Gonculators! — p.55

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CQ Amateur Radio

COMMUNICATIONS & TECHNOLOGY

JULY 2021

On the Cover: The bits and pieces, and final results, of various Heathkit restoration and modification projects we're bringing you this month and next. Our mini-special begins on page 16.

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ANNOUNCEMENTS

JULY

HARRISBURG, PENNSYLVANIA — The Harrisburg Radio Amateurs Club will hold its 50th Annual Firecracker Electronics Expo and Hamfest and 2021 ARRL Pennsylvania State Convention beginning 8 a.m., Saturday, July 3 at the Harrisburg Postal Employees Picnic Grounds, 1500 Roberts Valley Road, Contact: Terry Snyder, WB3BKN, (717) 896-0256. Email: <wb3bkn1@gmail.com>. Website: <www.w3uu.org>. Talk-in 147.075 (PL 123). DXCC / WAS /VUCC card checking.

PLAINS, PENNSYLVANIA — The Murgas Amateur Radio Club will hold the 42nd Annual Wilkes-Barre, Murgas ARC Hamfest and Computerfest beginning 8 a.m., Sunday, July 4 at the Polish American Veterans, 2 South Oak Street. Contact: Herb, K2LNS, (570) 829-2695. Email: <murgasarc@gmail.com>. Website: <http://hamfest.murgasarc.org>. Talk-in 146.61 (PL 82.5). VE exams.

MENDOTA, ILLINOIS — The Starved Rock Radio Club will hold the Amateur Radio Hobbyist & Collectors Show from 8 a.m. to 3 p.m., Sunday, July 6 at the Mendota Tri-County Fairgrounds, 503 1st Avenue. Email: <starvedrockhamfest@gmail.com>. Website: <www.w9mks.org>. Talk-in 147.120+ (PL 103.5).

INDIANAPOLIS, INDIANA — The Indianapolis Hamfest Association will hold the 50th Indianapolis Hamfest and 2021 ARRL Indiana State Convention from 2-7 p.m., Friday, July 9 and from 6 a.m. to 2 p.m., Saturday, July 10 at the Marion County Fair Grounds, 7300 East Troy Avenue. Phone: (317) 829-6868. Email: <wtakin@gmail.com>. Website: <www.indyhamfest.com>. Talk-in 146.76- (PL 151.4).

AUBURN, INDIANA — The Northeastern Indiana Amateur Radio Association will hold the Auburn Hamfest from 9 a.m. to 2 p.m., Saturday, July 10 at the Auburn Cord Duesenberg Museum, 1600 S. Wayne Street. Email: <w9ou@arrl.net>. Website: <www.w9ou.org>. Talk-in 147.015

CAMILLUS, NEW YORK — The Radio Amateurs of Greater Syracuse will hold the RAGS Hamfest 2021 from 7:30 a.m. to 12:30 p.m., Saturday, July 10 at the Camillus Elks Lodge #2367, 6117 Newport Road. Contact: Roger Hamilton, WA2AEW, <hamfest@ragsclub.org>. Website: <www.ragsclub.org>. Talk-in 146.91- (PL 103.5). VE exams

CAVE CITY, KENTUCKY — The Mammoth Cave Amateur Radio Club will hold the 45th Annual Cave City Tailgate Hamfest beginning 8 a.m., Saturday, July 10 at the Cave City Convention Center Parking Lot, 502 Mammoth Cave Street. Contact: Larry Brummett, KN4IV, (270) 651-2363. Email: <lbrummett@glasgow-ky.com>. Website: <http://ky4x.org>.

ERIE, PENNSYLVANIA — The Wattsburg Wireless Association will hold the 2021 NW PA Hamfest beginning 7 a.m., Saturday, July 10 at the Greene Township Municipal Building, 9333 Tate Road. Email: <hamfest@wattsburg-wireless.us>. Website: <http://wattsburg-wireless.us>. Talk-in 147.315 (PL 186.2). VE exams

MANSFIELD, OHIO — The InterCity Amateur Radio Club will hold the 2021 Mansfield Mid-Summer TrunkFest on Saturday, July 10 at the Richland County Fairgrounds, 750 North Home Road. Website: <iarc.club>.

NORTH BEND, NEBRASKA — The Pioneer Amateur Radio Club will hold its 23rd Annual Flea Market from 9 a.m. to 12:30 p.m., Saturday, July 10 at the North Bend Auditorium, 741 N. Main Street. Contact: Rich Mehaffey, KØEFC, (402) 652-3410. Email: <4randjme@futuretk.com>. Talk-in 146.61-. VE exams.

PISCATAWAY, NEW JERSEY — The Raritan Valley Radio Club will hold the W2QW – Hamfest from 8 a.m. to noon, Saturday, July 10 at Piscataway High School, 110 Behmer Road. Contact: Marv, K2VHW, (732) 887-0875 or Rich, W2PQ, (732) 752-0580 (Before 9 p.m.). Website: <http://w2qw.org>. Talk-in 146.625- (PL 141.3) or 442.250- (PL 141.3). VE exams, DXCC / VUCC / WAS card checking.

OAK CREEK, WISCONSIN — The South Milwaukee Amateur Radio Club will hold the WI9SM 2021 Swapfest beginning at 6:30 a.m., Saturday, July 10 at the American Legion Post 434, 9327 South Shepard Avenue. Contact: Karen, KC9WQJ, (414) 578-0492. Email: <kc9wqj@gmail.com>. Website: <http://southmilwaukeearc.org>. Talk-in 146.91 (PL 127.3).

ROSEVILLE, MINNESOTA — The Minnesota Amateur Group of Independent Communicators will hold the MAGIC Tailgater from 8 a.m. to noon, Saturday, July 10 at the Galilee Lutheran Church, 145 N. McCarrons Boulevard. Website: <http://magicrepeater.net>. Talk-in 145.170- (PL 100). VE exams.

TEXAS CITY, TEXAS — The Tidelands Amateur Radio Society will hold the Annual Texas City Hamfest from 8 a.m. to 2 p.m., Saturday, July 10 at the Charles T. Doyle Convention Center, 2010 5th Avenue North. Website: <http://tidelands.org>. Talk-in 147.14 (PL 167.9) or 442.025 (PL 103.5). VE exams.

ESSEX, MONTANA — The 87th Annual Glacier – Waterton International Peace Park Hamfest will be held from Friday, July 16 through Sunday, July 18 at the Glacier Meadow RV Park, 15735 U.S. Highway 2 East. Email: <directors@gwhamfest.org>. Website: <http://gwhamfest.org>. VE exams, T-hunt.

ALEXANDER, NEW YORK — The Lancaster Amateur Radio Club will hold the Batavia Hamfest beginning 6 a.m., Saturday, July 17 at the Alexander Firemen Grounds, 10708 Alexander Road (Rt. 98). Contact: Luke, N2GDU, <luke48@gmail.com>. Website: <http://w2so.org>. Talk-in 147.285 (PL 141.3).

ATHENS, TENNESSEE – The McMinn County Amateur Radio Club will hold its 17th Annual MCARC Hamfest beginning 7 a.m., Saturday, July 17 at the McMinn County Expo Center. Phone: (423) 829-7264. Email: <stephenrickerson@bellsouth.net>. Website: <www.mcminnarc.com>. Talk-in 147.060- (PL 141.3). VE exams.

CHIPPEWA FALLS, WISCONSIN — The Chippewa Valley Amateur Radio Club will hold its HamFest / Tailgater from 9 a.m. to 2:30 p.m., Saturday, July 17 at the Eagle's Banquet Center and Conference Hall, 2588 Hallie Road. Email: <hamfest@w9cva.org>. Website: <http://w9cva.org/hamfest>. Talk-in 147.375+ (PL 110.9).

ELYRIA, OHIO — The Northern Ohio Amateur Radio Society will hold NOARSfest 2021 from 9 a.m. to 1 p.m., Saturday, July 17 at Loraine County Community College - Spitzer Conference Center, 1005 North Abbe Road. Contact: Carl Rimmer, W8KRF, (215) 256-9624. Email: <noarsfest@noars.net>. Website: <http://noars.net>. Talk-in 146.700- (PL 110.9).

KIMBERTON, PENNSYLVANIA — The Mid-Atlantic Amateur Radio Club will hold the 2021 MARC Hamfest beginning 8 a.m., Saturday, July 17 at the Kimberton Fire Company grounds, 742 Pike Springs Road. Email: <n3jiz@marc-radio.org> or <k3ds@marc-radio.org>. Website: <http://marc-radio.org>. Talk-in 145.13 (PL 131.8). VE exams.

SIOUX FALLS, SOUTH DAKOTA — The Sioux Empire Amateur Radio Club will hold its Tailgate Swapfest from 9 a.m. to noon, Saturday, July 17 at Marlin's Truck Stop, 47056 271st Street. Website: <http://w0zwy.org>. Talk-in 146.895.

WARRENSBURG, MISSOURI — The Warrensburg Area Amateur Radio Club will hold its Hamfest 2021 beginning 8 a.m., Saturday, July 17 at the Johnson County Fairgrounds, 386 NW 145th Road. Contact: Kristl Thompson, KRiSTL, <hamfest@waarci.org>. Website: <http://waarci.org>. Talk-in 146.88 (PL 107.2).

AUGUSTA, NEW JERSEY — The Sussex County Amateur Radio Club will hold the 2021 SCARC Hamfest beginning 8 a.m., Sunday, July 18 at the Sussex County Fairgrounds, 37 Plains Road. Contact: Dan Carter, N2ERH, (973) 862-8197. Email: <hamfest@scarcnj.org>. Website: <www.scarcnj.org>. Talk-in 147.30+ (PL 151.4). VE exams.

PEOTONE, ILLINOIS — The Kankakee Area Radio Society will hold KARSFEST 2021 beginning 6 a.m., Sunday, July 18 at the Will County Fairgrounds, 710 S. West Street. Contact: Art Reis, K9XI, (815) 348-7752. Email: <karsfest@gmail.com>. Website: <www.w9az.com>. VE exams, card checking.

CHAMBERSBURG, PENNSYLVANIA — The Cumberland Valley Amateur Radio Club will hold the CVARC Hamfest 2021 from 8 a.m. to noon, Saturday, July 31 at the Cumberland Valley Engine & Machinery Association Show Grounds, 1501 Criders Church Road. Email: <hamfest@w3ach.org>. Website: <http://w3ach.org>. Talk-in 147.120 (PL 100). VE exams.

LEBANON, TENNESSEE — The Wilson Amateur Radio Club will hold Hamquest 2021 from 8 a.m. to 3 p.m., Saturday, July 31 at the James E. Ward Agricultural Center, 945 E. Baddour Parkway. Email: <reservations@midtnhamquest.com>. Website: <http://midtnhamquest.com>.

WINCHESTER, INDIANA — The East Central Indiana Hamfest will be held from 8 a.m. 4 p.m., Saturday, July 31 at the Randolph County 4-H Fairgrounds, 1855 U.S. Highway 27. Phone: (765) 383-0011. Email: <inhamfest@gmail.com>. Website: <http://inhamfest.com>.

AUGUST

PEOTONE, ILLINOIS — The Hamfesters Amateur Radio Club will hold the Hamfesters Hamfest beginning 8 a.m., Sunday August 1 at the Will County Fairgrounds, 710 S. West Street. Contact Jim Riley, W9JPR, <w9jpr@gmail.com>. Talk-in 442.450 (PL 114.8).

CARLINVILLE, ILLINOIS — The Macoupin County Amateur Radio Club, Okaw Valley Amateur Radio Club, Montgomery County Amateur Radio Club, Sangamon Valley Radio Club will hold the West Central Illinois Hamfest from 7 a.m. to 1 p.m., Saturday, August 7 at the Macoupin County Fairgrounds, 21149 IL Route 4. Contact: Jim Pitchford (217) 670-5777. Email: <n9lqf@arrl.net>. Website: <www.wcilhamfest.com>. Talk-in 444.250 (PL 103.5). VE exams, card checking

CENTRAL CITY, IOWA — The Cedar Valley Amateur Radio Club will hold the CVARC Hamfest and 2021 ARRL Iowa State Convention on Saturday, August 7 and Sunday, August 8 at the Linn County Fairgrounds, 201 Central City Road. Contact David Cripe, NMØS, <nm0s@arrl.net>. Website: <http://w0gq.org/hamfest>. Talk-in 146.745- (PL 192.8).

ELKHART, INDIANA — The Northern Indiana Repeaters (K9DEW) will hold the Elkhart East Hamfest from 9 a.m. to 3 p.m., Saturday, August 7 at the Northern Indiana Events Center, 21565 Executive Parkway. Email: <info@elkharteasthamest.com>. Website: <http://elharteasthamfest.com>. Talk-in 145.430 (PL 141.3) VE exams.

(Continued on page 37)

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HAM RADIO NEWS

A Kickstart for Cycle 25?

The solar scientist who's been bucking the tide of pessimism from most of his colleagues and predicting a huge sunspot cycle (see News Bytes, Sept. 2020 issue) continues to see lots and lots of spots in the future. According to spaceweather.com, Scott McIntosh of the National Center for Atmospheric Research in Colorado, along with colleague Bob Leamon of the University of Maryland / Baltimore County, are predicting that a "terminator event," in which oppositely charged magnetic fields collide near the sun's equator and annihilate each other, will be occurring soon. This is a normal occurrence between solar cycles, they say, but the key to predicting the strength of the new cycle lies in the timing between terminator events — the longer the time between them, the weaker the new cycle will be. They are predicting a short 10 years between the previous terminator event and the upcoming one, and McIntosh says, "If the Terminator Event happens soon, as we expect, new Solar Cycle 25 could have a magnitude that rivals the top few since record-keeping began."

Asked about the fact that most other solar scientists feel the new cycle will be a weak one, like its predecessor, McIntosh replied, "What can I say? We're heretics!"

NOAA: Expect Another Active Hurricane Season

The National Oceanic and Atmospheric Administration (NOAA) is predicting another above-average hurricane season in the Atlantic and Caribbean this year, but does not expect a repeat of last year's season in which the number of named storms exceeded the letters in alphabet. NOAA's Climate Prediction Center says we should expect 13-20 named storms, of which 6-10 will develop into hurricanes and 3-5 will become major hurricanes, with sustained winds of 111 miles per hour or greater. Hurricane season officially began on June 1st and runs through November 30th, but the season's first named storm, Ana, developed in late May. The center is also predicting a near- or below-normal season in the central Pacific.

FCC Promises to Keep Hams' Email Addresses Private

As of June 29th, all license-related applications filed with the FCC must include an email address at which commission staff may contact you. Changes in email addresses must also be provided, and licenses are subject to cancellation or revocation if emails are returned as undeliverable. The new requirement raised concerns about privacy, but the ARRL says its counsel has been assured by FCC staff that amateurs' email addresses will be "masked" in the Universal Licensing System (similar to date of birth) and will not be visible to the public. This is part of an FCC move to eliminate all paper correspondence with licensees, including the mailing of licenses, which now may only be downloaded from the FCC website.

A Tale of Two SATERNs

Among hams, SATERN has long been an acronym for the Salvation Army Team Emergency Radio Network. Now, according to the ARRL, it also stands for Strategic Auxiliary Team Emergency Readiness Net, a new group organized by former Salvation Army SATERN manager Lee Glassman, WA5LEE. To make matters even more confusing, the "new SATERN" holds daily nets on 14.265 MHz, the frequency formerly used by the original SATERN for its daily nets, which have now been moved to 14.325 MHz on a reduced 3-day-a-week schedule.

Salvation Army SATERN National Committee Chair Michele Heaver told ARRL that her organization considers the new SATERN to be a "breakaway" group, does not support it, and has no association with it. Glassman reportedly took the action because of "a conflict of ideals," including increased credentialing requirements and background checks being imposed by The Salvation Army on net members, and because it stopped holding daily nets on 14.265. He said his new group used the same acronym and frequency because they were already familiar to net participants.

Latest WSJT-X Release Includes New Q65 Mode

A new version (2.4.0) of WSJT-X, the software suite that includes FT8 and other digital protocols, has introduced a new mode, Q65. According to the release notes, it is designed to accommodate fast-fading signals and paths with Doppler shifts of more than a few Hertz. "Q65 is particularly effective," the notes say, "for tropospheric scatter, rain scatter, ionospheric scatter, TEP (trans-equatorial propagation), and EME (Earth-Moon-Earth) on VHF and higher bands." It uses the same message formats and sequencing as those used in FST4, FT4, FT8, and MSK144. Q65 is one of 11 total modes included in the latest WSJT-X package. For more information or to download the free software, visit <https://tinyurl.com/nzcmxywm>.

SuperDARN Radars Identified as QRM Source on HF

The *ARRL Letter* reports that the SuperDARN ionospheric research radar network has been identified by the International Amateur Radio Union's Region 1 Monitoring Service as a source of interference on 14.210 MHz and possibly other frequencies. This is in addition to over-the-horizon radars, mostly based in Russia and China, that have long been sources of QRM on the HF ham bands.

SuperDARN stands for Super Dual Auroral Radar Network, which operates 35 HF radars in both the Northern and Southern Hemispheres. They operate continuously to track the motion of charged particles in the ionosphere and help scientists better predict space weather hazards, such as geomagnetic storms.

ARDC is Busy With Major Grants

Amateur Radio Digital Communications, or ARDC, administers the AMPRNet (44) internet domain and recently came into lots of money as a result of selling off a portion of that domain that it determined it was unlikely ever to be used by hams. In 2019, it began making grants for various projects and programs involving amateur radio and/or digital communications. It recently made its largest grant ever as well as its first international grant.

The organization donated $1.6 million in May to the Massachusetts Institute of Technology (MIT) to help save its iconic radome and large dish antenna it protects from removal as part of roof renovations on the building where it sits. The dish is used by the MIT Radio Society, W1MX, for moonbounce and other microwave communications, as well as radioastronomy. Plans are being developed for additional uses by the university and the club.

A separate ARDC grant to the Deutscher Amateur Radio Club (DARC, Germany's national ham radio organization), will help in "boosting and securing European HAMNET expansion by providing sponsored hardware for radio links to make use of the AMPRNet IP space in Europe," according to ARDC. It is the group's first grant to an organization outside the United States. HAMNET is a high-speed digital network using amateur radio microwave bands.

CONTENTS

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16 COVER: New Life For Old Heathkits — Part 1

Restoring half-century old radios to operating condition can be a very involved process, from replacing leaky capacitors to painstakingly recreating a badly damaged front panel using 21st-century technology. Our Heathkit restoration mini-special begins on page 16. *(Cover montage by Art Director Elizabeth Ryan)*

RESTORATION MINI SPECIAL: As most restorers know, restoration of old electronics takes a deft hand, patience, and ingenuity to get the best results. This month, three authors tackle restoring old Heathkits to their former glory and share with us their tips for making the project as successful as possible. Read all about it on pages 16, 20, and 24.

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ZERO BIAS: A CQ Editorial

BY RICH MOSESON,* W2VU

Restorative Medicine

News Flash! 3Y0J Bouvet DXpedition Cancelled ... Details on CQ Newsroom and in August issue

My hometown has weekly "Cruise Nights" each summer, at which classic car fans get together to show off their vehicles, compare notes, and generally have a good time together...This issue is the radio version of Cruise Night, with four articles on the topic of vintage gear, along with two more that we couldn't fit in and will bring you next month.

My hometown has weekly "Cruise Nights" each summer, at which classic car fans get together to show off their vehicles, compare notes, and generally have a good time together. Some of the cars on display have been carefully cared for since they were new; others (perhaps the majority) were saved from junkyards and lovingly restored to working order. It's a step back into a simpler age, when cars were mechanical marvels rather than computers on wheels.

This issue is the radio version of Cruise Night, with four articles on the topic of vintage gear, along with two more that we couldn't fit in and will bring you next month. Three of the four deal with Heathkits, K9ARZ's "Three 'Gifts' From Heathkit," N8RG's restoration of the very first Heathkit electronic kit, the K-1 AM "All-Wave" receiver, and K3MD's restoration of a classic Heathkit DX-60 transmitter. (Next month, we'll have an article by AG4W on converting an SB-220 HF amplifier to 6 meters and a "CQ Classic" look back to 1954 for our first review of a Heathkit radio.) Our fourth article on the same theme is "A Dummy Load for Power Supplies," in which KBØVKS guides us through the process of making sure that a "pre-owned" power supply you might pick up online or at a flea market doesn't itself need restoration before use. Plus, KØNEB's Kit-Building column this month focuses on a one-tube AM broadcast transmitter kit one could build to provide your own signal source to crystal sets or restored antique broadcast receivers.

Of course, restoring and operating vintage gear has long been a popular sub-hobby in amateur radio, but I was struck by the number of restoration-related articles we received in a short period of time. Was there a connection, I wondered, between restoring old radios and what we've all gone through in the past year-plus with the Coronavirus pandemic? Does doing this take us back to a simpler and more predictable time — when radios glowed in the dark and were marvels of mechanical as well as electrical engineering rather than computers that generate RF — and give us at least a temporary sense of order and control? Is this "restorative medicine" in a non-physical sense?

I posed these questions to frequent *CQ* contributor Jim Millner, WB2REM, who practices psychology when he isn't writing radio articles. His response not only confirmed what I was thinking, but also drew a parallel between the field of restorative medicine and the activity of restoring vintage radios.

"Restorative medicine provides a chemical balance to your body while restoring old rigs takes broken parts and makes the radio whole again." Jim wrote. "Our lives over the last year or so with Covid have been broken like old-time radios. There have been many pieces in our lives that have been lost forever or are in dire need of repair. By restoring a classic rig, the act of taking something broken and making it whole again can be symbolic of what life will be after the pandemic is in the rear mirror … The word 'gestalt' also comes to mind, 'An organized whole that is perceived as more than the sum of its parts.'"

Thank you for your perspective, Jim. In our view, ham radio has always been more than the sum of its parts. It is not just a jumbled assemblage of many different interest areas, from contesting and DXing to restoring classic radios, but so much more when the skills and experiences gained in each of those many interest areas are brought together to create something greater, particularly in times of need.

Ham radio helped many of us get through the pandemic with our mental health intact by providing a means of social contact even if we were quarantined in our homes. It might have been working DX or contesting, taking part in nets that went from weekly to daily in order to check in regularly on members, or using ham radio to help schedule vaccine appointments, as WB2REM described in his most recent *CQ* article, "The Ham Radio Hunger Games," in this past May's issue.

Now it's poised to help us through the return to normalcy, by taking our rigs outdoors to activate "OTA" (on the air) locations such as summits or parks, expanding the limits of our networking technology (as N2IRZ discusses in his Digital Connection column this month), or restoring classic radios. Like bringing old rigs back to life in our shacks, ham radio itself provides us with a good dose of "restorative medicine" when we let it.

One final note on restorations: Restoring an old radio doesn't necessarily mean using old parts and old tools to complete the job. When N8RG was fixing up his K-1 receiver, he realized that the front panel was too badly damaged to be repaired. So he used two decidedly 21st-century tools — a high-resolution digital camera and a personal computer — to help him along. He took a very hi-res photo of the damaged front panel, opened that photo in his drawing program, and reconstructed an image of the original panel, pixel by pixel. He then sent that image to a company that prints photos directly onto a sheet of aluminum. When the finished product arrived a few days later, Ray drilled new holes for various switches and dials, trimmed the edges and, voilà, brand new front panel!

Also in this issue, we have the results of last February's CQ WPX RTTY Contest, our CQ Hall of Fame inductees for this year and finally, *gonculators*! Ya gotta read KH6WZ's Ham Notebook column to find out what that's all about.

Enjoy this issue, and your summer, and we hope that both will provide you with a good dose of restorative medicine.

– 73, Rich, W2VU

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

NEWS BYTES

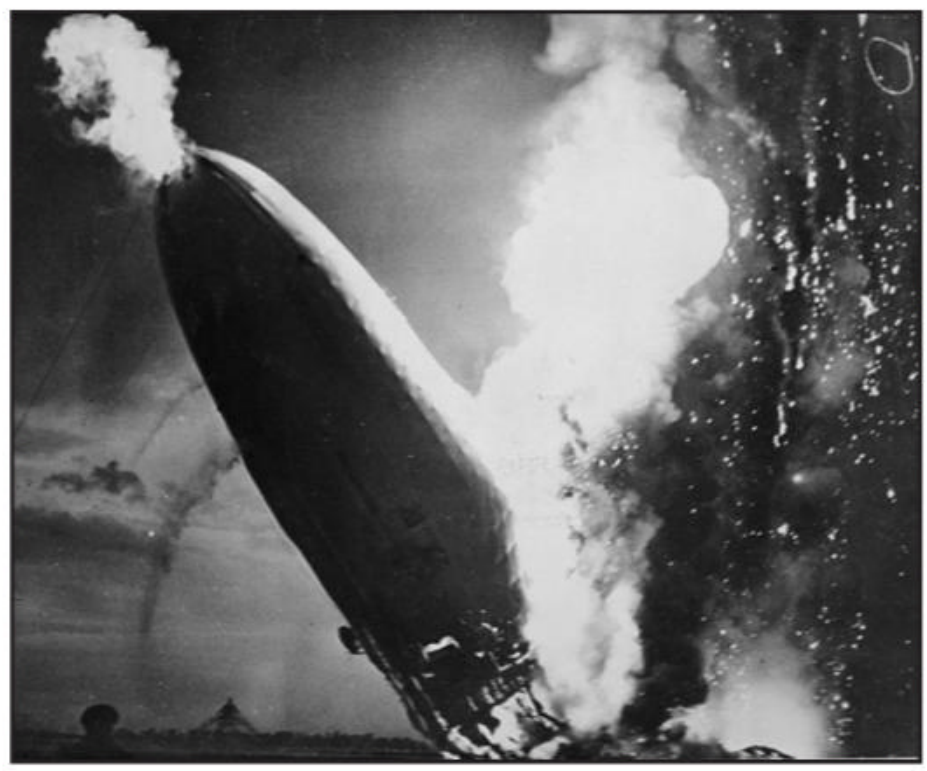
"Oh, the Humanity!"

This has no direct link to amateur radio, but involves CQ DX Editor Bob Schenck, N2OO, and his family. Plus, it's fascinating! – ed.

One of the most famous air disasters in history was the May 6, 1937 crash of the Hindenburg airship as it prepared to land in Lakehurst, New Jersey. WLS (Chicago) radio reporter Herbert Morrison was on the scene recording the landing when the ship burst into flames and crashed to the ground, leading to his famous quote, "Oh, the humanity!"

The source of the spark that ignited the hydrogen gas that carried the Hindenburg had not been determined in the nearly 85 years that have passed since the disaster. Enter N2OO, and airship expert Dan Grossman, whom Bob met at a 75th anniversary observance in Lakehurst in 2012. It seems that back in 1937, Bob's mom and his uncle were at Lakehurst to watch the Hindenburg's arrival, and Uncle Harold was filming the landing. He was in a different spot than all the newsreel cameramen and had a different perspective on the airship as it approached. According to Bob, his uncle offered to share the film with investigators at the time, but no one was interested.

Skip ahead 75 years and Dan Grossman was very interested. Now, Bob, and Uncle Harold's film, are the centerpieces of a PBS "Nova" documentary, "Hindenburg; The New Evidence." The program aired on May 19th but is available online at <https://tinyurl.com/3fhphy7w>. There's enough science and technology involved to keep most hams interested. And the secret word is: Capacitor. (Tnx to N2OO and NL7XM)



The crash of the Hindenburg on May 6, 1937. N2OO's uncle, Harold Schenck, shot film of the disaster from a different angle. (U.S. Information Agency photo, via National Archives)

Results of the 2021 CQWW WPX RTTY Contest

BY CHRIS TATE, * N6WM

The 2021 CQWW WPX RTTY contest was held 11 months into the global coronavirus pandemic. Vaccines were being offered to only the oldest age groups and seniors in care facilities. Remote operations, one of the only really safe ways to maintain multi-op collaborative efforts, became the norm, with many taking advantage of technology either to activate multi-op stations or to navigate travel restrictions to regular DX contesting sites around the world. As with other contests over the last year, this changed the landscape of the logs submitted, both from whom and how many were received. This fact, and with the Northern Hemisphere struggling with typical winter weather woes, certainly had an impact.

"*With covid restrictions in place, I was unable to head to my preferred contest location in Devon. So, a simple 40-meter vertical with ground radials was hidden among the trees outside my flat and I am amazed at how well it worked, surrounded by trees in a dip with a hill to the west of me.*" –Rob G1N (GØURR)

I think it's safe to say there was quite a bit of this going on. But it did not stop hundreds of RTTY contest enthusiasts from getting on the air, from wherever, and however to have a great time.

* *Email: <n6wm@largeradio.org>*

2021 WPX RTTY TOP WORLD SCORES

SINGLE OPERATOR

HIGH POWER

ALL BAND

CR6K (CT1ILT) 9,950,535
SN7Q (SP7GIQ).....9,381,528
OM5ZW 9,045,876
AA3B 7,888,300
AK1W (K5ZD).....7,825,566
RG9A.....7,098,316
P3X (5B4AMM) 6,817,338
SO9I (SQ9ORQ) 6,187,710
HG8R (HA8JV).....6,041,518
UW8SM 5,753,542

28 MHz

D41CV (IK2NCJ) 23,400
LU1DX.....23,100
NH2DX 16,016
NA4W (K4WI).....1,224

21 MHz

V51WH 1,610,743
CV7S (CX7SS).....1,460,448
CR6T (CT1ESV).....1,169,480
3G1B (CE1KV) 856,830
UT2IV 410,564

14 MHz

LX7I (DF7EE) 2,326,064
HG1S (HA1DAE).....2,289,492
YT3X 2,224,080
SO4M 2,152,548
HG5D (HA8QZ) 1,853,326

7 MHz

9A5W.....6,730,556
OM2VL 5,420,520
IT9RBW.....4,956,246
YUØW 4,798,752
WQ5OO (N8OO) 3,982,134

3.5 MHz

9A9A.....2,575,210
9A5X.....2,537,740
UX2X (UT2XQ).....2,268,000
9A5Y (9A3LG) 2,166,112
I4AVG.....1,804,680

LOW POWER

ALL BAND

TM3Z (F4DSK) 6,977,412
IK6VXO 6,148,000
LY7Z.....5,932,500
UW1M 5,612,264
IK2YCW (IT9RGY) 5,102,412
UWØK (USØKW) 4,715,965
KK9A 4,220,550
LY6A.....3,361,500
UT4LW 3,282,878
YL1ZF.....2,997,234

21 MHz

EA8AH.....2,451,204
PY2UD 1,019,172
ZV2C (PY2CX) 839,257
PY2QT.....481,573
PU2UAF 294,866

14 MHz

EF1A (EA1X).....810,576
LZ2JA 627,300
YTØW (YU1JW) 605,200
S52OT 603,360
F1DHX.....593,736

7 MHz

DK9IP 2,062,590
IR9D (IW3RUA).....1,774,584
OK2RU 1,358,204
LY5T.....1,337,248
WT4O 1,287,716

3.5 MHz

9A6A.....1,256,520
F1AKK 1,039,008
S51W.....966,000
HA8WY.....830,126
OM3IAG 799,254

QRP

ALL BAND

RM5F.....1,081,520
WK9U 768,593
YU1LM 687,939
IZ8JFL 532,123
R2PU 405,251
UA3QJJ 402,868
JA6GCE 388,705
HA6IAM 387,440
K2YG.....372,000
N2WK 302,498

21 MHz

YO3DAC.....13,800
YO8WW 7,938
PY2RKG.....7,392
JR1NKN 7,252
HA3HX 4,182

14 MHz

H2X (5B4ALX).....1,061,260
HA3JB 249,407
DK7HA 231,544
SP4LVK.....69,600
YU1NR 66,198

7 MHz

YT5DEY 302,292
DDØVS.....221,616
SP9KAG (SP9CXN) 142,044
UR5EPM 131,760
IU3FBL 116,250

3.5 MHz

LY5G 193,256
OK1NG.....170,754
IK4UXA.....117,216
SP6EIY.....76,728
W2NTN.....53,928

MULTI-OPERATOR

SINGLE TRANSMITTER (HIGH)

IQ4FC.....14,345,793
IQ1RY.....12,176,574
OL57ZW 11,179,872
9A5D 8,302,392
OK7O 7,715,520
A6ØA.....7,327,264
OG66X 6,034,894
OM5M.....5,581,136
OK1KSL 5,448,080
DP6A 5,092,656

MULTI-OPERATOR

SINGLE TRANSMITTER (LOW)

WP3C 5,995,392
EC7MA 3,664,122
DM4X 3,528,048
DQ4W.....2,778,560
DJ4MX.....2,202,720
K9NR.....2,155,200
V31MA.....1,772,331
S57ZT.....1,541,528
NA5NN 1,496,012
S54I 1,274,592

MULTI-OPERATOR

TWO TRANSMITTER

ED1R.....8,061,273
YL2UI 6,877,911
NB3R.....5,889,886
NW8S 4,805,376
NCØDX 4,073,760
EA2ESZ.....3,850,956
DM5B 3,119,376
NA4DA 2,704,790
KT7E 1,732,470
KB3VQC.....1,638,864

MULTI-OPERATOR

MULTI-TRANSMITTER

DP7D.....12,987,476
W3GH.....5,971,467
NR6O 4,575,900
DR3W.....3,920,376
DG7RO.....800,670
JK2EIJ/Ø 1,100

MULTI-OPERATOR

MULTI-DISTRIBUTED

J42S 9,451,887
IQ3ME 5,506,074
WW4LL.....5,412,376
WV4P 5,378,570
IR9K 4,511,430
XM2X.....4,169,700
IU2NSZ.....3,120,390
KZ1W 1,553,885
VR2CC 954,750
OL1Z 516,516

ROOKIE

HIGH POWER

DM7XX 3,390,524
UA4S (R4SAD).....2,190,509
W3MLJ 1,120,434
LB5GI 4,216
DJ5CT 3,042
HP1ELV.....2,178
KN4QDE.....1,456

LOW POWER

NN2DX (W4IPC) 1,374,090
DL4VDA 609,102
EA3CI 425,334
UR5EPV 416,448
SO5KR 374,664
N2OG 335,240
TA4IGN 325,268
YB1RKT 223,014
S55AL.....207,100
EW1OK 201,720

CLASSIC

HIGH POWER

ED8W (EA8DO) 4,844,484
EC5K 2,351,250
W3LL 1,766,256
IZ2FOS.....1,321,155
ON4CT 1,210,880
SN4X (SP5OXJ).....1,083,754
LX2LX.....1,044,240
PX2A (PY2XV) 1,032,846
AJ6V.....926,187
IK5FKE 838,228

LOW POWER

DK1KC 1,089,004
VE3KI 1,086,176
MØHMO 1,051,498
IW1PNJ 1,051,024
MW9W.....967,904
DK5DQ 863,328
OQ4U 789,243
GUØSUP.....693,427
ON3LX.....664,326
DF4ZL 626,400

TRIBANDER / WIRES

HIGH POWER

GWØA (GW4SKA) 4,006,440
N3QE.....3,500,643
UZ1WW.....3,369,762
MM9I (GMØOPS).....3,284,424
T6A.....3,266,703
DQ9Y (DF2SD) 3,246,264
SV2BXA 3,215,355
M7T (G3YYD).....3,192,045
YQ6A (YO6BHN).....3,046,050
DP6K (DJ3NG).....2,905,084

LOW POWER

UT4LW 3,282,878
YL1ZF.....2,997,234
3V8SS (KF5EYY) 2,825,134
ED7N (EA7KHB) 2,723,462
4U1A (HB9RB) 2,639,756
PQ2M (PY2MNL) 2,511,492
ON5GQ 2,485,596
RT9S 1,942,450
DL9YAJ 1,874,727
YO4NF 1,851,408

*Low Power

2021 WPX RTTY TOP EUROPE SCORES

SINGLE OPERATOR

HIGH POWER ALL BAND

CR6K (CT1ILT) 9,950,535
SN7Q (SP7GIQ).....9,381,528
OM5ZW 9,045,876
SO9I (SQ9ORQ) 6,187,710
HG8R (HA8JV).....6,041,518
UW8SM 5,753,542
YO9HP 4,952,172
EA4GOY.....4,843,616
EMØI 4,729,074
EM2G (UR7GO).....4,694,375

21 MHz

CR6T (CT1ESV).....1,169,480
UT2IV 410,564
9A1CCY (9A7DX).....281,820
HA1TJ 232,290
SV9COL 133,136

14 MHz

LX7I (DF7EE) 2,326,064
HG1S (HA1DAE).....2,289,492
YT3X 2,224,080
SO4M 2,152,548
HG5D (HA8QZ) 1,853,326

7 MHz

9A5W.....6,730,556
OM2VL 5,420,520
IT9RBW.....4,956,246
YUØW 4,798,752
UT4U (UT5UJO).....3,884,706

3.5 MHz

9A9A.....2,575,210
9A5X.....2,537,740
UX2X (UT2XQ).....2,268,000
9A5Y (9A3LG) 2,166,112
I4AVG.....1,804,680

LOW POWER ALL BAND

TM3Z (F4DSK) 6,977,412
IK6VXO 6,148,000
LY7Z.....5,932,500
UW1M 5,612,264
IK2YCW (IT9RGY) 5,102,412
UWØK (USØKW) 4,715,965
LY6A.....3,361,500
UT4LW 3,282,878
YL1ZF.....2,997,234
ED7N (EA7KHB) 2,723,462

21 MHz

EB7DX.....200,123
IK4RQJ.....100,998
RQ7R 72,842
LY1R 64,722
IZ8MXB 61,138

14 MHz

EF1A (EA1X).....810,576
LZ2JA.....627,300
YTØW (YU1JW) 605,200
S52OT 603,360
F1DHX.....593,736

7 MHz

DK9IP 2,062,590
IR9D (IW3RUA).....1,774,584
OK2RU 1,358,204
LY5T.....1,337,248
RA4FUN 1,133,160

3.5 MHz

9A6A.....1,256,520
F1AKK 1,039,008
S51W.....966,000
HA8WY.....830,126
OM3IAG 799,254

QRP

ALL BAND

RM5F.....1,081,520
YU1LM 687,939
IZ8JFL 532,123
R2PU.....405,251
UA3QJJ 402,868
HA6IAM 387,440
EA1CM 293,265
LZ3GW 287,955
LZ3RR 270,314
UX8IW 204,580

21 MHz

YO3DAC.....13,800
YO8WW 7,938
HA3HX 4,182
RA4DX 3,354
UR3ABM 2,574

14 MHz

HA3JB 249,407
DK7HA 231,544
SP4LVK.....69,600
YU1NR 66,198
R7KO.....54,912

7 MHz

YT5DEY 302,292
DDØVS.....221,616
SP9KAG (SP9CXN) 142,044
UR5EPM 131,760
IU3FBL 116,250

3.5 MHz

LY5G 193,256
OK1NG.....170,754
IK4UXA.....117,216
SP6EIY 76,728
M9N (G7WHI).....13,334

MULTI-OPERATOR

SINGLE TRANSMITTER (HIGH)

IQ4FC.....14,345,793
IQ1RY.....12,176,574
OL57ZW 11,179,872
9A5D 8,302,392
OK7O 7,715,520
OG66X 6,034,894
OM5M.....5,581,136
OK1KSL 5,448,080
DP6A 5,092,656
LY5W.....4,773,909

MULTI-OPERATOR

SINGLE TRANSMITTER (LOW)

EC7MA 3,664,122
DM4X 3,528,048
DQ4W.....2,778,560
DJ4MX.....2,202,720
S57ZT.....1,541,528
S54I 1,274,592
Z36W.....1,130,415
OK1RPL 517,230
9A7B.....512,952
ED2C.....384,504

MULTI-OPERATOR

TWO TRANSMITTER

ED1R.....8,061,273
YL2UI 6,877,911
EA2ESZ.....3,850,956
DM5B 3,119,376

MULTI-OPERATOR

MULTI-TRANSMITTER

DP7D.....12,987,476
DR3W.....3,920,376
DG7RO.....800,670

MULTI-OPERATOR

MULTI-DISTRIBUTED

J42S 9,451,887
IQ3ME 5,506,074
IR9K 4,511,430
IU2NSZ.....3,120,390
OL1Z 516,516

ROOKIE

HIGH POWER

DM7XX 3,390,524
UA4S (R4SAD).....2,190,509
LB5GI 4,216
DJ5CT 3,042

LOW POWER

DL4VDA 609,102
EA3CI 425,334
UR5EPV 416,448
SO5KR 374,664
S55AL.....207,100
EW1OK 201,720
SP9NSA 146,202
R7LY 118,678
GM4UQG 101,920
SP9MUF.....88,044

CLASSIC

HIGH POWER

EC5K 2,351,250
IZ2FOS.....1,321,155
ON4CT 1,210,880
SN4X (SP5OXJ).....1,083,754
LX2LX.....1,044,240
IK5FKE 838,228
MI5K (MIØSLE) 737,472
LX4ØDA (LX1DA) 731,747
UT2AU.....598,986
SO5E (SP5VIH).....573,400

LOW POWER

DK1KC 1,089,004
MØHMO 1,051,498
IW1PNJ 1,051,024
MW9W.....967,904
DK5DQ 863,328
OQ4U 789,243
GUØSUP 693,427
ON3LX.....664,326
DF4ZL 626,400
GØFGI.....589,164

TRIBANDER / WIRES

HIGH POWER

GWØA (GW4SKA) 4,006,440
UZ1WW.....3,369,762
MM9I (GMØOPS).....3,284,424
DQ9Y (DF2SD) 3,246,264
SV2BXA 3,215,355
M7T (G3YYD).....3,192,045
YQ6A (YO6BHN).....3,046,050
DP6K (DJ3NG).....2,905,084
9A9A.....2,575,210
UR5R (UTØRM) 2,533,704

LOW POWER

UT4LW 3,282,878
YL1ZF.....2,997,234
ED7N (EA7KHB) 2,723,462
4U1A (HB9RB) 2,639,756
ON5GQ 2,485,596
DL9YAJ 1,874,727
YO4NF 1,851,408
R7MM.....1,647,680
OK4GP 1,553,955
LC7N (LA5LJA) 1,478,700

2021 WPX RTTY PLAQUE DONORS AND WINNERS

SINGLE-OPERATOR HIGH POWER

World: Jeff Blaine, ACØC. Won by: CR6K (op. Filipe Monteiro Lopes, CT1ILT)
North America: Marty Sullaway, NN1C. Won by: ZF2WF (op. Bill Fehring, W9KKN)
USA: Abroham Neal Software by K3NC. Won by: Bud Trench, AA3B
USA 7th Call Area: Hank Lonberg, KR7X in memory of Bob Wruble, W7GG. Won by: Jeff Stai, WK6I/7
Europe: FlexRadio Systems. Won by: SN7Q (op. Krzysztof Sobon, SP7GIQ)
Africa: Vlado Karamitrov, N3CZ. Won by: ED8W (op. Manuel Angel Manolo, EA8DO)
Asia: Mike Trowbridge, KA4RRU in memory of Steve Veader, N4DXS. Won by: Yuri Kurinyi, RG9A

SINGLE-OPERATOR LOW POWER

World: Gerry Treas, K8GT. Won by: TM3Z (op. Dimitri Cosson, F4DSK)
North America: Wray Dudley, AB4SF. Won by: Ted Jimenez, HI3T
USA: Gerry Treas, K8GT. Won by: John Bayne, KK9A
Europe: FlexRadio Systems. Won by: Andrea Tonci, IK6VXO
Oceania: Doug Faunt, N6TQS. Won by: Kent Carlson, KH6CJJ

SINGLE-OPERATOR QRP

World: Vlado Karamitrov, N3CZ. Won by: Vitaly Filonenko, RM5F
North America: FlexRadio Systems. Won by: Edibel Frias Mesa, CM3EFM

SINGLE-OPERATOR SINGLE BAND

World 14 MHz: Steve "Sid" Caesar, NH7C. Won by: LX7I (op. Helmut Mueller, DF7EE)
World 14 MHz Low Power: Kenny Young, AB4GG. Won by: EF1A (op. Juan R. Varela Seoane, EA1X)
North America 21 MHz: Doug Faunt, N6TQS. Won By: Jose A Rivera Carrasquillo, KP4JFR
World 28 MHz: Steve Booklout, NR4M, and the "Goat Farm Gang". Won by: D41CV (op. Luca Aliprandi, IK2NCJ)

MULTI-OPERATOR, SINGLE-TRANSMITTER HIGH POWER

World: Rich Cady, N1IXF. Won by: IQ4FC (ops. I4IFL, IK4DCW, IK4HVR, IK4MGP, IU4OMO, IZ4NIC)
USA: John Lockhart, WØDC. Won by: WF7X (ops. N7TY, W6RW)
Europe: Billy, GM6DX. Won by: IQ1RY (ops. IW1ARB, IZ1LBG)

MULTI-OPERATOR, SINGLE-TRANSMITTER LOW POWER

World: Ed Muns, WØYK. Won by: WP3C (ops. WP3C, WP3TT, W2VQ, N2GK)
USA: FlexRadio Systems. Won by: K9NR (ops. K9NR, K9QT)

MULTI-OPERTATOR, MULTI-TWO

World: Steve Bookout, NR4M, and the "Goat Farm Gang". Won by: ED1R (ops. EA1P, EA1TL, EC1KR, EA4AOC)
USA: CTRI Contest Group in memory of Chris, KA1GEU (SK). Won by: NB3R (ops. NJ3I, NB3R)
Europe: FlexRadio Systems. Won by: YL2UI (ops. YL2UI, YL2CI, YL3CU)

MULTI-OPERATOR, MULTI-TRANSMITTER

World: Steve Bookout, NR4M, and the "Goat Farm Gang". Won by: DP7D (ops. DF1QR, DJ4MH, DH8AF, DL3YCX, DL1REM, DO8EJ)
USA: BeLoud.US. Won by: W3GH (ops. N3WMC, W3BUW, WC3O, K3WM, AG3I, N2GBR, WA3HGW, K3ES, N2MA, K3STL, KC3QWF, AC3GB, KC3PXQ)

MULTI-OPERATOR, MULTI-DISTRIBUTED

Canada: FlexRadio Systems. Won by: XM2X (ops. VA2RC, VE2FK, VE2PI, VE2SG, VE2EBK)

CLUB COMPETITION

World: Potomac Valley Radio Club. Won by: Bavarian Contest Club
USA: Northern California Contest Club: Won by: Potomac Valley Radio Club

2021 WPX RTTY TOP UNITED STATES SCORES

SINGLE OPERATOR
HIGH POWER
ALL BAND

AA3B 7,888,300
AK1W (K5ZD).....7,825,566
K9CT 4,751,984
WK1Q (K1MK @K1TTT).....3,571,240
AI9T 3,501,936
N3QE.....3,500,643
AB3CV.....3,367,760
N6AR.....3,357,368
K6DTT 2,881,620
WK6I/7.....2,879,235

28 MHz
NA4W (K4WI).....1,224

21 MHz
K2RD 163,920
KRØP 147,368
KY7M.....112,560
K5QR.....30,952
K2PAL 8,216

14 MHz
NB2P 718,960
K8YE 678,131
W9ILY.....647,724
KA6BIM 559,430
WV1K (N1IXF).....526,110

7 MHz
WQ5OO (N8OO).....3,982,134
NA3M 1,952,748
K8IA.....1,493,910
NØNI 1,346,948
NU4E.....1,269,120

3.5 MHz
WW2R (N2CEI) 381,480
NJ4U (K4EA).....233,064
N6SS 194,920
K3GP.....139,392
K2TW 19,096

LOW POWER
ALL BAND

KK9A 4,220,550
WW3S 1,584,448
NN2DX (W4IPC) 1,374,090
NG1R (W1QK) 1,307,208
KM4SII.....1,280,512
KF2O 1,127,500
N8CWU 1,032,430
N4BAA.....828,064
KS1J.....808,992
K2LNS 798,752

21 MHz
W9SN 232,656
WØPV 4,224
N8URE 1,632

14 MHz
W4LC 227,445
K7SCX.....121,218
NK5G.....43,512
K5WW 42,687
K6JO 42,294

7 MHz
WT4O 1,287,716
WA1FCN 643,300
KS4S 351,072
KG4IGC.....269,864
WB8K 246,006

3.5 MHz
W9FY 27,354
W8WTS 3,080

QRP
ALL BAND

WK9U 768,593
K2YG.....372,000
N2WK 302,498
AC9KW.....182,484
W6QU (W8QZA) 100,496
WE6EZ.....96,480
W4DWS.....66,576
W4ER 55,913
WS9V 36,875
AI9K.....18,748

14 MHz
WU5K (K5NZ) 49,170
K7XC 12,432

7 MHz
KP2XX/W9 (KP2XX) 2,170

3.5 MHz
W2NTN.....53,928
KH6KG/W5.....25,284

MULTI-OPERATOR
SINGLE TRANSMITTER (HIGH)

WF7X 3,537,756
N4SS 3,294,109
NK5P 3,156,468
WO4D.....2,199,438
K3AJ.....1,356,300
KT1I.....875,792
WB9TFF 660,270
KU1CW 581,160
NØKE 430,122
ND2T 218,136

MULTI-OPERATOR
SINGLE TRANSMITTER (LOW)

K9NR.....2,155,200
NA5NN 1,496,012
WTØDX 696,602
K4MM 335,478
NJ1F.....110,390
W9JWC 5,445

MULTI-OPERATOR
TWO TRANSMITTER

NB3R.....5,889,886
NW8S 4,805,376
NCØDX 4,073,760
NA4DA 2,704,790
KT7E 1,732,470
KB3VQC.....1,638,864
KI6DY 1,186,220
W2MKM.....1,062,360
K3CCR 591,822
AK2S 436,240

MULTI-OPERATOR
MULTI-TRANSMITTER

W3GH.....5,971,467
NR6O 4,575,900

MULTI-OPERATOR
MULTI-DISTRIBUTED

WW4LL.....5,412,376
WV4P 5,378,570
KZ1W 1,553,885

ROOKIE
HIGH POWER

W3MLJ 1,120,434
KN4QDE.....1,456

LOW POWER

NN2DX (W4IPC) 1,374,090
N2OG 335,240
W4SSF 92,232
K3WHD 56,480
KD9NYE 40,812
KI5IXP 40,698
KN1OLA 36,192
KB2S 28,404
W6KSR.....10,556
KO4GBD 5,243

CLASSIC
HIGH POWER

W3LL 1,766,256
AJ6V.....926,187
WJ2P (N2BA) 837,935
WF4W 751,713
AG1RL (W1SRD) 746,428
N7WY 663,534
WQ5L 576,032
NØTA 543,244
W4VIC 368,637
K4WW 366,975

LOW POWER

AB1J.....564,616
KY3W 547,170
WDØT 470,840
WB8BZK.....429,831
KF6RY (W6ZL).....308,275
N3CKI.....307,380
NXØI.....291,082
AG2AA 288,002
K3JT 277,947
AC4G.....273,780

TRIBANDER / WIRES
HIGH POWER

N3QE.....3,500,643
KE2D 2,121,312
N4CW.....2,073,478
KA2K 1,763,694
WT3K 1,685,480
WX2NJ (K2RET) 1,616,470
W2JV.....1,472,166
W2CDO 1,415,340
NR4O 1,344,410
NB6U (N6ZFO).....1,272,480

LOW POWER

WT4O 1,287,716
KM4SII.....1,280,512
NG1M 724,470
AH2O.....606,284
WB8JUI 474,300
K9CW 411,348
AB9YC.....411,140
WA3LXD.....407,880
K7GS.....394,290
AA8OY 380,072

We also introduced the Multi-Distributed category, giving operators an opportunity to try something new by collaborating with other physical stations, helping keep the multi-op torch burning during the pandemic.

Conditions

There was a broad sample of reports on conditions during this contest, ranging from, “GREAT!” to, “not so great.” As most regular contesters are aware, aside from the odd anomaly that boosts scores across the board, this contest – like most others –was favorable in certain areas and a bit more challenging in others. In North America, the general consensus was that most would rather be operating RTTY prefixes than shoveling snow, provided that ice was not weighing down their antennas.

So, with that, let’s take a look at the competition itself and see how it came together.

In the Single-Op High Power (SOHP) All-Band category, CR6K operated by Filipe, CT1ILT, managed to best SN7Q (SP7GIQ), both with scores approaching 10 million points. A couple of well-known North American contesters made the box, and had a close race themselves, with Bud, AA3B, taking top North American honors and narrowly beating AK1W, operated by Randy, K5ZD.

Single-Op Low Power All-Band had another close race with TM3Z, operated by Dimitri, F4DSK, taking the top spot over IK6VXO, who was close behind. The sole U.S. entrant in the top 10 was John, KK9A, who turned in a respectable 4.2 million points to represent North America in this group.

Classic is a category that seems to be gaining more popularity of late. With a shorter operating window and a more traditional approach, new and fierce competition can be found here as well.

...this contest – like most others –was favorable in certain areas and a bit more challenging in others.

The Classic High-Power category produced a clear winner as Manuel, EA8DO, operating as ED8W, solidly took first place with nearly twice the score of the runner up.

In the Classic Low-Power category, there was a tight four-way race with Michael, DK1KC, taking top honors with VE3KI just on his tail as runner up by just 3,000 points.

Vitaly, RM5F, took top QRP All-Band category honors and Jason, WK9U, powered through to win the U.S. Please check the line scores for the Single-Operator, Single-Band QRP winners.

Triband / Wires Overlay

In the High-Power category, GWØA operated by John, GW4SKA, took the top position overall with Tim, N3QE, not too far behind to take the North American lead.

The Low-Power category was won by Yuri, UT4LW, who made a solid showing with a tight race with YL1ZF, who finished in second over third-place finisher 3V8SS (op. KF5EYY).

Rookie Category

There were some big scores in the Rookie High-Power category with Robert, DM7XX, taking top honors over Alexandr, R4SAD, operating as UA4S coming in second. In the U.S., W3MLJ came in first.

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

FT-70DR

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

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144/430 MHz Dual Band 50 W
Digital Transceiver

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

CW/SSB/AM/FM/C4FM
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NN2DX, being helmed by Connor, W4IPC, wisely chose the Low-Power category and managed to take top rookie honors for the world. This was a solid win with the closest European challenger showing with just half the score Connor racked up.

The Multi-Ops

The entire Multi-Single High-Power category top 10 box was dominated by European stations. The IQ4FC station managed to take top honors over team IQ1RY in this category.

The Multi-Single low-power category saw a team operating Alfredo's fine station, WP3C, in Puerto Rico to take top honors in category. EC7MA had a great score for second place in the world but was first place in Europe.

Multi-Two Transmitter top honors were taken by the ED1R contest team, while NB3R (ops. NB3R and NJ3I) were able to take top U.S. honors with a very simple setup. David, NB3R, commented, "one dual-band, 40/20 beam. Wires for everything else. Great fun." Wow, two great WPX calls ... the author speculates they probably discussed which one to use!

The Multi-Multi category was a bit anemic this year, with the pandemic in various stages of flaring up around the world, and the safter Multi-Distributed category as safe haven, which led to only six entrants. DP7D was able to rack up the most QSOs for a solid category win with their first outing in the M/M category. They used only three radios and focused on two bands and that worked to put them on top. The second and third place categories, both in the U.S., had W3GH and a 13-operator team taking top honors and besting the very experienced NR6O team who managed to position themselves in third place overall from the San Francisco area.

Multi-Multi Distributed

We were curious who would take advantage of this new category offering, and some of the callsigns are quite surprising and it's great to offer options even during a global pandemic. The J42S contest team entered this category from Greece and took top honors with a solid 9.5-million point score. IQ3ME with an eight-person Italian team racked up 5.5 million points for second. WW4LL and a seven-person team managed to take top U.S. honors out of Georgia.

The Multi-Multi category was a bit anemic this year, with the pandemic in various stages of flaring up around the world...

Of note is the up-and-coming WV4P team, Ron and Trina Koenig, W4VP and NR4L respectively, who have been working hard to build up their presence in Tennessee. The station was under construction during the contest, so Ron setup a camper to QRV their old station, while Trina operated the new site. The two of them managed to come within striking range of the WW4LL team. We will need to keep an eye on these two.

The Single Banders

High-Power 10 Meters: Luca, IK2NCJ, operating as D41CV, managed to barely edge out Dan, LU1DX, in Argentina to take top honors in the world. NA4W operated by Cort, K4WI, was first place in the U.S.

High-Power 15 Meters: Gunter, V51WH, won first place by narrowly beating CV7S (op. CX7SS) across the Southern Hemisphere pond. Ira, K2RD, was able to position himself on top in the U.S. from his Nevada QTH.

High-Power 20 Meters: Helmut, DF7EE, piloted LX7I to the top in the world, narrowly beating Tibi, HA1DAE, who beat HG1S for second. Dan, NB2P, managed the top U.S. position from New Jersey.

High-Power 40 Meters: Nicola, 9A5W, took the top spot in the world by over a million points. Victor, N8OO, operating

2021 CQWW RTTY WPX BAND-BY-BAND BREAKDOWN — TOP ALL BAND SCORES

Number groups indicate: QSOs / Prefixes on each band

WORLD SINGLE OPERATOR ALL BAND

Station	80	40	20	15	10
CR6K	402/196	1071/471	683/232	450/120	0/0
SN7Q	677/286	1021/362	900/273	51/15	0/0
OM5ZW	567/240	1164/444	711/249	24/20	0/0
AA3B	463/170	944/408	892/292	347/85	1/0
AK1W	466/210	859/341	1117/348	251/67	0/0

USA TOP SINGLE OPERATOR ALL BAND

Station	80	40	20	15	10
AA3B	463/170	944/408	892/292	347/85	1/0
AK1W	466/210	859/341	1117/348	251/67	0/0
K9CT	277/107	768/303	921/374	133/67	0/0
*KK9A	321/122	717/308	796/258	233/59	0/0
WK1Q	218/125	424/195	662/317	191/123	0/0

WORLD MULTI-OPERATOR SINGLE TRANSMITTER

IQ4FC	487/153	1489/562	1271/387	121/39	0/0
IQ1RY	519/179	1259/509	1025/327	167/72	0/0
OL57ZW	553/195	1277/501	1018/360	0/0	0/0
9A5D	510/147	852/351	1089/424	122/47	0/0
OK7O	609/253	884/384	808/263	49/12	0/0

USA MULTI-OPERATOR SINGLE TRANSMITTER

WF7X	198/39	832/335	1041/327	45/31	0/0
N4SS	270/60	640/325	673/254	154/42	3/2
NK5P	161/32	904/422	862/237	46/18	0/0
WO4D	99/22	681/343	902/272	7/2	0/0
*K9NR	178/80	696/287	513/215	39/16	2/2

WORLD MULTI-OPERATOR TWO TRANSMITTER

ED1R	260/84	912/418	907/342	475/119	0/0
YL2UI	436/216	886/265	1035/367	71/19	0/0
NB3R	506/212	810/311	1020/314	105/37	0/0
NW8S	629/198	941/317	670/191	199/62	0/0
NC$$DX	420/89	895/334	906/260	220/52	5/1

USA MULTI-OPERATOR TWO TRANSMITTER

NB3R	506/212	810/311	1020/314	105/37	0/0
NW8S	629/198	941/317	670/191	199/62	0/0
NCØDX	420/89	895/334	906/260	220/52	5/1
NA4DA	72/19	625/285	733/272	337/93	2/1
KT7E	47/13	563/218	680/192	391/87	0/0

WORLD MULTI-OPERATOR MULTI-TRANSMITTER

DP7D	868/311	1318/419	897/277	292/80	1/0
J42S	779/222	1283/403	722/176	283/77	1/1
W3GH	577/177	964/316	933/275	330/83	0/0
IQ3ME	549/186	861/331	554/242	113/41	2/1
WW4LL	378/96	1028/367	963/304	303/73	5/2

USA MULTI-OPERATOR MULTI-TRANSMITTER

W3GH	577/177	964/316	933/275	330/83	0/0
WW4LL	378/96	1028/367	963/304	303/73	5/2
WV4P	413/105	924/363	876/312	229/85	0/0
NR6O	482/90	880/278	844/218	693/113	10/1
KZ1W	224/53	452/198	470/197	248/57	4/0

as WQ5OO turned in another solid performance to take top U.S. honors.

High-Power 80 Meters: Emil, 9A9A, chose to take on the 80-meter band this year and was successful in winning the category narrowly over fellow Croatian station 9A5X. WW2R operated by Stephen, N2CEI, finished first in the U.S.

Low-Power 10 Meters: A win for Takeshi, JF1OVA, who was unable to make too many QSOs but had enough to win the category with XE2N picking up second place.

Low-Power 15 Meters: A great score from Pekka, EA8AH, bested second place PY2UD in the world. Steve, W9SN, with a fair showing, was good enough to take top U.S. honors.

Low-Power 20 Meters: EF1A operated Juan, EA1X, took the solid win over another great effort by LZ2JA, who finished in second place in the world. James, W4LC, finished first in the U.S.

Low-Power 40 Meters: Winfried, DK9IP, powered through the band in low power for the win. WT4O finished first in the U.S.

Low-Power 80 Meters: Petar, 9A6A, won first place in the world with by over a million points. There were only two entrants in category from the U.S. and Olaf, W9FY, came out on top.

Congratulations to the Winners

On behalf of Ed, WØYK, and the entire CQ WPX RTTY team, we hope you had fun and are looking forward to the next run. As of this writing things are looking very good here in North America for a return to traditional contest conditions, and we certainly hope the same for all of our worldwide RTTY contesting colleagues.

– 73, Chris Tate, N6WM

(Scores begin on page 93)

EUROPE TOP SINGLE OPERATOR ALL BAND

Station	80	40	20	15	10
CR6K	402/196	1071/471	683/232	450/120	0/0
SN7Q	677/286	1021/362	900/273	51/15	0/0
OM5ZW	567/240	1164/444	711/249	24/20	0/0
*TM3Z	531/248	1062/391	447/208	62/30	0/0
SO9I	533/258	797/302	600/253	88/50	0/0

EUROPE MULTI-OPERATOR SINGLE TRANSMITTER

IQ4FC	487/153	1489/562	1271/387	121/39	0/0
IQ1RY	519/179	1259/509	1025/327	167/72	0/0
OL57ZW	553/195	1277/501	1018/360	0/0	0/0
9A5D	510/147	852/351	1089/424	122/47	0/0
OK7O	609/253	884/384	808/263	49/12	0/0

EUROPE MULTI-OPERATOR TWO TRANSMITTER

ED1R	260/84	912/418	907/342	475/119	0/0
YL2UI	436/216	886/265	1035/367	71/19	0/0
EA2ESZ	186/77	502/159	713/281	476/207	0/0
DM5B	557/238	565/212	277/137	75/37	0/0

EUROPE MULTI-OPERATOR MULTI-TRANSMITTER

DP7D	868/311	1318/419	897/277	292/80	1/0
J42S	779/222	1283/403	722/176	283/77	1/1
IQ3ME	549/186	861/331	554/242	113/41	2/1
IR9K	309/165	721/199	802/305	187/65	6/1
DR3W	484/222	519/263	471/256	32/17	0/0

2021 WPX RTTY CLUB SCORES

United States

Club	# Entrants	Score
POTOMAC VALLEY RADIO CLUB	85	42,525,469
FRANKFORD RADIO CLUB	47	38,134,928
SOCIETY OF MIDWEST CONTESTERS	59	30,838,265
NORTHERN CALIFORNIA CONTEST CLUB	60	28,690,022
YANKEE CLIPPER CONTEST CLUB	31	21,833,340
ARIZONA OUTLAWS CONTEST CLUB	27	15,790,326
FLORIDA CONTEST GROUP	20	9,657,999
WILLAMETTE VALLEY DX CLUB	24	7,020,545
MINNESOTA WIRELESS ASSN	26	6,017,176
DEEP DIXIE CONTEST CLUB	4	5,800,244
KENTUCKY CONTEST GROUP	12	5,795,494
WESTERN WASHINGTON DX CLUB	25	4,859,766
TENNESSEE CONTEST GROUP	16	4,033,018
KANSAS CITY CONTEST CLUB	8	3,898,363
SWAMP FOX CONTEST GROUP	11	3,829,939
CENTRAL TEXAS DX AND CONTEST CLUB	6	3,724,445
DFW CONTEST GROUP	14	3,646,429
GRAND MESA CONTESTERS OF COLORADO	9	3,570,450
ORDER OF BOILED OWLS OF NEW YORK	6	3,438,506
NORTH COAST CONTESTERS	9	2,851,959
SOUTH EAST CONTEST CLUB	9	2,577,594
NE MARYLAND AMATEUR RADIO CONTEST SOCIETY	14	2,412,310
ALABAMA CONTEST GROUP	12	2,156,214
SOUTHERN CALIFORNIA CONTEST CLUB	16	1,963,844
NIAGARA FRONTIER RADIOSPORT	8	1,844,612
CAROLINA DX ASSOCIATION	9	1,532,687
SPOKANE DX ASSOCIATION	8	1,433,062
BAY AREA DXERS	5	1,087,622
HUDSON VALLEY CONTESTERS AND DXERS	5	731,974
METRO DX CLUB	7	653,710
AARDVARK WIRELESS GROUP	5	568,026
MAD RIVER RADIO CLUB	6	217,599

DX

BAVARIAN CONTEST CLUB	125	95,865,947
ITALIAN CONTEST CLUB	95	75,109,498
UKRAINIAN CONTEST CLUB	63	69,108,064
EA CONTEST CLUB	35	44,920,673
INTEREST GROUP RTTY	28	40,915,704
CROATIAN CONTEST CLUB	15	21,866,907
RHEIN RUHR DX ASSOCIATION	42	17,649,933
CONTEST CLUB ONTARIO	33	17,628,801
VYTAUTAS MAGNUS UNIVERSITY RADIO CLUB	15	16,863,668
LATVIAN CONTEST CLUB	7	15,619,566
SLOVENIA CONTEST CLUB	11	14,397,307
CONTEST CLUB SERBIA	11	13,644,372
CZECH CONTEST CLUB	5	10,976,136
CONTEST CLUB FINLAND	10	9,287,196
5NNDXCC	12	8,961,714
SOUTH URAL CONTEST CLUB	4	8,648,943
LA CONTEST CLUB	5	8,223,099
RUSSIAN CONTEST CLUB	17	7,465,069
ORCA DX AND CONTEST CLUB	15	7,235,618
CONTEST GROUP DU QUEBEC	7	6,922,996
SP DX CLUB	12	6,668,453
ARAUCARIA DX GROUP	17	6,584,915
BELARUS CONTEST CLUB	5	5,250,236
KAUNAS UNIVERSITY OF TECHNOLOGY RADIO CLUB	5	4,486,590
CONTEST CLUB BELGIUM	17	3,802,320
KRIVBASS	5	3,355,241
CHILTERN DX CLUB	6	3,180,162
CLIPPERTON DX CLUB	8	3,145,060
OKAYAMA DX CLUB	4	3,022,431
RIO DX GROUP	10	2,915,052
SHARKS DX TEAM	4	2,669,331
RUSSIAN CW CLUB	5	2,634,769
LU CONTEST GROUP	7	2,346,006
RUSSIAN DIGITAL RADIO CLUB	16	2,179,618
MEDITERRANEO DX CLUB	5	2,162,592
HA-DX-CLUB	4	2,087,658
YB LAND DX CLUB	52	1,672,163
THRACIAN ROSE CLUB	8	1,527,907
VK CONTEST CLUB	8	1,263,342
POLISH RADIOVIDEOGRAPHY CLUB	4	1,199,528
RTTY CONTESTERS OF JAPAN	8	1,164,205
DANISH DX GROUP	4	1,134,097
GIPANIS CONTEST GROUP	4	958,172
SIAM DX GROUP	6	915,392
CATALONIA CONTEST CLUB	8	714,414
GMDX GROUP	5	700,520
ARCK	5	693,834
SK5AA VASTERAS RADIOKLUBB	4	628,070
599 CONTEST CLUB	4	605,602
CABREUVADX	11	419,922
YB6_DXC	13	172,278
YB7-DX CLUB	10	162,220
RADIO CLUB VENEZOLANO CARACAS	4	126,370
CDR GROUP	5	98,496
YBDXPI	4	83,193

Club scores with 4 or more entries.

K9ARZ reflects on three station accessories that made his early days in ham radio much more successful and fulfilling.

Three "Gifts" From Heathkit

BY LAWRENCE W. STARK,* K9ARZ

For those of you who do not remember the "halcyon days" of ham radio during the late 1950s and early 1960s, let me say it was a magical time for the amateur service. Sunspots were numerous and the manufacturers of amateur radio equipment did their best to provide us with numerous offerings of domestically produced radios. Back then, radios were large and heavy, with lots of steel used in their manufacture. I personally lusted after my good friend Zack's[1] Hallicrafters SX101A receiver. Unfortunately, the cost of the SX101A at that time was far beyond what I could afford with my lawnmowing and part-time water meter reading jobs while in high school. I had to settle for a 15-year-old used receiver that I purchased from Allied Radio's inventory of reconditioned gear. That first really quality multi-band receiver, a Hallicrafters SX-25, was a big improvement over the S-38 that I used as a shortwave listener or my single-band war surplus BC-454. The SX-25 was only reasonably sensitive but it did have a crystal filter circuit that was capable of rather sharp selectivity if adjusted properly (using the CW pitch control along with the crystal phasing adjustment). Unfortunately, the crystal filter, once adjusted, introduced some loss to the receiver that wasn't the most sensitive to begin with.

Heathkit's First Gift

During those times, I always had my nose in the ham radio publications. I devoured old issues of *CQ* and *QST* magazines, which were given to me by one of my mentors, Bill Nolan, W9TQL.[2] I read the magazines over and over until the covers fell off and the bindings came apart. I did notice in some of the station pictures, a little box perched atop a receiver. That device looked like something I had seen in a Heathkit advertisement. The device was my first "gift" from Heathkit, the QF-1 Q-multiplier kit (*Photo A*). I read the advertisement for the Q-multiplier and thought it might help improve the performance of my SX-25 receiver. I call it my first "gift" from Heathkit, and although it wasn't a "free gift," at the $9.95 price tag, it was well within my lawnmowing and meter-reading budget. After purchasing the QF-1, I still had money left over for dates and gasoline (24 cents a gallon) for my father's car when I needed it. The only other Q-multiplier available at that time was Millen Model DQ, which sold for more than twice the price of the QF-1 in kit form.

Well, I connected the completed QF-1 to my SX-25 and was totally amazed at the performance of the device. In the peaking mode, it could bring a weak signal up well above the noise level while narrowing the passband when receiving AM and CW signals. In the peak mode it functioned similar to today's APF (audio peak filter), but it was more effective than an APF because it functioned in the IF (or mixer) rather than the AF chain.

In the null mode, the QF-1 could be used to "notch out" unwanted carriers such as nearby CW stations or those annoying carriers that plagued the AM portions of the band. Technically speaking, the Q-multiplier is an oscillator circuit that is regenerative but kept below the point of regeneration or oscillation. When coupled to the mixer plate or plate of the first IF stage (remember, these were all tube radios at the time), the Q-multiplier raises the "Q" of the tuned circuits thus improving the selectivity and sharpening the received signal. The QF-1 was designed for receivers having an IF of between 450-460 kHz. Many of the receivers of the 1940s and 1950s had IFs of 455-456 kHz. That included the following Hallicrafters receivers: S-20R, SX24, SX25, SX28, S-40, S40A&B, S-85, SX-42, SX-99, S-108, SX-110 etc.; Nationals included: HRO, HR0-5&7, NC-57, NC-88, NC-98,

Photo A. The author's Heathkit QF-1 Q-multiplier (top), still in use today with his Hallicrafters SX-25 receiver.

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NC-188, NC-109, etc.; Radio Manufacturing Engineers receivers: RME-45, RME-69, RME-4300, RME-4350; Hammarlund receivers: HQ-120, HQ-129, HQ-140, and a myriad of others. Again, any receiver with an IF near 455 kHz (not including AC/DC types) could be used with the QF-1.

Heathkit's Second Gift

After upgrading from Novice to General, like many at that time, I was confounded by crystal control. Novices were required to operate their transmitters at no more than 75 watts input power with crystal control of the frequency. Many novices, like myself, had only a few crystals to use with their transmitters. I remember having a 3713 kHz and 3747 kHz for 80 meters (the novice band ranged from 3700-3750 kHz at that time).

For 40 meters, I had a 7175-kHz crystal (7150- to 7200-kHz novice range on 40 meters), and a 7051-kHz crystal which tripled to 21153 kHz (21,100- to 21,250-kHz range) for 15 meters. The common practice was to get on and call CQ on one of your crystal frequencies, and then on receive to "tune the band" to listen for an answer. As I recall, most of my contacts on the novice bands were completed "split frequency." Some contacts were made on the same frequency because most of the crystals used were military surplus and were for channelized military frequencies during World War II. So, it was possible for novices to have crystals on the same frequency.

When operating AM (even by 1960, SSB was occupying a small portion of the phone bands), there were a large number of operators using crystal control of their AM transmitters, especially those using "homebrew" gear. Home construction of vacuum tube VFOs (variable frequency oscillators) was possible, but not for the faint of heart. Mechanical integrity and electrical stability were issues one had to deal with. I tried several times to build a VFO circuit from a magazine article, but instability and drift doomed my efforts.

So if you were operating in the AM portion of the band, besides the wail of annoying heterodynes caused by the beating of one carrier with another, you were likely to hear the following: "CQ, CQ, CQ, this is W9XXX, W9XXX, W9XXX, calling CQ on 75 meters and tuning, 'K' someone please." So just as novice operators used split-frequency operation, many higher license classes of ham operators still used split-frequency operation due to crystal control or to facilitate contact with those who were "rock bound."

VFOs were available during that time period, but they were either relatively expensive or built into newer radios such as the Heathkit DX-100, Viking Ranger, Viking Valiant, or Collins 32V series of transmitters. All of those transmitters were well beyond my meager budget so I looked for something less expensive that I could connect to my Heathkit DX-35 transmitter to allow for frequency agility.

The answer to what I looked for was the Heathkit VF-1 VFO kit (*Photo B*). The VF-1 easily fit into my budget with its kit price of $19.50, less than half the price of the Johnson Viking VFO that was designed to be used with the Johnson Viking I and II model transmitters. The VF-1 uses a single oscillator tube (6AU6) and voltage regulator tube (0A2) to improve its stability. Both the Heathkit VF-1 and the Johnson VFO are similar in size and in performance. The average output of the VF-1 is approximately 10 volts, which is sufficient to drive most transmitters. I am currently using my VF-1 with an old Johnson Viking Adventurer CW transmitter. The keying circuit of the VF-1 is tied into the keying circuit of the transmitter, which

Photo B. The author's Heathkit VF-1 external VFO is currently teamed up with his classic Johnson Viking Adventurer transmitter.

Photo C. Heathkit's AM-2 made it affordable for a ham on a tight budget to have an SWR meter that could operate under full power and be left inline all the time. (Photo from Penson, Heathkit: A Guide to the Amateur Radio Products, Second Edition, CQ Communications Inc., 2003)

allows for ease of operation. The keyed signal is amazingly stable for a combo that is over 60 years old. When I first hooked up the VFO there was a bit of AC on the CW note, but that was cured by re-soldering the connections on the 6AU6 tube socket. Either on the DX-35 back in 1961, or connected to my Adventurer in 2020, the VF-1 has performed beyond my expectations. Connecting the output to a frequency counter, I find the dial readout of frequency to be superior to that of most transmitters of that era. Also, the circuitry of the VF-1 is identical to the VFO used in the Heathkit DX-100 and DX-100B transmitters.

Heathkit's Third Gift

At present, we amateurs are slaves to SWR (standing wave ratio) and why not? The SWR on a feedline (coaxial cable in this case) is an indication of reflected power vs. forward power on that line. If the SWR is too high, we are losing precious energy that is dissipated as heat along the line. In the old days when most hams were using balanced line, RF ammeters or light bulb samplers were used to indicate whether RF energy was moving up the feedline or not. When we made the transition to coaxial cables to feed energy to our antennas, other techniques were used to determine the effectiveness of our coupling devices and matching systems. When I put up my first doublet antenna, I consulted the handbook. The book indicated the formula for determining the total length of the antenna. The formula used was the (hopefully) familiar *468/freq in MHz = length of the antenna in feet*. Once the antenna was measured, cut, and assembled with the coaxial feedline, it was attached to the transmitter, and if the transmitter loaded according to the manual, you assumed the antenna was okay and ready for use. In the 1950s, I would guess that there were more stations *not* using devices for measuring SWR than those who were. I am basing this generalization on the published pictures of amateur radio stations that appeared in *CQ* and *QST* magazines at the time. The *ARRL Antenna Book* provided a circuit for an SWR bridge that could be used to determine the reflected power on a coaxial line, but it required a very low-power signal source and could not be left in the line for constant monitoring of the antenna's efficiency.

Then came the third "gift" from Heathkit, the model AM-2 Reflected Power Meter (*Photo C*). Like the previous two "gifts," the AM-2 was advertised at the very reasonable kit price of $15.95, far below the cost of the Jones Micro-Match or the E.F. Johnson reflectometer (same as the one that was later incorporated into the later model Johnson Matchboxes).

The AM-2 could be easily assembled in an evening. When connected in series with the coaxial cable from the transmitter to the antenna, the AM-2 indicates the percentage of reflected power, the SWR from 1:1 to 6:1,[3] and provides a relative forward power reading that can aid in tuning up a traditional transmitter, or indicate added output when an amplifier is switched in. Now you no longer had to guess if you had cut your antenna to the proper length for the band in use. You had a good indicator of the relative efficiency of your antenna and you could leave the SWR meter "in-line" to allow for the continuous monitoring of your transmitted signal. I no longer own an AM-2, having replaced mine with Heathkit SWR / wattmeters that provide me with a more complete picture of actual forward power from my transmitter or amplifier.

Conclusion

The Heath Company has provided amateur radio operators with many quality examples of transmitters, receivers, and other accessories over the years, not to mention well-designed test gear to permit us to service and design our own gear. I have owned or built the following Heathkit kits since that time: DX-20, DX-35, DX40, DX-100, Apache, SB-301, SB-401, HW-32A, HW-101, SB-101, SB-102, SB-200, SB-220, SB-104, HW-5400, SA-2014, SA2016A, HM-102, HM-2140, and many pieces of Heathkit test equipment, not the least of which was the Heathkit grid dip meter.[4] All of these were great examples of Heath engineering and some of these items I still own and use today. But I will never forget the "three gifts" from Heathkit[5] that came at a very critical time in my ham career, when affordable aids to my operating convenience were made available. Thank you Heathkit, we miss you, and your products. (*Editor's note: Heathkit has returned, with new owners and a limited product line. Among its focal points today are products intended to help builders learn and practice the art of surface-mount construction. See <www.heathkit.com>.*)

Notes:

1. Julius Zaccagnini, then W9EQW, now AAØU.
2. William J. Nolan, W9TQL, then Chief Engineer WLS Radio, Chicago.
3. Later models of the AM-2 indicated SWR to 3:1.
4. Details on any of the Heathkit amateur products can be found in Chuck Penson's book: *Heathkit: A Guide to the Amateur Radio Products*, Second Edition, CQ Communications Inc., 2003.
5. All three of the "gifts" from Heathkit were eventually replaced with updated versions: The QF-1 was replaced by self-powered models, the HD-11 and the GD-125. The VF-1 VFO was replaced by the HG-10 (redesigned) and could be used with both cathode-keyed or grid-block keyed transmitters. The AM-2 was replaced by the HM-11 and HM-15, which were essentially the same circuit in a cosmetically re-designed package.

18+

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Now, this is dedication … the Heathkit K-1 receiver the author purchased online was in such bad shape that he had to recreate the front panel! Read how he did it, along with restoring the rest of the radio, inside and out.

Restoring the Original Heathkit – The K-1 AM "All-Wave" Receiver

BY RAY GRIMES,* N8RG

The K-1 medium-wave and shortwave AM radio was Heathkit's first electronics kit, offered from 1948 through 1949.[1] The Heath Company itself, though, goes back to the early 1900s when it manufactured and sold airplane kits.[2]

Edward Bayard Heath designed and built a series of aircraft starting in 1909 with a Bleriot-inspired monoplane. Heath purchased the Chicago-based Bates Aeroplane Company in 1912, founding the E.B. Heath Aerial Vehicle Co., later becoming the Heath Airplane Company. His company produced the Heath Feather and Heath Favorite after World War I, and later the Heath Parasol series of aircraft powered with Henderson motorcycle engines.

Some years after Heath's death (in an unfortunate airplane testing accident in 1931), the company was eventually purchased and after World War II, changed its product line to kit electronics. It went through a variety of owners over the years until the Heathkit Education Company of Benton Harbor, Michigan, filed for bankruptcy and closed in 2012.[3] In 2019, a successor company established a live website at <www.heathkit.com>. According to its website, Heathkit is back in business, making a limited line of electronics kits and offering a variety of interesting products and services.[4] Heathkit's early success and profitability, along with electronics hobby kit affordability, was undoubtedly founded on its designs around abundant supplies of war surplus NOS (New Old Stock) electronics components that were readily available from government auctions and sales for pennies on the dollar.

The Heathkit K-1 advertisements (*Photo A*) listed pricing at $8.75 ($97.40 in 2021 dollars) for the receiver kit, an optional 2-1/2-inch permanent magnet loudspeaker for $1.95, and headphones for $1.00. The K-2 successor radio kit also offered an optional mahogany cabinet for $2.50. There is ambiguity as to whether more than one plug-in coil was necessary to receive all of the 550 kHz to 6.0 MHz advertised tuning range. From my test of the restored K-1, I'd guess that this radio was designed to cover the entire broadcast and shortwave range with one coil, as selectivity and overload protection is seriously lacking in the design. In fact, a few feet of antenna wire seems to work better than a longwire antenna, improving the K-1's ability to separate stations and to prevent overload. Regardless, the K-1's tuning and regeneration control operation is a delicate balancing act, in which this radio is prone to self-oscillation and saturation as would be expected for such a simple regenerative radio design.

Photo A. An ad for the Heathit K-1 "All-Wave" radio kit. It covered the AM broadcast band and shortwave through 6 MHz (actually, Mc in those days). (Image courtesy rigreference.com)

The Basic Circuit

The Heathkit K-1 employs a three vacuum tube circuit (*Figure 1*), with one 12C8 (VT-169) and two 12A6 (VT-134) tubes. The 12C8 operates as a regenerative receiver and AM detector, feeding a 12A6 tetrode audio amplifier stage that drives an audio output transformer and speaker. A second 12A6 tetrode performs as a half-wave rectifier, producing around 150-volts DC. The 12A6 rectifier plate and two grids are tied together, operating as a diode (12A6s must have been abundant and cheap).

This regenerative receiver operates from a built-in transformer-operated 120-volt AC power supply, with internal speaker and plug-in band coils. The circuitry is efficiently laid-

* *Email: <aero-one@verizon.net>*

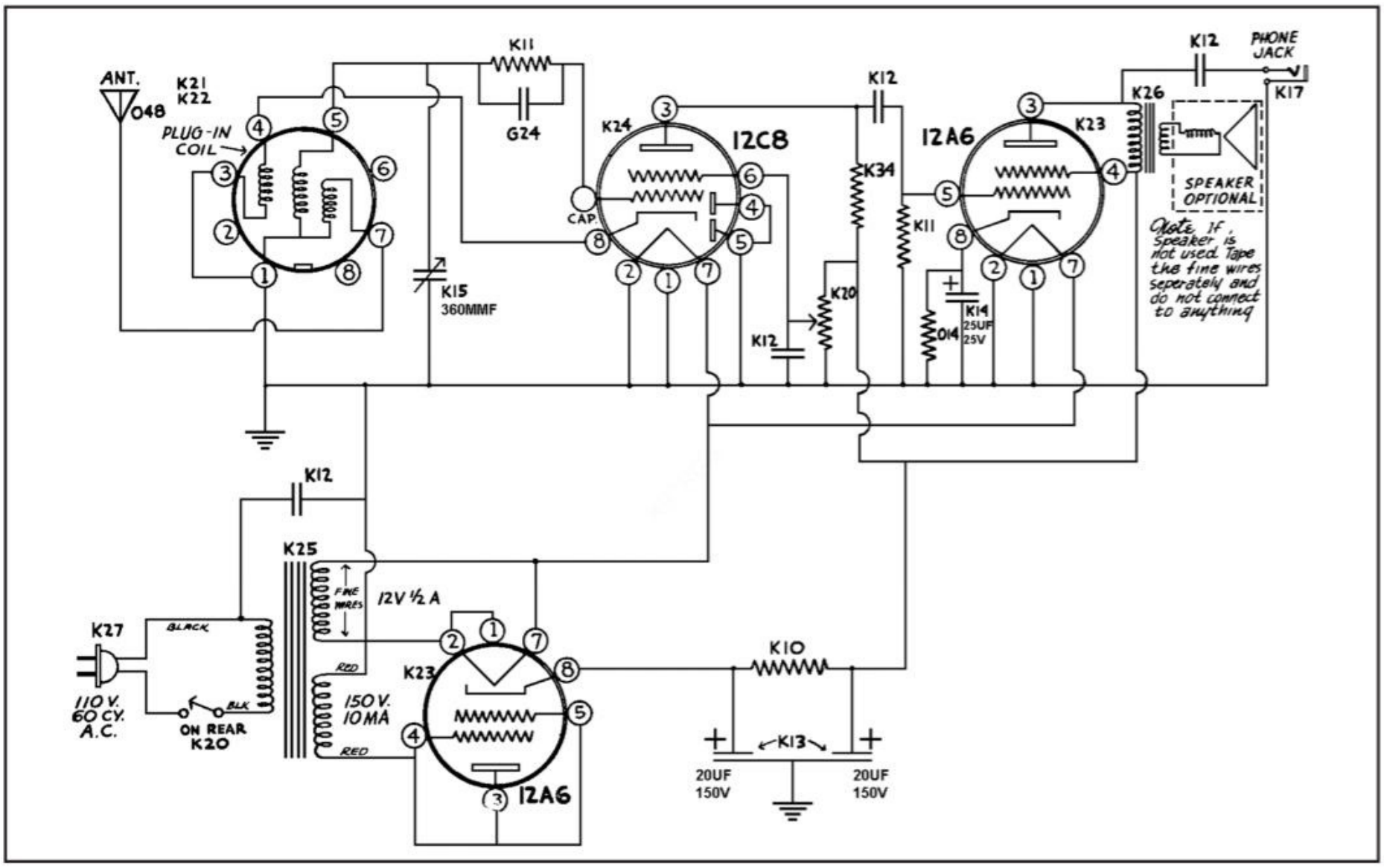

Figure 1. Schematic of the K-1 as it appeared in the construction manual. (Heath Company image)

out in a 6-1/2- x 5-inch package. The front panel includes a 2-1/2-inch speaker, an earphone jack, a tuning control, and a combined regeneration and power ON/OFF switch (though the regeneration function isn't labeled).

My Heathkit K-1 quest began with a previous eBay search for vintage ham radio equipment, finding an auction for a rare K-1 radio receiver. Unfortunately, I wasn't aggressive or willing to spend enough to capture this prize. I continued to watch for another Heathkit K-1 radio and much to my surprise, one appeared a couple months ago and I was the happy auction winner, though it cost me $136. My K-1 was a mess, showing signs of poor storage over the past 70 years, with considerable front panel and chassis corrosion and rust (*Photos B*, *C* and *D*). Regardless, it was still an important historical item that deserved careful restoration.

Starting the Restoration

When restoring vintage electronics, I start by testing all vacuum tubes, then replacing all original paper and wax capacitors. It's been my experience if I replace defective tubes and all original capacitors, vintage radios will more than likely work on the first try (unless they suffered mishandling, a short circuit or fire, or that someone got their hands into it first). I then replace brittle AC cords (as they present a fire and shock hazard). Once the tubes and capacitors have been replaced and the chassis cleaned using an air hose, I can power-it up using my Variac® rheostat to slowly bring up the line voltage (lis-

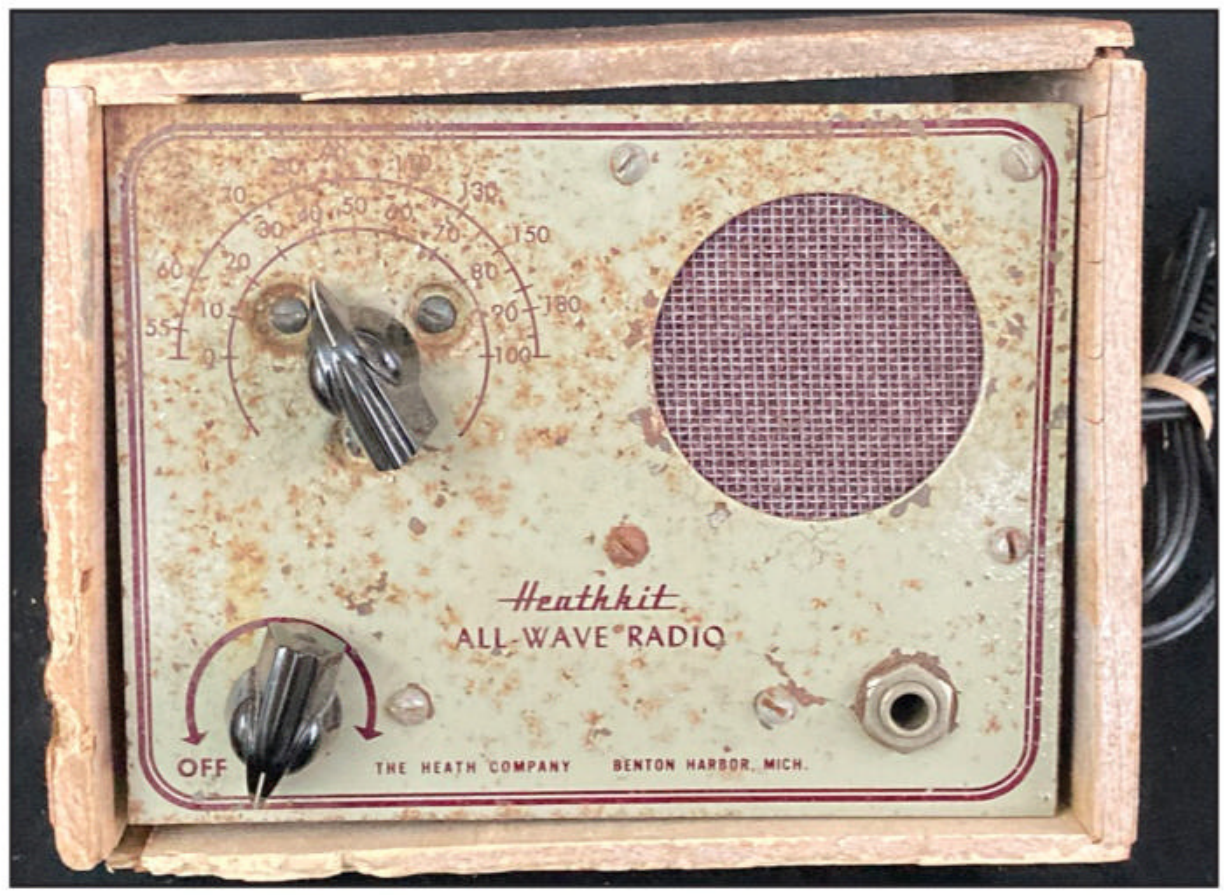

Photo B. The author's "new" K-1 before restoration.

tening for crackling and sizzling, and maybe a bad smell). When reaching full line voltage through the Variac, it's likely that the radio under test will work.

Unfortunately, I soon recognized that one of the transformer secondary wires was hanging free, which was a sign that someone had attempted to troubleshoot a problem but hadn't completed the repair. I determined that the 12-volt secondary winding was open-circuit, although the 150-volt high-voltage winding was intact. With some effort, I located a replacement power transformer that was small enough to fit in the original space.

Photo C. The chassis of the K-1 was in nearly as bad shape as the front panel!

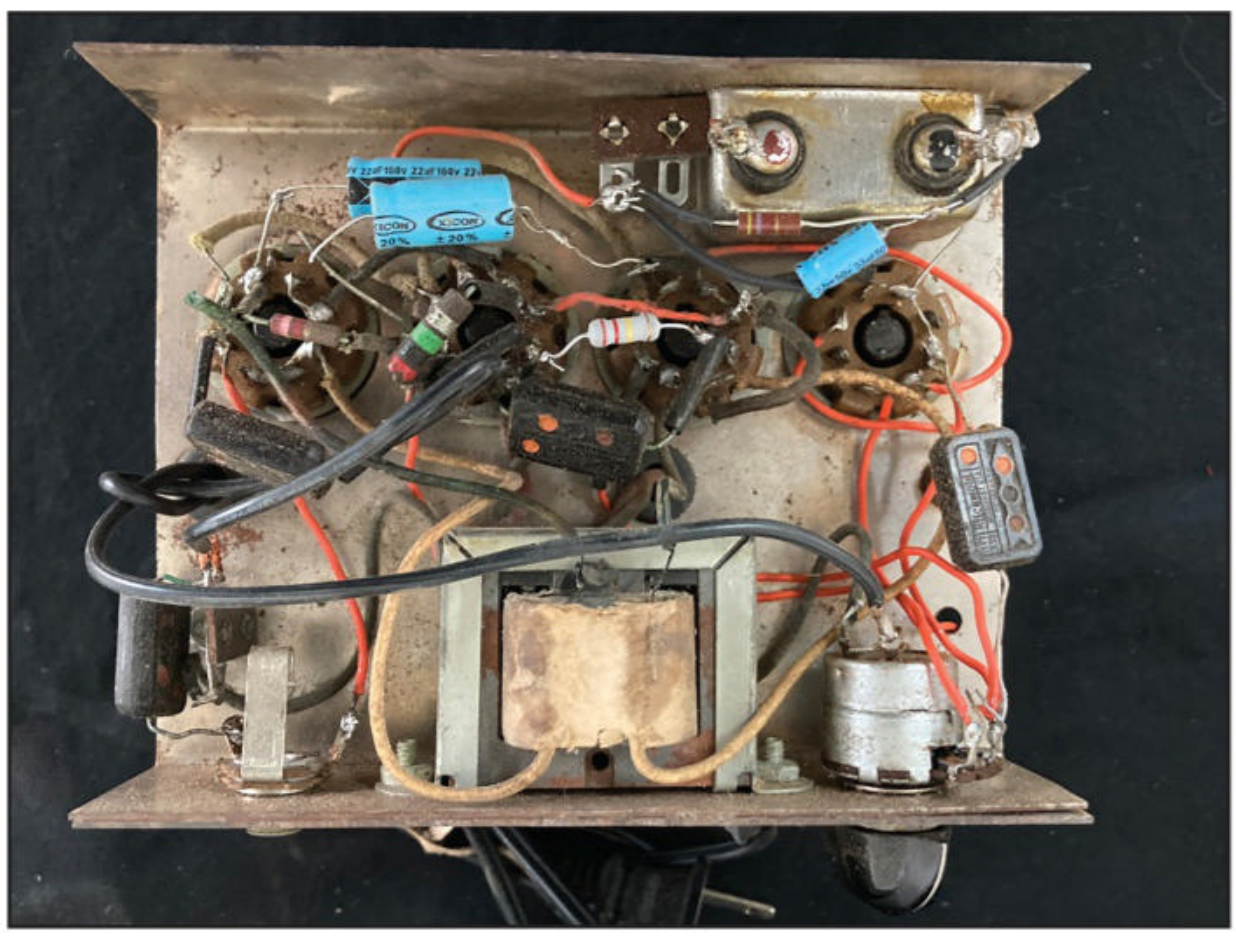

Photo D. Somehow, the underside managed to stay in slightly better shape than the rest of the radio.

Upon replacing the power transformer, the radio still didn't work. After resoldering several connections, and upon closer inspection, I discovered that the original kit builder (some 70 years ago) attached the transformer wire from a tie strip to one of the power switch terminals but failed to solder it. After that quick repair, the radio came to life.

The next challenge was to attempt a cosmetic repair of the chassis surface which was badly corroded and pitted. Chemical rust remover / reverser had little effect on the surface damage. I then decided to carefully remove the surface rust using sandpaper and steel wool, being careful to not allow metal chips and debris to fall into the circuitry. I then masked and applied a metal-colored spray paint to the chassis. I also removed each vacuum tube and masked them (protecting the white labelling), applying flat black paint to cover scuffs and rust.

The biggest challenge was the K-1 front panel. As with the chassis, chemical rust remover / reverser had little effect, and wouldn't be able to help with the paint loss and panel metal pitting problems. I decided that only a new front panel would suffice. I took a high-resolution digital photograph of the damaged front panel then proceeded to repair the image using Corel PaintShop Pro©, repairing every defect one pixel at a time. This process took around 8 hours but the result was well worth the effort. I then located a company that made color photograph murals on 1/16-inch sheet aluminum. There are numerous companies offering large format metal prints but I found only one that listed a 5- x 7-inch print option (though custom size adjustments weren't offered).[5] I had concerns that the colors might not be permanent and that flaking of the print material might occur. Most fortunately, the print arrived within a week from ordering, the printing was well-bonded to the aluminum, and the colors and resolution were outstanding.

I then trimmed the metal print edges slightly to the original panel dimensions, using a nibbler tool and small file. I then cut out the speaker grill which was not as difficult a job as I first expected. I used a large hole punch tool then a nibbler tool and small file to reach the proper speaker hole diameter. The original panel served as a template to locate the

Photo E. N8RG had to recreate the front panel by taking a high-resolution photo of it, filling in the pitting and other damage pixel-by-pixel and then having the "new" image printed onto a piece of sheet aluminum.

Photo F. The restored chassis reinstalled in the original builder's homebrew wooden cabinet.

Photo G. The final product, looking like new (or maybe even a little better!)

controls and headphone jack connector holes for the new panel (*Photo E*).

The crowning touch was a rebuild of the seriously decayed wooden cabinet that I suspect the original kit builder made, as a wooden cabinet option wasn't offered until the K-2 version (1949-1950). The K-2 cabinet had 3/4-inch walls, unlike the home-built cabinet that came with my K-1, made with 3/8-inch stock. I clamped and glued the original cabinet pieces to restore the unit's integrity then glued 3/4-inch pine plywood over it. Finally, I added 3/4-inch wood molding to the cabinet front edge, finishing by sanding then applying two coats of walnut stain and an overcoat of Deft© satin clear wood finish to smooth the surface.

A "Like New" Result

This Heathkit K-1 restoration was a fun project that required some electronics and basic woodworking skills and a lot of creativity, combined with 15 hours of labor and around $50 in materials. The end product (*Photos F* and *G*) is a "like new" restoration of a memento reaching back to the origins of commercially available radio kits that no doubt sparked interest and skills in many of us that lead to rewarding lifetime hobbies and careers.

This Heathkit K-1 restoration was a fun project that required some electronics and basic woodworking skills and a lot of creativity...

Credits and References:
1. <https://tinyurl.com/2eavym2s>
2. Edward Bayard Heath (Wikipedia) <https://tinyurl.com/4phbh44j>
3. <https://tinyurl.com/yuwbx5m2>
4. <https://tinyurl.com/3nyvxfpn>
5. <https://tinyurl.com/k72ky69y>

Want to bring a piece of ham radio's golden age into your station … and put it on the air? K3MD walks us through the process of restoring a favorite transmitter of the 1960s and '70s, the Heathkit DX-60.

Restoring a Heathkit DX-60 Transmitter

BY JOHN W. THOMPSON,* K3MD

There have been numerous articles in *CQ* and *QST* magazines recently on restoring tube-type receivers and transmitters from the 1950s and '60s. In this article, we will present the restoration of a Heathkit DX-60 transmitter as a how-to article. I have restored around 20 tube-type amateur radio transmitters and receivers, and this article will only cover the very basics of restoring vintage gear. I am mainly a high-speed CW contester, VHF contester, CW ragchewer, microwave wannabe, and dabbler in local ham radio politics, and am not an "expert."

In this day of the COVID-19 virus, hamfests are few and far between, so eBay, QTH.com classifieds, and eham.net classifieds are the current main source of gear, as well as local amateurs, some of whom would drop used gear off unprotected from the weather at our clubhouse (Susquehanna Valley ARC). The clubhouse has since been reclaimed by the county airport, after demanding removal of our three towers and a Hustler 5BTV vertical.

Be extremely careful bidding on eBay (obviously). If the price is on the low side, there is a problem with the gear that is not described. For instance, a Heathkit MT-1 mobile AM transmitter I recently restored had a frozen band switch, which I forced to 40 meters, and proceeded from there. For shipping, I prefer FedEx or UPS ground to the USPS, which will almost surely damage your radio, especially if is inadequately packed. Inadequate packing is common.

Photo A. Unrestored DX-60 (underside, case removed).

Getting Started

The DX-60 in question is illustrated in *Photo A*, with the case removed and flipped upside down. You must first spray adequate non-filming contact cleaner on all switches and controls. Use of Dexoit™ is often indicated. However, I find that this agent needs to dry overnight, and you may still find unevaporated residue on the chassis. It should be used sparingly. Work each control to its full range several times. Switch detents are often gone, and may be unrepairable. This has no effect whatever on switch functionality. I use an analog meter (Simpson 260 or Tenma, 20,000 ohms per volt sensitivity) to check ohmic and voltage values. The DX-60 may curse you permanently if you use a digital meter. Sometimes use of a VTVM with its 15-megohm input resistance will be required, particularly in the grid and screen circuits of amplifier stages. VTVMs are prolific on eBay and most are extremely easy to restore (unless they fall into the impossible-to-restore category, which some do).

As far as cleaning the chassis, I personally just use a moist cloth. One can also use contact cleaner. You will find that rust on top of the chassis is inconsequential in most cases, unless it affects an electrical contact or some sort of RF shielding.

All paper capacitors must be replaced. I use 600-volt mylar capacitors obtained online from Bob's Antique Radios and Electronics, <radioantiques.com>, as illustrated in *Photo B*. Order the starter kit. These can also be obtained in individual values from Moyer Electronics [(570) 286-6707, <moyerelectronics.com>]. Of course, you may be required

* Email: <k3md009@gmail.com>

Photo B. 600-volt Mylar capacitors.

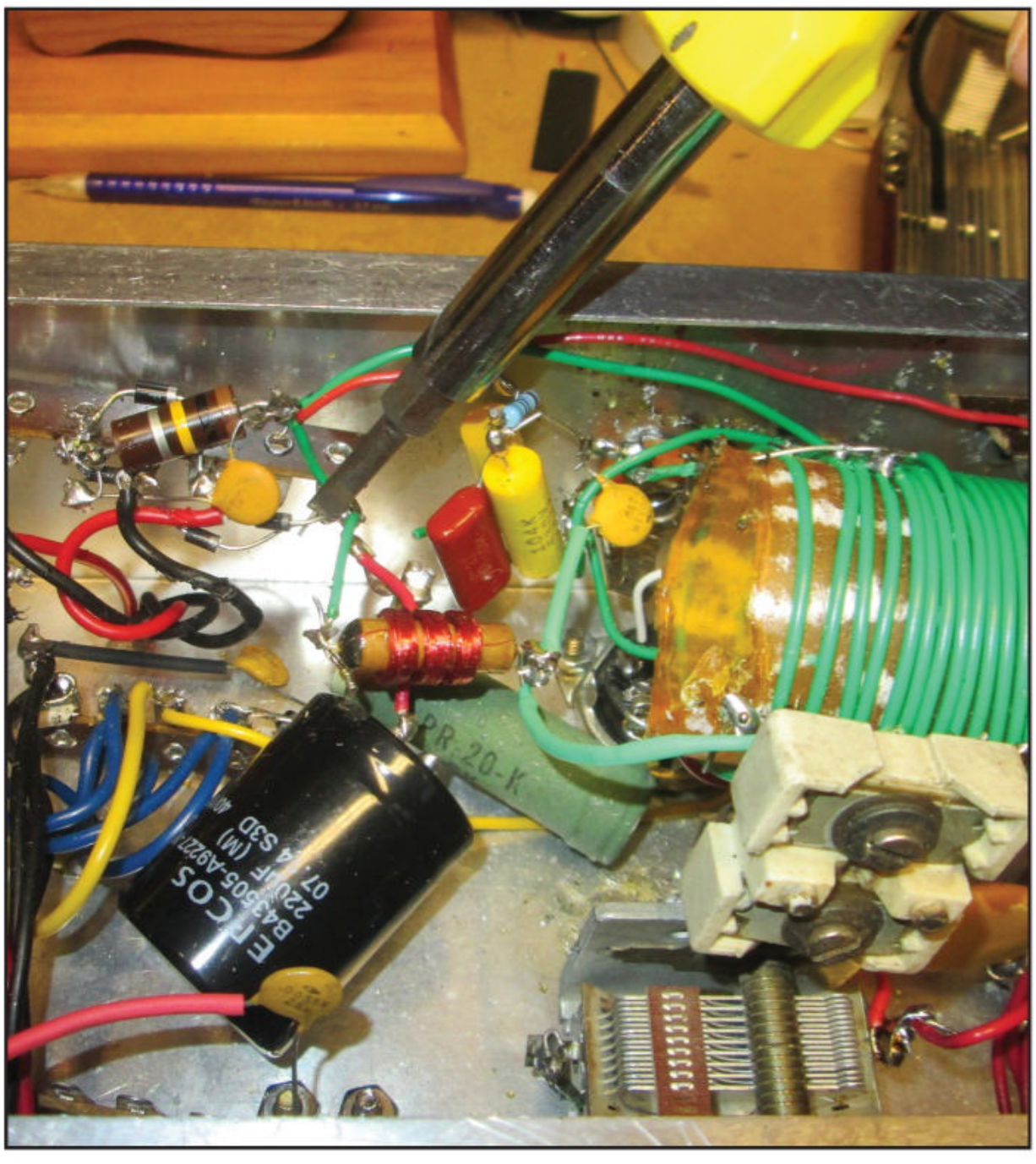

Photo C. High-voltage electrolytic discharge technique. Note that operator is insulated from metal and that the shaft of the screwdriver is touching the metal chassis.

Photo D. Ugly method of replacing above-chassis multiple capacitor cans.

Photo E. Two-wire double-fused Heathkit or Johnson style plug.

to place some capacitors in parallel in order to obtain the correct value. The capacitance of capacitors in parallel is the sum of the individual capacitance values (a General Class license examination question).

At the very least, print out a DX-60 or DX-60B schematic (visit <https://tinyurl.com/wj4wexjz>). The 40-microfarad filter caps must be replaced. I used 100-µF, 450-volt capacitors obtained from <tubesandmore.com>. Moyer's also stocks them. Remember, extra filtration will lessen ripple, however, discharge of the filter capacitors from the bleeders will increase in time. ALWAYS use a "chicken stick" to discharge the filter capacitors. I use a screwdriver, as shown in *Photo C*. If you do not follow this plan, you will be very unpleasantly surprised. The above-chassis capacitor is just replaced with under-chassis units, after clipping off the factory leads and isolating them with shrink-wrap tubing or high-voltage electrical tape, as shown in *Photo D*. Do not worry, the stiff leads of the replacement capacitors will prevent them from shorting out to the chassis itself. The stem from the above-chassis capacitor is severed with a large diagonal cutter, leaving the leads soldered together intact. Exact-replacement above-chassis capacitors are available at <tubesandmore.com> or elsewhere, but remember, the electrons do not care what it looks like.

The 20-µF, 160-volt electrolytic capacitors in the bias circuit for the 6146 must be replaced. Any capacitor in the

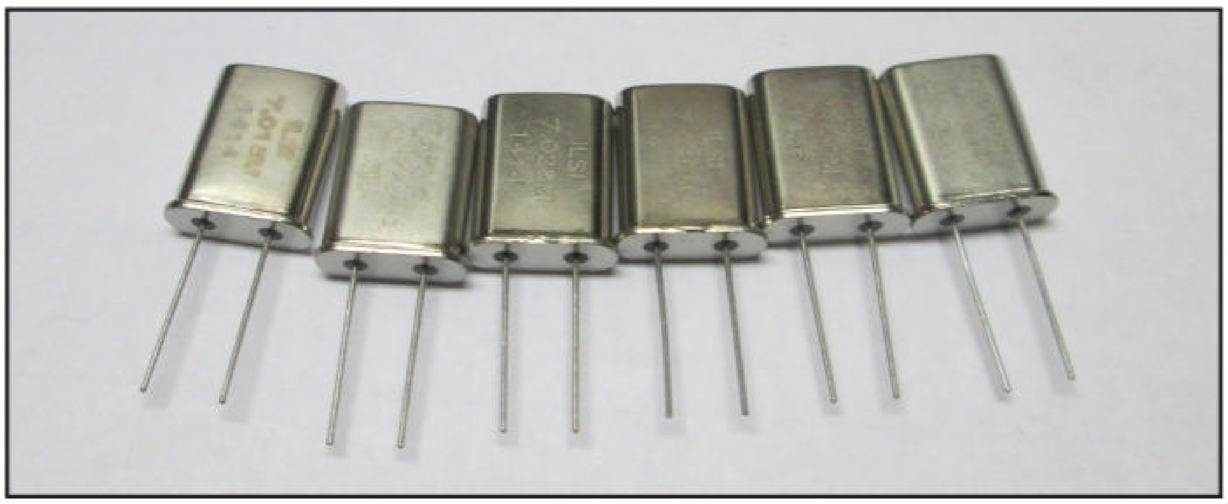

Photo F. QRP crystals.

Photo G. Final product.

Photo H. Restoring classic ham gear can be habit-forming! Here's part of the author's collection.

what's new

PolyPhaser Adds New VHF/UHF 4.3-10 RF Surge Protectors with 12 Configurations

PolyPhaser has introduced a new 4.3-10 RF surge protector with 12 configurations, available in all gender combinations. Designed to protect outdoor radio and antenna installations, PolyPhaser's new 4.3-10 VHF/UHF RF surge protectors offer 20-kiloamps of bi-directional, repetitive strike surge protection.

Built into a waterproof IP-67-rated case, the 4.3-10 RF surge protectors are also UL497E certified while being Motorola R56 compliant and offer two different mounting bracket options.

With high performance surge protection, the 4.3-10 offers a low let-through high-pass filter design. providing high CW and peak input power (PIP) RF power and low PIM, with 4.3-10 connectors on both sides. It offers reliable broadband performance from 100 MHz to 520 MHz.

Polyphaser's new surge protectors are available now and have a suggested retail price of $178. For more information, visit <https://tinyurl.com/rtjuetw3>.

20- to 100-µF range, rated at 160-300 volts, will do. I keep a stock of 100-µF, 150-volt units in stock for helping to restore problem 5-tube AM radios under contract from Rebar's Radio Attic <https://tinyurl.com/5xf9a3fs>.

Some purists test the tubes, but many amateurs do not possess tube testers. Mine is a Heathkit TC-2 that I got at a hamfest for $5 and restored. EBay prices are up to $200 for a working unit that tests 7- and 9-pin miniatures, as well as octal types. The data for setting the switches is the first thing to go, and it is impossible to ascertain in some units on eBay if this is available to be clearly read out or not. Depending on your budget, replacement of all tubes with NOS (new old stock) tubes from eBay, Moyer, or tubesandmore.com is recommended, if you do not have a tube tester. A copy of the *RCA Receiving Tube Manual* is useful but not absolutely necessary, as data is also available from Frank's Electron Tube Data sheets, <https://frank.pocnet.net>.

The DX-60 meter can easily be tested with your VOM in the 10K or higher multiplier position. Do not use the x1 or x10 position, as you may burn out the meter due to excessive current through the armature of the meter. The AC line cord should be replaced with a cord obtained from a 2-conductor extension cord. In the case of my DX-60B, the circuit breaker had been removed and there was no room left on the chassis for a fuse holder, so I used a Heathkit-style double-fused AC plug (*Photo E*). Purists will highly recommend replacing the 2-wire power cord with a 3-wire cord, but I just make certain everything is grounded together before plugging anything in.

Testing

Initial tests should be done with a wattmeter on the output and a 50-ohm dummy load. I use a 13.8-volt AC wall wart. The HV (high-voltage) DC and bias DC can be tested, and the 6.3-volt AC for the filaments will be (13.8 / 120) x 6.3 or 0.73 VAC.

An autotransformer is ideal for initial testing but not entirely necessary. ALWAYS use clip-leads to your multimeter for HV testing. Seven-hundred-volt DC may electrocute you, depending upon what you are standing upon on your basement's concrete floor, how wet it is, and how many microamps go through your right ventricle. More details are available in *Grounding and Bonding for the Radio Amateur*, H. Ward Silver, NØAX (ARRL). If you must test HV with a probe, use theone-hand-in-pocket technique. Although uncommon, the power transformer may be nonfunctional due to water damage.

Use an FT-243 crystal for initial testing. These are easily obtained on eBay. Alternatively, QRP crystals obtained from <qrpme.com> (*Photo F*) can be used, either directly soldered into the crystal switch, or less preferably, soldered to #12 bare wire and inserted in the FT-243 sockets. If you use a VFO, use a Heathkit HG-10 with the proper dropping resister from the auxiliary power plug, or with the VFO powered by another transmitter with a different high-voltage value and the proper dropping resistor for that high voltage. An N3ZI DDS VFO (pending re-issue due to parts from China) can be used, but in this case, I found I had to design and build my own buffer amplifier, as the recommended buffer circuit did not work for me. You need about 5 to 8 volts peak-to-peak VFO output. The HG-10 will drift a little. There are many cheap Chinese DDS circuits available on eBay. They will all require shielding and a homebrew class A amplifier, a design available in literally every issue of the *ARRL Handbook* since 1970, to drive the DX-60.

You should be able to get 50 watts or more out of the DX-60. If things do not work, do resistance testing. The diodes should conduct in one direction only. Cold solder joints are always a problem. If you want to do AM, use a crystal microphone. These are easily stolen from old CB radios, but finding the proper microphone connector could be tricky. Moyer's Electronics has them in stock. Any 10-MHz oscilloscope will be very handy for testing. These are often available for free or at low cost from local amateurs. Use AC coupling and be certain you do not exceed the high-voltage rating of the vertical input amplifier.

About Those Mods…

What to do with undocumented modifications? These are always a problem, and Heathkits were favorites for all sorts of mods. On my Hallicrafters HT-37, I finally just ripped out the VOX-on-CW circuit, since it tended to cut off the first character of every word send after the VOX relay returned to its unexcited state. On this particular DX-60, a PTT and what looks like a super-modulation circuit had been added. I just replaced all of the associated electrolytics with exact-replacement values and hoped for the best. It worked in this case. Remember, this is Heising modulation, and will not sound as good as the plate modulation you might be used to on a Johnson Ranger, Eico 720, or similar plate-modulated transmitter.

The final product is illustrated in its case in *Photo G*.

What's Next?

After you conquer the DX-60, you may want to do more. Classic rig restoration may be habit-forming! (*Photo H*) Perhaps your next project might be to build the K3MD junkbox QRP transmitter, or, if you are really into it, restore a Collins KWM-2A with a converted Heathkit HP-23B power supply or a Collins 516F-2 (extremely overpriced and needs to be converted to solid state with an eBay kit). Get out your 100-watt soldering gun, 1.5-mm solder, long-nose pliers, and diagonal clippers! 73!

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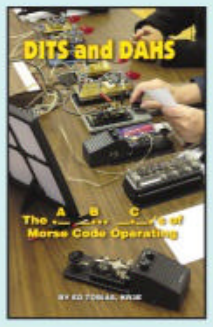

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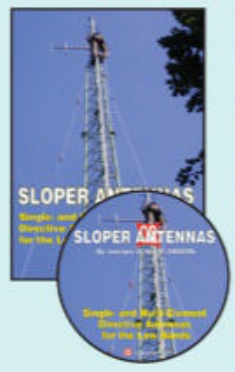

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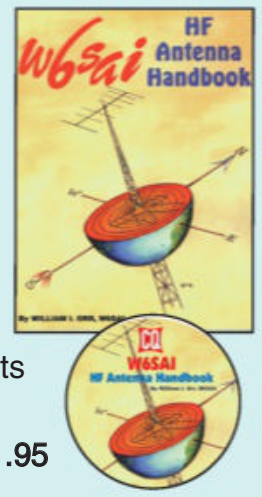

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You got a great deal on a DC power supply at a hamfest. But how do you know you won't fry your rig when you plug it in? KBØVKS has a simple-to-build resistive test load to make sure everything is OK before you connect it to your radio.

A Dummy Load for Power Supplies

BY DAN SWENSON,* KBØVKS

If you acquire an unknown power supply, it would be a good idea to test that supply before connecting it to your radio. Testing may save your expensive radio from being damaged by a bad power supply. To test the power supply, a resistive load takes the place of the radio. This article shows you how to build one to test 13.8-volt DC supplies with varying current levels and a minimum of parts. It will also take you, step-by-step, through the design process.

Designing a Test Load

Three things are needed to design a proper load, and they won't cost you a dime:

1. Ohm's Law, I = E / R. I is current measured in amps, A. E is electrical force measured in volts, V. R is resistance measured in ohms, (Ω).
2. Watt's power formula, P = I x E. P is power measured in watts, W. I & E are the same as above.
3. Parallel resistance formula, $1/R_T = 1/R_1 + 1/R_2 + 1/R_3 + \ldots$ R_T is total resistance. R_1 is first resistance. R_2 is second resistance. The formula accommodates many resistances.

Design

I had an unknown 30-amp, 13.8-volt supply that needed to be tested. A test load needs to draw less current than the maximum output of the supply. Using 28 amps as a trial design target, estimate the required load resistance. Changing Ohm's Law to R = E / I gives you 13.8V / 28A = 0.49Ω. Round to 0.5Ω. Now let's move from an estimate to concrete figures. Re-calculate the load current with Ohm's Law, I = E / R as 13.8V / 0.5Ω = 27.6A. Next, use Watt's formula to determine the total amount of heat to dissipate. P = I x E = 27.6A x 13.8V = 381 watts. It is desirable to spread this large amount of heat among several smaller resistors instead of one large expensive resistor. Let's aim for a parallel configuration that has about 100 watts per leg. This results in 381W / 100W = 3.8 legs. Round to four parallel legs. This is 381W / 4 = 95.2 watts per leg, much easier to manage with common power resistors.

Now determine the current per leg. Changing Watt's formula to I = P / E = 95.2W / 13.8V = 6.9A per leg. Determine the resistance per leg using this form of Ohm's Law, R = E / I or 13.8V / 6.9A = 2Ω per leg. Since this structure has four parallel legs, let's verify the result using the parallel resistance formula:

$$1/R_T = 1/R_1 + 1/R_2 + 1/R_3 + 1/R_4$$
$$1/R_T = 1/2 + 1/2 + 1/2 + 1/2\ \Omega$$
$$1/R_T = 2\Omega$$
$$R_T = 0.5\Omega$$

This result agrees with the beginning calculation. While 2- or 4-Ω resistors could be used to build this project, online research revealed more favorable pricing for 1-Ω resistors, about $1.80 each in quantity of 10. Also, I can easily use the excess 1-Ω resistors in other projects. Let's decide on using two 1-Ω resistors in series, resulting in 2Ω per leg, for each of four parallel legs. There is also a thermal advantage to this configuration which can be seen next.

Previously, there was 95.2 watts per leg. This heat is shared by two series resistors, resulting in 95.2W / 2 = 48W per resistor. While it might be tempting to use resistors rated at 50 watts, it is common design practice to use a 2:1 safety factor when selecting the wattage rating of power resistors. So, 2 x 48W = 96W. Round up to a 100-watt rating. In this way, there is less thermal stress on each resistor.

In summary, the design result has four parallel legs, each leg consisting of two 1-Ω 100W resistors in series, yielding

Photo A. KBØVKS's "dummy load for power supplies." The large sheet of aluminum is necessary for effective heat dissipation.

* *Email: <kb0vks@gmail.com>*

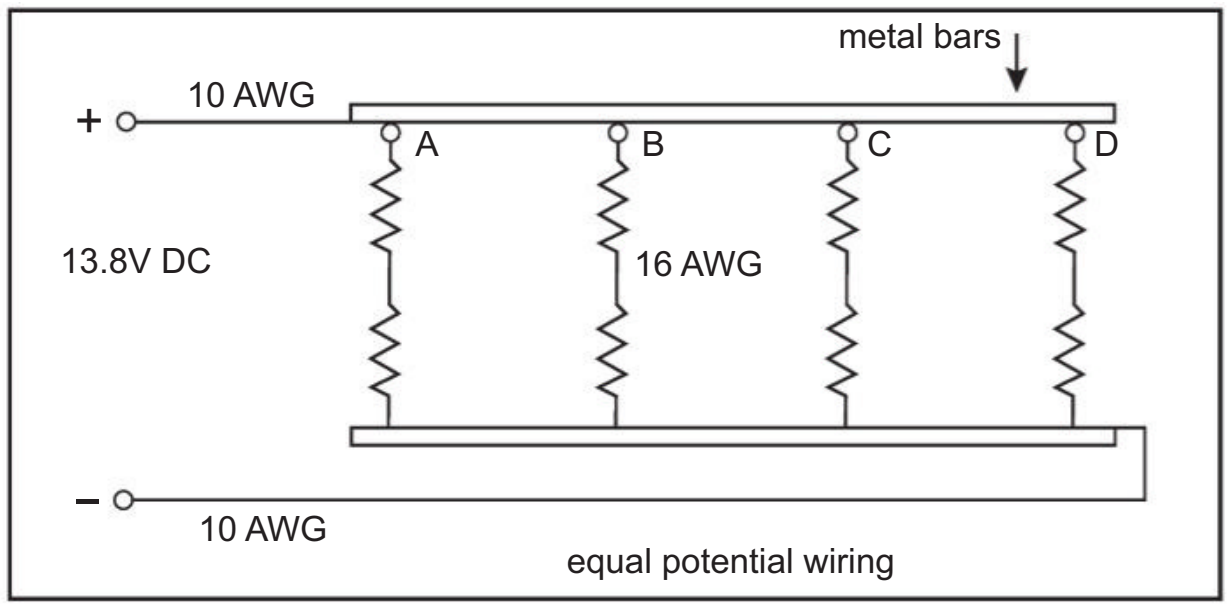

Figure 1. Schematic of the test load circuit. All resistors are 1-ohm, 100-watt, 5% tolerance. See text and Photo A *for wiring to engage varying loads, and* Table 1 *for maximum current values. (Artwork by Emily Leary)*

a design total of eight reasonably-priced resistors, sharing the 381 watts of total thermal dissipation with a nice safety margin.

Construction

I used a scrap aluminum plate 17-inches wide x 24-inches tall x 1/8-inch thick. This provides about 50 square inches per resistor (remember, they're dissipating a lot of heat). Since testing is an intermittent process, most of the heat dissipation is by conduction. If you opt for 3/16-inch thickness, the outer dimensions of the plate could be reduced to 15-inches wide x 18-inches tall, and still have the same mass of heat sink. Exact dimensions are not critical. The important part is to mount the resistors a uniform distance from each other on a stiff flat surface that has mass (see *Photo A*).

Put a thin film of thermal compound underneath each resistor. Two pieces of dry plywood on each end of the metal panel provide electrical insulation for mounting the metal bars. Two coats of polyurethane will keep the wood dry. The metal bars were drilled and tapped for the connecting hardware. I recommend the metal bars be copper or brass, not aluminum. Using copper or brass bars keeps all the plated copper connections in the same galvanic family, thereby preventing corrosion in the connections.

Each leg was wired with the same length of 16 AWG stranded wire (equal lengths are important; see below). The main cables are 10 AWG stranded wire. All wire ends were tinned to prevent splaying of the strands. I built my project so that I could individually connect and disconnect each leg at points A, B, C, and D as shown on the schematic (*Figure 1*). This feature allows changing the load, depending on the size of the power supply. Lastly, a barn door handle at the top of the project provides for easy transport (*Photo A*).

A panel to test 50-amp supplies could be easily constructed with the same format. Use seven legs on a proportionally taller panel. The load would be 6.9A x 7 = 48A. The gauge of the leg wiring remains the same. The gauge of the main cables would need to be increased to 8 AWG.

Equal Potential Wiring

An easy way to visualize the concept is to trace the various current paths. First, trace from the positive terminal, through the A leg, then to the negative terminal. Note the length of the path. Second, trace the entire path through the B leg. Again, note the length of the path. Do the same with the third and fourth legs. By comparison, all four paths are exactly the same length through the conductors. The symmetry ensures the voltage drop in the bars will be equal, no matter which path is used. This assures that each leg receives equal voltage while under load. Whether you use bars or thick wires, the concept is the same.

Leg	Max. current (in amps)
A only	6.9
A+B	13.8
A+B+C	20.7
A+B+C+D	27.6

Table 1. Maximum current values for different configurations at 13.8-volts DC. Maximum load should be less than the rated capacity of the power supply.

Testing Hints

The first thing to test is *voltage sag under load*. Measure the voltage with no load, then measure the voltage under load. Some voltage sag under load is normal. Some power supplies have remote sensing. Properly wired, these supplies have little voltage sag under load. Some power supplies have a duty cycle; 20% is a common figure. For example, in a 50-second cycle, 10 seconds (20%) at full load should be followed by 40 seconds (80%) of light or no load. Typical power supplies are not designed to deliver full load continuously. Do not subject them to heavy loads for extended periods. Lastly, while under load, use a scope to see how much residual ripple is present. Specifications and individual results will depend on the manufacturer and on the application.

A Special Note for Beginners

Do not let the math intimidate you. Doing the math, one step at a time, will help you immensely in understanding Ohm's Law, Watt's power formula, and the parallel resistance formula. This will benefit you greatly as you progress in electronics.

Announcing:

2021 Inductees to the CQ Amateur Radio, Contest, and DX Halls of Fame

CQ magazine is pleased to announce its 2021 Hall of Fame inductees, including two new members each for the CQ DX Hall of Fame and the CQ Contest Hall of Fame, along with six inductees to the CQ Amateur Radio Hall of Fame. This year's inductions were again conducted online due to event cancellations resulting from the COVID-19 pandemic.

The CQ Amateur Radio Hall of Fame honors those individuals, whether licensed hams or not, who have made significant contributions to amateur radio; *and* those amateurs who have made significant contributions either to amateur radio, to their professional careers or to some other aspect of life on our planet. This year, we are inducting six new members, bringing to 339 the total number of members inducted since the hall's establishment in 2001.

The 2021 inductees (listed alphabetically) are:

Archibald Doty, W7ACD (SK), engineer, inventor, researcher into efficient radial systems for vertical antennas and pioneer of college radio; co-founded what is now WESU at Wesleyan University in Connecticut in 1939, the second-oldest college radio station in the U.S.; also served as a pilot in the U.S. Army Air Corps in World War II.

Nathaniel Frissell, W2NAF, founder of HAMSci (Ham Radio Science Citizen Investigation), a collaboration between radio amateurs and ionospheric scientists; organizer of the 2017 Solar Eclipse QSO Party, which also served as a research project on the effects of a total solar eclipse on HF propagation.

Lorin Hollander, WA1PGB, world-renowned classical concert pianist who has performed with virtually every major philharmonic orchestra in the U.S., along with many others overseas; heavily involved in music and arts education and in relationships between music and medicine.

Christopher Imlay, W3KD, ARRL Counsel and General Counsel from 1982-2018; represented the League before the FCC on a wide variety of issues, including PRB-1, now enshrined in FCC Rule 97.15 (b), that requires state and local regulations to reasonably accommodate amateur radio antenna structures.

Cathryn Mitchell, MØIBG, Academic Director of the University of Bath Doctoral College (UK) and recipient of the 2019 Edward Appleton Medal "for pioneering research in tomography and data assimilation revealing a completely new perspective on Earth's ionosphere in response to extreme space weather."

Admiral Charles "Chas" Richard, W4HFZ, commander of USSTRATCOM, the United States Strategic Command, one of 11 unified commands of the Department of Defense; served previously as Commander of U.S. submarine forces and Director of Undersea Warfare at the Pentagon.

CQ DX and Contest and Halls of Fame

The CQ DX and Contest Halls of Fame honor those amateurs who not only excel in personal performance in these major areas of amateur radio but who also "give back" to the hobby in outstanding ways.

The CQ DX Hall of Fame was established in 1967 to recognize those amateurs who have made major contributions to DXing and DXpeditioning. This year, we induct two new members. The 2021 inductees are:

Jacky Calvo, ZL3CW/F2CW, a veteran of the French Air Force and the International Committee of the Red Cross, with postings that took him (and his ham station) to a dozen countries around the world; a participant in more than two dozen DXpeditions and WRTC (World Radiosport Team Championship) competitions from 2010-2018 and is a team leader for 2022.

Francesco Valsecchi, IKØFVC/HVØA, who has regularly activated Vatican City for the past 30 years using HVØA and other callsigns, as well the Sovereign Military Order of Malta (SMOM) as 1AØKM, along with fellow operators. Francesco has logged more than

CQ DX Hall of Fame inductee Jacky Calvo, ZL3CW/F2CW. (Photo courtesy of ZL3CW)

CQ DX Hall of Fame inductee Francesco Valsecchi, IKØFVC/HVØA. (Photo courtesy of IKØFVC)

300,000 QSOs for the two tiny entities, averaging roughly 10,000 contacts per year for hams around the world.

The CQ Contest Hall of Fame was established in 1986 to recognize those amateurs who have made major contributions to the art of radio contesting. The 2021 inductees are:

Robert Wolbert, K6XX, a "renaissance man" of contesting, advancing the state of the art in designing amateur equipment at Elecraft, a participant in more than 1,100 contests over 35 years and a many-time winner (he is a 9-time recipient of the Jim Maxwell Memorial Trophy for the highest-scoring California single-op unassisted station in the ARRL DX CW Contest); member of the organizing committee for the first WRTC in 1996 and a team leader in 2000 and 2014; has authored many articles for amateur contesting publications, presented at multiple conferences and is a longtime member and leader of the Northern California Contest Club (NCCC).

David A. Pruett, K8CC (SK), author of the NA contest logging program as well as a log-checking program and host of many multi-multi operations from his Michigan contest station over 30 years; longtime chairman of the Michigan QSO Party; former editor of the *National Contest Journal* and longtime member and leader of the Mad River Contest Club.

Formal inductions to the CQ Contest and DX Halls of Fame were conducted online once again, as a result of the COVID-19-related cancellations of the Dayton Hamvention® and associated contest and DX dinners. CQ World Wide DX Contest Director John Dorr, K1AR, led the Contest Hall of Fame induction at the conclusion of Contest University's online seminar on May 20th, while CQ DX Editor Bob Schenck, N2OO, conducted the DX Hall of Fame induction on May 26th on the Ham Nation podcast on the Ham Radio Crash Course YouTube channel.

Recordings of both ceremonies may be found online. The Contest Hall of Fame induction is on DX Engineering's YouTube channel at <https://tinyurl.com/mpn2e48b> (beginning at approximately 7 hours and 37 minutes into the Contest University video), and the DX Hall of Fame presentation may be found at <https://tinyurl.com/3ycxbymv>, starting 3 minutes and 30 seconds into the podcast.

Our thanks to all and congratulations to the inductees!

CQ Contest Hall of Fame inductee Robert Wolbert, K6XX. (Photo courtesy of K6XX)

CQ Contest Hall of Fame inductee Dave Pruett, K8CC (SK), operating at KP2TM. (Photo courtesy of the Pruett family)

Announcing:

2021 CQWW DX RTTY Contest

September 25-26
Starts 0000 UTC Saturday; Ends 2359 UTC Sunday

Join more than 5,000 participants from over 150 DX entities and all 40 CQ Zones in the world's largest RTTY contest.

The CQ World Wide DX RTTY Contest (CQWW RTTY) offers 48 hours of non-stop DX chasing fun. Whether you are competing for awards, looking for a few new band-countries, or simply filling the logbook, the CQWW has something for everyone. Check out the Classic and Rookie Overlay Categories.

Contest Basics

Working stations is easy. Exchange and log signal report and your CQ Zone number, e.g 599 14. Continental U.S. and VE stations also send QTH, e.g., 599 05 MA. If you're not sure which zone you're in, visit <http://bit.ly/1BHtmsP>. Generally speaking, the U.S. West Coast is in Zone 3, the East Coast is in Zone 5, and the rest of the lower 48 is in Zone 4.

Contacts are only valid on the 3.5-, 7-, 14-, 21-, and 28-MHz amateur bands. Please observe established band plans.

Scoring

Final score is based on QSO points earned for each contact times the number of multipliers worked.

Multipliers are the number of DX entities worked on each band plus the number of CQ Zones worked on each band plus the number of US/VE QTHs worked on each band.

Contacts with other continents count three points each. Contacts with the same continent, but different country, count two points. Same country contacts count one point.

Don't worry about calculating your score; the contest log checking software will do that for you when you submit a log.

Entry Categories

The competition is divided into Single Operator and Multi-Operator categories. Single Operator categories also offer two additional Overlay categories.

Single Operator (all bands or any single band): only the one operator finds, makes, and logs all contacts.

- High power: Up to 1,500 watts
- Low power: 100 watts or less
- QRP: 5 watts or less

Single Operator Assisted (all bands or any single band): the one operator may use the DX Cluster or other tools to help find contacts. The one operator must make and log all contacts.

Classic Overlay: Allows the use of only one radio, no QSO finding assistance, and only counts the first 24 hours of operating time — off times are a minimum of 60 minutes during which no QSO is logged. Single Operator Assisted entries are not eligible for this Overlay category.

Rookie Overlay: Only open to operators who were first licensed as radio amateurs less than three (3) years before the date of the contest. Indicate date licensed in the soapbox field of your log.

Multi-Operator: More than one person is involved in operating the station.

Single-Transmitter: This category allows one transmitter to work any station. It may change bands as many as 8 times per hour. Note: A second transmitter may be used to work multipliers only. This category has some very specific restrictions so please read the full rules carefully.

- High power: Up to 1,500 watts
- Low power: 100 watts or less

Two-Transmitter: Allows the use of two transmitted signals on two bands. Each station may change bands as many as 8 times per hour.

Unlimited: Allows the use of one transmitted signal on each of the five bands.

Awards

Electronic certificates will be made available for download for everyone who submits an entry.

Submitting Your Log

All entrants who use a computer to log the contest or prepare their contest logs MUST submit their logs electronically. Electronic logs should be in the Cabrillo format. Upload your log on the Web at <www.cqww.com/logcheck/>. The website also includes a utility to convert your ADIF format log file if needed. See full rules for instructions regarding paper logs.

All entries must be sent WITHIN FIVE (5) DAYS after the end of the contest: No later than 2359 UTC October 1, 2021. Resubmitting an entry after the deadline will result in it being considered as a late log.

Only one entry is permitted for each callsign. Any log submission will replace any previous submissions.

Full Rules

The complete rules of the CQWW RTTY DX Contest are available in different languages on the Web at <www.cqwwrtty.com/rules.htm> and in English only on the *CQ* magazine website at <www.cq-amateur-radio.com> (Look for link on home page or the CQWW RTTY DX Contest main page). Please review the rules before the contest. Questions may be submitted by email to <questions@cqwwrtty.com>.

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MATH'S NOTES

BY IRWIN MATH,* WA2NDM

Working With Supercapacitors, Part II

As promised last month, we will continue our discussion of supercapacitors in this issue. As we mentioned, these unique devices can actually replace batteries in some applications and can be recharged many times, but have one important consideration that you must be aware of. The maximum voltage of many of these is only around 2.7 volts. If you need higher voltages, then you have to connect them in series. With "normal" capacitors this is not a problem, but with supercapacitors you usually cannot exceeded 2.7 volts per device or you run the risk of damaging them. The schematic in *Figure 1* shows one way to do this safely and to charge them.

As you can see, we have taken four supercapacitors and connected them in series. This makes the voltage across the string equal to 10.8 volts *maximum*. You will also note that in order to not exceed this value when charging them, we have used a 10-volt regulator, the Texas Instruments µA7810 series, to drive the string. This will assure we do not exceed the 10.8-volt level since the maximum output of the µA7810 regulator is 10.7 volts (according to the data sheet). In addition, the minimum input voltage of the regulator is 12.5 volts so all should be OK. Note that a 12-volt input would be marginal but might actually be OK; you will have to check this. If you use a different 10-volt regulator, it would be a good idea to check the output voltage of it as well be sure it will not exceed the 10.8-volt point. You will also note the 56K resistors across each capacitor. These are there to equalize the voltage across each capacitor so that they divide properly. This is a technique often used in the past to do the same when series-connecting high-voltage capacitors as well.

The use of the 15-ohm 10-watt power resistor at the output is to limit the maximum current when charging the capacitor string. When the capacitor string is fully discharged, it will have an impedance of close to 0 ohms and, with an input of 12.5 volts, the regulator will provide 10.7 volts and the resistor will limit the current to around 0.72 amperes (10.7 volts across 15 ohms). As a result, the resistor will dissipate about 7.7 watts (10.7 volts x 0.72 amperes). The total power dissipated by the circuit will then be 12.5 x 0.72 or 9.2 watts with the additional 1.5 watts dissipated by the regulator.

If the input now rises to 14 volts, the regulator output will still be 10.7 volts and as a result the resistor will still dissipate 7.7 watts but the whole circuit will now dissipate 14 x 0.72 or 10 watts and the dissipation of the regulator will rise to 2.3 watts. These power ratings for the two components are therefore liable to result in warm or even hot components during operation so it is best to take this into account when mounting them. As the capacitor string charges, however, the dissipation of the resistor and regulator will drop.

The output of the supercapacitor string is then applied to a three-terminal regulator from the common 7800 series family, and since the output from the resistor driving them will be around 10.7 volts when the capacitors are fully charged, the regulators can be the common 7805, 7806, or 7808 series. The purpose of these regulators is to try to keep the output voltage constant as the capacitors discharge. You can also use Zener diodes or other types of regulating circuitry to achieve this. Remember, however, that a fully charged capacitor string will discharge at a rate determined by the load.

The information given here is simply one way to assure that supercapacitors in a series string can be charged properly and used to provide a stable higher voltage output. The same technique can certainly be extended to capacitors with higher voltages (if you can find some), but in all cases, be sure to take steps to not inadvertently apply too much voltage to any supercapacitor string in excess of its ratings. Also, when connecting them in series, be sure to use all capacitors with the same voltage rating. Do not try to mix them. If you do, the string may not divide properly and you may damage expensive parts.

In conclusion, please forgive my calculations as I have not bench-tested this exact circuit. Due to tolerances, voltages, currents, and wattage values may not be exactly the same as stated here so your results may not be as close as my calculations. But most important of all, before connecting the actual capacitor string to the circuit, recheck all connections and then test the circuit first with the capacitor string replaced by short (the discharged position) and then disconnected (the fully charged position). *– 73, Irwin, WA2NDM*

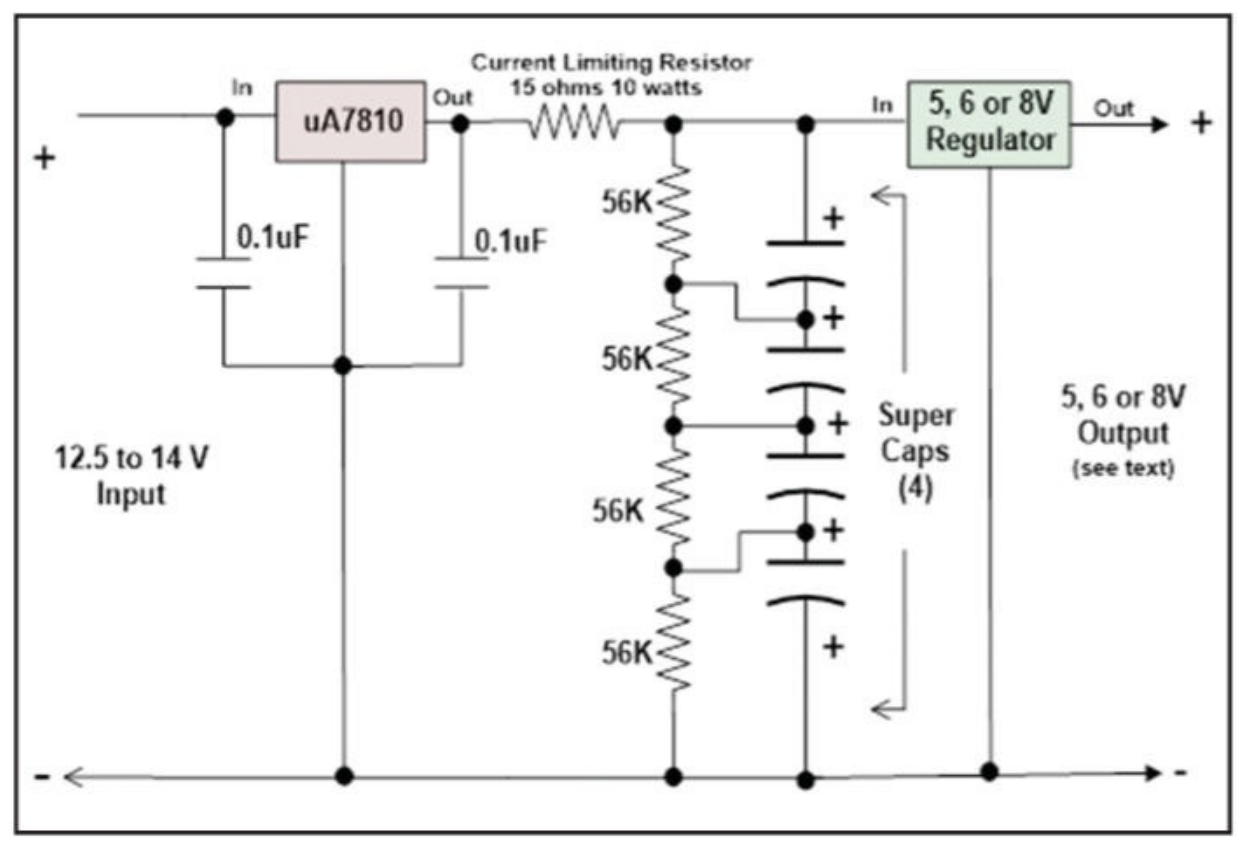


Figure 1. Schematic of "high voltage" supercapacitor string.

*c/o CQ magazine

ANNOUNCEMENTS *(from page 2)*

JEFFERSON, WISCONSIN — The Tri County Amateur Radio Club will hold its Hamfest 2021 from 8 a.m. to 1 p.m., Saturday, August 7 at the Jefferson County Fairgrounds 892 North Jackson Avenue. Email: <dan@kc9iki.com>. Website: <http://w9mqb.com>. VE exams.

ONALASKA, WISCONSIN — The Riverland Amateur Radio Club will hold its Swapfest from 8 a.m. to 1 p.m., Saturday, August 7 at the Onalaska American Legion Hall, 731 Sand Lake Road. Contact: Rick Kolter (608) 397-5386. Email: <rckolter@gmail.com>. Talk-in 146.970 (PL 131.8). VE exams, DXCC / VICC / WAC / WAS / 160m card checking.

ROANOKE, VIRGINIA — The Roanoke Valley Amateur Radio Club will hold the RVARC Hamfest from 8 a.m., to 1 p.m., Saturday, August 7 at the Gospel Light Baptist Church, 6307 Cloverdale Road. Contact: Regis, KF4PIY, (703) 873-7794 or Kevin Scott (540) 293-3138. Website: <http://w4ca.com>. Talk-in 146.985- (PL 107.2).

FAYETTEVILLE, NORTH CAROLINA — The Cape Fear Amateur Radio Society will hold the CFARS SwapFest from 8 a.m. to noon, Saturday, August 14 at the Cumberland County Shrine Club, 7040 Ramsey Street. Contact: David KI4W, <kr4oe@nc.rr.com>. Website: <http://cfarsnc.org>. Talk-in 146.910- (PL 100). VE exams.

FORT PIERCE, FLORIDA — The Fort Pierce Amateur Radio Club will hold the Fort Pierce Hamfest from 8 a.m. to 1 p.m., Saturday, August 14 at the Indian River State College, 3209 Virginia Avenue. Contact: Pete, KD4SPW, (772) 465-5204. Website: <www.fparc.org>. Talk-in 147.345+ (PL 107.2).

WORLDWIDE — The QSO Today Virtual Ham Expo will be held continuously from Saturday, August 14 through Sunday, August 15 and will feature a virtual expo hall and speakers, panel discussions, kit-building workshops and much more. Website: <www.qsotodayhamexpo.com>.

EAST GREENBUSH, NEW YORK — The East Greenbush Amateur Radio Association will hold its Hamfest 2021 from 8 a.m. to 1 p.m., Saturday, August 21 at the East Greenbush Town Park, Town Park Road. Contact: Bryan Jackson <w2rbj@outlook.com>. Website: <http://egara.club>.

HUNTSVILLE, ALABAMA — The Huntsville Hamfest and 2021 ARRL Southeastern Division Convention will be held from 9 a.m. to 4:30 p.m., Saturday, August 21 and from 9 a.m. to 3 p.m., Sunday, August 22 at the Von Braun Center, 700 Monroe Street SW. Email: <info@hamfest.org>. Website: <www.hamfest.org>. Talk-in 146.94 (PL 100). VE exams.

LEXINGTON, KENTUCKY — The Bluegrass Amateur Radio Society will hold the Central Kentucky Hamfest on Saturday, August 14 at 2319 Woodhill Drive. Website: <http://bluegrass.org>.

BARABOO, WISCONSIN — The Yellow Thunder Amateur Radio Club will hold the Circus City Hamfest from 8 a.m. to noon, Saturday, August 28 at the Badger Steam & Gas Engine Show Grounds, E3347 Sand Road. Contact: Tom Harrison, N9PQJ, (608) 963-0762. Email: <n9pqj@yellowthunder.org>. Website: <www.yellowthunder.org>. VE exams.

MILWAUKEE, WISCONSIN — The Milwaukee Radio Amateurs' Club and MAARS will hold the MCARC & MAARS Interclub Swapfest from 8 a.m. to noon, Saturday, August 28 at the Elks Lodge #46, 5555 W. Good Hope Road. Phone: (414) 459-9741. Email: <swapfest@w9rh.org>. Website: <www.w9rh.org>. Talk-in 145.390 (PL 127.3) or 145.130 (PL 127.3).

OWENSVILLE, OHIO — The Cincinnati Hamfest and W8DXCC Convention will be held from 8 a.m. to 2 p.m. (hamfest) and from 2-6 p.m. (convention), Saturday, August 28 at the Clermont County Fairgrounds, 1000 Locust Street. Email: <info@cincinnatihamfest.org>. Website: <http://cincinnatihamfest.org>. Talk-in 147.345+ (PL 123.0) or 443.450+ (PL 123.0). VE exams.

NEW KENSINGTON, PENNSYLVANIA — The Skyview Radio Society will hold its 2021 Swap N Shop Sunday, August 29 at its club grounds, 2335 Turkey Ridge Road. Contact: John Italiano, WA3KFS, (724) 339-3821. Website: <www.skyviewradio.net>. Talk-in 146.640- (PL 131.8).

NEWTOWN, CONNECTCUT — The Candlewood Amateur Radio Association will hold the Western CT Hamfest beginning 8 a.m., Sunday, August 29 at the Edmond Town Hall, 45 Main Street. Contact: John Morelli, W1JGM, (203) 417-0160. Email: <hamfest@cararadioclub.org>. Website: <http://cararadioclub.org>. Talk-in 147.300+ (PL 100).

SEPTEMBER

NAPERVILLE, ILLINOIS — The Northern Illinois DX Association will hold the W9DXCC Convention Friday, September 10 and Saturday, September 11 at the Chicago Marriott Naperville, 1801 North Naper Boulevard. Website: <http://w9dxcc.com>.

CEDARBURG, WISCONSIN — The Ozaukee Radio Club will hold the ORC Regional Fall Swapfest from 6 a.m. to noon, Saturday, September 11 at the Fireman's Park, W65 N796 Washington Avenue. Phone: (262) 377-6945 or (262) 844-6331. Website: <www.ozaukeeradioclub.org>.

MULLICA HILLS, NEW JERSEY — The Gloucester County Amateur Radio Club will hold its 43rd Annual Hamfest and 2021 ARRL Southern New Jersey Convention beginning 8 a.m., Sunday, September 12 at the Gloucester County 4-H Fairgrounds, 235 Bridgeton Pike (Rt. 77). Contact: Sheldon Parker, K2MEN, <sheldonparker@comcast.net>. Website: <http://w2mmd.org>. Talk-in 147.180+ (PL 131.8) VE exams.

COLOGNE, MINNESOTA — The SMARTS Radio Club will hold SMARTSFEST 2021 from 8 a.m. to noon, Saturday, September 18 at the Cologne Community Center, 1211 Village Parkway. Email: <contactus@smartsfest.org>. Website: <http://smartsfest.org>. Talk-in 147.165+. VE exams, card checking.

PEKIN, ILLINOIS — The Pekin Area Amateur Radio Club will hold the PAARC Superfest from 6 a.m. to 4 p.m., Saturday, September 18 and from 6 a.m. to 1 p.m., Sunday, September 19 at Avanti's Dome, 3401 Griffin Avenue. Email: <w9uvi@arrl.net>. Website: <http://w9uvi.org>. Talk-in 147.075+ (PL 156.7). VE exams, balloon launch.

RICHMOND, KENTUCKY — The Central Kentucky Amateur Radio Society will hold the Richmond Hamfest from 8 a.m. to 1 p.m., Saturday, September 18 at the Madison County Fairgrounds, 3237 Old KY 52. Website: <http://ckars.org>. Talk-in 145.370 (PL 192.8). VE exams.

ADRIAN, MICHIGAN — The Adrian Amateur Radio Club will hold the 46th Annual Hamfest and Computer Show beginning 8 a.m., Sunday, September 19 at the Lenawee County Airport, 2651 W. Cadmus Road. Contact: Mark Hinkleman, NU8Z, (517) 423-5906. Email: <cqnu8z@comcast.net>. Website: <www.w8tqe.com>. Talk-in 145.370- (PL 85.4). VE exams.

WEST FARGO, NORTH DAKOTA — The Red River Radio Amateurs will hold the RRRA Hamfest and 2021 ARRL Dakota Division Convention from 8 a.m. to 2 p.m., Saturday, September 25 at the RRV Fairgrounds – Hartl Building, 1805 Main Avenue W. Phone: (701) 371-1398. Email: <hamfest@rrra.org>. Website: <http://rrra.org>. Talk-in 145.350- (PL 123) or 444.875 (PL 123). VE exams.

EAST STROUDSBURG, PENNSYLVANIA — Eastern Pennsylvania Amateur Radio Association will hold its Hamfest 2021 beginning 8 a.m., Sunday, September 26 at the American Legion Post 346, 126 E. 5th Street. Phone: (570) 350-1185. Email: <3w3fnz@gmail.com>. Website: <www.qsl.net/n3is>. Talk-in 147.045 (PL 131.8). VE exams.

THE LISTENING POST

BY GERRY DEXTER

Mysterious South American Stations Perplex SWLers

Now that Austria has blitzed replying to QSLs, your only hope for that country is through AWR's Moosbrunn relay.

~ There is (or was) a bizarre Brazilian station showing up on 5899.1 and 7455 kHz between 1000 and 200 UTC identified as Radio Casa 8000 in Ampara, in Sao Paulo state, playing continuous rock/pop music. Supposedly using 750 watts on 5 MHz and 350 watts on 7455 kHz, claiming to be a non-profit operation.

~ That mysterious Venezuelan Radio Onda Cofta Venezjuela (ROCV) from El Tigre has been recently noted in Europe around 0500 UTC on 6216 kHz. The station was previously heard on 6205 kHz and myriad other frequencies.

~ Here comes yet another North Korean opposition broadcaster: The North Korean Democratization Committee. CDNK radio goes on the air Tuesday, Thursday, and Saturday from 1400-1430 UTC via an unspecified location in Central Asia.

~ Eye Radio, the South Sudan opposition station, has deleted its broadcasts via Issoudun (France).

~ Denmark's World Music Radio is now supposedly using a new transmitter on 25770 kHz, although no specific air hours were announced.

~ It took almost a year, but a British DXer finally got a QSL from VOIRI's English service on 9855 kHz.

~ In Myanmar, over 100 staff members of Myanmar Radio have joined some 1,000 government employees in protests against the government and the military coup. That unrest might help explain Myanmar Radio's spotty operation of late.

Listener Logs

Your shortwave broadcast station logs are always welcome. But please ensure to double or triple space between the items, list each logging according to the station's home country and include your last name and state abbreviation after each. Also needed are spare QSLs, station schedules, brochures, pennants, station photos, and anything else you think would be of interest. The same holds for you amateur radio operators who also listen to shortwave broadcasts ... I know you're out there! Even though there are no call letters after my name, you, too, are also most welcome to contribute!

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

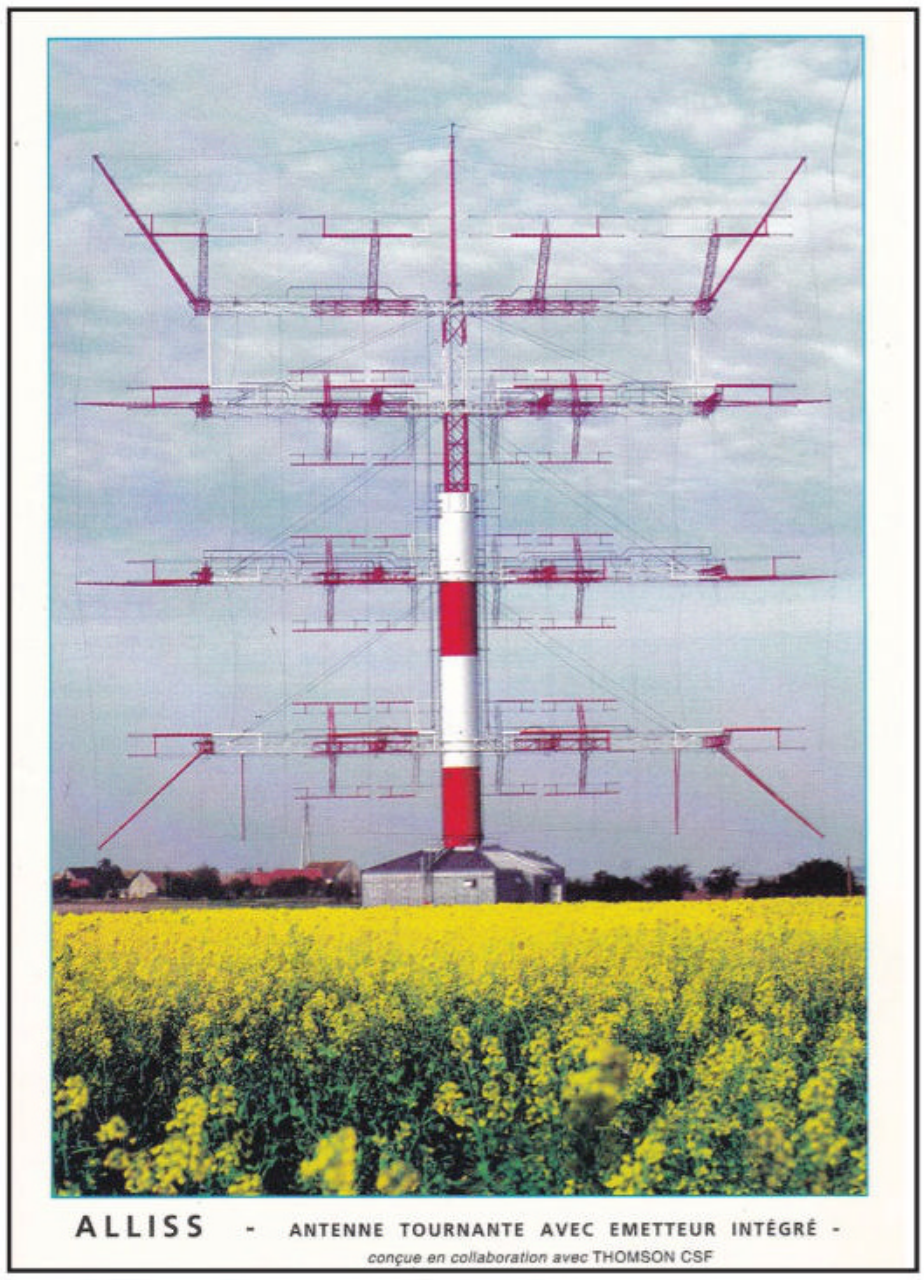
ALASKA—KNLS from Anchor Point on 7355 at 1226 with a woman speaking in English; on 9580 at 1422 with contemporary Christian music. (Taylor, WI) On 9730 at 1530 in Russian and a possible religious lecture; On 13635 from the Mali relay at 1800 open. (Barton, AZ)

ALGERIA—Radio Algerienne on 6050 via France at 0359 with opening, a man singing, male and female announcers beginning Arabic service. (D'Angelo, PA) On 11985 at 1937 with Arabic talks. (Brossell, WI)

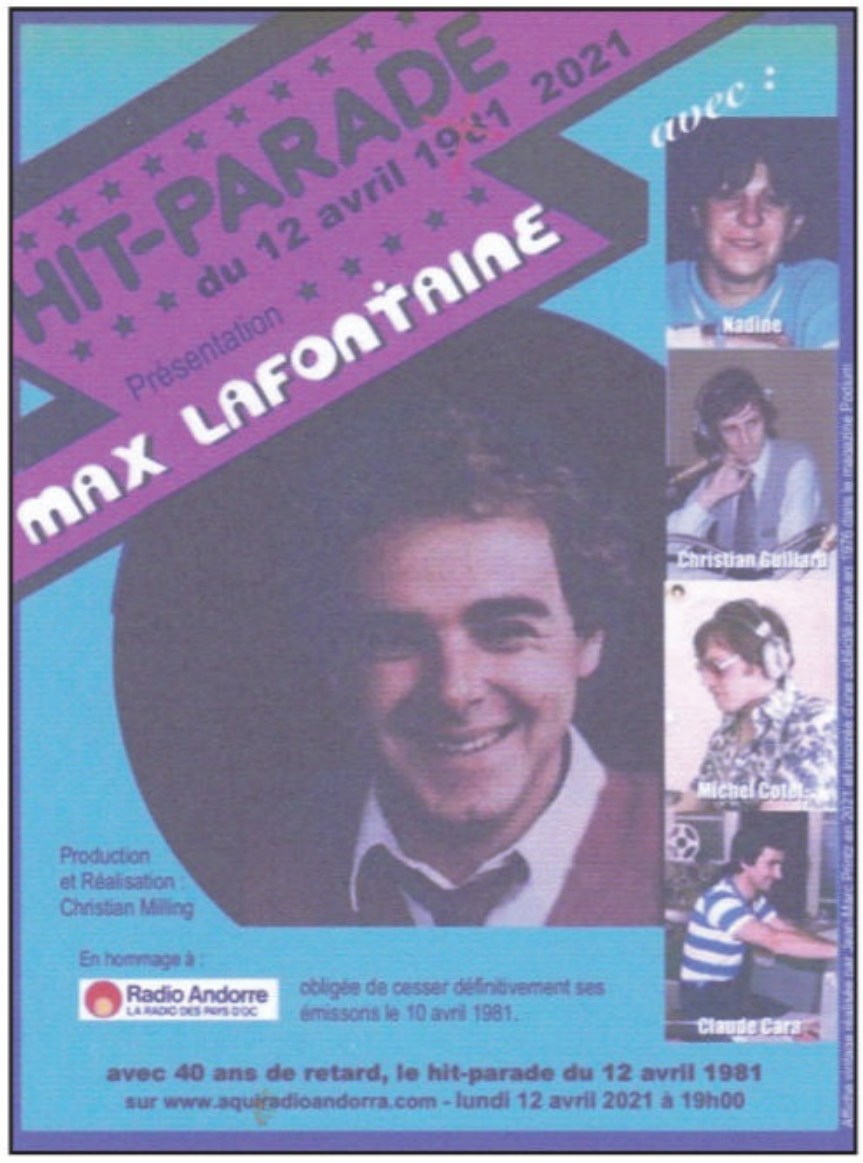
ASCENSION ISLAND—BBC North Atlantic Relay on 11810 at 2105 on Armenia. (Sellers BC) On 15410 at 1952 in Hausa. (Brossell, WI)

AUSTRALIA—Reach Beyond on 9590 from Kununurra at 1212 with woman speaking in Hindi; on 11905 at 1148 in Rohingya, male followed by female announcers. (Taylor, WI) On 9610 at 1306 in Marathi. (Taylor, WI)

**c/o CQ magazine*



Issoudun, the RFI transmitter site, also relays other international broadcasters as well as several opposition broadcasters.



Radio Andorra, which went off shortwave some years back, recently marked 80 years of broadcasting through a tribute on Atlantic 2000.

AUSTRIA—Adventist World Radio on 11880 via Moosbrunn at 2049 in French with woman giving a Cote d'Ivoire address. (Sellers, BC)

BOTSWANA—VOA Relay on 15580 at 1938 on an asteroid seen in Hawaii. (Sellers, BC) On 2150 with station ID and hip-hop. (Brossell, WI)

BRAZIL—Radio Nacional Amazonia from Brasilia on 11780 at 2023 in Portuguese with smooth jazz. (KB2DMD, PA) On 2133. (Brossell, WI)

CHINA—China Radio International on 5965 from Beijing at 1500 in Russian; on 7220 from Jinhua with woman speaking in Japanese and instrumental music. (Barton, AZ) On 9590 from Shijiazhuang in Russian; on 11980 at 1201 from Kunming in English with news; on 13630 via Mali with Chinese language lesions. (Brossell, WI)

CNR-5-Beijing, Cross Points Radio-Beijing in Mandarin at 1203. (Taylor, WI)

CNR-6 on 6165 from Beijing (co-channel) at 1936 with Thazin Radio at 1148 in Mandarin / Burmese, China with man and occasionally a woman with choral vocals. (Taylor, WI)

CNR-7 Cross Strait Radio on 5925 from possibly Beijing at 1036 with contemporary music, male and female announcers. (Taylor, WI)

CNR-11 on 9530 from Bojiin at 1148 in Tibetan with man talking at length. (Taylor, WI)

CNR-13 on 9420 from Lingshi at 1214 in Uighur. (Taylor, WI)

PBS Nei Menggu from possibly Hohhot on 9520 at 2235 in Mandarin. (Taylor, WI)

Voice of the Strait on 4900 from Fuzhou at 1210 with man speaking in Amoy. (Barton, AZ)

BPM time/frequency station on 10000 at 1258, reception was just audible with time pips and a CW station ID. (Taylor, WI)

CUBA—Radio Progresso on 4765 from Bejucal at 0345 with a woman speaking in Spanish, children singing national anthem, off at 0400. (Barton, AZ)

ECUADOR—HCJB on 6050 from Pichincha in Quechuan at 0135 with sanjuanitos. (KB2DMD, PA)

ENGLAND—BBC on 11810 from Woofferton at 2001 on COVID-19. (Brossell, WI) On 11825 via Philippine Relay with carrier on at 2258, audio from 2259 then station IDs, time pips, news. (Sellers, BC)

ESWATINI (Swaziland)—Trans World Radio on 15105 from Manzini at 1946 in Lingala. (Brossell, WI)

FRANCE—Radio France International on 11995 from Issoudun at 1900 with man speaking in French and probable news. (Barton, AZ) On 15300 at 1936 in French. (Brossell, WI)

GERMANY—Deutsche Welle on 15275 via France at 1602 in Amharic. (Brossell, WI) At 1320 in Fulani, woman giving an interview. (Taylor, WI)

GUAM—Adventist World Radio on 9875 at 1237 in Mandarin with Bible teaching. (Taylor, WI) On 12040 from Agat at 2200 sign on in Sudanese followed by man speaking in English, English listed here Sunday, Tuesday, Thursday. (Sellers, BC)

INDIA—All India Radio on 11560 from Bengaluru at 1322 in Dari. (Brossell, WI) Possibly on 13710 from Bengaluru at 2342 popping on in mid-program with man and woman speaking in Chinese. (Sellers, BC)

IRAN—VOIRI on 6150 from Sirjan at 0043 with woman and their Turkish service. (D'Angelo, PA)

SWBC DX get together. Ah … summer!

JAPAN—Radio Japan on 6135 at 0400 with woman giving station ID and open in Russian; on 13650 from Yamata at 2356 close with continuous instrumental music, listed in Vietnamese or Burmese. (D'Angelo, PA) On 9820 at 0118 with woman speaking in Hindi, carrier dropped at 0120. (Taylor, WI) On 9855 via Madagascar at 2045 in French. (Brossell, WI)

MADAGASCAR—World Christian Broadcasting on 11610 from Mahajanga at 2100 sign on with IS, announcements, website and into Chinese. (Sellers, BC)

African Pathways Radio on 13670 from Mahajanga at 1800, man giving a religious lecture. (Barton, AZ)

MALI—RTV du Mali on 5995 from Bamako at 2310-0000 with man speaking in French and lively group vocals. (D'Angelo, PA) At 2326 from Bambara. (Taylor, WI)

MEXICO—Radio Educacion from Mexico D.F. on 6185 at 0433 with continuous romantic vocals and a woman speaking in Spanish. (D'Angelo, PA)

NEW ZEALAND—Radio New Zealand on 15720 from Rangitaiki at 0042 with pop, then an interview. (Barton, AZ)

NIGERIA—Voice of Nigeria on 11770 from Abuja at 2035 with talks in Hausa. (Brossell, WI)

NORTH KOREA—Pyongyang Broadcasting Station on 6180 at 1157 with DPRK opera. (Taylor, WI)

OPPOSITION—Voice of Hope (South Korea to North) on 3990 at 1113 with woman speaking in Korean leading into man talking; also on 4885 & 9100 with poor reception and fading. (Taylor, WI)

Furusato No Kaze (via Taiwan to North Korea) on 9705 at 1345 in Japanese. (Taylor, WI)

Nippon No Kaze (via Taiwan to North Korea) on 9940 at 1208 in Korean. (Brossell, WI) At 1301. (Taylor, WI)

Echo of Hope (South Korea to North) on 9095 at 1214 with Korean pop music. (Taylor, WI)

National Unity Broadcasting (via Taiwan to North Korea) on 9475 at 1205 with man and woman speaking in Korean and Korean pop music, DPRK grind jamming. (Taylor, WI)

Eye Radio (via Vatican to South Sudan) on 15410 at 1609 with Arabic talks. (Brossell, WI)

Radio Tamazuj (via Madagascar to South Sudan) on 11650 at 0412 in Juba Arabic to 0427; also on 7315 unheard. (D'Angelo, PA)

Denge Welat (via Moldovia to Turkey), at 1226 with woman talking at length in Kurdish. (Taylor, WI)

Radio Lap Loi Song Nui (via Taiwan to Vietnam) at 1234 in Vietnamese with DPRK jamming also audible. (Taylor, WI)

Republic of Yemen Radio (Saudi Arabia to Yemen) on 11880 at 1302 with man talking in a slow Arabic. (Taylor, WI)

PHILIPPINES—Far East Broadcasting on 9795 from Iba at 2320 with man speaking in the Mon language, songs, IS at 2330 and into Laotian. (Sellers, BC) On 9920 from Iba at 1217 in Jarai (a Vietnamese minority language) with stringed instrumental music. (Taylor, WI)

PIRATES—Chinese Dick Radio on 6925 at 2020, 2027 mention of Ashley Falls, MA address, off at 2029. Butplug Radio, 6930 USB (u) at 2358, seemed to be comedy pop. (*These names get cuter and cuter, don't they? – GLD*). Skunk House Radio on 6928u at 2153 with several progressive rock things. Outhouse Radio on 6925u at 2349 occasional Ute QRM, Slow-Scan TV (SSTV) / FAX. (Hassig, IL)

Reported earlier: Radio's Ballsmacker, Wolverine, Two Dog, Mix, Radio Enigma 7, KDOG, TRI, Fubar, KIND. (Hassig, IL)

Goat Farmer Radio on 4180u at 0201, Zeeky thanks Redhat for a good show, "Long Cool Woman" with station ID. Goat Herder Radio on 6925u at 0119 with looped phrase, Zeeky comments, goat sound effects, etc. (Taylor, WI)

Reported earlier: Pee Wee Radio, X-FM, Ballsmacker Radio, WDOG, WDDR, Two Dog Radio, WTF Radio, Fubar Radio, Radio Illuminati, Enigma7, Wolverine Radio, Nowhere Radio, Wasteland Radio, KIPM, Enigma 7. (Taylor, WI)

ROMANIA—Radio Romania International on 9610 from Tiganesti at 1943 in Spanish. (Brossell, WI) On 7310 at 2233 with traditional music, male announcer and poor reception. (Sellers, BC)

SAO TOME—VOA Relay on 11900 from Pinheira at 1929 in French with English station ID. (Brossell, WI) At 2110 with an English lesson, (Sellers, BC)

SAUDI ARABIA—BSKSA on 9675 at 1848 in Turkish. (Brossell, WI)

Al-Azm Radio on 11745 from Jeddah at 1257 in Arabic. (Taylor, WI)

Holy Qur'an Radio on 17895 from possibly Riyadh at 1348 with a man speaking in Arabic on the Qur'an, (Taylor, WI)

SINGAPORE—BBC-Far East Relay on 9410 from Kranji at 1153 with woman telling a story; on 12065 at 1308 with "Newshour." (Taylor, WI)

SPAIN—REE on 11685 at 2126 with interview, brief instrumental music, dead air until 2234, into French. (D'Angelo, PA) On 11940 from Nobeljas at 2205 with its Monday, Wednesday, Friday with English service and in-depth news coverage. (Sellers, BC)

SWEDEN—IBRA Radio on 15510 via Woofferton at 1830 in Spanish, man then man and woman with Bible lesson. (Taylor, WI)

TAIWAN—Radio Taiwan International on 9425 from Paochung at 1254 in Vietnamese; on 9490 at 1156 in Spanish. (Taylor, WI)

TURKEY— Voice of Turkey on 9635 from Emirler at 2010 in French. (Brossell, WI) On 9830 from Emirler at 2211 with news. (Sellers, BC)

UNITED STATES—VOA on 9740 from Greenville at 2124 with man and woman speaking in French on the telephone, off at 2129. (Sellers, BC) On 9800 via Philippines at 1304 in Korean; on 11610 via Woofferton at 1613 in Somali; Dewa Radio on 12035 via Thailand at 1306 in Pashto. (Taylor, WI, Brossell, WI)

Radio Liberty on 15090 via Lampertheim at 1357 in Pashto with woman giving the station ID sequence; on 15225 via Thailand Relay at 1400 in Turkman; on 15310 from Woofferton at 1495 in Uzbek. (Taylor, WI)

Radio Farda on 12005 via Woofferton at 1304 & 1756 in Farsi. (Taylor, WI, Brossell, WI)

Adventist World Radio on 9800 via Nauen at 2130 sign on with English station ID into the Twi language. (Sellers, BC) On 11680 via Madagascar at 1954 in Arabic. (Brossell, WI) On 15255 via

Tajikistan at 1315 in Napalese; on 15430 via Sri Lanka at 1325 in Bengali; on 15440 via Tajakistan at 1330 in Thai. (Taylor, WI)

Overcomer Ministry on 5900 via Bulgaria at 0330 with Brother Stair. (D'Angelo, PA)

VATICAN—Vatican Radio on 13830 at 1814 in Portuguese. (Brossell, WI)

VIETNAM—Voice of Vietnam on 11885 from SonTay at 2108 with news in Spanish then news in English at 2139. (Sellers, BC)

Quien Sabe?

Harold Sellers notes an unidentified on 9930 kHz with a man and woman talking in an unknown language at 0216 UTC, then a man in a discussion. Weak signal, and gone by 0234 UTC.

QSL Quests

Radio Austria International is saying "nuts" to this QSL business. No explanation was given. Let's just guess it was too expensive and/or too time-consuming for their already limited staff. Likely one of those standby excuses. You can still QSL Austria through the Adventist World Radio Moosbrunn relay, most often heard on 6185 kHz.

As Time Goes By

The Malawi Broadcasting Corporation, Kimbe, running 100 kilowatts for English on 3380 kHz. Heard at 0409 UTC on September 27, 1995. Sign on was at 0301 UTC.

Just Sayin'

I've finally had it with this pirate "garbage." As one, now retired, Voice of America (VOA) guy likes to say of pirates,

World Music Radio (Denmark) recently announced the additional use of 25770 kHz.

"kids playing radio." I suspect there are only a handful of guys operating all the Radios this or that or the Besmerch Radios. That, and the same-old / same-old programming tends to be a total turn off. So, henceforth, I will include pirates only if they are new or have an unusual aspect attached.

Thank You

Thank you, thank you to Rick Barton, El Mirage, AZ; Harold Sellers, Vernon, BC; Mark Taylor, Madison WI; William Hassig, Mt. Pleasant, IL; Rich D'Angelo, Wyomissing, PA; Rich Parker, KB2DMD, PA; and Bob Brossell, Pewaukee, WI.

Until next time, keep on keepin' on ... and be sure to CELEBRATE SHORTWAVE!

EMERGENCY COMMUNICATIONS

BY STAN BROADWAY,* N8BHL

Can We Really? (Yes, We Can)

This column is not about me, or my own experience. It's about you — amateur radio operators around the world who step up when things are down. That might be to help coordinate a neighborhood fun run. It might be a major athletic or political event. It might be a genuine emergency … a weather-related disaster, a large wildfire, an earthquake or now, even a pandemic. This column is about questions which can be universal to our corner of this great hobby and service. Some of those I received from my new ARRL Section Manager, Tom Foy, WB8LCD, who is busy trying to do the "rapid indoctrination" into the many facets of amateur radio going on in the Ohio section. Tom can't be the only one wondering … even those of us deep in the trenches have found ourselves wondering, "Can we really?" In answering him, I hope to be an encouragement, prodding you to keep going, keep the enthusiasm, keep the dedication to community. And I thank Tom for graciously allowing me to share his questions with you.

"When All Else Fails…"

This is a pretty bold statement, Tom writes. "It seems that about 99% of emergencies that we deal with are weather-related. I used to be pretty confident that industry and government were hardening their systems so that weather would not be such a big factor in the future. This year's storms in Texas kind of debunked that theory! Are we prepared for that kind of emergency?"

It is easy to point him to situations where a lone ham operator was able to cobble together an antenna and portable power supply to be the first heard from a devastated area. I've taken that hurricane report from an operator whose antenna was lying on the ground as she looked out her window at 100+ mile-per-hour winds. We replay tapes from the Haitian earthquake (*Photo A*) and Caribbean hurricanes containing the excitement of masterfully handled radio communication. But can the average ham operator perform in like fashion today, he wonders. For the good of your response, we all should find out.

Amateur radio is still a frontline system anywhere in the country when severe weather is a threat. The Skywarn system has expanded over recent years to include winter storms and conditions (see *Figure 1*). While the National Weather Service has a well-provisioned cadre of weather condition reporters <www.cocorahs.org>, the onset of warm or cold severe weather can (and I think should) prompt hams to start communicating. Spotter activities are a bit unique in that ham operators are *already* deployed — we live in the midst of it — and we are in a unique position to organize our reporting and deliver significant observations to our local agencies,

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Photo A. Despite the massive destruction caused by an earthquake in Haiti in 2010, hams were still able to get on the air and communicate with the outside world. (Illustrations courtesy of National Oceanic and Atmospheric Administration)

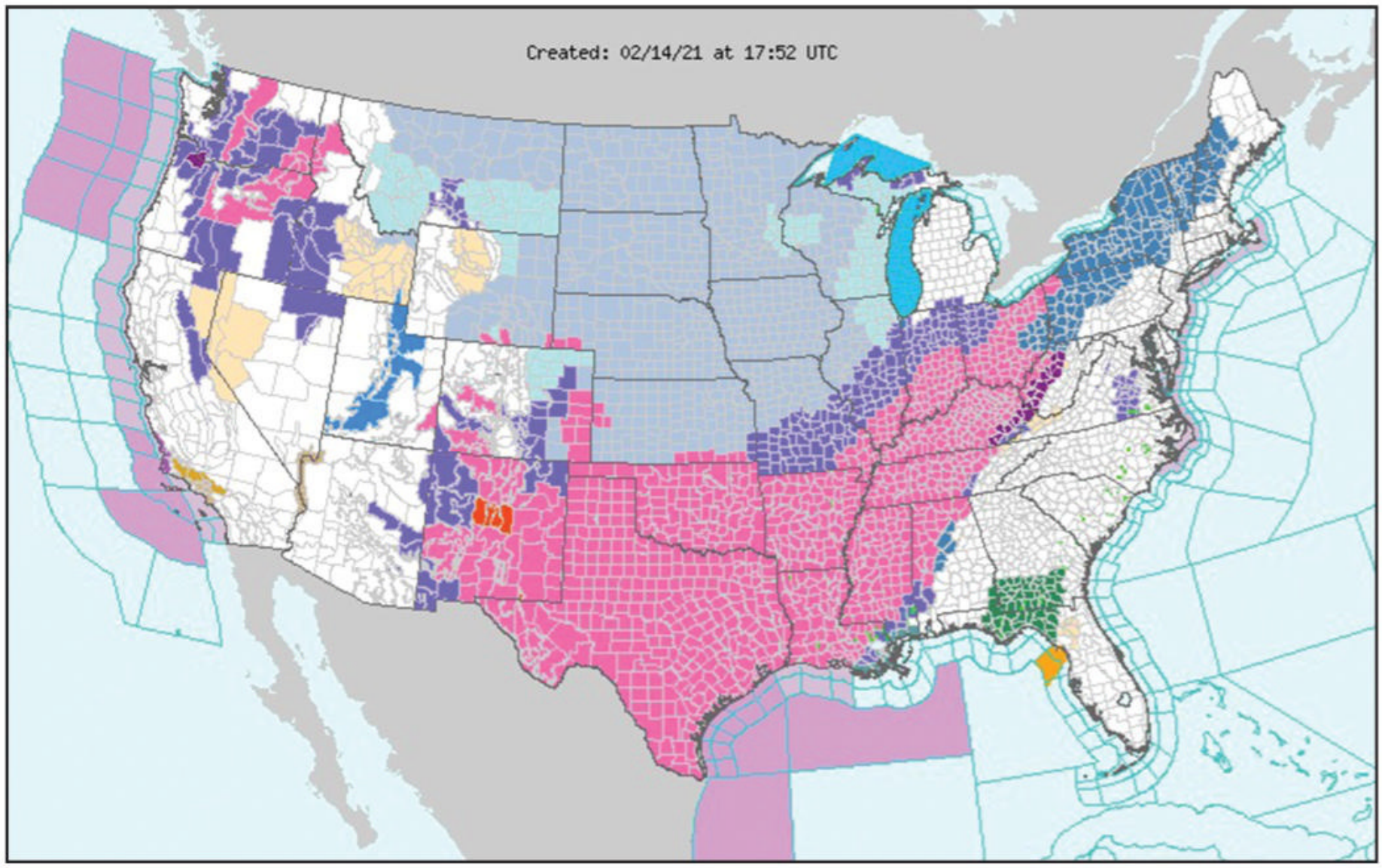

Figure 1. NOAA winter storm warning map.

from the Weather Service to emergency management agencies (EMAs) and more. Weather spotting got me interested in this hobby, and it continues to hold my attention.

There are other immediate activities that find amateur operators providing exemplary service. Here in the safety of flyover states, we dodge the threats of hurricanes, wildfires (*Photo B*), and earthquakes. If you're in the western states, you may be a volunteer for the different wildfire teams … setting up comm points, deploying MESH nodes and cameras, and tracking movement of troops and flame. Your work is exciting and exemplary! Despite enhanced public communication systems, large-scale event managers welcome amateur radio as an additional resource able to communicate over and around mountainous terrain.

In Iowa last year, severe derecho conditions with pockets of over 120 miles-per-hour winds raked across the state (*Figure 2*) flattening communication resources and parts of cities. Amateurs immediately started talking … in the simplest form of communication, exchanging news of what important stores were open, where supplies were available and where there was damage. Iowa SEC (Section Emergency Coordinator), now Section Manager, Lee Garner, WAØUIG, who lived in the middle of one of the hard-hit areas, reported recently that hams readily grabbed their radios to participate and serve their communities even in situations where public service radio still existed.

Powerless

Back to Tom's original question, yes, Texas' winter storm did test everyone's ability to cope. The storm nearly dropped the state's power grid, coming within four short minutes of triggering shutdown because of power draw and a drop in cycles-per-second to dangerous low levels. After Texas, after major earthquakes, and after all severe weather events, there is at least one common element: The loss of commercial power for a prolonged period. Obviously, other major problems exist depending on the situation, but power's a big deal.

Can I tell my new Section Manager not to worry, we've got this covered? No, I don't think I can. That would be overly optimistic. But I believe there is a significant majority of seasoned amateur operators out there who could figure out how to get a battery set up, find a generator, cut an antenna, and get on the air. Would we start dispatching emergency crews, climb poles and drive big bucket trucks? Never. Would we be able to provide accurate situational awareness to our local and state EMAs? Yes, absolutely. Would we be able to transmit formal messages between agencies? Many would, others would quickly catch up.

We Can Get Even Better

There are ways we can teach newer hams how to be productive during an emergency event. In my area, a series of "Ham Boot Camps" is springing up. These educational experiences help participants learn things like antenna basics, how power supplies work, operating radios in different conditions, and so on. I see great promise in this where hams who may get a "one-day-and-done" amateur radio license can now get more deeply involved in learning what can make them more valuable to their communities. Simple acts that many take for granted can make all the difference — soldering a coax connector, securing and measuring antenna wire, creating an off-grid power source — are all absolutely critical in an emergency. George Reidel, N1EZZ, spent time standing portions of broken antenna towers back up, repairing antenna parts, and get-

ting crippled police / fire stations back on the air in the aftermath of Hurricane Maria on the islands. These are skills amateur operators should all possess.

What About Other Things?

Tom's letter continues to ask about other types of emergencies. He writes, "the recent pipeline shutdown seems significant. What kind of communications problems could result from that type of activity and are we prepared to do anything about it?" (*See, he's already doing what great Emergency Coordinators and communicators do … playing that "What if" game! –SB*). He continues to the heart of this issue, asking, "What could hackers do to our whole communications infrastructure and what kind of response could amateur radio provide?"

The answer, despite declarations to the contrary from people selling communication systems, is yes, our public communication system can be vulnerable. These are not fragile systems by any means. Some of the best minds are behind protecting these systems, especially because many depend on the internet in some form or other to operate. But they can be crippled. In Ohio several years back, a pinhole-sized steam leak saturated a switching office and took down six state radio systems, along with 911 service over six counties. These stories are few, but significant when they happen. Our optimistic approach is the worse it gets, the more useful amateur radio will be. Again, it takes hams who are capable of portable, off-grid power operation. Can you?

It also takes good operators who can function in very tightly controlled net conditions! This is no place for rambling "sunshine reports" from operators who really want to participate but who aren't seasoned enough to know that listening is often more important. It takes hams who can handle digital messaging. Our agencies are years … *centuries?* … past the word-limited ARRL message form. They depend on the NIMS/ICS forms and we need to be able to live, work, and breathe in that environment. Our goal, then, is to train newer hams and constantly refresh the veterans so that when it does hit, all are ready. My years in the fire service convince me beyond a doubt that constant training will produce actions that get the job done when finally called for.

Other Situations

Many amateur groups were pressed into service to assist our agencies with pandemic response. Some helped direct

Photo B. Hams on the west coast responding to wildfires face different challenges from those in the southeast who worry most about hurricanes.

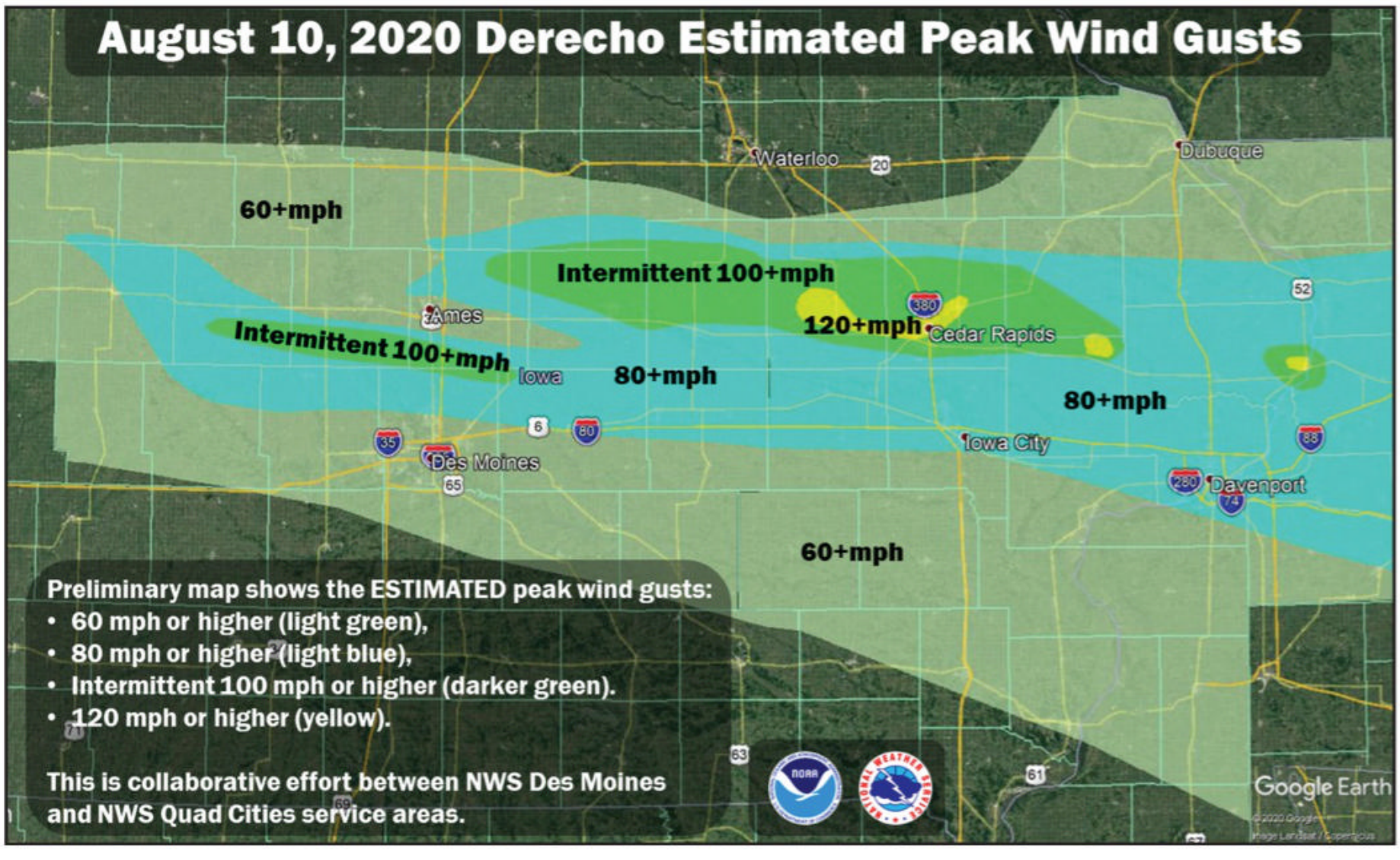

Figure 2. Estimated maximum wind gusts during last year's "derecho" storms in Iowa.

crowds, communicated needs and flow. Others actually handled health department call centers, volunteering for weeks at telephones, scheduling times and places. That type of response can translate into communication for PODs (Points of Distribution) after large disasters and understanding the health concerns in those situations.

Tom continues his "What if" scenario by noting a malware situation might last longer than a couple of days or, if there was no ransom, it was an attack merely to bring us down. Now we're getting serious! The good thing is that amateur radio doesn't rely on the internet; it's impervious to hacks. That makes it a dependable resource that can continue untouched through many situations. As mentioned, the common element in many of our doomsday examples is a long-term power outage, perhaps a grid down scenario. Research has shown that the U.S. power grid is extremely vulnerable and if taken down, it would be down for many months. Can we amateurs step into that situation and be successful, wonders Tom. I would like to think we'd "save the world" but it would honestly involve a much lower number of participants. We would have to overcome the challenge of a long-term backup power source … a challenge that grows as power-lost time expands. Consider that nearly all of what we take for granted would eventually stop. How long would we be able to continue? How long would you?

The "Really Big One"

Tom's question then goes a step further — to EMP, or electromagnetic pulse, resulting from the high-altitude detonation of a nuclear bomb. He says, "I've asked this question many times over the past 20 years and the answer (from some pretty bright and/or connected people) is always the same: Not something we need to worry about. Exactly why I worry about it! What would we be capable of? How could we be better prepared?"

I think he's going to work out all right.

The best answer I can suggest is from the bomb scares of the '70s. Despite frenzied warnings to the population, the common-sense approach involved a potential enemy not needing to turn the entire continent into scorched rubble. They might conquer the country, but if there was nothing left, there would be no benefit to having it. Calmer minds in those years suggested that since a lot of aggression was a matter of making a statement, we might expect attacks on the government, military, commerce, and maybe communication. That would bring down several larger cities but not the entire country. It made sense to me at the time.

The same might be true of an aggressor's EMP. Would it really take the entire continent back to the 1800s? Or would there be wide areas where electronics still function? There might be one or two EMP-proof buildings around (how do you test that?), but I would suggest the majority of us would potentially be finished when it comes to communication equipment. There might be a few with a radio inside a grounded metal can, but not many. There are many who would have to ignore the radio in favor of finding supplies, food, water, and other survival needs. Perhaps the worst case is a solar EMP, which is far more indiscriminate.

Now he's got *me* doing it!

Writes Tom, "I'd like to be able to say these are things that we've at least got some kind of a pre-planned response for." I totally agree, and I am reassured that the vast majority of amateur organizations do have some level of planning in place. We all should. Do you? And as life happens, we'll be able to improve them if we share our experiences.

KIT BUILDING

BY JOE EISENBERG,* K0NEB

Finding Hidden Treasure

One of the consequences of the pandemic is spending a lot of time at home and on the air and, of course, building kits. I have spent lots of hours cleaning up and updating my shack and antennas as well as my workbench, and finally the rest of the basement got its turn. Although not yet complete, over 42 trash bags later, I have made significant progress, and begun sorting things into storage totes. I now have storage containers of finished kits, unbuilt kits, parts, and connectors. RF adapters alone filled a small container.

Now that I know what things I don't need to buy anymore at hamfests, it will be a lot easier to know what I really do need. The other benefit of this task has been finding unbuilt kits that will be lots of fun to assemble. Some of the kits I found are no longer available, but the supplier has similar kits still available.

One kit I found was the K-488 one-tube AM broadcast transmitter kit (*Photo A*) that could be used to generate a signal to demonstrate things like crystal sets, restored antique radios, etc. with your own music instead of the more talk-oriented broadcast stations more common on AM radio.

The K-488 used to be produced by Antique Electronic Supply in Tempe, Arizona. The company still produces a 2-tube regenerative AM and shortwave receiver kit built in a similar fashion to K-488, but it runs on DC. This AM transmitter kit includes an AC transformer and power cord as it runs directly from 120-volts AC. A drilling template (*Photo B*) is part of the manual for drilling pilot holes and mounting holes into the supplied wooden base. I taped the template to the block of wood and used a Dremel® tool to make tiny holes so I could then remove the template and use my regular drill. Drilling the holes and mounting the lugs and things like the transformer come first in the assembly of the AM transmitter (*Photo C*).

**7133 Yosemite Drive, Lincoln, NE 68507*
email: <k0neb@cq-amateur-radio.com>
Hamfest Hotline #5855

Photo A. The K-488 AM transmitter parts all sorted out and ready to assemble. The tuning tool was included in this kit, as was the 12SA7 tube.

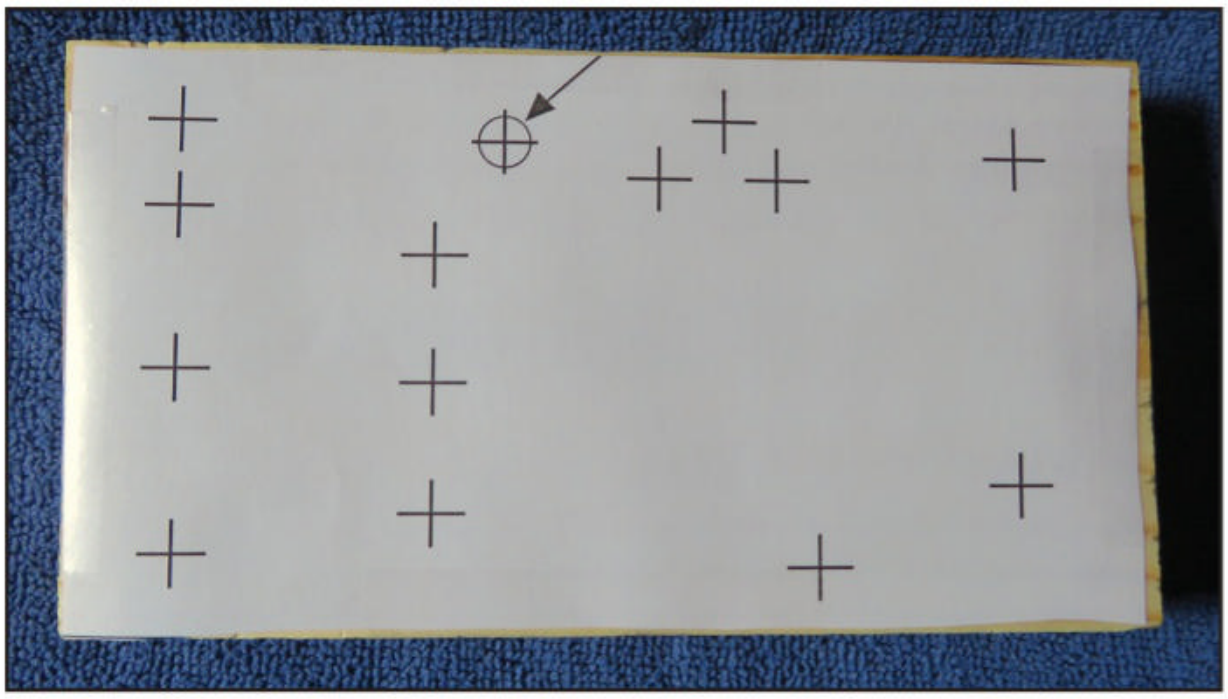

Photo B. The template is cut out from the manual and taped onto the supplied pine board.

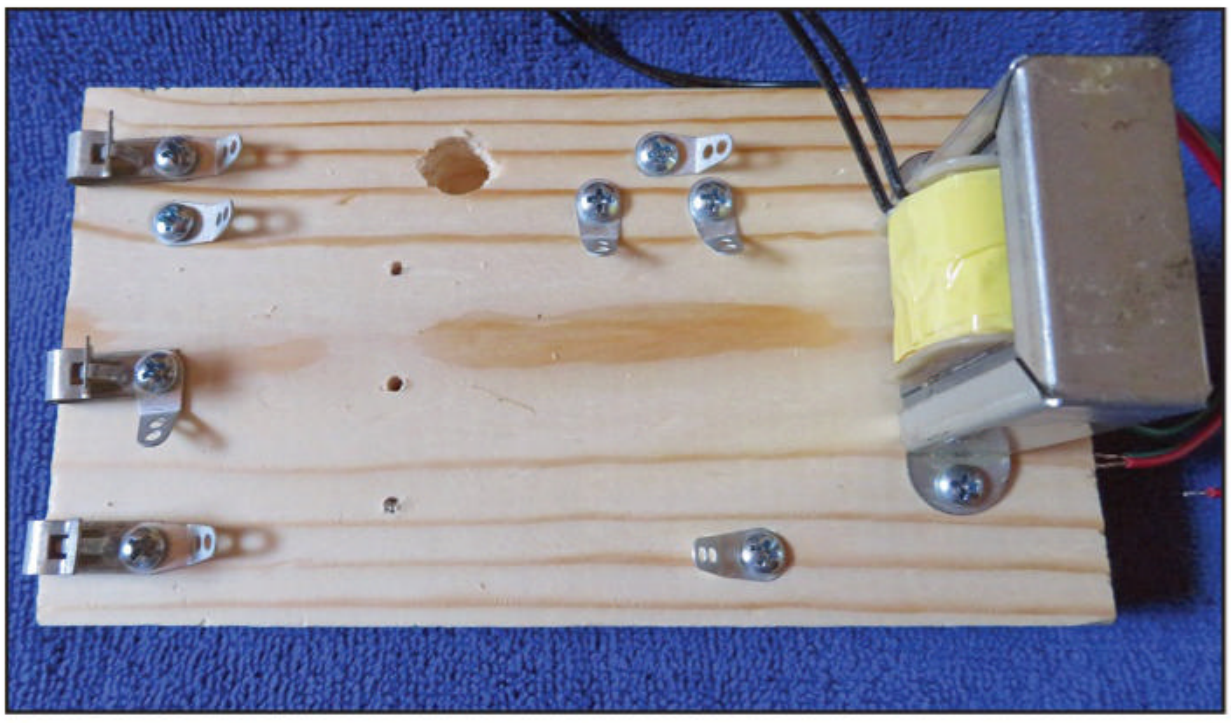

Photo C. The transformer, solder lugs, and Fahnestock clips are mounted to the board.

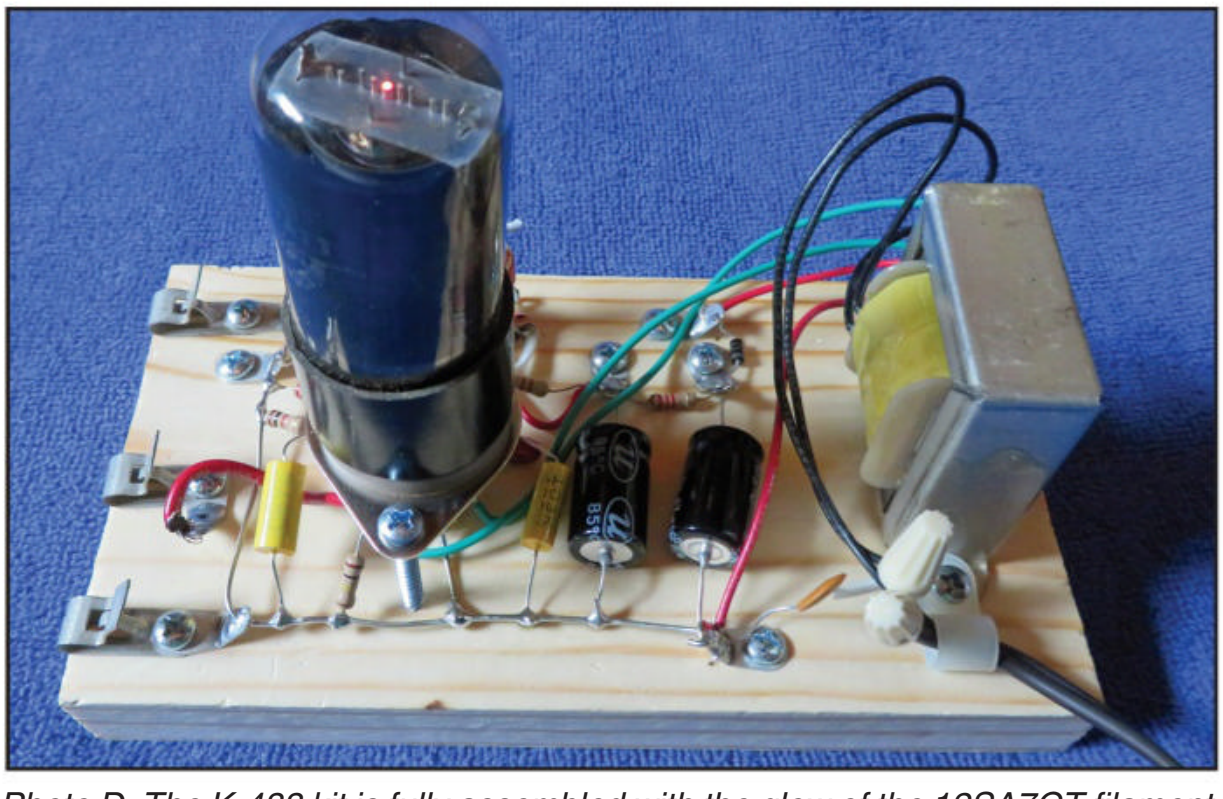

Photo D. The K-488 kit is fully assembled with the glow of the 12SA7GT filament visible.

Once the lugs are in place, the components that are on the main board are soldered into place, followed by the components that attach to the tube socket. The socket is then mounted to the board and its components soldered to their respective terminals. There are some leads that need to be sleeved due to the higher voltage applied to them or their proximity to other nearby leads. I measured 153-volts DC on the B+, which is open in several places, so be careful when using this kit or any similar tube-type kits. I used the included tuning tool to place the signal on AM 1150, unused in my area, and found that it needs speaker level audio to modulate it. I simply turned up the audio level from my source until it sounded good in my radio and was not distorted. You can get a similar kit that makes a 2-tube regenerative receiver from Antique Electronic Supply at <www.tubesandmore.com>.

Pinball Wizard?

Another treasure uncovered in the process was a 1975 Gottlieb pinball machine (*Photo E*) I had gotten in the mid-80s and restored, but it had been used for many years and then, once it quit working, it was covered up and relegated to a far corner. Uncovering it revealed a need to replace the rubber bumpers, which had become stiff and dried out or crumbling. A host of #44 bulbs were flickering or out and so ordering a kit to restore it was in order.

A complete set of the “rubbers” as well as a few bulbs and a couple of new balls and a Plex-stone rounded out my order. The Plex-stone is a flexible abrasive contact cleaner that should only be used on pre-1977 machines, due to the materials used on the contacts on the relays and switches. After 1977, silver- or gold-plated contacts, similar to those we see on our CW keys and paddles, came into use as the voltages involved lowered significantly once the scoring and playfield changed from purely electromechanical to a microprocessor-based controller and score display. Using an abrasive like this on more modern contacts would remove the coatings vital to low-resistance contacts. In these older machines, using an emery board, as we do for removing the insulation from enameled wire leaves grit particles from the board between the contacts, while the Plex-stone does not shed any. It is still not appropriate to use any abrasive on key or paddle contacts, or most relays we use in radios.

I spent a few hours cleaning the glass

and playfield as well as doing the maintenance (*Photo F*) and was rewarded with a fully functional 1975 electromechanical pinball machine almost arcade-ready! The coin box and coin mechanism are the only things I did not deal with yet. Wiring a doorbell button across the quarter coin drop contacts allows games to be initiated without having to open the door and touch the contacts or put coins in. The loud doorbell-type chimes and loud snap of the free game solenoid to me are much nicer than hearing the digitally synthesized sounds of more modern arcade gaming machines. All the "logic" in these electromechanical machines is made up of solenoids, relays, and motorized rotary switches that perform tasks such as coin handling, resets, target values, scoring, ball count, tilt / tamper control, and awarding free games.

With wiring harnesses similar to those found inside the Heathkit SB-200 amplifier, there are a lot of similarities between these entertaining machines and some older radios of the same era. The good thing is that these older pinball machines have retained their value and there are sources for some replacement parts, such as the solenoids and switch contacts. These are not old parts, they are currently manufactured as many models of pinball machines continue to share a lot of the same basic parts. I found my parts at <www.marcospecialties.com>. There are a number of other parts suppliers as well, depending on which type and make of machine you are working on.

Hamfests Ahead

I am anxiously anticipating the Huntsville Hamfest in August as well as others, including the Peoria Superfest in September, so I can once again see everyone in person. Be sure to say "hi" and enjoy the easing back into more normal life.

– Until next time, 73 de KØNEB Hamshack Hotline #5855

Photo E. Just about arcade-ready, this 1975 Gottlieb pinball machine is ready to play!

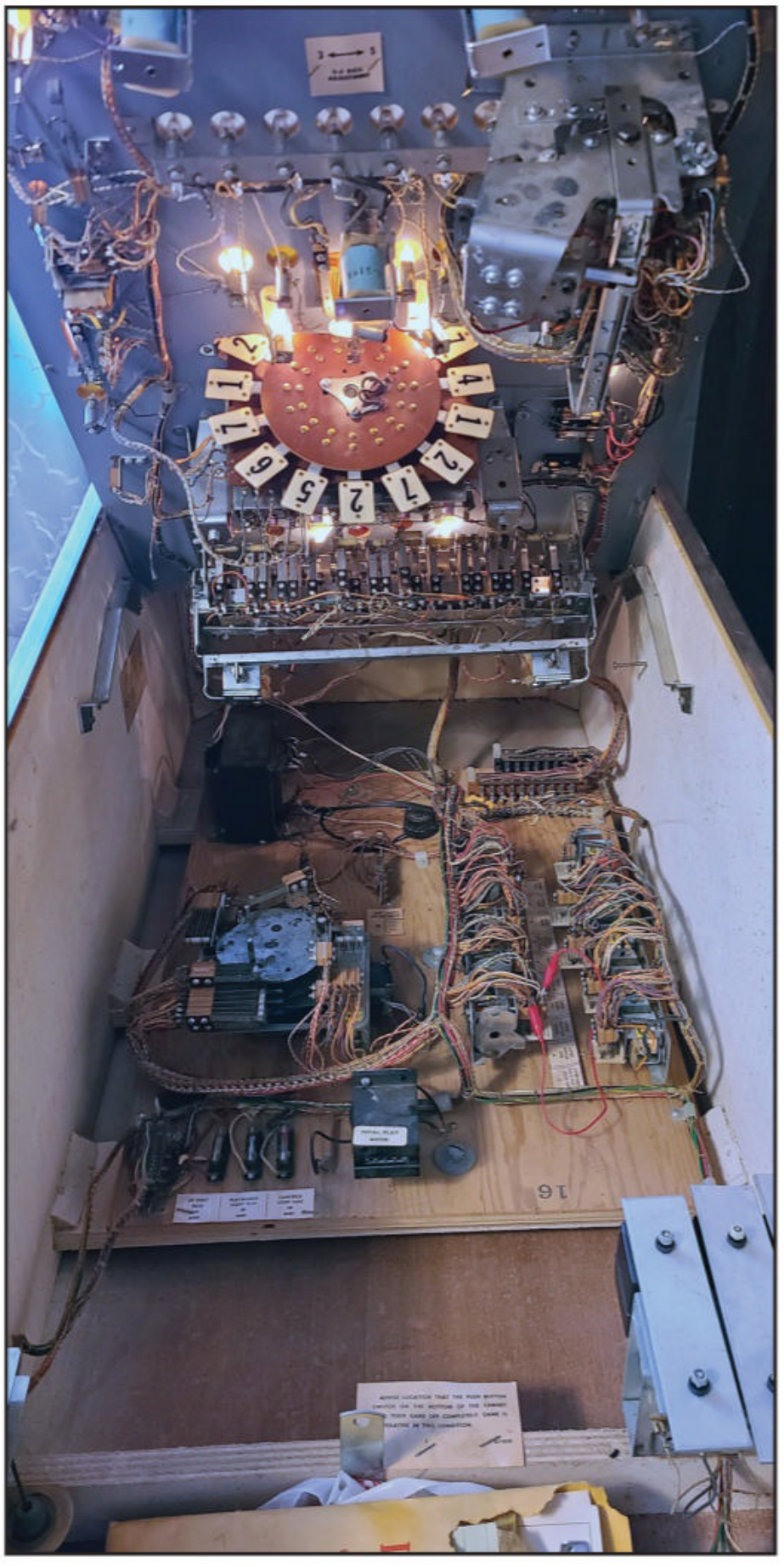

Photo F. With the glass removed and the playfield lifted, the main chassis of the machine reveals numerous relays, solenoids, rotary switches, and target mechanisms. There is even a wall socket inside the machine for the service technician to plug in a pencil-type soldering iron common to the mid-1970s.

MAGIC IN THE SKY

BY JEFF REINHARDT,* AA6JR

Firsts

A simple crystal radio kit, such as this one from Vectronics, helped AA6JR discover the "Magic in the Sky" as a boy, even though it took him many more years to get his ham license.

We humans seem to have a trait that forever embeds in our memories significant "firsts." First day of school, first date, first car, just to name a few.

Now I have a friend, a real estate broker, who wryly told me there are times when it pays to be second. I asked, "for instance?" She shot back, "Second mouse, second wife, second real estate agent."

This being a magazine devoted to our magnificent hobby, I'll shift back to firsts and have you recall the thrills of your first encounter with the existence of radio, your first successful experience passing a license exam, your first two-way contact and after that, you can fill in the blanks on those significant "firsts" of your own, such as awards, new (to you) operating modes, your first experience operating a "dream" radio and so on. Each significant recollection should raise a smile, as these and more are what has been the crux of this column for so many years — the *Magic In The Sky* — and it is really an indescribable, unquantifiable force, perhaps similar to dark matter, that first attracts us, then keeps us engaged and fascinated by this medium we call "radio."

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For me it was a crystal radio, a gift from Dad (KB2YAL-SK). He was an electronic technician by trade and didn't become a licensed ham until his senior years, but even in the 1940s he saw the future was centered around electronics. He told my youthful ears in the early 1960s to think about studying computer technology because that's where the world was headed. Remember, those were the days when IBM and UNIVAC were words just beginning to make their way into the business world. Paper punch cards and tape reels were the storage media of the time. And while he plied his trade mostly in aerospace technologies, he always had a home workshop that repaired TVs and radios, mostly for friends and relatives, and usually at little or no profit to himself. Somehow, he either saw in me, or instilled in me, a fascination with radio. He also taught me how to operate a tube checker. Guess what my job was when we went to a TV repair call?

The crystal set was a kit that was able to assemble, using Fahnestock clip connectors for the components. My room was on the second floor of a city house that looked quite similar to that shown at the beginning of *All in the Family.* Archie Bunker could well have been one of my neighbors, except that I lived at the other end of New York State. What mattered was that I could throw about 25 feet of antenna wire

out of the window next to my bed, without it hitting the driveway that separated our home from the house next door. Following the instructions, I looked for a suitable place to connect the ground wire. Then discovered I didn't really need one. For whatever the reason, the small headphone came to life and I was able to receive radio stations near and far quite well.

In a sop to the instructions, and prompted by a possible increase in reception performance, I tried running a ground connection to the nearby furnace register. However, it didn't make a difference, so I removed that trip hazard that for a brief time, ran across the bedroom floor.

That little cardboard-mounted crystal set lasted years. The earphone was replaced by one of those flexible plastic ear sets that inserted in your ear and came supplied with many of the early "shirt pocket" transistor radios, you know, the kind you'd take to school and try to hide from the teacher while you listened to the World Series games that were all played in daytime back in those days. Thus, that little earphone began my love affair with listening for late night DX AM radio signals, especially when the other local stations would sign off, after playing the National Anthem, of course. And sometimes, when signoff was occurring, that station would have a very official sounding announcer state the callsign, location of that station, and a statement that might say, "WXXX (name the city) is licensed by the Federal Communications Commission to operate on 950 kilocycles at an authorized power of 5,000 watts, with studios and transmitter located in (name of the city.) We now conclude our broadcast day and will return to the air at 5 a.m. tomorrow morning with the Farm and Home show. Goodnight." OK, I was hooked. While some guys my age were reading Ian Fleming novels under the blankets with a flashlight, I was tuning up and down the loopstick searching for new DX, often falling asleep with the earphone embedded in my noggin.

Then one Christmas, Dad gave my brother and me a pair of 100-milliwatt CB handhelds. This was a big improvement over the string and soup can communicators we had tried to perfect. It seemed going around corners or past closed doors always messed up the can and string experiments. As those were no longer obstacles, we went through 9-volt batteries like a thirsty mule drinks water in Death Valley. We even broke the law by talking to some nice lady in the neighborhood who happened to chat on a licensed CB station. We never figured out who she was but she had to be nearby given our limited power output; nevertheless, she heard us "five by nine." Fortunately for us (and her) the FCC apparently took no interest or failed to monitor our illicit transmissions. I only disclose that now, assuming the statute of limitations has run out on this confession. Otherwise, I may have to request a presidential pardon for this federal infraction.

A visit to relatives in Boston really sealed the deal for me. Shortly after arrival, I learned my older cousin was a ham. He was thrilled that I took interest in his hobby and I spent most of the evenings during our visit with him in his "shack." We made several contacts on a 6-meter AM rig (he even let me talk!), respecting the limits of his Technician Class license, but we spent many more hours tuning and listening to the many ham and shortwave frequencies his 12-ton (so it seemed) hollow-state receiver could pull in.

I never assembled the money to buy a rig, or the knowledge to take the FCC ham test, until much later in life. It seemed that in my youth, one of those issues compounded the other; no money, no rig, no license, flip the order any way you like and you come up with the same result. High school brought its myriad topics of focus (courses) and distractions (girls, extracurricular activities, sports, cars, part-time jobs) and radio kind of dropped down the list of

interests. College started the same way, but then I took up working at the campus radio station as a DJ, later going on to be program director and station manager. Radio and I were reunited, this time on a professional level, as after graduation I made a living in broadcast radio for some 15 years. While I never became a broadcast radio superstar like Rick Dees or Don Imus, it paid the bills and got me over the fear of taking a FCC license test, as you needed at least a third-class radiotelephone license with "broadcast endorsement" to operate most stations back in those days. There was also some technical satisfaction in operating transmitters ranging from 250 watts up through 50 kilowatts.

Fast forward a decade or so and I shifted from broadcasting to a marketing career, part of which required a move to California. There I became part of my new community by joining a citizen response team (now called CERT) that would assist in times of emergency, something with which Californians are all too familiar. In that group, I met a few folks who were hams and, *voila,* they helped me overcome my resistance to obtaining a license and getting on the air. The rest, as they, is history. I ascended quickly to an Extra Class ticket, even having to pass the 20-wpm code test to attain it, not for any ego-driven reasons but to enjoy the full set of privileges that come with that license.

So, it took several decades from my radio "awakening" with the crystal set to achieve the important "firsts" like first contact, first award certificate, first Field Day, and many others. Special thrills came from making contacts with old friends and making many new ones with logbook entries and QSL cards from all over the planet. But it's been great fun and radio continues to fascinate, entertain, challenge and at times, mystify.

While this installment has been an unintentional autobiography, the underlying intent is for you, dear reader, to reflect on your own radio history and perhaps share it with children, grandkids and any others who may wonder what it is that drove you to making the commitment to learning the technology, investing in your knowledge and in your equipment, and using radio as a means to reaching out to others across "the ether" as an extension of yourself.

So after a lifetime of fascination, I still can't explain what makes you or me attracted to this amazing pastime. I can only refer to it as part of "*The Magic In The Sky.*"

Congressional Resolution Declaring Amateur Radio Day Reintroduced

A bipartisan resolution has been introduced in Congress (H. Res 329) that would designate April 18, 2022 as National Amateur Radio Operators Day. This is a second attempt to move the resolution forward; the first expired at the end of the last session.

To promote passage, it would be helpful if each ham would contact his or her representative using email or USPS with a simple message, "Please support H. Res 329." To find your representative's email or mailing address, go to <www.house.gov>. It would make a good statement to send your request for support to the rep's DC office on a QSL card – *AA6JR*

LEARNING CURVE

BY RON OCHU, KOØZ

CQ Reviews: Ham Radio for Dummies, 4th edition

Our avocation encompasses so many disciplines and facets that I could argue that the sum of ham radio's parts does indeed exceed its whole. That's the beauty of ham radio, there's a niche for anyone. All it requires is an interest. With time and experience, that interest will deepen into a rewarding and lifelong hobby that contributes not only to personal development, but to the community as well. Ham radio has so much to offer; yet it can be daunting as to where to begin. And once on that path, what suggestions are there for continued growth within our hobby?

There are a lot of publications available to inform and guide prospective and fledgling ham radio operators into the hobby. All of them are very good, but "*Ham Radio for Dummies, 4th edition*" by H. Ward Silver NØAX, excels (*Photo A*). The "*… Dummies*" series, published by John Wiley & Sons, Inc., is well known and respected for taking complex subjects and managing them into fun-to-read, easily understandable bites, and NØAX's book is no exception. In fact, Ward Silver's book excels in briefly covering the entire amateur radio spectrum. It is for those interested in entering the hobby, as well as those already licensed.

It's no easy task to write a friendly, easy-to-read introductory book to ham radio. Yet, Ward Silver's welcoming prose invites the reader to discover more about radio by briefly introducing ham radio's many operating and technical aspects to get them up to speed as quickly as possible. Ward points out, "A ham radio license is really a license to learn!" His writing makes it easy to get started and to learn more about ham radio. For those already licensed but not yet on the air, Ward's book will assist you in moving from being a listener to becoming a doer. Ward cautions readers that his book isn't a license exam study guide, for that would make for a very thick book. I agree, but I'd like to point out that reading his book will put you well on your way toward passing a ham radio exam.

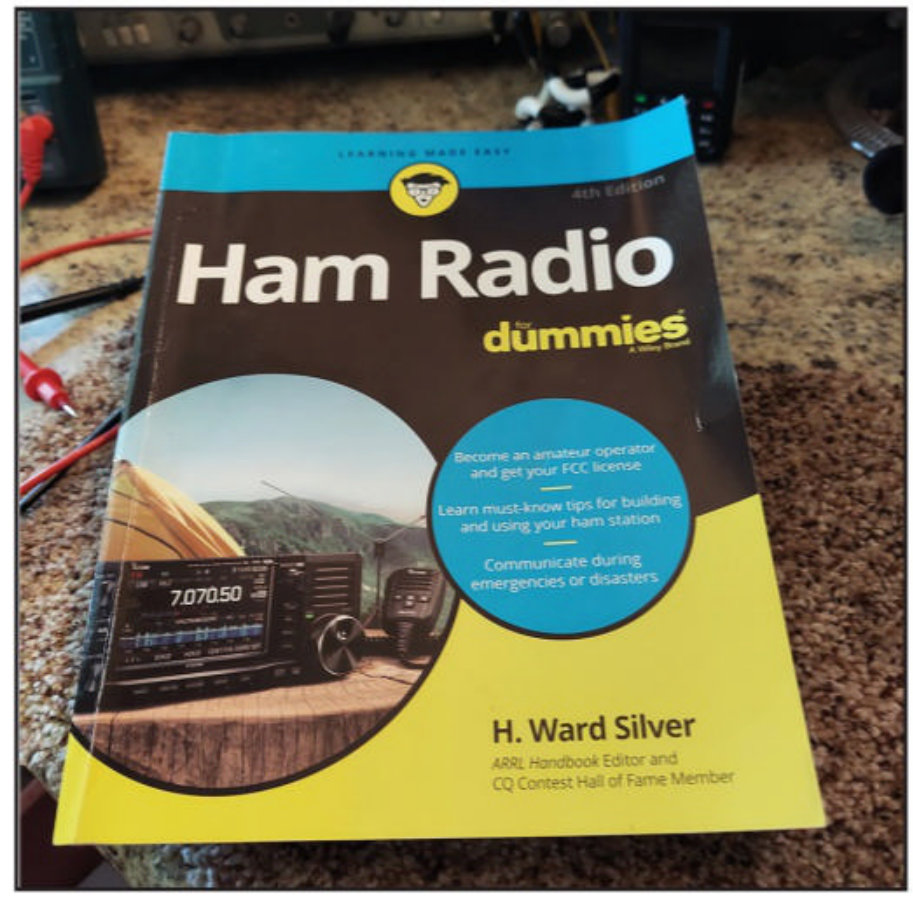


Photo A. "Ham Radio for Dummies, 4th Edition" by H. Ward Silver, NØAX, is a well-written and comprehensive introduction to ham radio. (All photos by author)

Contents at a Glance

Ward's "Contents at a Glance" is an excellent start to get a "feel for the landscape" (*Photo B*). "*Ham Radio for Dummies*" is a perfect read that answers almost any question newcomers have regarding ham radio. Ward even offers an explanation as to how ham radio came to be known as "ham radio." If you're curious, I suggest getting the book and checking out page 8, "Ham: Not Just for Sandwiches Anymore." As the title suggests, Ward employs a little humor to make points, which makes for fun, enjoyable learning. For newbies, NØAX reminds them that they are already using a two-way radio in their pocket. Cell phones are wireless radios, but many people don't think of them in that way. "Contents at a Glance" offers the reader a quick topic reference, letting you then go to the Table of Contents for a more focused explanation without having to search the entire chapter. It allows you to shop and choose topics of interest.

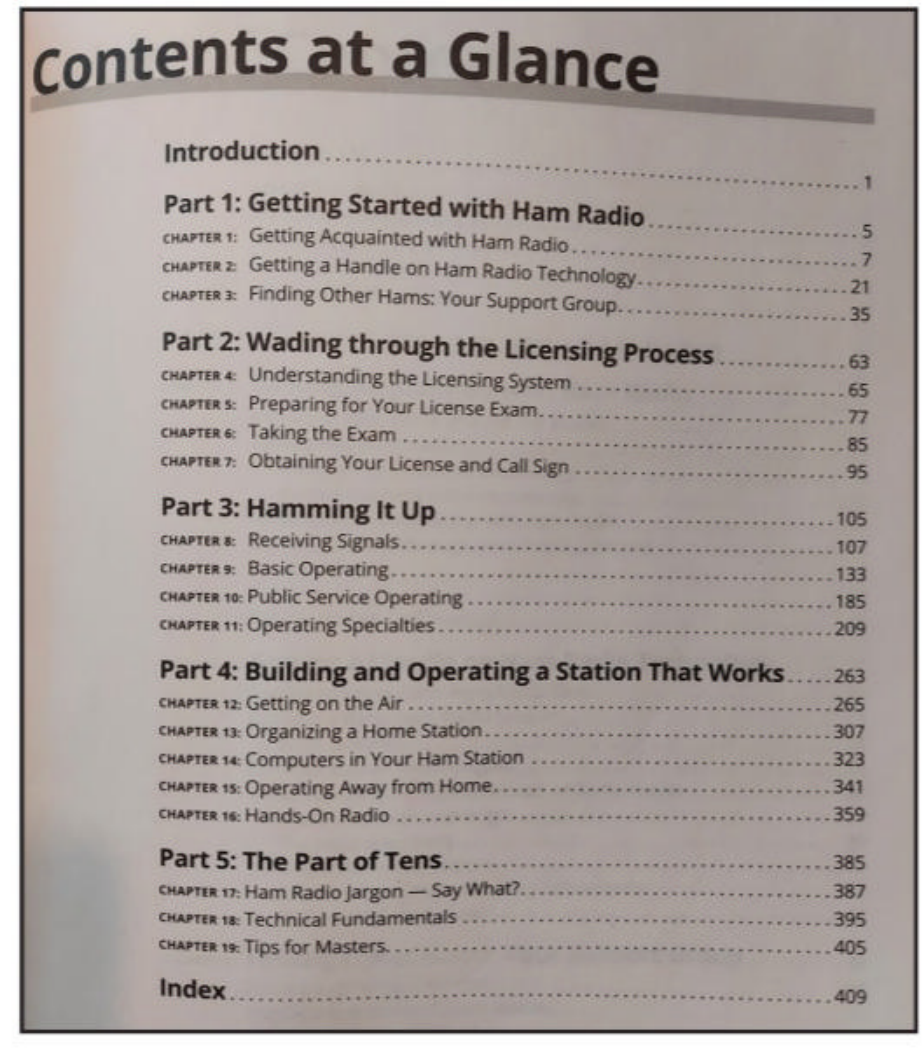


Photo B. Contents at a Glance gives the reader a great "feel for the land" before delving into the material. It also allows a reader, based upon personal experience, to shop and choose various topics.

Table of Contents

"*Ham Radio for Dummies, 4th Edition*" is 409 pages, but the book does not need to be read cover to cover (although I

**Email: <ko0z@cq-amateur-radio.com*

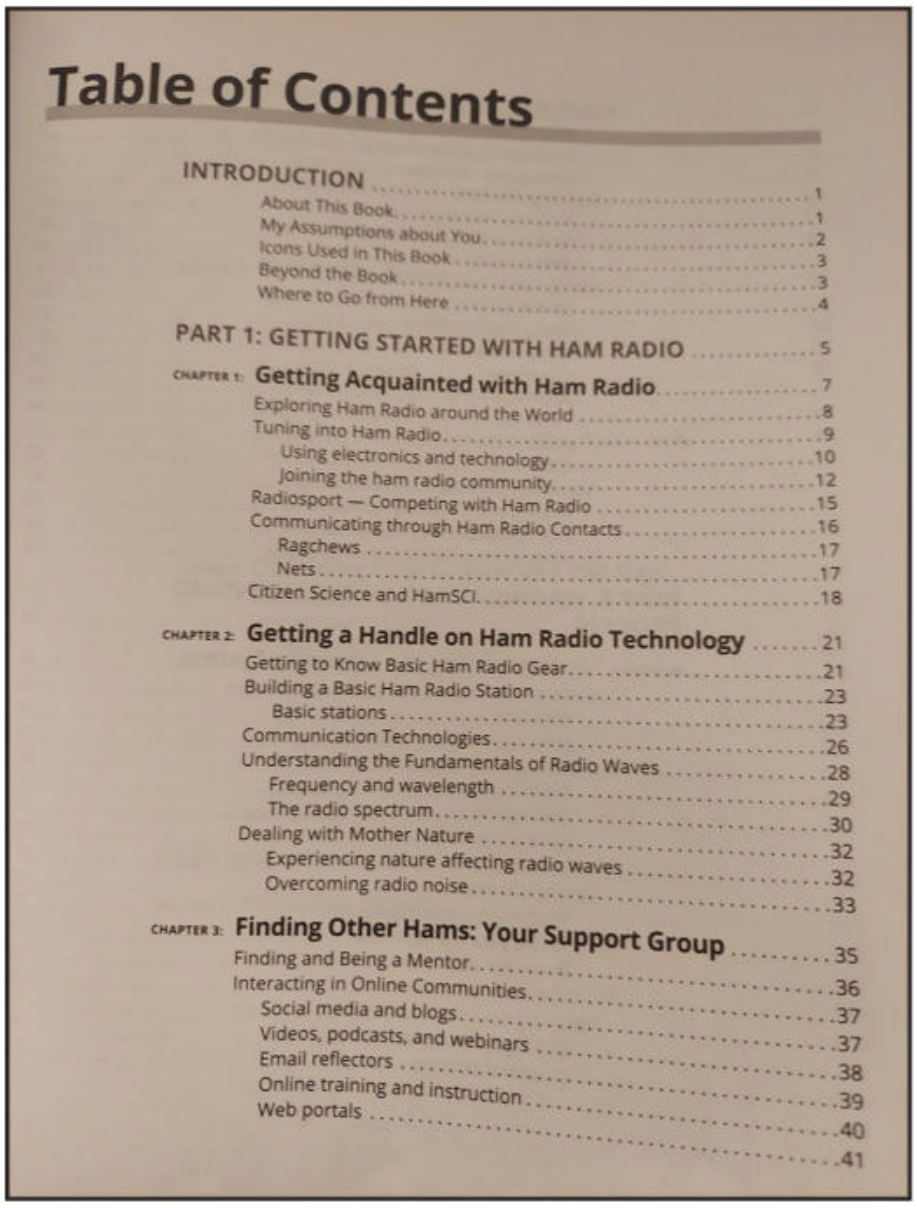
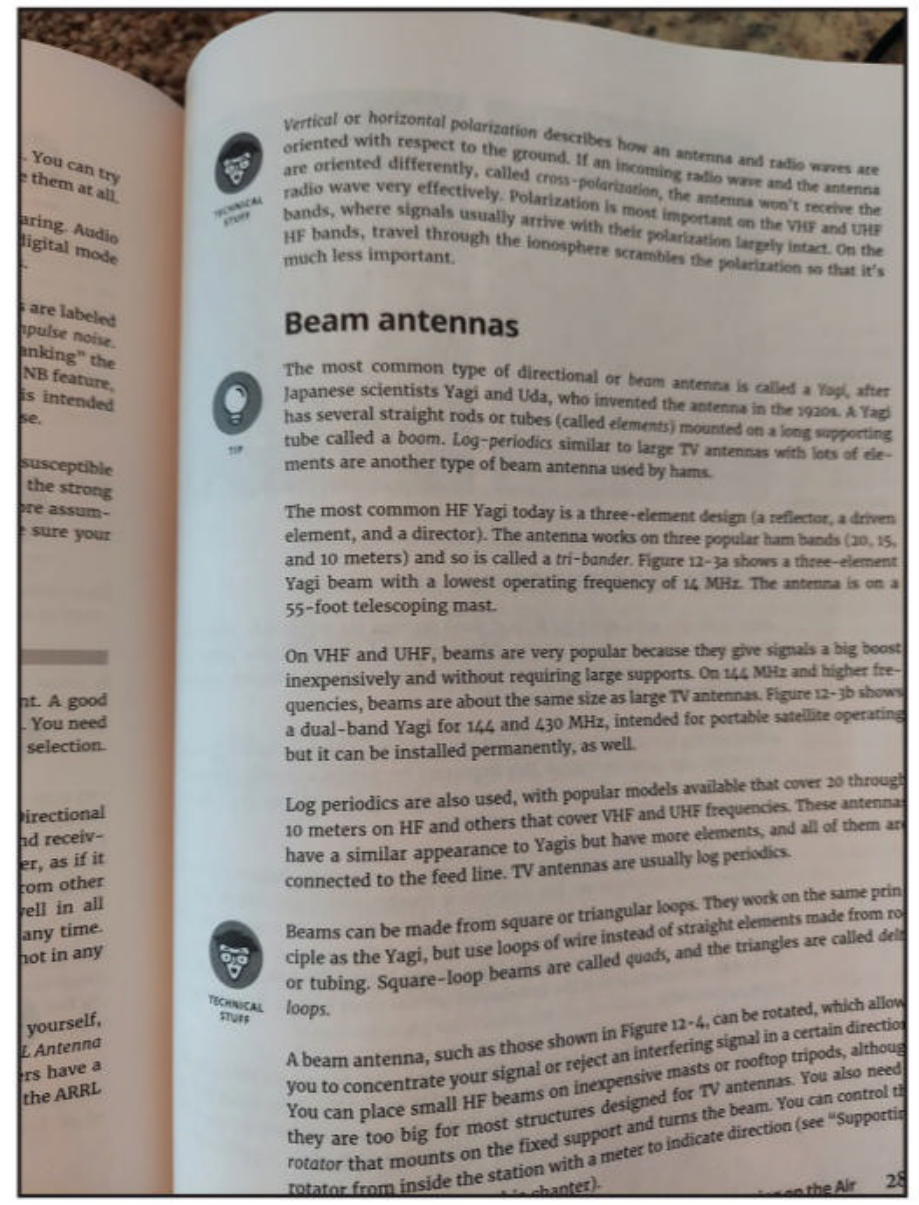


Table of Contents

Photo C. Table of Contents goes into more detail, chapter by chapter.



Vertical or *horizontal polarization* describes how an antenna and radio waves are oriented with respect to the ground. If an incoming radio wave and the antenna are oriented differently, called *cross-polarization*, the antenna won't receive the radio wave very effectively. Polarization is most important on the VHF and UHF bands, where signals usually arrive with their polarization largely intact. On the HF bands, travel through the ionosphere scrambles the polarization so that it's much less important.

Beam antennas

The most common type of directional or *beam* antenna is called a *Yagi*, after Japanese scientists Yagi and Uda, who invented the antenna in the 1920s. A Yagi has several straight rods or tubes (called *elements*) mounted on a long supporting tube called a *boom*. *Log-periodics* similar to large TV antennas with lots of elements are another type of beam antenna used by hams.

The most common HF Yagi today is a three-element design (a reflector, a driven element, and a director). The antenna works on three popular ham bands (20, 15, and 10 meters) and so is called a *tri-bander*. Figure 12-3a shows a three-element Yagi beam with a lowest operating frequency of 14 MHz. The antenna is on a 55-foot telescoping mast.

On VHF and UHF, beams are very popular because they give signals a big boost inexpensively and without requiring large supports. On 144 MHz and higher frequencies, beams are about the same size as large TV antennas. Figure 12-3b shows a dual-band Yagi for 144 and 430 MHz, intended for portable satellite operating but it can be installed permanently, as well.

Log periodics are also used, with popular models available that cover 20 through 10 meters on HF and others that cover VHF and UHF frequencies. These antennas have a similar appearance to Yagis but have more elements, and all of them are connected to the feed line. TV antennas are usually log periodics.

Beams can be made from square or triangular loops. They work on the same principle as the Yagi, but use loops of wire instead of straight elements made from rod or tubing. Square-loop beams are called *quads*, and the triangles are called *delta loops*.

A beam antenna, such as those shown in Figure 12-4, can be rotated, which allows you to concentrate your signal or reject an interfering signal in a certain direction. You can place small HF beams on inexpensive masts or rooftop tripods, although they are too big for most structures designed for TV antennas. You also need a *rotator* that mounts on the fixed support and turns the beam. You can control the rotator from inside the station with a meter to indicate direction (see "Supporting

Photo D. The Dummies series uses icons for tips, technical stuff, warnings and remember, thereby enabling easier learning of the material.

highly recommend it). It is arranged so topics of interest can be quickly found and read (*Photo C*). Topics include: What is a station, choosing a radio, antenna, station accessories, mikes, keys, remote control, RF (radio frequency) and electrical safety, grounding, logging, operating on the airwaves, interference, mobile radio, QSLing (confirming contacts), mastering Morse Code, Citizen Science, HamSCI, cubeSats, radio jargon, technical fundamentals, and tips from masters. Wow! Don't let the 409 pages scare you off. NØAX arranges his book in bite-sized pages in easy-to-understand prose. Perhaps, at this time, you have little interest in satellites. That's okay, you don't need to read that section. That's the beauty of his book. You as the reader get to shop and choose topics. In traditional "dummies" format, icons for tip, remember, technical stuff, and warning are prevalent throughout the pages (*Photo D*) and these facilitate learning.

Mentoring

Ham radio mentors (also known as "Elmers") are the unsung heroes of our hobby. These dedicated folks take inexperienced, want-to-be hams and licensed hams new to a particular facet under their tutelage and show them the ropes. Ward devotes an entire chapter (Chapter 3) to mentors, online communities, videos, and training. However, he doesn't stop there. He continues with ham radio specialty groups such as Youth on the Air (YOTA), Handihams (a very beneficial group devoted to assisting hams with physical impairments), Young Ladies Radio League (YLRL), Parks on the air (POTA), Summits on the air (SOTA), Islands on the air (IOTA), Radio Amateur Satellite Corporation (AMSAT), and QRP (very low power) clubs. The listing of available resources, alone, makes purchasing this book a good investment.

The power of mentoring cannot be overstated. Mentoring not only helps folks get into ham radio, but it also sustains active participation. NØAX's quote, "A ham radio license is really a license to learn!" is so apropos. Ham radio clubs looking to increase membership rosters can gleam a plethora of helpful suggestions from this edition. Ward Silver is conscientious about keeping his book updated and current.

Hamming It Up

Part 3: "Hamming It Up," is one of my favorite sections. It includes Chapter 8: Receiving Signals, Chapter 9: Basic Operating, Chapter 10: Public Service Operating, and Chapter 11: Operating Specialties. I made mention that NØAX is diligent with regards to keeping his book current and topical. For example, Chapter 8: Receiving Signals encourages his readers to learn by listening. He delves into using receiver tuning with a knob and with software-controlled tuning. Software-defined radio (SDR) is the current cutting-edge rage in ham rigs. In addition, he explores tuning on the HF (high frequency), VHF (very high frequency), and the UHF (ultra-high frequency) bands. In so doing, he is able to reach out and touch just about every reader's radio interests. He also offers helpful tips on listening to SSB (single sideband), CW (continuous wave), as well as digital signals. Some newcomers and more seasoned hams are hesitant to ask questions, mostly out a concern for appearing to be stupid among

peers. Of course, we know that the only stupid question is the one not asked, but still we hesitate. NØAX's book takes away that fear. Many of those questions are answered throughout the text.

Public Service

A good number of new licensees enter ham radio to get involved with public service operating, and that is laudable. NØAX dedicates Chapter 10 to public service operating. Tips on finding a public service group, volunteering for ARES (Amateur Radio Emergency Service), and preparing for and operating in emergencies and disasters are explored. Ward also offers tips on providing public service for activities like parades, charity events, and weather spotting.

Operating Specialties

Part 3 is rounded out with an exploration of ham radio operating. Going digital with FT8, FT4, PSK31, Automatic Packet Reporting System (APRS), and radioteletype (RTTY) has 10 pages devoted to these modes. DXing (long distance contacts) on HF, VHF, and UHF are covered. Likewise, radio contests are included in this chapter. Although this section does not offer a detailed set of instructions on how to set up these modes, it does however, give the reader a good explanation of what these modes are, and why hams enjoy operating them so much. Choices, choices, so many choices!

Building a Station

Part 4: "Building and Operating a Station that Works," is another strong, informative section of this book. NØAX dedicates four chapters to developing and building a station. To be honest, NØAX's entire book both directly and indirectly moves the reader along toward that goal. Currently, most ham radio stations utilize computers, and this book offers tips and suggestions on what to examine for your station. When you do get on the air, many hams enjoy confirming their contacts (QSL) with you. NØAX offers advice on how to participate in the ham radio tradition of QSLing.

Interference

Getting on the air is rewarding. Getting on the air and hearing interference is frustrating. I think it is safe to say that nearly every ham radio operator will experience interference of some type. This book explores many of the reasons for interference and offers suggestions on managing it. I'm impressed with NØAX's willingness to not only write about the great offerings of ham radio, but to also write about some of its "pitfalls," such as interference.

Part 5: The Part of Tens

Part 5 of "Ham Radio for Dummies", is aptly titled: "The Part of Tens." Ward introduces his readers to the 10 most-common types of ham radio jargon heard on the air, he explores 10 important technical fundamentals that make ham radio work and follows up with 10 tips from ham radio masters. Being somewhat of a geek, I had to see which 10 technical fundamentals NØAX selected. There are so many to choose from.

Chapter 18 deals with technical fundamentals. This chapter is informative, well-illustrated and clearly written. NØAX introduces us to electrical units and symbols. He then describes Ohm's Law, power, decibels, attenuation (loss and gain), bandwidth, filters, antenna patterns, standing wave ratio (SWR), battery characteristics, and finally satellite tracking. By my count, I keep coming up with 11; although, I suppose satellite tracking isn't as critical to making ham radio work (big gasp!), technically speaking, like power, attenuation, bandwidth, and antenna patterns. Regardless, I assure you that after reading that chapter you'll be able to converse with anyone on these topics. Better yet, after reading this chapter, you'll have a far better understanding while attending a seminar and hearing an expert expound on the subject. You may even want to join us on satellites.

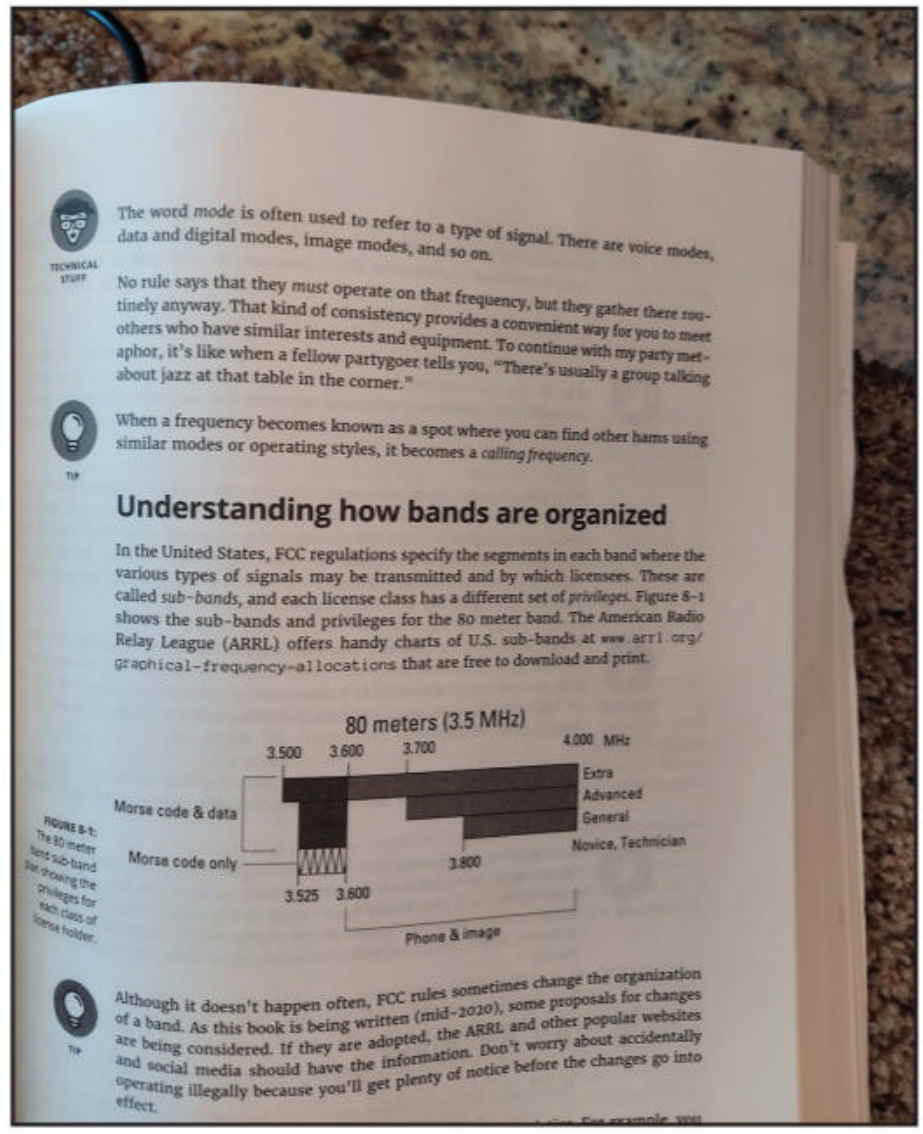


Photo E. This book contains many excellent illustrations that support the material being presented.

Final Thoughts

I take pride in my station and my ham radio library. I have some very notable collections in my radio library. Among them is an autographed copy of the late Doug DeMaw, W1FB's, "QRP Notebook." I met Doug years ago at the QRP suite in Dayton, Ohio at the Hamvention®. I wanted to say something meaningful to Doug when he signed my copy of his book. I thanked him by telling him that I cut my "ham radio teeth" by reading his publications when I was starting off. He stopped, flashed me an ear-to-ear grin and thrust out his hand to shake mine and he then thanked me! I vividly remember that evening, almost as if it were yesterday, some 40-odd years later. W1FB's writing style brought concepts down to ground (pun intended) in a fun, straightforward and sometimes lighthearted way. I believe you'll find Ward Silver's, "Ham Radio for Dummies, 4th Edition" to be equally informative. I welcome his book as a fine addition to my personal library and I believe that you will as well. The book is available in both print and digital editions, retailing for $29.99 and $18.00, respectively, wherever "Dummies" books are sold.

– Thank you for reading CQ *and until next month, 73 from Ron KOØZ*

THE HAM NOTEBOOK

TEXT AND PHOTOS BY WAYNE YOSHIDA*, KH6WZ

Gonculators, Imagination, and the New Ham Conundrum

This article is inspired by a chain of coincidences from very different origins. One of my sisters asked me to make some "electrical busy box toys" for her three- and five-year-old sons, since they are always playing with (and often breaking) appliances and gadgets around the house, like the cellphone, clock radio, TV remote controls, and other things.

So I built some "gonculators" for my nephews, see *Photo A*. The gadgets are intended to keep little hands and minds busy. Kids using the machines may learn something in the process and may become curious and use their imaginations as they play with the units. In the picture, from left to right: "Number One" has single-pole, double-throw (SPDT) switches randomly connected to power and LEDs. The banana jacks can be connected to the second unit, called "Octopus," which features eight test leads, multiple jacks, LEDs, and a button-activated piezo buzzer. The third gonculator is a model rocket launch controller, equipped with safety features to prevent accidents.

Like my electronic art / sculpture called "Inventory Reduction" in *Photo B*, the boxes feature switches, lights, and sound-makers. Electrically speaking, none of these units do much. Inventory Reduction is a fancy wall lamp with decorations. When it was on display at Maker Faire, I was always surprised by how many people — usually kids — were so fascinated by the thing.

The name gonculator comes from the 1960s television comedy series "Hogan's Heroes" in the episode "Klink vs. the Gonculator." The prisoners of war create a ruse based on an electro-mechanical contraption made from junk parts to meet and help an enemy engineer trying to defect to the allied side.

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Imagination, Imagination, and Creativity

Within the same week, one of my LinkedIn connections, Vicki Skrull, shared an article from the online publication

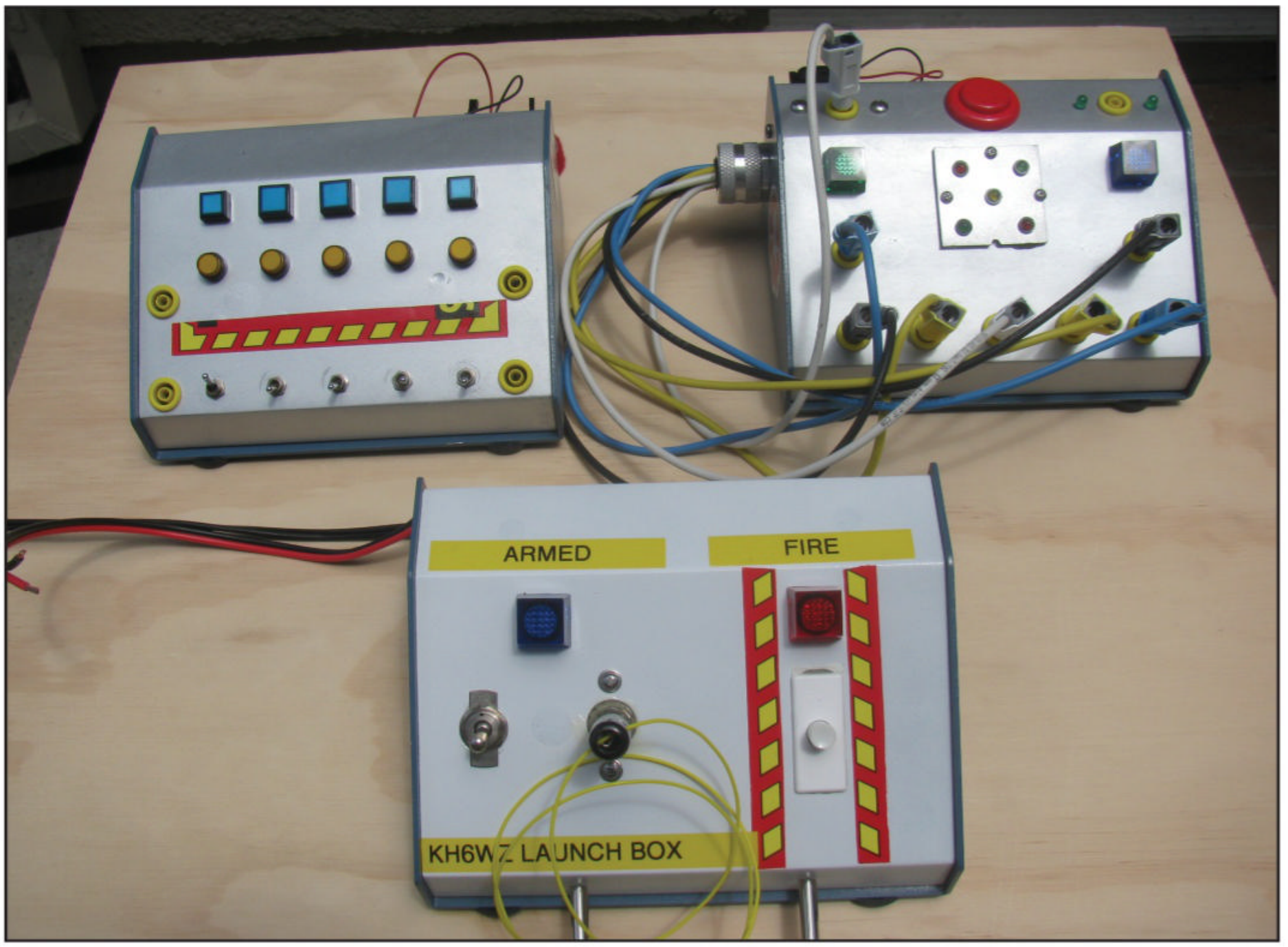

Photo A. Three gonculators, intended to keep little hands busy and stimulate the imagination.

Communication Arts about a marketing campaign by Fisher-Price called "See Toys Everywhere."

In the 30-second commercial, a young boy talks about and shows examples of everyday things that can become toys if one uses imagination. The light switch for the ceiling lamp turns into a "strobe light," a colander from the kitchen becomes a "bonnet," a broom becomes a "guitar," a garden hose becomes a "snake," and a twig becomes a "magic wand."

The *Communication Arts* article includes responses by a company spokesperson, who said the commercial spot is directed at parents and is a reminder that kids "see the world differently" and the pandemic taught us that "humans are resilient and resourceful — and that goes double for kids ... we wanted to celebrate that spirit of childlike optimism in an authentic and playful way. We took to the social media platforms parents use every day to show them how to embrace this spirit."

As I think about this, it reminds me of a LinkedIn article I wrote called "Staying Relevant by Staying Curious," inspired by a series of promotions for public television (PBS). In one commercial, a young boy wakes up before dawn, grabs a flashlight, goes to the family's chicken coop and shines the flashlight into the coop. The rooster wakes up, thinking it is a new day, and crows. In another spot, a young girl wonders about raising fish. She goes into the kitchen, grabs a jar of caviar, and dumps it into a fishbowl. I guess she wanted some new pets.

In my article, I emphasize the importance of having an inquisitive mind and having a continuous desire to learn about new things, which are important traits to have in one's career and life.

In both cases, this "feature" of being a kid — the use of one's imagination — often goes away when kids grow into adults. Having an imagination is similar to creativity, and creativity often leads to useful skills in problem solving.

The Opposite Thing

On the other hand, I remember many days when a group of us kids sat on the front porch on a Saturday morning, having a conversation like this:

"What do you want to do today?"

"I dunno. What do you wanna do?"

We had many days filled with boredom, which often led to doing something destructive or some other activity that led to trouble. (*Of course, asking mom this question always led to the answer, "clean your room." – WY*)

Photo B. The electronic sculpture "Inventory Reduction," always attracted a surprising amount of attention at Maker Faire events.

This problem of boredom and lack of imagination is similar to discussions I've heard both on and off the air by many people new to ham radio. And that question is, "I got my license. Now what?"

Every time I hear this question, I sort of cringe, since this question should have come up before the person studied for the license and successfully passed the exam. It may be possible that ham radio is not for this person.

There. I said it. It is the same as getting the cart before the horse. Something is out of order.

I suppose a person who approaches ham radio this way may have been motivated by something besides the enjoyment of getting on the air or building something — like ham radio volunteer public service, such as Community Emergency Response Team (CERT), Amateur Radio Emergency Service (ARES), or Radio Amateur Civil Emergency Service (RACES). And that is a good thing. Every community needs trained and helpful emergency communicators to help when normal channels of communication are disrupted.

Another possibility could be — "because I have kids in school," or "my spouse is into it," or "because my parents said I should get a ham license."

For this line of thinking, I must wonder whether or not the person understands what ham radio is about, and it almost seems like they did not learn anything from the ham radio license classes and the examination.

Something Good and Helpful and Positive and Supporting

On the positive side of this conundrum, and my advice anytime this question comes up, is to guide the person to join a local ham radio club. It provides an excellent forum where one can make new friends who may be in the same situation, as well as people who have experienced the same thing.

Of course, a great resource for this advice is the radio club or radio school that helped coach the person in learning how to pass the exam.

At least one radio club produces a series of workshops specifically for the new ham and divides them up according to license class.

George Zafiropolous, KJ6VU, a co-host on the Ham Radio Workbench podcast and BayNet Radio Club member, points to the club's ham radio training workshops.

The club website Resources page has a section called "Ham Radio 101 - New Ham / New Upgrade Training" and currently lists the following classes:

- Ham Radio 101 (2019) VHF Gear for the new Technician class ham
- Ham Radio 101 (2019) VHF operating for the new Technician class ham
- Ham Radio 102 (2019) Digital voice modes for VHF & UHF

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• Ham Radio 201 (2019) HF gear for the new General/ Extra class ham
• Ham Radio 201 (2019) HF operating for the new General/ Extra class ham

George says, "the Tech session is very VHF- and UHF-centric and the General / Extra session is very HF-centric.

"The gear sessions cover the basics of what a station should include with specific examples. We try to answer questions like 'what is the difference between a $30 HT and a $300 HT?' and 'which one should I buy and why?'

"In the operating sessions we cover the basics of frequency spectrum, propagation, modes of operation, operating activities, and so on."

The Orange County Amateur Radio Club, W6ZE, is a "general purpose" club with many active hams who are active in all aspects of ham radio. More than a dozen activities are listed, including "just talking to other hams."

During the pandemic year, I discovered some other online resources that address this issue. One very relevant discussion is from the "100 Watts and a Wire" podcast, Episode 296: "This Isn't What I Thought I Was Getting Into." As hosts Christian and Steve point out, the discussion "could have gone another way."

But as I listened to the podcast, I am not sure if the discussion and the suggestions – as well as the comments on the Facebook page – were helpful, since I am unsure what the person was looking for. It is similar to my boring Saturdays on the porch, trying to think about what to do.

Become a Kid Again

And here is where the power of imagination and creativity comes in.

Armed with ham radio knowledge, the license to make station operation legal, a bit of imagination and guidance from advisors, there is an entire universe of things to do with one's ham radio license.

I am sure this is why a ham license is also known as a "ticket." It is a credential that can lead anyone to go on an amazing adventure.

In short, ham radio is what one makes of it.

No one can answer the question for another: Each individual must begin his or her own journey on the airwaves.

Entering "what to do with a ham radio license" into the Google search engine spits out about 6,110,000 results in 0.65 seconds. That is a lot.

As a practical exercise, let us consider what one can do with the U.S.'s entry level ham ticket, the Technician class license. Off the top of my head, here are some things I have done, or want to do — and I have an Amateur Extra. The list is limited to operating on the bands and does not include any of the non-on-the-air activities such as teaching a radio class or building something like an antenna.

1. Talk on VHF or UHF FM repeaters and make new friends
2. Access IRLP or any of those gateway stations to access DX
3. Participate in a VHF / UHF contest
4. Work the ham satellites
5. Go fox-hunting
6. Join and participate in CERT / ARES / RACES activities
7. Build and operate a portable APRS (Automatic Packet Reporting System) beacon
8. Set up a slow-scan TV (SSTV) station to receive images from the International Space Station (ISS)
9. Talk to the ISS
10. Get on the 10-meter band, on FM and CW
11. Get on the microwave- and / or millimeter-wave ham bands

So, if you are bored or do not know what to do with your license, become a kid and let your imagination and creativity kick in. You just might find something fun or interesting to do, and maybe even avoid cleaning up your ham shack or garage. *– 73, Wayne, KH6WZ*

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<www.hamradioworkbench.com>
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what's new

bhi ATT2 Attenuator Pad High-Level to Low-Level Audio Converter

The new bhi ATT2 audio converter is used to convert high-level audio signals to low-level audio. The ATT2 attenuator pad was designed for use with amateur radio transceivers and receivers, mainly for use with the bhi ParaPro EQ20 range of audio DSP units, but can also be used with other audio equipment.

The ATT2 is a passive device which effectively enables a wider range of AF/volume adjustment to be used on the radio equipment before the overload LED on the bhi ParPro EQ20 unit comes on, making it less sensitive and easier to use. The ATT2 accepts mono or stereo speaker level signals and will accept input levels up to 2 watts (2.828 volts p-p into an 8-ohm speaker) and will attenuate the audio down to line level at around 1 volt (line level at 10k Ohm).

The ATT2 unit simply fits between the extension speaker socket of your radio (high level audio source) and your bhi ParaPro EQ20/EQ20-DSP unit, or audio equipment. Connect from the extension speaker socket of your radio or audio source to the input socket on the ATT2 unit using a 3.5-millimeter mono or stereo jack plug lead. Connect the output lead of the ATT2 unit to your bhi ParaPro EQ20/EQ20-DSP unit or audio equipment.

The ATT2 is available now at DXEngineering.com or GigaParts.com and has a suggested retail price of $32.99 U.S. For more information, contact: bhi Ltd, P.O. Box 318, Burgess Hill, RH15 9NR England. Website: <www.bhi-ltd.com>.

DIGITAL CONNECTION

BY DON ROTOLO,* N2IRZ

Packet Not Packet

Should You Care How Your Message Moves?

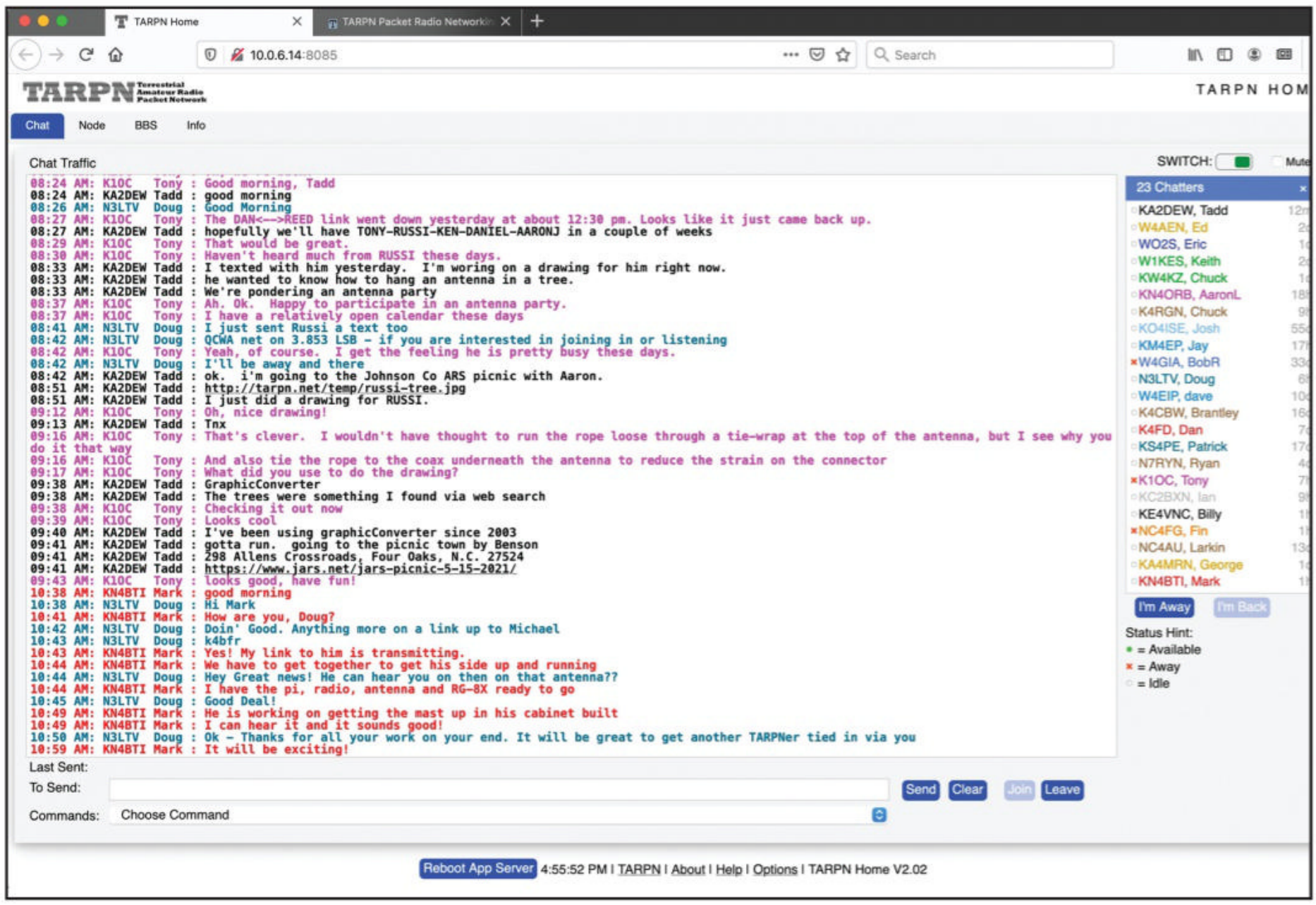

Figure 1. The chat service as seen using TARPN Home. You can conveniently access chat from any device with a browser via your home data network. TARPN Home can also be used to manage the node among a few other tasks. (Screen capture courtesy of Tadd Torborg, KA2DEW)

When you call CQ, it's not a stretch of the imagination to understand the mechanism of how your signal gets to be heard. You don't need to really understand the physics behind it all, it's sufficient to understand that you press a button, and your properly connected wiring allows your antenna to scatter your signal into the ether. But now consider a telephone call: Do you really know how your signal gets to the other end? While it is likely to be a mixture of technologies, the real question is, should you care? As long as you can get Grandma on the phone, all is well.

The point is, it isn't necessary or even sometimes desirable to understand a technology as long as the application layer (e.g., a full-duplex audio circuit) does what it's supposed to. It just works, and that's enough. This sets us up for a discussion of the TARPN packet radio network.

TARPN, What's It Good For?

I've written often about TARPN (Terrestrial Amateur Radio Packet Network <tarpn.net>), and interest and networks continue to grow. But many start out wondering what good it is, a so-last-century technology whose replacements are far superior. Sure, folks still cling to AM, and CW shows no sign of becoming any less popular than it was in the 1970s, so maybe it is simply folks using a technology out of sheer technical interest and potential learning experiences? In other words, why build a TARPN packet network in 2021?

Well, it isn't to support the BBS function. It's nice to have, sure, but other technologies have that covered. Another nice-to-have feature is the emergency communications potential, the ability to move a useful amount of text over dozens of

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

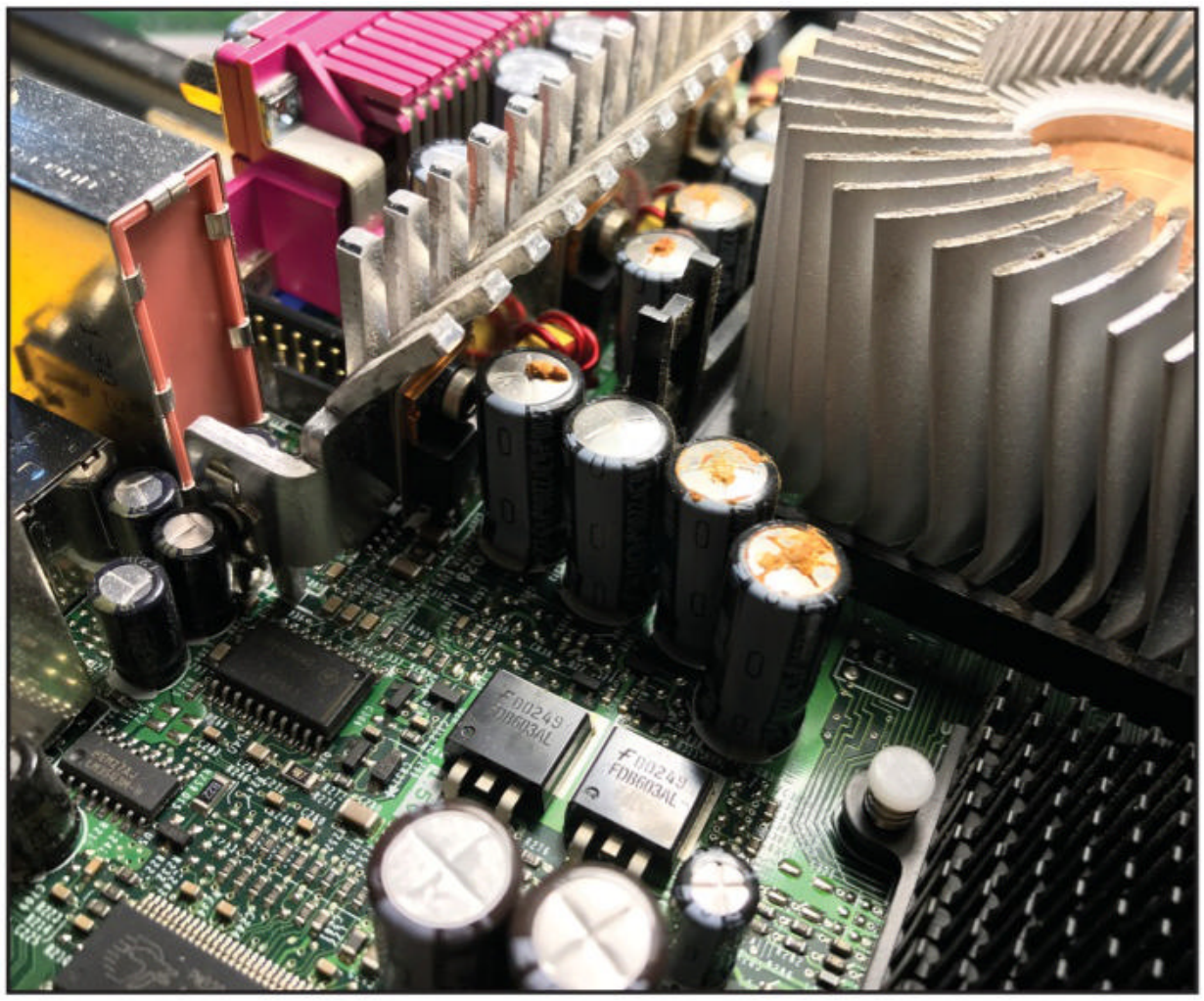

Photo A. Leaking electrolytic capacitors were cause for worry on the one motherboard I had that provided good floppy disk drive support. Thankfully it worked long enough for the needed task, after which it was reverently recycled.

miles almost instantly, but that's still not its primary function. Oh, sure, you can learn a bit about radios, Linux, Raspberry Pi computers, antennas, propagation, and perhaps several other technologies and skills, but lots of things in amateur radio offer similar learning experiences. So, I ask again, why?

As it turns out, building a TARPN network is really for a singular purpose, and the fact that it's a packet network is almost irrelevant. The killer app, as it might be called, is *Chat*. Chat is a text-based system allowing several people to maintain conversations in real time. Due to its architecture, stations on the edges of a TARPN network get roughly the same performance as those in the middle of it — latencies on the order of a second or three are typical. And, again due to its architecture, as the TARPN approaches 100% data saturation, its performance barely degrades, almost too little to measure.

The pandemic made it clear to many of us that even if we consider ourselves introverts (as I do) we still want and need human contact. I may have mentioned before that I'm an avid homebrewer of beer. Brewer's Friend, one of my online tools, has a forum and every month we have a Zoom call where we all get together and talk. Generally, we talk about beer and brewing but the conversations tend to range far and wide. I genuinely look forward to these monthly meetings, chatting with friends from literally around the world, representing six of the seven continents.

My local ham radio club has moved its meetings to Zoom as well. The most recent North Fulton Amateur Radio League <nfarl.org> meeting had over 80 participants, so many that we couldn't all fit on a single screen. As I write this, the United States Centers for Disease Control <cdc.gov> says you don't need a mask anymore if you're fully vaccinated, so the May meeting (we write about two months in advance of publication) will be held in person — the first one in a while — and many of us are excited for it.

But one thing I'd enjoy is somewhat more frequent interaction. I can email friends in the club, but I don't know everyone's email address. Ditto with texting. I mean, I only joined a few months ago and have not really established many friends in the club. So what about something like a text, but in real time, with multiple participants, accessible through most any device (PC, phone, tablet, etc.), amongst a group of like-minded people? Ah, this is Chat.

Let's Chat

The G8BPQ node software has a chat feature, by which anyone on the network can chat with anyone else. The TARPN network leverages this and the TARPN Home application (essentially a web-enabled GUI structure), written by Fin Gold, NC4FG, to create a local chat network consisting of everyone with a node (i.e., everyone on the network). Just put your node on the air within the network, start TARPN Home (which runs on a Raspberry Pi computer), and open the chat tab in a browser. Since the Pi can be accessed by any device that can connect to your home network, I can connect to TARPN Home with my iPhone or iPad to keep in touch while enjoying a beer in the backyard, for example, or playing in the workshop.

Don't underestimate the power of chat. With it you have a real-time connection to everyone else in the network. Your device can be set to alert you to any new messages, or messages directed at you, much like cell phone texting. The other network ops are your friends, who share a common set of interests (including ham radio and TARPN), whom you've visited to help get their stations running, and upon whom you depend for help when needed.

In practice, we find that conversations aren't limited to TARPN or even ham radio. Get a bunch of people together, and the conversations tend to diverge rapidly into many different directions. Just like on my brewing forum, where a discussion about hops devolves into boiling times for hot wort and the best yeast for making cider. This makes it interesting and refreshingly unpredictable.

But chat uses packet. TARPN to be specific. And to participate in a TARPN network, you become a node operator. I've written about this before, but TARPN eliminates the concept of user ports, and at the same time removes the division between users and infrastructure supporters. Everyone runs a node with a connection to at least one other node, and access to the network is through your own node. There are several advantages to this, as well as a few disadvantages, but this Networking On Purpose (NOP) is proving to be useful at drawing younger hams into the social fold, all due to the chat.

Build a TARPN Network

Tadd Torborg KA2DEW, doesn't try to promote TARPN as a packet network, but as a real-time online chat system for local hams, which just happens to use radio to move data. Building a node is surprisingly inexpensive, often under $150 including radio and antenna. So far, as with many endeavors, the hardest part is finding another ham who both

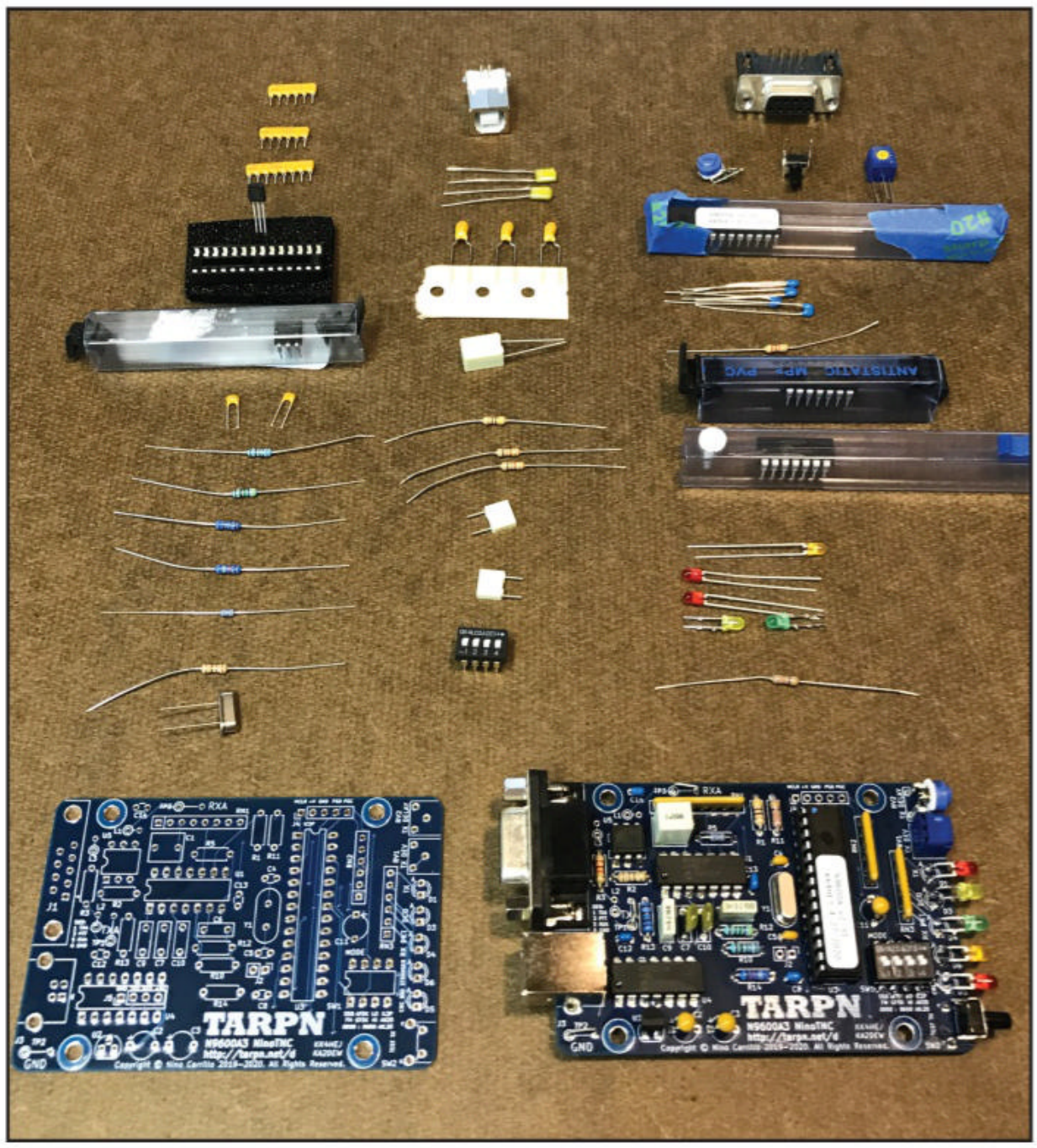

Photo B. A NinoTNC board and components, with a completed board lower right. This packet radio terminal node controller costs under $30 as a kit, supports several data rates including standard 1,200 and 9,600 baud, uses USB, and supports a KISS interface. Using only through-hole components, assembly of this A4-version board took about an hour.

wants to link to your node and lives in a place to which a radio path exists.

I currently have the first part here in Atlanta, but not the second part. One interested fellow is over in Kennesaw, Georgia, but between us is a tall ridge about 400 feet higher than either of us. The residents on the ridge peak are, sadly, not hams, and access to the commercial site at the tippy top is, er, difficult. We did try a 2-meter voice QSO to see if, by some miracle, a path might exist, but physics said no. So, what we need is someone living nearby but maybe 30° off the direct line between our stations, and a three-node network could be born. Still looking.

Here's the bottom line: If you and one or more local hams have even a slight interest in a real-time chat system, even if just to play with the concept, look at building a TARPN. This kind of communication is very interesting to young hams, who have grown up in a world that always has an internet and iPhones. The network has other, more traditional uses, of course, but the primary purpose isn't packet for the sake of packet, but as a tool for chat box connectivity.

Spring Cleaning

Switching gears, a short blurb about old data and electrolytic capacitors. Doing some spring cleaning recently, I decided to power up the many leftover computers littering the basement shelves to see which ones still worked and how they were equipped. A side goal was to take all the data I have off the floppy disks — hundreds of 5-1/4-inch and 3-1/2-inch floppies — and move them onto a more modern storage medium, like a USB hard disk. To do that, I needed a computer that had floppy drive support and USB support, or at the very least used an IDE hard drive, which I could temporarily connect to a computer with USB support.

The short version of the story is that the data from virtually all of my 3.5-inch floppies is now safely archived, and virtually none of the data on my 5-1/4-inch floppies has survived. I did have one computer that supported a 5-1/4-inch drive, but the first dozen disks I tried couldn't be read. Not willing to believe that all the disks were bad, I tried several things, including another floppy drive, but the results were consistently awful.

Desperate, I formatted a floppy and wrote data to it, and it read back perfectly. Ugh. The conclusion was that almost every one of the floppies had failed, and the data was lost. Nothing of tremendous consequence, of course — I hadn't even looked at that data for over a decade — but I'd have liked to keep some of it.

So the lesson here is: If you have data sitting on some older hardware (like floppy disks), take action to preserve it. At the very least, identify what might be valuable and focus on that. Bootleg copies of old commercial software really have little value since you can probably find a genuine copy somewhere online and you'll need hardware that it can run on. But your own data, that's unavailable elsewhere and should be your focus.

That week I got rid of a bunch of old motherboards and some other bits and pieces, properly disposed at the town's recycling center. As it turned out, the motherboard that best supported floppy disk drives was on its last legs. Once its last task was done, it got recycled. Close inspection revealed that the "modern" electrolytic capacitors had mostly failed and, if it were to be used extensively, would suffer some reliability problems before it finally failed, most likely with a spectacular release of the magic smoke. Take a look at *Photo A* to see what I mean.

And so, a second lesson: Open up your computer this weekend and blow out all the accumulated dust. Look everything over for things like leaking capacitors or a weak CMOS battery, and take action as necessary. A little preventive maintenance goes a long way.

Thinking preventatively, think about the cyberattacks in the news lately, and decide if your computer system is even moderately resistant to such an attack. Of course, you know not to follow suspicious email links and to have a modern commercial anti-virus software subscription active. Also be wary

of anything asking you to verify your credentials or threatening to cut off your access to something. But do you have a backup?

I saw an 8 terabyte (that's 8,796,093,022,208 bytes) USB hard drive at a national warehouse store for $120. Back in 1986 when I got my first "hard disk" computer, even the government didn't have 8 TB online. Once a week, I connect this drive to my main computer, run a backup and store a system image, and disconnect it. While there is still a risk in keeping the backup in the same location as the computer — a fire could destroy both — a second USB disk rides in my car, but that gets new data only once a month. It would be rare that both backups get damaged, so even in the event of a ransomware attack, the worst case would be losing maybe a month's worth of data. For some, a good alternative is keeping an encrypted backup in the cloud.

In a chance encounter, I met computer pioneer David Larsen, KK4WW, (*Photo C*) and his wife Gaynell, KK4WWW, and had a long and pleasant conversation with them. We chatted about his early work in electronics and computers, and more recently their efforts as managing directors of FAIRS (The Foundation for Amateur International Radio Service). I'd seen the FAIRS classified ad in the back of *QST* since forever, but never really looked into it as an organization. While I'm out of space this month, go visit <fairs.org> and see if there's anything laying around in the shack to donate. I plan to send some VHF equipment that will be deployed in the Caribbean to help hams build and work voice repeaters and packet networks.

No Politics

Lastly, politics. While there are many reasons to subscribe to *CQ*, we're confident that politics isn't one of them. With apologies to Chuck Palahniuk, the first rule of politics club is you do not talk about politics club. I truly hope you're OK with that.

It's always nice to hear from readers, so drop me a line.

– Until next time, 73 de N2IRZ.

Photo C. David Larsen, KK4WW, electronics and computer pioneer, FAIRS founder and computer collector, behind his old-school computer (A.K.A. abacus), one of several of his artifacts on display at the Computer Museum of America in Roswell, Georgia. Behind David is part of the History Wall at the museum.

MF/LF OPERATING: Life Below the AM Broadcast Band

BY JOHN LANGRIDGE, * KB5NJD

KL7L/KH6 Returns to Air from Maui While W7XU Activates Arkansas and Louisiana on 630 Meters

Plus … W5EST 2020/2021 Compilation Released, a K6STI Software Update, and 2200 Meters Sees a Spike in Late Season Activity

Surprise! I'm still here. In spite of announcing my retirement from the column in my April article, I am still searching for that certain someone to take the helm. If this MF and LF stuff interests you and you are an unconventional, creative thinker who enjoys writing and can keep deadlines, let's chat a bit. I'll be here until we fill the position or until my information resources dry up. Now, on with the show!

Annual KL7L Portable Operation in KH6 was a Resounding Success

Laurence Howell, KL7L, returned to Hawaii for his annual work trip, operating 630 meters from a hotel balcony on Maui, grid square BL10ss. Any trip that allows him to set up a 630-meter antenna from the balcony of his accommodations and not get caught by staff is a successful trip but Laurence reported a few first-time accomplishments during this operation that really made his efforts even more worthwhile. Following the 2020 trip, Laurence determined that the antenna coupler he had built for portable use lacked the range and power-handling capabilities necessary for consistent success using the very short antenna that he was able to install. For the 2021 trip, he knew that he would be limited to a similar antenna consisting of a 10-meter-long fiberglass pole with an attached wire and possibly a short section of top-loading wire which he would be unable to guarantee until he arrived on site. Coupling the 50 watts from his Monitor Sensors 630-meter transverter would be challenging for such an antenna with a compact coupler, but it was far from impossible.

Size and weight for couplers are always serious considerations, so a compact loading and matching scheme configured as an L-network was in order (see *Figure 1*). While ferrite loading can be a lossy proposition for such a short antenna, the travel constraints dictated that this was going to be the suitable approach for a suitcase-style operation. Like any QRP operation, the station at the other end of the path was probably going to have to do most of the "heavy lifting."

On arrival to his accommodations on Maui, Laurence secured a room with a seaside view on the sixth floor. The

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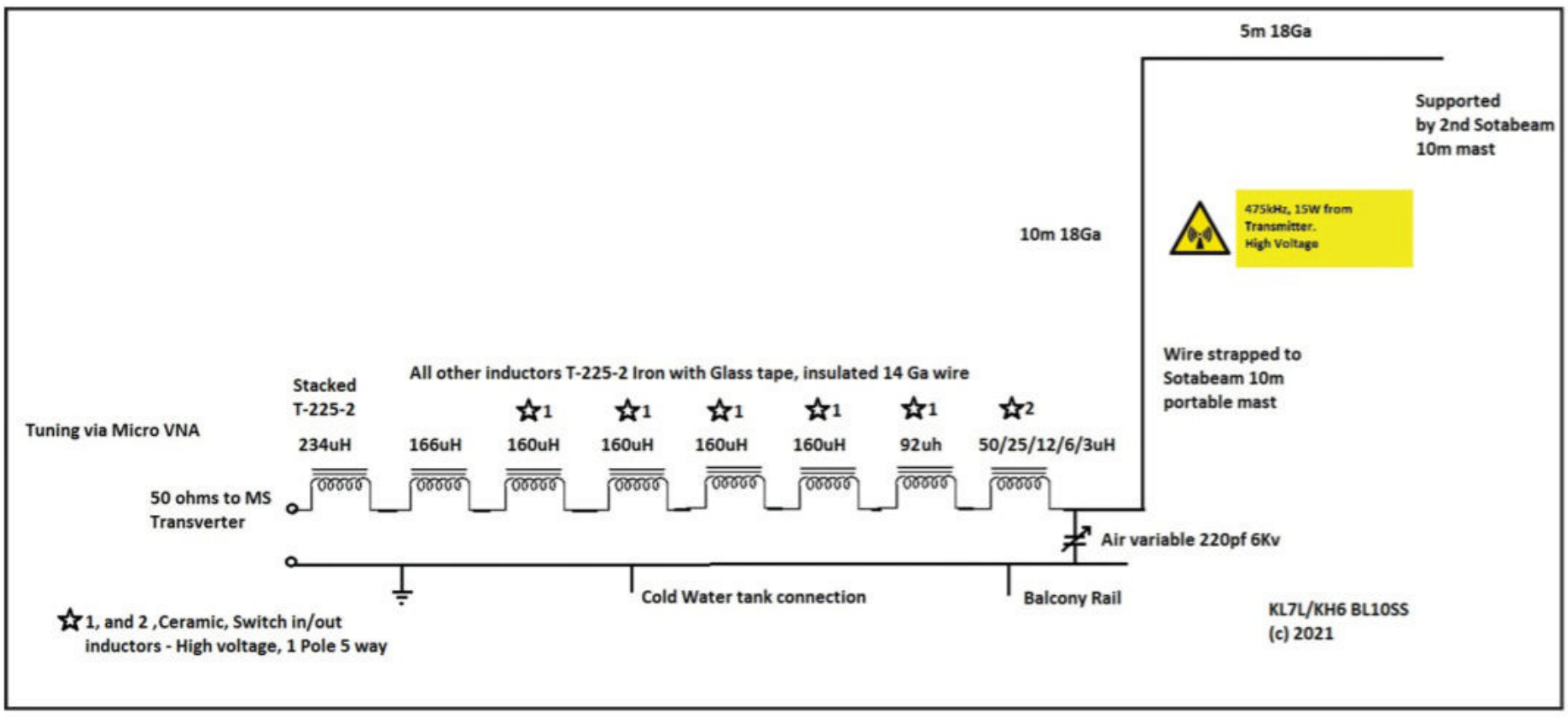

Figure 1. Here is the loading and matching arrangement used in the KL7L/KH6 operation. Switchable ferrite inductors allow a wide range of values to be selected, forming an L-network when used in conjunction with a shunt variable capacitor. While ferrite loading can often be a lossy approach, traveling often dictates compact solutions. In this case, Laurence enjoyed remarkable success for such a small antenna system.

balcony (*Photo A*) would allow the antenna support and attached wire to be "wedged" at a roughly 45° angle away from the building (*Photo B*) and a nearby palm tree might facilitate an endpoint for a top-loading wire. Initial reception tests (*Figure 2*) showed that many of the typical noise sources at his accommodations were manageable, at least during the day. Laurence observed that after 10 p.m. local time, however, solar converters located on the roof and operating in "idle" mode made considerable noise that seriously impacted signal-to-noise ratio, specifically impacting weaker signals. Unfortunately, that's a reality for this type of operation and operators have to learn to fight through difficulties.

Photo A. The antenna feed point was quite close to saltwater on the sixth-floor balcony. This height above ground likely contributed to a far better system than calculations suggested on paper.

Photo B. Just because it's not perfectly vertical does not mean it's not a vertical antenna. KL7L's arrangement of a sloping fiberglass pole from a balcony once again shows that successful 630-meter micro-operations are possible.

Timestamp	Call	MHz	SNR	Drift	Grid	Pwr	Reporter	RGrid	km	az	Mode	# Spots
2021-03-30 10:16	VK4YB	0.475759	-27	0	QG62ku	1	KL7L	BL10ss	7623	51	2	3
2021-03-30 06:10	W7XU	0.475675	-22	1	EN13lm	5	KL7L	BL10ss	5994	265	2	16
2021-03-30 06:56	KB5NJD	0.475607	-27	0	EM12mp	1	KL7L	BL10ss	5980	273	2	4
2021-03-30 02:50	A06XOP	0.475657	-37	0	RL32	2	KL7L	BP51ip	5470	26	5	1
2021-03-30 06:22	KR6LA	0.475662	-26	0	CN90ao	2	KL7L	BL10ss	3929	246	2	7
2021-03-30 04:38	K9FD	0.475617	+11	0	BL11je	1	KL7L	BL10ss	91	121	2	37

Figure 2. WSPR reception results were fairly consistent with these observed on March 30th. Laurence was hearing well into the central U.S. despite elevated local noise.

Timestamp	Call	MHz	SNR	Drift	Grid	Pwr	Reporter	RGrid	km	az	Mode	# Spots
2021-04-02 07:32	KL7L	0.475680	-31	0	BL10	0.2	NO3M	EN91wr	7447	52	2	4
2021-04-02 08:36	KL7L	0.475682	-29	0	BL10	0.2	ZL2AFP	RF91ah	7073	202	2	13
2021-04-02 09:46	KL7L	0.475681	-25	0	BL10	0.2	KB5NJD	EM12	6042	64	2	1
2021-04-02 07:26	KL7L	0.475686	-29	0	BL10	0.2	VE6JY	DO33or	5252	34	2	17
2021-04-02 07:12	KL7L	0.475681	-27	0	BL10ss	0.2	KM5SW	DM65st	5113	60	2	33
2021-04-02 07:18	KL7L	0.475680	-28	0	BL10	0.2	KA7OEI-1	DN31uo	4796	50	2	32
2021-04-02 05:36	KL7L	0.475773	+7	0	BP51ip	5	K9FD	BL11je	4540	191	2	32
2021-04-02 07:00	KL7L	0.475681	-20	0	BL10	0.2	VE7BDQ	CN89la	4374	35	2	55
2021-04-02 06:30	KL7L	0.475680	-29	0	BL10	0.2	WO7I	DN10cw	4335	49	2	11
2021-04-02 10:10	KL7L	0.475682	-27	0	BL10ss	0.2	WW6D	CM88pk	3776	51	2	2
2021-04-02 05:30	KL7L	0.475770	-26	0	BP51ip	5	ND7M	DM16xf	3648	125	2	54
2021-04-02 05:36	KL7L	0.475771	-28	0	BP51ip	5	KR7O	DM07ba	3410	130	2	5
2021-04-02 05:48	KL7L	0.475771	-28	0	BP51ip	5	W6UV	CM87wx	3225	132	2	29
2021-04-02 05:36	KL7L	0.475770	-27	0	BP51ip	5	KP4MD	CM98iq	3188	130	2	39
2021-04-02 05:18	KL7L	0.475772	-19	0	BP51	5	KJ6MKI	CM88oi	3139	133	2	72
2021-04-02 05:18	KL7L	0.475771	-23	0	BP51	5	WB7ABP	CM88ok	3131	133	2	77
2021-04-02 05:18	KL7L	0.475774	-23	0	BP51ip	5	KR6LA	CN90ao	2973	129	2	32
2021-04-02 05:18	KL7L	0.475769	-17	0	BP51ip	5	N6LF	CN83lt	2620	127	2	80
2021-04-02 05:24	KL7L	0.475771	-24	0	BP51	5	KK6PR	CN94ik	2616	124	2	74
2021-04-02 05:42	KL7L	0.475767	-26	0	BP51	5	WA6OUR-K	CN87xo	2297	120	2	19
2021-04-02 05:18	KL7L	0.475772	-26	0	BP51	5	VA7JX	CN79kv	1956	120	2	49
2021-04-02 05:18	KL7L	0.475650	-17	0	BP51	5	KL7KY	BP42xc	87	323	2	74
2021-04-02 06:48	KL7L	0.475680	+10	0	BL10	0.2	KH6KR	BL10ts	77	65	2	15
2021-04-02 06:18	KL7L	0.475681	+17	0	BL10	0.2	AI6VN/KH6	BL10rx	76	43	2	74

Figure 3. Additional top loading made the difference with Laurence's transmissions, which were successfully heard as far away as the eastern U.S., New Zealand, and Australia.

As he prepared to take to the air, Laurence's first antenna arrangement was a simple 10-meter-long radiator with no top loading. There were concerns that his operation would be cut short by the staff if he were caught connecting wires to adjacent trees from his balcony but there was plenty of plausible deniability for a fiberglass pole that resembled a long fishing pole which was extended beyond the balcony given his proximity to water. Grounding was accomplished by connecting to the facility ground. While not an ideal situation, it was a technique used in previous trips that worked well and was essentially the only practical option.

Initial transmissions using WSPR were impressive (*Figure 3*) as his receivers back in Alaska were decoding his signal despite more than a foot of new snow on the ground, covering the receive antenna feed points. Additionally, K9FD (/KH6) and AI6VN/KH6 were reporting his signal around the islands and KL7KY was also hearing him back in Alaska. He noted that K9FD was reporting his signal at better than -10 dB S/N which is squarely in CW "ragchew" territory and would be a very simple digital QSO to complete, which had been accomplished on previous trips. To be safe, he chose to lower the pole at bedtime on the first few nights. With the previously reported noise that was observed during the late evening, it was not a huge loss.

Laurence's next test included the full 10-meter-long radiator with a 5-meter top-loading extension. Laurence noted that the antenna deployment allowed for the top-loading wire to be installed

Photo C. This simple operating position made a number of 630-meter operators happy as W7XU activated two states that have until now eluded on-air activity. The Elecraft K3S used a 160-meter IF to drive a Monitor Sensors transverter. FST4 and CW were used during these operations. Note the level of local interference on the waterfall that was experienced from this site in Arkansas.

with the angle at least 90° with respect to the pole. Doing so minimized negative impact to the already tenuous radiation resistance. The addition of a 5-meter top-loading wire made an improvement, as expected, but Laurence was not done with his experiment.

The next step involved an additional top-loading wire using the 10-meter long "vertical" nested at 45° plus a maximum of about 13 meters of top-loading wire. In order to minimize the slope of the "vertical" radiator with respect to the top-load wire, a second fiberglass pole was installed to help extend the top-loading wire away from the radiator section. A longer wire meant a different end point, changing the dynamics of the situation. Still, this addition resulted in the best results for the system, with several morning WSPR transmissions being heard as far east as NO3M in western Pennsylvania and fairly consistently in the central U.S. At this point, Laurence was less worried about getting caught and no one really said anything about his antennas, so he generally left them in place until sunrise each operating session.

So what did Laurence learn during this trip? He showed that a very short, portable antenna with minimal top loading and system grounding was feasible and could be heard as far away as the eastern U.S. mainland, Australia, and New Zealand, even at very low power levels. While most of us are using sizable loading coils, Laurence successfully loaded his system with ferrite coils and a capacitor, forming an L network. While I don't recommend trading in your bucket coil just yet, the arrangement that Laurence tested was absolutely a workable solution for his situation. Being located next to saltwater certainly did not hurt anything.

In January, I reported that Laurence was testing underwater receive antennas. Those very long wires continue to produce good reception results and have on a few occasions resulted in interesting transmit results with reports of his signal in Hawaii and along the west coast of North America. One interesting but not exclusively radio-related fact that Laurence learned was that in the silt, at ground level under the frozen lake, water flowed all winter long, probably due to geothermal effects. He made this determination by way of impedance measurements. Possibly more on this observation and others in the future. Congratulations to Laurence on yet another exciting radio adventure below the AM broadcast band.

CW Milestone Reached on 630 Meters

Mike Michaels, W3TS, has completed a season-high 911 CW contacts between September 1, 2020, which was the start of the new season, and April 2021 when this article is being prepared. Noise levels and fading can make every contact challenging and that is certainly the case on CW, where the operator decodes the signal by ear. Congratulations to Mike and there is still time for him to reach the 1,000 CW contact milestone before the next season begins. Let hope for a quieter than typical summer!

There is a robust CW community on 630 meters. For the would-be operator simply listening for signals, it can be challenging and I often hear comments that "I don't hear anything." CW on both 630 and 2200 meters is not like CW on 20 meters most of the time. In many respects, it may not even be like CW on 160 meters. Yes, strong signals are heard at ragchew quality for extended periods pretty regularly, but the casual operator may miss those opportunities or may simply not be prepared to deal with noise or weak signals in a way that might result in a successful listening session. Check the Reverse Beacon Network and filter for 472 kHz or 137 kHz. Also watch DXSummit with filters for 472 kHz and 137 kHz. Do *not* set a filter for "CW" as the filter algorithm seems to think that there is no CW on the band, which could not be further from the truth. I regularly post stations during my evening and morning operating exercises and almost always list the mode as CW in the note column. Also, get involved with the active community. Want to know how? Send me an email and I can help you get started. Perhaps you, too, will be the next operator on the way to a 1,000 CW contact season.

W5EST Releases Volume Four of His 630-Meter Analysis

If you followed the daily summary that I published for many years on my website, you are no doubt familiar with the efforts of Jim Hollander, W5EST, who spent countless hours poring over data to make sense of some of the observations that

Photo D. W7XU reports that this is the, "set-up at Cricket Creek Campground in northwest Arkansas. Visible is the fiberglass mast off the back of my camper. It supported an inverted-L about 30-feet high and 100-feet horizontal. I had six radials, each 50-feet long. The loading coil is visible in the foreground." This system netted three FST4 QSOs through very challenging noise conditions.

were reported on the air. Beginning in 2016, Jim compiled many of his best presentations into organized chapters on a variety of topics from propagation to hottest receivers for the year to antenna ideas that were in use by successful operators and continued these seasonal compilations with newly available information and on-air observations until 2021 when my daily reports ceased. Because I no longer maintain a website, volume four has been released to a cloud server with the table of contents found in the biography section of my QRZ.com page.[1] Navigate to QRZ.com and search for my callsign, "KB5NJD"; on the biography tab, there will be a link near the top of the entry that will allow you to navigate through other information posted on the page to the W5EST volume of interest. Congratulations to Jim on another fine presentation. It is largely believed that volume four will be his last to be compiled, but I would not put it past him to create additional presentations as the situation warrants.

W7XU Puts Arkansas and Louisiana On the Map for 630-Meter Operators

It was late Fall in 2020 when Arliss Thompson, W7XU, included a note with his daily statistics asking about the feasibility of a portable operation on 630 meters to Arkansas and Louisiana this April. He and his wife would be "on the road," visiting family and amateurs along the way and camping at venues that might present opportunities to put both states on the air for the first time.

Both states are considered high-value targets and, while Arliss is a seasoned DXpeditioner with experience in thinking on his feet to resolve seemingly insurmountable problems, these potential operations might be on par with some of the biggest DX operations in amateur radio when it comes to competition and importance to those within the MF and LF communities. This was not an opportunity to be taken lightly.

On top of the physical-layer challenges of getting a portable 630-meter station on the air and operating effectively are seasonal storms and associated noise that are present in the spring, particularly in the central U.S. and points east. Weather conditions would certainly be a factor for these operations, even before travel has been initiated. Arliss also made his UTC notifications for both of the anticipated campsites, which went unchallenged.

The antenna system for the operation was to be a 30- to 40-foot tall inverted-L with a 100-foot horizontal section and resonated with a small coil at the feed point. Radials would be added but the specific details were unknown until arrival at the first campsite in Arkansas. Arliss felt like this antenna would likely fit the campsite somehow, but he prepared for a number of eventualities. The weeks leading up to departure were met with a number of challenges, not the least of which were very high winds back home in South Dakota. While best practice said that the antenna system and station needed to be tested before leaving home, if for no other reason than to ensure that all necessary components were present and accounted for, the winds had other ideas. Arliss reported that his first attempt to raise a free-standing support to elevate the inverted-L ended in disaster, resulting in a "plan B." The specific details of what happened and what solution was implemented were not disclosed but like any portable operation, multiple options were always available so the setback did not seem to truly threaten the operation.

Early April arrived and the first operation from Arkansas under Part-97 rules commenced from EM36 near the Missouri / Arkansas border in the Ozarks (*Photo C*). The inverted-L was successfully installed among trees at the campsite (*Photo D*), but Arliss noted a power supply problem that limited his power output to something on the order of 25-watts total power out and a radiated power level well below the 5-watt EIRP limit. Given the attenuation from trees and relatively low efficiency, there was not much power being radiated but it was not zero! And as can so often happen in the spring, weather does not always cooperate. While storms were avoided at the campsite, associated noise from regional weather made operating very difficult. At the suggestion of NO3M, Arliss added an additional sloping top-loading wire to the antenna and on the second operating session, improved efficiency led to successfully completed FST4 contacts with WØSD, N9RU, and K5DNL. Arliss was heard

Photo E. This was the antenna setup in Louisiana. Arliss reported that the, "trees were much taller here. My friend Bill, N5YA, who lives across Toledo Bend Reservoir in Texas, loaned me a fishing pole so I could get a line high in a tree. My inverted-L here ended up 80- to 90-feet high and 100-feet horizontal. I had the same six radials, 50-feet each." From this location, Arliss completed FST4 QSOs with 16 stations as well as one CW QSO.

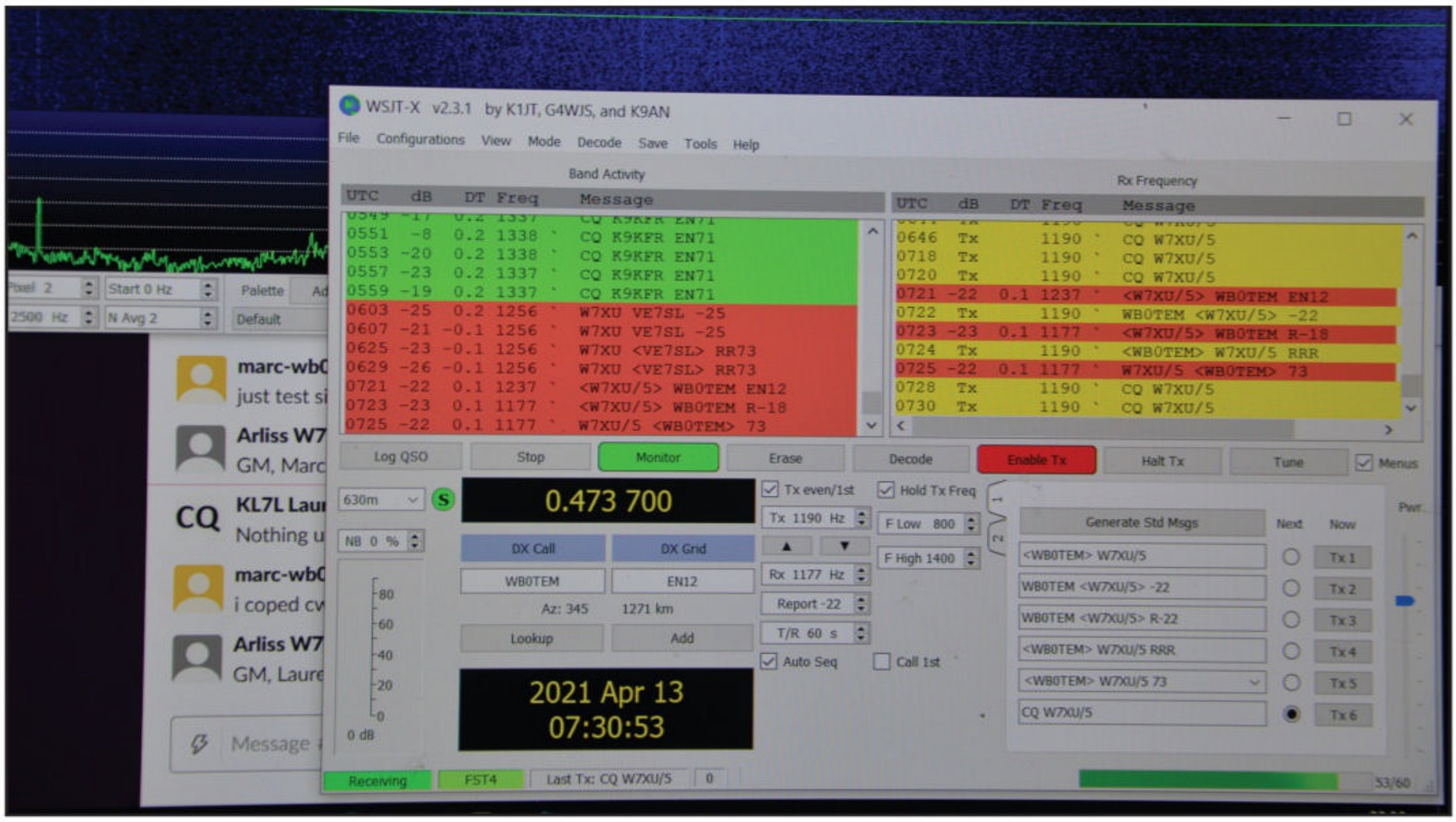

Photo F. W7XU's best DX from Louisiana was VE7SL in British Columbia. While these paths are taken for granted in the winter, chasing high-value targets in the spring can be a massive undertaking. Arliss hopes to return to these locations in the late fall when noise and storms will hopefully have subsided. The need for activity in these states continues.

here in North Texas on WSPR overnight, but in the -21 dB S/N range, which meant that a CW QSO was likely out of the question. While QSO totals were low compared to the effort put into this first operation in Arkansas, a tremendous amount was learned about setting up a portable operation on 630 meters. This is nothing like setting up a portable operation on HF!

On to the next venue, a few days later found Arliss and his operation in EM31 near the Toledo Bend Reservoir on the Texas / Louisiana border (*Photo E*). Trees at the campsite allowed for a far more robust antenna, with a wire vertical that was near 90-feet tall with a mostly horizontal top-loading wire that was 100-feet long. Arliss also enjoyed better noise conditions than the Arkansas operation due to a break in the weather, allowing him to complete FST4 QSOs with WØSD, KØKE, K9KFR, N9RU, K5DNL, AB5S, WB4JWM, NO3M, KE7A, W9SRW, WA3U, WBØTEM, N9LB, W7XU (op. NØLAN), VE7SL (*Photo F*), and KM5SW. He also completed a lone CW QSO with me, KB5NJD.

Arliss hopes to return to Arkansas and possibly Louisiana again in the fall or winter to fill some of the holes from this trip. Congratulations to Arliss on a job well done. He made many operators happy and potentially motivated many others.

K6STI Reports New Release of Q and Inductance Programs

Brian Beezley, K6STI, reported that he has released a new version of his inductance and Q calculator software.[2] He noted that the changes are specifically for VLF (below 30 kHz!) and that he, "replaced the HF approximation for skin effect with a calculation accurate at any frequency. The proximity effect calculation also now makes sense at low frequencies." No doubt that these changes will benefit medium- and low-frequency operators as well. He also indicated that error for inductance while comparing a statistically significant number of samples was about 2% of expected values and 5% for expected values when measuring Q. His software is designed for Windows® and is free to use.

Surge in 2200-Meter Activity During the First Quarter of 2021

The first quarter of 2021 saw an increase in 2200-meter activity using WSJTx's FST4 variants. Stations like WB4JWM, K8HTL, and WB9OWN joined the fray, adding to the ranks from Georgia, Michigan, and Wisconsin, respectively. A number of QSOs were completed during late evening and overnight operating periods in February and, while no DX QSOs were reported, WSPR and FST4W DX signals were reported in parts of North America.

Notable were reports of several Japanese stations in the central and mountain regions of the U.S. By mid-April, however, fortunes had turned once again as Roger Crofts, VK4YB, reported that he, "struggled to get a single WSPR decode at KL7L and AI6VN/KH6. The usual JA FW30 signals were not detected here overnight, nor at VK2AN." Laurence Howell, KL7L, reported slightly better conditions, noting that he decoded FST4W-30 signals from "... JH1OFX, WSPR VK4YB (just one). No real push of conditions south eastward sadly to L48 (lower 48) or Canada ..."

That's it for this month. Perhaps you will see me again in October. You can contact me at <KB5NJD@gmail.com>.

Notes:

1. KB5NJD's QRZ bio with TOC for W5EST volumes: <https://tinyurl.com/ukfueejn>
2. K6STI's coil.zip download: <https://tinyurl.com/zvxmdv22>

GORDO'S SHORT CIRCUITS

BY GORDON WEST, * WB6NOA

Tracking (and Treating) Local Noise Sources

When broadband noise creeps into your radio system, there are two more-common local noises you may encounter. By "local," I mean *your* house or your neighborhood.

QRM Reduction Starts at Home

On 2 meters, the newest noise you *see* on your FM rig's S-meter may be interference from light emitting diode (LED) light bulbs right in your own house (*Photo A*). On weak stations, it is the background noise that makes them hard to hear when nearby ceiling or lamp LED lights are on.

This noise peaks around 150 MHz, and goes about 20 MHz either side, affecting our 2-meter band. The LED noise usually does not affect the HF, or high frequency, bands (3-30 MHz).

This noise is not generated by the LED itself, but by the "chopper" switcher innards taking 110-volt AC down to a much smaller voltage to make the individual LED illuminate. The dimmer function on some LED modules (*Photo B*) is the noisiest, especially in the mid-dimmer setting.

Try this — tune your 2-meter rig to a distant weather station on 162.400 MHz, or a very weak repeater, and then switch on your radio room or porch LED light bulb. If there is no change in reception, you are good to go.

However, if you turn on the LED bulb or track-light LED lighting, and the weather channel or distant repeater suddenly gets covered with noise, time to switch out the LED bulb for another manufacturer's bulb. Each manufacturer has its own way of filtering this noise, some with good success, yet others, have no success at all. Again, this LED interference is usually in your own house, and mainly interferes with weak 2-meter reception.

Around the Neighborhood (AND In Your House)

On HF, our latest noisemakers are cheap high-current grow lights, and the incessant noise from the power supplies that drive them to full brilliance.

Now add to this RF racket the wall chargers for cell phones and tablets, which frequently cause interference on high frequency within your own house. They are broadbanded in their noise output, from the AM broadcast band all the way up to 10 meters.

Here is the plan to find these HF noisemakers — with a portable receiver (*Photo C*), start sniffing within your own house first. Remove each wall charger from the AC socket and listen to hear if this one is generating broadband noise. Plug, unplug, replug, and unplug. If the noise stops, then starts again, you've found the culprit. But don't stop there; more than one of these chargers may be noise sources.

Time to search for a replacement, or raid your junk box for older transformer chargers. Just be sure and get the correct voltage, and most important, cor-

Photo A. LED light bulbs with heat sinks — some are quiet, others not!

Photo B. Dimmer circuits create major static on HF band reception.

Photo C. Finding noise sources, using the CCrane receiver on AM.

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rect polarity, where center socket MIGHT be "+" (positive), but COULD be "–" (negative).

Now it's time to find the HF noise sources all around your neighborhood. Chances are the neighbor's grow lights were direct imports from overseas with no FCC compliance sticker, and the noise can wipe out 40 and 75 meters, up to a block away. Shielding and clamp-on filters may not help — this HF noise is coming straight out of the power supply box. Best bet is to replace them with FCC-compliant models.

Use diplomacy when working with neighbors — I usually indicate these cheap import knock offs *could* be a fire danger — after all, I could direction-find to the exact house from which the noise and possible fire hazard are coming. This usually works.

I use a simple AM radio to spot this type of noise — but if you have a shortwave receiver — AM or SSB — all the better. Good excuse to buy that portable QRP internal battery rig you have been drooling over.

There are tons of other noise makers that affect our ham setups, but most only radiate a few feet and go undetected. It is the LED light bulbs in your own home that make a VHF racket, and cheap grow lights with their chopper circuits in the power supply that radiate noise on 75 to 10 meters, tons of noise, halfway down the street.

The Elk Beam is a Log for Great DFing!

OK, you solved some of your local noise issues with the pesky LEDs and grow-light switching power supplies, but now you need to find the source of a "birdie," a steady carrier smack dab on 146.520 MHz FM, the national calling frequency.

You live beside an RV storage park, and luckily for you, the manager is a ham. She says to come on in, find the noise, and she will make contact with the RV owner.

Your mobile Doppler gets you to one end of the park, but all the reflections won't let you pinpoint the source. Out comes the Elk log periodic antenna (*Photo D*), which resonates with directivity from about 140-500 MHz. You are now getting closer, but the signal is so strong, your HT without *any* antenna picks it up at full signal strength. With the log antenna attached, it is far too strong to DF.

Easy solution, only requiring some math skills, and a broadband directional beam antenna, like the portable Elk LP: Go for the second harmonic. Too strong? Try the third harmonic. Weaker, but still too strong. At the fourth harmonic for the signal on 146.520 MHz, heard weakly at 586.08 MHz, your HT with extended RX, tied into the Elk log antenna, sniffs it right down to the old fifth wheel with a beat-up old battery "tender" charger, which emits a birdie on 52. Success!

The owner is informed of the potential *fire* danger, and being such a good ham, you buy him a new automatic charger for the RV.

Photo D. The Elk log periodic antenna is great for hunting down noise sources on VHF and UHF.

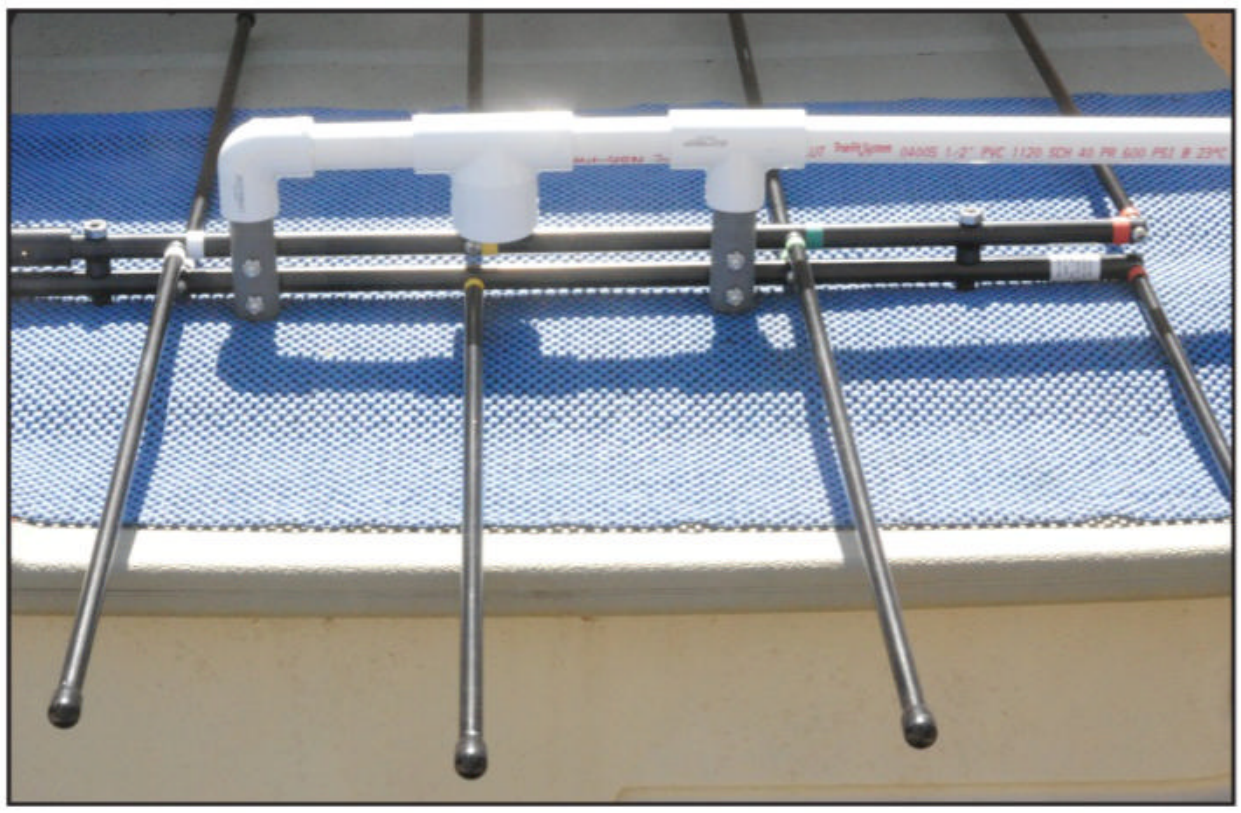


Photo E. The Elk log periodic antenna assembles in minutes.

Antennas for DFing at UHF

Now here is the real deal on harmonics for DFing: Trying to use a tape measure 2-meter antenna at the 586 MHz fourth harmonic won't work, as the dedicated 3-element tape measure beam is no longer a directional beam up this high in frequency, and yields essentially omnidirectional reception to the actual "signal" source.

The log periodic antenna continues to hold its beam pattern, way up at 500 MHz, and will still hold a nice tight bearing to the signal source on the second, third, or fourth harmonic. Your HT with broadband receive will no longer overload with no antenna attached, as it is now tuned to the fourth harmonic, just microvolts in signal strength.

A log periodic directional beam, like the popular Elk, is a series of dipole ele-

ments that get shorter down the twin booms, to where they are fed from the front. Each element that detects resonance becomes the active element, and the longer rear elements now act as reflectors. Total frequency coverage is from the length of the longest dipole element to the length of the shortest dipole element.

The individual resonant dipole elements take a small added inductive energy from the longer rear elements as reflectors, and the short elements in the front now become capacitive directors, adding some gain. Expect about 6 dB of forward lobe gain.

On the Elk log periodic beam, each set of dipole elements is screwed into a twin boom, each "side" of the boom insulated from the other side, with a coaxial SO-239 50-ohm connector (See *Photos E*, *F* and *G*). The coax-ground goes to one side of the boom, and the center conductor goes to the other side. The SO-239 is already factory assembled.

The log periodic element spacing leads to a 180° phase shift from one set of elements to the longer element behind it, and the shorter element in front of it. This makes the frequency-resonant dipole the "driven" element. Feedpoint impedance stays around 50 ohms, with slight variations, if a chosen frequency falls in between element resonances.

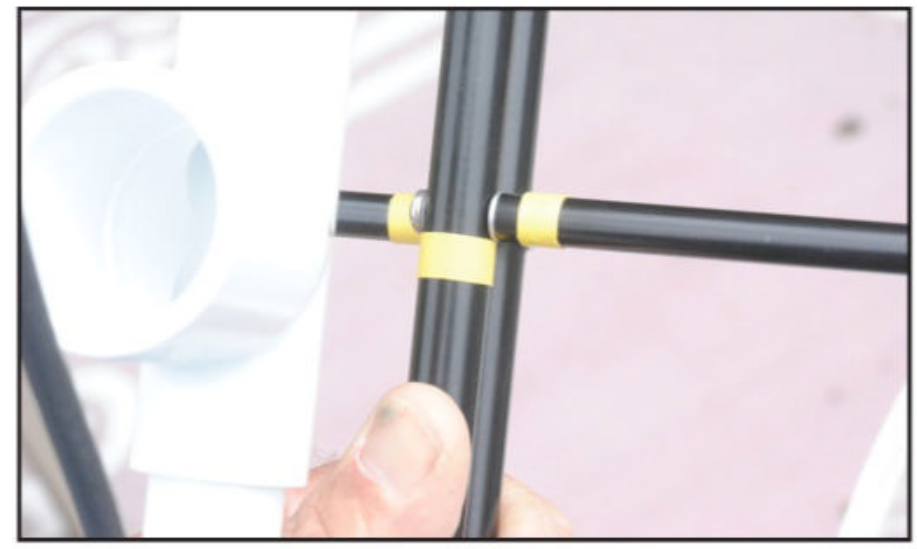


Photo F. All elements are color-coded for easy quick assembly.

When comparing gain to boom length of a single-band VHF Yagi, the 2-meter T-hunt tape measure antenna has a bit more gain and sharper directivity than the log with the same boom length. Same with the Arrow VHF/UHF antenna — it, too, may offer a bit more gain than the log period-

"Ham Nation" Goes Big-Time!

We had many great video podcast-years with Leo Laporte, W6TWT, on his TWIT Network, hosting and producing our weekly "Ham Nation" shows, with Bob Heil, K9EID; George with Smoke and Solder; Tamitha with solar video; Don with Newsline, plus Amanda, Valerie, Randy, and yours truly.

After multiple years with the fabulous TWIT team, our weekly guests many times outnumbered input lines to the TWIT studio. We needed more guest video line inputs, so we were pleased that Ray Novak, N9JA, with ICOM America, suggested Josh Nass's "Ham Radio Crash Course" site.

Most of our "Ham Nation" hosts were already familiar with Josh, KI6NAZ, and his wife, Leah, KN6NWZ, who were doing 'casts on multiple venues ... Facebook, Instagram, YouTube (with 182,000 followers), Discord, live streams, etc. Everyone who has watched Josh and Leah knows the excitement at "Ham Radio Crash Course," seen all over the internet, all over the world.

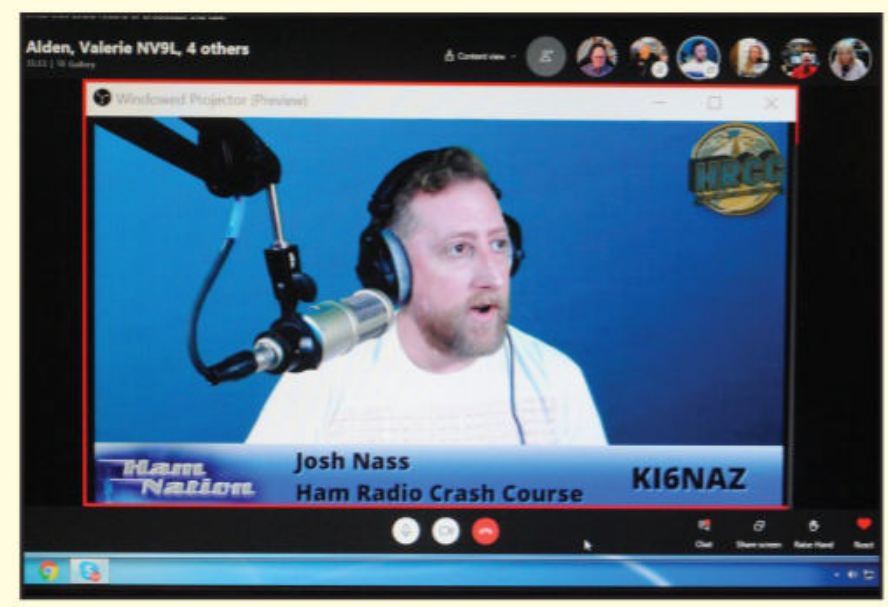
So, after hundreds of shows and many very successful years with the TWIT network, we made the switch last January to the "Ham Radio Crash Course" live and recorded video podcasts.

We expected our first few shows with Josh might be overwhelming for his home studio, and we were all pleasantly amazed at the smooth transition, and seamless bi-weekly showing of "Ham Nation" and all our regular hosts. And when it came time for multiple guests, Josh made it happen! Josh is an engineer, and we found that nothing fazes him in live-show on-air production!

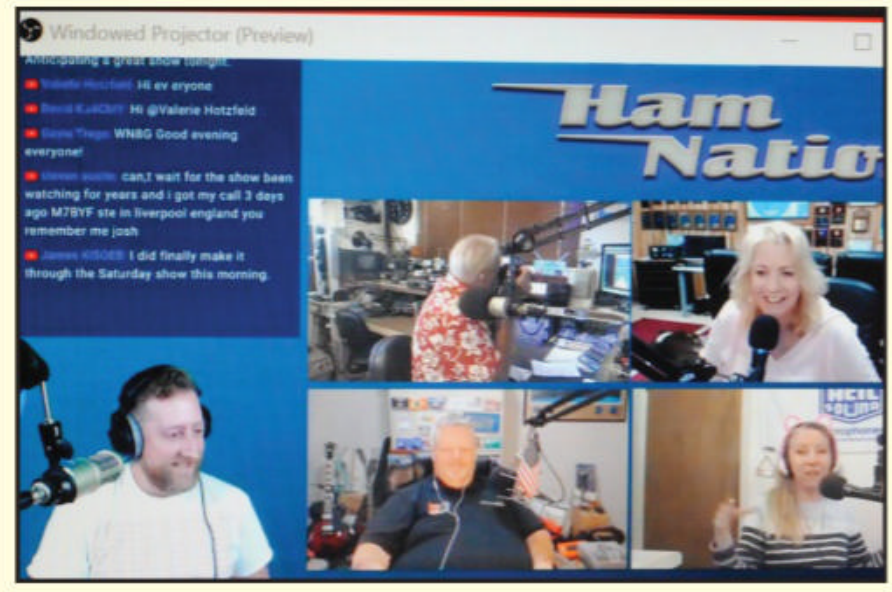
Josh is a *classic* podcast host, always upbeat, and usually first with any new ham radio gizmo for his live-action reviews.

Josh is also a *real* ham, regularly on the air, and always putting new products under the video microscope, and on the air reviews, all with fun and smiles, two of his many trademarks.

So see for yourself what "Ham Radio Crash Course" offers with so much variety of ham radio topics, and be as amazed, as all of us on "Ham Nation" are, for our new bi-weekly home! See you every other week! <www.hamradiocrashcourse.com>



Josh Nass, KI6NAZ, whose "Ham Radio Crash Course" on YouTube is the new home of the long-running "Ham Nation" podcast.



Josh is able to bring live chats for all to see (left side of screen) in addition to live video and audio.

ic, if each set of VHF and UHF elements is fed with separate coax cable leads.

But where the log periodic antenna from Elk Antennas shines is major broadband capabilities on both transmit and receive, which I needed when working with the Coast Guard Auxiliary to locate a 121.5-MHz EPIRB (emergency position-indicating radiobeacon) localizing signal, 170-MHz TX for authorized military channels, 400-MHz military channels, and second harmonic attenuation for finding stuck mics on 156.800 MHz transmissions in the local harbor.

And ... the Elk log periodic elements unscrew from the twin boom in less than 45 seconds total, and are color coded for easy reassembly.

Just remember, the log antenna feeds from the front (the end with the shortest elements), with the coax hanging away from the boom to keep the directional pattern sharp.

And for working the Elk log antenna into the International Space Station's cross-band repeater, it was a near-instant simple setup, a PVC handle for aiming it, and I was working the ISS even before and after AOS and LOS predictions. (AOS: Acquisition of Signal; LOS: Loss of Signal)

Photo G. SO-239 connector supplied with the Elk. Notice the two booms held apart with an insulator.

Elk Antennas now has a new home for increased product development in Wyoming, but the company's website remains the same: <www.elkantennas.com>.

BEHIND THE BYLINES ...

... a little bit about some of the authors whose articles appear in this issue

Chris Tate, N6WM ("Results of the 2021 CQWW WPX RTTY Contest," p. 10), is a member of the CQ RTTY Contest Committee. He is an accomplished contester and DX-peditioner, including being a team member on the 2018 VP6D Ducie Island DXpedition. A past president of the Northern California Contest Club, Chris is also a founding member of the Livermore Amateur Radio Group Endeavors (LARGE) club, which operates the W6LRG/WV6I contest station in Livermore, California. He lives in nearby Discovery Bay (which doesn't appear to actually have a bay!)

Lawrence Stark, K9ARZ ("Three 'Gifts' From Heathkit," p. 16), has been licensed since 1960 and has been building his own gear for nearly as long. A retired geographer, Larry is primarily a DXer (we'll bet he can find every place he works on a map!) and is a member of the Northern Illinois DX Association as well as the Antique Radio Club of Illinois. He lives in the Chicago suburb of Lake Charles, Illinois.

Ray Grimes, N8RG ("Restoring the Original Heathkit…" p. 20), is a public safety communications consultant who has written extensively on aviation safety. A resident of Los Alamitos, California, he has been restoring classic radios for years, and had an article in *CQ VHF* in 2004 on restoring the rare Rogers Black Widow VHF transceiver.

John Thompson, K3MD ("Restoring a Heathkit DX-60 Transmitter," p. 24), has had approximately 40 articles published in both amateur radio and professional journals (he is a radiologist) and is active on all bands from 160 meters to 23 centimeters, and on all modes except amateur TV. A contributing editor for the *National Contest Journal* since 2017, John is vice president of the Susquehanna Valley Amateur Radio Club and a member of many others, including the Frankford Radio Club, Mt. Airy VHF Radio Club, and First Class CW Operators' Club (FOC). He lives in Winfield, Pennsylvania.

Mnemonics

As ham radio operators reporting to a public safety or served emergency agency dispatch center, we need our incoming reports to flow with that agency's computer or written report form. I find it helpful to identify a *mnemonic* — a word or words to remind me of the *order* of voice data when reporting weather emergencies, traffic accidents to 911 operators, crimes in progress, etc.

For example, firewatch hams on a hilltop, reporting wind and weather conditions, can simply remember "WIDTH"

W wind
I intensity
D direction
T temperature
H humidity

Every agency has its own progression of needed information, *in order*, on its dispatch screen. Reporting that information, *in order*, makes everything go more smoothly and efficiently.

Send me a short mnemonic word and the progression of incoming voice or data for *your* served agency, and I will come up with a list for all to consider when calling in an emergency message, or communicating, *in order,* the short details needed by that agency. I will even come up with a word to stand for the flow of info.

Every agency is different, so let's all sound more professional when, as ham radio operators, we give them the information they need, *in order*, to flow into the programs in their dispatch centers.

Tropo Time in July

Finally, on a hot day in July, with a high-pressure system stalled overhead, dial in your mobile or base station 2-meter system to the weather channels, the ones that are usually too far away to hear on VHF line-of-sight (162.400 MHz to 162.550 MHz, 25 kHz steps, FM, vertically polarized), to monitor for *tropo*, or tropospheric scatter or ducting.

Last year, Dayton heard Dallas, Texas heard the Florida Keys, and Virginia was hearing Miami. Troposphere ducting at its summertime best, which leads to some fun 2-meter, 440-MHz FM, data, CW, and SSB long(er) range contacts.

Enjoy this summer's radio-fireworks in July!

VHF PLUS

BY TRENT FLEMING,* N4DTF

Tropospheric Ducting Propagation on the Rise in July

In May, we discussed leveraging your Technician-class privileges. Since that column went to print, there have been many good openings on both 6 meters and 2 meters, with many hams making exciting contacts on digital, CW, and phone modes. Before we leave the benefits of the Technician class, I wanted to mention that you do have access to portions of the 10-meter band (Technicians may use phone and CW on 28.3 to 28.5 MHz, as well as digital modes like FT8). While not technically a VHF band, 10 meters often benefits from Sporadic-E (E_s) propagation and it is safe to say that if 6 meters is open, so is 10.

When solar cycle 25 gets fully under way, you will also see worldwide propagation on 10 meters. It can be open day and night to various parts of the world. My point is simply that this is another example of a great opportunity to enjoy our hobby with "just" a Technician license. A simple dipole or vertical for 10 meters can be easily built or erected and give you hours of endless enjoyment when the band is open.

Now that I've gotten that off my chest, let's get back to our regularly scheduled "VHF Plus" programming. As we round out July, the normal E_s season will be winding down (but keep an ear out for any late season opportunities). This is a good time to start thinking about late summer and fall, and the tropospheric ducting (tropo) that may result from both the changing seasons and from hurricane activity in the Gulf of Mexico and along the East Coast of the U.S. This is primarily a 2-meter-and-above event, so perhaps it is time to evaluate your current capabilities, including FM, SSB / CW, and digital modes.

There are a couple of VHF-and-above contests in the late summer, and these are great times to try out your equipment or seek out local hams who are doing exciting things on the GHz-and-above frequencies and check out their activities. As far as tropo propagation, early mornings and late evenings are great times to listen and call for such activity, as temperature inversions are often enhanced during those times, as air settles before or after the heat of the day. In addition to longer distance contacts via weak-signal modes, you will often find that FM signals are positively impacted, allowing you to hear distant repeaters and make contacts on simplex frequencies including 146.52 MHz. Many folks keep an FM broadcast-band radio tuned to an empty frequency in order to hear if propagation brings in more distant stations. You can do the same thing on a NOAA weather radio channel not used in your area, listening for distant stations. Both methods will help you see which direction(s) you might be able to work on 2 meters and above.

Tropo can bring added excitement to higher frequencies, including 222, 432, 903 MHz, and above. Many claim that 222 often provides the best of all worlds, compared to even 2 meters. Remember, as frequencies rise, gain antennas become more manageable. As with any band, the quality of your antenna is an important starting point in building a strong station.

As the seasons change, so do propagation opportunities. The bands are seldom truly dead, we just need to create more activity. Let me know what your plans are for the fall operating season.

On the Bands

May has been an exciting month, as previously mentioned, on various bands. E_s was active for several days early in the month, including some U.S. contacts into Asia, South America, and Europe.

~ Fabrizio Monti, IZØAEG, reported that on May 3rd, from 1540-1730 UTC he observed the first opening this year with the U.S. on 50 MHz. Monti was able to hear W4TAA, AC4TO, NF4A, KA6U, WC3W, and others using FT8. "I don't use a very long antenna. I use a 6-element with a 7-meter boom, 20 meters above ground. The transceiver is a Kenwood 590SG

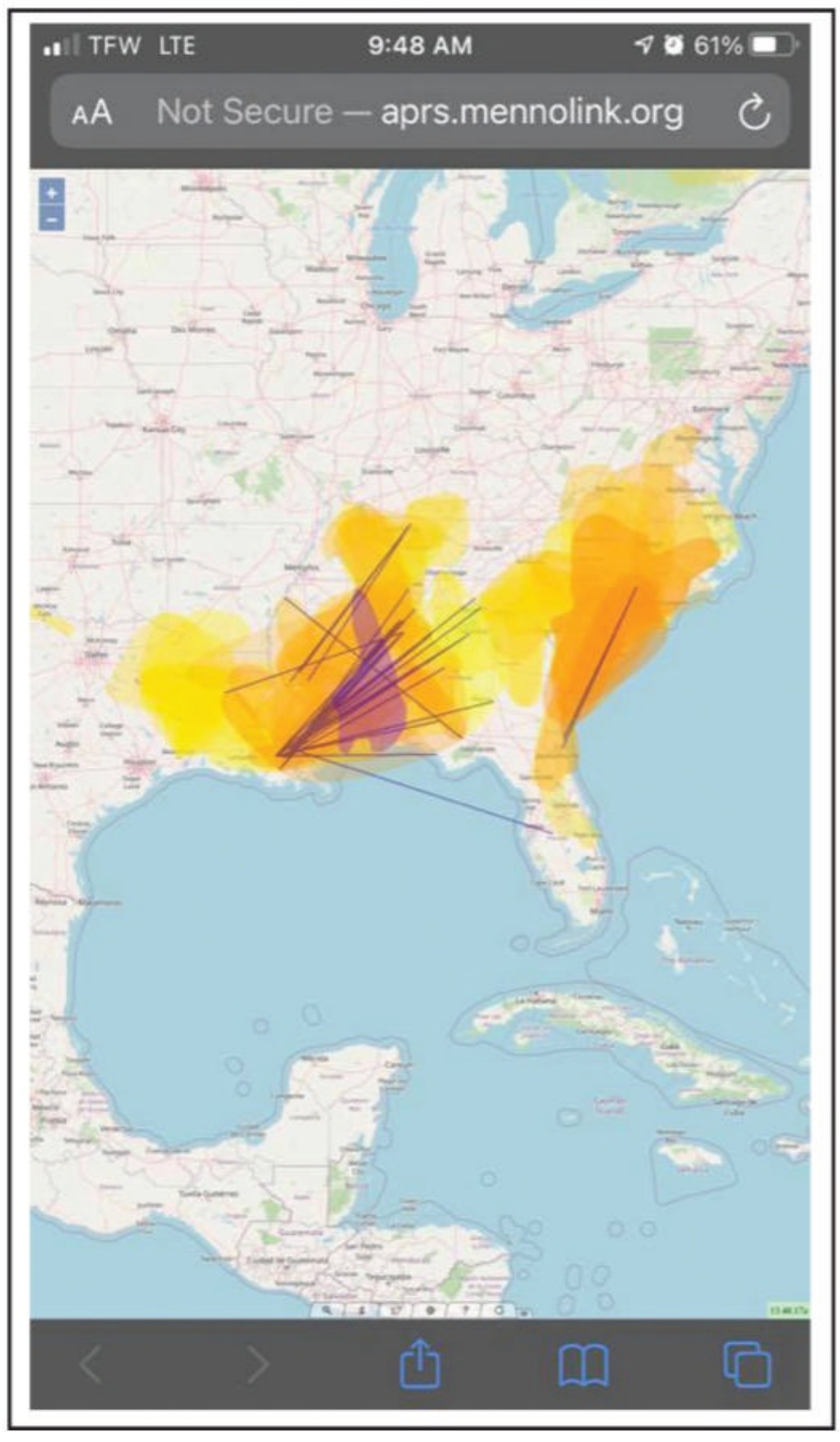


Photo A. On May 9th, a tropospheric duct opened up paths among the southeastern U.S. states.

* <n4dtf@cq-amateur-radio.com>

and a SunSDR 2 pro," said Monti. He really likes 6 meters and holds DXCC endorsement #203.

~ Paul Merrill, W7IV, reports on some exciting Asian contacts in early May. Paul reports, "Basically, I checked the band before going to bed about 2230 local [time] and saw some activity, so I ran out to the shack. I worked about a dozen JAs [Japanese stations], decoded a number who I had worked in previous openings, so I didn't prioritize them. I saw flags into Western China and Vietnam, but couldn't complete. I had a couple overs with BV2 and BV6, but never completed. I did get DU6/PE1NSQ, YB1TJ, and VR2XYL into the log and quickly confirmed via LoTW (Logbook of the World). Additionally, I was able to decode two stations in France yesterday (May 14th) at about 1600 UTC and get one in the log. I know some guys in Southern California either copied stations in EU (Europe) or were flagged there, but I'm not sure if anyone completed." Paul is running a Flex 6700 and PGXL into a 7-element LFA at 100-feet high.

~ Tropo openings were seen on several days as well, ranging from 2 meters to 222 MHz and up to 432 MHz. Ron Hooper, W4WA, reports that he worked several stations in Florida on 2 meters,

Photo B. Mike Kana, AA9IL, and Tom Staley, K9TMS, near Grayslake, Illinois, began testing their equipment in anticipation of the summer contest season.

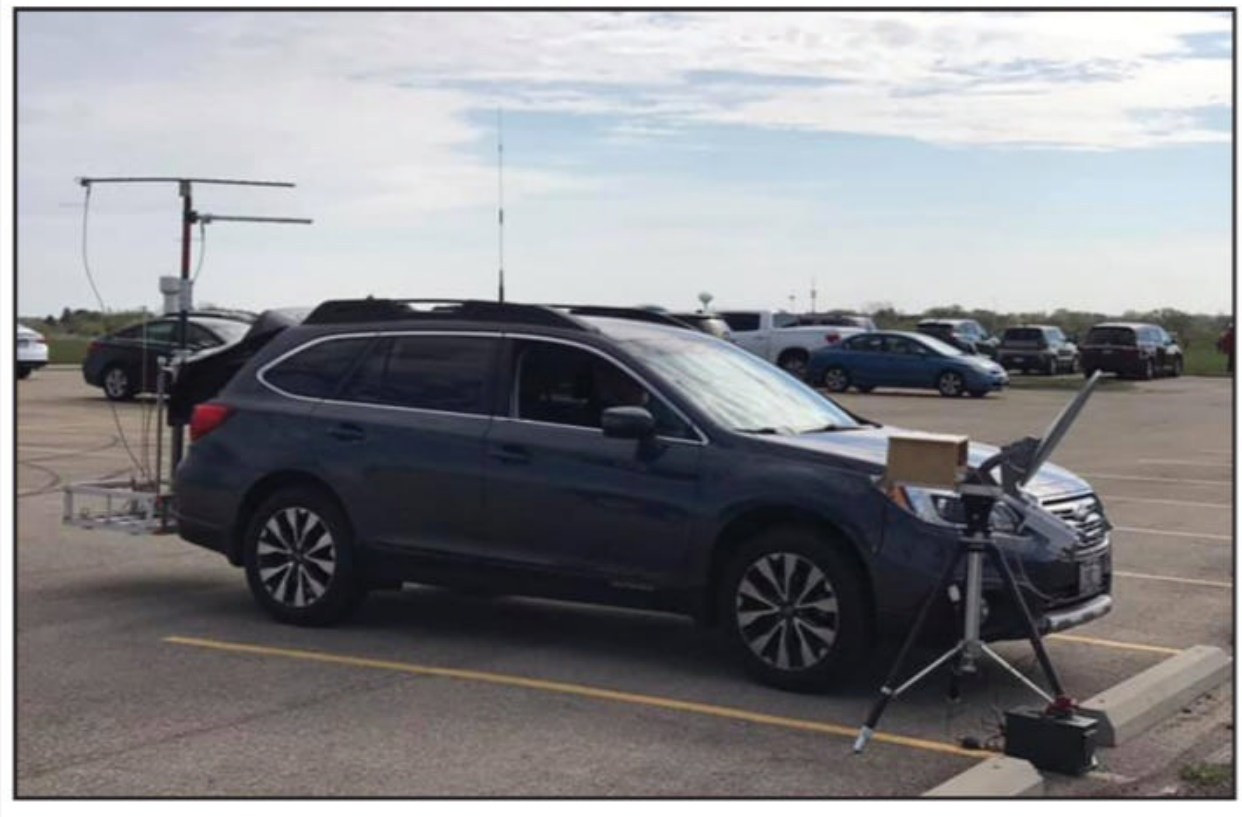


Photo C. The next day, while acting as a rover, AA9IL was able to provide K9TMS his first contact on the 122-GHz band.

Looking Ahead...

Here are some of the articles we're working on for upcoming issues of *CQ*:

- New Life for Old Heathkits Mini-Special – Part 2
- Converting an SB-220 to 6 Meters
- CQ Classic: Reviewing the Heathkit AT-1/AC-1
- What You Need to Know About the FCC's New RF Exposure Rules

Plus…

- Results: 2021 CQWW 160-Meter Contest
- OH2BH: A Life of DX

Upcoming Special Issues

October: Emergency Communications
December: Technology
February: QRP
June: Take it to the Field

Do you have a hobby radio story to tell? 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>.

222, and 432 MHz from his station in EM84. (see *Photo A*)

~ Mike Kana, AA9IL, reports on some rover / portable work that he and Tom Staley, K9TMS, did (*We are in the N9UHF Stoned Monkey contest group. That sounds like a fun group, right? –AA9IL*). Kana and Staley said they "were testing equipment for the spring / summer contest season and getting some experience working on 122 GHz. We made QSOs on 902 MHz, 1.2 GHz, and 10 GHz from EN52, at the Allegheny Sports Park near Grayslake, Illinois. We were contacting Pete Walter, K9PW, and John Kalenowsky, K9JK, who were in EN51." (See *Photos B* and *C*)

Mike was also able to provide K9TMS with his first 122-GHz contact of over 1 mile using the VK3CV transmitter / downconverter boards with 21-dBi conical horns. They are planning to extend this range by adding a PTFE lens or offset dishes. Exciting work is being done on the 122-GHz band.

That's it for this month. Keep those activity reports coming in, as well as photos of your station, your operating activities, etc.

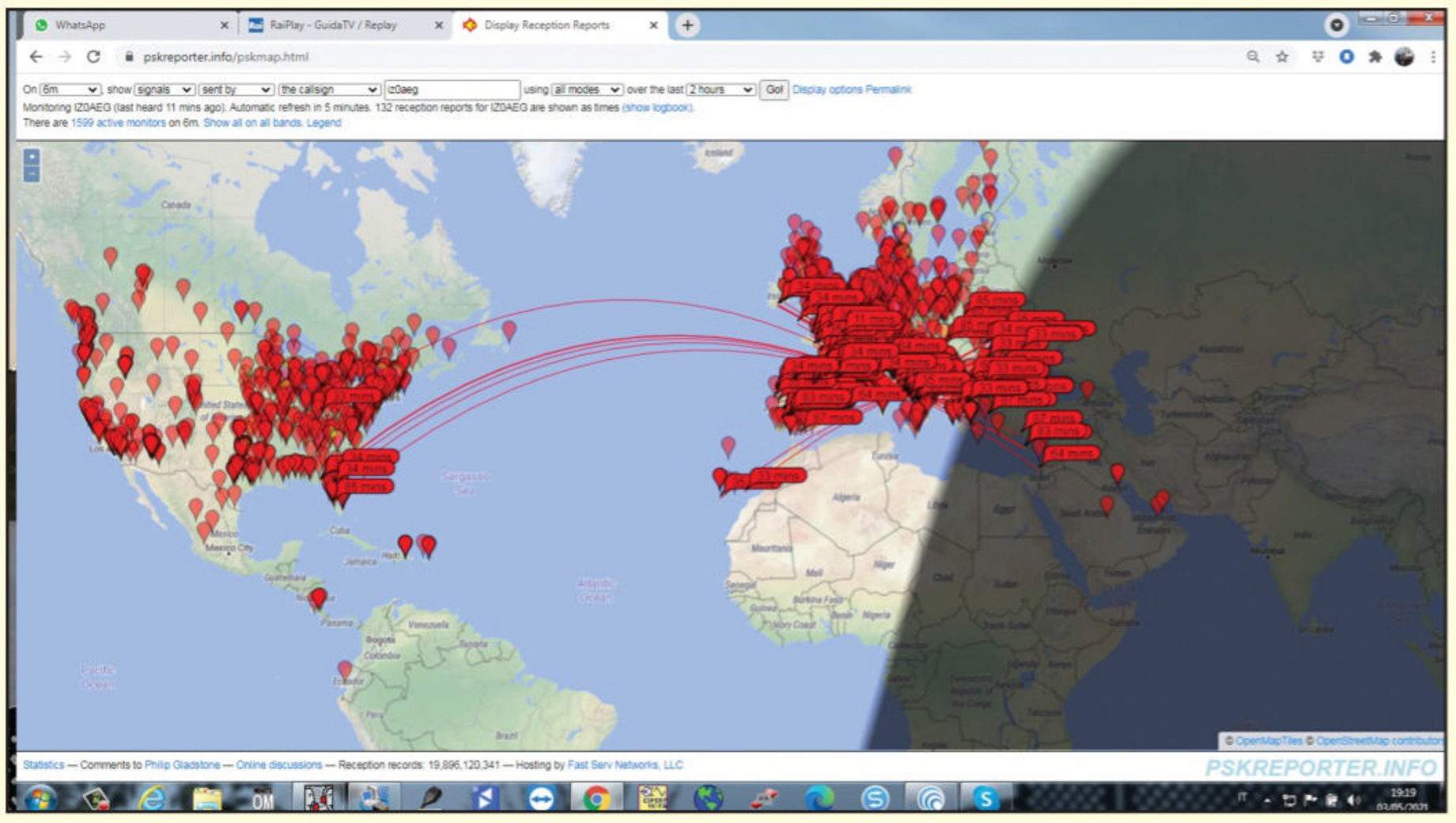


Photo D. Six meters came alive thanks to Sporadic-E propagation and a huge body of saltwater (aka Atlantic Ocean). All the action was primarily on the FT8 digital mode between Europe, Caribbean, and the east coast of the U.S.

Transatlantic Contacts

On several days in May (including May 3rd, as discussed in this column) there were excellent transatlantic openings from Europe into North America (*Photo D*). Multi-hop Sporadic-E propagation, combined with an excellent path over saltwater, combined for several powerful, long-distance openings. Several European stations reported the contacts beginning with the Caribbean in late afternoon, moving north into the U.S. mainland later in the evening. As with most things 6 meters these days, FT8 was the place to be, with only a few phone and CW contacts being made.

AWARDS

BY STEVE MOLO,* KI4KWR

YBDXPI: A Passion for DXing, YB-Style

Photo A. Budi Santoso, YE1AR

Hello everyone … this month's column will be on a new award from Indonesia (YB-Land) and widely seen daily on Facebook. I'm lending the keyboard this month to Budi Santoso, YE1AR, to tell you about this prestigious Indonesian award. At the time of writing this up, I have seen a lot of YB stations on 17 meters chasing FT-8, which is — as we all are aware — the current hot ham radio trend. Enjoy this month's article!

YBDXPI (YB-Land DXing Passion *Is*) is an online community of radio amateurs that was formed on August 29, 2018 initiated by Budi Santoso, YE1AR (*Photo A*), an active Indonesian amateur radio operator.

Membership is based on the desire to share knowledge — including DXing, contesting, homebrew experiments, and other interests — with fellow members who share the same interests. YE1AR created YBLand DXing Passion *Is* on the WhatsApp chat application and began attracting Indonesian hams who rallied around its mission.

The main purpose of YBDXPI is to share knowledge and best communication procedures with hams throughout Indonesia and the world. The group also encourages members to earn the DX Century Club (DXCC) award from the American Radio Relay League (ARRL). "Keep High Spirit for New Entity" is the tagline and motto of YBDXPI, which is a passion shares by many Indonesian hams.

*Email: <KI4KWR@cq-amateur-radio.com>

CQ USA-CA Monthly Update

500 County Level
N6PAT – Award number 3808 dated May 5, 2021
N4RRR – Award number 3809 dated May 10, 2021

1000 County Level
N6PAT – Award number 1937 dated May 5, 2021

1500 County Level
JA7QVI – Award number 1596 dated April 14, 2021
K4OP – Award number 1597 dated May 11, 2021

2000 County Level
W8SP – Award number 1474 dated May 2, 2021

The group is expected to be of benefit to all amateur radio operators, both individually and in groups. It is also a gathering point for hobbyists and users of amateur radio frequencies wherever they are.

YBDXPI hopes that in the future, it will help encourage the "birth" of new DXers and contesters who are reliable, professional, and operate with integrity. Of course, we also want to maintain the continuity of the regeneration process for amateur radio members in Indonesia.

YBDXPI Appreciation Award

"Given to those who have sought to achieve it," this award (*Photo B*) seeks to encourage an amateur to communicate with as many people as possible, as far away as possible, and using the various modes that exist. It is necessary to have time and patience, two things that cannot be valued in nominal money. YBDXPI has a program to reward members as a form of motivation and respect for hard work and constant persistence in carrying out their hobby. (*Awards are only for group members, but anyone anywhere can join. Indonesian amateurs must have confirmed at least 10 DX entities; members elsewhere must qualify for DXCC. –ed*)

To get this award, members must be able to prove two-way communication by providing confirmation as evidence recorded in the ARRL Logbook of the World or LoTW.[1] LoTW is one of the most trusted independent two-way communication recording media. It is managed by the American Radio Relay

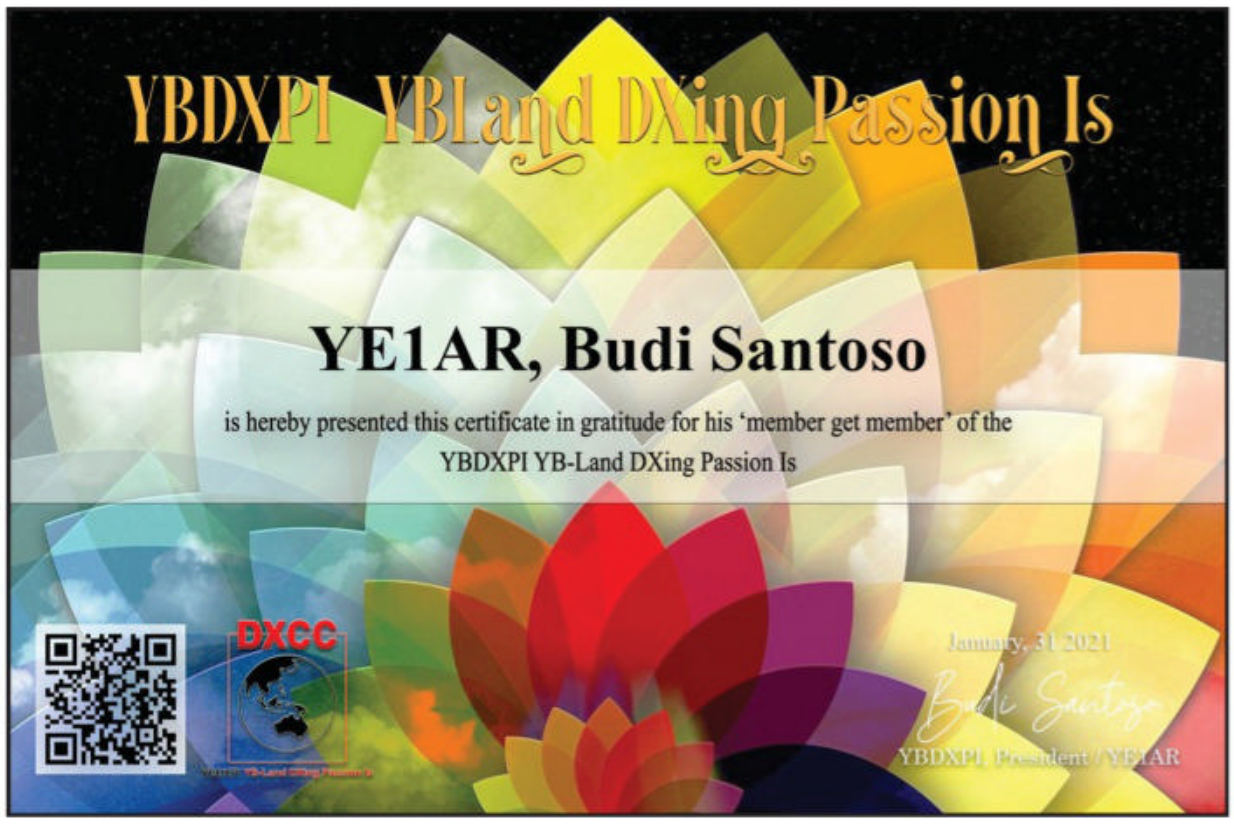


Photo B. Sample award certificate

Photo C. The YBDXPI trophy has special meaning in Indonesian culture. See text for details.

League, which is headquartered in Newington, Connecticut. The ARRL is also a member of the IARU (International Amateur Radio Union).

The following are the categories for award certificates and placards given to members who send LoTW recordings after going through the validity evaluation process:

CERTIFICATE

ARRL DXCC: 50 / 100 / 125 / 150 / 200 / 250 / 300 / 340 entities

DXCC Certificate: Single-mode, Mixed, Single-band -

DXCC Challenge: 500 / 1,000 / 1,500 / 2,000 / 2,500 / 3000

ARRL WAS: 50 Mixed / Band / Mode

CQ WPX: 500 / 1,000 / 1,500 / 2,000 / 2,500 / 3,000 Prefix

CQ WAZ: 40 Mixed / Band / Mode

PLAQUE

Super Star: DXCC Challenge 5- / 8- / 10-band with 500 / 1,000 / 1,500 / 2,000 / 2,500 / 3,000 entities

Rising Star: Most entities in 1 year

New Star: Mixed DXCC holder for the first time

Star: Available to holders of certificates for entity mixed, mode, band, states, prefixes, and zones

Meaning of Plaque

The design of the YBDXPI plaque (*Photo C*) has special meaning. The logo is a Gunungan Wayang, which is a symbol for a house. The Semar represent characters in Javanese puppets who are described as caregivers and advisors of the knights. The amateur logo is the logo of the Indonesian amateur radio organization, ORARI.

For more information, visit <https://ybdxpi.net> or email Budi at <ye1ar@yahoo.com>.

Thank you, Budi, for a great article on the award and the passion that you and your fellow YB hams have for the amateur radio hobby.

Is there an award that you know about that is highly achievable and fun to obtain? If so, please pass it along to me and I will be glad to highlight it in an upcoming column. Hope to see many of you at the Huntsville Hamfest in Huntsville, Alabama, on August 21-22, 2021.

Note:

1. The ARRL generally limits use of Logbook of the World QSO data to its own awards and those sponsored by organizations, such as CQ, which have made specific arrangements with the League. CQ's publication of information regarding other organizations using LoTW data for award purposes does not imply our endorsement of this activity. – ed.

YBDXPI Organizational Structure

You may be curious about how does the YBDXPI organization structures its work process. Because it was formed from the beginning as a non-profit organization, the main activities are carried out by the management who work voluntarily without being paid to consistently complete their respective tasks and synergize for the benefit of the members and the amateur world in general. Of course, we all thank the donors and sustaining sponsors who have entrusted their money to YBDXPI for international-scale activities.

Functionally, there are three teams working simultaneously on the sidelines of their respective professional activities, namely the membership and database team, the website and infrastructure team, and the database processing team for printing certificates.

The database team is tasked with processing member data and verifying the accuracy of the data through various sources and recording it into an existing database system. After completion of verification, it is processed by the certificate or award team to be printed and then published to the web page by the website team, which has also gone through the validation process.

YBDXPI hopes that the Indonesian amateur world will increasingly realize how easy it is to communicate with fellow amateur hobbyists in Indonesia and with others anywhere in the world that can be reached by radio signals. We all also hope that the members continue to improve their knowledge and skills to become better amateur radio operators with world-class proficiency and integrity.

– Budi Santoso, YE1AR, YBDXPI President

DX

BY BOB SCHENCK, N2OO

QSL!

A Look at QSLing in Today's World of DXing

As many of you already know, I have been chasing DX since I was first licensed in 1965. I have also been an active QSL manager since the mid 1970s. I have pretty much seen it all. Let's look back and then look forward a bit.

Back in the Day …

When I first got licensed, I sent a QSL card to pretty much everybody I worked. It was exciting to collect QSL cards, not only for awards but also to help remember those very special QSOs. Recently, I was asked for a QSL card for a QSO made back in 1969 with my old call, WB2RJJ in Bergenfield, New Jersey. I went into my blank card files and could not locate any of my original WB2RJJ cards from Bergenfield, so I took a long shot and went to Google. I entered "WB2RJJ QSL" and I got a match with the website <www.oldqslcards.com>, which is run by Bob Green, W8JYZ, in North Carolina. I checked on the master file list and voila, there was WB2RJJ listed in Bergenfield! I contacted Bob and he kindly sent me a scan of the card he had in his files. But an added surprise was offered when he went into his "storage files" and located two more of different designs; another card from Bergenfield from 1966, and one more from when I moved to Tuckerton in 1975. He offered to send them to me, asking for a donation to help with his QSL project, which I happily provided. Once I got the cards from Bob, I scanned them myself and used one of the designs to recreate a WB2RJJ QSL card for the fellow requesting the card from 1969. Then, I went into my personal QSL card collection looking for QSLs that I received from the three stations that Bob sent to me. Lo and behold, I had all three. I now have three sets of QSLs representing both ends of the QSOs (see photo for example). Very cool. Bob has a very nice website with a variety of informational links as well as access to the QSL collection list. If you don't see a particular call that you are looking for, don't hesitate to drop him an email and he can check his "archives" for you.

In any case, the QSL card was the only way to confirm a QSO for a very long time. It wasn't until 2003, when the ARRL's Logbook of the World (LoTW) started, that the way we confirm our QSOs began to change forever. (*eQSL actually launched earlier, in 1998, but did not have the widespread impact on QSLing that resulted from the introduction of LoTW. – ed*).

*email: <n2oo@comcast.net>

Both sides of QSL cards for both sides of a QSO … On the left is the card — front and back — that Bob (then WB2RJJ) sent to W3KNK back in 1965, as well as Sherd's card in response on the right. (W3KNK card from N2OO's QSL collection; WB2RJJ card courtesy <oldqslcards.com>)

LoTW is a double-edged sword. On the one side, it has made QSLing for awards much easier and a bit less expensive. On the other side, it has diminished the use of paper QSL cards. Unfortunately, some folks are no longer using QSL cards and are using LoTW as an excuse to avoid them. I find this to be unfortunate and I beg any of you who have done this to reconsider.

The QSL card is NOT just about the awards. It is something that you can touch and see in order to remember a QSO with someone. It is also nostalgia that deserves to be preserved for eternity. I certainly do not expect everyone to send QSL cards to everyone you work like I did back in the 1960s! But, I believe that all hams SHOULD have QSL cards printed so that if anyone does ask for a printed card, you will be able to oblige by providing one of your own in reply. You might also need to send a QSL card in order to confirm something for an award from someone who does not participate in LoTW. If you are an inactive ham, purchasing a small batch of 250 cards might just hold you for a while and would not break the bank. Another option might be to design your own on your computer and print a few at a time on card stock. For those of you who are pretty active, there is a way to design your own QSL card and upload the image to an online printer. I use <www.gotprint.com>. The quality is awesome and the price will surprise you. VERY reasonable. A couple of hints, follow their online guidance. Select the appropriate size 3.5- x 5.5-inch postcard layout and use 14-pt Gloss Cover stock. Set the front for High Gloss UV Coating Front. For the back, do not select high gloss. It will print a non-glossy surface on the back that can be rubber stamped without smearing, or

The WPX Program

CW

4014 . . . . . MMØDVZ
4015 . . . . . ON1QX
4016 . . . . . VA3OKG
4017 . . . . . G4BLI
4018 . . . . . DL6NAV

SSB

4360 . . . . . N5JED
4361 . . . . . CE2EP
4362 . . . . . MMØDVZ
4363 . . . . . AB4KY
4364 . . . . . JAØOEK
4365 . . . . . KA5WMF
4366 . . . . . N1UZ
4367 . . . . . KA3D

Mixed

4229 . . . . . KC1EO
4230 . . . . . WQ9F
4231 . . . . . YBØFLY
4232 . . . . . KE4DRF
4233 . . . . . IK1TZO
4234 . . . . . KT4TC
4235 . . . . . N1UZ
4236 . . . . . KD2NF
4237 . . . . . OE7BJT
4238 . . . . . N1ECC
4239 . . . . . KW2P
4240 . . . . . K5QO
4241 . . . . . HK5FCI
4242 . . . . . KC1OCA

Digital

1504 . . . . . N7RGF
1505 . . . . . JF1XHA
1506 . . . . . K6UIP
1507 . . . . . YBØFLY
1508 . . . . . DO2MOG
1509 . . . . . PY4ALE
1510 . . . . . KE4DRF
1511 . . . . . W2LAT
1512 . . . . . JS2IYY
1513 . . . . . OH3PYY
1514 . . . . . SM6WKB
1515 . . . . . JL2ULM
1516 . . . . . DC1OA
1517 . . . . . KD2NF
1518 . . . . . VK2EY
1519 . . . . . OE7BJT
1520 . . . . . SP4MPF
1521 . . . . . KW2P
1522 . . . . . K5QO
1523 . . . . . AA5NA
1524 . . . . . HK5FCI
1525 . . . . . EA5B
1526 . . . . . KC1OCA

CW: 350: PG9HF, ON1QX. 400: G4BLI. 650: K6UIP. 1550: W2YR. 8200: WA2HZR.

SSB: 350: N5JED. 400: KE8LXN. 450: K6UIP. 500: N1UZ. 600: JAØEOK. 700: KA3D. 850: JK7QJK. 1650: W2YR.

Mixed: 450: KE4DRF, K5QO, KC1OCA. 500: MMØDVZ, KT4TC, KW2P. 550: KD2NF, YBØFLY. 600: OE7BJT. 650: AJ6X. 700: WØWND. 750: IU1HGN, KF8QL. 800: WØWND. 850: N5JED, KA3D. 950: KB2S. 1050: K6UIP. 1100: DK1MCS. 1400: N5YY. 1700: N1UZ, EA5B. 2100: JR3UIC, N6PM. 2350: IZØFUW. 2600: W2YR. 4150: PY5EG. 5450: ON4APU.

Digital: 350: K6UIP, AB5WX, SP4MPF, KW2P, HK5FCI. 400: KC1EO, AB1Q, KC1OCA. 450: KE4DRF, OE7BJT, YBØFLY, K5QO. 500: DO2MOG, KT4TC, KD2NF. 600: N2TC, JL2ULM. 650: N5JED, AJ6X, KA5WSS. 700: WØWND, KF8QL, OH3PYY. 750: WØWND. 800: DK1MCS. 900: KB2S. 1000: W2YR, JJ1CWC. 1150: EA3UU. 1200: EA5B. 1750: JR3UIC. 1800: PY5EG. 2000: N6PM. 2250: HA9PP.

160 Meters: W2YR, OH3PYY, KD2NF, WØWND
80 Meters: K6UIP, W2YR, KD2NF, K5QO, EA5B
40 Meters: N5YY, K6UIP, YBØFLY, PY4ALE, W2YR, KT4TC, JL2ULM, KW2P, EA5B
30 Meters: KB2S, KA5WSS, W2YR, DK1MCS, WØWND, EA5B
20 Meters: N5JED, K6UIP, W2YR, JJ1CWC, N1UZ, WØWND, EA5B
17 Meters: W2YR, EA5B
15 Meters: K6UIP, DO2MOG, KA5WSS, W2YR, EA5B
10 Meters: N6PM, W2YR

Asia: JF1XHA, YBØFLY, KE8FMJ, JAØEOK, W2YR, JS2IYY, JJ1CWC, OH3PYY, N1UZ, JL2ULM, VK2EY, DK1MCS, EA5B
Europe: N5JED, MMØDVZ, ON1QX, YBØFLY, DO2MOG, IK1TZO, W2YR, G4BLI, DL6NAV, JJ1CWC, OH3PYY, N1UZ, SM6WKB, JL2ULM, DC1OA, OE7BJT, N1ECC, SP4MPF, EA5B, KC1OCA
Oceania: YBØFLY, JAØEOK, JJ1CWC, JL2ULM, EA5B
North America: N5JED, KC1EO, N7RGF, WQ9F, K6UIP, KE4DRF, W2YR, KA5WMF, KT4TC, W2LAT, JJ1CWC, N1UZ, KD2NF, N1ECC, KW2P, K5QO, AA5NA, HK5FCI, EA5B, KC1OCA, KA3D
South America: CE2EP, K6UIP, W2YR, N1UZ, EA5B

17M Bar: W2YR

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.

The WAZ Program

SINGLE BAND WAZ

6 Meter

169 . . . . . JA7KHQ, 26 Zones

20 Meter Digital

28 . . . . . JO4JDU
29 . . . . . JG8IBY

160 Meter

666 . . . . . UT1CZ, 35 Zones
667 . . . . . KR9U, 40 Zones
668 . . . . . Z31RQ, 30 Zones
669 . . . . . WB9CIF, 34 Zones
670 . . . . . N1RR, 31 Zones

ALL BAND WAZ

CW

1144 . . . . . DL6GBM
1145 . . . . . RN4ZT
1146 . . . . . JB1FML

Digital

239 . . . . . JH1MFN
240 . . . . . KE4BKL
241 . . . . . YC1AYO
242 . . . . . JP1EOM
243 . . . . . HB9JNM
244 . . . . . MM1PTT
245 . . . . . W4PNY
246 . . . . . JG8IBY
247 . . . . . K9QJ
248 . . . . . IZ4IRO

Mixed

10027 . . . . . DD2WW
10028 . . . . . EA3HRE
10029 . . . . . N1UZ
10030 . . . . . W2PD
10031 . . . . . F5VIF
10032 . . . . . EA5B
10033 . . . . . W4PNY
10034 . . . . . HB9GWJ
10035 . . . . . K9QJ
10036 . . . . . JH1DGJ

SSB

5509 . . . . . DL4TL

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>.

Update: Split-Level VHF/UHF Go-Box Plus Base Station

June cover story author Jay Taft, K1EHZ, offers this update to his article, "A Split-Level VHF/UHF Go-Box Plus Base Station," (CQ, June 2021, p. 10)

After using the VHF/UHF go box remotely with Winlink VHF packet on the Raspberry Pi for a number of weeks, I decided the system needs an on-board Windows® computer that can handle all Winlink modes, including Winlink Radio Message Server gateway programs. I looked online at several single-board Windows computers to replace the original Raspberry Pi and DRAWS hat. I settled on a Beelink T4 mini pc with 4GB memory, 64 GB internal storage, and Windows 10 Pro <https://tinyurl.com/2crbe5vp> for $139 from Amazon. Conveniently, it also runs on 12-volts DC.

I set it up with an HDMI TV as the monitor, along with a USB keyboard and mouse. After Wi-Fi and Windows Remote Desktop Connection were activated, the mini PC was operated headless over the network, similar to the Raspberry Pi. I then downloaded the NBEMS and Winlink software. I was hoping to use the mobile hotspot built into Windows 10 Pro for remote access, but it turns out the hotspot doesn't like operating without the internet being present. I was unable to get around this issue with several software fixes suggested online.

To provide remote access without the internet, I set up a Raspberry Pi 3B+ with RaspAp Wi-Fi router software <https://raspap.com>. RaspAp provides IP addresses to Wi-Fi connections with and without internet availability. The RaspAp computer is powered from a USB port on the Beelink T4. The Beelink T4 and RaspAP fit on the lower level of the go box with the original Raspberry Pi removed and still leave some stow space.

Combining the Windows 10 mini computer with the Raspberry Pi Wi-Fi router provides all the capability to run NBEMS, Winlink Express, and Winlink RMS gateway programs on the VHF go box. For remote access to the go box, I use Windows Remote Desktop Connection, or free versions of VNC Server / Viewer <www.realvnc.com>, NoMachine <www.nomachine.com>, or TeamViewer <www.teamviewer.com>, depending on internet availability and operating conditions.

– Jay Taft, K1EHZ

you will be able to write using a regular pen. I just looked at the last order I placed for 1,000 cards and it was approximately $44 plus tax and shipping. Pretty hard to beat and the quality is awesome. Again, there is a small learning curve. So, the first time you use the service, I suggest getting a proof, which costs a little more. But once you get the hang of it, then you can move to auto-proofing. Of course, if you don't mind spending a little more, there are many reasonable QSL card printers out there like <www.lz1jz.com>, <www.ux5uoqsl.com>, <www.kb3ifh.homestead.com>, <www.franklinprinting.us>, and many others.

When it comes to a DXpedition's QSL practice, another angle to focus on is "sponsors." When an expensive DXpedition team starts to put together its plan, one of the most important aspects is to seek foundation, corporate, club, and individual support. The DXpedition team is expected to include major supporters' logos or personal calls on the QSL card in order to thank them for their support. The QSL card lasts forever. Yes, adding the logo on a website is nice, and is also usually required. But it

5 Band WAZ

As of April 15, 2021
2306 stations have attained at least the 150 Zone level, and
1082 stations have attained the 200 Zone level.

As of April 15, 2021
The top contenders for 5 Band WAZ (Zones needed on 80 or other if indicated):
CHANGES shown in BOLD

Callsign	Zones	Zones Needed
AK8A	199	17
DM5EE	199	1
EA5RM	199	1
EA7GF	199	1
H44MS	199	34
HAØHW	199	1
HA5AGS	199	1
I5REA	199	31
IKØXBX	199	19 on 10M
IK1AOD	199	1
IK8BQE	199	31
IZ3ZNR	199	1
JA1CMD	199	2
JA5IU	199	2
JA7XBG	199	2
JH7CFX	199	2
JK1AJX	199	2 on 10M
JK1BSM	199	2
JK1EXO	199	2
K1LI	199	24
K4HB	199	26
K5TR	199	22
K7UR	199	34
K9KU	199	22 on 15M
KZ4V	199	26
N3UN	199	18
N4NX	199	26
N4WW	199	26
N4XR	199	27
N8AA	199	23
N8DX	199	23
N8TR	199	23 on 10M
RA6AX	199	6 on 10M
RU3DX	199	6
RWØLT	199	2 on 40M
RX4HZ	199	13
RZ3EC	199	1 on 40M
S58Q	199	31
SM7BIP	199	31
VO1FB	199	19
W1FJ	199	24
W1FZ	199	26
W3LL	199	18 on 10M
W3NO	199	26
W4LI	199	26
W6DN	199	17
W6RKC	199	21
W6TMD	199	34
W9OO	199	18 on 10M
W9XY	199	22
9A5I	198	1, 16
EA5BCX	198	27, 39
F5NBU	198	19, 31
F6DAY	198	2 on 10M & 15M
G3KDG	198	1, 12
G3KMQ	198	1, 27
HB9FMN	198	1 on 80M & 10M
I1EIS	198	1 & 19 on 10M
JA1DM	198	2, 40
JA3GN	198	2 on 80M & 40M
JA7MSQ	198	2 on 80M & 10M
JH1EEB	198	2, 33
KØDEQ	198	22, 26
K1BD	198	23, 26
K2EP	198	23, 24
K2TK	198	23, 24
K3JGJ	198	24, 26
K3LR	198	22, 23
K4JLD	198	18, 24
K9MM	198	22, 26
KI1G	198	24, 23 on 10M
KZ2I	198	24, 26
N4GG	198	18, 24
NXØI	198	18, 23
ON4CAS	198	1,19
OZ4VW	198	1, 2
UA4LY	198	6 & 2 on 10M
UN5J	198	2, 7
US7MM	198	2, 6
VK3GA	198	12 & 13 on 10M
W5CWQ	198	17, 18
W6RW	198	2 & 22 on 10M
W9RN	198	26, 19 on 40M
WC5N	198	22, 26
WL7E	198	34, 37
Z31RQ	198	1, & 2 on 10M
ZL2AL	198	36, 37
ZL2AL	198	36, 37

The following have qualified for the basic 5 Band WAZ Award:

Callsign	5BWAZ #	Date	# Zones
SV2DCD	2303	2021-04-21	200
WA1JMP	2304	2021-04-21	200
EA5B	2305	2021-04-30	161
RN4ZT	2306	2021-05-04	177

Updates to the 5BWAZ list of stations:

Callsign	5BWAZ #	Date	# Zones
W7AH	1311	2021-04-15	196
W6WF	2213	2021-04-26	155
K5OT	1975	2021-04-29	200
IK5ZUK	1908	2021-05-05	194

New recipients of 5 Band WAZ with all 200 Zones confirmed:

5BWAZ #	Callsign	Date	All 200 #
2303	SV2DCD	2021-04-21	1080
2304	WA1JMP	2021-04-21	1081
1975	W5OT	2021-04-29	1082

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).

only lasts as long as the DXpedition is in the news. A QSL card lasts forever. I have looked at QSLs from 40 years ago that show sponsors who are still around today. One thing for sure, an LoTW confirmation will never show this support. Thus, most DXpeditions will focus heavily on providing a paper QSL card, especially in the early QSLing process, in order to support and thank their major sponsors. Often, LoTW will be provided in the early period following the DXpedition ONLY when a QSL card is requested. A full upload to LoTW otherwise could be delayed up to a full year after the DXpedition goes QRT. This is not hard and fast, but it is a reasonable thing to expect. So, there is another reason why QSL cards will continue along for quite a long time to come.

Now, how about those QSL managers? Most QSL managers are hard-working regular hams who are devoted to providing you with an appropriate QSL card for any QSO that they can confirm in the DX station's log. They provide this valuable service so that the DX station can spend more time on the radio instead of processing QSL cards.

The CQ DX Field Award Program

Endorsements – SSB

AE4WZ .....28 MHz

Endorsements – Mixed

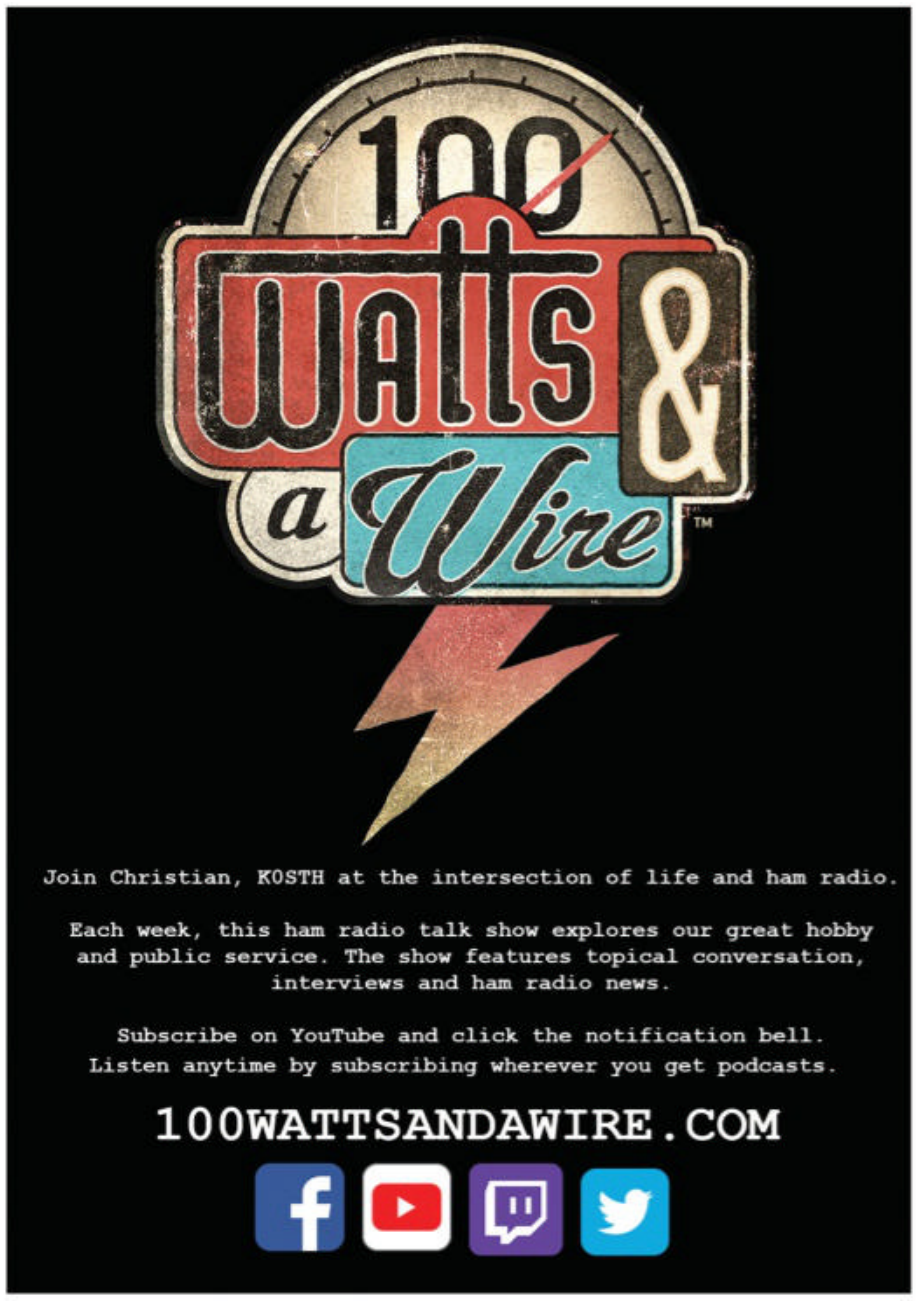
AE4WZ .....28 MHz

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.

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.



what's new

SSB Electronic LNA 30 Wideband Preamplifier

SSB Electronic Germany has released the LNA 30, its latest wide-band preamplifier for the 5-kHz to 30-MHz frequency range.

The mast-mounted LNA 30 is built into a UV-resistant, weatherproof mast housing, making the unit ideal for all types of outdoor applications. Signals above 30 MHz are strongly suppressed by a low-pass filter at the input of the amplifier. The MMIC used has a low noise figure with high signal strength. This amplifier can be fed with 12 to 24 volts of power via the UHF socket, which is an N-type connector; or the device can be powered by a 24-volt battery.

The greatest signal strength is achieved with a 24-volt supply and clocks in at 21- / 1.8-dB at 10 MHz, while a 12-volt supply will present the smallest noise figure. Only linear power supplies are recommended for the voltage supply of the LNA 30, since switching power supplies often generate very high interference levels in the low-frequency ranges.

The LNA 30 is available now with a suggested retail price of $217.99. For more information, visit <www.ssb-electronic.com> or email <sales@ssb-electronic.com>.

Most QSL managers do this as a passion. Although they usually require that you provide return funds or an SASE (self-addressed stamped envelope) for direct QSL requests, most will answer bureau cards as well. I can relate, having just shipped out about 75 pounds of cards directly to DX QSL bureaus, which cost me in excess of $600. Add additional costs like card printing, labels, envelopes, postage, incoming bureau expense, rubber stamps, etc., and you can see that it can be costly to all QSL managers for sure. Many now use an online QSL request system (OQRS) such as Club Log which helps. But I can attest that many request FREE bureau QSLs on Club Log OQRS without any regard for the costs to the QSL manager. If you are requesting a bureau card from a fellow private individual ham in a fairly common DXCC entity, then that is probably all OK. But if you are requesting free bureau QSLs from DXpeditions via a QSL manager, then you SHOULD at least add a donation when checking out. There is usually a place for you to do that but far too many just click past it since it is voluntary. Also, please use an OQRS system if it is available when requesting a bureau QSL. Most QSL managers must pay to receive QSLs from their incoming bureau as well as the cost to ship them out to you. There are so many ways to thank the QSL manager for handling bureau cards, why not take a moment to help out? I must say that there has been background chatter on adding a charge to a QSL bureau OQRS request, especially for a DXpedition. I hope that is not necessary, but fair warning. Think a little when you ask for that bureau card. Especially for a DXpedition QSL card.

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	KØDEQ....221	NIØC....196
W1CU....267	WI8A....219	ON4CAS....194
VE7IG....254	HA1AG....218	N4NX....192
HAØDU....253	JN3SAC....214	HA1ZH....190
OM3JW....253	HA9PP....213	BA4DW....188
W6OAT....249	WA5VGI....213	HB9DDZ....188
IK1GPG....245	IV3GOW....211	K2AU....187
OK1ADM....245	W4UM....210	K8YTO....186
HA5WA....243	N4MM....208	WO7R....185
K8SIX....240	OK1AOV....208	N3RC....184
HA1RW....239	F6HMJ....206	K2SHZ....182
VE3XN....239	KF8UN....205	KJ6P....180
I6T....230	OM2VL....205	W6XK....180
N8PR....229	VE7SMP....204	W5ODD....177
HA5AGS....228	RW4NH....203	NØFW....176
9A5CY....227	K1NU....201	WA9PIE....176
K8OOK....227	HB9AAA....200	HB9BOS....175
K9YC....227	N5KE....200	NKØS....175
VE3ZZ....226	W3LL....199	

SSB

W1CU....249	W4UM....198	W3LL....187
W4ABW....202	JN3SAC....191	NØFW....176
VE7SMP....201	N4MM....189	DL3DXX....175
KØDEQ....198	WA5VGI....189	

CW

W1CU....253	W4UM....200	N4NX....177
HA5WA....234	OK1AOV....198	N7WO....175
DL6KVA....233	WA5VGI....197	
KØDEQ....214	NIØC....196	
JN3SAC....211	HB9DZZ....186	
DL3DXX....210	N4MM....186	
DL2DXA....209	OK2PO....184	

Digital

W1CU....195	HA5WA....177	KØDEQ....175

Finally, I have always enjoyed keeping a QSL card album for my DXCC cards. It would be pretty hard to do this without all of the QSL cards. I cannot imagine what I would do if a DX station that I needed from a rare location did not print QSL cards but only did LoTW. What would I put in that spot in the album? Nothing at least until I could work someone else from that entity who DOES provide QSL cards.

There are plenty of QSL managers out there who would gladly help any semi-rare DX station with QSLing. When it comes right down to it, all the DX needs to do is send a log to the QSL manager on a regular basis. There are multiple methods for doing this, even something like providing Club Log OQRS access to the QSL manager. If the DX station has funds but not time to deal with cards, then he/she should help by providing some funds to the QSL manager for printing cards. If the DX station is unable to provide such funds, many QSL managers will print cards at their own expense. So, for the semi-rare DX out there, please QSL! If you need a QSL manager, drop me an email or visit the QSL Managers Society web page at <www.qslmanagers.net>.

– See ya' in the Pileups folks!
De N2OO

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

9272 9A2AA	4934 W9OO	3130 SV1EDY	2420 WA6KHK	1955 NIØC	1480 K4JKB	1219 K6HRT	1036 DL5KW	758 N4JJS
8188 K2VV	4757 I2MQP	3099 N6FX	2400 N7ZO	1870 JH1QKG	1462 AC7JM	1217 AB1QB	1032 DG5LAC	757 WB3D
7922 9A2NA	4681 JH8BOE	3050 K1PL	2394 AE5B	1828 K7LV	1462 DL4CW	1204 VA2IG	1023 N4WQH	736 JA3MAT
7889 W1CU	4673 NN1N	3028 IK2DZN	2391 WO7R	1825 N5KAE	1447 K3XA	1201 K9BO	1016 W9QL	718 KE4PLT
6722 EA2IA	4574 JN3SAC	2987 W6XK	2356 NE6I	1824 WF7T	1422 I2VGW	1167 WA9PIE	1012 NØVVV	711 AG1T
6577 KF2O	4517 IK2ILH	2987 AG4W	2330 IZØFUW	1821 PY5FB	1408 NH6T	1153 N3CAL	1010 VE3RZ	695 W8WDW
5715 S53EO	4462 K1BV	2968 AB1OC	2225 JH1APK	1746 K6UXO	1398 ES4RLH	1148 SP8HKT	1007 AA4QE	682 AI8P
5677 ON4CAS	4342 WB2YQH	2963 N3RC	2203 KI1U	1719 N6PEQ	1377 KC1UX	1137 YO5BRZ	1006 NØRQV	674 N5JED
5645 KØDEQ	4298 VE3XN	2951 NXØI	2176 V51YJ	1711 NS3L	1361 VA3VF	1136 KO9V	1000 WB6IZG	661 AL4Y
5539 N4NO	4241 N6QQ	2697 AK7O	2174 N6PM	1667 AD3Y	1333 AF4T	1116 YU7FW	969 4F3BZ	633 TI5LUA
5482 VE1YX	4201 YO9HP	2651 HK3W	2159 VA7CRZ	1643 SV1DPI	1322 AA4FU	1112 N6MM	966 W6WF	623 AB1Q
5453 YU1AB	4053 N1RR	2616 9A2GA	2133 KØKG	1616 TA1L	1301 KB9OWD	1107 PY2MC	919 ON7MIC	621 K4HDW
5401 N8BJQ	4030 W3LL	2589 DG7RO	2113 W2FKF	1612 W1FNB	1301 K1DX	1100 WA3GOS	889 WU1U	616 AC6BW
5387 W9OP	3978 WD9DZV	2583 PA2TMS	2056 NKØS	1590 JF1LMB	1301 KM5VI	1109 KE8FMJ	866 K2KJ	605 IW2FLB
5299 N6JV	3784 K9UQN	2550 K6ND	2040 K4HB	1570 PY5VC	1299 JA6JYM	1084 KG4JSZ	857 R1AV	
5215 I5RFD	3665 AB1J	2528 W2YR	2016 N2WK	1568 N3AIU	1295 NIØC	1074 WU9D	851 N3DF	
5186 ON4APU	3538 9A4W	2457 K5UR	1995 JR3UIC	1524 NH6T/W4	1280 WF1H	1069 IZ4MJP	835 K6RAH	
4944 WA5VGI	3459 W9IL	2453 AA8R	1972 K3CWF	1484 FG4NO	1260 UR6LEY	1058 N6DBF	803 JP1KHY	

SSB

6992 OZ5EV	3174 I3ZSX	2568 SM6DHU	2094 I8LEL	1622 K5CX	1222 YF1AR	1031 IK8OZP	808 UR6LEY	690 W6PN
6334 9A2NA	3172 YO9HP	2532 W9IL	2093 W2WC	1616 W2YR	1187 IZ1JLG	1022 NW3H	802 N6OU	684 KO9V
6145 K2VV	3141 DL8AAV	2483 AG4W	2084 K5UR	1611 W2ME	1183 KI1U	1012 KU4BP	801 K3XA	675 F1MQJ
5404 VE1YX	3114 N8BJQ	2451 EA3GHZ	2076 K2XF	1587 N3XX	1150 VE6BMX	1004 K4HB	766 I2VGW	655 VA3VF
5149 KF2O	3108 I4CSP	2443 JN3SAC	2070 NXØI	1550 IK2RPE	1146 SQ7B	1004 WA5UA	763 K4JKB	647 YB8NT
4800 EA2IA	3097 WA5VGI	2335 KG1E	2048 W4QNW	1442 DG7RO	1136 K3CWF	978 EA7HY	758 IV3GOW	640 UA9YF
4410 I2MQP	3067 N6QQ	2326 CX6BZ	2008 WD9DZV	1389 NKØS	1112 NH6T	957 W9QL	724 WF1H	637 K5WAF
3990 KØDEQ	2990 KF7RU	2311 K1PL	1955 EA3NP	1386 HK3W	1098 K4CN	934 PY5VC	724 W3TZ	630 W6US
3681 N4NO	2984 KI7AO	2209 IK2QPR	1935 SV1EOS	1386 IK4HPU	1096 JA7HYS	931 YB1AR	717 KØDAN	624 K6KZM
3622 I8KCI	2953 N1RR	2201 NQ3A	1884 WA6KHK	1373 N5KAE	1093 N6MM	929 NS3L	717 N3JON	606 KJ4BIX
3585 SV3AQR	2935 PT7ZT	2200 N6FX	1879 K3IXD	1371 VE6BF	1089 IZ8FFA	919 KA5EYH	714 YB2TJV	604 GØBPK
3505 NN1N	2903 IN3QCI	2198 AB1OC	1848 AB5C	1338 NE6I	1089 IT9ABN	893 W9RPM	713 JH1APK	600 WU1U
3456 W9OO	2857 4X6DK	2131 N3RC	1825 KQ8D	1334 EA3EQT	1057 W6XK	889 N3AIU	710 WA9PIE	600 WA3PZO
3363 W3LL	2650 IK2DZN	2129 K9UQN	1812 K6ND	1262 K7LV	1042 IZØBNR	875 K7SAM	700 N4FNB	
3333 CT1AHU	2595 EA1JG	2122 AE5B	1646 VE7SMP	1258 N1KC	1032 DG5LAC	854 K6HRT	700 JA1PLL	
3274 YU7BCD	2582 PA2TMS	2113 W2FKF	1641 AE9DX	1248 N6PEQ	1031 K4CN	833 DK8MCT	694 KG4HUF	

CW

7406 WA2HZR	4145 WA5VGI	3012 WD9DZV	2357 W9HR	1708 NIØC	1421 KN1CBR	968 K3CWF	783 YB1AR	620 AF5DM
7200 K2VV	4076 I7PXV	2948 IK3GER	2291 N3XX	1691 KI1U	1389 IT9ELD	962 K7LV	763 N5KAE	615 JH6JMM
6024 9A2NA	3974 JN3SAC	2943 N6QQ	2212 AC5K	1620 DG7RO	1342 VE6BMX	955 N6PEQ	752 K6HRT	608 W9RPM
5261 KF2O	3804 W9OO	2915 KA7T	2086 NXØI	1595 PY5FB	1235 JH1APK	944 AB1OC	743 JA5NSR	600 NY4G
5160 N4NO	3675 NN1N	2811 OZ5UR	2022 AF5CC	1523 W2YR	1220 AA4FU	908 NH6T	738 NH6T/W4	600 IK2SGV
5209 N6JV	3504 YU7BCD	2667 W9IL	1998 K5UR	1505 R3IS	1210 DL4CW	897 HK3W	732 SQ7B	
5104 EA2IA	3357 K9UQN	2548 EA2CIN	1973 N3RC	1498 W6XK	1196 N3AIU	891 DK8MCT	727 JF1LMB	
4905 W8IQ	3349 N1RR	2531 I2MQP	1905 WA6KHK	1483 VE1YX	1098 LU5OM	890 NS3L	722 WA9PIE	
4687 IZ3ETU	3279 IØNNY	2490 N6FX	1832 N4YB	1480 WO3Z	1062 K3XA	889 N3AIU	720 K4CN	
4673 N8BJQ	3214 SM6DHU	2477 VE6BF	1762 K6ND	1477 K1PL	1036 DL5KW	864 YO5BRZ	652 IK2DZN	
4659 KØDEQ	3041 YO9HP	2424 W2WC	1744 NE6I	1458 AG4W	1027 AE5B	848 PY5VC	636 NKØS	
4570 I3FIY	3031 EA7AAW	2404 W3LL	1727 K6UXO	1443 WA2VQV	992 F5PBL	821 HB9DAX	629 IV3GOW	

DIGITAL

2886 N8BJQ	2139 WA5VGI	1535 NXØI	1218 W1FNB	1051 KH6SAT	923 K9UQN	811 WF1H	680 K2KJ	600 ADØFL
2855 W3LL	2103 K2YYY	1500 JH1APK	1189 JF1LMB	1047 RW4WZ	917 K7LV	810 N3CAL	672 K9AAN	
2690 KF2O	2004 N6PM	1426 AB1OC	1149 W9IL	1021 NN1N	881 NE6I	800 WA3GOS	670 IV3GOW	
2570 WD9DZV	1836 AG4W	1378 K3CWF	1112 AB1QB	1009 GUØSUP	870 WB6IZG	783 YB1AR	670 N1RR	
2558 NT2A	1818 W1EQ	1345 K1PL	1108 KE8FMJ	1003 W2YR	866 SQ7B	758 N4JJS	668 KA5EYH	
2496 W6XK	1790 JN3SAC	1308 NKØS	1093 KI1U	1002 NØRQV	858 WU9D	750 ON7MIC	654 JA3MAT	
2428 KØDEQ	1759 N7ZO	1279 KC1UX	1091 VA3VF	966 NS3L	855 R1AV	750 NH6T/W4	640 WA9ONY	
2242 HK3W	1704 IK2DZN	1250W2/JR1AQN	1089 AC7JM	947 I2VGW	844 N3DF	713 JP1KHY	636 W9RPM	
2217 YO9HP	1643 N3RC	1227 ES4RLH	1060 AF4T	922 EA2IA	812 UR6LEY	681 PY5VC	611 KO9V	

REMOTE OPERATION

CW	MIXED	SSB	DIGITAL
7277 K9QVB	4026 N1RR	2953 N1RR	671 N1RR
3292 N1RR			

CONTESTING

BY TIM SHOPPA,* N3QE

7QP Roving Fun and All About the NAQP

The 7th Call Area QSO Party (7QP) took place May 1 and May 2, 2021 on a busy weekend for state and regional QSO parties. Randy Foltz, K7TQ, and Jay Holcomb, WAØWWW went mobile for the 7QP, activating 24 counties in four states. Jay reports their usual operating pattern as, "we take turns operating for two hours then switch to driving for two hours. That helps break up the day." *Photos A* and *B* show Randy and Jay in the operating seat. "We used N1MM+ on an HP latptop with full rig control," Randy notes.

Photo C shows Randy's Ford Ranger with a Scorpion 680 antenna mounted in the center. The team used an Elecraft KX2 transceiver with an outboard KXPA100 amplifier to bring the transmit signal up to 100 watts. Randy notes that the 40-meter band was their most productive, with 467 QSOs as compared to only 165 QSOs on 20 meters.

Photo A. Randy Foltz, K7TQ, in the radio seat while operating K7TQ/M during the 2021 running of 7th Call Area QSO Party.

The July and August North American QSO Parties Attract Both New and Experienced Contesters

The North American QSO Parties were my gateway into contesting when I returned to on-air activity in 2008. The 100-watt power limit on all entrants levels the playing field and was a big attraction given my limited station. My first successes CQing during a contest came in the NAQPs. The events only last half a day (starting midday Saturday and Saturday evening), so it was easy to fit a substantial amount of activity into a weekend filled with other family activities. The NAQPs also attract experienced and skilled contesters who enjoy the thrill of operating single-operator-two-radio (SO2R) by interleaving activity simultaneously on two (or more) bands. I learned the basics of contesting in the NAQPs, thanks to the experienced operators and their efficient and friendly on-air exchanges.

This summer, the NAQP RTTY event is Saturday, July 17th. The CW and SSB sessions are on August 7th and 21st, respectively. The *National Contest Journal* (NCJ) sponsors them and you can find the full rules on its website at <https://ncjweb.com/naqp>.

email: <n3qe@cq-amateur-radio.com>

I will briefly explore the pre-history and growth of the NAQPs, then launch into the valuable propagation knowledge we can learn from this fun on-air activity. Then we'll look at the way NAQPs build multiple operating skills important in the bigger contests, and finally discuss how contesting clubs have challenged each other to reach new pinnacles in club participation via the NAQP events.

The ARRL CD Parties Were Forerunners of the NAQPs

The CD Parties began in summer 1946. CD stands for "Communication Department" of the ARRL, and appointees of the department and ARRL officials were eligible to work each other on the HF bands for points. ARRL sections (not per band, but per contest, like Sweepstakes) were part of the exchange and served as a multiplier. The other part of the on-air exchange consisted of each participant's appointed position in the ARRL organization. There were separate Saturday events for CW and phone activity. By 1964, the high CW scores had more than 500 QSOs.

In 1969, the ARRL expanded participation in some CD parties to include all ARRL members. Participation exploded in the "open" version of the CD parties, with the most active operators making over a thousand contacts in just 10 hours of operation.

CD parties continued three times a year — April, January, and October — into 1982. I asked about the very last CD party on the CQ-Contest mailing list and Jim Cain, K1TN, informed me that, "the last ARRL CD Party was April 1982."

A Simpler Exchange in NAQP Resulted in More Participation

Dave Pruett, K8CC (SK), helped conceive the NAQPs at the 1985 ARRL National Convention in Louisville, Kentucky. Dave explained in a 2003 CQ-Contest thread, "the NAQP was invented to replace the CD parties that the ARRL had just dropped." The name and state exchange was different from the old CD party exchange that was, "intended to foster QSOs with casual participants," he explained. The first NAQPs were held on two Saturdays in April 1986, in the phone and CW mode. Like the CD parties, operators could be on the air for up to 10 of the 12 hours.

From 1986 to 1990, the CW and SSB NAQP continued in April. In 1991, the April events were discontinued, replaced by four events a year, two in January and two in August. In July 1996, the summer RTTY session was

added, and the February RTTY event began in 2003. With these additions, the NAQP reached its current slate of six events a year.

The popularity of the NAQPs continues to grow. In January 2021, Marty Sullaway, NN1C, made 1,752 QSOs as a single operator in 10 hours of operation from Massachusetts. Like many east coast stations, Marty's best hours were right around sunset on the 40-meter band — in particular, he reported 231 QSOs in the hour just after sunset. His competition on the west coast was Dan Craig, N6MJ, who made 1,695 QSOs, with a stunning 316 of them in just the first hour of activity on the 20- and 15-meter bands.

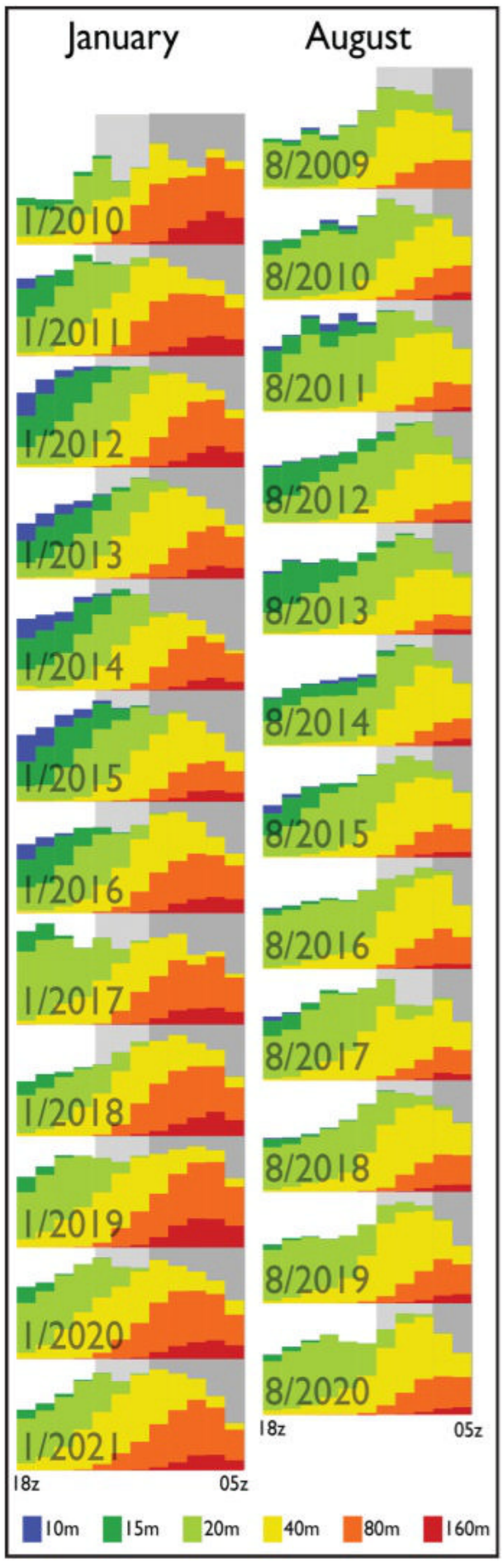


Figure 1. Band usage during 12 years of NAQP CW. (CW skimmer data from <Reversebeacon.net> archive)

Learn About HF Propagation Through NAQP Participation

In *Figure 1*, I show band usage over 11 years (a complete solar cycle) of the winter and summer NAQP CW events. For each of the 12 hours in the contest, I used the <reversebeacon.net> archive of skimmer data to count, by band, North American CQ activity picked up by CW skimmers. Winter NAQP CW band usage is shown on the left, and the summer band usage is on the right. The light grey begins when sunset begins for the east coast, and the dark grey band marks when sunset has arrived on the west coast.

The last hour of the contest (0500-0559Z) often has the least activity with fewer stations CQing. Many single-operators operating all 10 hours plan their on-air time so that it runs out shortly after the beginning of this hour.

For the past several years at solar minimum, the 10-meter band has not yielded much activity. From my QTH in Maryland, at the starting bell of the contest I can reliably work three to five surrounding states via ground wave. At solar maximum, the conditions can be significantly better, as can be seen by the noticeable blue (10-meter) activity bars in the activity chart. In the wintertime at solar max, the first two to four hours has the majority of activity on 10 meters. But in the summertime, activity on 10 meters can be more sporadic and occur anytime during daylight.

My most memorable 10-meter opening in a summer NAQP was the August 2014 CW event, near the peak of the last solar maximum. I followed my usual advice of starting at 1800Z with some CQs on 10 meters, and in the first 15 minutes I worked locals in Maryland, Virginia, and West Virginia, as well as several stations in Texas, for four state multipliers on this band. At 2200Z, I took a quick listen to 10 meters for activity and was surprised to hear strong activity from all over the Midwest and southeast. I worked 20 additional U.S. and Canadian multipliers and 76 QSOs in the next hour, all on the 10-meter band.

Contesters use the 15-meter band almost exclusively in the daylight hours. The dark green representing 15-meter activity in the charts is much more pronounced in the 2012-2016 graphs, as the band was more broadly useful during solar maximum. Even outside solar maximum, count on 15 meters for multipliers from the other coast. And especially early in the contest during summer, E-skip on 15 meters can yield some close in multipliers.

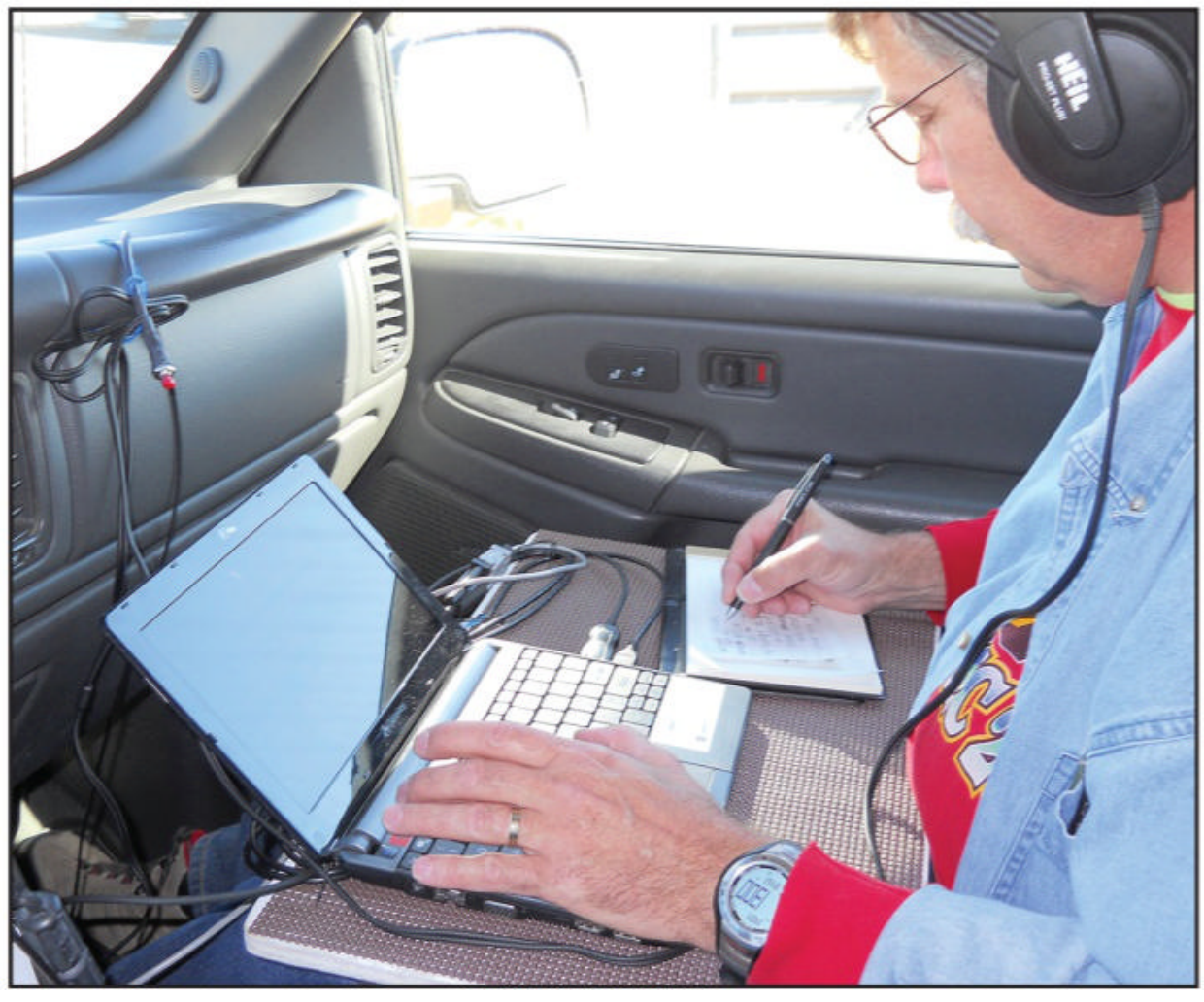


Photo B. Jay Holcomb, WAØWWW, has his turn operating K7TQ/M.

Calendar of Events

All year	CQ DX Marathon	http://bit.ly/vEKMWD
July 1	RAC Canada Day Contest	www.rac.ca/contesting-results
July 2-4	Original QRP Contest	www.qrpcc.de/contestrules/index.html
July 3-4	Marconi Memorial HF Contest	www.arifano.it/contest_marconi.html
July 3-4	DL-DX RTTY Contest	www.drcg.de
July 3-4	PODXS 070 Club 40-Meter Firecracker Sprint	http://bit.ly/2FUmeOL
July 5	RSGB 80m Club Championship, CW	http://bit.ly/3avHbk3
July 7	VHF-UHF FT8 Activity Contest	www.ft8activity.eu/index.php/en
July 10-11	10-10 Int. Weak Signal QSO Party	http://bit.ly/1FrFeBc
July 10-11	IARU HF Championship	www.arrl.org/iaru-hf-world-championship (Featured in this month's column)
July 10-11	Veron SLP Contest	http://bit.ly/2L9eT1L
July 11	QRP ARCI Summer Homebrew Sprint	www.qrparci.org/contests
July 14	VHF-UHF FT8 Activity Contest	www.ft8activity.eu/index.php/en/
July 14	RSGB 80m Club Championship, SSB	http://bit.ly/3avHbk3
July 17-18	CQWW VHF Contest	www.cqww-vhf.com (Featured in this month's column)
July 17-18	North American RTTY QSO Party	http://ncjweb.com/NAQP-Rules.pdf (Featured in this month's column)
July 18	CQC Great Colorado Gold Rush	https://tinyurl.com/4dfmmyv7
July 18	RSGB International Low Power Contest	www.rsgbcc.org/hf/rules/2021/rqrp.shtml
July 22	RSGB 80m Club Championship, Data	http://bit.ly/3avHbk3
July 24-25	RSGB IOTA Contest	www.rsgbcc.org/hf/rules/2021/riota.shtml
July 25	ARS Flight of the Bumblebees	http://arsqrp.blogspot.com/
July 26	RSGB FT4 Contest Series	http://bit.ly/3mCNXXH
July 31-Aug. 1	Missouri QSO Party	https://tinyurl.com/fnwswvre
July 31- Aug. 1	Russian WW MultiMode Contest	http://bit.ly/2CMbWOM
Aug. 1	SARL HF Phone Contest	http://bit.ly/H0IqQf
Aug. 4	VHF-UHF FT8 Activity Contest	www.ft8activity.eu/index.php/en
Aug. 7	European HF Championship	http://bit.ly/H2eMg5
Aug. 7	FISTS Summer Sprint	http://fistsna.org/operating.html#sprints
Aug. 7	WAB 144 MHz Low Power Phone	http://bit.ly/31yE4kT
Aug. 7-8	10-10 Int'l Summer Contest SSB	http://bit.ly/1FrFeBc
Aug. 7-8	ARRL 222 MHz and Up Distance Contest	http://bit.ly/2IJZcy9
Aug. 7-8	Batavia FT8 Contest	https://batavia-ft8.com
Aug. 7-8	North American CW QSO Party	http://ncjweb.com/NAQP-Rules.pdf (Featured in this month's column)
Aug. 11	VHF-UHF FT8 Activity Contest	www.ft8activity.eu/index.php/en
Aug. 14	QRP ARCI European Sprint	www.qrparci.org/contests
Aug. 14	SARL Youth Sprint	http://bit.ly/H0IqQf
Aug. 14-15	CVA DX Contest CW	http://cvadx.org/regulamento
Aug. 14-15	Worked All Europe CW Contest	http://bit.ly/2vufgcb
Aug. 14-15	Maryland-DC QSO Party	www.w3vpr.org/node/325
Aug. 15	FISTS Summer Sprint	http://fistsna.org/operating.html#sprints
Aug. 15	NJQRP Skeeter Hunt	https://tinyurl.com/yzkh6e8m
Aug. 15	SARL HF Digital Contest	http://bit.ly/H0IqQf
Aug. 21-22	ARRL 10 GHz and Up Contest	www.arrl.org/10-ghz-up
Aug. 21-22	CVA DX Contest SSB	http://cvadx.org/regulamento
Aug. 21-22	International Lighthouse Lightship Weekend – ILLW	https://illw.net
Aug. 21-22	SARTG RTTY Contest	www.sartg.com/index.html
Aug. 21-22	North American SSB QSO Party	http://ncjweb.com/NAQP-Rules.pdf (Featured in this month's column)
Aug. 21-22	KCJ Contest	www.kcj-cw.com/e_index.htm
Aug. 22	ARRL Rookie Roundup RTTY	www.arrl.org/rookie-roundup
Aug. 28-29	Ohio QSO Party	www.ohqp.org/index.php/rules
Aug. 28-29	Hawaii QSO Party	http://hawaiiqsoparty.org
Aug. 28-29	Kansas QSO Party	www.ksqsoparty.org
Aug. 28-29	YO DX HF Contest	www.yodx.ro/en
Aug. 28-29	ALARA Contest	www.alara.org.au/contests
Aug. 28-29	World Wide Digi DX Contest	https://ww-digi.com (Featured in this month's column)
Aug 28-29	W/VE Island QSO Party	https://usislands.org/qso-party-rules
Aug. 29	SARL HF CW Contest	http://bit.ly/H0IqQf
Sept. 25-26	CQWW RTTY DX Contest	www.cqwwrtty.com (Rules in this issue)

Photo C. The Scorpion 680 antenna in the truck bed of K7TQ/M.

Twenty-meter activity is always heavy during the initial hours of the test. You can see from the data on the left of *Figure 1* that in summertime, the 20-meter activity reliably continues even after the sun has set on the continent.

Activity on 40 meters (the yellow activity bars) begins several hours before sunset. Especially in the wintertime, the 40-meter band goes long around sundown, and if you get to the band too late, you may miss out on many close-in multipliers. In the wintertime, 40-meter action becomes less prominent 4 or 5 hours before the end of the contest. In the summertime, 40 meters is often useful right up to the end of the contest.

In the winter, the two lowest frequency bands — 80 and 160 meters — carry the majority of activity in the final hours. As soon as the sun sets on the east coast, activity starts picking up on 80. Summer action on 80 and 160 meters is less consistent and can be hampered by thunderstorms anywhere on the continent — yet they are important for getting multipliers, and a great way to exercise your skills working stations through QRN.

If Going Full-Time, Read the Fine Print of the Off-Time Rule

Single operators in the NAQPs may operate 10 of the 12 hours, with a minimum of 30-minutes off-time. You might think this means that logging one QSO at 18:30:01 and the next at 19:00:10 would count as sufficient off-time, but that is not how the computer log-checking works. NAQP rule 5.a.iv clarifies, "in order to count as off-time, the difference between the times of consecutive contacts must be greater than or equal to 31 minutes (i.e. 30 intervening minutes, during which no contacts occur)," as seen by the log-checking computer in your Cabrillo log.

In the example above, you have one QSO recorded in your Cabrillo log at 1830z, followed by a second at 1900z. Cabrillo logs do not show seconds, just whole minutes, and the time between the two QSOs is only 29 intervening minutes. To have your off-time count, your first QSO after the gap must be at 1901z or later.

The popular N1MM+ logging program has its "Info" window that can be configured to help you with the detailed off-time accounting. Go to the "Info" window, right click in the off-time counter, choose "Display Off Time (full minutes with no QSOs)," and choose "Current Interval Count Up Timer." Careful attention to off-time details like this in your NAQP entry is excellent preparation for the world of esoteric and varying band-

change rules for Multi-Single and Multi-Two categories in the big DX contests.

Call CQ in the NAQP to Learn New Skills

Have you been almost entirely search-and-pounce in contests? If so, the North American QSO Party is a great place to try calling CQ. First, you have to find your run frequency. The band activity details in *Figure 1* tells us there are at least two bands in play at any point in time. For those with simple stations, it often it will be easier to find a run frequency in the second most productive band. Look for an unused frequency and give CQing a try.

Keep your CQ short. When things are slow, a CQ consisting of your callsign repeated twice in phonetics, followed by "CQ Contest" or "CQ North America," works well. When your rate starts picking up, shorten your CQ to include your callsign only once.

When a station replies to your CQ, keep your response short and to the point. No need for "please copy," just read back his callsign, then your name and state. When done, a simple "Thanks" is all that's needed to acknowledge the complete QSO.

Have you ever been frustrated because a CQing station wasn't identifying for a stretch as a series of callers was worked? Now you're the guy calling CQ and you have the responsibility to frequently identify with your call. Even if your rate is high, be sure to identify after at least every third "Thanks."

Learn How to Move QSOs and Mults to New Bands in the NAQP

Dave, K8CC, noted in 2003 that, "mults-per-band was a conscious effort to allow little gun stations to get into the strategy of moving mults between bands, like the bigger stations do in DX contests."

The NAQPs are a prime ground to learn how to ask for a move. As an example: In the last hour of NAQP SSB in August 2020, I worked Todd, NRØP, in Kansas on the 40-meter band. I hadn't yet worked Kansas on 80 meters, so I asked, "Todd, can we try working on 80 meters?" He said he could do so, so I gave him a frequency of 3.772 MHz — a frequency I had recently vacated — and 40 seconds later we had completed the QSO on 80, a new multiplier for both of us.

A broad awareness of propagation is important, as well as some specific knowledge of conditions at that point in the contest. Is the Midwest getting socked with thunderstorms? If so, moving a needed mult in Iowa to 160 meters might not be successful. Have you heard some loud signals from New England booming in on the 10-meter band? If so, it's a great time to ask for a move if you need any state up there for a multiplier.

Asking for moves with extreme politeness is most effective. You are asking the other station to go to the effort of changing bands, which may require him to switch to a different antenna, and possibly crank some knobs on his antenna tuner as well. It's best if you have a target frequency for him to find you on. The politeness comes across best in SSB, but it's also possible to do on RTTY or CW. For example, asking "PSE QSY TO 28.083" on RTTY politely is one approach. And on CW, asking "PSE 28026" after completing a QSO is a way to ask.

The NAQP Challenge Increased Participation by Three Large Contesting Clubs

In the January 2013 Northern California Contest Club newsletter, Dean Wood, N6DE, noted that his club's members had, "ranked NAQP in the top 5 of all contests that NCCC should emphasize." To spur activity, NCCC challenged two other large U.S. contesting clubs, the Potomac Valley Radio Club and the Society of Midwest Contesters, to a club competition across the six NAQPs in 2014 with an interesting twist: Each club would earn points for each event by multiplying the sum of members' scores by the number of club members on for the event. The three clubs began encouraging members to get on, if even briefly, to run up their participant multiplier, while a smaller number of full-timers at each club ran up the club's total points for that event. The sum of each club's points across all six events determined the final result for the year. NCCC won the first event, and in subsequent years both SMC and PVRC have taken possession of the traveling trophy.

In 2016, the administration of the NAQP Challenge passed to Tim Gennett, K9WX. He maintains the NAQP Challenge website at <https://naqpc.org>, where you can find the formal rules and the scoring details, as well as a detailed history of scorekeeping.

By 2017, it was becoming clear that big wins in the first two events — the January CW and SSB — could dominate a club's points for the entire year. The smaller RTTY events had less weight, and if a clear leader emerged in the January results, clubs were less successful in persuading members to turn out for the summer events.

An interesting twist in the club competition was added in 2017 with the introduction of an "Irish Points" system. Ken Low, KE3X, explained that this innovation would, "keep the competition close all year, so a single BIG WIN (like our win in the January 2016 CW event) does not make the rest of the year uninteresting for the other clubs." He went on to point out that it would, "provide an equal incentive across all three modes," because the Irish points earned by a top place finish in RTTY club win would count just as much as a top place finish in CW or SSB.

The club challenge issued by NCCC was very successful in boosting on-air participation by the challenged clubs. In 2013, SMC members submitted 247 logs across the six events. By 2020, they had more than doubled their initial participation with 638 logs. PVRC participation increased from 371 logs in 2013 to 677 logs in 2020.

July and August Contest Highlights

In addition to the summer NAQPs, I'd like to highlight three more contests in the months of July and August:

The IARU HF World Championship Contest has activity on both SSB and CW, and uses IARU Zones and Headquarters stations as multipliers per band. Make a point of asking the Headquarters stations what other frequencies they are active on, so you can work them on each band for the multipliers. This contest is on for 24 hours between July 10th and 11th, and full details are at <www.arrl.org/iaru-hf-world-championship>.

The CQ World Wide VHF Contest is on July 17th and 18th. Six- and 2-meter contacts on the digital, CW, and SSB modes count for points. If you are operating on the digital modes and notice good conditions, please consider changing modes to SSB or CW where you can achieve higher rates.

The World Wide Digi DX Contest uses the FT4 and FT8 modes and is 24 hours on the last weekend of August (the 28th and 29th). Multipliers are the 2-character grid fields that are commonly exchanged in these modes. The exchange is compatible with non-contesting users of these digital modes, as long as a grid square is being exchanged. Check out rules and especially the operating tips at <https://ww-digi.com>.

PROPAGATION

BY TOMAS HOOD,* NW7US

Burning Up the Clouds With NVIS

Quick Look at Current Cycle 25 Conditions:
(Data rounded to nearest whole number)

Sunspots:
Observed Monthly, April 2021: 25
12-month smoothed, October 2020: 12

10.7-cm Flux:
Observed Monthly, April 2021: 75
12-month smoothed, October 2020: 75

ONE YEAR AGO:
(Data rounded to nearest whole number)

Sunspots:
Observed Monthly, April 2020: 3
12-month smoothed, October 2019: 2

10.7-cm Flux:
Observed Monthly, April 2020: 70
12-month smoothed, October 2019: 70

As explained many times in this column, the ionosphere is an essential player in propagating an HF (high frequency; 3-30 MHz, also known as shortwave) radio signal beyond line-of-sight distances between a radio transmitter and a radio receiver. Radio signals in the HF spectrum are bent (actually, a combination of mostly refraction and seldom reflection) by the ionosphere, allowing a signal to skip from one location to another. Like a flashlight's beam of light, reflected off a wall-mounted mirror in a dark room, you can see the beam arriving and departing the mirror at an angle — a radio wave can be reflected in a similar way off the ionosphere.

When the ionosphere is highly energized by solar activity, higher HF frequencies are refracted. But, when solar activity is low, as it is right now because we're at the beginning of Solar Cycle 25, the ionosphere is weakly to moderately energized. Only the mid-HF frequencies and lower are being efficiently refracted (*as a general rule; even the 10-meter band has openings now, when the 10.7-cm Radio Flux rises –TH*). The Technician operator who longs to talk to the world by using SSB on HF is generally cut off from the world (but not from regional coverage). The operator must move down to lower bands to work radio stations around the world.

The 10-meter band is useful for shorter distances because of several common types of propagation. These include, for instance, Sporadic-E (E_s). And, if shorter distances are desired on HF communications, there is a technique used to target closer areas, using the F- and E-regions. This is known as Near Vertical Incidence Skywave, or NVIS, and it is highly effective.

NVIS is pronounced as "niv-iss." Another loving descriptive name for NVIS propagation is *cloud burning*. This radio propagation mode involves using antennas that radiate most of the radio energy at very high radiation angles, approaching or reaching 90° (straight up at and into the ionosphere), at a frequency below the critical frequency of the ionosphere at the point of entry by that radio wave (*that frequency that is just lower than what would punch through the ionosphere rather than be refracted back toward the origin of the radio wave –TH*).

Using NVIS, it is possible to establish reliable communications over a radius of approximately 200 miles, give or take 100 miles. This technique is used by military and emergency teams when operating in hilly or mountainous terrain where line-of-sight VHF communications is impossible and no repeaters are available. (*I've had many private correspondences with military communications personnel located in the Middle East, asking for practical details on the best way to utilize NVIS for tactical comms –TH*).

If you're an amateur radio operator with General or Extra license privileges, and have spent time on 160 or 80 meters

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LAST-MINUTE FORECAST

Day-to-Day Conditions Expected for July 2021

	Expected Signal Quality			
Propagation Index	(4)	(3)	(2)	(1)
Above Normal: 1-3, 5, 8, 17-19, 22, 25-30	A	A	B	C
High Normal: 4, 7, 10-11, 13, 15-16, 23-24, 31	A	B	C	C-D
Low Normal: 9, 12	B	C-B	C-D	D-E
Below Normal: 20	C	C-D	D-E	E
Disturbed: 6, 14, 21	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 CQ Shortwave Propagation Handbook, 4th Edition" by Carl Luetzelschwab, 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 2 will be good on July 1st through July 3rd, fair on July 4th, then good again on July 5th, 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.

at night, talking with others within a 300-mile area, you might have thought you were working them with ground wave propagation, in which the radio signal hugs the ground as it spreads out away from your antenna. However, the case is quite different.

While I lived in Washington and Montana, very tall mountains were within two miles or less, and nearly all around my station. Using NVIS, I was able to establish communications with stations between 50 and 300 miles as if they were line-of-sight from my antenna. Ground wave was not possible, as I was in a deep valley (well, in one residence, a canyon). I had tried to contact them on frequencies above the critical frequency, like on 20, 15, or 10 meters, with no success. Yet, on frequencies below the critical cutoff, we were able to communicate with reliable signals. This was particularly useful when I was in the U.S. Army MARS.

One way of picturing how NVIS works is to imagine taking a flashlight and aiming its light beam toward a white, reflective wall (or mirror). If you were to shine it straight at the wall at a 90° angle, you would see the light reflected back at you. This is how we discovered the ionosphere's ever-changing ability to reflect a radio wave at any given frequency. Ionospheric sounding is done by sending pulses of radio waves straight up at the ionosphere, and measuring at what frequency the reflections cease. The highest frequency that is reflected back is the critical frequency at that location.

Now, slowly re-aim the flashlight so that you are angled about 10° to the left. What happens to the reflected light? The beam's azimuth changes, and the light beam illuminates an area just to your left. The more of an angle used, the farther away from you the reflected light radiates. Let's call that distance the *skip zone*. In radio, the same thing happens with a radio wave that is refracted. The angle at which the radio energy arrives at the reflective ionospheric layer dictates how far away the reflection will end up. The greater the angle of incidence of the radiation, the farther the distance the radio signal can be propagated.

One then can see that NVIS is all about reducing the angle of incidence, so that the reflected radio energy returns at locations much closer to the originating antenna, than if we were trying to shoot the radio wave far out to the low horizon so we could work very distant stations.

How do you make an antenna so that it radiates most of its energy toward the overhead sky, rather than out to the low horizon? Part of the answer is in how high above the ground you deploy your antenna. Most NVIS antennas are horizontal in polarization, and kept much lower than the height typically sought when attempting DXing. The closer to the ground that you locate an antenna, the higher the angle of the signal's main radiation. For this reason, it is common to see a dipole cut for 5 MHz only up at the 8-foot level.

A great introduction to NVIS is found at WB5UDE's page <www.qsl.net/

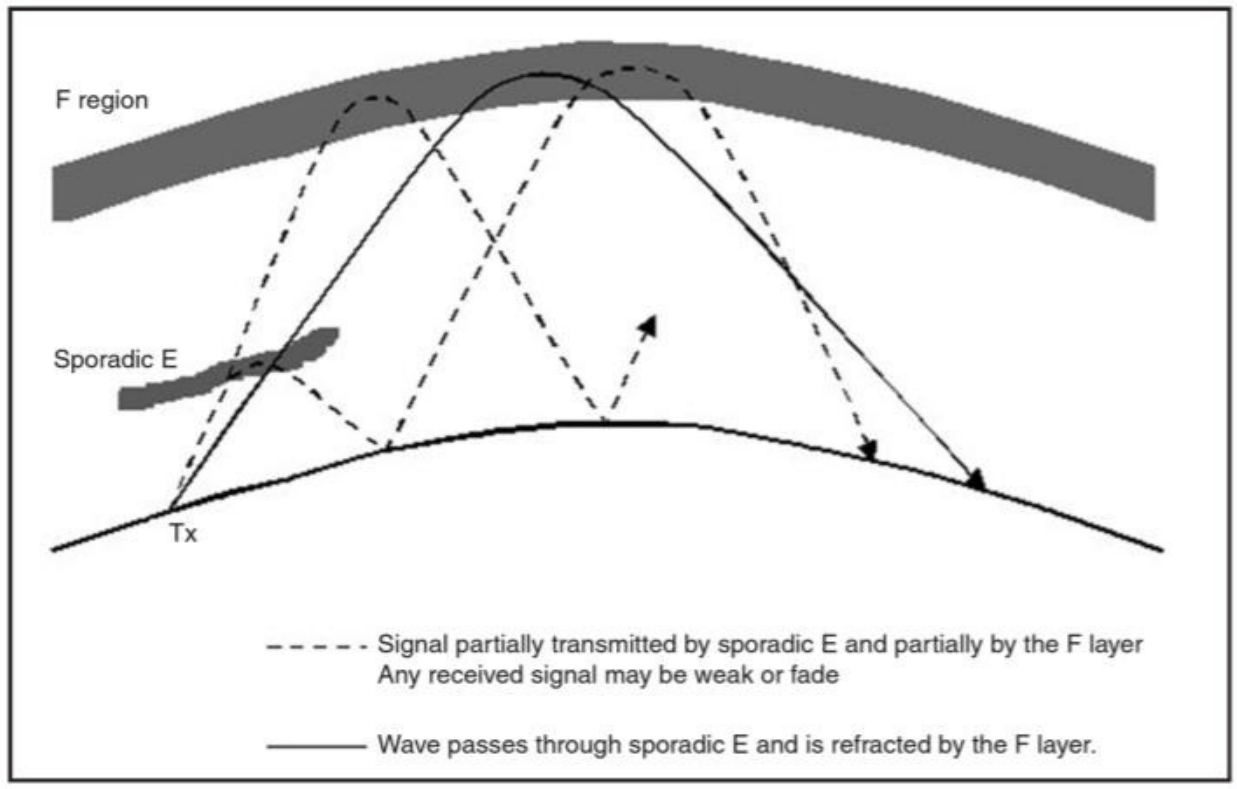

Figure 1. An artist's overview of the various ionospheric regions and the sporadic ionized cloud in the E-Region that can create sporadic-E propagation on the 10-meter band, and higher into VHF. (Courtesy of U.S. Military)

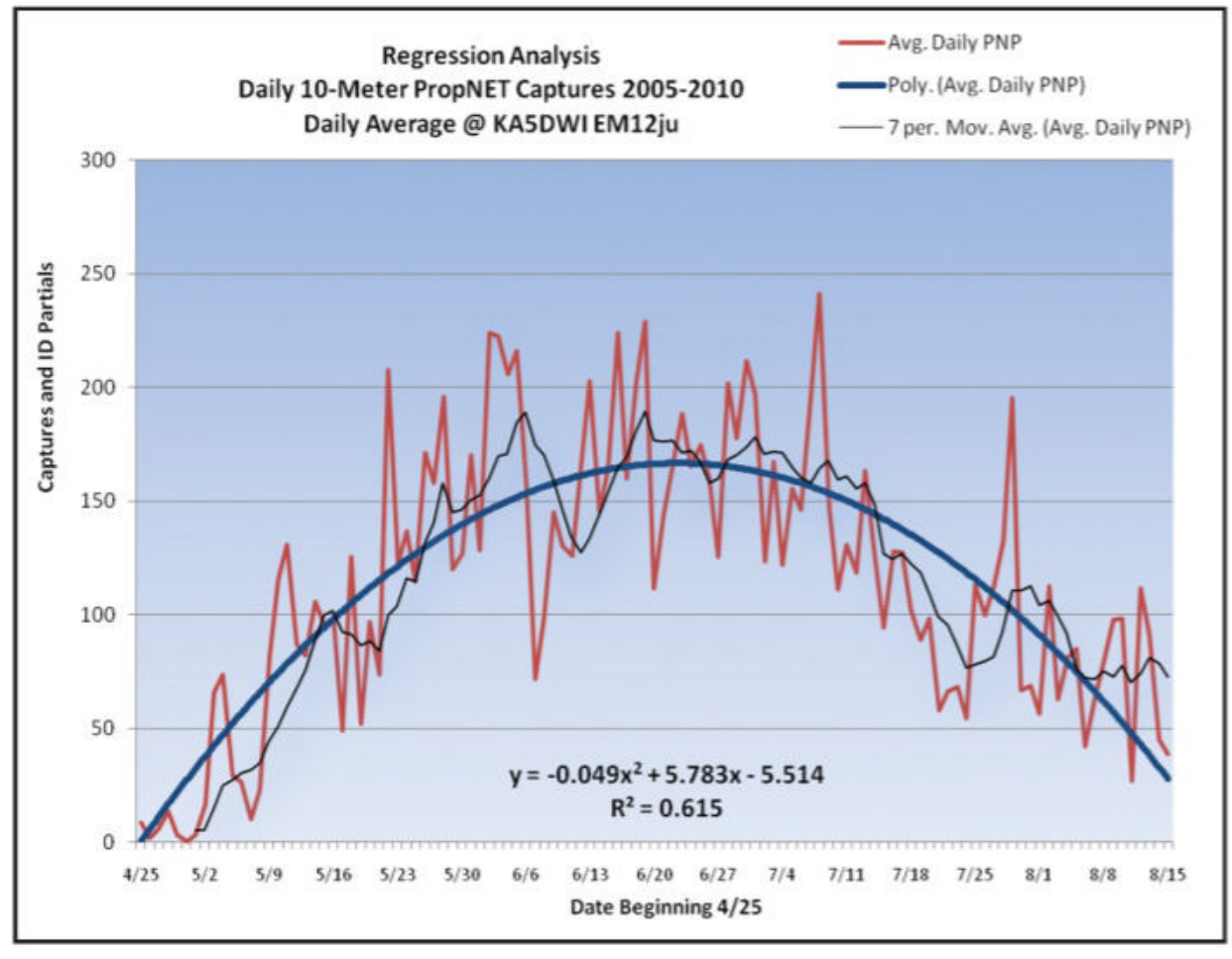

Figure 2. Sporadic-E appears around the beginning of May (as if a switch is turned on!) and lasts to around September each year. Activity-wise, it peaks very near the summer solstice. It rises quickly and fades out over time. July is one of the most active months, and this year should be favorable for not only exciting Sporadic-E propagation, but some enhancements perhaps from F-region propagation, due to the increased sunspot activity. (Image by Art Jackson, KA5DWI <http://propnet-studies.blogspot.com>)

wb5ude/nvis>. Additional resources include KV5R's page <https://tinyurl.com/y8r7rdme>.

Sporadic-E Propagation

It is also possible to use the E-region of the ionosphere for HF communications even when the Sun's activity is low. This region is located about 90-160 kilometers above the Earth. The region's height varies, as does the density of electrons caused by ionization. All of this depends on solar zenith angle. During daylight hours, the E-region is more energized than during nighttime hours, because the supply of soft X-rays from the Sun is the main source of the region's ionization. These ionization densities are expected under normal conditions, absent of E_s.

Within the E-region, very thin regions of extremely dense ionization can form. These thin regions become dense enough to refract higher frequencies (typically up to 50 or 60 MHz, and higher on rare occasions) than when there are no extremely dense areas. These E_s areas are known to become so densely ionized that they can strongly refract VHF frequencies, allowing VHF signal reception over greatly extended distances beyond line-of-sight. An example of a VHF opening is when E_s allows you to hear an FM station from several states away.

According to the Space Environmental Services Center (SESC), "E_s is transient, localized patches of relatively high electron density in the E-region of the ionosphere which significantly affect radio wave propagation. E_s can occur during daytime or nighttime, and it varies markedly with latitude. E_s can be associated with thunderstorms, meteor showers, solar activity, and geomagnetic activity."

While this is the best official definition of E_s, we do not yet fully understand the causes of E_s. Scientists are still pursuing the cause or more likely the multiple causes of E_s. As far back as 1959, 10 distinct types of E_s and at least nine different theories of causation were offered. The classification of distinct types has been retained, but since the 1960s, the wind shear theory has become one of the most accepted theories.

Wind shear occurs when the wind blows at different directions and speeds as you increase elevation. Simply, the wind shear theory holds that gaseous ions in the E-layer are accumulated and concentrated into small, thin, patchy sheets by the combined actions of high-altitude winds and the earth's magnetic field. The resulting clouds may attain the required ion density to serve as a reflecting medium for higher HF as well as VHF radio waves. Although most research has confirmed a close association between wind shear and E_s propagation, not all aspects of the E_s phenomenon can be explained, including its diurnal and seasonal variations.

Sporadic-E is mostly a summertime phenomenon, though there is normally some E_s activity during late December and early January. It is well documented that E_s occurs most often in the summer, with a secondary peak in the winter. These peaks are centered very close to the solstices. The winter peak can be characterized as being five to eight times weaker than the summer E_s peak.

What does this mean to the Technician-class amateur radio operator? It means that during the summer E_s season, it is possible to work distances beyond the reach of NVIS-mode propagation. While you might not work a station on the other side of the world on 10 meters, you may well be able to work amateur stations many states away from you. At press-time, there are reports of propagation between mid-U.S. and the Caribbean, on even the amateur 6-meter band.

There are other modes of propagation that occur from time-to-time on 10 meters. We'll look at some of those in the upcoming issues.

Even now at the beginning of Sunspot

Cycle 25, you can enjoy the world of HF communications this month because of the summer E_s season. And, if you use NVIS as well, you have great opportunity to stay communicating.

July Propagation

In the Northern Hemisphere, the long-range F-region propagation of radio waves in the highest shortwave frequencies (HF) will be poor, except on paths running mostly north/south crossing the equator. At the same time, July is generally the month in which E_s ionization is most intense. This should result in a considerable increase in short-skip openings on almost all of the HF amateur bands and on 6 and 2 meters as well.

Twenty meters should continue to be the best band for DX propagation during the month. The band is expected to remain open to one area of the world or another from sunrise through the early evening. Peak conditions are expected for a few hours after local sunrise and again during the late afternoon and early evening, when the band should open in almost all directions. In early afternoon through midnight, expect 20-meter openings first towards South America, then towards the South Pacific, and then Oceania. During the best days of the month (when we have the most sunspots), expect additional paths to open, starting with trans-polar paths into Europe and elsewhere.

Fewer DX openings are expected on 15 meters and very few, if any, on 10 meters during July. This is due to a combination of changing seasonal conditions and the current level of solar activity. During this level of sunspot activity, 15 meters should occasionally open towards the south. Look for some short-skip openings into the Caribbean area and Central America as early as 10 a.m., with a peak expected to all areas of Latin America between 3 and 5 p.m. local daylight time. When conditions are better (more sunspots) the band may also open to Africa during the late afternoon from the eastern half of the country, and to Australasia and the South Pacific area during the late afternoon and early evening from the western half of the U.S. Seventeen meters will act somewhat the same as 15, but openings will tend to be longer, and signals perhaps stronger and more stable.

Don't expect much DX on the 10- and 12-meter bands during July, except by way of short-skip openings towards the Caribbean and possibly Central America as a result of E_s ionization. If we get a high number of sunspots (or more specifically, when the 10.7-cm radio flux exceeds 85) an occasional opening deeper into South America may be possible, especially during the afternoon hours.

Nighttime openings into many areas of the world are possible on 20, 30, and 40 meters. But seasonally high static levels may often make DX reception difficult on 40 meters. High static levels are also expected to result in somewhat poorer DX conditions on 80 meters, although some long-distance openings are forecast during the hours of darkness. Look for 160 meters to be virtually shut down due to the high static levels of summer. Best bet for 40-, 80-, and 160-meter DX openings is an hour or two before midnight for openings toward the north and east, and just before local sunrise for openings toward the south and west.

VHF Conditions

Yes, July is one of the two summer months when we expect hot short-skip, E_s propagation. This is a yearly phenomenon, and many radio hobbyists focus most of their efforts on nothing but E_s activity.

Short-skip E_s propagation over distances ranging between approximately 600 and 1,300 miles is typical on 6 meters, and twice that on 10 meters. Openings may also be possible on 2 meters during periods of intense E_s ionization, with stations up to 1,300 miles away. While E_s openings can take place at just about any time of the day or night, statistics indicate that conditions should peak for a few hours before noon and again during the late afternoon and early evening. During July, you can expect 10- and 6-meter E_s on at least three out of every four days. Openings may last from a few minutes up to several hours.

DX enthusiasts know that during the summer months, FM radio stations between 88 and 108 MHz are regularly propagated long distances via E_s propagation. The first sign that an E_s event is starting is by hearing FM stations from distant cities popping up on the local scene. Some of these stations can come in so strongly as to override a local station, capturing the channel. As the ionization level increases, the FM band becomes filled with signals. During E_s propagation, signals can abruptly appear or disappear. Signals are usually strong, and ordinary rabbit-ear antennas are adequate for reception, and are preferred by some FM DXers because they can be sharply directional.

A number of minor meteor showers are expected during July, but none looks promising for significant meteor-scatter propagation. The best chance for meteor-scatter openings will be during the last week of July, when the δAquariids shower is expected to intensify. It should peak on July 30th, but with only about 16 meteors per hour. Check out <https://tinyurl.com/yebf98y9> for a complete calendar of meteor showers in 2021.

If you use Twitter.com, you can follow <@hfradiospacewx> for hourly updates that include the K-index numbers. You can also check the numbers at <http://SunSpotWatch.com>, where I provide 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 April 2021 is 24.83, a nice bump up from the previous 17.03 in March. The 12-month running smoothed sunspot number centered on October 2020 is 11.5. A smoothed sunspot count of 19, give or take about 7 points, is expected for July 2021.

The Dominion Radio Astrophysical Observatory at Penticton, BC, Canada, reports a 10.7-cm observed monthly mean solar flux of 74.74 for April 2021. The 12-month smoothed 10.7-cm flux centered on October 2020 is 75.20. The predicted smoothed 10.7-cm solar flux for July 2021 is 76, give or take 7 points.

Geomagnetic activity this month is expected to vary greatly, from day to day at times. Overall, expect mostly active to minor storm level activity, leading to dismal propagation at times, but yielding consistently good propagation conditions during other periods this month (remember that you can get an up-to-the-day *Last-Minute Forecast* at <http://SunSpotWatch.com> on the main page).

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 call letters denote folowing: Band (A = all), Final Score, Number of QSOs, and Prefixes. An asterisk (*) before a call indicates low power. Certificate winners are listed in boldface. Late logs are listed in Italic. (Note that country names and groupings reflect the DXCC list at the time of the contest.)

SINGLE OPERATOR
NORTH AMERICA

United States

District 1

AK1W	A	7,825,566	2693	966
				(OP: K5ZD)
WK1Q	"	3,571,240	1495	760
				(OP: K1MK @K1TTT)
K6DTT	"	2,881,620	1180	630
KB1W	"	1,040,333	931	449
NV1Q	"	720,360	754	435
K1SM	"	658,442	653	401
W1TO	*"*	*446,294*	*438*	*326*
N1KM	"	388,143	522	303
KR1CW	"	369,929	506	301
				(OP: W1CTN)
KX1X	"	300,796	446	278
KB1QU	"	161,250	343	215
WX1S	"	157,206	197	197
N1MD	"	106,560	205	160
KV1J	"	11,869	106	83
N1RR	"	1,950	27	26
WA1DRQ	"	54	6	6
WV1K	14	526,110	578	390
				(OP: N1IXF)
NT1N	"	22,256	131	107
N1SNB	7	76,320	210	144
*NG1R	A	1,307,208	1064	502
				(OP: W1QK)
*KS1J	"	808,992	717	477
*NG1M	"	724,470	782	410
*NC1CC	"	677,952	745	428
				(OP: WA1BXY)
*AB1J	"	676,620	789	378
*W1ARY	"	512,295	614	357
*K1VW	"	325,670	483	290
*KA1YQC	"	322,936	528	296
*W1HS	"	250,160	414	265
*AF1R	"	199,808	375	223
*N1API	"	159,996	268	268
*KA2KON	"	144,957	265	211
*K7RB	"	144,778	282	191
*KG1V	"	144,281	339	223
*W1DYJ	"	105,525	267	175
*KC1ERO	"	89,088	229	174
*W1GD	"	72,360	138	135
*KB1LRL	"	62,878	195	149
*KA1C	"	57,744	195	144
*AA2S	"	53,339	193	143
*AE6JV	"	51,183	156	121
*WA3SWJ	"	44,556	203	141
*N1RDN	"	40,135	152	115
*KC1SA	"	38,870	140	115
*W1EDX	"	37,996	151	118
*W1IG	"	26,695	119	95
*N1EEK	"	24,722	127	94
*N1XQ	"	22,704	107	86
*K1ECU	"	21,627	114	89
*K1LHO	"	14,378	93	79
*W1ZFG	"	11,550	78	66
*W1MI	"	11,040	85	69
*WA1N	"	6,156	59	54
*KO4GBD	"	5,243	54	49
*K1AR	"	3,600	40	36
*WA1LAD	"	2,808	44	39
*W1MJ	"	2,720	36	32
*NZ1U	"	1,984	35	32
				(OP: W1UJ)
*K1VOI	"	323	19	19
*WB1AEL	14	13,320	124	90
*N1GDD	"	2,576	50	46
*AA1SU	7	23,904	99	83

District 2

KE2D	A	2,121,312	1205	608
KA2K	"	1,763,694	1194	573
WX2NJ	"	1,616,470	1023	545
				(OP: K2RET)
N2HMM	"	1,564,959	1209	517
W2JV	"	1,472,166	1052	566
KU2M	"	1,299,441	927	507
W3MLJ	"	1,120,434	863	518
K2RB	"	896,400	957	432
NN2NN	"	870,658	843	458
WB2NVR	"	853,573	804	427
WJ2P	"	837,935	790	445
				(OP: N2BA)
K2UA	"	781,820	660	388
K4RUM	"	572,615	627	355
WB2PJH	"	476,918	648	338
WB2WPM	"	463,884	585	348
KE1IH	"	461,538	527	333
N2MM	"	440,202	482	329
WO2T	"	340,128	472	288
WA2BOT	"	267,894	368	246
WS9M	"	183,222	399	234
KB2CKN	"	153,080	398	215
NG2P	"	146,080	312	220
NS2N	"	145,754	321	203
KF2TI	"	122,534	287	197
WB2NFL	"	94,180	272	170
N2RC	"	77,463	180	151
W1WV	"	77,127	202	141
K4KGG	"	55,860	183	133
K2XA	"	43,416	135	108
K2QB	"	26,832	112	104
WA2VIU	"	21,060	101	81
W2TB	"	16,926	120	91
KA2AEY	"	14,790	110	85
WA3AFS	"	8,957	54	53
K2PAL	21	8,216	59	52
NB2P	14	718,960	779	473
N2NF	"	248,292	426	297
N2YBB	"	166,515	351	255
KY2N	"	156,940	301	236
				(OP: N2ZN)
K2TW	3.5	19,096	104	77
*NN2DX	A	1,374,090	865	489
				(OP: W4IPC)
*KF2O	"	1,127,500	738	550
*AA2EQ	"	686,181	740	381
*AH2O	"	606,284	711	413
*KV2U	"	415,264	621	304
				(OP: KC2WUF)
*AG2AA	"	288,002	490	286
*WB2JVO	"	242,840	473	260
				(OP: K2AL)
*WB2COY	"	219,840	432	240
*WA2DNI	"	203,544	424	257
*K2QMF	"	170,699	256	211
*AC2RL	"	155,433	308	197
*WA2QAU	"	127,605	303	181
*KS2G	"	126,442	316	191
*KC2IEB	"	109,554	295	186
*AC2OC	"	83,200	216	160
*K3WHD	"	56,480	215	160
*ND2K	"	53,724	201	132
*AC2IK	"	41,454	179	126
*W2FDJ	"	41,358	145	113
*WB2WGH	"	39,100	172	115
*WC2L	"	34,128	142	108
*W2DXE	"	32,520	150	120
*KD2DXJ	"	31,350	149	110
*N2FF	"	29,859	115	111
*K2GLS	"	28,890	147	107
*N2UZQ	"	24,459	101	93
*W2LCQ	"	21,708	163	134
*WO2Y	"	17,200	107	86
*AB2TB	"	16,878	119	87
*KA2ENE	"	10,981	103	79
*KB2MMI	"	10,541	103	83
*KD2DVW	"	9,686	66	58
*KF2UJ	"	8,892	84	76
*K2YR	"	7,250	58	50
*K9CHP	"	7,011	66	57
*N8CL	"	2,485	35	35
*WB2KWC	"	2,040	37	30
*W2XK	"	1,300	26	26
*WA2UBK	"	900	21	20
*N2OWD	"	25	5	5
*KB2URI	21	36	6	6
*W2VTV	7	207,452	351	239
*NA2NY	"	103,620	263	165
*WA2DE	"	15,984	100	72
*N2IVN	"	50	5	5

District 3

AA3B	A	7,888,300	2647	955
N3QE	"	3,500,643	1665	739
AB3CV	"	3,367,760	1424	688
KA3GIK	"	2,646,976	1477	701
				(OP: W3FIZ)
K3MM	"	2,106,720	1309	608
W3LL	"	1,787,322	1180	498
W3FV	"	1,696,140	1018	540
WT3K	"	1,685,480	1126	580
W2CDO	"	1,415,340	918	540
NY3B	"	1,017,678	907	474
K3WJV	"	991,608	788	474
W3XOX	"	933,660	934	420
K9RS	"	905,004	716	414
NT3U	"	831,464	827	424
NE3F	"	762,615	882	405
KD3TB	"	550,290	654	390
K3PP	"	497,325	483	349
NN3RP	"	438,515	554	335
K3TN	"	411,477	547	337
N3FJP	"	326,700	498	275
N3ALN	"	308,574	483	279
K3AU	"	263,250	358	250
				(OP: K2YWE)
W3JX	"	237,120	362	240
K3UL	"	229,910	374	277
WC3N	"	222,768	388	238
N3XL	"	195,776	373	224
N8WXQ	"	159,495	352	217
KG4USN	"	119,910	230	210
K3QIA	"	117,436	265	187
K2XR	"	113,040	206	180
K1BZ	"	104,823	257	171
N3EEN	"	95,018	209	154
N3DUE	"	92,502	231	162
K2EJ	"	75,922	206	154
K3TEF	"	75,317	261	167
NN3Q	"	74,649	184	149
K1RH	"	64,325	193	155
K3MD	"	57,640	164	131
WY3A	"	57,330	163	117
N3MWQ	"	54,670	202	142
KA3D	"	37,236	145	116
N3RM	"	34,969	141	121
K3WW	"	33,957	125	99
AF3I	"	33,640	151	116
AB3AH	"	33,300	159	111
K3FH	"	31,284	127	99
AA3S	"	29,140	96	94
N3WMC	"	25,602	144	102
KB3Z	"	20,999	94	83
K3OK	"	18,693	124	93
WN3I	"	14,861	103	77
N3ZP	"	14,421	73	69
N3FM	"	13,940	97	82
KB3KCN	"	2,112	37	33
NA3M	7	1,952,748	963	567
WA3AAN	"	532,016	555	328
NI3Q	"	121,094	275	191
				(OP: W3FA)
*WW3S	A	1,584,448	1085	608
*K2LNS	"	798,752	793	436
*KY3W	"	547,170	633	390
*KB3AAY	"	486,450	606	345
*NF3R	"	281,668	491	268
*KC3JNW	"	246,634	406	254
*WA3ZSC	"	146,110	369	190
*W3KB	"	143,166	254	214
*AC3U	"	123,959	315	191
				(OP: W3UL)
*WA1HEW	"	119,560	327	196
*KQ3F	"	112,968	255	216
*N3BD	"	106,218	298	189
*N3PKJ	"	106,128	280	176
*AB3SX	"	106,080	266	170
*AK3B	"	105,525	275	201
*AB3GY	"	91,416	221	156
*WU3U	"	79,856	240	161
*W3RE	"	78,894	190	162
*K3ORC	"	68,856	224	151
*AI3KS	"	57,222	183	153
*KE3ZT	"	54,264	195	152
*WA4GUD	"	51,712	150	128
*AA3K	"	37,408	139	112
*KN1OLA	"	36,192	140	116
*K3RWN	"	35,310	135	107
*WA3KCP	"	32,120	132	110
*WB3JIS	"	28,512	120	108
*NS3X	"	24,768	110	96
*W3DQT	"	19,125	104	85
*K3JSJ	"	15,580	93	82
*ND3R	"	13,690	90	74
*WC3B	"	7,280	56	52
*WY3P	"	6,365	111	95
				(OP: N3VOP)
*WA3TD	"	5,220	69	58
KA3KAG	*"*	*5,136*	*55*	*48*
*AG3I	"	5,084	48	41
*KD4IZ	"	5,016	35	33
*KC3OQJ	"	2,961	54	47
*AJ3DI	"	1,274	29	26
*KØBAK	"	630	18	18
N3RDV	*"*	*555*	*17*	*15*
*N3RUM	"	171	9	9
*N8URE	21	1,632	33	32
*N3NZ	14	884	26	26
WA3FAE	*7*	*305,368*	*404*	*266*
*W3IDT	"	113,488	236	173

District 4

N6AR	A	3,357,368	1736	718
W4PK	"	2,693,174	1453	646
WW4R	"	2,310,070	1594	610
				(OP: N4ZZ)
N4CW	"	2,073,478	1273	614
NR4O	"	1,344,410	1184	466
AA4DD	"	1,298,853	1068	521
N4IQ	"	1,218,171	1150	491
NS4X	"	1,169,280	1011	480
NU4Y	"	1,160,568	1137	486
WJ2D	"	1,057,029	877	463
N1RM	"	1,053,780	735	420
KU4V	"	920,244	712	442
K4SO	"	890,802	759	409
NF4J	"	841,325	970	461
K4BWP	"	814,959	977	381
K3IE	"	801,312	721	408
WS6X	"	792,232	795	392
WF4W	"	751,713	833	381
K5VIP	"	738,162	723	414
K8LF	"	629,140	603	379
W1AJT	"	615,996	538	426
				(OP: VE3UTT)
AB4SF	"	608,404	689	356
AI4WW	"	606,464	782	368
W3SA	"	520,608	700	348
W4UK	"	499,500	681	333
AD4TJ	"	492,450	585	350
N4CF	"	482,584	613	337
N3MN	"	467,381	491	323
KEØL	"	461,340	592	330
WX4G	"	403,216	487	316
K4XL	"	376,300	408	284
W4VIC	"	368,637	456	309
K4WW	"	366,975	490	315
K3DNE	"	315,300	488	300
K8KI	"	311,934	566	294
AA8R	"	298,452	475	308
W3IK	"	295,932	531	273
AC6ZM	"	257,214	466	263
WB4YDY	"	243,972	452	251
W3DQS	"	240,808	366	248
N4QS	"	239,679	409	269
WB4HRL	"	199,272	399	228
KA4RRU	"	191,400	304	220
W4WWQ	"	167,480	335	212
K7OM	"	157,248	338	208
W3GQ	"	156,769	278	223
N2TU	"	152,005	293	215
NK4I	"	140,298	352	201
NN4NT	"	139,620	292	195
KF5MU	"	130,611	321	197
W1BQ	"	126,480	338	204
K3WA	"	115,818	314	199

K4DXV	"	104,481	250	171
W4GHV	"	92,853	244	181
KG4W	"	91,956	211	158
AF4T	"	91,520	227	160
W4UEF	"	76,272	293	168
KO8V	"	74,582	235	178
KH6HGP/W4	"	71,668	238	164
				(OP: W7HJ)
K4QD	"	68,552	226	164
N2LEE	"	64,079	179	139
W4CU	"	54,058	194	151
W4CB	*"*	*51,072*	*144*	*114*
				(OP: W2RU)
AA9HQ	"	49,385	144	119
N4TL	"	47,554	177	118
W4BCG	"	46,683	199	133
W4NF	"	46,374	189	131
NN4SS	"	42,681	142	123
NR3X	"	41,022	159	129
				(OP: N4YDU)
WD4OHD	"	37,720	142	115
KK4PH	"	31,395	153	115
N3KN	"	30,552	147	114
K2SD	"	26,775	117	105
WA2SCB	"	24,924	114	93
AB4L	"	23,205	94	85
				(OP: N4GU)
AC4MC	"	19,110	118	91
WA2PCN	"	18,490	106	86
W4GHD	"	11,658	73	67
KD4S	"	9,380	69	67
K4KZ	"	9,238	76	62
W4GKM	*"*	*8,448*	*76*	*66*
NY4I	"	7,169	79	67
N4FP	"	6,655	60	55
N4JKO	"	4,950	71	55
WC9D	"	4,352	91	68
N3ND	"	3,392	34	32
KN4QDE	"	1,456	31	28
N2NL	"	836	19	19
K4ELI	"	800	22	20
NA4W	28	1,224	23	18
				(OP: K4WI)
W4TTY	21	4,120	46	40
W1IE	14	195,132	420	276
NU4E	7	1,269,120	860	480
W4GE	"	401,860	416	283
WW2R	3.5	381,480	546	289
				(OP: N2CEI)
NJ4U	"	233,064	412	234
				(OP: K4EA)
*KK9A	A	4,220,550	2067	747
*KM4SII	"	1,280,512	870	512
*KT4Q	"	790,716	917	393
*ND4Y	"	544,656	852	336
*WA3LXD	"	407,880	701	309
*N2ESP	"	362,556	461	324
*K2MK	"	341,691	568	307
*N2OG	"	335,240	555	290
*NN4NN	"	332,061	508	289
*KK4DF	"	326,826	550	271
*N3CKI	"	307,380	490	282
*WA4IPU	"	289,845	507	285
*W4PJW	"	280,900	473	265
*AC4G	"	273,780	450	270
*AB4GG	"	245,952	493	244
*KK4HEG	"	239,604	488	246
*K4BX	"	233,280	470	240
*K4GM	"	229,392	418	243
*KS3H	"	212,298	457	246
*N4YTM	"	190,162	394	238
*KM4JAK	"	187,271	441	217
*KM4FO	"	187,227	421	213
*NN4RB	"	171,842	341	214
*KC4SAW	"	164,250	333	219
*AI4GR	"	145,320	351	210
*N5SMQ	"	135,360	325	192
*N4MMR	"	126,720	286	192
*KG3V	"	116,775	259	173
*AA4LR	"	111,150	323	195
*K4FTO	"	104,859	304	183
*W4EE	"	104,413	304	193
*W4NNF	"	103,598	348	187
*KF1P	"	102,837	254	177
*AE4Y	"	97,226	289	173
*WA8OJR	"	95,370	248	170
*NV4B	"	93,568	266	172
*NE8O/4	"	92,752	264	176
*K4FJW	"	92,736	241	161
*W4SSF	"	92,232	258	168
*K8RGI/4	"	92,120	291	196
*K4YDE	"	91,800	230	170
*WE4M	"	90,681	269	181
				(OP: N2QT)
*N3MM	"	90,552	268	168
*KG4CUY	"	89,178	317	178
*AA2MA	"	88,478	239	166
*KT3T	"	87,039	243	171
*WGØY	"	86,000	285	172
*KN4GDX	"	85,176	238	182
*WN8Y	"	83,720	250	161
*W4NZ	"	77,751	267	163
*K4MIL	"	76,950	241	162
*KO4XB	"	75,484	254	167
*WT4R	"	69,732	238	156
*WK9M	"	69,414	218	138
*K4BRU	"	66,882	180	142
*N1IA	"	63,384	220	152
*N4FWD	"	57,669	248	141
*W4JSI	"	54,981	203	149
*W2GFV	"	49,206	168	139
*KC3EF	"	46,950	190	150
*NZ4N	"	42,120	154	120
*W5NZ	"	35,520	148	111
*WG4M	"	34,568	149	116
*KS4YX	"	32,832	150	114
*AA5JF	"	32,230	138	110
*K3NC	"	31,106	129	103
*W3OA	"	30,510	148	113
*N4HER	"	30,199	140	101
*NQ4K	"	29,184	144	114
*N4MRM	"	28,119	119	103
*N3CW	"	26,182	122	106
*KW4J	"	25,800	129	100
*W4CQE	"	22,788	161	108
*K4YCR	"	21,620	114	92
*KM4JA	"	21,146	128	97
*K4HAL	"	20,790	128	90
*K4MI	"	19,458	107	94
*KE4QCM	"	19,314	96	87
*W2CG	"	18,662	94	86
*WA4EEZ	"	17,523	151	99
*KA3MTT	"	16,880	97	80
*KK4WX	"	16,560	86	72
*WX4W	"	16,068	101	78
*KM4RK	"	15,089	105	79
N2JF	*"*	*15,048*	*82*	*76*
*N4GL	"	14,703	110	87
*AD4EB	"	14,025	101	75
*W2MKW	"	12,879	97	81
*KQ3K	"	12,690	127	90
*W4GDG	"	12,231	124	81
*K3TD	"	11,573	88	71
*WO4X	"	11,492	80	68
*N4TAE	"	10,857	97	77
*K3FHP	"	10,710	93	70
*K2WK	"	10,472	77	68
K4LIX	*"*	*7,742*	*97*	*79*
*N4JAW	"	6,670	82	58
*W4PF	"	6,324	61	51
*W4NBS	"	5,148	39	39
*N5VX	"	5,049	53	51
*N4BFR	"	4,732	62	52
*KG4WOJ	"	2,944	37	32
*K3TW	"	2,739	34	33
*K4NWX	"	2,701	41	37
*KC4EZN	"	2,442	42	37
*AD4ET	"	1,470	30	30
*WA4DYD	"	1,160	35	29
*N2YF	"	1,160	21	20
*N4KXO	"	1,054	38	34
*WJ4HCP	"	999	31	27
*N4JRG	"	966	23	23
*W4WNT	"	651	21	21
*N4XL	"	493	17	17
*WA1PMA	"	72	7	6
*KW1K	"	40	8	8
*W9SN	21	232,656	414	262
*WØPV	"	4,224	48	44
*W4LC	14	227,445	387	295
*WU4G	"	2,790	53	45
*N3UA	"	2,460	47	41
*W4SCP	"	1,998	40	37
				(OP: WAØLJM)
*N4JOW	"	273	22	21
*WT4O	7	1,287,716	764	493
*WA1FCN	"	643,300	644	350
*KS4S	"	351,072	520	276
*KG4IGC	"	269,864	435	244
*KC4WQ	"	82,928	210	146
*K4FT	"	13,668	75	67
*AAØO	"	6,806	42	41
		District 5		
AD5XD	A	1,087,611	1203	469
AA5AU	"	1,038,048	940	528
NT5V	"	1,017,126	1020	467
KG5VK	"	635,375	852	391
WQ5L	"	576,032	684	376
K5YAC	"	424,935	641	315
W5JK	"	319,422	731	278
NN5O	"	305,100	537	270
N5VU	"	283,282	537	278
NM5NM	"	265,356	519	252
				(OP: AA5B)
W2GS	"	231,540	356	255
KA5M	"	229,463	498	247
K5LY	"	194,400	480	243
K5XH	"	154,026	392	199
WA9JBR	"	149,296	392	217
AG5S	"	92,600	347	200
N5PU	"	89,930	259	170
N5VGK	"	62,456	373	211
N5EKW	"	54,102	244	142
K5CI	"	48,280	229	142
N5LPT	"	32,963	147	119
W5GFI	"	30,952	171	106
WA5LXS	"	29,532	146	107
WØZW	"	26,967	124	101
K5XS	"	14,924	103	91
N5UM	"	11,972	103	82
N5DD	"	3,306	41	38
K5GZR	"	3,237	43	39
W5PR	28	3	1	1
K5QR	21	30,952	153	106
N5XJ	14	7,749	69	63
WQ5OO	7	3,982,134	1480	741
				(OP: N8OO)
W5TN	*"*	*350,984*	*519*	*292*
K5MXG	"	156,768	311	213
WBØTEV	3.5	1,664	28	26
*WB5BHS	A	526,143	860	327
*AD5LU	"	297,792	560	282
*NN5T	"	288,798	520	254
*WA8ZBT	"	223,635	523	255
*N5KWN	"	138,125	446	221
*W5IO	"	121,644	282	186
*KF5BA	"	79,904	336	176
*WB5JJJ	"	78,080	272	160
*AB8YZ	"	75,366	315	159
*KC5TT	"	72,680	335	184
*WA5LFD	"	55,476	208	134
*WDØGTY	"	55,208	219	134
*N5CHA	"	53,268	218	138
*K5YX	"	52,398	208	142
*N5YT	"	51,183	194	141
*N5PD	"	42,051	193	131
*KI5IXP	"	40,698	203	126
*KK5JD	"	22,048	134	104
*N5AF	"	20,501	125	83
*N5XE	"	16,683	101	83
*WA9AFM	"	14,195	115	85
*W5LA	"	9,860	87	68
*KD5JHE	"	7,854	76	66
*WØAMT	"	5,310	74	59
*AF5CC	"	4,257	50	43
*KE5LQ	"	4,048	49	44
*K7ZYV	"	3,478	57	47
WBØRUR	*"*	*198*	*12*	*11*
*NK5G	14	43,512	226	148
*K5WW	"	42,687	241	153
*KF9LI	"	31,496	183	127
*K5IB	7	161,504	308	206
*KF5KWO	"	5,040	48	45
		District 6		
KK6P	A	2,498,580	1715	630
				(OP: W7IV)
KYØW	"	1,933,352	1827	536
KU6W	"	1,787,324	1433	539
				(OP: K9YC)
NB6U	"	1,272,480	1282	482
				(OP: N6ZFO)
WQ6K	"	1,070,399	1138	473
				(OP: N6IE)
AJ6V	"	926,187	1067	433
K6OK	"	864,528	957	434
AG1RL	"	746,428	974	382
				(OP: W1SRD)
WQ6X	"	663,798	786	349
AG6AU	"	517,032	932	344
				(OP: W1RH)
W6EU	"	473,859	793	333
K6RB	"	443,980	713	316
K6TQ	"	424,514	744	334
K6RC	"	389,376	613	288
W6PZ	"	368,752	614	304
N6RV	"	362,896	565	296
AF6SA	"	316,092	614	318
W6SX	"	304,020	628	270
NJ6G	"	279,946	549	278
W6DR	"	236,130	393	255
WE6Z	"	209,804	486	254
K6NR	"	204,314	509	251
WF6C	"	189,344	499	244
				(OP: N6XI)
NA6MG	"	180,576	424	228
W6OQI	"	179,515	430	223
K6HGF	"	169,857	519	243
NN6DX	"	169,569	449	249
				(OP: W1PR)
K6LRN	"	165,912	387	248
NK6A	"	143,003	447	217
NC6R	"	136,278	375	201
K6NV	"	134,904	404	219
W6IA	"	124,670	314	182
NF6A	"	123,930	242	162
				(OP: K6XX)
N6VH	"	119,260	372	178
KO6LU	"	111,784	330	178
K6EU	"	104,104	287	182
W6SR	"	101,200	349	220
AB1U	"	87,606	241	157
				(OP: W6RKC)
N6HE	"	81,081	268	143
K6ELE	"	64,128	277	167
K8TR	"	45,750	248	150
W6JBR	"	44,226	178	117
K6ZH	"	39,776	144	113
W6MOB	"	37,878	147	118
KR6N	"	28,224	125	96
N6QQ	"	27,451	122	97
KW6S	"	21,252	113	84
WD6T	"	19,838	136	109
AK6M	"	18,972	128	93
				(OP: K6MM)
WT6K	"	17,091	127	81
KA6W	"	12,870	98	78
KF6NCX	"	12,320	109	70
K6MI	"	4,232	53	46
WA6URY	"	1,000	20	20
N5KO	"	672	17	16
K6KM	"	247	15	13
NA6O	"	242	16	11
				(OP: @W6SRR)
N5YJZ	"	130	10	10
NG6O	*14*	*186,872*	*485*	*284*
				(OP: K6GHA)
K6TET	7	468	15	13
*WN6K	A	436,540	747	299
*KF6RY	"	308,275	682	295
				(OP: W6ZL)
*K6FA	"	84,042	252	161
*KK6KMU	"	53,640	239	149
*W7XZ	"	52,338	217	143
*N6RVI	"	49,140	228	130

*NF6P	"	47,272	248	152
*N6GEO	"	42,112	206	128
*K6BIR	"	38,052	213	126
*K6TJ	"	35,475	217	129
*N7WLC	"	35,100	190	117
*K6VVK	"	31,476	158	122
*K6TLH	"	24,735	165	97
*K6PO	"	11,256	81	67
*W6KSR	"	10,556	73	58
*NA6MB	"	9,855	96	73
*KD6HOF	"	7,946	69	58
*AA6XA	"	3,652	58	44
*N6UTC	"	2,294	47	37
*NT6V	"	2,106	44	39
*W6DMW	"	1,443	45	37
*KE6SHL	"	450	20	18
*WU6X	"	360	18	18
*AG6JA	"	112	9	8
*WZ8AA	21	18	7	6
*K6JO	14	42,294	178	133
*K5OA	"	5,890	77	62
*K6CTA	"	3,120	55	48
*N6YEU	"	352	17	16

District 7

WK6I/7	A	2,879,235	2296	587
KZ7X	"	2,442,960	1797	624
				(OP: K6LL)
N7GP	"	1,529,423	1553	511
W7YAQ	"	1,260,450	1307	450
KO7SS	"	952,496	885	472
K7QA	"	881,109	1132	423
N9NA	"	655,557	979	399
W7GES	"	569,264	816	376
WA7LNW	"	515,652	791	388
N7UVH	"	499,985	955	361
K7AR	"	476,064	695	342
KX7DX	"	412,566	625	329
				(OP: W7CD)
WC7Q	"	410,501	756	347
KN7K	"	380,608	735	313
N7JP	"	369,628	705	301
N7ZUF	"	324,937	598	293
WR7Q	"	299,250	604	285
W7XQ	"	292,600	609	266
K7RL	"	291,276	628	279
K7JQ	"	285,576	587	292
KC7V	"	266,311	574	251
KB7N	"	265,366	592	277
N7QT	"	264,784	481	268
W6OAT	"	243,294	447	246
WU6W	"	221,130	517	243
KU7T	"	214,476	369	244
K7MO	"	199,500	523	266
WA7CPA	"	189,895	494	233
W7LD	"	176,732	495	226
AA7V	"	176,656	434	244
W7PU	"	152,460	409	242
K7VIT	"	139,860	362	222
WB6JJJ	"	128,895	298	195
N7BT	"	107,868	302	178
KB7AZ	"	107,640	262	180
KW7AA	"	103,200	240	172
				(OP: K7BTW)
KX7L	"	96,579	312	189
K7BVT	"	96,111	289	177
W7BP	"	85,440	305	178
NG7M	"	84,072	320	186
W7CO	"	82,960	293	170
W7VXS	"	70,238	301	173
WS7L	"	57,436	234	166
K6UM	"	51,745	206	131
W7VJ	"	50,250	216	150
W7GYM	"	46,080	208	144
AC7GL	"	44,590	191	130
K7EDX	"	43,911	164	123
W7SLS	"	41,788	192	124
K7KB	"	38,205	175	135
N7VGO	"	37,200	192	124
WR7T	"	33,550	189	122
KG7QXE	"	33,072	167	106
KØIP	"	21,637	107	77
WD7E	"	21,204	113	93
KF7ZN	"	15,456	103	84
K7LFY	"	13,695	99	83
NN7SS	"	13,244	94	77
				(OP: K6UFO)
W9PL	"	6,909	55	49
K9QJS	"	3,570	52	42
K7EG	"	3,570	57	51
K2RD	21	163,920	418	240
KY7M	"	112,560	341	201
KA6BIM	14	559,430	809	430
K8IA	7	1,493,910	968	503
K6SEA	"	544,476	506	314
				(OP: KA6BIM)
K7WP	"	164,836	291	203
N6SS	3.5	194,920	385	220
K7IU	"	312	13	13
*K7TQ	A	477,425	890	325
*K7GS	"	394,290	590	390
*WS7V	"	267,003	662	279
*K7VAP	"	243,243	567	273
*W7BOB	"	221,256	502	252
*AD7XG	"	194,549	403	257
*W7OM	"	167,832	467	252
*N7UR	"	158,788	430	214
*WAØWWW	"	152,382	388	233
*WW7E	"	138,400	402	200
				(OP: W7VO)
*WZ8T	"	138,212	364	218
*N7ESU	"	137,634	399	226
*KE6K	"	127,982	324	178
*AB9O	"	117,888	298	192
				(OP: W7DN)
*W7TMT	"	107,042	383	179
*W7PP	"	57,512	194	158
*AK6A	"	57,510	197	135
*NG7Z	"	48,512	241	128
*KB7AK	"	43,290	192	130
*W7SO	"	34,526	179	122
*WG7X	"	34,453	198	131
*NW7D	"	29,890	137	98
*KB2S	"	28,404	160	108
*AF7NX	"	28,248	158	107
*K7MY	"	27,540	157	108
*NV1O	"	25,228	152	106
*K7AZT	"	24,948	149	99
*AF9W	"	24,753	140	111
*WA7BRL	"	18,974	138	106
*WN7Y	"	18,920	114	86
N7VS	"	*17,765*	*129*	*95*
*N7WS	"	17,325	89	77
*K7TM	"	15,247	99	79
*N7XCZ	"	14,620	110	86
*K7ARJ	"	12,600	97	75
*KK7A	"	11,356	100	68
*AA4Q	"	11,323	98	67
*WB7QMR	"	11,172	96	76
*WB7CYO	"	10,920	97	78
*K7MK	"	10,530	99	81
*NN7M	"	10,251	82	67
*KNØW	"	10,001	99	73
*KF7GMV	"	9,177	89	69
*K6DGW	"	8,568	78	68
*N7AME	"	7,790	110	82
*K7RBT	"	5,952	77	62
*WB7UOF	"	5,775	74	55
*AD7L	"	4,752	64	54
*W7VAS	"	4,212	56	52
*AA7UN	"	3,360	37	35
*W7RCS	"	2,760	44	40
*N1JM	"	2,294	42	37
*W6US	"	1,596	45	38
*W7QL	"	1,595	31	29
*W7JHR	"	1,550	36	31
*KI7DET	"	1,178	37	31
*K7STO	"	770	25	22
*W7MTL	"	464	16	16
*K7CAM	"	208	14	13
*W7FZY	"	55	11	11
*N7VPN	14	13,692	102	84
*KI6QDH	"	1,368	44	36
*N8FKF	"	1,056	34	32
*K6VHF	7	45,828	155	114

District 8

N8BJQ	A	1,694,616	1138	588
WA8MCD	"	957,521	961	479
KI8I	"	582,824	787	358
K8PK	"	471,861	656	327
K8RCT	"	396,516	579	346
AD8FD	"	377,478	536	313
W8TWA	"	259,722	436	282
W8JE	"	*94,772*	*262*	*172*
WS8G	"	75,203	208	157
N8AA	"	56,304	223	138
KD8FS	"	56,056	167	143
KA8G	"	51,546	189	142
N4RA	"	45,500	157	130
WA8KAN	"	32,452	169	122
AB8RL	"	30,393	128	99
N8PWM	"	11,492	99	68
K8BZ	"	9,513	75	63
K8ESQ	"	5,150	64	50
WX8C	"	735	22	21
K8YE	14	678,131	677	461
W8JWN	7	337,512	524	287
KG9Z	"	111,630	234	183
KF8MZ	"	924	22	21
K3GP	3.5	139,392	298	192
*N8CWU	A	1,032,430	1081	430
*KE3K	"	511,638	742	317
*WB8JUI	"	474,300	678	306
*AA8OY	"	380,072	533	308
*NX8G	"	314,440	505	280
*K3JT	"	277,947	499	267
*ND3N	"	252,252	503	234
*KM8V	"	190,152	359	228
*WT8WV	"	189,696	381	228
*W8AKS	"	185,380	360	230
W8JGU	"	*144,210*	*346*	*209*
*AB8OU	"	136,712	325	184
*AC8JW	"	125,636	337	196
*K8MU	"	120,481	346	211
*AA8SW	"	118,728	324	194
*N8WCP	"	86,856	248	168
*N8OXC	"	82,302	200	174
*WA8YZB	"	78,735	278	145
*WB8JAY	"	72,675	209	153
*WS6K	"	72,000	242	160
*N8TFD	"	66,752	226	149
*K7DR	"	64,350	210	143
*KB8TL	"	60,604	192	139
*KK8MM	"	50,625	198	135
*K4YJ	"	46,726	156	122
*W8EH	"	43,180	181	127
*K8BL	"	39,446	152	121
*WW8RT	"	35,746	146	122
*KE8HBV	"	35,700	136	119
*W5UHQ	"	31,080	121	105
*W3CRZ	"	28,536	141	116
*K8AJS	"	25,900	111	100
*AF8A	"	24,115	123	91
*K8TJM	"	22,272	122	96
K3YP	"	*21,294*	*118*	*91*
*AC8ZU	"	18,705	107	87
*W8RZ	"	17,286	133	86
*K9NW	"	15,170	94	74
*AB8SF	"	14,100	91	75
*AF8C	"	13,348	83	71
*NF8M	"	12,012	102	77
*KB8DX	"	11,620	85	70
*K8VUS	"	9,690	82	57
*NE8J	"	9,039	93	69
*N8TCP	"	7,480	60	55
*W8XY	"	6,171	59	51
*N8FYL	"	3,690	51	41
*W3CB	"	1,482	30	26
*K8AKC	"	1,156	35	34
*WB8K	7	246,006	400	237
*NN8UU	"	15,600	99	75
*W8WTS	3.5	3,080	35	35

District 9

K9CT	A	4,751,984	2099	851
AI9T	"	3,501,936	1864	747
KD9MS	"	2,140,047	1494	603
KT9L	"	1,958,598	1091	699
WT9U	"	1,678,066	1381	554
N7US	"	1,508,136	1036	573
N9OK	"	1,103,400	1074	450
W9PA	"	926,134	540	473
N2BJ	"	861,272	1016	398
WE9V	"	717,794	655	413
AC9S	"	690,897	798	391
K9UC	"	605,898	747	369
W9FFA	"	603,885	739	381
ND9G	"	513,342	613	361
AIØY/9	"	419,533	711	281
AG9S	"	352,434	532	302
WT2P	"	267,120	517	240
KC9K	"	250,525	452	275
KØTQ	"	205,590	422	231
WI9WI	"	189,185	402	241
AA9L	"	162,624	400	231
KZ9DX	"	109,000	277	200
N9TK	"	96,944	285	166
WA9IVH	"	92,020	275	172
K9DUR	"	91,932	255	163
NT9E	"	83,190	251	177
KC9EOQ	"	58,788	217	138
N9WG	"	55,419	148	147
W9OA	"	53,599	213	133
W9KXQ	"	38,739	133	111
KG9N	"	34,574	135	118
W9PDS	"	32,818	139	122
N9TR	"	7,980	59	57
KS9K	28	80	6	5
				(OP: N4TZ)
W9ILY	14	647,724	648	462
NN9C	"	2,553	40	37
KC9EE	7	41,514	145	111
*N4BAA	A	828,064	817	452
*K9PW	"	560,174	765	346
*WB8BZK	"	429,831	684	293
*K9CW	"	411,348	577	332
*AB9YC	"	411,140	568	337
*N9UA	"	310,534	525	287
*N9SJ	"	309,120	524	280
*KB9OWD	"	246,528	496	256
*K9CS	"	187,146	433	222
*K9ZO	"	179,375	401	205
*W9YK	"	122,012	321	188
*KW9U	"	103,713	253	191
*K9PY	"	96,288	262	177
*WB9B	"	91,840	258	164
*KD9NHZ	"	83,448	269	171
*WA9LEY	"	83,420	267	172
*WD9CIR	"	80,920	243	170
*KB9DVC	"	73,610	260	170
*KC9YL	"	73,024	234	163
*N9BBE	"	66,805	234	155
*N9SB	"	65,410	229	155
*KD9ERS	"	61,446	246	147
*N9ID	"	53,198	202	134
*N9LQ	"	53,170	182	130
*KK9V	"	48,888	173	126
*W9VQ	"	48,191	168	143
*WB9YIG	"	42,640	194	130
*K9BAZ	"	41,265	186	131
*KD9NYE	"	40,812	162	114
*W9PI	"	39,431	167	131
*WB9DAR	"	33,633	166	111
*KF9VV	"	24,717	150	107
*N9LYE	"	22,936	136	94
*KB9S	"	21,010	110	110
*K9AWM	"	17,928	122	83
*K9QC	"	10,074	83	69
*KJ9C	"	10,017	72	63
*WB9TNZ	"	8,636	77	68
*W1QC	"	8,370	68	62
*KK9N	"	7,965	64	59
*KX3H	"	7,747	79	61
*N9AKR	"	7,540	75	58
*K9QH	"	5,940	60	45
*WD9IGY	"	5,712	54	51
WB9VGO	"	*3,116*	*48*	*41*
*WA9LKZ	"	2,640	44	40
*N9VPV	"	1,798	30	29
*K9SGB	"	1,652	31	28
*KA9CLP	"	777	22	21
*K9PG	"	136	8	8
*KR9U	7	18,696	93	82
*W9FY	3.5	27,354	144	97

		District Ø		
KZØUS	A	1,806,250	1497	578
				(OP: W7RY)
ACØC	*"*	*1,644,838*	*1261*	*533*
WØMB	"	947,600	1141	412
W7II	"	832,832	987	416
NIØK	"	730,904	958	433
WØPR	"	708,546	882	439
N7WY	"	663,534	755	386
NØTA	"	543,244	919	337
NØAT	"	474,500	827	325
KØJJR	"	463,752	680	342
KØAD	"	383,228	659	298
WBØN	"	365,330	603	307
WØZQ	"	350,165	581	295
NOØL	"	330,106	585	266
NØKQ	"	312,026	665	286
KØFJ	"	243,800	540	265
KØTC	"	224,576	509	242
WØHRO	"	221,250	481	250
KS9W	"	220,022	472	274
NØVT	"	207,870	426	246
KVØI	"	180,800	500	226
ABØS	"	137,904	347	204
KØVG	"	122,760	306	186
WKØB	"	99,297	309	187
NFØN	"	98,629	266	179
N6RSH	"	96,162	281	186
NØIRM	"	74,676	212	147
KØAP	"	55,948	200	142
KL7NW	"	52,635	235	145
W8LYJ	"	49,896	211	132
KØWA	"	42,560	240	140
ACØE	"	40,260	194	122
WØUY	"	34,102	152	118
NØAJN	"	32,155	141	109
KDØEZS	"	31,753	145	113
WBØWIV	"	29,694	116	98
KØALT	"	27,930	124	98
N5TU	"	27,604	119	103
WB9QAF	"	22,477	132	91
WØPC	"	19,847	119	89
KØHB	"	17,302	108	82
K5ZG	"	2,107	46	43
KRØP	21	147,368	310	218
NØIS	14	292,481	487	329
WMØL	*"*	*26,500*	*186*	*125*
WØTY	"	20,900	118	100
NSØM	"	10,360	97	74
NØNI	7	1,346,948	961	479
KSØAA	"	432,100	627	298
WØGJ	"	167,688	284	204
KCØV	"	140,600	310	190
WØEEE	"	3,332	37	34
				(OP: KEØYIJ)
*WDØT	A	470,840	831	316
*AAØAW	"	349,600	620	304
*NXØI	"	291,082	599	262
*KØKX	"	267,565	426	295
*WØAAE	"	229,152	552	231
*KØMKL	"	209,550	445	254
*NWØM	"	167,232	401	208
*KFØUR	"	150,052	479	233
*K4IU	"	146,370	394	210
*WA7NPX	"	125,370	321	210
*ABØTA	"	98,808	257	179
*WØDC	"	85,562	266	179
*WXØZ	"	83,600	258	176
*KØYB	"	83,000	277	166
*KA4GAV	"	76,128	256	156
*WO7U	"	70,560	249	147
*K7BG	"	61,628	213	142
*WAØLPV	"	61,380	241	155
*AD1C	"	50,260	175	140
*AI6O	"	49,914	186	141
*KØJP	"	48,988	200	148
*KAØKVW	"	44,774	192	122
*W5AP	"	34,391	154	119
*KF6YU	"	31,720	197	122
*KØUAS	"	27,400	157	100
*WØRX	"	21,922	111	97
*WAØMHJ	"	21,526	97	94
*WAØEJX	"	20,952	128	97
*NØUX	"	19,400	139	100
*AAØK	"	14,620	120	85
*KDØWUQ	"	12,150	110	75
*NØKRE	"	5,424	56	48
*KBØHP	"	4,500	54	45
*NØQBX	"	3,649	43	41
*N2RSC	"	3,496	46	38
*KØTLG	"	2,788	43	41
*WAØLIF	"	2,440	49	40
*NYØJ	"	1,664	39	32
AEØX	*"*	*660*	*25*	*20*
*W3ZF	"	364	13	13
*K7SCX	14	121,218	315	227
*WDØBGZ	7	42,164	128	127
		Alaska		
KL7SB	A	673,552	702	344
AL7LO	"	305,448	493	264
KL7IWC	"	213,208	438	232
AL7A	"	180,048	380	186
N6QEK/KL7	"	32,032	133	91
NL8F	3.5	3,712	37	29
*AL1G	14	55,062	215	133
		Barbados		
*8P2K	7	200,340	229	189
		Canada		
		District 1		
VO1CH	A	937,080	711	456
VE1ANU	"	145,470	269	195
VE9AA	"	21,510	116	90
*VA1XH	A	901,470	662	398
*VE1RSM	"	512,940	495	309
*VE9HF	"	402,903	460	267
*VE9BWK	"	64,356	177	124
*VO1BQ	"	16,796	93	76
*VE1FTL	3.5	7,176	48	39
		District 2		
VA2AM	A	2,243,475	1152	585
VE2GSO	"	991,125	838	375
VE2EZD	"	140,248	263	188
*VE2BVV	A	946,476	715	431
*VE2HEW	"	407,360	517	268
*VA2SIB	"	222,156	365	204
*VA2QR	"	159,324	289	204
*VE2OWL	"	131,144	215	194
*VE2QV	"	9,625	60	55
*VE2NCG	28	6	3	2
		District 3		
VA3DF	A	3,655,410	1468	726
VE3JI	"	2,081,664	1192	556
VA3LR	"	1,708,188	1020	503
VE3NE	"	1,123,590	789	402
VE3DZ	"	824,360	632	370
VE3GYL	"	655,452	634	378
VE3TW	"	620,052	618	317
VE3CV	"	431,122	440	314
VA3IK	"	180,864	298	192
VA3SB	"	171,130	297	218
VE3NRT	"	134,064	236	152
VA3WW	"	82,080	188	135
VE3YT	"	76,557	188	151
VA3MW	"	55,775	138	115
VE3DZP	"	40,950	144	105
VE3SD	"	32,736	129	93
VE3EEJ	"	25,400	104	100
VE3SS	"	13,167	77	63
*VE3PJ	A	1,224,108	858	444
*VE3KI	"	1,086,176	826	416
*VE3MGY	"	943,533	816	369
*VA3MJR	"	935,712	800	361
*VE3LVW	"	355,110	443	266
*VE3BR	"	181,792	301	184
*VA3WB	"	161,332	313	212
*VE3WG	"	155,246	286	182
*VA3ROC	"	125,136	249	158
*VE3SST	"	123,930	261	162
*VE3FZ	"	102,357	222	153
*VA3JLF	"	97,276	233	166
*VA3AUW	"	90,335	202	145
*VE3ZDR	"	60,390	155	110
*VE3VID	"	58,764	158	118
*VE3IBW	"	47,495	151	115
*VA3PAF	"	47,412	155	108
*VE3RKS	"	42,513	152	111
*VE3NFN	"	27,888	105	83
*VE3MZD	"	27,057	107	87
*VE3XAT	"	26,214	104	102
*VE3EP	"	19,440	93	80
*VE3HG	"	19,363	84	67
*VE3XD	"	16,440	82	60
*VA3DKL	"	15,057	72	63
VE3AND	*"*	*4,371*	*56*	*47*
*VE3TM	14	245,976	374	277
*VA3SK	"	672	16	16
*VA3FF	3.5	333,318	396	219
		District 4		
VE4VT	A	334,368	477	258
*VA4HZ	A	396,704	539	253
*VE4DL	"	64,260	221	135
		District 5		
VE5MX	7	2,073,366	990	503
*VE5KS	A	300,364	501	244
		District 6		
VE6BBP	A	964,712	1001	392
VE6UM	"	546,334	672	346
VE6WQ	14	360,297	599	301
*VE6SPS	A	112,797	283	151
*VA6RCN	"	87,252	232	132
*VA6AK	14	182,727	383	237
*VE6PFL	"	420	15	14
		District 7		
VA7ST	A	1,353,826	1156	437
VE7CC	"	1,337,112	1211	392
VA7KO	"	1,023,408	974	412
VE7KAJ	"	351,486	575	283
VA7MAY	"	254,016	415	224
VE7KDU	"	73,602	247	141
VE7IO	"	51,728	173	122
VE7SZ	14	612,346	737	382
VA7GI	"	34,317	160	123
*VE7DX	A	310,554	494	243
*VE7BC	"	215,487	428	207
*VE7LGP	"	116,180	312	185
*VA7RN	"	60,417	209	137
*VE7AX	"	32,970	126	105
*VA7ZM	"	25,404	124	87
*VE7BGP	"	11,970	75	63
*VE7ZFE	14	240	12	12
		District 8		
VY1XY	14	21,024	115	96
		Cayman Islands		
ZF2WF	A	5,572,161	2478	723
				(OP: W9KKN)
		Costa Rica		
*TI2OY	A	334,815	494	255
*TI2ALF	21	2,844	39	36
*TI2YO	14	536,625	695	375
		Cuba		
CO2VE	A	26,400	130	96
*CO6WD	A	132,260	214	170
*CO2GL	"	126,419	277	167
*CO2KY	"	100,285	230	155
*CO2WL	"	1,054	41	34
*CO2AME	14	470,235	674	345
*CO6OV	"	185,372	371	242
*CO6RD	7	332,258	352	233
*CM6GBR	"	264,076	280	214
*CM2CHR	"	39,000	133	100
*CO6SRS	"	11,368	58	49
*CO2JD	3.5	40,040	119	91
*CO2XK	"	10,290	55	49
		Dominica		
*J79WTA	A	277,263	431	243
		Dominican Republic		
*HI3T	A	1,438,722	1116	498
*HI3AA	"	916,748	942	406
*HI3K	"	220,173	354	237
*HI8DL	21	27,244	133	98
		Guatemala		
*TG9ANF	A	341,611	511	251
*TG9ADQ	14	174,867	362	231
		Mexico		
XE2W	A	83,712	207	128
*XE1YD	A	277,008	487	232
*XE2AU	"	164,352	380	214
*XE2S	"	144,570	304	158
*XE2YWB	"	80,793	238	141
XE2A	*"*	*57,340*	*198*	*122*
				(OP: XE2KJ)
*XE2T	"	23,530	98	65
*XE1SVT	"	18,615	88	73
*XE2RT	"	16,120	93	65
*XE2OK	"	13,728	88	78
*XE2B	"	13,703	78	71
*XE1MYO	"	10,640	71	56
*XE2UF	"	8,366	60	47
XE1CT	*"*	*5,434*	*41*	*38*
*XE1GZU	"	5,040	51	45
XE2Q	*"*	*320*	*20*	*16*
*XE2N	28	63	7	7
*XE1SPM	14	278,110	578	274
*XE1H	7	315,520	341	232
		Panama		
HP3SS	A	676,800	747	376
HP1ELV	"	2,178	39	33
*HP1DCP	21	5,049	56	51
		Puerto Rico		
KP4JRS	7	228,140	278	187
*NP4TX	A	389,640	465	255
*KP3G	"	179,332	331	214
*KP4JFR	21	37,400	151	110
*NP3V	"	5,712	57	51
		U.S. Virgin Islands		
NP2X	A	13,179	79	69
				(OP: K9VV)
WP2Z	"	2,964	40	38
				(OP: W4LIS)
*KP2B	A	575,640	752	351
				(OP: WP3A)
*NP2KW	"	368,989	441	263
*KP2DX	"	202,436	371	221
				(OP: KP2BH)

AFRICA

		Canary Islands		
ED8W	A	4,844,484	1805	666
				(OP: EA8DO)
EA8DIG	"	1,558,152	843	456
EB8AH	*"*	*317,573*	*313*	*227*
				(OP: EA8ZS)
*EA8OM	A	689,624	539	349
				(OP: DJ1OJ)
*ED8L	"	645,806	522	326
				(OP: EA8DHH)
*EA8BQM	"	429,056	388	256
*EA8AQV	"	412,929	415	291
*EA8W	"	159,280	232	181
*EA8AH	21	2,451,204	1337	639
		Cape Verde		
D41CV	28	23,400	101	78
				(OP: IK2NCJ)
		Cueta & Melilla		
*EA9E	21	105,938	226	161
		Gabon		
*TR8CA	A	51,527	147	119
		Ghana		
*9G5FI	A	1,981,792	1022	544
				(OP: DL2RMC)
		Morocco		
*CN8KD	7	793,142	432	313

		Namibia		
V51WH	**21**	**1,610,743**	**968**	**563**
		Tunisia		
***3V8SS**	**A**	**2,825,134**	**1285**	**563**
				(OP: KF5EYY)

ASIA

		Afghanistan		
T6A	**A**	**3,266,703**	**1491**	**561**
		Asiatic Russia		
		District 9		
RG9A	**A**	**7,098,316**	**2306**	**799**
RT9A	"	3,379,712	1421	656
R9OK	"	496,398	502	318
UA9TF	"	324,240	414	280
RZ9A	"	319,920	365	258
UA9UR	**21**	**81,528**	**190**	**158**
UC8U	**14**	**1,051,599**	**790**	**501**
RA9AU	"	1,033,328	797	464
***RT9S**	**A**	**1,942,450**	**969**	**530**
*RO9A	"	405,099	429	309
*R9MJ	"	249,498	328	249
*RU8W	"	224,250	263	195
*RK9UE	"	186,270	303	210
*RZ9AD	"	112,200	195	165
*R9AAL	"	75,614	181	154
*RZ9UO	"	32,421	120	101
*RX9DJ	"	25,300	101	92
***R9YU**	**21**	**71,400**	**184**	**150**
*RZ9UF	"	2,688	32	32
***UA9D**	**14**	**95,568**	**195**	**176**
*RA8AI	"	46,540	145	130
*RQ9O	"	19,565	95	91
*RW9MZ	"	5,704	48	46
***UA9OV**	**7**	**780**	**15**	**15**
		District Ø		
UAØSR	**A**	**1,856,754**	**1029**	**522**
RKØUT	"	935,825	785	415
UAØSU	"	751,111	638	391
RWØSR	"	481,470	532	330
RAØACM	"	458,337	491	323
RUØLL	"	417,663	500	279
UAØOK	"	197,230	354	242
RAØQD	"	162,120	295	210
RØCAF	"	130,467	288	157
RMØF	"	99,801	199	117
UCØA	**14**	**858,346**	**706**	**467**
RMØW	**7**	**70,356**	**150**	**123**
***RDØA**	**A**	**979,232**	**729**	**431**
*UAØAGI	"	394,659	486	311
*RØCW	"	186,665	374	185
*UAØLKD	"	110,554	227	167
*RNØJT	"	88,944	245	136
*RØUAV	"	86,868	200	171
*UAØJGI	"	68,540	238	149
*RØJD	"	49,200	198	100
*UAØJFD	"	43,428	159	132
*RØUT	"	37,510	138	110
*RØCM	"	15,795	100	65
*RCØAJ	"	15,147	92	81
*RØCK	"	14,720	96	64
*RAØAY	"	3,325	37	35
***RAØWHE**	**14**	**144,022**	**263**	**214**
*RGØS	"	136,010	293	203
*RWØAJ	"	47,060	131	130
*RØCD	"	10,875	98	75
*UAØQNV	"	6,765	59	55
		Asiatic Turkey		
***TA7I**	**A**	**1,372,964**	**809**	**436**
*TA7OYG	"	663,624	543	312
*TA3ON	"	631,071	541	371
*TA4IGN	"	325,268	346	233
*TA4RC	"	207,080	217	167
*TA3LHH	"	205,623	269	201
*TA7AEK	"	204,428	264	196
*TA2E	"	141,040	223	164
*TA2L	"	12,780	67	60
***TA7AZC**	**21**	**139,830**	**287**	**177**
***TA4CS**	**7**	**272**	**8**	**8**
		Azerbaijan		
***4J3DJ**	**7**	**112,050**	**150**	**135**
		China		
BH7PFH	**A**	**113,602**	**257**	**158**
BG2VIA	"	48,884	170	101
BD1RX	"	13,145	75	55
BD2RJ	"	8,619	62	51
BD3CB	**14**	**143,112**	**314**	**201**
BA3AX	"	28,490	175	110
***BD4SDO**	**A**	**92,304**	**256**	**144**
*BG2ASC	"	76,440	217	147
*BH9ELJ	"	70,413	188	147
*BH2RO	"	57,200	217	110
*BA2BA	"	25,254	151	69
*BD4SS	"	12,408	71	66
*BI4VIP	"	6,240	53	40
*BH6KWC	"	3,510	36	30
*BD7BW	"	3,136	46	32
*BA4SCP	"	1,134	19	18
*BH4UMN	"	3	1	1
***BD7KSF**	**21**	**12,024**	**82**	**72**
***BG4WOM**	**14**	**10,440**	**78**	**60**
*BH3ERS	"	8,352	63	58
BGØAVI	*"*	*3,024*	*37*	*36*
*BI7JMD	"	2,958	42	34
*BA3MM	"	420	17	14
***BG6SNJ**	**7**	**18,582**	**62**	**57**
		Cyprus		
P3X	**A**	**6,817,338**	**2148**	**759**
				(OP: 5B4AMM)
P33W	"	175,941	212	173
				(OP: 5B4AJC)
5B4WN	*A*	*15,708*	*52*	*51*
		Hong Kong		
VR2VIY	**14**	**29,637**	**153**	**89**
		India		
VU2DED	**A**	**305,536**	**362**	**248**
***VU2IBI**	**A**	**74,292**	**185**	**151**
*VU2SMS	"	119	7	7
***VU2MIB**	**7**	**378**	**9**	**9**
		Israel		
4Z5LY	**3.5**	**344,352**	**287**	**211**
***4Z5OI**	**A**	**44,166**	**118**	**102**
***4Z5MY**	**21**	**3,135**	**35**	**33**
***4X6FR**	**14**	**235,944**	**327**	**261**
		Japan		
		District 1		
JM1XCW	**A**	**1,597,528**	**953**	**503**
JN1THL	"	757,218	650	363
JE1LFX	"	508,160	493	320
JH1RFM	"	493,649	485	299
JA1SJV	"	349,851	409	277
JF1LMB	"	340,818	413	258
JA1AYO	"	301,410	401	255
JR1EMO	"	214,548	316	228
JA1BWA	"	214,136	344	232
JA1EPJ	"	154,160	275	188
JH1OAI	"	153,755	271	191
7K4VPV	"	144,300	263	185
JH1CTV	"	121,989	237	157
JA1XRA	"	104,280	207	158
7K1III	"	83,766	198	138
JN1BMX	"	42,642	120	103
JH1BNC	"	34,944	94	84
JK1HIY	"	26,350	98	85
JH1APK	"	24,258	84	78
JR1BAS	"	12,120	64	60
JE1FDQ	"	7,482	48	43
JS1NDM	"	6,191	45	41
JK1LUY	"	5,588	50	44
JH1LNL	"	5,092	47	38
JA1FNO	"	3,224	35	31
JI1JPJ	"	416	13	13
JK1BAB	"	32	4	4
JR1NHD	**14**	**170,820**	**290**	**219**
JG1LHB	"	107,800	233	175
***JH8KYU/1**	**A**	**824,232**	**662**	**366**
*7N2UQC	"	405,528	479	277
*JA1MZM	"	188,997	312	219
*JG1FML	"	133,816	238	172
*JA1UII	"	128,304	255	176
*JA1EMQ	"	121,616	234	176
*JF1WNT	"	121,072	243	161
*JE1RRK	"	113,076	231	162
*JH1BHW	"	92,726	225	142
*JI1ALP	"	84,790	196	139
*JG1XIO	"	60,260	172	131
*JA1SCE	"	56,496	170	107
*JL1CNY	"	55,290	153	114
*JA1DDZ	"	48,578	150	107
*JJ1ENZ	"	44,748	132	113
*JA1IZ	"	43,709	147	109
*JK1JAS	"	40,940	126	92
*JE1RXJ	"	22,161	127	89
*JA1ATM	"	19,125	96	75
*JE1FYV	"	15,548	63	52
*JQ1COB	"	12,032	70	47
*7N4JXR	"	6,624	55	48
*8N1IZA/1	"	5,544	47	36
				(OP: JI1HFJ)
*JK1FNN	"	4,422	38	33
*JA1OHP	"	4,200	45	40
*JF1WCK	"	2,688	38	32
*JA1RRA	"	2,580	33	30
*JA1QML	"	2,494	34	29
*JH1KPT	"	1,806	22	21
*JH1TJH	"	1,650	26	25
*JA1HFY	"	1,610	39	35
*JH1DWQ	"	480	10	10
*JE1ILP	"	378	16	14
*JG1SWV	"	312	12	12
***JF1OVA**	**28**	**200**	**10**	**8**
***JF1RYU**	**21**	**43,992**	**150**	**117**
*JG1UKW	"	8,680	66	56
*JI1BBN	"	4,329	46	39
*JA1DBG	"	940	23	20
*JR1AKD	"	260	10	10
***JE1CAC**	**14**	**97,812**	**214**	**171**
*JF1TEU	"	96,280	213	166
*JA1QIF	"	37,290	128	113
*JH1KYA	"	34,125	118	105
*JA2JNC/1	"	34,068	139	102
*JR1AQI	"	32,334	118	102
*JK1NSR	"	22,952	107	76
*JE1GZB	"	1,632	26	24
*JH1EYM	"	560	16	16
***JP1LRT**	**7**	**52,724**	**120**	**98**
*JA1GZK	"	4,266	28	27
		District 2		
JA2HYD	**A**	**531,810**	**511**	**311**
JR2PMT	"	177,219	267	203
JG2REJ	"	163,064	265	187
JF2FIU	"	53,724	156	121
JA2AXB	"	51,975	136	99
JA2ATE	"	13,952	70	64
JA2FSM	**14**	**304,895**	**417**	**289**
JR2BCF	"	31,600	116	100
JH2BTM	**7**	**16,416**	**63**	**54**
JF2XGF	**3.5**	**10,192**	**61**	**49**
***JA2FXV**	**A**	**108,346**	**232**	**142**
*JF2VAX	"	74,391	178	137
*JA2GHP	"	64,120	170	140
*JH2MYN	"	27,375	84	75
*JA2MNB	"	18,975	91	75
***JH2JNU**	**21**	**4,074**	**45**	**42**
*JE2CPI	"	2,584	40	34
*JF2AIJ	"	171	10	9
***JR2MIN**	**14**	**2,295**	**35**	**27**
*JA2KCY	"	532	14	14
		District 3		
JA3HBF	**A**	**279,210**	**372**	**246**
JA3QOS	"	267,424	363	244
JR3NZC	"	218,088	318	233
JA3QCM	"	58,102	200	139
JR3RIU	"	50,388	147	114
JE3RMQ	"	45,430	140	110
JR3UIC	"	3,744	35	32
JR3RIY	**21**	**47,360**	**145**	**128**
JF3PNQ	**14**	**39,294**	**139**	**111**
JA3VOV	"	5,184	55	48
JM3UGA	"	4,602	46	39
JA3GOJ	"	1,716	27	26
JH3FUK	**7**	**353,808**	**275**	**234**
JF3LOP	"	9,944	49	44
***JH3WKE**	**A**	**99,381**	**220**	**157**
*JA3JM	"	91,932	220	141
*JA3LEB	"	56,161	179	113
*JL3MCM	"	53,248	134	104
*JH3GMI	"	14,280	88	68
*JO3QVT	"	10,368	66	54
*JA3JND	"	9,632	71	56
*JP3UBR	"	8,154	62	54
*JN3TSY	"	6,460	52	38
*JA3HKR	"	2,369	25	23
*JG3OML	"	60	5	5
***JJ3WPX**	**21**	**560**	**15**	**14**
***JF3IYW**	**14**	**48,375**	**163**	**125**
*JA3MIB	"	6,517	53	49
*JA3GZE	"	2,432	34	32
***JI3FLA**	**7**	**24,948**	**89**	**77**
JR3GPP	*"*	*2,546*	*23*	*19*
		District 4		
JR4OZR	**A**	**2,804,978**	**1184**	**649**
JH4UTP	"	2,029,836	1121	564
JG4AKL	"	487,340	470	295
JA4CZM	"	184,473	302	199
JI4WHS	"	171,587	301	197
JR4CTF	"	81,340	195	140
JH4CPC	"	30,640	85	80
JO4CFV	"	585	16	15
JR4VEV	**7**	**38,356**	**103**	**86**
***JE4MHL**	**A**	**305,786**	**382**	**247**
***JA4RMX**	**14**	**17,175**	**88**	**75**
***JH4FUF**	**7**	**1,020**	**15**	**15**
		District 5		
JA5SUD	**A**	**171,678**	**285**	**213**
JE5JHZ	"	20,221	81	73
JA5NSR	**3.5**	**2,268**	**32**	**27**
***JA5OXV**	**A**	**5,762**	**47**	**43**
*JE5HTN	"	4,224	39	33
***JG5DHX**	**21**	**765**	**17**	**17**
***JH5HDA**	**14**	**24,552**	**103**	**93**
		District 6		
JA6MWW	**A**	**269,001**	**337**	**243**
JA6FFO	"	30,444	118	86
JA6BZI	"	7,104	59	37
JA6BCV	**14**	**36,059**	**121**	**107**
JA6LCJ	"	16,500	89	75
***JH6QIL**	**A**	**105,266**	**235**	**146**
*JA6GMC	"	61,480	149	106
*JS6UGC	"	18,810	94	66
***JA6WFM**	**21**	**31,000**	**119**	**100**
***JH6SCA**	**14**	**10,492**	**69**	**61**
		District 7		
JH7QXJ	**A**	**470,080**	**513**	**320**
JO7KMB	"	291,102	368	239
JA7ACM	"	247,720	338	220
JF7PHE	"	227,766	323	203
JA7MAD	"	180,297	296	201
JM7OLW	"	49,797	162	99
JR7IWL	"	38,412	133	97
JA7IC	"	33,100	126	100
JR7IWC	"	30,411	103	93
JA7GYP	"	4,340	35	35
JH7RTQ	**14**	**373,632**	**438**	**336**
JA7LLL	"	29,973	109	103
***JR7ANB**	**A**	**39,592**	**116**	**101**
*JA7MWC	"	13,050	79	58
*JA7ZP	"	6,864	51	44
*JM7GTK	"	1,180	21	20
***JO7GVC**	**7**	**450**	**9**	**9**
		District 8		
JA8KSF	**A**	**943,950**	**708**	**435**
JA8TR	"	476,452	491	311
JA8IDS	**21**	**31,108**	**125**	**101**
JH8JYV	**14**	**35,970**	**122**	**110**
JA8TGD	"	98	7	7

***JM8FEI**	**A**	**81,135**	**235**	**135**
*JE8CLT	"	11,232	72	52
*JE8KKX	"	7,084	49	44
*JK8PBO	"	6,348	58	46
*JA8DNV	"	3,689	34	31
***JA8UON**	**7**	**1,116**	**20**	**18**
		District 9		
JA9CCG	**A**	**101,574**	**223**	**171**
JH9CEN	"	25,800	100	86
JA9CWJ	**14**	**197,635**	**307**	**235**
***JA9LX**	**A**	**27,370**	**122**	**85**
		District Ø		
JAØBZY	**A**	**42,488**	**105**	**94**
JHØMJY	"	41,288	121	104
JAØGCI	**7**	**5,530**	**38**	**35**
***JJØPJD**	**A**	**115,552**	**241**	**157**
*JAØBJY	"	18,423	89	69
*JRØBNF	"	16,107	74	59
*JRØDZH	"	12,031	68	53
*JRØGXA	"	1,260	20	18
***JHØEPI**	**14**	**7,599**	**54**	**51**
		Kazakhstan		
UN3M	**A**	**1,682,978**	**976**	**454**
UN7LV	**14**	**283,932**	**376**	**297**
***UN6LN**	**A**	**1,482,159**	**922**	**489**
***UN4PG**	**21**	**117,180**	**232**	**186**
*UN7PGA	"	83,680	196	160
***UN7CN**	**14**	**172,800**	**287**	**225**
*UN4PD	"	46,996	138	124
		Lebanon		
***OD5YA**	**A**	**443,575**	**459**	**275**
***OD5PY**	**14**	**11,532**	**66**	**62**
***OD5ZF**	**7**	**1,154,320**	**541**	**376**
		Mongolia		
JU1DX	**14**	**43,307**	**144**	**127**
				(OP: JT1BV)
***JT5DX**	**A**	**960,696**	**724**	**396**
				(OP: JT1CO)
*JT1BZ	"	20,240	104	92
		Oman		
A42K	**7**	**253,460**	**244**	**190**
				(OP: A41CK)
		Qatar		
***A71MM**	**21**	**149,205**	**267**	**203**
				(OP: A71AE)
		Republic of Korea		
HL2CFY	**A**	**100,380**	**216**	**140**
HL4CEL	"	20,424	120	74
***HL1VAU**	**A**	**20,592**	**98**	**72**
*HL5JCB	"	18,432	85	72
***D9ØM**	**7**	**93,440**	**170**	**128**
				(OP: HL3AMO)
*DS5DNO	"	4,356	34	33
*HL2KV	"	2,592	27	24
*DS1TRU	"	1,408	18	16
		Saudi Arabia		
***HZ1TT**	**A**	**1,237,575**	**703**	**435**
***HZ7C**	**7**	**382,360**	**285**	**242**
				(OP: 7Z1SJ)
		Singapore		
9V1YC	**A**	**50,730**	**153**	**114**
		Taiwan		
BV2LA	**A**	**312,095**	**398**	**241**
BV4VQ	"	4,914	64	39
***BV3UF**	**A**	**4,070**	**52**	**37**
*BU2BE	"	2,970	32	27
		Thailand		
HS6VW	**A**	**11,122**	**72**	**67**
E25KAE	**21**	**192,395**	**325**	**239**
E2ØXMG	"	68,700	189	150
HS3NBR	**14**	**8,150**	**67**	**50**
E2A	**7**	**295,260**	**291**	**210**
				(OP: E21EIC)
***E29TGW**	**A**	**244,737**	**318**	**213**
*HS4MLV	"	4,526	48	31
***HS5ZLD**	**21**	**2,015**	**32**	**31**
***E21YDP**	**14**	**163,520**	**291**	**224**
*E24OYI	"	20,202	132	78
		United Arab Emirates		
A65DR	**A**	**1,694,952**	**985**	**456**
				(OP: G7SLP)
A61QQ	"	1,666,332	996	444
		West Malaysia		
***9M2TDX**	**A**	**170,918**	**332**	**187**
*9M2TO	"	29,799	109	77
*9M2SAF	"	22,592	104	64
***9W2VIR**	**7**	**4,884**	**50**	**22**

EUROPE

		Aland Islands		
OGØR	**A**	**3,337,460**	**1396**	**769**
				(OP: OH2PM)
		Austria		
OE2LCM	**A**	**449,228**	**493**	**326**
OE6MMD	"	354,312	366	252
OE5TXF	**3.5**	**1,290,264**	**724**	**444**
				(OP: G3TXF)
***OE2E**	**A**	**1,637,368**	**959**	**472**
				(OP: OE2GEN)
*OE1CIW	"	267,032	327	232
*OE9MDV	"	215,332	292	202
*OE1TKW	"	53,926	138	118
*OE6STD	"	25,696	95	88
***OE4NAU**	**14**	**1,276**	**30**	**29**
***OE5FDM**	**3.5**	**8,550**	**48**	**45**
		Balearic Islands		
EC6DX	**A**	**404,340**	**421**	**276**
***EA6ZS**	**A**	**21,384**	**99**	**88**
		Belarus		
EV1R	**A**	**3,233,835**	**1338**	**695**
EW8DX	"	1,128,160	856	440
EW8OM	"	493,614	509	297
EW8Z	"	137,280	229	165
EU1DX	**14**	**184,747**	**321**	**239**
***EW6DM**	**A**	**744,640**	**643**	**358**
*EW1OK	"	201,720	283	205
*EW1NM	"	192,907	261	209
*EW4R	"	116,688	190	156
*EU1ST	"	115,128	210	164
*EU1FQ	"	39,800	118	100
*EU8RO	"	36,084	110	93
***EU8F**	**7**	**120,280**	**197**	**155**
***EU8A**	**3.5**	**269,438**	**299**	**241**
		Belgium		
ON4CT	**A**	**1,210,880**	**770**	**440**
OR3A	"	742,616	547	356
				(OP: ON6CC)
ON7ET	"	296,208	320	242
ON4ACW	"	61,965	155	135
ON4VT	**21**	**44,250**	**150**	**125**
ON6NL	**14**	**737,070**	**667**	**474**
OQ5M	"	29,680	119	106
				(OP: ON5ZO)
***ON5GQ**	**A**	**2,485,596**	**1258**	**618**
*ON3LX	"	955,668	722	372
*OQ4U	"	789,243	614	413
*ON5SV	"	592,280	523	335
*ON6AT	"	501,811	447	317
*ON3UN	"	401,200	408	272
*ON5AM	"	320,606	430	286
*OP4A	"	318,372	356	258
*ON6OM	"	149,665	255	185
*ON3EA	"	91,500	222	183
*ON5SWA	"	85,345	215	169
*ON3AR	"	67,072	160	128
*ON7KEC	"	60,150	166	150
*ON6PH	"	47,196	123	108
*ON7BT	"	31,262	108	98
*OT1V	"	23,562	82	77
				(OP: ON8VM)
*ON6FC	"	20,553	105	93
*ON2AD	"	10,502	67	59
***OQ4B**	**14**	**309,618**	**419**	**309**
				(OP: ON4BHQ)
*OT5Q	"	143,412	281	228
*OPØJ	"	110,898	243	202
				(OP: ON5GF)
*ON1DX	"	82,536	208	181
*ON4LY	"	18,816	99	96
***ON4CBA**	**7**	**129,600**	**208**	**162**
*ON5KDX	"	31,494	99	87
*ON4AXU	"	16,936	62	58
*ON5IA	"	784	14	14
		Bosnia-Herzegovina		
E77DX	**A**	**733,040**	**495**	**385**
E72U	"	240,672	282	218
***E78T**	**A**	**592,696**	**527**	**328**
*E77D	"	249,312	326	224
*E73FDE	"	31,951	103	89
				(OP: E77AR)
***E73KM**	**21**	**7,672**	**63**	**56**
***E73AA**	**7**	**1,041,964**	**674**	**398**
*E74HJ	"	79,086	179	147
*E7ØA	"	42,224	114	91
***E77EA**	**3.5**	**573,992**	**472**	**314**
*E79SL	"	376,232	377	262
				(OP: E79LS)
*E78CB	"	105,184	179	152
		Bulgaria		
LZ8E	**A**	**2,028,048**	**983**	**552**
				(OP: LZ2BE)
LZ1KDP	"	563,094	549	327
				(OP: LZ3GU)
LZ4AE	"	38,232	126	108
LZ1ZM	**14**	**1,491,348**	**1054**	**633**
LZ5K	**7**	**1,118,742**	**656**	**411**
LZ2ZG	"	86,944	149	143
LZ33E	**3.5**	**800,982**	**581**	**351**
				(OP: LZ5XQ)
LZ6Y	"	590,318	492	313
				(OP: LZ1KU)
LZ1QZ	"	55,944	128	111
***LZ1QV**	**A**	**695,862**	**523**	**402**
*LZ2ZY	"	492,804	512	338
*LZ1G	"	172,572	254	197
				(OP: LZ5RG)
*LZ1GE	"	22,484	84	73
***LZ5DD**	**21**	**5,808**	**58**	**48**
***LZ2JA**	**14**	**627,300**	**692**	**410**
***LZ1MC**	**7**	**64,856**	**131**	**121**
*LZ2YO	"	62,100	141	115
		Crete		
SV9COL	**21**	**133,136**	**303**	**212**
SV9FBG	**14**	**112,200**	**288**	**204**
***SV9RNG**	**A**	**189,750**	**356**	**230**
*SV9FBK	"	88,505	169	155
*SV9MBH	"	52,320	143	120
*SV9FBP	"	52,272	169	144
		Croatia		
9A2U	**A**	**3,293,739**	**1305**	**719**
				(OP: 9A2ZI)
9A7R	"	2,441,880	1128	612
9A1CCY	**21**	**281,820**	**384**	**308**
				(OP: 9A7DX)
9A2NO	**14**	**116,963**	**240**	**217**
9A4W	"	17,181	99	83
9A5W	**7**	**6,730,556**	**1617**	**887**
9A9A	**3.5**	**2,575,210**	**1104**	**571**
9A5X	"	2,537,740	1074	569
9A5Y	"	2,166,112	995	533
				(OP: 9A3LG)
***9A7Y**	**A**	**259,408**	**314**	**248**
*9A5CC	"	90,770	179	145
*9A1DR	"	61,122	152	122
*9A3AAW	"	29,568	99	88
*9A2EU	"	20,736	67	64
*9A5ISS	"	10,692	76	66
***9A8A**	**28**	**48**	**5**	**4**
***9A6KZH**	**14**	**256,054**	**394**	**289**
***9A4R**	**7**	**700,700**	**507**	**350**
***9A6A**	**3.5**	**1,256,520**	**737**	**444**
*9A7T	"	732,864	552	347
				(OP: 9A5MR)
*9A1AD	"	394,000	403	250
*9A9TT	"	219,072	283	224
*9A1CBM	"	51,528	123	114
				(OP: 9A5ST)
		Czech Republic		
OK1FRD	**A**	**1,353,996**	**885**	**486**
OK2EA	"	1,237,650	771	446
OK1DBE	"	835,380	622	390
OK3X	"	628,320	532	357
				(OP: OK1VK)
OK6DJ	"	420,849	428	297
OK1PI	"	153,062	250	203
OK1EP	"	94,872	179	177
OK1A	"	90,720	170	135
OK5SWL	"	1,292	19	19
				(OP: OK2SWD)
OK1XC	**21**	**39,648**	**136**	**112**
OK6CX	**14**	**92,920**	**220**	**184**
OK1FPS	**7**	**111,438**	**178**	**151**
OL7P	**3.5**	**987,976**	**622**	**412**
				(OP: OK1CRM)
***OK4GP**	**A**	**1,553,955**	**778**	**507**
*OK2VV	"	1,220,259	826	411
*OK2CLW	"	975,390	637	410
*OK2LC	"	725,036	589	382
*OK5TX	"	616,607	504	323
*OK1PMA	"	584,518	518	326
*OK1ULL	"	523,584	496	324
*OK1SI	"	510,570	466	310
*OK1HEH	"	486,432	471	288
*OK2PF	"	384,552	414	294
*OK1MDK	"	384,252	418	284
*OK1PX	"	325,221	356	269
*OK1BR	"	318,114	362	258
*OK5NW	"	270,556	332	242
*OK2VIR	"	211,582	270	238
*OK2APY	"	164,424	251	186
*OK7N	"	144,624	247	184
*OK2WMC	"	132,126	231	183
*OK1MGA	"	125,071	224	181
*OK4RQ	"	112,365	204	165
*OK1SLA	"	106,920	199	162
*OK1BJ	"	79,328	171	148
*OK1AUO	"	59,860	176	146
*OL8M	"	30,510	98	90
*OK5OK	"	26,486	97	82
*OK1FAK	"	1,365	24	21
***OK7KW**	**14**	**85,100**	**215**	**185**
*OK2DIK	"	23,500	108	100
***OK2RU**	**7**	**1,358,204**	**718**	**457**
*OK2PDM	"	337,698	322	257
*OK2BXW	"	7,392	43	42
*OK1AY	"	2,070	23	23
***OK2HBR**	**3.5**	**570,960**	**489**	**305**
*OK1HMP	"	549,640	480	302
*OK1BOA	"	442,494	416	279
*OK1CT	"	80,668	164	134
*OK1XBF	"	54,466	138	113
		Denmark		
OZ9GA	**A**	**2,076,515**	**1113**	**553**
5Q2J	"	829,925	631	373
OZ3ØEU	"	641,485	503	355
OZ1LFI	"	64,468	172	142
OZ1AXG	"	13,696	68	64
OZ1ADL	**21**	**13,396**	**79**	**68**
OZ11A	*7*	*1,264,356*	*772*	*414*
OZ7DK	**"**	**226,008**	**256**	**219**
***OZ1DAE**	**A**	**202,464**	**284**	**222**
*OZ6AGX	"	176,778	283	207
*OZ1QX	"	105,600	192	150
*OZ1AOO	"	12,369	62	57
***OZØJD**	**7**	**509,894**	**466**	**301**
*OZ1JVX	"	6,142	42	37
		England		
M7T	**A**	**3,192,045**	**1377**	**723**
				(OP: G3YYD)
GØDWV	"	2,672,080	1235	635

M2G	"	744,136	630	382
			(OP: G4RCG)	
GØHDV	"	699,315	592	345
GX5EA	"	242,634	330	218
			(OP: M1DDD)	
G1SCT	"	233,682	316	237
G3PXT	"	121,935	212	165
M1X	"	115,821	208	153
			(OP: GØCKP)	
G3SVD	"	53,200	158	140
M2D	"	41,638	118	109
			(OP: G4NVR)	
M2L	**21**	**67,650**	**198**	**165**
M2E	**7**	**443,608**	**412**	**284**
			(OP: GØRPM)	
GX4GA	"	39,104	102	94
			(OP: G4IRN)	
***M3AWD**	**A**	**1,620,810**	**901**	**522**
*M2J	"	1,354,560	803	480
			(OP: G4NBS)	
*MØHMO	"	1,054,872	704	414
*M3ECT	"	678,712	612	344
*GØFGI	"	589,164	508	348
*2EØYAO	"	580,800	490	363
*G4OZG	"	522,203	516	319
*MØBLF	"	521,554	497	314
*GØC	"	477,700	512	340
			(OP: GØCER)	
*G2L	"	293,571	365	249
			(OP: G4LOO)	
*G2U	"	267,776	343	256
			(OP: GØUGO)	
*G4DDL	"	253,700	348	236
*M1G	"	248,292	331	242
*G1JCC	"	195,125	291	223
*G9F	"	161,874	261	207
			(OP: G4BVY)	
*2EØCVN	"	150,220	292	203
*MØTKM	"	120,925	222	175
*G4ELZ	"	106,053	201	159
*G4JBA	"	104,280	213	165
*MØTQR	"	98,820	217	180
*G4IDF	"	94,122	182	162
*MØVQP	"	56,280	150	120
*MØRPK	"	51,754	129	113
*MØCGF	"	47,170	129	106
*M3R	"	41,612	139	103
			(OP: G3RTU)	
*G6GLP	"	41,006	120	101
*G7H	"	40,582	131	103
			(OP: G7SYW)	
*G4BHT	"	33,550	136	122
*G3KNU	"	28,662	109	102
*G4RRM	"	27,753	96	87
*G7HYS	"	26,565	96	77
*G8AFN	"	25,571	98	91
*M3X	"	22,568	99	91
			(OP: MØIHT)	
*G7RTI	"	19,950	84	75
*G8HXE	"	17,600	84	80
*MØCAR	"	13,054	70	61
*G3MXH	"	12,400	65	62
*2EØOBO	"	9,006	64	57
*GØMDR	"	7,102	57	53
*MØNMA	"	3,689	33	31
*G4AWP	"	2,275	37	35
*G6AD	"	1,672	22	22
*G7WHI	"	144	6	6
***MØXAR**	**21**	**4,664**	**45**	**44**
*G1RVD	"	697	17	17
***GØSNG**	**14**	**27,108**	**117**	**108**
*G8PGO	"	22,365	119	105
*G4WGE	"	2,844	37	36
*G4NXG/M	"	1,320	24	24
***G4DBW**	**7**	**723,282**	**494**	**357**
*G1N	"	358,258	381	257
			(OP: GØURR)	
*G4ZOB	"	326,592	318	252
*G4N	"	321,100	334	247
			(OP: G4ZVB)	
*MØUNI	"	252,636	267	222
*G1P	"	26,600	89	76
			(OP: MØIEP)	
***G6N**	**3.5**	**217,568**	**276**	**208**
			(OP: GØGDU)	
*M5BIR	"	216,678	288	201
*G4DZL	"	69,940	151	130

Estonia

ES4RD	**A**	**816,080**	**702**	**404**
***ES1BH**	**A**	**56,712**	**163**	**136**

European Russia
District 1

RV1CC	**A**	**16,458**	**82**	**78**
***RA1ALC**	**A**	**722,425**	**668**	**355**
*RX1AG	"	169,126	278	206
*RL1F	"	100,050	225	174
*RN1AO	"	52,632	164	129
*RK1NA	"	32,928	132	112
*RO1M	"	3,636	38	36
***RZ1ZZ**	**14**	**190,451**	**359**	**289**
*R1YY	"	6,944	68	62

District 3

RM3DA	**A**	**2,839,680**	**1437**	**612**
R5AJ	"	2,232,616	1187	596
RC5Z	"	1,887,690	1152	534
RQ3M	"	417,639	451	323
RG2A	"	380,575	455	325
RY5A	"	184,617	287	219
			(OP: RK3TD)	
RV3TG	"	178,295	292	211
RA3NC	"	117,260	223	164
RA3TT	"	92,421	227	189
RT5C	"	30,272	98	86
R5AK	"	21,021	93	91
R3TE	**14**	**296,092**	**473**	**316**
RK3TT	"	155,652	318	238
R3KM	**7**	**294,056**	**294**	**236**
***RN5AA**	**A**	**841,923**	**753**	**417**
*RU5X	"	445,200	491	300
*RZ3AV	"	294,742	394	259
*RU3OZ	"	258,332	340	262
*RX3Z	"	227,480	336	235
*UA3LID	"	210,370	300	218
*R2UZ	"	200,868	313	228
*RC2MT	"	136,224	229	176
*UB5MBA	"	133,190	267	190
*RT2H	"	131,928	231	184
*RK3DSW	"	121,342	242	169
*RK2M	"	92,588	207	158
*RN3OG	"	85,824	206	149
R3WA	*"*	*66,171*	*176*	*137*
*R3GZ	"	55,752	162	138
*RA3Y	"	49,788	135	108
*RA3V	"	45,513	149	117
*R3OR	"	44,109	153	117
*RX3VF	"	42,262	141	113
*R2YES	"	23,463	93	79
*UA3NFG	"	15,089	94	79
*RX3MM	"	10,368	72	64
*UA3MKI	"	9,240	63	56
*R3EK	"	8,487	77	69
*UB3SAR	"	6,642	45	41
*RA3FD	"	928	17	16
***R3LC**	**21**	**13,845**	**88**	**71**
***R5ACQ**	**14**	**246,210**	**408**	**290**
*RA3TE	"	79,920	224	185
*UA3XO	"	29,155	132	119
*UA3IHJ	"	15,120	85	80
*RJ3F	"	7,380	67	60
*RM3F	"	5,184	49	48
			(OP: UA3DPX)	
***UA3PI**	**7**	**465,850**	**446**	**275**
*R2AGS	"	22,650	81	75
***UF5A**	**3.5**	**422,820**	**391**	**290**
*R2AL	"	20,064	90	76

District 4

UA4S	**A**	**2,190,509**	**1246**	**541**
			(OP: R4SAD)	
RG4A	"	1,001,000	827	440
RD4A	"	394,155	417	285
UA4CC	"	307,450	416	275
RA4HL	"	121,485	258	195
R4CI	"	91,960	203	152
RA4ZA	"	85,305	195	141
UD4F	**14**	**1,847,296**	**1169**	**704**
RA4WE	"	196,393	346	277
***RW4W**	**A**	**477,648**	**496**	**372**
*R4OF	"	324,198	8443	279
*RU4LM	"	282,864	394	284
*RZ4AZ	"	243,000	392	250
*UA4FX	"	229,600	340	224
*UC4I	"	178,965	290	205
*RA4L	"	107,937	244	179
*RA4AG	"	95,625	228	153
*RA4CL	"	90,117	211	153
*R4RB	"	80,597	234	187
*R4FCJ	"	79,218	212	163
*R4LZ	"	38,627	120	107
*R4WT	"	27,872	117	104
*RK4NB	"	21,484	97	82
*UA4WJ	"	20,935	90	79
*UI4F	"	6,608	64	56
*R4AJ	"	336	13	12
***RW4M**	**21**	**2,117**	**30**	**29**
***RT4W**	**14**	**429,660**	**561**	**372**
*RU4SS	"	78,540	205	187
*R41WCMB	"	71,344	212	182
				(OP: RL1I)
*UA4SJO	"	60,555	194	165
*RU4PH	"	31,970	126	115
***RA4FUN**	**7**	**1,133,160**	**656**	**420**

District 6

R7CD	**A**	**1,842,834**	**1122**	**534**
RU6MO	"	46,116	131	108
RK6C	"	12,090	71	62
RU6YJ	**21**	**39,474**	**152**	**129**
UA6CE	**14**	**648,356**	**668**	**449**
UC6N	"	620,436	649	447
RC7A	"	113,594	285	221
R7RF	**7**	**347,652**	**328**	**261**
***R7MM**	**A**	**1,647,680**	**1045**	**542**
*RT6DI	"	548,800	593	343
*RK6ART	"	355,500	477	300
*R6KX	"	326,190	386	262
*R7RIB	"	238,480	318	220
*R6CW	"	219,876	308	219
*UB7K	"	184,324	278	203
*R7BN	"	139,472	257	184
*RA6GW	"	51,750	145	125
*R7NA	"	51,528	134	114
*RV6ADY	"	25,645	122	115
*R6LAQ	"	4,048	44	44
*R6KEE	"	286	11	11
***RQ7R**	**21**	**72,842**	**214**	**154**
*R7CT	"	984	28	24
***R6DNK**	**14**	**266,114**	**435**	**298**
*RA6LIS	"	201,761	389	259
*RU6YK	"	149,520	299	240
*R7MT	"	110,656	248	208
*RY6AAG	"	51,450	175	147
***R7LY**	**7**	**118,678**	**219**	**173**
*RJ7M	"	48,972	121	106
*R7RBE	"	35,376	101	88
***RA6C**	**3.5**	**259,910**	**317**	**235**

District 9

***RA9XSL**	**A**	**17,298**	**97**	**93**
***RA9FEL**	**21**	**18,183**	**103**	**87**
***R8XF**	**14**	**354,816**	**502**	**336**

European Turkey

TA1CQ	**7**	**246,672**	**294**	**216**
***TA1BX**	**A**	**17,100**	**111**	**95**
*TA1NCT	"	11,342	55	53

Fed. Rep. of Germany

DM7XX	**A**	**3,390,524**	**1334**	**778**
DK7A	"	3,378,749	1193	751
			(OP: DJ8VH)	
DQ9Y	"	3,246,264	1226	756
			(OP: DF2SD)	
DP6K	"	2,905,084	1222	694
			(OP: DJ3NG)	
DM5TI	"	2,475,770	1179	634
DLØHMK	"	2,289,790	1122	590
			(OP: DF2HN)	
DJ5MW	"	2,254,397	1027	641
DL5JS	"	2,085,825	957	609
DL6JZ	"	2,028,257	1089	583
DHØGHU	"	2,021,355	909	621
DFØGDX	"	1,734,690	965	530
			(OP: DL6DH)	
DC6O	"	1,713,474	870	567
			(OP: DL3DW)	
DJ9DZ	"	1,547,034	945	493
DL1QW	"	1,489,425	864	525
DL7ØTRS	"	1,418,319	870	479
			(OP: DJ8QP)	
DH8BQA	"	1,300,168	760	491
DL7VOG	"	1,272,525	839	475
DF8QB	"	1,271,398	788	463
DF3VM	"	1,268,982	704	493
DQØY	"	1,256,112	792	488
			(OP: DF2RG)	
DJ9RR	"	1,248,015	697	551
DK4VW	"	1,235,160	813	470
DL6NCY	"	1,155,076	796	458
DR1X	"	1,035,984	655	382
DD5A	"	1,022,868	708	451
			(OP: DK3RA)	
DJ5IW	"	995,128	665	424
DJ8EW	"	989,712	688	432
DL5YM	"	911,465	727	433
DL4ZA	"	848,000	669	400
DL3LJ	"	776,260	599	370
DF6QV	"	689,928	527	356
DD5ZZ	"	649,985	531	343
DL1EKO	"	614,328	550	358
DP5L	"	612,744	467	363
			(OP: DH1TST)	
DF4XX	"	599,148	525	374
DL1PSK	"	570,700	535	325
DF1LX	"	517,128	408	348
DK6CQ	"	505,500	487	337
DK2AT	"	502,106	489	319
DGØCH	"	491,069	481	311
DG7NFX	"	417,088	424	304
DJ9KM	"	398,567	431	299
DM6DX	"	390,978	377	321
DL6KVA	"	382,778	418	274
DJ1XT	"	373,644	422	291
DL9MKN	"	359,268	401	273
DL1RTL	"	311,373	336	261
DF5BX	"	296,140	359	260
DK6WL	"	280,756	328	271
DH6BH	"	249,561	310	237
DJ6TB	"	208,440	294	216
DK8ZZ	"	208,069	289	233
DL1STG	"	200,256	272	224
DK2CC	"	185,300	292	218
DK3GI	"	181,896	267	212
DL6TK	"	179,961	284	223
DK5MB	"	179,140	250	212
DG9BEO	"	169,041	266	201
DK1AX	"	148,800	245	200
DK6IM	"	142,560	258	160
DG3FK	"	138,226	248	206
DL7URH	"	134,850	212	174
DH6DAO	"	132,678	214	189
DQ6Q	"	112,660	204	172
DK5KK	"	83,657	157	133
DF8V	"	81,169	183	157
			(OP: DF8VO)	
DF8JK	"	64,528	179	148
DK9HN	"	55,968	159	132
DL7CX	"	53,110	143	113
DJ9HX	"	51,500	143	125
DL6OCM	"	51,094	135	118
DL2OE	"	48,708	130	123
DL1NEO	"	48,384	121	108
DF2LH	"	23,384	85	79
DJ6TF	"	11,424	60	51
DJ5CT	"	3,042	43	39
DF6QE	"	2,821	35	31
DKØIU	"	901	17	17
			(OP: DJ4KW)	
DQ2C	**21**	**33,088**	**125**	**94**
			(OP: DL2SAX)	
DL1DTL	**14**	**237,412**	**384**	**278**
DR165TESLA	"	46,530	159	141
DL4HCF	"	37,211	149	127

DL4JLM	"	24,310	106	85
DL1LQL	"	19,260	102	90
DK3AX	"	11,256	79	67
DL4ME	**7**	**888,000**	**551**	**400**
DAØDX	"	476,982	427	297
			(OP: DL2DCX)	
DF1LON	"	340,200	324	270
DF7AP	"	254,250	268	225
DL2AK	"	210,144	279	199
DJ5TT	"	201,760	238	208
DJ7TO	"	107,260	167	155
DK1WU	"	87,406	169	137
DL4ABR	"	49,504	122	104
DL7LX	"	1,406	19	19
DL3BQA	**3.5**	**1,594,140**	**884**	**489**
DF1MM	"	1,331,040	770	470
***DL9YAJ**	**A**	**1,874,727**	**852**	**603**
*DK1KC	"	1,089,004	754	437
*DL1MGB	"	1,051,520	687	424
*DK8NT	"	988,388	713	412
*DK2OY	"	987,648	731	384
*DL3SYA	"	978,670	755	385
*DJ2AX	"	891,636	704	402
*DK5DQ	"	863,328	648	391
*DA3T	"	767,136	632	366
			(OP: DL8DXL)	
*DD5M	"	731,445	589	363
			(OP: DJØZY)	
*DF4ZL	"	626,400	537	348
*DL4VDA	"	609,102	565	342
*DL6RDR	"	562,740	514	332
*DL1DWR	"	527,752	514	328
*DL73TXL	"	507,680	501	304
			(OP: DL7YS)	
*DJ9MH	"	501,952	469	352
*DD7UW	"	489,720	482	318
*DL1ZBO	"	482,700	493	300
*DM3M	"	472,320	461	320
			(OP: DM3XRF)	
*DG2BWG	"	469,798	487	322
*DL8TG	"	436,240	446	304
*DL9NDV	"	403,488	420	288
*DL5ARM	"	334,626	390	258
*DFØBV	"	309,290	318	314
			(OP: DL1MAJ)	
*DM5JBN	"	301,570	383	265
*DK6OR	"	283,500	369	252
*DO3PKE	"	275,000	345	250
DL1EAL	*"*	*266,110*	*306*	*230*
*DM7W	"	260,064	290	288
			(OP: DL8MAS)	
*DL9YED	"	253,134	287	246
*DLØFTL	"	243,210	325	242
*DF1HPK	"	238,848	304	256
*DL3MXX	"	229,368	295	228
*DL7LE	"	229,360	325	244
*DL6SFR	"	226,319	293	227
*DL4VK	"	222,914	285	227
*DL4KW	"	222,666	305	222
*DF3IS	"	216,580	326	245
*DK2TG	"	208,250	314	250
*DM6EE	"	186,244	278	202
*DL9NCR	"	185,752	282	217
*DL2DIE	"	180,600	283	215
*DL2RUG	"	169,728	258	204
*DM2WB	"	166,518	251	198
*DH1OK	"	160,979	259	203
*DK2WU	"	159,804	238	193
*DL2KWA	"	152,076	256	174
*DK4IO	"	143,313	244	201
*DJ4WT	"	139,742	254	214
*DL2HYH	"	139,104	210	189
*DL6FCK	"	136,701	241	183
*DHØDX	"	135,880	244	172
			(OP: DK5TX)	
*DJ3GE	"	132,432	230	186
*DL2LDE	"	128,148	216	181
*DL2FQ	"	114,526	209	173
*DL7UGN	"	113,064	203	168
*DL3OH	"	111,606	212	178
*DL8DWL	"	111,360	198	160
*DL6EZ	"	107,870	218	161
*DKØKG	"	103,240	204	145
*DL5ANS	"	101,310	201	165
*DR7B	"	95,634	193	154
			(OP: DM5SB)	
*DL5ASK	"	95,151	203	161
*DR7T	"	94,214	171	163
			(OP: DF1DN)	
*DF9VN	"	90,592	180	149
*DL1EMA	"	88,452	187	156
*DJ1YFK	"	84,840	177	140
*DJ6TK	"	84,836	188	167
*DK9BM	"	84,303	205	171
*DL7ACN	"	79,104	183	128
*DL9GMC	"	65,278	165	127
*DL8ZAJ	"	62,832	163	132
*DL2LMS	"	61,701	148	131
*DL6DJ	"	60,382	157	133
*DF3EH	"	59,805	157	135
*DH6KM	"	59,478	168	138
*DL2GMK	"	58,370	146	130
*DJ3NJ	"	58,164	150	131
*DL7ALM	"	57,792	150	129
*DM5M	"	53,928	152	126
			(OP: DL5ZK)	
*DL1EHG	"	50,880	155	120
*DL4RDJ	"	48,768	142	127
*DM2DLG	"	47,792	140	116
*DG2MKR	"	47,538	170	139
*DB1KK	"	47,268	138	117
*DG4O	"	46,964	135	118
			(OP: DG2BPW)	
*DJ4WM	"	45,719	148	131
*DNØUKW	"	44,400	138	120
			(OP: DO9PL)	
*DL9ZWG	"	41,420	131	109
*DP4X	"	39,800	115	100
			(OP: DJ4MX)	
*DK3PM	"	39,211	113	113
*DL3FBB	"	38,728	117	103
*DF9XV	"	34,299	129	111
*DK4EF	"	33,027	115	101
*DF6JF	"	30,502	116	101
*DL9TU	"	28,888	109	92
*DK5WO	"	28,518	110	97
*DJ7JC	"	28,518	106	97
*DL5MHX	"	27,416	106	92
*DJ2FR	"	25,536	97	84
*DL1RPR	"	25,200	106	90
*DF2UA	"	24,070	96	83
*DB8AH	"	23,850	97	90
*DGØAM	"	20,148	106	92
*DK3WN	"	20,033	79	67
*DL1EJD	"	19,440	94	80
*DL3WM	"	16,940	99	77
*DF1HF	"	14,490	71	70
*DL6RBH	"	12,688	62	61
*DK9ZE	"	12,090	68	65
*DL4APJ	"	12,033	71	63
*DG4AM	"	11,685	61	57
*DJ6MK	"	11,375	69	65
*DL4LT	"	10,504	60	52
*DL5GAC	"	10,260	64	60
DL1JPF	*"*	*9,699*	*64*	*61*
*DM6CS	"	8,692	59	53
*DK2VM	"	8,096	52	46
*DL9FBF	"	7,050	52	50
*DG1CMZ	"	6,804	45	42
*DL9GMN	"	5,203	46	43
*DL1DQJ	"	3,696	35	33
*DH7TNO	"	3,045	30	29
*DL4AC	"	2,784	30	29
*DH2AAK	"	2,754	31	27
*DD5MA	"	2,250	26	25
*DL1STV	"	2,190	33	30
*DG8KAD	"	2,046	23	22
*DL1OAI	"	2,001	29	29
*DL4MFR	"	1,800	24	24
*DK2NVA	"	1,450	25	25
*DO2NH	"	1,260	18	18
*DK2BK	"	1,156	18	17
*DG9AK	"	837	31	31
DJ2IA	*"*	*432*	*13*	*12*
*DL9MEU	"	330	11	10
*DK4YB	"	285	15	15
***DJ9KH**	**21**	**15,552**	**91**	**81**
***DH7SA**	**14**	**206,773**	**338**	**271**
*DL3KVR	"	162,316	317	238
*DJ7UC	"	133,964	282	214
*DR6K	"	78,088	215	172
			(OP: DF6RK)	
*DF4WC	"	63,344	179	148
*DL1AKL	"	43,344	169	129
*DL3MB	"	21,266	110	98
*DK1YH	"	7,336	61	56
***DK9IP**	**7**	**2,062,590**	**815**	**591**
*DL2NBU	"	730,730	486	385
*DL5KUD	"	563,736	443	332
*DL8ZU	"	227,696	268	214
*DF7XH	"	196,400	257	200
*DJ5BK	"	95,432	173	151
*DL/LY3IV	"	54,450	144	121
*DJ2GMS	"	47,520	117	110
*DLØLA	"	47,328	113	102
			(OP: DL5RMH)	
*DM7CW	"	14,868	62	59
*DL2ZA	"	11,322	58	51
*DL5RMH	"	7,920	48	45
*DL9HK	"	4,824	36	36
*DK5TX	"	56	4	4
***DJ3WE**	**3.5**	**174,066**	**255**	**201**
*DO6BE	"	142,484	242	179
*DO4FZ	"	22,704	97	88

Finland

OG4W	**A**	**2,339,940**	**1203**	**590**
			(OP: OH4KZM)	
OH1F	"	2,257,163	1230	571
			(OP: OH1TM)	
OH3OJ	"	1,943,776	1123	556
OH2T	"	1,555,995	981	511
			(OP: OH2KW)	
OG7A	"	546,453	531	333
			(OP: OH6MW)	
OH1X	"	481,395	502	335
			(OP: OH3WW)	
OH7KBF	"	398,160	500	315
OG4X	"	147,680	308	208
			(OP: OH1MA)	
OH2GEK	"	86,688	198	144
OH6XY	"	66,138	194	146
OH1XX	"	15,844	70	68
OH3CV	"	15,189	87	83
OH6BA	"	11,275	61	55
OH5VT	**3.5**	**134,862**	**204**	**169**
***OG95AA**	**A**	**806,344**	**675**	**392**
			(OP: OH8KVY)	
*OG8T	"	668,724	583	399
			(OP: OH8TV)	
*OH2HOD	"	322,560	431	288
*OH2LZI	"	252,187	368	247
*OH2LU	"	245,271	316	247
*OH5C	"	101,200	217	176
			(OP: OH5CW)	
*OH2BP	"	18,286	96	82
			(OP: EA8DED)	
*OH2MAS	"	16,215	76	69
***OG16M**	**14**	**246,477**	**420**	**291**
***OH4MFA**	**7**	**130,808**	**207**	**166**
*OH5UQ	"	18,620	76	70

France

F5OAM	**A**	**836,380**	**639**	**380**
F1RHS	"	647,136	588	378
F8TRT	"	498,344	426	308
F4HRM	"	295,631	363	269
F5JY	"	272,356	367	284
F4FLF	"	116,708	190	163
F5MMB	"	81,180	188	164
F6BEE	"	68,663	151	119
F5PHW	"	49,680	125	108
F4GPB	"	42,612	113	106
F6ITD	"	1,716	28	26
F5SDD	**7**	**445,356**	**393**	**278**
TM9Z	"	268,416	296	233
			(OP: F4HJO)	
F5NBX	"	3,876	35	34
TM5T	**3.5**	**165,540**	**245**	**178**
			(OP: F5VKT)	
***TM3Z**	**A**	**6,977,412**	**2102**	**877**
			(OP: F4DSK)	
*F4EGA	"	1,428,072	897	471
*F4FHV	"	687,439	555	373
*F6EQZ	"	536,877	473	319
*TM1CCA	"	443,664	413	316
*F6GCI	"	326,274	398	282
*F4GYM	"	322,025	374	275
*F6BQG	"	238,602	328	247
*F5OYC	"	222,000	309	222
*F4ERS	"	215,696	303	221
*F/DJ4MZ	"	191,836	258	199
*F4FCE	"	179,280	279	216
*F1IWH	"	172,572	264	197
*F6IRA	"	152,640	234	180
*F4CZV	"	129,492	234	198
*F5TLZ	"	106,406	203	166
*F4FRC	"	101,135	218	179
*F8CPA	"	61,250	155	125
*F6EWX	"	61,204	157	143
*F5FDC	"	59,976	175	147
*F1IEH	"	52,896	171	152
*F5ITN	"	43,896	143	124
*F4BPJ	"	29,280	104	96
*F6FLU	"	19,068	90	84
*F5TYY	"	9,869	73	71
*F5NTG	"	6,424	46	44
***F1DHX**	**14**	**593,736**	**630**	**429**
*F8PMO	"	16,560	92	90
***F6KNB**	**7**	**136,776**	**202**	**164**
			(OP: F4DVX)	
*F4IRV	"	117,096	191	164
*F1IKA	"	108,116	174	151
*F4DVX	"	51,400	116	100
			(OP: @F6KNB)	
*F1HMR	"	48,618	124	111
*F4HWS	"	47,880	107	105
*F1MKC	"	45,800	120	100
*F5VHQ	"	42,924	103	98
*F4DZR	"	950	19	19
***F1AKK**	**3.5**	**1,039,008**	**625**	**411**
*TM6M	"	16,080	70	60
			(OP: F8DBF)	
*F8FTY	"	132	6	6

Greece

SV2BXA	**A**	**3,215,355**	**1240**	**715**
SV1RK	"	460,831	423	301
SV2KF	"	199,288	321	232
SV1ABB	"	167,624	237	184
SV1ELF	**21**	**34,983**	**148**	**117**
SZ1A	**14**	**741,936**	**722**	**492**
			(OP: SV1CIB)	
SV3EXU	"	277,631	441	313
***SV8DCY**	**A**	**458,800**	**492**	**296**
SV1CDN	*"*	*110,322*	*208*	*162*
*SV1JFL	"	86,240	245	154
*SV7CUD	"	63,196	151	122
*SV3/SV1NN	"	51,186	144	114
*SV3FUP	"	48,195	158	135
*SV1PMQ	"	21,840	95	78
*SV1MO	"	10,528	62	56
*SV1CEI	"	5,043	42	41
*SV1DOO	"	4,988	51	43
***SX2ØØCLJ**	**21**	**14,490**	**98**	**69**
			(OP: SV2CLJ)	
***SV1JG**	**14**	**539,643**	**650**	**411**
*SV3SKM	"	149,850	333	222
*SV8PMM	"	18,879	102	93
***SV3IBP**	**3.5**	**21,714**	**94**	**77**

Guernsey

***GUØSUP**	**A**	**693,427**	**546**	**413**
*2UØWZY	"	50,220	129	108

Hungary

HG8R	**A**	**6,041,518**	**1876**	**878**
			(OP: HA8JV)	
HAØHW	"	197,094	275	214
HA2VR	"	43,430	114	101
HA1TJ	**21**	**232,290**	**356**	**267**
HG1S	**14**	**2,289,492**	**1201**	**783**
			(OP: HA1DAE)	
HG5D	"	1,853,326	1079	709
			(OP: HA8QZ)	
HA1AD	"	416,059	501	343
HA8BT	**7**	**1,766,688**	**769**	**528**
HG2DX	"	789,828	512	366

HA8BE	**3.5**	**1,223,772**	**703**	**438**
***HA6NL**	**A**	**1,054,440**	**721**	**435**
*HA3OU	"	982,206	642	423
*HA4FB	"	863,075	690	395
*HG8C	"	625,240	555	385
*HA7MB	"	293,914	343	223
*HG83BTND	"	193,116	263	209
			(OP: HA5GY)	
*HA9RC	"	156,625	223	179
*HA3FUP	"	672	16	16
***HAØMS**	**14**	**73,788**	**200**	**172**
*HA8BQ	"	44,200	154	136
***HA5BSW**	**7**	**829,922**	**599**	**349**
*HA1TIB	"	419,520	395	276
*HA1TV	"	211,576	256	212
*HA9MDN	"	62,540	133	118
*HA1WD	"	41,552	106	98
***HA8WY**	**3.5**	**830,126**	**528**	**389**
		Iceland		
TF1AM	**A**	**2,454,952**	**1357**	**589**
TF3AO	**14**	**238,209**	**392**	**293**
***TF2MSN**	**A**	**64,824**	**177**	**148**
*TF3VE	"	4,838	94	82
		Ireland		
EI6HB	**A**	**211,176**	**337**	**252**
EI8IU	**21**	**48,512**	**180**	**128**
***EI4GAB**	**A**	**95,956**	**203**	**149**
*EI9ES	"	64,960	154	116
*EI5KO	"	36,108	115	102
*EI8FH	"	2,448	34	34
***EI3CTB**	**3.5**	**2,576**	**29**	**28**
		Italy		
IZ8CCW	**A**	**2,594,108**	**1313**	**638**
IØWBX	"	2,116,128	1157	564
IX1CLD	"	1,908,382	1031	503
IZ2FOS	"	1,321,155	792	495
IK4ZHH	"	1,296,486	736	477
I1JTQ	"	1,218,870	782	467
IK5FKE	"	838,228	621	367
I2DJX	"	817,740	618	420
IK5FKF	"	807,828	638	413
IK4MTK	"	798,380	596	382
I2SVA	"	723,430	582	365
I1NVU	"	609,588	518	354
IK2SND	*"*	*590,640*	*533*	*368*
IZ2ZQP	"	545,464	480	328
IZ2BVC	"	520,326	530	274
IV3DXW	"	508,428	449	348
IK2OWX	"	367,164	350	252
IV3WMS	"	362,796	396	294
IK7NXU	"	339,300	353	300
IZ4FUE	"	307,710	382	263
I7CSB	"	307,440	384	280
IK8SVQ	"	306,579	395	273
IK2AHB	"	287,646	334	251
I2WIJ	"	283,696	325	238
IK5PWS	"	278,331	355	257
IU2IHM	"	271,904	309	232
IN3EQD	"	261,958	299	227
IZ3XEF	"	218,652	289	228
IW2NOO	"	210,790	298	214
IZ8DVD	"	207,675	269	213
I3VJW	"	186,244	247	202
IZ4UFB	"	176,180	291	230
IK4HPS	"	172,159	312	221
IU4CSS	"	147,553	267	197
IZ5FSA	"	123,264	235	192
IK2GZU	"	122,388	228	188
I3FIY	"	113,849	223	181
IV3RYP	"	83,352	158	138
IK2SAI	"	75,988	210	157
IZ2DLV	"	53,802	142	126
IR2D	"	39,751	163	127
I1WXY	"	39,424	131	112
IKØFUX	"	34,080	106	96
IZ1UKX	"	34,026	117	106
IZ4IRO	"	33,660	100	85
IV3BLE	"	27,729	99	79
IV3NVB	"	14,348	77	68
IK2QIN	"	12,474	58	54
IZ8HUW	"	11,730	80	69
IV3XPP	"	11,269	60	59
IZØIRH	"	2,976	31	31
IKØYUT	"	1,701	27	27
IZ8PUQ	"	50	5	5
IV3ZXQ	**28**	**60**	**6**	**5**
I3FGX	**21**	**75,048**	**197**	**159**
IK2TDM	**14**	**1,528,219**	**1001**	**623**
IZ7ECL	"	1,303,932	972	602
IV3JCC	"	941,091	734	529
IU4CHE	"	867,996	746	486
IZ4ZZB	"	323,172	446	282
IK2LOL	"	110,246	244	199
IZ3LUF	"	86,940	218	180
IZ7XUQ	"	50,912	166	148
IU3BTY	"	23,700	117	100
I5WNN	**7**	**891,624**	**598**	**388**
IZ8GUQ	"	799,612	566	374
IV3DMJ	"	291,746	309	229
IKØLNN	"	217,360	250	190
IZ2GNQ	"	202,078	256	191
IZ2DII	"	32,088	97	84
IZ5EME	"	24,804	80	78
IKØXBX	"	8,928	52	48
I4AVG	**3.5**	**1,804,680**	**870**	**540**
IZ3SQW	"	691,840	487	368
IU1JCZ	"	37,758	109	93
IZ4REF	"	25,840	98	76
***IK6VXO**	**A**	**6,148,000**	**1891**	**848**
*IK2YCW	"	5,102,412	1706	798
			(OP: IT9RGY)	
*IK2BUF	"	1,047,444	717	457
*I2BRT	"	1,027,420	695	470
*IK1JJM	"	899,232	629	408
*IZ8XXE	"	717,024	569	388
*IK4ZIF	"	621,962	498	374
*IK3SSJ	"	600,369	512	339
*IW1CBG	"	548,093	501	317
*IV3XNF	"	544,166	486	329
*IK4QJF	"	517,440	488	330
*I2XLF	"	471,163	463	319
*IU4JJP	"	405,132	420	294
*IV3BCA	"	354,090	372	330
*IIØK	"	345,408	382	257
			(OP: IZØUME)	
*IW3IOD	"	318,273	393	277
*IN3OWY	"	306,675	384	225
*IZ1PKV	"	292,536	348	239
*IØGIA	"	292,468	332	253
*IKØPHY	"	284,991	374	287
*IU2JWF	"	245,245	296	245
*IK1RGK	"	241,400	380	284
*IZ4YAB	"	223,141	289	227
*IK7DXP	"	219,374	378	251
*IK6BSN	"	213,087	284	219
*IZ4JMA	"	200,254	307	223
*IK2AUK	"	192,640	290	215
*IK1XPK	"	188,470	281	235
*IW2FUT	"	184,864	284	212
*IKØYUO	"	177,888	278	204
*I2BZN	"	165,208	250	193
*IK3MLF	"	160,979	238	203
*I4IKW	"	155,310	225	186
*IK8IOO	"	150,265	256	205
*IK2OVT	"	150,084	231	198
*IKØPEA	"	145,436	232	206
*IZ5IMB	"	141,180	256	195
*IZ6BXQ	"	137,350	251	205
*IKØHTP	"	134,478	228	186
*IW4ECF	"	133,496	220	164
*IW5AOT	"	122,748	198	159
*IW1RLC	"	122,271	215	159
*IUØDZA	"	121,004	238	179
*IZ2QGF	"	116,820	226	180
*IK6CLX	"	116,460	227	180
*IQ3DD	"	114,426	217	163
			(OP: IN3RRX)	
*IZ1JJF	"	111,412	209	173
*I2JIN	"	96,836	204	172
*IW2ETR	"	91,784	188	149
*IV3ONZ	"	88,768	179	152
*IU2CKU	"	86,250	173	150
*IWØGYC	"	86,032	184	152
*IK7RVY	"	80,070	202	170
*IK8ARF	"	79,182	192	159
*IKØHBN	"	78,242	172	142
*IK3BVD	"	75,270	151	130
*IU2LTO	"	69,310	167	145
IZ7GIT	*"*	*68,906*	*145*	*131*
*IU8DKG	"	66,712	136	124
*IK3ZBM	"	65,025	163	153
*IK2IKW	"	64,944	149	132
*I4JEE	"	64,856	159	134
*IK2SAR	"	64,386	155	126
*IZ3ZMF	"	57,475	162	121
I5OYY	*"*	*49,284*	*148*	*148*
*IZ3GOG	"	47,082	144	118
*IW1CHX	"	46,482	146	127
*IK2SGF	"	41,552	133	106
*IZ5HQB	"	34,040	136	115
*IK4XQT	"	33,572	129	109
*IK6BAK	"	32,204	107	97
*IK2SYK	"	29,624	103	92
*IK2UEX	"	27,398	125	103
*I1YGQ	"	23,766	109	102
*I8IEQ	"	22,278	102	94
*I2ORX	"	20,169	87	81
*I2IOJ	"	19,832	83	74
*IZ2ABZ	"	19,550	85	85
*IN3FHE	"	16,128	74	72
*IZ3ZOO	"	14,555	74	71
*IK8UND	"	13,568	69	64
*IK2SBB	"	10,608	59	52
*IK5BSC	"	10,332	68	63
*IV3KKW	"	9,964	54	47
*IZ3XNJ	"	9,802	65	58
*IW5EIJ	"	8,804	68	62
*IU1FQQ	"	8,556	52	46
IZ7AUH	*"*	*8,464*	*51*	*46*
*IW1RLS	"	8,320	55	52
*IK2EBP	"	8,016	55	48
*IWØHK	"	7,452	57	54
*IK5JRZ	"	7,182	67	63
*IW4EBS	"	6,120	47	45
*IK1VQO	"	6,050	54	50
*IUØKTT	"	5,600	39	35
IV3VFR	*"*	*4,080*	*38*	*34*
*IZ1GLX	"	3,120	31	30
*IZ2BHQ	"	1,020	17	15
*IZ1MHY	"	630	14	14
*I1DXD	"	550	11	11
*IK5MEP	"	290	10	10
***IK4RQJ**	**21**	**100,998**	**219**	**181**
*IZ8MXB	"	61,138	172	154
*IZ7UMS	"	34,077	131	111
*IKØEIE	"	32,648	124	106
*IK3SSG	"	56	8	8
***IK5AMB**	**14**	**560,470**	**579**	**410**
*IK4ALM	"	308,273	450	329
*IK4DCX	"	158,456	276	232
*IZ7XNB	"	114,165	256	215
*IW2CXJ	"	47,121	165	139
*IQ2DN	"	1,012	22	22
			(OP: IZ2JQP)	
***IW1PNJ**	**7**	**1,051,024**	**655**	**403**
*IW2MXY	"	952,698	588	411
*IU5ICR	"	787,600	562	358
*IV3HAX	"	548,428	432	334
*IK4GNI	"	529,596	424	313
*IK4OMO	"	304,416	321	252
*IU4CHJ	"	302,016	304	242
*IK2AQZ	"	284,658	317	227
*IN3EYI	"	239,134	304	217
*IQ4RN	"	111,720	190	147
			(OP: IK4DCX)	
*IW3RCK	"	105,000	178	150
*IZ1PLH	"	65,250	145	125
*IW6PWC	"	41,790	111	105
*IK5ZUI	"	7,896	50	47
*IK4UOA	"	5,148	35	33
*IN3FOI	"	780	14	13
*IZ5OQX	"	528	12	12
***IZ3ZBP**	**3.5**	**209,090**	**296**	**203**
*IW2HUS	"	174,468	254	186
*IW2NEF	"	120,908	204	167
*IK4RVG	"	105,624	194	163
*IK2GWH	"	59,890	149	113
*IU4FKR	"	54,880	135	112
IV3GUY	*"*	*39,798*	*112*	*99*
*IV3AZV	"	33,464	110	89
*IZ8FDH	"	12,992	62	58
*IØYQV	"	11,232	57	52
		Kaliningrad		
RN2FQ	**A**	**29,197**	**117**	**97**
***UF2F**	**A**	**1,086,678**	**766**	**438**
***RA2FB**	**14**	**51,392**	**174**	**146**
		Latvia		
YL6W	**A**	**3,144,960**	**1384**	**702**
				(OP: YL2GD)
YL9T	"	1,703,520	995	520
YL5T	"	482,942	535	358
				(OP: YL3DQ)
YL7A	**7**	**618,096**	**482**	**316**
***YL1ZF**	**A**	**2,997,234**	**1284**	**657**
*YL2NK	"	275,844	364	254
***YL2LW**	**21**	**2,212**	**36**	**28**
*YL2QV	"	2,001	30	29
***YL3IR**	**14**	**30,720**	**120**	**120**
*YL2KF	"	920	21	20
		Liechtenstein		
HBØWR	**A**	**18,375**	**79**	**75**
		Lithuania		
LY2F	**A**	**1,578,892**	**998**	**476**
LY2BAW	"	941,074	695	419
LY2CX	"	119,006	204	157
LY3CY	"	38,160	114	90
LY2MM	**3.5**	**214,240**	**272**	**206**
***LY7Z**	**A**	**5,932,500**	**2027**	**875**
*LY6A	"	3,361,500	1485	675
*LY2TS	"	786,840	622	395
*LY4K	"	699,754	532	374
*LY2J	"	595,404	522	333
*LY7W	"	470,256	456	303
				(OP: LY2NZ)
*LY9Y	"	209,410	270	215
*LY2BAA	"	38,313	116	99
*LY5O	"	34,510	107	85
*LYØNAS	"	21,789	92	81
***LY1R**	**21**	**64,722**	**202**	**138**
***LY7L**	**14**	**162,554**	**313**	**238**
*LY2CG	"	75,069	220	171
***LY5T**	**7**	**1,337,248**	**743**	**464**
*LY2PAD	"	716,184	537	348
*LY2SA	"	217,424	249	214
*LY4BF	"	74,236	166	134
***LY2EW**	**3.5**	**291,312**	**321**	**238**
		Luxembourg		
LX2LX	**A**	**1,044,240**	**726**	**458**
LX4ØDA	"	731,747	611	361
				(OP: LX1DA)
LX7I	**14**	**2,326,064**	**1326**	**689**
				(OP: DF7EE)
LX1HD	**7**	**582,692**	**451**	**323**
***LX1ER**	**A**	**1,036,953**	**681**	**411**
		Malta		
***9H1CG**	**A**	**31,753**	**128**	**113**
		Maldova		
***ER5LL**	**A**	**708,796**	**598**	**362**
***ER1OO**	**7**	**706,272**	**523**	**336**
		Netherlands		
PAØWRS	**A**	**384,856**	**416**	**292**
PAØVHA	"	345,825	393	265
PB7Z	"	320,694	346	258
PAØCT	"	298,764	359	258
PG2K	"	247,520	343	260
PA2A	"	220,492	292	199
PC4H	"	148,365	238	189
PA4ARI	"	126,324	229	174
PA4B	"	46,976	152	128
PE1NYQ	"	26,746	96	86
PA5WT	"	23,644	102	92
PI4VPO	"	18,711	99	81
				(OP: PE1NYQ)
PHØAS	"	3,828	46	44
PF6W	"	2,100	30	28
PA1AW	**14**	**509,124**	**525**	**418**

PA3BWD	"	154,452	283	244
PA1CW	"	42,625	150	125
PA4O	**7**	**34,776**	**101**	**84**
PA3EWP	**3.5**	**157,470**	**224**	**181**
PA3ADU	"	4,958	38	37
***PI4CG**	**A**	**1,017,356**	**683**	**428**
				(OP: PD2PKM)
*PA4G	"	834,405	677	389
*PA7WW	"	501,396	474	329
*PD2JAM	"	332,142	373	281
*PA3BXR	"	296,604	366	231
*PA2TA	"	288,093	344	249
*PAØCMF	"	286,767	353	247
*PDØMHZ	"	265,550	344	235
*PE1FTV	"	244,296	311	232
*PAØALG	"	232,001	337	253
*PA2LP	"	213,032	331	248
*PA2JCB	"	205,326	296	198
*PD4RD	"	202,768	322	232
*PA3JB	"	198,875	318	215
*PAØPIW	"	188,580	285	210
*PA3DBS	"	169,952	252	188
*PA3T	"	148,488	217	184
*PDØJMH	"	137,825	220	185
*PE1LZZ	"	121,068	231	177
*PA4GDR	"	120,228	209	172
*PA2CVD	"	108,540	221	180
*PC9F	"	96,448	230	176
*PDØWR	"	96,432	198	168
*PAØFVH	"	82,641	195	163
*PA3DVA	"	63,945	165	147
*PG1R	"	63,744	148	128
*PE1CPJ	"	61,350	182	150
*PA2VS	"	59,750	146	125
*PC4C	"	57,070	150	130
*PD75E	"	51,875	147	125
*PA6ANT	"	37,387	128	109
*PA7KY	"	33,176	112	104
*PA5W	"	32,277	104	87
*PDØME	"	28,036	108	86
*PA3HGF	"	26,010	102	90
*PD5W	"	23,852	101	89
*PA3CXB	"	22,590	102	90
*PA1BBO	"	21,252	97	84
*PD5JOS	"	20,915	100	89
*PD2MDR	"	17,864	100	88
*PA3EPO	"	17,316	80	74
*PC9T	"	16,320	72	64
*PBØACU	"	14,848	75	64
*PC5D	"	13,041	71	63
*PE4KH	"	11,110	69	55
*PD1LG	"	10,492	71	61
*PD1AJJ	"	10,220	75	70
*PDØJSO	"	9,176	70	62
*PEØV	"	8,554	48	47
*PA3GMM	"	5,510	47	38
*PAØGRU	"	2,268	30	28
***PD3LPA**	**14**	**160,008**	**295**	**236**
*PD2GSP	"	6,966	56	54
*PC4L	"	2	1	1
***PD1RP**	**7**	**614,250**	**459**	**325**
*PA2REH	"	548,166	434	309
***PA4DN**	**3.5**	**38,728**	**108**	**94**
		North Macedonia		
Z35T	**14**	**1,426,620**	**1073**	**590**
***Z39A**	**A**	**159,516**	**244**	**211**
*Z32ZZZ	"	1,600	20	20
***Z36N**	**14**	**246,610**	**440**	**271**
***Z33F**	**3.5**	**66,000**	**142**	**120**
		Northern Ireland		
MI5K	**3.5**	**737,472**	**529**	**334**
				(OP: MIØSLE)
***GI4H**	**A**	**415,444**	**443**	**283**
				(OP: GI4JTF)
*GI7AXB	"	187,368	293	222
*MIØI	"	11,330	62	55
		Norway		
LC3A	**A**	**4,356,984**	**1690**	**758**
				(OP: LB8IB)
LC8P	"	1,603,061	990	503
LA3BO	"	1,383,858	928	441
LC6C	"	791,152	667	394
				(OP: LA6VQ)
LAØFA	"	629,880	543	348
LA3WAA	"	397,475	458	325
LA9TY	"	307,008	323	246
LN2T	"	225,552	318	222
				(OP: LB5SH)
LA9VBA	"	30,600	106	90
LA7GIA	"	21,156	93	82
LB5GI	"	4,216	37	34
LA8CJ	"	697	18	17
LB6KC	**14**	**88,044**	**221**	**174**
LN5O	**7**	**82,350**	**155**	**135**
				(OP: LB3RE)
***LC7N**	**A**	**1,478,700**	**939**	**477**
				(OP: LA5LJA)
*LA2XNA	"	174,894	283	206
*LA3BPA	"	170,208	240	197
*LB6VI	"	65,380	182	140
*LA2HFA	"	62,244	160	133
*LA4OGA	"	47,600	132	112
*LA8OKA	"	32,806	120	94
***LCØX**	**21**	**40**	**4**	**4**
				(OP: LB3RE)
***LB2TG**	**14**	**323,070**	**448**	**330**
		Poland		
SN7Q	**A**	**9,381,528**	**2649**	**936**
				(OP: SP7GIQ)
SO9I	"	6,187,710	2018	863
				(OP: SQ9ORQ)
SO6C	"	2,223,096	989	633
				(OP: SP6CIK)
SP8KP	"	1,880,846	1111	517
SP9KR	"	1,454,404	875	508
SN4X	"	1,083,754	697	398
				(OP: SP5OXJ)
SQ9V	"	615,685	511	343
SP4Z	"	407,296	417	296
SP6FAF	"	180,837	275	213
SP1JQJ	"	41,625	138	111
SN2M	"	31,776	108	96
SP9RQH	"	29,120	101	91
SP2QCW	"	9,460	59	55
SP7IIT	"	2,486	22	22
SQ7CL	**28**	**30**	**6**	**5**
SP6OJK	**21**	**58,387**	**175**	**133**
SO4M	**14**	**2,152,548**	**1270**	**684**
SQ2A	"	1,828,316	1174	644
				(OP: SQ2RCM)
SP1MWN	"	151,875	308	225
SP3A	"	44,278	148	131
SP1MVW	"	12,093	103	87
SQ9DXT	"	7,049	57	53
SP4TKR	**7**	**2,169,410**	**978**	**541**
SP8K	"	1,920,010	840	505
SN7F	"	505,408	419	298
				(OP: SP7AH)
SP3DIK	"	324,198	310	249
SP5UUD	"	5,670	36	35
SP5DL	**3.5**	**873,216**	**590**	**384**
SO5E	"	573,400	490	305
				(OP: SP5VIH)
SQ3MZU	"	12,138	60	51
***SP2EWQ**	**A**	**1,493,172**	**836**	**531**
*SQ1X	"	957,957	720	429
*SP9H	"	928,605	587	465
*SQ6PLE	"	753,322	606	362
*SP3EMA	"	555,716	487	356
*SP2MKI	"	519,771	399	371
*SQ6ELK	"	505,440	454	312
*SP6FXY	"	471,861	429	333
*SP1TJ	"	424,214	463	314
*SP3GAX	"	386,904	425	294
*SP9DLY	"	378,000	426	280
*SO5KR	"	374,664	400	268
*SP5GNI	"	338,217	396	277
*SP9BGS	"	316,389	349	263
*3Z9W	"	275,222	333	241
*SP4BPH	"	257,600	330	230
*HF1Z	"	246,848	319	232
				(OP: SP1EG)
*SP2TQQ	"	222,774	295	214
*SP3CCT	"	212,048	314	232
*SP6JZP	"	198,900	268	204
*SP9ICU	"	169,290	255	198
*SN9T	"	159,655	230	185
*SN5WD	"	159,470	239	185
				(OP: SO5WD)
*SP6SOZ	"	127,925	226	175
*SP3OKS	"	114,144	204	164
*SN1LH	"	100,492	186	148
				(OP: SP1J)
*SP9MUF	"	88,044	175	138
*SP1DMD	"	85,305	171	141
*SP9HE	"	84,528	167	144
*SP3CVT	"	80,330	184	145
*SP9Y	"	52,700	153	124
*SO1RON	"	51,408	143	119
*SP3QDX	"	45,870	139	110
*SP5GDY	"	42,959	129	119
*SP5CUK	"	42,108	116	116
*SP6IHE	"	36,300	110	100
*SP3JIA	"	23,409	90	81
*SP3OL	"	22,714	90	82
*SP9IHP	"	12,444	72	51
*SP9DEM	"	9,729	55	47
*SP9KJU	"	7,744	48	44
				(OP: SP9MDY)
*SP9GZW	"	494	13	13
***SQ9GOL**	**28**	**6**	**3**	**2**
***SP4NKJ**	**21**	**15,008**	**92**	**67**
*SP5IVC	"	8,512	73	56
*SP2AEK	"	3,956	53	43
*SQ6ELV	"	1,298	22	22
***HF6C**	**14**	**211,968**	**357**	**276**
				(OP: SP6OPC)
*SOØA	"	179,334	332	246
*SQ4HKU	"	21,344	108	92
*SQ3RX	"	2,997	40	37
***SP1HN**	**7**	**918,400**	**581**	**400**
*SP1DSZ	"	461,680	410	290
*SP2CHY	"	382,520	385	262
*SQ7LQJ	"	263,484	302	234
*SP9NSA	"	146,202	211	177
*SP2V	"	21,114	77	69
*SP3KX	"	10,302	54	51
*SP2HHX	"	684	20	19
*SQ2OMK	"	286	11	11
***SQ9I**	**3.5**	**149,604**	**224**	**182**
*SQ8NGO	"	95,880	189	141
*SQ9PPT	"	35,360	110	85
*SP2WGB	"	16,896	68	66
		Portugal		
CR6K	**A**	**9,950,535**	**2606**	**1019**
				(OP: CT1ILT)
CR6T	**21**	**1,169,480**	**919**	**520**
				(OP: CT1ESV)
CT1GFK	"	14,980	79	70
CT7AQS	**7**	**336,414**	**317**	**247**
***CR5O**	**A**	**2,088,036**	**1114**	**558**
				(OP: CT7AJL)
*CT1BWU	"	1,380,808	706	442
*CT1BXT	"	1,210,364	883	454
*CT1FKN	"	111,020	192	182
***CT7AUP**	**14**	**140,625**	**290**	**225**
*CQ7F	"	135,378	257	218
				(OP: CT1FOQ)
		Romania		
YO9HP	**A**	**4,952,172**	**1781**	**818**
YQ6A	"	3,046,050	1487	630
				(OP: YO6BHN)
YO3RU	"	2,154,146	1237	562
YO7CW	"	1,231,406	833	446
YO4FPF	"	879,284	794	434
***YO4NF**	**A**	**1,851,408**	**999**	**559**
*YO5OHY	"	650,100	509	330
*YO3VU	"	550,668	498	327
*YO4RDW	"	405,588	404	292
*YO2LXW	"	222,372	297	213
*YO9CWY	"	159,668	291	223
*YO8RFS	"	102,384	213	162
*YO4SI	"	68,199	154	127
*YO7HGM	"	61,908	152	134
*YO7LYM	"	60,346	172	143
*YO4BXX	"	58,548	147	119
*YO2LDU	"	18,632	75	68
*YO4RST	"	9,515	59	55
*YO7EY	"	8,695	50	47
***YO9BCM**	**14**	**225,720**	**383**	**285**
*YO2IS	"	169,344	321	252
*YO5AXF	"	76,384	205	176
*YO3JW	"	10,419	75	69
*YO5FMT	"	6,215	58	55
***YO8DHA**	**7**	**232,968**	**297**	**204**
*YO3LW	"	207,504	254	198
*YO9GSB	"	174,574	226	191
*YO8PS	"	145,464	205	174
*YO4CVV	"	1,554	21	21
***YO6HSU**	**3.5**	**270,036**	**305**	**234**
*YO4BEW	"	59,436	134	117
		Sardinia		
***IWØUWE**	**7**	**392,922**	**352**	**263**
		Scotland		
MM9I	**A**	**3,284,424**	**1484**	**638**
				(OP: GMØOPS)
GM2TT	"	500,025	536	339
GM4M	"	30,492	103	84
				(OP: GM4UBJ)
MM1E	**21**	**36,842**	**143**	**109**
				(OP: MMØGOR)
MMØGOR	**3.5**	**19,404**	**77**	**66**
***GM9A**	**A**	**391,776**	**486**	**336**
				(OP: GM4FDM)
*MM2T	"	222,006	322	227
*MMØCPZ	"	107,010	214	174
*GM4UQG	"	101,920	242	182
*GMØDYU	"	20,370	102	97
*GM4JKZ	"	1,736	29	28
***GM5M**	**14**	**157,773**	**324**	**231**
				(OP: GM4ZNC)
		Serbia		
YT2U	**A**	**1,333,800**	**818**	**456**
YU3A	"	285,714	286	286
YT8A	**28**	**78**	**6**	**6**
				(OP: YU1EA)
YT3X	**14**	**2,224,080**	**1269**	**720**
YUØW	**7**	**4,798,752**	**1349**	**772**
YU1UN	"	278,928	285	234
YT4TT	"	106,330	186	155
YU5R	**3.5**	**1,437,398**	**759**	**461**
				(OP: YT2AAA)
YT4T	"	1,227,546	755	423
YU7BW	"	173,124	233	189
***YTØX**	**A**	**965,178**	**700**	**387**
*YT9WW	"	151,404	258	186
*YU1KT	"	134,862	230	169
*YT3H	"	26,576	97	88
***YU4VBX**	**21**	**6,375**	**52**	**51**
***YTØW**	**14**	**605,200**	**640**	**425**
				(OP: YU1JW)
***YT9VM**	**7**	**957,588**	**579**	**401**
*YT7E	"	444,310	429	283
*YU4SMT	"	5,658	42	41
***YU7OPQ**	**3.5**	**138,976**	**217**	**172**
				(OP: YT7DS)
		Sicily		
IT9ESW	**A**	**933,606**	**663**	**459**
IT9UFP	"	1,682	30	29
IT9IMJ	**14**	**21,840**	**118**	**104**
IT9RBW	**7**	**4,956,246**	**1421**	**753**
IT9VCE	"	1,003,574	655	377
***IT9GHW**	**A**	**121,905**	**278**	**189**
*IT9AJP	"	117,469	215	181
*IT9FRX	"	46,625	160	125
*IW9GHJ	"	34,650	134	126
*IT9ORA	"	15,876	93	81
*IT9DGZ	"	14,880	64	62
***IT9RKR**	**21**	**3,800**	**42**	**40**
***IT9CIL**	**14**	**8,479**	**61**	**61**
***IR9D**	**7**	**1,774,584**	**869**	**503**
				(OP: IW3RUA)
*IW9GTD	"	713,856	544	352
		Slovak Republic		
OM5ZW	**A**	**9,045,876**	**2466**	**953**
OM7KW	"	1,453,194	893	459

OM3R	"	836,848	599	386
			(OP: OM3CFR)	
OM8LA	"	456,304	446	304
OM2VL	**7**	**5,420,520**	**1400**	**810**
OM3RM	"	3,769,722	1160	723
OM3CW	"	227,220	274	210
***OM5MX**	**A**	**402,289**	**423**	**293**
*OM2WX	"	304,817	361	263
*OM7JG	"	269,114	325	239
*OM4AZF	"	127,255	216	155
*OM8WG	"	74,230	153	130
*OM8MF	"	63,176	174	149
*OM7RU	"	33,792	106	96
*OM5AST	"	28,336	109	92
***OM1NW**	**14**	**133,263**	**271**	**221**
*OM8JP	"	111,504	248	202
***OM2BK**	**7**	**346,624**	**355**	**256**
*OM3TNA	"	192,060	245	198
***OM3IAG**	**3.5**	**799,254**	**565**	**361**
*OM5KM	"	487,900	437	287
*OM8ATS	"	299,228	338	239
		Slovenia		
S58M	**A**	**3,522,036**	**1486**	**644**
S5ØRY	"	1,850,030	947	535
			(OP: S53K)	
S51DD	"	834,169	727	443
S53F	"	139,346	193	193
S52F	"	135,200	215	160
S57DX	**14**	**1,488,256**	**1021**	**604**
S5ØXX	"	254,820	373	274
S59T	"	1,830	31	30
S51CK	**7**	**3,088,852**	**1148**	**622**
S53X	**3.5**	**1,622,754**	**862**	**477**
S53JW	"	212,344	281	209
***S57SWR**	**A**	**869,253**	**643**	**371**
*S55AL	"	207,100	297	190
*S52W	"	196,546	263	202
S53O	*"	*54,600*	*135*	*120*
*S5ØR	"	45,430	143	118
*S52WD	"	42,372	120	107
***S52OT**	**14**	**603,360**	**636**	**419**
*S51JQ	"	421,344	491	352
*S57YK	"	48,140	154	145
*S58L	"	19,530	100	90
***S57AM**	**7**	**37,536**	**100**	**92**
***S51W**	**3.5**	**966,000**	**670**	**375**
*S54Z	"	765,348	556	354
*S5ØB	"	69,192	142	124
		Spain		
EA4GOY	**A**	**4,843,616**	**1685**	**736**
EC5K	"	2,351,250	1271	627
EA2XR	"	1,546,796	1010	529
EA2DLX	"	945,438	743	391
EB5A	"	849,002	582	407
EA7BP	"	747,252	621	407
ED4T	"	526,464	545	384
			(OP: EA4R)	
EA5JX	"	490,758	441	311
EA2KU	"	474,354	536	342
EA2DR	"	311,969	428	287
EA5O	"	225,412	300	218
EA5FID	"	218,535	330	255
EA1AKS	"	189,107	396	269
EA1L	"	146,260	269	206
EA2DDE	"	93,536	199	158
EA3AKA	"	84,152	193	157
EA1CJ	"	21,489	101	87
EA7Z	**21**	**113,652**	**261**	**198**
EF5U	"	41,796	147	129
			(OP: EA5U)	
EF1C	**14**	**81,780**	**220**	**188**
			(OP: EC1RS)	
EA5GIE	"	16,284	109	92
EA7KE	"	5,300	53	50
EA3F	**7**	**1,233,530**	**729**	**421**
EA5NK	"	94,500	165	150
EF1L	"	83,936	144	122
			(OP: EA1DA)	
EB1IC	*"	*1,332*	*18*	*18*
EA1B	**3.5**	**294,756**	**343**	**242**
***ED7N**	**A**	**2,723,462**	**1309**	**658**
			(OP: EA7KHB)	
*EF7W	"	1,308,438	847	463
			(OP: EC7KW)	
*EA4BAS	"	1,058,910	827	470
*EA2RU	"	1,038,037	810	427
*EA4Z	"	680,120	637	347
*EA7JXZ	"	556,156	456	326
*EA2BNU	"	546,447	504	319
*EA2BJM	"	498,946	486	314
*EA1CH	"	489,600	505	306
*EE5O	"	435,256	509	328
*EB4GOO	"	411,822	418	274
*EA2CCG	"	386,100	428	300
*EA5HYJ	"	323,314	417	278
*EA5FDM	"	199,614	295	206
*EB5CUZ	"	196,948	310	212
*EA3AQ	"	187,812	299	222
*EA5ERA	"	181,779	354	237
*EA5LU	"	176,820	298	210
*EA3HCJ	"	157,384	249	191
*EA1IYK	"	155,200	284	200
*EA3EA	"	146,160	269	210
*EA7CVF	"	143,678	269	199
*EA5ICS	"	121,632	228	168
*EA5EX	"	117,030	232	166
*EB2DJ	"	113,344	207	161
*EA3HKA	"	96,298	267	178
*EA5KE	"	94,860	198	155
*EB7KA	"	84,372	222	178
*EA7K	"	77,216	199	152
*EA5R	"	71,136	193	152
*EA5JDN	"	68,392	213	166
*EB5CS	"	63,500	155	125
*EF3R	"	56,502	153	129
			(OP: EA3EYO)	
*EA3AYQ	"	52,256	186	142
*EB3EKZ	"	51,667	139	121
*EA1AAP	"	50,176	128	112
*EC5JC	"	46,287	126	111
*EA3X	"	44,232	122	97
*EA4CFT	"	37,129	128	107
*EC7AKV	"	33,040	125	112
*EB3TR	"	31,598	141	122
*EA4FIT	"	28,756	104	91
*EA7VJ	"	23,100	88	84
*EA3YM	"	21,483	103	93
*EA4GZD	"	18,012	89	76
*EB4BZA	"	7,280	59	56
*EA3CFV	"	6,032	61	58
EB1EB	*"	*1,175*	*26*	*25*
***EB7DX**	**21**	**200,123**	**334**	**253**
*EA1BDX	"	47,190	147	130
***EF1A**	**14**	**810,576**	**731**	**468**
			(OP: EA1X)	
*EA4DB	"	241,582	408	278
*EA5HJO	"	89,628	225	194
*EA3OH	"	9,360	67	65
*EA7FRX	"	6,909	54	49
*EB4ERS	"	4,200	44	42
***EA3Y**	**7**	**500,960**	**388**	**310**
*EC3A	"	322,080	335	244
*EB2CTA	"	284,544	328	228
*EA4FME	"	257,488	325	242
*ED2V	"	205,766	306	199
			(OP: EA2CYJ)	
*EA3IAZ	"	109,824	190	156
*EA5XC	"	101,292	193	138
*EA1DP	"	72,050	152	131
***EA3CI**	**3.5**	**425,334**	**409**	**273**
*EB3A	"	53,580	127	114
		Sweden		
SM6NOC	**A**	**2,316,726**	**1211**	**603**
SD5X	"	1,033,192	736	428
SF1Z	"	284,960	335	274
			(OP: SMØHEV)	
SM5ILE	"	245,579	348	241
SA6U	"	231,786	313	237
			(OP: SM6LJU)	
SM6MVE	"	123,120	234	180
SD1A	"	81,354	194	149
			(OP: SM1TDE)	
SD4C	"	78,165	180	135
			(OP: SMØSHG)	
***SE4E**	**A**	**1,149,705**	**834**	**435**
			(OP: SM4DQE)	
*7S6ØBQ	"	502,520	531	340
			(OP: SM7BHM)	
*SE6K	"	483,804	479	302
			(OP: SM6FZO)	
*SM3OMO	"	466,440	484	299
*7S5S	"	459,886	488	307
			(OP: SM5CSS)	
*SM5IMO	"	312,818	366	241
*SM5S	"	246,015	335	213
			(OP: SM5SIC)	
*SFØA	"	231,280	301	236
			(OP: SMØLPO)	
*SM6XHM	"	190,528	290	208
*SM5EFX	"	112,266	214	162
*SM7CIL	"	111,338	211	179
*SM6A	"	104,208	213	156
			(OP: SA6AQP)	
*SE3X	"	33,024	106	86
			(OP: SA3BYC)	
*SM5GRD	"	24,210	99	90
*SI9YL	"	17,577	104	93
			(OP: SM3LIV)	
*SM5DXR	"	16,050	82	75
***SM5MX**	**7**	**421,660**	**382**	**290**
***SM5EPO**	**3.5**	**127,050**	**199**	**165**
		Switzerland		
HB9AVK	**A**	**605,056**	**503**	**326**
HB5E	"	305,203	306	239
			(OP: HB9BUN)	
HB2U	"	301,077	328	243
			(OP: HB9EYP)	
HB9DVZ	"	278,226	361	261
HB9RMM	"	61,132	151	124
HB9DOS	"	38,709	116	99
HB9BTI	**14**	**171,561**	**314**	**249**
***HB9DHG**	**A**	**1,754,400**	**902**	**510**
*HB9VQQ	"	1,377,324	735	486
*HB9MXY	"	214,643	275	209
*HB9TZU	"	91,352	184	152
*HB9FKK	"	76,960	156	130
			(OP: IK1PMR)	
*HB9OCR	"	70,912	158	128
*HB9BXE	"	55,304	146	124
*HB9GFT	"	7,072	58	52
*HB9FHV	"	2,688	24	24
*HB9GKM	"	2,511	28	27
*HB9TSU	"	418	11	11
***HB9FKL**	**7**	**10,584**	**55**	**54**
		Ukraine		
UW8SM	**A**	**5,753,542**	**1912**	**874**
EMØI	"	4,729,074	1884	763
EM2G	"	4,694,375	1769	875
			(OP: UR7GO)	
UZ1WW	"	3,369,762	1436	682
UR5R	"	2,533,704	1374	579
			(OP: UTØRM)	
UV5U	"	1,971,120	950	573
			(OP: UX1UA)	
US2IR	"	1,927,464	1179	539
EO5ØFF	"	1,803,318	1184	534
			(OP: UXØFF)	
UY5ZZ	"	1,353,860	938	487
US7KC	"	1,351,712	977	424
UT7IS	"	1,012,648	761	428
UT4RZ	"	813,510	744	414
UT2AU	"	598,986	543	321
UT5ECZ	"	512,120	441	295
UT7NI	"	421,074	452	314
UX6IR	"	323,883	383	291
US5QUB	"	235,122	317	263
UV2V	"	199,704	285	212
			(OP: UX1VX)	
UT2II	"	190,269	330	243
UR4EI	"	187,572	320	231
UT3UV	"	160,197	281	201
UW3HM	"	81,090	206	153
UT7ZM	"	72,141	175	139
UY7C	"	66,722	154	146
UT2IV	**21**	**410,564**	**576**	**341**
UR8RF	**14**	**439,760**	**555**	**368**
UT3RS	"	438,240	560	352
US1IV	"	184,604	334	266
UT4U	**7**	**3,884,706**	**1208**	**717**
			(OP: UT5UJO)	
UT3N	"	456,104	429	292
			(OP: UT3NK)	
UX2X	**3.5**	**2,268,000**	**1035**	**560**
			(OP: UT2XQ)	
US1IB	"	364,420	386	274
***UW1M**	**A**	**5,612,264**	**2363**	**824**
*UWØK	"	4,715,965	1617	811
			(OP: USØKW)	
*UT4LW	"	3,282,878	1712	647
*UX1VT	"	2,284,725	1078	615
*UX1UX	"	1,588,375	988	485
*UR1HR	"	1,566,510	1011	505
*UT8EL	"	1,526,441	985	499
*UT5EPP	"	1,270,950	972	458
*US6CQ	"	1,061,770	797	445
*UR5WCQ	"	1,051,395	716	435
*UX7QV	"	967,494	867	411
*UT3SO	"	789,836	631	379
*URØHQ	"	714,100	608	386
*UR7EC	"	668,935	578	379
*UR5LY	"	663,564	540	363
*UX3I	"	628,609	589	359
			(OP: US7IY)	
*UT8IM	"	581,135	552	355
*UW1WU	"	447,552	454	288
*EO3Q	"	424,276	504	292
			(OP: UR3QCW)	
*UR5EPV	"	416,448	483	288
*UW2Q	"	383,080	489	314
			(OP: UR6QS)	
*UTØCK	"	369,117	440	279
*UT5EOX	"	344,560	386	295
*UR4CU	"	337,762	395	281
*UY5TE	"	326,029	437	277
*UR5ZGY	"	295,807	446	257
*US5ZFT	"	280,704	406	258
*UY8IF	"	257,164	397	269
*UT5CL	"	250,035	342	237
*UT5PQ	"	223,851	307	249
*US5CDH	"	216,008	329	248
*UT7MR	"	168,670	294	202
*UT4HZ	"	151,488	250	192
*UT4EK	"	150,696	270	207
*UZ5Q	"	140,700	278	201
			(OP: UY5QZ)	
*UT8AS	"	111,705	220	165
*UT4QV	"	103,455	218	165
*US8UA	"	103,194	223	182
*UR7QM	"	100,036	221	178
*UT5UHX	"	97,399	220	173
*UX6IB	"	62,133	167	139
*US5EEK	"	44,896	134	122
*UR5XMM	"	37,450	120	107
*UT2SQ	"	35,898	107	93
*UR3QTN	"	31,061	104	89
*UX4CR	"	28,616	119	98
*UR4MLS	"	26,970	95	87
*USØVA	"	5,593	51	47
***UX7LL**	**21**	**10,496**	**80**	**64**
*UV7E	"	1,943	34	29
***UY5VA**	**14**	**471,552**	**585**	**384**
*UY3U	"	351,368	489	334
*UR2Y	"	299,268	460	306
			(OP: USØYW)	
*UT1AN	"	217,764	373	276
*UT2EF	"	216,562	360	278
*UR7CB	"	142,200	297	225
*US5AT	"	32,804	140	118
*UT1IM	"	21,840	112	105
*UR5QU	"	21,462	108	98
UX4FC	*"	*18,424*	*99*	*94*
*UW7LL	"	198	11	11
***UR5SD**	**7**	**1,097,568**	**673**	**412**
*UZ4U	"	683,584	492	352
			(OP: UX7UW)	
*US5EOI	"	206,780	257	211
*UT3QD	"	123,648	189	168
*UW5U	"	102,480	193	140
			(OP: UY2UA)	

*UZ2HZ	3.5	733,096	549	371
***UY2IF**	"	**656,016**	**523**	**346**
*UY2ZA	"	55,632	141	114
		Vienna Intl. Ctr.		
***4U1A**	A	**2,639,756**	**1193**	**644**
				(OP: HB9RB)
		Wales		
GWØA	A	**4,006,440**	**1659**	**718**
				(OP: GW4SKA)
***MWØCRI**	A	**1,422,135**	**948**	**495**
*MW9W	"	967,904	740	406

OCEANIA

Australia

VK4SN	A	**439,263**	**553**	**261**
VK2RT	"	32,300	122	95
VK2PW	"	960	25	20
VK4BRT	21	**5,125**	**45**	**41**
VK3FN	7	**4,060**	**32**	**29**
***VK2GR**	A	**15,801**	**85**	**69**
*VK3YV	"	14,326	69	58
*VK4XU	"	8,094	49	38
*VK6WR	"	144	10	8
***VK4FJ**	21	**8,379**	**65**	**49**
***VK3TX**	7	**1,496**	**22**	**22**
		East Malaysia		
***9M8DEN**	A	**116,064**	**235**	**124**
***9W6EZ**	7	**30**	**3**	**3**
		Guam		
NH2DX	28	**16,016**	**98**	**56**
		Hawaii		
KH6ZM	A	**1,950,804**	**1259**	**446**
KH6TU	"	951,765	812	321
				(OP: AD6E)
***KH6CJJ**	A	**710,892**	**709**	**294**
*KH6EU	"	5,379	43	33
				(OP: N7ON)
*WH6FAM	"	2,660	41	28
***KH6AN**	14	**2,425**	**33**	**25**
***AH6KO**	7	**63,896**	**118**	**98**
		Indonesia		
YB1AR	A	**674,114**	**630**	**358**
YB4FIK	"	129,630	275	149
YB1TQL	"	122,220	259	180
YB2HAF	"	112,560	247	168
YB3IZK	"	41,640	160	120
YCØSAS	"	26,465	140	79
YB2TS	"	24,388	135	91
YC9VIZ	"	21,240	97	72
YB2IQ	"	20,550	102	75
YF2UFA	"	14,606	107	67
YB7MD	"	13,786	111	61
YB9BCS	"	8,700	95	58
YB2BBZ	"	5,376	75	32
YB1RUS	"	5,254	59	37
YB3RYX	"	2,945	67	31
YBØCOU	"	630	17	15
7E3E	"	171	9	9
				(OP: YG3FZR)
YB2MM	21	**36,288**	**124**	**112**
YB3BLJ	"	3,672	38	36
YC6BTI	"	2,960	37	37
YBØRI	14	**177,463**	**300**	**221**
YC9ELS	"	37,760	178	118
YB2CAA	"	6,624	58	46
YC3GOQ	7	**9,408**	**73**	**42**
YB7XN	"	3,696	57	33
YE3WIL	"	432	18	12
***YC2YSW**	A	**292,820**	**398**	**242**
*YB1RKT	"	223,014	365	218
*YB1BML	"	196,940	347	215
*YD7ACD	"	161,226	272	169
*YB8UTI	"	137,492	301	148
*YB1MIG	"	80,759	249	139
*YB2XVT	"	60,416	182	118
*YC2GBS	"	47,234	185	113
*YCØVM	"	42,400	185	106
*YB2BNN	"	39,312	149	126
*YB1KK	"	35,017	114	97
*YD1EMV	"	33,856	185	92
*YCØSCZ	"	31,955	128	83
*YB1UUN	"	27,880	116	85
*YB7HE	"	26,884	121	94
*YB8CMT	"	26,341	152	71
*YB1TJ	"	25,543	120	89
*YB1WCK	"	24,820	126	85
*YB7MP	"	21,402	113	82
*YCØSCL	"	21,280	146	76
*YB7HMB	"	20,562	117	69
*YC1CQU	"	16,146	117	54
*YC9BHJ	"	15,180	99	60
*YC5YC	"	14,756	100	62
*YC1PZ	"	13,568	79	64
*YC1IUQ	"	13,338	135	54
*YFØFRT	"	13,310	89	55
*YCØRLX	"	11,342	126	53
*YB1BA	"	11,200	93	64
*YD2KJC	"	9,672	84	52
*YBØGIN	"	9,500	93	50
*YC2XCD	"	9,200	113	46
*YC7YCP	"	9,063	68	53
*YCØSCV	"	7,396	81	43
*YF3ESW	"	7,314	81	46
*YBØMZI	"	6,142	77	37
*YB3HQM	"	6,063	68	43
*YB7MYS	"	5,510	87	38
*YB3BGM	"	4,760	52	40
*YC7SQV	"	4,257	49	33
*YB1DUU	"	3,597	73	33
*YD6ROA	"	3,572	67	47
*YD4SIZ	"	3,038	56	31
*YBØOHG	"	2,964	51	26
*YD1EYS	"	2,940	64	28
*YB3XVO	"	2,632	55	28
*YC9VM	"	2,480	38	31
*YB7XMR	"	2,214	31	27
*YD9BEK	"	2,112	47	24
*YC9BVB	"	2,024	54	23
*YC5YDD	"	1,848	58	28
*YD1FAM	"	1,728	42	27
*YD9MBM	"	1,536	35	24
*YC8MKA	"	1,440	36	20
*YC7NUL	"	1,400	46	25
*YD7HGS	"	1,320	33	20
*YB2BHX	"	1,280	44	16
*YB7WR	"	1,260	24	20
*YB1MBA	"	1,176	34	24
*YC1RIK	"	1,035	27	15
*YC1ILM	"	820	24	20
*YCØKBE	"	798	32	14
*YD6IOV	"	792	21	18
*YD1CHM	"	760	44	19
*YE8DWC	"	540	28	15
*YB1BRS	"	480	17	15
*YB1LRG	"	408	15	12
*YB1GIP	"	392	22	14
				(OP: YC1GIP)
*YDØAOM	"	380	19	10
*YB6UAF	"	312	14	13
*YF8AIK	"	234	15	13
*YC1IFR	"	220	13	10
*YB9GDP	"	110	11	10
*YE8RAF	"	16	8	8
*YC5NHD	"	8	2	2
*YC7VGB	"	6	3	3
*YCØPGN	"	6	1	1
***YC2VOC**	28	**1**	**1**	**1**
***YB9UA**	21	**18,748**	**128**	**86**
*YB9GWR	"	12,168	78	72
*YG9WKB	"	9,408	106	64
*YD3CER	"	7,089	55	51
*YD2UWF	"	6,760	59	52
*YB1PSI	"	987	22	21
*YB1HDR	"	507	13	13
*YC1NXR	"	234	9	9
***YC9XYP**	14	**177,463**	**314**	**221**
*YC1JGE	"	64,326	165	142
*YBØNSI	"	54,450	183	121
*YB8RW	"	45,011	190	103
*YC8MJG	"	26,642	146	77
*YB4GBN/1	"	20,580	107	84
*YB1RQX	"	12,144	74	66
*YF3FBV	"	7,980	65	60
*YB9GV	"	2,485	43	35
*YE4IJ	"	1,012	22	22
*YB6VWV	"	264	17	11
*YC2CAB	"	190	10	10
*YC8AO	"	81	13	9
***YB7OO**	7	**59,850**	**129**	**105**
*YCØBAS	"	40,606	157	79
*YB2ECG	"	20,832	143	62
*YG9EPK	"	19,072	119	64
*YD1AYO	"	14,420	120	70
*YD1APO	"	10,000	80	50
*YB8SB/7	"	9,114	83	49
*YC1JNV	"	8,288	92	37
*YB1HK	"	7,872	82	41
*YD1JDW	"	4,588	68	31
*YB4LVF	"	4,350	66	29
*YD7SAL	"	4,288	49	32
*YB2CTE	"	2,880	66	32
*YD1DPF	"	2,856	54	28
*YC1JEL	"	2,538	68	27
*YC1GDF	"	2,448	60	24
*YD9HIB	"	2,116	35	23
*YB8OBM	"	1,624	34	28
*YD2UFR	"	1,536	54	24
*YC3ATK	"	1,520	40	20
*YD3TVV	"	1,518	39	23
*YD2NIR	"	1,480	45	20
*YB8ROP	"	1,116	23	18
*YB1NIN	"	986	35	17
*YD3TSJ	"	840	25	15
*YF3EKS	"	832	26	16
*YB2WA	"	800	17	16
*YD2UFV	"	780	28	15
*YC2TDP	"	728	58	26
*YC2DFD	"	572	25	13
*YD7HIJ	"	504	22	14
*YG3DBO	"	300	15	10
*YD1EEC	"	288	12	12
*YD1JBV	"	240	12	10
*YE3CIF	"	180	14	9
*YD3YGY	"	140	9	7
*YCØNAN	"	132	7	6
*YD7JLI	"	100	15	10
*YD1IYV	"	60	7	6
*YD1FFH	"	24	8	6

New Zealand

ZM2B	A	**203,632**	**287**	**208**
				(OP: ZL2BR)
ZL3P	"	29,106	111	98
				(OP: ZL3PAH)
ZM4T	21	**18,944**	**88**	**74**
				(OP: ZL3IO)
***ZL3VZ**	A	**46,964**	**139**	**118**

Philippines

DY1T	A	**130,824**	**293**	**158**
				(OP: DU1IVT)
DU1RB	14	**21,736**	**112**	**76**
DU1R	7	**188,100**	**248**	**165**
				(OP: DU1UGZ)
***DU1JM**	A	**586,608**	**625**	**264**
*DU1/N6HPX	"	22,420	125	76
*4I1AWM	"	5,040	54	48
*4I1BNC	"	1,144	29	26
***4F3BZ**	21	**59,880**	**181**	**120**
*DW3CWM	"	6,532	58	46
***4G1DIF**	7	**158,490**	**231**	**135**

SOUTH AMERICA

Argentina

LU5VV	A	**1,882,854**	**1179**	**522**
LU1BJW	"	394,200	462	300
LU6ETB	"	42,624	135	111
LU4DX	"	12,528	95	58
LU1DX	28	**23,100**	**105**	**84**
L55D	7	**67,100**	**128**	**110**
***LU1KCQ**	A	**89,838**	**199**	**161**
*L21RCA	"	28,170	125	90
				(OP: LU8ADX)
*LU1DW	"	40	5	5
***LW6EQG**	21	**4,104**	**46**	**36**
***LU7DUE**	14	**230**	**11**	**10**
***LU1VYL**	7	**13,566**	**60**	**57**
*LU7DW	"	1,050	16	15
		Brazil		
PY2KNK	A	**1,779,309**	**1056**	**549**
PT2AA	"	457,776	480	306
PP1CZ	"	396,474	459	299
PY2XJ	"	15,407	91	71
PY2AE	"	8,601	68	61
PY2EU	"	7,049	61	53
PY2GZ	"	270	33	30
PS7DX	21	**9,222**	**70**	**58**
PX2A	14	**1,032,846**	**806**	**474**
				(OP: PY2XV)
PY5ZHP	"	93,912	218	168
PS8CW	"	5,670	49	45
PY2KJ	7	**16,748**	**57**	**53**
PY5DC	"	3,888	28	27
***PQ2M**	A	**2,511,492**	**1204**	**564**
				(OP: PY2MNL)
*PP5DZ	"	669,036	637	381
*PY1FI	"	516,488	579	322
*PP5FZ	"	61,912	177	142
*PT8DX	"	29,355	120	95
*PY5ZW	"	22,680	126	81
*PY1SAD	"	22,264	118	88
*PV8AAS	"	22,072	114	89
*PU2USK	"	20,748	110	84
*PY4LH	"	19,840	107	80
*PY2ZA	"	14,000	89	70
*PT2SR	"	13,330	80	62
*PY2CAT	"	13,068	78	66
*PU9OJZ	"	8,541	97	73
*PP5TI	"	7,540	71	65
*PU8YPL	"	7,395	64	51
*ZZ2WAS	"	6,765	66	55
*PY2GM	"	5,504	51	43
*PY2MIA	"	4,452	51	42
*PY4ARS	"	2,759	42	31
*PU4TPM	"	2,470	47	38
*PY2AD	"	1,652	35	28
*PY2XL	"	1,122	27	22
*ZV2F	"	1,008	27	24
				(OP: PY2SFA)
*PU2YMH	"	336	16	16
*PY3KN	"	154	17	14
***PY2UD**	21	**1,019,172**	**761**	**462**
*ZV2C	"	839,257	725	419
				(OP: PY2CX)
*PY2QT	"	481,573	535	337
*PU2UAF	"	294,866	402	286
*PU1JSV	"	242,526	355	249
*PY2XC	"	85,652	203	161
*PY2VZ	"	81,432	194	156
*PY2KO	"	41,364	142	108
*PU2WDX	"	6,240	50	48
*PV8DX	"	1,950	28	25
*PU7ASP	"	1,482	33	26
*PY1IR	"	1,274	27	26
*PU1MIL	"	760	20	20
***PY2NY**	14	**411,642**	**490**	**297**
*PY4XX	"	209,933	344	233
*PY2TC	"	15,106	98	83
*PY2ZR	"	5,152	52	46
***PV8AJ**	7	**4,680**	**32**	**30**
		Chile		
3G1B	21	**856,830**	**761**	**390**
				(OP: CE1KV)
CA4PSH	7	**142,846**	**181**	**151**
***CE3KRM**	A	**5,456**	**51**	**44**
*XQ3SK/4	"	1,173	33	23
***CE3BN**	21	**36,234**	**129**	**99**
***CE7VPQ**	14	**72,280**	**199**	**130**
		Colombia		
HK6P	3.5	**6,586**	**43**	**37**
***HK3JJB**	21	**265,398**	**400**	**267**
		Equador		
***HC1JQ**	14	**115,731**	**241**	**167**

		Paraguay		
***ZP5DVD**	**A**	**134,848**	**240**	**172**
*ZP5DNB	"	21,844	108	86
***ZP5FIA**	**14**	**5,547**	**49**	**43**
		Peru		
***OA4DOS**	**A**	**14,912**	**93**	**64**
		Suriname		
***PZ5RA**	**A**	**1,430,244**	**842**	**459**
		Uruguay		
CX9AU	**A**	**147,136**	**276**	**176**
CV7S	**21**	**1,460,448**	**991**	**528**
				(OP: CX7SS)
***CX3CQ**	**14**	**30**	**5**	**5**
		Venezuela		
YV6BXN	**A**	**25,600**	**94**	**80**
YV4ABR	**7**	**24,066**	**68**	**63**
***YY5RAB**	**A**	**50,388**	**161**	**114**
***YV1SW**	**21**	**36,408**	**133**	**111**
***YV5LMW**	**14**	**1,200**	**20**	**20**
***YY5AEP**	**7**	**13,974**	**53**	**51**
*YV6BTF	"	9,000	51	50

QRP

RM5F	**A**	**1,081,520**	**983**	**440**
WK9U	**"**	**768,593**	**909**	**413**
YU1LM	**"**	**687,939**	**558**	**357**
IZ8JFL	**"**	**532,123**	**467**	**337**
R2PU	"	405,251	437	277
UA3QJJ	"	402,868	502	302
JA6GCE	**"**	**388,705**	**452**	**289**
HA6IAM	**"**	**387,440**	**422**	**290**
K2YG	**"**	**372,000**	**550**	**300**
N2WK	"	302,498	421	287
EA1CM	**"**	**293,265**	**337**	**245**
LZ3GW	**"**	**287,955**	**348**	**243**
LZ3RR	"	270,314	355	242
UX8IW	**"**	**204,580**	**313**	**212**
AC9KW	"	182,484	362	274
DL8MBS	**"**	**171,380**	**285**	**220**
ON/SO2U	**"**	**161,028**	**275**	**213**
				(OP: SP2UUU)
IK3TZB	"	140,410	236	190
DL1FCU	"	134,502	229	174
YL3FW	**"**	**115,656**	**203**	**158**
DL8LR	"	108,460	228	170
W6QU	**"**	**100,496**	**319**	**176**
				(OP: W8QZA)
WE6EZ	**"**	**96,480**	**332**	**180**
JH7UJU	**"**	**93,720**	**209**	**142**
TA1BM	**"**	**81,312**	**201**	**154**
JK1TCV	**"**	**80,958**	**196**	**131**
OK7CM	**"**	**74,100**	**167**	**130**
G8VVY	**"**	**72,324**	**187**	**164**
UT1AM	"	66,899	165	133
W4DWS	**"**	**66,576**	**223**	**146**
R3IBT	"	63,075	169	145
PE2K	**"**	**62,480**	**187**	**142**
JA4XHF/3	**"**	**59,169**	**183**	**121**
W4ER	"	55,913	218	143
EW8G	**"**	**52,514**	**149**	**121**
EA1GT	"	49,408	170	128
RV3DBK	"	47,243	159	119
PY2GTA	**"**	**45,108**	**145**	**126**
WS9V	"	36,875	170	125
VE3NZ	**"**	**36,801**	**125**	**87**
OK1DMP	"	35,890	107	97
CM3EFM	**"**	**30,590**	**114**	**95**
PC2F	"	29,904	99	89
GW7APP	**"**	**28,710**	**114**	**99**
SM1NJC	**"**	**26,789**	**102**	**89**
YO4AAC	**"**	**22,990**	**106**	**95**
I2BPP	"	18,900	90	84
AI9K	"	18,748	119	86
NE2P	"	18,357	109	87
OM3TLE	**"**	**18,009**	**98**	**87**
WAØMN	**"**	**17,388**	**126**	**92**
				(OP: NØUR)
EA4U	"	15,691	80	71
HK3W	**"**	**12,084**	**61**	**53**
DL3MHT	"	10,850	62	62
DK2CX	"	7,956	53	51
KKØU	"	6,642	68	54
ON3TG	"	5,994	59	54
UR3QGJ	"	5,750	53	50
BH8PHG	**"**	**5,740**	**52**	**41**
WB4OMM	"	5,566	48	46
NØSTP	"	4,488	55	51
KG4WZZ	"	2,964	48	39
9A5HZ	*"*	*2,408*	*28*	*28*
N6HI	**"**	**2,211**	**48**	**33**
NE3R	**"**	**2,208**	**35**	**32**
DL2BIS	"	1,872	27	24
XE2OCM	**"**	**1,334**	**31**	**29**
KBØUAZ	"	1,218	30	29
7L4IOU	"	1,064	20	19
BG5OA	"	476	18	14
CE3GCA	**"**	**336**	**17**	**14**
BA4VE	"	196	7	7
N4NQY	"	135	16	15
K8ZT	"	77	7	7
PA6ML	"	70	5	5
				(OP: PD4LYN)
KE8QID	"	2	1	1
JH3DMQ	**28**	**154**	**10**	**7**
YO3DAC	**21**	**13,800**	**89**	**69**
YO8WW	"	7,938	65	54
PY2RKG	**"**	**7,392**	**61**	**56**
JR1NKN	**"**	**7,252**	**59**	**49**
HA3HX	**"**	**4,182**	**44**	**41**
YD9UW	**"**	**3,360**	**54**	**42**
RA4DX	**"**	**3,354**	**42**	**39**
UR3ABM	**"**	**2,574**	**40**	**33**
JA4DQX	**"**	**2,340**	**31**	**30**
LZ5U	**"**	**1,925**	**32**	**25**
				(OP: LZ1MC)
LV4V	**"**	**1,344**	**26**	**24**
S54X	**"**	**1,200**	**25**	**24**
Z35Z	**"**	**840**	**20**	**20**
DF5RF	**"**	**261**	**10**	**9**
ZM3T	**"**	**45**	**5**	**5**
				(OP: ZL3TE)
DO8DHH	"	6	2	2
H2X	**14**	**1,061,260**	**777**	**470**
				(OP: 5B4ALX)
HA3JB	**"**	**249,407**	**382**	**289**
DK7HA	**"**	**231,544**	**362**	**281**
SP4LVK	**"**	**69,600**	**184**	**160**
YU1NR	**"**	**66,198**	**203**	**177**
R7KO	**"**	**54,912**	**182**	**143**
WU5K	**"**	**49,170**	**229**	**165**
				(OP: K5NZ)
G5N	**"**	**48,081**	**172**	**141**
				(OP: GØSBN)
CO2CW	**"**	**23,660**	**128**	91
HAØGK	"	18,914	112	98
K7XC	**"**	**12,432**	**117**	**84**
IZ2JPN	**"**	**10,508**	**77**	**74**
IZ8NWA	"	6,784	60	53
GWØEGH	**"**	**6,634**	**67**	**62**
9A3ZI	**"**	**5,814**	**54**	**51**
GMØHVS	**"**	**4,346**	**53**	**41**
IW1BCO	"	3,444	45	41
IZ2JNN	"	3,124	48	44
VE6EX	**"**	**2,623**	**45**	**43**
GØWAT	"	1,830	30	30
EA3FHP	**"**	**1,325**	**25**	**25**
UT8UU	**"**	**1,232**	**30**	**28**
UW5EJX/MM	"	663	23	13
UB4FFB	**"**	**572**	**45**	**44**
DF5EM	"	210	10	10
M5W	"	32	4	4
YT5DEY	**7**	**302,292**	**317**	**243**
DDØVS	**"**	**221,616**	**272**	**228**
SP9KAG	**"**	**142,044**	**206**	**178**
				(OP: SP9CXN)
UR5EPM	**"**	**131,760**	**223**	**183**
IU3FBL	**"**	**116,250**	**181**	**155**
DL2TM	"	74,620	153	130
9A1ØFF	**"**	**47,124**	**123**	**102**
				(OP: 9A6TT)
PD8DX	**"**	**31,980**	**96**	**82**
7N4WPY	**"**	**22,528**	**82**	**64**
IZ2QKG	"	19,152	74	72
R7MU	**"**	**6,806**	**43**	**41**
M2S	**"**	**3,596**	**33**	**31**
				(OP: GØMGM)
KP2XX/W9	**"**	**2,170**	**37**	**35**
US5WAC	"	420	16	15
YC8FXI	**"**	**48**	**6**	**6**
K7ILO	**"**	**2**	**1**	**1**
LY5G	**3.5**	**193,256**	**260**	**196**
OK1NG	**"**	**170,754**	**266**	**191**
IK4UXA	**"**	**117,216**	**233**	**176**
SP6EIY	**"**	**76,728**	**159**	**139**
W2NTN	**"**	**53,928**	**208**	**126**
KH6KG/W5	**"**	**25,284**	**130**	**98**
				(OP: KH6KG/W5)
M9N	**"**	**13,334**	**63**	**59**
				(OP: G7WHI)

ROOKIE
NORTH AMERICA

		United States		
		District 1		
***KO4GBD**	**A**	**5,243**	**54**	**49**
		District 2		
W3MLJ	**A**	**1,120,434**	**863**	**518**
***NN2DX**	**A**	**1,374,090**	**865**	**489**
				(OP: W4IPC)
*K3WHD	"	56,480	215	160
		District 3		
***KN1OLA**	**A**	**36,192**	**140**	**116**
		District 4		
KN4QDE	**A**	**1,456**	**31**	**28**
***N2OG**	**A**	**335,240**	**555**	**290**
*W4SSF	"	92,232	258	168
		District 5		
***KI5IXP**	**A**	**40,698**	**203**	**126**
		District 6		
***W6KSR**	**A**	**10,556**	**73**	**58**
*W6DMW	"	1,443	45	37
		District 7		
***KB2S**	**A**	**28,404**	**160**	**108**
		District 8		
***KE8QID**	**A**	**2**	**1**	**1**
		District 9		
***KD9NYE**	**A**	**40,812**	**162**	**114**
		Canada		
		District 3		
***VA3DKL**	**A**	**15,057**	**72**	**63**
		District 7		
***VE7ZFE**	**14**	**240**	**12**	**12**
		Panama		
HP1ELV	**A**	**2,178**	**39**	**33**

ASIA

		Asiatic Turkey		
***TA4IGN**	**A**	**325,268**	**346**	**233**
		China		
***BH3ERS**	**14**	**8,352**	**63**	**58**
		Japan		
		District 1		
JK1BAB	**A**	**32**	**4**	**4**
		District 6		
***JS6UGC**	**A**	**18,810**	**94**	**66**
		West Malaysia		
***9M2TDX**	**A**	**170,918**	**332**	**187**
*9M2SAF	"	22,592	104	64

EUROPE

		Belarus		
***EW1OK**	**A**	**201,720**	**283**	**205**
*EU8RO	"	36,084	110	93
		Belgium		
***ON3TG**	**A**	**5,994**	**59**	**54**
		European Russia		
		District 4		
UA4S	**A**	**2,190,509**	**1246**	**541**
				(OP: R4SAD)
		District 6		
***R7LY**	**7**	**118,678**	**219**	**173**
***RY6AAG**	**14**	**51,450**	**175**	**147**
*R7RBE	7	35,376	101	88
		Fed. Rep. of Germany		
DM7XX	**A**	**3,390,524**	**1334**	**778**
DJ5CT	"	3,042	43	39
***DL4VDA**	**A**	**609,102**	**565**	**342**
***DG4O**	**"**	**46,964**	**135**	**118**
				(OP: DG2BPW)
		Italy		
***IU2LTO**	**A**	**69,310**	**167**	**145**
*IUØKTT	"	5,600	39	35
		Netherlands		
***PEØV**	**A**	**8,554**	**48**	**47**
		Norway		
LB5GI	**A**	**4,216**	**37**	**34**
***LB6VI**	**A**	**65,380**	**182**	**140**
		Poland		
***SO5KR**	**A**	**374,664**	**400**	**268**
***SP9NSA**	**7**	**146,202**	**211**	**177**
*SP9MUF	A	88,044	175	138
		Scotland		
***GM4UQG**	**A**	**101,920**	**242**	**182**
		Serbia		
***YU4SMT**	**7**	**5,658**	**42**	**41**
		Slovenia		
***S55AL**	**A**	**207,100**	**297**	**190**
		Spain		
***EA3CI**	**3.5**	**425,334**	**409**	**273**
***EA5JDN**	**A**	**68,392**	**213**	**166**
		Ukraine		
***UR5EPV**	**A**	**416,448**	**483**	**288**

OCEANIA

		Australia		
VK2PW	**A**	**960**	**25**	**20**
		Indonesia		
7E3E	**A**	**171**	**9**	**9**
				(OP: YG3FZR)
***YB1RKT**	**A**	**223,014**	**365**	**218**
*YD1EMV	"	33,856	185	92
***YD1APO**	**7**	**10,000**	**80**	**50**
***YC2XCD**	**A**	**9,200**	**113**	**46**
***YC1JNV**	**7**	**8,288**	**92**	**37**
***YD3CER**	**21**	**7,089**	**55**	**51**
*YD2UWF	"	6,760	59	52
***YD1JDW**	**7**	**4,588**	**68**	**31**
*YD9HIB	"	2,116	35	23
***YD1FAM**	**A**	**1,728**	**42**	**27**
***YD2UFR**	**7**	**1,536**	**54**	**24**
*YD2NIR	"	1,480	45	20
***YB2BHX**	**A**	**1,280**	**44**	**16**
***YF3EKS**	**7**	**832**	**26**	**16**
*YD7HIJ	"	504	22	14
*YD1EEC	"	288	12	12
*YD1JBV	"	240	12	10

*YD1IYV	"	60	7	6
*YD1FFH	"	24	8	6
		Philippines		
***4G1DIF**	**7**	**158,490**	**231**	**135**
***DW3CWM**	**21**	**6,532**	**58**	**46**
***4I1BNC**	**A**	**1,144**	**29**	**26**

SOUTH AMERICA

Venezuela

***YY5RAB**	**A**	**50,388**	**161**	**114**

CLASSIC

NORTH AMERICA

United States

District 1

W1TO	*A*	*446,294*	*438*	*326*
*AB1J	A	564,616	789	378
*AF1R	"	199,808	375	223
*W1DYJ	"	105,525	267	175
*W1GD	"	72,360	138	135
*AE6JV	"	51,183	156	121
*N1RDN	"	40,135	152	115

District 2

WJ2P	A	837,935	790	445
				(OP: N2BA)
*AG2AA	A	288,002	490	286
*KB2MMI	"	10,541	103	83
*W2NTN	3.5	53,928	208	126

District 3

W3LL	A	1,766,256	1180	498
NI3Q	7	121,094	275	191
				(OP: W3FA)
*KY3W	A	547,170	633	390
*N3BD	"	106,218	298	189
*WA4GUD	"	51,712	150	128
*KD4IZ	"	5,016	35	33
*AJ3DI	"	1,274	29	26
*N3NZ	14	884	26	26

District 4

WF4W	A	751,713	833	381
W4VIC	"	368,637	456	309
K4WW	"	366,975	490	315
W3IK	"	226,904	531	273
*N3CKI	A	307,380	490	282
*AC4G	"	273,780	450	270
*N5SMQ	"	135,360	325	192

District 5

WQ5L	A	576,032	684	376
N5PU	"	89,930	259	170

District 6

AJ6V	A	926,187	1067	433
AG1RL	"	746,428	974	382
				(OP: W1SRD)
K6NR	"	204,314	509	251
WA6URY	"	1,000	20	20
*KF6RY	A	308,275	682	295
				(OP: W6ZL)
*N7WLC	"	35,100	190	117

District 7

*WW7E	A	126,029	402	200
				(OP: W7VO)
*K7AZT	"	24,948	149	99
**N7VS*	"	*17,765*	*129*	*95*
*AD7L	"	4,752	64	54
*W7RCS	"	2,760	44	40
*KI7DET	"	1,178	37	31
*N8FKF	14	1,056	34	32
*W7MTL	A	464	16	16

District 8

*K3JT	A	277,947	499	267
*AC8JW	"	125,636	337	196
*WS6K	"	72,000	242	160
*N8FYL	"	3,690	51	41

District 9

WI9WI	A	189,185	402	241
KS9K	28	86,814	6	5
				(OP: N4TZ)
*WB8BZK	A	429,831	684	293
*K9CS	"	187,146	433	222
*K9ZO	"	179,375	401	205
*KB9DVC	"	73,610	260	170

District Ø

N7WY	A	663,534	755	386
NØTA	"	543,244	919	337
WØZQ	"	350,165	581	295
KRØP	21	147,368	310	218
*WDØT	A	470,840	831	316
*NXØI	"	291,082	599	262
*WA7NPX	"	125,370	321	210
*WØDC	"	85,562	266	179
*KKØU	A	6,642	68	54

Alaska

NL8F	3.5	3,712	37	29

Canada

District 2

*VE2OWL	A	131,144	215	194

District 3

VE3DZ	A	824,360	632	370
VE3GYL	"	655,452	634	378
VA3WW	"	82,080	188	135
VA3MW	"	55,775	138	115
*VE3KI	A	1,086,176	826	416

District 4

*VE4DL	A	64,260	221	135

District 6

*VA6RCN	A	87,252	232	132

Cuba

*CO6OV	14	185,372	371	242
*CO2XK	3.5	10,290	55	49

Mexico

*XE2OCM	A	1,334	31	29

Puerto Rico

*NP3V	21	5,712	57	51

AFRICA

Canary Islands

ED8W	A	4,844,484	1805	666
				(OP: EA8DO)

ASIA

Asiatic Russia

District Ø

RWØSR	A	481,470	532	330
*RØUAV	A	86,868	200	171
*RØUT	"	37,510	138	110
*UAØQNV	14	6,765	59	55

Asiatic Turkey

*TA7AEK	A	143,819	264	196
*TA2L	"	12,780	67	60

India

VU2DED	A	305,536	362	248
*VU2IBI	A	74,292	185	151

Japan

District 1

JR1NHD	14	170,820	290	219
JA1XRA	A	104,280	207	158
*JA1ATM	A	19,125	96	75
*JA1GZK	7	5,100	28	27

District 3

JA3QOS	A	267,424	363	244
**JR3GPP*	*7*	*5,301*	*23*	*19*

District 6

JA6BCV	14	36,059	121	107
JA6BZI	A	7,104	59	37

EUROPE

Belarus

EW8Z	A	137,280	229	165
*EU1FQ	A	39,800	118	100

Belgium

ON4CT	A	1,210,880	770	440
*OQ4U	A	789,243	614	413
*ON3LX	"	664,326	722	372
*OPØJ	14	110,898	243	202
				(OP: ON5GF)

Croatia

**9A5HZ*	*A*	*2,408*	*28*	*28*

Czech Republic

OK1XC	21	39,648	136	112
*OK1MDK	A	381,767	418	284
*OK7N	"	144,624	247	184
*OK1BJ	"	79,328	171	148
*OK2BXW	7	7,392	43	42

Denmark

OZ11A	*7*	*1,264,356*	*772*	*414*
*OZØJD	7	509,894	466	301
*OZ1AOO	A	12,369	62	57

England

*MØHMO	A	1,051,498	704	414
*GØFGI	"	589,164	508	348
*G1N	7	358,258	381	257
				(OP: GØURR)
*G4ZOB	"	320,000	318	252
*G4DDL	A	253,700	348	236
*G8VVY	A	72,324	187	164
*G5N	14	48,081	172	141
				(OP: GØSBN)

European Russia

District 1

*R1YY	14	6,944	68	62

District 3

RT5C	A	30,272	98	86
R5AK	"	21,021	93	91

District 4

*RA4AG	A	95,625	228	153

District 6

*RA6LIS	14	201,761	389	259
*RJ7M	7	48,972	121	106

Fed. Rep. of Germany

DL1DTL	14	237,412	384	278
DL2AK	7	210,144	279	199
DK6IM	A	142,560	258	160
*DK1KC	A	1,089,004	754	437
*DK5DQ	"	863,328	648	391
*DF4ZL	"	626,400	537	348
*DFØBV	"	309,290	318	314
				(OP: DL1MAJ)
*DL6SFR	"	226,319	293	227
*DL2HYH	"	139,104	210	189
*DK9BM	"	84,303	205	171
*DL9GMC	"	65,278	165	127
*DL8ZAJ	"	62,832	163	132
*DL6DJ	"	60,382	157	133
*DF6JF	"	30,502	116	101
*DL9TU	"	28,888	109	92
*DL1RPR	"	25,200	106	90
*DK2VM	"	8,096	52	46
*DL1OAI	"	2,001	29	29

Finland

OH1X	A	481,395	502	335
				(OP: OH3WW)
OG4X	"	147,680	308	208
				(OP: OH1MA)
*OH2LZI	A	252,187	368	247
*OH2LU	"	245,271	316	247

France

TM5T	3.5	165,540	245	178
				(OP: F5VKT)

Greece

*SV3SKM	14	149,850	333	222
*SV7CUD	A	63,196	151	122
*SV1MO	"	10,528	62	56

Guernsey

*GUØSUP	A	693,427	546	413

Hungary

*HG83BTND	A	193,116	263	209
				(OP: HA5GY)
*HA9MDN	7	62,540	133	118
*HAØGK	14	18,914	112	98

Italy

IZ2FOS	A	1,321,155	792	495
IK5FKE	"	838,228	621	367
IZ4UFB	"	176,180	291	230
IZ3LUF	14	86,940	218	180
*IW1PNJ	7	1,051,024	655	403
*IU4JJP	A	405,132	420	294
*IK4ALM	14	308,273	450	329
*IW1RLC	A	122,271	215	159
**IZ7GIT*	"	*68,906*	*145*	*131*
*I4JEE	"	64,856	159	134
**I5OYY*	"	*49,284*	*148*	*148*
*IZ3ZOO	"	14,555	74	71
*IZ3XNJ	"	9,802	65	58

Lithuania

*LYØNAS	A	21,789	92	81

Luxembourg

LX2LX	A	1,044,240	726	458
LX4ØDA	"	731,747	611	361
				(OP: LX1DA)

Malta

*9H1CG	A	31,753	128	113

Netherlands

*PA6ANT	A	37,387	128	109

North Macedonia

*Z35Z	21	840	20	20

Northern Ireland

MI5K	3.5	737,472	529	334
				(OP: MIØSLE)
*MIØI	A	11,330	62	55

Norway

*LA8OKA	A	32,806	120	94

Poland

SN4X	A	1,083,754	697	398
				(OP: SP5OXJ)
SO5E	3.5	573,400	490	305
				(OP: SP5VIH)
SN7F	7	505,408	419	298
				(OP: SP7AH)
*SP9BGS	A	316,389	349	263
*SP9HE	"	84,528	167	144
*SQ4HKU	14	21,344	108	92
*SP4NKJ	21	15,008	92	67
*SP9GZW	A	494	13	13
*SP9KAG	7	142,044	206	178
				(OP: SP9CXN)

Romania

*YO5AXF	14	76,384	205	176

Scotland

*GMØHVS	14	17,040	53	41

Serbia

YU3A	A	285,714	286	286
*YU1KT	A	134,862	230	169

Sicily

*IT9FRX	A	46,625	160	125

Slovak Republic

*OM1NW	14	133,263	271	221
*OM3TLE	A	18,009	98	87

Spain

EC5K	A	2,351,250	1271	627
EA2KU	"	474,354	536	342
*EB4GOO	A	411,822	418	274
*EF3R	"	56,502	153	129
			(OP: EA3EYO)	
*EB3TR	"	31,598	141	122
*EA3CFV	"	6,032	61	58

Switzerland

HB9RMM	A	61,132	151	124

Ukraine

UT2AU	A	598,986	543	321
*UT1AN	14	217,764	373	276
*USØVA	A	5,593	51	47
*UW5EJX/MM	14	3,078	23	13
*UR3ABM	21	3,042	40	33

Wales

*MW9W	A	967,904	740	406
*GW7APP	A	28,710	114	99

OCEANIA

Australia

*VK3TX	7	1,496	22	22

Indonesia

YB2HAF	A	112,560	247	168
*YC9XYP	14	177,463	314	221
*YB3BGM	A	4,760	52	40
*YC5YDD	"	1,848	58	28
*YB1NIN	7	986	35	17
*YC8AO	14	368	13	9
*YC7VGB	A	6	3	3
*YC2VOC	28	1	1	1

Philippines

DY1T	A	130,824	293	158
			(OP: DU1IVT)	

SOUTH AMERICA

Argentina

*L21RCA	A	28,170	125	90
			(OP: LU8ADX)	

Brazil

PX2A	14	1,032,846	806	474
			(OP: PY2XV)	
PY2KJ	7	16,748	57	53
PY2EU	A	7,049	61	53
*PY2NY	14	411,642	490	297

TRIBANDER / WIRES

NORTH AMERICA

United States

District 1

K1SM	**A**	**658,442**	**653**	**401**
N1KM	"	388,143	522	303
KR1CW	"	369,929	506	301
			(OP: W1CTN)	
WA1DRQ	"	54	6	6
***NG1M**	**A**	**724,470**	**782**	**410**
*KA1YQC	"	322,936	528	296
*K7RB	"	144,778	282	191
*W1IG	"	26,695	119	95
*K1AR	"	3,600	40	36
*W1MJ	"	2,720	36	32

District 2

KE2D	**A**	**2,121,312**	**1205**	**608**
KA2K	"	1,763,694	1194	573
WX2NJ	"	1,616,470	1023	545
			(OP: K2RET)	
W2JV	"	1,472,166	1052	566
NN2NN	"	870,658	843	458
WB2NVR	"	853,573	804	427
WO2T	"	340,128	472	288
N2YBB	**14**	**167,535**	**351**	**255**
NS2N	A	145,754	321	203
K2TW	**3.5**	**19,096**	**104**	**77**
KA2AEY	A	14,790	110	85
***AH2O**	**A**	**606,284**	**711**	**413**
*WB2JVO	"	242,840	473	260
				(OP: K2AL)
***W2VTV**	**7**	**207,452**	**351**	**239**
*AC2RL	A	155,433	308	197
*KS2G	"	126,442	316	191
*NA2NY	7	103,620	263	165
*W2FDJ	A	41,358	145	113
***KB2URI**	**21**	**36**	**6**	**6**

District 3

N3QE	**A**	**3,500,643**	**1665**	**739**
WT3K	"	1,685,480	1126	580
W2CDO	"	1,415,340	918	540
K3WJV	"	991,608	788	474
WA3AAN	**7**	**532,016**	**555**	**328**
N3ALN	A	308,574	483	279
K3AU	"	263,250	358	250
			(OP: K2YWE)	
N3XL	"	195,776	373	224
K3MD	"	57,640	164	131
N3MWQ	"	54,670	202	142
***NF3R**	**A**	**281,668**	**491**	**268**
*AC3U	"	123,959	315	191
			(OP: W3UL)	
***W3IDT**	**7**	**113,488**	**236**	**173**
*K3ORC	A	68,856	224	151
*AI3KS	"	57,222	183	153
*WB3JIS	"	28,512	120	108
*KØBAK	"	630	18	18

District 4

N4CW	**A**	**2,073,478**	**1273**	**614**
NR4O	"	1,344,410	1184	466
NU4E	**7**	**1,269,120**	**860**	**480**
NU4Y	A	1,160,568	1137	486
K4SO	"	890,802	759	409
WS6X	"	792,232	795	392
K5VIP	"	738,162	723	414
W1AJT	"	615,996	538	426
			(OP: VE3UTT)	
AB4SF	"	608,404	689	356
AD4TJ	"	492,450	585	350
KEØL	"	461,340	592	330
W4GE	7	446,335	416	283
K3DNE	A	315,300	488	300
AA8R	"	298,452	475	308
AC6ZM	"	257,214	466	263
W4CU	"	54,058	194	151
AB4L	"	23,205	94	85
			(OP: N4GU)	
***WT4O**	**7**	**1,287,716**	**764**	**493**
***KM4SII**	**A**	**1,280,512**	**870**	**512**
*WA3LXD	"	407,880	701	309
*NN4NN	"	332,061	508	289
*W4PJW	"	280,900	473	265
*K4GM	"	229,392	418	243
***W4LC**	**14**	**227,445**	**387**	**295**
*K4FTO	A	104,859	304	183
*KT3T	"	87,039	243	171
*AA5JF	"	32,230	138	110
*W3OA	"	30,510	148	113
*W4NBS	"	5,148	39	39
***WØPV**	**21**	**4,224**	**48**	**44**
*W4SCP	14	1,998	40	37
			(OP: WAØLJM)	
*W4ER	A	55,913	218	143

District 5

AD5XD	**A**	**1,087,611**	**1203**	**469**
W5JK	"	319,422	731	278
NM5NM	"	265,356	519	252
			(OP: AA5B)	
K5MXG	**7**	**159,745**	**311**	**213**
K5CI	A	48,280	229	142
K5QR	**21**	**31,458**	**153**	**106**
***NN5T**	**A**	**288,798**	**520**	**254**
***K5IB**	**7**	**161,504**	**308**	**206**
*WA5LFD	A	55,476	208	134
*N5PD	"	42,051	193	131
*KF5KWO	7	5,040	48	45
*AF5CC	A	4,257	50	43

District 6

NB6U	**A**	**1,272,480**	**1282**	**482**
				(OP: N6ZFO)
K6TQ	"	424,514	744	334
AF6SA	"	316,092	614	318
W6SX	"	304,020	628	270
NG6O	*14*	*186,872*	*485*	*284*
				(OP: K6GHA)
NN6DX	A	169,569	449	249
				(OP: W1PR)
N6HE	"	81,081	268	143
KF6NCX	"	12,320	109	70
N5KO	"	672	17	16
NA6O	"	242	16	11
				(OP: @W6SRR)
***WZ8AA**	**21**	**36**	**7**	**6**

District 7

KO7SS	**A**	**952,496**	**885**	**472**
WA7LNW	"	515,652	791	388
N7UVH	"	499,985	955	361
K7JQ	"	285,576	587	292
KC7V	"	266,311	574	251
WU6W	"	221,130	517	243
W7LD	"	176,732	495	226
AA7V	"	176,656	434	244
KB7AZ	"	107,640	262	180
K6UM	"	51,745	206	131
W7SLS	"	41,788	192	124
***K7GS**	**A**	**394,290**	**590**	**390**
*WZ8T	"	138,212	364	218
*KE6K	"	127,982	324	178
*W7PP	"	57,512	194	158
*W7SO	"	34,526	179	122
*K7MY	"	27,540	157	108
*KNØW	"	10,001	99	73
*K6DGW	"	8,568	78	68

District 8

WA8MCD	**A**	**957,521**	**961**	**479**
K8YE	**14**	**881,010**	**677**	**461**
K8PK	A	471,861	656	327
KG9Z	**7**	**111,630**	**234**	**183**
WS8G	A	75,203	208	157
N8AA	"	56,304	223	138
***WB8JUI**	**A**	**474,300**	**678**	**306**
*AA8OY	"	380,072	533	308
***WB8K**	**7**	**246,006**	**400**	**237**
*W8AKS	A	185,380	360	230
*N8OXC	"	82,302	200	174
*K7DR	"	64,350	210	143
*KK8MM	"	50,625	198	135
*W8EH	"	43,180	181	127
*K8BL	"	39,446	152	121
*AF8C	"	13,348	83	71
*W3CB	"	1,482	30	26

District 9

W9ILY	**14**	**647,724**	**648**	**462**
ND9G	**A**	**513,342**	**613**	**361**
K9DUR	"	91,932	255	163
***K9CW**	**A**	**411,348**	**577**	**332**
*AB9YC	"	411,140	568	337
*N9UA	"	310,534	525	287
*KB9OWD	"	246,528	496	256
*KW9U	"	103,713	253	191
*WB9B	"	91,840	258	164
*KK9V	"	48,888	173	126
*WB9YIG	"	42,640	194	130
*KB9S	"	21,010	110	110
*AC9KW	A	182,484	362	274

District Ø

NIØK	**A**	**730,904**	**958**	**433**
W8LYJ	"	49,896	211	132
KØALT	"	27,930	124	98
***WØAAE**	**A**	**229,152**	**552**	**231**
*KØMKL	"	209,550	445	254
*NWØM	"	167,232	401	208
*K4IU	"	146,370	394	210
*KØJP	"	48,988	200	148
*WAØMN	A	17,388	126	92
				(OP: NØUR)

Alaska

AL7LO	**A**	**305,448**	**493**	**264**

Canada

District 1

***VA1XH**	**A**	**901,470**	**662**	**398**

District 2

***VE2BVV**	**A**	**946,476**	**715**	**431**
*VE2QV	"	9,625	60	55
***VE2NCG**	**28**	**63**	**3**	**2**

District 3

VE3JI	**A**	**2,081,664**	**1192**	**556**
VE3NE	"	1,123,590	789	402
VE3TW	"	620,052	618	317
VE3SS	"	13,167	77	63
***VE3MGY**	**A**	**943,533**	**816**	**369**
*VE3LVW	"	355,110	443	266
***VE3TM**	**14**	**306,020**	**374**	**277**
*VE3SST	A	123,930	261	162
*VE3RKS	"	42,513	152	111

District 6

VE6WQ	**14**	**360,297**	**599**	**301**
***VA6AK**	**14**	**182,727**	**383**	**237**

District 7

VE7CC	**A**	**1,337,112**	**1211**	**392**
***VE7DX**	**A**	**310,554**	**494**	**243**
*VE7AX	"	32,970	126	105
*VE7BGP	"	11,970	75	63

Costa Rica

***TI2OY**	**A**	**334,815**	**494**	**255**

Dominican Republic

***HI3AA**	**A**	**916,748**	**942**	**406**

Mexico

***XE1H**	**7**	**315,520**	**341**	**232**
***XE2OK**	**A**	**13,728**	**88**	**78**

Panama

HP3SS	**A**	**676,800**	**747**	**376**

Puerto Rico

KP4JRS	**7**	**496,446**	**278**	**187**
***NP4TX**	**A**	**389,640**	**465**	**255**
***KP4JFR**	**21**	**125,280**	**151**	**110**

U.S. Virgin Islands

***KP2B**	**A**	**575,640**	**752**	**351**
				(OP: WP3A)

AFRICA

Canary Islands

EA8DIG	**A**	**1,558,152**	**843**	**456**
***EA8W**	**A**	**159,280**	**232**	**181**

Morocco

***CN8KD**	**7**	**793,142**	**432**	**313**

Tunisia

***3V8SS**	**A**	**2,825,134**	**1285**	**563**
				(OP: KF5EYY)

ASIA

Afghanistan

T6A	**A**	**3,266,703**	**1491**	**561**

Asiatic Russia

District 9

RA9AU	**14**	**1,033,328**	**797**	**464**
***RT9S**	**A**	**1,942,450**	**969**	**530**
*RX9DJ	"	25,300	101	92
***UA9OV**	**7**	**780**	**15**	**15**

District Ø

UAØSU	**A**	**751,111**	**638**	**391**
RMØF	"	99,801	199	117
***RAØWHE**	**14**	**144,022**	**263**	**214**
***RAØAY**	**A**	**3,325**	**37**	**35**

Asiatic Turkey

***TA3ON**	**A**	**631,071**	**541**	**371**
*TA4RC	"	207,080	217	167

China

***BH9ELJ**	**A**	**70,413**	**188**	**147**

Japan

District 1

JA1BWA	**A**	**214,136**	**344**	**232**
7K4VPV	"	144,300	263	185
JH1CTV	"	121,989	237	157
JG1LHB	**14**	**107,800**	**233**	**175**
JI1JPJ	A	416	13	13
***7N2UQC**	**A**	**405,528**	**479**	**277**
*JA1MZM	"	188,997	312	219
*JF1WNT	"	121,072	243	161
***JE1CAC**	**14**	**97,812**	**214**	**171**
*JI1ALP	A	84,790	196	139

District 2

JF2FIU	**A**	**53,724**	**156**	**121**
***JA2FXV**	**A**	**108,346**	**232**	**142**
***JF2AIJ**	**21**	**171**	**10**	**9**

District 3

JA3HBF	**A**	**279,210**	**372**	**246**
JM3UGA	**14**	**4,602**	**46**	**39**
***JH3WKE**	**A**	**99,381**	**220**	**157**
*JL3MCM	"	53,248	134	104
*JN3TSY	"	6,460	52	38
*JA4XHF/3	A	59,169	183	121

District 4

***JE4MHL**	**A**	**305,786**	**382**	**247**
***JA4RMX**	**14**	**17,175**	**88**	**75**
***JH4FUF**	**7**	**1,020**	**15**	**15**

District 6

***JH6QIL**	**A**	**105,266**	**235**	**146**
***JH6SCA**	**14**	**10,492**	**69**	**61**

District 7

JA7MAD	**A**	**180,297**	**296**	**201**
***JA7MWC**	**A**	**13,050**	**79**	**58**

District 8

***JM8FEI**	**A**	**81,135**	**235**	**135**
*JE8KKX	"	7,084	49	44
*JK8PBO	"	6,348	58	46

District 9

JA9CWJ	**14**	**197,635**	**307**	**235**
JA9CCG	**A**	**101,574**	**223**	**171**
JH9CEN	"	25,800	100	86

District Ø

***JJØPJD**	**A**	**115,552**	**241**	**157**

Kazakhstan

***UN4PG**	**21**	**117,180**	**232**	**186**

Lebanon

***OD5ZF**	**7**	**1,154,320**	**541**	**376**

Saudi Arabia

***HZ7C**	**7**	**382,360**	**285**	**242**
				(OP: 7Z1SJ)

United Arab Emirates

A65DR	**A**	**1,694,952**	**985**	**456**
				(OP: G7SLP)

EUROPE

Belarus

EU1DX	**14**	**184,747**	**321**	**239**
***EW8G**	**A**	**52,514**	**149**	**121**

Belgium

OR3A	**A**	**742,616**	**547**	**356**
				(OP: ON6CC)
ON6NL	**14**	**737,070**	**667**	**474**
ON7ET	A	296,208	320	242
***ON5GQ**	**A**	**2,485,596**	**1258**	**618**
*OP4A	"	318,372	356	258
***OQ4B**	**14**	**309,618**	**419**	**309**
				(OP: ON4BHQ)
*OT5Q	"	143,412	281	228
***ON4CBA**	**7**	**129,600**	**208**	**162**
*ON/SO2U	A	161,028	275	213
				(OP: SP2UUU)

Bosnia-Herzegovina

E72U	**A**	**240,672**	**282**	**218**
***E73AA**	**7**	**1,041,964**	**674**	**398**
***E77EA**	**3.5**	**573,992**	**472**	**314**
***E77D**	**A**	**249,312**	**326**	**224**

Bulgaria

LZ1ZM	**14**	**1,491,348**	**1054**	**633**
***LZ1QV**	**A**	**695,862**	**523**	**402**

Crete

SV9COL	**21**	**133,136**	**303**	**212**
***SV9RNG**	**A**	**189,750**	**356**	**230**

Croatia

9A9A	**3.5**	**2,575,210**	**1104**	**571**
9A4W	*14*	*17,181*	*99*	*83*
***9A6A**	**3.5**	**1,256,520**	**737**	**444**
*9A1CBM	"	51,528	123	114
				(OP: 9A5ST)

Czech Republic

OK1FRD	**A**	**1,353,996**	**885**	**486**
OK6DJ	"	420,849	428	297
OK1PI	"	153,062	250	203
***OK4GP**	**A**	**1,553,955**	**778**	**507**
***OK2RU**	**7**	**1,358,204**	**718**	**457**
*OK2VV	A	1,220,259	826	411
*OK2CLW	"	975,390	637	410
*OK1PMA	"	584,518	518	326
***OK1BOA**	**3.5**	**442,494**	**416**	**279**
*OK2PF	A	384,552	414	294
*OK2APY	"	164,424	251	186

Denmark

OZ9GA	**A**	**2,076,515**	**1113**	**553**
5Q2J	"	829,925	631	373

England

M7T	**A**	**3,192,045**	**1377**	**723**
				(OP: G3YYD)
GX5EA	"	242,634	330	218
				(OP: M1DDD)
G3PXT	"	121,935	212	165
G3SVD	"	53,200	158	140
M2D	"	41,638	118	109
				(OP: G4NVR)
GX4GA	**7**	**39,104**	**102**	**94**
				(OP: G4IRN)
***M2J**	**A**	**1,354,560**	**803**	**480**
				(OP: G4NBS)
***G4N**	**7**	**321,100**	**334**	**247**
				(OP: G4ZVB)
*MØUNI	"	252,636	267	222
*M1G	A	248,292	331	242
***M5BIR**	**3.5**	**216,678**	**288**	**201**
*2EØCVN	A	150,220	292	203
*MØVQP	"	56,280	150	120
*G8AFN	"	25,571	98	91

Estonia

ES4RD	**A**	**816,080**	**702**	**404**

European Russia

District 1

RV1CC	**A**	**16,458**	**82**	**78**

District 3

R3TE	**14**	**296,092**	**473**	**316**
RA3TT	**A**	**92,421**	**227**	**189**
***UF5A**	**3.5**	**422,820**	**391**	**290**
***R5ACQ**	**14**	**246,210**	**408**	**290**
***UA3LID**	**A**	**210,370**	**300**	**218**
***R3LC**	**21**	**140,556**	**88**	**71**
*RN3OG	A	85,824	206	149
*RA3TE	14	79,920	224	185
*R3IBT	A	63,075	169	145

District 4

RA4WE	**14**	**196,393**	**346**	**277**
***UA4FX**	**A**	**229,600**	**340**	**224**
*R4RB	"	80,597	234	187
*UI4F	"	6,608	64	56

District 6

UC6N	**14**	**620,436**	**649**	**447**
***R7MM**	**A**	**1,647,680**	**1045**	**542**
***R6DNK**	**14**	**266,114**	**435**	**298**

Fed. Rep. of Germany

DQ9Y	**A**	**3,246,264**	**1226**	**756**
				(OP: DF2SD)
DP6K	"	2,905,084	1222	694
				(OP: DJ3NG)
DM5TI	"	2,475,770	1179	634
DLØHMK	"	2,289,790	1122	590
				(OP: DF2HN)
DL6JZ	"	2,028,257	1089	583
DHØGHU	"	2,021,355	909	621
DJ8EW	"	989,712	688	432
DD5ZZ	"	649,985	531	343
DP5L	"	612,744	467	363
				(OP: DH1TST)
DF1LX	"	517,128	408	348
DK8ZZ	"	208,069	289	233
DK3GI	"	181,896	267	212
DK5MB	"	179,140	250	212
DG9BEO	"	169,041	266	201
DG3FK	"	138,226	248	206
DK5KK	"	83,657	157	133
DL4ABR	**7**	**79,647**	**122**	**104**
DL6OCM	A	51,094	135	118
DL1NEO	"	48,384	121	108
DR165TESLA	**14**	**46,530**	**159**	**141**
DQ2C	**21**	**33,088**	**125**	**94**
				(OP: DL2SAX)
DL7LX	7	1,406	19	19
***DL9YAJ**	**A**	**1,874,727**	**852**	**603**
*DL1MGB	"	1,051,520	687	424
*DK2OY	"	987,648	731	384
*DL3SYA	"	978,670	755	385
*DJ2AX	"	891,636	704	402
***DL5KUD**	**7**	**563,736**	**443**	**332**
**DL1EAL*	*A*	*266,110*	*306*	*230*
*DL9YED	"	253,134	287	246
*DM6EE	"	186,244	278	202
***DL3KVR**	**14**	**162,316**	**317**	**238**
*DK2WU	A	159,804	238	193
*DHØDX	"	135,880	244	172
				(OP: DK5TX)
*DJ3GE	"	132,432	230	186
*DL5ASK	"	95,151	203	161
*DF3EH	"	59,805	157	135
*DL2ZA	7	11,322	58	51
*DL5GAC	A	10,260	64	60
*DM6CS	"	8,692	59	53
*DG1CMZ	"	6,804	45	42
*DH7TNO	"	3,045	30	29
*DD5MA	"	2,250	26	25
*DG8KAD	"	2,046	23	22
*DK5TX	7	56	4	4
***DF5RF**	**21**	**261**	**10**	**9**

Finland

OH2GEK	**A**	**86,688**	**198**	**144**
***OG95AA**	**A**	**806,344**	**675**	**392**
				(OP: OH8KVY)
*OG8T	"	668,724	583	399
				(OP: OH8TV)

France

***F8PMO**	**14**	**16,560**	**92**	**90**

Greece

SV2BXA	**A**	**3,215,355**	**1240**	**715**
SV2KF	"	199,288	321	232
***SX2ØØCLJ**	**21**	**14,559**	**98**	**69**
				(OP: SV2CLJ)

Guernsey

***2UØWZY**	**A**	**50,220**	**129**	**108**

Hungary

HA8BE	**3.5**	**1,223,772**	**703**	**438**
HAØHW	**A**	**197,094**	**275**	**214**
***HA3OU**	**A**	**982,206**	**642**	**423**
*HA7MB	"	293,914	343	223
*HA9RC	"	156,625	223	179
***HA1WD**	**7**	**41,552**	**106**	**98**

Ireland

***EI3CTB**	**3.5**	**39,894**	**29**	**28**

Italy

IX1CLD	**A**	**1,908,382**	**1031**	**503**
IU4CHE	**14**	**867,996**	**746**	**486**
I2DJX	A	817,740	618	420
I2SVA	"	723,430	582	365
IZ3SQW	**3.5**	**691,840**	**487**	**368**
IK2SND	*A*	*590,640*	*533*	*368*
IZ2BVC	"	520,326	530	274
IK7NXU	"	339,300	353	300
I7CSB	"	307,440	384	280
IK2AHB	"	287,646	334	251
IK5PWS	"	278,331	355	257
IZ2GNQ	**7**	**202,078**	**256**	**191**
IU4CSS	A	147,553	267	197
IZ5FSA	"	123,264	235	192
IV3RYP	"	83,352	158	138
IZ4IRO	"	33,660	100	85
IZ4REF	3.5	25,840	98	76
IZ5EME	7	24,804	80	78
IV3NVB	A	14,348	77	68
IV3XPP	"	11,269	60	59
***IK2BUF**	**A**	**1,047,444**	**717**	**457**
***IW2MXY**	**7**	**952,698**	**588**	**411**
*IU5ICR	"	787,600	562	358
*IK4ZIF	A	621,962	498	374
*IW1CBG	"	548,093	501	317
*IK4QJF	"	517,440	488	330
*IV3BCA	"	354,090	372	330
***IK4DCX**	**14**	**158,456**	**276**	**232**
*IK2OVT	A	150,084	231	198
*IKØPEA	"	145,436	232	206
*IZ5IMB	"	141,180	256	195
*IW5AOT	"	122,748	198	159
*IUØDZA	"	121,004	238	179
*IZ7XNB	14	117,720	256	215
*IK6CLX	A	116,460	227	180
***IK4RQJ**	**21**	**100,998**	**219**	**181**
*IV3ONZ	A	88,768	179	152
*IWØGYC	"	86,032	184	152
*IU8DKG	"	66,712	136	124
*IZ1PLH	7	65,250	145	125
*IK3ZBM	A	65,025	163	153
*IK2IKW	"	64,944	149	132
*IZ8MXB	21	61,138	172	154
***IU4FKR**	**3.5**	**58,348**	**135**	**112**
*IV3AZV	"	33,464	110	89
*IK2UEX	A	27,398	125	103
*IK8UND	"	13,568	69	64
*IØYQV	3.5	11,232	57	52
*IV3KKW	A	9,964	54	47
*IW1RLS	"	8,320	55	52
*IK5ZUI	7	7,896	50	47
*IWØHK	A	7,452	57	54
*IK4UOA	7	5,148	35	33
*IZ1GLX	A	3,120	31	30
*IZ2BHQ	"	1,020	17	15

*IQ2DN	14	1,012	22	22
			(OP: IZ2JQP)	
*I1DXD	A	550	11	11
*IK3SSG	21	56	8	8
*IZ8JFL	A	532,123	467	337
*IZ2QKG	7	21,684	74	72
		Latvia		
YL9T	**A**	**1,703,520**	**995**	**520**
***YL1ZF**	**A**	**2,997,234**	**1284**	**657**
***YL3IR**	**14**	**30,720**	**120**	**120**
*YL3FW	A	115,656	203	158
		Lithuania		
LY2MM	**3.5**	**214,240**	**272**	**206**
***LY2TS**	**A**	**786,840**	**622**	**395**
***LY2PAD**	**7**	**716,184**	**537**	**348**
*LY4K	A	699,754	532	374
		Luxembourg		
***LX1ER**	**A**	**1,036,953**	**681**	**411**
		Netherlands		
PAØWRS	**A**	**384,856**	**416**	**292**
PA2A	"	220,492	292	199
PC4H	"	148,365	238	189
***PDØWR**	**A**	**96,432**	**198**	**168**
*PG1R	"	63,744	148	128
*PA5W	"	32,277	104	87
*PD5W	"	23,852	101	89
		North Macedonia		
Z35T	**14**	**1,426,620**	**1073**	**590**
***Z39A**	**A**	**159,516**	**244**	**211**
		Norway		
LA3BO	**A**	**1,383,858**	**928**	**441**
LN5O	**7**	**82,350**	**155**	**135**
			(OP: LB3RE)	
***LC7N**	**A**	**1,478,700**	**939**	**477**
			(OP: LA5LJA)	
***LCØX**	**21**	**40**	**4**	**4**
			(OP: LB3RE)	
		Poland		
SO6C	**A**	**2,223,096**	**989**	**633**
			(OP: SP6CIK)	
SP5DL	**3.5**	**873,216**	**590**	**384**
***SP9H**	**A**	**928,605**	**587**	**465**
*SP3EMA	"	555,716	487	356
*SQ6ELK	"	505,440	454	312
*HF1Z	"	246,848	319	232
			(OP: SP1EG)	
*SP2TQQ	"	222,774	295	214
*SN1LH	"	100,492	186	148
				(OP: SP1J)
*SO1RON	"	51,408	143	119
*SP3QDX	"	45,870	139	110
***SQ9PPT**	**3.5**	**36,540**	**110**	**85**
***SQ9GOL**	**28**	**34,944**	**3**	**2**
***SQ3RX**	**14**	**2,997**	**40**	**37**
		Romania		
YQ6A	**A**	**3,046,050**	**1487**	**630**
			(OP: YO6BHN)	
YO3RU	"	2,154,146	1237	562
***YO4NF**	**A**	**1,851,408**	**999**	**559**
*YO5OHY	"	650,100	509	330
***YO2IS**	**14**	**169,344**	**321**	**252**
*YO9CWY	A	159,668	291	223
*YO3JW	14	10,990	75	69
		Scotland		
MM9I	**A**	**3,284,424**	**1484**	**638**
			(OP: GMØOPS)	
MM1E	**21**	**36,842**	**143**	**109**
			(OP: MMØGOR)	
GM4M	A	30,492	103	84
			(OP: GM4UBJ)	
MMØGOR	**3.5**	**19,404**	**77**	**66**
***MM2T**	**A**	**222,006**	**322**	**227**
***GM5M**	**14**	**157,773**	**324**	**231**
			(OP: GM4ZNC)	
		Serbia		
YT2U	**A**	**1,333,800**	**818**	**456**
YU7BW	**3.5**	**173,124**	**233**	**189**
***YTØX**	**A**	**965,178**	**700**	**387**
***YT9VM**	**7**	**957,588**	**579**	**401**
*YT9WW	A	151,404	258	186
		Sicily		
IT9VCE	**7**	**1,003,574**	**655**	**377**
IT9UFP	**A**	**1,682**	**30**	**29**
		Slovenia		
S5ØRY	**A**	**1,850,030**	**947**	**535**
			(OP: S53K)	
***S57SWR**	**A**	**869,253**	**643**	**371**
*S52W	"	196,546	263	202
		Spain		
EA2DLX	**A**	**945,438**	**743**	**391**
ED4T	"	526,464	545	384
				(OP: EA4R)
EA1B	**3.5**	**294,756**	**343**	**242**
EF1L	**7**	**83,936**	**144**	**122**
			(OP: EA1DA)	
EF5U	**21**	**41,796**	**147**	**129**
			(OP: EA5U)	
EA7KE	**14**	**5,300**	**53**	**50**

***ED7N**	**A**	**2,723,462**	**1309**	**658**
			(OP: EA7KHB)	
*EF7W	"	1,308,438	847	463
			(OP: EC7KW)	
*EA4BAS	"	1,058,910	827	470
***EF1A**	**14**	**810,576**	**731**	**468**
			(OP: EA1X)	
***EA3Y**	**7**	**500,960**	**388**	**310**
*EE5O	A	435,256	509	328
*EA2CCG	"	386,100	428	300
*EA4FME	7	257,488	325	242
*EA4DB	14	241,582	408	278
*EA4U	A	15,691	80	71
		Sweden		
SF1Z	**A**	**284,960**	**335**	**274**
			(OP: SMØHEV)	
SM6MVE	"	123,120	234	180
SD1A	"	81,354	194	149
			(OP: SM1TDE)	
SD4C	"	78,165	180	135
			(OP: SMØSHG)	
***SE6K**	**A**	**483,804**	**479**	**302**
			(OP: SM6FZO)	
*SFØA	"	231,280	301	236
			(OP: SMØLPO)	
*SM7CIL	"	111,338	211	179
*SE3X	"	33,024	106	86
			(OP: SA3BYC)	
		Switzerland		
HB5E	**A**	**305,203**	**306**	**239**
			(OP: HB9BUN)	
		Ukraine		
UZ1WW	**A**	**3,369,762**	**1436**	**682**
UR5R	"	2,533,704	1374	579
			(OP: UTØRM)	
US2IR	"	1,927,464	1179	539
US7KC	"	1,351,712	977	424
UT5ECZ	"	512,120	441	295
UT3N	**7**	**456,104**	**429**	**292**
			(OP: UT3NK)	
UR4EI	A	187,572	320	231
***UT4LW**	**A**	**3,282,878**	**1712**	**647**
*UT5EPP	"	1,270,950	972	458
***UR5SD**	**7**	**1,097,568**	**673**	**412**
*UX7QV	A	967,494	867	411
UZ2HZ	*3.5*	*733,096*	*549*	*371*
***UR2Y**	**14**	**299,268**	**460**	**306**
			(OP: USØYW)	
*US5EOI	7	206,780	257	211
*UR7CB	14	142,200	297	225
*UT8AS	A	111,705	220	165
*US5EEK	"	44,896	134	122
*UR5EPM	7	131,760	223	183
		Vienna Intl Ctr		
***4U1A**	**A**	**2,639,756**	**1193**	**644**
			(OP: HB9RB)	
		Wales		
GWØA	**A**	**4,006,440**	**1659**	**718**
			(OP: GW4SKA)	
***MWØCRI**	**A**	**1,422,135**	**948**	**495**

OCEANIA

		Australia		
VK3FN	**7**	**4,060**	**32**	**29**
		Hawaii		
***KH6CJJ**	**A**	**710,892**	**709**	**294**
		Indonesia		
YB4FIK	**A**	**129,630**	**275**	**149**
YC9ELS	**14**	**37,760**	**178**	**118**
***YBØNSI**	**14**	**54,450**	**183**	**121**
***YB9UA**	**21**	**36,960**	**128**	**86**
***YB2ECG**	**7**	**20,832**	**143**	**62**
***YD2KJC**	**A**	**9,672**	**84**	**52**
*YD3TVV	7	1,632	39	23
*YB2WA	"	800	17	16
*YD9UW	21	3,360	54	42
		New Zealand		
ZM2B	**A**	**203,632**	**287**	**208**
			(OP: ZL2BR)	
***ZL3VZ**	**A**	**46,964**	**139**	**118**
***ZM3T**	**21**	**2,331**	**5**	**5**
			(OP: ZL3TE)	
		Philippines		
***4F3BZ**	**21**	**61,105**	**181**	**120**

SOUTH AMERICA

		Argentina		
LU1BJW	**A**	**394,200**	**462**	**300**
LU4DX	"	12,528	95	58
***LU1KCQ**	**A**	**89,838**	**199**	**161**
		Brazil		
PP1CZ	**A**	**396,474**	**459**	**299**
***PQ2M**	**A**	**2,511,492**	**1204**	**564**
			(OP: PY2MNL)	
***ZV2C**	**21**	**839,257**	**725**	**419**
			(OP: PY2CX)	
*PY2XC	"	85,652	203	161
*PY2VZ	"	82,739	194	156

*PP5FZ	A	61,912	177	142
*PT8DX	"	29,355	120	95
*PY4LH	"	19,840	107	80
*PY2ZA	"	14,000	89	70
*PU7ASP	21	1,755	33	26
*ZV2F	A	1,008	27	24
				(OP: PY2SFA)
*PY3KN	"	154	17	14
*PY2RKG	21	7,392	61	56
		Chile		
***CE3BN**	**21**	**36,234**	**129**	**99**
***XQ3SK/4**	**A**	**1,173**	**33**	**23**
		Colombia		
HK6P	**3.5**	**6,586**	**43**	**37**

MULTI-OPERATOR
SINGLE TRANSMITTER HIGH POWER
NORTH AMERICA

	United States		
	District 1		
KT1I	875,792	910	431
	District 3		
K3AJ	1,356,300	888	495
	District 4		
N4SS	3,294,109	1740	683
WO4D	2,199,438	1689	639
	District 5		
NK5P	**3,156,468**	**1973**	**709**
	District 6		
ND2T	218,136	485	244
NN6NN	93,536	267	158
	District 7		
WF7X	**3,537,756**	**2116**	**732**
KU1CW	581,160	745	348
	District 9		
WB9TFF	660,270	868	390
	District Ø		
NØKE	430,122	781	343
	Canada		
	District 3		
VE3KTB	547,995	541	307
	District 7		
VE7KW	1,307,356	1215	422

ASIA

	United Arab Emirates		
A6ØA	**7,327,264**	**2339**	**784**
	West Malaysia		
9M4CPS	**9,622**	**77**	**34**

EUROPE

	Belgium		
OT6M	**4,198,029**	**1495**	**759**
	Croatia		
9A5D	**8,302,392**	**2573**	**969**
	Czech Republic		
OL57ZW	**11,179,872**	**2848**	**1056**
OK7O	7,715,520	2350	912
OK1KSL	5,448,080	1938	820
OL6D	2,374,952	1048	614
	European Russia		
	District 3		
RK3DXW	825,968	810	418
	Fed. Rep. of Germany		
DP6A	5,092,656	1705	816
DAØBCC	2,435,664	1243	616
	Finland		
OG66X	**6,034,894**	**2237**	**893**
	France		
F8KCF	**2,300,160**	**1169**	**599**
	Ireland		
EIØW	**1,481,760**	**950**	**504**
	Italy		
IQ4FC	**14,345,793**	**3368**	**1141**
IQ1RY	12,176,574	2970	1087
	Lithuania		
LY5W	**4,773,909**	**1662**	**809**
	Romania		
YO3GNF	675,078	598	354

	Slovak Republic		
OM5M	5,581,136	1823	836
	Switzerland		
HB9OK	148,896	252	198
	Wales		
MC2I	**4,435,227**	**1903**	**703**

OCEANIA

	Australia		
VK3VT	**959,994**	**732**	**399**
VK5GR	785,013	642	367
	Philippines		
4E3X	**1,762,640**	**1158**	**440**

SOUTH AMERICA

	Uruguay		
CX5A	**667,131**	**682**	**381**

MULTI-OPERATOR SINGLE TRANSMITTER LOW POWER

NORTH AMERICA

	United States		
	District 2		
*NJ1F	110,390	254	166
	District 4		
*K4MM	335,478	512	299
	District 5		
***NA5NN**	**1,496,012**	**1349**	**529**
	District 9		
***K9NR**	**2,155,200**	**1428**	**600**
*W9JWC	5,445	66	55
	District Ø		
***WTØDX**	**696,602**	**1067**	**379**
	Belize		
***V31MA**	**1,772,331**	**1199**	**473**
	Puerto Rico		
***WP3C**	**5,995,392**	**2276**	**832**

ASIA

	Japan		
	District 2		
*JK2VOC	106,904	242	161
	West Malaysia		
*9M2S	2,280	28	19

EUROPE

	Croatia		
*9A7B	512,952	511	319
	Czech Republic		
*OK1RPL	517,230	487	315
*OK1OFM	5,143	41	37
	Estonia		
*ES5YG	41,772	133	118
	European Russia		
	District 6		
*UA6KAC	135,450	289	215
	Fed. Rep. of Germany		
***DM4X**	**3,528,048**	**1383**	**744**
*DQ4W	2,778,560	1327	608
*DJ4MX	2,202,720	1046	624
*DB7QJ	151,700	246	185
*DQ4X	57,589	160	133
	Finland		
*OH5Z	327,144	368	258
	North Macedonia		
***Z36W**	**1,130,415**	**745**	**429**
	Poland		
*SP5KCR	278,331	365	257
*SN65KDU	172,396	253	188
	Romania		
*YO4KAK	5,060	49	44
	Slovenia		
***S57ZT**	**1,541,528**	**892**	**466**
*S54I	1,274,592	904	426
	Spain		
***EC7MA**	**3,664,122**	**1578**	**726**
*ED2C	384,504	444	296
	Ukraine		
*EN15ØPLU	362,544	420	273
*UR4NWW	108,054	218	174

OCEANIA

	Australia		
*VK4WIS	8,370	70	54
	Philippines		
*DX7EVM	245,895	404	195

MULTI-OPERATOR TWO TRANSMITTER

NORTH AMERICA

	United States		
NB3R	5,889,886	2441	874
NW8S	**4,805,376**	**2439**	**768**
NCØDX	**4,073,760**	**2446**	**736**
NA4DA	2,704,790	1769	670
KT7E	1,732,470	1681	510
KB3VQC	1,638,864	1200	599
KI6DY	1,186,220	1152	458
W2MKM	1,062,360	778	454
K3CCR	591,822	536	366
AK2S	436,240	592	328

ASIA

E2E	**699,504**	**681**	**354**

EUROPE

ED1R	**8,061,273**	**2554**	**963**
YL2UI	**6,877,911**	**2428**	**867**
EA2ESZ	3,850,956	1877	724
*DM5B	3,119,376	1474	624
LA1K	*1,891*	*33*	*31*

MULTI-OPERATOR MULTI-TRANSMITTER

NORTH AMERICA

	United States		
W3GH	5,971,467	2804	851
NR6O	**4,575,900**	**2909**	**700**

ASIA

*JK2EIJ/Ø	1,100	24	20

EUROPE

DP7D	**12,987,476**	**3376**	**1087**
DR3W	3,920,376	1506	758
*DG7RO	800,670	658	390

MULTI-OPERATOR MULTI-DISTRIBUTED

NORTH AMERICA

	United States		
WW4LL	**5,412,376**	**2677**	**842**
WV4P	5,378,570	2442	865
KZ1W	1,553,885	1398	505

CANADA

XM2X	**4,169,700**	**1862**	**738**

ASIA

VR2CC	**954,750**	**957**	**375**

EUROPE

J42S	**9,451,887**	**3068**	**879**
IQ3ME	5,506,074	2079	801
IR9K	**4,511,430**	**2025**	**735**
*IU2NSZ	3,120,390	1507	702
OL1Z	516,516	468	286

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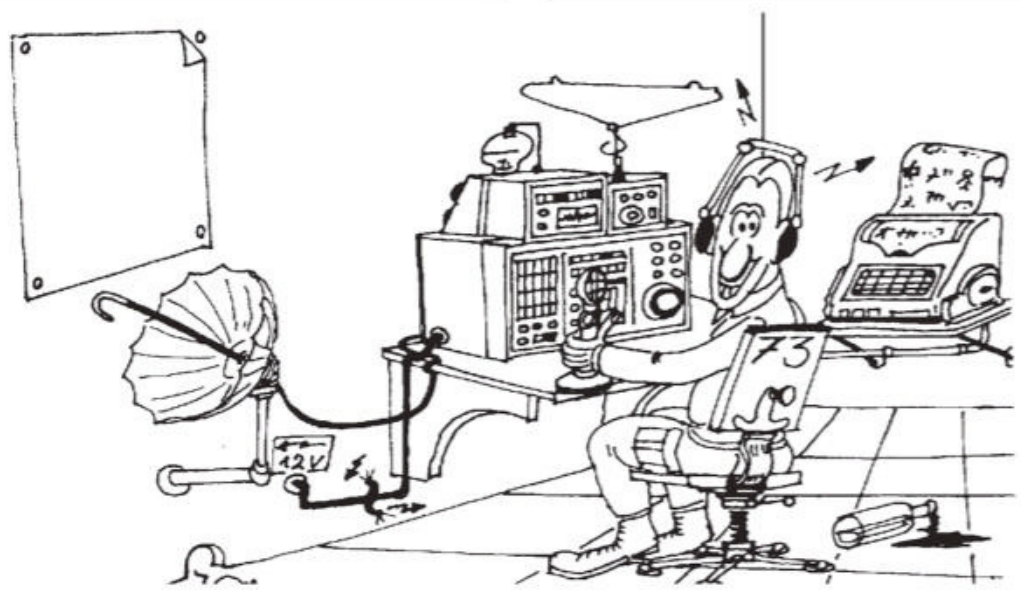

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