating to a group our size. The dining room is on the ground floor so there are no steps, the dining room is very large, and there is ample free, on-site parking. This dinner is always well attended by some of the most avid DXers in the world. The 2019 dinner had over 400 attendees! As in the past, there will be some major door prizes, and there is always great anticipation as to who will be named the "DXpedition of the Year®", the "IOTA DX-Peditioner of the Year", as well as the inductees in to the CQ DX Hall of Fame during the dinner.

Tickets may be purchased on the SWODXA Events website at <https://tinyurl.com/s34pppw>. Program details and a list of the prizes will be on the website as they become available and updates will be sent out regularly via Twitter. Follow us on Twitter - @SWODXA. You can also check <https://tinyurl.com/rgzt45b> for the latest news.

5 Band WAZ

As of January 15, 2020
2184 stations have attained at least the 150 Zone level, and
1032 stations have attained the 200 Zone level.

As of January 15, 2020
The top contenders for 5 Band WAZ (Zones needed on 80 or other if indicated):
CHANGES shown in **BOLD**

Callsign	Zones	Zones Needed	Callsign	Zones	Zones Needed
AK8A	199	17	VO1FB	199	19
DM5EE	199	1	W1FJ	199	24
EA3GP	199	19 on 10M	W1FZ	199	26
EA5RM	199	1	W2LK	199	23
EA7GF	199	1	W3NO	199	26
H44MS	199	34	W4LI	199	26
HAØHW	199	1	W4UM	199	23
HA5AGS	199	1	W6DN	199	17
I5REA	199	31	W6RKC	199	21
IKØXBX	199	19 on 10M	**W6TMD**	**199**	**34**
IK1AOD	199	1	W9XY	199	22
IK8BQE	199	31	WAØMHJ	199	23
IZ3ZNR	199	1	WA2BCK	199	23
JA1CMD	199	2	9A5I	198	1, 16
JA5IU	199	2	EA5BCX	198	27, 39
JA7XBG	199	2	F5NBU	198	19, 31
JH7CFX	199	2	G3KDG	198	1, 12
JK1BSM	199	2	G3KMQ	198	1, 27
JK1EXO	**199**	**2**	HB9FMN	198	1 on 80 & 10
K1LI	199	24	**I1EIS**	**198**	**1&19 on 10**
K2RD	199	18	JA1DM	198	2, 40
K4HB	199	26	JA3GN	198	2 on 80 & 40
K5FUV	199	23	JA7MSQ	198	2 on 80 & 10
K5TR	199	22	JH1EEB	198	2, 33
K7UR	199	34	K2EP	198	23, 24
K9KU	199	22 on 15	K2TK	198	23, 24
KBØEO	199	23	K3JGJ	198	24, 26
KZ4V	199	26	K3LR	198	22, 23
LU2DX	199	23	K3PA	198	18,23
N3UN	199	18	K4JLD	198	18, 24
N4NX	199	26	K5OT	198	18, 23
N4WW	199	26	KZ2I	198	24, 26
N4XR	199	27	N2QT	198	23, 24
N8AA	199	23	N4GG	198	18, 24
RA6AX	199	6 on 10M	N8TR	198	18, 23 on 10
RU3DX	199	6	UA4LY	198	6 & 2 on 10
RWØLT	199	2 on 40M	UN5J	198	2, 7
RX4HZ	199	13	US7MM	198	2, 6
RZ3EC	199	1 on 40M	W5CWQ	198	17, 18
S58Q	199	31	W9RN	198	26, 19 on 40
SM7BIP	199	31	WC5N	198	22, 26
SP3RBG	199	2 on 10M	WL7E	198	34, 37
E2TZT	199	23	ZL2AL	198	36, 37

The following have qualified for the basic 5 Band WAZ Award:

Callsign	5BWAZ #	Date	# Zones
DK9WI	2175	2019-12-15	200
I1EIS	2176	2019-12-16	198
W4QN	2177	2019-12-18	196
R5DT	2178	2019-12-23	200
RV3LO	2179	2019-12-26	200
RU6L	2180	2019-12-28	200
DL1QQ	2181	2019-12-31	188
9A6W	2182	2020-01-03	200
KK8X	2183	2020-01-05	154
W0VTT	2184	2020-01-09	200

Updates to the 5BWAZ list of stations:

Callsign	5BWAZ #	Date	# Zones
W7AH	1311	2019-12-20	190
W6TMD	2011	2019-12-19	199
NH6T/W4	2053	2019-12-30	168
WA2ALY	1946	2020-01-05	161
JR3UIC	1835	2020-01-07	193
JK1EXO	2170	2020-01-11	199

New recipients of 5 Band WAZ with all 200 Zones confirmed:

5BWAZ #	Callsign	Date	All 200 #
2175	DK9WI	2019-12-15	1027
2178	R5DT	2019-12-23	1028
2179	RV3LO	2019-12-26	1029
2180	RU6L	2019-12-28	1030
2182	9A6W	2020-01-03	1031
2184	WØVTT	2020-01-09	1032

Rules and applications for the WAZ program may be obtained by sending a large SAE with two units of postage or an address label and $1.00 to: WAZ Award Manager, John Bergman, KC5LK, 125 Deer Trail, Brandon, MS 39042-9409. The processing fee for the 5BWAZ award is $10.00 for subscribers (please include your most recent *CQ* mailing label or a copy) and $15.00 for nonsubscribers. An endorsement fee of $2.00 for subscribers and $5.00 for nonsubscribers is charged for each additional 10 zones confirmed. Please make all checks payable to John Bergman. Applicants sending QSL cards to a *CQ* checkpoint or the Award Manager must include return postage. KC5LK may also be reached via e-mail: <kc5lk@cq-amateur-radio.com>.

***Please note: Cost of the 5 Band WAZ Plaque is $100 shipped within the U.S.; $120 all foreign (sent airmail).**

18+

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The WPX Honor Roll

The WPX Honor Roll is based on the current confirmed prefixes which are submitted by separate application in strict conformance with the CQ Master Prefix list. Scores are based on the current prefix total, regardless of an operator's all-time count. Honor Roll must be updated annually by addition to, or confirmation of, present total. If no up-date, files will be made inactive.

MIXED

8891 .....9A2AA
8021 .....K2VV
7551.....W1CU
7414.....9A2NA
6589 .....EA2IA
6261 .....KF2O
5589 .....N4NO
5582 .....ON4CAS
5536.....VE1YX
5510.....YU1AB
5483.....S53EO
5428.....W9OP
5360 .....KØDEQ
5260.....I5RFD
5227 .....N6JV
5204.....N8BJQ
4934 .....W9OO
4837 .....WA5VGI
4757.....I2MQP
4681.....JH8BOE
4574.....JN3SAC
4561 .....NN1N
4521.....IK2ILH
4462.....K1BV
4342 ....WB2YQH
4298.....VE3XN
4201 .....YO9HP
3880 .....W3LL
3855 ....WD9DZV
3821 .....N6QQ
3764 .....K9UQN
3611 .....W2OO
3539 .....AB1J
3538 .....9A4W
3459 .....W9IL
3099 .....N6FX
3073 .....IK2DZN
3021.....SV1EDY
2968.....AB1OC
2963.....N3RC
2866.....AG4W
2850 .....NXØI
2729.....W6XK
2697.....AK7O
2651.....HK3W
2589.....DG7RO
2583.....PA2TMS
2550.....K6ND
2457.....K5UR
2394 .....AE5B
2363.....AA8R
2340 .....NE6I
2293 ....WA6KHK
2225.....JH1APK
2203.....KI1U
2200.....N7ZO
2176 .....V51YJ
2133 .....KØKG
2113.....W2FKF
2040.....K4HB
2016.....N2WK
1972 .....K3CWF
1934 .....NKØS
1888.....VA7CRZ
1828 .....K7LV
1824.....WF7T
1821 .....PY5FB
1813.....IZØFUW
1798.....N6PM
1784.....JR3UIC
1771 .....NIØC
1758.....N5KAE
1746 .....K6UXO
1711 .....NS3L
1692.....N6PEQ
1667.....AD3Y
1647.....9A2GA
1643 .....SV1DPI
1616 .....TA1L
1585 .....JH1QKG
1570.....PY5VC
1568 .....N3AIU
1524 ...NH6T/W4
1484.....FG4NO
1480 .....K4JKB
1462 .....AC7JM
1462.....DL4CW
1447 .....K3XA
1422.....I2VGW
1408.....NH6T
1398.....ES4RLH
1361 .....VA3VF
1341 .....W1FNB
1322 .....AA4FU
1301.....JF1LMB
1301 ....KB9OWD
1301.....K1DX
1301 .....KM5VI
1295 .....NIØC
1280 .....WF1H
1275.....JA6JYM
1260.....UR6LEY
1219.....K6HRT
1217.....AB1QB
1204.....VA2IG
1201.....K9BO
1193.....KC1UX
1167.....WA9PIE
1153.....N3CAL
1148.....SP8HKT
1137 .....YO5BRZ
1136.....KO9V
1116.....YU7FW
1107.....PY2MC
1100 ....WA3GOS
1074 .....WU9D
1071 .....N6MM
1069 .....IZ4MJP
1036.....DL5KW
1032 .....DG5LAC
1023.....N4WQH
1016.....W9QL
1012.....NØVVV
1010.....VE3RZ
1007.....AA4QE
1006 .....NØRQV
948 .....W6WF
919 .....ON7MIC
889 .....WU1U
857.....R1AV
835 .....K6RAH
780.....N3DF
766.....WB6IZG
762.....JP1KHY
758 .....N4JJS
757.....WB3D
736 .....JA3MAT
718 .....KE4PLT
711 .....AG1T
682 .....AI8P
661 .....AL4Y
633 .....TI5LUA
621 .....K4HDW
616.....AC6BW
605 .....IW2FLB
600 .....WA3QWA

SSB

6673.....OZ5EV
6074.....K2VV
5955.....9A2NA
5404.....VE1YX
4988 .....KF2O
4800 .....EA2IA
4410.....I2MQP
3927 .....KØDEQ
3681 .....N4NO
3613 .....SV3AQR
3456 .....W9OO
3433 .....NN1N
3403 .....I8KCI
3344 .....W3LL
3333 .....CT1AHU
3274 .....YU7BCD
3174 .....I3ZSX
3172 .....YO9HP
3141.....DL8AAV
3108.....I4CSP
3101 .....WA5VGI
3075.....N8BJQ
2990.....KF7RU
2984.....KI7AO
2936 .....N6QQ
2903 .....IN3QCI
2862 .....PT7ZT
2857.....4X6DK
2650 .....IK2DZN
2623 .....W2OO
2595 .....EA1JG
2582.....PA2TMS
2568 ....SM6DHU
2532 .....W9IL
2451.....EA3GHZ
2443.....JN3SAC
2362.....AG4W
2335.....KG1E
2326.....CX6BZ
2209 .....IK2QPR
2201.....NQ3A
2200 .....N6FX
2198.....AB1OC
2131.....N3RC
2122 .....AE5B
2113.....W2FKF
2105 .....K9UQN
2094.....I8LEL
2093.....W2WC
2084.....K5UR
2076 .....K2XF
2048 .....NXØI
2048 .....W4QNW
1955.....EA3NP
1935.....SV1EOS
1921 ....WD9DZV
1879.....K3IXD
1848.....AB5C
1825.....KQ8D
1812.....K6ND
1789 ....WA6KHK
1646.....VE7SMP
1641.....AE9DX
1622.....K5CX
1611 .....W2ME
1587.....N3XX
1550.....IK2RPE
1442.....DG7RO
1386.....HK3W
1386 .....IK4HPU
1383 .....NKØS
1371 .....VE6BF
1338 .....NE6I
1334 .....EA3EQT
1330.....N5KAE
1262 .....K7LV
1258.....N1KC
1237.....N6PEQ
1222 .....YF1AR
1187 .....IZ1JLG
1183.....KI1U
1150.....VE6BMX
1146.....SQ7B
1136.....K3CWF
1112.....NH6T
1098.....K4CN
1096.....JA7HYS
1089.....IZ8FFA
1089.....IT9ABN
1053.....N6MM
1042 .....IZØBNR
1032 .....DG5LAC
1031.....K4CN
1031.....IK8OZP
1022 .....NW3H
1012.....KU4BP
1004.....K4HB
1004 .....WA5UA
998 .....W6XK
978.....EA7HY
957 .....W9QL
934.....PY5VC
931.....YB1AR
929 .....NS3L
919.....KA5EYH
893.....W9RPM
889 .....N3AIU
875 .....K7SAM
854.....K6HRT
833.....DK8MCT
808.....UR6LEY
802 .....N6OU
801 .....K3XA
766.....I2VGW
763 .....K4JKB
758.....IV3GOW
724 .....WF1H
724 .....W3TZ
717 .....KØDAN
717.....N3JON
714 .....YB2TJV
713.....JH1APK
710.....WA9PIE
700.....N4FNB
700 .....JA1PLL
694 .....KG4HUF
690.....W6PN
684.....KO9V
675.....F1MQJ
655 .....VA3VF
647.....YB8NT
640.....UA9YF
637 .....K5WAF
630.....W6US
624 .....K6KZM
606 .....KJ4BIX
604 .....GØBPK
600 .....WU1U
600 .....WA3PZO

CW

7236 ....WA2HZR
7062.....K2VV
5634.....9A2NA
5160 .....N4NO
5112 .....N6JV
5104 .....EA2IA
5004 .....KF2O
4756.....W8IQ
4570 .....I3FIY
4493.....N8BJQ
4469 .....IZ3ETU
4429 .....KØDEQ
4132 .....WA5VGI
4067.....I7PXV
3974.....JN3SAC
3804 .....W9OO
3584 .....NN1N
3504 .....YU7BCD
3318 .....K9UQN
3279 .....IØNNY
3214 ....SM6DHU
3041 .....YO9HP
2948 .....IK3GER
2915 .....KA7T
2846 ....WD9DZV
2811 .....OZ5UR
2685 .....W2OO
2667 .....W9IL
2615 .....N6QQ
2531.....I2MQP
2490 .....N6FX
2477 .....VE6BF
2424.....W2WC
2357 .....W9HR
2295.....EA7AAW
2291.....N3XX
2278 .....W3LL
2212 .....AC5K
2040 .....NXØI
2022 .....AF5CC
1998.....K5UR
1973.....N3RC
1832.....N4YB
1772 ....WA6KHK
1762.....K6ND
1744 .....NE6I
1727 .....K6UXO
1691 .....KI1U
1620.....DG7RO
1595 .....PY5FB
1505 .....R3IS
1487 .....NIØC
1483 .....VE1YX
1480 .....WO3Z
1443 ....WA2VQV
1415 .....W6XK
1389 .....IT9ELD
1362 .....KN1CBR
1342 .....VE6BMX
1295 .....AG4W
1235.....JH1APK
1220 .....AA4FU
1210.....DL4CW
1196 .....N3AIU
1098.....LU5OM
1062 .....K3XA
1036.....DL5KW
1027 .....AE5B
992 .....F5PBL
968 .....K3CWF
962 .....K7LV
944.....AB1OC
939.....N6PEQ
908.....NH6T
897.....HK3W
891.....DK8MCT
890 .....NS3L
889 .....N3AIU
864 .....YO5BRZ
848.....PY5VC
821 .....HB9DAX
783.....YB1AR
752.....K6HRT
743.....JA5NSR
738 .....NH6T/W4
735.....N5KAE
732.....SQ7B
722.....WA9PIE
720.....K4CN
711.....JF1LMB
652 .....IK2DZN
629.....IV3GOW
620 .....AF5DM
615 .....JH6JMM
608.....W9RPM
605 .....NKØS
600.....NY4G
600 .....IK2SGV

DIGITAL

2701.....N8BJQ
2636 .....W3LL
2558 .....NT2A
2360 .....KF2O
2345 .....N6QQ
2290 ....WD9DZV
2242.....HK3W
2217 .....YO9HP
2208.....W6XK
1790.....JN3SAC
1759 .....WA5VGI
1756 .....KØDEQ
1734.....AG4W
1704 .....IK2DZN
1643.....N3RC
1628.....N6PM
1565.....N7ZO
1509.....K2YYY
1500.....JH1APK
1426.....AB1OC
1378 .....K3CWF
1340 .....NXØI
1325 .....W2OO
1250W2/JR1AQN
1227.....ES4RLH
1149 .....W9IL
1129 .....NKØS
1112.....AB1QB
1093.....KI1U
1091 .....VA3VF
1089 .....AC7JM
1086.....KC1UX
1051.....KH6SAT
1047.....RW4WZ
1021 .....NN1N
1009 ....GUØSUP
1002.....NØRQV
971.....JF1LMB
966.....NS3L
947.....I2VGW
922 .....EA2IA
917 .....K7LV
901.....W1FNB
898 .....K9UQN
866.....SQ7B
858 .....WU9D
855.....R1AV
830 .....NE6I
812.....UR6LEY
811 .....WF1H
810.....N3CAL
800.....WA3GOS
783.....YB1AR
772 .....N3DF
758 .....N4JJS
750 .....ON7MIC
750 .....NH6T/W4
681.....PY5VC
672.....K9AAN
670 .....IV3GOW
668.....KA5EYH
661.....AF4T
660.....JP1KHY
654.....WB6IZG
654 .....JA3MAT
640.....WA9ONY
636.....W9RPM
611.....KO9V
600 .....N1RR
600.....ADØFL

REMOTE OPERATION

CW
7277.....K9QVB
3292 .....N1RR

MIXED
4026 .....N1RR

SSB
2953 .....N1RR

DIGITAL
671 .....N1RR

CONTESTING

BY DAVID SIDDALL,* K3ZJ

ARRL DX Phone Contest Leads off a Busy Contesting Month

March is a busy month for contesters. Here are the events we'll be looking at this month:

- ARRL DX Phone Contest
- Russian DX Contest
- CQ World Wide WPX Phone Contest
- South American 10-Meter and Stew Perry Challenge 160-Meter Contests
- Dayton Contest Activities
- IARU Region 1 Young Contesters Program
- New State QSO Challenge

This month, three more contests will be held on the path to WRTC2022 in Italy — ARRL DX Phone, Russian DX, and CQ World Wide WPX Phone. The quest will be completed next November with the close of the annual CQ World Wide DX CW contest. The latest competition results, standings, and other information related to WRTC2022 can be viewed at <www.wrtc2022.it>.

Activity in the venerable ARRL DX Phone contest has been slowly increasing despite the lack of sunspots and resulting lack of worldwide propagation on 10 and 15 meters. As noted last month, the number of logs submitted in 2019 was only 100 fewer than the all-time high. The phone weekend kicks off at 0000 UTC on March 7th and continues until 2400 UTC on Sunday, March 8th. Keep an eye out for the young (YCP) operators at LX2ØI, discussed below; and check NG3K's list of planned DX contest operations for the ARRL DX and CQ World Wide WPX contests here: <https://tinyurl.com/uwgdwzy>.

Want a change of pace and a contest that doesn't occupy the whole weekend? One can be relaxed and still compete in two contests on the weekend of March 14-15. See Discussion below about the 10- and 160-meter contest weekend.

Contest activities at the Dayton Hamvention®, will extend from Wednesday, May 13th through Sunday, May 17th, and will be sufficient to occupy much of your visit. Details are below. The International DX Convention at Visalia, California, to be held April 24-26th, 2020, also offers a good opportunity to mix with fellow DXers and contesters. This year's schedules were not available as this column went to press, but should be available by the time you read this at: <www.dxconvention.org>.

IARU Region 1 Youth Working Group Chair Lisa Leenders, PA2LS, has announced the next series of hosted contest operations conducted at "Top-Gun" stations under the auspices of the Youth Contest Program (YCP). As indicated below, in March, young operators from around Region 1 are invited to LX7I to operate during the ARRL DX Phone contest. They will use the callsign LX2ØI. At the end of the month, another team of youth operators is invited to operate at 9A1A in the CQ World Wide WPX contest.

Finally, a group of dedicated state QSO party operators have organized the State QSO Party Challenge. QSO parties representing 47 states over the February through October period are included in the challenge. Participation is as easy as uploading your state QSO party scores to the 3830scores website after each weekend competition; see below.



The Youth Contest Program (YCP), organized by IARU Region 1, announced that young contesters from member societies are invited to operate at LX2ØI, 9A1A, and EC2DX for the ARRL DX Phone, CQWW WPX Phone, and King of Spain contests, respectively.

Russian DX Contest

The Russian DX Contest (RDXC) will begin on March 21st at 1200 UTC and extend through March 22nd at 1200 UTC. Both CW and Phone modes are employed simultaneously, but one can enter CW-only, Phone-only, or mixed. In the mixed-mode category, each station may be worked twice per band (once in each mode), but multipliers count only once per band.

The RDXC rules do have some aspects worth keeping in mind. Credit is given for QSOs ONLY if both you and the other operator correctly copy and record the callsign and exchange. If there is any error, the QSO is removed from BOTH logs (albeit without any additional penalty). Also, there is no "true" single operator category. All single operator logs are judged in the same category whether or not assistance — such as the Reverse Beacon Network (RBN) or DX spotting — was employed. But note that self-spotting IS prohibited. Uniquely, soliciting contacts by telephone, telex, internet, packet, mail, or other such means is forbidden BEFORE the contest, as well as during the contest.

Also, in the RDXC you may submit two single-band entries using the same sta-



The 2020 Russian DX Contest is a mixed CW and Phone event that will take place March 21-22nd, 2020.

email: <k3zj@cq-amateur-radio.com>

Calendar of Events

All year (Starts Jan. 1)	**CQ DX Marathon**	**http://bit.ly/vEKMWD**
Feb. 29-Mar. 1	North American RTTY QSO Party	http://ncjweb.com/naqp
Feb. 29-Mar. 1	UBA CW DX Contest	http://bit.ly/W0gZiE
Mar. 1	SARL Hamnet 40M Simulated Emergency Contest	http://bit.ly/H0IqQf
Mar. 1-2	North Carolina QSO Party	http://ncqsoparty.org
Mar. 2	RSGB 80m Club Championship, Data	www.rsgbcc.org/hf/rules/2020/r80mcc.shtml
Mar. 3	AGCW YL-CW QSO Party	http://bit.ly/1uNZkyi
Mar. 4	UKEICC 80m Contests SSB	http://bit.ly/2MbaURB
Mar. 7-15	Novice Rig Round-Up	www.novicerigroundup.org
Mar. 7-8	ARRL SSB DX Contest	www.arrl.org/arrl-dx
Mar. 7-8	Open Ukraine RTTY Championship	http://krs.ho.ua/openrtty
Mar. 7-8	Veron SLP Contest	http://bit.ly/2L9eT1L
Mar. 8	SARL YL Sprint	http://bit.ly/H0IqQf
Mar. 8	UBA Spring Contest 80m CW	http://bit.ly/2KKAtb9
Mar. 11	RSGB 80m Club Championship, CW	www.rsgbcc.org/hf/rules/2020/r80mcc.shtml
Mar. 11-12	AWA John Rollins Memorial DX Contest	http://bit.ly/1DEIKTK
Mar. 14	AGCW QRP Contest	http://bit.ly/14XJyHs
Mar. 14	YB DX RTTY Contest	http://rtty.ybdxcontest.com/dx-station-rules
Mar. 14	QRP ARCI Spring Thaw SSB Sprint	www.qrparci.org/contests
Mar. 14-15	EA PSK63 Contest	http://concursos.ure.es/en/eapsk63/bases
Mar. 14-15	Idaho QSO Party	www.pocatelloarc.org/idahoqsoparty
Mar. 14-15	Oklahoma QSO Party	http://k5cm.com/okqp.htm
Mar. 14-15	QCWA QSO Party	www.qcwa.org/qcwa.php
Mar. 14-15	RSGB Commonwealth CW Contest	www.rsgbcc.org/hf/rules/2020/rberu.shtml
Mar. 14-15	SARL VHF / UHF Analogue / Digital Contest	http://bit.ly/H0IqQf
Mar. 14-15	Stew Perry Topband Challenge	www.kkn.net/stew/stew_rules.html
Mar. 14-15	FIRAC HF Contest	www.firac.de/html/contest.html
Mar. 14-15	South America 10 Meter Contest	www.sa10m.com.ar/index.html
Mar. 14-15	Tesla memorial HF CW Contest	www.radiosport.org.rs/HFTeslaMemorial
Mar. 14-15	AWA John Rollins Memorial DX Contest	http://bit.ly/1DEIKTK
Mar. 15	North American RTTY Sprint	http://ncjweb.com/north-american-sprint
Mar. 15	UBA Spring Contest 2m CW/Phone	http://bit.ly/2KKAtb9
Mar. 15-16	Wisconsin QSO Party	www.warac.org/wqp/wqp.htm
Mar. 21	AGCW VHF / UHF Contest	http://bit.ly/1lFdRW0
Mar. 21	PODXS 070 Club St. Patrick's Day Contest	http://bit.ly/38ugUiF
Mar. 21-22	Virginia QSO Party	http://bit.ly/2YIINzh
Mar. 21-22	Russian DX Contest	www.rdxc.org/asp/pages/rulesg.asp
Mar. 21-23	BARTG HF RTTY Contest	http://bartg.org.uk/wp/contests
Mar. 22	UBA Spring Contest 80m SSB	http://bit.ly/2KKAtb9
Mar. 25	UKEICC 80m Contests CW	http://bit.ly/2MbaURB
Mar. 26	RSGB 80m Club Championship, SSB	www.rsgbcc.org/hf/rules/2020/r80mcc.shtml
Mar. 28	FOC QSO Party	www.g4foc.org/qsoparty
Mar. 28-29	Veron SLP Contest	http://bit.ly/2L9eT1L
Mar. 28-29	**CQWW WPX SSB Contest**	**www.cqwpx.com**
Apr. 1	UKEICC 80m Contests SSB	http://bit.ly/2MbaURB
Apr. 2	SARL 80m QSO Party	http://bit.ly/H0IqQf
Apr. 4	LZ Open 40m Sprint Contest	www.lzopen.com
Apr. 4-5	EA RTTY Contest	http://concursos.ure.es/en/eartty/bases
Apr. 4-5	Louisiana QSO Party	http://laqp.org
Apr. 4-5	Mississippi QSO Party	www.arrlmiss.org
Apr. 4-5	Missouri QSO Party	www.w0ma.org/index.php/missouri-qso-party
Apr. 4-5	PODXS 070 Club 31 Flavors Contest	http://bit.ly/2SESbDg
Apr. 4-5	SP DX Contest	https://spdxcontest.pzk.org.pl/2019/rules.php
Apr. 4-5	UBA Spring Contest 6m CW/Phone	http://bit.ly/2KKAtb9
Apr. 5	North American SSB Sprint	https://ssbsprint.com/rules
Apr. 5	RSGB RoLo SSB Contest	www.rsgbcc.org/hf/rules/2020/rolo.shtml
Apr. 6	RSGB 80m Club Championship, CW	www.rsgbcc.org/hf/rules/2020/r80mcc.shtml
April 11	QRP Spring QSO Party	www.qrparci.org/contests
Apr. 11-12	Georgia QSO Party	http://georgiaqsoparty.org
Apr. 11-12	JIDX CW Contest	www.jidx.org
Apr. 11-12	New Mexico QSO Party	www.newmexicoqsoparty.org/wp
Apr. 11-12	OK-OM DX SSB Contest	http://okomdx.crk.cz/index.php?page=englis
Apr. 11-12	Yuri Gagarin International DX Contest	http://gc.qst.ru/en/section/32
Apr. 12	Hungarian Straight Key Contest	http://hskc.ha8kux.com
Apr. 12	International Vintage Contest HF	https://contestvintage.beepworld.it/rules-2012.htm
Apr. 15	RSGB 80m Club Championship, SSB	www.rsgbcc.org/hf/rules/2020/r80mcc.shtml
Apr. 17-18	Holyland DX Contest	www.iarc.org/iarc/#HolylandContest
Apr. 18	ES Open HF Championship	http://bit.ly/2BLBNGL
Apr. 18-19	CQ Manchester Mineira DX Contest	www.cqmmdx.com/rules
Apr. 18-19	Michigan QSO Party	www.miqp.org/index.html
Apr. 18-19	Ontario QSO Party	www.va3cco.com/oqp/rules.htm
Apr. 18-19	Texas State Parks on the Air	www.tspota.org
Apr. 18-19	YU DX Contest	http://yudx.yu1srs.org.rs/
Apr. 19	ARRL Rookie Roundup, SSB	www.arrl.org/rookie-roundup
Apr. 23	RSGB 80m Club Championship, Data	www.rsgbcc.org/hf/rules/2020/r80mcc.shtml
Apr. 25-26	10-10 Spring Digital Contest	http://bit.ly/1FrFeBc
Apr. 25-26	Florida QSO Party	www.floridaqsoparty.org
Apr. 25-26	Helvetia Contest	http://bit.ly/2IR2L8v
Apr. 25-26	SP DX RTTY Contest	www.pkrvg.org/strona,spdxrttyen.html
Apr. 26	Bartg Sprint75 Contest	http://bartg.org.uk/wp/contests
Apr. 29	UKEICC 80m Contests CW	http://bit.ly/2MbaURB
May 30-31	**CQWW WPX CW CONTEST**	**www.cqwpx.com**

10 Years of CQ World Wide WPX Growth, 2010-2019

Year	SSB Entries	CW Entries	Total Entries
2019	5,516	4,420	9,936
2018	5,391	4,242	9,633
2017	5,441	4,373	9,814
2016	5,302	4,227	9,529
2015	5,874	4,221	10,095
2014	5,500	4,055	9,555
2013	5,460	4,120	9,580
2012	5,365	4,323	9,688
2011	5,143	3,869	9,012
2010	4,758	3,566	8,324

Table 1. The number of entries in the CQWW WPX Contest took a big jump from 2010 to 2011 and has maintained those higher levels throughout the past decade, holding steady even after the peak of the current sunspot cycle (2019, at the solar minimum, was second only to 2015, at the cycle's peak).

tion and callsign. Club participation also has no geographic boundaries, so you may submit your score for credit to your favorite club no matter where you and the club are located. Complete rules are at <https://tinyurl.com/ycoext99>.

CQ World Wide WPX

The CQ World Wide WPX phone and CW contests attract thousands of operators every year. Only the CQ World Wide DX phone and CW contests attract more participants than the WPX. See *Table 1* for a look at participation in the WPX contests over the past decade.

WPX phone is scheduled just after the spring equinox, a prime propagation time. This year's event will start on March 28th at 0000 UTC and run through March 29th at 2400 UTC. This year, Easter weekend falls two weeks later, so expect the full contingent of North American and European stations to be on during the weekend.

Keep in mind that everyone works everyone in this contest, so it's a great time to get on, even "barefoot with a wire." In past years, the low power category of 100 watts or less has been the most popular. Prefixes are multipliers, regardless of location and count only once regardless of band, so there is never-ending excitement working new multipliers. This year, be sure to watch for and work the youth team that will be piloting 9A1A.

The 2020 rules appear to be unchanged from those used in 2019. Check the rules and the Frequently Asked Questions (FAQ) associated with them here: <https://cqwpx.com/index.htm>. For general information and some operating tips, review the 2013 webinar conducted by Randy Thompson, K5ZD, at <https://tinyurl.com/sgu2ymb>.

10- and 160-Meter Contest Weekend

Operate a 160-meter contest and a 10-meter contest on the same weekend, and still have time for other activities? It's within reach. Why not try it?

This year, the 10-meter South America Contest most likely will present an opportunity to rack up QSOs to the South without competition from Europe or Asia (due to poor east-west propagation on 10). Both CW and SSB are employed, and QSOs made with stations outside South America also count for the contest (although with fewer points earned). The contest runs from 1200 UTC on March 14th through 2400 UTC on March 15th.

Notwithstanding the low sunspot numbers, many South American stations should be heard and worked on 10 meters from most locations in North America. In low sunspot years the trans-equatorial propagation may last only for a few hours, but on most days it is there at least during the middle part of the day, especially to Argentina and Brazil. Details of this LU-sponsored contest are at <http://sa10m.com.ar/index.html>.

Three hours after the South America 10-meter contest begins, the 160-meter Stew Perry Topband Challenge kicks off. But the most-likely strategy would be to move to 160 meters only after 10 meters is definitely gone for the day. The "Stew" contest presents an opportunity to play one last time on topband this winter. Your CW skills may be challenged as one of the best-ever 160-meter contest seasons comes to a close. The competition will begin on March 14th at 1500 UTC and end 24 hours later. Scores are based on the distance between the two communicating stations. Complete details are at <www.kkn.net/stew>.

Contest Activities at the 2020 Dayton Hamvention®

The Dayton Hamvention® is held at the Greene County Fairgrounds in Xenia, Ohio, about 15 miles east of downtown Dayton. However, except for the contest and related forums that are held at the Fairgrounds proper, contest activities are centered in downtown Dayton at the Crowne Plaza Hotel.

Contest activities will commence on Wednesday, May 13th, with the opening of the Contest Super Suite. They end after the Contest Dinner and Super Suite on Saturday, May 16th. A list of activities and links for the latest information on each activity is at <https://tinyurl.com/y2h2sdap>. Here are some highlights:

Contest University (CTU): At CTU, contesters and budding contesters will be treated to a series of presentations and Q & A sessions. Each one is related to a specific contest topic. The sessions start at 8 a.m. and continue to 5 p.m., with a light lunch included. This year's substantive sessions include the following.

- Contest Station Optimization, by K3LR
- Tower Safety for the Radio Amateur, by W3YQ
- Contest Transceiver RX & TX Comparisons – Great RX Performance but TX Limitations Dominate, by NCØB
- Effective Low Band Receiving Antennas, by W3LPL
- Strategies to Improve Your Competitiveness in Contests, by W3LPL
- Stations and Antennas, by W3LPL
- Engineering & Maintaining Transmitting Antennas for Competitive Results, by W3LPL
- Log Checking Reports and How to Use Them, by N6TR
- Assembling Your Station for Optimum Contest Operation, by K1DG
- Waterfalls and Contest Logging Software Applications, by N6TV
- Everything You Want to Know about USB Interfaces, by N6TV
- Waterfalls, Ports and the Reverse Beacon Network, by N6TV
- FT8, FT4 and the WSJT-X 2.0 Software Suite for HF and VHF Contesting, by WØYK
- Digital Contesting is Fun, by WØYK
- Taking Digital Contesting to the Limit, by WØYK
- Digital and RTTY Contesting, by WØYK

• Effective Contest Strategies for Little Pistols and Medium Guns, by NØAX
• Grounding, Bonding and RF, by NØAX
• Your Roadmap to Radiosport Improvement, by K1DG & N6TR
• Youth in Contesting, by NN1C
• Space Weather and Ham Radio Propagation, by W2NAF
• What's Up with HF Propagation in 2020 and Beyond, by W2NAF

Pre-registration is required to attend CTU. Sessions overlap, so not all can be attended, but some are recorded and later available on the Web. Online videos of many presentations from past years are collected at <https://tinyurl.com/yxbx3o29>. There are no refunds, no cancellations, and no registrations at the door. Youth age 25 or under may apply for a scholarship to attend; consult the website linked above.

Contest Dinner: The annual contest dinner will be held at the Crowne Plaza on Saturday evening, May 16th. At this dinner, the *CQ* magazine Contest Hall of Fame honorees are announced and inducted. There always is a variety of prizes with random drawings by the very entertaining master-of-ceremonies, John Dorr, K1AR.

This year's keynote speaker will be Bryant Rascoll, KG5HVO. On his long list of achievements, both in amateur radio and in other endeavors, Bryant was the youngest competitor at WRTC 2018 in Germany. Bryant has been a regular attendee at the dinner the past several years and continues to find ways to be on the air in contests among his many other activities. He is working the contests to earn another spot on a team at WRTC 2022 in Bologna, Italy.

Contest Super Suite: The Super Suite is open each night in second floor ballrooms at the downtown Dayton Crowne Plaza, from Wednesday May 13th through Saturday, May 16th. Informal socializing and tall stories over a beer are standard fare. This is perhaps the largest informal gathering of contesters anywhere outside of the quadrennial World Radio Team Championships (WRTCs). A cash bar is onsite and pizza is delivered late each evening courtesy of some of the nation's major contest clubs. At any moment there may be a hundred or more contesters coming or going, many sporting very familiar callsigns on their badges.

Antenna, Contest, and RTTY Contest Forums: At the Hamvention proper in Xenia, there are three forums of particular interest to contesters. The 2020 schedule was not available when this was being written, but the latest information on these sessions should be available by now at <https://tinyurl.com/y8t7bjnx>. Traditionally, on Friday afternoon, Tim Duffy, K3LR, moderates the antenna forum. This is followed on Saturday morning by Doug Grant, K1DG, conducting the annual contest forum. And finally, on Saturday afternoon, Ed Muns, WØYK, has conducted the RTTY Contest forum. Barring unforeseen circumstances, we expect the same basic schedule to be followed this year.

Friday Dinner: Many contesters also are DXers (naturally) and attend the annual DX Dinner that is organized by the Southwest Ohio DX Association. It is here that *CQ* magazine's DX Hall of Fame nominees are announced and inducted. This dinner is held at the Dayton Marriott. Information and reservations are at <https://tinyurl.com/rgzt45b>.

Other contesters elect to attend the traditional Top Band (160-meter) dinner



Bryant Rascoll, KG5HVO, at WRTC-2018 in Germany. Bryant is this year's featured speaker at the annual Contest Dinner at the Dayton Hamvention. (Courtesy of WRTC2018)



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IARU Region 1 Youth Contest Program team at LX7I for the ARRL DX Phone contest in 2019. Pictured, L-R: Markus, DL8GM; Tom, F4HWS; Tomi, HA8RT; Claudia, DC2CL; and Louis, DK4EE. This year a new YCP team will return, using the callsign LX2ØI, celebrating the 20th anniversary of host station LX7I. (Courtesy of YOTA Region 1)

held at the Crowne Plaza Hotel. This year's speaker is Glenn Johnson, WØGJ. Reservations and information are at: <www.topbanddinner.com>.

IARU Region 1 Youth Contest Program

International Amateur Radio Union Region 1's Youth Working Group Chair, Lisa Leenders, PA2LS, announced that youth members from IARU member societies in Europe, Africa, and the Middle East will take part this spring in three contests from "Top-Gun" stations in Europe. More contest stations for the second half of 2020 are expected to be announced at a later time. The contests and stations scheduled for the first half of the year are:

- ARRL DX Phone, March 7–8, at LX2ØI (LX7I);
- CQWW WPX Phone, March 28–29 at 9A1A; and
- King of Spain Phone, June 27–28, at EC2DX.

Every year the Youth Contest Program (YCP) provides opportunities for young hams to learn about contesting and contest stations, improve their operating skills and knowledge, and experience working as a team member to optimize results. Often the young hams also are visiting the host country for the first time. They share amateur radio knowledge with like-minded local youngsters as well as with other visiting young contesters.

State QSO Party Challenge

Five ardent state QSO party participants have organized the first annual State QSO Party (SQP) Challenge. The SQP Challenge contests consist of 47 state QSO parties that take place between February and October. To participate, you only need to (1) participate in as many of the 47 QSO party contests as possible, and (2) post your claimed scores as soon as possible to <3830scores.com>. You can obtain full details and track your results at <http://stateqsoparty.com>.

– Until next month, 73, Dave, K3ZJ

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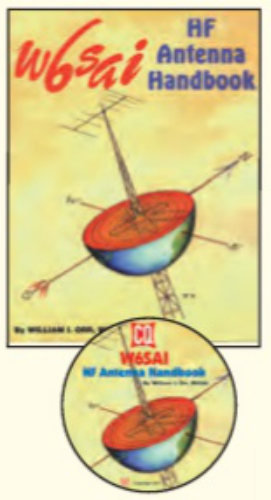
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Enjoy the Hobby read, read, read...



W6SAI HF Antenna Handbook

by Bill Orr, W6SAI

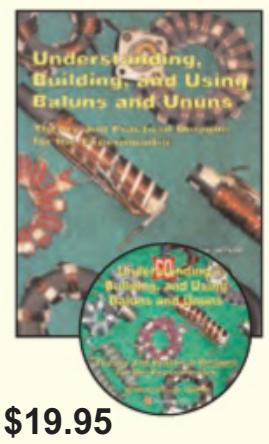


W6SAI was known for his easy-to-understand writing style. In keeping with this tradition, this book is a thoroughly readable text for any antenna enthusiast, jam-packed with dozens of inexpensive, practical antenna projects that work!

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by Bob Haviland, W4MB

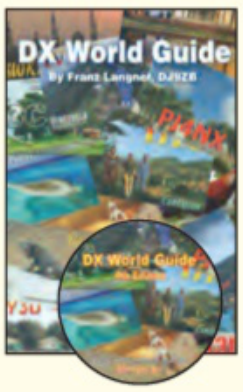


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PROPAGATION

BY TOMAS HOOD,* NW7US

Ionospheric Radio Signal Propagation

A Quick Look at Current Cycle 24 Conditions
(Data rounded to nearest whole number)

Sunspots:
Observed Monthly, December 2019: **1**
12-month smoothed, June 2019: **2**

10.7-cm Flux:
Observed Monthly, December 2019: **71**
12-month smoothed, June 2019: **70**

A_p Index:
Observed Monthly, December 2019: **4**
12-month smoothed, June 2019: **6**

***One Year Ago:* A Quick Look at Solar Cycle Conditions**
(Data rounded to nearest whole number)

Sunspots:
Observed Monthly, December 2018: **2**
12-month smoothed, June 2018: **5**

10.7-cm Flux:
Observed Monthly, December 2018: **70**
12-month smoothed, June 2018: **70**

A_p Index:
Observed Monthly, December 2018: **7**
12-month smoothed, June 2018: **7**

During the daylight hours, the energy from the Sun ionizes our upper atmosphere, causing distinct layers of ionized gas to form. These layers, or regions, form the Earth's ionosphere. The region closest to the Earth is called the *D-region*. Because this region generally absorbs some of the energy of a radio wave, the D-region is often called the *absorption layer*.

Higher up in our ionosphere we find the *E-region* which plays a role in *Sporadic-E* (E_s) propagation, as well as some absorption.

Higher yet, we find the *F-region*, which during the day splits into up to three different distinct regions, *F1*, *F2*, and *F3*, with the F3 primarily existing over the equator. The E-region and F-region may refract a radio signal back to Earth if the signal's frequency is at or below the Maximum Usable Frequency (MUF).

During the day, the Sun is ionizing all of these layers, from the D-region through the highest F-region.

As a radio signal travels through the D-region, it gets attenuated. The more ionized the region, the greater the attenuation.

During solar flares, hard X-rays (wavelength <1 nm) increase the D-region ionization as well. The more intense the X-ray radiation, the denser the D-region becomes, and the higher the frequencies that are blocked.

The rest of the time, without the increased X-ray radiation from a solar flare, the daytime D-region will only block the lowest HF frequencies, while higher frequencies will lose some - but not all - of their energy. Since solar radiation has to travel the farthest to get the D-region, absorption is usually minimal. Unless there is a major solar radiation storm, we have minimal daytime absorption and good skip propagation.

If the radio signal makes it through the D-region, it then reaches the E-region. If the E-region is highly ionized (say, during an E_s condition) and the frequencies are low enough, the signal will be refracted back to the Earth much like a light beam from a flashlight is refracted by a mirror. Lower HF signals tend to be refracted by the E-region,

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LAST-MINUTE FORECAST

Day-to-Day Conditions Expected for March 2020

	Expected Signal Quality			
Propagation Index	**(4)**	**(3)**	**(2)**	**(1)**
Above Normal: 7-10, 12-15, 19-22	A	A	B	C
High Normal: 1-3, 5-6, 11, 16-18, 23, 27-30	A	B	C	C-D
Low Normal: 24, 26	B	C-B	C-D	D-E
Below Normal: 4, 25, 31	C	C-D	D-E	E
Disturbed: n/a	C-D	D	E	E

Where expected signal quality is:
A--Excellent opening, exceptionally strong, steady signals greater than S9
B--Good opening, moderately strong signals varying between S6 and S9, with little fading or noise.
C--Fair opening, signals between moderately strong and weak, varying between S3 and S6, with some fading and noise.
D--Poor opening, with weak signals varying between S1 and S3, with considerable fading and noise.
E--No opening expected.

HOW TO USE THIS FORECAST

1. Using the Propagation Charts appearing in *The New Shortwave Propagation Handbook*, by George Jacobs, Theodore J. Cohen, and R. B. Rose.

a) Find the Propagation Index associated with the particular path opening from the Propagation Charts.

b) With the Propagation Index, use the above table to find the expected signal quality associated with the path opening for any given day of the month. For example, an opening shown in the Propagation Charts with a Propagation Index of 1 will be fair to poor on March 1 through March 3, non-existant on March 4, but then poor to fair again March 5 and March 6, and so forth.

2. Alternatively, you may use the Last-Minute Forecast as a general guide to space weather and geomagnetic conditions throughout the month. When conditions are Above Normal, for example, the geomagnetic field should be quiet, and space weather should be mild. On the other hand, days marked as Disturbed will be riddled with geomagnetic storms. Propagation of radio signals in the HF spectrum will be affected by these geomagnetic conditions. In general, when conditions are High Normal to Above Normal, signals will be more reliable on a given path, when the ionosphere supports the path that is in consideration. This chart is updated daily at <http://SunSpotWatch.com> provided by NW7US.

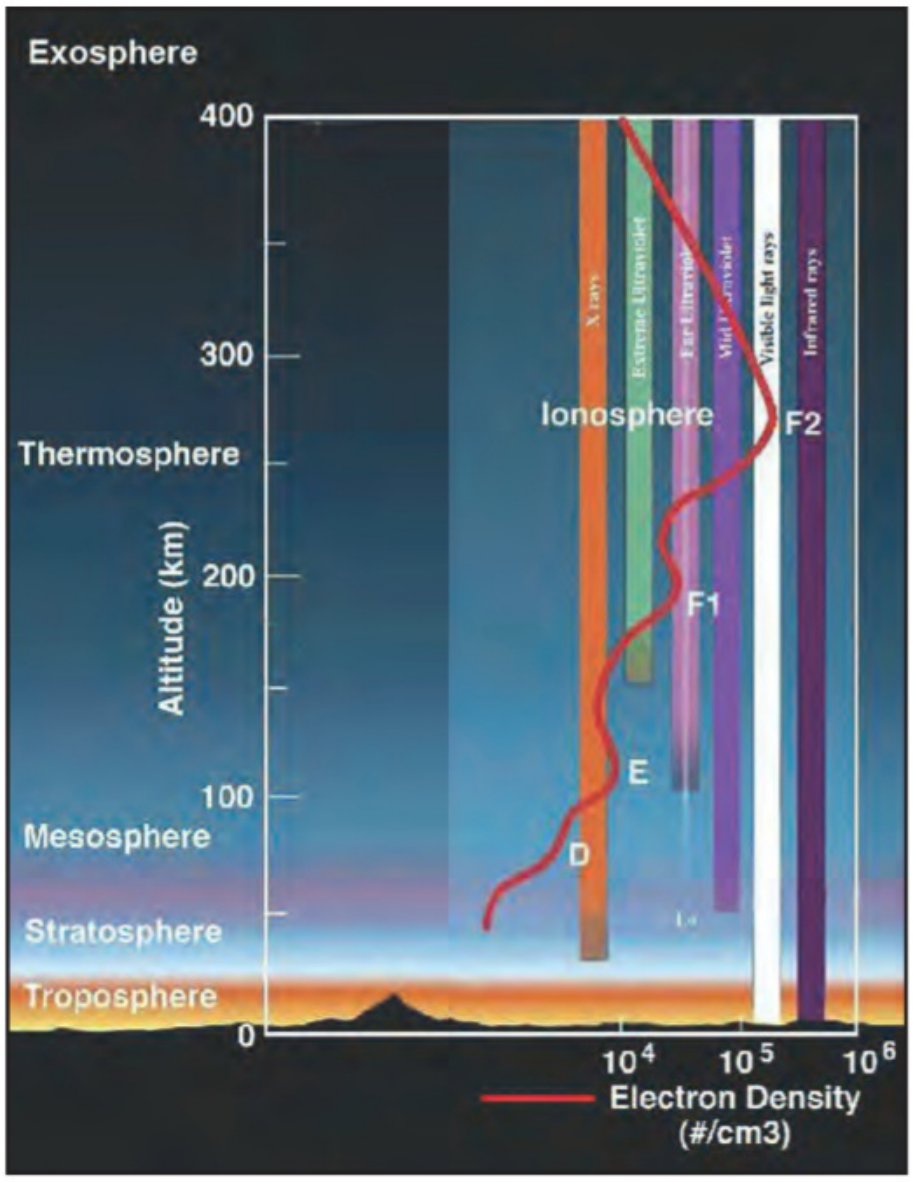


Figure 1. This diagram shows the layers within Earth's ionosphere, following the ion density curve in the atmosphere (red line). The D-region is the lowest, and is mostly present during daylight hours. The D-region absorbs radio waves from longwave to shortwave. The other regions refract shortwave frequencies (see text). (Courtesy of NASA)

especially at night. During the day, the D-region generally blocks these lower HF signals. Higher frequencies, however, punch through the E-region and reach the F-region. If they are at or below the MUF, they, too, are refracted back to the Earth, but at greater distances away from their source. This is called *skip propagation*.

At sunset, solar radiation no longer strikes the ionosphere and the active solar-induced ionization stops. Without this solar radiation, the regions of ionization decrease in density by a process called *recombination*. This causes the MUF to go down as well, which is why, by total darkness, the highest HF bands close down. Signals at those frequencies do not get refracted; they travel into space.

Gray-Line Propagation

The D-region is the first layer where ionization stops. Since the D-region is closest to the ground, when night arrives sunlight no longer reaches it. At the same time, higher levels of the ionosphere remain in sunlight. Think about how you can see a passing satellite by the sunlight reflected on its surface. You are standing in darkness, but the satellite is in sunlight; it's dark on the ground, but at the altitude of the satellite, there is full sunlight illumination. As the D-region goes into recombination, the electron density goes down, and the absorption dies down, allowing previously blocked (absorbed) radio signals to continue onward toward the higher ionospheric layers.

During the twilight hours, the D-region rapidly loses its ionization and does not absorb radio signals passing through it, while the E- and F-regions are still being ionized by sunlight. This makes for about 45 to 60 minutes of stronger signal propagation on a wide range of HF frequencies.

As the ionization decreases, lower and lower frequencies start to punch through the D-region with almost no signal attenuation. Yet the MUF is still high, allowing long-distance skip propagation. Then, when the Sun is blocked from illuminating the E- and F-regions, the MUF can drop dramati-

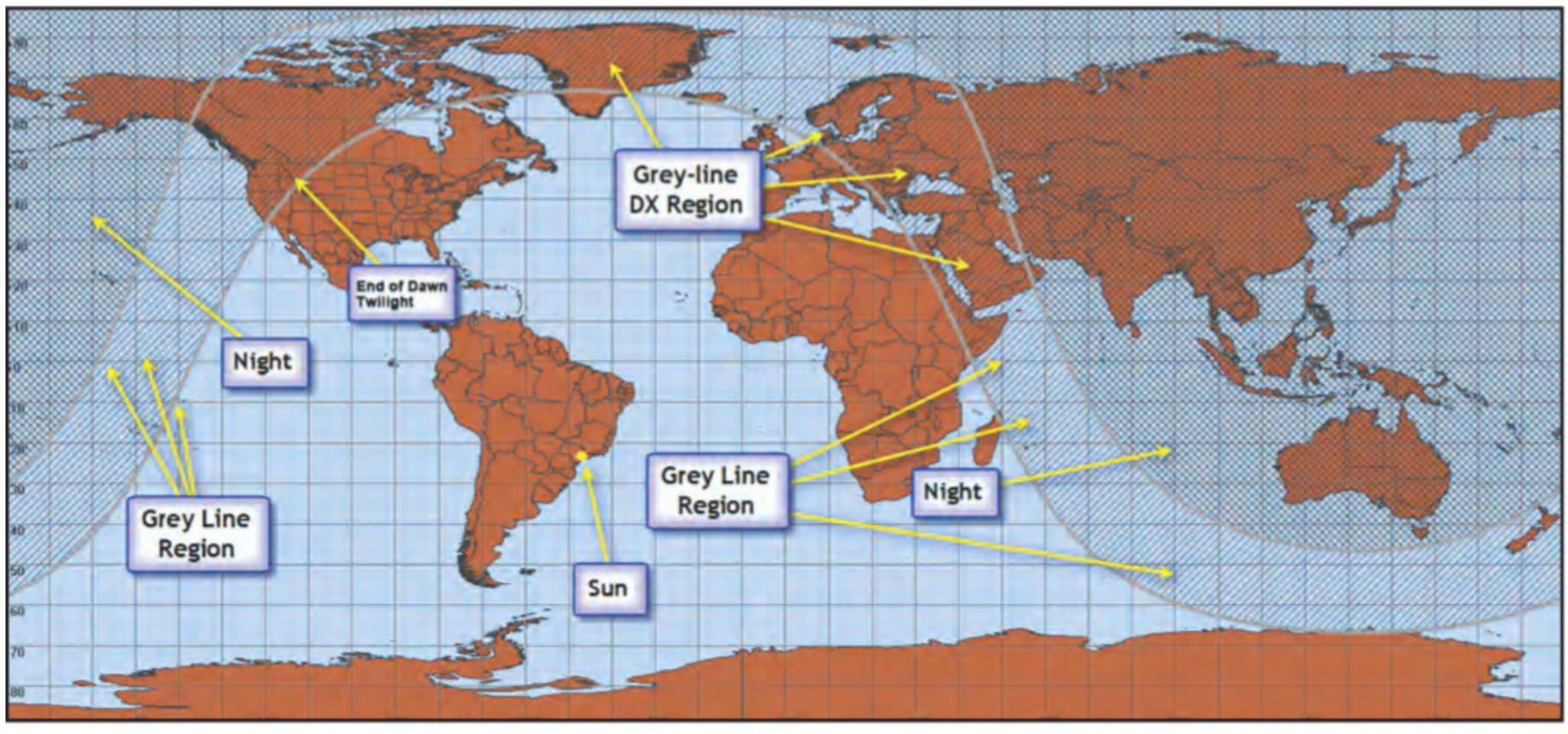


Figure 2. This map includes the daylight and gray-line regions created by the position of the Sun. Notice that the gray-line region is not a narrow, hard line dividing daylight and darkness. The terminator region is quite wide. When the transmitting and receiving stations are both located in the gray-line region, and if the MUF along that radio path supports propagation, signals tend to be strong and reliable, because the D-region is weaker than during the hours of daylight (see text). (Image by Tomas Hood, NW7US)

cally and very quickly (within minutes). This twilight zone, where the Sun is exactly 12° below the horizon, is called the *gray-line*, or in astronomical terms, the *terminator* <https://en.wikipedia.org/wiki/Terminator_(solar)>.

The same principles apply at sunrise; the upper ionosphere begins to become ionized, while the D-region is still dark and low in density, offering free passage of very low HF signals, even medium-wave signals.

Signals that are aimed along a path that stays within the gray-line often experience significant improvements in propagation. When propagation is open between two regions that are simultaneously experiencing sunrise or sunset, we refer to this as *gray-line propagation*, and it's a very exciting way to hear exotic DX signals.

These signals may be coming in from the long path as well as the short path, but always along this gray-line. The frequencies that skip along this terminator are dictated by the MUF along the given path.

There is an excellent article regarding gray-line propagation, by Steve Nichols, GØKYA, at <www.qsl.net/g0kya/radcom.html>. Steve, a member of the Radio Society of Great Britain's Propagation Studies Committee, believes that propagation around sunrise and sunset is not fully understood. His article outlines the mechanisms behind gray-line and other twilight propagation modes, and explains a research project designed to better understand these modes.

As we are right at the start of the rise phase of Solar Cycle 25, gray-line propagation will improve, bringing exciting DX. Tune around the lower shortwave bands about an hour before sunrise, and again right before sunset, and look for these long-distance signals. Of course, gray-line DX will occur on most of the HF spectrum, but is quite noticeable on these lower shortwave bands, since DX signals on these bands are less common.

March Shortwave (HF) Propagation

As the spring equinox approaches (March 19th this year), the boundary line (the *gray-line terminator*) between daylight and darkness begins to run straight north and south. With the gradual return of sunlight to the polar north, the HF bands improve because more of the ionosphere is being energized during the longer period of daylight each day. To this seasonal improvement on the shortwave spectrum we add the slight (possible) increase in solar activity as the Sun becomes more active in this beginning upward phase of Solar Cycle 25. This results in an exciting DX season developing on the high frequencies.

While the highest HF bands begin to see more openings, they will still be shorter and sometimes weak. The most reliable paths will be north / south, with only slight improvement for east / west propagation paths. By next month, though, this improvement will be noticeable. Amateur radio operators may look for 10-meter DX openings in the early morning and again in the early evening, though there will be openings throughout the day for shorter paths. On 12 through 15 meters, this change will be more pronounced.

Shortwave radio listeners will find more DX from international broadcasting stations on 16 and 19 meters. These bands will be fairly stable for regional as well as DX propagation, following the Sun — DX from the east of the listener's location during the early morning, moving to the west of the listener's location by evening. The prime evening hours in the U.S. are sunrise hours across parts of Asia, Europe, the Middle East, and Africa. Look for long-path propagation, as well, on these bands.

Between sunset and midnight, expect exciting DX openings between the 41-meter band and 16 meters, especially from the east and south azimuths from your location, as well as via the polar paths. After midnight through morning, propagation will be spotty above the 31-meter band, but from 31 meters down to the tropical bands, expect hot propagation.

One adverse change this month is the slow rise in atmospheric noise on the shortwave spectrum, due to weather changes and the way this RF noise propagates long dis-

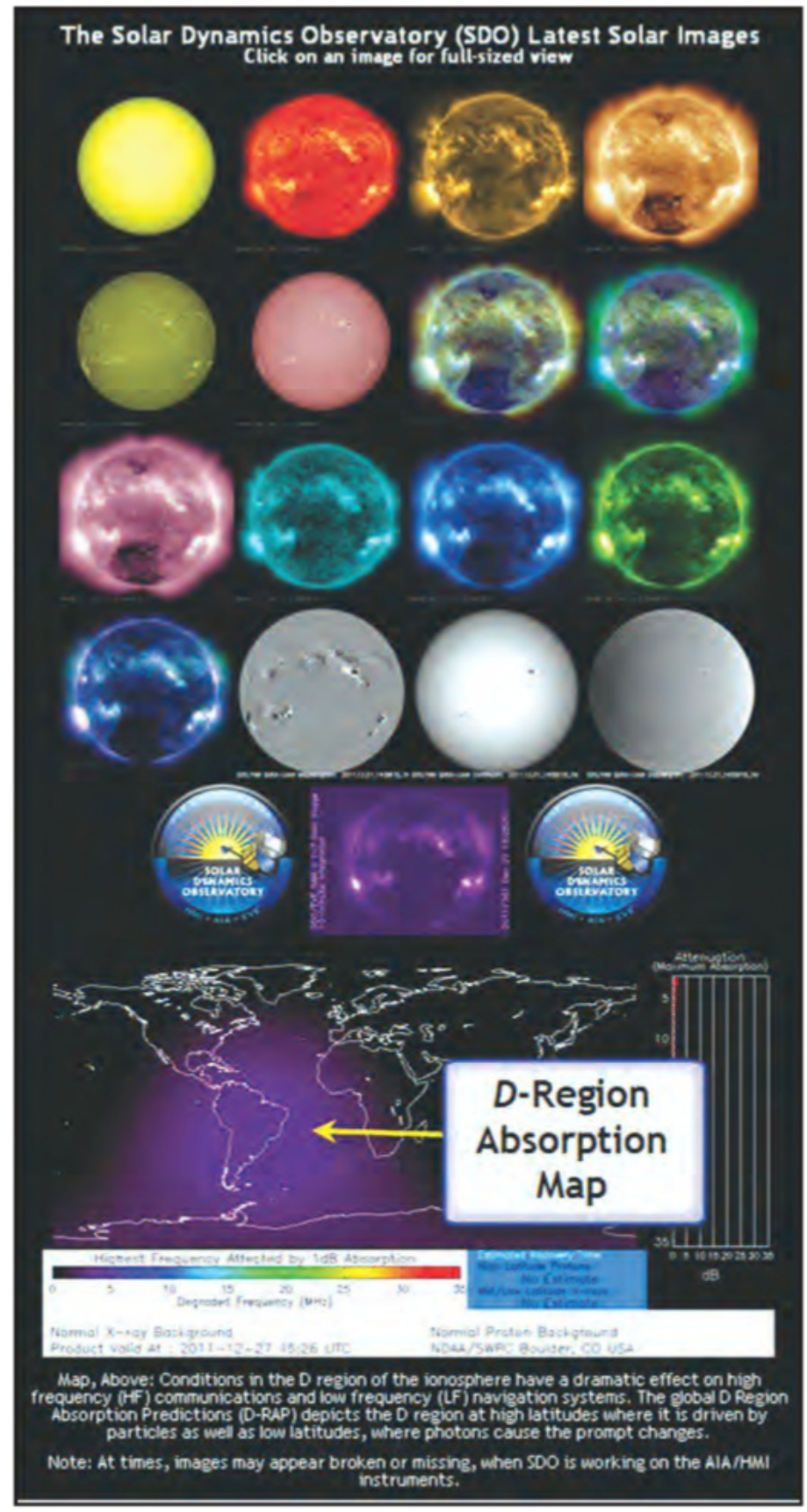


Figure 3. Screen capture from the columnist's space weather and radio propagation website, <http://SunSpotWatch.com>, showing images of the Sun, as well as the D-Region absorption map. The region that is colored is the area in which D-region absorption is occurring; the color purple illustrates weak and lower frequency absorption. If the color changed from purples and blues into red, then absorption is very strong, and high in frequency (effectively absorbing all frequencies from medium wave through high shortwave). This map is in real-time, and will also indicate the impact of an X-ray flare. [Courtesy of <http://SunSpotWatch.com>, Tomas Hood (NW7US), SWPC, NASA, SDO, AIA]

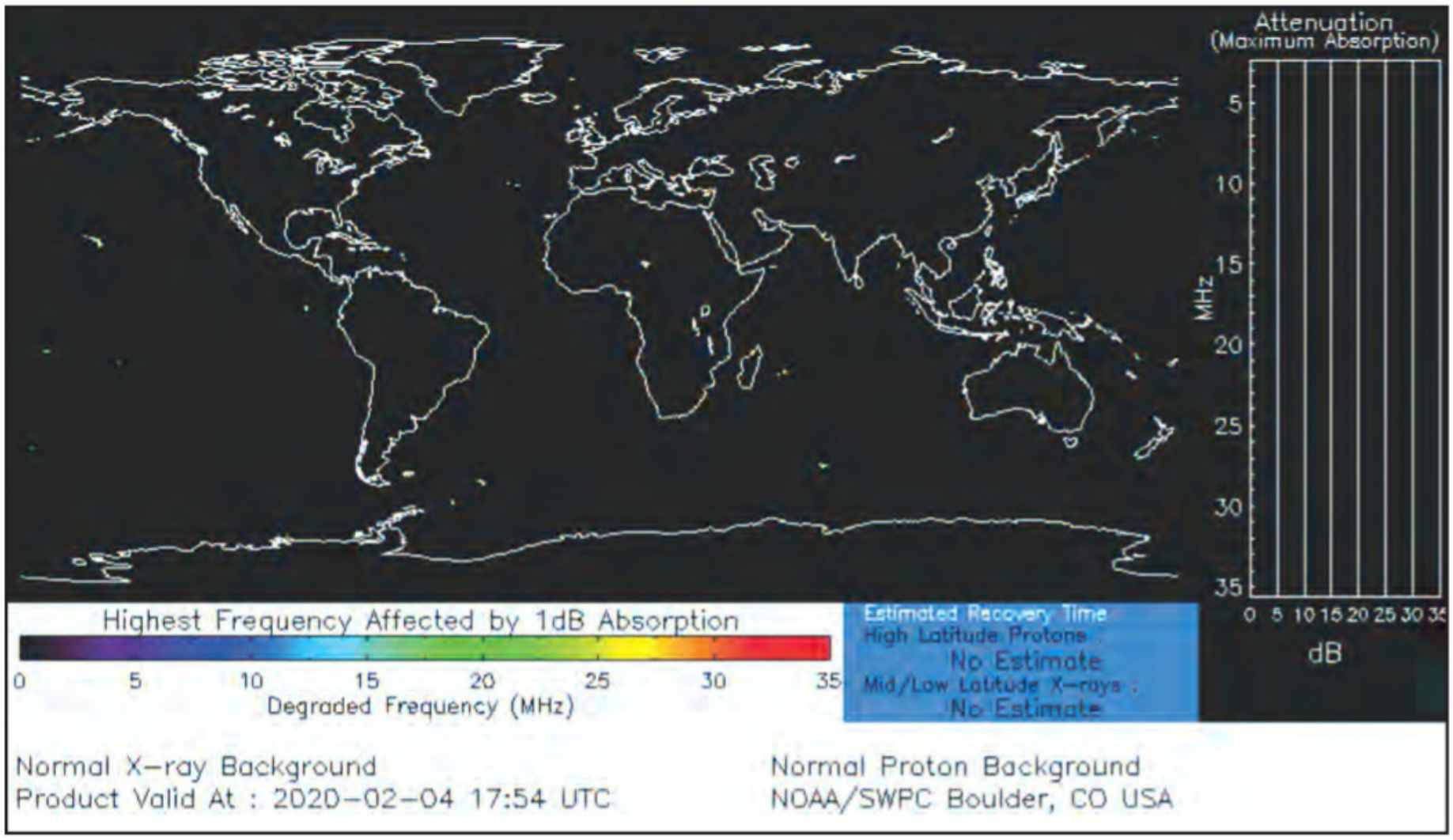


Figure 4. The D-region absorption map on February 4th just before UTC noon. There is no area colored, because there is no absorption occurring. This map is in real-time, and will also indicate the impact of an X-ray flare. [Courtesy of <http://SunSpotWatch.com>, Tomas Hood (NW7US), SWPC]

tances via the ionosphere. Of course, with the rise in solar activity, geomagnetic conditions are expected to become more chaotic, with occasional storm periods that will degrade shortwave propagation. A strong geomagnetic storm can lower the effective maximum usable frequency over a given path between two stations by as much as 30%. The increase in noise as well as geomagnetic disturbances will make for periods of more challenging DXing.

Look for gray-line DX in the mornings and evenings on lower frequencies. Trans-equatorial propagation will be more likely toward sunset during days of high solar flux and a disturbed geomagnetic field (*look for days with an A_p greater than 15, or a planetary K index (K_p) greater than 3 –TH*). E_s openings should be increasing, for shorter-range openings.

VHF Conditions

Check for low-VHF short-skip openings during the daylight hours. Some short-skip openings over distances of about 1,200 to 2,300 miles may occur. The best times for such openings are during the afternoon hours.

Auroral activity often occurs during periods of radio storminess on the HF bands. Look for days where the A_p is climbing, when the K_p reaches 4 or higher. These are the days on which VHF auroral-type openings are most likely to occur. Check the Last-Minute Forecast for those days expected to be Below Normal or Disturbed during March.

If you use Twitter, you can follow <@hfradiospacewx> for hourly updates that include the K index numbers. You can also check the numbers at <http://SunSpotWatch.com>, where this columnist provides a wealth of current space weather details as well as links. Please report your observations of any notable propagation conditions, by writing this columnist via Twitter, or via the Space Weather and Radio Propagation Facebook page at <https://fb.me/spacewx.hfradio>.

Current Solar Cycle Progress

The Royal Observatory of Belgium reports that the monthly mean observed sunspot number for December 2019 is 1.0. The 12-month running smoothed sunspot number centered on June 2019 is 2.2. A smoothed sunspot count of 3, give or take about 3 points, is expected for March 2020.

The Dominion Radio Astrophysical Observatory at Penticton, BC, Canada, reports a 10.7-cm observed monthly mean solar flux of 70.9 for December 2019. The 12-month smoothed 10.7-cm flux centered on June 2019 is 69.6. The predicted smoothed 10.7-cm solar flux for March 2020 is 64, give or take 4 points.

The observed monthly mean planetary A-Index (A_p) for December 2019 is 4. The 12-month smoothed A_p index centered on June 2019 is 6.5.

Geomagnetic activity this month should be mostly quiet with fair to good propagation conditions, except for those days indicated in the Last-Minute Forecast during which we expect degraded propagation (*remember that you can get an up-to-the-day Last-Minute Forecast at <http://SunSpotWatch.com> on the main page –TH*).

I welcome your thoughts, questions, and experiences regarding this fascinating science of propagation. You may email me, write me a letter, or catch me on the HF amateur bands. If you are on Facebook, check out <https://fb.me/spacewx.hfradio> and <https://fb.me/NW7US> — speaking of Facebook — check out the *CQ Amateur Radio* magazine fan page at <https://fb.me/CQMag>.

– 73, Tomas, NW7US

Number groups after callsigns denote the following: Band, Final Score, QSOs, Zones, Countries, States/Provinces. An asterisk (*) indicates low power. Certificate winners are listed in boldface. Late logs are listed in italics.

2019 CQWW DX RTTY RESULTS

SINGLE OPERATOR
NORTH AMERICA

United States, District 1

K5ZD	A	992,628	1356	61	159	131
WA2HIP	"	39,360	213	25	48	50
K1SND	"	38,544	229	29	45	58
*N1IXF	A	705,348	1098	54	138	119
*NE1D	"	241,837	504	49	111	97
*AE1P	"	159,570	433	35	73	89
*W1ARY	"	95,749	288	36	79	66
*W1DYJ	"	54,165	203	33	61	63
*KG1V	"	37,872	145	33	63	48
*KB1LRL	"	33,813	147	23	55	39
*KC1SA	"	32,364	164	25	43	48
*KC1ERO	"	30,240	127	25	54	33
*K1VW	"	26,536	160	23	44	40
*N1RDN	"	19,200	109	24	42	30
*KX1X	"	10,270	77	20	31	28
*K3SSS	"	4,503	58	15	18	24
						(OP: @W1/CHAPLIN)
*WC4E	"	3,944	40	18	19	21
*K1LHO	"	3,660	63	17	14	30
*K1CGZ	"	3,350	39	15	19	16
*KO4W	"	2,091	49	8	6	27
*AB1J	14	64,400	292	17	56	39
K6DTT/1	AA	1,400,100	1542	70	200	120
KB1W	"	435,768	884	46	116	109
W1DX	"	336,429	610	50	122	89
						(OP: W1AN)
WA1Z	"	166,222	352	47	103	67
KW1DX	"	139,722	361	37	86	51
N1MD	"	107,445	309	32	78	35
NV1Q	"	34,444	155	27	53	29
W1CTN	"	14,400	104	21	29	25
K1SOC	"	12,500	98	25	26	49
						(OP: W1CTN)
WW4LL	14A	408,558	1171	25	82	42
K1SM	"	28,981	176	13	40	20
W1VE	"	26,598	186	9	31	22
NN9DD	7A	161,536	687	19	62	47
N1MGO	3.5A	187	12	5	5	7
*KS1J	AA	351,833	645	49	122	86
*N1API	"	150,897	396	32	87	60
*KA2KON	"	132,854	355	35	88	58
*AE1EZ	"	120,801	388	40	84	77
*K1ECU	"	66,528	250	36	62	78
*K7RB	"	60,417	242	28	56	63
*W1GD	"	56,446	142	42	89	38
*W1FSH	"	6,615	54	17	23	23
*K1JSM	14A	50,467	278	18	55	36

District 2

K2RET	A	197,736	580	41	89	101
K2XA	"	129,285	304	44	87	64
NN2NN	"	95,228	351	33	64	82
K4RUM	"	68,970	255	34	55	76
W2LE	"	61,854	221	24	57	41
KA2AEY	"	13,908	118	16	29	31
N2YBB	14	70,818	306	18	61	32
*WB2NFL	A	115,248	331	38	80	78
*W2JV	"	76,560	300	21	57	42
*WB2COY	"	73,372	276	32	59	75
*KC2WUF	"	58,212	213	35	56	63
*W2FDJ	"	56,248	218	37	57	64
*N2HMM	"	55,211	271	23	45	69
*AC2OC	"	46,893	205	33	49	65
*NS2N	"	37,639	167	32	45	56
*W2DXE	"	36,494	171	31	47	64
*K2GLS	"	24,084	155	21	31	56
*N2MUN	"	22,320	121	21	42	30
*AK2S	"	20,160	124	16	34	34
*N2CU	"	19,800	103	21	42	36
*ND2K	"	14,790	110	19	27	41
*KE2D	"	7,735	61	19	26	20
*KA2WIK	"	5,772	74	18	15	41
*KD2DVW	"	3,404	50	11	11	24
*WA2QAU	"	648	17	9	6	12
*KS2G	14	10,850	109	12	25	25
*W2VTV	7	23,630	199	14	32	39
N2WK	AA	226,269	464	55	115	109
K2NV	"	203,232	490	45	92	95
W2YK	"	81,675	216	40	92	33
AA2GF	"	77,695	298	42	87	76
WA3AFS	"	75,516	243	42	75	69
K2PAL	"	67,452	269	29	61	56
N2CG	"	8,763	50	25	41	3
N6EE	"	725	16	9	9	7
WB2NVR	14A	36,375	193	13	51	33
*NY6DX	AA	235,711	652	42	90	91
*K2AL	"	72,933	265	27	57	77
*K2TWI	"	67,482	209	24	69	45
*W2TT	"	22,464	111	27	43	34
*K2SI	"	21,008	125	22	31	48
*KB2URI	"	12,684	88	20	32	32
*K1NY	"	5,670	48	18	27	18

District 3

W3RGA	A	383,625	859	52	108	119
KE3GK	"	177,410	449	41	95	90
K3UL	"	143,528	412	51	96	86
K1BZ	"	112,401	315	42	85	80
N3XL	"	81,269	323	35	64	82
N3DUE	"	79,119	293	31	56	90
W8LYJ	"	54,257	243	32	60	69
KW3A	"	50,325	201	38	60	67
K3QIA	"	40,320	173	27	52	47
KG4USN	"	16,262	106	21	35	38
K3OK	"	16,074	113	21	33	40
4U1WB	14	58,140	452	18	31	46
						(OP: AJ3M)
AI3Q	"	30,310	159	13	46	11
N3MWQ	"	3,036	48	12	15	17
*KB3AAY	A	202,356	495	45	88	98
*AJ3C	"	116,372	385	34	70	84
*K3URT	"	96,048	334	36	67	81
*WA3ZSC	"	81,550	325	32	52	91
*K3NDM	"	45,903	201	28	48	67
*AI3KS	"	26,568	151	24	36	48
*KC3JNW	"	26,550	199	32	46	12
*N3CHX	"	22,646	143	39	42	53
*NG3Y	"	18,810	134	25	30	44
*KE3ZT	"	18,531	127	17	38	32
*W3BUI	"	14,194	101	22	27	45
*WA3AAN	"	12,720	86	20	29	31
*N3VOP	"	8,208	84	17	29	26
*KC3MIO	"	6,786	55	25	30	23
*WA3FAE	"	5,488	47	15	27	14
*W3FA	"	4,725	63	14	19	30
*W3UL	"	4,118	54	15	14	29
*KA3FZN	"	3,825	35	17	22	12
*N8HM	"	361	10	7	7	5
*N3GH	21	3,444	57	13	17	11
*KF3EB	14	9,180	99	11	20	29
*KX2S	"	4,048	49	8	17	21
*K3LT	"	1,749	27	11	15	7
*KB3LIX	7	5,076	61	10	16	28
AA3B	AA	2,578,576	2467	90	261	188
N3QE	"	1,372,820	1762	68	177	170
W3FIZ	"	984,192	1381	62	170	120
W3FV	"	800,020	1149	60	148	132
K3MM	"	662,998	932	73	175	158
K3PP	"	599,104	804	69	165	118
NA3M	"	383,551	530	63	159	127
K3MD	"	211,560	625	34	85	96
NN3RP	"	130,296	443	29	66	88
KD3TB	"	108,592	352	31	67	78
W3MF	"	100,800	264	37	82	41
N4ZR	"	80,272	241	32	74	67
AA3S	"	51,342	181	31	62	36
K3TN	"	19,448	107	25	40	39
N3FJP	"	12,792	106	17	23	42
KB3Z	"	8,505	77	18	23	40
W3OU	"	2,077	25	9	18	4
W3GVX	14A	8,996	101	14	18	20
*W3KB	AA	279,300	543	56	120	109
*NY3B	"	233,230	496	56	113	112
*KN3A	"	15,010	101	23	36	36

District 4

AG4W	A	678,506	1221	62	132	152
K4ADR	"	374,227	953	46	90	124
W4PK	"	307,720	743	41	86	118
W4GKM	"	296,438	818	45	79	145
AC8Y	"	246,829	573	38	89	82
AI4WW	"	236,829	571	50	99	118
K7OM/4	"	196,750	544	45	80	125
W3IK	"	134,976	404	48	74	106
W4OX	"	94,430	293	38	77	75
AD4TJ	"	81,337	281	34	56	73
W3SA	"	73,548	276	33	54	75
W3TB	"	71,435	294	31	53	73
NN4NT	"	67,115	239	32	57	66
KO8V	"	66,598	243	21	61	60
KG4CUY	"	59,494	250	32	55	64
W4BCG	"	59,006	277	31	46	86
NØSMX	"	55,432	218	38	60	66
N4CF	"	53,066	211	39	56	74
WB4YDY	"	52,480	199	41	55	64
K2PS	"	40,610	225	29	48	54
WF4W	"	32,128	151	28	39	61
KC4SAW	"	30,634	144	21	53	32
K4MI	"	30,480	184	26	31	70
N3KN	"	27,370	149	26	36	53
N4TL	"	27,060	132	25	43	42
KB4QZH	"	25,544	162	24	32	47
NR4C	"	20,223	122	22	34	51
K4CV	"	15,624	100	20	35	29
WR4JW	"	15,228	111	20	26	48
NN4SS	"	11,040	65	21	38	10
W5XB	"	3,604	43	17	20	16
W1GKT	"	3,168	50	9	13	22
K4WI	28	5,124	76	10	13	19
K3KG	21	32,088	228	17	37	30
W4UK	14	627	22	8	7	4
K4FJ	3.5	28,466	267	11	31	44
*AA2MF	A	612,766	1414	53	120	149
*W4GO	"	572,782	1079	60	134	132
*NU4E	"	304,440	742	57	99	139
*KC4HW	"	160,548	575	34	64	106
*KF4FC	"	117,384	369	40	66	95
*W3DQS	"	92,058	391	41	53	107
*KQ4AV	"	85,170	255	33	74	60
*WA3LXD	"	78,126	299	33	62	79
*K4LPQ	"	69,030	290	35	53	89
*N3CKI	"	58,756	293	25	43	80
*K4FTO	"	55,173	221	36	58	65
*KM4FO	"	54,450	295	27	36	87
*W4PJW	"	53,742	278	31	43	85
*KW4J	"	53,016	242	28	52	61
*K4FJW	"	51,436	219	34	48	72
*KC8GCR	"	48,140	202	31	54	60
*W5MMW	"	46,500	175	40	56	59
*WA8OJR	"	43,200	185	29	44	62
*KC4TNQ	"	41,817	194	35	44	80
*W1BQ	"	39,337	181	33	47	59
*W4GHV	"	32,560	183	39	58	13
*AI4GR	"	32,340	169	31	40	61
*KD4YDD	"	31,220	142	37	49	54
*NF4J	"	30,246	179	31	42	69
*NN4RB	"	29,500	138	31	47	47
*K4BX	"	26,656	158	23	33	56
*W4WWQ	"	26,568	122	33	47	43
*K8ARY	"	25,630	127	23	43	44
*N7IVV	"	22,425	144	22	37	56
*WF7T	"	19,320	110	26	34	45
*AA5JF	"	17,784	104	30	39	45
*W4TIJ	"	16,461	114	22	30	41
*W1LZ	"	16,150	112	20	31	44
*AB4IQ	"	16,032	107	27	31	38
*KQ4KX	"	15,197	103	22	33	36
*KK4HEG	"	14,661	160	12	12	57
*NC4MI	"	13,392	100	23	28	42
*W5VS	"	13,248	97	20	26	46
*KC3EF	"	12,420	104	23	26	41
*W4JSI	"	12,126	89	26	38	30
*W4HM	"	11,495	92	24	25	46
*WC4T	"	11,205	116	16	18	49
*K4GMH	"	9,600	118	11	20	33
*KS4X	"	9,440	72	20	26	34
*KS4S	"	7,812	101	12	14	37
*N4AU	"	4,815	40	14	30	1
*KM4MK	"	3,465	43	18	15	22
*W5JR	"	2,907	43	14	14	23
*KK4WX	"	2,862	43	17	13	24
*WJ4HCP	"	2,576	46	15	14	27
*KA3EHL	"	2,142	44	14	17	20
*N4MRM	"	2,070	27	9	21	0
*KT3T	"	1,575	64	21	21	33
*N5SMQ	"	1,551	32	11	12	10
*NQ4K	"	1,517	29	11	9	17
*K4YDE	"	1,184	27	11	9	17
*K6BY	"	1,032	33	12	12	19
*N8AID	"	621	17	9	10	8
*KA6PNL	"	390	22	5	6	2
*W4LC	14	90,016	393	17	59	40
*KC4WQ	"	12,222	102	14	28	21
*K3ZV	"	4,200	54	13	17	20
*KO4OL	"	289	14	5	4	8
*AE4ED	7	61,586	414	17	39	50
*WN4AFP	"	6,912	100	9	17	28
*AAØO	"	5,148	65	10	18	24
*W4NBS	"	1,247	28	7	8	14
N6AR	AA	823,752	1101	77	166	165
K5EK	"	637,146	933	62	149	131
W4CU	"	560,994	940	66	135	160
N4IQ	"	470,750	995	62	122	166
NR4O	"	452,682	999	52	111	140
W4TTY	"	424,908	665	60	147	112
K4XL	"	347,139	607	59	134	106
N4QS	"	337,225	742	56	97	134
W4JAM	"	308,524	612	57	116	101
N4BCD	"	305,532	631	55	106	115
N4ZZ	"	281,542	776	40	81	118
AA4DD	"	245,760	589	50	93	113
K4JKB	"	241,920	598	51	103	116
W3YY	"	239,088	513	50	115	107
WJ2D	"	208,884	452	38	105	63
K2WK	"	204,368	456	48	101	92
K3IE	"	192,864	444	50	103	93
K4FX	"	192,140	417	59	103	98
W4VIC	"	175,471	405	45	98	84
N4TGD	"	140,224	428	43	64	117
NS4X	"	127,656	432	40	72	85
WB4HRL	"	120,848	352	41	77	90
K8AC	"	105,504	304	33	70	54
AJ4VE	"	102,135	303	34	66	65
N4YDU	"	96,300	299	47	74	93
K4QD	"	85,840	283	36	68	81
W4TM	"	83,300	284	47	66	83
NZ4N	"	76,360	269	33	66	67
K4RO	"	74,730	265	39	58	62
K1LTJ	"	65,065	224	40	76	53
W5MX	"	61,535	314	31	38	86
WR4B	"	60,828	198	36	69	43
W4GE	"	58,259	179	40	71	38
N3UA	"	52,184	252	16	48	24
NJ2F	"	51,408	197	42	52	74
N3ND	"	43,878	156	33	57	52
N2TU	"	38,940	168	30	50	52
N4MM	"	32,886	156	15	47	25
AJ4A	"	25,420	131	33	39	52
K4NV	"	24,752	180	21	28	55
K3WA	"	24,360	156	19	33	53
N4GU	"	20,128	111	17	44	7
WB2BTJ	"	15,570	104	18	37	35
KSØCW	"	13,197	99	19	30	34
K4WW	14A	125,857	440	20	63	44
K4MGE	"	17,617	188	14	27	38
*AA4LS	AA	180,075	538	47	84	114
*W3OA	"	143,166	341	51	97	75
*N2QT	"	96,333	331	38	64	95
*KG4IGC	"	94,488	305	38	82	66
*K2MK	"	64,527	298	34	42	81
*W4EE	"	54,810	242	26	55	45
*KK4R	"	52,947	201	31	52	76
*KN4LKC	"	41,540	174	28	52	54
*N4YCI	"	18,392	125	28	39	54
*KG3V	"	17,542	103	22	35	41
*NZ6T	"	11,385	104	23	26	50
*K4VBM	"	11,125	88	22	28	39
*KM4RK	"	10,764	64	25	33	20
*K3KZU	"	3,776	53	19	23	22
*N1IA	"	3,504	59	10	11	27
*WN8Y	"	2,392	50	15	16	21
*K4FT	"	870	20	9	8	13
*WA1FCN	14A	147,686	625	24	65	48

District 5

N5VU	A	161,568	504	44	75	97
N5RZ	"	160,400	504	43	62	95
N5DD	"	32,526	151	36	42	61
KF5VRD	"	23,622	207	16	18	59
W5KI	"	6,100	57	17	24	20
N5OT	"	1,932	36	10	10	22
N5ATM	"	1,728	46	7	7	22
W5PR	28	7,744	96	12	17	15
N5TF	14	1,749	43	8	9	16
*NN5T	A	179,690	485	49	74	101
*K5DHY	"	133,272	421	47	76	93
*WB5BHS	"	109,395	503	31	39	117
*N5KWN	"	98,000	404	35	54	86
*KK5JD	"	89,646	355	44	57	100
*K5GDX	"	87,178	316	38	54	90
						(OP: WQ5L)
*K5IB	"	84,422	311	41	56	94
*NK5P	"	76,109	356	42	50	95
*N5RLM	"	74,676	268	45	56	95
*WB5K	"	51,623	312	29	30	84
*AJ4F	"	48,396	208	36	51	61
*NZ5O	"	45,717	203	36	49	62
*KG5U	"	30,030	156	39	42	62
*WB5AAA	"	29,149	167	24	42	37
*W5LA	"	27,027	176	29	32	56
*KD5ILA	"	26,078	226	23	18	77
*N5EKW	"	21,850	150	25	31	59
*KØGEO	"	20,304	146	25	25	58
*KF5BA	"	15,515	131	25	26	56
*KJ6DQ	"	14,664	110	18	29	31
*NM5Z	"	14,652	124	23	24	52
*AB8YZ	"	11,718	143	30	29	3
*KM6HB	"	8,774	75	24	21	37
*N5KAE	"	8,118	74	15	23	28
*W5TD	"	5,460	58	18	20	27
*K5CRJ	"	4,060	52	15	14	29
*WV5Y	"	2,760	51	11	10	19
*WW5XX	"	1,739	47	11	11	15
*KE5XV	"	1,520	35	8	7	23
*K5ND	21	2,190	31	12	14	4
*KD5JHE	14	10,622	101	12	32	3
*W5CUY	"	2,730	35	14	17	11
*N5RMS	7	480	47	5	3	22
NT5V	AA	539,601	1080	62	123	136
AC4CA	"	527,672	1105	57	97	130
K5BG	"	168,715	492	44	75	86
KA5M	"	167,877	517	40	75	92
K8LS	"	140,114	485	46	66	109
N5XJ	"	69,966	247	31	62	45
K5CI	"	69,142	294	43	52	86
W5VQ	"	68,640	281	34	64	32
K5CKS	"	65,400	242	32	57	61
K5XH	"	53,808	270	27	37	88
N5TIT	"	35,765	238	26	33	56
WA5LXS	"	31,020	158	34	41	57
NN5O	"	24,192	184	21	22	65
KN5S	"	19,800	169	22	26	40
						(OP: K5WW)
K5UV	"	7,904	56	24	27	25
W2GS	"	5,850	50	11	31	3
N8MTV	"	1,739	20	15	17	5
AA5AU	14A	188,635	659	24	77	54
*WA5LFD	AA	103,207	331	52	67	102
*KE5LQ	"	36,936	166	40	48	64
*K5HDU	"	5,712	75	15	16	37
*K5WW	"	2,436	48	8	7	27
*W5IDX	"	112	8	5	3	6
*W5DCC	14A	22,630	265	12	15	46
						(OP: NK5G)

District 6

N6JV	A	338,640	917	52	65	138
N3RC	"	256,486	805	48	69	140
NN6XX	"	197,036	663	48	53	125
NN6DX	"	148,730	437	49	70	95
						(OP: W1PR)
N6GP	"	146,674	451	49	61	116
K6TD	"	143,520	456	38	51	95
NC6K	"	119,925	456	36	45	124
KI6VC	"	119,464	595	42	42	134
K6TQ	"	106,470	393	40	51	91
W6JBR	"	66,990	290	38	43	73
K6NR	"	34,472	185	29	35	60
WA6URY	"	19,203	135	28	29	54
AI6O	"	12,880	113	19	18	55
K6XX	14	1,540	25	8	15	5
W6RKC	7	10,240	83	17	20	27
K6TET	"	165	13	3	2	6
*WN6K	A	223,223	763	43	46	134
*N6RVI	"	113,712	415	43	48	93
*KK6KMU	"	48,312	270	27	30	75
*AA2IL	"	30,976	200	26	26	69
*KD6C	"	24,864	186	35	38	11
*WK6I	"	19,608	105	37	33	44
*K6BIR	"	18,315	134	24	26	49
*N5YJZ	"	18,117	147	20	20	59
*AF6GQ	"	17,160	119	28	28	48
*K6JF	"	14,964	125	22	21	44
*N6UTC	"	12,348	111	23	23	38
*W6RQ	"	11,745	105	23	24	40
*WU6K	"	6,440	68	20	19	31
*W6SFI	"	6,365	73	16	15	36
*N6OPE	"	6,120	93	20	18	34
*KC9EI	"	5,460	72	22	21	27
*WB6KDH	"	2,016	41	14	12	10
*AA6MK	"	1,798	55	11	9	42
*KD6HOF	"	1,050	31	7	7	16
*AI6V	"	580	22	9	8	12
*KM6VEK	"	54	5	3	2	4
*KF6RY	14	24,210	185	19	31	40
						(OP: W6ZL)
*N6BHX	"	2,816	38	14	12	18
N6IE	AA	562,700	942	71	116	153
WE6Z	"	286,995	772	57	71	137
W6SX	"	169,389	491	51	59	151
K6OK	"	162,945	476	46	57	110
W6RC	"	158,685	561	45	54	114
NX6T	"	157,896	540	45	51	108
W9KKN	"	134,590	468	50	53	112
W6RDF	"	96,525	476	32	39	94
						(OP: N6CY)
N6RV	"	42,976	175	41	45	50
W1RH	"	40,740	208	27	35	78
W6IA	"	40,440	232	26	26	68
NK6A	"	40,256	186	35	41	60
NN6NN	"	39,420	205	32	33	70
						(OP: W6XK)
K6HGF	"	32,542	191	29	28	49
N6QQ	"	30,414	128	37	43	31
K6MM	"	27,610	171	31	30	49
K6ZH	"	17,115	110	29	27	49
AF6SA	"	15,150	91	31	34	36
W6MOB	"	9,675	57	32	37	6
K6AW	14A	140,012	577	26	63	53
*KE6GLA	AA	114,800	459	44	43	113
*AG6JA	"	360	11	8	8	4

District 7

N7GP	A	366,482	1018	51	74	132
W7XQ	"	241,150	577	57	85	123
W7QDM	"	181,575	607	42	62	121
WU6W	"	131,242	488	40	46	125
KB7N	"	106,590	411	42	46	99
K7LFY	"	104,493	453	40	46	97
K7VIC	"	67,828	397	21	30	73
AC7GL	"	61,934	260	37	44	92
KI6QDH	"	53,284	283	34	36	84
W7YAQ	"	49,590	235	38	39	68
AK7O	"	46,228	321	25	25	77
K7EG	"	31,992	171	31	41	52
AC7JW	"	31,460	182	31	38	61
WD7E	"	18,256	111	28	27	57
AD7XG	"	15,416	82	27	38	17
K6UM	"	12,876	100	23	23	41
K9QJS	"	6,138	63	17	16	29
WO7V	"	832	18	9	8	9
N7XCZ	"	161	17	6	5	12
AA7V	14	26,010	225	19	21	45
*N7IR	A	406,692	939	61	94	131
*WS7V	"	58,282	282	33	38	90
*KC7CM	"	51,606	273	32	30	78
*NW7D	"	46,035	234	33	35	87
*K7HKR	"	44,968	208	31	37	78
*N7DB	"	44,070	240	33	36	61
*K7AZT	"	37,884	199	31	31	70
*N7UVH	"	23,985	175	25	23	69
*KB7AK	"	19,690	142	26	25	59
*N7ESU	"	19,341	239	24	31	8
*K7RBT	"	18,914	138	26	25	47
*N7AME	"	15,617	155	24	25	48
*KE7GKI	"	14,877	151	17	16	54
*K7MY	"	14,342	104	24	24	53
*KG7VIZ	"	12,996	143	16	15	45
*WB7CYO	"	12,628	134	16	14	47
*N7FG	"	12,367	96	25	26	32
*AA4Q	"	11,440	106	19	18	43
*WB6JJJ	"	10,731	109	17	15	41
*KB7ABJ	"	10,624	95	21	20	42
*AF7NX	"	8,280	90	17	18	34
*W7JHR	"	6,630	103	22	20	9
*KO6UW	"	5,915	70	19	18	28
*N7JI	"	5,782	68	17	15	27
*NE7O	"	5,538	94	14	13	44
*KK7A	"	3,888	61	11	12	31
*W7QL	"	3,240	47	12	14	28
*KU7Y	"	2,679	38	14	14	19
*AA7IH	"	1,989	37	13	11	15
*WT8P	"	1,813	38	14	11	24
*KF7GMV	"	1,736	54	9	7	12
*WM7X	"	910	24	12	11	12
*K6ST	"	841	29	7	6	16
*KR7X	"	56	8	2	1	4
*AA7UN	14	1,932	28	10	18	0
*K7JSG	"	858	31	6	5	11
*W7PP	"	676	16	9	8	9
*W7JSD	"	55	9	4	2	5
*WB3JFS	7	10,089	115	14	14	31

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*KF7R	"	4,606	77	10	10	29
K6LL	**AA**	**1,147,450**	**1713**	**85**	**158**	**190**
KO7SS	"	786,044	1144	80	152	187
W7ZR	"	598,965	958	78	136	151
KF7U	"	465,567	1101	57	89	165
N7NM	"	282,880	725	55	81	124
NG7M	"	210,056	591	52	78	118
K7RL	"	200,100	597	48	63	119
W7VXS	"	155,230	655	32	47	111
NG7E	"	150,912	536	38	44	110
KØIP	"	129,626	396	43	68	86
N9NA	"	125,944	504	35	40	98
K7VIT	"	99,034	377	43	45	81
W7GES	"	93,744	347	38	53	77
K7AR	"	59,466	227	39	50	70
W7CXX	"	58,384	248	40	43	95
KB7AZ	"	39,325	157	39	51	53
K2RD	"	32,482	138	42	53	54
W7CT	"	31,623	222	19	27	37
W7GYM	"	29,590	197	23	24	63
KT7G	"	26,208	179	23	27	62
W7BP	"	24,453	154	29	34	54
W7CO	"	14,268	134	21	19	47
WS7L	"	9,796	98	20	21	38
KG7QXE	"	7,416	77	19	17	36
W9PL	"	4,508	44	17	20	9
W7SLS	"	3,300	54	14	11	30
N6SS	**28A**	**2,604**	**39**	**10**	**12**	**9**
N7BV	**14A**	**60,907**	**352**	**20**	**45**	**48**
K7WP	**7A**	**74,880**	**403**	**25**	**43**	**52**
N7AT	"	54,648	382	19	32	48
						(OP: K8IA)
***AK6A**	**AA**	**123,948**	**398**	**42**	**51**	**105**
*W7OM	"	84,309	357	42	46	91
*N7ZUF	"	56,242	301	28	37	57
*K7GS	"	49,657	248	28	44	55
*W7WSV	"	49,113	212	34	43	76
*KD7PCE	"	37,672	197	37	38	61
*KN7K	"	20,758	182	23	21	53
*K7VAP	"	16,684	143	21	24	41
*WAØWWW	"	10,868	100	19	18	39
*AC7JM	"	9,680	97	20	19	41
*WA7YAZ	"	7,504	79	15	16	36
*N1JM	"	3,105	45	14	13	18
*N7CPM	"	936	26	13	8	15
***N6MZ**	**28A**	**18**	**6**	**1**	**1**	**1**
***K7XC**	**14A**	**17,286**	**145**	**17**	**27**	**42**
*KB7HDX	"	1,032	21	10	8	6

District 8

K8RCT	*A*	*117,208*	*393*	*34*	*66*	*96*
K8AJS	**"**	**92,036**	**311**	**35**	**61**	**77**
K8BZ	*"*	*74,148*	*318*	*27*	*44*	*96*
K8MM	"	44,640	237	17	39	40
KB8VAO	"	44,064	158	34	60	50
WA8Y	"	39,767	188	30	55	48
KTØG	"	8,446	85	20	23	39
W8TOM	**7**	**27,927**	**257**	**17**	**23**	**47**
KG9Z	"	17,040	152	14	27	39
***K3DMG**	**A**	**143,902**	**420**	**38**	**81**	**92**
*N8CWU	"	140,030	455	39	69	101
*ND3N	"	48,600	296	22	25	88
*N8TCP	"	40,365	219	21	37	59
*WB8JUI	"	37,520	210	29	33	78
**K8SIA*	*"*	*33,670*	*177*	*27*	*43*	*60*
*WB8JAY	"	26,796	144	26	36	54
**AA8EN*	*"*	*16,781*	*135*	*21*	*24*	*52*
**K3YP*	*"*	*13,104*	*96*	*20*	*29*	*35*
*W5UHQ	"	9,373	96	19	23	49
*N8WCP	"	7,488	69	16	26	30
*K8ALM	"	750	19	6	7	12
*KE8LUE	"	312	24	4	3	17
***NF8M**	**14**	**644**	**16**	**8**	**8**	**7**
***W8WTS**	**3.5**	**360**	**16**	**5**	**3**	**10**
N8BJQ	**AA**	**609,224**	**914**	**62**	**147**	**135**
KA8G	"	74,700	242	32	68	66
K8PK	"	18,693	115	28	38	27
K8ESQ	"	15,810	101	20	32	33
W8BI	*"*	*14,596*	*138*	*18*	*16*	*55*
						(OP: KB8UEY)
W8JWN	**14A**	**682**	**17**	**7**	**9**	**6**
***KK8MM**	**AA**	**48,032**	**204**	**34**	**53**	**65**
*AA8SW	"	44,998	231	33	41	75
*KØACP	"	34,945	205	29	36	80
*N4EL	"	34,902	204	26	34	66
*K8GT	"	15,246	120	20	29	50
*N8VV	"	10,295	66	20	33	18
***KD8VMM**	**14A**	**364**	**10**	**5**	**8**	**0**
***W8EH**	**7A**	**221**	**14**	**3**	**3**	**11**

District 9

WI9WI	**A**	**394,584**	**989**	**42**	**78**	**125**
KF9US	"	102,480	347	36	64	83
AC9KW	*"*	*101,579*	*388*	*23*	*47*	*87*
ND9Z	"	70,224	287	29	49	76
KZ9DX	"	29,532	171	24	41	42
K9ZO	*"*	*19,100*	*130*	*22*	*26*	*52*
KK9N	"	15,580	99	20	32	30
K9GWS	"	10,902	101	18	22	39
KG9N	"	10,368	113	17	14	50
NN9C	"	2,478	37	11	12	19
N9LD	"	154	7	5	4	5
***KD9MS**	**A**	**248,600**	**593**	**53**	**103**	**119**
*K9CW	"	135,876	396	36	65	100
*WD9CIR	"	95,352	391	30	49	95
*N9LYE	"	77,328	324	37	47	95
*KOØZ	"	76,557	324	31	51	87
*KW9U	"	75,516	319	34	50	90
*AIØY/9	"	70,493	366	26	28	103
*WB9HFK	"	45,360	257	26	35	74
*N9LF	"	41,538	245	26	27	85
*WB9DAR	"	35,723	257	24	34	81
*N9WG	"	34,425	190	28	37	70
*KB9DVC	"	31,980	192	28	35	67
*WB8BZK	"	30,607	196	25	28	74
*W9OA	"	18,326	152	18	20	60
*KB9S	"	7,560	104	10	11	39
*K9QJ	"	5,538	61	22	17	39
*KC9YL	"	4,346	65	13	11	29
*KE9UA	"	2,793	57	11	9	29
*N9TR	"	2,548	46	11	8	30
*KE9V	"	192	10	6	3	7
***W9BGX**	**14**	**5,555**	**74**	**11**	**14**	**30**
						(OP: WA9LKZ)
*KC9EOQ	"	2,415	40	10	13	12
*WQ9T	"	1,104	28	7	6	10
*N9YLZ	"	1,014	23	9	11	6
***W9LU**	**7**	**14,616**	**150**	**13**	**18**	**41**
*W9AKS	"	9,462	152	8	7	42
ND9G	**AA**	**644,988**	**1056**	**67**	**130**	**157**
K9OM	"	509,406	871	62	133	159
KT9L	"	379,472	754	58	116	122
N2BJ	"	270,710	733	44	77	132
K9NW	"	251,930	434	65	125	115
N9OK	"	186,760	659	42	64	126
AC9S	"	179,564	504	38	72	102
WT9U	"	159,216	435	31	65	90
N9LQ	"	118,085	380	41	59	109
AJ9C	"	114,410	335	38	76	56
K9PY	"	86,304	316	38	63	85
KC9K	"	70,590	218	46	69	66
W9YK	"	35,306	209	25	30	72
NS9I	"	16,692	109	15	31	32
W9RN	"	850	17	8	12	5
W9ILY	**14A**	**208,772**	**596**	**26**	**85**	**53**
W9PA	**7A**	**42,660**	**253**	**18**	**43**	**47**
***AA9L**	**AA**	**89,570**	**343**	**32**	**62**	**75**
*N9UA	"	56,160	236	29	45	70
**KB9OWD*	*"*	*34,596*	*215*	*21*	*29*	*74*
*N9VPV	"	33,660	173	26	38	68
*WA9LEY	"	33,306	207	23	26	73
*KG9X	"	26,378	150	25	39	57
*N9SB	"	24,307	155	26	28	55
*N9AKR	"	18,404	88	20	51	15
*WA9IVH	"	17,928	127	23	29	56
*NR9K	"	17,484	120	21	29	43
**KC9TZO*	*"*	*8,732*	*100*	*14*	*13*	*47*
*K9GY	"	4,745	51	18	20	27
**K9PG*	*"*	*40*	*3*	*2*	*3*	*0*
***AB9YC**	**7A**	**23,068**	**244**	**12**	**17**	**50**

District Ø

WX8C/Ø	**A**	**599,625**	**1044**	**62**	**124**	**139**
KØJJR	"	251,500	611	44	85	121
KØAD	"	184,179	693	39	54	126
WBØN	"	105,468	356	40	63	101
NØKQ	"	86,768	377	41	49	97
ABØS	"	72,698	343	30	42	91
KDØZV	*"*	*66,993*	*312*	*32*	*44*	*87*
KØTC	"	49,200	259	27	29	94
KIØI	"	32,125	185	32	36	57
WØVM	*"*	*26,355*	*147*	*22*	*35*	*48*
NØBUI	"	14,820	141	18	18	59
NØLEF	"	11,322	125	24	26	52
KØSRL	**7**	**3,528**	**66**	**7**	**6**	**29**
WØPC	"	2,304	49	7	7	22
NØOK	**3.5**	**7,000**	**121**	**8**	**9**	**33**
***AAØAW**	**A**	**142,480**	**436**	**43**	**66**	**99**
**KØFX*	*"*	*121,458*	*450*	*40*	*65*	*81*
**KCØZNI*	*"*	*86,730*	*337*	*35*	*55*	*87*
*AEØEE	"	80,703	327	38	43	108
*WAØLJM	"	52,920	259	32	42	73
*NRØT	"	50,694	277	28	39	75
*NWØM	"	42,028	238	25	30	78
*N5TU	"	32,896	189	28	30	70
*WAØLIF	"	31,339	195	26	32	63
*WØDC	"	25,289	129	26	38	57
*WØTUP	"	24,089	176	16	25	68
*WAØBSW	"	19,635	131	28	34	57
*WO7U	"	19,436	143	23	23	67
*KI6DY	"	15,184	131	17	23	33
*N6RSH	"	12,528	94	23	25	39
*NØGOS	"	10,570	130	13	10	47
*KEØKDX	"	8,690	127	14	12	53
*KBØHP	"	8,239	85	19	22	36
*W9LHG	"	5,562	89	13	12	29
*W3ZF	"	3,172	62	12	10	30
*KBØR	"	3,024	53	12	10	26
*WAØTXJ	"	2,000	49	6	6	28
*NYØJ	"	1,845	48	9	6	26
*KDØWUQ	"	1,739	43	10	7	20
*NØKK	"	1,564	41	6	5	23
*WB9QAF	"	57	14	7	5	7
*KØCV	"	18	3	2	1	3
***WØPI**	**14**	**9,849**	**97**	**14**	**27**	**26**
*AEØDM	"	4,002	63	10	11	25
*KEØSTT	"	1,025	33	5	5	15
NØAT	**AA**	**322,056**	**761**	**48**	**96**	**140**
ACØC	*"*	*258,408*	*634*	*54*	*108*	*134*
WØMB	"	250,920	689	49	88	109
NXØI	"	240,081	822	40	64	133
W7RY	"	160,475	450	45	74	126
KØYR	"	101,462	345	37	66	91
K2DSW	"	92,017	521	24	30	113
NUØW	"	66,352	257	38	56	82
KØPC	"	32,896	183	27	38	63
WØDET	*"*	*31,360*	*189*	*29*	*41*	*58*
NØAJN	"	23,270	121	35	34	61
WBØWIV	"	17,199	100	20	35	36
KØAP	"	16,704	100	17	35	20
K5ZG	"	7,345	73	18	19	28
WØCP	"	748	21	8	6	20
KSØAA	**14A**	**27,468**	**201**	**18**	**35**	**31**
NOØL	"	12,012	114	13	26	27
KFØIQ	"	6,372	70	15	20	19
KØWPM	"	2,691	58	7	6	26
						(OP: ACØE)
WØGJ	**7A**	**112,005**	**686**	**23**	**54**	**54**
***WØJW**	**AA**	**239,652**	**646**	**50**	**78**	**124**
*KØRC	"	184,260	467	49	94	106
*WXØZ	"	120,224	358	37	76	95
*KØMPH	"	90,710	388	39	44	110
*WØJM	"	38,528	183	33	48	47
*ACØE	"	10,414	108	18	17	47
*K4IU	"	10,152	106	18	19	35
**KTØW*	*"*	*5,915*	*74*	*16*	*15*	*34*
*AAØYY	"	961	28	10	10	11
*WAØMHJ	"	868	16	12	13	6
*NØMK	"	378	19	6	3	12
*KEØOR	"	200	12	7	5	8

Alaska

KL7SB	**AA**	**374,680**	**858**	**45**	**70**	**75**
KL7JVD	"	5,676	63	11	11	22

Barbados

***8P2K**	**7**	**58,656**	**263**	**13**	**44**	**39**

Belize

***V31MA**	**3.5**	**34,279**	**192**	**13**	**34**	**36**

Canada
District 1

***VA1XH**	**A**	**189,222**	**426**	**30**	**84**	**69**
*VE1RSM	"	76,050	228	29	65	56
VY1AAA	**14A**	**1,568**	**52**	**2**	**2**	**12**
VY2/W5AJ	**3.5A**	**117,974**	**419**	**18**	**60**	**44**
						(OP: W5AJ)
***VO1CH**	**AA**	**56,950**	**180**	**29**	**74**	**31**
*VO2AC	"	43,335	183	22	42	43
*VE1OP	"	3,619	35	16	17	14

District 2

VE2GSO	**A**	**478,077**	**930**	**36**	**83**	**100**
VA2FO	"	75,190	266	27	60	59
***VE2BVV**	**A**	**246,962**	**545**	**29**	**77**	**88**
*VE2QV	"	21,244	101	19	37	38
***VE2NCG**	**21**	**143**	**7**	**4**	**7**	**0**
VE2FK	**AA**	**421,971**	**829**	**31**	**86**	**92**
VE2NMB	"	220,492	523	32	73	94
VE2CSM	"	125,584	333	33	66	68
VE2PI	"	83,472	299	25	58	58
VE2RYY	**14A**	**360,930**	**878**	**26**	**90**	**43**
VE2EBK	**7A**	**101,460**	**426**	**17**	**47**	**50**
***VA2QR**	**AA**	**81,087**	**240**	**30**	**70**	**51**

District 3

VE3TW	**A**	**424,380**	**848**	**33**	**80**	**107**
VE3GYL	"	337,550	688	37	89	89
VA3MW	"	70,890	246	19	46	74
VA3WW	"	56,290	205	29	47	54
VA3XFC	"	51,045	181	21	46	56
VE3YAA	**14**	**29,592**	**196**	**12**	**28**	**32**
						(OP: VE3FJ)
***VE3DZ**	**A**	**1,197,770**	**1408**	**57**	**119**	**137**
*VE3BR	"	154,544	363	43	73	92
*VE3FH	"	77,964	259	29	39	78
*VA3FF	"	63,492	214	30	46	72
*KØMKL/VE3	"	44,010	157	27	39	69
						(OP: KØMKL)
*VE3HG	"	42,693	170	17	40	50
*VA3IK	"	15,808	100	18	24	34
*VE3PQ	"	14,210	85	12	28	30
*VE3MCF	"	13,068	89	15	26	25
*VA3FN	"	3,969	47	12	9	28
*VE3RUA	"	3,828	43	10	8	26
VE3UTT	**AA**	**784,714**	**965**	**58**	**159**	**105**
VE3CX	"	545,600	912	47	100	128
***VA3DF**	**AA**	**731,688**	**900**	**67**	**156**	**121**
*VE3PJ	"	315,456	581	47	99	102
*VE3CV	"	246,016	445	47	93	108
*VE3MGY	"	57,960	229	20	40	78
*VE3XD	"	10,498	89	11	15	32
*VE3MZD	"	6,649	42	20	32	9
*VA3ROC	"	5,432	52	12	12	32
*VE3WEJ	"	1,998	24	13	13	11
*VA3JHQ	"	238	12	5	3	9
***VE3TM**	**14A**	**40,734**	**179**	**16**	**52**	**25**

District 4

***VE4TLA**	**A**	**8,220**	**67**	**14**	**13**	**33**
VE4VT	**AA**	**29,568**	**148**	**24**	**28**	**44**

District 5

***VE5KS**	**7**	**6,670**	**84**	**6**	**5**	**35**
VE5MX	**AA**	**367,521**	**652**	**48**	**94**	**117**

District 6

VA7ST	**A**	**231,052**	**599**	**36**	**53**	**99**
VE6TK	"	158,424	472	31	45	92
***VA6RCN**	**A**	**67,056**	**274**	**24**	**24**	**79**
*VE6SPS	"	6,390	74	8	7	30
VE6BBP	**AA**	**192,969**	**512**	**42**	**45**	**102**
VE6UM	"	72,956	304	25	31	66

District 7

VA7MAY	**A**	**6,050**	**58**	**15**	**13**	**22**
						(OP: @VA7MM)
VA7RN	"	252	11	3	1	10
***VE7BC**	**A**	**71,375**	**280**	**27**	**28**	**70**
*VA7EU	"	15,691	118	16	15	40
*VE7BGP	"	391	10	7	7	3
VE7SZ	**AA**	**367,472**	**692**	**52**	**68**	**118**
VE7IO	"	203,975	502	46	49	104
VE7KAJ	"	147,906	459	34	47	85
VA7KO	"	126,558	351	39	55	84
VE7CC	**3.5A**	**5,922**	**71**	**11**	**11**	**25**

District 8

***VY1XY**	**14**	**960**	**30**	**5**	**4**	**11**

Costa Rica

***TI2OY**	**A**	**557,568**	**946**	**52**	**100**	**136**

Cuba

***CO3JN**	**A**	**264,845**	**482**	**51**	**96**	**98**
*CO3VR	"	45,900	179	32	48	55
*CO2GL	"	14,446	119	12	13	37
*CO8BYT	"	5,551	50	15	19	27
*CO2XK	"	2,745	34	13	9	23
***CO2RQ**	**21**	**9,996**	**88**	**12**	**15**	**24**
***CO2AME**	**14**	**252,850**	**933**	**18**	**60**	**52**
*CO6OV	"	63,552	335	15	38	43
*CO2YQ	"	32,923	214	12	20	41
*CO2WL	"	5,687	87	7	8	32
***CM2EAP**	**7**	**19,593**	**127**	**14**	**28**	**21**
***CO2JD**	**3.5**	**24,948**	**169**	**12**	**26**	**39**

Dominican Republic

HI8PJP	**14**	**22,791**	**166**	**12**	**26**	**33**
***HI8DL**	**A**	**31,297**	**107**	**34**	**48**	**37**

Greenland

***OX3LX**	**AA**	**69,091**	**237**	**22**	**60**	**39**

Mexico

XE2X	**3.5**	**31,692**	**216**	**12**	**23**	**41**
**XE2AU*	*A*	*46,107*	*210*	*23*	*28*	*58*
***XE2YWB**	**"**	**25,758**	**123**	**27**	**26**	**53**
*XE1VY	"	23,920	137	27	35	42
*XE2NK	"	21,497	129	20	20	43
*XE2KJ	"	3,696	61	11	8	25
***XE1CT**	**14**	**80,352**	**409**	**17**	**30**	**49**
*XE1CQ	"	20,336	195	10	13	39
*XE2YWH	"	11,590	93	15	16	30
*XE1SPM	"	9,943	103	11	16	34
***XE2OK**	**7**	**12,040**	**101**	**13**	**13**	**30**
***XE1H**	**3.5**	**10,304**	**99**	**11**	**12**	**33**
XE2B	**AA**	**272,220**	**637**	**44**	**71**	**80**
***XE2AD**	**AA**	**193,347**	**484**	**43**	**73**	**73**
*XE2FGC	"	114,666	307	39	45	90
***XE1EE**	**14A**	**18,054**	**178**	**6**	**7**	**38**

Panama

***HP3SS**	**A**	**358,743**	**722**	**38**	**83**	**110**

Puerto Rico

***KP4JFR**	**A**	**123,120**	**369**	**31**	**70**	**51**
*KP4JRS	"	106,358	344	22	48	72
*NP3F	"	84,075	243	39	70	68

St. Lucia

**J69DS*	*A*	*21,760*	*110*	*16*	*32*	*37*

St. Pierre & Miquelon

FP/KV1J	**AA**	**348,178**	**653**	**39**	**105**	**70**

AFRICA

African Italy

***IH9YMC**	**7**	**336**	**16**	**2**	**6**	**0**

Canary Islands

EA8LG	**A**	**225,952**	**444**	**38**	**113**	**33**
***EA8AQV**	**A**	**259,532**	**415**	**47**	**118**	**52**
*EA8BQM	"	191,544	377	34	97	53
***EA8PT**	**14**	**273,180**	**645**	**27**	**80**	**38**
*EA8ARI	"	95,150	302	17	51	42
*EA8BGO	"	66,198	239	19	53	30
*EA8ARG	"	9,660	73	9	27	10
EA8ZS	**AA**	**170,542**	**481**	**24**	**83**	**35**
***EA8CNR**	**AA**	**288,400**	**584**	**38**	**128**	**9**

Ceuta & Melilla

EA9LZ	**14**	**4,114**	**47**	**8**	**22**	**4**

Gabon

TR8CA	*AA*	*102,500*	*282*	*35*	*89*	*1*

Ghana

***9G2HO**	**14**	**39,096**	**196**	**15**	**42**	**15**
						(OP: 9G5SA)

Morocco

***CN8KD**	**7A**	**83,832**	**340**	**11**	**51**	**22**

Tanzania

5H3MB	**A**	**16,740**	**97**	**14**	**45**	**1**
						(OP: IK2GZU)

Uganda

***5X8C**	**A**	**23,571**	**109**	**23**	**46**	**12**
						(OP: ON6NL)

ASIA

Afghanistan

T6A	**AA**	**562,919**	**1007**	**48**	**155**	**0**
						(OP: S53R)

Asiatic Russia
District 9

RG9A	**A**	**1,201,662**	**1453**	**66**	**230**	**0**
RK9AX	"	1,070,662	1609	59	188	10
RU8W	"	206,640	540	34	105	1
RZ9A	"	159,900	475	32	98	0
RA9CNC	"	32,904	169	19	53	0
RA9AEA	**21**	**2,275**	**37**	**9**	**16**	**0**
RK9AY	**7**	**34,348**	**208**	**14**	**48**	**0**
***RZ9AD**	**A**	**325,832**	**673**	**33**	**133**	**0**
*R9AAL	"	80,697	264	24	87	0
*RZ9UO	"	46,903	211	26	63	0
*RA9MLR	"	2,232	28	11	20	0
***RL9L**	**14**	**59,272**	**345**	**14**	**48**	**0**
*RA9AFZ	"	8,814	80	10	29	0
*RW9MZ	"	6,633	68	7	26	0
*RA9UEP	"	1,606	38	7	15	0
UC8U	**AA**	**433,825**	**947**	**53**	**132**	**0**
UA9CTT	"	76,540	308	16	71	2
RY9C	"	1,421	19	13	16	0
						(OP: UA8DX)
RQ9O	**14A**	**12,864**	**107**	**13**	**35**	**0**
***RT9S**	**AA**	**643,771**	**836**	**65**	**209**	**7**
*RO9A	"	361,836	632	53	152	2
*UA9SBQ	"	96,525	290	40	94	1
*RK9UE	"	10,432	74	26	38	0

District Ø

UAØSR	**A**	**181,608**	**426**	**49**	**116**	**3**
RØCAF	"	68,068	365	38	47	6
RUØLL	"	4,325	78	8	9	8
RDØA	**14**	**207,234**	**951**	**20**	**67**	**0**
RYØA	"	2,880	50	10	14	0
***RØUT**	**A**	**67,415**	**302**	**37**	**60**	**0**
*UAØJGI	"	34,091	265	30	40	3
*RØJD	"	33,453	278	23	36	0
*RAØWHE	"	17,226	122	19	39	0
*UAØSU	"	14,484	78	24	44	0
*RØCM	"	13,981	167	17	22	2
*UAØJFD	"	9,159	120	19	23	1
*UAØLD	"	8,636	135	12	22	0
*UIØA	"	6,594	65	14	28	0
***RWØAJ**	**14**	**28,644**	**171**	**16**	**46**	**0**
***RWØSR**	**7**	**7,266**	**92**	**16**	**26**	**0**
RKØUT	**AA**	**419,895**	**833**	**63**	**152**	**2**
RAØSMS	"	1,914	34	12	17	0
UCØA	**14A**	**124,254**	**595**	**17**	**61**	**0**
RXØAE	"	36,355	257	10	45	0
RWØA	*7A*	*14,260*	*118*	*14*	*32*	*0*
						(OP: RZØAI)
***RØAS**	**AA**	**67,146**	**255**	**35**	**79**	**0**
*RMØW	"	13,770	107	15	39	0
***RØSBZ**	**14A**	**731**	**17**	**6**	**11**	**0**
*RØCBK	"	4	1	1	1	0

Asiatic Turkey

TA7UZU	**14**	**11,193**	**98**	**6**	**23**	**10**
TC4A	**7**	**18,492**	**161**	**10**	**32**	**4**
						(OP: TA4CS)
***TA3/ HB9ØFIH**	**A**	**116,472**	**337**	**24**	**112**	**2**
						(OP: HB9FIH)
*TA3NEB	"	48,125	217	17	58	2
*TA7OYG	"	41,877	198	17	64	0
*TA2JU	"	31,900	179	24	76	0
***TA7UHS**	**14**	**55,080**	**336**	**10**	**49**	**1**
*TA7MRL	"	9,800	100	6	25	4
*TA7AO	"	6,755	79	10	25	0
*TA7OTT	"	2,340	43	4	13	3
*TA4PR	"	810	25	5	10	3
*TA3AER	"	30	2	2	2	1
***TA7LZB**	**7**	**1,575**	**23**	**5**	**15**	**1**
***TA4RC**	**AA**	**41,640**	**155**	**31**	**80**	**9**
***TA3/ UA9CDC**	**14A**	**11,792**	**100**	**10**	**31**	**3**
						(OP: UA9CDC)

Azerbaijan

**4J3DJ*	*A*	*12,596*	*94*	*10*	*37*	*0*

Bahrain

A92AA	**14A**	**36,480**	**232**	**11**	**45**	**1**

China

BH4EUJ	**A**	**170,528**	**502**	**48**	**82**	**16**
						(OP: BA4DL)
BD5BPA	**14**	**11,200**	**176**	**14**	**18**	**0**
***BG8NG**	**A**	**30,783**	**151**	**37**	**56**	**0**
*BA5AB	"	5,280	38	14	29	5
*BG3IAY	"	2,378	39	12	17	0

*BG5BRT	"	663	21	8	9	0
						(OP: BG5BRG)
*BA3MM	14	51,724	333	17	45	5
*BD7OXR	"	12,948	153	14	21	4
*BG8PM	7	216	7	6	6	0
BG5BAA	AA	4,200	88	20	21	1
*BH4OUF	14A	2,987	52	11	18	0

Cyprus

*5B4WN	A	15,963	113	10	41	0
P33W	AA	4,510,000	3196	100	319	81
						(OP: LZ2HM)
*5B4AIF	AA	59,897	247	21	68	0
						(OP: 5B4AIE)

Hong Kong

*VR2VIY	A	30,429	218	24	38	1

India

VU2ZMK	A	245,280	567	36	124	0
VU2YQ	14	16,350	126	12	38	0
*VU2EOJ	A	2,415	32	11	24	0
*VU2KWJ	14	748	21	7	10	0
VU2DED	AA	129,150	324	46	104	0
VU2IBI	"	74,088	232	36	89	1
*VU3ESV	AA	13,300	75	26	44	0

Israel

*4Z5MY	14	3,672	47	5	22	0
*4Z5UN	3.5	83,214	445	12	51	6
*4Z5FI	"	9,396	100	7	29	0

Japan
District 1

JA1AYO	A	207,756	442	69	107	23
7K3BKZ	"	70,751	212	52	71	16
JR1EMO	"	55,176	190	41	68	12
JH1CTV	"	46,098	182	44	62	11
JA1QOW	"	36,480	139	33	50	12
JA1EPJ	"	34,594	135	36	53	9
JG1LHB	"	29,580	143	29	42	16
JQ1CIV	"	16,830	75	32	47	6
JA1GHR	"	9,730	50	24	32	14
JA1WWO	"	*6,750*	*49*	*19*	*18*	*13*
JH1BIU	"	2,940	36	12	19	4
JG1TGQ	"	1,534	32	12	10	4
JI1CIN	"	35	3	3	2	0
JK1HIY	14	9,690	63	19	26	12
JR1NHD	"	7,203	56	15	29	5
JI1LNR	"	*5,888*	*49*	*13*	*24*	*9*
JK1LUY	"	465	13	6	9	0
JI1JPJ	7	2,277	25	13	16	4
JS1NDM	"	24	2	1	1	2
*7N2UQC	A	181,300	432	64	98	23
*JM1MTE	"	136,116	344	60	95	16
*JA1IAZ	"	57,456	177	47	73	13
*JA1SCE	"	56,608	205	45	65	12
*JQ1COB	"	50,996	165	45	58	19
*JA1IZ	"	39,905	143	42	60	13
*JE1RRK	"	37,908	149	38	54	16
*JS1KKY	"	26,600	115	35	50	10
*JF1WNT	"	26,214	117	41	47	14
*JA1OVD	"	22,601	89	36	47	14
*JA1PCM	"	20,928	92	37	51	8
*JA1UII	"	18,792	93	29	42	10
*JA1IE	"	13,124	110	28	30	10
*7N4JXR	"	9,261	72	26	35	2
*JA1DDZ	"	8,792	67	22	30	4
*JA3GZE/1	"	6,912	73	18	24	6
*JF1WCK	"	5,712	66	21	26	1
*JH1IHG	"	5,152	46	20	23	3
*JA1HFY	"	4,747	63	20	22	5
*JA1OHP	"	4,224	41	20	24	0
*JN1BBO	"	3,960	49	19	22	4
*JP1BVR	"	2,376	45	15	16	2
*JH1WOY	"	432	11	7	9	2
*JF1OVA	28	231	10	5	6	0
*JG1UKW	21	5,032	56	12	22	0
*JA1DBG	"	1,848	31	11	13	0
*JF1TEU	14	20,605	139	20	32	13
*JA1QIF	"	16,260	100	18	33	9
*JJ1ENZ	"	14,193	103	19	34	4
*JH1KYA	"	10,143	81	19	29	1
*JR1AQI	"	7,020	60	18	26	8
*JH1BHW	"	3,927	52	13	16	4
*JK1NSR	"	3,745	41	11	18	6
**JI1FLB*	"	*1,210*	*26*	*8*	*9*	*5*
*JE1GZB	"	455	21	5	8	0
*JQ1PCT	"	70	4	3	4	0
*JH1EYM	"	20	2	2	2	0
*JF1CKO	7	1,700	40	11	9	5
*JR7KVA/1	"	84	10	3	3	0
JM1XCW	AA	516,964	785	70	136	53
JH1RFM	"	177,439	341	61	108	22
JF1LMB	"	156,275	358	56	101	18
JA1WSK	"	153,822	310	57	104	25
JE1LFX	"	45,375	166	43	61	17
JR1BAS	"	14,861	69	28	35	14
JH1APK	"	1,680	22	11	13	4
JN1BMX	14A	21,080	119	23	40	5
JH1OAI	"	15,642	84	19	36	11
7K4VPV	"	15,480	112	20	35	5
JA1SJV	7A	8,428	66	18	27	4
JM1NKT	3.5A	3,250	92	9	10	6
*JH8KYU/1	AA	404,175	622	73	148	34
*JA1BWA	"	59,211	202	48	66	15
*JA1MZM	"	18,160	102	31	42	7
*7L4IOU	"	17,548	105	31	36	15
*JL1CNY	"	12,972	91	30	34	5
*JM1CMA	14A	540	19	6	7	2
*JA1BPA	"	165	7	3	3	5

District 2

JR2PMT	A	110,346	280	50	89	20
JG2REJ	"	106,134	290	47	81	19
JA2XYO	"	82,368	223	47	76	20
JF2FIU	"	63,612	232	47	66	11
JH2BTM	"	28,616	116	35	52	11
JA2VHO	"	17,974	86	33	42	11
JR2NMJ	"	1,674	20	12	17	2
JJ2VLY	14	17,821	98	26	41	4
JR2BCF	"	8,556	70	14	24	8
JR2ALA	7	1,403	23	9	12	2
JH2LMH	"	190	7	4	4	2
JE2OTM	3.5	351	27	4	6	3
*JE2DLR	A	35,048	144	38	54	12
*JE2BOM	"	33,708	129	43	59	4
*JA2FXV	"	25,482	110	36	48	9
*JA2GHP	"	24,960	128	27	46	5
*JA2AXB	"	12,012	77	23	35	8
*JM2LEI	"	9,577	67	24	33	4
*JA2QVP	"	5,777	50	24	24	5
*JF2KWM	28	18	2	1	2	0
*JH2JNU	21	2,200	32	9	16	0
*JA2JNC	14	11,550	100	19	27	4
*JR2MIN	"	1,272	24	11	12	1
*JK2AQT	"	954	21	7	11	0
*JH2MYN	7	12,586	101	20	33	5
JA2HYD	AA	178,983	355	58	111	20
JH2FXK	14A	21,630	112	20	30	20
JF2XGF	3.5A	4,464	74	13	15	8
*JE2CPI	28A	75	5	2	3	0
*JM2LHB	"	6	1	1	1	0
*JF2AIJ	21A	833	17	6	11	0
*JR2MIO	14A	5,040	50	15	21	6
*JA2KCY	"	1,711	29	11	14	4
*JF2IWL	3.5A	2	1	1	1	0

District 3

JA3HBF	A	141,600	374	53	92	15
JA3QOS	"	35,908	169	37	53	4
JR3RIY	21	12,300	97	19	31	0
JH3QFY	14	17,952	103	23	35	10
JH3FUK	7	57,680	217	28	60	15
*JA3LEB	A	34,592	173	38	48	8
*JH3GMI	"	5,635	58	20	25	4
*JO3JYE	"	4,512	57	13	19	0
*JE3CDW	"	3,783	41	17	19	3
*JH3BYX	"	1,650	64	11	14	0
*JO3EVM	"	667	16	11	11	1
*JH3SIF	21	13,034	111	18	31	0
*JA3RAZ	"	3,762	49	17	21	0
*JA3HKR	14	612	15	8	9	0
*JI2UPG/3	"	480	13	7	8	0
*JR3GPP	3.5	9	1	1	1	1
JN3SAC	AA	76,310	215	45	72	13
JN3TMW	"	72,576	205	54	78	12
*JH3WKE	AA	47,916	172	46	60	15
*JA4XHF/3	"	35,970	118	39	59	12
*JF3GFH	"	3,040	34	17	19	4

District 4

JR4CTF	A	18,525	128	29	41	5
*JH4FUF	A	11,026	68	31	38	5
*JE4IVN	"	792	14	10	12	0
*JA4RWN	"	464	12	7	6	3
*JN4JGK	14	2,088	32	12	13	4
*JA4RMX	"	1,562	29	8	14	0
JH4UYB	AA	1,425,382	1522	93	222	56
JR4OZR	"	1,060,409	1282	84	193	46
JN4MMO	"	977,974	1122	90	194	53
JI4WAO	"	5,406	54	19	27	5
JO4CFV	"	3,960	43	21	21	3
JH4UTP	14A	264,045	737	31	81	33
JR4VEV	7A	12,586	104	18	33	7
*JM4WUZ	3.5A	185	35	2	3	0

District 5

JE5JHZ	*A*	*13,041*	*80*	*22*	*35*	*6*
JA5NSR	3.5	507	31	5	7	1
*JG5DHX	A	252	8	7	7	0
*JA5OXV	14	779	17	9	10	0
*JA5CBU	7	390	12	4	5	4
JA5FNX	AA	37,430	215	39	47	9
JH5MXB	14A	40,257	222	20	48	3
*JH5HDA	AA	36,750	192	36	49	13

District 6

JA6BZI	14	53,382	212	25	53	15
JA6LCJ	"	5,106	41	16	23	7
*JE6JNC	A	25,668	106	35	49	9
*JA6BCV	"	25,434	113	26	42	13
*JG6QHE	"	7,526	64	23	28	2
*JE6PJP	"	608	23	8	8	0
*JA6WFM	14	27,877	220	17	34	10
*JR6AG	"	660	27	7	8	0
JA6ZPR	14A	298,319	874	30	70	33
						(OP: JH6JSR)
*JA6GCE	AA	487,890	842	75	164	31
*JG6JAV	"	111,159	296	58	96	25
*JH6QIL	14A	13,122	124	19	32	3
*JE6TUP	7A	120	7	4	4	0

District 7

JA7ACM	A	230,514	462	65	106	35
JR7IWL	"	77,040	237	51	76	17
JG7AMD	"	50,752	163	39	58	25
JN7TAN	"	1,230	19	13	17	0
JA7LLL	14	43,860	202	25	43	18
JA7CVL	"	34,672	205	24	48	16
JK7CJM	7	2,304	61	9	10	5
*JH7BMF	A	17,316	99	30	40	8
**JK7BEJ*	"	*2,590*	*38*	*15*	*16*	*4*
*JA7HMZ	21	120	7	4	6	0
*JE7HYK	14	18,476	123	18	33	11
*JA7KQC	"	88	5	5	5	1
*JI7VNJ	7	11,660	90	20	26	7
**JH8CLC/7*	"	*4*	*1*	*1*	*1*	*0*
JO7KMB	AA	37,177	132	41	53	19
JA7GYP	"	22,192	116	24	44	5
JR7IWC	"	14,578	75	30	39	5
JH7RTQ	14A	47,704	214	23	49	17
*JA7ZP	AA	40,656	155	42	59	11

District 8

JA8TR	A	152,210	437	48	84	23
JA8DNV	"	9,288	54	27	34	11
JA8TGD	"	228	7	6	6	0
JA8IDS	21	6,766	95	15	19	0
*JM8FEI	A	11,918	113	25	27	7
*JE8KKX	"	160	6	3	4	3
*JA8KGG	21	120	5	4	4	0
*JE8KGH	14A	27,342	205	18	39	5
*JA8UON	7A	576	22	7	9	0

District 9

JH9CEN	A	87,138	234	47	82	12
JA9CWJ	14	29,181	149	20	37	14
JA9CCG	"	16,317	109	19	37	7
JH9FCP	"	14,098	110	17	34	2
*JA9LX	A	77,004	213	51	75	12
*JA9EJG	"	5,616	56	22	22	4

District Ø

JHØILL	A	20,655	90	25	51	9
*JJØPJD	A	81,855	198	52	83	18
*JRØDZH	"	12,127	76	28	28	11
*JAØNFP	"	5,280	51	17	24	7
**JRØBNF*	"	*4,371*	*39*	*22*	*21*	*4*
*JAØAVS	"	1,856	27	11	12	6
*JHØEPI	14	35,440	180	25	47	8
*JJØNSL	"	16,821	101	18	36	9
*JAØGCI	"	3,145	43	11	21	5
*JAØBJY	"	2,952	30	13	18	5
JAØGCY	AA	68,783	199	46	82	15
*JAØBZY	AA	1,242	19	11	14	2

Kazakhstan

UN7JX	A	111,540	344	35	95	0
*UN7PGA	A	150,500	491	33	92	0
*UN7ZAF	"	138,450	383	29	101	0
*UN7ID	"	66,054	235	29	80	0
*UN8PT	21	4,046	53	13	21	0
*UN6LN	14	226,722	949	19	67	1
*UN7CN	"	41,785	250	14	47	0
UN4PG	3.5A	23,616	181	9	39	0

Kuwait

*9K2GS	A	53,124	243	13	56	7

Lebanon

*OD5YA	A	18,600	110	12	46	2
*OD5ZF	14	146,200	614	18	58	9

Mongolia

*JT1PB	A	180	11	5	5	0

Qatar

A71AE	21A	20,286	147	14	35	0
*A71EM	14A	12,802	127	8	29	0

Republic of Korea

*DS5DNO	A	11,032	87	24	25	7
*HL2CFY	"	8,058	64	21	25	5
*HL5JCB	14	2,550	37	11	16	3
*HL2ASZ	7	160	9	4	4	0
DS5USH	*AA*	*39,673*	*171*	*39*	*55*	*3*
HL5YI	7A	7,968	65	16	30	2
*HL1VAU	AA	53,705	199	43	65	7
*DS4GQR	"	7,844	61	22	29	2
*HL3AMO	14A	29,055	184	20	40	5

Saudi Arabia

*7Z1SJ	14	318,351	925	24	76	21

Singapore

9V1YC	A	8,640	120	13	19	0

Taiwan

BV2LA	A	84,132	310	38	60	16
BV1EK	"	23,821	107	29	52	2
BX4AG	14	6,364	67	14	29	0
*BU2BO	A	10,791	152	14	19	0
*BU2BE	14	17,394	206	16	21	2
**BX2AGV*	"	*144*	*11*	*4*	*5*	*0*

Thailand

*HS5ZLD	A	23,765	109	33	64	0
*E2ØZFD	"	13,392	88	25	37	0
*E2ØWXA	21	5,056	62	11	21	0
*HSØACS	7	1,650	32	10	14	1
HS5NMF	AA	77,361	336	38	67	2
E2ØWUE	"	75,264	292	39	71	2
HS5XWY	"	23,985	179	25	40	0
E21YDP	7A	36,478	248	17	38	6
*HS8HEX	AA	15,028	89	24	41	3
**HS8JWH*	"	*9,960*	*79*	*26*	*34*	*0*

United Arab Emirates

A65DR	14	195,408	757	20	65	4
						(OP: G7SLP)

West Malaysia

9M2TDX	14	6,929	69	12	29	0
9M2CDX	7	1,853	42	6	11	0
*9W2VGR	7	12,789	96	14	30	5
9M2SAF	AA	56,430	266	25	59	6
*9M4DXX	7A	20,496	135	15	38	3
						(OP: JE1SCJ)

EUROPE

Andorra

*C31MF	7	24,528	225	6	47	3

Austria

OE5BGN	A	322,876	734	38	139	35
OE1TKW	"	33,578	165	23	73	7
*OE2E	A	128,232	393	26	105	25
						(OP: OE2GEN)
*OE1CIW	"	43,616	183	29	78	9
OE2LCM	AA	196,854	418	46	139	33
OE3DXA	"	107,000	237	44	134	22

Azores

*CT8/DJ5MW	A	23,408	134	16	36	25

Balearic Islands

*EA6ZS	A	3,198	48	10	29	0
*EC6DX	AA	49,858	274	18	68	11

Belarus

EW8DX	A	457,470	974	45	170	15
EW8OM	"	226,504	612	37	142	1
*EW1P	A	153,120	412	40	127	9
*EW6DM	"	142,600	537	34	118	3
*EW1NM	"	92,300	355	28	99	3
*EU1FQ	"	49,374	180	29	81	7
*EU6A	"	44,733	200	24	84	3
**EW8AP*	"	*22,365*	*166*	*18*	*53*	*0*
*EU1ST	7	5,544	87	5	28	0
EV1R	7A	250,971	923	27	90	16
*EW7BA	AA	571,604	1183	45	185	12
*EW4R	"	155,040	391	42	137	11
*EU8F	7A	39,159	347	10	47	0
*EU8A	3.5A	42,578	375	9	51	1

Belgium

ON8AJ	*A*	*188,955*	*534*	*33*	*107*	*31*
OT2X	"	*89,024*	*439*	*20*	*84*	*3*
ON5AM	"	43,173	174	24	67	26
*ON4CT	A	588,848	925	62	201	41
*ON5GQ	"	416,322	869	36	154	39
*ON2CQ	"	152,805	481	28	109	16
*ON6AT	"	147,420	392	33	116	33
*ON2AD	"	18,640	113	21	57	2
*ON4LY	"	14,628	106	13	53	3
*ON4AXU	"	2,883	46	7	23	1
*OT5Q	14	25,216	196	13	40	11
*ON4APU	7	36,642	297	9	52	1
*ON4CBA	"	29,110	198	10	46	15
*OPØJ	"	13,948	174	5	39	0
						(OP: ON5GF)
*ON5IA	"	10,449	138	6	36	1
OR3A	AA	885,720	1118	66	237	60
						(OP: ON6CC)
OQ5M	"	15,611	116	16	47	4
						(OP: ON5ZO)
ON9CC	3.5A	1,848	44	4	18	0

Bosnia-Herzegovina

*E72U	A	83,190	259	28	87	26
**E74O*	"	*20,210*	*111*	*18*	*61*	*7*
*E75MHM	28	2	1	1	1	0
*E79Q	7	29,799	249	10	43	10
E78T	AA	91,845	409	18	88	11
*E77EA	7A	18,408	173	12	39	1

Bulgaria

LZ9R	A	1,580,140	1802	88	271	51
LZ1ND	21	83,076	438	23	62	1
LZ5QZ	"	16,074	168	11	36	0
LZ1MC	7	19,100	188	11	39	0
*LZ2HT	A	8,967	70	17	42	2
*LZ2JA	14	74,060	357	19	51	22
LZ6K	AA	649,612	991	60	212	35
						(OP: LZ2PL)
LZ6ØKAA	"	245,905	635	42	127	18
LZ4A	"	160,825	447	39	120	16
						(OP: LZ1YQ)
LZ6Y	14A	192,786	637	29	80	29
						(OP: LZ1KU)
LZ5K	7A	117,807	562	20	63	24
LZ2ZG	3.5A	27,500	269	8	47	0
*LZ5RG	AA	89,375	323	32	107	4
**LZ1ZM*	*14A*	*225,225*	*732*	*30*	*87*	*26*
*LZ1QV	7A	90,720	401	24	74	10
*LZ5XQ	3.5A	74,880	493	13	58	7
*LZ1QZ	"	15,300	170	6	39	0

Corsica

TK5MH	14A	273,780	695	27	79	50

Crete

*SV9FBK	7	10,164	120	8	34	2
SV9DJO	AA	188,336	599	32	115	11
SV9COL	14A	32,504	240	16	44	8

Croatia

9A1CBM	14	32,417	185	15	42	20
						(OP: 9A5ST)
9A2NO	7	24,635	179	13	52	0
*9A6KZH	14	16,701	129	12	37	8
*9A4W	"	2,146	39	7	18	4
*9A4R	7	54,418	286	21	63	7
*9A5HZ	"	4,773	65	6	31	0
9A7DX	AA	495,360	553	78	257	49
9A6OY	"	53,000	261	23	76	7
9AØBB	"	10,835	91	14	38	3
						(OP: 9A3XV)
9A5D	21A	129,504	625	21	64	11
						(OP: 9A3VM)
9A6NA	3.5A	61,472	462	10	56	2
*9A9TT	7A	16,632	198	7	37	0
*9A3LYL	3.5A	5,600	72	5	35	0

Czech Republic

OK1PI	A	12,212	76	23	41	7
OL9A	14	586,401	1355	34	95	48
						(OP: OK2ZAW)
OK1XC	"	35,175	199	21	53	1
OK6CX	"	9,800	89	13	32	4
OK1FIM	7	22,703	155	15	54	4
OK2SFP	3.5	20,580	301	4	31	0
*OK2HFC	A	150,300	445	32	129	6
*OK4RQ	"	149,226	398	36	140	11
*OK1PX	"	27,968	152	23	66	3
*OK2VIR	"	25,312	117	22	89	1
*OK1BJ	"	9,815	85	15	50	0
**OK7N*	"	*9,100*	*70*	*19*	*40*	*6*
*OK1LO	14	6,250	71	12	31	7
*OK6T	7	251,518	860	25	80	29
						(OP: OK1WCF)
*OK1DAR	"	4,794	72	6	28	0
*OK2SWD	"	2,044	45	4	24	0
*OK2HBR	3.5	56,320	469	8	54	2
OK2PYA	AA	166,320	399	40	127	22
OK1VK	"	155,142	329	46	161	14
OK1DOY	"	96,901	322	32	70	25
OK6DJ	"	96,624	435	22	95	5
OK2SG	"	51,800	189	34	105	9
OK1DBE	"	28,776	169	21	65	2
OK3C	3.5A	181,230	873	18	71	16
						(OP: OK2ZC)
*OK1PMA	AA	131,718	372	32	130	12
*OK2UHP	"	117,453	385	27	100	20
*OK2RN	"	20,930	105	24	58	9
*OK6AB	"	16,728	98	21	51	10
*OK4GP	"	1,736	22	12	14	5
*OL6D	7A	19,080	142	15	47	10
						(OP: OK1DWQ)
*OK4K	3.5A	24,486	235	9	42	2
						(OP: OK1BOA)

Denmark

OU1E	A	63,560	216	32	98	10
5P9X	14	66,400	307	21	60	19
						(OP: OZ9GA)
OV2T	*7*	*33,972*	*297*	*8*	*46*	*3*
*OZ/DF4ZL	A	139,365	433	29	123	11
						(OP: DF4ZL)
*OZ1DAE	"	94,724	417	23	96	0
*OZ4FF	"	70,928	278	27	109	7
*OZ1AOO	"	52,241	222	23	94	2
*OZ1QX	"	38,095	206	18	76	1
*5Q5R	"	13,398	113	12	43	3
*OZ1LFI	"	6,300	65	15	34	1
*OZ7DK	7	3,696	59	5	28	0
OZ3ØEU	AA	266,112	613	44	155	17
5Q7DX	"	35,325	242	16	56	3
						(OP: PA7JWC)
OU2X	7A	5,698	76	6	31	0
*OZ4VW	AA	60,691	199	29	86	22
*OZ7HB	"	51,064	243	16	83	5

Dodecanese

*SV5/DL3DRN	A	127,248	514	24	108	0
						(OP: DL3DRN)
*SV5DKL	7A	56,544	296	20	67	6

England

G4RS	A	425,019	917	47	154	58
						(OP: GØURR)
G1SCT	"	136,045	394	33	119	17
G3T	"	133,110	380	33	118	23
						(OP: G3VGZ)
G4HBI	"	73,656	287	23	84	17
GØMGM	"	22,357	127	16	44	19
M2G	14	135,720	490	21	55	41
						(OP: G4RCG)
G4LPD	"	27,388	165	14	45	23
M5A	"	15,486	116	11	25	22
						(OP: G3WVG)

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M2E	3.5	38,454	365	7	49	2
						(OP: GØRPM)
***GØHDV**	A	213,860	663	29	126	15
*G4OZG	"	127,484	402	29	118	10
*GØFGI	"	116,808	357	26	112	19
*G3RLE	"	94,080	331	26	102	12
*G4DDL	"	86,256	293	27	102	15
*G3SNU	"	63,041	295	22	98	1
*MØTQR	"	50,064	227	23	80	9
*G4AFJ	"	38,985	175	23	83	9
*2EØFNU	"	38,896	193	19	79	6
*MØDHP	"	36,946	198	16	69	6
*GØMTN	"	33,252	162	20	74	8
*M3ECT	"	29,993	172	17	63	9
*G8GHD	"	29,232	150	18	49	17
*G4SJX	"	22,200	166	14	57	3
*G1M	"	19,788	150	14	51	3
						(OP: MØITR)
*MØNPT	"	13,260	123	11	48	1
*M5M	"	10,148	96	13	44	2
						(OP: G4OGB)
*G7RTI	"	9,860	86	13	41	4
*G4WGE	"	8,642	75	16	40	2
*GØSNG	"	6,063	67	9	30	4
*G6GLP	"	3,800	44	12	23	5
*G3L	"	1,386	27	11	15	7
						(OP: HJ)
*G3XYF	"	380	14	7	12	0
***MØYTT**	14	70,596	275	20	62	29
**GØCXW*	"	21,615	191	9	38	8
*MØVQP	"	9,450	95	9	34	7
*G4NXG/M	"	4,264	49	9	22	10
*2EØXRD	"	2,535	76	9	24	6
*MØDVV	"	1,274	23	7	15	4
*M1G	"	874	30	6	13	0
***G6N**	3.5	29,348	267	7	49	2
						(OP: GØGDU)
M7T	AA	1,036,068	1472	60	216	58
						(OP: G3YYD)
G4S	"	493,468	739	55	202	45
						(OP: G3TXF)
GØBNR	"	276,018	487	52	167	38
G2U	"	252,255	625	34	145	22
						(OP: GØUGO)
G7T	"	105,600	268	34	139	19
						(OP: MØVSE)
GØJSP	"	76,928	257	27	75	26
M5SB	"	43,798	193	28	86	8
						(OP: G3YSX)
G4MKP	"	19,328	156	16	48	0
G3PXT	"	15,036	99	19	57	8
G8UBJ	"	8,772	61	20	43	5
G4UJS	14A	171,872	576	23	73	35
MØBJL	"	920	21	5	11	7
G4DBW	7A	54,780	320	14	58	11
MØUNI	"	31,453	223	11	49	11
G3YJQ	"	14,250	132	10	44	3
***2EØYAO**	AA	135,270	424	27	119	16
*2EØCVN	"	96,330	390	24	99	7
*GØCKP	"	80,765	256	24	93	28
*MØAFZ	"	74,041	291	24	91	12
*M6VFT	"	57,462	233	23	87	12
*G8VPE	"	42,957	196	21	89	1
*MØIHT	"	38,364	209	17	71	4
*M3R	"	27,416	156	17	70	5
						(OP: G3RTU)
*G1P	"	24,648	175	15	61	2
						(OP: MØIEP)
*G3KNU	"	17,384	99	20	56	6
*M6XAT	"	9,408	71	18	39	7
*G4CTY	"	2,277	35	8	24	1
***G1VDP**	14A	5,856	57	12	25	11
***G8X**	3.5A	73,800	505	11	55	9
						(OP: G4FJK)
*MØHMJ	"	67,145	536	8	51	6
*M6BIR	"	18,810	263	5	33	0

Estonia

ES4RD	A	351,190	814	44	159	0
***ES1ACS**	A	24,705	157	16	60	5
ES1BH	AA	18,955	119	19	66	0
***ES6PA**	7A	23,320	216	12	43	0

European Russia

District 1

***RA1ALC**	A	140,447	431	33	131	3
*RU1AT	"	101,001	411	26	105	0
*RX1AG	"	27,625	164	20	65	0
*UB1OAE	"	15,504	144	14	54	0
*R1NO	"	2,952	48	8	28	0
**R1AI*	"	1,647	32	7	20	0
*R1CAV	"	1,118	21	9	17	0
***RZ1ZZ**	14	15,309	116	12	43	8
*R1AV	"	4,719	97	9	30	0
***R1BBL**	7	7,068	98	6	32	0
***R1FZ**	AA	123,840	460	30	114	0
*RN1AO	"	17,088	126	17	47	0
**RO1M*	"	11,388	73	19	49	5
*RK1NA	"	377	16	4	9	0

District 3

R3BB	A	220,140	587	44	133	3
RA3NC	"	52,514	255	25	93	3
RV3TG	"	44,414	207	24	82	0
RT5C	"	27,391	160	24	67	0
RA3TT	"	13,916	97	18	52	1
RA3ZH	"	11,900	62	27	39	4
RW3XZ	14	158,920	669	25	79	12
RU5TT	"	138,768	702	21	70	7
						(OP: R3TE)
RZ3AV	"	60,726	330	18	64	5
R3GZ	"	57,090	257	24	73	13
RQ2Q	"	38,454	235	16	58	4
R5FI	7	2,233	47	7	22	0
***RV3ZN**	A	224,812	568	40	153	3
*R3VL	"	117,312	406	30	108	3
*RW3LB	"	98,890	362	31	114	0
*RU5X	"	98,106	312	35	128	3
*R2PU	"	72,416	295	26	98	0
*RA3E	"	68,120	248	25	105	1
*RX3VF	"	59,280	269	23	97	0
*UB3PDW	"	52,488	270	18	90	0
*UA3XO	"	52,324	282	21	82	0
*R3RAF	"	41,004	209	20	82	0
*RW3ZA	"	28,720	192	18	62	0
*RA3LJ	"	28,120	161	22	73	0
*R3XP	"	24,200	150	19	69	0
*RA3V	"	23,895	151	20	61	0
*RK3DSW	"	21,450	143	15	63	0
*R3AQ	"	19,422	125	23	53	2
*RU3XW	"	18,147	126	14	55	0
*RX3MM	"	18,018	111	19	59	0
*UA3GQ	"	14,040	101	17	55	0
*RW3DY	"	10,295	90	22	49	0
*R3WA	"	9,250	108	12	38	0
*RA3UAG	"	7,248	83	11	37	0
*R3NAM	"	780	24	5	15	0
***RV3YR**	14	36,000	222	15	54	11
*UA3DPM	"	10,416	111	10	38	0
*R3PV	"	2,077	40	8	23	0
RM3DA	AA	989,115	1553	63	220	22
R3KF	"	269,212	619	44	165	5
R2CA	21A	882	18	10	11	0
***UA3PI**	AA	85,204	390	27	91	1
*UC5D	"	57,225	287	26	83	0
*RK2M	"	37,800	196	21	78	1
*R5FN	"	16,422	121	15	54	0
*RX3AFE	"	16,226	130	14	45	2
***UA5F**	3.5A	30,153	299	8	48	1
*R2AT	"	325	15	4	9	0

District 4

R4OF	A	143,370	456	39	123	0
R4CI	"	55,104	244	30	92	1
RA4HL	"	1,736	34	9	22	0
UA4NC	"	273	12	9	12	0
UA4CC	3.5	2,236	46	6	20	0
***RW4YD**	A	204,241	580	37	123	7
*RA4CON	"	128,772	490	28	118	0
*RA4UDC	"	116,784	428	31	113	0
*RZ4AZ	"	47,100	251	18	82	0
*R4RB	"	30,883	194	19	69	1
*R4WT	"	20,900	164	18	57	1
*RK4NB	"	8,533	77	13	40	0
*RW4LMR	"	5,452	57	15	32	0
*RW4M	"	4,814	38	21	35	2
*R4FCJ	"	3,360	60	8	34	0
***UA4SJO**	14	25,088	201	14	50	0
*RA4L	"	6,981	100	7	32	0
*R4LZ	"	1,140	25	7	13	0
***RA4FUN**	7	91,608	511	21	67	0
UA4HBM	AA	79,925	292	27	112	0
RW4WZ	"	49,159	224	24	85	0
UD4F	3.5A	78,776	481	15	68	3
***RG4A**	AA	433,846	797	62	192	12
*UC4I	"	121,625	351	40	134	1
*RU4LM	"	110,940	320	37	135	0
*R4IQ	"	9,440	86	17	42	0
*R4FD	"	4,730	58	12	31	0
***R4IM**	14A	168,399	810	22	70	7
*RU4SS	"	132,396	612	20	78	4
*RU4PH	"	31,740	214	15	54	0

District 6

R7RIB	A	78,076	332	22	109	0
RA6GW	"	19,656	124	23	61	0
RK7X	"	17,792	151	18	45	1
RA6AAW	"	4,230	44	12	35	0
R6DM	"	3,002	29	19	19	0
UA6CE	14	255,045	813	29	93	25
RU6YK	7	3,367	43	9	28	0
***R7MM**	A	343,294	733	50	165	11
*RQ7R	"	327,534	694	49	167	21
*RT6DI	"	297,687	677	46	167	8
*R6KX	"	54,600	196	32	91	7
*RJ7M	"	50,099	199	31	87	1
*UA6BJY	"	48,360	192	31	79	10
*R6DKQ	"	22,425	188	16	52	1
*RW6APC	"	12,261	109	19	48	0
***RA6LIS**	14	32,648	303	14	41	1
***R6CC**	7	28,755	214	15	54	2
R7CD	AA	675,328	1268	56	161	39
R7AB	3.5A	127,017	658	20	71	8
***UD7G**	AA	56,769	233	29	98	0
*R7CT	"	7,038	81	12	31	3
***R7DA**	21A	12,169	125	12	31	0
***RJ7J**	14A	9,750	104	12	38	0
*RT6N	"	5,343	63	12	27	0

District 9

***RA9XSL**	A	6,027	74	12	29	0
***R9FBT**	7	23,954	222	10	49	0
***R8XF**	AA	5,320	75	8	27	0

European Turkey

***YM1KE**	A	6,880	124	6	34	0
						(OP: TA1BX)

Finland

OH1XY	A	34,684	134	29	72	15
OH1HS	"	28,197	113	26	84	7
OH5EAB	"	25,668	153	20	70	2
OH2V	"	1,612	31	9	17	0
						(OP: OH4KA)
OH5UQ	7	48,525	330	16	58	1
***OG3P**	A	137,484	399	37	117	17
						(OP: OH3P)
*OG8T	"	57,132	206	26	107	5
						(OP: OH8TV)
*OH1SIC	"	46,866	217	23	83	1
						(OP: SM5SIC)
*OH2EUU	"	24,960	140	22	70	4
*OH1NOA	"	20,336	134	17	63	2
*OH2LZI	"	16,884	133	12	50	1
*OH2MAS	"	2,958	51	9	25	0
***OH2HOD**	14	12,648	117	9	39	3
*OH8EJW	"	4,860	68	9	27	0
***OH5C**	7	3,458	70	5	21	0
						(OP: W)
*OH2ECG	"	810	24	4	14	0
OH2HAN	AA	1,112,150	1406	80	267	30
OH3OJ	"	436,035	1045	38	165	2
OH1XT	"	432,663	924	43	181	7
OH2KW	"	178,882	552	35	135	3
OH6DX	"	127,680	356	34	121	13
OH8WW	"	120,600	485	29	100	5
OG6N	"	97,776	229	40	145	9
						(OP: OH6NIO)
OH1TM	"	74,236	265	27	102	5
OH6BA	"	30,176	160	17	74	1
OH3FM	"	27,001	206	10	57	0
OH2BBT	"	10,220	69	24	46	0
OH3UU	"	256	10	7	9	0
OH8A	14A	161,055	540	28	79	28
						(OP: OH8WW)
OH8WR	"	21,318	172	18	47	1
OG2P	3.5A	33,201	275	10	53	0
OG7A	"	10,582	144	6	31	0
						(OP: OH6MW)
***OH8KA**	AA	5,145	53	14	33	2
***OH8KVY**	14A	51,506	267	19	59	13

France

F5QE	A	240,864	578	36	133	39
F6AUS	"	138,168	323	35	93	43
F5OHM	"	108,224	314	31	87	34
F6BIP	"	10,956	82	15	49	2
F5GFA	"	8,160	105	11	34	3
F4ERS	"	6,095	49	13	26	14
***F6BQG**	A	170,774	390	37	130	39
*F6GCI	"	162,350	388	39	127	25
*F5OYC	"	142,100	384	29	126	20
**TM5CQ*	"	135,759	385	37	122	18
						(OP: F4FRG)
*F6FTB	"	131,064	385	32	123	17
*F1IWH	"	93,010	300	26	95	21
*F6EQZ	"	81,466	255	34	99	21
*F5TLZ	"	79,365	286	27	103	13
*F4FRC	"	52,416	251	22	90	5
*F5PVJ	"	46,973	221	20	84	3
*F5TRB	"	42,768	200	22	82	4
*F5ITN	"	21,780	116	21	59	10
*F4FHV	"	20,825	104	21	51	13
*F8ATS	"	13,632	102	17	51	3
*F5MA	"	9,486	71	14	41	7
*F4FSB	"	7,524	72	13	41	3
*F1VEV	"	3,266	32	14	28	4
*F4BKT	"	693	14	5	13	3
***F5BEG**	3.5	91,014	597	12	58	7
*F1AKK	"	81,244	541	12	56	8
F8CRS	AA	282,642	426	62	190	37
F4GWY	"	84,688	323	26	84	24
F4GGQ	14A	298,200	780	30	89	49
F5BSB	"	57,420	297	17	49	24
F5NBX	"	1,320	22	8	13	3
F4DVX	7A	460,795	1382	29	91	37
F4HJO	"	59,150	431	12	56	2
***TM3Z**	AA	1,969,506	2058	81	275	85
						(OP: F4DSK)
*TM7Y	"	682,660	1153	53	195	42
						(OP: F8BDQ)
*F4EFI	"	201,348	383	45	156	37
***F4HUA**	14A	7,605	83	11	34	0

Germany

DLØWW	A	486,180	736	58	177	57
						(OP: DK3GI)
DJ3NG	"	410,592	904	33	127	48
DL1DTL	"	319,152	652	48	167	29
DJ2IA	"	190,728	437	43	151	22
DK1LRS	"	158,880	519	28	123	9
DL6ON	"	134,676	382	30	133	11
DF5BX	"	111,154	380	28	115	6
DK6CQ	"	108,054	328	32	113	17
DL5LED	"	107,682	440	25	98	8
DM5RC	"	102,884	269	42	118	18
DL7ØAFUG	"	98,940	279	36	111	23
						(OP: DF8QB)
DJ1YF	"	89,089	296	27	102	14
DQ12ØØASP	"	85,146	321	28	108	2
						(OP: DK1AX)
DK5OS	"	71,511	280	24	75	22
DL3XM	"	31,096	168	14	75	3
DL4ABR	"	26,560	142	20	53	10
DL3KUD	"	22,908	106	24	54	14
DL8UI	"	21,300	96	24	75	1
DG7CF	"	20,580	157	11	59	0
DL2XC	"	19,099	115	18	42	11
DH4JQ	"	11,628	109	11	35	11
DL7LX	"	6,670	59	17	41	0
DF4PD	"	4,187	44	17	35	1
DK3AX	"	4,005	48	14	25	6
DR5E	7	48,230	352	13	55	2
						(OP: DK2CF)
DJ8ES	"	7,812	96	6	36	0
***DM5B**	A	336,108	775	44	156	22
						(OP: DG6IMR)
*DK1KC	"	212,553	496	40	147	22
*DL1FCU	"	161,160	496	31	128	11
*DL3SYA	"	157,699	448	33	132	14
*DL5KUD	"	149,952	441	35	134	7
*DL2OE	"	148,010	359	45	136	24
*DB2KT	"	141,828	465	26	119	14
*DD5MA	"	100,860	305	31	106	27
*DJ6TK	"	88,800	291	26	101	23
*DB2BJT	"	85,936	377	26	103	2
*DL1EAL	"	85,840	280	30	105	13
*DL6SFR	"	82,940	266	31	100	14
*DF3EH	"	79,056	244	31	88	25
*DL2ZA	"	76,342	305	22	107	4
*DJ3JD	"	74,613	274	24	97	12
*DL4PT	"	62,220	278	27	90	5
*DL5JBW	"	58,338	243	26	100	0
*DL4KW	"	49,288	203	28	91	3
*DJ3NJ	"	49,200	195	23	89	11
*DL7UXG	"	48,578	207	25	70	12
*DL4ZA	"	43,560	199	22	82	6
*DL9NEI	"	43,008	200	22	85	5
*DL2RUG	"	41,296	181	28	82	6
*DL5RMH	"	40,492	205	20	86	0
*DH1OK	"	40,215	204	19	84	2
*DG5MLA	"	32,616	172	26	71	11
*DG2BAR	"	32,342	161	24	76	3
*DK9BM	"	31,372	179	18	68	6
*DL6NWA	"	31,248	140	21	54	18
*DG6ME	"	27,368	149	19	62	7
*DJ4WM	"	26,730	150	20	70	0
*DL8ZAJ	"	26,316	120	26	69	7
*DL2KWA	"	26,240	185	14	66	0
*DM5SB	"	23,322	162	16	52	10
*DJ5CT	"	23,205	169	21	78	6
*DL3ARK	"	22,022	117	24	62	5
*DL4LT	"	20,501	130	17	65	1
*DL8ZU	"	20,412	128	19	52	10
*DL6RBH	"	19,758	149	15	59	0
*DK4EF	"	19,620	107	22	58	10
*DKØBM	"	17,762	135	16	67	0
						(OP: DK7CH)
**DH6BH*	"	17,250	100	15	41	19
*DL1LZ	"	16,932	112	20	60	3
*DL3DQL	"	16,380	112	16	60	2
**DL5KUA*	"	14,625	98	18	55	2
*DJ6UP	"	12,816	96	16	53	3
*DL1EJD	"	9,752	91	12	40	1
*DJ7UC	"	8,670	81	11	37	3
*DO1NPF	"	7,304	98	10	34	0
*DK9ZE	"	7,089	67	14	35	2
*DLØVBG	"	5,936	57	16	39	1
						(OP: DF5AN)
*DK4IO	"	5,824	51	15	33	4
*DG1RPU	"	5,720	64	11	29	4
*DL6DJ	"	5,586	58	12	36	1
*DL4KCA	"	5,424	65	13	29	6
*DM2DLG	"	5,035	52	15	37	1
*DM4AB	"	4,900	60	13	37	0
**DK3PM*	"	4,648	40	15	40	1
*DL9ZWG	"	4,140	47	13	30	3
*DL4SEW	"	3,116	48	10	31	0
*DL1STV	"	2,997	42	10	27	0
*DK7GH	"	1,665	24	12	22	3
*DL1AOB	"	1,664	27	11	21	0
*DF9GH	"	1,600	22	13	15	4
*DL9FB	"	1,161	24	12	15	0
*DL6GCE	"	946	21	8	14	0
*DC6MT	"	667	25	7	16	0
*DLØTDS	"	552	18	6	17	0
						(OP: DJ5NN)
*DL1DXF	"	496	17	5	10	1
*DHØJAE	"	460	11	8	11	1
*DG9AK	"	336	14	5	11	0
*DH1MJ	"	64	5	3	4	1
***DL5PW**	21	5,616	67	11	26	2
*DO1BEN	"	264	12	3	8	0
***DR6K**	14	72,774	285	25	67	25
						(OP: DF6RK)
*DJ9KH	"	11,890	94	14	30	14
*DL2LDE	"	10,010	65	16	33	16
*DL1AKL	"	8,960	107	9	31	0
*DLØGEO	"	4,655	64	7	20	8
						(OP: DL2YAK)
*DL9GWA	"	3,010	43	9	23	3
*DF6JF	"	936	25	6	11	1
***DL1AIW**	7	38,115	281	15	56	6
*DL1THB	"	15,080	162	9	43	0
*DK1AUP	"	11,236	118	8	41	4
*DM7CW	"	6,825	89	6	33	0
*DJ5BK	"	3,762	50	8	28	2
*DAØKOL	"	2,910	53	6	24	0
						(OP: DL5HN)
*DL1XAS	"	2,156	48	5	23	0
***DF1MM**	3.5	54,976	484	8	54	2
*DO1TOM	"	2,187	50	5	22	0
*DO1EMC	"	1,750	34	5	20	0
*DF9YC	"	20	7	2	3	0
DK9IP	AA	1,059,300	1031	86	278	86
DQ9Y	"	922,869	1189	70	238	61
						(OP: DF2SD)
DP8M	"	738,833	1009	67	229	53
						(OP: DL6NDW)
DK2OY	"	726,138	1169	58	212	36
DL5JS	"	693,861	962	61	204	64
DL2RMC	"	681,162	1027	63	215	43
DJ8VH	"	666,135	712	72	245	76
DL7URH	"	602,536	836	72	216	46
DQ1P	"	553,580	822	61	192	58
						(OP: DK1IP)
DD1JN	"	545,300	954	55	202	30
DL9GTB	"	526,761	792	62	224	35
DL1QW	"	382,658	617	62	200	31
DF6QV	"	351,536	646	48	176	30
DM5TI	"	350,500	724	52	168	30
DL6KVA	"	328,304	578	59	180	33
DH8BQA	"	321,024	592	56	169	31
DK2LO	"	291,893	514	46	179	34
DF2RG	"	281,930	545	52	153	37
DJ9KM	"	231,601	429	59	158	24
DK9ETM	"	215,488	515	35	145	28
DK6WL	"	213,526	395	53	163	25
DJ5TT	"	212,296	482	41	147	35
DL5NAM	"	176,421	347	45	138	34
DL1NEO	"	146,415	278	46	155	26
DF1LX	"	132,480	342	34	144	14
DL5ØNFA	"	130,928	384	33	116	18
						(OP: DC3RJ)
DL3DW	"	129,200	309	43	131	26
DF2LH	"	126,278	296	46	138	22
DL1DAW	"	124,608	309	42	124	26
DL1STG	"	121,396	334	40	129	9
DL5XJ	"	115,415	277	42	144	19
DL5ST	"	103,028	294	38	125	9
DG7NFX	"	99,665	305	32	112	11
DL9NCR	"	98,496	309	35	117	10
DK2AT	"	87,230	323	27	104	12
DL3FCG	"	82,800	261	32	98	20
DL4JLM	"	51,342	176	35	77	17
DL7CX	"	49,392	167	41	92	11
DL8ARJ	"	38,734	186	20	86	1
DF1LON	"	25,953	98	27	90	6
DJ3WE	"	23,569	135	20	71	0
DHØGHU	"	22,339	108	19	55	15
DL5ZK	"	18,403	128	14	56	7
DL8RDL	"	17,242	104	16	49	9
DK2CX	"	16,482	126	15	44	8
DJ5IW	"	15,300	119	11	57	0
DJ6TB	"	12,859	80	23	53	1
DJ5AN	"	713	12	10	11	2
DK3T	14A	394,914	997	33	88	45
						(OP: DK4EE)
DF9GR	"	186,921	512	31	96	34
DJ3IW	"	17,889	69	21	34	34
DL7VOG	"	13,560	97	14	41	5
DFØRW	"	220	9	4	7	0
DL4ME	7A	33,300	237	16	56	3
DL3BQA	3.5A	117,810	769	15	63	7
DL8OH	"	80,370	518	15	61	14
***DL9YAJ**	AA	649,931	889	69	228	50
*DR7T	"	342,348	585	52	198	32
						(OP: DF1DN)
*DJ1OJ	"	288,116	625	43	149	31
*DK3WN	"	228,480	524	44	165	15
*DD5M	"	222,359	480	43	159	27
						(OP: DJØZY)
*DL1GME	"	150,890	403	42	133	16
*DL7YS	"	122,400	430	28	119	3
*DJ9MH	"	118,125	309	37	133	19
*DL1ARJ	"	100,598	321	32	128	19
*DM7W	"	84,303	279	31	107	15
						(OP: DL8MAS)
*DK5TX	"	79,520	244	29	113	18
*DL6MHW	"	78,400	215	39	116	20
*DL2FQ	"	76,300	266	28	96	16
*DK5WO	"	60,260	246	19	73	23
*DL2FK	"	50,716	185	27	81	16
*DL7UGN	"	50,699	213	22	96	3
*DM5JBN	"	45,465	205	24	70	11
*DL6RDR	"	44,505	174	25	72	18
*DM6DX	"	42,521	226	19	82	0
*DF5EM	"	36,504	160	25	92	0
*DL5ANS	"	33,784	174	24	78	1
*DJ1YFK	"	29,585	162	21	70	6
*DL4SDW	"	26,691	135	23	64	6
*DL1RTS	"	23,100	157	15	62	0
*DL5GAC	"	21,060	121	15	49	14
*DL1NHW	"	17,222	116	19	58	2
*DL5ARM	"	15,554	101	18	57	2
*DJ1MM	"	15,197	100	18	73	0
*DD1FLO	"	14,774	100	22	56	5
*DL1DVE	"	13,608	98	17	52	3
*DL2ART	"	13,332	100	17	47	2
*DG1HXJ	"	10,570	75	20	45	5
*DK2WU	"	10,362	70	18	38	10
*DN5HR	"	8,700	64	21	37	2

*DG4AM	"	7,611	60	16	37	6
*DJ6OI	"	5,565	53	15	35	3
*DJ2FR	"	2,537	44	12	31	0
*DM3M	"	1,696	21	12	15	5
*DL6DCX	"	682	21	6	16	0
***DF4WC**	**14A**	**16,992**	**129**	**11**	**37**	**11**
*DG8AM	"	646	22	7	12	0
***DJ8DS**	**7A**	**28,578**	**247**	**12**	**52**	**2**
***DO2XX**	**3.5A**	**19,800**	**214**	**7**	**42**	**1**

Greece

SV3EXU	**A**	**150,072**	**461**	**33**	**111**	**25**
SV6JHA	"	129,532	306	44	121	23
SV8DCY	"	67,080	255	33	90	7
SZ6P	**14**	**62,664**	**354**	**16**	**51**	**17**
(OP: SV1BJW)						
SV1JG	**3.5**	**2,562**	**63**	**4**	**17**	**0**
***SV8OVH**	**A**	**120,733**	**418**	**35**	**122**	**0**
*SV1DOO	"	48,880	278	20	74	0
*SV1JFL	"	39,520	278	14	64	2
*SV8/PA1FJ/P	"	4,017	56	10	27	2
(OP: PA1FJ)						
*SV1RUX	"	1,890	27	11	19	0
*SV2/SV7CUD	"	396	15	6	12	0
(OP: SV7CUD)						
***SV1MO**	**14**	**4,200**	**49**	**11**	**25**	**4**
SV2BXA	**AA**	**373,984**	**741**	**52**	**182**	**14**
SV2ESW	"	233,506	637	38	118	26
SV2KF	"	100,873	343	36	94	19
SZ1A	**14A**	**154,051**	**539**	**26**	**75**	**26**
(OP: SV1BDO)						
***SV8PMM**	**AA**	**14,040**	**98**	**18**	**52**	**2**
***SV2AEL**	**14A**	**106,692**	**506**	**19**	**63**	**20**

Guernsey

***GUØSUP**	**A**	**162,918**	**405**	**34**	**134**	**21**

Hungary

HAØHW	**A**	**171,287**	**539**	**34**	**114**	**9**
HA9PP	**14**	**1,752**	**32**	**9**	**15**	**0**
HA8BT	*3.5*	*90,132*	*528*	*16*	*65*	*6*
***HA5AQ**	**A**	**53,060**	**151**	**43**	**81**	**16**
**HA7PO*	"	*30,996*	*144*	*28*	*76*	*4*
***HAØLW**	**14**	**19,272**	**122**	**15**	**37**	**14**
***HAØMS**	**7**	**20,644**	**199**	**9**	**43**	**0**
***HA8WY**	**3.5**	**49,910**	**411**	**9**	**50**	**3**
HA1AG	**AA**	**35,541**	**157**	**23**	**55**	**21**
HA2VR	"	*3,234*	*46*	*10*	*32*	*0*
HA8JV	**14A**	**596,717**	**1304**	**34**	**107**	**46**
HA8QZ	"	168,073	564	25	70	36
HG5D	**7A**	**177,360**	**706**	**23**	**82**	**15**
(OP: HA8QZ)						
HA8BE	**3.5A**	**121,432**	**711**	**15**	**66**	**5**
***HA6NL**	**AA**	**291,940**	**661**	**46**	**155**	**19**
*HG8C	"	167,240	411	39	113	33
*HA3OU	"	108,570	307	37	119	9
*HA2OS	"	10,476	100	11	43	0

Iceland

***TF8KY**	**A**	**8,692**	**80**	**13**	**35**	**5**
*TF3DC	"	5,550	49	14	31	5
***TF1OL**	**14**	**276**	**21**	**4**	**7**	**1**

Ireland

EI3GRB	**A**	**27,436**	**189**	**15**	**53**	**8**
EI8IU	**14**	**67,811**	**394**	**11**	**46**	**26**

Italy

I4JED	**A**	**838,572**	**1202**	**54**	**170**	**74**
IK7NXU	"	350,842	634	47	175	24
IK1BPL	"	174,834	436	39	134	25
IX1CLD	"	170,868	472	33	122	19
IV3ARJ	"	168,004	398	38	132	24
IK5FKF	"	138,237	364	33	119	25
IK2SND	"	*122,310*	*372*	*26*	*92*	*33*
IV3VBM	"	*114,741*	*341*	*37*	*120*	*14*
IZØHAP	"	85,536	304	32	104	8
I2OGV	"	58,420	224	20	70	25
IKØYUO	"	52,029	208	29	94	0
IZ3LUF	"	41,500	177	19	57	24
I1WQR	"	*21,973*	*153*	*14*	*59*	*0*
IK2AHB	"	12,765	77	16	37	16
IK6FTZ	"	*10,550*	*102*	*10*	*25*	*15*
I3FGX	**21**	**20,740**	**137**	**18**	**48**	**2**
IZ1PKV	**14**	**380,000**	**999**	**29**	**91**	**40**
IQ4RN	"	168,148	588	25	68	34
IK1NEG	"	68,264	300	21	66	19
IK4GNI	"	64,416	317	17	43	28
IZ3GYS	"	53,508	227	16	51	31
IZ2GRG	"	41,600	166	21	61	22
IZ1HDR	"	18,768	127	15	45	8
IW1PNJ	**7**	**138,425**	**590**	**21**	**70**	**22**
IK5UAN	"	62,901	362	14	56	17
IZ4GOL	"	4,154	72	4	27	0
IZØKBR	**3.5**	**121,600**	**608**	**17**	**62**	**21**
***IW2MXY**	**A**	**342,672**	**730**	**34**	**133**	**13**
*IK1RGK	"	239,292	574	38	121	38
*IZ4OSH	"	188,160	425	59	126	25
*IK2RZG	"	170,625	396	36	116	43
*IZ8WDH	"	159,720	502	30	127	8
*IC8FJX	"	158,580	454	35	130	15
*I2XLF	"	143,234	400	35	121	26
*IZ8XXE	"	137,264	342	40	119	25
*IØGIA	"	133,525	363	38	117	20
*IV3XNF	"	128,304	338	39	114	23
*IU5ICR	"	119,808	391	27	108	21
*IWØGYC	"	111,573	340	32	119	10
*IK8IOO	"	95,046	358	34	104	8
*IW1CBG	"	93,148	340	25	115	6
*IZ5IMB	"	88,350	271	30	101	24
*IK3SSJ	"	82,804	354	24	89	14
*IK2AUK	"	77,655	275	30	110	15
*IK4IDP	"	76,032	262	32	90	22
*IZ8DVD	"	72,517	294	25	90	12
*IK2OVT	"	66,240	204	31	90	23
**IK4QJF*	"	*61,264*	*287*	*22*	*85*	*5*
*IW4EJK	"	51,272	197	24	70	22
*IK2SAR	"	46,287	241	27	81	3
*I2BZN	"	35,952	178	22	84	1
*IZ3XNJ	"	35,752	140	24	63	22
*IK8ARF	"	30,192	147	29	76	6
*IZ7GEG	"	28,684	147	23	67	11
*IU3FBL	"	28,372	160	15	46	21
*I6FDJ	"	25,650	147	20	70	0
*IN3OWY	"	25,530	218	9	60	0
*IK2YSJ	"	24,598	140	20	77	1
*IK3MLF	"	23,956	97	27	75	11
*IK5BSC	"	23,738	119	19	44	20
*IK6BSN	"	22,008	118	21	52	11
*IV3XPP	"	21,093	143	18	57	4
*IZ6BXQ	"	18,270	115	22	52	13
*IU4CSS	"	15,387	125	14	46	9
*IK6ZDE	"	14,760	100	16	54	2
*IU1FHJ	"	14,620	116	15	53	0
*IK4XQT	"	13,601	118	15	50	2
*IK2AOO	"	12,444	108	14	47	0
*I8IEQ	"	12,040	87	17	52	1
*IK2IKW	"	11,696	86	18	50	0
*IZ5HQB	"	11,036	88	13	44	5
*IK4RQJ	"	10,034	96	15	43	0
**IW2JRV*	"	*8,533*	*74*	*10*	*32*	*11*
*IV3IQY	"	5,335	46	15	38	2
*IZØTWI	"	1,876	47	5	23	0
*IZ3GOG	"	540	11	7	8	3
*I1DXD	"	513	11	8	11	0
***IZ7UMS**	**21**	**11,092**	**117**	**12**	**35**	**0**
***IU1DUB**	**14**	**54,600**	**231**	**18**	**52**	**30**
*IZ7XNB	"	34,255	184	16	49	20
*IK7RVY	"	22,125	176	16	43	16
*IZ2JPN	"	18,963	147	12	42	9
*IU1HCC	"	17,728	123	12	39	13
*IW3RQT	"	14,322	95	16	39	11
*IZ8GUQ	"	11,189	79	16	35	16
*IK7XNF	"	9,672	86	11	26	15
*I2ORX	"	9,010	78	10	34	9
*I4UUL	"	7,392	67	11	21	12
*I3PXN	7	94,367	519	19	65	7
*IW2LLH	"	10,472	106	9	44	3
*IU4IBC	"	9,328	121	7	37	0
*IK1ODN	"	8,820	108	6	36	0
*I5WNN	"	4,664	56	10	31	3
**I1WXY*	*3.5*	*54,925*	*462*	*7*	*53*	*5*
***IK5AMB**	**"**	**46,260**	**417**	**8**	**51**	**1**
**IW2HUS*	"	*13,314*	*163*	*4*	*38*	*0*
*I4JEE	"	6,384	107	6	32	0
IQ2CJ	**AA**	**2,646,900**	**2359**	**100**	**324**	**95**
(OP: IT9RGY)						
IV3WMS	"	750,164	967	63	201	70
I2WIJ	"	632,111	895	67	193	63
IK2XDE	"	623,076	1046	50	183	41
I7CSB	"	457,545	693	63	184	48
IØWBX	"	312,354	705	47	152	23
I2DJX	"	249,536	491	41	147	36
IK2LFF	"	224,070	713	36	123	6
IK5PWS	"	128,484	380	31	117	18
IKØXBX	"	74,822	195	36	116	27
IK4UOA	"	65,274	202	32	78	28
IZ3QHA	"	45,243	259	16	83	0
IZ2DLV	"	44,064	173	26	57	25
IN3BFW	"	32,032	205	18	59	0
IK2EGL	"	23,858	158	19	58	2
I2SVA	"	*22,092*	*120*	*17*	*49*	*18*
IZ3XEF	"	*9,301*	*66*	*20*	*48*	*3*
IN3EQD	"	5,830	50	18	32	3
IZ2FOS	**21A**	**7,296**	**96**	**11**	**27**	**0**
IQ1RY	**14A**	**786,111**	**1572**	**37**	**108**	**56**
(OP: IZ1LBG)						
IZ3GOM	"	304,065	917	27	73	45
IW1CHX	"	201,432	668	22	64	46
IU4CHE	"	147,506	482	26	72	33
IK3XJP	"	92,092	276	28	77	38
IU3BTY	"	43,180	239	18	55	12
IK4ZHH	"	14,579	99	14	26	21
I4AVG	**7A**	**539,240**	**1409**	**31**	**94**	**45**
IZ2DII	"	169,740	674	25	80	18
IZ5EME	"	*30,400*	*181*	*17*	*55*	*8*
I1JTQ	**3.5A**	**75,392**	**543**	**13**	**55**	**8**
IV3AZV	"	26,620	257	8	46	1
***I2BRT**	**AA**	**671,132**	**1026**	**61**	**198**	**49**
*IZ3EIN	"	109,051	334	31	123	13
*IZØEHL	"	108,884	341	28	117	22
*IV3HAX	"	77,184	276	29	113	2
*IWØQO	"	65,928	258	25	102	7
*IZ4XAI	"	28,690	156	20	72	3
*IK2RLS	"	25,652	119	28	72	6
*IW5EIJ	"	21,824	118	21	58	9
*IN3FHE	"	13,230	65	24	63	3
*IU1LCU	"	10,890	83	15	41	10
*IZ5ILK	"	8,804	60	17	31	14
*IZ3NVR	"	7,728	110	6	36	0
*IZ8GBT	"	7,645	60	17	29	9
***IK3TPP**	**14A**	**164,294**	**524**	**26**	**76**	**40**
*IZ2JQP	"	24,309	142	15	40	18
*IV3XZG	"	14,652	103	15	41	10
***IK4RVG**	**7A**	**100,108**	**458**	**23**	**78**	**15**
*IZ4JMA	"	80,538	435	16	63	14
*IZØUME	"	18,300	153	10	45	6
*IK2WAD	"	15,635	133	11	44	4
***IZ5OQX**	**3.5A**	**5,536**	**98**	**5**	**27**	**0**

Jersey

***MJØX**	**A**	**158,556**	**556**	**26**	**116**	**4**
(OP: MØRTI)						

Kaliningrad

UA2CZ	**A**	**115,650**	**388**	**30**	**113**	**7**
***RN2FQ**	**A**	**22,092**	**139**	**23**	**60**	**1**
***RA2FB**	**14A**	**8,370**	**97**	**11**	**33**	**1**

Latvia

YL2CI	**14**	**158,799**	**548**	**26**	**77**	**26**
YL2HR	**7**	**60,492**	**430**	**12**	**59**	**0**
***YL2GP**	**A**	**82,110**	**284**	**28**	**105**	**5**
*YL2IP	"	15,600	105	20	58	0
*YL3CU	"	264	11	3	8	0
YL2UI	**AA**	**297,873**	**689**	**38**	**144**	**25**
YL2GD	"	250,182	488	57	180	9
YL9T	"	190,180	519	35	148	2
(OP: YL2TW)						
YL2KO	"	8,723	54	19	32	10
YL2KF	**7A**	**121,346**	**694**	**17**	**69**	**0**
***YL2NK**	**AA**	**77,364**	**311**	**25**	**94**	**7**
*YL5T	"	22,794	124	22	63	2
(OP: YL3DQ)						
***YL2SM**	**14A**	**10,890**	**69**	**14**	**41**	**11**

Liechtenstein

HBØ/DL5YM	**AA**	**375,147**	**792**	**35**	**141**	**43**

Lithuania

LY7Z	**A**	**1,851,116**	**2159**	**87**	**281**	**44**
LY1FW	**7**	**222,902**	**921**	**27**	**85**	**6**
***LY9Y**	**A**	**563,094**	**1133**	**48**	**180**	**18**
*LY2BAA	"	13,260	108	16	52	0
***LY2CG**	**14**	**24,500**	**183**	**14**	**47**	**9**
*LY1D	"	16,566	122	16	45	5
*LY2CV	"	2,910	47	9	21	0
***LY5W**	**7**	**138,780**	**640**	**22**	**80**	**6**
LY1R	**AA**	**476,224**	**982**	**52**	**148**	**24**
LY2SA	"	107,500	296	39	124	9
LY3CY	"	81,664	318	22	104	2
LY2NY	**14A**	**212,176**	**620**	**30**	**84**	**35**
LY2FN	**3.5A**	**68,096**	**451**	**13**	**60**	**3**
***LY5T**	**AA**	**86,144**	**360**	**25**	**103**	**0**

Luxembourg

***LX1JH**	**A**	**21,924**	**142**	**18**	**68**	**1**
LX1HD	**14A**	**22,568**	**162**	**11**	**36**	**15**

Moldova

***ER5LL**	**A**	**10,824**	**82**	**21**	**40**	**5**
***ER1OO**	**3.5**	**31,806**	**305**	**9**	**44**	**1**
ER4A	**AA**	**820,812**	**1378**	**55**	**203**	**34**
(OP: UT5UDX)						

Netherlands

PA5TT	**A**	**41,472**	**190**	**22**	**68**	**18**
PAØCT	"	41,000	199	19	71	10
PA4DN	"	40,768	203	21	75	8
PA4B	*14*	*26,600*	*150*	*15*	*41*	*20*
***PF6X**	**A**	**141,735**	**439**	**28**	**121**	**16**
*PA3T	"	80,010	305	24	89	14
*PA4G	"	76,755	335	21	81	17
*PA2CVD	"	72,795	322	22	83	10
*PAØFVH	"	71,724	286	23	91	15
*PA3JB	"	65,750	311	23	100	2
*PA8KW	"	65,747	241	25	101	13
*PA1JM	"	54,670	249	18	88	4
**PAØPIW*	"	*53,954*	*264*	*22*	*73*	*11*
*PC7E	"	43,329	225	19	79	3
*PA4GDR	"	38,950	203	18	76	1
*PDØWR	"	37,054	186	17	68	12
*PG1R	"	36,408	165	23	73	15
*PA3DBS	"	34,888	207	17	71	1
*PA3EWG	"	29,841	170	16	68	3
*PAØALG	"	29,412	198	15	68	3
*PBØACU	"	23,532	159	15	49	10
*PAØCMF	"	21,660	150	14	58	4
**PA2W*	"	*20,916*	*118*	*17*	*58*	*8*
*PAØTCA	"	17,908	113	16	50	8
*PA3ADU	"	17,712	111	20	55	7
*PC5D	"	12,608	103	12	50	2
*PA4R	"	11,760	91	15	52	3
*PA2EJD	"	11,748	99	14	51	1
*PD3ALX	"	10,985	91	16	43	6
*PA2VS	"	10,971	102	10	43	0
*PA3CDN	"	10,780	97	16	53	1
*PA2LP	"	7,155	71	15	38	0
*PA3DTR	"	6,318	58	16	36	2
*PDØMWG	"	4,059	52	11	28	2
*PA9DD	"	3,737	52	8	29	0
*PAØZH	"	1,305	24	10	18	1
*PA2DK	"	1,248	27	5	19	0
*PD5PET	"	660	23	6	16	0
***PG7V**	**7**	**7,638**	**103**	**5**	**33**	**0**
PA4O	**AA**	**910,134**	**1207**	**64**	**231**	**59**
PA7LV	"	760,760	1177	55	208	45
PA5WT	"	438,768	717	46	181	50
PG3N	"	168,032	452	34	125	19
PB7Z	"	129,282	353	35	121	18
PAØM	"	97,950	301	27	103	20
PA5N	"	67,602	299	20	92	2
PAØGJV	"	66,430	230	29	79	22
PA3EVY	"	40,981	193	20	71	16
***PC3T**	**AA**	**212,742**	**455**	**46**	**142**	**35**
*PE1FTV	"	157,210	502	30	121	7
*PE5O	"	102,144	295	37	117	14
*PA2TA	"	79,728	299	25	95	12
*PC1PM	"	78,470	302	26	100	7
*PA3BXR	"	76,800	302	24	96	8
*PAØGRU	"	45,276	240	17	72	9
*PDØMHZ	"	32,470	186	17	63	5
*PD5JFK	"	31,706	240	16	62	5
*PE4BAS	"	31,314	157	24	67	11
*PD3EM	"	29,184	197	13	61	2
*PD1RO	"	28,469	167	16	58	9
**PA2PKZ*	"	*26,240*	*164*	*21*	*48*	*11*
*PA1LEX	"	20,448	158	13	55	3
*PDØME	"	20,276	142	17	54	3
*PF6W	"	14,976	112	12	45	7
*PA4WM	"	14,668	86	17	52	7
*PD2TW	"	14,579	109	13	32	16
*PC4C	"	14,271	108	13	49	5
*PA3DUU	"	13,157	114	13	41	5
*PA4J	"	6,321	63	10	33	6
***PD1RP**	**14A**	**836**	**15**	**8**	**10**	**4**

North Macedonia

***Z35Z**	**A**	**9,288**	**95**	**10**	**43**	**1**
***Z36N**	**7**	**36,160**	**290**	**11**	**48**	**5**
Z39A	**AA**	**81,510**	**266**	**27**	**95**	**21**
Z35T	**7A**	**329,130**	**1169**	**25**	**81**	**29**
***Z33B**	**AA**	**18,626**	**141**	**17**	**50**	**0**
***Z33F**	**7A**	**116,207**	**631**	**18**	**64**	**9**

Northern Ireland

***GN5DX**	**A**	**51,984**	**237**	**17**	**82**	**15**
(OP: MIØJZZ)						
***MIØSAI**	**14**	**118,874**	**511**	**14**	**40**	**44**
GI5I	**AA**	**280**	**10**	**5**	**7**	**2**
(OP: GI4DOH)						
MIØSLE	**3.5A**	**61,376**	**490**	**8**	**49**	**7**

Norway

***LA5LJA**	**A**	**201,310**	**456**	**43**	**145**	**17**
*LA2HFA	"	58,564	249	21	94	6
*LA6CF	"	57,531	266	25	93	9
**LC8P*	"	*52,828*	*293*	*16*	*78*	*0*
*LA7SI	"	26,664	156	16	72	0
*LC7D	"	12,408	98	15	46	5
(OP: LA6PBA)						
**LB2WG*	"	*7,696*	*102*	*9*	*28*	*0*
*LA4OGA	"	4,876	63	9	37	0
*LA2L	"	4,708	54	11	33	0
(OP: LA3CLA)						
LA9TY	**AA**	**619,320**	**1144**	**49**	**181**	**30**
LB6KC	"	70,610	314	24	87	4
LA8CJ	**14A**	**3,382**	**38**	**12**	**22**	**4**
***LA3BPA**	**AA**	**108,888**	**346**	**34**	**113**	**9**
*LA9RY	"	24,932	152	18	70	4
***LC9S**	**14A**	**12**	**2**	**1**	**2**	**0**
(OP: LA9GSA)						

Poland

SP7AH	**A**	**161,304**	**509**	**35**	**116**	**5**
SP3DIK	"	133,620	370	37	122	11
SP2QCW	"	53,500	191	30	80	15
SN6A	"	30,590	137	22	51	22
(OP: SP6CES)						
SP1JQJ	"	26,228	160	16	63	4
SP4W	"	22,185	130	23	54	8
SQ2RGB	**14**	**15,871**	**117**	**15**	**37**	**7**
SO9I	**3.5**	**107,692**	**745**	**11**	**60**	**5**
(OP: SQ9ORQ)						
SP5DL	"	50,211	425	9	53	1
SP6IHE	"	40,424	356	9	52	1
***3Z9M**	**A**	**1,177,177**	**1658**	**70**	**235**	**44**
(OP: SQ9UM)						
*SQ2WHH	"	481,984	877	59	188	25
*SP9H	"	304,996	661	43	161	22
*SP8EEX	"	213,745	530	42	134	21
*SQ6PLE	"	110,282	420	22	107	5
*SP6EIY	"	105,090	343	36	116	3
*HF1ØØPS	"	84,940	318	26	105	6
(OP: SP9CXN)						
*SP6JZP	"	79,872	297	29	91	8
*SQ3MZ	"	72,610	283	26	101	10
*SP5GNI	"	67,268	247	29	93	12
*SP4BPH	"	64,240	293	20	88	2
*SQ6ELV	"	56,280	188	29	88	23
*SQ6ELK	"	55,297	232	27	85	9
*SP3MEO	"	54,834	296	26	78	7
*SP4LVK	"	52,440	218	30	79	6
*SN1LH	"	50,161	262	17	86	0
(OP: SP1EG)						
*SQ6UV	"	46,247	234	20	83	0
*SP9KB	"	39,000	202	20	79	1
*SN8ØWW	"	33,286	198	20	69	0
(OP: SP1MWF)						
*SP2GDK	"	32,054	178	19	74	1
*SP1DMD	"	27,115	161	18	56	11
*SQ2NNN	"	27,048	302	7	41	1
*SP9GKJ	"	14,256	102	17	55	0
*SQ9NFQ	"	12,276	99	17	44	1
*SP8CGU	"	10,440	76	19	39	2
*SP9WZO	"	8,740	107	11	35	0
*SP5BUJ	"	4,708	50	11	33	0
*SP9IHP	"	3,192	34	15	21	2
***SP4DC**	**21**	**540**	**17**	**4**	**11**	**0**
***SP6DMI**	**14**	**14,300**	**127**	**12**	**35**	**5**
*SP2AEK	"	10,976	111	13	33	3
*SP5TAZ	"	9,550	101	11	36	3
*SP9EZM	"	3,706	53	9	23	2
*SP9MDY	"	792	31	5	13	0
***SQ5CZP**	**7**	**36,018**	**260**	**13**	**53**	**3**
*SP9BCH	"	17,712	161	10	43	1
*SP2BLC	"	17,442	219	9	42	0
*SQ8W	"	17,116	207	7	37	0
**SP6BEN*	"	*17,004*	*159*	*9*	*40*	*3*
*SP5CQI	"	4,840	64	8	32	0
*SP9BGS	"	4,212	51	7	23	6
*SO1RON	"	1,300	33	5	15	0
*SP9KJU	"	629	16	6	11	0
(OP: SP9MDY)						
***SP5VIH**	**3.5**	**7,956**	**123**	**6**	**30**	**0**
*SQ9PPT	"	5,742	99	4	29	0
SN7Q	**AA**	**3,107,940**	**2658**	**99**	**317**	**94**
(OP: SP7GIQ)						
3Z5ØKP	"	161,530	543	26	106	13
(OP: SP5KP)						
SP8K	"	*108,080*	*342*	*41*	*91*	*8*
SP6AXW	"	66,918	295	22	87	5
SP9KR	"	48,178	206	28	76	5
SP1NY	"	29,640	126	28	70	16
SP6NZ	"	6,840	58	17	35	5
SP5I	"	1,824	27	10	22	0
SP2KPD	**14A**	**6,596**	**97**	**9**	**25**	**0**
(OP: SP2IJ)						
SP5OXJ	**7A**	**99,200**	**492**	**20**	**71**	**9**
SP5IVC	"	89,376	609	14	59	3
SP9RQH	"	8,131	102	9	38	0
***SP6FXY**	**AA**	**87,746**	**291**	**36**	**101**	**9**
*SQ9FMU	"	69,160	241	31	85	17
*SP2MKI	"	23,436	135	18	63	3
*SP2WGB	"	13,680	100	18	54	0
*SN6E	"	4,418	58	13	34	0
(OP: US6EU)						
*SQ9IWA	"	260	7	6	7	0
***SNØR**	**21A**	**432**	**12**	**5**	**11**	**0**
(OP: SQ9IAU)						
***SO5WD**	**7A**	**16,072**	**172**	**7**	**41**	**1**
*SP2KAC	"	8,592	89	9	39	0

Portugal

CR6T	**21**	**113,221**	**495**	**18**	**62**	**21**
(OP: CT1ESV)						
***CT1ILT**	**A**	**1,169,754**	**1565**	**54**	**181**	**96**
*CR5O	"	654,724	1165	41	169	58
(OP: CT7AJL)						
*CT7AUP	"	130,350	398	29	100	29
*CS25FOQ	"	24,948	104	24	52	23
(OP: CT1FOQ)						
***CT7AIX**	**14**	**24,820**	**132**	**14**	**36**	**23**
***CS25ARR**	**AA**	**430,416**	**787**	**50**	**150**	**52**
(OP: CT1BXT)						

Romania

YPØC	**A**	**636,225**	**1208**	**52**	**170**	**33**
(OP: YO3CZW)						
YO3VU	**21**	**31,570**	**273**	**15**	**40**	**0**
***YO6HSU**	**A**	**315,432**	**651**	**51**	**168**	**15**
*YO3YV	"	127,395	382	36	129	6
*YO2LEA	"	70,278	216	37	100	22
*YO7DBR	"	39,437	194	31	79	3
*YO4SI	"	38,760	159	27	75	12
*YO2LDU	"	28,322	153	22	73	3
*YO2LXW	"	25,120	165	19	61	0
*YO4UQ	"	16,500	145	12	48	0
***YO2IS**	**14**	**40,125**	**271**	**13**	**47**	**15**
*YO9CWY	"	27,936	198	12	50	10
*YO8DHA	"	20,916	177	13	40	10
***YO4DFT**	**7**	**45,600**	**299**	**15**	**58**	**2**
*YO4CVV	"	9,632	111	8	35	0
***YO5OHY**	**3.5**	**23,184**	**256**	**6**	**42**	**0**
YQ6A	**AA**	**868,644**	**1258**	**72**	**212**	**40**
(OP: YO6BHN)						
YO9HP	"	688,675	1010	71	239	15
YO7CW	"	223,668	668	33	133	5
YO4FPF	"	157,916	547	27	108	13
YO4DW	"	27,477	185	18	51	2
YO9BPX	**14A**	**82,890**	**414**	**18**	**57**	**15**
YO8WW	**3.5A**	**17,297**	**190**	**7**	**42**	**0**
***YO4NF**	**AA**	**303,212**	**687**	**38**	**171**	**12**

Sardinia

***ISØBRQ**	**A**	**31,518**	**149**	**20**	**77**	**6**
*ISØGVH	"	18,615	138	16	56	1

Scotland

***GM4JKZ**	**A**	**61,585**	**276**	**21**	**72**	**20**
*MMØCPZ	"	35,432	195	14	63	9
*GM9C	"	13,978	130	12	45	1
(OP: MMØGHM)						
***MMØGOR**	**14**	**7,680**	**99**	**6**	**32**	**2**
GM4FDM	**7A**	**247,758**	**1014**	**26**	**78**	**15**
***GM6DX**	**AA**	**8,112**	**93**	**9**	**39**	**0**
***MM2T**	**14A**	**5,282**	**65**	**8**	**24**	**6**

Serbia

YT2AAA	**A**	**66,783**	**291**	**25**	**80**	**8**

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YU1UN	21	65,989	392	19	54	4
*YU4SMT	A	5,203	98	8	35	0
*YT8A	21	17,334	152	14	38	2
*YU7RIM	3.5	9,756	138	5	31	0
YT2U	AA	192,246	531	40	125	14
YU1KT	"	63,828	302	21	87	0
YU5R	21A	82,398	400	23	65	5
(OP: YT2AAA)						
*YT3H	AA	3,710	50	9	26	0
*YU2A	14A	60,552	335	18	52	17
*YT9VM	7A	22,002	212	14	42	1
*YU7U	"	16,072	195	6	33	2

Sicily

IT9VCE	A	768,911	1283	49	178	56
*IT9CIL	A	29,640	157	19	69	7
*IT9CKA	7	16,415	168	9	40	0
IT9ESW	AA	704,370	1026	60	198	60
IT9ZZO	28A	171	15	3	6	0
IR9K	7A	232,624	1030	18	67	27
(OP: IT9DSZ)						
IT9STX	"	114,624	570	14	54	28
*IT9ACJ	AA	51,076	236	29	83	1
*IT9XTP	3.5A	44,631	394	7	50	0
*IT9RZU	"	25,596	240	8	46	0

Slovak Republic

OM3IAG	3.5	33,984	302	10	47	2
*OM3R	A	95,238	337	30	109	4
(OP: OM3CFR)						
*OM7AG	"	89,712	330	29	108	7
*OM5MX	"	60,931	264	21	76	12
*OM2DT	"	59,784	203	34	91	16
*OM5NL	"	47,573	203	21	71	21
*OM8JP	14	10,600	97	12	31	7
*OM7PY	7	12,222	144	7	35	0
*OM3ZWA	3.5	27,387	280	6	45	0
OM2VL	AA	465,776	599	75	237	32
OM2AGN	14A	18,786	99	22	55	16
OM3CW	7A	20,458	195	11	42	0

Slovenia

S53TM	14	172,569	628	24	66	33
S53F	7	590,178	1535	30	96	41
S5ØA	"	526,384	1455	31	97	39
*S57AM	A	373,320	685	50	164	41
*S55BA	"	137,788	493	26	111	11
*S57SWR	"	92,456	386	26	101	0
*S57YK	"	78,625	299	25	85	15
*S51JQ	14	43,097	256	17	53	1
*S57X	7	42,021	303	11	54	4
S57AW	AA	1,174,716	1185	88	295	64
S58J	14A	228,512	657	28	86	34
S57S	"	6,468	59	9	17	16
S51CK	7A	222,300	856	24	83	23
S58Q	"	58,598	370	17	61	5
*S5ØRY	AA	153,384	451	31	103	32
(OP: S53K)						
*S53O	"	57,040	229	23	86	15
*S56A	"	49,296	148	32	115	11
*S53BB	"	18,942	138	19	57	1
*S52WW	7A	7,696	109	6	31	0
*S51RBC	"	4,224	66	6	26	0
(OP: S57LR)						

Spain

EA2XR	A	513,136	1076	31	120	57
EE3E	"	302,895	493	50	159	56
(OP: EA3ELZ)						
EA1DA	"	272,889	515	47	146	50
EA1CF	"	62,580	210	26	80	34
EA5DFV	"	36,380	164	15	39	31
EA7AQV	"	19,236	125	17	54	13
EB1IC	"	2,970	31	9	9	15
EF1C	14	93,656	507	16	56	20
ED4T	"	56,472	215	21	52	31
(OP: EA4CWN)						
EA7KI	7	104,400	612	16	55	19
EA2KU	3.5	38,056	304	9	44	14
EA3FF	"	12,282	136	6	38	2
*EA3FZT	A	532,032	928	45	178	49
*EA3CI	"	401,692	809	41	145	47
*EA1XT	"	391,848	717	40	125	67
*EA4BAS	"	295,554	682	41	137	39
*EA5HRT	"	165,612	561	23	106	19
*EA2BNU	"	157,815	389	36	123	30
*EA3GCT	"	115,675	308	32	115	28
*EA4CRP	"	71,136	262	29	96	19
*EA4DXP	"	58,650	205	30	99	9
*EA1EH	"	49,950	219	20	74	17
*EB5CS	"	40,832	172	21	89	6
*EA5XC	"	39,923	280	16	66	1
*EA1IYK	"	35,310	172	23	76	11
*EA4EJR	"	34,606	135	29	79	13
*EA5LD	"	34,020	138	24	70	14
*EA3HKA	"	27,974	194	16	49	6
*EA5ICS	"	19,602	126	17	61	3
*EA3JW	"	18,060	90	21	43	22
*EB5CUZ	"	17,658	110	21	59	1
*EA1EWY	"	15,631	101	16	54	7
*EA3IAZ	"	9,648	95	13	54	0
*EA7VJ	"	2,628	30	12	24	0
*EA1BDX	21	3,705	48	11	25	3
*EA7IA	14	36,279	202	15	48	24
*EA3GOM	"	19,341	145	9	36	18
*EA3OH	"	10,556	96	11	33	8
*EA7CU	7	3,498	57	5	28	0
*EA4FJX	3.5	6,536	84	7	35	1
EA1AKS	AA	883,080	1251	56	182	92
EA1CJ	"	501,696	976	41	133	60
EA1WS	"	497,105	852	47	132	66
ED1MK	"	398,658	752	41	142	64
(OP: EA1MK)						
EA5FIV	"	288,234	648	35	124	42
EA5JX	"	174,984	481	35	128	21
EA3HWE	"	92,463	340	27	114	6
EA5GIE	"	54,944	288	17	72	12
EA2OK	"	34,656	135	20	35	41
EA2DDE	"	260	7	5	5	3
EA1BD	14A	122,015	485	21	55	39
EA7ZY	"	85,782	479	14	45	28
EA1VM	"	10,860	77	11	20	29
EB1DMQ	"	858	29	6	20	0
*EC7KW	AA	283,465	557	55	153	37
*EB1EB	"	50,900	244	21	66	13
*EF5Y	"	44,196	157	32	78	17
(OP: EA5FR)						
*EA5/PA3GCU	"	25,740	156	14	45	19
*EF3C	14A	49,686	243	15	44	32
(OP: EA3CV)						
*EA2CCG	"	17,420	114	12	28	27
*EA5HJO	"	12,939	119	12	40	5

*EB1ADD	7A	9,250	88	11	32	7
*EB3CW	3.5A	129,168	656	19	70	15

Sweden

SJ3A	A	115,115	361	30	125	6
(OP: SM3OMO)						
SM6LJU	"	97,626	297	32	102	25
SD1A	"	36,127	197	18	69	4
(OP: SM1TDE)						
SM5C	"	25,344	125	23	66	7
(OP: BM)						
*SE4E	A	293,780	786	34	144	7
(OP: SM4DQE)						
*SM5FQQ	"	223,750	616	36	132	11
*SF1Z	"	117,859	419	26	116	7
(OP: SMØHEV)						
*SM7CIL	"	66,768	290	21	70	16
*SE6K	"	66,708	311	21	87	1
(OP: SM6FZO)						
*SM5ACQ	"	55,499	222	26	92	9
*SM5DXR	"	30,780	192	17	73	0
*SM6GBM	"	3,616	55	8	24	0
*SD6M	"	2,923	34	10	18	9
(OP: SA6BGR)						
*SM5MX	7	180	9	4	8	0
SM5EPO	AA	436,480	834	46	175	27
SM5FUG	"	259,369	589	39	148	22
SM6MVE	"	58,072	249	21	93	5
SE3X	7A	16,875	205	7	38	0
(OP: SA3BYC)						
*SM5IMO	AA	178,880	499	27	124	21
*SE6N	"	33,000	195	18	69	1
(OP: SA6AXR)						
*SF5M	"	28,302	153	19	68	2
(OP: SM5SYO)						
*SM5EFX	"	15,879	120	16	51	0
*SK6AW	7A	55,556	408	12	56	0
(OP: SA6CBY)						

Switzerland

HB9ØTOC	A	814,800	1247	50	167	74
HB9ODP	"	535,767	910	50	172	49
HB9CAL	"	84,560	308	32	111	8
HB9DOS	"	22,849	149	12	49	12
HB9ØAWS	3.5	18,260	183	12	42	1
*HB9AVK	A	47,684	160	34	82	15
*HB9MXY	"	40,810	201	22	80	4
*HB9DDZ	"	37,500	144	24	86	15
*HB9HFM	"	32,522	153	22	69	10
*HB9ØGKM	"	770	21	5	17	0
(OP: HB9GKM)						
*HB3YGD	21	225	13	3	6	0
HB9TTK	AA	189,054	589	27	106	29
HB9ØDUR	"	96,424	366	24	111	1
HB9DVZ	"	82,944	252	36	119	7
HB2U	"	77,372	318	21	62	33
HB9DHG	7A	172,856	655	23	75	26
HB9FKK	"	33,245	271	12	48	1
(OP: IK1PMR)						
*HB9VQQ	AA	299,640	584	41	137	49
*HB9ØBXE	"	78,936	266	37	110	9
*HB2K	"	55,237	321	15	75	1
*HB9OAB	14A	2,232	44	7	17	0

Ukraine

EMØI	A	1,542,378	2114	70	237	47
(OP: UT2IZ)						
UV5U	"	1,013,446	1238	81	251	47
(OP: UX1UA)						
UY5VA	"	675,880	1188	54	203	20
UT4RZ	"	377,235	804	51	184	14
UR5WCQ	"	355,871	716	43	143	30
UY5ZZ	"	307,102	780	42	124	28
UT2AU	"	208,715	621	32	137	0
UT2UB	"	163,208	470	40	138	6
UY5UF	"	157,688	418	36	140	8
UR5CN	"	113,091	385	32	110	7
UR4EI	"	80,848	326	25	99	0
UY5QZ	"	54,860	242	33	95	2
UT1QQ	"	49,594	192	31	106	0
UX3UU	"	10,773	86	17	46	0
UT3RS	14	78,225	348	22	67	16
EM235QM	"	22,968	205	12	44	2
(OP: UR7QM)						
UX2X	3.5	186,340	883	21	75	14
(OP: UT2XQ)						
UR8RF	"	5,425	98	4	27	0
*UT5EPP	A	484,191	1056	47	172	18
*UX7QV	"	358,399	992	37	155	7
*US6CQ	"	345,780	759	44	167	15
*UR8EQ	"	249,767	575	47	158	12
*UT8IM	"	215,488	532	46	158	4
*UT3SO	"	177,325	538	34	129	9
*UR7EC	"	134,460	357	44	133	3
*UR6QS	"	130,788	371	37	131	5
*UR7CB	"	120,945	370	34	122	9
*UR3AC	"	114,413	336	38	123	8
*UTØCK	"	112,996	347	30	125	9
*UT7EJ	"	98,908	312	36	122	0
*UR5TL	"	97,128	308	31	98	5
*UY5TE	"	90,528	333	29	108	1
*UX1CL	"	87,300	282	34	111	5
*UR5ZDZ	"	82,490	286	35	107	4
*UX1CN	"	78,200	326	32	104	0
*UR3VKE	"	76,176	300	32	105	1
*UR5EPV	"	74,298	330	25	97	0
*UT3IA	"	62,408	288	25	90	1
*UT7NI	"	60,636	315	22	97	5
*UY5QJ	"	46,095	193	26	70	9
*UT5UML	"	44,426	240	17	80	0
*UT7MR	"	43,491	229	22	87	0
*UXØFF	"	41,296	168	30	72	14
*UT3UV	"	35,535	171	29	83	3
*UR3QTN	"	34,000	174	24	72	4
*UT4UQ	"	20,605	168	13	52	0
*UT5UHX	"	20,124	120	24	62	0
*UT5UN	"	20,111	100	25	58	8
*UT8IA	"	13,560	122	12	48	0
*US5LOC	"	12,224	105	16	48	0
*UR3QQV	"	11,210	104	14	45	0
*US2E	"	2,880	46	10	22	0
*UR2Y	14	202,750	753	24	66	35
(OP: USØYW)						
*UT2EF	"	51,408	286	15	60	9
*UT1AA	"	33,654	296	14	54	3
*UT5PQ	"	21,080	146	13	49	6
*UX4CR	"	18,585	150	14	45	4
*EO3Q	"	13,112	140	6	24	14
(OP: UR3QCW)						
*UR8QR	"	748	17	9	8	0
*US7KC	7	68,686	583	11	50	0
*UR5ZEP	"	19,195	174	10	45	0
*UT3QD	"	13,860	111	14	46	0
*UR6LF	"	1,197	32	5	14	0
*UT5PY	3.5	45,771	427	7	48	2
*UT1AM	"	22,992	266	6	42	0
*UY8IF	"	8,550	98	9	41	0
*UX7VA	"	4,343	65	7	36	0
UW1M	AA	2,771,055	2791	95	298	70
(OP: UR5MW)						
UW3U	"	1,912,128	2061	90	288	55
(OP: UT7UJ)						
EN5V	"	673,475	1241	52	201	22
(OP: UX1VT)						
UW5U	"	358,267	837	46	166	5
(OP: UY2UA)						
UR6EA	"	223,886	501	45	150	23
US7IID	"	174,573	583	29	130	4
UR5R	"	141,450	506	26	104	8
(OP: UTØRM)						
UT4HZ	"	101,384	302	30	109	13
UX1VX	"	26,622	160	18	69	0
UT5ECZ	"	9,280	69	16	44	4
UT2G	21A	74,760	401	22	62	0
(OP: UR7GO)						
UX1UX	14A	190,384	591	28	86	32
*UT8EL	AA	573,600	946	64	220	16
*UY7C	"	366,860	657	58	184	18
*UR5QU	"	144,738	250	55	186	17
*US2YW	"	111,520	247	45	145	15
*UR3GU	"	97,300	347	28	100	11
*US5QUB	"	94,535	229	42	136	7
*UX3I	"	51,729	211	32	97	0
*UR3PA	"	26,319	152	20	71	2
*UXØSX	"	23,028	143	20	52	4
*UR3QM	"	6,840	79	10	35	0
*UZ1WW	14A	18,270	109	17	52	1
*UT5YY	7A	42,344	284	15	62	2
*UZ4U	"	39,750	266	17	57	1
(OP: UX7UW)						
*UR4CU	"	36,984	272	13	56	0
*UR3QSW	"	31,806	262	10	48	4
*UW1WU	"	5,472	76	9	27	0
*UR5WCW	3.5A	32,879	302	8	52	1
*UT3N	"	23,608	285	8	44	0
(OP: K)						

Vienna Intl. Center

*4U1A	A	636,260	1108	59	192	39
(OP: HB9RB)						

Wales

MW2I	A	727,536	1254	50	182	44
(OP: GW4FRE)						
*MW6M	A	119,970	400	26	116	13
(OP: GW4BVJ)						
*GW4HBK	14	5,412	59	9	27	5
GW4MVA	AA	60,770	261	22	88	8
*GW4TSG	AA	36,504	145	22	56	26
*MW9W	14A	41,790	291	14	48	8
(OP: GWØKRL)						

OCEANIA

Australia

VK4QH	A	1,126,080	1170	83	163	99
VK3JA	"	116,688	323	45	69	18
*VK2GR	A	2,670	32	12	18	0
*VK5IR	"	24	4	2	2	0
*VK4FJ	7	12,446	102	12	11	26
*VK3TNL	"	2,625	29	13	17	5
*VK4AFU	"	608	15	7	8	4
*VK3BWM	"	350	11	5	4	5
*VK4SN	7A	252	8	5	5	4

Guam

NH2DX	28	2,912	63	8	8	0
(OP: KG6DX)						

Hawaii

KH6ZM	A	1,044,684	1191	70	90	146
KH6TU	"	265,036	539	47	52	74
*KH6CJJ	A	360,022	549	58	63	106
*KH6GMP	"	19,136	106	18	16	30
*AH6KO	7	13,018	100	11	10	25
NH6Y	AA	132,348	291	50	48	66
*WH6FAM	AA	510	12	6	5	4

Indonesia

YC6RMT	A	145,390	434	43	86	5
YB2IQ	"	67,354	264	37	73	9
YC2HML	"	46,280	254	28	46	3
YC3DXG	"	15,841	123	31	39	3
YF3FBV	"	2,816	47	12	19	1
YC8UYJ	21	12,051	119	14	25	0
YC3GOQ	"	2,940	35	8	20	0
YF2UFA	"	1,595	25	10	19	0
YBØNDT	14	211,530	695	29	70	11
YB3BLJ	"	2,328	42	9	15	0
YB9UA	7	6,188	95	17	24	11
YC2EEE	"	4,318	82	11	22	1
*YC7YGR	A	150,535	383	53	100	8
*YB2MM	"	120,909	371	39	80	4
*YB7WR	"	65,296	231	32	62	12
*YB4KRZ	"	55,854	250	39	62	6
*YB4FIK	"	53,207	290	28	42	7
*YB2BNN	"	46,610	171	38	80	0
*YE7SPN	"	41,062	229	32	58	8
*YD7SAL	"	30,108	168	29	45	4
*YC2GBS	"	26,873	146	27	50	0
*YB1ELP	"	25,487	147	23	54	0
*YC4KAR	"	21,775	165	24	39	4
*YB1BON	"	14,508	93	20	42	0
*YCØBAS	"	13,725	100	25	36	0
*YB2VYY	"	13,456	102	21	37	0
*YD2DSV	"	5,371	79	17	19	5
*YD2KJC	"	5,243	68	18	26	5
*YC8MKA	"	4,992	103	13	17	2
*YCØRLX	"	2,695	48	16	19	0
*YDØSCZ	"	1,365	31	8	12	1
*YC1DAH	"	575	45	10	12	3
*YB4AS	"	546	41	16	26	0
*YB1EID	"	360	32	9	11	0
*YD1TJJ	21	1,173	24	10	13	0
*YE4IJ	14	10,272	78	13	34	1
*YC1PZ	"	3,103	49	12	17	0
*YB4VX	"	207	11	4	5	0
*YC8MJG	7	13,684	149	15	18	11
*YC2BDL	"	5,160	86	16	21	3
*YC1NXR	"	3,570	56	12	20	3
*YCØVM	"	2,744	67	10	18	0
*YC9ATS	"	1,232	36	7	7	2
*YB2UFM	"	234	17	4	5	0
*YD7VGB	"	180	11	4	4	1
*YC3ATK	"	20	10	1	1	0
YB7OO	AA	97,342	340	41	70	8
YB3IZK	"	15,336	135	26	42	3
YC2VOC	"	6,525	61	19	25	1
YB2TS	"	4,802	94	19	29	1
YE3AA	"	294	21	6	7	1
YB8UM	"	190	14	5	5	0
YCØRI	21A	16,238	128	16	30	0
YC8AO	"	2,158	43	11	15	0
YB3FTD	"	1,596	32	8	11	0
YC6BTI	"	1,128	21	9	15	0
YB3BX	7A	1,197	45	7	10	2
YE3WIL	"	96	12	3	3	0
YF3CYT	3.5A	4	2	1	1	0
*YFØTUR	AA	278,160	560	56	124	10
*YC2YIZ	"	155,216	348	55	115	8
*YC9DE	"	58,560	206	44	66	10
*YF5YUD	"	25,839	123	26	57	4
*YCØMAT	"	13,426	117	14	34	1
*YC1PSI	"	8,568	71	20	29	2
*YC2YSW	21A	19,008	140	15	33	0
*YB1BML	14A	43,734	224	19	48	7
*YB5BOY	"	23,453	194	12	35	0
*YB8UTI	"	16,758	177	15	27	0
*YD8RHD	7A	1,045	35	8	10	1
*YD1IDC	"	770	44	6	8	0
*YG3FZR	"	308	21	5	5	1

New Zealand

ZM1A	7	138,645	434	26	47	44
(OP: ZL3CW)						
*ZL2AYZ	A	41,503	139	39	63	19
ZM4T	AA	702,720	797	64	128	113
(OP: ZL3IO)						
ZM2B	"	275,462	483	49	95	65
(OP: ZL2BR)						
ZL3PAH	"	53,940	169	31	49	44
ZL2RX	"	45,942	151	37	55	22
ZL4NR	"	3,348	32	9	9	18

Philippines

DU1IVT	A	3,540	54	12	16	2
*DU1JM	A	174,423	397	54	98	7
*4F3BZ	"	102,290	349	39	63	4
*DU1NA	14	198	11	4	5	0
DU1/N6HPX	AA	2,945	48	14	17	0
(OP: N6HPX)						
*4F3OM	7A	7,296	92	10	19	3

Tonga

A35JT	AA	52,318	188	30	42	29
(OP: VK5GR)						

SOUTH AMERICA

Argentina

LW9ETQ	A	5,700	50	17	21	12
LU5VV	21	84,778	316	19	41	37
L77D	14	18,585	114	14	25	24
(OP: LU6DC)						
*LU5MT	A	11,147	65	23	30	18
*LU1MPK	"	9,782	65	27	26	20
*LU1XP	"	8,880	71	22	36	2
*LW5DQ	21	8,632	68	14	22	16
*LU1WI	14	33,698	154	17	39	27
*LU7DUE	7	3,440	42	12	24	4
*LU1YJG	"	1,012	22	9	10	4
LU7HN	AA	282,744	509	43	71	90
LU1BJW	"	179,676	322	53	78	76
LU1KCQ	"	67,602	217	27	38	49
L73H	"	56,974	173	29	38	55
(OP: LU4HK)						
LU8DZJ	"	2,106	24	16	19	4
LO5D	21A	255,500	719	21	54	50
(OP: LU9ESD)						
*LU2JCW	AA	9,709	53	25	35	13
*LU3EBG	"	1,323	34	17	18	14
*LW5EAE	28A	6,930	60	11	13	21

Aruba

P49X	A	5,590,480	3447	92	230	238
(OP: WØYK)						

Bolivia

*CP6UA	A	33,562	164	33	44	20

Brazil

ZZ2T	A	2,180,996	1672	82	213	163
(OP: PY2MNL)						
PY5DK	14	132	6	5	5	2
*PU1JSV	A	21,682	118	19	31	24
*PY2KP	"	9,600	63	19	27	14
*PU7ASP	"	6,588	56	22	26	13
*PY1KB	"	4,489	44	26	33	8
*PU4YJS	"	1,008	17	10	14	0
*PU2USK	"	960	21	13	19	0
*PY2OSD	"	651	15	9	11	1
*PY2UD	21	131,100	397	18	62	35
*PX2M	"	51,243	214	17	38	38
(OP: PY2XC)						
*PU2WDX	"	32,550	168	16	26	33
*PU2TRX	"	4,224	61	12	17	19
*PY2NY	14	299,744	756	25	61	50
*PV8DX	"	1,032	17	7	7	10
*PP7DX	7	11,993	83	14	34	19
PY2KJ	AA	795,570	806	69	160	116
PY2SHF	"	409,510	546	74	140	96
PY5ZHP	"	184,867	343	57	87	79
PT2AW	"	154,154	340	44	80	58
PY2NM	"	4,346	47	20	29	4
PY2RKG	21A	5,828	49	14	24	9
PY2VM	14A	168,474	476	23	58	48
ZX2V	"	63,147	275	17	48	28
(OP: PY2XV)						
PY7XC	"	38,927	180	16	45	22
PY7KG	"	7	7	3	4	0
*PY2FRQ	AA	159,594	286	47	86	68
*PY2CAT	"	42,570	146	38	66	25
*PR2E	"	35,175	130	26	35	44
(OP: PY2XIZ)						
*PU9OJZ	"	10,075	91	19	23	23
*PY1SAD	"	7,107	58	23	41	5
*PY2UGO	"	6,325	63	16	25	14
*PY2TOP	"	1,734	20	14	14	6
*PU2UJG	"	1,664	25	13	11	8
*PU1MIL	"	800	15	11	10	4
*PU2NAX	"	130	9	6	7	0
*PU2WAV	"	20	2	2	2	0
*ZY2R	21A	207	17	4	5	0
(OP: PY2SFA)						
*PY4XX	14A	76,725	283	17	38	44
*PY2VZ	"	14,040	87	15	21	29
*PP2CC	"	9,495	75	9	8	28
*PS7DX	"	54	3	3	3	0

Chile

CE3DNP	14	49,416	225	16	34	37
*CE3GCA	A	8,925	85	23	28	24
*CA5GRF	"	6,642	59	13	12	16
*CE7VPQ	14	61,382	244	20	35	39
*CE1LTL	"	32,234	160	18	20	33
*CE3CBM	21A	29,273	149	16	23	34
*CA3KRM	7A	798	19	9	11	1

Colombia

HK3C	A	9,009	51	19	20	24
HK6P	3.5	1,596	28	9	10	9
*HK3W	14	1,917	26	6	6	15

Ecuador

*HC1JQ	14	122,718	391	19	47	47

Paraguay

*ZP5DNB	A	308	17	9	11	2
*ZP6SKY	7	528	19	7	9	0

Suriname

PZ5RA	A	2,057,643	1795	70	174	155

Uruguay

CW4MAX	21	384,394	947	24	67	51
*CX9AU	A	94,860	209	48	56	66
CV7S	21A	295,393	804	23	59	51
					(OP: CX7SS)	
CX5UA	7A	18,662	109	14	29	19
CX4SS	"	672	14	9	11	1

Venezuela

YW1K	14	581,664	1250	27	83	56
					(OP: YV1KK)	
*YV5EMG	A	97,486	226	32	67	59
*YV5LMW	"	4,836	38	18	27	7
*YV5TNT	21	32,200	172	15	25	30
*YV5OIE	14	5,217	53	10	10	17
*YY5AEP	7	48	4	3	4	1
*YV4NY	3.5	4,800	60	12	21	15
YW6CQ	AA	54,096	161	37	61	40
					(OP: YV6BXN)	
YV4ABR	7A	17,892	104	14	35	22

QRP

DK7HA	A	282,132	718	32	145	27
K2YG	"	143,154	411	35	80	83
YO9BCM	"	156,816	454	29	121	2
W6QU	"	122,040	370	53	57	106
					(OP: W8QZA)	
UX2MF	"	105,357	307	41	129	3
OK2FD	"	91,670	243	39	119	20
RT4W	"	86,944	318	33	109	1
OH2LU	"	55,566	213	27	89	10
HAØGK	"	35,152	206	21	82	1
AA8OY	"	33,579	201	25	35	63
RV3DBK	"	23,384	161	14	60	0
EE2A	"	22,873	127	20	67	2
					(OP: EA2SN)	
EA1GT	"	16,644	103	19	53	4
					(OP: /QRP)	
NØUR	"	16,170	140	21	24	53
DJ3GE	"	16,133	108	17	54	2
IK1XPK	*"*	*15,879*	*100*	*17*	*61*	*1*
G4FPA	"	14,322	107	13	53	0
YT5DEY	"	13,988	143	11	41	0
LA8OKA	"	13,845	109	14	55	2
IK5RUN	"	13,280	74	17	51	12
YO4AAC	"	12,920	89	19	49	0
N7RCS	"	12,348	107	20	31	47
G6EES	"	11,041	93	13	48	0
YBØANN	"	8,056	95	16	21	1
DL2DWP	"	7,176	78	12	40	0
EA4CU	"	6,902	61	15	40	3
VE6BIR/3	"	5,978	53	15	19	27
IK2EBP	"	3,588	35	14	27	5
W6GMT	"	3,087	65	9	7	33
HK4KM	"	666	23	14	17	6
DL8TG	"	464	13	7	8	1
YL3FW	"	252	11	6	8	0
JE1ILP	"	180	11	6	6	0
K7AHA	"	96	6	3	4	5
YO3LW	21	5,535	64	14	31	0
JR1NKN	"	5,148	62	15	18	0
JR2EKD	"	2,616	41	10	14	0
OK1LV	"	2,430	44	7	20	0
LV4V	"	1,378	21	10	9	7
UR1YDD	"	684	21	4	14	0
DL2TM	"	448	16	4	10	0
JA1GZK	"	6	1	1	1	0
YU1NR	14	56,180	251	24	67	15
WE6EZ	"	20,280	264	17	34	1
LY5G	"	13,600	133	10	36	4
RW3AI	"	12,137	107	12	41	0
UX8ZA	"	9,315	113	10	35	0
II8MI	"	7,728	69	11	26	11
					(OP: IW8EHK)	
CO6WYR	"	5,900	56	13	16	21
RA3XEV	"	5,082	76	6	27	0
N8URE	"	3,159	60	9	9	21
S54G	"	1,950	27	8	12	10
RAØAY	"	1,380	27	9	14	0
IZ2JNN	"	700	17	5	15	0
N6HI	"	380	22	4	3	13
YO8TRU	"	338	11	4	8	1
EA3FHP	"	189	10	4	5	0
OK2VWB	7	37,572	301	12	49	1
ON3DI	"	31,689	259	9	45	9
EW8G	"	21,500	221	8	42	0
YO3DAC	"	21,330	202	9	45	0
CO8RCP	"	20,264	153	10	23	35
KH6KG/W5	"	15,549	187	14	22	37
					(OP: KH6KG/W5)	
PA2REH	"	15,080	145	9	43	0
UR7TV	"	7,600	103	6	34	0
GW7APP	"	6,342	80	6	35	1
R2FI	"	4,726	78	5	29	0
CO6SRS	"	2,288	48	10	12	22
OE5FDM	"	1,534	31	7	18	1
CO2KY	"	1,269	28	7	7	13
SM6IQD	"	450	17	3	12	0
IZ2QKG	"	408	16	4	13	0
YD1ILM	"	126	12	3	3	0
CA3DPV	"	102	6	3	3	0
YD1GUE	"	16	8	1	1	0
YT5YTT	3.5	17,342	198	7	38	1
WD9FTZ	"	5,265	119	7	6	32
PAØAWH	"	3,306	62	5	24	0
K3TW	"	2,320	50	9	8	23
YT9WW	"	1,968	49	4	20	0
OK1MGW	"	1,760	53	4	16	0
US4EXD	"	950	34	4	15	0
					(OP: UT4EK)	
US3IW	"	260	10	3	10	0
DH4HN	"	8	4	1	3	0
MM3AWD	AA	429,624	864	35	166	33
IZ8JFL	"	406,886	766	47	178	37
YU1LM	"	194,928	530	37	128	21
					(OP: /QRP)	
PE2K	"	72,590	314	23	90	6
SV9/DJ9XB	"	70,336	313	18	90	4
					(OP: DJ9XB)	
R4WZ	"	38,808	196	24	74	0
SFØA	"	38,640	238	16	65	3
					(OP: SMØLPO)	
JK1TCV	"	38,418	135	45	55	14
OK1NG	"	35,280	207	18	72	0
RA3DJA	"	24,846	164	19	63	0
UR5XMM	"	3,648	48	13	25	0
YB6DE	"	3,492	56	11	24	1
PDØJMH	"	1,288	30	7	21	0
JH3DMQ	28A	135	9	4	5	0
YP8A	"	20	2	2	2	0
					(OP: YO8WW)	
E74EB	"	6	3	1	1	0
JF1RYU	"	6	1	1	1	0
R7TU	21A	10,560	95	18	37	0
HA3JB	"	9,936	102	12	36	0
OT6M	"	816	23	5	12	0
					(OP: ON9CC)	
YR8Y	"	697	19	6	11	0
					(OP: YO8WW)	
G5N	"	12	2	1	2	0
					(OP: GØSBN)	
OQ4B	14A	34,800	195	17	46	17
					(OP: ON4BHQ)	
YU1RH	"	15,060	124	10	38	12
HA3HX	"	14,365	100	13	39	13
YB1BD	"	4,070	47	13	24	0
R6KEE	"	4,025	58	9	25	1
YO8TND	"	300	14	4	8	0
IZ7FLP	7A	155,788	663	21	73	22
LZ3RR	"	73,508	409	19	66	9
HG6C	"	24,384	207	15	44	5
					(OP: HA6IAM)	
W4ER	"	5,537	100	9	10	30
Z32ID	"	12	5	3	3	0
OK6K	3.5A	24,424	298	6	37	0
					(OP: OK5IM)	
IZ3IBL	"	19,533	202	6	45	0
UT8UU	"	2,072	55	4	24	0
JG1LFR	"	700	60	3	4	3
JG3SVP	"	639	64	3	4	2
KB2HSH	"	448	29	2	2	12

MULTI-OPERATOR SINGLE TRANSMITTER

NORTH AMERICA

United States

District 1

*W1QK	449,700	807	56	125	119

District 2

*K2OAK	57,354	219	34	59	65

District 3

K3LR	2,563,484	2396	99	246	194

District 4

WV4P	773,806	1262	73	148	153
N4CW	581,236	923	66	146	119
K2ADA	526,776	1111	49	111	122
W4MLB	294,555	924	57	83	129

District 5

*NA5NN	697,300	1204	73	150	157

District 6

W6DR	397,210	785	70	96	148

District 7

W7WW	1,290,210	1903	91	158	186
NA7TB	1,274,898	1872	85	161	185
KU1CW	1,057,968	1632	76	135	161
K7BTW	680,202	1465	65	110	143
K7RI	415,520	1155	56	73	136
*AE7K	1,344	37	15	14	19

District 9

NV9L	1,606,688	1838	90	194	188
*W9JWC	165,536	497	45	70	109

District Ø

NØKE	238,600	894	46	63	91
KØDDD	*37,536*	*179*	*35*	*39*	*62*

Belize

V31VP	1,587,476	1649	82	176	178

Canada

District 3

VA3LML	231,000	488	40	77	114

District 7

VE7FO	131,804	386	38	45	83

Mexico

*XE2N	14,874	118	18	17	39

AFRICA

Canary Islands

*EA8DED	901,912	1188	47	172	77

ASIA

Asiatic Russia

District Ø

*RØMM	9,225	110	17	20	4

Asiatic Turkey

*TC2Y	403,506	889	30	143	1
*TA3LHH	48	8	1	7	0

China

*BH2RO	25,520	215	22	35	1

Japan

District 2

*JK2VOC	70,563	273	48	70	11

Taiwan

*BV2B	17,121	209	19	20	0

Thailand

E2X	565,616	944	59	165	8

United Arab Emirates

*A61EK	660,231	1148	36	158	15

West Malaysia

9M2TO	170,016	472	45	104	5
*9M4CPS	363	17	5	6	0

EUROPE

Belarus

EW6W	*1,705,440*	*1990*	*81*	*276*	*51*

Bulgaria

LZ5R	4,412,550	3451	111	361	103

Croatia

*9A7T	1,079,568	1087	89	283	69
*9A7B	63,099	292	25	98	0

Czech Republic

OK7O	1,304,912	1649	68	243	71
OK1KSL	1,220,959	1567	70	228	61
*OK1RPL	18,900	136	16	54	5

Denmark

*OZ/DJ5LA	213,000	536	38	145	17

England

GØBRC	274,274	757	33	111	38

Estonia

*ES9C	465,740	781	70	209	13

European Russia

District 3

RK3SWS	182,596	485	51	138	2
RL3A	21,449	104	26	49	14

District 6

*RY6Y	601,634	1227	49	189	15
*R7LY	14,734	158	9	44	0

Finland

OG7ØAD	236,742	653	41	136	10

France

*TM6V	563,580	882	53	194	63
*TM1D	100,548	333	34	126	11

Germany

DA2X	1,402,167	1466	91	312	68
DLØZZ	47,190	230	23	88	10
*DD1A	1,240,706	1495	76	258	60
*DQ4W	486,024	981	48	177	39
*DG7RO	122,661	336	40	134	15
*DLØHDB	8,784	96	10	37	1

Hungary

HG7T	2,175,952	2001	98	316	82

Iceland

TF2R	113,280	487	17	78	23

Italy

IQ4FC	5,061,250	3404	118	374	133
IQ5ZP	344,608	763	42	168	32
IU2IBU	256,360	494	42	133	46
IQ3PN	177,300	501	37	144	16
*IQ3RK	1,406,784	1554	81	282	68
*IQ6SE	82,940	293	29	102	12

Norway

LA1K	276,722	922	25	136	5

Poland

SP6ØDXC	131,493	410	33	115	11
SP9KDA	105,952	355	36	106	12
*SP4YPB	418,470	776	62	206	22

Portugal

*CS5CRE	1,167,790	1584	65	200	73

Romania

YO3GNF	296,631	695	44	159	4
*YO4KAK	4,995	50	15	30	0

Sicily

IQ9UI	*2,267,136*	*2154*	*93*	*296*	*103*
*IT9BLB	2,189,763	1925	99	323	99

Slovak Republic

OM4Q	696,942	1210	52	190	37
*OM3RJB	280,208	661	43	144	24
*OM3KSI	81,510	323	21	101	8

Slovenia

S53S	3,222,804	2575	108	348	110

Spain

ED1R	1,497,821	1860	70	225	82
EA1AP	*304,470*	*703*	*40*	*112*	*47*
*ED3D	334,740	806	38	144	28
*EE5O	120,879	577	19	102	0
*EA4URE	77,859	337	24	87	12

Sweden

SK7K	242,172	603	36	117	33

Ukraine

EM2Q	3,243,230	3209	98	316	64
UV2E	104,880	541	21	99	0
UT7AXA	2,482	34	10	24	0
*UR4RWW	19,008	137	12	60	0
*UR4PWC	16,352	123	14	58	1

OCEANIA

Australia

VK4BRT	249,849	450	54	84	69

East Malaysia

*9M4CRP/6	11,186	98	14	27	6

Indonesia

7A1A	161,750	499	41	81	3
*7E1A	45,136	172	40	66	6

Philippines

*4E3X	340,992	814	50	84	14
*DX9EVM	41,317	216	28	46	5

SOUTH AMERICA

Argentina

*LW3DC	198,912	338	56	94	74

Chile

CE2LR	2,306,400	1678	93	229	174

MULTI-OPERATOR TWO-TRANSMITTER

UNITED STATES

K9CT	2,199,132	2745	88	189	204
WØLSD	1,416,576	2125	80	164	190
W3GH	1,283,355	1967	67	158	170
KØOO	1,011,528	1362	83	201	162
NW8S	960,514	1568	62	141	155
KT7E	854,350	1576	70	111	169
NJ3I	826,595	1157	69	182	134
N2PA	546,220	1256	52	113	145
K3CCR	367,030	691	59	130	100
WM5DX	323,232	826	49	85	139
WA8MCD	205,933	576	42	84	91
K3ODX	*39,825*	*155*	*33*	*58*	*44*
W4CDA	3,127	56	11	10	32

NORTH AMERICA

HQ9X	3,539,646	3072	97	213	221
T43MY	352,500	778	56	91	135
COØCHE	298,452	642	42	89	97
T48SC	262,332	577	48	91	113

AFRICA

CR3DX	7,742,862	4474	106	331	169

ASIA

JT5DX	613,364	1278	62	171	3
VR2CC	374,510	964	51	107	12
JA1ZGP	129,996	377	52	84	21
BV2A/3	128,010	580	34	63	5
JR1ZTI	26,481	147	37	52	8

EUROPE

S5ØW	3,853,068	3167	101	344	102
LX7I	3,836,308	3242	94	323	112
S51A	3,264,066	2962	99	327	96
OMØM	3,030,318	3084	92	277	90
IQ4FA	3,001,185	2732	94	323	100
DP7D	2,863,761	2718	92	320	87
PI4COM	2,567,951	2484	88	311	88
DP9A	2,430,490	2324	96	320	77
EI7M	2,360,156	2546	77	268	86
DM4X	2,053,870	2063	89	287	79
ED3M	1,531,020	1947	68	230	82
C37NL	1,346,630	2026	52	181	78
ED2C	1,214,784	1854	66	204	72
OU2PA	974,974	1747	55	204	27
PI4CG	*528,192*	*1124*	*48*	*180*	*34*
LN5O	97,216	442	18	89	5

MULTI-OPERATOR MULTI-TRANSMITTER

UNITED STATES

K1SFA	3,557,940	3266	95	268	207
NR4M	2,191,132	2529	82	210	174
N6WM	1,606,895	2267	91	152	202

NORTH AMERICA

VE5RI	231,626	685	37	42	100

AFRICA

CR3W	5,753,769	4021	91	287	119

ASIA

A44A	1,079,664	1554	58	192	21

EUROPE

9A1A	7,068,236	4690	118	401	139
HG1S	3,630,896	3163	99	324	91
I3VRD	1,038,916	1349	71	220	67

OCEANIA

YB3ZBD	2,553	34	15	21	1

ROOKIE

United States

Dictrict 3

*KC3JNW	26,550	199	32	46	12
*KC3MIO	6,786	55	25	30	23

Dictrict 4

*AA4LS	180,075	538	47	84	114
*W5MMW	46,500	175	40	56	59
*KN4LKC	41,540	174	28	52	54

Dictrict 5

*KK5JD	89,646	355	44	57	100
*W5CUY	2,730	35	14	17	11

Dictrict 7

*K7AHA	96	6	3	4	5

Dictrict 8

*AA8SW	44,998	231	33	41	75
*KE8LUE	312	24	4	3	17

Canada

Dictrict 4

*VE4TLA	8,220	67	14	13	33

ASIA

China

BX2AGV	*144*	*11*	*4*	*5*	*0*

India

VU2ZMK	245,280	567	36	124	0

Japan

District 1

*JA1HFY	4,747	63	20	22	5

Lebanon

***OD5ZF**	**146,200**	**614**	**18**	**58**	**9**

Thailand

HS5XWY	**23,985**	**179**	**25**	**40**	**0**

West Malaysia

9M2SAF	**56,430**	**266**	**25**	**59**	**6**
9M2TDX	6,929	69	12	29	0
9M2CDX	1,853	42	6	11	0

EUROPE

Andorra

***C31MF**	**24,528**	**225**	**6**	**47**	**3**

Croatia

***9A3LYL**	**5,600**	**72**	**5**	**35**	**0**

England

***2EØFNU**	**38,896**	**193**	**19**	**79**	**6**
***2EØXRD**	**2,535**	**76**	**9**	**24**	**6**

European Russia

District 1

***R1CAV**	**1,118**	**21**	**9**	**17**	**0**

District 3

***R2PU**	**72,416**	**295**	**26**	**98**	**0**
*UB3PDW	52,488	270	18	90	0
*R3NAM	780	24	5	15	0

District 4

RA4HL	**1,736**	**34**	**9**	**22**	**0**

District 6

***RJ7J**	**9,750**	**104**	**12**	**38**	**0**

Finland

***OG8T**	**57,132**	**206**	**26**	**107**	**5**
				(OP: OH8TV)	

Germany

***DK9BM**	**31,372**	**179**	**18**	**68**	**6**
*DJ5CT	23,205	169	21	78	6
*DN5HR	8,700	64	21	37	2
*DC6MT	667	25	7	16	0
*DH4HN	8	4	1	3	0

Greece

***SV8OVH**	**120,733**	**418**	**35**	**122**	**0**

Iceland

***TF1OL**	**276**	**21**	**4**	**7**	**1**

Italy

***IU5ICR**	**119,808**	**391**	**27**	**108**	**21**
*IU1LCU	10,890	83	15	41	10
*II8MI	7,728	69	11	26	11
				(OP: IW8EHK)	

Netherlands

***PA4R**	**11,760**	**91**	**15**	**52**	**3**
*PA4J	6,321	63	10	33	6
*PDØMWG	4,059	52	11	28	2

Poland

***SP9KB**	**39,000**	**202**	**20**	**79**	**1**
*SQ8W	17,116	207	7	37	0

Serbia

***YU4SMT**	**5,203**	**98**	**8**	**35**	**0**

OCEANIA

Australia

***VK3BWM**	**350**	**11**	**5**	**4**	**5**

Indonesia

***YFØTUR**	**278,160**	**560**	**56**	**124**	**10**
*YC7YGR	150,535	383	53	100	8
*YD7SAL	30,108	168	29	45	4
*YC2GBS	26,873	146	27	50	0
*YC8MJG	13,684	149	15	18	11
*YD2DSV	5,371	79	17	19	5
*YCØRLX	2,695	48	16	19	0
*YB1EID	360	32	9	11	0
*YG3FZR	308	21	5	5	1

SOUTH AMERICA

Argentina

***LU1YJG**	**1,012**	**22**	**9**	**10**	**4**

Brazil

***PY2FRQ**	**159,594**	**286**	**47**	**86**	**68**
***ZY2R**	**207**	**17**	**4**	**5**	**0**
				(OP: PY2SFA)	

Chile

***CA3DPV**	**102**	**6**	**3**	**3**	**0**

Venezuela

***YY5AEP**	**48**	**4**	**3**	**4**	**1**

CLASSIC

United States

District 1

***AE1P**	**159,570**	**433**	**35**	**73**	**89**
*AB1J	60,144	271	17	56	39
*W1DYJ	54,165	203	33	61	63
*N1RDN	19,200	109	24	42	30
*K3SSS	4,503	58	15	18	24
				(OP: @W1/CHAPLIN)	
*K1CGZ	3,350	39	15	19	16

District 2

N2YBB	**70,818**	**306**	**18**	**61**	**32**
***W2JV**	**76,560**	**300**	**21**	**57**	**42**
*KC2WUF	58,212	213	35	56	63
*NS2N	37,639	167	32	45	56
*W2VTV	23,630	199	14	32	39
*N2MUN	22,320	121	21	42	30
*N2CU	19,800	103	21	42	36
*KS2G	10,850	109	12	25	25

District 3

W3RGA	**383,625**	**859**	**52**	**108**	**119**
KG4USN	16,262	106	21	35	38
N3MWQ	3,036	48	12	15	17
***AI3KS**	**26,568**	**151**	**24**	**36**	**48**
*WA3AAN	12,720	86	20	29	31
*KB3LIX	5,076	61	10	16	28

District 4

K4ADR	**282,360**	**769**	**46**	**90**	**124**
AC8Y	246,829	573	38	89	82
AD4TJ	81,337	281	34	56	73
K4CV	15,624	100	20	35	29
***NU4E**	**304,440**	**742**	**57**	**99**	**139**
*KF4FC	117,384	369	40	66	95
*W3DQS	92,058	391	41	53	107
*W4LC	89,900	392	17	59	40
*WA3LXD	78,126	299	33	62	79
*AE4ED	61,586	414	17	39	50
*KM4FO	54,450	295	27	36	87
*W4PJW	53,742	278	31	43	85
*NF4J	30,246	179	31	42	69
*NN4RB	29,500	138	31	47	47
**K8ARY*	*25,630*	*127*	*23*	*43*	*44*
*WF7T	19,320	110	26	34	45
*AA5JF	17,784	104	30	39	45
*NC4MI	13,392	100	23	28	42
*WC4T	11,205	116	16	18	49
*WN4AFP	6,912	100	9	17	28

District 5

N5RZ	**160,400**	**504**	**43**	**62**	**95**
N5TF	1,749	43	8	9	16
N5ATM	1,728	46	7	7	22
***NN5T**	**154,784**	**450**	**49**	**74**	**101**
*WB5BHS	109,395	503	31	39	117
*K5IB	84,422	311	41	56	94
*NK5P	76,109	356	42	50	95
*NM5Z	14,652	124	23	24	52
*W5TD	5,460	58	18	20	27

District 6

N6JV	**338,640**	**917**	**52**	**65**	**138**
N3RC	256,486	805	48	69	140
NN6XX	190,292	649	48	53	125
NN6DX	148,730	437	49	70	95
				(OP: W1PR)	
K6TD	143,520	456	38	51	95
W6JBR	66,990	290	38	43	73
WA6URY	19,203	135	28	29	54
AI6O	12,880	113	19	18	55
W6RKC	10,240	83	17	20	27
***KF6RY**	**24,210**	**185**	**19**	**31**	**40**
				(OP: W6ZL)	
*WK6I	19,608	105	37	33	44
*K6BIR	18,315	134	24	26	49
*N5YJZ	18,117	147	20	20	59
*W6RQ	11,745	105	23	24	40
*WU6K	6,440	68	20	19	31
*N6OPE	6,120	93	20	18	34
*N6BHX	2,816	38	14	12	18

District 7

WU6W	**131,242**	**488**	**40**	**46**	**125**
K7LFY	104,493	453	40	46	97
K7VIC	67,828	397	21	30	73
N7XCZ	161	17	6	5	12
***KC7CM**	**48,860**	**257**	**32**	**30**	**78**
*K7HKR	44,968	208	31	37	78
*N7DB	44,070	240	33	36	61
*K7AZT	37,884	199	31	31	70
*K7MY	14,342	104	24	24	53
*KG7VIZ	12,996	143	16	15	45
*N7FG	12,367	96	25	26	32
*KF7R	4,606	77	10	10	29
*K7JSG	858	31	6	5	11

District 8

K8RCT	*117,208*	*393*	*34*	*66*	*96*
K8MM	**44,640**	**237**	**17**	**39**	**40**
W8TOM	27,927	257	17	23	47
***AA8OY**	**33,579**	**201**	**25**	**35**	**63**
*N8URE	3,159	60	9	9	21

District 9

WI9WI	**392,000**	**987**	**42**	**78**	**125**
AC9KW	*101,579*	*388*	*23*	*47*	*87*
KZ9DX	29,532	171	24	41	42
***K9CW**	**135,876**	**396**	**36**	**65**	**100**
*WD9CIR	95,352	391	30	49	95
*WB8BZK	30,607	196	25	28	74
*W9LU	14,616	150	13	18	41
*W9AKS	9,462	152	8	7	42
*KB9S	7,560	104	10	11	39
*K9QJ	5,538	61	22	17	39
*KC9YL	4,346	65	13	11	29

District Ø

***AEØEE**	**80,703**	**327**	**38**	**43**	**108**
*WAØLJM	52,920	259	32	42	73
*WO7U	19,436	143	23	23	67
*KI6DY	15,184	131	17	23	33
*WØPI	9,849	97	14	27	26
*W3ZF	3,172	62	12	10	30
*NYØJ	1,845	48	9	6	26

Barbados

***8P2K**	**58,656**	**263**	**13**	**44**	**39**

Belize

***V31MA**	**34,279**	**192**	**13**	**34**	**36**

Canada

District 1

***VA1XH**	**189,222**	**426**	**30**	**84**	**69**

District 2

***VE2BVV**	**246,962**	**545**	**29**	**77**	**88**
*VE2NCG	143	7	4	7	0

District 3

VE3GYL	**337,550**	**688**	**37**	**89**	**89**
VA3MW	70,890	246	19	46	74
VA3WW	56,290	205	29	47	54
***VE3DZ**	**755,582**	**1035**	**57**	**119**	**137**
*VE3BR	154,544	363	43	73	92
*KØMKL/VE3	44,010	157	27	39	69
				(OP: KØMKL)	
*VE3RUA	3,828	43	10	8	26

District 6

***VE6SPS**	**6,390**	**74**	**8**	**7**	**30**

District 7

***VE7BC**	**71,375**	**280**	**27**	**28**	**70**

Costa Rica

***TI2OY**	**557,568**	**946**	**52**	**100**	**136**

Mexico

***XE1H**	**10,304**	**99**	**11**	**12**	**33**

Panama

***HP3SS**	**358,743**	**722**	**38**	**83**	**110**

AFRICA

Ghana

***9G2HO**	**39,096**	**196**	**15**	**42**	**15**
				(OP: 9G5SA)	

ASIA

Asiatic Russia

District 9

RG9A	**1,192,288**	**1447**	**66**	**230**	**0**
RA9AEA	2,275	37	9	16	0
***RZ9AD**	**303,780**	**638**	**33**	**133**	**0**

District Ø

***RØJD**	**33,453**	**278**	**23**	**36**	**0**
*RAØWHE	17,226	122	19	39	0
*UAØSU	14,484	78	24	44	0

India

VU2YQ	**15,778**	**126**	**12**	**38**	**0**

Japan

District 1

JH1CTV	**46,098**	**182**	**44**	**62**	**11**
JA1QOW	36,480	139	33	50	12
JR1NHD	7,203	56	15	29	5
JK1LUY	465	13	6	9	0
***JS1KKY**	**26,600**	**115**	**35**	**50**	**10**
*JA1IE	13,124	110	28	30	10
*JR1AQI	7,020	60	18	26	8
*JF1WCK	5,712	66	21	26	1
*JN1BBO	3,960	49	19	22	4
*JR7KVA/1	84	10	3	3	0
*JQ1PCT	70	4	3	4	0
*JA1GZK	6	1	1	1	0

District 2

JR2ALA	**1,403**	**23**	**9**	**12**	**2**
***JE2BOM**	**33,708**	**129**	**43**	**59**	**4**
*JA2JNC	11,550	100	19	27	4

District 3

JA3QOS	**35,908**	**169**	**37**	**53**	**4**
JH3QFY	17,952	103	23	35	10
***JH3SIF**	**13,034**	**111**	**18**	**31**	**0**
*JA3HKR	612	15	8	9	0

District 4

***JH4FUF**	**11,026**	**68**	**31**	**38**	**5**
*JN4JGK	2,088	32	12	13	4

District 5

***JG5DHX**	**252**	**8**	**7**	**7**	**0**

District 6

***JE6JNC**	**25,668**	**106**	**35**	**49**	**9**
*JA6BCV	25,434	113	26	42	13

District 7

***JA7KQC**	**88**	**5**	**5**	**5**	**1**

District 8

JA8DNV	**9,288**	**54**	**27**	**34**	**11**

District 9

***JA9EJG**	**5,616**	**56**	**22**	**22**	**4**

District Ø

**JRØBNF*	*4,371*	*39*	*22*	*21*	*4*

Kazakhstan

***UN7PGA**	**150,500**	**491**	**33**	**92**	**0**
***UN7ZAF**	**138,450**	**383**	**29**	**101**	**0**

Mongolia

***JT1PB**	**180**	**11**	**5**	**5**	**0**

Taiwan

BV1EK	**23,821**	**107**	**29**	**52**	**2**

United Arab Emirates

A65DR	**178,623**	**718**	**20**	**65**	**4**
				(OP: G7SLP)	

EUROPE

Belarus

EW8OM	**201,960**	**557**	**37**	**142**	**1**
***EU1FQ**	**49,374**	**180**	**29**	**81**	**7**
*EU6A	44,733	200	24	84	3

Belgium

***ON4CT**	**588,848**	**925**	**62**	**201**	**41**
*ON2CQ	100,827	351	28	109	16
*OPØJ	13,948	174	5	39	0
	(OP: ON5GF)				

Bulgaria

***LZ2HT**	**8,967**	**70**	**17**	**42**	**2**

Crete

***SV9FBK**	**10,164**	**120**	**8**	**34**	**2**

Czech Republic

OK2SFP	**20,580**	**301**	**4**	**31**	**0**
***OK1LO**	**6,250**	**71**	**12**	**31**	**7**
*OK1LV	2,430	44	7	20	0

Denmark

***OZ1AOO**	**52,241**	**222**	**23**	**94**	**2**
*5Q5R	13,398	113	12	43	3
*OZ1LFI	6,300	65	15	34	1

England

G3T	**133,110**	**380**	**33**	**118**	**23**
				(OP: G3VGZ)	
GØMGM	22,357	127	16	44	19
***GØFGI**	**116,808**	**357**	**26**	**112**	**19**
*G3RLE	94,080	331	26	102	12
*G4DDL	86,256	293	27	102	15
*MØDHP	36,946	198	16	69	6
*GØMTN	33,252	162	20	74	8
*M5M	10,148	96	13	44	2
				(OP: G4OGB)	
*M1G	874	30	6	13	0

Estonia

ES4RD	**351,190**	**814**	**44**	**159**	**0**

European Russia

District 1

***RA1ALC**	**140,447**	**431**	**33**	**131**	**3**
*RX1AG	27,625	164	20	65	0

District 3

R3GZ	**57,090**	**257**	**24**	**73**	**13**
***RV3ZN**	**224,812**	**568**	**40**	**153**	**3**
*R3VL	117,312	406	30	108	3
*RU5X	98,106	312	35	128	3
*RX3VF	59,280	269	23	97	0
*RW3DY	10,295	90	22	49	0

District 4

R4OF	**143,370**	**456**	**39**	**123**	**0**
***RA4CON**	**128,772**	**490**	**28**	**118**	**0**
*RA4L	6,981	100	7	32	0
*R4FCJ	3,360	60	8	34	0
*R4LZ	1,140	25	7	13	0

District 6

UA6CE	**255,045**	**813**	**29**	**93**	**25**
***R7MM**	**343,294**	**733**	**50**	**165**	**11**
*RA6LIS	32,648	303	14	41	1
*R6CC	28,755	214	15	54	2
*RW6APC	12,261	109	19	48	0

District 9

*R9FBT	23,954	222	10	49	0

Finland

***OH1SIC**	**46,866**	**217**	**23**	**83**	**1**
				(OP: SM5SIC)	
*OH2EUU	24,960	140	22	70	4
*OH1NOA	20,336	134	17	63	2
*OH2MAS	2,958	51	9	25	0

France

*F4FRC	52,416	251	22	90	5

Germany

DJ3NG	**410,592**	**904**	**33**	**127**	**48**
DL1DTL	319,152	652	48	167	29
DL5LED	107,682	440	25	98	8
DL7ØAFUG	98,940	279	36	111	23
				(OP: DF8QB)	
DK5OS	71,511	280	24	75	22
DL4ABR	26,560	142	20	53	10
DL7LX	6,670	59	17	41	0
***DK1KC**	**212,553**	**496**	**40**	**147**	**22**
*DL3SYA	157,699	448	33	132	14
*DL5KUD	149,952	441	35	134	7
*DL2OE	148,010	359	45	136	24
*DL1EAL	85,840	280	30	105	13
*DL6SFR	82,940	266	31	100	14
*DF1MM	54,976	483	8	54	2
*DL5RMH	40,492	205	20	86	0
*DL8ZAJ	26,316	120	26	69	7
*DL2LDE	10,010	65	16	33	16
*DL1EJD	9,752	91	12	40	1
*DJ7UC	8,670	81	11	37	3
*DM4AB	4,900	60	13	37	0
*DL9ZWG	4,140	47	13	30	3

Greece

***SV1MO**	**4,200**	**49**	**11**	**25**	**4**
*SV2/SV7CUD	396	15	6	12	0
				(OP: SV7CUD)	

Hungary

***HAØGK**	**35,152**	**206**	**21**	**82**	**1**

Italy

I4JED	**838,572**	**1202**	**54**	**170**	**74**
IK7NXU	306,270	591	47	175	24
IK1BPL	174,834	436	39	134	25
IX1CLD	170,868	472	33	122	19
IV3ARJ	168,004	398	38	132	24
IK2SND	*122,310*	*372*	*26*	*92*	*33*
IV3VBM	*114,741*	*341*	*37*	*120*	*14*
IZØHAP	85,536	304	32	104	8
IK2AHB	12,765	77	16	37	16
IK6FTZ	*10,550*	*102*	*10*	*25*	*15*
***IK1RGK**	**209,805**	**520**	**38**	**121**	**38**
*IK2RZG	170,625	396	36	116	43
*IW2MXY	166,860	476	34	133	13
*IWØGYC	111,573	340	32	119	10
*IZ5IMB	88,350	271	30	101	24
*IW4EJK	51,272	197	24	70	22
*I2BZN	35,952	178	22	84	1
*IZ3XNJ	35,752	140	24	63	22
*IK8ARF	30,192	147	29	76	6
*IK2YSJ	24,598	140	20	77	1
*IK7RVY	22,125	176	16	43	16
*IK6BSN	22,008	118	21	52	11
*IV3XPP	21,093	143	18	57	4
*IU1HCC	17,728	123	12	39	13
*IU1FHJ	14,620	116	15	53	0
*IK2AOO	12,444	108	14	47	0
*I8IEQ	12,040	87	17	52	1
*IK2IKW	11,696	86	18	50	0
*IK7XNF	9,672	86	11	26	15
**IW2JRV*	*8,533*	*74*	*10*	*32*	*11*
*IZØTWI	1,876	47	5	23	0
*I1DXD	513	11	8	11	0

Lithuania

***LY1D**	**16,566**	**122**	**16**	**45**	**5**

Macedonia

***Z35Z**	**9,288**	**95**	**10**	**43**	**1**

Netherlands

***PG1R**	**36,408**	**165**	**23**	**73**	**15**
*PBØACU	23,532	159	15	49	10
*PA3ADU	17,712	111	20	55	7
*PC5D	12,608	103	12	50	2
*PA2VS	10,971	102	10	43	0



RG9A's antenna farm. (Inset) Uri, RG9A, won the Classic overlay.

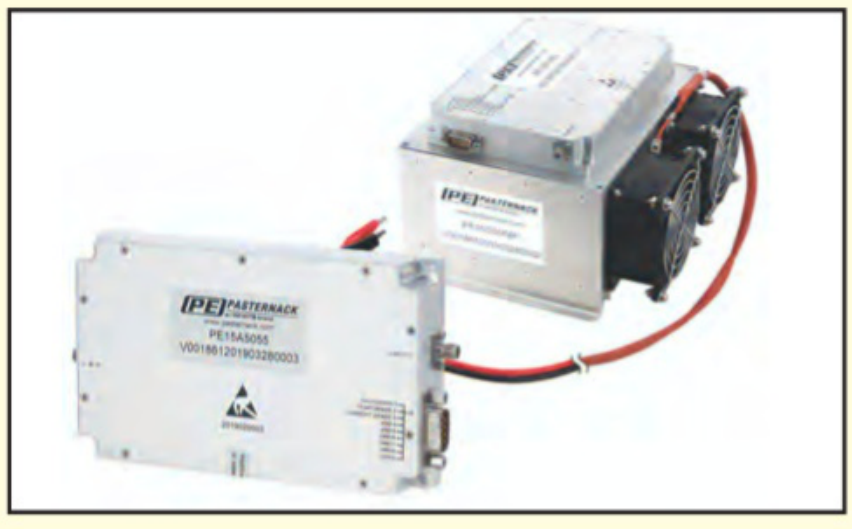
what's new

Pasternack Launches New Class AB High Power Amplifiers

Pasternack has launched a new series of high power, class AB broadband amplifier modules that incorporate GaN, LDMOS, or VDMOS semiconductor technology. Pasternack offers a selection of 18 new amplifiers that cover frequency bands from 20 MHz to 18 GHz that feature saturated output power levels ranging from 10 watts to 200 watts and power gain up to 53 dB. Designs operate in a 50-ohm environment and are unconditionally stable. The compact coaxial packages use SMA or N-Type connectors and have integrated D-Sub control connectors for DC bias, enabled with TTL logic control, current sense, and temperature sense functions.

These rugged assemblies operate over a wide temperature range from -20°C to 60°C and can withstand relative humidity exposure up to 95% maximum. To ensure optimum baseplate temperature, Pasternack offers two new heatsink modules with DC-controlled cooling fans that are specifically designed for these power amplifiers.

Pasternack's new class AB, high power amplifiers and heatsinks are in-stock and available for immediate shipping with no minimum order quantity required. For more information contact Pasternack, 17792 Fitch Irvine, CA 92614. Phone: (949) 261-1920. Website: <www.pasternack.com>.



Norway

***LA5LJA**	**201,310**	**456**	**43**	**145**	**17**
*LA8OKA	13,845	109	14	55	2

Poland

SP7AH	**161,304**	**509**	**35**	**116**	**5**
SP5DL	50,211	425	9	53	1
***SP9H**	**290,410**	**628**	**43**	**161**	**22**
*HF1ØØPS	84,940	318	26	105	6
			(OP: SP9CXN)		
*SP1DMD	27,115	161	18	56	11
*SP6DMI	14,300	127	12	35	5
*SP8CGU	10,440	76	19	39	2
*SP9BGS	4,212	51	7	23	6
*SP9EZM	3,706	53	9	23	2
*SP9MDY	792	31	5	13	0
*SP9KJU	629	16	6	11	0
			(OP: SP9MDY)		

Portugal

***CT7AUP**	**130,350**	**398**	**29**	**100**	**29**
*CS25FOQ	24,948	104	24	52	23
			(OP: CT1FOQ)		
*CT7AIX	24,820	132	14	36	23

Romania

YPØC	**636,225**	**1208**	**52**	**170**	**33**
			(OP: YO3CZW)		
***YO2IS**	**40,125**	**271**	**13**	**47**	**15**
*YO9CWY	27,936	198	12	50	10
*YO5OHY	23,184	256	6	42	0
***YO9BCM**	**118,864**	**405**	**29**	**121**	**2**

Sardinia

***ISØGVH**	**18,615**	**138**	**16**	**56**	**1**

Serbia

YT2AAA	**66,783**	**291**	**25**	**80**	**8**
***YT9WW**	**1,968**	**49**	**4**	**20**	**0**

Slovak Republic

*OM2DT	59,784	203	34	91	16
*OM5NL	47,573	203	21	71	21

Slovenia

S53TM	**172,569**	**628**	**24**	**66**	**33**
***S55BA**	**137,788**	**493**	**26**	**111**	**11**
*S57SWR	92,456	386	26	101	0

Spain

EA1DA	**272,889**	**515**	**47**	**146**	**50**
EF1C	93,656	507	16	56	20
EA2KU	38,056	304	9	44	14
EA5DFV	36,380	164	15	39	31
EA7AQV	19,236	125	17	54	13
***EA3GCT**	**115,675**	**308**	**32**	**115**	**28**
*EA4CRP	71,136	262	29	96	19
*EA4DXP	58,650	205	30	99	9
*EA7IA	36,279	202	15	48	24
*EA1IYK	35,310	172	23	76	11
*EA3GOM	19,341	145	9	36	18
*EA1BDX	3,705	48	11	25	3
***EE2A**	**22,873**	**127**	**20**	**67**	**2**
				(OP: EA2SN)	
*EA4CU	6,902	61	15	40	3

Sweden

***SF1Z**	**117,859**	**419**	**26**	**116**	**7**
				(OP: SMØHEV)	

Switzerland

*HB9MXY	40,810	201	22	80	4

Ukraine

UR5WCQ	**293,112**	**642**	**43**	**143**	**30**
UT2AU	208,715	621	32	137	0
UR8RF	5,425	98	4	27	0
***UT3SO**	**173,548**	**530**	**34**	**129**	**9**
*UR3VKE	76,176	300	32	105	1
*US7KC	68,686	583	11	50	0
*UR5TL	68,072	241	31	98	5
*UT7NI	60,636	315	22	97	5
*UT1AM	22,992	266	6	42	0
*UT4UQ	20,605	168	13	52	0
*US5LOC	12,224	105	16	48	0
***UX2MF**	**105,357**	**307**	**41**	**129**	**3**
*UX8ZA	9,315	113	10	35	0
*UR1YDD	684	21	4	14	0

Wales

MW2I	**727,536**	**1254**	**50**	**182**	**44**
				(OP: GW4FRE)	
***MW6M**	**119,970**	**400**	**26**	**116**	**13**
				(OP: GW4BVJ)	
*GW4HBK	5,412	59	9	27	5
*GW7APP	6,342	80	6	35	1

OCEANIA

Indonesia

YC2HML	**37,114**	**236**	**28**	**46**	**3**
YC2EEE	4,318	82	11	22	1
***YD1TJJ**	**1,173**	**24**	**10**	**13**	**0**
**YC3ATK*	*20*	*10*	*1*	*1*	*0*

New Zealand

ZM1A	**138,645**	**434**	**26**	**47**	**44**
				(OP: ZL3CW)	
***ZL2AYZ**	**41,503**	**139**	**39**	**63**	**19**

Philippines

***4F3BZ**	**102,290**	**349**	**39**	**63**	**4**

SOUTH AMERICA

Argentina

L77D	**18,585**	**114**	**14**	**25**	**24**
				(OP: LU6DC)	

Brazil

***PP7DX**	**11,993**	**83**	**14**	**34**	**19**
*PU7ASP	6,588	56	22	26	13
*PU2TRX	4,224	61	12	17	19
**PY2OSD*	*651*	*15*	*9*	*11*	*1*

Chile

***CE1LTL**	**32,234**	**160**	**18**	**20**	**33**
*CA5GRF	6,642	59	13	12	16

Colombia

HK3C	**9,009**	**51**	**19**	**20**	**24**

Uruguay

***CX9AU**	**94,860**	**209**	**48**	**56**	**66**

Venzuela

***YV5TNT**	**32,200**	**172**	**15**	**25**	**30**

CHECK LOGS

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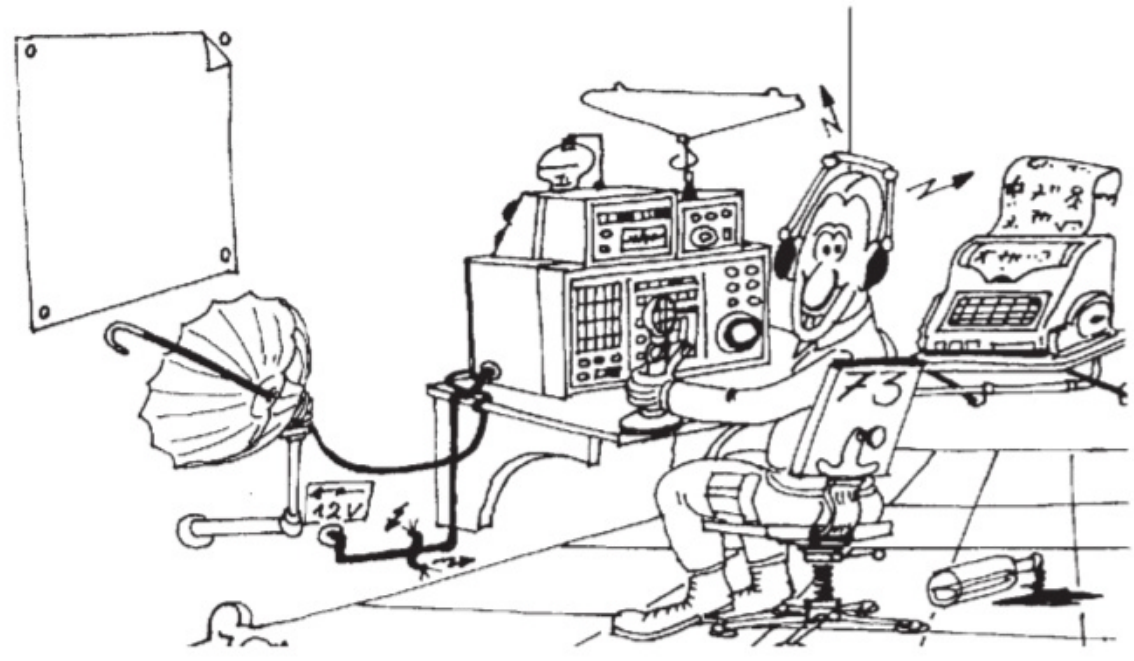
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