New Sunspot Cycle Flares to Life! p. 92

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CQ Amateur Radio

COMMUNICATIONS & TECHNOLOGY

JULY 2020

75 ANNIVERSARY

- Drive in License Exams, p. 12
- Results, 2020 CQ WPX RTTY Contest, p. 20
- Contesting Your Way to DX Success, p. 28

On the Cover: Putting an antenna to the test on a range at a microwave conference. KØIZ looks at plotting HF antenna patterns in this month's Learning Curve on page 64. Who's on this month's cover? See page 32 to learn how you can help solve our mystery and win a prize!

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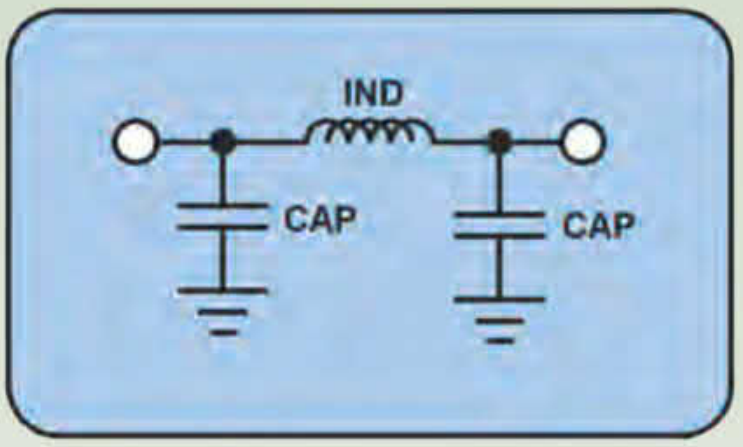
Basic Tuners

Not sure which tuner design does what? It's confusing for everyone. Check out this handy chart of popular tuner configurations made with capacitors and variable or tapped inductors. Each one has its useful place in the Ham shack. LDG Tuners are Switched-L Networks for a balance of efficiency, size and tuning range. Visit www.ldgelectronics.com to learn more and see our full line of Ham Radio accessories.

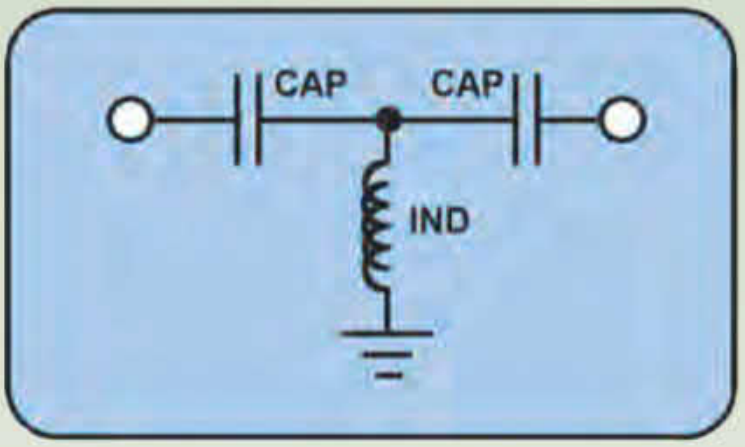
Pi Network

Widest Range. Used mainly for long wire and ladder line matching with its 100:1 SWR tuning range. Variable capacitors of 200pF and 470pF are obtainable through surplus, but large 20 µH variable inductor values increases size and cost



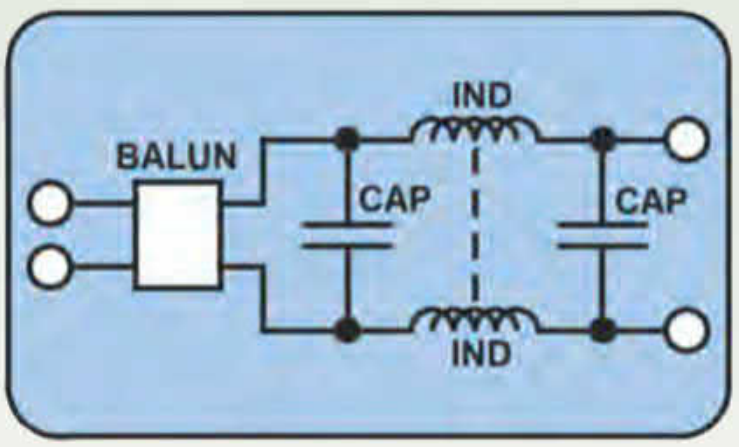
T-Match

Most versatile. Typically two variable 470 pF capacitors one 10 uH variable or tapped inductor. Popular for manual desktop matching due to its 60:1 SWR range. Prone to False tunes. The variable capacitors must be insulated from enclosure ground.



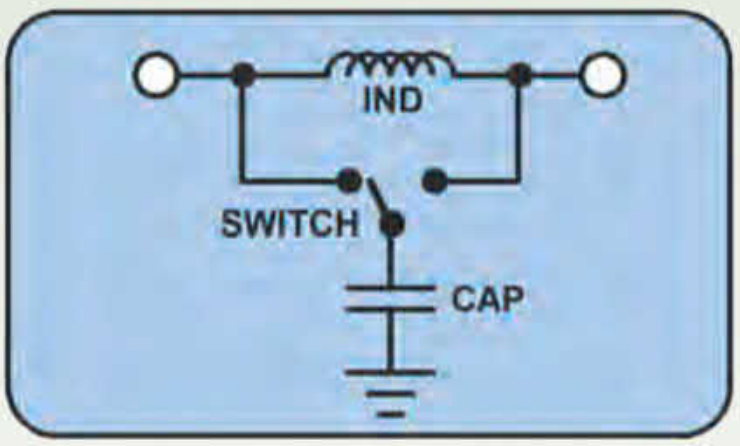
Balanced

Lowest loss, but it has the most parts and makes it the most expensive. The 20 uH inductors must be synchronized to turn at the same time and a 1:1 balun is used. Excellent for 450 ohm Ladder-Line and other balanced feedlines.



Switched-L

Most popular. Lowest parts count allows for smallest size and portable operation. One 10 uH inductor, one 4000 pF capacitor, and one Hi/Lo-Z switch. A medium 10:1 range limits tuning on antennas with very high SWR.



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ANNOUNCEMENTS

COVID-19 UPDATE

The COVID-19 pandemic has radically altered plans for any social gathering and hamfests and ham radio-related conferences are taking a huge hit. CQ urges all readers to please check with the organizers of these events to ensure the event will still be held.

JULY

AUBURN, INDIANA — The Northeastern Indiana Amateur Radio Association will hold the **Auburn Hamfest** from 9 a.m. to 3 p.m., Saturday, July 11 at the Auburn Cord Duesenberg Museum, 1600 Wayne Street. Email: <w9ou@arrl.net>. Website: <http://w9ou.org>. Talk-in 147.015+.

ALEXANDER, NEW YORK — The Lancaster Amateur Radio Club will hold the **Batavia Hamfest** beginning 6 a.m., Saturday July 18 at the Alexander Firemen Grounds, 10708 Alendaer Road (Rt. 98). Contact Luke, N2GDU, <luke48@gmail.com>. Website: <http://w2so.org>. Talk-in 147.285 (PL 141.3). VE exams.

CARY, NORTH CAROLINA — The Cary Amateur Radio Club will hold its 48th Annual Cary Mid-Summer Swapfest from 8 a.m. to 1 p.m., Saturday, July 18 at the Town of Cary's Ritter Park, 301 W. Lochmere Drive. Email: <n4nc@arrl.net>. Website: <www.caryarc.org>. Talk-in 146.88. VE exams.

CAMBRIDGE, MASSACHUSETTS — The Harvard Wireless Club, **MIT Electronics Research Society**, **MIT UHF Repeater Association**, and **MIT Radio Society** will hold the **Flea at MIT** from 9 a.m. to 2 p.m., Sunday, July 19 at the parking garage on Albany and Main Streets. Phone: (617) 253-3776. Website: <www.swapfest.us>. Talk-in 146.52 or 449.725- (PL 114.8).

VAN WERT, OHIO — The Van Wert Amateur Radio Club will hold the 32nd Annual **Van Wert Hamfest** on Sunday, July 19 at the Van Wert County Fairgrounds, 1055 S. Washington Street. Contact: Steve Kouts, WA8WKF, (419) 771-8152. Email: <secretary@w8fy.org>. Website: <http://w8fy.org>.

CHAMBERSBURG, PENNSYLVANIA — The Cumberland Valley Amateur Radio Club will hold the **CVARC Hamfest 2020** from 8 a.m. to noon, Saturday, July 25 at the Cumberland Valley Engine & Machinery Association Show Grounds, 1502 Criders Church Road. Email: <hamfest@w3ach.org>. Website: <www.w3ach.org>. Talk-in 147.120+ (PL 100). VE exams.

UTICA, NEW YORK— The Utica Amateur Radio Club will hold **RADIOCOM 2020** from 8 a.m. to noon, Sunday, July 26 at the Deerfield Firehouse Grounds, 5476 Trenton Road. Website: <www.uticaarc.com>. Talk-in 146.76-. VE exams.

AUGUST

TRUMANSBURG, NEW YORK — The Tompkins County Amateur Radio Association will hold the **Ithaca Hamfest** from 7 a.m. to noon, Saturday, August 1 at the Trumansburg Fairgrounds, NYS 96. Email: <ne2t@arrl.net>. Website: <http://tcara-ny.org>.

CENTRAL CITY, IOWA — The Cedar Valley Amateur Radio Club will hold the **3rd Annual Midwest STEM TechFest** and **2020 ARRL Iowa State Convention** on Saturday, August 8 and Sunday, August 9 at the Linn County Fairgrounds, 201 Central City Road. Contact: David Cripe, NMØS, <nm0s@arrl.net>. Website: <http://w0qg.org>. Talk-in 146.745- (PL 192.8). VE exams.

ELKHART, INDIANA — The Elkhart East Hamfest will be held from 9 a.m. to 3 p.m., Saturday, August 8 at the Northern Indiana Event Center, 21565 Executive Parkway. Email: <info@elkharteasthamfest.com>. Website: <www.elkharteasthamfest.com>. Talk-in 145.430 (PL 141.3).

FAYETTEVILLE, NORTH CAROLINA — The Cape Fear Amateur Radio Society will hold the **22nd Annual Ole Fashioned CFARS SwapFest** from 8 a.m. to noon, Saturday, August 8 at the Cumberland County Shrine Club, 7040 Ramsey Street. Contact: David, KI4W, (910) 624-1394. Email: <n4ughpat@aol.com>. Website: <http://cfarsnc.org>. Talk-in 146.910- (PL 100). VE exams.

O'FALLON, MISSOURI — The St. Charles Amateur Radio Club will hold the **SCARC Hamfest** from 7 a.m. to noon, Sunday, August 9 at the O'Fallon Elks Lodge, 1163 Tom Ginnever Avenue. Contact: Michael Maninger, KCØGKN, (636) 697-5381. Email: <scarc.hamfest.gmail.com>. Website: <http://wb0hsi.org>. Talk-in 146.670- or 145.330-.

RINGWOOD, NEW JERSEY — The Ramapo Mountain Amateur Radio Club will hold its **42nd Annual Hamfest** beginning 8 a.m., Saturday, August 15 at St. Catherine's Roman Catholic Church Parish Center, 112 Erskine Road. Contact: Anthony Cassera, N2KDZ, (973) 839-3564. Email: <n2kdz@optonline.net>. Website: <www.qsl.net/rmarc>. Talk-in 146.49 (PL 107.2).

CAMBRIDGE, MASSACHUSETTS — The Harvard Wireless Club, **MIT Electronics Research Society**, **MIT UHF Repeater Association**, and **MIT Radio Society** will hold the **Flea at MIT** from 9 a.m. to 2 p.m., Sunday, August 16 at the parking garage on Albany and Main Streets. Phone: (617) 253-3776. Website: <www.swapfest.us>. Talk-in 146.52 or 449.725- (PL 114.8).

NEWTOWN, CONNECTICUT — The Candlewood Amateur Radio Association will hold the **Western CT. Hamfest** beginning 8 a.m., Sunday, August 23 at the Edmond Town Hall, 45 Main Street. Contact: John Morelli, W1JGM, (203) 417-0160. Email: <hamfest@cararadioclub.org>. Website: <http://cararadioclub.org>. VE exams

OWENSVILLE, OHIO — The Milford Amateur Radio Club will hold the **2020 Cincinnati Hamfest** in conjunction with **W8DXCC** from 8 a.m. to 6 p.m., Saturday, August 29 at the Claremont County Fairgrounds, 1000 Locust Street. Website: <http://cincinnatihamfest.org>. Talk-in 147.345+ (PL 123) or 443.450+ (PL 123). VE exams.

RENSSELAER, NEW YORK — The East Greenbush Amateur Radio Association will hold its **19th Annual Hamfest** beginning 8 a.m., Saturday, August 29 at the East Greenbush Fire Department, 68 Phillips Road. Contact: Bryan Jackson <w2rbj@outlook.com>. Website: <www.egara.club>.

NEW KENSINGTON, PENNSYLVANIA — The Skyview Radio Society will hold its **2020 Swap N Shop** on Sunday, August 30 at their club grounds, 2335 Turkey Ridge Road. Contact John Italiano, WA3KFS, (724) 339-3821. Website: <www.skyviewradio.net>.

(Continued on page 96)

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HAM RADIO NEWS

More COVID Changes …

We have more cancellations and format changes to report this month due to the COVID-19 pandemic, along with one new event. The Huntsville Hamfest in Alabama, scheduled for mid-August, has been cancelled for this year; the AMSAT Space Symposium and annual meeting has been converted to a virtual event on the same weekend, October 16-18; and ARISS, the Amateur Radio on the International Space Station program, has been continuing to test its "MultiPoint Telebridge" system to allow students in a variety of locations (such as their homes) to still visit with ISS astronauts via amateur radio. In addition, Youth on the Air in the Americas replaced its planned summer camp in late June with a series of on-air events, including "Virtual YOTA Day" on June 24th and a special event station, W8Y, which was to be operated during the week of June 21-26th from various locations by the young hams who had been scheduled to attend the camp that week. Across the Atlantic, IARU Region 1's Youngsters on the Air program inaugurated monthly online meetings to discuss various topics, such as Region 1's Youth Contesting Program.

On the flip side, trying to fill the vacuum created by so many hamfest cancellations, *QSO Today* podcast host Eric Guth, 4Z1UG, has organized a worldwide virtual hamfest for the weekend of August 8th and 9th. The "QSO Today Virtual Ham Expo" will use an online exposition platform to connect attendees with various vendors and to present talks on a variety of ham radio subjects. More information is available at <www.qsotodayhamexpo.com>.

Don't Send Those Buro Cards Just Yet

If you still enjoy exchanging paper QSL cards with DX stations, you should know that getting those cards from here to there may be a problem for the foreseeable future. The U.S. Postal Service says it has temporarily stopped accepting international mail for nearly 100 countries around the world due to impacts from the COVID-19 pandemic. As of June 10th, mail service to 21 countries had been suspended due to "foreign postal operator service suspension" and another 75 countries were on the "do not mail" list due to "unavailability of transportation." The regularly updated list of specific countries, along with procedures for requesting a refund or remailing in the future is at <http://tinyurl.com/sxvuqwb>.

In a related story, the ARRL says it was experiencing 1-3 week delays in shipping member orders as of mid-May, due to restrictions on how many people at a time could be present in their warehouse and excessive demands on shipping carriers. Here at *CQ*, we have experienced very slow and sporadic mail delivery. On the bright side, our offices, which have been closed since mid-March under state stay-at-home orders, were scheduled to reopen on June 15th.

"Above Normal" Hurricane Season Predicted

The National Oceanic and Atmospheric Administration's Climate Prediction Center says we're likely to be in for an "above normal" hurricane season this year, with 13-19 named storms, 6-10 hurricanes and 3-6 major hurricanes of category 3 or higher. A typical season has 12 named storms and 6 hurricanes, of which 3 become major, according to NOAA. The forecast isn't surprising, since there had already been two named storms before the season officially began on June 1st, and the third one, Cristobal, formed on June 2nd. The season runs through November 30th.

Amateur radio operators are preparing as always. According to the *ARRL Letter*, WX4NHC — the ham station at the National Hurricane Center — conducted its annual station test on May 30th and Hurricane Watch Net Manager Bobby Graves, KB5HAV, said "I'm not liking what I'm seeing," noting that the net has activated for nine major landfalling hurricanes in the past five years, four of which were rated at Category 5, the most intense.

Ham Makes Space History

One of the two astronauts launched to the International Space Station on May 30th aboard the SpaceX Dragon capsule is a ham — Bob Behnken is KE5GGX. He and crewmate Doug Hurley were the first astronauts to travel to orbit aboard a commercially built and operated spacecraft, as well as the first to be launched from a U.S. spaceport in over nine years. According to *Newsline*, Behnken and Hurley join the ISS's Expedition 63 crew, which is commanded by another ham, astronaut Chris Cassidy, KF5KDR.

New RF Safety Rules Take Effect; ARRL Seeks Clarification

The FCC's new RF safety rules for amateurs (and others) took effect on June 1st, eliminating some categorical exemptions from making evaluations, and hams now have two years in which to determine whether evaluations will need to be made for any aspects of their stations. The ARRL has filed a petition for clarification with the FCC on two elements of the amended rules, specifically relating to the 2200-meter band and to handheld portable devices (HTs). According to the *ARRL Letter*, the request centers on technical measurement requirements, noting that the standards themselves have not changed, only the circumstances under which amateurs will need to make specific evaluations.

Ham-Owned Company Helps Improve Ventilator Flexibility

We've reported previously on ham involvement in designing a "MacGyver" type ventilator using an Arduino microcontroller and parts from local hardware stores. Now, hams in New England are helping the University of Massachusetts at Amherst improve the flexibility of ventilators already in use by BayState Health. Those ventilators used short control cables and ran on D-cell batteries that needed to be replaced every 48 hours. The hospital wanted longer control cables to allow personnel to safely control the ventilators without needing to wear personal protective equipment, and a wall-power solution to eliminate the need for frequent battery changes.

The university's Electrical and Computer Engineering Department determined that cables as long as 50 feet would work in theory, then fabricated a test cable that worked properly. The university then worked with the control cable manufacturer to design and produce the longer cables.

For the power solution, the department reached out to one of its former professors — and *CQ* author — Robert Glorioso, W1IS, who now runs The Battery Eliminator Store with his son, Scott, K1SRG. Bob and Scott found an off-the-shelf battery eliminator that met the unit's needs and, after successfully testing it on a portable ventilator, filled the hospital's order for 50 of the units. The combination of the longer cable and the ability to run off of wall power makes it safer for the hospital staff to use and control the ventilators.

CONTENTS

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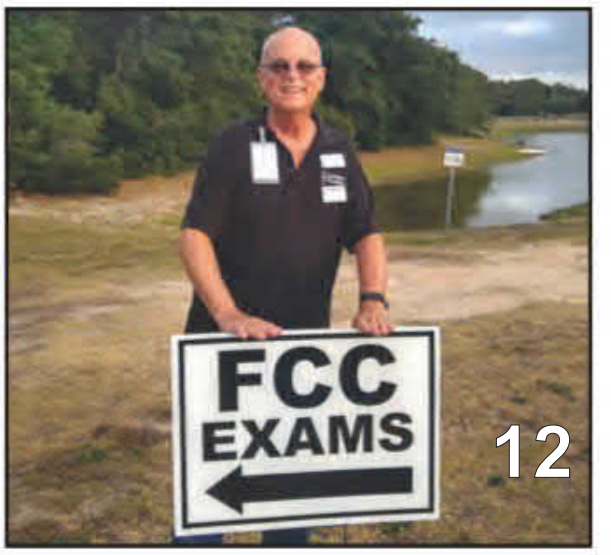
On the Cover: *Cover mystery alert!* Knowing how well your antenna is performing and where your signal is heading are important for DXing success on any band. KO0Z's Learning Curve column shows you how to approximate your antenna pattern on HF. Or, for VHF, UHF or microwave antennas, you can head to a VHF-focused conference such as Microwave Update and put your antenna to the test on a professional-quality antenna range, as shown on our cover. Certain elements of our cover photo are a mystery, though, and we're offering a prize to the first person who can solve it. See page 32 for details.



FEATURES

FOCUS ON: Volunteer examiners are the gatekeepers of amateur radio. They volunteer their time and resources to ensure everyone who takes the test is given a fair exam and is graded with integrity. This month, we examine the history of the VE system and how one enterprising Northern Florida ham club met the challenge of giving the exams during the COVID-19 pandemic. You can find these stories on pages 12, 16, and 19.

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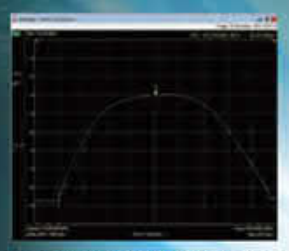

15MHz wide IF OUT viewed on external spectrum analyzer.

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ZERO BIAS: A CQ Editorial

BY RICH MOSESON,* W2VU

A Ham Radio Success Story

Our lead article this month is about ham ingenuity, a volunteer examiner team in Florida that worked with COVID-19 restrictions in place at the time to administer license exams in a parking lot, with candidates socially-distancing by remaining in their cars (the full story is on page 12). Last month, we reported on remotely-administered exam sessions. Since exam sessions seem to be a hot topic, we thought it would be interesting for our "CQ Classics" series in this issue to look back to the dawn of volunteer examining 35 years ago. Actually, the first VE sessions were held in 1984, but that was a hybrid year, with a mix of volunteer examining and traditional testing in FCC offices. By the beginning of 1985, though, all testing was being conducted by volunteers.

The original structure and operation of the program was nothing like it is today. The FCC originally anticipated having different VECs for each call district, each of which would have independent responsibility for creating exams from question sets provided by the Commission. Over time, two VECs with accreditation in all 13 call districts — W5YI and ARRL — came to dominate the testing program, although several smaller groups continue to function as VECs, including originals such as the Anchorage Amateur Radio Club VEC in Alaska (which also has accredited teams in Maine and Colorado) and the Laurel Amateur Radio Club VEC, which has exam teams around the country. Also with time, responsibility for preparing exam questions shifted from the FCC to the umbrella group for the VECs, the National Conference of Volunteer Examiner Coordinators, or NCVEC.

What really struck me in researching the early days of volunteer examining were the widespread doubts among leading amateurs that the system would even work at all. There were concerns about getting enough volunteers, about the integrity of test sessions, and about the logistics of getting exam materials prepared, distributed, and returned for processing.

Dick Bash, KL7IHP, published license guides based on submissions from exam candidates who wrote down as many exact questions as they could remember right after their tests (there were no publicly-available question pools at the time). He began writing a "Ticket Talk" column in *CQ* in June 1984. In his first column, which is reprinted in this issue, Dick expressed serious doubts about the viability of volunteer examining, citing likely difficulty in recruiting VEs to volunteer their time with no reimbursement for out-of-pocket expenses (a special bill was needed to be passed by Congress to permit Volunteer Examiner Coordinators, or VECs, to collect test fees) and the patience required to sit through an exam session while accommodating various special needs. He wrote that "private conversations with Washington sources have shown that they are pessimistic about the chances of the program's success."

The ARRL shared Dick's concern about cost reimbursement and, in fact, delayed applying to become a VEC until the FCC put rules in place to permit cost recoupment. At the same time, some other hams were concerned that fees would become a piggy bank for VECs and that some might use them as an opportunity for "profiteering."

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

All of this negativity almost overshadowed the potential positives of the program. I've been around long enough to remember the pre-VEC days, when one needed to travel to an FCC field office or other federal building for exams that were scheduled for the convenience of the examiners, not the candidates. I was fortunate enough in those years to live near either New York City or Washington, DC, where exams were available on a regular basis (although I can't remember right now if those opportunities were weekly or monthly). In other parts of the country, FCC examiners visited smaller cities on a quarterly basis, so if you didn't pass on one visit, you'd need to wait three months for your next opportunity. If you lived more than a certain distance from a testing site, local hams could administer an exam for a Conditional Class license, which carried General Class privileges, but Advanced and Extra Class exams would require a trip to "the big city" to take the test with an FCC examiner. This was virtually always a full-day venture, and often required an overnight stay. Ah, yes, the good ol' days…

So, How'd That Work Out?

Looking back today from 35 years out, I think it's safe to say that the volunteer examining program has been — and continues to be — an unqualified success. There has been no problem recruiting volunteer examiners. The number of sessions with integrity issues can be counted on one hand. Exam sessions are readily accessible in locations all over the United States (and beyond), and mostly scheduled at convenient times for candidates, such as evenings and weekends. And, in the event of a pandemic, VE teams and the VECs have the flexibility to adapt and to innovate, including test sessions held outdoors, in parking lots, and online.

The NCVEC's Question Pool Committee maintains and regularly updates the question pools from which the exams are generated. Electronic submission of exam results to the FCC by the VECs has reduced wait times for license issuance from weeks to days, and sometimes, hours. The success of the VE program is a major reason behind the growth of amateur radio in the United States from roughly 412,000 licensees at the end of 1984[1] to more than 762,000 today,[2] an increase of approximately 85%.

Congrats to KØNEB!

Finally, a double set of congratulations to *CQ* Kit-Building Editor Joe Eisenberg, KØNEB, for recognition as a hometown hero by the Lincoln, Nebraska Fire-Rescue Department and as a ham radio hero by the YASME Foundation. See "News Bytes" on page 10 for details.

We hope you'll be able to enjoy some outdoor hamming this summer (make sure your contacts are at least 6 feet away!) and will be able to take advantage of summertime sporadic-E as well as any surprises that may be in store from the newly-emerging Solar Cycle 25!

– 73, Rich, W2VU

Notes:
1. Source: *W5YI Report*, *CQ* archives
2. Source: ARRL, as of 6/5/2020

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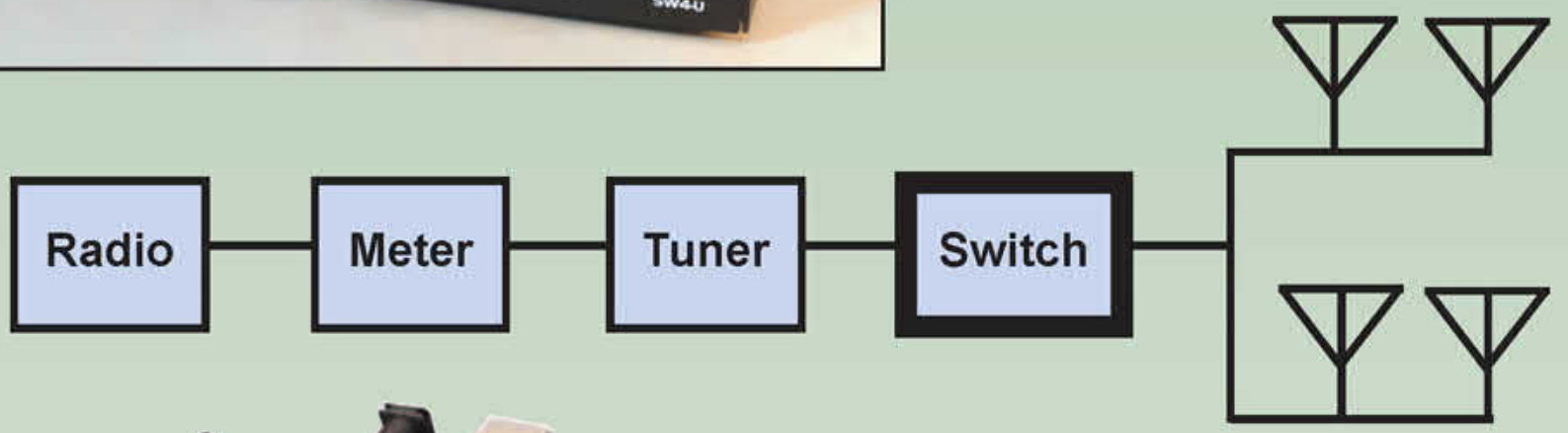

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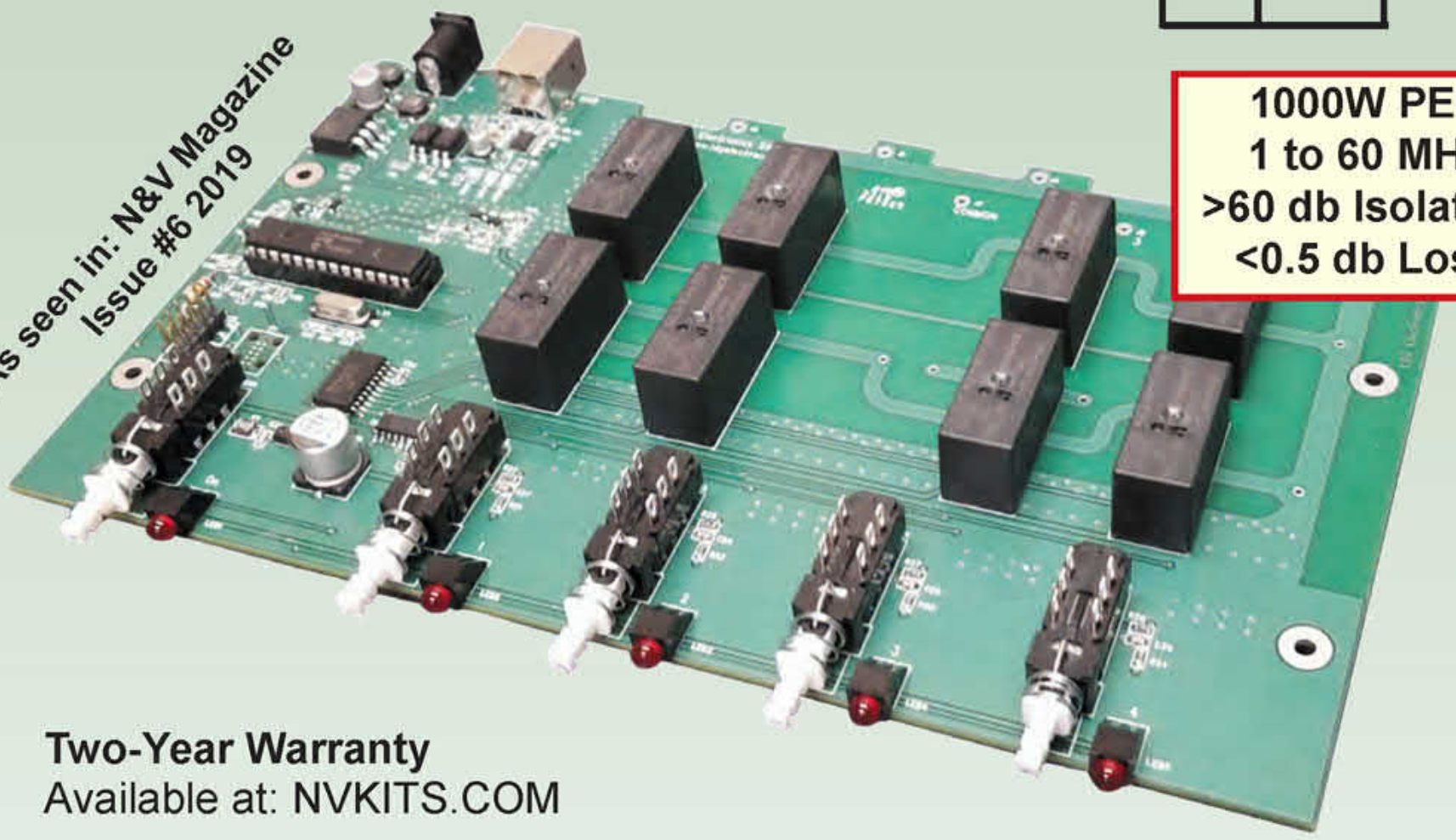

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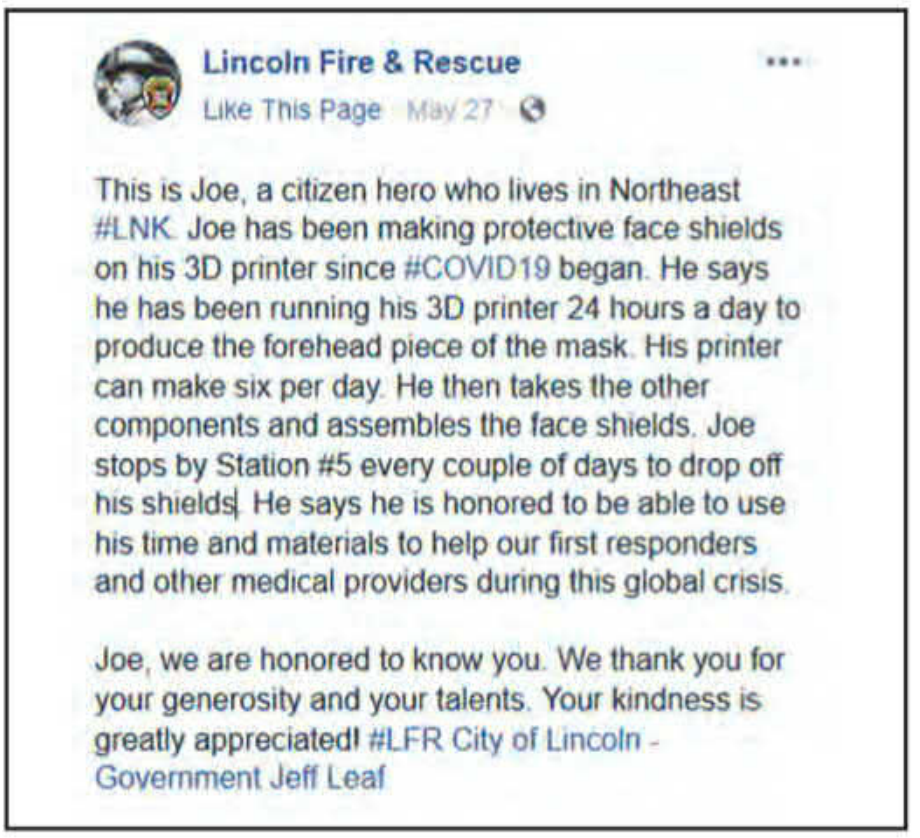
NEWS BYTES

Double Kudos for KØNEB

For the past couple of months, *CQ* Kit-Building Editor Joe Eisenberg, KØNEB, has been writing in his column about using his 3D printer to make face shields for local first-responders in his hometown of Lincoln, Nebraska. His efforts were recognized by the Lincoln Fire & Rescue Department with a post on its Facebook page, including a photo and the following message:

"This is Joe, a citizen hero who lives in Northeast #LNK. Joe has been making protective face shields on his 3D printer since #COVID19 began. He says he has been running his 3D printer 24 hours a day to produce the forehead piece of the mask. His printer can make six per day. He then takes the other components and assembles the face shields. Joe stops by Station #5 every couple of days to drop off his shields. He says he is honored to be able to use his time and materials to help our first responders and other medical providers during this global crisis.
Joe, we are honored to know you. We thank you for your generosity and your talents. Your kindness is greatly appreciated! #LFR City of Lincoln - Government Jeff Leaf



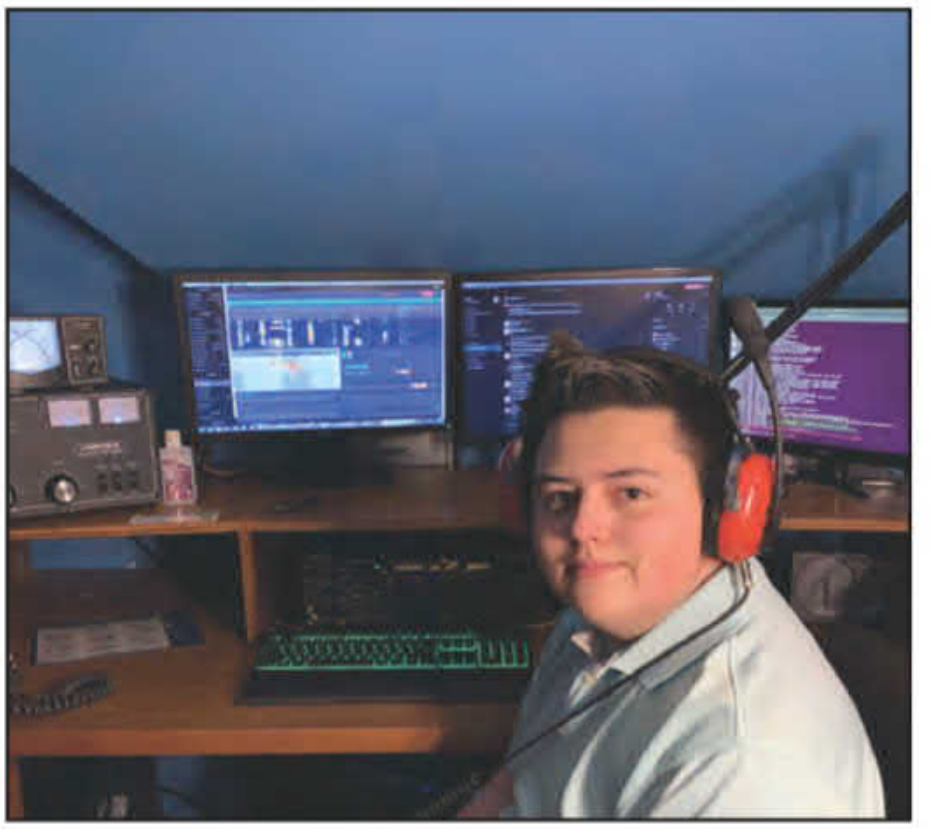
Screen capture of Facebook post by Lincoln, Nebraska, Fire & Rescue, recognizing the work of Joe Eisenberg, KØNEB, in producing face shields for first responders on his 3D printer. (Photo by Lincoln Fire Captain Jeff Leaf)

Separately, Joe was honored for his contributions to ham radio as the newest recipient of the YASME Excellence Award. This award is presented to individuals who have made a significant contribution to amateur radio through either technical, operating, or organizational achievements. Joe was recognized for his kit-building seminars conducted at hamfests and club meetings around the country, and for his contributions as editor of the Kit-Building column for *CQ* magazine. According to the foundation's announcement, "Joe exemplifies the 'give back' and 'self-teaching' spirit of ham radio, especially in training youngsters." The award consists of an engraved globe and a cash grant of $1,000.

The foundation also made grants of $5,000 each to scholarship programs administered by the ARRL and the Foundation for Amateur Radio.

W4IPC Named "Young Ham Lends a Hand" Winner

Connor Black, W4IPC, of Chesapeake, Virginia, is this year's winner of the "Young Ham Lends a Hand" contest. Connor, who is 18, was first licensed in 2018 and has been instrumental in helping the members of the Great Bridge High School Amateur Radio Club, W4GBH (of which he was president in the 2019-2020 school year), get licensed and get on the air.



2020 "Young Ham Lends a Hand" Winner Connor Black, W4IPC, of Chesapeake, Virginia. (Photo courtesy of W4IPC)

More broadly, he is an avid contester and DXer and has been helping get high school students interested in those activities. Connor has paired up with Remote Ham Radio to expand the number of remote ham stations in schools and colleges for youth to operate from anywhere in the world. He has been a pioneer in this endeavor by using his own home station as the first remote youth-only station. Connor has also invited young hams to his home station in the past to compete in the Virginia QSO party, and to operate amateur satellites.

Earlier this year, Connor was part of a team that included several youth friends that operated the CQ WPX SSB Contest remotely from Maine and was featured on the cover of *CQ*'s May issue. In addition, Connor and some friends have started a sprint-style contest called WWSAC, or Worldwide Sideband Activity Contest. It is held weekly for one hour at a time and gives extra points for working youths and YLs. See <https://wwsac.com> for details. Connor has just graduated high school and hopes to earn an electrical engineering degree from Virginia Tech.

The "Young Ham Lends a Hand" program is sponsored jointly by the Radio Club of America and the Quarter Century Wireless Association. The winner is usually announced at the Dayton Hamvention® Youth Forum, but was announced via email this year by moderator Carole Perry, WB2MGP, as a result of the COVID-induced cancellation of the Hamvention. The goal of the competition is to encourage volunteerism among young hams. The winner receives a check for $100.

Who Needs Sunspots?

In case you'd heard that the bands are dead because we're in the solar minimum, take a look at this bandscope shot taken by Bob Hopkins, WB2UDC, at his shack in New Jersey on Saturday morning of the CQ WPX CW Contest at the end of May. The photo shows activity on a portion of the 20-meter band, centered on 14.016 MHz. Each peak, says Bob, is another station calling "CQ TEST."

(Photo by Bob Hopkins, WB2UDC)

We reported last month in News Bytes on innovative ways in which Volunteer Examiner teams and coordinators are administering FCC license exams amid restrictions on group gatherings. N4UF reports on a new concept used with success by a VE team in northern Florida.

Drive-In FCC Exams Attract a Crowd (Sort of)

BY BILLY WILLIAMS,* N4UF

March started out strong for hams in Jacksonville, Florida. On Saturday March 7th, Duval County ham operators continued a 40-plus-year tradition by assisting with communications at the 2020 Gate River Run. In the main event, the nation's largest 15K, runners followed a 9-mile course that wound through scenic neighborhoods and historic streets near the St. Johns River bank and then back across the tall Hart Bridge to the finish line near the football stadium. More than 20,000 runners participated.

Coronavirus was an emerging threat at the time, but another week would pass before reality started settling in as sports leagues and golf tournaments closed shop. By mid-March, opportunities for aspiring ham operators to pass FCC license exams evaporated as state and local governments imposed "stay home" mandates.

Jacksonville's largest ham group, the North Florida Amateur Radio Society (NOFARS), moved to online meetings. With extra study time available to prepare for new licenses and upgrades, requests for testing sessions mounted. April passed with little improvement in the outlook.

Enter Jacksonville's Laurel Volunteer Exam Team with free FCC exams. Since 2017, the group — coordinated by the Laurel Amateur Radio Club VEC — has assisted in licensing 350 new operators and upgrading many more. Lack of open suitable sites led to several scheduled March and April sessions being canceled.

Team Leader Rajesh Verma, K4SK, said, "we have been searching for a place where we could hold exams, but our usual locations of libraries, churches, schools, and hospitals are not capable of hosting. As a result, we are going to have an exam in a parking lot of a public park."

Drive-In Testing

Rajesh and Brandi Kiehl, K4PL, went to work and lined up the large Ed Austin Regional Park located midway between central Jacksonville and the beach. They made meticulous plans and waited for Jacksonville Mayor Lenny Curry to reopen parks.

With favorable long-range weather forecasts, Jacksonville Laurel announced four testing sessions for Saturday, May 16th, each starting a half hour apart — at 5:00, 5:30, 6:00, and 6:30 p.m. — with a limited number of applicants for each time slot. Each session included from four to 10 applicants policed by a dozen Laurel VEs. Publicity consisted of announcements on area nets and local radio websites, plus a presentation during the May 14th online NOFARS meeting.

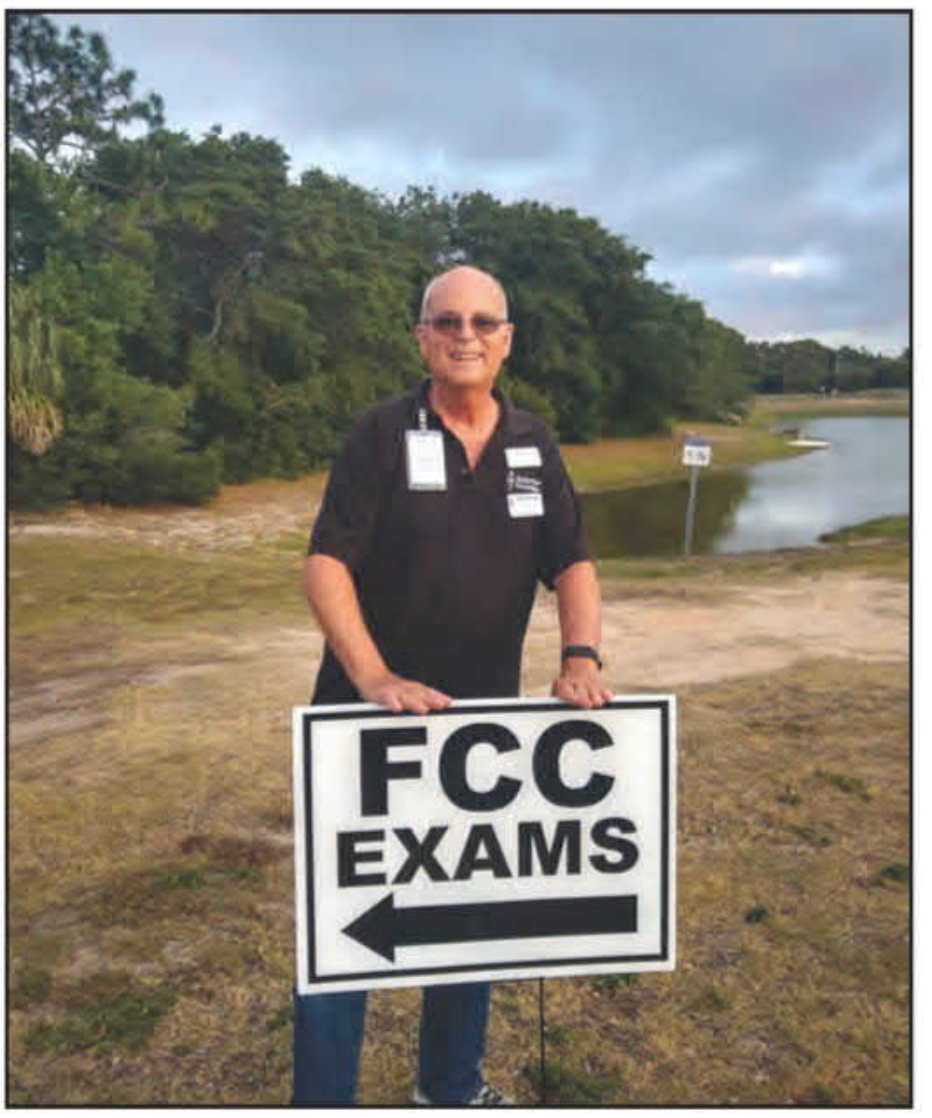


Photo A. VE Ross Goodall directs incoming traffic with sign. (Photos courtesy of Rajesh Verma, K4SK)

Volunteer Examiner Ross Goodall, WD4NJV, said "our Jacksonville Laurel Group selected a large city park which is several acres in size and formerly the site of a golf course. An 18- x 24-inch sign was posted on the road indicating directions to the site (*Photo A*). A VE stationed in the parking lot directed those to be tested to park along the curb (*Photo B*). Examinees were given a packet and a slip to post on their dashboard and were required to remain in their vehicles.

* *Email: <n4uf@nofars.net>*

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"Another VE used a laminated list of COVID-19 symptoms and asked each applicant if they were experiencing any. Another delivered the examination packet and checked IDs while a third checked calculator memory. Several VEs circulated the parking area keeping close watch to ensure that proper testing procedures were being followed and to pick up completed exams. Exams were graded immediately."

Brandi, K4PL, explained the procedures that were put in place. "Ed Austin Park is a considerably large park where some VEs regularly go for exercise," she said. "After visiting the park on a couple of Saturdays in the early evening to observe activity, the 5 p.m. start time was chosen because the potentially oppressive Florida heat would be less with plenty of sunlight and daylight available.

"To prevent large gatherings and limit the number of people in the area at one time, start times were staggered every 30 minutes. Brand new exams were printed and discarded after the sessions. Gloves and masks were offered to all candidates and VEs. All paperwork was pre-printed in case candidates passed their first exam. The four candidates who passed both Technician and General elements had their Certificates of Successful Completion (CSCEs) handwritten.

"While checking in, candidates cleared their vehicle seats, turned off their radios, removed drinks, put their electronics

Photo B. Check-in area. Note the blue tent in background where exam packets were logged and distributed. All VEs wore protective equipment when exposed to potential distance separation problems.

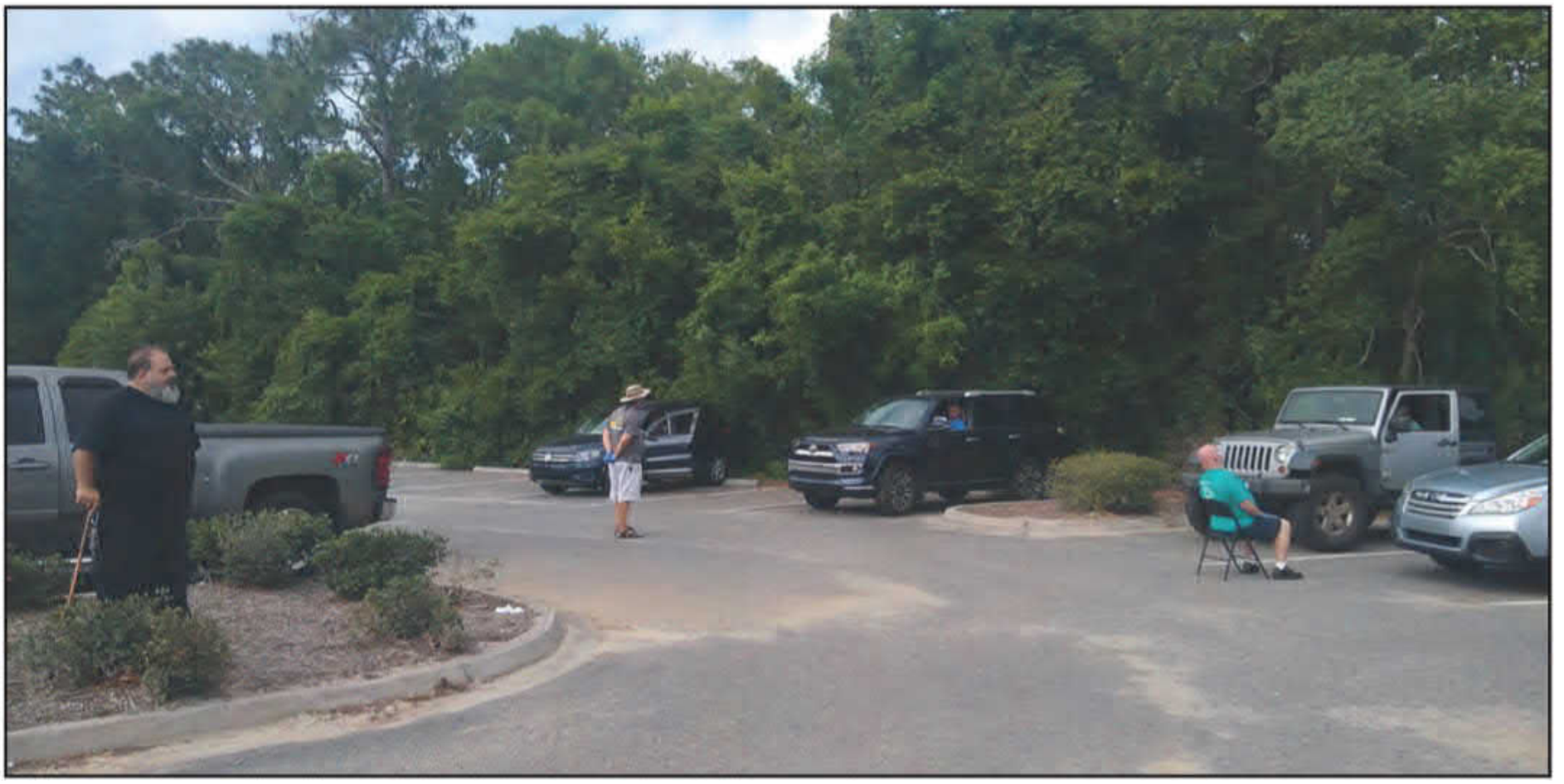

Photo C. VEs keep close watch while testing is in progress. (More VEs were stationed off-camera.)

Grading exams in the open air … from left, VEs Bill Vetter, KK4CAM; Brandi Kiehl, K4PL; and Russ Langel, K4HRL.

on the dash where they could be seen, etc. VEs were comfortable that applicants didn't have undue access to exam aids. Identification and calculators were checked. A printout on dashboards indicated which cars needed to be watched. Candidates remained in their cars with windows cracked open for the entire exam.

"Some VEs stayed between or in front of every car while others roamed the parking lot to ensure the mandated minimum coverage. At least three VEs were able to observe each candidate per FCC regulations (*Photo C*).

"VEs set up portable tables and a lawn umbrella to create a makeshift grading station (*Photo D*). They endured uncomfortable seats and paperwork trying to fly away with the wind (none managed to escape). Radios, water bottles and soda bottles served as makeshift paper weights."

Team leader K4SK added, "Within 24 hours of posting details about the drive-in opportunity, we had 17 people pre-register. This was our largest Laurel exam in our 2-1/2 years. Three candidates drove over two hours since there wasn't testing in the Orlando, Lakeland, or Gainesville areas. We are hoping that city libraries or a church will be open for a test session in early June. If not, we will probably have another parking lot exam."

The Exam Session from an Examiner's Perspective

BY ROSS GOODALL, WD4NJV

Testing has been a learning curve for all VEs during the (Coronavirus) outbreak. The Laurel group successfully navigated through CDC (Centers for Disease Prevention and Control), state, and local regulations. Rajesh Verma, K4SK; Brandi Kiehl, K4PL; and 12 other VEs participated in four testing sessions under almost-Field Day conditions (82° F, cloudy and windy weather). We had 27 candidates, administered 37 exam elements and gained 16 Technicians, 6 Generals (4 from zero to General), and 3 Extra Class licenses. The tests were administered separately in each candidates' vehicle having them park along the curb.

What worked for us:

- Having a roadside sign directing everyone to the proper location in the large park.
- Using a VE to ensure that candidates parked in the right spaces.
- Having tables, water, and all testing supplies available.

CQ CLASSICS

The Dawn of Volunteer Examining

This issue's lead feature focuses on the creativity of a Volunteer Examiner (VE) team in Jacksonville, Florida, in administering FCC license exams while following COVID-19 social distancing guidelines. Last month, we wrote about the launch of fully-remote license exams. It's easy to forget that it wasn't all that long ago that volunteer examining itself was new and different. Actually, it *is* kind of long ago now … this year marks the 35th anniversary of the full implementation of the VE program.

So for this month's edition of the *CQ Classics* series, we take you back to the beginning of the VE era with two columns from 1984. First up is the first "Ticket Talk" column in June by Dick Bash, KL7IHP (who some of you might remember as the person who first published actual FCC exam questions and was primarily responsible for today's publicly-available question pools). We follow that with excerpts from the August "dateline … Washington, D.C." column by Ted Cohen, N4XX, in which he reports on the first exams conducted by volunteers as well as the FCC's plans to phase out testing at Commission offices by the end of the year.

It's also worth noting that in the beginning, the FCC continued to prepare the exam questions. It was several years before that task was transferred to the Volunteer Examiner Coordinators (VECs). As you'll see, it was far from certain back in 1984 whether volunteer examining would be successful or even workable. We're pleased to report with 20/20 hindsight that it has turned out to be everything its proponents hoped it would be.

Ticket Talk

by Dick Bash, KL7IHP*

Welcome to the newest column in *CQ,* 'Ticket Talk.' Each month I hope to answer the ever-growing number of questions about the amateur radio licensing structure. Amateur radio is experiencing a great deal of regulatory change right now and there is a great deal of confusion about the meaning of all of this.

At the time of this writing (April 11th), the big word in ham radio is "volunteer licensing." This seems to be the greatest source of confusion. The next problem that creates a lot of questions is the way the new Novice licensing program is to be run. Hopefully I'll be able to answer these questions in this column. If you still have questions, please write me either c/o *CQ* or else at the address shown below. A reply will be sent to those enclosing a self addressed stamped envelope. If you can't wait for an answer, either call me at (415) 278-8275 or else call your local FCC Field Office.

10 Year Tickets

Before we get into a discussion about the volunteer program, let's first clarify the status of the ten (10) year license. The FCC recently changed 97.59 to read as follows:

(a) Amateur operator licenses are normally valid for a period of ten years *from the date of issuance of a new, modified or renewed license.*

(b) Amateur station licenses are normally valid for a period of ten years from the date of issuance of a new, modified or renewed license. All amateur station licenses, regardless of when issued, will expire on the same date as the licensee's amateur operator license.

(c) A duplicate license shall bear the same expiration date as the license for which it is a duplicate.

Not Getting Junk Mail?

That information should be self-explanatory. If your license is about to expire, renew it! It will then be valid for 10 years. If you're upgrading, your new ticket will be valid for 10 years. Period. The drawback is that many companies who manufacture or sell amateur radio products buy a mailing list of ham operators. If you don't advise the FCC of your change of address (which, by law, you are required to do), then you won't be getting the literature from those companies. Also, I suggest that you advise *The Radio Amateur Callbook* of any address change.

The V.E.C.

The FCC has one major problem right now: money and the lack of it. Because of this, they are forced to make budgetary cuts. According to Washington sources, the FCC was approached awhile back and asked to turn over amateur testing to the hams. Naturally the FCC went for this in a big way because of financial considerations. A program was developed whereby selected organizations would be permitted to become Volunteer Examiner Coordinators (VEC's). A new subpart to Part 97 was written to accomo-

*P.O. Box 2115, San Leandro, CA 945577

date these new rules (97.501 - 97.523). As of right now there are about 8 VEC's approved by Washington.

These VEC's are to solicit hams with Advanced or Extra Class licenses to become unpaid volunteer examiners. The VEC's are to put together exams, print them, distribute them to the volunteer examiners, advise the local FCC Field Office of the exam date at least 30 days prior to the registration deadline, somehow let the ham community know that exams will be given (I haven't seen how this is to be accomplished yet), collect the 610 Forms of those that passed the tests from the volunteer examiners, verify that the forms are correct, send the forms to Gettysburg, and (when they have nothing else to do) the VEC's are responsible for "evaluating the clarity and accuracy of examination questions..." Can you see why I think the VEC will need at least one secretary, a room full of filing cabinets, a hard disk based computer, and an office?

No Free Lunches!

All of this is free, right? Ha! Well, some people suddenly realized that it was going to cost a considerable amount of money to run the volunteer licensing program so they went to a U.S. Senator and asked him to sponsor a bill permitting the VEC to assess a fee to hams taking exams. This bill has been approved by Congress and signed by the President but there is no change to Part 97 at this time permitting the collection of fees. So, any VEC who runs an exam is doing it gratis. Additionally, the VEC and the individual hams serving as volunteer examiners may not receive any compensation (lodging, meals, airline tickets, gasoline, etc.). When the FCC writes the changes to Part 97 permitting the collection of a fee from the hams, it is my understanding that the fee may not exceed $4.00 initially (and it can be lower but I seriously doubt if that will ever happen). This fee may be increased as the consumer price index is increased. You see, in the past your hard earned tax dollars were paying for everything. However, of the thousands of hams I've spoken with, the vast majority go along with a fee for taking tests. Those readers with a background in finance may share the doubt that $4.00 is enough to cover the expenses of all of this.

Written Tests

The FCC published a list of 500 questions for the General/Technician written exams. They also published a list of 200 questions for the Novice Class exams. The VEC's are to use these questions when composing a General or Technician written test or Novice exam or combined Novice/Technician written test. The FCC has *not* published questions for the Advanced or the Extra Class exams yet. Therefore, as of right now, the VEC and his volunteer examiners can only come up with the Novice written test, the combined Novice and Technician written tests, a General Class written test (same as Technician), or the 5, 13, or 20 w.p.m. International Morse code tests. If you want to take an Extra or Advanced Class written test you *must* take it before the FCC. Accordingly, as we all prepare to go to the Dayton Hamvention later this month, we will see a lot of unhappy hams who thought they would be able to take the Advanced or Extra written exams. Life is not fair!

During the time between now and the middle of November, the FCC will be giving exams in their offices during the first week or so of May, the first week or so of August and the first week or so of November. After that time, the FCC is scheduled to be out of the exam business and all examining is to be done by VEC's and their examiners. This assumes that the VEC program will be organized by then. Like all government programs that I have seen, they have the best of intentions and are usually a bear to implement.

The Examining Team

An additional problem regarding the volunteer examining program that you absolutely must be aware of is that the examining team must be made up of three (3) Advanced or Extra Class licensed hams. If one or more of the examiners has an Advanced Class license, the team may only administer the 5 w.p.m. code test, the Novice Class written test, the Technician or General Class written test, or the combined Novice/Technician written exam. In order for the examining team to give the 13 or 20 w.p.m. code tests, the Advanced, or Extra Class written tests, *all three members of the examining team must hold Extra Class licenses.*

Now the problem arises of getting three Extra Class licensees to agree to meet at one place at one time *without any compensation whatsoever* and sit there for several hours giving and grading tests and doing the associated paperwork. If you think there is nothing to this, just ask the folks at the FCC Field Offices what problems are found during exam administration. This team must be prepared to deal with the public and ready to serve the needs of individual hams having unique problems. Giving exams under these conditions requires patience, patience, and more patience. This real-world qualification will undoubtedly eliminate many potential examiners. Others will simply not have the time to devote to the project. Once again, private conversations with Washington sources have shown that they are pessimistic about the chances of this program's success. During this period of change we as hams must be patient with the VEC''s and the volunteer examiners.

Handicapped Hams

Under the present scheme of things, when a handicapped individual wishes to take an amateur radio exam, the local FCC Field Office has a ham who was approved by them test the applicant in the applicant's home. Several hams who are visually impaired or non-ambulatory have expressed the concern that under the volunteer program this seems to imply that 3 duly appointed examiners must be present to give them exams and these hams are justifiably concerned that they might not get to take exams with the ease they do now. In the next column I will have an answer to this particular problem. The rules seem to affirm the fact that not

less than three approved examiners must be present during exam administration. No mention is made of those with impairments. As hams we must be concerned for those of us who are not blessed with perfect health and/or abilities.

The Novice Program

The Novice Class program was changed completely. In the past, an applicant wishing to take the Novice test merely found a ham with a General Class or higher license. The ham would give them a 5 w.p.m. code test and mail a completed FCC 610 Form to Gettysburg informing them the applicant had passed the code test and to have the FCC send the ham examiner a written test. When the 20 question written test was received, he/she would give the Novice applicant the exam and mail it back to Gettysburg. If the applicant passed the exam, the FCC would issue them a license. If they failed, the FCC would advise them accordingly. Ah, those *were* the good old days, because it's no longer that simple.

Now the applicant for the Novice license still has to ferret out an examiner with a General or higher ticket. The ham still gives the applicant the 5 w.p.m. code test. This code test, by the way, may be a receiving test only. If you doubt this (and I realize the regs say both a sending *and* receiving test), please call the Washington office of the FCC. The FCC hasn't given sending tests in years because they interpret the law to permit them to give just a receiving test and what's good enough for them is o.k. for you too. You can still give a sending test if you wish, though. The applicant didn't pass the code test? No problem. Just return the 610 Form and tell him or her to try again in 30 days.

If the applicant passes the code test the the fun begins. You are required to now *create* a written test for the applicant instead of writing away and having the FCC prepare it. The questions *must* come from the FCC published list of 200 questions. You may give the applicant a multiple choice test (in which case you have to figure out the choices), an essay test, or a single answer type of exam. Most hams I have spoken with agree that anyone who gives a Novice applicant an essay or single answer type of exam should be shot at dawn. You are to also provide the answer sheet. Because the examiner is expected to prepare all of this, some of the publishers of amateur radio publications have prepared examination packages which contain multiple choice exam(s) and answer sheet(s). Then you just pull an exam out of the package, give the applicant the sup plied answer sheet, and monitor the test. After the applicant takes the test, you are to grade it (you did figure out the correct answers, didn't you?). The companies providing Novice exams have supplied answers, naturally. If he/she passes, complete the 610 Form and send it to Gettysburg. The FCC will send the new license to the applicant in about a month. If the applicant fails, you are to return the 610 Form to him/her and tell them they may re-take the exam in not less than 30 days, *at which time they have to re take the code test as well.*

Records, Records, Records!

FCC Rule 97.28(d) presently states: *...For Novice Class examinations, the test papers, including answer sheets, must be retained as part of the volunteer examiner's station records for one year from the date the examination is administered.* Thus, you must keep both the answer sheet and a file copy of the exam around for not less than a year. Those of you thinking of doing this on a computer should keep this in mind and make hard copies and plenty of backups. You should read the applicable rules in 97.19 through 97.33. Make sure you are reading a *current* set of rules!

That's it for this introductory column for this month. As you can see, the licensing program is not at all simple and the confusion is every bit understandable. In cooperation with the publisher and editor of *CQ,* we will keep you up-to date with the latest changes. If you have questions (how can you not have questions?), don't hesitate to ask.

73!

dateline...
Washington, D.C.

a regular feature by
THEODORE J. COHEN, N4XX

THE INS AND OUTS OF THE WASHINGTON SCENE

Volunteer Exam Program Off To A Successful Start

The first official volunteer-administered amateur radio examinations were given on 17 April 1984 by KL7LK, KL7HFQ, and KL7CQ, "World's First Volunteer Examiners." All three are members of the Anchorage Radio Club, the Volunteer Examination Coordinator (VEC) for the KL7 District.

Following on the heels of this success, says John Johnston, Special Services Division, Private Radio Bureau, FCC, was the administration of 350 exams by members of the Dayton Amateur Radio Association (DARA). DARA is the 8th District's VEC, and the exams were given as part of the 1984 Dayton Hamvention.

Finally, from Chicago comes word that the DeVry Amateur Radio Society, the 9th District's VEC, has started to give exams in that city on a weekly basis. Contact the Society for details.

According to Johnston, all three VECs plan to expand their examination activities throughout their districts during the coming months.

In commenting on the initial administration of exams under the volunteer program, Senator Barry Goldwater (Congressional Record, Senate, 3 May 1984) stated:

"Across the entire country, other volunteers are preparing to administer the amateur technical and Morse code examinations. Even as this occurs, the FCC has announced that they will have completely phased out their own testing by the end of 1984.

"As a radio amateur myself, I am proud to report these events to my fellow Senators. The radio amateurs of this Nation are once again demonstrating their dedication and abilities. The taxpayers benefit by not picking up the tab for amateur examinations, and the amateurs benefit by having examinations more readily available and a more direct role in the Amateur service."

ARRL Files in Support of VEC Cost Recoupment

As reported in *The ARRL Letter,* the League has filed comments with the Commission supporting proposals to amend the Amateur Rules "to allow reimbursement of out-of-pocket expenses incurred by both Volunteer Examiners and Volunteer Examiner Coordinators." The comments were in response to the Notice of Proposed Rulemaking proposals contained in Personal Radio Bureau Docket 84-265.

In supporting its position, the League noted that the rule changes proposed simply implemented provisions of the Federal Communications Commission Authorization Act of 1983. Statements made on the floor of the Senate by Senator Barry Goldwater, which supported cost-recovery provisions similar to those in the Notice, were also cited.

The Notice does not address how any funds collected are to be divided among VECs and VEs. However, it is apparently the League's belief that the method of dividing reimbursement funds should be a matter of discussion between a VEC and its VEs.

Once the Commission permits the re- coupment of costs incurred by VECs (up to the limits provided for in the Notice), it is likely that the League will file application to become a VEC in all 13 districts.

In a related action, Joe Schroeder, W9JUV, filed comments on the Notice to address the problem that a VEC may "profiteer" in its participation in the cost recoupment program. To this end, Schroeder requested that the Commission require VECs to justify their charges using proper accounting procedures. He also suggested that VECs be required to file an "Examination Fee Schedule" and the justification used in setting its fees.

November 1984 FCC Exams To Be the Last

According to Richard Smith, Chief, Field Operations Bureau, examinations scheduled to be held in FCC offices this November will be the last. It is the Commission's expectation, says Smith, that by that time the Volunteer Examination Program will be fully operation.

The switch to examinations administered by volunteers, however, does not eliminate the possibility that the Commission may choose, on a case-by-case basis, to conduct tests. Such examinations would ordinarily be done at the convenience of the Commission in cases in which fraud was suspected.

Results of the 2020 CQ WPX RTTY Contest

BY ED MUNS*, WØYK

I enjoyed the contest ... ***7N4JXR***
Love having so many multipliers. A shot of endorphins with every one! ... ***AK1W***
Nice contest ... ***DF6JF***
Great contest ... ***G3WYW***
Very good participation ... ***IK2OVT***
That was fun! ... ***IT9RGY***
It was great to see so much RTTY activity on the bands! ... ***K8YE***
A really fun contest with all the multipliers! ... ***K9OM***
Great contest, loved the maze of callsigns ... ***KN5TX***
All good fun and as always – RTTY rocks ... ***MW9W***
What a fantastic contest ... ***TM3Z***
Great participation, loads of fun! ... ***WDØT***
Great fun, can't wait till next year ... ***WV4P***

The 26th CQ WPX RTTY Contest flourished despite another year with minimal solar activity. The good news is that most scientists believe we are already a few months into Cycle 25, so conditions will hopefully improve over the next five years. The number of submitted logs was 3,088. Another 1,928 calls appeared at least three times in these logs for an overall participation exceeding 5,000 active stations, just a few less than last year.

** P.O. Box 1877, Los Gatos, CA 95031-1877*
Email: <w0yk@cqww.com>

The 9A1A Multi-Multi winning team are: (front) Aron, 9A7ROR; (back, l. to r.) Mario, 9A7C; Emil, 9A9A; Braco, 9A7R; Nikola, 9A5W; and Mark, 9A8A.

Both 15 and 10 meters remained at a 10-year low in activity, same as last year. For example, only five stations made 10 or more contacts on 10 meters, led by 4E3X with 39. The top QSO achiever on 15 meters was CV7S with 767 contacts. This historical table shows percent of QSOs by band, across all logs received for the last 11 years:

Multi-Two CR3DX achieved the highest QSO total for the second year in a row with 4,540; the 9A1A Multi-Multi came in second with 3,922. On multipliers, though, 9A1A had 1,096 for the contest high and CR3DX was second with 1,080. Being in different categories, they both won!

Jan, OL9A (op. OK2ZAW), topped 80-meter QSOs with 1,132 in his 80-Meter High Power win. 9A1A topped 40-meter QSOs with 1,468; CR3DX was close behind with 1,429. On 20 meters, CR3DX was way out in front with 1,585 QSOs. Eugenio, CV7S (CX7SS), led 15 meters with 767 QSOs.

Five new Continental records were set despite challenging conditions:

	World		Continent	
	New	Avail	New	Avail
SO10	0	3	0	18
SO15	0	3	0	18
SO20	0	3	0	18
SO40	0	3	2	18
SO80	0	3	2	18
SOAB	0	3	0	18
MSH	0	1	0	6
MSL	0	1	1	6
M2	0	1	0	6
MM	0	1	0	6
Total	0	22	5	132

First time working a RTTY contest. Was fun ... ***K6FA***
First time for RTTY great fun ... ***K7STO***
First time in this contest, I'll be back! ... ***K8JT***
New to RTTY but had a lot of fun. Learning from other great operators ... ***KD5ILA***
First time in RTTY ... ***KP4ALR***
My first time ever on RTTY in over 60 years ... ***KVØI***
My first WPX contest. Looking forward to improving my score in 2021 ... ***N6OPE***
First RTTY contact in 61 years as an amateur ... ***W8KNO***

Single-Operator (2,872 entries)

There are many single operator entry categories to satisfy a wide range of interests. Low Power remains the most popu-

Band	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
80	13%	15%	11%	11%	8%	7%	10%	17%	17%	20%	21%
40	27%	28%	23%	26%	21%	21%	23%	33%	36%	35%	34%
20	36%	35%	27%	28%	22%	21%	25%	36%	41%	41%	42%
15	23%	21%	30%	29%	28%	27%	32%	14%	5%	5%	4%
10	0.5%	1%	9%	6%	21%	25%	11%	0.1%	0.03%	0.05%	0.03%

Table 1. Band-by-band breakdowns of QSO percentages, 2010-2020

lar power level while 40 and 20 meters were again the most popular single band categories again this year:

	80	40	20	15	10	SB	AB	SO
QRP	13	22	21	7	1	63	72	135
LP	74	144	174	36	1	429	1225	1654
HP	51	81	105	15	2	253	775	1028
Total	138	247	300	58	4	747	2072	2817

QRP (135)

Val, LZ3RR, led the All Band category with almost double the score of the next competitor.

The 13 80-meter entries came from five continents with Virgil, YO9BCM, once again taking the top spot with twice the score of the second-place entry. Galih, VC2VOC, set a new Oceania record with just six QSOs.

Forty meters had 22 entrants across four continents, and Vitas, LY5G, finished ahead of the group. Doni, VCØVM set a new Oceania record.

Vlad, UT2EF, won 20 meters with Gab, HG3IPA (HA3JB), next in line.

Atsushi, JR1NKN, topped the seven entries in 15-meter QRP again this year.

Munehiro, JH3DMQ, was the only 10-meter entry, with five QSOs.

Low Power (1,654)

Andrea, IK6VXO, won All Band again this year in a close race among the top three. Dimitri, TM3Z (F4DSK), was second; and Gabry, IT9RGY, finished third. Dimitri dealt with Storm Ciara disturbing antennas, two short power outages, no 10 meters and almost no 15 meters. However, 80 and 40 worked well and overall, he had a great time battling it out with Andrea and Gabry. Don, AA5AU, won North America just below the top nine spots dominated by European stations.

Martin, OK6T (OK1WCF), won 80 meters with Gerard, F5BEG, a close second followed by Serge, UZ2HZ.

Igor, Z32ID, won 40 meters with 822 QSOs, followed by Ivan, YU5R (YT2AAA); and Alek, 3Z9M (SQ9UM), who were both nearly tied.

Gerardo, AN1PM (EC1A), led the top six entries on 20 meters with 766 QSOs. Fabio, IZ3IBL, was next, followed

2020 WPX RTTY TOP WORLD SCORES

SINGLE OPERATOR ASSISTED HIGH POWER ALL BAND

P49X (WØYK) 10,752,650
SN7Q (SP7GIQ) 7,476,770
ZF2WF (W9KKN) 6,095,712
UW1M (UR5MW) 6,046,320
AA3B 5,820,840
UA4M (RL4R) 5,183,171
HG8R (HA8JV) 5,172,432
LY7Z 4,741,347
ER4A (UT5UDX) 4,363,320
I2WIJ 4,338,720

28 MHz

NA4W (K4WI) 726
W5PR 242

21 MHz

CV7S (CX7SS) 943,890
LU7HN 864,678
IZ4COW 79,704
K1SFA (K1MK @K1TTT) 24,840
JA8IDS 10,184
RN6A 6,656
AJ4VE 5,217
ZL2RX 4,838
IK3ASM 3,948
TM5J (F5TMJ) 2,618

14 MHz

IQ1RY (IZ1LBG) 2,659,589
IT9ZMX 2,315,193
S52X 2,090,880
EC1KR 1,814,652
9A5D (9A7Z) 1,738,156
YT1X 1,431,930
RA9Y 1,265,616
4L8A 1,153,359
N4BP 1,106,858
EA1B 1,010,412

7 MHz

EB8AH (OH4KA) 5,164,830
IZ4NIC 4,309,540
OM2VL 3,829,228
WQ5OO (N8OO) 2,875,904
ED1R (EA1TL) 2,599,496
YU7U 2,589,312
GB6ØATG (GW4SKA) 2,543,234
SQ2A 2,354,104
S51CK 2,210,908
K9OM 1,717,296

3.5 MHz

OL9A (OK2ZAW) 3,128,400
SN2M (SP2XF) 2,510,244
OL4C 2,211,928
UX2X (UT2XQ) 2,139,552
I4AVG 2,055,636
IZØKBR 1,931,250

HG5D (HA8QZ) 1,825,270
DL3BQA 1,324,320
WK1Q (K1MK @K1TTT) 1,218,124
SP5DL 765,002

ASSISTED LOW POWER ALL BAND

IK6VXO 5,463,707
TM3Z (F4DSK) 5,311,416
IT9RGY/4 5,294,496
US2YW 3,574,208
LY6A 3,238,239
RT9S 2,639,175
EA4GOY 2,544,750
UT4LW 2,485,056
UR6EA 2,131,844
AA5AU 2,112,033

28 MHz

L55D 1,196

21 MHz

PY2CX 314,088
CE3CBM 79,527
LU3MAM 55,216
YT8A (YU1EA) 29,160
UR5QU 28,560
YV1SW 28,310
BD7OXR 11,264
PU1JSV 9,672
PU2NBI 8,184
PY2XC 5,805

14 MHz

AN1PM (EC1A) 836,140
IZ3IBL 754,390
UN6LN 731,124
GI5NI (MIØSAI) 665,712
UR2Y (USØYW) 611,892
EA1X 578,556
7Z1SJ 513,513
IP9IPY (IT9YMM) 484,058
USØMM 457,560
EA8W 390,264

7 MHz

Z32ID 1,832,370
YU5R (YT2AAA) 1,556,516
3Z9M (SQ9UM) 1,544,306
G8X (G4FJK) 1,196,972
PZ5RA 1,101,204
IR9K (IT9AHI) 1,078,884
J35X 1,035,414
IZ3NXC 950,274
Z33F 902,480
IW1PNJ 882,000

3.5 MHz

OK6T (OK1WCF) 1,115,520
F5BEG 1,013,308

UZ2HZ 901,472
F1AKK 767,808
I1WXY 756,126
HA8WY 690,120
S56A 642,048
LZ33E 628,320
E79D 552,750
ER1OO 514,692

ASSISTED QRP ALL BAND

LZ3RR 1,549,301
DK7HA 799,848
OK2FD 707,074
EU8F 510,940
YU1LM 480,384
N2WK 408,930
MØHMJ 404,481
UT5EOX 371,110
MM3AWD 333,788
K2YG 301,376

28 MHz

JH3DMQ 21

21 MHz

JR1NKN 2,838
WP4O 2,178
YC8UYJ 1,792
IZ3NVR 990
YO8WW 950
DL2TM 902
JR2EKD 608

14 MHz

UT2EF 157,842
HG3IPA (HA3JB) 118,038
YU1NR 79,980
RQ7R 66,400
HA3HX 50,337
IZ2JPN 47,560
NK5G 44,992
UX8ZA 44,415
SP4LVK 31,790
YU1RH 18,612

7 MHz

LY5G 163,812
A71AE 110,390
YT5DEY 108,190
JA6GCE 107,520
E77T 92,184
DG3EK 63,196
DJ3GE 59,890
CO8RCP 45,696
N3CRT 36,600
GMØHVS 34,144

3.5 MHz

YO9BCM 206,586

UT1AM 103,362
YL3FW 45,150
KH6KG/W5 (KH6KG/W5) 42,262
WD9FTZ 40,404
UT8UU 22,496
W2NTN 18,252
JG1LFR 4,608
KB2HSH 4,160
CR6A (CT1IUA) 3,078

MULTI-OP SINGLE-TRANSMITTER HIGH POWER ALL BAND

DR5N 6,626,312
J42L 6,616,512
EC5V 5,764,202
UZ2I 5,611,000
OG73X 5,595,834
PX2A 5,285,774
SX2I 4,765,846
LZ6Y 4,617,264
LZ7A 3,514,503
OK1KSL 3,291,375

MULTI-OP SINGLE-TRANSMITTER LOW POWER ALL BAND

9A7T 3,892,911
ES9C 3,318,435
YL1ØCWO 3,137,197
LY5W 3,048,514
IK4RQJ 2,477,167
TC7G 2,232,066
DF7ØDARC 1,566,720
DQ4W 1,249,438
NA5NN 1,055,250
ED3D 947,646

MULTI-OP TWO-TRANSMITTER ALL BAND

CR3DX 21,011,400
S51A 9,846,324
DP7D 9,597,284
DP9A 8,984,146
K9CT 8,218,630
W3GH 4,326,224
NCØDX 3,932,544
WV1K 3,667,794
WV4P 3,175,836
NB3R 3,158,400

MULTI-OP MULTI-TRANSMITTER ALL BAND

9A1A 16,273,408
HG1S 10,251,135
LY2W 10,084,250
LX2ØI 9,224,970

OMØM 7,528,164
RWØA 6,847,632
DKØKC 5,598,100
KA4RRU 4,317,848
NR6O 4,052,545
N3OW 762,870

ROOKIE HIGH POWER

9A5AAX (DJ4MX) 2,361,582
EU8A 554,200
SP9PUZ 256,060
VU2ZMK 227,136
IU1LCU 175,123
K6KM 51,992
NA6US 43,815

LOW POWER

EA7KHB 789,859
EU8F 510,940
R2PU 328,293
W9JWC (KD9LSV) 236,680
HA1TIB 216,876
LZ2ZY 205,224
IU3LYJ 134,688
UR4MH 128,505
YC1RKT 114,023
AA8SW 104,550

TRIBANDER/WIRES HIGH POWER

N3QE 2,960,342
GB6ØATG (GW4SKA) 2,543,234
IK2XDE 2,037,184
R5AJ 2,014,272
S5ØRY (S53K) 1,994,039
KO7SS 1,988,746
T6A (S53R) 1,879,818
K9OM 1,717,296
DLØHMK (DF2HN) 1,663,592
YO3RU 1,647,300

LOW POWER

RT9S 2,639,175
UR6EA 2,131,844
DK9IP 2,002,752
IK3TPP 1,982,460
EW7BA 1,601,400
UZ1WW 1,556,610
CR5O (CT7AJL) 1,485,143
DL/KU1CW (KU1CW) 1,478,598
UT5EPP 1,475,005
CT7AUP 1,400,850

by Vlad, UN6LN; and Simon, GI5NI (MIØSAI).

Mauricio, PY2CX, dominated the 36 entries on 15 meters with 409 contacts.

Osvaldo, L55D, was the sole 10-meter entry and had 24 QSOs with 23 prefix multipliers.

High Power (1,058)

Ed, P49X (WØYK) won All Band from South America while Chris, SN7Q, took second from Europe and relative newcomer Bill, ZF2WF (W9KKN), was third from North America. Victor, UW1M (UR5MW), was fourth and Bud, AA3B, in fifth, also won the USA.

Jan, OL9A (OK2ZAW), took a decisive first on 80 meters with Mac, SN2M (SP2XF), second and Jan, OL4C (OK1WCF), in third. Michael, WK1Q (K1MK), in 9th below eight European stations, set a new North America record.

Kari, EB8AH (OH4KA), ran ahead of the large 40-meter pack to set a new Africa record. Nicola, IZ4NIC, was second and Laszlo, OM2VL, was third while Vic, WQ5OO (N8OO), won North America in fourth.

Filippo, IQ1RY (IZ1LBG), won 20 meters with slightly fewer QSOs than second-place Vittorio, IT9ZMX, but had 80 more prefix multipliers. Tadej, S52X, was third; followed by Jesus, EC1KR, and Luka, 9A5D (9A7Z).

Eugenio, CV7S (CX7SS), won 15 meters again this year. Rene, LU7HN, was close behind.

Cort, NA4W (K4WI), won 10 meters with 24 contacts in almost 2 hours.

Mubarak, A71AE, took second place in Single Operator, 40-meter QRP category.

Marco, DJ7MH, (left) and Joel, LX1ER, (right) operating DP7D in Multi-2.

2020 CQWW WPX RTTY TOP UNITED STATES SCORES

SINGLE OPERATOR ASSISTED HIGH POWER ALL BAND

AA3B	5,820,840
AK1W (K5ZD)	3,739,892
NV9L (WB9Z)	3,510,262
KF3P (K3MM)	3,340,295
N3QE	2,960,342
ACØC	2,913,452
W4PK	2,912,811
KS7AA (WK6I)	2,873,156
W3FV	2,386,628
WK7S (K6LL)	2,355,600

28 MHZ

NA4W (K4WI)	726
W5PR	242

21 MHZ

K1SFA (K1MK @K1TTT)	24,840
AJ4VE	5,217

14 MHZ

N4BP	1,106,858
W9ILY	872,081
N2MM	805,194
K6HGF	151,704
K8YE	146,132
N7BV	126,084
K5QR	124,632
WA7AN (K9DR)	102,960
WTØDX	45,582
WA2PCN	18,048

7 MHZ

WQ5OO (N8OO)	2,875,904
K9OM	1,717,296
K8IA	1,592,000
WJ2D	658,308
W9PA	440,910
N7US	434,070
KSØAA	209,174
KT6V	123,120
NR4O	59,340
W3LL	32,088

3.5 MHZ

WK1Q (K1MK @K1TTT)	1,218,124
NJ4U (K4EA)	448,880
KZ7X (W6RW @W6RW)	275,336
WRØH	211,988
W5MX	210,012
NØOK	169,060
K2TW	160,792
KE3GK	65,552
WA3FRP	8,892
K9DUR	1,848

ASSISTED LOW POWER ALL BAND

AA5AU	2,112,033
AA2MF	1,521,704
NG1R (W1QK)	1,340,889
N2HMM	651,896
KF2O	641,356
W4LC	620,880
W3KB	552,750
NØGZ	539,148
WN6K	464,184
KE3K	437,987

21 MHZ

N2HX	112

14 MHZ

NG6O (K6GHA)	144,240
NØGOS	22,932
WØYJT	16,940
KC7V	14,994
WA7SHP	8,814
N6MA	7,040
K4FT	4,928
ND4G	864
K6ST	580
KJØP	15

7 MHZ

NU4E	697,872
AE4ED	409,480
AB1J	317,328
KK4HEG	223,210
K5IB	106,420
W2VTV	98,010
W3IDT	85,008
W6HGF	75,456
W1FSH	58,716
WB9WOZ	22,134

3.5 MHZ

K5ND	15,960
KB4KBS	10,780
W7CD	10,560
KA5W	2,340

ASSISTED QRP ALL BAND

N2WK	408,930
K2YG	301,376
WE6EZ	125,376
WAØMN (NØUR)	124,218
W6QU (W8QZA)	71,709
K4LPQ	16,264
KEØTT	4,704
N6HI	4,500
N8URE	1,972
W1IG	1,770

14 MHZ

NK5G	44,992
WT1L	4,560
K3TW	900

7 MHZ

N3CRT	36,600
W4ER	13,490

3.5 MHZ

KH6KG/W5 (KH6KG/W5)	42,262
WD9FTZ	40,404
W2NTN	18,252
KB2HSH	4,160

MULTI-OP SINGLE-TRANSMITTER HIGH POWER ALL BAND

AK6A	2,602,920
K5RZA	2,395,214
K3AJ	2,240,128
KT7E	2,122,110
K2ADA	2,005,560
KN4BIT	1,921,360
KA6BIM	1,914,405
KT1I	842,193
ND2T	378,798
NE9A	301,840

MULTI-OP SINGLE-TRANSMITTER LOW POWER ALL BAND

NA5NN	1,055,250
WB9TFF	227,504
K3GP	168,181
WS$$Z	55,151

MULTI-OP TWO-TRANSMITTER ALL BAND

K9CT	8,218,630
W3GH	4,326,224
NCØDX	3,932,544
WV1K	3,667,794
WV4P	3,175,836
NB3R	3,158,400
AC3BU	2,474,460
NW8S	2,184,655
K3CCR	1,197,979
WU5K	1,021,644

MULTI-OP MULTI-TRANSMITTER ALL BAND

KA4RRU	4,317,848
NR6O	4,052,545
N3OW	762,870

ROOKIE HIGH POWER

K6KM	51,992
NA6US	43,815

LOW POWER

W9JWC (KD9LSV)	236,680
AA8SW	104,550
KC3OOL	66,297
N8JLM	60,768
KB7AK	23,712
KC3OSK	11,033
K1TIG	6,854
WRØJ	720
AE8AT	352

TRIBANDER/WIRES HIGH POWER

N3QE	2,960,342
KO7SS	1,988,746
K9OM	1,717,296
ND9G	1,552,015
K2XR	1,303,500
WW5M	1,266,552
WX2NJ (K2RET)	1,260,396
AD5XD	1,066,362
W6SX	1,056,000
W2CDO	1,023,295

LOW POWER

NU4E	697,872
W4LC	620,880
NØGZ	539,148
WA3LXD	404,096
K9CW	383,724
K2QB	373,107
KV2U (K2AL)	368,300
WB8BZK	341,884
AB1J	317,328
K2YG	301,376

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Thanks as always for such enjoyable contests ... ***AE1EZ***
Enjoyable contest ... ***GMØOPS***
I had some fun, and enjoyed the time I had ... ***GUØSUP***
Always great fun ... ***IW1CBG***
I enjoyed the contest very much! ... ***JA1CCH***
Had fun working the contest! ... ***KEØYI***
Good contest. See you again friends ... ***OK2SWD***
Thank you for the nice contest ... ***RA3XEV***
Very good contest! ... ***YV5KAJ***
Had big fun ... ***W3GH***

Multi-Operator (125)

Multi-Single is the most popular multi-operator category, by far:

MSL	MSH	M2	MM
36	56	21	12

Multi-Single Low Power (36)

9A7T (9A2EU, 9A5MR) prevailed over ES9C (ES3TI, ES4NY, ES5JR, ES5QA, ES5RY, ES5MAIN, ES5KAAR, and ES5MIKE). TC7G (TA7AZC, TA7LMI, TA7LMN, TA1HZ, and TA7EB) was the top non-European station, in 6th place overall, breaking the Asian record the group set in 2019. Ops included three youths, ages 14, 18, and 21, plus two adults as support. NA5NN (K2FF and W5UE) was 9th for the top North America entry.

Multi-Single High Power (56)

DR5N (DJ9DZ, DK5OS, and DL9YAJ) eked out the win over a virtual tie with J42L (SV2KF, SV2AEL, SV2BXA, and SV2DCD). The next three places were also tightly clustered in score: EC5V (EC5V, EA1CJ, EA5AQB, EC5W, EB5BQC, EA5EY, and EA5IPM), UZ2I (UT2II, UT2IV, UY2IF, US2IR, and US1ITU), and OG73X (OH8WW, OH8GDU, OH8KA, OH8KTN, OH2HAN, and OH6CT). AK6A (AK6A and K2PO) won North America and HU1DL (DH8WR, DJ6TF, and DL4SVA) won South America.

Multi-Two (21)

CR3DX (CT3DZ, CT3EN, CT3FW, CT3KY, OK1HRA, and OM2KW) won, falling short of the world record they set in 2019. S51A (F5RAV, DJ5CT, S53F, S55KZ, S57PM, S56DE, S55LL, S53NW, S50LD, S56B, S51ZJ, and S51TC) and DP7D (DF1QR, DH8AF, DJ4MH, DL1REM, DL3YCX, and LX1ER) nearly tied once again this year, but switched positions for 2nd and 3rd, respectively. K9CT (AI9T, K9WX, N9CK, K9NR, KT9L, and K9CT) was again first in North America for fourth place worldwide.

2019 CQWW WPX RTTY TOP EUROPE SCORES

SINGLE OPERATOR
ASSISTED HIGH POWER
ALL BAND

SN7Q (SP7GIQ) 7,476,770
UW1M (UR5MW) 6,046,320
UA4M (RL4R) 5,183,171
HG8R (HA8JV) 5,172,432
LY7Z 4,741,347
ER4A (UT5UDX) 4,363,320
I2WIJ 4,338,720
EMØI (UT2IZ) 3,966,304
S53X 3,676,290
EA1AKS 3,621,024

21 MHZ

IZ4COW 79,704
RN6A 6,656
IK3ASM 3,948
TM5J (F5TMJ) 2,618
YO3LW 390
GX4GA (G4IRN) 27

14 MHZ

IQ1RY (IZ1LBG) 2,659,589
IT9ZMX 2,315,193
S52X 2,090,880
EC1KR 1,814,652
9A5D (9A7Z) 1,738,156
YT1X 1,431,930
EA1B 1,010,412
IU4CHE 922,530
YT5A (Z3ØA) 777,975
SZ1A (SV1CIB) 770,868

7 MHZ

IZ4NIC 4,309,540
OM2VL 3,829,228
ED1R (EA1TL) 2,599,496
YU7U 2,589,312
GB6ØATG (GW4SKA) 2,543,234
SQ2A 2,354,104
S51CK 2,210,908
HG1G 1,462,680
F4HJO 1,117,376
UR5SD 1,023,408

3.5 MHZ

OL9A (OK2ZAW) 3,128,400
SN2M (SP2XF) 2,510,244
OL4C 2,211,928
UX2X (UT2XQ) 2,139,552
I4AVG 2,055,636
IZØKBR 1,931,250
HG5D (HA8QZ) 1,825,270
DL3BQA 1,324,320
SP5DL 765,002
EU8A 554,200

ASSISTED
LOW POWER
ALL BAND

IK6VXO 5,463,707
TM3Z (F4DSK) 5,311,416
IT9RGY/4 5,294,496
US2YW 3,574,208
LY6A 3,238,239
EA4GOY 2,544,750
UT4LW 2,485,056
UR6EA 2,131,844
UX1UX 2,055,504
DD2ML 2,055,169

21 MHZ

YT8A (YU1EA) 29,160
UR5QU 28,560
G9D (G6NHU) 2,574
IT9RZU 1,700
SV5DKL 648
PA2REH 351
HB3YGD 324
EA1BDX 180
SP4DC 98
IZ5OQX 96

14 MHZ

AN1PM (EC1A) 836,140
IZ3IBL 754,390
GI5NI (MIØSAI) 665,712
UR2Y (USVYW) 611,892
EA1X 578,556
IP9IPY (IT9YMM) 484,058
USØMM 457,560
IK5AMB 384,475
SV1JG 372,498
S52OT 350,056

7 MHZ

Z32ID 1,832,370
YU5R (YT2AAA) 1,556,516
3Z9M (SQ9UM) 1,544,306
G8X (G4FJK) 1,196,972
IR9K (IT9AHI) 1,078,884
IZ3NXC 950,274
Z33F 902,480
IW1PNJ 882,000
OK2RU 791,986
YT9VM 740,784

3.5 MHZ

OK6T (OK1WCF) 1,115,520
F5BEG 1,013,308
UZ2HZ 901,472
F1AKK 767,808
I1WXY 756,126
HA8WY 690,120
S56A 642,048
LZ33E 628,320
E79D 552,750
ER1OO 514,692

ASSISTED
QRP
ALL BAND

LZ3RR 1,549,301
DK7HA 799,848
OK2FD 707,074
EU8F 510,940
YU1LM 480,384
MØHMJ 404,481
UT5EOX 371,110
MM3AWD 333,788
SFØA (SMØLPO) 288,552
DL5RK 285,995

21 MHZ

IZ3NVR 990
YO8WW 950
DL2TM 902

14 MHZ

UT2EF 157,842
HG3IPA (HA3JB) 118,038
YU1NR 79,980
RQ7R 66,400
HA3HX 50,337
IZ2JPN 47,560
UX8ZA 44,415
SP4LVK 31,790
YU1RH 18,612
RA3XEV 10,336

7 MHZ

LY5G 163,812
YT5DEY 108,190
E77T 92,184
DG3EK 63,196
DJ3GE 59,890
GMØHVS 34,144
DJ2GMS 28,884
R7RAG 12,508
GW7APP 8,280
HAØGK 5,940

3.5 MHZ

YO9BCM 206,586
UT1AM 103,362
YL3FW 45,150
UT8UU 22,496
CR6A (CT1IUA) 3,078
OP4A 896
DQ5M (DK6SP) 2

MULTI-OP
SINGLE-TRANSMITTER
HIGH POWER
ALL BAND

DR5N 6,626,312
J42L 6,616,512
EC5V 5,764,202
UZ2I 5,611,000
OG73X 5,595,834
SX2I 4,765,846
LZ6Y 4,617,264
LZ7A 3,514,503
OK1KSL 3,291,375
OE9R 2,814,840

MULTI-OP
SINGLE-TRANSMITTER
LOW POWER
ALL BAND

9A7T 3,892,911
ES9C 3,318,435
YL1ØCWO 3,137,197
LY5W 3,048,514
IK4RQJ 2,477,167
DF7ØDARC 1,566,720
DQ4W 1,249,438
ED3D 947,646
S57ZT 882,205
OK1RPL 459,900

MULTI-OP
TWO-TRANSMITTER
ALL BAND

S51A 9,846,324
DP7D 9,597,284
DP9A 8,984,146
LN5O 242,606
ED2V 106,704

MULTI-OP
MULTI-TRANSMITTER
ALL BAND

9A1A 16,273,408
HG1S 10,251,135
LY2W 10,084,250
LX2ØI 9,224,970
OMØM 7,528,164
DKØKC 5,598,100
MØSQC 272,571
DG7RO 2,485

ROOKIE
HIGH POWER

9A5AAX (DJ4MX) 2,361,582
EU8A 554,200
SP9PUZ 256,060
IU1LCU 175,123

LOW POWER

EA7KHB 789,859
EU8F 510,940
R2PU 328,293
HA1TIB 216,876
LZ2ZY 205,224
IU3LYJ 134,688
UR4MH 128,505
EA4C 76,960
I4JEE 62,436
SP9KB 45,066

TRIBANDER/WIRES
HIGH POWER

GB6ØATG (GW4SKA) 2,543,234
IK2XDE 2,037,184
R5AJ 2,014,272
S5ØRY (S53K) 1,994,039
DLØHMK (DF2HN) 1,663,592
YO3RU 1,647,300
SV2ESW 1,387,512
IW3FVZ 1,258,368
DL6JZ 1,111,432
IX1CLD 1,078,650

LOW POWER

UR6EA 2,131,844
DK9IP 2,002,752
IK3TPP 1,982,460
EW7BA 1,601,400
UZ1WW 1,556,610
CR5O (CT7AJL) 1,485,143
DL/KU1CW (KU1CW) 1,478,598
UT5EPP 1,475,005
CT7AUP 1,400,850
YO4NF 1,334,256

Here is a nice video of the K9CT operation <www.cqwpxrtty.com/k9ct.mp4>. From left to right are: Don, K9NR; Larry, KT9L; Tim, K9WX; and Steve, N9CK operating MultiFlex ... two operators using one FlexRadio 6600 radio and one PGXL amplifier per side. You can see them interleaving their run and mult QSOs.

We had great fun ... ***S51A***

Multi-Multi (12)

World record holder 9A1A (9A5W, 9A9A, 9A6A, 9A7R, 9A7ROR, 9A7C, and 9A8A) again took top honors as has been the case every year since 2012. Second and third places were nearly tied: HG1S (HA1TJ, HA1DAI, HA1SN, HG2DX, and HA1DAE) and LY2W (LY1FW, LY2FN, LY2MM, LY2NY, LY2PAD, LY3VP, and LY4K). KA4RRU (KA4RRU, WA4GSD, WC4J, K4MIL, NR4M, KD6AKC, K3UI, N3ZV, W4GO, and K5OF) and NR6O (K6AW, N6RO, N6WM, NA6O, WD6T, WX5S @N6RO, mostly remote operation) battled it out in North America with KA4RRU prevailing.

RWØA (RAØAM, RWØAR, RZØAT, RZØAI, RGØA, RAØASG, RØACG, RQØA, RCØAK, and RUØAM) has dominated this category in Asia for two decades, winning 17 of 21 years, breaking the continental record nine times. WPX RTTY is one of this serious team's favorite contests. With seven operating positions, 18 transmit and receive antennas on nine towers from 16 to 50 meters, five receive-only antennas and nine power amplifiers, they are clearly focused on having fun making big scores. Typically, they have two operator positions per band where S&P is quite successful but running is difficult from eastern Asia.

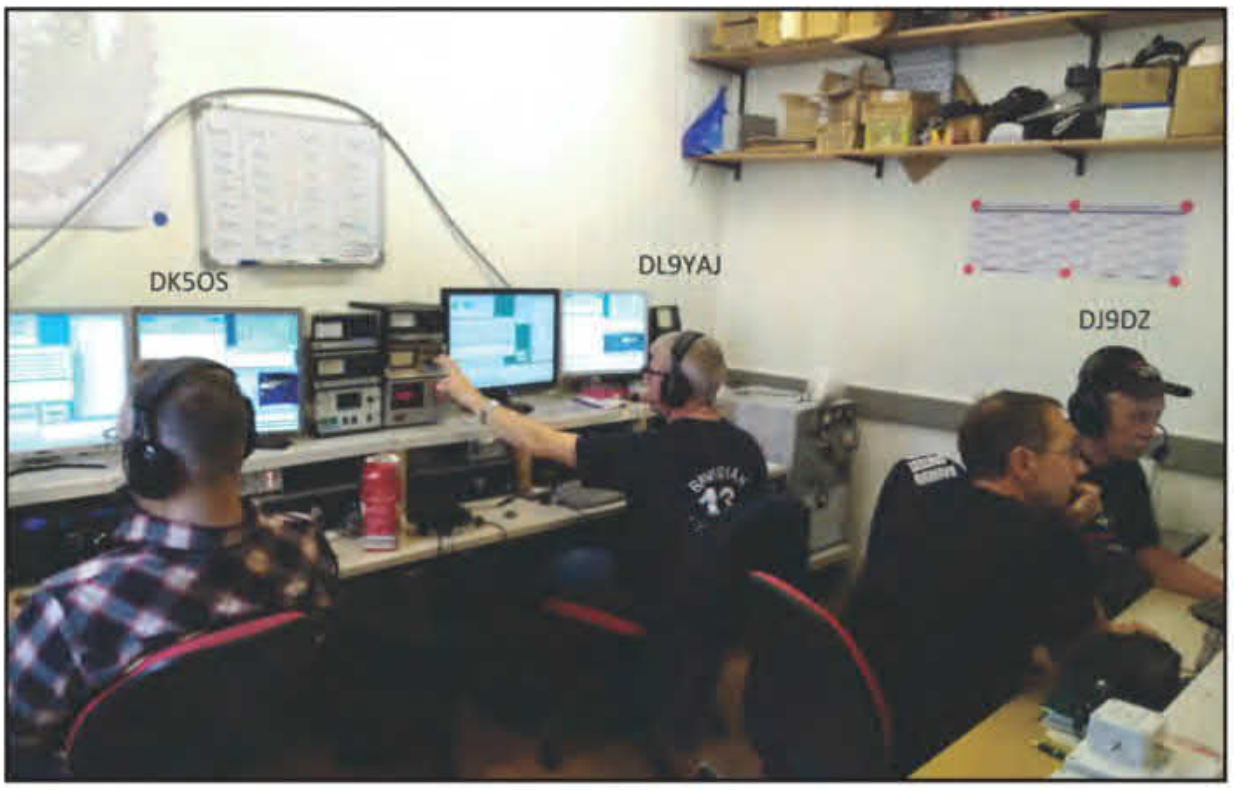
Club Competition

DX: The Bavarian Contest Club dominated again this year with 95 logs for first place. Also repeating, the Ukrainian Contest Club finished 2nd again with its 55 entries. The Croatian Contest Club, Slovenia Contest Club, Interest Group RTTY, and Italian Contest Club followed.

USA: The Northern California Contest Club with 45 logs was 3rd worldwide to win the USA competition. The Potomac Valley Radio Club and Frankford Radio Club were next in the USA, with 4th and 5th place worldwide finishes.

Closing

A searchable database of the results from every CQ WPX RTTY Contest is



This DR5N team won the Multi Single High Power category: Olaf, DK5OS; Bernd, DL9YAJ; and Vasily, DJ9DZ.

2020 WPX RTTY PLAQUE WINNERS AND DONORS

SINGLE-OPERATOR HIGH POWER

World: Jeff Blaine, ACØC. Won by: **Ed Muns, P49X (op. WØYK)**
North America: Marty Sullaway, NN1C. Won by: **Bill Fehring, ZF2WF (op. 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, KS7AA (op. WK6I)**
Europe: FlexRadio Systems. Won by: **Krzysztof Sobon, SN7Q (op. SP7GIQ)**
Asia: Mike Trowbridge, KA4RRU in memory of Steve Veader, N4DXS. Won by: **Takayuki Miyachi, JH4UTP**

SINGLE-OPERATOR LOW POWER

World: Gerry Treas, K8GT. Won by: **Andrea Tonci, IK6VXO**
North America: Gerry Treas, K8GT. Won by: **Victor Paul, V31VP (op. WB0TEV)**
Europe: FlexRadio Systems. Won by: **Dimitri Cosson, TM3Z (op. F4DSK)**
Asia: Doug Faunt, N6TQS. Won by: **Yuri Kotelnikov, RT9S**
Oceania: Doug Faunt, N6TQS. Won by: **Turjiman Kendhagawessi, YE0TUR**

SINGLE-OPERATOR QRP

World: Vlado Karamitrov, N3CZ. Won by: **Val Borissov, LZ3RR**
North America: FlexRadio Systems. Won by: **Ilias Nikolaidis, TG9IN**

SINGLE-OPERATOR SINGLE BAND

World 3.5 MHz: Wray Dudley, AB4SF. Won by: **Jan Sustr, OL9A (op. OK2ZAW)**
World 14 MHz: Steve "Sid" Caesar, NH7C. Won by: **Filippo Vairo, IQ1RY (op. IZ1LBG)**
World 14 MHz Low Power: Kenny Young, AB4GG. Won by: **Gerardo Guntin, AN1PM (op. EC1A)**
World 28 MHz: Steve Booklout, NR4M, and the "Goat Farm Gang". Won by: **Courtney Judd, NA4W (op. K4WI)**

MULTI-OPERATOR, SINGLE-TRANSMITTER HIGH POWER

World: Rich Cady, N1IXF. Won by: **DR5N (ops. DJ9DZ, DK5OS, DL9YAJ)**
USA: John Lockhart, W0DC. Won by: **AK6A (ops. AK6A, K2PO)**

MULTI-OPERATOR, SINGLE-TRANSMITTER LOW POWER

USA: FlexRadio Systems. Won by: **NA5NN (ops. K2FF, W5UE)**

MULTI-OPERATOR, MULTI-TWO

World: Steve Bookout, NR4M, and the "Goat Farm Gang". Won by: **CR3DX (ops. CT3DZ, CT3EN, CT3FW, CT3KY, OK1HRA, OM2KW)**
North America: Ed Muns, WØYK. Won by: **UNCLAIMED** (No non-USA/Canada entrant this contest)
USA: CTRI Contest Group in memory of Chris, KA1GEU (SK). Won by: **K9CT (ops. AI9T, K9WX, N9CK, K9NR, KT9L, K9CT)**
Europe: FlexRadio Systems. Won by: **S51A (ops. F5RAV, DJ5CT, S53F, S55KZ, S57PM, S56DE, S55LL, S53NW, S50LD, S56B, S51ZJ, S51TC)**

MULTI-OPERATOR, MULTI-TRANSMITTER

World: Steve Bookout, NR4M, and the "Goat Farm Gang". Won by: **9A1A (ops. 9A5W, 9A9A, 9A6A, 9A7R, 9A7ROR, 9A7C, 9A8A)**
North America: Fred Dennin, WW4LL. Won by: **UNCLAIMED** (No non-USA/Canada entrant this contest)
Canada: FlexRadio Systems. Won by: **UNCLAIMED** (No Canadian entrant this contest)

CLUB COMPETITION

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

available at <www.cqwpxrtty.com/scores.htm>. The search criteria are very versatile, allowing one to see results and records for virtually any combination of category and geographical area in the world. It's a fine way to "level the playing field" and see how one's operating stacks up with more similar stations.

Log Check Reports (LCRs) can suggest ideas to improve operating accuracy. This valuable information is available upon request to <w0yk@cqwpxrtty.com>. (*As well, we now have capability to email each participant a link to their personal LCR. –WØYK*). You can compare your log check statistics with the averages across all logs in this contest. This year's statistics are very close to last year's. This may be due in part to improved log-checking algorithms:

- 1.0% busted (incorrect) received callsign
- 1.7% busted serial number received
- 1.8% NIL (Not In Log)

Taking top honors in the U.S. Multi-2 category was K9CT made up of (l. to r.): Don, K9NR; Larry, KT9L; Tim, K9WX; and Steve, N9CK. Each pair of operators shares one Flex-6600 / PGXL for interleaving run and search & pounce QSOs on one band.

2020 WPX RTTY CLUB SCORES

United States

Club	# Entrants	Score
POTOMAC VALLEY RADIO CLUB	59	35,242,211
NORTHERN CALIFORNIA CONTEST CLUB	45	37,366,397
POTOMAC VALLEY RADIO CLUB	73	35,034,053
FRANKFORD RADIO CLUB	39	25,767,904
SOCIETY OF MIDWEST CONTESTERS	47	22,419,504
YANKEE CLIPPER CONTEST CLUB	25	15,198,656
ARIZONA OUTLAWS CONTEST CLUB	22	10,766,632
FLORIDA CONTEST GROUP	18	9,901,183
WILLAMETTE VALLEY DX CLUB	20	8,589,201
KANSAS CITY CONTEST CLUB	7	6,510,422
DFW CONTEST GROUP	16	5,856,451
CENTRAL TEXAS DX AND CONTEST CLUB	5	5,284,662
GRAND MESA CONTESTERS OF COLORADO	8	4,832,323
TENNESSEE CONTEST GROUP	12	4,318,789
MINNESOTA WIRELESS ASSN	29	2,983,031
SWAMP FOX CONTEST GROUP	9	2,009,302
KENTUCKY CONTEST GROUP	12	1,911,064
CTRI CONTEST GROUP	6	1,831,929
NIAGARA FRONTIER RADIOSPORT	8	1,587,758
SOUTHERN CALIFORNIA CONTEST CLUB	10	1,553,815
ORDER OF BOILED OWLS OF NEW YORK	5	1,340,256
METRO DX CLUB	5	1,332,349
CAROLINA DX ASSOCIATION	6	1,214,832
NORTHEAST MARYLAND AMATEUR RADIO CONTEST SOCIETY	9	916,905
NORTH COAST CONTESTERS	5	914,637
IDAHO DX ASSOCIATION	5	852,145
SOUTH EAST CONTEST CLUB	5	778,268
SPOKANE DX ASSOCIATION	5	507,471
ALABAMA CONTEST GROUP	7	458,873
MAD RIVER RADIO CLUB	6	404,876
WESTERN WASHINGTON DX CLUB	6	343,898

DX

BAVARIAN CONTEST CLUB	95	52,877,212
UKRAINIAN CONTEST CLUB	55	51,286,166
CROATIAN CONTEST CLUB	9	23,080,879
SLOVENIA CONTEST CLUB	8	20,113,395
INTEREST GROUP RTTY	12	19,476,750
ITALIAN CONTEST CLUB	28	18,456,384
EA CONTEST CLUB	23	13,709,530
RUSSIAN CONTEST CLUB	13	13,410,073
HA-DX-CLUB	4	12,785,419
RHEIN RUHR DX ASSOCIATION	27	11,556,190
CONTEST CLUB ONTARIO	22	10,288,867
BALTIC CONTEST CLUB	5	10,228,051
ARIPA DX TEAM	7	9,656,146
CONTEST CLUB SERBIA	12	6,335,586
THRACIAN ROSE CLUB	5	5,764,581
ARAUCARIA DX GROUP	7	5,748,296
BELARUS CONTEST CLUB	6	4,556,612
ORCA DX AND CONTEST CLUB	8	3,927,612
RTTY CONTESTERS OF JAPAN	9	3,827,241
LATVIAN CONTEST CLUB	4	3,761,601
CONTEST CLUB FINLAND	10	3,554,079
RUSSIAN DIGITAL RADIO CLUB	14	2,839,757
CONTEST GROUP DU QUEBEC	8	2,654,075
KRIVBASS	5	2,623,977
YB LAND DX CLUB	33	2,590,480
LU CONTEST GROUP	11	1,947,438
CATALONIA CONTEST CLUB	5	1,936,539
SP DX CLUB	9	1,669,068
SK5AA VASTERAS RADIOKLUBB	4	1,364,382
CHILTERN DX CLUB	7	1,119,068
VK CONTEST CLUB	5	1,051,183
RU-QRP CLUB	5	798,107
SOUTH URAL CONTEST CLUB	4	765,463
ARCK	4	691,688
POLISH RADIOVIDEOGRAPHY CLUB	4	646,705
GIPANIS CONTEST GROUP	4	618,165
RUSSIAN CW CLUB	4	595,049
RIO DX GROUP	7	517,028
GMDX GROUP	4	362,284
DANISH DX GROUP	6	346,374
SP5PBE	4	255,727
RADIO CLUB VENEZOLANO CARACAS	4	220,134
GUARA DX GROUP	4	8,218
CABREUVADX	4	2,974

Club scores with **4 or more** entries.

- 5.2% total error rate
- 11.1% score reduction (with penalties and lost mults, score reduction is higher than total error rate)

Achieving a zero error rate may mean that too much time is being spent on accuracy. Speed and accuracy are a trade-off for optimal communication.

Certificates are available online for download and printing locally. The link for your certificate is on the far right of your score listing in the Scores Database at <www.cqwpxrtty.com/scores.htm>.

Sponsoring a plaque is an opportunity to give back and show appreciation for the contest. You can choose an unsponsored plaque in any category, whether listed or not at <www.cqwpxrtty.com/plaques.htm>. Contact Rich, N1IXF, at <plaques@cqwwrtty.com> to sign up.

A number of volunteers work tirelessly in the background to bring contests to us. Ken, K1EA, and Randy, K5ZD, continue to improve and support the log-checking and website software. KM3T, N5KO, and K5TR quietly manage the IT infrastructure behind the log submittal robots, log storage, and log checking software. The WWROF (WorldWide Radio Operators Foundation) provides financial support for the IT services required among other support for contesting in general. All of us can help with our donations to WWROF, so please consider this as a way to give back to radiosport. Finally, thanks to Jason, KD2IWM, Managing Editor at *CQ Amateur Radio* for his supportive editing work on these results.

The 27th CQ WPX RTTY Contest will be held on 13-14 February 2021. I look forward to seeing everyone again then!

I drank so much Sunday afternoon and left the contest out, so sorry ... ***PY2N***

Rene, LU7HN's, QTH used to take 2nd place in the Single Operator 15 Meter High Power category.

(Scores on page 97)

Are you working on wallpaper for your shack? K5FUV explains how contests offer great opportunities for building up your DX totals, whether you're seeking basic awards or more difficult and specialized ones.

Contesting Your Way to DX Success

BY BILL KENNAMER,* K5FUV

Are you a beginning DXer, working toward the basic DX awards such as DXCC or CQ DX? Or perhaps you're a little more experienced and you've decided to chase Worked All Zones (WAZ), 5-Band WAZ, the DXCC Challenge, or even one of the many other specialty DX awards offered by various organizations around the world (and regularly featured in *CQ*'s Awards column). If you're not satisfied with your current results and want to improve upon them, maybe you should try contesting.

Some operators feel contests are just a bunch of noise that interrupts their ham radio weekends, but in fact, they serve several very useful purposes: The increased activity contests provide shows regulators that the amateur bands are in fact being used and we don't need to have our allocations cut; experimenters use contests to try new equipment and techniques, and award chasers use them to help in their quest to work "new ones" in pursuit of those goals.

My Introduction

In the mid '70s, I was basically a confirmed 75-meter ragchewer who would work the occasional DX station if one happened to break in to our group. At that time, I had been largely inactive for 10 years, even to the point of having to retake my FCC exams. As it happened at the time, I walked into a radio store in Dallas with the intention of finding a 3/16-inch microphone plug. I met enthusiastic contester N5AU, and walked out with a lasting interest in contesting and DXing.

At the time I started serious DXing, I had no station. Equipment, yes, but as an apartment dweller, no antennas. So, if I wanted to contest, it was either multi-op from somewhere or borrow a station or antenna. My first operation under my own call was in 1977. I borrowed a station with a tri-bander at 25 feet, and built a G5RV that had the apex at 25 feet on the same tower. With a KWM-2, R4C, and SB-200 amp, and two other even less-experienced operators than me, we slogged our way to 277 QSOs. Not a great effort. However, by hanging around throughout the contest, we managed to work such stuff as ZL1AA/K on Kermadec Island (now ZL8), KX6LA on 40-meter SSB (now V7, and one of only four QSOs made on 40 meters), KC4AAA in Antarctica, ZK1DR (E5) and VR4DX (H44). These were the notables, but many DX entities were worked that weekend. I had DXCC within a year, with almost all contacts from borrowed stations during contests.

Currently, I find that I usually work at least 100 different DX entities in each major contest weekend, all on low power with a Hexbeam. Over the years, I have been able to fill in DXCC entities on the bands necessary for 5-band DXCC. If I can do it, anyone can. I don't consider myself more than an average operator. I am persistent, and do operate the contests seriously, because that's the best way to get the numbers one needs for DXing success. Quantity counts, because not everyone will QSL, and not everyone has you in their log correctly. But by working the contests seriously, trying for maximum score, a new DXer will find that his/her DX score will go up with almost every contest for several years. If you happen to be chasing Worked All States (WAS), the ARRL Sweepstakes in November in each year should provide you with WAS. The January and August North American QSO Party events should

Account Status

DXCC Award	New LoTW QSLs	LoTW QSLs in Process	DXCC Credits Awarded	Total (All)	Total (Current)
Mixed	0	0	352	352	338
CW	0	0	340	340	332
Phone	0	0	318	318	307
Digital	0	0	130	130	130
160M	0	0	55	55	54
80M *	0	0	254	254	247
40M *	0	0	279	279	272
30M	0	0	197	197	197
20M	0	0	318	318	311
17M	0	0	223	223	223
15M	0	0	275	275	268
12M	0	0	112	112	112
10M *	0	0	239	239	233
6M	0	0	42	42	42
Challenge *	0	0	1959	—	1959
5-Band *	—	—	—	—	—
5-Band 30M *	—	—	—	—	—
5-Band 17M *	—	—	—	—	—
5-Band 12M *	—	—	—	—	—

* = Award has been issued

Figure 1. Logbook of the World (LoTW) can provide a real-time picture of your DXCC credits. It will also provide a look at both CQ WPX and CQ WAZ credits. It this case, it shows credits for each DXCC award as well as DXCC Challenge totals. Many contesters now use LoTW instead of bureau QSLing after they complete a contest. Fast, neat, free to upload and keep track of what you've worked.

* Email: <k5fuv@prodigy.net>

do so also. They will also help you collect counties for the USA-CA Award, as will state QSO parties.

There are also many contest DXpeditions every year, especially for the CQ contests with their "world works the world" format. Many of these entities will not often be found in daily DXing activities, but they will be there and usually present on all bands. Many times, rare DX stations around the world will turn up during the contest, and at few other times during the year.

Taking it to the Next Level

If you've ever considered yourself a casual contester in the past, taking your activity to the next level is simple enough. First, you have to know when a particular contest occurs. Then, you need to know what the contest exchange is, and what areas of the world you can work. There are many specialty contests throughout the year sponsored by organizations worldwide. This will bring out activity from those areas that wouldn't ordinarily be active, and they all want a contact from you. Information about these contests may be found in the contesting column here in *CQ* and on the magazine's website, plus at <www.contestcalendar.com>. Bruce Horn, WA7BNM, started this project years ago, and it will give you the dates of each contest, as well as a link to the rules. Of course, the major contests are well-known, but there are others with specific areas involved that will provide opportunities to work DX from areas that you won't find on the air every day.

Computers have made contesting both easier and more productive. Not only can you track your progress during the contest, but after the contest it's possible to upload your QSOs from your everyday logging program to the ARRL's Logbook of the World (LoTW) and Club Log. You can then find out what you may have added to your DX totals during

DXCC Entity	160M	80M	40M	30M	20M	17M	15M	12M	10M	6M
D2 - ANGOLA		D2EB	D25L	D2EB	D2FGC	D2EB	OK3TAB/D2A			
D4 - CAPE VERDE		D4CBC	D44BC	D44TUK	D4CBS	D4D	D4B	D4D	D4C	
D6 - COMOROS		D66D	D68XX	D66D	D66D	D66D	D68XX		D68XX	
DL - FEDERAL REPUBLIC OF GERMANY	DJ4MM	DL2GGA	DL8OH	DL1NKS	DL8OH	DP65HSC	DL1A	DF2KK	DL6LAU	DK8NE
DU - PHILIPPINES		DU7ET	DU3T	DU3LA	DU1KA	DU3LA	KE9A/DU3		WA1APX/DU2	
E3 - ERITREA		E31A	E30GA		9ER1TB	E31A			E30HA	
E4 - PALESTINE		E44/HA1AG	E44DX		E44DX					
E5 - NORTH COOK ISLANDS		E51MQT		E51MQT	ZK1AM	E51LYC			ZK1AM	
E5 - SOUTH COOK ISLANDS		E51Q	E51Q	E51DWC	E51DWC	E51DWC	ZK1XT	E51DWC	VE3EEW/ZK1	
E6 - NIUE		ZK2YY	ZK2YY	E6GG	E6AF	E6GG	ZK2YY	E6GG	ZK2YY	
E7 - BOSNIA-HERZEGOVINA	E77DX	E77DX	YZ4Z	E77DX	E7DX		YZ4Z		YZ4Z	
EA - SPAIN		ED7TV	EA3IN	EA7GV	EA4DX	EA5HT	ED1R	AM100AST	EA4AK	EA2XR
EA6 - BALEARIC ISLANDS		EA6CE	EA6CE	EA6NB	EF6T	EA6AAJ	EA6IB		EA6/OH1XM	
EA8 - CANARY ISLANDS	EF8R	EA8RL	EA8ACH	EA8CN	EA8EA	EA8TL	EA8CN	EA8TL	EA8TY	EA8DBM
EA9 - CEUTA & MELILLA		EA9EO	EA9EO	EA9/DL2RNS	ED9ED	EA9ABC	EA9EO	EA9EU	EA9IF	

Figure 2. Here is the LoTW matrix view showing individual credits with callsigns for the DXCC Challenge. It's also possible to show individual modes or bands. It works for WPX and WAZ, too.

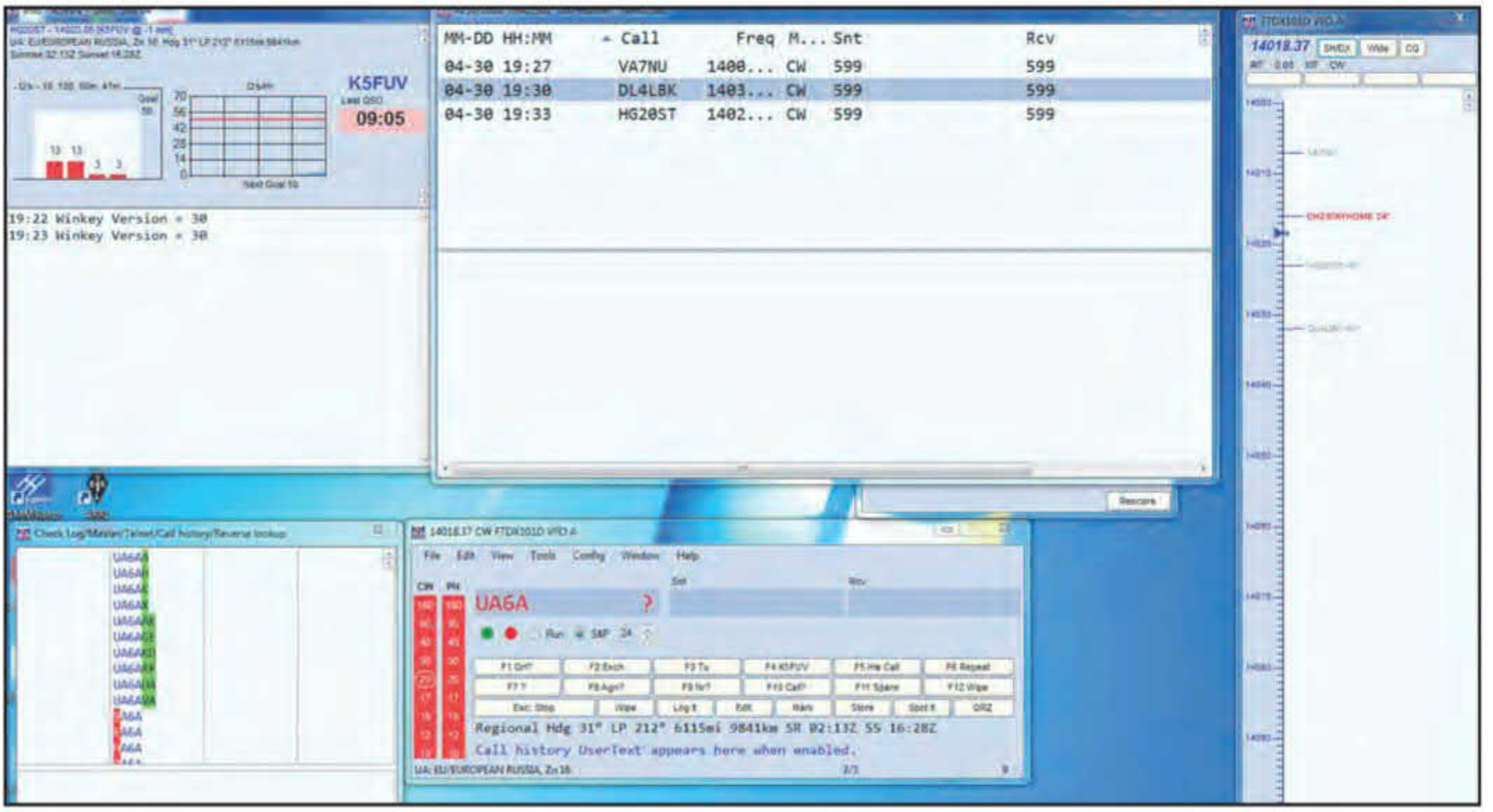


Figure 3. This is a simple screen set up for N1MM+. At left is the rate screen, then the log screen, where the contacts are shown. The band map is on the right. It shows contacts worked in gray, the red is a multiplier. Unworked would be blue. Bottom left, the check partial screen shows possible UA6 callsigns. The entry window shows a UA6 call that has not been completed and entered. Since the call has not been determined yet, it is followed in the entry screen by a question mark.

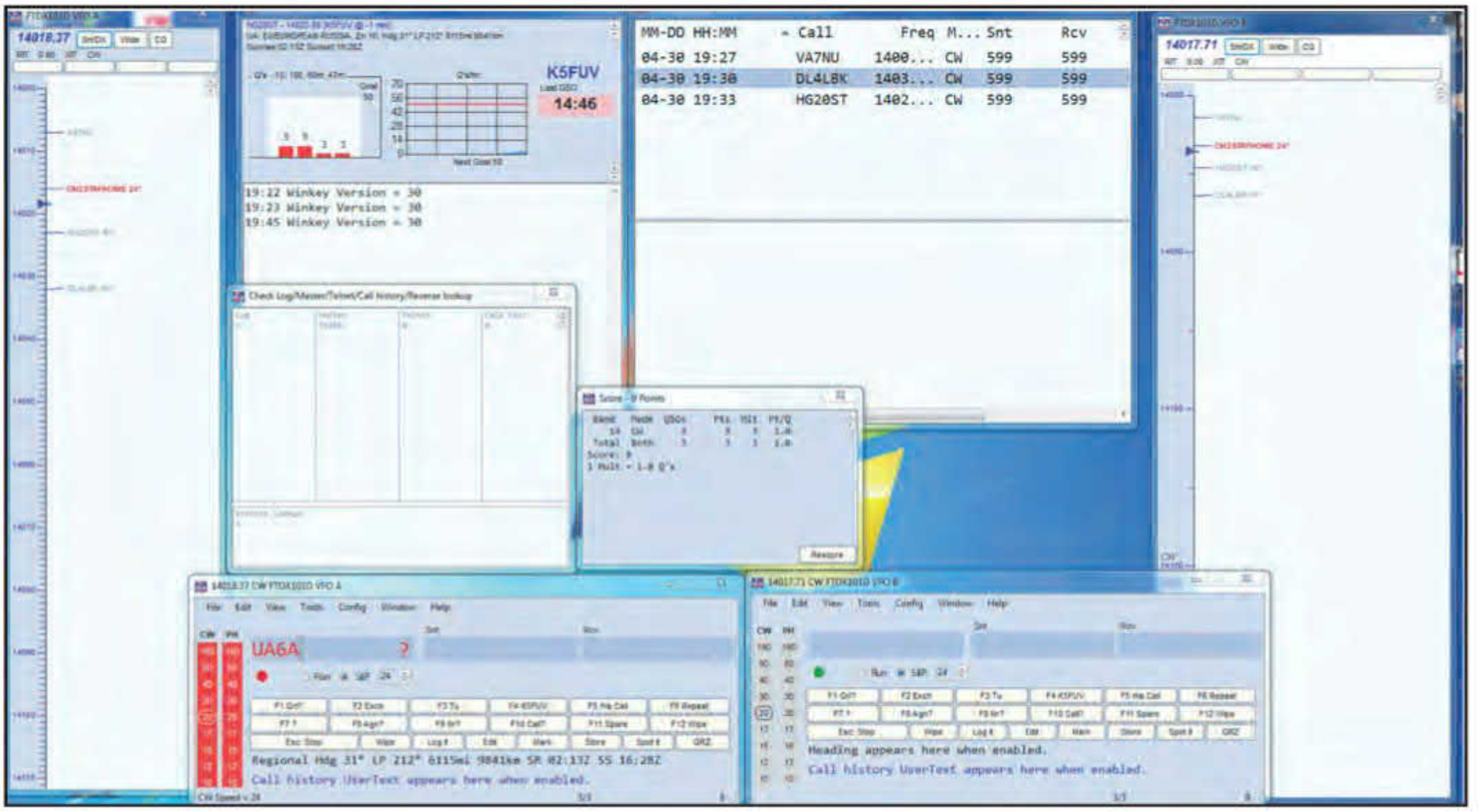


Figure 4. This is my normal N1MM+ screen. Since I use two VFOs with separate receivers, there is an entry screen and band map for each one. Not necessary if you are just learning of the many features of this program.

the contest. Not having to manually dupe-check the logs as had to be done when I first started is truly deliverance from evil.[1] Having the information available post-contest for QSLing is also great.

The computer and internet have made confirming your QSOs easier. All DXers and contesters should be participating in LoTW, in my view. It's free to use (you don't even have to be an ARRL member), and it relieves a lot of the burden of QSLing after the contest. Several of the major awards program will accept verifications through LoTW, including CQ's WPX and WAZ awards. If, like me, you had operated a lot of contests during the days of all paper QSLs, you'd understand why contesters appreciate LoTW so much. I'd rather spend my time operating or station building than filling out 200+ QSL cards after a bureau dump. LoTW is used by many contesters worldwide for uploading their contest QSOs. Not only does this save preparing and shipping hundreds of cards to the bureau after each contest, it also will show up in your DXCC records, IF you're also using LoTW (see *Figures 1* and *2*). While there is a fee for applying QSO credits toward an award application, it's much less expensive than mailing cards and including return postage. Again, in my opinion, every active DXer should use it. It's easy, just go to <www.arrl.org/logbook-of-the-world> to enroll. Download the latest TQSL program from the LOTW page, and request enrollment. DX stations will need to email a copy of their license and a copy of some government-issued document or utility bill with the sensitive information blacked out. You will then be sent a certificate and password, and you're ready for easy QSLs. Take advantage of this service.

Record-Keeping

Record-keeping is always important for the DXer, and never more so than in real time during a contest. You need to know where you stand during the contest, and whether you may have already worked that DX station under a big pile-up. By using a contest-logging program, you can know all of this and more. N1MM+ Logger is far and away the most popular contest-logging program in the world today (see *Figures 3* and *4*). It's free, and may be found at <www.n1mmwp.hamdocs.com>. This program can interface with your transceiver to record and/or select frequencies as well as do your CW keying. In fact, when properly interfaced, it can also do your voice keying. It has many windows that provide useful information during the contest, and will give you the beam heading for the entered callsign, as well as the DX entity name and multiplier status. For help in installation and setup, go to <www.youtube.com> and search for "How to download and setup N1MM+ Logger for CQ WPX SSB Contest." This video guide is general enough to provide help for all contests.

Among the many features of N1MM+ Logger that I find useful is the band map. As you tune the bands working stations in the "search and pounce" mode, just put the callsign of any station you hear in the log window. If you don't work the station, tuning away from his frequency will automatically populate the band map, and you can click on that callsign to check back to that station when conditions may be better for working him. I also maintain a score summary window to see where I stand with multipliers. Other windows I find useful are the info window (rate) and the statistics (hourly and total contacts).

Three Hands?

Using a computer for logging and scorekeeping is nice, but it can be a handful if you are using a hand mic, or one with push-to-talk. You will want both hands free on SSB in order to use the keyboard. While I use a boom mic / headset, it's also possible to jury-rig a microphone on a stick and suspend

it over the keyboard. You can also purchase a boom to hold your mic. I use a footswitch as well to keep my hands totally free for keyboard use. The footswitch can be as simple as an old straight key mounted on a board, or just about any type of commercial footswitch (see *Photo A*).

Taking full advantage of the opportunities of the contest to improve your DX score will require some investment of time. Try to block out a minimum of 12 to 24 hours during a 48-hour contest weekend. This should take you through some propagation and band changes that will give you a shot at several different areas of the world. Working a lot of Europe should lead to working several of the less common countries. Some of these countries are not on every day, but they usually turn out for the contest. It's the same with Africa and Asia. Quantity is a key here. The more stations you work, the more likely you'll be to find something new for your award quests. With the quantity will come the quality (new entities) to improve your award scores.

Set Reasonable Goals

Keep track of your score and keep trying to improve it. Look for one more country, or zone, or state, or IOTA (Islands on the Air) counter. Set objectives for yourself. I often look at the leading line scores from the previous year and try to work at least half of the multipliers that last year's winner did. This gives me a reasonable measuring stick to see how I'm doing. I also use my own last year's score in an effort to do better.

Operating Strategies

There are two ways to make contacts during the contest, either "search and pounce" or calling CQ, also known as "running." Either method will produce contacts, and both can be

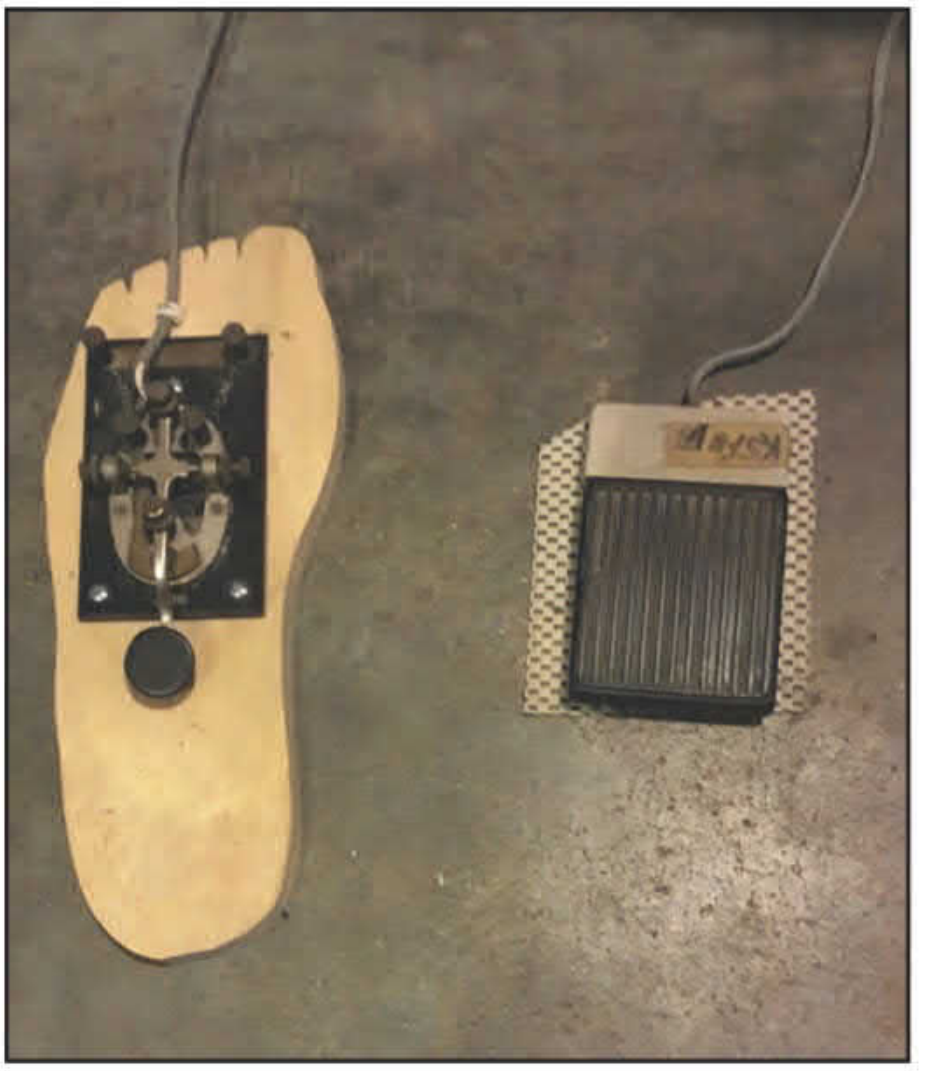


Photo A. The footswitch allows hands-free operation. It can be simple or elaborate. The one on the left uses an old hand key mounted to a board. It's also handy for QLF contests.[2] The one on the right comes from a yard sale.

On the Cover

Help us solve our cover mystery and win a prize! Here's the mystery … "Learning Curve" editor Ron Ochu, KOØZ, shot this photo of an antenna range at the 2013 Microwave Update conference in Morehead, Kentucky. The person at the far right is *CQ* Antennas Editor Kent Britain, WA5VJB, and the hand on the clipboard at the lower left belongs to Donn Baker, WA2VOI. Neither Ron, Kent, nor Don remembers the names or calls of the other two people in the photo.

We suppose Kent can be forgiven for not remembering … he's been running conference antenna ranges (often with help from WA2VOI, since 1987, generally covering 900 MHz to 47 GHz, while Marc Thorsen, WBØTEM, tests antennas for 50-432 MHz.

Here's the deal: The first person to correctly identify all of the people in the cover photo will win a free one-year subscription (or extension) to *CQ*'s digital edition; with a bonus three months added on if you can correctly identify the antenna under test! Send your responses to *CQ* Editor Rich Moseson, W2VU, at <w2vu@cq-amateur-radio.com>. We'll report on results in a future issue. (*Cover photo by Ron Ochu, Jr., KOØZ*)

productive. But ideally, it takes a mixture of both. There are many DX stations that know you want to work them who will only call CQ all weekend. But there are other stations, which often tend to be rarer, that will only answer a CQ. So finding an occasional open frequency and calling a few CQs can reap big benefits. Make the CQs short, and don't waste a lot of time forcing it.

Pileups are a part of contesting. They can be fun or frustrating, depending upon the nature of the pileup. If's it's a huge, raging, mess with everyone trying to be the last one to get their call in, mark the frequency in your band map and leave. Check back from time to time and it will thin to a reasonable level, or the station that attracted the pile will have decided that it's a waste of his time and left the frequency. Sometimes you can hear a multiplier that you will never work because of the behavior of the pile. The worst pileups are the *cluster pileups*, based on a spot on the DX Cluster rather than actually hearing the station (there's a reason that assisted class is often called "single-op distracted"). You can tell what they are because the big gun stations are there with you, and the station never gives his call because those working him got the call from the cluster.

Heads up: Many times, the call that comes off the cluster is incorrect, or isn't even the call of the station being worked, because he's already gone, and someone else took the frequency. The largest pileups are time wasters. Avoid them and check back later, they'll dissipate. One thing I've found is that contest pileups are never as busy as a DXpedition pileup. That's because there's a veritable smorgasbord of DX on the bands to choose from, so there are fewer callers in the individual pileups.

If you should decide to call a CQ, clarity is essential. Enunciate clearly so that you can be understood. Don't talk so fast that you are tripping over your words. It isn't necessary. If you listen to the stations that win, they are easy to understand, and they aren't talking extremely fast. They don't waste words, and generally will give your call and report only. They expect you to respond to their CQ with your call one time only, then respond to their reply with only your report. The correct way to respond to a CQ is with your call, phonetically, one time (don't use the other station's call, he knows his call). Wait until acknowledged, then give the required exchange, and log it.

On CW, I usually call CQ at around 22-24 wpm. I am trying to attract casual stations who may not be proficient in Morse code. These stations are important to your score, and you will find that multipliers will often call you. These stations may never call a CQ at all during the weekend. When answering a CQ, I may set my speed at around 28 wpm, adjusting up or down as necessary. When calling stations on CW, listen carefully until you get the callsign, then send your call.

How Many Countries?

At the beginning, I mentioned that contesting is a way to increase your DX score. CQ World Wide DX Contest Director John Dorr, K1AR, recently calculated the number of entities available in the CQWW contests since 2013. During those years, the number ranged from 199 to 236, with only one year (2018) being less than 200. Most of them are available on more than one band, many on five or six bands. By seriously operating the contest, you should be able to dig out at least 100 entities, and quite likely more. In the same way, you will find all states active each year in the ARRL Sweepstakes (SS) contest. So working all states can also be a one-weekend project. Contesting has served me well in my DX pursuits over the years, and it can do the same for anyone who makes the effort.

To become proficient takes time. But the thrust of this article is not to immediately make you a contest expert, but to encourage you to explore new things and to achieve award objectives faster than you would without contests. By spending some time contesting, you will improve your operating skills. Over time, you will learn more about your station's capabilities and shortcomings. You will want to improve, both your skill set and your station, and you'll also possibly gain some more wallpaper for the shack wall.

Notes:

1. Most contest rules give credit for only one contact per band or mode with a particular station. A station worked more than once was known as a *duplicate*, or *dupe.* Dupe-checking was the practice of hand-checking your paper log to remove any dupes before submitting it to the contest sponsor. Today, computer log-checking programs automatically find and eliminate dupes from submitted logs, generally without penalty.

2. QLF is an informal Q-code meaning "Now send with your left foot!" Originally coined to describe someone with a poor "fist" on sending Morse code, some groups decided to add some fun by running events in which participants actually send with their feet!

Announcing:

2020 CQWW DX RTTY Contest

September 26-27
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 2, 2020.** 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>.

Announcing:

2020 CQ Hall of Fame Inductees

CQ magazine is pleased to announce its 2020 Hall of Fame inductees, including two new members of the CQ DX Hall of Fame, three inductees into the CQ Contest Hall of Fame, and seven new members of the CQ Amateur Radio Hall of Fame. This year's inductions were 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 seven new members, bringing to 333 the total number of members inducted since the hall's establishment in 2001.

The 2020 inductees (listed alphabetically) are:

• **Chet Atkins**, **W4CGP (SK)**, legendary musician known as "Mister Guitar" and music producer; ushered in "the Nashville sound" on RCA Records (Note: Chet's call has subsequently been re-issued)

• **Les Barclay**, **G3HTF (SK)**, propagation expert, leader of International Telecommunication Union propagation study groups and Chairman of the ITU's first Radiocommunication Assembly in 1993; top official in the UK's telecommunication regulatory agency.

• **George Laurer**, **K4HZE (SK)**, developer of the "bar code" or UPC (universal product code) on merchandise, permitting items purchased at stores to be scanned on checkout rather than manually rung up.

• **Yasuo "Zorro" Miyazawa**, **JH1AJT**, whose Foundation for Global Children helps fund educational and medical programs for children around the world; FGC also works with several countries to help them organize and train teams for the Olympic Games and Paralympic Games. Zorro is also a member of the CQ DX Hall of Fame.

• **Champ Muangamphun**, **E21EIC**, is a DXer and DXpeditioner who has been a sparkplug for growing interest in ham radio in Thailand and throughout Southeast Asia. Champ also accompanies JH1AJT on many of his humanitarian missions and operates DXpedition-style ham stations while Zorro works with government officials and non-governmental organizations on behalf of the Foundation for Global Children.

• **Sultan Qaboos bin Said**, **A41AA (SK)**, Sultan of Oman from 1970-2020; transformed impoverished country into a modern and prosperous state with influence throughout the Middle East.

• **Tom Roscoe**, **K8CX**, a champion of amateur radio history who collects and makes available online his "Ham Gallery" of old QSL cards and other historic photos.

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 2020 CQ DX Hall of Fame virtual induction ceremony was held live on the "Ham Nation" podcast on May 20th. Clockwise from top left, "Ham Nation" co-host Val Hotzfeld, NV9L; CQ DX Editor Bob Schenck, N2OO; inductees Tony Gonzalez, EA5RM; and Ned Stearns, AA7A. (Ham Nation podcast screen grab)

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 2020 inductees are:

Tony Gonzalez, **EA5RM** – has been an active DXpeditioner for 20 years, often organizing and leading teams to operate from difficult and challenging locations. Tony and his teams have also helped establish or re-establish amateur radio activities in several countries, including Rwanda (where it had been banned for a decade due to civil war) and the newly-independent country of South Sudan. In addition, Tony has made 10 trips to Bolivia to establish and maintain HF communication links between medical facilities and remote villages in the Amazon rain forest, and has operated as CP1XRM during his free time. Tony's work in South America earned him the ARRL International Humanitarian Award in 2015.

Edward "Ned" Stearns, **AA7A** – is an accomplished DXer, DXpeditioner (he's been on 32 of them and led 8), and technical innovator. He introduced the use of switchable vertical dipole array antennas on island DXpeditions and designed "dual-band discone" antennas for use with the Northern California DX Foundation's worldwide beacon network. Ned also worked with 2019 DX Hall of Fame inductee Joe Taylor, K1JT, on developing the "Fox / Hound" mode for FT8 used by DXpeditions. In addition, Ned maintains two remote stations in Arizona, has made presentations at many technical conferences and has served in a variety of leadership roles in the hobby. On the air, he is at the Top of the Honor Roll for DXCC Phone and Mixed, was the first recipient of 11-band DXCC and has worked over 160 countries via EME (Earth-Moon-Earth).

CQ Contest Hall of Fame inductee Geoff Howard, WØCG / PJ2DX. (Photo courtesy of WØCG)

Bill Myers, K1GQ, is a 2020 inductee into the CQ Contest Hall of Fame (Courtesy of K1GQ)

Gene Zimmerman, W3ZZ (SK), in 1998. Gene, Geoff, and Bill were inducted into the CQ Contest Hall of Fame at the conclusion of the daylong Contest University webcast on May 14th. (CQ file photo)

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 2020 inductees are:

Geoffrey Howard, **WØCG/PJ2DX** – purchased and restored the PJ9JT contest station in 2000 that had been owned by CQ Contest Hall of Famer John Thompson, W1BIH / PJ9JT. The location was named "Signal Point" and the PJ2T callsign pays homage to PJ9JT. Geoff established the Caribbean Contest Consortium to help manage and maintain the station, and has consistently made the station available to guest operators over the years, including serving as host station several times for young operators participating in the Dave Kalter Youth DX Adventure program. He has also worked closely with VERONA, Curacao's national ham radio society. Geoff served for more than 25 years in the United States Air Force, retiring as a colonel; worked for RCA and the Federal Aviation Administration, and taught in the Graduate School of Management at Kent State University in Ohio.

Willard "Bill" Myers, **K1GQ** – is a pioneer of computer-based systems for designing and switching antennas at contest stations, designed the Cushcraft "Skywalker" series of monoband Yagis, helped build the early PacketCluster network and served as mentor to several of today's most prominent contesters, including K1AR, K1DG, K1JX, and others. Bill was also a major behind-the-scenes force at the 2014 World Radiosport Team Championship (WRTC) competition in Massachusetts, and is currently providing support and refinement of the *SkookumLogger* contest logging program for Apple computers.

Gene Zimmerman, **W3ZZ (SK)** – was a major force in VHF contesting as well as an accomplished HF contester. He was a member of both ARRL's and CQ's contest committees at various times between 1972 and 2012, was *QST* magazine's VHF Editor for nearly a decade, and was *CQ Contest* magazine's VHF columnist as well. Gene took over the struggling CQ World Wide VHF Contest in 1999, reinvented it as a 6- and 2-meter-only event and sparked its growth into a truly worldwide competition. He was also instrumental in organizing the mid-Atlantic VHF contesting group that became known as the K8GP Grid Pirates.

Formal inductions to the CQ Contest and DX Halls of Fame were conducted online for the first time, as a result of the COVID-19-related cancellations of the Dayton Hamvention® and associated contest and DX dinners. CQ Contesting Editor Dave Siddall, K3ZJ, led the Contest Hall of Fame induction at the conclusion of Contest University's online seminar on May 14 (thank you to DX Engineering and the World Wide Radio Operators' Foundation); and CQ DX Editor Bob Schenck, N2OO, conducted the DX Hall of Fame induction on May 20 on the Ham Nation podcast on twit.tv (thank you to Bob Heil, K9EID, and Val Hotzfeld, NV9L)

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/yaeppylx>, and the DX Hall of Fame presentation may be found at <https://tinyurl.com/y9h87h6w> (beginning 36 minutes and 30 seconds in).

Our thanks to all and congratulations to the inductees!

MATH'S NOTES

BY IRWIN MATH,* WA2NDM

Optical Laser Communication Transmitter Evaluation

Safety First

When working with such a setup, please be extremely careful to never look directly into the output beam of the laser or any direct reflection of it, regardless of the output power. The light beam can cause serious damage to the eye, especially for higher output lasers. If you must look at the beam do it from a surface that is not reflective such as an index card or something similar.

In past columns we have presented several approaches to communicating in the THz range, primarily to prompt you to experiment at frequencies not normally used by amateurs. Since the THz region contains visible light (which, of course, is electromagnetic radiation just like radio waves) and is well beyond the normal amateur spectrum of interest, it can and is in some cases being used for optical communications, a new area that is ideal for exploration. Like all such ultra-high frequency systems, it is basically line-of-sight to the degree that even fog can limit its range. As a result, the higher the power, the longer the potential range can be. Don't think that this is not true electromagnetic transmission. The fact that you can see the beam of light is just the nature of the fact that the wavelengths (frequencies) happen to fall into and around the visible region.

Recently we have come across several companies offering high-power laser pointers that seem ideal for use with experimental optical communication systems. Although various complex approaches have been described in the past (in previous columns and by others), at this point we just want to see how well these devices may actually work. To do so, we would like to suggest a simple approach to audio modulation that can be used as part of a simple test procedure. Keep in mind that this effort is just to evaluate potential light sources. It is not a complete suggestion although it will demonstrate, in a very simplistic manner, what optical communications is all about. For more details regarding actual complete systems, please see either some of my prior columns or do a search on the internet.

*c/o CQ magazine

A Test Setup

Figure 1 shows a cutaway view of a typical laser pointer and is comparable to some of the newer ones. Note that while we are primarily interested in light output, we do need an easy way to produce a recognizable signal. A simple way to do this is by modulating a visible (red or green) laser via the battery connections as shown. Although this case describes a laser pointer with the negative polarity of the battery easily accessible from the removable back of the pointer housing, polarity is not important. As you can see, the low impedance winding of a common audio transformer is connected in series with the battery. The thin piece of double-sided circuit board material (cut to fit) is used to allow the secondary to be connected in series with the battery. Leads are soldered to each side of the circuit board material to isolate the battery from one of its connections and the copper on the circuit board is trimmed so that the edges do not short against the housing. When audio is applied to the primary of the transformer, the audio output from the low impedance voltage at the secondary varies the voltage applied to the laser (at the audio rate) and results in a modulated laser output beam. This output can then be received by something as simple as a cheap solar cell (from a $2 garden light or something similar) in series with a pair of earphones as shown in *Figure 2*. Again, polarity is not an issue. By carefully setting up a fixed

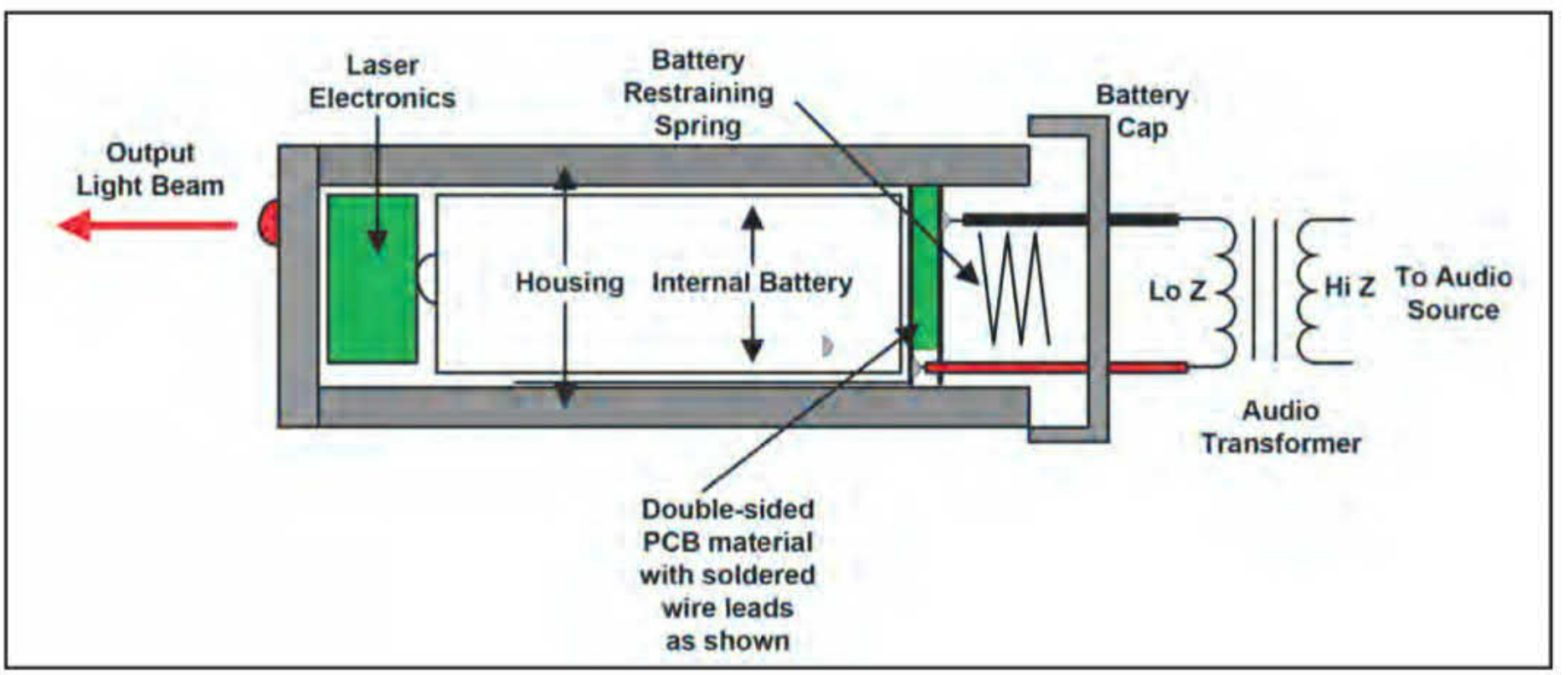


Figure 1. Cutaway view of a typical laser pointer

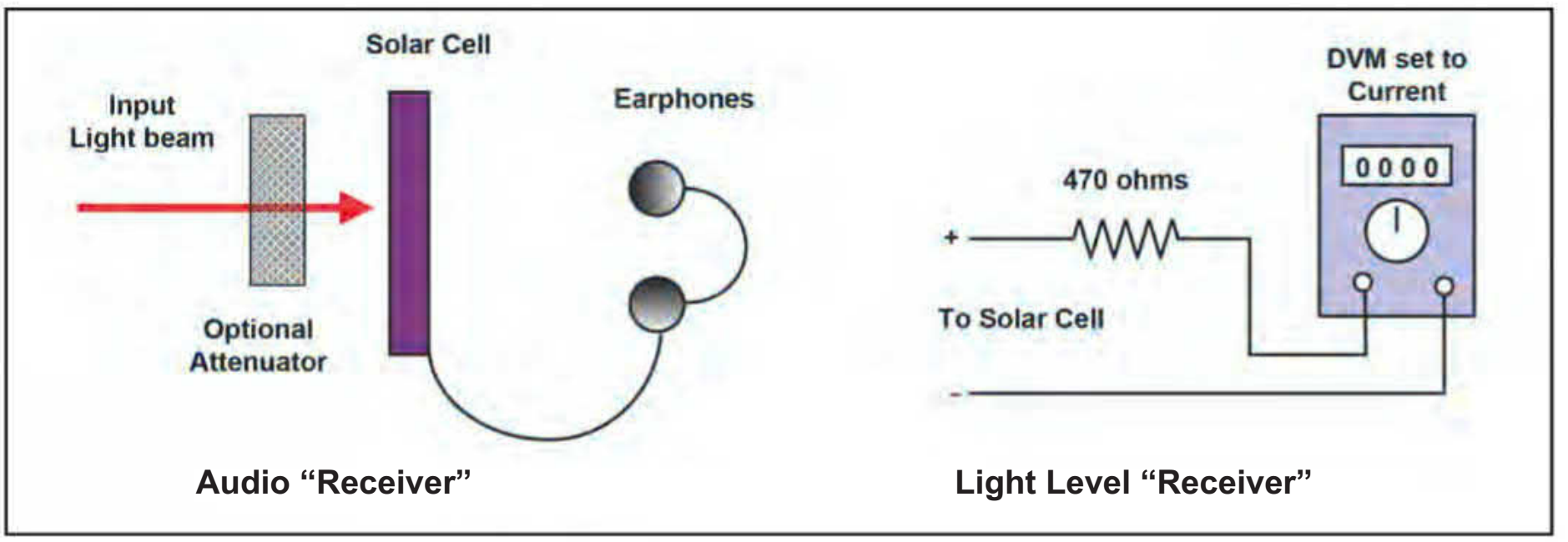


Figure 2. Preliminary laser receiver for evaluation purposes

test distance, pointers can be interchanged with the results evaluated.

To use this system, simply connect the audio output of some convenient device to the primary of the audio transformer at the laser end and a set of earphones to the solar cell "receiver." Note that we did not specify high or low impedance phones in our diagram but you can certainly try whatever you may have on hand. Since solar cells can usually drive low impedance loads, most types of headphones may work just as well. With the fixed distance maintained, various pointers you wish to evaluate can be exchanged and the level of received audio will give some idea of how one device compares to another. If the audio output is too high or it seems that the solar cell is saturated by too much light input, try to use some sort of an attenuator somewhere in the path of the light beam or, if feasible, just increase the distance between the laser and the solar cell. The solar cell "receiver" is very insensitive compared to what you would use in a real system so the danger of saturation is not very great but it can be with high-power lasers. For more accuracy, you could actually connect a low-value resistor in series with the solar cell and use a DVM to measure the current produced by the cell as a function of the strength of the received light beam as also shown in *Figure 2*. We indicated 470 ohms but you can experiment with whatever value gives you the best results.

– 73, Irwin, WA2NDM

what's new

Eton Elite 750 Receiver

When it comes to portable shortwave receivers, the venerable Grundig Satellit 750 stood tall among a crowded field as the radio that can listen to a wide selection of bands for an affordable price.

With the introduction of the Eton Elite 750, Eton Corporation picks up the mantle of the Satellit and carries it into the future with improvements to the internals while keeping the classic look of the Satellit.

Eton kept the dimensions of the Satellit for the Elite 750, measuring 7.24-inches high, 14.65-inches wide, 5.75-inches deep and weighing in at 7.1 pounds, keeping it rather portable. In addition, there are two large carrying handles on the front face.

Most of the original design on the front was carried over, including a large tuning knob on the right; LCD screen that displays the frequency, battery power, attenuation, and time; numerical keypad to enter frequencies or search the memory banks; speaker; analog S-meter, and numerous knobs that control RF gain, volume, bass, treble, and squelch.

The right side panel contains the antenna connections including a BNC and terminal-type for shortwave and FM reception while the back panel is where you can find the battery bank and a connection for a 6-volt DC input. On the top of the Elite 750, Eton added a 360° rotating AM antenna to help pull in weak signals.

Reception on the Elite 750 is quite varied as it can receive nearly every radio wavelength including, AM, FM, long wave, shortwave, and the VHF aircraft band. Eton uses a digital-signal processing (DSP) unit to enhance tuning sensitivity and help

filter out interference. Additionally, you may select between wide or narrow band with a knob on the front of the Elite 750.

With so many frequencies to choose from, Eton packed the Elite 750 with 1,000 channels of memory, 100 for each band plus 500 customizable channels to quickly recall your favorite station. If you just feel like spinning the dial, you can set the frequency step to 9-10 kHz for AM and FM.

There is a line-input jack so you can listen to your own media through the speaker as well as an audio output jack so you can listen to the audio from Elite 750 on another device.

Powering the Elite 750 are four D-cell batteries or you can connect it to a 6-volt DC power cord.

The Eton Elite 750 is available now and has a suggested retail price of $399. For more information contact Eton Corporation, 1015 Corporation Way, Palo Alto, CA 94303. Phone: (800) 872-2228. Email: <info@etoncorp.com>. Website: <www.etoncorp.com>.

THE LISTENING POST

BY GERRY DEXTER

Australia's Shepperton Transmitter Site Torn Down

Although Some Dead Stations Have Returned to Life

~ Radio Australia's mammoth transmitter site at Shepperton is being torn down. I presume that will put "finis" to all the forlorn dreams for a return of Radio Australia. I hope the workers on that wrecking crew all have trouble getting to sleep each night.

~ Brazil's Radio Aparecida was thought to have been off shortwave and was even deleted from the 2020 edition of the *World Radio TV Handbook* (WRTH). However, regular monitoring by Danish DXer Anker Peterson has shown differently. He still hears the station on its usual 5035, 6135, 9630, and 11855 kHz frequencies.

~ Well, it's not quite Radio Television Italiana, but that country has (sort of) returned to shortwave. IBC (the Italian Broadcasting Corp.) has begun using 3975 and 6160 kHz. It operates 3975 kHz on Saturday from 2200-2300 UTC; Sunday sees both frequencies on the air from 0900-1000 UTC; Mondays the station is on at 1600-1700 UTC on 3975 kHz, then at 0900-1000 UTC on both frequencies; Wednesdays it uses 3975 kHz from 2100-2200 UTC, then from 1300-1400 UTC on both frequencies. The transmitter on both frequencies uses 1 kilowatt of power. The frequency usage is far less practical than was Rome's longtime 11810-kHz outlet at 0100 UTC when you could actually hear the transmitter's open carrier come on. IBCs programming today is only in Italian.

~ Papua New Guinea's Wantok Radio Light has returned to shortwave on 7325 kHz. Our best chance to hear them would be before 1000 UTC when CRI signs on and dominates the frequency.

~ Someone has noted Radio Vanuatu with a 24-hour schedule. It's using 2485 (occasional), 3945, 5040, and 7260 kHz at various hours to complete the full 24-hour day. But I'd caution against assuming this is anything permanent, it might be part of their coverage area experiments.

~ XEPPM (Radio Educacion) 6185 kHz, has adjusted its regular frequency and is being well heard. Formerly the Mexican station was a few Hertz off. It is generally well heard later in the evenings.

Listener Logs

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

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

ALGERIA—**Radio Algerienne** via **France** relay, 9655 at 2047 with talks in Arabic. (Brossell, WI).

ASCENSION—**BBC-North Atlantic Relay**, English Bay, at 0605 with *World News*, 0606 *Business Weekly*. (Sellers-BC) 15400 at 1650 with a report on corruption in Zimbabwe. (Brossell, WI).

BOTSWANA—**VOA Relay-Mopeng Hill**, 12075 at 2152 with talks in listed Bambara. (Brossell, WI).

Pirate WBLU sent this QSL some years ago.

Still active is pirate Wolverine Radio. Designs on pirate QSLs are much improved compared to the amateurish ones from few years ago.

**c/o CQ magazine*

BRAZIL—(*All in Portuguese –GLD*)

Radio Nacional Amazonia, Brasilia, 6180 with Brazilian pop music at 0112; also on 11780, both frequencies were at excellent level. (Sellers, BC) 11780 at 2101 with talks. (Brossell, WI).

Voz Missionaria, Florianapolis, 9665 at 2252 with passionate talks. (Brossell, WI).

CANADA—**CFRX**, Toronto, 6070 at 0107 with promo for the *Rookies* TV program, *Newstalk 10-10*, station ID and back to a talk show. (Sellers, BC)

CHINA—**China Radio International**, 9580 via **Cuba** at 0142, also on 9470 and 9675; 9580 was excellent, the other two from China were both poor. (Sellers, BC) 6100, Kunming at 2335 with talks in Sinhala. (Brossell, WI).

PBS Xinjiang, Changji (Urumqi), 6120 at 1215 with man and woman talking in Uighur, poor reception. (Taylor, WI)

CNR-1 jammer, 1428 in Mandarin with man and woman talking alternatively, reception was poor to fair. Many additional frequencies including 11580, 9900, 9920, 9990, and 15110. (Taylor, WI)

Firedrake jammer, 9535 at 2030, Firedrake loop of percussive music vs. Radio Free Asia in Mandarin via Saipan, **Mariana Islands**. Reception of the Jammer was fair. (Taylor, WI)

CUBA—**Radio Havana Cuba**, on 6145 (unlisted) at 0137, fair-good reading listener letters, also on 6000. Nothing on 6165. (Sellers, BC)

ENGLAND—**BBC-Woofferton**, 15500 at 1640 with talks in listed Sinhala; 15420 from the **Madagascar** relay at 1652 with talks in KinyaRwanda-Kirundi; 15330 from Woofferton, at 1640 with talks in Sinhala. (Brossell, WI).

ERITREA—**Voice of the Broad Masses**, 7140, Asmara at 0305. Weak but improving in Tigrinya with HOA music. Earlier I had it as an unidentified station. (Perry, IL)

FRANCE—**Radio France International**, 15300 at 1618 with talks in listed Hausa. (Brossell, WI).

The U.S. government-run Radio Farda (USAGM) broadcasts only in Farsi to Iran.

GREECE—**Voice of Greece**, 9420 at 2135 with talks in Greek. (Brossell, WI)

GUATEMALA—**Radio Verdad**, Chiquimula, 4055 at 2348 with songs and talks in Spanish. (Brossell, WI) 0543 in English with enthusiastic preacher; At 0602 ended English with Radio Truth IDs and their postal address, then same in Spanish. (Sellers, BC)

GUINEA—**RTV Guineenne**, 9650 at 2105 with man and woman conversing in French. (Brossell, WI).

INDIA—**All India Radio**, 9865, Vividh Bharati Service, Bengaluru at 1415, in Hindi; Indian film music with a woman announcer. Poor reception. (Taylor, WI)

IRAN—**VOIRI**, 7230, Sirjan at 0013 in Spanish at 0013, man and woman alternating talking with fairly long sections, instrumental music. Fair, Also on 9315, fair reception. (Taylor, WI)

JAPAN—Radio Japan, 9855 **Madagascar** relay at 2030 sign-on with station ID of "Ici Radio Japan," then presumed news in French. (Brossell, WI)

MADAGASCAR—African Pathways Radio, 11965 at 2005 with secrets to a happy marriage. (Brossell, WI).

Light of Life Radio, 11610 at 2103 with talks in Mandarin. (Brossell, WI).

MALI—Radiodiffusion Télévision du Malienne, Bamako, 5995 already on at 0539 in local language with talk and music; at 0558 marching band to begin normal sign-on, flute music and French announcements. Good, but marred by co-channel QRM. (Sellers, BC)

MEXICO—Radio Educación, Mexico City, 6185 at 0548 playing instrumental Salsa music. (Sellers, BC)

NEW ZEALAND—Radio New Zealand International, Rangitaiki, 5945 at 0700 with a story from the Cook Islands; 11725 at 0653 with a concert at 2018, 0658 announcements closing this frequency for a move to 5945, excellent reception; 13840 at 0203 with news. (Sellers, BC)

NIGERIA—Voice of Nigeria, Abuja, 7255 at 0601 in Hausa, sounded like news. (Sellers, BC)

NORTH KOREA—Korea Central Broadcasting Service, Pyongyang, 9665 at 1400 in Korean, 3+1 time pips, choir, male announcer, then into another choir, Poor reception. (Taylor, WI)

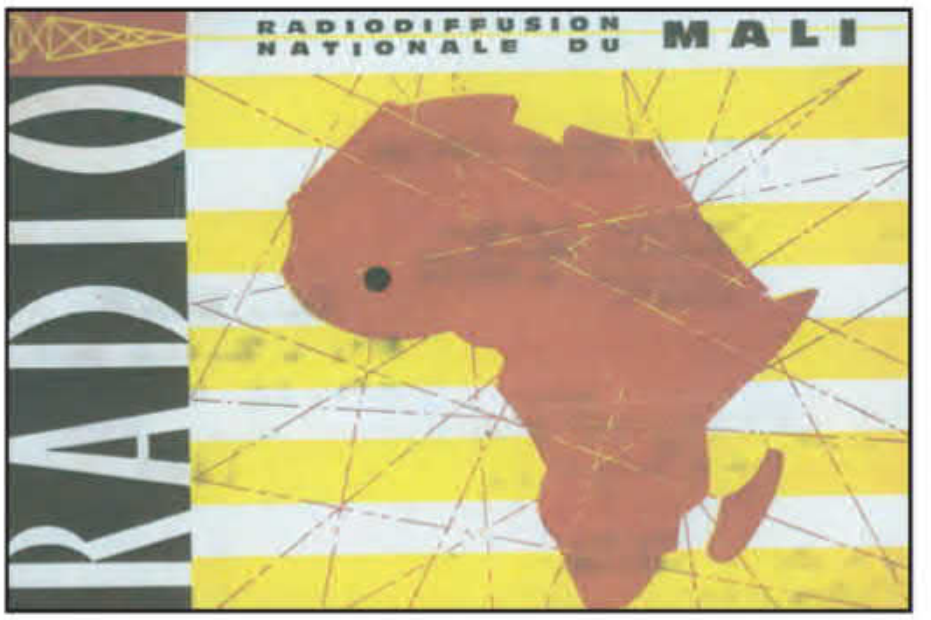
OPPOSITION—Fuusato No Kaze (via Taiwan to North Korea), 9560 at 1449, in Japanese, man and woman alternating, poor reception. (Taylor, WI)

Voice of the People (possibly), (South Korea to North), at 1038 in Korean, martial female vocals and announcer. (Taylor, WI)

OMAN—BBC-Eastern Relay, A'Seela, 6195 at 0051, in Dari, male and female announcers alternating with short sections, reception was poor to fair. (Taylor, WI)

PHILIPPINES—Radio Liangyou, 9275, Bocaue at 1159 in Mandarin, woman talking to 1400 followed by fanfare, station ID, pause then a man (maybe a program introduction), female announcer, hymn, a longer talk by a second man. Reception was fair, best reception of the Hong Kong-produced program in some time. (Taylor, WI)

PIRATES—Radio Free Whatever, 6970u at 2355, some canned IDs at 0053. Off, but later came back on 4195u. **Captain Morgan Shortwave**, 6940.4 at 0046, off at 0110. **Damn Skippy**, 6950u at 0055 with hard rock and SSTVs; also, 6955u at 0212. **Ballsmacker Radio**, 6960 at 0120 with station ID indicating he'd be on Fridays. **WTF Radio**, 6950u at 2350 various rock and phonetic ID. **Radio Free Potato**, 6960 at 0110 with man and apparent Christmas monologue, station ID, and brief music bits. **YHWH**, 7475 at 0243 with Josiah preaching. **Robin Hood Radio**, at 0237, SSTV (kitten with "Robin Hood Radio 6930 kHz"), station ID, into a program of rock with another SSTV before end. Signal slowly declining to fade out. **Underdog**, 6855u at 2052, hard rock, break then some tones, more rock, segued, SSTV, station IDs and one more SSTV, 2033 ofd. **The Final Countdown**, 6855u with Pennywhistle IS, 0202 woman with call up into numbers. The rest was a clever pattern of IS, ID, into a rotation of entertainment, a rock or a vocal. Email address for QSL. Into program of "home"-themed songs with frequent station IDs. 0215 final station ID, IS, and off at 0217. **Zeeky's Attic**, 6964u at 2347. Zeeky having a fit about people being on his "list" for not liking him going off, quick station ID, hard rock, then off. **Laser Hot Hits**, 6205-Ireland, 0053. Mellow music, man talking into similar song. Not a frequent visitor this far West. **Radio Free Billy**, 6930 at 0026, ending song, rock, Billy talks over song with station ID, another station ID at the end of song and talk, progressive rock talking and many ID's, poor reception. **Pee Wee**, 6930 2124, pop rock, SSTV ("Pee Wee Was Here,") "Setting Sun," into several pieces of conceptual rock, "Setting sun" again, SSTV (didn't decode here), off at 2206. **Radio Virus**, 6931 at 2335, going out now with this op with time to close down, thanking folks, at 0000. **Skunk Hole Radio**, 6955u at 2328. Several pieces of songs,



Another QSL from one of the French Africans — Radio Mali, now on 5995 and 9635 kHz.

announcer with next song and shout outs and requests, op complains about SDRs and someone telling him to play AC/DC, talking to and about "ma" (his wife), going into FM for a clearer sound, song by Rush, into a program of era songs and talk eventually a station ID. Gone at 0000. **Hour of Slack**, 6935u 0252. Reverend Ivan Stang with various skits, address, and station ID given just before going off at 0328. **Radio Azteca**, 5150 at 0023, male singer, some radio drama into another song into a program, of novelty songs, sketches, and occasional station IDs. (Taylor, WI)

ION Radio, 5165u at 2300, very weak, could barely hear a man speaking. **XFM relay**, 5150 and 4175u, at 2333; 5150 too weak to hear audio, 4175u weak with low noise, rock, short announcement at 2339 followed by heavy metal stuff. **WTF Radio**, 4920u, 0000, playing "Earache My Eye", at 0016 said "WTF Radio Worldwide," at 0027 another tune, nice variety from 1970s, at 0105 station ID as "WTF Radio Worldwide." **Captain Morgan**, 6924, 0018, poor under noise, could barely hear rock. **Skippy Radio**, 6930u, 0109, good signal, heavy metal rock then a few seconds of SSTV / FAX and back to same. (Hassig, IL)

ROMANIA—Radio Romania International, 9810, Gabeni at 1445 with songs in Ro. (Brossell, WI)

SAO TOME—VOA Relay, Pinheira, 6080 at 0545 with talk about the virus, Trump, and the November election. (Sellers, BC) 11900 at 2015 with talks in French. (Brossell, WI).

SAUDI ARABIA—BSKSA, 15435 at 1507 with talks in Arabic. (Brossell, WI).

SPAIN—Radio Exterior de Espana, 11940 at 2019 with talks in Spanish. (Brossell, WI)

TAIWAN—Radio Taiwan International, 9900, Danshui at 2258 with talks in Mandarin. (Brossell, WI).

TURKEY—Voice of Turkey, 5960 at 2303 with a program on home construction in Turkey. (Brossell, WI).

UNITED STATES—VOA via **Woofferton relay**, 11610 at 1732 with talks in Somali. (Brossell, WI).

Radio Free Asia (possibly), 13835 from the **Tadzhikistan** relay at 1354, interviewing a woman. Off at 1400. (Taylor, WI) 9900, Lampertheim (**Germany**) relay, at 2345 with talks in Mandarin. (Brossell, WI)

Radio Prague International, 9395 via WRMI at 0131 with station ID, comments on the music being played. WRMI station ID came on at 0159. (Sellers, BC)

Adventist World Radio, **Austria relay**, 7270, at 2115 with hymns to 2118 station ID of "This is Adventist World Radio, The Voice of Hope"; 17570, **Madagascar** relay at 2007 with talks in Moore. (Brossell, WI)

VATICAN—Vatican Radio, 7365 at 2128 with brief talks in Portuguese, station ID of "Aqui Radio Vaticano," and off at 2159,

These guys are among the types mentioned in my Just Sayin' series which has been running for the past few issues.

11625 via **Madagascar** at 1735 with sub-continental songs and talks in Tigrinya. (Brossell, WI).

QSL Quests

No QSLs to report this month but here are a few email addresses that ought to bring them in:

~ Radio Nacional Arcangel: <tranlra36@radionacional.gov.ar>

~ Radio Nacional Ammazonia: <ouvidoria@ebc.coim,br>

~ China Tibet Broadcasting Station: <holytibetprogram@163.com>

~ Radio Tamazuji: <RadioTamazuj@gmail.com>

~ Trans World Radio: <lstavrop@twr.org>

~ Radio Verdad: <radioverdad5@yahoo.com>

Quien Sabe (Who Knows?)

~ 9792 kHz at 2041 UTC in an unidentified language. Several medium speed ballads in a row by a woman, eventually with a male announcer. Moved down at 2045 kHz with a man making a brief announcement (if a station ID, I couldn't identify it even after listening to the recording), into a similar ballad style by a man. Good reception. (Taylor, WI)

As Time Goes By

Radio Cenit, Portoveijo, Ecuador, 4700 at 0435, April 6, 1957 with its domestic Spanish program. HC4MX used just 200 watts.

Just Sayin'

(…Continued from June) Another SWBC DXer arranged with several of his learned compatriots to put together a number of articles on various DX subjects. He privately published these annually for a number of years. Yet another DXer published a similar, but rather more pop-ish, volume that sold some 5,000 copies. Still another guy wrote a book on writing reception reports and QSLing SWBC stations. (More next month…)

Thanks To

Harold Sellers, Vernon, BC; Mark Taylor, Madison, WI; William Hassig, Mt Pleasant, IL; Bob Brossell, Pewaukee, WI; and Ralph Perry, Wheaton, IL.

Keep on Keepin' On … and Remember … Celebrate Shortwave!

EMERGENCY COMMUNICATIONS

BY CQ STAFF

Net Basics

Ham operator participates in a net during a disaster drill from a station set up in the back of her vehicle. (CQ archive photo by Gordon West, WB6NOA)

Every once in a while, it's good to go back to basics on various elements of amateur radio. That includes emergency communications. At the heart of the service we provide to our community in an emergency or during a public service event is the *net*, which is short for network. A net is a gathering of more than two hams on the same frequency at the same time for a specific purpose. Some may be regularly-scheduled; others may be set up *ad-hoc* to meet a particular need. Some may be informal while others may be tightly structured. Some may allow any station to check in, others may be restricted to members of a specific group. But they all share some common characteristics and we'll start with focus here on the types of nets most commonly run in conjunction with emergencies or public service events.

The Directed Net

Most public service or emergency nets will have one station assigned to be the "traffic cop" who ensures that communications flow smoothly and efficiently. This station is generally known as the *net control station* or *NCS.* In a directed net, the NCS determines who may transmit when, and all communications from net participants are directed to or through the NCS. One participating station may not directly call another station without permission from net control. This is not a power trip; it is a way to keep things orderly, and the NCS might have higher priority traffic to deal with or might want the two stations to communicate on another frequency, keeping the net frequency clear for additional traffic.

Net Procedures

A typical public service or emergency net will begin with a "call-up" by the NCS. He or she will announce the name and purpose of the net and lay out basic guidelines. Is any station welcome to check in or is participation limited to stations involved with the activity? Do all comms go through net control or may stations call each other directly? Will standard callsigns or "tactical" callsigns be used?

The NCS will then generally stand by for any emergency traffic and then begin accepting check-ins. In the case of an event net, the NCS will usually call out each location rather than just opening the door for general check-ins. For example, if the net is for a race, NCS may go down a list of locations, asking "Water station one, please check in." If W2ABC is the operator at water station one, he / she should respond, "Net, this is W2ABC at water station one. Over." That's it. No pleasantries, no chit-chat.

As the net progresses, NCS may contact you for specific information, or an official at your location may ask you to get some information. Let's say you're at water station one, it's 20 minutes before the race begins and you have no water yet! First of all, it isn't up to you to ask about it. It's up to the station manager (who many know details that you don't). IF the station manager asks you to find out when the water might show up, the conversation on the net might go something like this:

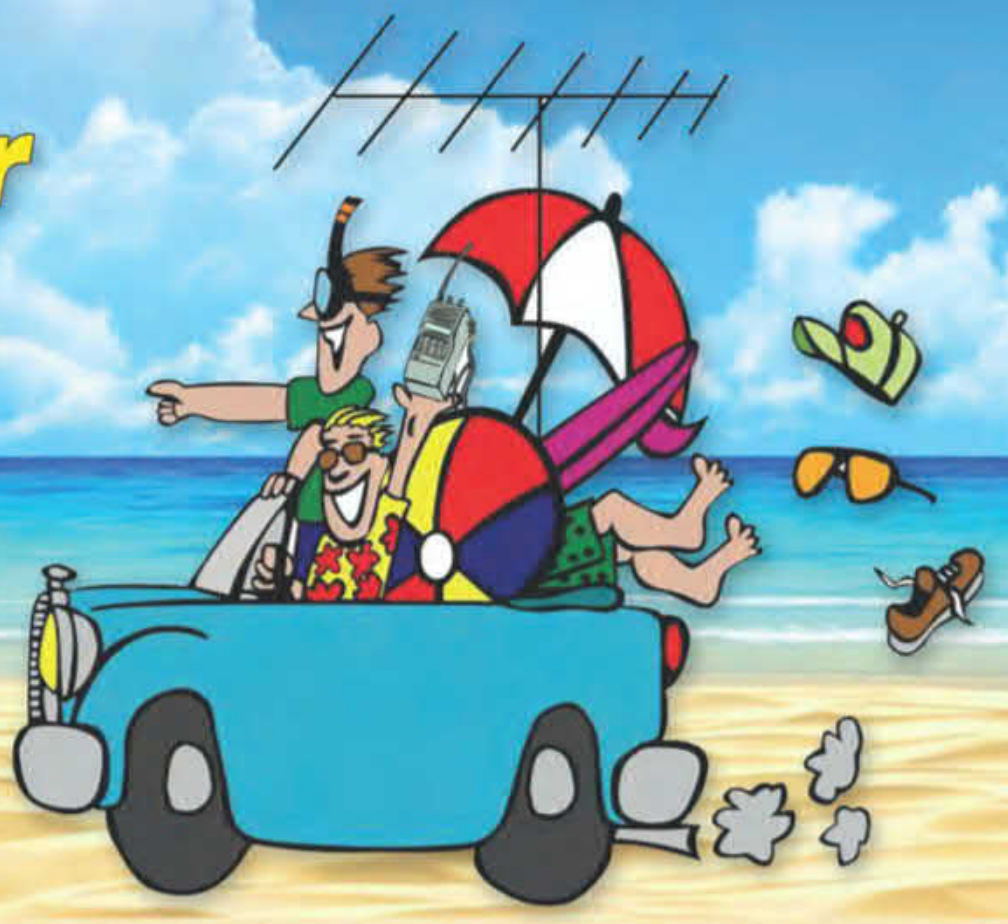
You: "Water station one to net." (Unkey the mic and wait for a response)
NCS: "Water station one, what's your traffic?"
You: "The station manager is asking when we should expect our water to arrive." (Again, be direct and to the point. No need to discuss of how close to start time it is, or how long it will take to set things up once it arrives.)
NCS: "Roger. Net to supply truck." (the ham stationed on the supply truck)
Supply truck: "Supply truck to net. Driver says five minutes. Over." (The op on the supply truck has been listening and was able to immediately provide the answer)
NCS: "Thank you, supply. Water station one, did you copy that? Over."
You: "Roger. Five minutes. Thank you. W2ABC out." (Three things accomplished in a very short transmission: 1) acknowledging receipt of the information; 2) confirming that you copied it accurately; and 3) providing your every-10-minutes station ID as required by FCC rules.)

The keys here are to be concise and accurate, and to relay information quickly and efficiently. Note the use of "tactical callsigns," indicating location ("Water station one") or function ("Supply truck" or "Net") rather than FCC-issued callsigns. This is perfectly legal — as long as you also transmit your FCC call every 10 minutes or at the end of a series of transmissions (as above). Using tactical callsigns improves clarity and makes it easy to switch operators at a given location without causing confusion.

Emergency!

One of the main reasons that hams provide communication for public service events is in case an emergency develops in the course of the event. Most commonly, it's a medical issue, although hams at the Boston Marathon bombing several years ago had to shift instantly from public service event to full-on emergency. Fortunately, that kind of thing is very rare and you are more likely to encounter "run of the mill" emergencies such as injuries or other medical problems.

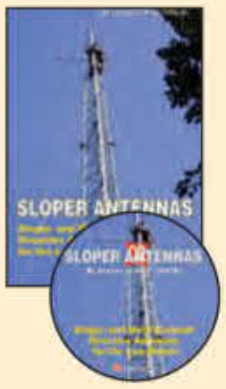
Get Ready for Summer!



Sloper Antennas

BY JUERGEN A. WEIGL, OE5CWL

Single- and Multi-Element Directive Antennas for the Low Bands



With calculations and practical experience, this book shows which basic concepts have to be considered for sloper antennas for the low bands.

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BY SEVICK, W2FMI

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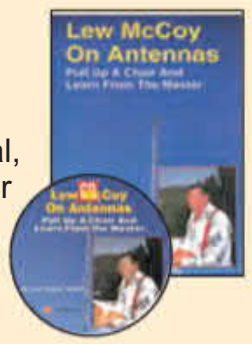
Lew McCoy on Antennas

BY LEW MCCOY, W1ICP



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DITS and DAHS

The .A _B... C_._.'s of Morse Code Operating

BY ED TOBIAS, KR3E

This small but solid guide is the perfect read for those interested in learning or improving CW operating techniques!

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Here's how that might go:

NCS: "Water station 5, please advise on your supply status." (Routine net traffic)
You: "Mile 3, emergency." (Stay calm and still wait for net control)
NCS: "Net stand by. Mile 3, what's your emergency?"
You: "Runner reports a bystander collapsed about 100 yards south of my location. No pulse. CPR under way. Need EMS, over." (Once again, just the facts, ma'am)
NCS: "Roger. Stand by." (The net is to remain silent until NCS returns)
NCS: "Mile 3, EMS en route. Break. Water station 5, please advise on your supply status." (The emergency has been dealt with and now it's back to routine net traffic)

Being There

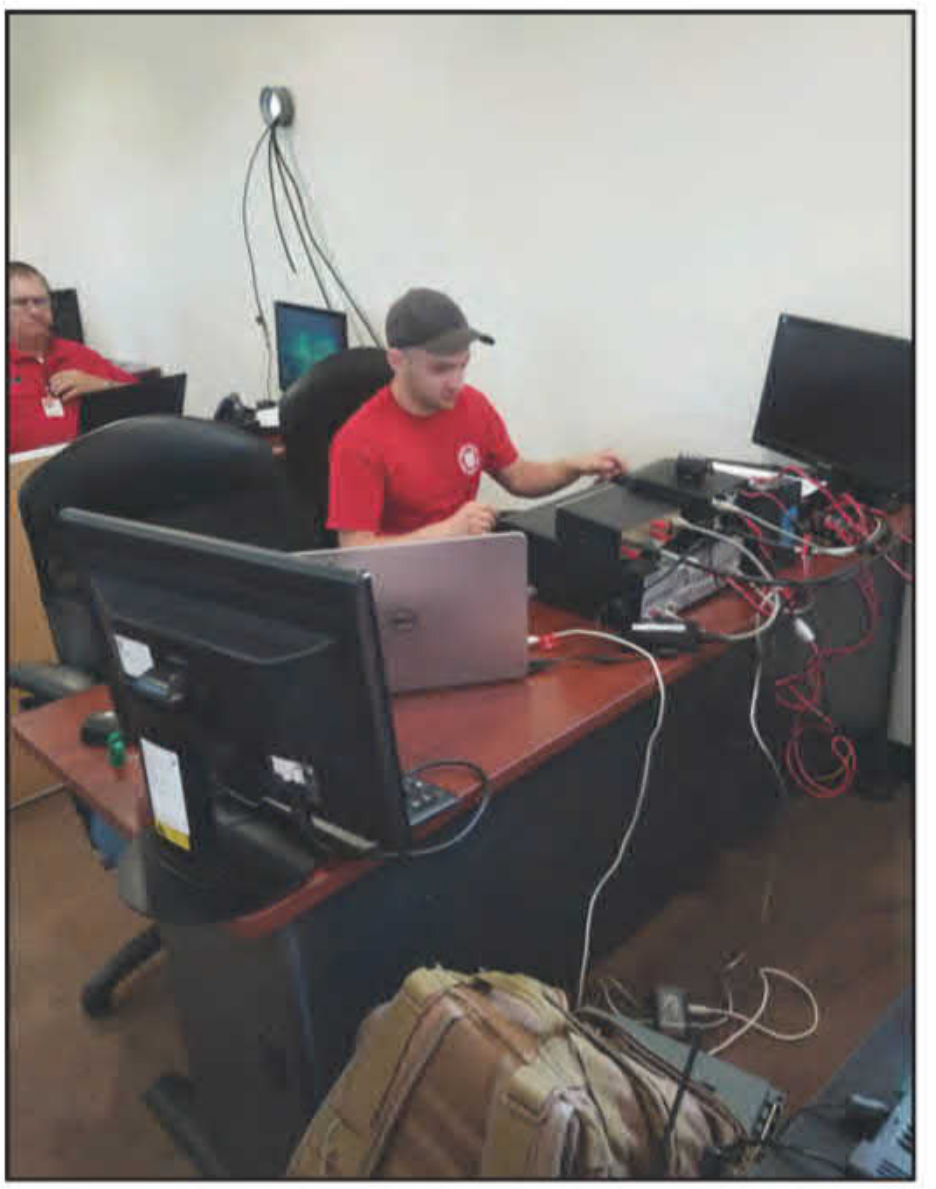
One vital part of being in a net is always being available and / or being sure to notify NCS if you will briefly be away from the radio. During a lengthy operation, we all need a bathroom break from time to time. If there isn't another ham at your location who can fill in for you, it is vital to let net control know both when you leave and when you return. The same applies if you and another station are directed to another frequency to pass traffic (information) without tying up the net frequency. Once you're finished, it's important to notify net control that you're back on frequency, in case there's traffic for you.

"Securing" the Net

Once an event or emergency is winding down, NCS may allow stations with little to no activity to shut down, or "secure," in netspeak. Once again, it's important not to shut down without net control's OK. Generally, it's best to wait for NCS to initiate the direction to secure, but sometimes you'll need to ask. For example, if you're at a shelter and officials there are packing up and shutting down, and tell you that you need to be out of the building in 15 minutes, it's OK to relay that to NCS and ask permission to secure. But never just disappear, assuming that net will figure it out.

Training, Training, Training

This month's column has covered only the basic basics of public service / emergency net operation. There's much more to know and differences in specifics between nets run by different organizations. FEMA, the ARRL, and others offer many training opportunities, often for free or at very low cost. Take advantage of these opportunities, learn everything you can, and then practice your skills by taking part in public service activities so you'll be ready and at your best if a real emergency arises.



Some events are too big for just one NCS. In this photo from the 2019 Patriot North exercise, highlighted in our October 2019 issue, SATERN (Salvation Army Team Emergency Radio Network) members Jared Polack, NØMJP (L), and Bob Dennis, KX8BOB (R), share net control duties, each monitoring multiple frequencies. (CQ archive photo by Scott Ruesch, W9JU)

KIT-BUILDING

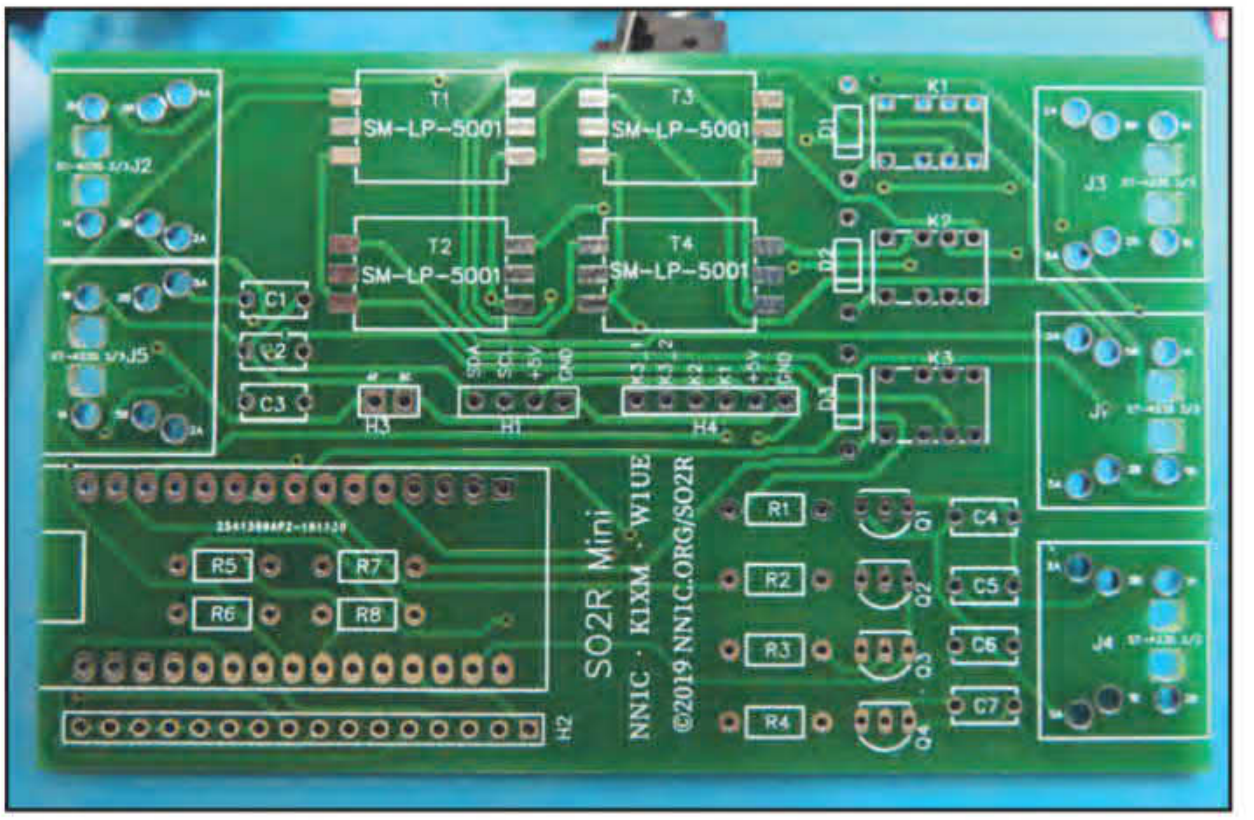
BY JOE EISENBERG,* KØNEB

The SO2R Mini: Are Two Better than One?

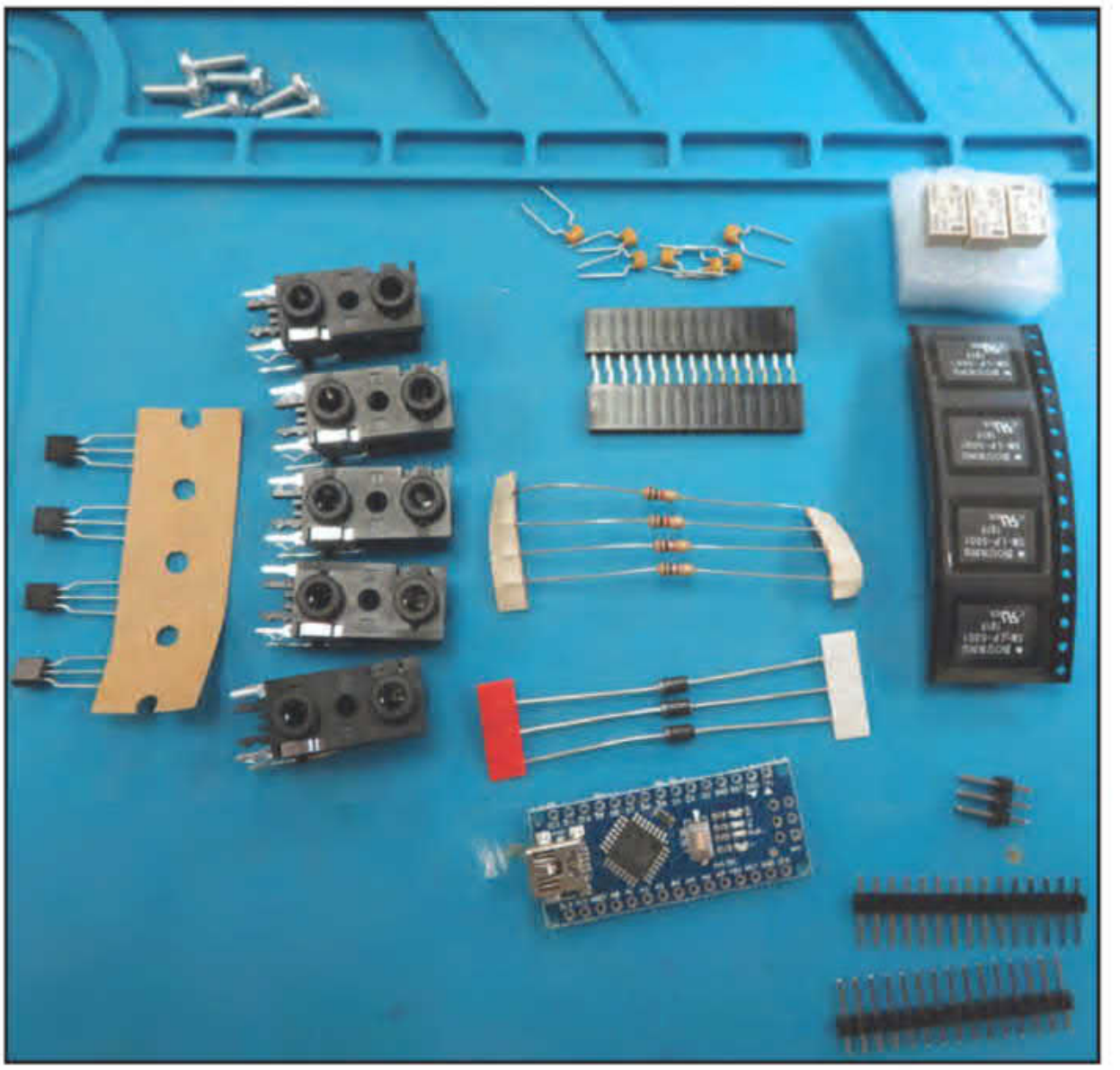
As time spent at home has grown, so has the number of projects to do at home. Of course, for me, that also includes building more kits. I have also kept busy with my project of making clear face shields for our local first responders, primarily doing the 3D printing and assembly of these face shields (see last month's column). Although the audio noise level of my printer makes operating SSB or CW a bit annoying, operating FT8 / FT4 is not a problem.

I never imagined my 3D printer would be given the workout it has, being run almost around the clock. So far, it has performed well, and as long as I keep it clean and replace worn parts, it keeps running. The main component I had to replace was the extruder nozzle. The nozzles common to most 3D printers are made from brass. Brass conducts heat well, but the main drawback is that brass is soft, and after a while, the tiny tip becomes blocked, causing bad print quality. The opening in many standard nozzles is 0.4 millimeters, which is very small and can easily get clogged. I replaced the nozzle in my printer with a product made by Micro Swiss in Minnesota. This new type of nozzle is made with plated tool steel, making it extremely durable. At $19.75, it seems to be well worth it. The brass nozzles can often be found for $3 or $4 and sometimes as low as 5 for $10. But you get what you pay for. My new nozzle installed easily and the results were immediate. I did find that I had to slightly increase the temperature of the nozzle to compensate for the lower heat transfer compared to brass. Micro Swiss makes nozzles and upgrade kits for many common 3D printers. You can find Micro Swiss products at <micro-swiss.com>.

Newer versions of the face shield have surfaced as the project progressed, but all are still based on the original Budmen design. I have printed most of the face shields using the Budmen RBW 4.3 design as it allows me to print two in a bit under seven hours. Yes, 3D printing is slow. Along the way, I have learned more about the ins and outs of 3D printing and what I



SO2R Mini PC board ready to begin!



SO2R Mini parts. A low parts count and identical values for all parts makes for a very easy kit to assemble.

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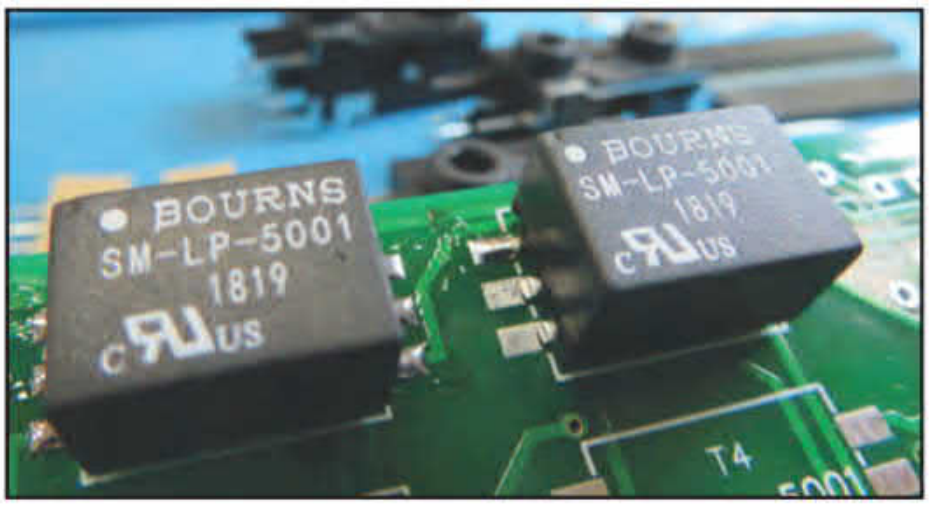
want in my next 3D printer. Automatic bed leveling is a feature I want and recommend. Manual bed leveling can be imprecise and lead to problems. As of this writing, I have already used three 1-kilogram spools of filament and am well on the way to using much more. It is not often we builders can use our skills to help in an emergency, and I am glad to have had the opportunity. The latest face shield designs are available at <www.budmen.com>.

Back to Ham Radio – the SO2R Mini Kit

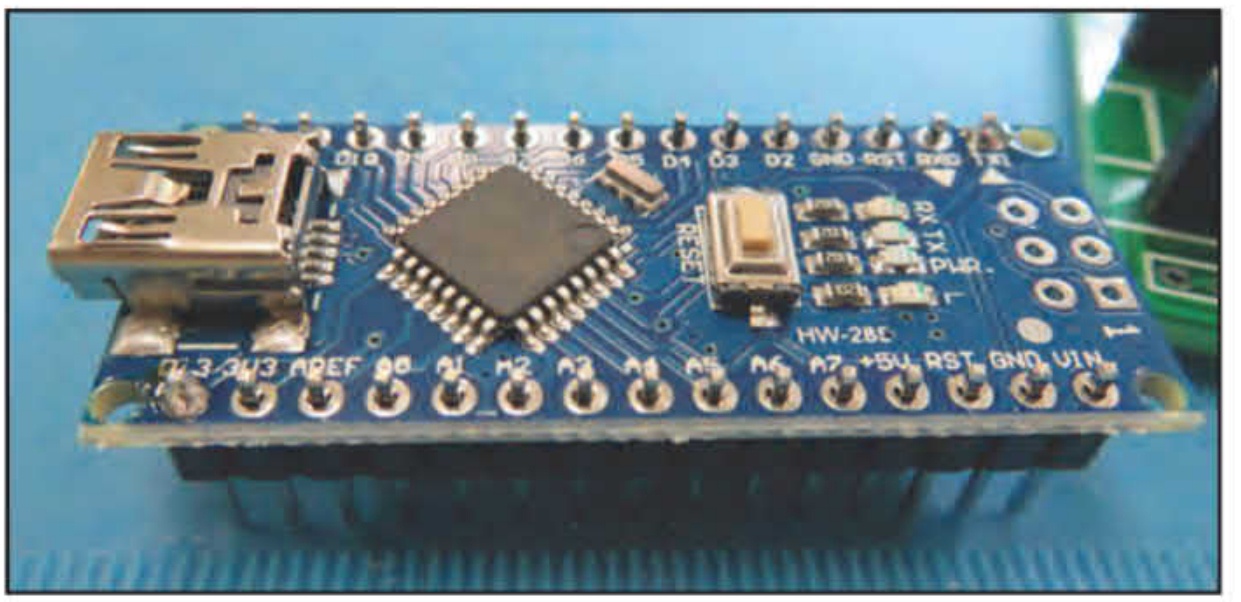
Although this is summertime, the fall contest season is not too far away. With lots of shack time at hand during stay-at-home measures, seasoned contesters can spend a lot of time preparing their stations to be the best competitors. Single Operator 2 Radio has become a popular way to optimize your station to be more competitive. SO2R allows you to control two separate radios with a special controller and your logging software to optimize your ability to run (calling CQ) on one frequency and quickly pick up multipliers on another frequency or band. The SO2R technique requires two separate radios and antennas as well as a highly integrated interface using a microcontroller to perform the switching of audio sources and PTT or CW keying as well as transmit audio for SSB.

A great solution to this need has been created that is easy to build and very affordable. A group of talented guys, led by Marty Sullaway, NN1C, developed the SO2R Mini kit as a low-cost means to use this valuable contesting tool. In addition to Marty, who designed the hardware, Dennis Egan, W1UE, handles shipping the orders and Paul Young, K1XM, wrote the software.

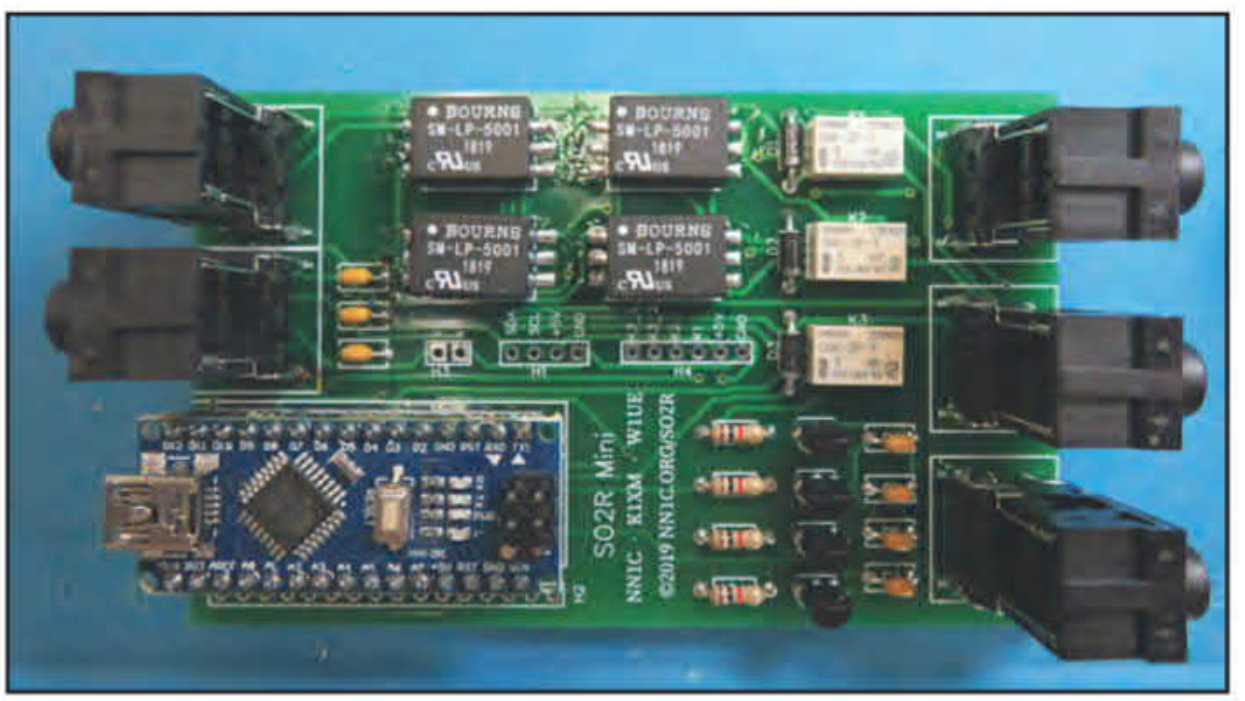
The assembly of this kit was simple and straightforward, with very explicit directions along with good quality photos on the web and in the manual that is available for free download. A nice touch is that all the major components



The surface mount audio transformers are very easy to install.



The Arduino Nano is the smarts of the SO2R Mini and requires the pins to be soldered in two rows.



The finished SO2R Mini is assembled easily in under an hour and is ready to be put in the supplied case.

The finished SO2R Mini ready to go.

are identical, making component identification very easy. All the resistors are the same value, as are the capacitors, transistors, relays, etc. Normally, I would not recommend a kit that has surface-mount components for a builder who has only assembled one or two kits, but this kit is an exception.

The assembly process begins with the mounting of the four surface-mount audio isolation transformers. I found a very easy way to do this that begins with putting a dab of solder on just one of the pads. I chose the pad farthest away from the adjacent transformers yet to be installed to make this process easier. After placing the dab of solder on the pad, I simply held the transformer with my fingers, aligning it with all six pads and heated that pre-tinned pad while holding the transformer, ensuring all the other leads stayed lined up evenly with the other pads. It is a lot easier to realign it by just reheating that one pad and making sure it is aligned evenly with all six than needing to desolder everything. Once you are satisfied it is where it needs to be, solder a pad on the opposite side, which will ensure it is held securely in place. I next reheat the first pad and add solder if needed for best appearance, then solder the other pads to complete each transformer. Be extra careful to align the transformers to match the orientation as shown in the photos. The middle pads do not have to be soldered as they are not used, but I soldered mine anyway.

Follow the remaining instructions to complete your SO2R Mini. I found it took me easily under an hour to assemble this kit, including taking the photos and writing notes. The included case makes this a great looking kit when completed. I suggest using a special tiny brush and a bottle of model paint to fill in the markings on the sides of the case before removing the masking tape on both sides for a better appearance. I also highly recommend avoiding the temptation to use cheap audio cables and instead use high quality shielded cables and connectors to minimize the chance of stray RF creating a problem whenever you connect anything to your HF rig. An updated version of the SO2R Mini should be available as of this July that adds opto-isolated keying outputs.

The latest version of the SO2R mini kit can be ordered at nn1c.org for $60. The newer version also includes connections to add status LEDs as well as other enhancements. An assembled version is also available for $120.

I hope to see everyone again as soon as possible and until then I'll keep building kits and bringing them to you.

– Until next time, 73 de KØNEB

THE HAM NOTEBOOK

TEXT AND PHOTOS BY WAYNE YOSHIDA*, KH6WZ

Projects on the Workbench

As this installment of "The Ham Notebook" is being written, I am in month two of the COVID-19 mandatory work-from-home lockdown. Like everyone in this situation, this completely changed how we live and do ordinary, everyday things — including personal face-to-face meetings, going shopping, eating in restaurants, going to work, etc.

As an introverted person, I am adapting to this new normal fairly well. I am trying to make life as close as possible to my previous normal routine, and yet comply with local and day job requirements.

Working from home full-time means a lot of things are moving from the back burner to the front, and in the radio and electronics sense, a lot of projects are moving from ideas in my head or sketches and notes from my notebook to the workbench and final use.

But, as is often the case, as projects are initiated and completed, I formulate new ideas and additional projects make their way onto the workbench.

Although I am not a big fan of thinking about things in future tense, I am doing this to solidify my ideas into an actual "to-do" list and to make a commitment to get these things completed. (*See the References section for more on this philosophy. –WY*)

This month, we will take a peek into some of my projects and ideas that you may find useful as-is or as idea incubators for your workshop, toolbox, or station.

A New Tool for the Shop: A De-Soldering Iron

After struggling for several minutes to remove a bridge rectifier from a double-sided circuit board, I decided to look for a better de-soldering tool, something to replace my 20- or 30-year old SOLDAPULLT device.

After some internet research, I selected the Hakko FR-301, shown in *Photo A*. It is an excellent tool, and it makes removing parts from double-sided boards easy, something a bit challenging for the plastic tool I used before. I discovered this de-soldering iron opens a lot of new possibilities for harvesting used parts from circuit boards.

email: <kh6wz@cq-amateur-radio.com>
LinkedIn: www.linkedin.com/in/wayneTyoshida

Photo B. This bench-top tool caddy got its inspiration from a book by Adam Savage. The simple idea makes selecting a particular tool fast and easy. To build it, I used empty tin cans that are grouped and held together with hot glue.

Photo A. My new desoldering iron makes repairing and harvesting parts easy and fast.

Photo C. This old variable power supply will get a new power cord, new electrolytic capacitors, and possibly other components.

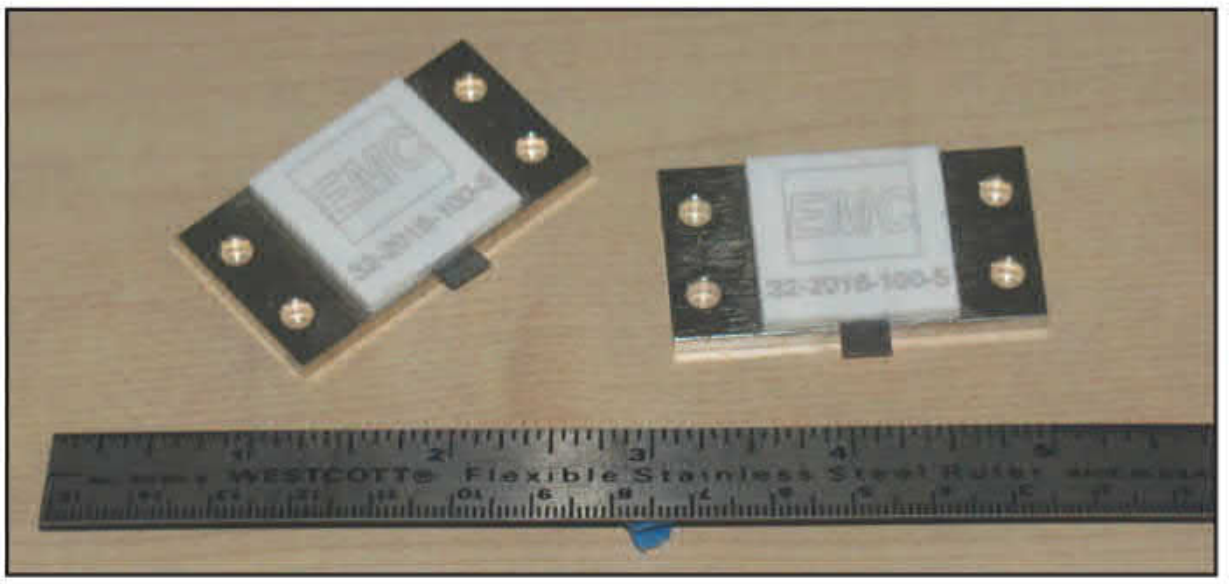


Photo D. These power resistors will soon become a 1-kilowatt dummy load.

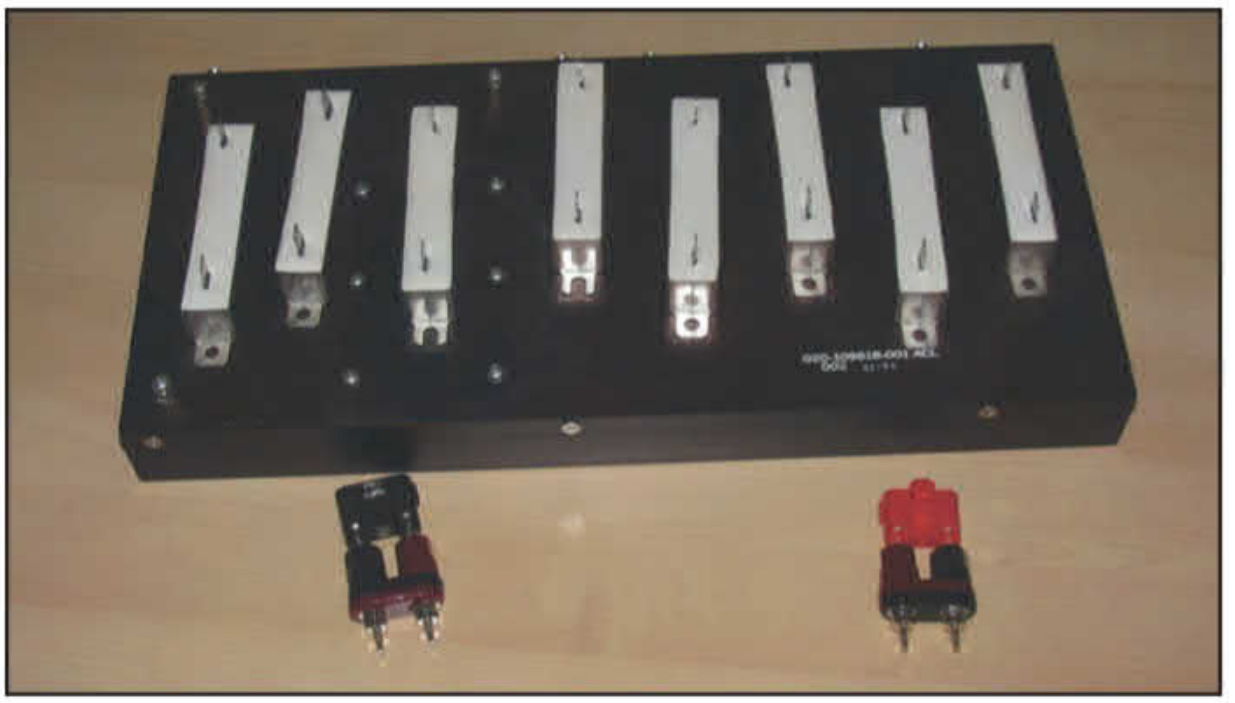


Photo E. These 100-watt power resistors will become an audio load for 8 or 16 ohms.

Photo F. These parts from my junk box will become an isolated, variable AC power supply. It will ensure safe testing of unknown power transformers and other AC line-operated devices.

I used to think removing some parts — such as multi-pin connectors and switches — was not worth the time and effort. But the de-soldering iron changes this. Now I can safely and easily remove used DB- and DIN-style connectors, as well as other multi-pin parts, on double-sided or multilayer boards.

The SOLDAPULLT is still in my toolbox and is handy when in the field or if AC power is not available.

Workbench Tool Caddy

Inspired by the book, *Every Tool's a Hammer*, by Adam Savage, this tin-can tool caddy has helped improve my efficiency when working on projects. Instead of rooting around inside my toolbox, I can now immediately reach for the exact tool I need. It is a simple idea and can be easily made with empty tin cans and hot glue (see *Photo B*).

The concept is simple: Think about the pencil cup you probably have on your desk. Notice the pens, pencils and hi-lighters are clearly visible, making it simple and quick to select the proper item for the task.

Now apply this pencil cup idea to the often-used tools for your projects; expand the storage capacity to accommodate your tool set; and the new tool caddy is born.

Early sketches for my tool caddy included using scraps of PVC pipe in various diameters and lengths and gluing them together. Since my collection of PVC pipe scraps is small, I decided to put the tool caddy idea on the back burner.

But one day, after rinsing out a can of chili and tossing the empty can into the recycle bin, I thought — here is the answer!

A deluxe version of this may include a carrying handle. Visualize a six-pack of beverage bottles and the cardboard carrier with the handle in the middle. Now make the carrier with some sheet material like thin plywood or plastic.

Not bad for a zero-cost solution. I did not paint the cans, since they are galvanized and should be durable without any finish. I suppose I could spray some color on it, but I like the way it looks.

Bench Power Supply Re-Cap

Years ago, a ham friend gave me the Power Designs variable voltage power supply seen in *Photo C*. The power supply appears to be in good condition, but it's just old. The power cord is brittle, so at minimum I will replace the cord. Since I will have to perform surgery on the unit, I might as well check the entire unit and

restore it. The rather huge "computer-grade" electrolytic capacitors will likely be replaced by compact, modern parts.

High Power Dummy Loads

I have the parts for a kilowatt-rated 50-ohm dummy load. The ceramic-packaged high-power resistors can handle 500 watts each (*Photo D*). I have a giant heat sink from a solid-state RF amplifier power supply taking up some shelf space in my garage. The power resistors will be mounted on the massive heat sink, and I will run a short length of coax to a Type-N or SO-239 connector on the front panel. The unit will be housed in a metal chassis box, I may use a discarded piece of stereo gear for this. I may add a fan, but it I don't think it will be needed.

The second high-power dummy load is for audio applications. The power resistors for this project will be mounted on a similar heat sink (*Photo E*). Banana lead jumpers will be used to select either eight or sixteen ohms.

Power Supply Load

I was reading my copy of the 2018 *ARRL Handbook for Radio Communications* and discovered this device. It is a simple circuit, consisting of a 2N3055 transistor, a fixed resistor, a potentiometer, and a meter. It will be housed in the old Heathkit signal generator cabinet. A big 10-amp meter in my meter bin will be perfect for this project.

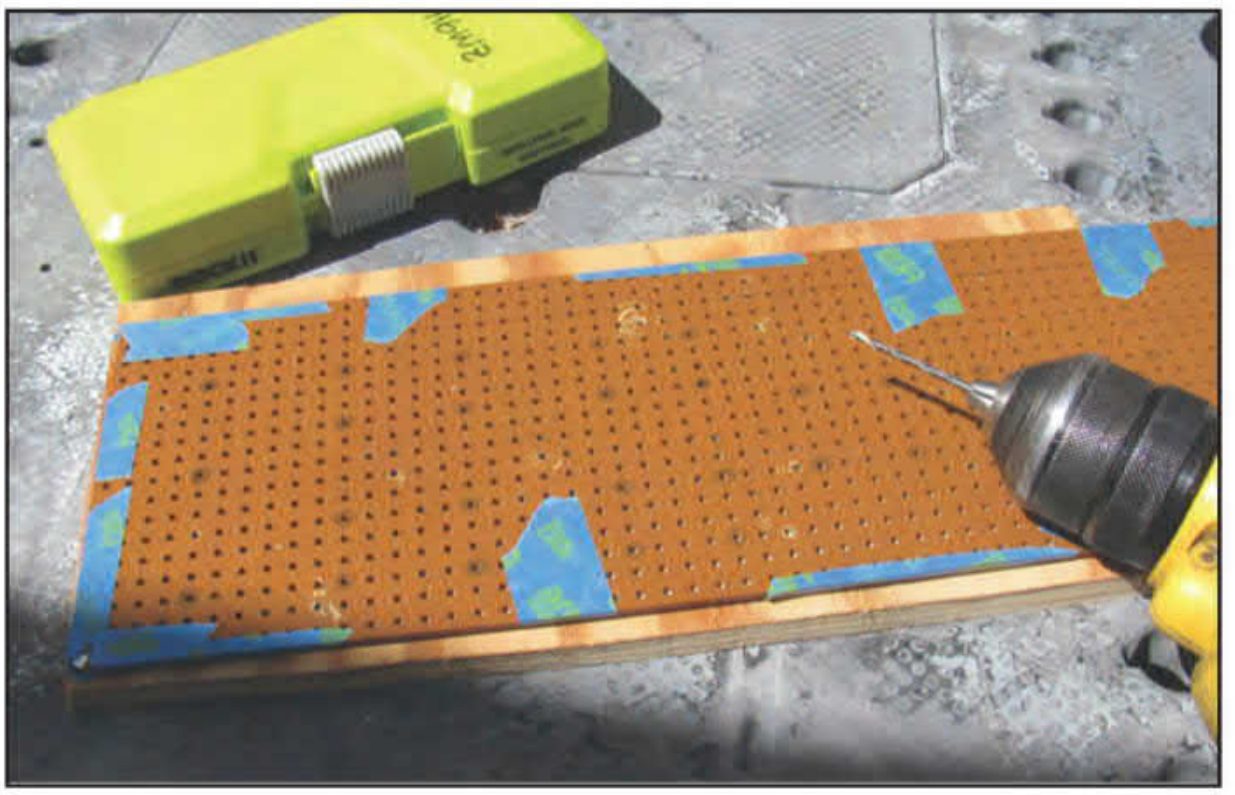


Photo G. I use perforated materials, like this old-time prototype board, as jigs to ensure multiple holes are lined up exactly right, without measuring and marking.

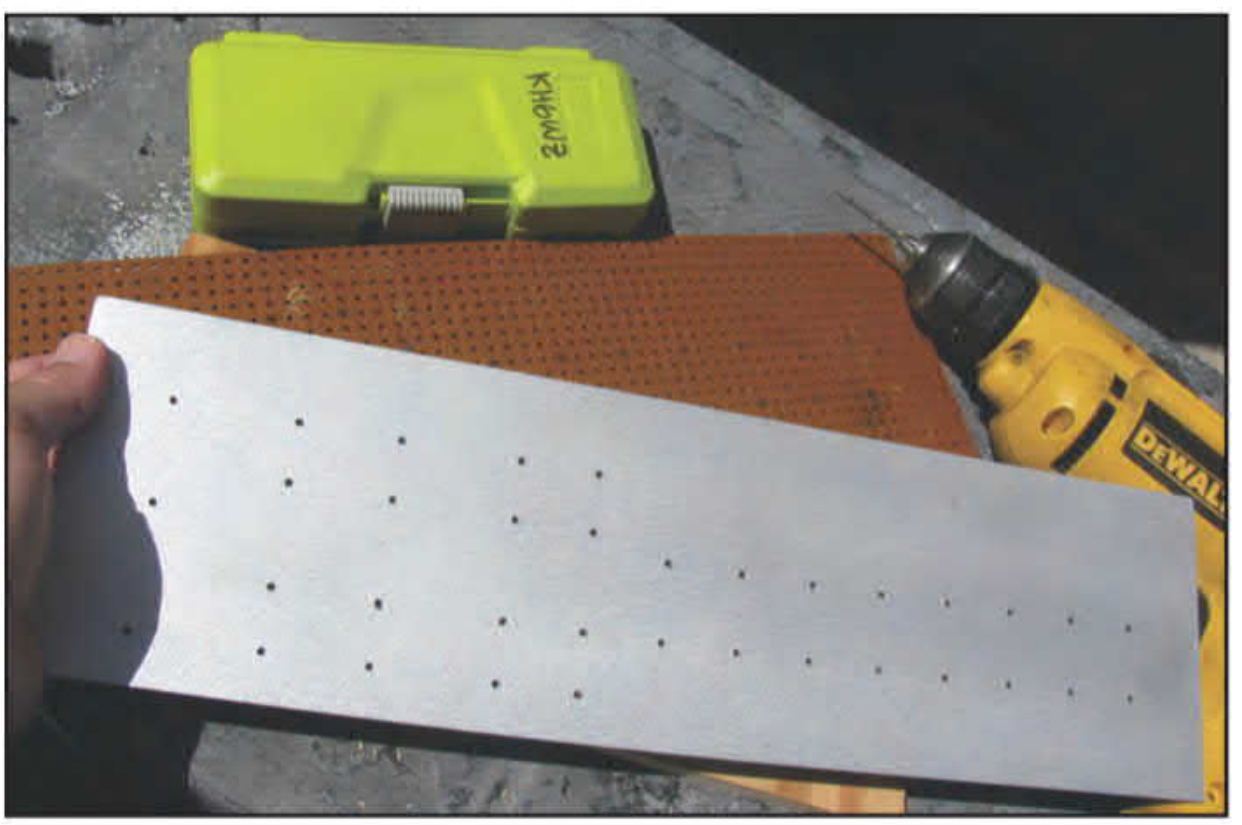


Photo H. The pilot holes made from the drilling jig.

New Variable Voltage Bench Power Supply

New buck- and boost-converters from Analog Devices are available (LTC-3780) and very inexpensive voltage and current regulator sub-assemblies are available from eBay and other online stores. By removing the trim pots and replacing them with panel-mounted versions, adding an input source, and putting the parts into a cabinet, I can create a simple to use and robust variable power supply for the workbench.

Variable AC Power Supply and Mains Isolation Thing

This is another item on a very old to-do list. A best practice for testing old equipment in unknown condition is to apply AC voltage slowly to see if there are any shorted components or circuits. In addition, it is a good idea to isolate the AC power main from the gear under test. An isolation transformer (a special type of power transformer with a 1:1 winding) is used to do this. The AC input is made variable with an autotransformer. My version will be a combination of ideas from the ARRL *Handbook* and other online sources. Almost all of the parts needed are shown in *Photo F*.

Re-Packaging to Enhance Utility

Brian Yee, W6BY, one of my Maker Faire friends, showed something to me a while ago. It's a nearly pocket-sized plastic box that interfaces to a computer via a USB port. It's called the Analog Discovery 2, made by Digilent. It is intended to be an affordable prototyping and educational platform and can be configured to perform over a dozen functions, including a two-channel oscilloscope, waveform generator, and logic analyzer.

Since the unit is designed to be compact and inexpensive, it uses small solderless jumper wires that plug between the Analog Discovery and a solderless breadboard. Selector switches for certain functions are not used; it uses 0.1-inch spaced connectors and shorting jumpers instead.

While this is a good idea, I did not like how the unit flopped around on the

workbench. I wanted something in a handier chassis box or cabinet, with better wiring interface. Since I decided to re-package the unit into a cabinet, an AC line operated, 5-volt power supply seemed to be an obvious addition.

I used a 4U rack cabinet purchased several years ago. Rather than patching the existing front panel as I normally do, I decided to replace it with a new one, since I had to drill many identical holes in straight lines.

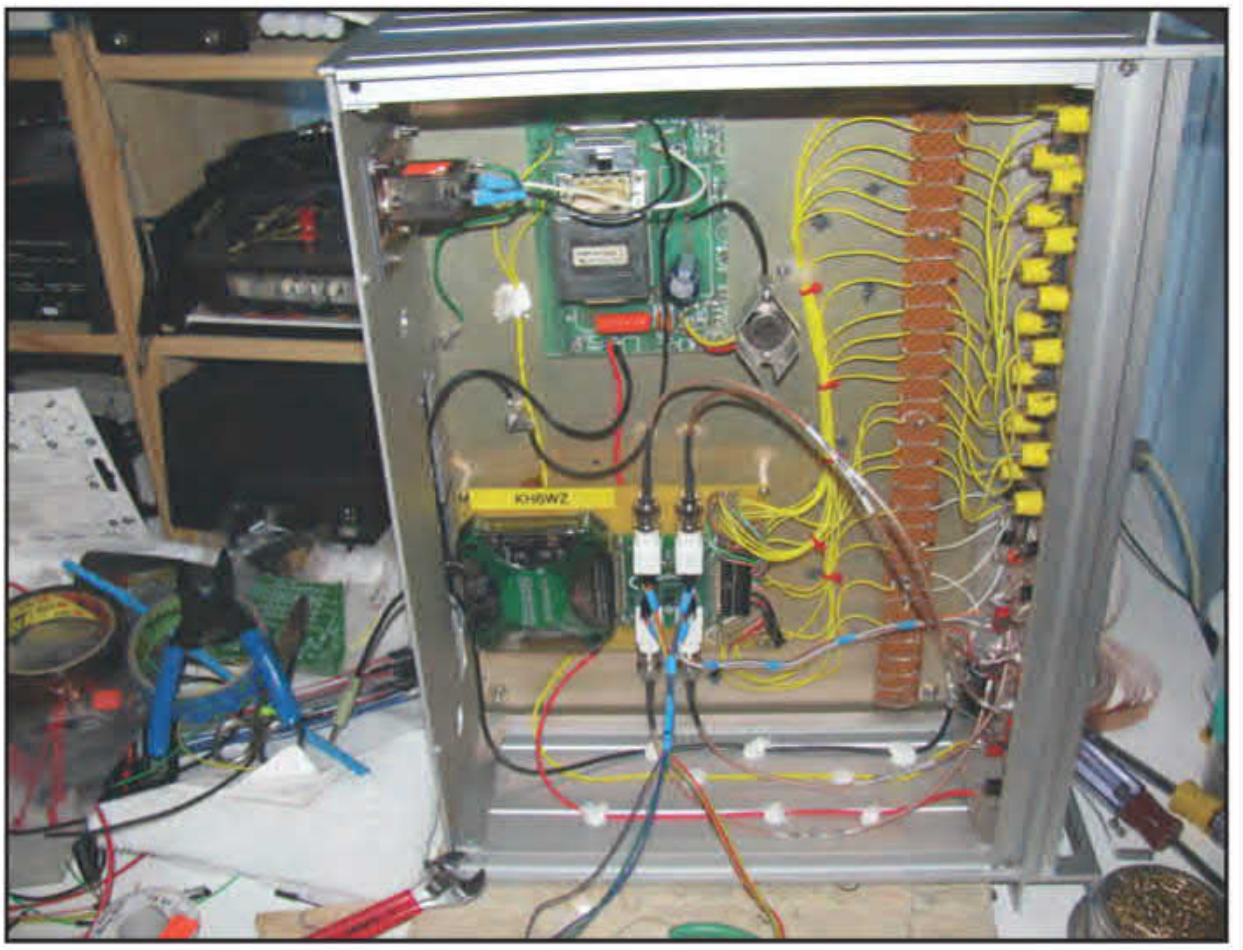


Photo I. Re-packaging the Analog Discovery 2 into a cabinet. At the upper left is a 5-volt power supply cut out of a lab instrument. The Analog Discovery unit is at the bottom left. Lots of banana jacks are mounted on the front panel.

Photo J. The re-packaged Analog Discovery 2.

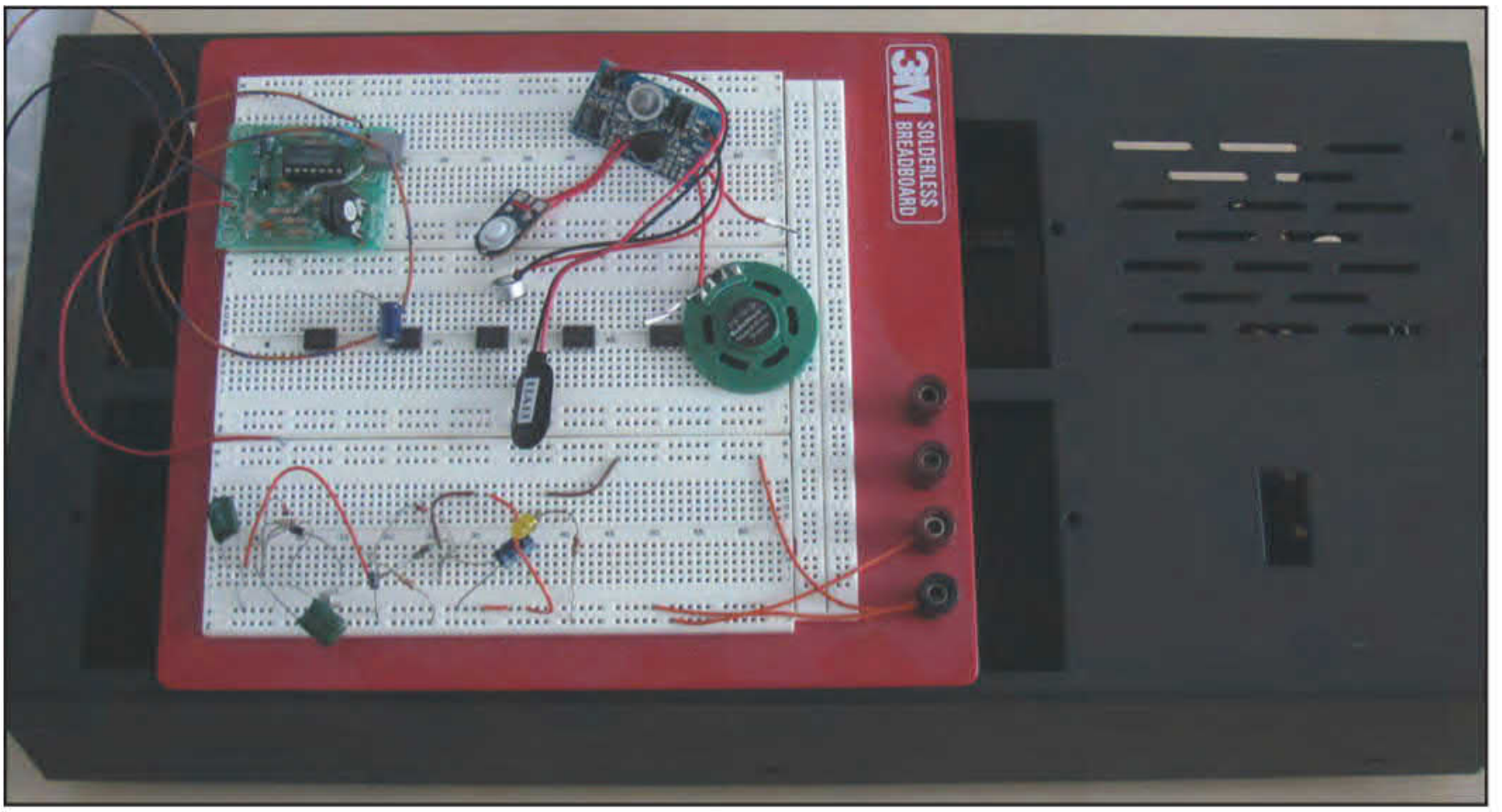


Photo K. A discarded gang charger will be turned into a cabinet power supply-amplifier and speaker for my solderless breadboard.

There are several challenges in this project: The first is selecting the correct front panel connectors and figuring out how to lay out and drill the cabinet or panel so all holes line up in nice, straight lines.

Looking into my connectors bin, I had about a thousand fully insulated yellow banana jacks just waiting to be used. Unfortunately, there are no nuts, but that's the likely reason they were such a great bargain. I also bought several dozen banana plug jumper leads from the same seller. These are high quality, very flexible, silicone-insulated test leads and should last a long time.

Photo L. A desktop "Goes Nowhere, Does Nothing" box. It does have a powered USB hub and fan. The meter serves as a power-on indicator.

I used a scrap piece of old perf board to create a drilling guide for all the holes. This jig ensures that all holes would line up in perfect straight lines (see *Photos G* and *H*).

Since the plugs did not come with nuts, I used JB Weld epoxy to mount them to the front panel.

I made a zero-cost, 5-volt power supply from a scrapped instrument by cutting a section out of the main circuit board and adding a 1-watt-rated, three-terminal regulator (7805 in a TO-3 case) to the unregulated DC output (*Photo I*).

The final outcome is shown in *Photo J*. I made some banana plug to solid wire adapters so the test leads can be used with this setup.

This will be a fun tech-toy to play with over the next few weeks.

Solderless Breadboard Workstation

This is related to the Analog Discovery re-packaging project, but not really. I had this idea for several years, but just didn't get make time to make it.

The parts are shown in *Photo K*. The main chassis is from a discarded HT gang charger. I found this in a trash bin at the office. When I saw it, the power

Photo M. Discarded monitor stands can make good project displays, like my microwave energy detector project.

supply and charge cups were already gone. Too bad. I will add a carrying handle, power supply, speaker, and audio amplifier to this unit to make breadboarding more — fun.

Just for Fun – A GNDN Box

This project started out as a new desk lamp, made with a homemade, tube-based crystal oscillator (or something) from a surplus shop I discovered on my way to the Bay Area Maker Faire several years ago (*Photo L*). The chassis and meter called me to make me take it home.

As you can see, the idea morphed into something completely different. I planned on using some USB-powered LED lamps, but my order was delayed and so I decided to turn it into an unusual powered USB hub. At the time of the "design change," a heat wave made me think about turning it into a desk fan.

So I added a small 12-volt power supply, made with a hacked wall wart. Since the fan exhaust points straight up, I have a PVC pipe chimney and will add a 90° elbow to direct the airflow. The chimney is not installed in the pictures.

The meter displays the AC line voltage. It's really a power-on indicator. It could have been a neon pilot light but removing the meter would leave a very large hole in the center of the front panel. Besides, I have dozens of 150-volt AC meters in my meters box.

But I still need a new desk lamp.

Oh. The term "GNDN" may be familiar to fans of the original "Star Trek" TV series. In some episodes, various pipes and switches or pathways are labeled "GNDN" plus some numbers. The term GNDN stands for "Goes Nowhere, Does Nothing."

So far, only two toggle switches and adjacent LEDs are used: One for the fan and one for the meter. The others are not connected to anything. But the LEDs do light when the switch is thrown.

Just for Fun 2: Game of Life Display

While browsing the Make: store at one of the Maker Faire events, I picked up several Arduino-based kits from Adafruit. One of these is called "Conway's Game of Life Kit" and simulates the one-player game created by John Conway.

Thinking this could be a fun desk decoration, I bought several kits, intending on mounting them on some sort of display stand. I thought for a long time about this, and then forgot about this project completely. I re-discovered this while looking through a box in my closet.

Some months ago, I found a huge pile of computer monitor stands in the hallway at the office. These were being thrown out, since the computer workstations in our operations center had special stands built in. These stands will make great display stands for projects like this.

My Microwave Energy Detector display uses a similar stand arrangement (*Photo M*).

Digital Multimeter Hack

For some reason, I bought a handful of cheap multimeters from an auto parts store. These are just begging to be hacked. I may take these apart and do some mild hacking to make them dedicated voltage and current displays for the variable power supply project.

An Improved Scrolling Digital Clock from a Kit

While browsing the kit aisle at my favorite electronics store, I came across a digital clock featuring an LED matrix. The display shows time by scrolling the numbers across a matrix made with 3-millimeter LEDs arranged in a 5x7 matrix.

I decided the LEDs are too small and will replace the unmounted LEDs with some nicer ones with diffuser mounts, and then mount the unit into a cabinet of some kind.

I hope some of these ideas will inspire you to get going in your workshop. I find that keeping busy and keeping the mind occupied with challenges helps ease the stress of our current situation. It is better than watching too many television shows or YouTube videos.

What's on your workbench? Do you have or are you working on any "GNDN-type" projects, just for fun? Let me know via email and we can share them in this column.

– 73, Wayne, KH6WZ

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- High power hybrid load resistors are available from Henry Radio, Inc.: <https://tinyurl.com/ybd4rfvr>
- Analog Devices LTC3780 datasheet: <https://tinyurl.com/y9c8xjb5>
- Digilent Analog Discovery 2: <https://store.digilentinc.com>
- Adafruit Conway Game of Life Kit: <www.adafruit.com/product/89>

MAGIC IN THE SKY

BY JEFF REINHARDT,* AA6JR

The Bands Are Buzzing!

With the recent confinement brought about by COVID-19, it turns out we are mighty fortunate to be ham radio enthusiasts. Not only do we have a hobby built around communication with one or more at a given time, but it ironically *encourages* social distancing. In the case of DX aficionados, the greater the distance, the better.

Now I realize the higher frequency HF bands have suffered from less than favorable solar conditions, but there has been a lot of activity on 80, 40, and 30 meters, with occasional openings on 20. The digital modes have enjoyed a robust renewal in interest, with FT8 leading the charge. I know several hams who have recently completed Worked All States and DXCC awards using digital modes. I've also noticed an increase in CW traffic and more than a few clubs have found renewed interest from members seeking to become proficient with a key, by running code-training classes on regional HF and VHF frequencies.

There's More Magic On the Air

The VHF and UHF modes have also come alive. Some long-dormant repeaters now support increased traffic, and in my locality, there are four daily "Bored Meetings" (yes, the spelling is correct) held on a 2-meter repeater at 9 a.m., noon, 6 p.m., and again at 9 p.m. These roundtables are hosted by net control operators who juggle somewhere between 20-40 participants at each gathering. Those checking in are happy to just say hello, share their activities of that day, recommend good take-out restaurants, give weather reports, pose trivia or technical questions, recommend a location with the lowest gasoline price — you get the idea. The real message is that most of us are anything BUT bored. Reports come from home stations, mobiles, bicyclists, and even some dog-walkers using an HT.

The upshot is, we're able to maintain contact with our friends. Unlike others who have been observing the recommendations to limit contact with the outside world, we can do that but still enjoy the good company available through our hobby without risking our health and well-being. Remember, there are well over 700,000 ham licensees just in the U.S., and I'll bet you haven't communicated with all of them. At least not yet, right?

This period of time has also provided a good training ground for RACES and ARES groups to conduct drills and meetings on their respective designated frequencies. Done in conjunction with the leadership of the served agencies, they also highlight the diverse skills and geographic distribution of the volunteers who comprise those groups.

There's also been a notable increase in activity on the VHF / UHF digital modes. Linked repeater systems add to the fun, with cross-country and international contacts occurring quite often, depending on which system is being used. I recently monitored a VHF digital contact between a ham in my region and an elderly gentleman at a senior living facility in South Carolina who was sharp as a tack and happy for the QSO through his HT. Talk about brightening someone's day.

Roundtables on 75 and 40 meters have been going on forever but now there seem to be more of them. A few are pretty tightly knit but most will welcome newcomers and it's a great way to get to know some new folks and pass the time of day.

A member of my home club is Pete Heins, N6ZE, an avid VHF / UHF enthusiast *par excellence* who seems to come up with a new contest challenge every week or two. I must admit, his frequent email reminders to make a contact often coax me to get on 6 meters and experiment with SSB modes on 144-, 222-, 440-MHz, and even 1.2-GHz FM. While I'm not a grid square collector per se, I'm glad to give a few contacts to Pete and the many other VHF / UHF enthusiasts who travel to hilltops near and far; those are some seriously dedicated folks.

The summer months are also a great time to catch tropo and sporadic-E openings on 6 meters and even on 2 meters,


Western Reserve Amateur Radio Club

The Wave Bender

May 2020

Award Winning Newsletter

Ohio Section

WRARC Prez

Hello everyone,

It seems to be that the end of these stay at home orders is near. Soon we will all be able to get together again.

I don't have much if anything to report since slotnofmplans had to be put on hold not being able to have meetings. I hope that everyone has been able to do some operating while being stuck at home. If anyone has any questions, or has something they have done while staying at home, they would like to share with the club, I'd like to make time for you to do so.

Just know that when we are able to hold meetings again we'll be working on putting things back in order as quickly as possible. The plans for learning workshops are still in place, just on hold. Once everything is finished we will post dates and times of everything.

Hold tight everyone, and we'll see you soon

73 WF9U, Chris
WRARC/Club President

Surprise Geomagnetic Storm

The first geomagnetic storm of 2020 (category G1) took forecasters by surprise this morning when a CME impact sparked bright auroras over Canada and some northern-tier US states. At the time of this writing, Earth's magnetic field is still reverberating from the impact, raising the possibility of more high-latitude auroras tonight.

Space Weather News for April 20, 2020
https://spaceweather.com
https://www.spaceweatheralerts.com

Photo A. The front page of the excellent newsletter from Ohio's Western Reserve Amateur Radio Club (Courtesy of K8JAA, editor)

*5904 Lake Lindero Drive, Agoura Hills, CA 91301
e-mail: <aa6jr@cq-amateur-radio.com>

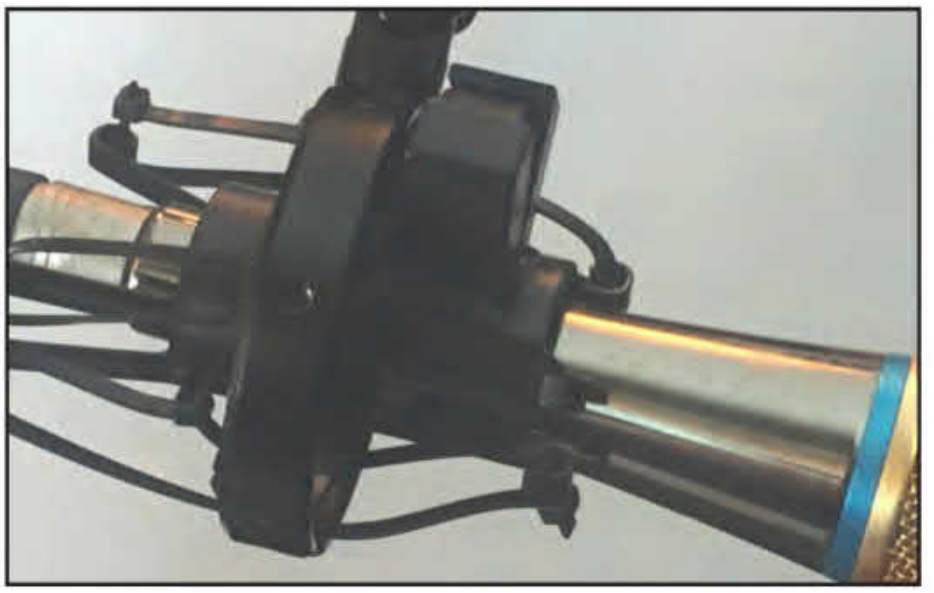


Photo B. OK, it's not pretty but it works — See text for explanation! (Photo by AA6JR)

and let's not forget the opportunities for fun working meteor scatter, which can be expected during the annual Perseids meteor shower period in August.

The Clubs Are Alive, Too

While this is not an endorsement of Zoom® or any particular brand of meeting software, I know several clubs across the U.S. have embraced that method of holding gatherings and sharing excellent presentations on a wide variety of topics, including how to get going on FT8, how to establish a mesh network, refresher classes on using APRS® and packet communications, how to experiment with NVIS on 40 meters (okay, near vertical incidence skywave) which does not require a high-altitude HF antenna, in fact, quite the opposite, and more. So these club activities show there's a lot that can be done in terms of communicating different facets of our craft without the need to come into close physical contact. Many of these activities require little or no investment, either.

Don't Forget the Newsletter and Website

Each month I look forward to reviewing news from my own club and I sneak a peek at many others by visiting their respective websites. It's vital to keep that information fresh and a great way to share some "how to" technical info in graphic form that can't be adequately shared over the air.

I'll do a shout-out to Ohio's Western Reserve Amateur Radio Club and newsletter editor Jane Avnet, K8JAA. Each month she assembles and distributes a multipage newsletter that's newsy, topical, and punctuated with a bit of humor. It's distributed via email in PDF format so it's easy to read and distributed to anyone who wants it. This proactive approach to distribution is another way to reach club members who may not be able to participate in nets and, in recent months, unable to attend meetings. Their newsletter format is a good template for other clubs to emulate. If you need samples, an archive is available at the club's website, <www.wrarc.net>.

The Round Tuits

We all have them. Projects that are classified as, "yeah I'll do that when I get around to it."

Well, that time is here. So far, I've repaired a few annoying items, replaced a bunch of non-standard and aging connectors with Powerpoles®, and I'm about to replace a very old run of coax to my HF vertical when the weather is agreeable.

As one acquaintance recently told me, "If you aren't taking on those deferred projects during this spell, you probably never will." So I've used that chide to take on a number of "round tuits," some ham radio related, others more in keeping with the maintenance of my home, office, and cars. Among those items and my weekly music lesson (done via FaceTime®), I often wonder where the time has gone when I take a moment to look at the clock.

Don't Laugh – It Works

So on the lighter side of technology, one of the "round tuit" items I'd been deferring was fixing the suspension system for my Heil microphone. Now I love Bob Heil and what he's done for audio, professionally and for amateur radio, and we've had several nice chats over the years. But some time ago, I purchased the microphone suspension system that insulates the excellent Heil mic from vibration by supporting its mount in a web of elastic material. The only problem is, the suspension web eventually stretches and sags until it can suspend no more. So I've replaced the suspension loop of material several times, which is a thrill all its own, but finally came to realize that an alternative was needed. Rubber bands were frustrating, difficult to string, and prone to snapping or stretching. String or fishing line? Difficult to string and maintain the proper tension. So one afternoon I decided to try plastic cable ties. It took some time and patience but — *voila* — it seems to be working quite well — so far.

We'll Come Out of This Better

This column has afforded us the opportunity to review just some of the ways amateur radio hobbyists have used their skills and abilities to push back from the effects of the COVID-19 experience. We know it won't be "over" for some time, so let's continue to be diligent in protecting ourselves, our families, and others by maintaining good practices. As a former local elected official, I can share this with you: It's very difficult to have others perceive the benefits of having taken a preventive action, such as installing a traffic light at a busy intersection. We'll never know how many lives were saved by that simple measure and quite frankly, it's hard to run for re-election based on something that (thank goodness) *didn't* happen.

On a larger scale, we all remember the September 11th attacks, but who knows how many other incidents may have been foiled through unseen intervention? Similarly, while sequestered at home and perhaps frustrated by our way of life having been upended, take a moment to reflect that by adhering to the recommended safeguards, you may have saved yourself and others from becoming victims. So while we all hope to wake up one day and find this bad dream behind us, please give a little slack to those who have worked so hard to keep us safe and healthy, as managing this threat to our well-being has not been easy. I would also like to give kudos to the health-care professionals who have worked so hard to save lives.

As to ham radio, I'm pleased and proud to be counted among those who communicate with others, brightening their day and in return, having my own spirits lifted.

Since the discovery of radio waves, we've learned they can traverse long distances, pass through a vacuum, and travel forever across the universe. They're immune to biological maladies and now we know they cut through isolation like a hot knife through soft butter. You're one of those in command of this amazing energy. It is truly *Magic In The Sky.*

MF/LF OPERATING: Life Below the AM Broadcast Band

BY JOHN LANGRIDGE,* KB5NJD

What is This WSPR-15 That You Speak Of?

Plus, a West Virginia 630-meter portable operation by WA3ETD that was temporarily postponed by COVID-19 and amazing very low power results on 2200 meters for NI7J

This month I want to briefly discuss the mode that simply would not die, WSPR-15. Following its addition to the WSPR-x software package in 2013 (arguably the predecessor of WSJT-x), it quickly fell out of favor with developers, which led to its removal from subsequent software releases.[1] Since its removal, WSPR-15 has garnered a cult following with numerous approaches developed to generate and decode signals that in some cases included using very old software releases that contained the mode to elegant script-based command lines approaches to accomplish the task. These efforts culminated in at least one new world record and long-haul receptions that would likely not have been possible with the mode's faster counterpart, WSPR-2, also known simply as WSPR.

The point that I hope to make in these brief paragraphs is neither technical nor comprehensive. A simple search engine query will bring up many pages of details of the recent exploits of amateurs who sought to use the mode on the air. Instead I want to make readers aware of what is going on with this mode, some of its advantages, some of its problems and where it is used, in addition to pointing prospective users to information resources that are available in hopes of growing activity in the coming season. Candidly, I am not a WSPR-15 user and I will shortly explain that further, but like many, I have been an observer to this season's activity and accomplishments and reference many of the details from the innovators who have worked to bring this mode to the mainstream.

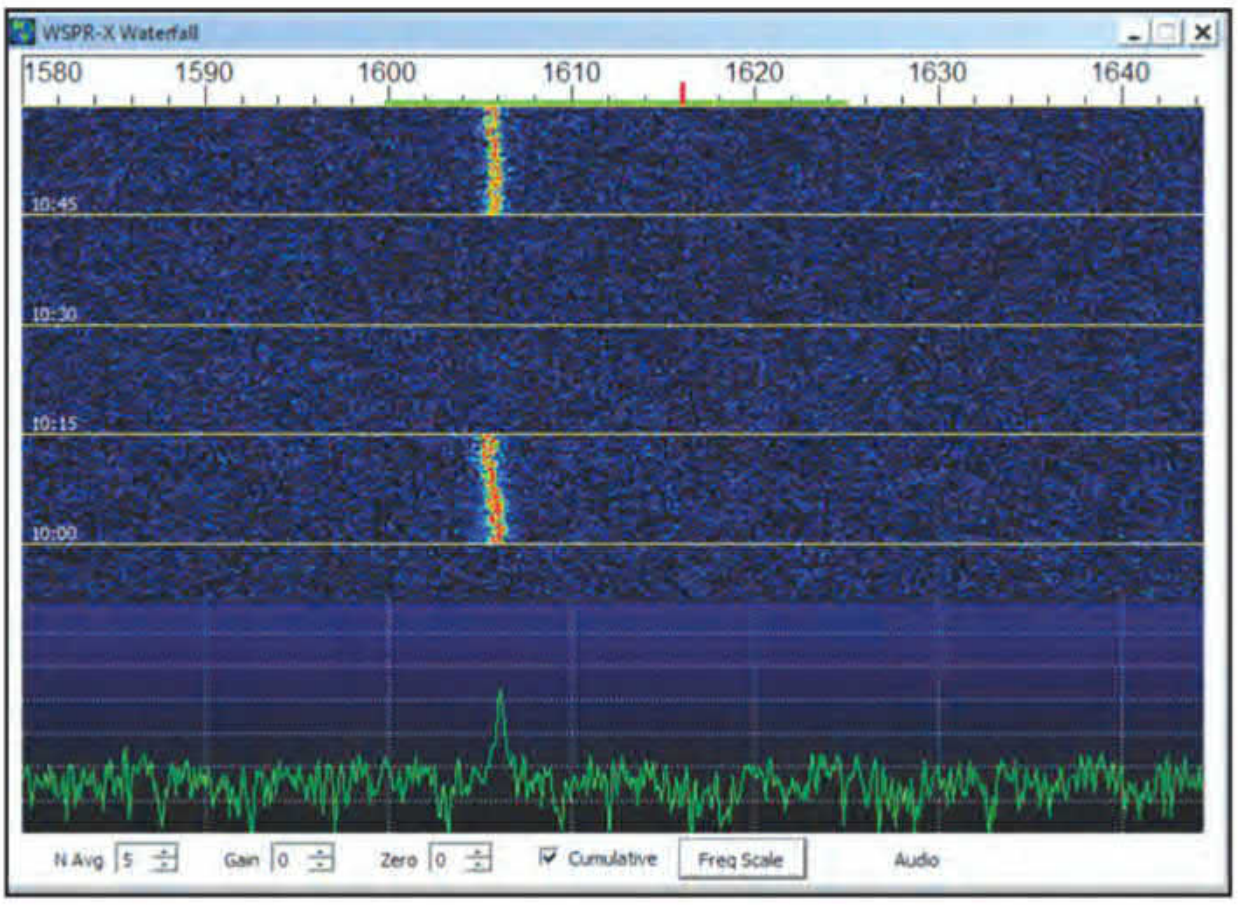


Figure 1. Here is what can happen with long-cycle modes like WSPR-15 when oscillator stability of the exciter is lacking. While not the worst signal seen on the air, it can complicate the decode process, even negatively impacting the detection limit by several dB.

What is WSPR-15?

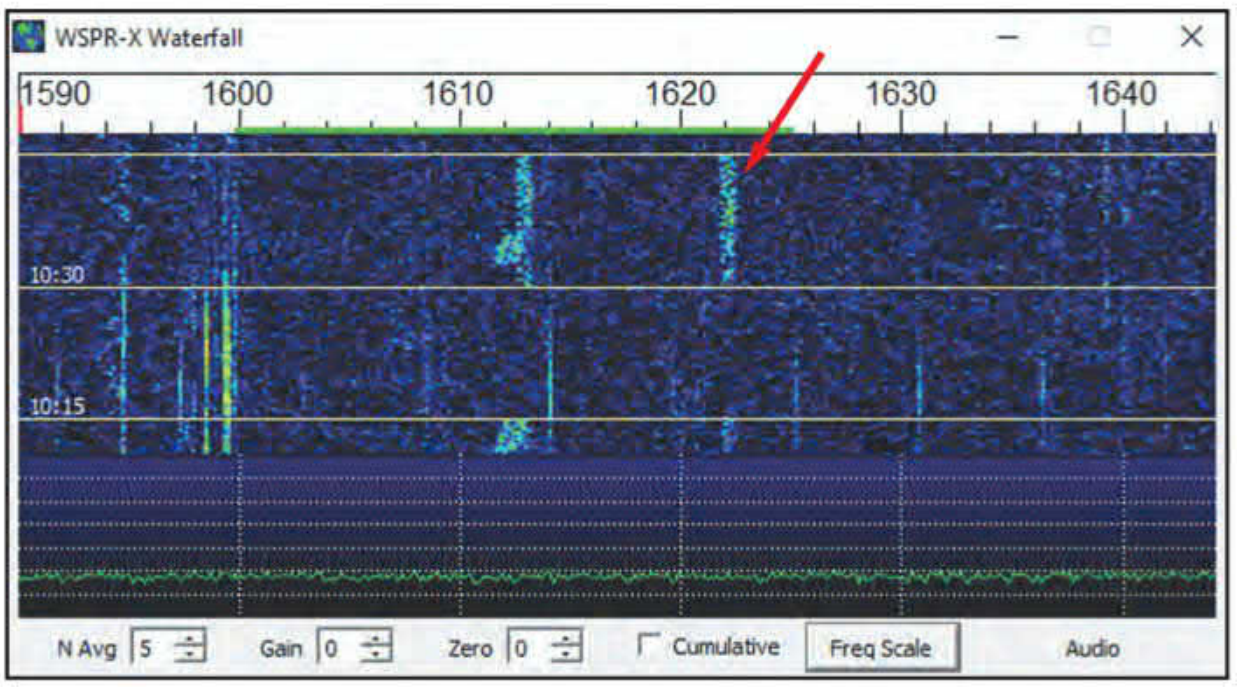
WSPR-15, like its faster counterpart, WSPR-2, is a four-tone AFSK (audio frequency shift keying) beacon mode. WSPR stands for *Weak Signal Propagation Reporter*, a mode developed by WSJT pioneer Joe Taylor, K1JT. What sets apart WSPR-15 from WSPR-2 is that, rather than the roughly 2-minute transmit cycles (precisely, it's about 1 minute, 50 seconds in length), it uses a *15-minute* transmit cycle, gaining approximately nine decibels of advantage over the 2-minute variant.[2] The result is an automated digital mode with a detection limit on par with some of the mid-range QRSS CW variants without the need for the operator to potentially review many screen captures to determine whether a signal was received. As an operator who prefers analog modes, I can say that sometimes reviewing those captures is part of the fun but many do not share that sentiment.

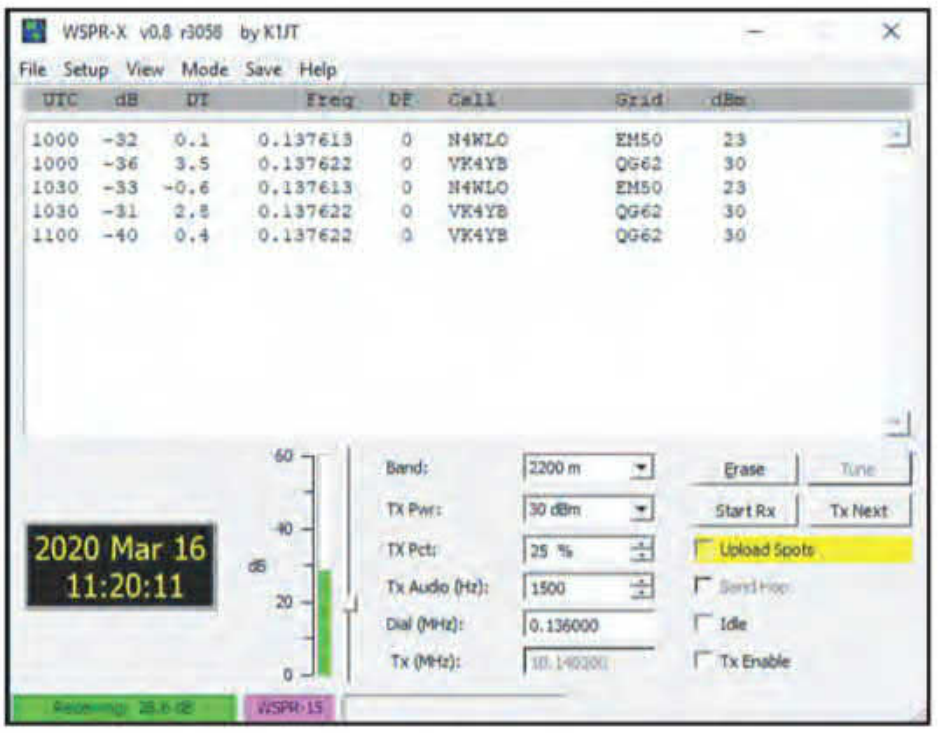
Traditionally, WSPR has been a very good tool for rapidly determining where band openings might exist by way of the WSPRnet website,[3] in many cases leading to two-way QSO attempts. In contrast, the longer variant has largely been used by stations seeking to achieve distance records on their band(s) of interest.

But There is Always a Catch!

While nine decibels sounds pretty good, particularly for small stations, there are always costs and "gotchas" to consider. Frequency stability is a very big consideration and many exciters don't make the grade (see *Figure 1*). Even some transceivers that are capable of using an external reference like a rubidium standard or GPS source are reported to have problems. In some cases, simply moving a crystal oscillator or other timebase from sources of drafts can resolve the problem, but this is an invasive process that can void one's warranty. Others have reported success by adding insulation to the oscillator circuit to prevent

** 827 Middle Run Ct.
Duncanville, TX 75137
<kb5njd@cq-amateur-radio.com>





Figures 2 and 3. The world record reception by N1BUG of WSPR-15 transmissions but VK4YB can be seen quite well at 1622 Hz. Reports of VK4YB during this session were as high as -31 dB S/N and -40 dB S/N (Courtesy of N1BUG)

heating and cooling cycles from having drastic effects. Combinations of these approaches are also reported to be worthwhile solutions for some.

One complication that has kept me on the sideline with WSPR-15 is a lack of comfort in abusing my exciter, amplifiers, and associated power supplies by running at full duty cycle for nearly 15 minutes. Long transmissions can be extremely taxing on hardware and a number of reports suggest that many HF transceiver manufacturers have observed an increase in power amplifier failures in their products from long-winded digital mode operators on HF. Many transceivers used on 630 and 2200 meters provide a low-level signal designed to drive a high-gain amplifier (often less than 1 milliwatt out), however, and this configuration is probably less problematic for the exciter. However, the amplifier and power supply remain concerns. Be prepared to add additional cooling and allow longer periods between transmissions so the hardware can recover. Many of the homebrew amplifiers and their power supplies are built for this type of abuse but the last thing I would want to hear about is someone who embarked on transmissions with long, full-duty cycle modes like WSPR-15 and ran into a failure. Scale your systems accordingly and make sure to keep lots of spare parts, like FETs and power supplies, on hand.

Another issue that is more annoying than anything else is related to the 15-minute receive and transmit cycle. For someone looking for quick results, waiting for the next transmissions cycle can be excruciating and when problems occur, forcing the operator to wait for the next cycle, important openings can be missed. This is particularly problematic on the low bands during greyline periods when time is limited and operators may only get one shot. Only a handful of anecdotes related to some type of failure or false start have been reported over the last few years, but when it happens it seems to be at the worst possible time, preventing what might have been a record opening. Just keep this possibility in mind.

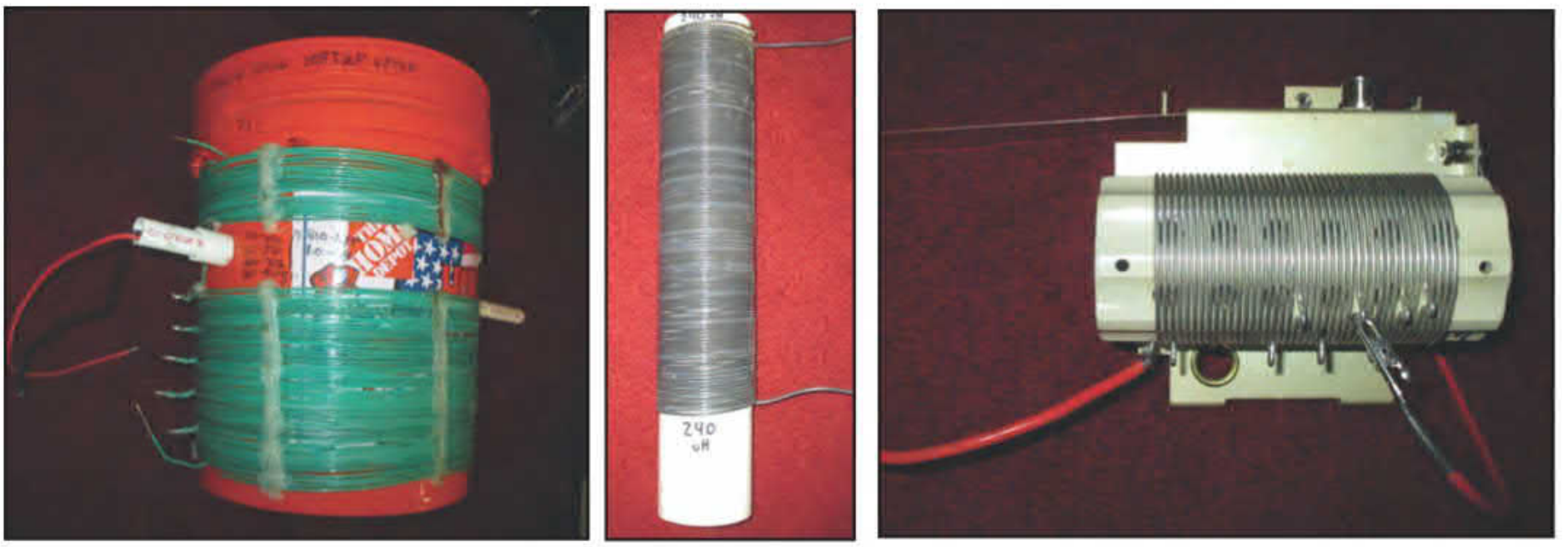
What About the Software?

There are a few options for decoding and generating WSPR-15 transmissions but, unfortunately, the process can be a bit more complicated than simply clicking an icon on your desktop and walking away. As previously mentioned, the version of WSPR-X from 2013 that contained the mode did not have a lot of staying power and the code was buggy and incomplete. In recent years, efforts have focused on fixing and completing existing code framework for the traditional graphic interface version of the software. Several operators, many in Europe, have been involved in this undertaking, which has led to a mostly stable executable file. According to Markus Vester, DF6NM, in a post from March 4, 2020 on the RSGB-LF Groups.IO reflector,[4] the current working version of the software is v0.8 r3058. A version 0.8 r3575 seems to contain some custom modifications by Eric Tichansky, NO3M, and does not appear to be publicly available in spite of references in email posts. Eric has also created scripts to manage some of the processes, many of which are in the public domain as plain text on the Groups.IO reflector. There also seem to be a few download sources but a recent discussion with Geoff, GØLUJ, revealed that he is hosting the v0.8 r3058 version on his website.[5]

There have been some reports of Windows® users having unexplained crashes of earlier versions of the software but details are limited and reported incidences were fewer this season compared to previous years, based on posted reports. It's possible that some of these issues were related to memory leaks associated with the signal processing in addition to serial connections that key a transceiver. Embarking on WSPR-15 should probably be accompanied with a grain of patience.

Where Can Signals Be Found?

WSPR-15 has primarily found a home on 2200 meters, where QSB cycles are more stable and predictable. Compared to 630 meters, antenna efficiency is often considerably poorer on 2200 meters and the 1-watt EIRP maximum legal limit can be difficult to achieve so nine decibels of detection limit improvement over traditional WSPR is very



Photos A, B, and C. John Molnar, WA3ETD's, base-loading scheme for his 35-foot-tall portable vertical to be used from West Virginia sometime in the future. John hopes to be able to use the 1-milliHenry "bucket" variometer (left) alone, but just in case something happens and it's not enough, he has an additional 240-microHenry coil (center) to add in series. A small 60-microHenry tapped shunt coil (right) should be plenty so he can match to his 50-ohm coax. These coils will be used in conjunction with a top hat on the vertical. (Photos courtesy of WA3ETD)

attractive. Having said that, WSPR-15 audio frequencies can most commonly be found starting 1600 Hz up from each band's traditional WSPR dial frequencies, 474.2 kHz and 136.0 kHz for 630 meters and 2200 meters, respectively. Activity is low enough that few signals have been observed above 1650 Hz but it is probably useful to be watching posts on the RSGB-LF Groups.IO reflector for up-to-date information. This is very fluid activity and by winter 2020/2021, there could be numerous changes and advancements.

While 2200 meters offers a more favorable environment for WSPR-15, I don't want to give the impression that the mode cannot be used on 630 meters. On a very stable night with limited QSB or longer QSB cycles, benefits could probably be realized; but on a typical night, a 15-minute transmit cycle could experience numerous QSB cycles that might render the benefits of the deeper detection limit to be no better than that of WSPR-2. Regardless of what band you choose to operate the mode, it's probably beneficial for you to get involved with the active community to ensure that someone is listening for you or providing signals for you to decode. Unlike WSPR-2, WSPR-15 is more of a niche tool.

26 spots:

Timestamp	Call	MHz	SNR	Drift	Grid	Pwr	Reporter	RGrid	km	az	# Spots
2020-04-11 05:20	WH2XND	0.137577	-28	0	DM33xt	20	KL7L	BP51ip	4059	331	1
2020-04-11 05:12	WH2XND	0.137581	-27	0	DM33xt	20	N2HQI	FN13sa	3237	61	2
2020-04-11 05:20	WH2XND	0.137577	-25	0	DM33xt	20	K3MF	FM19sr	3215	68	1
2020-04-11 05:12	WH2XND	0.137577	-22	0	DM33xt	20	KD2OM	FN12gx	3156	61	2
2020-04-11 05:12	WH2XND	0.137577	-11	0	DM33xt	20	NO3M	EN91wr	2921	63	2
2020-04-11 05:12	WH2XND	0.137577	-27	-1	DM33xt	20	WA3TTS	EN90xn	2915	66	1
2020-04-11 05:12	WH2XND	0.137577	-22	0	DM33xt	20	W3PM	EM64or	2316	80	2
2020-04-11 05:12	WH2XND	0.137577	-16	0	DM33xt	20	K9AN	EN50wc	2229	65	2
2020-04-11 05:12	WH2XND	0.137576	-15	0	DM33xt	20	VE6JY	DO33or	2215	359	2
2020-04-11 05:12	WH2XND	0.137577	-24	0	DM33xt	20	VE7BDQ	CN89la	1919	335	2
2020-04-11 05:20	WH2XND	0.137576	-27	0	DM33xt	20	WA6OUR	CN87xo	1747	334	1
2020-04-11 05:20	WH2XND	0.137578	-27	0	DM33xt	20	AE5LY	EL29io	1650	102	1
2020-04-11 05:12	WH2XND	0.137578	-6	0	DM33xt	20	W7IUV	DN07dg	1629	339	2
2020-04-11 05:12	WH2XND	0.137577	-4	0	DM33xt	20	N6LF	CN83lt	1462	323	2
2020-04-11 05:12	WH2XND	0.137577	-7	0	DM33xt	20	KK6PR	CN94ik	1424	329	2
2020-04-11 05:12	WH2XND	0.137580	-15	0	DM33xt	20	K5DOG	EM00wh	1367	103	2
2020-04-11 05:12	WH2XND	0.137577	-12	0	DM33xt	20	KPH	CM88mc	1091	299	2
2020-04-11 05:12	WH2XND	0.137577	-22	0	DM33xt	20	KJ6MKI	CM88oi	1089	301	1
2020-04-11 05:20	WH2XND	0.137577	-23	0	DM33xt	20	WW6D	CM88pk	1086	301	1
2020-04-11 05:12	WH2XND	0.137577	-30	0	DM33xt	20	N6GN/K	DN70ll	966	38	2
2020-04-11 05:20	WH2XND	0.137577	-24	0	DM33xt	20	WO7I	DN10cw	941	329	1
2020-04-11 05:12	WH2XND	0.137577	-11	0	DM33xt	20	KA7OEI-1	DN31uo	867	359	2
2020-04-11 05:12	WH2XND	0.137581	-19	0	DM33xt	20	KA7OEI	DN40ao	755	1	2
2020-04-11 05:20	WH2XND	0.137577	-33	0	DM33xt	20	K6FOD	DM04wc	562	275	1
2020-04-11 05:12	WH2XND	0.137577	-31	0	DM33xt	20	N3IZN/1	DM13ji	481	265	1
2020-04-11 05:12	WH2XND	0.137577	-3	0	DM33xt	20	ND7M	DM16xf	453	308	2

*Figure 4. Ron Douglas, NI7J, operating as Part-5 experimental station WH2XND, was both shocked and excited to see these results on 2200-meter WSPR from just 11-milliwatts EIRP from his combination top-and base-loaded 100-foot-tall vertical. The WSPRnet database detail suggests he was at 20 watts ERP, which would be common for his experimental station but during this session he was operating at just 250 milliwatts to the antenna due to ongoing amplifier maintenance and forgot to change the entry in the software to reflect the real values. (Yes, 20-watts **ERP,** not EIRP … But 11-milliwatts **EIRP**)*

World Record Reports With WSPR-15

For quite some time, Paul Kelley, N1BUG, located in Maine, attempted to replicate the success of Eric Tichansky, NO3M, and Wayde Bartholomew, K3MF, both in Pennsylvania, by reporting Roger Crofts, VK4YB, on 2200-meter WSPR-2 for what would represent a new world distance record on the band using the mode. This was a very challenging undertaking and, in spite of just a few hundred miles of distance between the stations, local noise from a utility provider near Paul's station made decoding Roger with WSPR-2 a seemingly impossible endeavor. On March 16th, 2020 his efforts paid off using WSPR-15 with a -36-dB S/N report of VK4YB at 1000z for a distance of 15,819 kilometers (about 9,829 miles). Paul indicated on the RSGB-LF Groups.IO reflector that "The band had become quite noisy around 0100z as sunset moved past some thunderstorms over Texas. When the alarm

went off at 0445 local time, I got out of bed thinking 'this will not be the day for hearing VK4YB.' Wrong again! But I have never been happier to be wrong." (See *Figures 2* and *3*)

On March 15th into March 16th, 2020, NO3M reported the reception of UA4AAV at -39 dB S/N using WSPR-15. Eric also decoded transmissions from UA3DJG on March 17th, both stations at a distance of 7,000-8,000 kilometers (roughly 4,700 miles). The significance of these reports was reinforced by comments from Luis, EA5DOM, who noted in a March 31st post on the RSGB-LF Groups.IO reflector that much of the WSPR activity in Europe and Russia on 2200 meters has already transitioned to WSPR-15, so if your goal is to search for low-frequency European stations, this mode is one that should be taken seriously. It does not appear to be going away any time soon.

Viral Outbreak Postpones West Virginia 630-Meter Portable Operation

A portable operation to West Virginia by John Molnar, WA3ETD, that was scheduled for the end of March was postponed due to the COVID-19 outbreak. John assembled a self-contained station suitable for rapid installation, including a combination top and base-loaded vertical antenna that could be raised by one person (see *Photos A*, *B,* and C). I suspect that if someone else does not activate the state first, John will plan on going just as soon as the world returns to some semblance of normal (coinciding with good propagation, of course.) West Virginia is one of seven U.S. states that, as this was written, still lack two-way QSO activity on 630 meters. There has been past interest expressed to activate Wyoming, Arkansas, and Louisiana, but so far those have not come to fruition.

Surprising Low-Power Results for NI7J on 2200 Meters

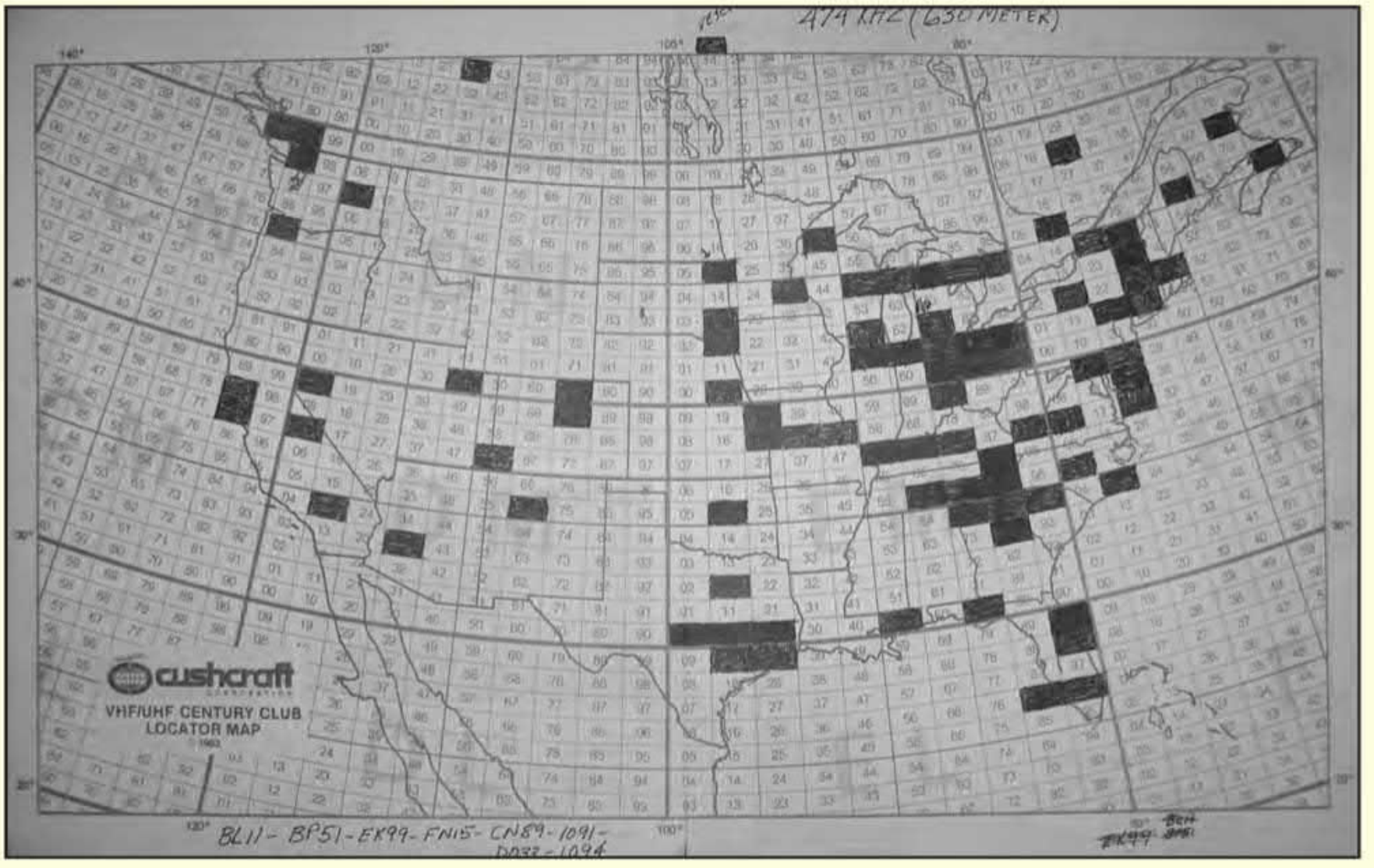
Ron Douglas, NI7J, also known for his Part-5 experimental activity as WH2XND, made a startling discovery while operating with a drive level signal from his Han Summer's Ultimate-3S beacon platform, commonly known as the U3S. Typically, Ron would operate at an estimated 20-watts EIRP under Part-5 rules, using a nearly 100-foot tall cage vertical with extensive top loading and miles of radials from his station in the Phoenix, Arizona area. The stock U3S operating at approximately 250-milliwatts total power out resulted in an estimated EIRP of 11.5 milliwatts. Ron reported WSPR decodes from many eastern stations in addition to KL7L near Anchorage, Alaska (see *Figure 4*). These are impressive results that many stations would be proud of while operating at the full 1-watt EIRP legal limit. Ron has spent tremendous effort and money over the last 10 years to perfect a world-class station. Congrats Ron!

That's all for this month. If you have questions or comments, please contact me at <KB5NJD@gmail.com>.

Notes:

For your convenience the following links, in addition to bonus material, can be found at <http://njdtechnologies.net/cq>:

1. K1JT weak signal software page: <https://tinyurl.com/mmfjh38>
2. WSPR-X user guide: <https://tinyurl.com/cyxwzox>
3. WSPRNet: <https://tinyurl.com/kqk8lz>
4. RSGB-LF Groups.IO email list: <https://tinyurl.com/ydfsyke2>
5. WSPR-X download from GØLUJ's website: <https://tinyurl.com/y79rsmu2>



Bob Johnson, K9KFR, of Columbia City, Indiana, submitted this photo of a chart showing his worked grids on 630 meters, 96 of them at the time that this article is being written, and representing a pretty good distribution of stations in North America. For the would-be grid activator and grid chaser, there are a lot of possibilities on MF and LF. (Photo courtesy of K9KFR)

DIGITAL CONNECTION

BY DON ROTOLO,* N2IRZ

Alphabet Soup: ULS, FEC, IL2P

As I sit down to write this, social distancing is in full swing and the curve has been flattened. I am fortunate to be able to work from home, but so many of us cannot. All we can do is keep the curve flat so that the health-care system can cope, and hope that when (not if) we are infected, we're among the roughly 90% who have only moderate or mild symptoms. I've always been diligent about washing my hands well and keeping away from infectious things, so I'm not scared, just diligent and alert. As with many things, time will tell.

My license will be expiring soon, and so I thought I'd write a few words on the process of renewing it using that most digital of resources, the internet. Perhaps this article will come in handy for you now or in the future. Although ARRL members can fill out a form and have the League handle it for you, or you can fill out and mail an FCC Form 605 along with Schedule D, online renewal is faster and very easy to do yourself. If your license is less than 90 days from expiring, or has already expired (but less than two years ago), now is the time to renew.

The first step is to visit the FCC's Universal Licensing System (ULS) page at <https://bit.ly/2PVSE1w>. You can also start at the FCC's main page <www.fcc.gov> and click the ULS link to end up at the same place, seen in *Figure 1*.

Start with a search of your callsign, using the License Search at the bottom left. Type in your callsign, click "Search" and, on the page that shows the results, click your callsign. Here, verify your mailing address and note your FCC Registration Number (FRN), which you will need to log in to CORES (COmmission REgistration System — those government types sure do love their acronyms, don't they?).

If you are a new ULS user and don't have an FRN, you will need to first register with CORES to obtain one. This is quite easy but requires complete contact information and a Social Security Number. In the past, prior to FRNs, CORES used your SSN as a unique personal identifier. This was identified as a potential security issue, and the FRN system was created.

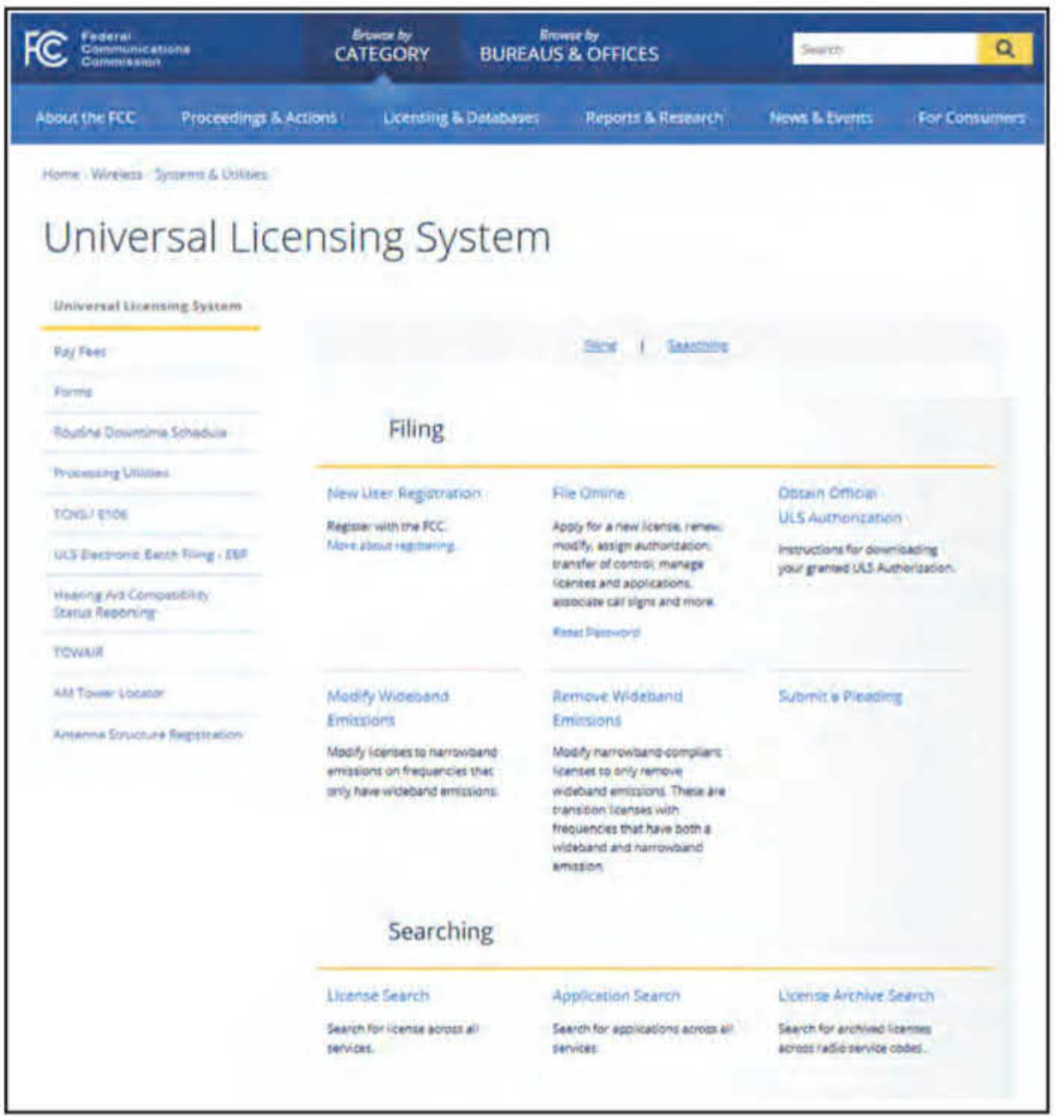


Figure 1. The FCC Universal Licensing System home page. This is the starting point for your license renewal, or to just download a PDF of your license. Some users will have to register with ULS to get started.

Back on the ULS main page, start your renewal filing by following the "File Online" link and log in using your FRN and password. You can reset your password if you've forgotten it. On the left, click "Renew Licenses." If your license is eligible for renewal, you'll see it listed on this page. If it isn't listed, either it is not yet 90 days before the expiration date, or it has lapsed for more than 2 years. You'll have to visit a license exam session to get yourself a new license.

Anyway, select the license you want to renew from the list at the left (usually just one), and "add" it to the list on the right, then click "Continue." You are presented with a list of questions to answer, after which your request for renewal can be submitted. Typical processing times for routine renewals are very short, hours or days.

If all you want to do is download or print a copy of your license, follow the link to "Obtain Official ULS Authorization." Log in to the License Manager using your FRN and password, and click the link "Request Duplicates." Select the license you want to download from the list at the left (again, usually just one) and "add" it to the list on

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

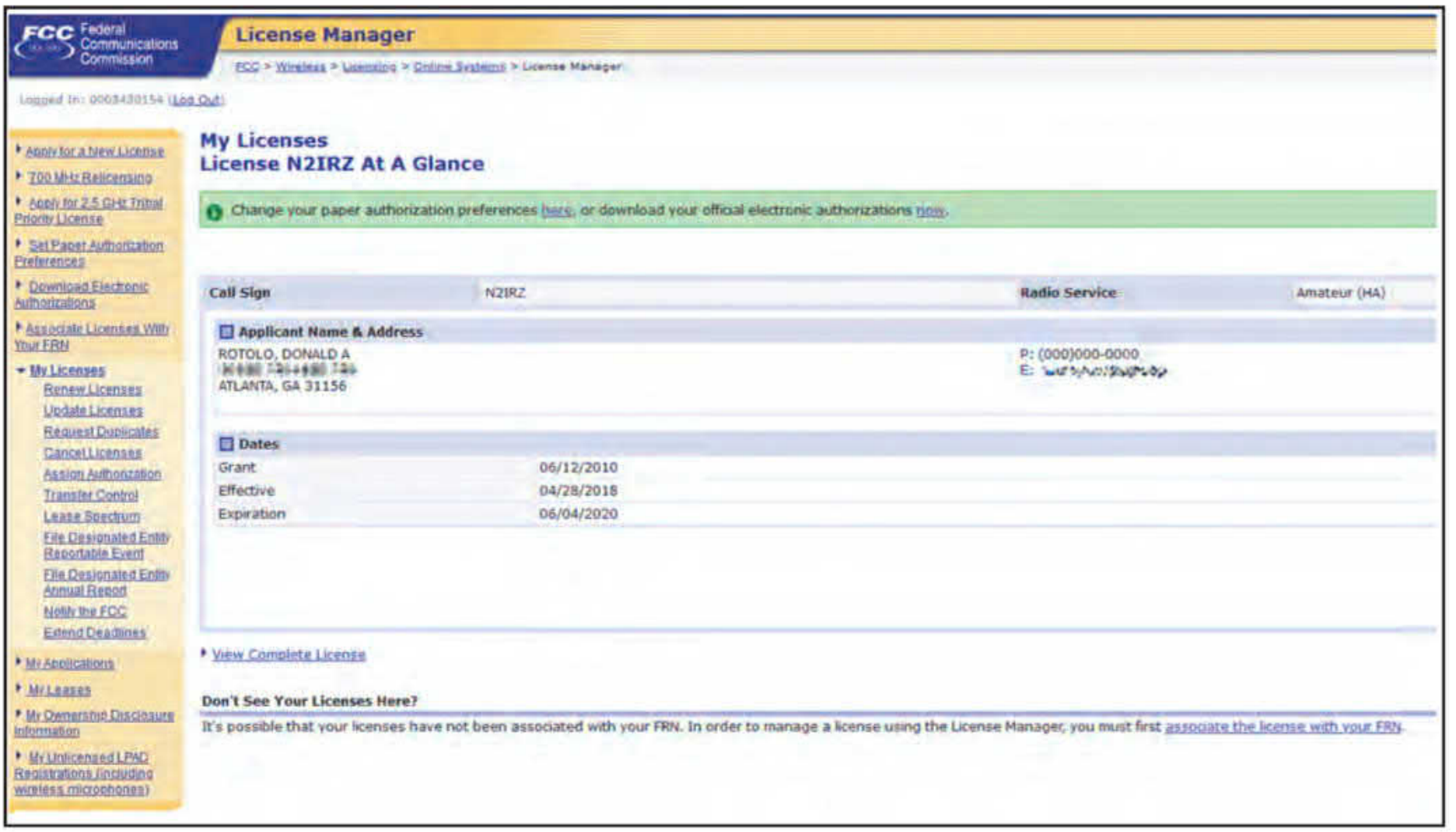


Figure 2. Here is my data record in the FCC's License Manager. The link in the green bar lets me download a PDF of my license, and a link at the left side starts the process of renewing my license, which will have expired by the time you read this.

the right, then click "Continue." Save the file as a PDF and you can then print it as many times as you wish.

Forward Error Correction

I've written in great detail before about Forward Error Correction (FEC), but I find a need to touch on it once again. Recently I have been writing about what is being called the NinoTNC, which is being adopted by the TARPN <www.tarpn.net> team. Designed by Nino Carrillo, KK4HEJ, this small packet Terminal Node Controller (TNC) has several innovative features that make it very attractive: The kit costs less than lunch at Chick-Fil-A, offers several data rates (especially the standard 1,200- and 9,600-baud operations, but not at the same time), uses a USB interface, has lots of blinking lights and — most relevant here — implements a new type of FEC.

The initial batch of 200 NinoTNC boards (version A2) with pre-programmed PIC went on sale in early March ... and promptly sold out, so fast that I was unable to buy a pair for hands-on testing. A second batch (version A3) was announced as I was writing this, so I placed my order for two of the boards plus pre-programmed PIC controller on Etsy <https://etsy.me/2Wn16dH> for

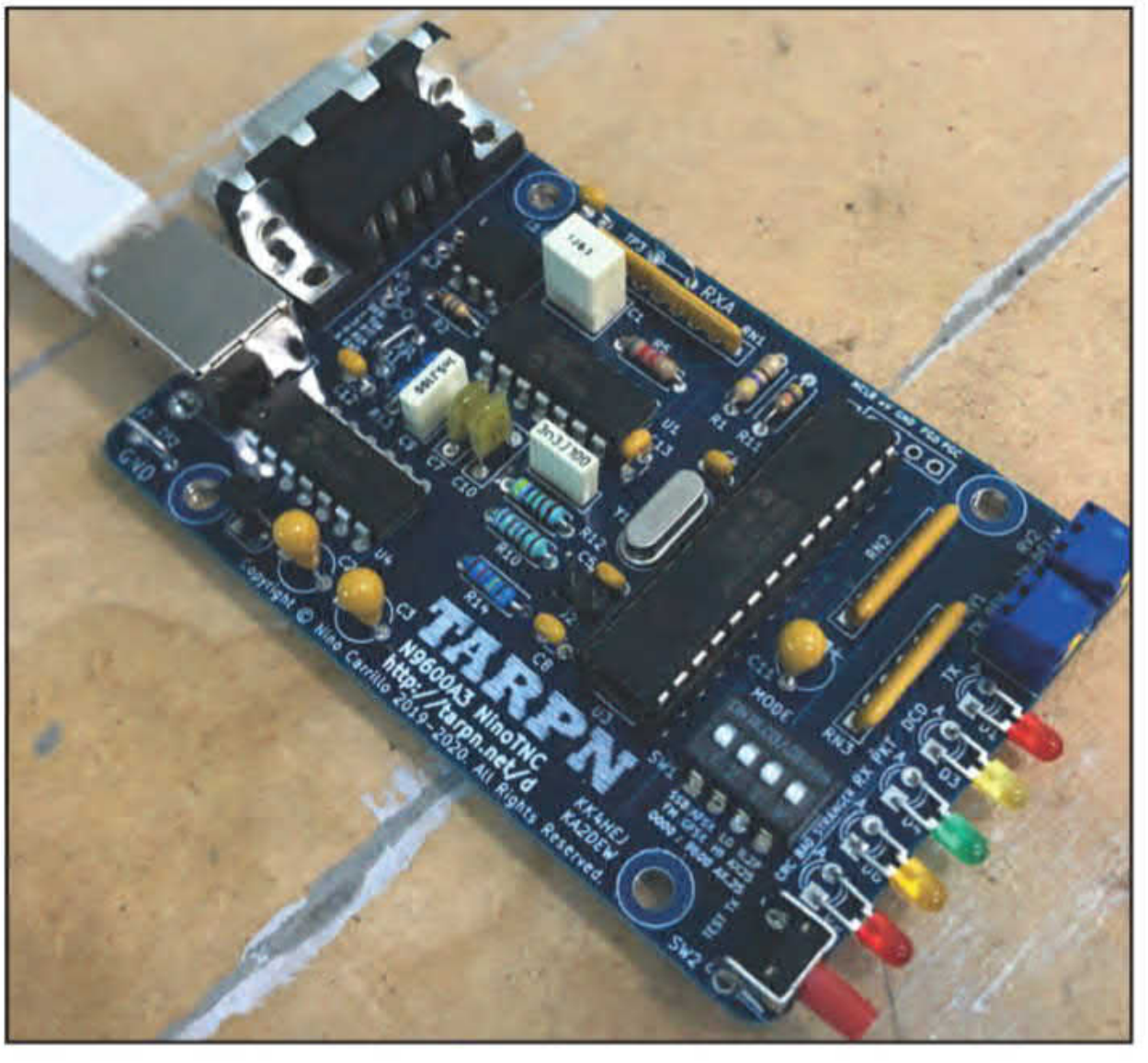


Photo A. The A3 version of the NinoTNC. Note the 4-position DIP switch at lower right, which is used to control the baud rate and protocol (AX.25 or IL2P). When using IL2P, both ends of the link need to have switch 4 "on".

```
r r
TADD:KA2DEW-2} Routes
> 1 NC4FG-2   200 12!1430  46  3% 0 0 21:20 0 200
> 2 KN4ORB-2  200 19!1350  78  5% 0 0 21:15 0 200
> 3 KA2DEW-3  200 16!1668 178 10% 0 0 21:18 0 200
> 5 KM4EP-2   200  3!1625  25  1% 0 0 21:12 0 156 note: 9600 with Kenwood TK8180
> 6 K4RGN-2   200 10!1788 607 33% 0 0 21:23 0 200 note: 9600 with Kenwood TK8180
  7 N2CGY-2   200  0!    0   0     0 0 00:00 0 0
> 8 N3LTV-2   200  8!1940   7  0% 0 0 21:11 0 200 note: 9600 with Tait TM8105
```

Figure 3. An example of the results of an [r r] command from the TARPN node named TADD at KA2DEW's location. See the text to understand what all these numbers mean.

US$7.57 each. I will also have to buy some components from DigiKey (or another supplier of choice) that might run me around $18 per TNC plus shipping, but I know I have some of these parts in the shack already.

The ability to run either 1,200-baud AFSK or 9,600-baud GMSK (G3RUH-compatible) data is a huge feature that has never been seen in a TNC before. The price — under $30 if you buy everything new — is also unprecedented. But the inclusion of FEC, that's above and beyond. Rather than explain how the FEC is done — you can read a PDF of that for yourself at <tarpn.net/t/il2p/il2p.html> — let's have a look at why this is such a big deal.

This isn't the first time Forward Error Correction has been developed for the AX.25 packet protocol. Nearly 15 years ago, FX.25 was released in a paper <https://bit.ly/2vm7gzX>, but was never widely implemented. Some say that FX.25's interoperability with AX.25 — you could send either kind of packet and it would be decoded — limited its efficiency and presented some other design challenges.

The NinoTNC implements a new protocol, called IL2P (Improved Layer 2 Protocol), and either you use IL2P on a given link or you don't. The efficiency is around 90% at a payload size of 234 bytes, and increases to a peak of just over 95% at a payload byte count of 988. Payload is the useful data being sent in a packet, which doesn't include the bytes needed for the rest of the packet.

In this case, efficiency means the percentage of payload data being sent versus the complete packet size. So for a 90% efficiency, 90% of the data is what you want to send, and the other 10% is (more or less) needed for everything else: Headers, parity, flags, addresses, error correction, and so on. On a packet link with excellent signal strength and virtually no retries, FEC will not make all that much of a difference, and might suffer a little bit because of the additional FEC data required. Conversely, on links that are a little bit noisy or prone to interference, FEC can dramatically improve the link's overall efficiency by actually correcting bit errors within the packet.

AX.25 packet is what is known as an "error-free" protocol: Any packet that arrives is checked for errors and, if any are found, the packet is not acknowledged by the receiver. This lack of "ACK" causes the sending station to re-send the packet until it is ACKed, or the connection fails due to excessive retries. This ensures that what is received matches exactly what was sent — error-free — which is very important when sending a file, for example. Other protocols like PSK-31 are not error-free and so, while perfectly fine for keyboard-to-keyboard ragchews, they are not suitable for file transfers.

In a perfect world, a packet received with an error would be re-sent immediately, without wasting time. But AX.25 needs to wait a little while before the transmitting station concludes that the receiving station is not going to ACK the most recently sent packet. If the errors in the received packet could be corrected at the receiving end — Forward Error Correction — this delay and waste of time is avoided. So we not only don't waste airtime re-sending the packet, we also avoid the waiting period for the ACK. During that time, perhaps three or more packets could be sent instead, moving more data, faster, which more than overcomes the hypothetical efficiency loss due to the additional bytes ("overhead") needed for the FEC.

What does this mean for the average packet networker? A link that doesn't work at all won't magically start working, but a link that is somewhat fragile now can become noticeably more robust. A link that seems to be performing well won't see much benefit however, although there won't be much detriment, either.

IL2P is a little better than typical FEC implementations, in that it compresses the packet header, enough to pack in the extra data required for the FEC without making the packet any larger (and in some cases, a little smaller) than a standard AX.25 packet. More on that in a moment.

ARRL / TAPR Digital Communications Conference to go Virtual

Every year a group of hams dedicated to the digital world make their way to the ARRL / TAPR DCC, a journey that every ham needs to make whenever it's being held within driving distance of the QTH. This year's was scheduled to be in Charlotte, North Carolina, close enough to Atlanta for me to make the trip. Alas, COVID-19 squashed that plan.

But what kind of digital hams would we be if we couldn't leverage technology and make this still happen?

On September 11-13th, the 2020 ARRL and TAPR Digital Communications Conference will occur online virtually, the same dates as originally planned for Charlotte. Visit <https://tapr.org/conferences> to register, and for details as they are released in the coming months. I was planning to attend regardless, and with my new experience working from home, I think we can pull it off seamlessly.

In *Figure 3* we see some example results of an [r r] command from the TADD node at KA2DEW. We see that the link to K4RGN has a 33% retry rate, with 607 packets out of 1,788 having to be re-sent due to errors. Contrast that with the link to N3LTV, which has an excellent 0% rate, needing only seven retries out of 1,940 information packets sent. (*Note that the K4RGN link has since been fixed, currently running around 3%. –N2IRZ*) What you should get from this is that only two or three of these links would benefit from FEC, although the rest wouldn't suffer from it. In fact, in some cases, there would be a very small improvement even on a near-perfect link.

So how *do* you get blood from a stone — Forward Error Correction AND a smaller packet? Compress the header. In AX.25, each letter of a callsign uses 8 bits, but IL2P uses only six. AX.25 uses the same 8 bits to encode the SSID, but with only 16 possible values, IL2P uses only 4 bits (half a byte, which is a nibble). Other parts of the header are also compressed, in a lossless way (meaning that no data is lost), leaving room for the FEC parity bits while still keeping the header the same size (or smaller). Free FEC!

In addition, if one uses open-squelch Data Carrier Detection (DCD) on a link, it is not uncommon to detect what appears to be the AX.25 8-bit flag (meaning "data is here") from the noise on the channel. IL2P uses a 24-bit (3-byte) syncword, much less likely to be mistakenly decoded, and so this serves as a more robust DCD method than standard AX.25. What this means in practice is that your DCD is more reliable, and so you are far less likely to lose the DCD because of the noise and transmit while the other end of the link is still sending data. Note that on high-performance packet links, the use of squelch DCD is not a best practice, since this is less reliable and slower to respond than "open-squelch" or data-based DCD.

All these features result in what is called *coding gain*. Coding gain is measured in decibels (dB), just like antenna gain or feedline loss. It is actual gain: 3dB of coding gain and a 3-dB increase in transmitting power are the same. So, good links will remain solid, while weaker links will improve. At this time, the actual coding gain from Il2P under various conditions has not been measured, but I am waiting anxiously for such measurements to be performed.

To set the IL2P mode on the TNC, you just flip a switch. But IL2P is not AX.25, meaning that both ends of the link, as well as anyone wanting to listen in, must be in IL2P mode. A regular TNC running AX.25 will decode only gibberish if anything at all. The NinoTNC, when in IL2P mode, will transmit a beacon identifying the transmitting callsign and a shortened URL link for information about the IL2P protocol.

IL2P is an open protocol, meaning anyone is welcome to implement it. Nino's paper has more than enough information for someone to do this. You can also ask Nino questions via email on the groups.io reflector <ninotnc@groups.io>. Indeed, that is exactly how got some of the material for this article.

Thank you to everyone who wrote to me after I set out the challenge in March to tell me what you want to hear about. Now in July, as we're sequestered to avoid getting sick, I ask you again to write and let me know what interests you, or something new you'd like to try. After many years of writing, I'm looking for something new to try, too. It would be great to hear from you.

– Until next time, 73 de N2IRZ

LEARNING CURVE

BY RON OCHU, KOØZ*

A Relative *Approach to Making Antenna Radiation Patterns*

Welcome to another installment of "The Learning Curve." Although this is the July issue, *CQ* editors submit articles two months prior to publication. Your editor has been busy moving from Illinois to Missouri amidst the viral outbreak. Not an easy task. Fortunately, I prepared ahead of time which made the move a bit more tolerable. Hopefully, you are healthy and faring reasonably well as America lifts the quarantine. I would like to thank all *CQ*'s readers for supporting our publication, and while I am at it, a big shout-out to everyone who's emailed me with comments. Your feedback is always welcome and extremely helpful. As regular readers are aware, this column is dedicated to "newly minted" radio amateurs. By the same token, this column can also serve "seasoned" hams by offering a new perspective, or renewing interest on an interesting topic. With that in mind, let's take another look at a topic that is sure to be near and dear to every radio amateur's heart — the antenna.

Antennas

Any ham who is "radio-active" understands the importance of an antenna. An antenna is the device that couples a transceiver's radio emissions through free space to another radio amateur's antenna. No antenna, no contacts. The more efficiently our antenna radiates signals, the more success we'll have communicating with someone beyond our own backyard.

Antenna Efficiency

Antenna efficiency is a subject worth delving into for every radio amateur. According to the AntennaTheory.com website <https://tinyurl.com/y8z9rauq>, antenna efficiency is defined as "a ratio of the power delivered to the antenna relative to the power radiated from the antenna. A highly efficient antenna has most of the power present at the antenna's input radiated away." In other words, if power (watts) being radiated from the antenna is close to the same as power (watts) feeding into the antenna's input via coax, then you have one heck of an efficient antenna.

I'm not aware of any antenna that is 100% efficient. Losses in feedline, connectors, impedance matching network, and the antenna's metal elements (*Photo A*) all add up to resistive losses that convert into heat and subsequent loss of efficiency. Still, designers strive to reduce those losses and to put more

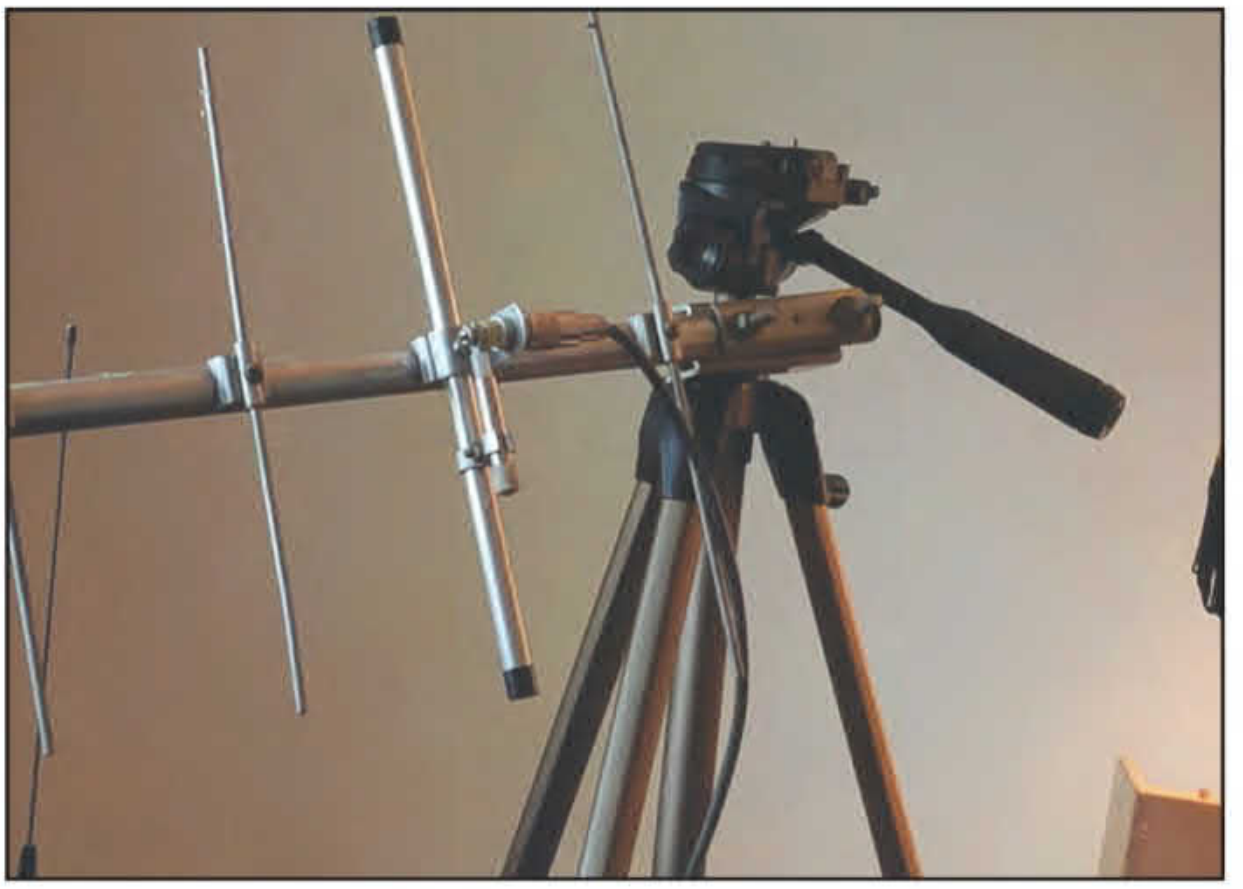


Photo A. A 70-centimeter, gamma-matching network on a small Yagi antenna. Matching networks introduce some losses. (All photos by KOØZ)

Photo B. Mark Thorson, WBØTEM, long-time Central States VHF Society VHF-UHF antenna range guru, busy measuring an antenna's gain.

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

signal into the ether from their "skyhook" designs.

Antenna Ranges

Curious radio amateurs may be asking, "just how can I measure my antenna efficiency?" That is an exceptionally good, but "loaded" question. It's a loaded question because there are a lot of dynamic factors in play, such as which bands are being tested, antenna size, availability of calibrated laboratory equipment, use of a calibrated reference antenna, ground losses, antenna under test, height above ground placement, etc.

Wow, that's a lot to digest isn't it? Basically, it all depends on desired accuracy and precision by controlling variable factors. Professional antenna designers will use an *antenna range* to conduct measurements. Typically, a professional antenna range will have a calibrated reference antenna, a known range, known ground conductivity, laboratory-grade measuring devices, and a team to record every measurement and adjustment.

Most radio amateurs don't have the resources for or access to a professional antenna range, but reasonable and accurate ranges can be made, especially at various VHF (very high frequency) conferences such as the Central States VHF Society (*Photo B* and *C*). Usually, an open field or asphalt parking lot is pressed into service to serve as a range at the conference. (*These locations should be free of any obstructions such as trees, homes, cars, etc. –KOØZ*). At one end of the parking lot, approximately 50 yards away from the test point, a reference antenna of known gain for the band / antenna being measured is positioned. This known reference antenna will be the signal source that will transmit a low-level signal along with a 1,000-Hz tone.

The antenna under test (AUT) is mounted on a mast and connected to a nearby power meter to test forward gain in decibels (dB). There is also a speaker that allows the 1,000-Hz tone to be heard, giving the person holding the AUT mast feedback as to where to point the antenna for maximum pitch and loudness. Front-to-back ratios can easily be determined by pointing the AUT in the opposite direction (180° from the original heading) and obtaining a reading.

Measuring HF (high frequency) antennas requires more free space as compared to VHF, UHF (ultra high frequency), and microwave antennas for more accurate results. Various obstacles in the path may affect the results.

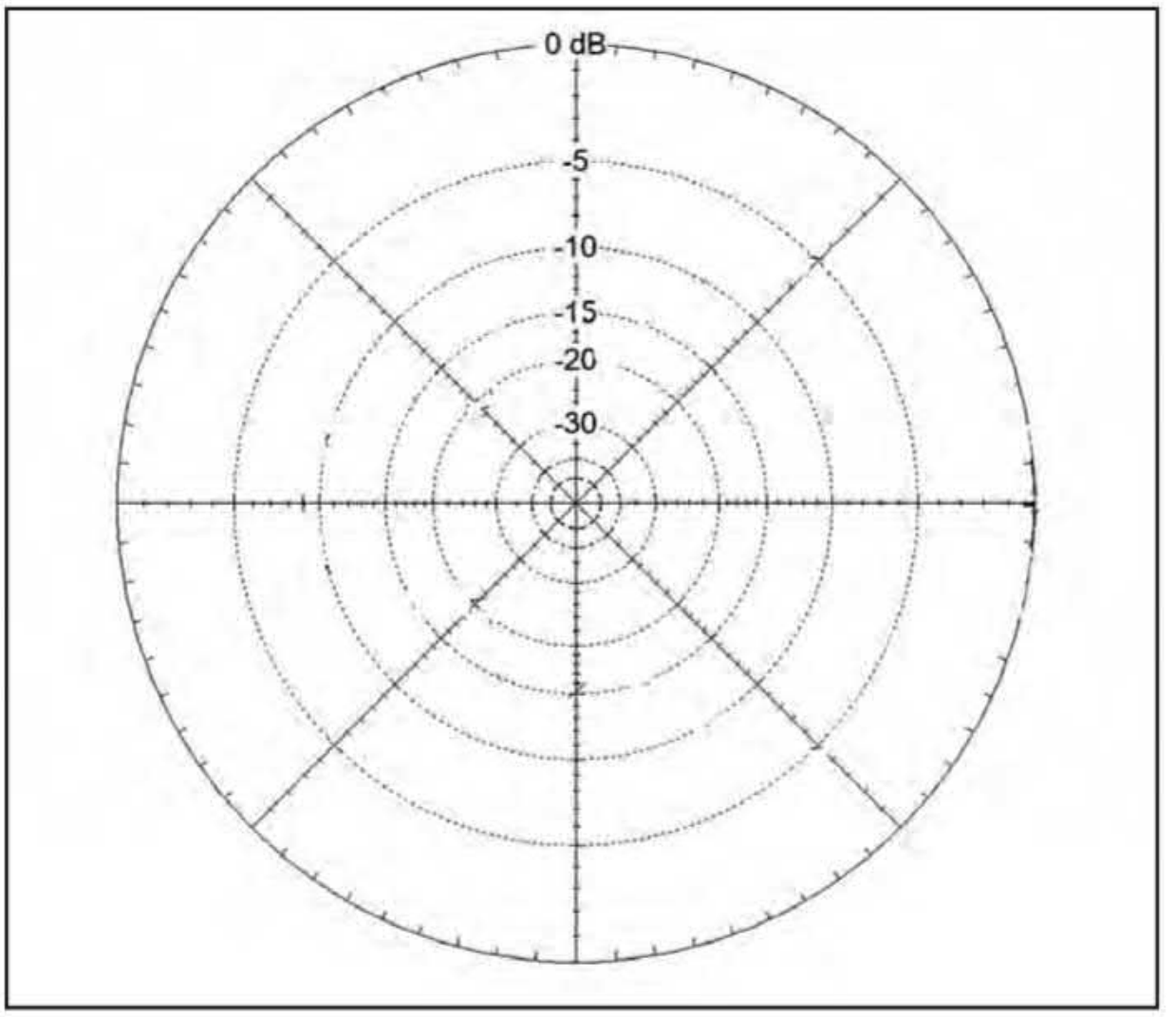


Figure 1. An antenna radiation pattern worksheet. Note the concentric circles surrounding the X- and Y-axes.

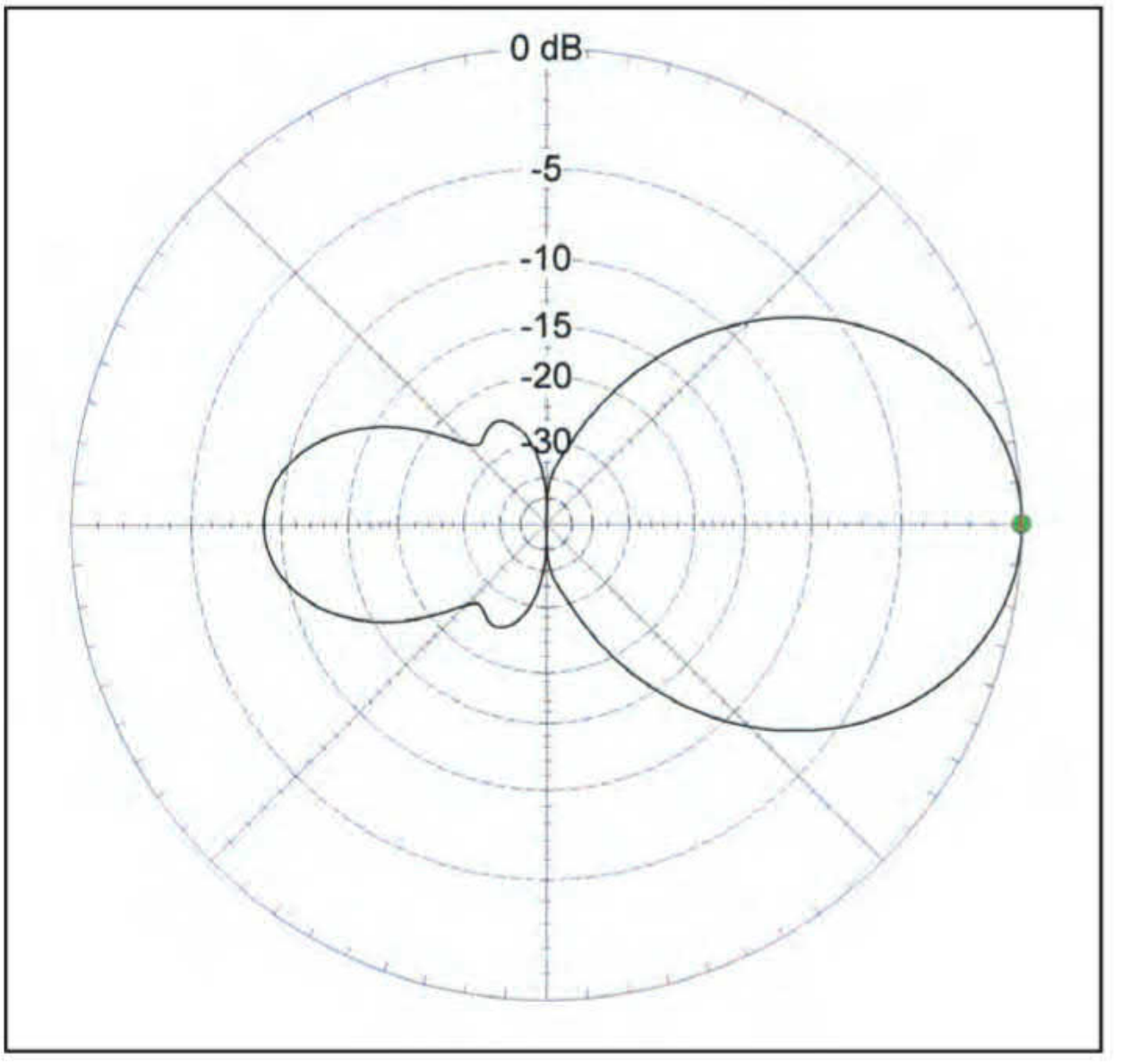


Figure 2. Azimuth antenna radiation pattern for a 6-meter Yagi antenna. This Yagi exhibits forward gain and it's indicated by the large lobe pointing right along the X-axis. (Image from EZNEC)

On the other hand, data obtained from measuring those obstacles can serve to provide a somewhat more accurate picture of the antenna's actual performance in that location. So, how can the data from a ham radio antenna be presented in some usable form? One of the most common forms is to plot data on an *antenna radiation pattern graph* (*Figure 1*).

Antenna Radiation Pattern Graph

Antenna radiation pattern graphs come in two flavors: Azimuth and elevation. An *azimuth* radiation pattern will show an antenna's horizontal radiation pattern (*Figure 2*). Picture it as if you had a bird's eye view of the antenna and you could see the radio waves leaving the antenna and traveling along the ground.

The other radiation pattern is the *elevation* pattern (*Figure 3*). Imagine looking at the antenna at ground level and seeing the radio waves leave the antenna and climbing in height with distance. A broadside view of the antenna, if you will. An elevation pattern is useful for determining take off angles. Typically, a low angle take-off radiation pattern is useful for working DX (long distance). For our discussion, though, let's focus on the azimuth radiation pattern.

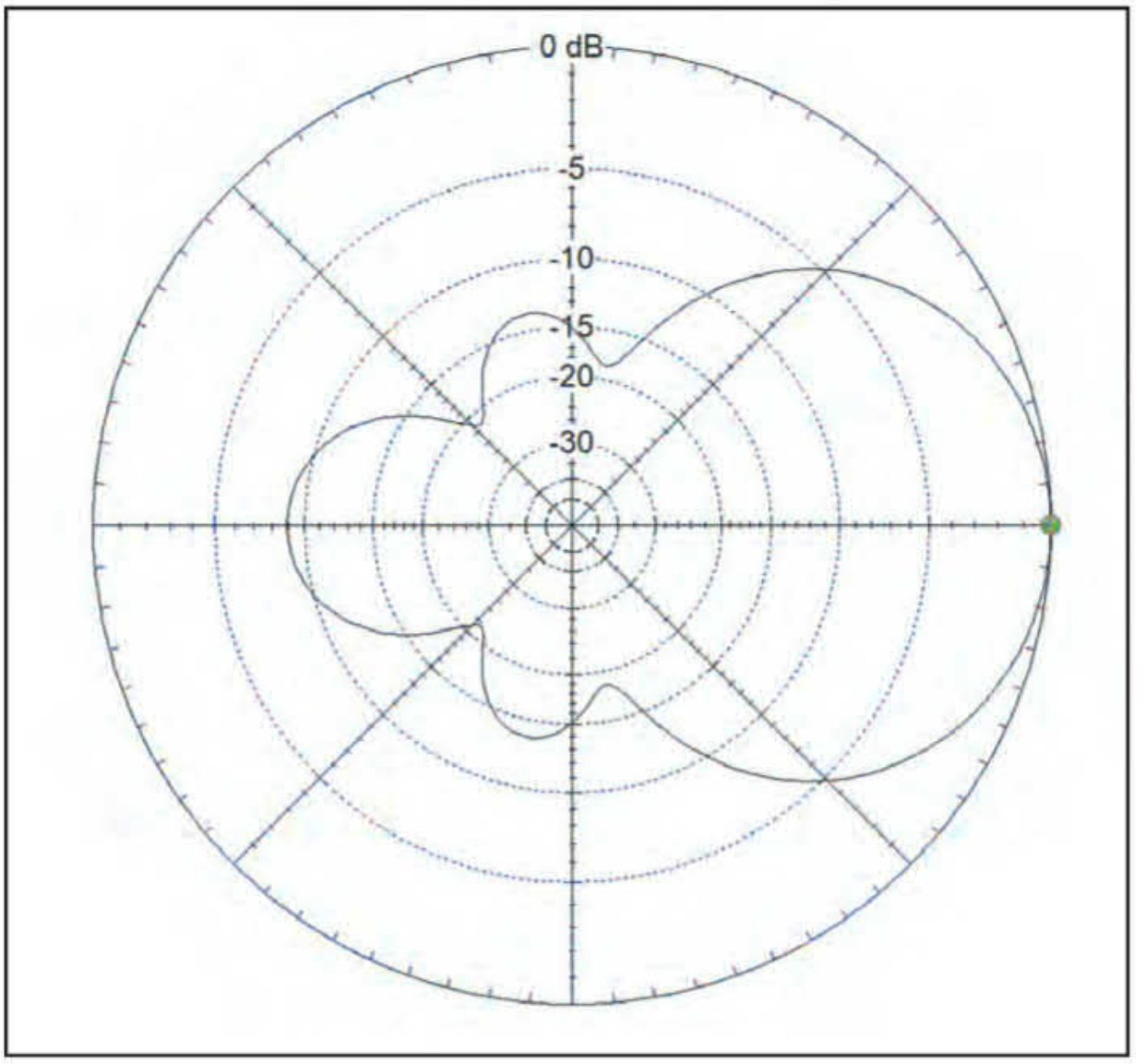


Figure 3. Elevation antenna pattern of a 6-meter Yagi. This pattern is useful for seeing signal take-off angles. (Image from EZNEC)

Azimuth Pattern

Taking a closer look at the antenna radiation pattern in *Figure 1*, we see this pattern is similar to the one generated by the antenna modeling program EZNEC. Looking at *Figure 1*, please note there's a big circle with concentric circles inside it becoming increasing smaller in circumference as they approach the center of the larger circle. An artesian graph is also present inside the circles. Along the Y-axis there are numbers ranging from -30 to 0 dB (decibels). On this pattern sheet, 0 dB represents a strong signal and -30 dB a significantly less strong signal being radiated from the antenna. As a signal is transmitted by the antenna, data points are recorded on the graph.

Figure 2 depicts a 6-meter Yagi's azimuth radiation pattern. Notice that the strongest signal is along the X-axis towards 90°. The signal is symmetrical along the X-axis that indicates proper RF (radio frequency) current distribution throughout the antenna. Note there are two nulls along the Y-axis where it meets the X-axis. There is also a smaller lobe heading 270° along the left side of the X-axis. This smaller lobe is the backside of the Yagi antenna. The main

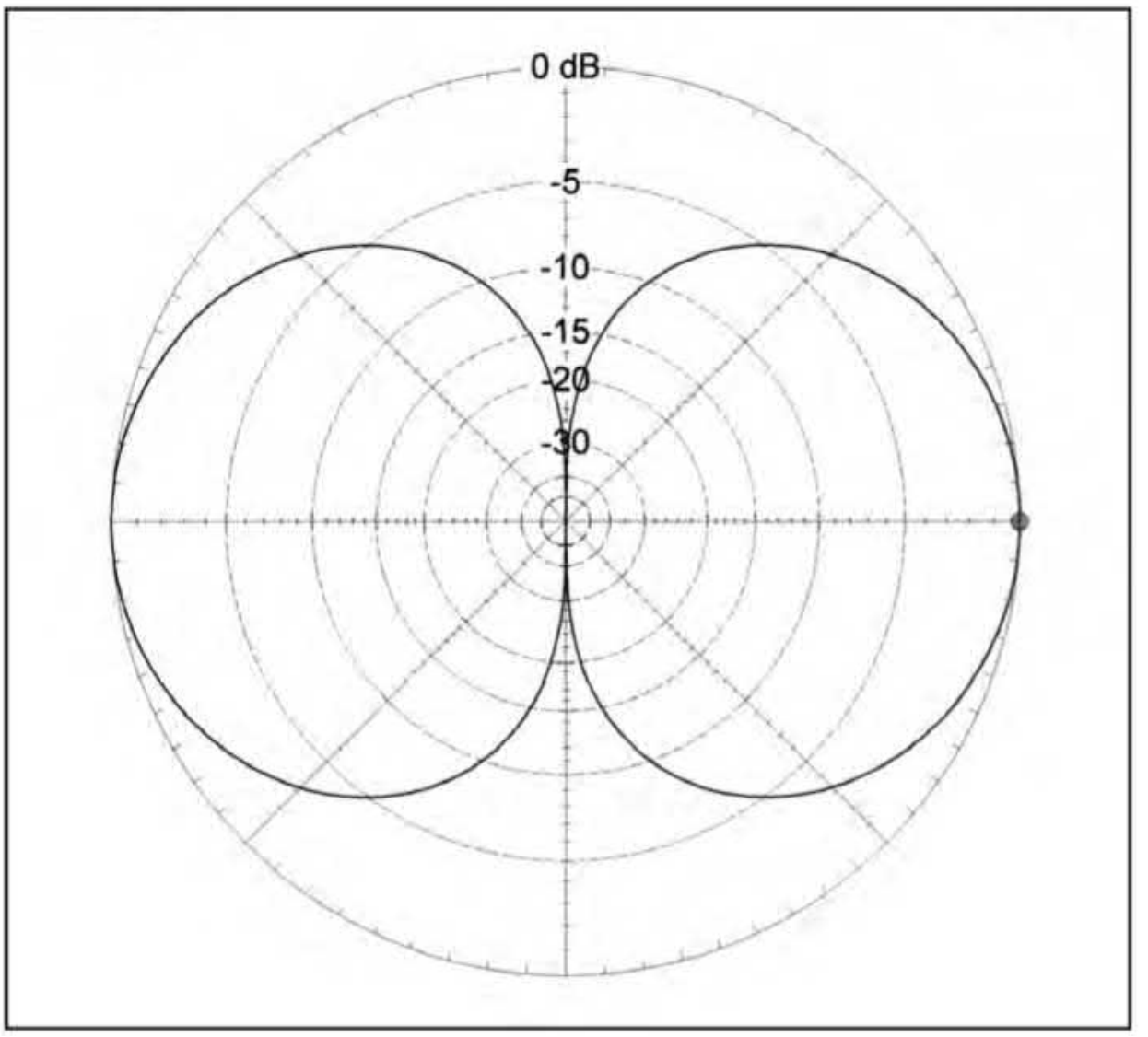


Figure 4. Azimuth antenna radiation pattern for a 2-meter dipole antenna.

NEW!

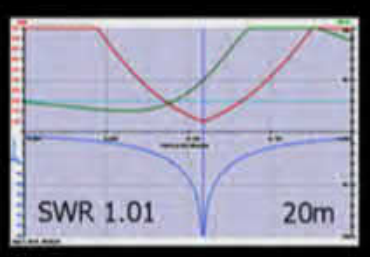
Step up to Top Performance with the HG3 Stepper Mag Loop!

The new HG3 stepper tuned Mag Loop Antenna (MLA) sets a new standard delivering unprecedented capability in remote tuning, performance and convenience for an MLA. It employs a proven, accurate and repeatable stepper motor design. Band selection, remote tuning, including optional loop rotation, is controlled via a microcontroller driving a high resolution stepper motor.

A built-in digital SWR bridge provides auto-tuning based on an SWR scan. This ensures compatibility with most radios. Manual tuning uses a convenient rotary encoder knob - no more finicky push buttons. The four-line LCD displays band selected, SWR, ERP, Cap value and more. The bottom line - count on top-notch RX and TX performance!

KEY FEATURES

- STEPPER MOTOR ACCURACY
- CONVENIENT REMOTE TUNING
- DISPLAYS BAND, SWR, ERP & MORE
- QUICK BAND SELECTION
- AUTO-TUNING BASED ON SWR
- 80m - 10m COVERAGE AVAILABLE
- NO COMPROMISE SPOT-ON TUNING



A precise LC match at the desired frequency ensures spot-on tuning (red SWR, blue RL, green Z) and minimizes mismatch losses within the MLA's specified frequency range.

preciseRf
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Patent pending

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Photo C. CQ Antennas Editor Kent Britain, WA5VJB, longtime CSVHFS and Microwave Update UHF-microwave antenna range guru, testing antenna gain.

lobe (radiation pattern) is alongside the right-hand side of the X-axis or 90°. This Yagi exhibits forward gain and it does have some front-to-back rejection. In other words, this directional antenna offers forward gain, but it also has a significant rear lobe. So, there is some signal rejection from the rear of the Yagi, but it isn't as great as a Yagi with more elements and different spacing. A lot can be gleaned from looking at a pattern.

Data Collection

Hopefully, my discussion is making sense and I haven't confused you. Going back to our antenna range, we have a calibrated reference antenna, let's say 2 meters, of known gain, at one end. At the other end is the antenna being tested, let's say a 2-meter Yagi. A low-level signal is fed into the reference antenna and an RF (radio frequency) voltage is induced into the Yagi antenna that is being measured. There are several ways to make measurements of the received signal. Measurements can be made with a calibrated power meter (*Photo D*), a spectrum analyzer (*Photo E*), and even a field-strength meter (*Photo F*) connected to the AUT. Warning, if using a spectrum analyzer be sure to include enough attenuation between the antenna and the analyzer to prevent overloading the analyzer and burning out its receive circuitry.

The AUT should be aimed at the reference antenna while receiving the transmitted signal from the reference antenna.

Photo D. An older commercial grade RF power meter can often be found at VHF conferences.

Take a measurement from the meter and record it. This process will continue for 360°. By rotating the antenna under test 360°, the received signal's strength will be plotted out; thereby giving a graphic representation of the antenna's radiation pattern.

Another method is to simply reverse this procedure by having the AUT do the transmitting and use the reference antenna of known gain as the receiving antenna with the meter attached to it. Always use low-power levels to prevent overloading and put distance between the two antennas and don't forget to include attenuation; especially, if using a signal analyzer or a FS meter with signal amplification.

Practical, Backyard Application

Now that we have some basic information, how can this be practically used? Wouldn't it be fun to determine the relative radiation pattern of an antenna, especially one you've built? The operative word in the prior sentence is *relative.* Not having a professional antenna range, calibrated antennas and calibrated laboratory meters, you will not get precise, totally accurate data.

However, with a little ham radio ingenuity and a can-do attitude, a relatively reasonable antenna radiation pattern can be obtained. RF field-strength (FS) meters like the old Heathkit Model HD-1426 in *Photo F* can be used. However, they can be sensitive to the HF spectrum, but far less sensitive to VHF / UHF frequencies. It is possible to get a reading at UHF frequencies using this FS meter, but the transmitter needs to be relatively close to the meter. A better idea would be to build a FS meter with components sensitive to VHF / UHF frequencies. The detection diode is the primary component in a FS meter that detects the field strength's sensitivity. Of course, tuned circuits and amplification further aid the usefulness of the FS meter.

Commercial FS Meters

MFJ manufactures the MFJ-801 FS meter, usable from 100 kHz to 500 MHz. The ham radio dealer, GigaParts, had this to say about the meter on its website: "This easy-to-use MFJ antenna meter shows the strength of the actual field being radiated from your antenna. You can use it to determine the basic radiation pattern of your antenna and see which direction your signal is strongest. You can make changes to your antenna and instantly know if it radiates better or worse. You can compare one antenna to another find out which one radiates the strongest signal.

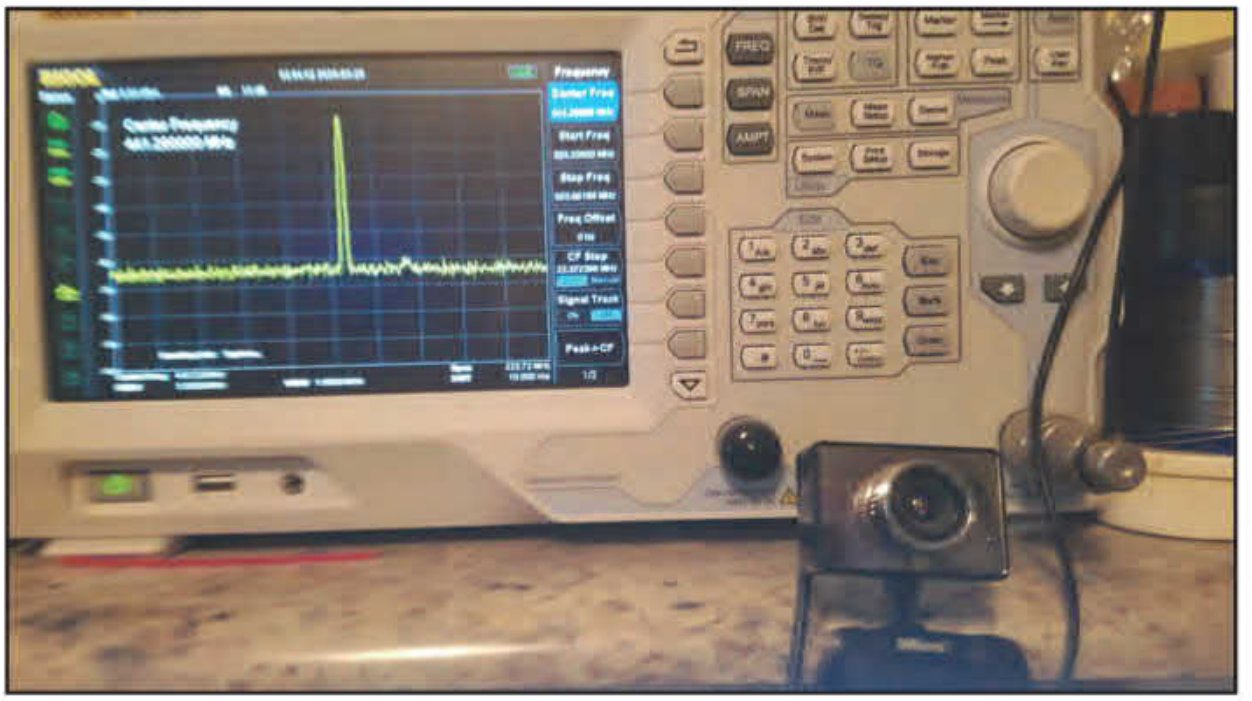


Photo E. A Rigol spectrum analyzer is a very useful, but pricey, test bench accessory indicating the presence of RF.

Measure your HF antenna now and compare it later to make sure its performance is still up to par. Adjust a ground lead, artificial ground, counterpoise, or tune your transmitter or antenna tuner for maximum field strength. You can check for RF floating around the shack that may be caused by faulty antennas or poorly shielded equipment. Demonstrate the concept of gain or antenna polarization. Find hidden transmitter bugs at your office or house."

For the DIY (do it yourself) crowd, go online and Google "VHF field-strength meters" for schematics that use easily obtainable parts found in a lot of junk bins.

By far, field strength meters are the most affordable measuring test gear available to hams for relative FS results. Please keep in mind the word *relative* results. While eBay offers 100-kHz to 1000-MHz FS meters, I haven't used any of these products, but their prices are inexpensive and certainly worth experimenting with. I have used Heathkit meters and homemade FS meters. The key objective is to place the reference antenna far enough away from the AUT to avoid nearby obstructions, and still get a usable reading at the meter.

Photo F. A very old Heathkit field-strength meter.

Procedure

Procure a suitable field, clear of any nearby obstructions, especially metal ones such as lamp posts, metal siding, etc. Next, build a reference antenna for the band / antenna of interest. For example, build a simple 2-meter dipole antenna. Each element should be 19 inches long. A 70-centimeter dipole would have two 7-inch elements. These homemade antennas are not calibrated for gain, but they will suffice for *relative* readings.

Attach low-loss feedline, such as 75-ohm TV coax, to the reference antenna and run it back to your FS meter. If your FS meter doesn't have an external antenna connection, one can be added to the case and appropriate connections made inside. Another option would be to place the FS meter on a non-metallic chair, adjust the telescoping whip to the correct length for the band, remove yourself several yards away from the meter and use binoculars to read the meter during a test.

Take the antenna to be tested and put it on a non-conductive mast several feet off the ground and aim it directly at the reference antenna. Key up the transmitter using a low-power setting and note the meter's reading. Move the reference antenna closer to the antenna being tested until you get a full-scale reading. Make sure you're out of the way when the transmitter is keyed. I like to make this reading due north or 0° on my paper. Note the full-scale reading on a sheet of paper. Keep the transmitted low-level power **consistent** throughout each transmission. Now move the antenna 45° to the right of the reference antenna and take a reading. Note the FS meter reading and record it on a sheet of paper. Do this again at 90° (east), 135°, 180°, 225°, 270°, and 315°.

You now have your *relative* data points that can be plotted on the antenna pattern sheet. Instead of 0 dB, may I suggest you make it your full-scale reading from the meter. If full-scale is 10 on your meter, then make 0 dB on the antenna pattern chart equivalent to a "10." Calibrate the Y-axis accordingly. You get the idea. I must point out that the chart's concentric circles represent decibels, which are logarithmic functions. What I'm proposing is making the chart more of a linear function that will render our chart less accurate, but it will give you a ballpark idea of the anten-

na's radiation pattern. The FS meter is way too imprecise to give accurate dB readings. That's why I titled this article a relative approach to making antenna patterns. Yes, for the purists, the resulting pattern will not be precise, but it will reasonably indicate directional antenna characteristics, front to back ratio, and nulls.

Charting it Out

Once your antenna pattern worksheet in "calibrated" to your FS meter, it's time to take your data sheet and to plot out the data points. The first point will be the full-scale reading on your meter and you'll place that point directly on the Y-axis at the full-scale number on your chart (0 dB) on *Figure 1*. Now place your second point (reading) on the 45° line that lines up with the relative numeric value from your data sheet. Do the same with the 90° point and so on with the remaining points. Now, connect the dots and you should have a relative antenna pattern before your eyes. A directional antenna should look something like *Figure 2*. A dipole pattern should look like *Figure 4*.

Nothing Beats Data

Congratulations, you've plotted out your very own relative antenna pattern. From this pattern, you should get an idea about forward gain, nulls, and front-to-back ratio. If the 180° reading is close to the 0° reading, then your directional antenna is acting more like a dipole and something is amiss with the antenna. Experiment by adding a few more elements to the Yagi and measuring the results. Why not increase the Yagi's boom length and element spacing and check out the results? If you're testing a simple dipole antenna, measure a longer dipole (3/4-wavelengths long on each leg instead of 1/4-wavelength) against the reference antenna and check the pattern.

This can become a fun club project and it will give everyone a better understanding of antenna radiation patterns. Once again, keep in mind that antenna pattern charts are logarithmic, and my approach is linear so the plotted data will be skewed, but it is still fun to plot out your very own relative antenna patterns without having to rely on expensive, laboratory-grade equipment. I'd be curious to hear from readers who are willing to try this activity. Please send me your patterns and any stories associated with your experimentation.

– Thank you for reading CQ *and I wish you very 73, Ron KOØZ*

GORDO'S SHORT CIRCUITS

BY GORDON WEST, WB6NOA

Backyard Lockdown!

Plus Summertime Tropo for VHF / UHF DX

Last April and May, COVID-19 confined most of us to home-QTH operation. Many of us had lots of spare time to work over our "grab and go" radio bags, although the mandate was NOT to go ... *anywhere*. For most of us during the pandemic, the backyard would be the safest GO-TO proving ground for portable radio operation check outs!

Many emergency communicators have switched from their small 12-volt sealed lead acid (SLA) portable battery to the lithium iron phosphate battery (LiFePO4). Here is why: The typical grab-and-go bag 12-volt DC lithium iron phosphate battery, about the size of a brick, is about *half* the weight of a same-sized small SLA battery. But that's not all.

The lithium iron phosphate battery will pack twice the stable energy of a lead-acid battery of the same weight. With the LiFePO4 battery cells, oxygen is bonded tightly in the phosphate bonds, with the protection circuit module (PCM) also providing thermal protection.

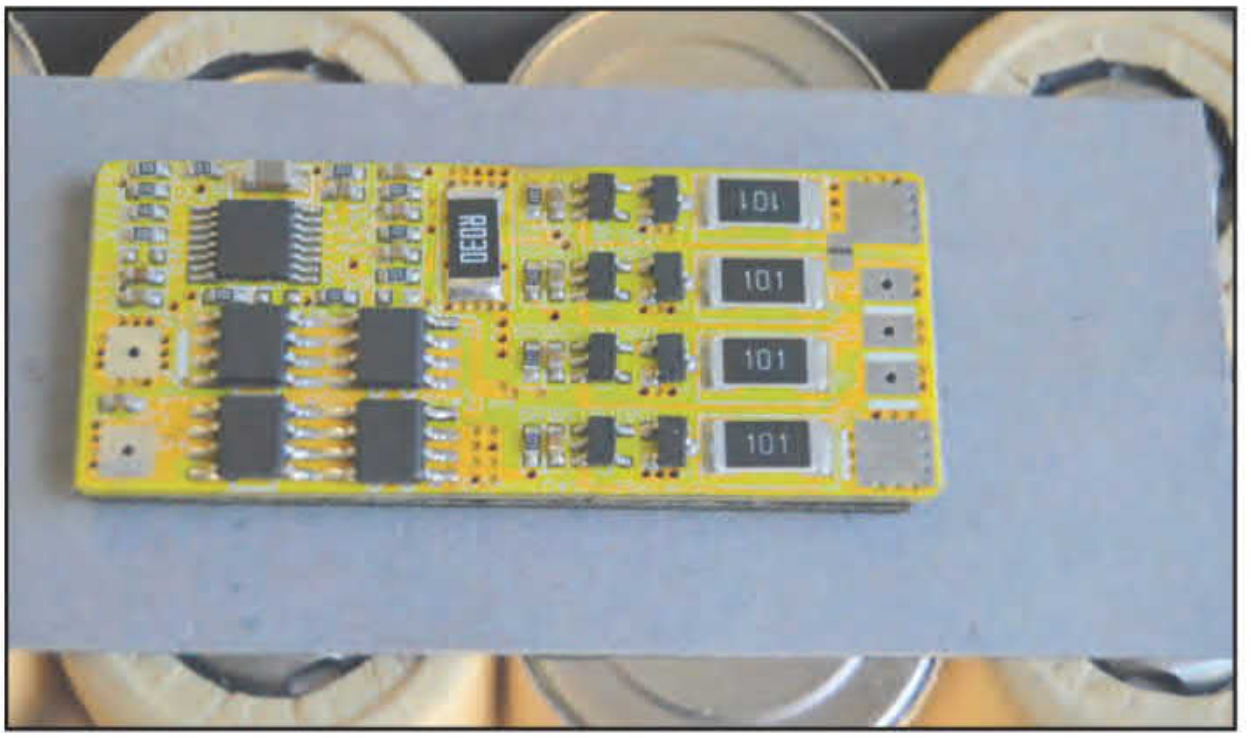
Most small lead-acid batteries will begin to show a significant drop in voltage, on radio transmit, when reaching 50% discharge. The LiFePO4 will hold a steady voltage to about 12.9 volts on radio transmit down to 80% of discharge. While 25-watt, dual-band mobile radios can tolerate a lead-acid battery voltage dip down to about 12.0 volts, any high frequency rig on a regular lead-acid battery will likely go in to distortion on transmit at 12.0 volts DC. In addition, the small lead-acid battery may only take 200 to 300 recharges. The LiFePO4 battery will take up to 2,000 recharges.

Accidentally shorting out a small go-bag lead-acid battery could result in toxic venting and possible fire. Even overcharging a small lead-acid battery could toast your grab-and-go setup completely.

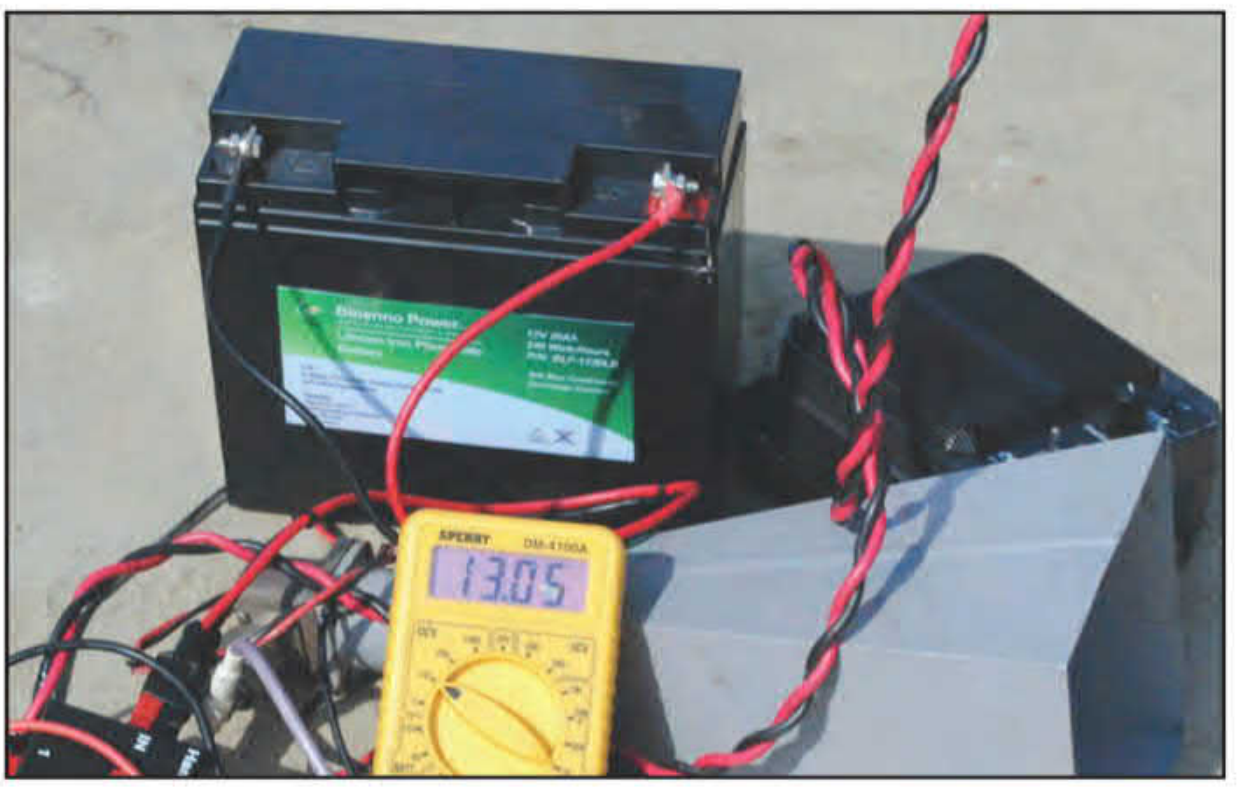
LiFePO4 batteries from Bioennopower (.com) and others have a built-in PCM to prevent over-current charging, over-

*CQ Contributing Editor
2414 College Dr., Costa Mesa, CA 92626
e-mail: <wb6noa@cq-amateur-radio.com>

Lithium iron phosphate (LiFePO4) batteries offer more energy and half the weight compared with traditional lead-acid batteries.



All LiFePO4 batteries include a protection circuit module (PCM), such as this one from Bioenno Power.



I use the 12 amp-hour (Ah) LiFePO4 battery during a day of microwave contacts.

When going maritime mobile, I need a single battery that will power my microwave gear all day at sea. A 12-Ah LiFePO4 works great for this operation.

discharge condition (short), thermal protection needing shut down, internal cell battery equalization, and shut down when it senses low voltage at the end of the weekend's use.

During my "short it out" tests, the LiFePO4 simply drops out of the circuit. Not even a spark. To reset it, just reconnect to any charged 12.8-volt DC battery and it springs back to life.

Over Voltage!

On one sunny day, I decided to try a direct-from-a-*small* 500-milliamp (1/2-amp max) 12-volt solar panel connection to give my grab-and-go bag LiFePO4 battery a small boost. The LiFePO4 instantly shut down. Why?

Even small solar panels have an open circuit voltage around 18 volts in direct sunlight, until a battery load is connected. As soon as the battery's protection circuit module saw this 18-volt no-load voltage, it instantly shut down the battery circuit. Voltage regulators are the answer, but if you are in the field — or backyard this spring — shade a few cells on the solar panel, connect the LiFePO4 battery, slowly unshade the panel, and the LiFePO4 battery will enjoy the charge.

In the snow or freezing weather, LiFePO4 will continue to put out the volts and amps, down to 10° Fahrenheit. The lead-acid battery won't perform well in freezing weather conditions.

There's Always a Catch…

Downside to lithium-iron battery technology? Their cost is about $10 per ampere hour capacity — a 12-Ah LiFePO4 battery, with built-in protection circuit module, costs about $140, but is well worth the investment for emergency communicators needing a dependable and lightweight go-bag battery system. Choose the 12-Ah for VHF / UHF mobile gear, or the 20-Ah LiFePO battery (around $230) for running a 100-watt HF rig with ease. The 20-Ah battery kept me going on Field Day last year for a full day of operation.

This LiFePO4 battery technology will also accept up to half the Ah capacity for fast charging, ensuring a 14.8-volt max is not exceeded. The PCM will take it out of circuit at 15 volts DC charging.

Tropo Time!

July and August are fun times to out-do the normal range of your local repeaters on 2 meters, 222 MHz, and 70 centimeters. Most repeaters, non-linked, will give us 50+ miles of coverage on a normal weather day.

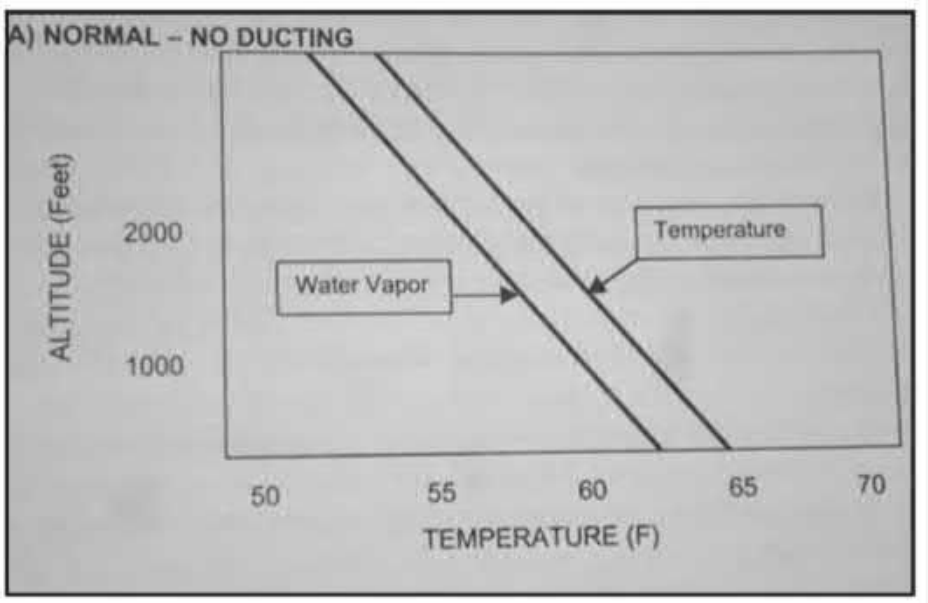
But what's that chatter also coming in on your local repeater output, when your repeater is not in use? Hmm … someone else put up a repeater smack-dab on your coordinated pair?

Keep listening — strange, you are in 5-land Texas, but after your local repeater drops its carrier, you hear two 4s talking about the weather in Key West! Key West, *Florida*? On 2 meters?

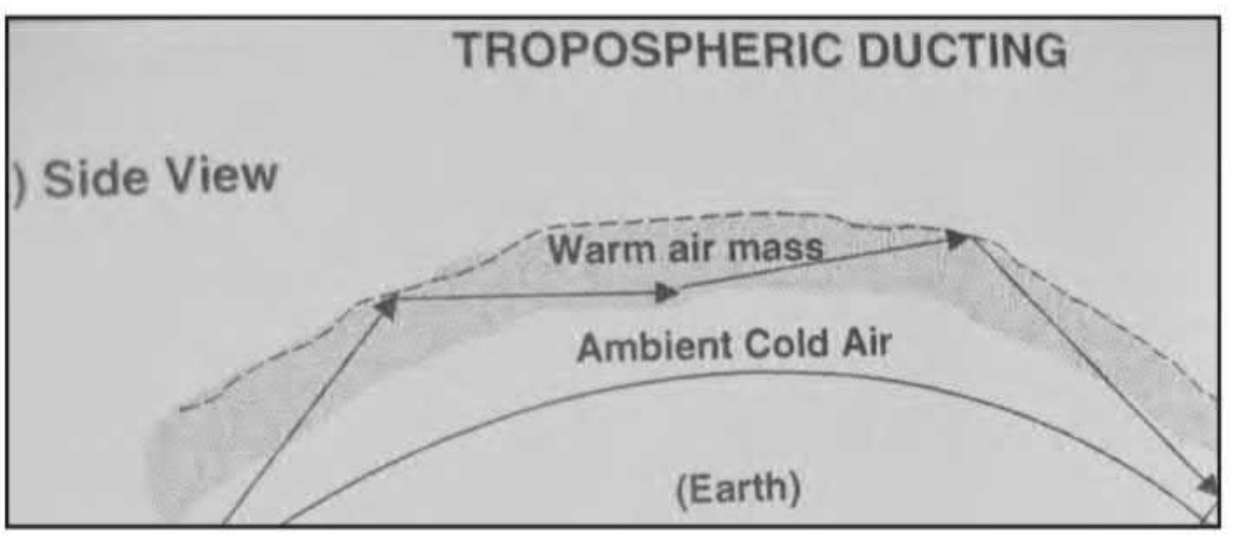
Yes, but not from sporadic-E (E_s) skip. Not from satellite, nor moonbounce ... it's the *weather*!

In July and August, the annual summertime atmospheric high-pressure cell drifts in from the west coast over the

My HF radios ran on the internal 20-Ah LiFePO4 battery for a weekend, with 12 volts still to spare!

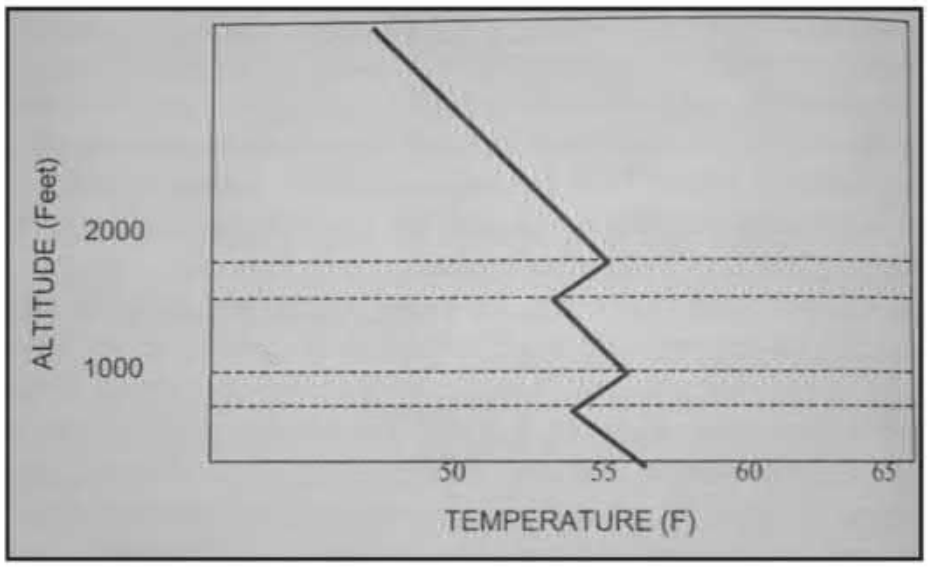


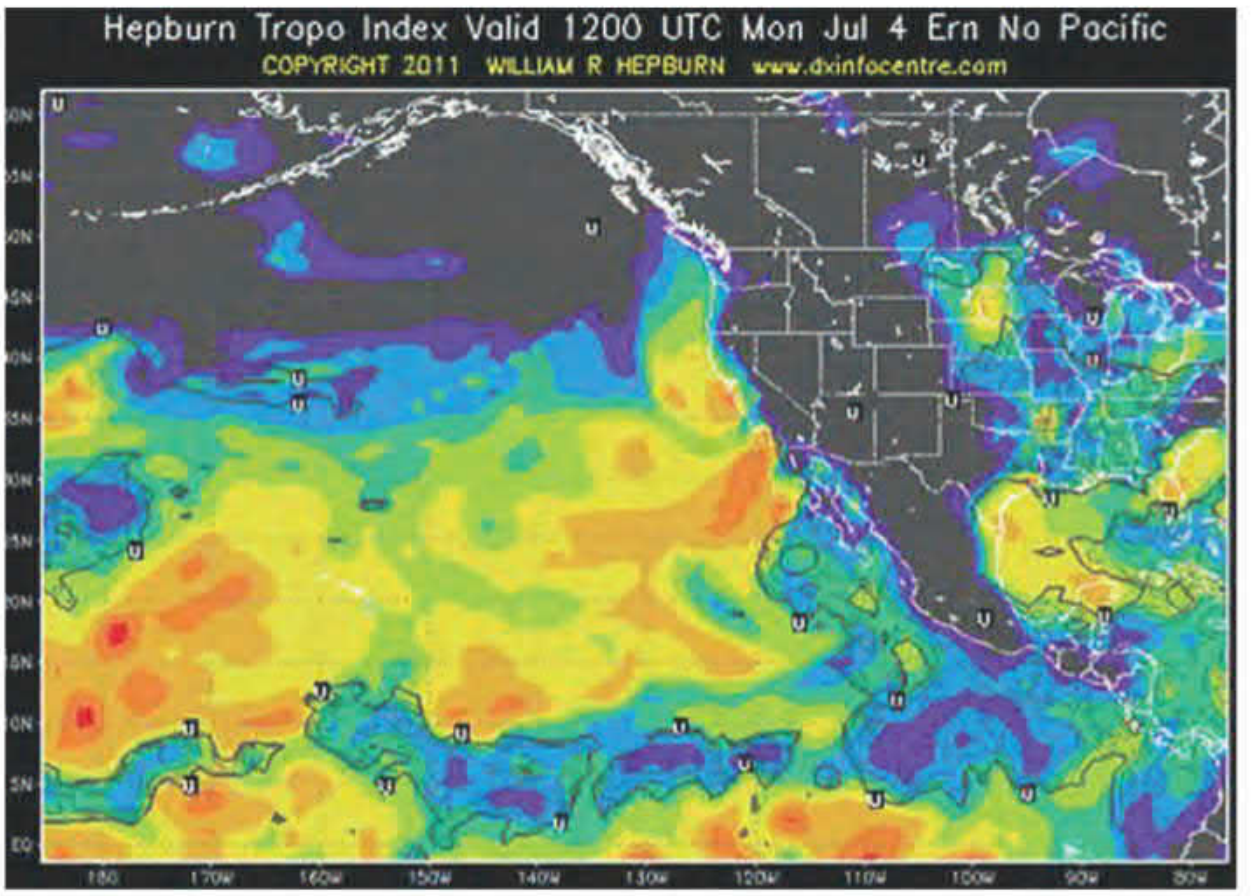
Normal weather, temperature, moisture, and pressure decrease with higher altitude. (Diagrams from Neubeck and West, VHF Propagation, CQ Communications, Inc.)



In tropo conditions, the tropospheric duct acts like a wave guide.

Sometimes multiple ducts may occur in stratified air, where temperature, humidity, and pressure suddenly increase with altitude.





Check out <http://dxinfocentre.com> for the daily Hepburn tropo reports. Orange and yellow indicate great tropo conditions. (Map via dxinfocentre.com)

Midwest, and many times parks itself over the warm water of the Gulf of Mexico.

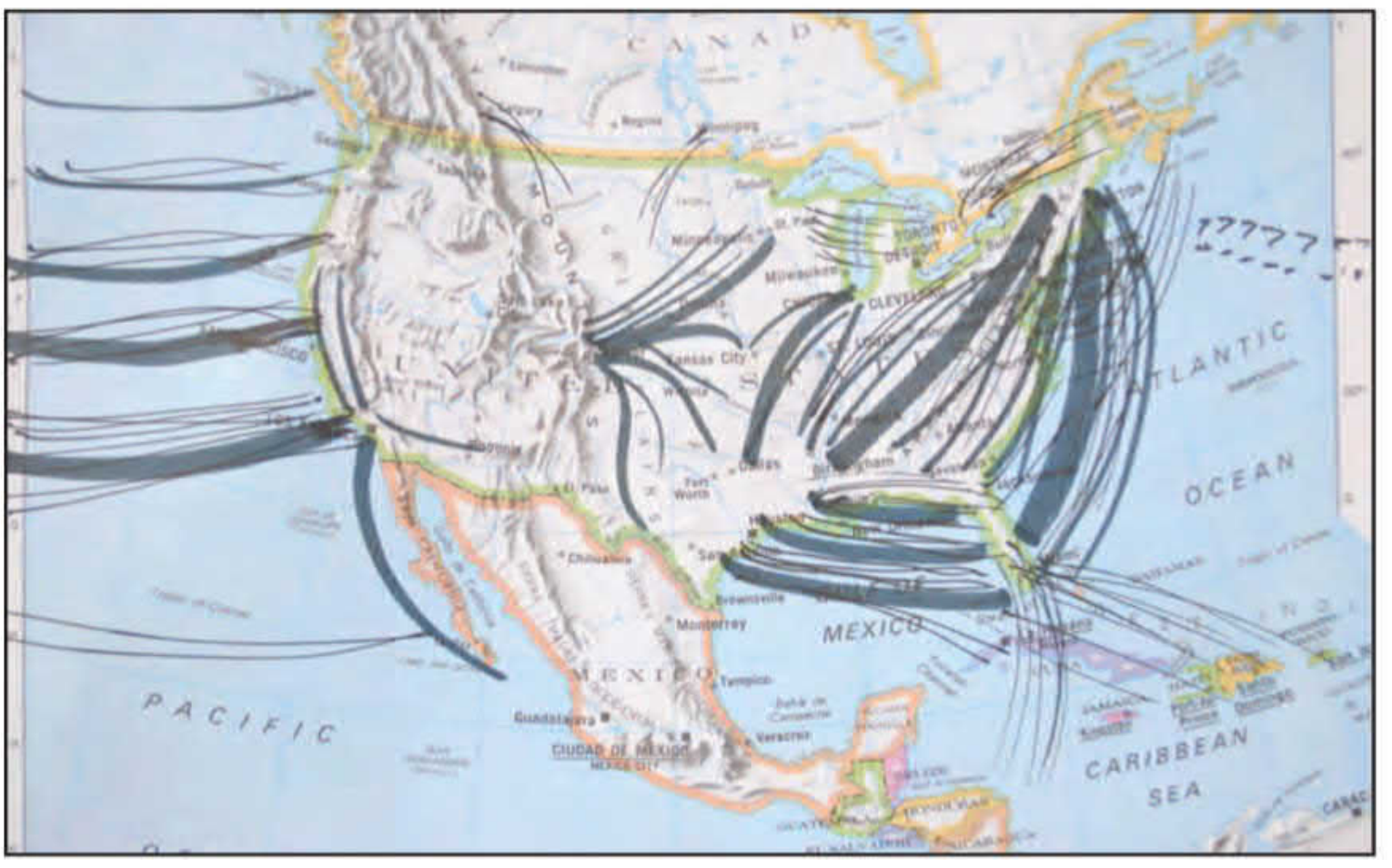
Plus, with eight hurricanes predicted for the Gulf and east coast this year, warm tropical pre-hurricane bands may begin to stratify between Texas and Florida, between California and Hawaii, or between Chicago and Alabama ... or even from Connecticut to South Carolina.

Air within a 1032-millibar, high-pressure cell is heavier than the air below, so it begins to sink. This *subsidence* of the air from above begins to layer out at about 1,000 feet over land and water during periods of calm wind in July and August. Add to that the warm stratified air from a tropical system south of the high, and stand by for several days of 2-meter / 440-MHz DX.

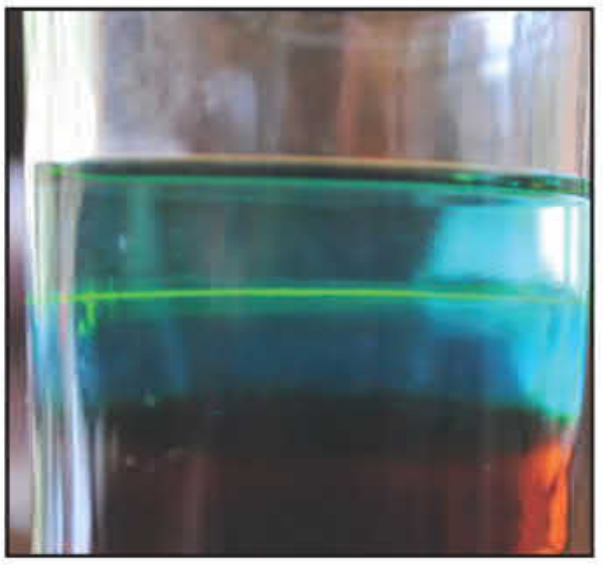
You optically see this brownish stratified air, which has trapped pollutants in a thin band, hanging over the horizon. Here on the West Coast, we call it the SMOG belt.

As air sinks from the high, it get compressed against the still air below, and compressing air heats it up. Also, within this thin layer (maybe 200 feet thick) moisture increases, and so does air pressure.

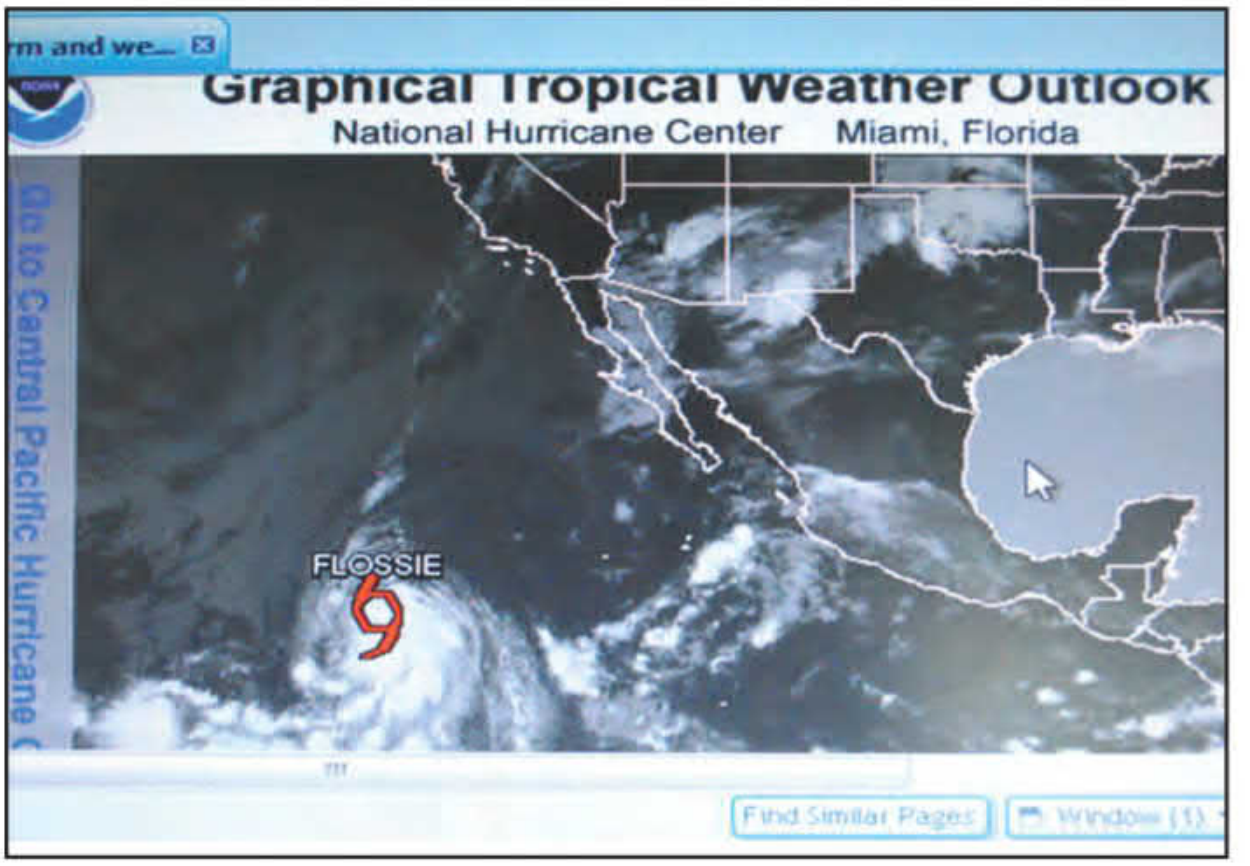
Usually, normal atmospheric temperature decreases with height, 20° Fahrenheit for every 5,000 feet of elevation. Air pressure decreases by one millibar every 30 feet in elevation, and moisture loses 1/2 gram per kilogram every 1,000 feet of elevation, based on “normal” atmospheric conditions at a refractive index of 1.000345.



In the summertime, tropo conditions will lead to 1000+ mile contacts all over the USA! (Map via dxinfocentre.com)



See the "waveguide" effect in laser light refraction of different density layers in a liquid.



Hurricanes to the south will often trigger very strong tropo conditions that might last up to 3 or 4 days, day and night. (NOAA National Hurricane Center photo)

But during a several-day stalled high-pressure system overhead, air is no longer "normal." This forms an atmospheric *duct*, if air temperature, which normally decreases with elevation, *increases* by at least 7° Fahrenheit within the thin inversion layer tropospheric duct.

The layering of this band of high-pressure "smog" causes the "normal" refractive index of air to abruptly change, acting much like a wave guide to VHF, UHF, and microwave signals within the duct.

Your mobile or base V/U signal gets into the duct, and comes out the other end hundreds and sometimes thousands of miles away, especially over ocean waters on windless days. Same for the Great Lakes fresh water, too.

Try this: Tune in, with squelch OFF, all the normal weather channels at 162.5xx MHz, and listen carefully to the really weak one, that is barely coming in. Listen long enough, and you may be surprised it is over 300 miles away. Since the NOAA weather channels are always transmitting, and ID every so often, or give a report of weather conditions *nothing* like the day *you* are having ... you are listening to the effects of tropospheric ducting.

This is a common atmospheric anomaly every July and August, all over the U.S., from summertime high pressure cells over the U.S. and our lakes and oceans, that stall, then sink, creating some fun DX on VHF and UHF.

Make some noise on 146.520 and 446.000 MHz simplex, and see what DX lurks within the smog belt above, on a hot windless day, anywhere in the U.S. Use your repeater guide for distant FM repeater tones, and DMR / Fusion / D-Star listing to access these systems from hundreds or even thousands of miles away, during the summertime high pressure DX events on VHF, UHF, and even microwave AREDN MESH networks.

The refractive index within the (faint) tropo duct actually visually reflects the image of the ship's superstructure, as it passes by with land seen on the left. Now imagine what this duct could do for extending VHF/UHF radio range.

VHF PLUS

BY TONY EMANUELE,* K8ZR

Neither Rain Nor Snow …

VHF Plus Calendar

CQWW VHF Contest: July 18th & 19th
DUBUS 1296 MHz EME Contest: July 17th & 18th
ARRL 222 MHz and Above Contest: August 1st & 2nd
ARRL 10 GHz and Above Contest: August 15th & 16th
ARRL September VHF Contest: September 12th – 14th
ARRL EME Contest 2.3 GHz and Up:
September 12th & 13th
ARRL 10 GHz and Above Contest (2nd weekend):
September 19th & 20th

In early 2005, Andy Flowers, KØSM, introduced his *RainScatter* program as a tool for microwave operators to help identify possible rainscatter (and snowscatter) paths between two stations. Primarily used by 10-GHz ops, the program automatically downloaded radar images from the National Weather Service and incorporated attributes associated with the storms, such as thunderstorm cell height, to create an overlay that indicated the area in which the storm would support a rainscatter path between two stations.

As Mother Nature would have it, rain droplets range in size from about 0.5 millimeters for drizzle up to 3 millimeters in a tropical downpour, or about 1/60th to 1/10th of a wavelength at 10 GHz. This makes rain an ideal scattering volume. Rainscatter is also possible at 3.4 and 5.7 GHz, but the signals are much weaker because of the fourth power law. For example, at 5.7 GHz, approximately half the frequency of 10.3 GHz, for a given size rain droplet the signal would be approximately 12 dB less in strength.[1] Since snow has a slower equivalent rainfall rate than rain, generally only heavier snowstorms are effective for communications at 10 GHz. Early or late season snow with large, moisture-laden, snowflakes works well. For a more detailed discussion of rainscatter, see Tom Williams, WA1MBA's, website at <www.wa1mba.org>.

To take advantage of new platforms such as smartphones and other devices, Andy recently introduced a web-based version of his *RainScatter* program. Though in beta-testing at the time of publication,[2] a number of stations have been taking advantage of the program to further their grid count on 10 GHz or give them an excuse to get out and exercise their gear and work an old friend.

Longtime VHFer Gedas Vysniauskas, W8BYA, located near Fort Wayne, Indiana, in EN70jt recently became QRV on 10 GHz. Setting up his portable 10-GHz station in his garage (*Photo A*) and taking advantage of the new web-based version of *RainScatter,* he has worked several stations via rainscatter in April and May including Russell Dwarshuis, KB8U, in EN71sw @ 140 kilometers (87 miles) and Ron Stefanskie, W9ZIH, EN51nv @ 330 kilometers (205 miles).

Others recently taking advantage of KØSM's handiwork were Dave Petke, K1RZ, at home in FM19jh; Peter Prabucki, VA3ELE, at home in FN03dm and with Steve Cruse, K3WHC

c/o CQ magazine
email: <k8zr@cq-amateur-radio.com>

Photo A. W8BYA has his 10-GHz gear set up in his garage near Fort Wayne, Indiana, ready to work rainscatter. (Photo courtesy of W8BYA)

in FN10pa; Hugh Duff, VA3TO, in FN03cn; and K8ZR in EN91ov, all portable when slow-moving rain cells made their way across western Pennsylvania late on the afternoon of Memorial Day. On May 28th, VA3TO and VA3ELE worked Ray Golley, N3RG, in FM29ki @ 607 kilometers (377 miles) via rainscatter for 10-GHz grid #33 for Peter and #28 for Hugh. See *Figure 1* for a screen capture of the *RainScatter* program. The red dots indicate rain cells that will support rainscatter at 10 GHz and the pink circular overlay indicates the extent of the coverage area. The black line shows the path between VA3TO and N3RG.

The 2020 Microwave and 50-MHz Spring Sprints

The microwave and 6-meter Spring Sprints were held on the first and second Saturdays in May, respectively, and based on reports submitted to the 3830scores.com website, participation was up significantly for both events. See *Charts 1* and *2*. As the name implies, these short-duration contests, six hours and four hours respectively, are meant to prompt activity in a way that is bit less intimidating than a full-blown contest. Hopefully, the increase in participation will carry over to the Fall Sprints just a couple of months away. The Spring Sprints are sponsored by the Central States VHF Society and the Fall Sprints are sponsored by Southeastern VHF Society. Thanks to both of those organizations for sponsoring the sprints.

On the Bands

The 2020 Sporadic-E (E_s) season, with its early start in April, continued to please many as, by the end of May, Magic Band openings were common and widespread. And like the previous month for those in the right place at the right time, 2-meter E_s was added to the mix. For most in North America,

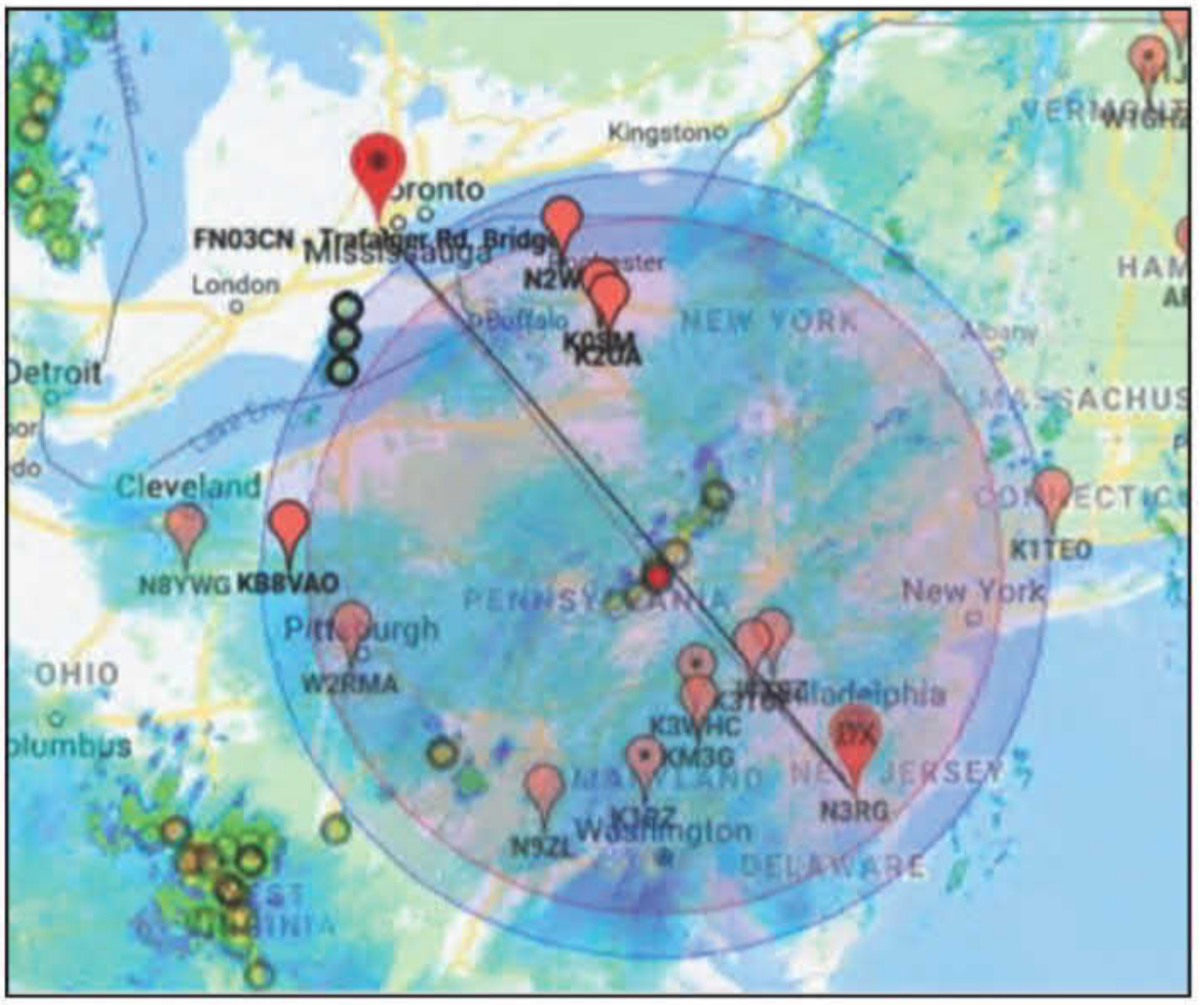


Figure 1. Rainscatter path between VA3TO and N3RG as seen on the RainScatter program.

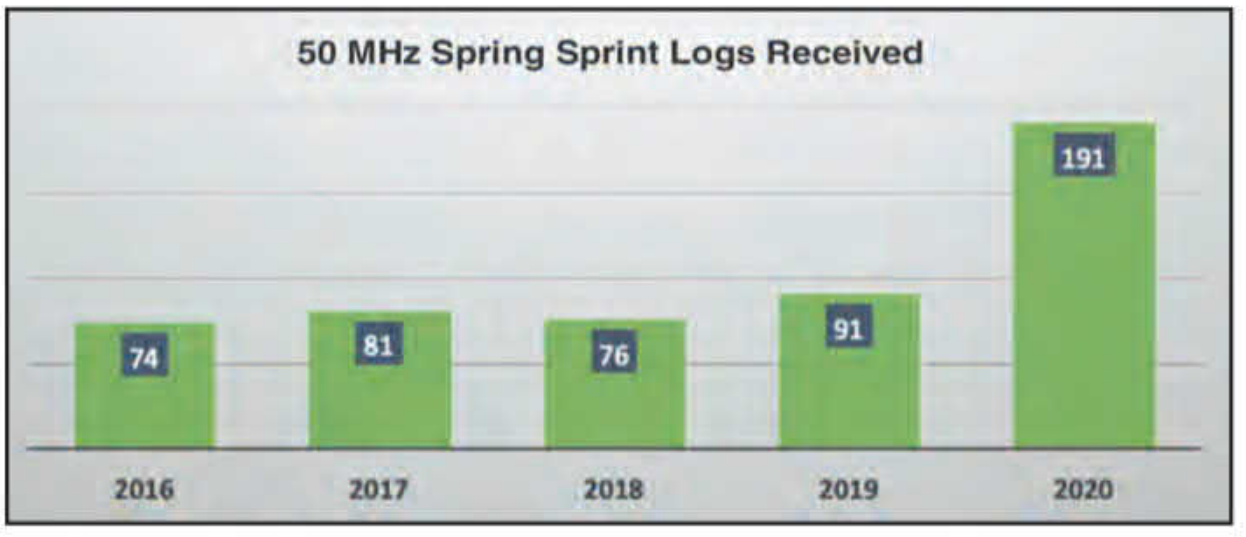


Chart 1. Participation in this year's 50-MHz Spring Sprint more than doubled over 2019, based on info from 3830scores.com.

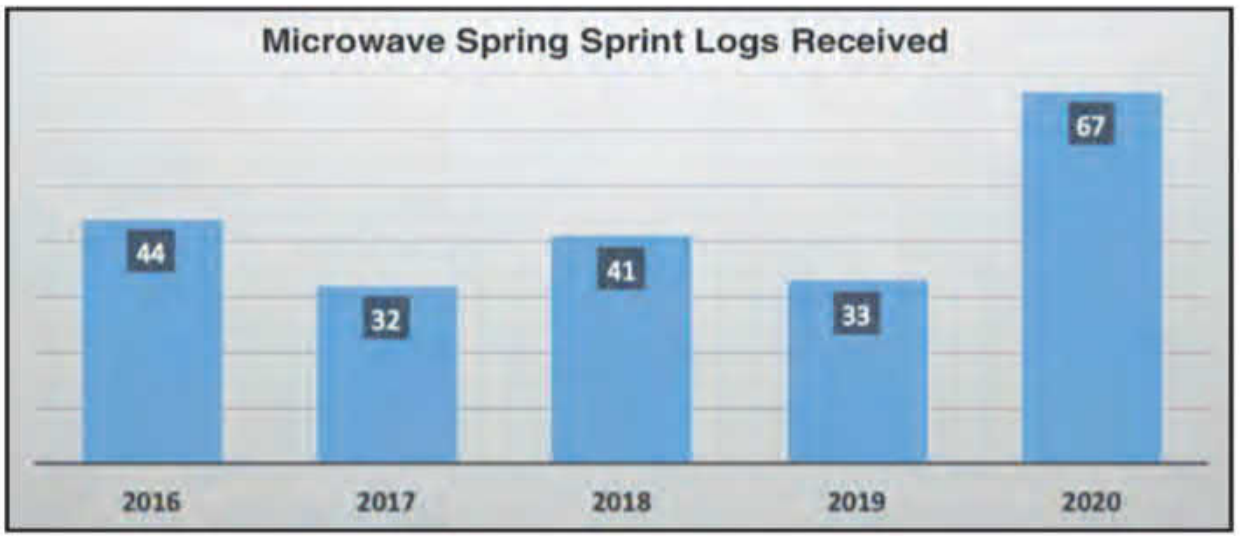


Chart 2. Statistics from 3830.com show that participation in this year's microwave Spring Sprint was also up significantly over recent years.

6 meters was open early on May 30th with noticeably short skip into New England and the Atlantic Seaboard areas. Sustained short skip, less than 800 kilometers / 500 miles, with signals that are noticeably strong, is the usual indicator that the MUF (maximum usable frequency) is rising and, if high enough, will result in 2-meter E_s. With much of the activity now on FT8, many stations are not paying much attention to signal strength and, as a result, are perhaps missing an opportunity to be alerted to a rising MUF and possible 2-meter E_s. There are other clues such as the VHF Propagation Map at <aprs.mennolink.org>. Though normally an indicator of tropo conditions, the map can also be an indicator of E_s as was the case on May 30th. With no weather conditions in the region to suggest a tropo event, the map's "red blob" covered a large region in the east, indicating E_s on 2 meters (see *Figure 2*). *Figure 3* is the estimated MUF at that time, courtesy of DX Maps.

Two-meter E_s openings are typically short in duration and that was the case on the 30th as the window of opportunity was approximately 30 minutes. Larry Davis, KØTPP, in EM48rk, was in the right place at the right time as he worked WA2QEG, KC3BVL, AA2UK, N3DGE, N2AMC, W3KM, W2NNG, WD3R, W1VD, and K1XJ with many of the stations on SSB. At the other end of the opening, Bill Lentz, AA2UK in FM29pv, worked KØTPP, WB8LNG, KA9CFD, and W8PU. Ron Klimas, WZ1V in FN31rh, worked AAØKM in EM39jd and KØTPP EM48rk, with both QSOs in excess of 1,500 kilometers (~1,000 miles).

The month of May ended with much of North America working into Europe on 6 meters. What made the 31st particularly noteworthy was a West Coast-to-Europe opening. KG7CW DN14xs worked ON7GB JO21ia @ ~8,000 kilometers (4,970 miles); N7BAV CN95 worked PAØRDY JO22 @ ~ 8,000 kilometers; W7EW, CN84lv worked S57RR JN65um @ ~9,100 kilometers (5,655 miles); KE7SW CN87 worked S57RR @ ~8,900 kilometers (5,530 miles); and VE7DAY, CO70ia worked LA8AJA JP50hp @ ~7,000 kilometers (4,350 miles).

July DX

There is likely plenty of 6-meter DX to be had in July — don't forget the CQ World Wide VHF Contest on the 17th & 18th. As a reminder, 50.323 MHz has been designated as the FT8 DX calling frequency. When calling or working

BEHIND THE BYLINES...

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

Billy Williams, **N4UF** ["Drive-In License Exams Attract a Crowd (Sort of)," p. 12], was *CQ*'s DX Awards Manager from 1979 to 2011. A former newscaster, Billy also taught electronic communications and computer technology for 25 years at Florida Community College at Jacksonville. He is a longtime trustee of the North Florida Amateur Radio Society and editor of its newsletter, the *Balanced Modulator*.

Bill Kennamer, **K5FUV** ("Contesting Your Way to DX Success," p. 28), was first licensed in 1960. He was the manager at AGL Electronics in the late 1970s, founding editor of the QRZ DX weekly newsletter, and DX columnist for *Ham Radio Horizons* magazine. After a break of several years as a government bond trader, he worked at ARRL headquarters as DXCC Manager and Membership Services Manager. He was the editor of How's DX in *QST*, and has written articles and reviews for *QST*, the *National Contest Journal*, and others. This is his second article for *CQ*.

Bob Allphin, **K4UEE** ("Unwinding Bouvet 2018," DX column, p. 81), became a full-time DXer after retirement and has the distinction of participating in (and frequently leading) DXpeditions to 11 of the "top 10" most-wanted DX locations around the globe! Bob is a member of the CQ DX Hall of Fame, past chairman of the ARRL DX Advisory Committee, and is a director of INDEXA, the International DX Association.

CQ Reader Needed for Handihams

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

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

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

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

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

European stations, North American stations are second sequence. When calling CQ on 50.323 MHz, North American stations are also second sequence. The intent is to minimize interference.

Conference Cancellations

Out of an abundance of caution, both the EME Conference scheduled for August in Prague and Microwave Update scheduled for October in Sterling, Virginia, have been postponed one year due to COVID-19.

– 73 and CU on the Bands. Tony, K8ZR

Notes:

1. Approximately (5.7 / 10.3) to the fourth power or ~12 dB.
2. The usual disclaimers regarding a Beta version including change in functionality, etc. are in effect.

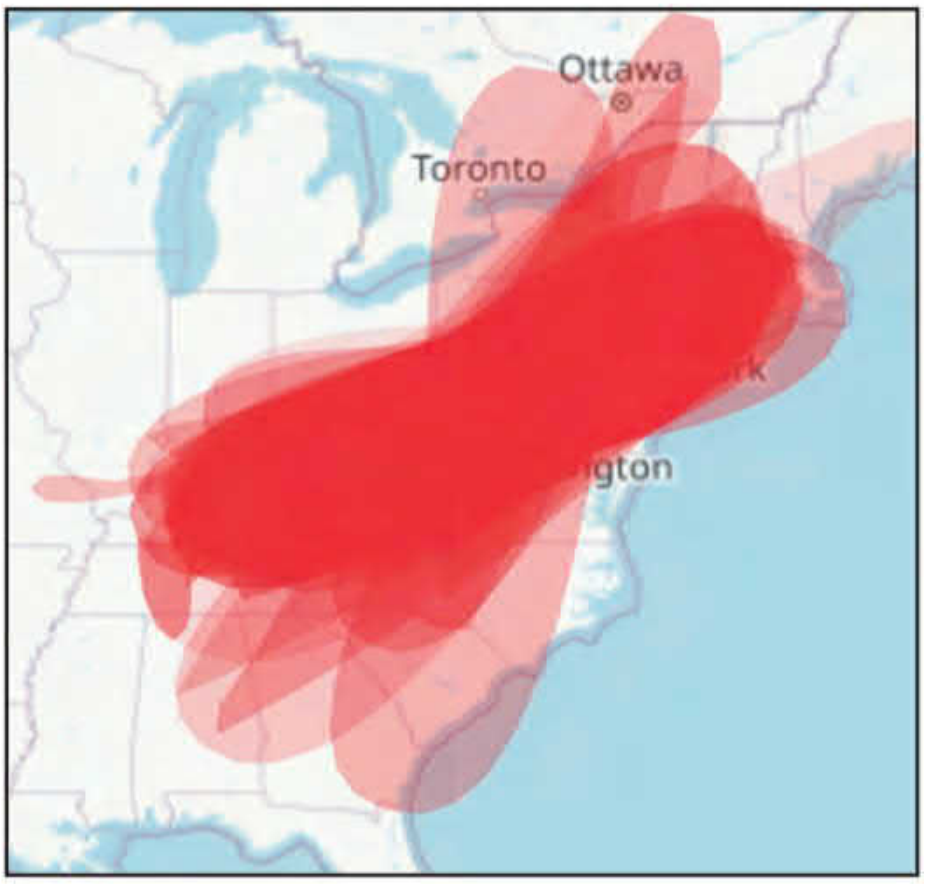


Figure 2. VHF propagation map for May 30th at 2300 UTC from <aprs.mennolink.org>, showing tropo openings throughout most of the eastern half of the United States.

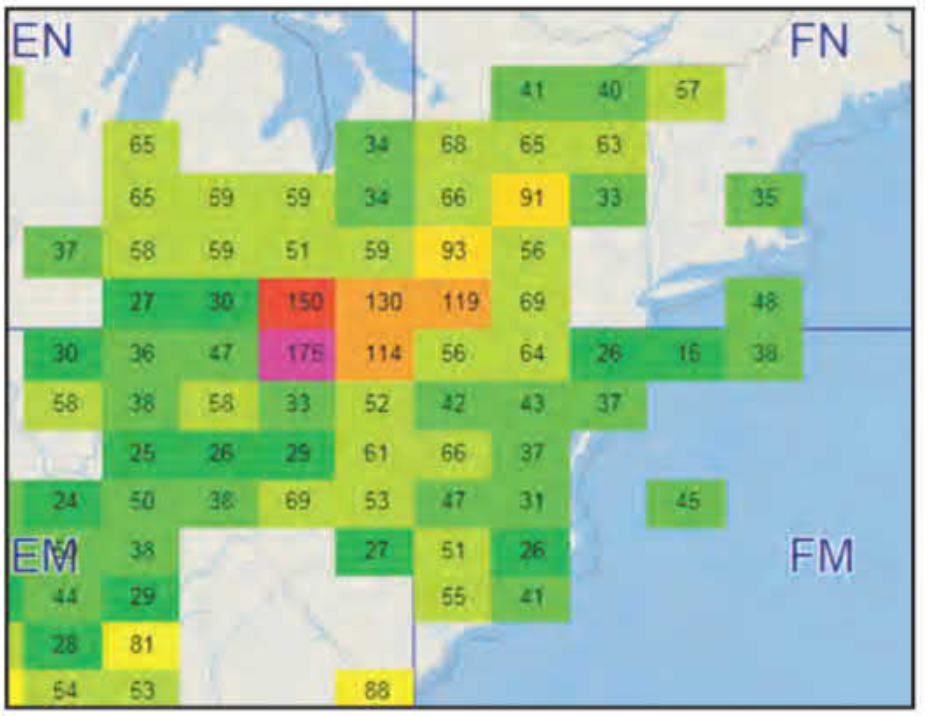


Figure 3. DX Maps image from the same time period as Figure 2, showing the MUF (maximum usable frequency) rising above 144 MHz in two grids. See text for discussion.

AWARDS

BY JIM HOUSER,* WA8JIM

4U1A United Nations Award Program

This month the United Nations Vienna (4U1A) award program is highlighted. The United Nations Amateur Radio Contest DX Club (ARCDXC) is based at the United Nations Office in Vienna, Austria. It is located at the third UN campus and building complex that was built after New York and Geneva (*There is a fourth UN headquarters campus in Nairobi, Kenya – ed.*). This organization has created an award program with enough variety and challenge to keep a paper chaser busy for a long while.

Follow the link <https://tinyurl.com/y8tv47hx> to the club's website to get all the information. Each award has a different set of rules so be sure to read each one carefully. However, the awards all have some elements in common. Unless otherwise noted, plaque fees are currently $48 U.S. / 43 / 1800 rubles, which includes airmail shipping. The ARCDXC Award Manager is Ken Vershkov, RW3DD. Applications and questions should be directed to him via email at <rw3dd@mail.ru>. Fee payments should be made via PayPal to <VershkovKN@gmail.com>. Contacts for all awards must be made on or after October 24, 1945, the date on which the United Nations was established. Unless otherwise noted, contacts on all bands between 160 and 10 meters may be counted. Shortwave listeners (SWLs) as well as radio amateurs are welcome to apply.

Let's take a look at a few of the 17 different awards offered by the 4U1A club:

The World of UN

Starting off with The World of the United Nations plaque (*Photo A*), this beautiful award will stand out on your wall. It has the same rules for both the SWLs and hams. In order to earn it, you must work and confirm 191 of the United Nations member states [North Korea (P5) and Turkmenistan (EZ) are not accepted]. The full list of countries is listed on the website.

Any contact in any mode on an HF band from 160-10 meters is accepted. Please ensure that you QSO one of 4U1A, 4U2U, 4UØR (or 4UNR), 4Y1A or C7A, which is mandatory. So, that brings the total to 192 contacts.

USA-CA Award Update

500 County Level
W9RPM – Award number 3783 dated April 29th, 2020
RZ1OA – Award number 3784 dated May 11th, 2020

1000 County Level
JA1NLX – Award number 1923 dated April 28th, 2020
WI7P – Award number 1924 dated April 28th, 2020
JA1WSK – Award number 1925 dated May 7th, 2020
RZ1OA – Award number 1926 dated May 11th, 2020

1500 County Level
RZ1OA – Award number 1587 dated May 11th, 2020

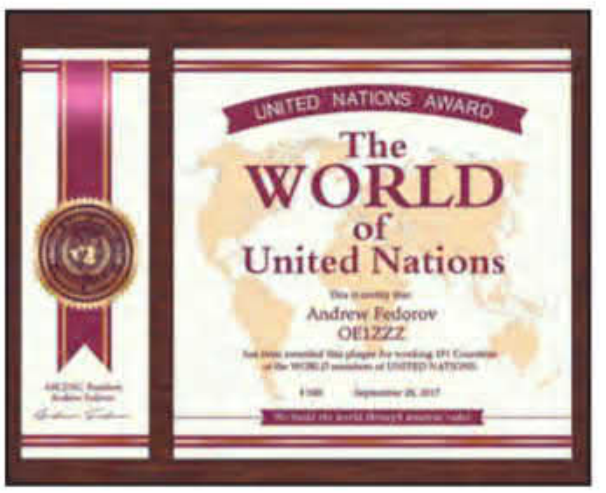


Photo A. The World of UN award can be yours if you've made confirmed contacts with hams in at least 191 United Nations member states. (All images courtesy of UNARCDXC website)

Photo B. The UN 5 Stars award requires only five confirmed contacts, but they're toughies. You must work all five callsigns associated with the UN ARCDXC - 4U1A, 4U2U, 4UØR (or 4UNR), C7A, and 4Y1A.

UN Five Stars Award

The UN Five Stars Award (*Photo B*) requires the operator or SWL to work and confirm five ARCDXC club stations on any HF band by using CW, SSB, or digital modes. 4U1A, 4U2U, 4UØR (or 4UNR), C7A, and 4Y1A are the callsigns you need to contact for this award.

UN Honor Roll Award

This challenging award is for the well-deserving and dedicated award hunter. The United Nations Honor Roll plaque demands not just working the 192 countries needed for the World of U.N. award, but also has additional requirements that make this award even more interesting.

Of the 192 total countries, it requires 22 specific QSOs that are listed on the website. They include the following:

- 9 QSOs with UN (4U) amateur radio club stations: 4U1A, 4U(*)UN, 4U(*)VIC, 4U(*)ITU, 4U1WB, 4U(*)GSC, 4U(*)F, 4Y1A, C7A (1 QSO with each club station).
- 8 QSOs with UN (4U) special event amateur radio stations.
- 4 QSOs with Field UN (4U/… …/4U – before 1995) or UN staff members.
- Finally, 1 QSO with a North Korea (P5) station on any HF band.

This award's fee is $60 US / 53 .

Since (P5) North Korea does not currently allow amateur radio activity, this award is particularly difficult to earn. However, there have been occasional P5 operations in the past and may be

* *email: <wa8jim@cq-amateur-radio.com>*

more in the future. It is not impossible so keep your ears open, you might get lucky.

Five-Band Vienna Award

The Five Band Vienna (VIC) Award will stand out on your wall as one of those head-turning double takes. With the beautiful plaque sized at 250 ? 200 millimeters (Photo C). You will need a good clear area on your ham shack wall.

In order to have the bragging rights to show off this award, you must work and confirm with 4U1A (ARCDXC) using CW, SSB, or digital on all five traditional HF bands (80-40-20-15-10 meters; note: contacts on 160, 60, 30, 17, and 12 meters do *not* count for this award).

According to the ARCDXC website, only five QSOs are required with 4U1A to earn this plaque. It doesn't sound difficult; in fact, it sounds quite easy. But it isn't … This award is a difficult challenge but will be worth it in the end. Good hunting!

Continental Awards

The UN ARCDXC also offers a plaque for each of the continents. We will let you check out the website for the whole list. In order to give you an idea of how each individual continent award is set up, we'll use the World of United Nations (South America) plaque as an example (*Photo D*).

You must work and confirm at least one station in each of the 13 countries in South America: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela, and Trinidad and Tobago. You might think this would be the end of the quest. No way, you still have the final challenge of looking for a QSO with 4U1A, 4U2U, 4UØR (or 4UNR), 4Y1A, or C7A. That brings the total to 14 contacts in all.

United Nations Gold and Silver Awards

The United Nations Gold Award has major obligations to be met in order to earn it. A total of 21 confirmed QSOs is required, with very specific requirements.

You must work each of the UN amateur radio club stations around the world, including one each with 4U1UN, 4U1VIC, 4U1ITU, 4U1WB, 4U1A, C7A, and 4Y1A.

Next, you will need seven QSOs with any 4U1A club member. The member list is on the website. Finally, seven other QSOs with any UN special event (4U) stations. Again, contacts may be on any band between 160 and 10 meters, via CW, SSB, or digital modes.

Photo C. To qualify for the 5-Band Vienna award, you must work club station 4U1A at least once on each of the 80-, 40-, 20-, 15-, and 10-meter bands.

Photo D. The UN Continental Award is granted to amateurs who make contacts with each country that make up a continent. In this case, all member nations located in South America.

The United Nations Silver Award (*Photo E*) recognizes an intermediate step along the path to the UN Gold Award. The same basic requirements apply, except that you only need to work five stations in each group rather than seven.

Unfortunately, the cost, size of the award, and how to obtain it, were not mentioned on the site. I highly suggest contacting the United Nations Amateur Radio Contest DX Club to make sure you have all the vital details on how to pay for pay for the award just in case the info has changed.

As I mentioned above the complete information about the club and the award program is on the internet at <https://tinyurl.com/yczj2uvg>. See the long list of awards that are offered.

Looking for Mercy

Finally, when you are on the air, be on the lookout for K6MRC. That's the ham station aboard the U.S. Naval medical ship U.S.S. Mercy, based out of San Diego, California. Its sister ship, the U.S.S. Comfort, does not have an amateur radio callsign, according to my internet searches.

Photo E. The UN Silver Award is earned by contacting 5 UN club stations, 5 UN ARCDXC club members, and 5 UN special event stations. There's also a Gold Award, which requires 7 contacts in each of those three categories.

Before we end this column for the month, I would like to leave with a personal note. As I write this column, it is now the end of April 2020, and in Illinois, we are still under stay-at-home orders due to COVID-19. As the Lead Radio Tech where I work, I am required to work despite the pandemic. I would like to pass on my personal thank-you to all the amateur radio operators and SWLs who are putting their lives on the line to resolve the problem. I would also like to give a shout-out to the first responders who deserve a huge thank you as well. Please pass on my appreciation and a note of thanks on to your co-workers and colleagues.

If you or your club have an award that you want *CQ* to talk about, please email me at <wa8jim@cq-amateur-radio.com>. Please include a valid email address and a phone number should I have questions. A sample picture of the award (high-resolution digital, please) and the rules will also be needed. If the award has a short active time frame, get it into *CQ* magazine ASAP. We need 2-3 months of lead time.

I will see you on the air.

– Happy 4th of July and 73, WA8JIM

DX

BY BOB SCHENCK, N2OO

Unwinding Bouvet 2018

The Final Chapter of the Ill-Fated 3YØZ DXpedition

This month, I am turning over the keyboard to my old friend, Bob Allphin, K4UEE, who will detail the final chapter of Bouvet 2018. I want to thank Bob and the entire Bouvet team for what they endured trying to bring us all a new one.

Quick note: I have occasionally given you my 60-meter update. As of mid-May, I have worked all 50 states, 7 continents, 28 CQ zones and 103 DX entities. Admittedly, I have not been very active on 60 of late due to having my tower tilted over for rotor repairs (my 60-meter antenna normally hangs from it), but we are back up and I will be getting back on. – N2OO

I have been participating in or co-organizing DXpeditions since 1987. In that time frame, I have participated in 43 DXpeditions, including 11 to the DXCC "top 10 most wanted" entities. I have travelled the world, set foot in over 130 DX entities and made QSOs from more than 80. I have seen sights and wonders and had experiences on this planet that most people never would imagine. More importantly, I have travelled and worked with some of the most honest, trustworthy, and wonderfully talented people in the amateur radio community. As exciting as all this sounds, not all of my experiences have been good. For example, my recent experience trying to activate Bouvet was a nightmare!

* *Email: <n2oo@comcast.net>*

3YØZ DXpedition team leader and this month's guest columnist, Bob Allphin, K4UEE. (All photos by and courtesy of Nodir Tursun Zade, EY8MM)

The Best Laid Plans …

About five years ago, Ralph Fedor, KØIR; Erling Wiig, LA6VM, and I decided to try to activate Bouvet Island with a big, well-equipped, and well-financed DXpedition team. Bouvet Island was

Our vessel, the Betanzos, with two helicopters!

then and still is the #2 "most wanted" DXCC entity worldwide. We meticulously planned every aspect of the project, and things were going fine until we arrived at Bouvet on January 31, 2018. At, not on. We had travelled 12 days to reach Bouvet only to find a very hostile weather situation. In fact, on the night of our third day there and still waiting for a chance to fly our first helicopter recon trip, another storm hit us with hurricane force winds. While fighting the storm, one of our vessel's two engines was overstressed, and a critical coupling failed. The next morning (our first nice day), the captain informed us that we must abort the DXpedition for safety reasons. It was his call and, considering the circumstances we were experiencing and the new reality of only one engine, it was the correct decision.

Of course, the team was devastated. All the time, effort, preparation, work, fund-raising, coordination with and advance visit to our transportation partner in Chile was down the drain. And to top it all off, the team spent 31 days travel-

The WPX Program

CW

3952 . . . . . IK6DLK
3953 . . . . . N8YO
3954 . . . . . K2ATZ
3955 . . . . . W2YR
3956 . . . . . KØHX
3957 . . . . . N2JNR
3958. . . . . KØITC
3959 . . . . . N5OP
3960 . . . . . K2EKM

SSB

4285 . . . . . IK6DLK
4286 . . . . . WX7P
4287 . . . . . DL7BO
4288 . . . . . W2YR
4289. . . . . W6NCB
4290 . . . . . KL7XD
4291 . . . . . EA1OT
4292 . . . . . MØOIA
4293 . . . . . KC9YTT

Mixed

3991 . . . . . K4KSV
3992 . . . . . W7DCM
3993 . . . . . IK6DLK
3994 . . . . . WX7P
3995 . . . . . DL7BO
3996. . . . . PY1SW
3997 . . . . . N8YO
3998. . . . . IU2LWL
3999 . . . . . N9TBC
4000. . . . . KC7HDE
4001 . . . . . K2RSB
4002 . . . . . KL7XD
4003 . . . . . N9NFT
4004 . . . . . N5JEH
4005 . . . . . KB2S
4006 . . . . . MØOIA
4007 . . . . . KC9YTT
4008 . . . . . N2YTF

Digital

1230 . . . . . HB3XUP
1231 . . . . . IK6DLK
1232 . . . . . VA3EP
1233 . . . . . KM4IYW
1234 . . . . . DL7BO
1235 . . . . . MMØRYP
1236 . . . . . K2ATZ
1237 . . . . . W2YR
1238 . . . . . N9TBC
1239. . . . . KC7HDE
1240 . . . . . IK2GOQ
1241 . . . . . K2RSB
1242 . . . . . AC8AZ
1243 . . . . . N9NFT
1244 . . . . . N5JEH
1245. . . . . SM6STI
1246 . . . . . KB2S
1247 . . . . . MØOIA
1248 . . . . . KC9YTT
1249 . . . . . N2YTF
1250. . . . . K9XT

CW: 350: KØITC. **400:** N5OP. **600:** N8YO, W2YR. **1100:** IZ2ESV. **1200:** IK6DLK. **1750:** DL6JZ. **3200:** EA7AAW. **5000:** W8IQ.

SSB: 400: W6NCB, KC9YTT. **450:** K4KSV. **500:** WX7P, AC8AZ. **750:** W2YR. **800:** KC5CMX, N8YO. **900:** DL6JZ. **1050:** IK6DLK. **1200:** HB9BIN. **1450:** EA1OT. **1500:** EA3EQT.

Mixed: 450: NY4P, N2JNR, KB2S, N2YTF. **500:** DL5KLX, IU2LWL. **550:** PY1SW, W5CSM, MØOIA, SAØBMV. **600:** K4KSV, WX7P, WW5XX, KM4IYW, IK8FLW, KL7XD, KE8FMJ, PDØDNA, KC9YTT. **650:** W6NCB. **750:** K9WIS. **800:** KG5RPZ. **850:** KC5CMX, K2ATZ, WU6K. **900:** KA5YCM. **950:** F6JSZ, K1KQC. **1000:** JH2WDT, AC8AZ. **1100:** WR7X. **1250:** DL7BO. **1500:** W1FNB. **1550:** EA3EQT. **1700:** R3LC. **2300:** N7ZO. **2550:** DL6JZ. **3100:** HB9BIN. **3450:** IK6DLK.

Digital: 350: VA3EP, AC8AZ, N9NFT, W5CSM, N5JEH. **400:** WQ7F, W6NCB, N9TBC, KC7HDE, KC9YTT. **450:** DL5KLX, K1KQC, KB2S, SAØBMV, KM4VI, N2YTF. **500:** WW5XX, K2ATZ. **600:** W2YR, F6JSZ, KE8FMJ, PDØDNA. **750:** DL7BO, WU6K, KA5YCM. **800:** KG5RPZ. **1000:** JH2WDT, WR7X. **1100:** W1FNB. **1200:** IK6DLK. **1400:** W2/JR1AQN. **1650:** N7ZO. **1700:** AA8R. K2YYY. **1800:** DL6JZ. **2050:** HB9BIN.

160 Meters: IK6DLK, DL7BO, W2YR, KG5RPZ, WU6K, N5OP
80 Meters: HB3XUP, IK6DLK, WQ7F, DL6JZ, K2ATZ, W2YR, KD7HDE, WU6K, KE8FMJ
40 Meters: K4KSV, IK6DLK, WX7P, WQ7F, DL6JZ, K2ATZ, W2YR, WU6K, KB2S, MØOIA, KC9YTT
30 Meters: IK6DLK, W2YR, KG5RPZ
20 Meters: IK6DLK, WX7P, DL5KLX, DL7BO, N8YO, DL6JZ, K2ATZ, W6NCB, WU6K, N2JNR, KL7XD, N9NFT, EA1OT, KE8FMJ, W5CSM, MØOIA, KC9YTT
17 Meters: IK6DLK, K2YYY
15 Meters: IK6DLK, K2YYY, EA1OT
10 Meters: W2YR, EA1OT

Africa: IK6DLK
Asia: IK6DLK, DL7BO, W6NCB, KC7HDE, WU6K, KL7XD, EA1OT, KB2S
Europe: K4KSV, HB3XUP, IK6DLK, DL7BO, PY1SW, N8YO, K2ATZ, MMØRYP, IW2LWL, IK2GOQ, KL7XD, KA5YCM, EA1OT, KE8FMJ, SM6STI, MØOIA
Oceania: IK6DLK, DL7BO, DL6JZ, WU6K, R3LC
North America: K4KSV, W7DCM, IK6DLK, WX7P, VA3EP, KM4IYW, N8YO, K2ATZ, W6NCB, N9TBC, KC7HDE, F5JSZ, KØHX, K2RSB, KL7XD, KØITC, AC8AZ, N9NFT, EA1OT, N5JEH, KB2S, N5OP, KC9YTT, N2YTF, K9XT
South America: IK6DLK, PY1SW, WU6K

Award of Excellence with 160 Bar: W2YR
30M Bar: W2YR
Digital 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.

CQ DX Awards Program

New Awards – CW

K1DX.....1882

Endorsements – CW

K1DX.....150, 200, 250, 275

The basic award fee for subscribers to *CQ* is $6. For non-subscribers, it is $12. In order to qualify for the reduced subscriber rate, please enclose your latest *CQ* mailing label with your application. Endorsement stickers are $1.00 each plus SASE. Updates not involving the issuance of a sticker are free. All updates and correspondence must include an SASE. Rules and application forms for the CQ DX Awards may be found on the <www.cq-amateur-radio.com> website, or may be obtained by sending a business-size, self-addressed, stamped envelope to CQ DX Awards Manager, Please make checks payable to the Award Manager, Keith Gilbertson. Mail all updates to Keith Gilbertson, KØKG, 21688 Sandy Beach Lane, Rochert, MN 56578-9604 USA. We recognize 341 active countries. Please make all checks payable to the award manager. Photocopies of documentation issued by recognized national Amateur Radio associations that sponsor international awards may be acceptable for CQ DX award credit in lieu of having QSL cards checked. Documentation must list (itemize) countries that have been credited to an applicant. Screen printouts from eQSL.cc that list countries confirmed through their system are also acceptable. Screen printouts listing countries credited to an applicant through an electronic logging system offered by a national Amateur Radio organization also may be acceptable. Contact the CQ DX Award Manager for specific details.

The CQ DX Field Award Program

New Award – SSB

AE4WG.....084

New Award – Digital

W2/JR1AQN.....032

New Award – Mixed

AE4WG.....167

Endorsements – SSB

AE4WG.....100

Endorsements – Mixed

AE4WG.....100

Endorsements – Digital

W2/JR1AQN.....100

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.

The hams of 3YØZ were truly an international team.

The WAZ Program

SINGLE BAND WAZ

10 Meter CW

223 ..... AIØO

12 Meter CW

107 ..... AIØO

15 Meter CW

373 ..... AIØO

15 Meter SSB

682 ..... LX2SM

17 Meter CW

129 ..... AIØO

20 Meter CW

658 ..... AIØO
659 ..... JF3LOP

20 Meter Digital

15 ..... WI7P
16 ..... VE2NGH

30 Meter CW

161 ..... AIØO

40 Meter CW

330 ..... AIØO
331 ..... AC4G

40 Meter Digital

7 ..... JF3LOP
8 ..... JE6JZP

80 Meter CW

106 ..... AIØO

160 Meter

635 ..... AIØO, 38 Zones
636 ..... N8DX, 40 Zones
637 ..... JH1RES, 40 Zones

160 Meter Update

364 ..... WB6RSE, 39 Zones
546 ..... DK1FW, 36 Zones

ALL BAND WAZ

CW

1082 ..... SM6TKG
1083 ..... I1SOP

Digital

137 ..... IZØHTW
138 ..... WQ6Q
139 ..... JA1IAZ
140 ..... JR2PAZ
141 ..... BD7OXR
142 ..... JR1HYA
143 ..... JF1DXJ
144 ..... NG7M
145 ..... J68HZ
146 ..... JK1VXE
147 ..... JL1JVT
148 ..... JAØMRW
149 ..... JJ1QDT
150 ..... SMØFGT
151 ..... JK1JAS
152 ..... LX2SM
153 ..... JA5VMQ
154 ..... CO2YQ
155 ..... JG3KMT
156 ..... S57NML
157 ..... SP3IBS
158 ..... 9A2GB
159 ..... OE6ATD

Mixed

9842 ..... EA8TK
9843 ..... DL4DW
9844 ..... IK6DLK
9845 ..... K6IPM
9846 ..... IZ1MHY
9847 ..... NG7M
9848 ..... W7KKC
9849 ..... N7DED
9850 ..... JF1WLK
9851 ..... K1PL
9852 ..... KI1G
9853 ..... W4ANT
9854 ..... WQ5O
9855 ..... JHØCLK
9856 ..... W6KF
9857 ..... JR1AWN
9858 ..... JG3KMT
9859 ..... K7WLX
9860 ..... CO2YQ
9861 ..... RZ1OA

RTTY

301 ..... AI9L
302 ..... OH3OJ

SSB

5474 ..... 8P6NW
5475 ..... AI9L
5476 ..... W4QK

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>.

Oops...

In our April "News Bytes" item about the 2020 Carole Perry Educator of the Year Award, we said that Melissa Pore, KM4CZN, was the award's first winner. Not quite. What we should have said was that Melissa was the first winner whose name isn't Carole Perry! The Orlando Amateur Radio Club's award is not only named in honor of Carole Perry, WB2MGP, but Carole was also the award's first recipient, in 2018. If you know of an educator who's using ham radio to do great things, check out the award information page at <www.hamcation.com/award>.

Orlando Hamcation® General Chairman Michael Cauley, W4MCA (left), and Carole Perry, WB2MGP (center), present the 2020 Carole Perry Educator of the Year Award to Melissa Pore, KM4CZN, at this year's Orlando Hamcation. (Photo by Bob Nocero, W4KBW)

ling on the Southern Ocean from the tip of South America to Bouvet Island and then ultimately on to Cape Town, South Africa. This, of course, is all history now and the story of the failure has been cussed and discussed since our return over two years ago.

We had tremendous support from the DX community with over 100 DX clubs and foundations, along with 3,700 individual DXers, making financial contributions. This was to have been the most expensive DXpedition ever attempted and was financed with the DXpedition team putting up 50% and the DX community the other 50%.

"Unwinding" the Finances

I want to share with you how this huge, expensive, project was "unwound" afterward. Our aborted mission and failure to complete the project resulted in DX Expeditions, Inc. (our tax-exempt corporation) being left with unused

5 Band WAZ

As of May 15, 2020
2216 stations have attained at least the 150 Zone level, and
1055 stations have attained the 200 Zone level.

As of May 15, 2020
The top contenders for 5 Band WAZ (Zones needed on 80 or other if indicated):
CHANGES shown in **BOLD**

Callsign	Zones	Zones Needed
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
IK6DLK	**199**	**1**
IK8BQE	199	31
IZ3ZNR	199	1
JA1CMD	199	2
JA5IU	199	2
JA7XBG	199	2
JH7CFX	199	2
JK1BSM	199	2
JK1EXO	199	2
K1LI	199	24
K2RD	199	18
K4HB	199	26
K5TR	199	22
K7UR	199	34
K9KU	199	22 on 15
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 10**
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
W4UM	199	23
W6DN	199	17
W6RKC	199	21
W6TMD	199	34
W9XY	199	22
9A5I	198	1, 16
EA5BCX	198	27, 39
F5NBU	198	19, 31
G3KDG	198	1, 12
G3KMQ	198	1, 27
HB9FMN	198	1 on 80 & 10
I1EIS	198	1 & 19 on 10
JA1DM	198	2, 40
JA3GN	198	2 on 80 & 40
JA7MSQ	198	2 on 80 & 10
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
K3PA	198	18, 23
K4JLD	198	18, 24
K5OT	198	18, 23
KI1G	**198**	**24, 23 on 10**
KZ2I	198	24, 26
N2QT	198	23, 24
N4GG	198	18, 24
NXØI	198	18, 23
UA4LY	198	6 & 2 on 10
UN5J	198	2, 7
US7MM	198	2, 6
W5CWQ	198	17, 18
W9RN	198	26, 19 on 40
WC5N	198	22, 26
WL7E	198	34, 37
ZL2AL	198	36, 37

The following have qualified for the basic 5 Band WAZ Award:

Callsign	5BWAZ #	Date	# Zones
AIØO	2202	2020-04-16	200
IK6DLK	2203	2020-04-22	199
K6IPM	2204	2020-04-22	176
N8DX	2205	2020-05-26	199
JF3LOP	2206	2020-04-28	200
J68HZ	2207	2020-04-29	171
KI1G	2208	2020-05-02	198
JO7WXN	2209	2020-05-02	200
IZ4DPV	2210	2020-05-05	150
JHØCLK	2211	2020-05-05	160
AA5JF	2212	2020-05-07	168
W6WF	2213	2020-05-10	150
RZ1OA	2214	2020-05-11	200
JG3KMT	2215	2020-05-11	167
VE2NGH	2216	2020-05-12	170

Updates to the 5BWAZ list of stations:

Callsign	5BWAZ #	Date	# Zones
K6FW	1646	2020-04-18	196
W3LL	1489	2020-04-21	199
N6UK	1647	2020-02-22	192
N8TR	2000	2018-04-29	199
W2IRT	1546	2020-05-02	197

New recipients of 5 Band WAZ with all 200 Zones confirmed:

5BWAZ #	Callsign	Date	All 200 #
2202	AIØO	2020-04-16	1051
2206	JF3LOP	2020-04-28	1052
2205	N8DX	2020-04-28	1053
2209	JO7WXN	2020-05-02	1054
2214	RZ1OA	2020-05-11	1055

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).**

Shelter erection practice in ship's hold.

The biggest problem: The helo pilots were wary of the lack of contrast between low clouds and the island's snow and ice. NO CONTRAST = NO FLYING.

So close, yet so far! We made it TO Bouvet, but were never able to go ashore.

funds. These unused funds, along with a fair settlement negotiated with our transportation partner in Chile, resulted in a significant balance in our DXpedition bank account. The decision was made to offer to return all the unneeded funds to our financial supporters. In DXpedition history, I do not believe anything like this has ever been done before. Certainly, not on a scale such as this.

Beginning in early January of last year, I announced our offer to return 48% to every team member, individual contributor, DX club, and DX foundation. This offer was widely circulated by the DX press and just to be sure, I sent reminder emails to all DX clubs, foundations and individuals that had donated over $250.00. The deadline for refunds was set as March 15, 2019, although I continued to make refunds for some time after that date. After all refund requests were satisfied, we still had a balance in our DXpedition checking account. This balance resulted because a large number of contributors never responded to the refund offer or asked that their refund be sent to the DXpedition team or to the larger DX foundations that supported us.

The next step was to distribute the remaining funds among the DX-

Looking Ahead

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

- An Old-School Counter and Digital Dial
- The Texas Star Multiband Antenna
- Adjustable Voltage Add-On for Your Power Supply

Plus…

- Results: 2020 CQWW 160-Meter Contest
- Vintage Foxhunting

Upcoming Special Issues

October: Emergency Communications
December: Technology
February: QRP

Do you have a hobby radio story to tell? Something for one of our specials? *CQ* covers the entire radio hobby. See our writers' guidelines on the CQ website at <http://bit.ly/2qBFOdU>.

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

9055 .....9A2AA	4837 .....WA5VGI	3459 .....W9IL	2357 ....WA6KHK	1821 .....PY5FB	1480 .....K4JKB	1260.....UR6LEY	1036.....DL5KW	758 .....N4JJS
8021 .....K2VV	4757.....I2MQP	3130.....SV1EDY	2356 .....NE6I	1784.....JR3UIC	1462 .....AC7JM	1219.....K6HRT	1032 .....DG5LAC	757.....WB3D
7551.....W1CU	4681.....JH8BOE	3099 .....N6FX	2300.....N7ZO	1771 .....NIØC	1462.....DL4CW	1217.....AB1QB	1023.....N4WQH	736 .....JA3MAT
7414.....9A2NA	4673 .....NN1N	3028 .....IK2DZN	2225.....JH1APK	1758.....N5KAE	1447 .....K3XA	1204.....VA2IG	1016.....W9QL	718 .....KE4PLT
6589.....EA2IA	4574.....JN3SAC	2987.....AG4W	2203.....KI1U	1746 .....K6UXO	1422.....I2VGW	1201.....K9BO	1012 .....NØVVV	711 .....AG1T
6261 .....KF2O	4521.....IK2ILH	2968.....AB1OC	2176 .....V51YJ	1711 .....NS3L	1408.....NH6T	1167.....WA9PIE	1010 .....VE3RZ	695 .....W8WDW
5659.....S53EO	4462.....K1BV	2963.....N3RC	2133 .....KØKG	1692.....N6PEQ	1398.....ES4RLH	1153.....N3CAL	1007.....AA4QE	682 .....AI8P
5589 .....N4NO	4342 ....WB2YQH	2850 .....NXØI	2113.....W2FKF	1667.....AD3Y	1361 .....VA3VF	1148.....SP8HKT	1006 .....NØRQV	661 .....AL4Y
5582 .....ON4CAS	4298.....VE3XN	2729.....W6XK	2057.....IZØFUW	1647.....9A2GA	1322 .....AA4FU	1137 .....YO5BRZ	966 .....W6WF	638.....KE8FMJ
5536.....VE1YX	4201 .....YO9HP	2697.....AK7O	2040.....K4HB	1651 .....JH1QKG	1301.....JF1LMB	1136.....KO9V	919 .....ON7MIC	633.....TI5LUA
5510.....YU1AB	3951 .....W3LL	2651.....HK3W	2016.....N2WK	1643 .....SV1DPI	1301 ....KB9OWD	1116.....YU7FW	903.....AF4T	621 .....K4HDW
5428.....W9OP	3855 ....WD9DZV	2589.....DG7RO	1972 .....K3CWF	1616 .....TA1L	1301.....K1DX	1107.....PY2MC	889 .....WU1U	616.....AC6BW
5360 .....KØDEQ	3821 .....N6QQ	2583.....PA2TMS	1934 .....NKØS	1570.....PY5VC	1301 .....KM5VI	1100 ....WA3GOS	857.....R1AV	605 .....IW2FLB
5260.....I5RFD	3784 .....K9UQN	2550.....K6ND	1888.....VA7CRZ	1568 .....N3AIU	1299.....JA6JYM	1074 .....WU9D	851 .....N3DF	600 .....WA3QWA
5260.....N8BJQ	3611 .....W2OO	2457.....K5UR	1885.....N6PM	1524 .....W1FNB	1295 .....NIØC	1071 .....N6MM	835 .....K6RAH	
5227 .....N6JV	3539 .....AB1J	2394 .....AE5B	1828 .....K7LV	1524 ...NH6T/W4	1287.....KC1UX	1069 .....IZ4MJP	766.....WB6IZG	
4934 .....W9OO	3538 .....9A4W	2363.....AA8R	1824.....WF7T	1484.....FG4NO	1280 .....WF1H	1058.....N6DBF	762.....JP1KHY	

SSB

6673 .....OZ5EV	3174 .....I3ZSX	2568 ....SM6DHU	2093.....W2WC	1611 .....W2ME	1183.....KI1U	1004.....K4HB	801 .....K3XA	675.....F1MQJ
6074 .....K2VV	3172 .....YO9HP	2532 .....W9IL	2084.....K5UR	1587.....N3XX	1150 .....VE6BMX	1004 .....WA5UA	766.....I2VGW	655 .....VA3VF
5955.....9A2NA	3141.....DL8AAV	2483.....AG4W	2076 .....K2XF	1550.....IK2RPE	1146.....SQ7B	998.....W6XK	763 .....K4JKB	647.....YB8NT
5404 .....VE1YX	3110.....N8BJQ	2451.....EA3GHZ	2048 .....NXØI	1442.....DG7RO	1136 .....K3CWF	978.....EA7HY	758 .....IV3GOW	640.....UA9YF
4988 .....KF2O	3108.....I4CSP	2443.....JN3SAC	2048 .....W4QNW	1386.....HK3W	1112.....NH6T	957.....W9QL	724 .....WF1H	637 .....K5WAF
4800 .....EA2IA	3101 .....WA5VGI	2335.....KG1E	1955.....EA3NP	1386 .....IK4HPU	1098.....K4CN	934.....PY5VC	724 .....W3TZ	630.....W6US
4410.....I2MQP	2990.....KF7RU	2326.....CX6BZ	1935.....SV1EOS	1383 .....NKØS	1096.....JA7HYS	931.....YB1AR	717 .....KØDAN	624 .....K6KZM
3927 .....KØDEQ	2984.....KI7AO	2209 .....IK2QPR	1921 ....WD9DZV	1371 .....VE6BF	1089.....IZ8FFA	929.....NS3L	717.....N3JON	606 .....KJ4BIX
3681 .....N4NO	2936 .....N6QQ	2201.....NQ3A	1879.....K3IXD	1338 .....NE6I	1089.....IT9ABN	919.....KA5EYH	714 .....YB2TJV	604 .....GØBPK
3613 .....SV3AQR	2903 .....IN3QCI	2200 .....N6FX	1848.....AB5C	1334 .....EA3EQT	1053 .....N6MM	893.....W9RPM	713.....JH1APK	600 .....WU1U
3505 .....NN1N	2862 .....PT7ZT	2198.....AB1OC	1832 ....WA6KHK	1330.....N5KAE	1042 .....IZØBNR	889 .....N3AIU	710.....WA9PIE	600 .....WA3PZO
3456 .....W9OO	2857.....4X6DK	2131.....N3RC	1825.....KQ8D	1262 .....K7LV	1032 .....DG5LAC	875.....K7SAM	700.....N4FNB	
3403 .....I8KCI	2650 .....IK2DZN	2129 .....K9UQN	1812.....K6ND	1258.....N1KC	1031 .....K4CN	854.....K6HRT	700 .....JA1PLL	
3382 .....W3LL	2623 .....W2OO	2122 .....AE5B	1646.....VE7SMP	1237.....N6PEQ	1031.....IK8OZP	833.....DK8MCT	694 .....KG4HUF	
3333 .....CT1AHU	2595 .....EA1JG	2113.....W2FKF	1641.....AE9DX	1222.....YF1AR	1022 .....NW3H	808.....UR6LEY	690.....W6PN	
3274 .....YU7BCD	2582.....PA2TMS	2094.....I8LEL	1622 .....K5CX	1187 .....IZ1JLG	1012.....KU4BP	802 .....N6OU	684.....KO9V	

CW

7294 ....WA2HZR	4429 .....KØDEQ	3031.....EA7AAW	2477 .....VE6BF	1832.....N4YB	1458.....AG4W	1062 .....K3XA	890 .....NS3L	722.....WA9PIE
7062 .....K2VV	4132 .....WA5VGI	2948 .....IK3GER	2424.....W2WC	1762.....K6ND	1443 ....WA2VQV	1036.....DL5KW	889 .....N3AIU	720.....K4CN
5634.....9A2NA	4067.....I7PXV	2915 .....KA7T	2364 .....W3LL	1744 .....NE6I	1415.....W6XK	1027 .....AE5B	864 .....YO5BRZ	711.....JF1LMB
5160 .....N4NO	3974.....JN3SAC	2846 ....WD9DZV	2357 .....W9HR	1727 .....K6UXO	1389.....IT9ELD	992 .....F5PBL	848.....PY5VC	652 .....IK2DZN
5112 .....N6JV	3804 .....W9OO	2811 .....OZ5UR	2291.....N3XX	1691 .....KI1U	1362 .....KN1CBR	968 .....K3CWF	821 .....HB9DAX	629 .....IV3GOW
5104 .....EA2IA	3675 .....NN1N	2685 .....W2OO	2212.....AC5K	1620.....DG7RO	1342 .....VE6BMX	962 .....K7LV	783.....YB1AR	620 .....AF5DM
5007.....W8IQ	3504 .....YU7BCD	2667 .....W9IL	2040 .....NXØI	1595 .....PY5FB	1235.....JH1APK	944.....AB1OC	752.....K6HRT	615 .....JH6JMM
5004 .....KF2O	3357 .....K9UQN	2615 .....N6QQ	2022 .....AF5CC	1505.....R3IS	1220 .....AA4FU	939.....N6PEQ	743.....JA5NSR	608.....W9RPM
4570 .....I3FIY	3279.....IØNNY	2548.....EA2CIN	1998.....K5UR	1487 .....NIØC	1210.....DL4CW	908.....NH6T	738 .....NH6T/W4	605 .....NKØS
4557.....N8BJQ	3214 ....SM6DHU	2531.....I2MQP	1973.....N3RC	1483 .....VE1YX	1196 .....N3AIU	897.....HK3W	735.....N5KAE	600.....NY4G
4469 .....IZ3ETU	3041 .....YO9HP	2490 .....N6FX	1843 ....WA6KHK	1480 .....WO3Z	1098.....LU5OM	891.....DK8MCT	732.....SQ7B	600 .....IK2SGV

DIGITAL

2733.....N8BJQ	2208.....W6XK	1643.....N3RC	1227.....ES4RLH	1089 .....AC7JM	947.....I2VGW	855.....R1AV	750 .....ON7MIC	654 .....JA3MAT
2721 .....W3LL	1836.....AG4W	1607.....K2YYY	1185.....KC1UX	1051.....KH6SAT	922 .....EA2IA	844 .....N3DF	750 .....NH6T/W4	640 .....WA9ONY
2558 .....NT2A	1790.....JN3SAC	1500.....JH1APK	1149 .....W9IL	1047.....RW4WZ	923 .....K9UQN	812.....UR6LEY	681 .....PY5VC	638.....KE8FMJ
2360 .....KF2O	1759 .....WA5VGI	1426.....AB1OC	1139.....W1FNB	1021 .....NN1N	917 .....K7LV	811 .....WF1H	672.....K9AAN	636.....W9RPM
2345 .....N6QQ	1756 .....KØDEQ	1378 .....K3CWF	1129 .....NKØS	1009 ....GUØSUP	881 .....NE6I	810.....N3CAL	670 .....IV3GOW	611.....KO9V
2290 ....WD9DZV	1711 .....N6PM	1340 .....NXØI	1112.....AB1QB	1002.....NØRQV	868.....AF4T	800 .....WA3GOS	668.....KA5EYH	600 .....N1RR
2242.....HK3W	1704 .....IK2DZN	1325 .....W2OO	1093.....KI1U	971.....JF1LMB	866.....SQ7B	783.....YB1AR	660.....JP1KHY	600.....ADØFL
2217 .....YO9HP	1661.....N7ZO	1250W2/JR1AQN	1091 .....VA3VF	966.....NS3L	858 .....WU9D	758 .....N4JJS	654.....WB6IZG	

REMOTE OPERATION

CW	MIXED	SSB	DIGITAL
7277.....K9QVB	4026 .....N1RR	2953 .....N1RR	671 .....N1RR
3292 .....N1RR			

CQ DX Field Award Honor Roll

The CQ DX Field Award Honor Roll recognizes those DXers who have submitted proof of confirmation with 175 or more grid fields. Honor Roll lisiting is automatic upon approval of an application for 175 or more grid fields. To remain on the CQ DX Field Award Honor Roll, annual updates are required. Updates must be accompanied by an SASE if confirmation is desired. The fee for endorsement stickers is $1.00 each plus SASE. Please make all checks payable to the Award Manager, Keith Gilbertson. Mail all updates to Keith Gilbertson, KØKG, 21688 Sandy Beach Lane, Rochert, MN 56578-9604.

Mixed

K2TQC 288	HA5AGS 228	OK1AOV 208	BA4DW 188
W1CU 267	9A5CY.....227	F6HMJ 206	HB9DDZ.....188
VE7IG 254	K9YC.....227	KF8UN 205	K2AU.....187
HAØDU 253	WI8A 227	OM2VL.....205	K8YTO 186
OM3JW 253	VE3ZZ.....226	VE7SMP 204	WO7R 185
W6OAT 249	K8OOK.....225	RW4NH.....203	N3RC 184
IK1GPG.....245	KØDEQ 221	HB9AAA.....200	K2SHZ 182
OK1ADM.....244	HA1AG.....218	N5KE.....200	KJ6P 180
HA5WA 243	JN3SAC 214	W3LL.....199	W6XK.....180
K8SIX.....240	HA9PP 213	K1NU 195	W5ODD.....177
HA1RW 239	WA5VGI 213	ON4CAS 194	NØFW 176
VE3XN 239	IV3GOW.....211	NIØC 193	WA9PIE 176
I6T.....230	W4UM 210	N4NX 192	HB9BOS 175
N8PR 229	N4MM 208	HA1ZH 190	NKØS.....175

SSB

W1CU.....249	KØDEQ 198	WA5VGI 189	NØFW 176
W4ABW.....202	W4UM 198	N4MM.....188	DL3DXX 175
VE7SMP.....201	JN3SAC.....191	W3LL 187	

CW

W1CU 253	JN3SAC 211	OK1AOV 198	N4MM 184
HA5WA 235	DL3DXX.....210	WA5VGI 197	OK2PO.....184
DL6KVA 233	DL2DXA.....209	NIØC 190	N4NX 177
KØDEQ 214	W4UM 200	HB9DZZ 186	N7WO 175

Digital

W1CU 195

pedition's major stakeholders. This included the Northern California DX Foundation (NCDXF), International DX Association (INDEXA), German DX Foundation (GDXF), and the DXpedition team. These funds were allocated on a pro-rata basis, proportional to the percentage of their combined support. This strategy was designed to return as much money as possible in order to recognize their considerable confidence in our team and their large financial investment in our Bouvet project.

Also, the final distribution was most likely to be "recycled" into other, future DXpeditions. I am immensely proud of how we handled this "unwinding" and believe we have served the best long-term interests of the DX community.

One additional note, the Board of Directors of DX Expeditions, Inc. has decided to close the corporation. This tax-exempt (501c7) corporation had its beginnings in 2002 with the KP1-5 Project. It has a long history of funding DXpeditions to some of the rarest, most difficult, locations on Earth. We are pleased to have made an indelible mark on amateur radio DXpedition history.

– 73, Bob Allphin, K4UEE
Co-leader and CFO of 3YØZ
President, DX Expeditions, Inc.

CONTESTING

BY DAVID SIDDALL,* K3ZJ

July Contests Keep the Bands Active

Plus … RSGB IOTA Contest Modifications for COVID-19 Concerns, Second Annual Worldwide Digital Contest, CQ Magazine Contest Hall of Fame Honorees

As this is being written, it is impossible to know whether contesters in various countries will remain in a stage of COVID-19 lockdown for the rest of the summer contest season and into the fall. There is great variation in both the spread of the disease and the measures being used to counteract it. There is even more variation with the activities that individuals, including contesters, feel comfortable resuming.

No matter what the situation may be in any particular locality on any contest weekend, it is apparent that in-person multiple-operator contesting likely will continue to be severely restricted through the summer in many (not all) countries. Restrictions on border crossings also may not be completely lifted by the fall contest season. It is apparent that there is no universal rule to apply to the situation.

Hopefully, ham radio contesting provides an escape from boredom and seclusion if that is your situation. The bands certainly are more active and noticeably more logs are being submitted in contests. Both locally and nationwide, increasing numbers of stations are adding remote capability. There are so many different implementations that it would take a long article devoted to the subject just to scratch the surface. I know one local ham who is just using standard office software. Others have found surprisingly simple ways to connect a variety of modern rigs to the internet so that they can be used by friends across town, or across the country and even from other countries by U.S. licensees.

In the just-completed CQ Worldwide WPX CW contest, KT6V included HP1XT (K2GO) operating remotely through the Web all the way from Inchon, South Korea. And WW1X had an entire remote crew and claimed a new multi-multi record to go with the Phone weekend claimed record using the WW2DX callsign. And just as for the Phone WPX weekend, the number of logs pouring in indicates that a substantially higher new participation record will be set.

This month, the IARU HF Championship and CQ VHF contests will draw the crowds on successive weekends. The HF Championship runs on Saturday, July 11th from 1200 UTC through Sunday, July 12th at 1159 UTC. On the following weekend the CQ World Wide VHF Contest will provide some exciting opportunities on 6- and 2-meter CW, SSB, and digital modes. It runs from 1800 UTC on Saturday, July 18th, through 2100 UTC on Sunday, July 19th. Details and links are in last month's column.

The annual RSGB Islands On the Air (IOTA) Contest is at the end July, from 1200 UTC on Saturday, July 25th through 1159 UTC on Sunday, July 26th. Usually, this is a great contest for getting out in the fresh air and traveling to an island somewhere. It is the most popular of all RSGB contests, but this year the rules have been modified so as to not promote unsafe travel. The changes are discussed below.

Although the annual Contest Dinner at Dayton had to be cancelled, three more operators were inducted into the CQ Contest Hall of Fame. Awards were made at the end of the online Contest University. Congratulations to Geoff Howard, WØCG, and Bill Myers, K1GQ. Gene Zimmerman, W3ZZ (SK) also was inducted.

RSGB Islands on the Air (IOTA) Contest

The RSGB IOTA contest has always spawned significant activity from far-away islands. The RSGB contest committee gave consideration given to canceling this year's event because travel to islands and DXpeditions are part of the fun but in most parts of the world, ill-advised or even illegal this year. After consultation, the event organizers decided to adopt the temporary changes described below and to continue the weekend event. It has been scaled back this year with operators competing only from their home stations.

With these decisions made, the way was cleared and both Phone and CW activity will commence as scheduled at 1200 UTC on Saturday, July 25th and continue until 1200 UTC on Sunday, July 26th. A permanent rules change *not* related to the pandemic requires sending signal reports — RS or RST — for each QSO. (Sending signal reports has been optional in previous years.)

The changes adopted for this year only because of the pandemic are that there will be no multi-operator and no DXpedition categories. This year's contest categories are for single operators only using their home stations, which may include single-operator fixed "Island" or "World" Stations. In addition, no trophies will be awarded.

RSGB HF Contest Committee Chair Nick Totterdell, G4FAL, provided the following explanation:

"The decision to continue the IOTA Contest in 2020 without multi-operator or DXpedition sections was made following consultation with 656 UK and international radio amateurs. 139 wished to see the contest cancelled altogether and 355 wished to see the contest continue but without DXpedition or multi-operator sections. It was also decided by consultation that no trophies should be awarded for the IOTA contest in 2020.

"The national guidance in the UK is to avoid non-essential travel and particularly to avoid travel to isolated communities, typical of our IOTA island destinations, which have limited healthcare facilities and possibly more vulnerable populations. Overnight trips for recreational purposes are currently illegal.

"Clearly there will be some locations around the world where a DXpedition to an uninhabited island might be appropriate,

email: <k3zj@cq-amateur-radio.com>

This fall, the competition for a seat at WRTC2022 in Italy will come to a finish after two years with the CQWW DX CW Contest weekend. The organizers of the next World Radiosport Team Championship event have been negotiating through a very rough COVID-19 pandemic in their region. We wish them the best in these challenging times.

but for the majority worldwide this is unlikely to be the case and therefore a DXpedition section would be significantly distorted if it were retained in 2020."

The complete rules as amended for this year are found at <https://tinyurl.com/ycvnceco>.

August World Wide Digi DX Contest

August 29-30th are the dates for the second World Wide Digi DX Contest. The competition will play from 1200 UTC Saturday until 1200 UTC Sunday (24 hours). Scoring in this contest is uniquely based on distance, as measured by the short-path distance between grid square centers. Each QSO is worth one point, plus one point for each 3,000 kilometers between grid square centers of the QSO partners. Multipliers consist of each different 2-character grid field contacted on each of the six bands used (160-80-40-20-15-10 meters).

This contest, sponsored jointly by the World Wide Radio Operators Foundation (WWROF) and the Slovenia Contest

Calendar of Events

All year	**CQ DX Marathon**	**http://bit.ly/vEKMWD**
June 29-July 5	10-10 Int. Spirit of 76 QSO Party	http://bit.ly/1FrFeBc
July 1	RAC Canada Day Contest	https://tinyurl.com/y73fy8ty
July 4	FISTS Summer Slow Speed Sprint	http://fistsna.org/operating.html#sprints
July 4-5	Marconi Memorial HF Contest	www.arifano.it/contest_marconi.html
July 4-5	DL-DX RTTY Contest	www.drcg.de
July 4-5	Original QRP Contest	www.qrpcc.de/contestrules/index.html
July 4-5	PODXS 070 Club 40 Meter Firecracker Sprint	http://bit.ly/2FUmeOL
July 4-5	YBDXC 80M Contest	https://80m.ybdxcontest.com
July 6	RSGB 80m Club Championship, CW	https://tinyurl.com/rksy9yo
July 11	FISTS Summer Sprint	http://fistsna.org/operating.html#sprints
July 11-12	IARU HF Championship	www.arrl.org/iaru-hf-world-championship
July 11-12	Veron SLP Contest	http://bit.ly/2L9eT1L
July 12	QRP ARCI Summer Homebrew Sprint	www.qrparci.org/contests
July 15	RSGB 80m Club Championship, SSB	https://tinyurl.com/rksy9yo
July 18-19	**CQWW VHF Contest**	**www.cqww-vhf.com**
July 18-19	North American RTTY QSO Party	http://ncjweb.com/NAQP-Rules.pdf
July 19	CQC Great Colorado Gold Rush	www.coloradoqrpclub.org/contests/gold.htm
July 23	RSGB 80m Club Championship, Data	https://tinyurl.com/rksy9yo
July 25-26	RSGB IOTA Contest	www.rsgbcc.org/hf/rules/2020/riota.shtml
July 27	RSGB FT4 Contest Series	http://bit.ly/38xg9V7
Aug. 1	European HF Championship	http://bit.ly/H2eMg5
Aug. 1	WAB 144 MHz Low Power Phone	http://bit.ly/31yE4kT
Aug. 1-2	10-10 Int'l Summer Contest SSB	http://bit.ly/1FrFeBc
Aug. 1-2	ARRL 222 MHz and Up Distance Contest	http://bit.ly/2IJZcy9
Aug. 1-2	North American CW QSO Party	http://ncjweb.com/NAQP-Rules.pdf
Aug. 2	SARL HF Phone Contest	http://bit.ly/H0IqQf
Aug. 6	NRAU 10m Activity Contest	http://bit.ly/2RTmcel
Aug. 8	QRP ARCI European Sprint	http://www.qrparci.org/contests
Aug. 8-9	Worked All Europe CW Contest	http://bit.ly/2vufgcb
Aug. 8-9	Maryland-DC QSO Party	https://www.w3vpr.org/node/325
Aug. 10	SARL Youth Sprint	http://bit.ly/H0IqQf
Aug. 15-16	ARRL 10 GHz and Up Contest	http://www.arrl.org/10-ghz-up
Aug. 15-16	CVA DX Contest CW	http://cvadx.org/regulamento/
Aug.15-16	KCJ Contest	https://www.kcj-cw.com/e_index.htm
Aug. 15-16	North American SSB QSO Party	http://ncjweb.com/NAQP-Rules.pdf
Aug. 15-16	SARTG RTTY Contest	http://www.sartg.com/index.html
Aug. 16	ARRL Rookie Roundup RTTY	http://www.arrl.org/rookie-roundup
Aug. 16	NJQRP Skeeter Hunt	http://w2lj.blogspot.com/p/njqrp-skeeter-hunt.html
Aug. 16	SARL HF Digital Contest	http://bit.ly/H0IqQf
Aug. 22-23	50 MHz Fall Sprint	http://svhfs.org/wp/
Aug. 22-23	CVA DX Contest, SSB	http://cvadx.org/regulamento/
Aug. 22-23	International Lighthouse Lightship Weekend – ILLW	https://illw.net/
Aug. 22-23	Ohio QSO Party	http://www.ohqp.org/index.php/rules/
Aug. 22-23	RDA Contest	http://rdaward.org/rdac1.htm
Aug. 22-24	Hawaii QSO Party	http://hawaiiqsoparty.org/
Aug. 29	Kentucky State Parks on the Air	https://k4msu.com/kypota/
Aug. 29-30	Kansas QSO Party	http://www.ksqsoparty.org/
Aug. 29-30	YO DX HF Contest	https://www.yodx.ro/en/
Aug. 29-30	ALARA Contest	http://www.alara.org.au/contests/
Aug 29-30	W/VE Island QSO Party	https://usislands.org/qso-party-rules/
Aug. 29-30	World Wide Digi DX Contest	https://ww-digi.com/
Aug. 30	SARL HF CW Contest	http://bit.ly/H0IqQf
Sept. 26-27	**CQWW RTTY DX Contest**	**www.cqwwrtty.com**

Club (SCC), was held for the first time last year. A total of 178,906 QSOs were represented in the 1,328 logs submitted from all over the world, even though the contest itself was announced just weeks before it was held. The sponsors' stated intent is to schedule this contest every year on the last full weekend of August to kick off the world wide DX contest season. The CQ World Wide RTTY DX Contest follows on the last full weekend of September. It is in turn followed by CQWW DX Phone on the last full weekend of October and the CQWW DX CW on the last full weekend of November.

The WW Digi DX contest website and rules have been updated and are available at <www.ww-digi.com>. Note that both FT4 and FT8 will likely be used by most operators during the competition. The published operating tips on the website contain a wealth of useful information, including how to avoid excessive NIL (not-in-log) penalties and frequency options when the bands get crowded.

The most notable change in the rules from last year is that the NIL penalty has been reduced. Some of last year's scores actually were negative when the originally-mandated penalties were applied. You are encouraged to explore these resources as you prepare for this year's event. Confirming a successful contact has been a problem not only in this particular competition, but also in other digital contests using FT4 and FT8. The WSJT-X team and some contesters have studied this problem. What they found and advice on ensuring a completed QSO on both ends is recounted in an article in the May / June (2020) *National Contest Journal* (NCJ) by Contest Director Ed Muns, WØYK, at p. 29. It can be read at <https://tinyurl.com/yajlkn3x>.

Another aspect often discussed about use of FT4 and FT8 modes in contests is the length of time required to complete a QSO compared to that needed when using other modes. This especially is a topic among those who participate in VHF / UHF contests because phone and CW may also be used in those competitions and both allow for quicker exchanges and hence greater "rate." But because of their superior weak-signal capabilities, FT4 and FT8 support many QSOs with multipliers and stations that otherwise could not otherwise be worked.

So what kind of rate is possible using FT4 / FT8? In last year's contest, the top 60-minute QSO rate was attained by K6MR operating at NV6D, with 102 QSOs. Runner-up was K5ZD clocked at 97 QSOs, and in third place was DF7EE operating at LX7I with 88 QSOs. The contest website has the complete records list nicely accompanied by a log extract covering the relevant hour and top rates-per-minute also specified.

Photo A. 2020 CQ Contest Hall of Fame inductee Geoff Howard, WØCG, seen here operating from PJ2T in Curacao. (Photo courtesy of WØCG)

Also note that Rule 12 provides that "Each QSO must require some action by the operator, e.g., selecting a QSO partner. In other words, robots not allowed to spell (or take the place) of human operators.

Log deadline is 5-1/2 days (yes, this was confirmed as correct) after the end of the contest. Deadline is 2359 UTC on Friday, September 4. Logs *MUST* be submitted using the web submission tool specified in the rules. As with most contests today, the last-submitted log is the final and only log retained if you submit your log multiple times. Therefore, if you submit your log again after the deadline, the log will be considered as having been submitted late, even if you submitted the same log earlier. A "logs-received" list is provided on the website to double-check receipt if you do not receive a direct acknowledgement at the email address you provide.

CQ Contest Hall of Fame Honorees

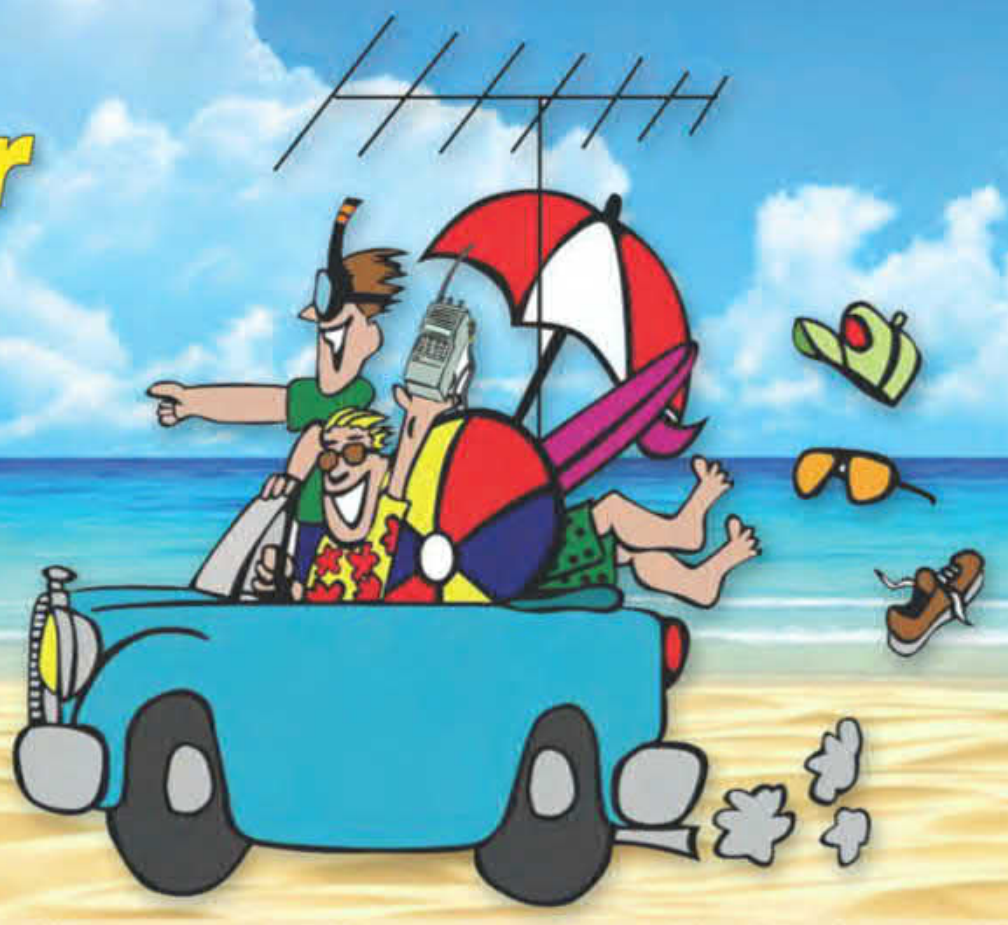
This year, *CQ* magazine was pleased to honor three contesters for their outstanding and sustained contributions to the radiosport. This year's inductees are Geoff Howard, WØCG (*Photo A*); Bill Myers, K1GQ (*Photo B*); and Gene Zimmerman, W3ZZ (SK) (*Photo C*). The awards were made at the conclusion of Contest University, which this year was held virtually on a Zoom® webinar. Their accomplishments are recognized elsewhere in this issue.

– Until next month, 73, Dave, K3ZJ

Photo B. Bill Myers, K1GQ, was also inducted into the CQ Contest Hall of Fame this year. (Photo courtesy of K1GQ)

Photo C. This year's third Contest Hall of Fame inductee was Gene Zimmerman, W3ZZ (SK).

Get Ready for Summer!



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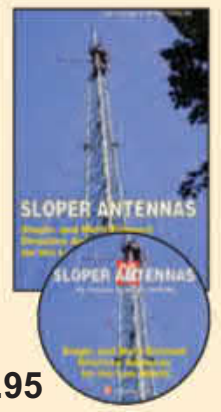

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PROPAGATION

BY TOMAS HOOD,* NW7US

Cycle 25 Solar X-Ray Flare!

A Quick Look at Current Cycle 24 / 25 Conditions
(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

A_p Index:
Observed Monthly, April 2020: 6
12-month smoothed, October 2019: 6

***One Year Ago:* A Quick Look at Solar Cycle Conditions**
(Data rounded to nearest whole number)

Sunspots:
Observed Monthly, April 2019: 6
12-month smoothed, October 2018: 4

10.7-cm Flux:
Observed Monthly, April 2019: 72
12-month smoothed, October 2018: 70

A_p Index:
Observed Monthly, April 2019: 6
12-month smoothed, October 2018: 7

The new Sunspot Cycle 25 is bursting to life — and the first M-class flare of this new cycle erupted on May 29, 2020, between 07:20 and 07:30 UTC. It peaked at a maximum energy level of M1.1. The event started at 0713, peaked at 0724, and ended at 0728 UTC, the first major flare in 925 days. (*See Figure 1*)

Some have wondered if we had entered a grand solar minimum <https://g.nw7us.us/2MrV5q6>. The truth is, just like the cycle minimum period between Cycles 23 and 24, this period between Cycle 24 and the new Cycle 25 was prolonged, but not in the same category as the Grand Solar Minimum of 1645 to 1715 during which sunspots became exceedingly rare, as was noted then by solar observers <https://g.nw7us.us/mm1645>. At least, that's the consensus at the moment. There have been more sunspots, this year, as 2020 unfolds.

Another sign that we are entering Sunspot Cycle 25 is Hale's Polarity Law holding true as Cycle 24 ends. Hale's Polarity Law pertains to how the sun's magnetic fields follow certain patterns. Specifically, this law states that the leading and trailing magnetic fields in an active solar region belonging to the older sunspot cycle have the opposite magnetic orientation to that of sunspots belonging to the new solar cycle. The law describes how the orientations of these magnetic fields flip in the incoming sunspot cycle.

In *Figure 2*, we see proof of the switch-over of the magnetic orientation as the left image shows an HMI magnetogram from April 3, 2011, in which the active regions reveal magnetic fields going into the Sun (as the black areas) on the leading edges, while magnetic field lines punching out of the Sun (as the white areas) are trailing.

Sunspots travel, from our perspective, from the left edge of the Sun to the right edge. The leading edge, then, is toward the right edge of the solar disc.

In the right HMI image in *Figure 2* from April 2, 2020, we see a high-latitude active region (Active Region 12759) which has the outward field leading the active region. The inward magnetic field is trailing.

The Sun actually has a larger cycle than the well-known 11-year sunspot cycles that we number (*Sunspot Cycle 25*

** P.O. Box 29553*
Lincoln, NE 68529
Email: <nw7us@nw7us.us>
@NW7US (https://Twitter.com/NW7US)
@hfradiospacewx (https://Twitter.com/HFRadioSpaceWX)

LAST-MINUTE FORECAST

Day-to-Day Conditions Expected for July 2020

	Expected Signal Quality			
Propagation Index	**(4)**	**(3)**	**(2)**	**(1)**
Above Normal: 1-3, 6-12, 14, 17, 20-23, 25, 28-30	A	A	B	C
High Normal: 4-5, 13, 15-16, 18-19, 26-27, 31	A	B	C	C-D
Low Normal: 24	B	C-B	C-D	D-E
Below Normal: n/a	C	C-D	D-E	E
Disturbed: n/a	C-D	D	E	E

Where expected signal quality is:
A--Excellent opening, exceptionally strong, steady signals greater than S9
B--Good opening, moderately strong signals varying between S6 and S9, with little fading or noise.
C--Fair opening, signals between moderately strong and weak, varying between S3 and S6, with some fading and noise.
D--Poor opening, with weak signals varying between S1 and S3, with considerable fading and noise.
E--No opening expected.

HOW TO USE THIS FORECAST

1. Using the **Propagation Charts** appearing in "The New Shortwave Propagation Handbook," by George Jacobs, Theodore J. Cohen, and R. B. Rose,

a. Find the *Propagation Index* associated with the particular path opening from the **Propagation Charts**.

b. With the *Propagation Index*, use the above table to find the expected signal quality associated with the path opening for any given day of the month. For example, openings shown in the Propagation Charts with a *Propagation Index* of 1 will be fair on July 1 through July 3, while July 4 and 5 will be poor to fair, and so forth.

2. Alternatively, you may use the *Last-Minute Forecast* as a general guide to space weather and geomagnetic conditions throughout the month. When conditions are *Above Normal*, for example, the geomagnetic field should be quiet, and space weather should be mild. On the other hand, days marked as *Disturbed* will be riddled with geomagnetic storms. Propagation of radio signals in the HF spectrum will be affected by these geomagnetic conditions. In general, when conditions are *High Normal* to *Above Normal*, signals will be more reliable on a given path, when the ionosphere supports the path that is in consideration. This chart is updated daily at <http://SunSpotWatch.com> provided by NW7US.

Figure 1. A moderately-strong X-ray flare erupted on May 29, at 0713 UTC, peaking minutes later and then fading before 0730 UTC. This fast flare is the first solar flare of any significant size in 925 days. Watch a video of the flare at <https://tinyurl.com/ybgsvqvh>. (Photo by NW7US)

is the 25th such 11-year cycle since we started counting in 1755–NW7US). The reversal of magnetic orientation between each 11-year cycle indicates that the Sun actually has a 22-year solar cycle — a full cycle — making our 11-year cycle only a half cycle.

There have been a few other such regions observed recently. That, coupled with this M1.1-class solar X-ray flare, leads many to think that we are at the cusp of the new cycle. Of course, that is welcome news to enthusiasts of shortwave radio signal propagation. The more solar activity — the more sunspots — the higher the frequencies that get propagated long distances via the ionosphere.

Stay tuned to this column for updates and an explanation of how all of this works. Take a look online at my up-to-the-day Last-Minute Forecast chart, available on my Space Weather and Radio Propagation Center at <http://SunSpotWatch.com>.

July Shortwave (HF) Propagation

Many DX hunters view July as the least exciting month of the year. With generally lower daytime Maximum Usable Frequencies (MUFs), the highest of the

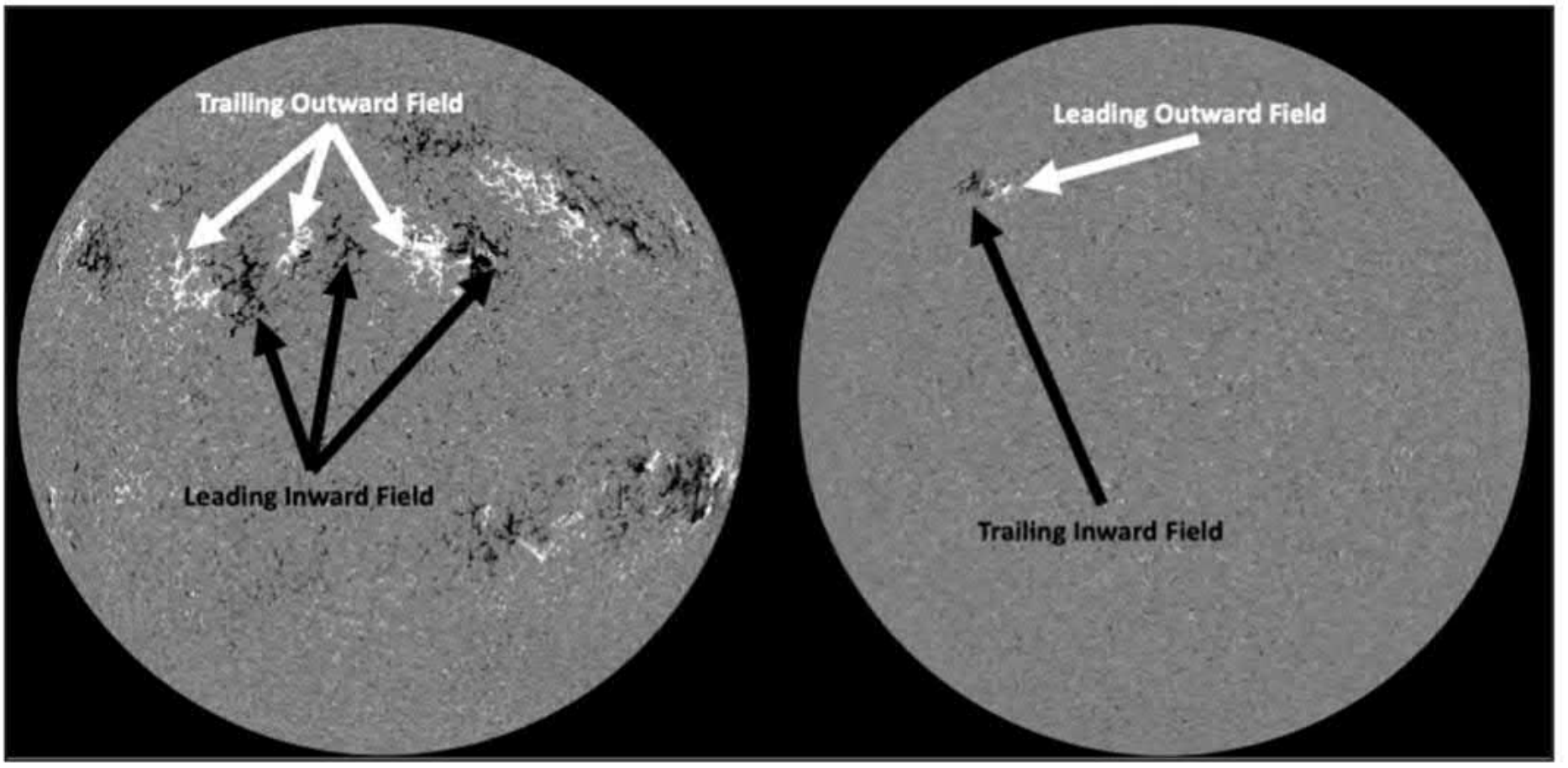


Figure 2. On the left is an HMI magnetogram from April 3, 2011, during the rise to the maximum of Solar Cycle 24. There are several active regions in the northern hemisphere of the Sun. The magnetic field going into the Sun is shown as black and the outward field is white. Arrows point to three active regions (AR 11180, 11183, and 11184, right to left arrows) and show that the inward field leads the outward field. On the right is a magnetogram from April 2, 2020. A high-latitude active region (AR 12759) has the outward field leading and the inward magnetic field is trailing. AR 12759 is at 28 N (the same latitude as Cape Canaveral, FL, SDO's launch site). The high-latitude, oppositely-directed field active region AR 12759 is just the beginning of Solar Cycle 25. The leading field is an outie. (Courtesy of Dean Pesnell, SDO)

amateur HF bands are mostly unusable for stable long-distance F-layer propagation during the summer. Added to this seasonal change is the low solar activity of this solar cycle minimum. With the 10.7-cm flux levels hovering right around 70, rarely will the highest amateur HF bands wake up.

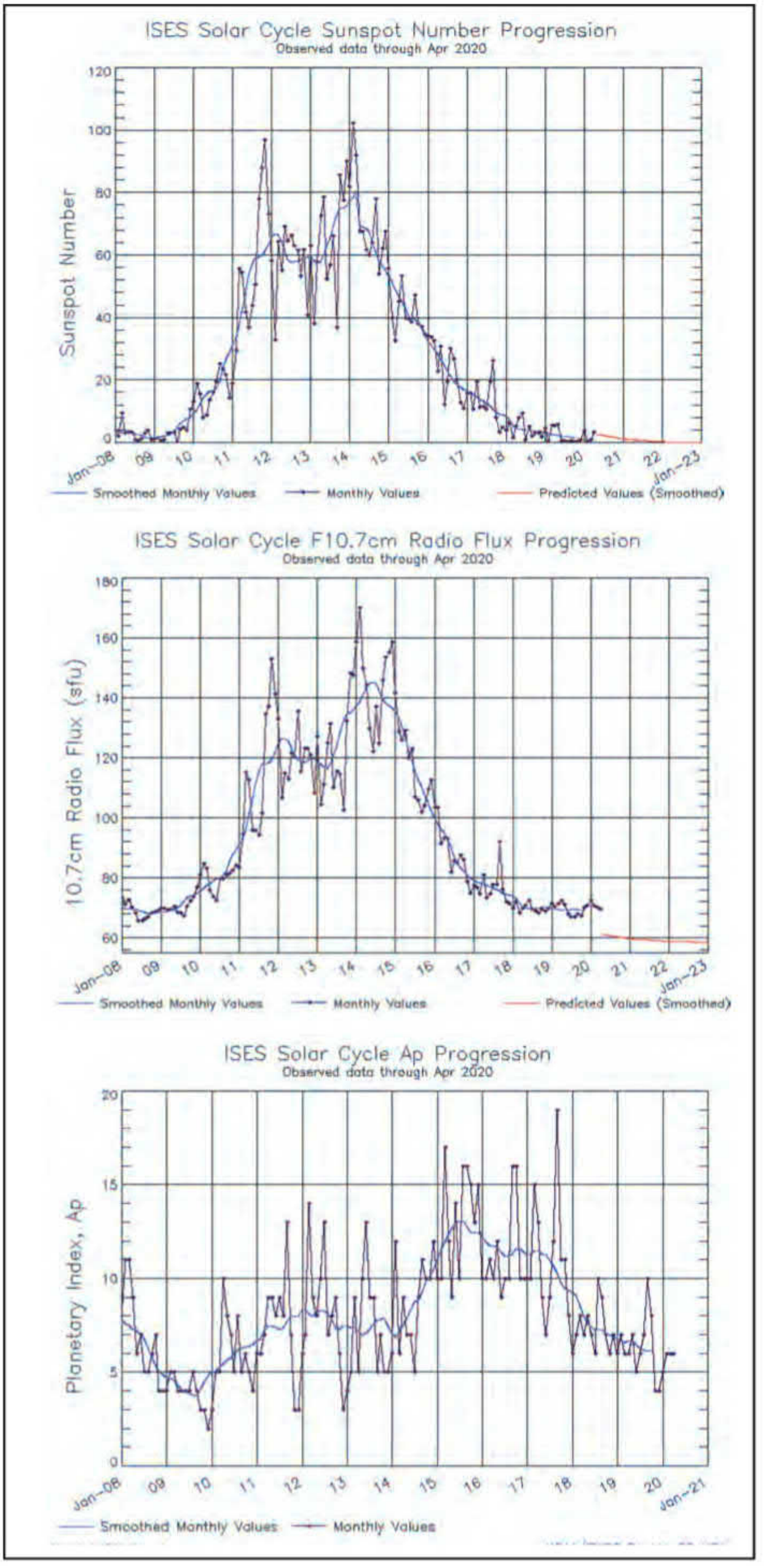
While F-layer propagation of the highest HF frequencies will be poor, radio signals near the Best Usable Frequency (BUF) will be stable over paths that could remain open for longer periods than during the winter and early spring season.

In addition, July's sporadic-E (E_s) ionization is near the year's seasonal peak. 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. When conditions are at least "Low Normal" (refer to the "Last-Minute Forecast"), the band is expected to open to one area of the world or another between sunrise and the early evening. Peak conditions on 20 meters are expected for a few hours after local sunrise and again during the late afternoon and early evening. When conditions are at least "Low Normal", expect 20-meter openings towards South America, the South Pacific, and Oceania until as late as midnight. When conditions are "High Normal" or better, the band should also remain open to most other areas of the world until as late as midnight.

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

Figure 3. The most recent solar cycle (Cycle 24) is represented in several ways. At the top is the Sunspot Number, in the middle is the F10.7-centimeter Radio Flux, and at the bottom, the A_p Index (a measure of geomagnetic activity) history. These plots are as of May 2020. In all of the plots, the black line represents the monthly averaged data and the blue line represents a 13-month smoothed version of the monthly averaged data. For the Sunspot Number and F10.7cm, the forecast for the rest of the solar cycle is given by the red line. As is clear, we are at the bottom of Sunspot Cycle 24. It is possible that we will see some significant increase in sunspot activity during 2020. (Courtesy of SWPC/ NOAA)



between 3 and 5 p.m. local daylight time, on 17 and 15 meters. When conditions are "High Normal" or better, these bands may also open to Africa during the late afternoon from the eastern half of the U.S., and to Australasia and the South Pacific area during the late afternoon and early evening from the western half of the country. Seventeen meters will act somewhat the same as 15, but openings will tend to be longer, and signals perhaps stronger and more stable.

Expect short-skip openings on the 10- and 12-meter bands during July toward the Caribbean and possibly Central America as a result of E_s ionization. When conditions are "High Normal" or better, an occasional opening deeper into South America may be possible, especially during the afternoon hours.

Overall, look for frequent short-skip openings on the 10-, 12-, 15-, and 17-meter bands between distances of 500 and 1,300 miles. During the afternoon hours, skip may extend to beyond 2,300 miles as a result of F-layer reflection.

Short-skip openings should range between 250 and 2,300 miles on 20 meters. Peak conditions are most likely to occur during the late morning and again during the late afternoon and early evening hours.

Daytime openings on 40 and 30 meters should range between 100 and 600 miles, increasing to between 250 and 2,300 miles after sunset.

Look for openings up to about 300 miles on 80 meters during the day, extending out to the maximum short-skip distance (one-hop F-layer reflection) of 2,300 miles during the hours of darkness.

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 both 30 and 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. However, 160 meters is 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 toward the north and east, and just before local sunrise for openings toward the south and west. Expect some 160-meter openings between sunset and sunrise for distances up to approximately 1,300 miles, if the static levels permit.

Peak Sporadic-E Propagation

Optimum short-skip propagation conditions are expected during July as a result of a seasonal peak in E_s ionization. Expect an increase in the number of short-skip openings on HF, and often on 6 and 2 meters. During the daylight hours, considerable short-skip openings are forecast for 10 and 15 meters over distances ranging between approximately 400 and 1,300 miles, with openings occasionally extending to beyond 2,000 miles.

Around-the-clock short-skip openings should be possible on most days on 20 meters, with the skip often as short as 300 miles and as long as 2,300 miles. Short-skip conditions on 20 meters should peak during the late afternoon and the early evening.

Good daytime openings on 40 and 30 meters should range between 100 and 750 miles, increasing to between 250 and 2,300 miles after sunset. Look for openings out to about 300 miles on 80 meters during the day, extending to the one-hop limit of 2,300 miles during the hours of darkness. However, these bands could be quite noisy.

While no short-skip openings are likely on 160 meters during the daylight hours of July, expect some openings between sunset and sunrise for distances up to approximately 1,300 miles, if the static levels are low.

VHF Propagation

Statistical studies show that a sharp increase in E_s propagation takes place at mid-latitudes during the late spring and summer months. During July and August, short-skip propagation over distances ranging between approximately 600 and 1,300 miles should be possible on 6 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 short-skip 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 6-meter E_s on at least three out of every four days. Openings may last from a few minutes up to hours.

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 this columnist provides a wealth of current space weather details as well as links. Please report your observations of any notable propagation conditions, by writing this columnist via Twitter, or via the Space Weather and Radio Propagation Facebook page at <https://fb.me/spacewx.hfradio>.

Current Solar Cycle Progress

The Royal Observatory of Belgium reports that the monthly mean observed sunspot number for April is 3.2, a nice bump up, perhaps an indication that Cycle 25 is ramping up. The 12-month running smoothed sunspot number centered on October is 1.6. A smoothed sunspot count of 6, give or take about 6 points is expected for July 2020.

The Dominion Radio Astrophysical Observatory at Penticton, BC, Canada, reports a 10.7-cm observed monthly mean solar flux of 70.1 for April 2020. The 12-month smoothed 10.7-cm flux centered on October is 69.5. These numbers staying steadily low is the clear indication of the current cycle minimum period. The predicted smoothed 10.7-cm solar flux for July 2020 is 68.

The observed monthly mean planetary A-Index (A_p) for April is at 6. The 12-month smoothed A_p index centered on October 2019 is 6.2.

Geomagnetic activity this month should be mostly quiet with fair to good propagation conditions, except for those days indicated in the "Last-Minute Forecast" during which we expect degraded propagation (remember that you can get an up-to-the-day "Last-Minute Forecast" at <http://SunSpotWatch.com> on the main page).

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

ANNOUNCEMENTS *(from page 2)*

SEPTEMBER

SHEPERDSVILLE, KENTUCKY — The Greater Louisville Hamfest Association will hold the **Greater Louisville Hamfest** from 8 a.m. to 2 p.m., Saturday, September 12 at the Paroquet Springs Conference Center, 395 Paroquet Sprinfs Drive. Website: <http://louisvillehamfest.com>. Talk-in 146.700 (PL 79.7) or 443.700 (PL 79.7).

TOWAMENCIN TOWNSHIP, PENNSYLVANIA — Special event station **W3L** will be on the air from Wednesday, September 16 through Friday, September 25 to commemorate the 243rd anniversary of the saving of the Liberty Bell. Frequencies include 14.240, 7.240, 3.840 MHz on SSB; 14.030 and 7.030 MHz on CW; 14.074 and 7.074 MHz for FT8. Website: <www.w3l.info>.

COLOGNE, MINNESOTA — The SMARTS Radio Club will hold **SMARTSFEST 2020** from 8 a.m. to noon, Saturday, September 19 at the Cologne Community Center, 1211 Village Parkway. Email: <contactus@smartsfest.org>. Website: <www.smartsfest.org>. Talk-in 147.165. VE exams.

ADRIAN, MICHIGAN — The Adrian Amateur Radio Club will hold the **Adrian Hamfest** from 8 a.m. to 1 p.m., Sunday, September 20 at the Lenawee County Airport, 2651 W. Cadmus Road. Contact Mark Hinkleman, NU8Z, (517) 423-5906. Email: <cqnu8z@comcast.net>. Website: <http://w8tqe.com>. Talk-in 145.970- (PL 85.4). VE exams.

CAMBRIDGE, MASSACHUSETTS — The Harvard Wireless Club, **MIT Electronics Research Society**, **MIT UHF Repeater Association**, and **MIT Radio Society** will hold the **Flea at MIT** from 9 a.m. to 2 p.m., Sunday, September 20 at the parking garage on Albany and Main Streets. Phone: (617) 253-3776. Website: <www.swapfest.us>. Talk-in 146.52 or 449.725- (PL 114.8).

EAST STROUDSBURG, PENNSYLVANIA — The Eastern Pennsylvania Amateur Radio Association will hold its **2020 Hamfest** beginning 8 a.m., Sunday, September 20 at the American Legion Post 346, 126 E. 5th Street. Phone: (570) 350-1185. Email: <wsk11@outlook.com>. Website: <www.qsl.net/n3is>. Talk-in 147.045 (PL 131.8). VE exams.

CARLTON, MINNESOTA — The Arrowhead Radio Amateur Club will hold its **HAM FEST** from 9 a.m. to 1 p.m., Saturday, September 26 at the Four Seasons Sports Complex and Events Center, 90 Chestnut Avenue. Contact Robert Schulz, KCØNFB, (218) 481-7458. Email: <arac_hamfest@charter.net>. Website: <http://thearac.org>. Talk-in 146.940- (PL 103.5), 147.000- (PL 103.5), or 146.940- (PL 114.8). VE exams, card checking.

BEREA, OHIO — The Hamfest Association of Cleveland will hold the **46th Annual Cleveland Hamfest and Computer Show** from 8 a.m. to noon, Sunday, September 27 at the Berea Fairgrounds, 160 Eastland Road. Phone: (800) CLEFEST (253-3378). Website: <www.hac.org>. VE exams.

2020 CQWW WPX RTTY Contest Line Scores

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, QRP entries follow low power. Category 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	**AA**	**3,739,892**	**1734**	**767**
				(OP: K5ZD)
KE1S	"	1,406,524	894	526
				(OP: W1AN)
K1SM	"	756,545	708	415
KB1W	"	687,752	700	389
NV1Q	"	506,044	603	371
K1DBO	"	301,894	479	271
KR1CW	"	266,509	444	257
				(OP: W1CTN)
W1TO	"	253,725	337	255
K3IU	"	215,475	370	255
NG1I	"	214,570	419	215
N1MD	"	179,070	307	235
KX1X	"	158,130	323	210
NX3Z	"	101,936	271	184
AE1T	"	88,570	221	170
WA2HIP	"	51,213	204	129
W1GSH	*"*	*33,184*	*131*	*122*
W1FA	"	15,504	86	68
K1SFA	**21A**	**24,840**	**137**	**120**
				(OP: K1MK @K1TTT)
WK1Q	**3.5A**	**1,218,124**	**743**	**466**
				(OP: K1MK @K1TTT)
***NG1R**	**AA**	**1,340,889**	**1070**	**537**
				(OP: W1QK)
*N1API	"	360,800	477	352
*W1ARY	"	354,548	494	302
*AE1EZ	"	286,272	485	284
*NM1C	"	152,978	346	223
*KA1C	"	125,826	321	201
*KS1J	"	113,696	221	176
*K1VW	"	112,800	283	188
*K1PLL	"	97,328	249	176
*K1ECU	"	90,720	234	162
*AA1SU	"	80,400	237	150
*KG1V	"	68,000	242	160
*KC1SA	"	66,868	218	146
WA1GOS	*"*	*59,318*	*186*	*133*
*WB1AEL	"	56,840	197	145
*WK1J	"	47,850	197	145
*W1HBR	"	36,234	161	122
*KE5ISO	"	30,184	145	98
*W1MAW	"	29,866	138	109
*KB1LRL	"	24,904	122	88
*W1NU	"	24,186	96	87
*AE1P	"	17,700	155	100
*K7RB	"	16,150	100	85
*N1RDN	"	6,972	47	42
*K1TIG	"	6,854	49	46
*K3IB	"	5,031	48	43
*W1MJ	"	2,552	34	29
*W1ZFG	"	1,742	31	26
*N1TYH	"	1,334	25	23
***N2HX**	**21A**	**112**	**14**	**14**
**N1GDD*	*14A*	*1,443*	*39*	*37*
***AB1J**	**7A**	**317,328**	**448**	**264**
*W1FSH	"	58,716	185	126
*NG1M	"	3,744	40	39
W1IG	**AA**	**1,770**	**37**	**30**

District 2

NR2C	**AA**	**1,702,943**	**1138**	**583**
WX2NJ	"	1,260,396	954	471
				(OP: K2RET)
K2RB	"	710,190	778	390
WA2MCR	*"*	*496,155*	*604*	*341*
WS9M	"	483,197	651	341
AA2GF	"	385,985	569	323
N1IBM	"	327,275	366	325
KE1IH	"	324,884	423	283
W2JV	"	282,720	416	285
N2YBB	"	270,788	454	266
WB2NVR	"	262,680	400	264
K2PAL	"	206,793	381	243
KU2M	*"*	*146,475*	*233*	*189*
N2CU	"	145,824	279	217
WB2WPM	"	122,748	306	212
KF2TI	*"*	*113,277*	*239*	*183*
AB2ZY	*"*	*105,792*	*261*	*174*
KN2M	"	52,668	171	133
KC2LST	"	52,632	179	129
N2RC	"	44,625	156	125
WB2PJH	*"*	*32,775*	*152*	*115*
N8CL	"	30,160	163	104
N2LK	*"*	*29,973*	*135*	*97*
KG2U	"	27,776	142	112
WA2DE	"	23,644	130	92
K2XA	"	18,785	69	65
NW2P	"	16,770	110	86
				(OP: N6EE)
KA2AEY	"	14,706	106	86
W2YK	"	13,938	78	69
KR2Q	"	1,260	18	18
NG2P	"	496	17	16
N2MM	**14A**	**805,194**	**792**	**481**
K2MFW	"	15,660	93	87
K2TW	**3.5A**	**160,792**	**334**	**199**
***N2HMM**	**AA**	**651,896**	**726**	**392**
*KF2O	"	641,356	565	436
*AG2AA	"	375,099	569	291
*K2QB	"	373,107	517	327
*KV2U	"	368,300	528	290
				(OP: K2AL)
*WA2QAU	"	230,635	445	239
**WB2NFL*	*"*	*226,500*	*422*	*250*
*WB2COY	"	225,040	420	232
*KC2WUF	"	223,015	382	235
*AH2O	"	213,760	400	256
*KE2D	"	209,077	314	229
**AK2S*	*"*	*203,150*	*319*	*239*
*NS2N	"	198,588	366	228
*KS2G	"	131,580	366	215
*NV2D	"	115,992	331	179
				(OP: K2CR)
*N2FF	"	105,148	223	194
*AC2OC	"	100,377	247	171
*W2DXE	"	80,240	229	170
*K9CHP	"	75,143	226	163
*W2FDJ	"	56,160	185	135
*KD2DVW	"	55,085	178	115
*W2GFV	"	49,590	181	145
*NA2NY	"	41,600	156	128
*AC2RL	"	36,050	126	103
*K2NV	"	25,389	99	91
*ND2K	"	24,180	125	93
*KB2NB	"	11,832	77	68
*K2YR	"	8,584	71	58
*AC2IK	"	5,995	62	55
**N2IPH*	*"*	*4,859*	*56*	*43*
*KB2URI	"	3,526	47	41
*N2LBZ	"	1,131	33	29
*KB2MMI	"	338	13	13
*AC2XC	"	216	9	9
***W2VTV**	**7A**	**98,010**	**220**	**165**
*KA2WIK	"	12,998	86	67
*N2OWD	"	208	14	13
***KA5W**	**3.5A**	**2,340**	**32**	**30**
N2WK	**AA**	**408,930**	**601**	**317**
K2YG	"	301,376	461	277
N3CRT	**7A**	**36,600**	**149**	**100**
W2NTN	**3.5A**	**18,252**	**108**	**78**
KB2HSH	"	4,160	49	40

District 3

AA3B	**AA**	**5,820,840**	**2269**	**855**
KF3P	"	3,340,295	1635	665
				(OP: K3MM)
N3QE	"	2,960,342	1549	658
KA3GIK	*"*	*2,553,759*	*1393*	*657*
				(OP: W3FIZ)
W3FV	"	2,386,628	1329	589
K3WW	"	1,482,756	1003	564
K2XR	"	1,303,500	855	550
NE3H	*"*	*1,152,000*	*933*	*500*
W2CDO	"	1,023,295	799	455
AB3CV	"	891,546	624	417
K3MD	"	797,650	814	430
NF3R	"	759,655	812	403
4U1WB	"	717,706	866	374
				(OP: AJ3M)
K3PP	"	499,044	490	364
N3FJP	"	459,172	629	322
N3OC	"	410,238	484	321
K3WJV	"	334,012	490	302
AA3S	"	284,416	412	256
N3ALN	"	236,924	406	244
K3TN	"	232,716	369	246
N3XL	"	230,989	406	253
NY3B	"	195,200	361	244
WC3N	"	195,140	407	220
N8WXQ	*"*	*177,285*	*359*	*223*
K1BZ	"	170,126	305	209
WY3A	"	158,589	283	201
K9RS	"	142,486	297	191
WW3S	"	135,201	252	187
W3OU	"	130,482	263	198
KD3TB	"	125,376	291	192
N3DUE	"	92,364	250	172
NN3RP	"	92,061	238	159
K3UL	"	77,252	236	178
KA3YJM	"	52,256	211	142
K3FH	"	21,200	99	80
WN3I	"	19,890	108	85
NA3M	"	7,998	43	43
K2EJ	"	3,264	36	34
K3OQ	"	2,516	50	37
AF3I	"	1,856	34	32
W3LL	**7A**	**32,088**	**97**	**84**
KE3GK	**3.5A**	**65,552**	**201**	**136**
WA3FRP	"	8,892	66	57
***W3KB**	**AA**	**552,750**	**521**	**375**
*WA3FAE	"	393,658	525	298
*KB3LIX	"	286,000	440	260
*K2LNS	"	265,506	404	274
*WA3AAN	"	230,808	409	236
*AB3GY	"	187,629	363	221
*KB3AAY	"	141,200	295	200
*KE3ZT	"	127,786	297	181
*N3PKJ	"	101,378	281	173
*K3URT	"	96,612	256	166
*WA1HEW	"	91,800	261	170
*KX2S	"	81,624	210	152
*KG4USN	"	76,437	175	149
*W3RGA	"	75,060	210	139
*KC3OOL	"	66,297	211	147
*KD3HN	"	64,116	163	137
*K3BLN	"	55,554	197	141
*K3ABE	"	46,428	205	146
*KC3JNW	"	45,704	166	116
*NG3Y	"	45,045	198	143
*N3RM	"	44,496	189	144
*KQ3F	"	38,985	145	113
*K3TEF	"	38,759	164	113
*WA3MD	"	38,522	131	103
*AI3KS	"	32,200	146	115
*WA3ZSC	"	30,765	141	105
*K3NDM	"	26,754	104	91
*N3WMC	"	21,112	122	91
*KC3ODW	"	20,475	94	75
*W3YR	"	15,990	97	78
*K3LT	"	14,706	103	86
*N3RDV	"	13,950	89	75
*KC3OSK	"	11,033	76	59
*ND3R	"	8,352	65	58
*N3JNX	"	6,650	59	50
*N8NA	"	6,435	64	55
*N3NZ	"	2,560	44	40
*N3JIX	"	2,436	30	28
*K3RL	"	2,240	35	32
*K3HW	"	2,025	28	27
*KC3KFW	"	144	9	9
***NI3Q**	**14A**	**4**	**2**	**2**
				(OP: W3FA)
***W3IDT**	**7A**	**85,008**	**222**	**154**
*NW3DC	"	2,808	31	27
				(OP: W3DQ)

District 4

W4PK	**AA**	**2,912,811**	**1560**	**671**
N6AR	"	2,012,800	1257	592
AB4GG	"	1,533,280	1249	518
K4XL	"	1,370,400	900	480
WW5M	"	1,266,552	1256	504
W4GKM	"	1,266,180	1272	470
WS6X	"	1,229,330	970	457
W4TTY	"	1,199,278	874	502
W1IE	"	943,630	917	479
AA4DD	"	840,086	860	409
N1RM	"	615,135	713	345
K8AC	"	586,224	637	368
WB4YDY	"	541,559	649	337
K5VIP	"	500,400	529	360
NY3DX	"	495,612	684	351
				(OP: K3SV)
NS4X	"	474,330	715	326
K4WW	"	453,549	487	327
K2PS	"	453,144	606	316
NF3C	"	416,302	503	326
				(OP: W4VIC)
K4FX	"	398,412	475	306
AC6ZM	"	395,400	610	300
WB4HRL	"	389,180	584	290
W3SA	"	386,506	536	298
AD4TJ	"	379,701	540	287
N4CW	"	370,252	386	302
N4CF	"	355,050	469	270
W3YY	"	332,100	401	270
K4RO	"	295,612	505	263
NF4J	"	295,074	491	291
W3IK	"	285,384	482	253
NR3X	"	265,740	420	258
				(OP: N4YDU)
AA8R	"	233,864	452	248
N4QS	"	232,566	357	249
KC4SAW	"	207,522	453	243
W4UK	"	191,040	433	199
K4MI	"	187,572	333	203
W4WWQ	"	179,712	327	216
W4GE	"	178,304	346	224
KSØCW	"	169,728	333	204
N4TL	"	163,236	320	223
W3DQS	"	153,750	288	205
KM4JAK	"	148,255	372	199
W3TB	"	147,018	314	214
K7OM	"	141,933	266	187
NJ4F	"	133,672	299	196
KE4KY	"	119,460	325	181
KO8V	"	109,343	235	169
KD4TRG	"	107,579	314	179
NR4M	"	99,144	208	162
KD4S	"	75,184	214	148
W3OA	"	74,382	200	154
NI7R	"	69,300	207	150
W2ECK	"	68,040	224	162
W7HJ	"	61,910	235	151
KB4QZH	"	57,150	145	127
AI4WW	"	52,984	193	148
W4UT	"	45,760	199	130
N3KN	"	34,992	153	108
K4QD	"	31,310	137	101
W2YE	"	30,192	112	102
KG3V	"	30,174	124	94
N8AID	"	28,380	98	86
N4MM	"	28,012	103	94

WO4O	"	27,800	125	100
N4IDH	"	26,190	124	97
WX4W	"	25,359	134	107
NR4C	"	23,958	124	99
W3GQ	"	23,478	111	91
K8KI	"	13,440	98	84
NN4SS	"	12,580	87	68
AB4IQ	"	6,992	50	46
N4JOW	"	6,862	54	47
N4FP	"	5,880	62	49
W4PF	"	5,856	54	48
AB4L	"	3,120	28	26
				(OP: N4GU)
K2AV	"	2,232	31	31
K4KZ	"	2,015	35	31
AJ4A	"	230	10	10
NA4W	**28A**	**726**	**24**	**22**
				(OP: K4WI)
AJ4VE	**21A**	**5,217**	**47**	**47**
N4BP	**14A**	**1,106,858**	**1135**	**563**
WA2PCN	"	18,048	110	96
K4MGE	"	12,576	124	96
K9OM	**7A**	**1,717,296**	**954**	**532**
WJ2D	"	658,308	609	357
KT6V	"	123,120	205	171
NR4O	"	59,340	153	129
W4AQL	"	8,928	73	48
				(OP: KN8U)
NJ4U	**3.5A**	**448,880**	**563**	**310**
				(OP: K4EA)
W5MX	"	210,012	397	222
***AA2MF**	**AA**	**1,521,704**	**1403**	**536**
*W4LC	"	620,880	721	398
*KEØNRY	"	428,535	725	321
*WA3LXD	"	404,096	677	308
*K8RGI/4	"	392,653	616	307
*KG4IGC	"	336,144	525	282
*K2MK	"	328,563	562	283
*KW4J	"	209,475	398	245
*WN4AFP	"	182,114	377	214
*NA5WH	"	165,006	295	206
*N3CKI	"	155,220	351	199
*N6DW	"	151,755	304	201
*K4BX	"	133,400	299	200
*KC8GCR	"	129,350	301	199
*W4PJW	"	127,970	312	191
*KM4FO	"	124,432	321	176
*K2WK	"	123,045	282	195
*WT4R	"	121,636	304	188
*W4GHV	"	114,536	255	206
*WO4X	"	111,931	280	173
*N3RN	"	111,925	263	185
*K4FTO	"	107,780	290	170
*KC4WQ	"	106,800	246	178
*N4UA	"	103,350	258	195
*AC4G	"	97,440	249	174
*W4TM	"	94,710	269	165
*AI4GR	"	81,312	233	154
*KK4R	"	78,624	203	144
*NN4RB	"	63,560	203	140
*AE4Y	"	61,380	234	132
*W4JSI	"	60,088	223	148
*W5NZ	"	56,330	205	131
*NC4MI	"	56,280	195	134
*KS4S	"	54,188	193	124
*K4YDE	"	48,620	170	130
*KU4V	"	42,130	174	110
*KK4ZWC	"	40,230	236	149
*N5SMQ	"	37,840	155	110
*KJ4GK	"	36,270	195	130
*N4LF	"	34,578	157	113
*N3MM	"	33,696	144	108
*KN4GDX	"	33,235	159	115
*KS4YX	"	31,191	154	111
*N2QT	"	30,260	99	89
*KM4RK	"	27,896	108	88
*W9FFA/4	"	26,125	186	125
*KA3MTT	"	24,846	139	101
*N3CW	"	21,844	107	86
*NQ4K	"	19,458	115	94
*KS4X	"	19,383	104	91
*WK9M	"	17,464	108	74
*KG4CUY	"	16,740	106	90
*W4EE	"	14,630	131	95
*W4NNF	"	14,364	94	76
*N4AU	"	13,875	101	75
*WB4MNK	"	11,656	74	62
*WN8Y	"	10,286	90	74
*WØQQG	"	9,570	72	66
*WJ4HCP	"	8,040	70	60
*N4DW	"	7,670	67	59
*AAØO	"	5,502	43	42
*KM4MK	"	4,756	45	41
*K4FJW	"	4,472	60	52
*W2DEN	"	4,365	46	45
*N4KH	"	4,275	50	45
*K2LYV	"	2,280	37	30
*N4NQY	"	1,680	47	42
*KN4DXT	"	1,482	30	26
*N4FY	"	1,475	25	25
*N1IA	"	1,474	29	22
*KO4Z	"	1,176	27	24
*W4NBS	"	722	22	19
*N3AO	"	361	21	19
*AD4YQ	"	348	15	12
*KX4KU	"	342	19	18
***N6MA**	**14A**	**7,040**	**65**	**64**
*K4FT	"	4,928	45	44
*ND4G	"	864	28	27
***NU4E**	**7A**	**697,872**	**633**	**372**
*AE4ED	"	409,480	504	290
*KK4HEG	"	223,210	420	221
*W6HGF	"	75,456	179	144
*NK4DX	"	16,940	86	70
*N4RLI	"	200	10	10
***KB4KBS**	**3.5A**	**10,780**	**77**	**70**
K4LPQ	**AA**	**16,264**	**101**	**76**
K3TW	**14A**	**900**	**27**	**25**
W4ER	**7A**	**13,490**	**80**	**71**
		District 5		
N5HC	**AA**	**1,859,192**	**1353**	**614**
AC4CA	"	1,777,536	1291	576
NT5V	"	1,457,755	1280	533
AD5XD	"	1,066,362	1154	453
KN5TX	"	667,926	1135	378
				(OP: WA5FWC)
NG5E	"	446,960	739	370
WQ5L	"	384,318	548	297
KD5J	"	248,412	489	254
W2GS	"	186,340	296	220
NM5NM	"	162,155	369	205
				(OP: AA5B)
K5CI	"	153,510	421	210
KØGEO	"	99,337	299	161
N5XJ	"	*75,046*	*250*	*157*
K5GZR	"	64,120	231	140
WA5LXS	"	55,744	198	134
K5XH	"	52,668	208	133
KN5S	"	36,576	184	127
WJ5DX	"	*22,330*	*145*	*110*
				(OP: W5AJ)
WBØRUR	"	21,185	106	95
N9TX	"	*15,222*	*128*	*86*
NF5T	"	11,946	71	66
K5MWR	"	11,946	70	66
K5CKS	"	9,424	64	62
W5PR	**28A**	**242**	**11**	**11**
K5QR	**14A**	**124,632**	**356**	**216**
WQ5OO	**7A**	**2,875,904**	**1275**	**656**
				(OP: N8OO)
W5KI	"	1,488	24	24
W5AJ	*3.5A*	*42,920*	*131*	*116*
***AA5AU**	**AA**	**2,112,033**	**1445**	**669**
*WB5BHS	"	352,683	701	263
*WA8ZBT	"	307,296	621	264
*AD5LU	"	277,438	512	266
*NN5T	"	192,198	422	206
*N5KWN	"	191,052	443	244
*WA5LFD	"	127,104	336	192
*NA5J	"	92,568	307	174
*KG5LRP	"	88,963	333	179
*WB5K	"	83,844	287	153
*KD5ILA	"	82,240	343	160
*KF5ALL	"	71,071	278	143
*KF5BA	"	70,835	275	155
*N5EKW	"	51,474	229	138
*KJ5T	"	42,828	197	129
*W5LA	"	27,664	135	112
*K5CRJ	"	27,451	141	97
*KE5LQ	"	26,980	140	95
*KC5RGQ	"	22,969	144	103
*K3NT	"	22,606	114	89
*KT5WB	"	20,235	147	95
*NR5T	"	18,200	129	91
*AA5SH	"	18,012	87	76
*KD2KW	"	15,096	94	74
*N5KXI	"	14,378	113	79
*WA9AFM/5	"	13,041	117	81
*N5TJD	"	11,025	97	75
*WDØGTY	"	9,548	97	77
*N5XE	"	6,765	80	55
*WW5DX	"	6,336	60	48
*WW5XX	"	6,110	66	65
*AE5P	"	4,896	55	48
*K7ZYV	"	4,212	59	52
*W5TD	"	3,276	51	42
*KD5JHE	"	2,666	34	31
*N5DN	"	1,782	30	27
*KB5DJX	"	1,200	24	24
*KY4DBY	*14A*	*126,985*	*446*	*233*
				(OP: K5TXM)
***K5IB**	**7A**	**106,420**	**240**	**170**
***K5ND**	**3.5A**	**15,960**	**100**	**76**
WE6EZ	**AA**	**125,376**	**325**	**192**
NK5G	**14A**	**44,992**	**257**	**152**
KH6KG/W5	**3.5A**	**42,262**	**145**	**113**
				(OP: KH6KG/W5)
		District 6		
WQ6K	**AA**	**2,047,192**	**1537**	**556**
W6SX	"	1,056,000	1185	440
K9YC	"	911,640	862	428
NX6T	"	821,096	1055	394
				(OP: WQ6X)
NB6U	"	816,762	1001	394
				(OP: N6ZFO)
K6OK	"	733,656	910	397
WX6V	"	642,747	806	381
N3RC	"	594,010	923	382
AF6SA	"	391,472	687	344
KW6S	"	344,208	618	303
K6TQ	"	338,873	652	317
N6QQ	"	267,158	473	278
WE6Z	"	234,640	544	280
AK6M	"	224,534	525	262
				(OP: K6MM)
K6LRN	"	221,361	462	249
W6RC	"	185,256	495	249
W6OQI	"	126,063	338	207
NK6A	"	113,918	400	206
K6NV	"	107,151	362	191
NF6A	"	105,018	205	138
				(OP: K6XX)
KO6LU	"	103,600	322	185
W6TK	"	98,766	267	186
N6GP	"	89,936	294	176
K6NR	"	88,452	338	189
W6JBR	"	80,070	259	157
W6IA	"	70,928	211	143
N6HE	"	63,910	277	154
W6MOB	"	*58,201*	*194*	*143*
W6RKC	"	55,350	199	135
K5OA	"	52,850	233	151
K6KM	"	51,992	199	134
K6ELE	"	48,723	234	149
NA6US	"	43,815	205	127
NN6DX	"	41,344	176	128
				(OP: W1PR)
KR6N	"	34,133	158	107
				(OP: K6MR)
KE6QR	"	30,624	167	116
ND6P	"	*21,951*	*122*	*81*
AG6AU	"	19,712	121	88
				(OP: W1RH)
N6YFM	"	11,026	97	74
K6RIM	"	7,973	79	67
WU6X	"	2,574	40	39
K6HGF	**14A**	**151,704**	**479**	**252**
KK6VIX	"	2,520	57	45
***WN6K**	**AA**	**464,184**	**799**	**307**
*KF6RY	"	215,712	501	252
				(OP: W6ZL)
*WW6RY	"	185,055	454	219
*N6GEO	"	121,030	353	182
*KE6SHL	"	84,270	314	159
*KE6GLA	"	63,990	236	135
*N6JNL	"	59,760	251	144
*K6FA	"	50,652	210	126
*N6FC	"	46,900	217	134
*W6SR	"	45,890	186	130
*W6TJK	"	31,388	217	133
*N6OPE	"	12,533	108	83
*KD6HOF	"	9,177	89	69
*K6BIR	"	8,211	81	69
*K6XV	"	3,348	48	36
*N6UTC	"	1,092	28	26
*WQ6X	"	918	28	27
*K6MI	"	45	5	5
***NG6O**	**14A**	**144,240**	**385**	**240**
				(OP: K6GHA)
*N6BHX	"	280	14	14
W6QU	**AA**	**71,709**	**263**	**159**
				(OP: W8QZA)
AG6NS	"	35	5	5
		District 7		
KS7AA	**AA**	**2,873,156**	**2237**	**572**
				(OP: WK6I)
WK7S	"	2,355,600	1792	624
				(OP: K6LL)
KO7SS	"	1,988,746	1366	614
N7GP	"	1,109,823	1165	429
W7YAQ	"	1,029,420	984	420
KF7U	"	987,696	1114	456
W7GES	"	560,455	685	335
K7JQ	"	461,790	791	315
K7WP	"	393,372	629	294
W7XQ	"	247,164	543	258
NA6AF	"	225,656	539	268
AD7XG	"	224,132	404	274
K7VIT	"	217,377	447	249
NW7D	"	215,213	471	241
NG7M	"	182,468	413	242
KD7PCE	"	181,104	405	231
W7CT	"	165,186	358	207
AC7GL	"	160,225	381	221
K7BVT	"	*158,776*	*368*	*223*
KI6QDH	"	*151,632*	*458*	*208*
W7PU	"	148,720	398	220
WA7LNW	"	146,412	362	196
AA7V	"	143,429	366	221
KØIP	"	130,634	325	217
WG7X	"	*103,950*	*355*	*189*
AK7O	"	103,788	349	186
KU7T	"	93,922	216	151
WA7CPA	"	73,947	256	157
N9NA	"	72,240	262	172
WU6W	"	58,058	220	143
WS7L	"	38,868	148	123
K6UM	"	36,740	163	110
K7QA	"	35,836	178	124
W7VXS	"	31,702	244	121
KG7QXE	"	29,425	164	107
KB7N	"	25,740	129	99
K2RD	"	*24,402*	*123*	*98*
WB6JJJ	"	22,654	130	94
KJ7MX	"	*19,153*	*150*	*107*
KB6MW	"	18,788	118	77
W7SLS	"	18,357	122	87
KT7G	"	17,794	109	82
W9PL	"	10,441	59	53
KB7AZ	"	5,989	61	53
W7CO	"	3,124	52	44
WR7Q	"	1,998	29	27
K3WYC	"	1,029	22	21
N7BV	**14A**	**126,084**	**349**	**228**
WA7AN	"	102,960	275	195
				(OP: K9DR)
NK9I	"	9,628	106	83

W7VJ	"	5,016	64	57
N7EPD	"	4,720	47	40
K7XC	"	4,374	62	54
K8IA	**7A**	**1,592,000**	**1037**	**500**
KZ7X	**3.5A**	**275,336**	**480**	**254**
				(OP: W6RW)
***WZ8T**	**AA**	**279,522**	**589**	**293**
*N7UVH	"	266,190	548	285
*K7TQ	"	258,818	562	278
*WS7V	"	238,425	518	275
W7OM	"	*170,085*	*450*	*255*
*N7ZUF	"	138,430	360	218
*N7ESU	"	137,256	390	228
KA7PNH	"	*129,717*	*399*	*203*
K7GS	"	*103,641*	*291*	*193*
*K7VAP	"	91,164	314	213
*W7QDM	"	77,376	266	186
*KN7K	"	67,466	254	158
*N7XCZ	"	65,096	270	158
*KC7CM	"	63,945	239	147
*KB7EEG	"	59,280	237	152
*WA7YAZ	"	48,465	197	135
*AA4Q	"	39,975	203	123
*K7AZT	"	38,646	195	114
*W7GSV	"	36,830	202	127
*W7SO	"	36,608	179	128
*KU7Y	"	28,482	161	101
*WB7CYO	"	25,853	165	103
*KB7AK	"	23,712	149	96
*N1JM	"	23,664	150	102
*NQ7R	"	22,660	144	103
*W7WSV	"	20,210	113	86
*K7RBT	"	20,160	140	96
*K7MK	"	19,998	133	101
*KK7MA	"	19,412	135	92
*KE7GKI	"	17,200	129	86
*W7ZRC	"	16,490	123	97
*W6US	"	15,470	130	91
*KD7RUS	"	13,685	119	85
*N7DB	"	10,368	108	81
*W7JSN	"	9,855	91	73
*KB7ABJ	"	8,514	85	66
*N7AME	"	7,178	89	74
*W7JHR	"	7,128	81	66
*KK7A	"	6,572	69	53
*K7STO	"	5,612	70	61
*KR7X	"	2,997	48	37
*KC7SDA	"	999	27	27
*K7JSG	"	475	20	19
*W7FZY	"	6	2	2
***KC7V**	**14A**	**14,994**	**125**	**98**
*WA7SHP	"	8,814	93	78
*K6ST	"	580	20	20
WN7Y	"	*60*	*6*	*6*
***W7CD**	**3.5A**	**10,560**	**78**	**66**
N6HI	**AA**	**4,500**	**78**	**50**
NN7SS	"	64	8	8
				(OP: K6UFO)
WT1L	**14A**	**4,560**	**70**	**57**
		District 8		
N8BJQ	**AA**	**1,098,628**	**954**	**457**
K8PK	"	333,231	515	277
KA8G	"	292,982	471	263
WZ8P	"	279,450	404	270
KC8VC	"	143,430	323	210
				(OP: W8JWN)
WB8TDG	"	*68,740*	*209*	*140*
K8ESQ	"	35,456	139	128
W8CAR	"	31,565	126	107
K8AJS	"	24,206	106	98
NI8Z	"	19,028	74	67
NQ8O	"	13,135	86	71
N8IW	"	8,030	66	55
K8YE	**14A**	**146,132**	**298**	**238**
W8AKS	**7A**	**23,328**	**95**	**81**
***KE3K**	**AA**	**437,987**	**629**	**319**
*N8CWU	"	354,960	586	306
*AA8OY	"	300,240	478	270
*K3JT	"	270,680	501	268
*WB8JUI	"	259,075	423	241
*NX8G	"	204,754	428	227
*WS6K	"	189,878	395	218
*ND3N	"	183,918	439	203
*N8VV	"	158,364	300	212
*AB8OU	"	105,672	295	168
*AA8SW	"	104,550	295	170
*WA8KAN	"	86,697	305	169
*N8WCP	"	80,995	232	167
*N8TFD	"	75,953	232	151
*K8VUS	"	75,096	232	149
*AE8S	"	73,386	227	151
K8JT	"	*68,949*	*224*	*163*
*N8JLM	"	60,768	196	144
*AA8EN	"	48,128	207	128
*N8FYL	"	41,886	171	117
*W8TB	"	38,880	151	108
*N8TCP	"	32,219	133	101
*W8EH	"	31,518	146	102
K3YP	"	*22,185*	*121*	*85*
*N8VWY	"	18,841	102	83
*KE8JIT	"	18,532	103	82
*KB8TL	"	18,018	101	77
*K7DR	"	13,725	108	75
*K8RO	"	11,628	92	76
*W8DN	"	9,520	75	68
*K8WU	"	4,183	58	47
*NF8M	"	3,072	39	32
*K8FAM	"	2,926	45	38
*AC8SA	"	1,725	26	23
*W8KNO	"	225	18	15
***KBØUPC**	**14A**	**1**	**1**	**1**
N8URE	**AA**	**1,972**	**39**	**34**
AE8AT	"	352	17	16
WD9FTZ	**3.5A**	**40,404**	**165**	**111**
		District 9		
NV9L	**AA**	**3,510,262**	**1778**	**731**
				(OP: WB9Z)
ND9G	"	1,552,015	1238	527
WT9U	"	1,387,519	1187	523
AC9S	"	1,205,874	1020	489
N9SE	"	435,686	529	358
K9UC	"	431,624	645	326
N9OK	"	332,880	521	292
KC9K	"	259,960	436	268
ND9Z	"	227,528	428	239
N9LD	"	175,915	352	233
WT2P	"	147,452	347	191
W9YK	"	126,881	334	181
K9PY	"	116,596	314	206
N9LQ	"	97,845	254	165
W9JA	"	91,670	292	178
K9NW	"	71,676	169	132
KC9EOQ	"	70,226	226	146
NT9E	"	68,684	241	154
KG9X	"	58,904	199	148
KA9BHD	"	*48,081*	*211*	*141*
WA9IVH	"	46,970	188	122
N9EP	"	20,286	122	98
W9OA	"	19,656	117	91
NN9C	"	5,900	61	50
W9BLF	"	1,710	41	38
W9ILY	**14A**	**872,081**	**773**	**553**
W9PA	**7A**	**440,910**	**376**	**355**
N7US	"	434,070	488	315
K9DUR	**3.5A**	**1,848**	**33**	**33**
***K9CW**	**AA**	**383,724**	**588**	**306**
*WB8BZK	"	341,884	592	254
*KD9MS	"	285,678	412	269
*W9JWC	"	236,680	452	244
				(OP: KD9LSV)
*WD9CIR	"	228,928	494	224
*N9UA	"	221,373	411	243
*AB9YC	"	154,560	274	230
*W9FY	"	115,850	325	175
*W9LU	"	114,450	299	175
*KEØYI	"	108,936	313	178
*KW9U	"	106,029	263	189
*AA9L	"	73,386	229	162
*N9LYE	"	72,471	263	147
*KB9DVC	"	66,452	235	148
*W9XT	"	62,118	177	153
*KB9S	"	53,055	225	135
*N9WG	"	49,875	166	125
*KD9NHZ	"	43,470	179	126
*N9VPV	"	38,961	149	111
*KZ9V	"	29,400	138	100
*NR9K	"	29,070	145	114
*KS9K	"	27,968	112	92
				(OP: N4TZ)
*WA9LEY	"	22,176	138	99
*N9SB	"	21,837	114	87
*KC9YL	"	19,136	114	92
*N9LJX	"	17,784	101	78
*N9WEW	"	16,644	87	76
*KC9JBU	"	13,193	102	79
*N9BT	"	12,250	95	70
*KE9UA	"	10,800	78	60
*WB9DAR	"	9,440	104	80
*KC9WCJ	"	8,820	68	60
*NQ6N	"	6,498	64	57
*W9BGX	"	5,490	70	61
				(OP: WA9LKZ)
*KC9BZL	"	3,478	49	47
*AI9K	"	3,403	48	41
*AJ9C	"	609	21	21
*N9HSJ	"	272	17	16
***WB9WOZ**	**7A**	**22,134**	**108**	**93**
*KA9VLC	"	8,970	75	65
*W9IZ	"	60	5	5
		District Ø		
ACØC	**AA**	**2,913,452**	**1712**	**698**
WX8C	"	2,309,375	1512	625
ABØRX	"	1,841,100	1551	570
N7WY	"	*1,382,458*	*1171*	*517*
ABØLR	"	771,120	1122	420
NØXR	"	707,644	796	398
				(OP: @NØNI)
NXØI	"	671,060	976	356
KØAP	"	558,000	818	360
KI6DY	"	549,289	796	377
KZØUS	"	483,132	728	326
				(OP: W7RY)
NØNI	"	383,830	542	293
W5AP	"	*372,300*	*592*	*300*
W7II	"	370,332	532	324
ABØS	"	367,080	658	276
KØTG	"	353,400	630	300
NØBUI	"	249,984	514	252
KØJJR	"	231,727	317	317
NØTA	"	223,200	561	240
KØWA	"	222,398	523	242
WBØN	"	207,279	407	243
NØKQ	"	205,650	515	225
K6XT	"	194,879	394	229
WAØJZK	"	158,670	376	205
WØZQ	"	146,568	381	197
NOØL	"	146,064	352	204
WØMB	"	141,288	337	203
WTØO	"	129,042	329	214
				(OP: KØTI)
N5TU	"	128,400	319	200
KØVG	"	121,808	332	184
KØTC	"	111,081	342	183
NUØW	"	102,490	294	185
KØSRL	"	92,421	275	163
WDØT	"	89,708	296	164
WBØWIV	"	81,120	220	169
NØAJN	"	81,065	262	155
WØDET	"	*35,772*	*188*	*132*
WØRX	"	34,944	143	112
W8LYJ	"	29,400	142	100
NØLEF	"	7,448	66	56
KØTLG	"	3,588	55	46
WTØDX	**14A**	**45,582**	**217**	**142**
KSØAA	**7A**	**209,174**	**442**	**223**
KØKX	"	30,544	89	83
WØMI	"	4,180	49	38
				(OP: ACØE)
WRØH	**3.5A**	**211,988**	**436**	**226**
NØOK	"	169,060	336	214
***NØGZ**	**AA**	**539,148**	**755**	**358**
NØIRM	"	*361,032*	*588*	*307*
*AAØAW	"	135,872	365	193
*NØBAK	"	113,570	321	205
*WBØQLU	"	101,231	297	169
*KA4GAV	"	78,196	263	173
*KFØUR	"	70,520	323	164
*KIØJ	"	58,220	245	142
*NFØN	"	56,823	202	141
KØRC	"	*56,330*	*176*	*131*
*NNØG	"	47,867	258	151
*KDØOIX	"	45,136	189	124
*KØMPH	"	40,320	194	126
*WØDC	"	39,975	189	123
*KØITC	"	26,162	159	103
N6RSH	"	*24,174*	*155*	*102*
*WAØLIF	"	24,084	154	108
KN4FRG	"	*21,736*	*112*	*88*
AEØX	"	*14,720*	*98*	*80*
*WA2JQZ	"	12,640	107	80
*KAØKVW	"	9,035	80	65
*ADØLI	"	8,316	97	63
*WØTUP	"	8,040	92	67
*NYØJ	"	7,820	86	68
*KBØHP	"	4,680	50	45
*WAØLJM	"	3,024	49	42
ACØQG	"	*2,700*	*38*	*36*
*WB9QAF	"	2,520	40	35
*KDØWUQ	"	2,378	44	41
W3ZF	"	*1,485*	*38*	*33*
KØYR	"	*1,118*	*32*	*26*
*WAØMHJ	"	1,104	27	24
*NØECK	"	840	23	21
*KDØNPT	"	810	19	18
*WRØJ	"	720	25	24
*KØCV	"	156	13	13
***NØGOS**	**14A**	**22,932**	**161**	**117**
*WØYJT	"	16,940	126	110
*KJØP	"	15	5	5
*WDØBGZ	7A	*125,780*	*284*	*190*
WAØMN	**AA**	**124,218**	**347**	**206**
				(OP: NØUR)
KEØTT	"	4,704	65	49
		Alaska		
AL7LO	**AA**	**234,156**	**432**	**237**
KL7JVD	"	105,456	272	156
KL2ZZ	"	17,024	97	64
		Barbados		
***8P2K**	**7A**	**411,768**	**360**	**258**
				(OP: 8P6SH)
		Belize		
***V31VP**	**AA**	**1,162,381**	**898**	**421**
				(OP: WBØTEV)
***V31MA**	**3.5A**	**20,328**	**80**	**66**
		Canada-District 1		
VE9AA	**AA**	**76,452**	**200**	**138**
***VA1XH**	**AA**	**456,196**	**471**	**283**
*VE1RSM	"	299,902	390	226
*VO1CH	"	78,165	191	135
*VO2NS	"	72,816	180	123
		District 2		
VE2GSO	**AA**	**1,240,587**	**948**	**449**
VE2NMB	"	866,970	761	342
WC1X/VE2	"	831,972	778	356
				(OP: WC1X/VE2)
VE2AXO	"	712,309	635	349
VE2PI	"	197,210	339	205
VE2FK	"	59,136	187	128
VE2EBK	**7A**	**535,668**	**463**	**294**
***VE2BVV**	**AA**	**686,517**	**615**	**377**
*VE2CSM	"	239,572	338	202
*VA2QR	"	219,780	329	220
*VA2YZX	"	52,320	164	109
*VE2QV	"	36,540	127	105
*VA2KLG	"	13,041	77	69
***VE2NCG**	**14A**	**6,670**	**66**	**58**
		District 3		
VE3UTT	**AA**	**2,306,396**	**988**	**653**
VA3LR	"	877,308	713	348
VE3KTB	"	763,524	679	334
VE3CV	"	519,570	488	345

VE3TW	"	507,472	521	322
VE3DZ	"	224,508	289	212
VE3SS	"	73,660	168	127
VE3YAA	**14A**	**34,800**	**143**	**116**
				(OP: VE3FJ)
***VA3DF**	**AA**	**1,949,432**	**1026**	**536**
*VE3MGY	"	622,512	628	297
*VA3SB	"	564,400	576	332
*VE3JI	"	544,289	564	317
*VA3MJR	"	529,376	558	284
*VE3BR	"	394,604	489	238
*VA3FF	"	306,888	393	228
*VE3CWU	"	126,846	246	174
*VA3IK	"	109,136	220	152
*VE3LVW	"	108,066	225	166
*VE3HG	"	87,234	179	134
*VA3JLF	"	66,170	192	130
*VE3XAT	"	65,794	148	134
*VA3TTB	"	33,504	116	96
*VA3PC	"	27,048	98	98
*VE3WEJ	"	15,812	79	67
*VE3SST	"	9,016	68	49
*VE3FWF	"	8,878	58	46
*VE3FZ	"	8,575	58	49
*VA3FN	"	3,366	38	33
***VE3MZD**	**21A**	**70**	**5**	**5**
***VE3TM**	**14A**	**112,800**	**256**	**188**
		District 5		
***VE5KS**	**7A**	**90,678**	**187**	**127**
		District 6		
VE6TK	**AA**	**355,740**	**529**	**245**
VE6RST	**14A**	**18,564**	**94**	**78**
***VA6RCN**	**AA**	**62,700**	**205**	**110**
				(OP: VE3RCN)
*VE6PFL	"	29,574	141	93
VE6EX	**AA**	**74,892**	**289**	**158**
		District 7		
VA7KO	**AA**	**1,062,596**	**962**	**422**
VA7ST	"	972,800	919	380
VC7R	"	873,144	894	362
				(OP: VE7SZ)
VE7KAJ	"	322,044	520	282
VE7IO	"	202,620	402	220
VE7BC	"	194,788	362	209
VA7GEM	*"*	*84,390*	*220*	*145*
VA7MAY	"	78,840	193	135
VE7CC	**3.5A**	**220,780**	**299**	**190**
***VE7JMN**	**AA**	**35,424**	**143**	**96**
*VA7ZM	"	22,792	112	74
*VE7BGP	"	7,600	58	50
*VE7KCY	"	4,368	47	39
***VE7DX**	**3.5A**	**31,680**	**113**	**80**
		District 8		
VYØERC	**7A**	**7,770**	**37**	**37**
				(OP: VE1RUS)
		Cayman Islands		
ZF2WF	**AA**	**6,095,712**	**2379**	**772**
				(OP: W9KKN)
		Costa Rica		
***TI2OY**	**AA**	**763,968**	**754**	**368**
		Cuba		
***CO8NMN**	**AA**	**570,486**	**583**	**289**
*CO6RD	"	515,070	555	291
*CO8ZZ	"	91,440	193	127
*CO2GL	"	70,725	192	123
*CO2VE	"	64,262	189	127
***CO6OV**	**14A**	**173,882**	**374**	**227**
*CO2AJ	"	68,544	212	168
***CO7OK**	**7A**	**50,676**	**116**	**103**
*CO6HLP	"	19,096	77	62
***CO2JD**	**3.5A**	**68,208**	**156**	**116**
*CO2XK	"	12,636	64	54
CO6EC	**AA**	**18,225**	**87**	**75**
CO2KY	**14A**	**4,876**	**57**	**53**
CO8RCP	**7A**	**45,696**	**118**	**96**
CO6SRS	"	26,344	100	89
		Dominica		
J79WTA	**AA**	**779,760**	**710**	**361**
		Grenada		
***J35X**	**7A**	**1,035,414**	**627**	**369**
		Guadeloupe		
TO7D	**AA**	**254,107**	**305**	**217**
		Guatemala		
***TG9ANF**	**AA**	**681,651**	**761**	**333**
*TG9ADQ	"	111,361	284	193
TG9IN	**AA**	**36,333**	**131**	**99**
		Mexico		
XE1YD	**AA**	**98,720**	**260**	**160**
XE2X	**3.5A**	**203,456**	**283**	**176**
***XE2FGC**	**AA**	**173,036**	**313**	**181**
*XE2AU	"	121,953	259	177
*XE2YWB	"	87,516	239	143
*XE1VY	"	61,920	199	129
*XE1H	"	58,536	134	108
***XE2N**	**14A**	**5,368**	**72**	**61**
***XE2KJ**	**7A**	**38,700**	**127**	**86**
**XE2OK*	*"*	*21,744*	*78*	*72*
		Panama		
***HP1ELV**	**21A**	**888**	**41**	**37**
		Puerto Rico		
KP4/K6DTT	**AA**	**2,426,424**	**1193**	**572**
WP4WW	**14A**	**5,616**	**56**	**48**
				(OP: KP4JRS)
***KP4JFR**	**AA**	**89,089**	**218**	**143**
*NP3V	"	47,601	196	123
*NP4TX	"	35,144	103	92
*KP4ALR	"	8	4	4
WP4O	**21A**	**2,178**	**37**	**33**
		Saba & St. Eustatius		
***PJ5/KG9N**	**AA**	**321,904**	**421**	**236**
		St. Kitts & Nevis		
***V47UM**	**AA**	**407,712**	**501**	**274**
				(OP: W3UL)
		St. Lucia		
J69DS	**AA**	**332,360**	**424**	**280**
		U.S. Virgin Islands		
***NP2KW**	**AA**	**188,175**	**291**	**195**

AFRICA

		Canary Islands		
EB8AH	**7A**	**5,164,830**	**1284**	**705**
				(OP: OH4KA)
***EF8O**	**AA**	**670,026**	**495**	**318**
				(OP: EA8OM)
*EA8BQM	"	140,580	210	142
*EA8AQV	"	60,840	149	130
***EA8W**	**14A**	**390,264**	**421**	**322**
*ED8H	"	224,442	353	222
				(OP: EA8ARI)
***EA8OM**	**7A**	**384**	**8**	**8**
		Egypt		
***SUØERA**	**AA**	**31,992**	**106**	**93**
				(OP: DL2RMC)
		Gabon		
TR8CA	*AA*	*41,356*	*116*	*98*
		Ghana		
***9G2HO**	**14A**	**25,470**	**95**	**90**
				(OP: 9G5SA)
		Madeira Islands		
***CT9/OH2HOD**	**AA**	**20,856**	**93**	**79**
		Morocco		
***CN8KD**	**7A**	**664,620**	**407**	**285**

ASIA

		Afghanistan		
T6A	**AA**	**1,879,818**	**1010**	**519**
				(OP: S53R)
		Asiatic Russia - District 9		
UC8U	**AA**	**1,733,316**	**1001**	**492**
RA9AEA	"	779,736	604	318
RZ9A	"	419,406	446	283
RU8W	"	205,296	251	188
RQ9O	"	24,628	101	94
R8IZ	*"*	*10,675*	*64*	*61*
				(OP: R9IR)
RF9C	"	3,182	40	37
				(OP: UA9CIR)
UA9UR	**21A**	**2,280**	**33**	**30**
RA9Y	**14A**	**1,265,616**	**920**	**517**
RA9AU	"	186,300	304	225
R9VA	"	80,408	180	152
RK9AY	**7A**	**83,640**	**138**	**123**
***RT9S**	**AA**	**2,639,175**	**1161**	**525**
*RO9A	"	392,445	395	285
*RK9UE	"	170,748	290	186
*UA9R	"	124,292	198	161
**RU9I*	*"*	*121,800*	*213*	*175*
*RZ9AD	"	109,906	226	179
*R9AAL	"	80,928	165	144
*R9OBJ	"	54,639	140	117
**RX9UK*	*"*	*44,352*	*133*	*112*
*R9MA	"	35,448	95	84
*RZ9UO	"	29,792	106	98
*RX9DJ	"	17,112	79	69
*RG8U	"	7,344	50	48
***RZ9UF**	**21A**	**338**	**13**	**13**
***RA9UN**	**14A**	**37,800**	**130**	**120**
*RA9AFZ	"	30,294	108	102
***R9RA**	**3.5A**	**67,184**	**114**	**104**
		District Ø		
RKØUT	**AA**	**1,336,783**	**910**	**437**
RAØACM	"	961,350	699	390
RUØS	"	679,326	678	354
RUØLL	"	435,325	515	275
UAØOK	"	394,155	500	285
RAØQD	"	78,642	205	153
UAØLD	"	4,440	48	40
UCØA	**14A**	**676,092**	**626**	**412**
RNØD	"	540,672	583	384
UAØSR	**7A**	**1,555,648**	**696**	**436**
RMØW	"	186,850	229	185
***RØUT**	**AA**	**298,116**	**395**	**252**
*UAØSU	"	235,265	328	223
*RAØWHE	"	183,658	296	229
*RNØJT	"	76,320	251	120
*UAØLKD	"	71,852	202	142
*RØJD	"	57,031	198	107
*UAØJGI	"	38,306	180	107
*RØAS	"	38,279	130	101
*UAØJFD	"	33,592	180	104
*RØCK	"	9,522	76	46
*UAØAKY	"	4,300	45	43
*UIØA	"	1,584	26	24
***RØCW**	**14A**	**102,725**	**260**	**175**
*RWØAJ	"	23,023	97	91
***RØJAS**	**7A**	**2,050**	**25**	**25**
RØWC	**AA**	**158,826**	**284**	**206**
RAØAY	"	12,834	67	62
		Asiatic Turkey		
TA4CS	**AA**	**7,095**	**46**	**43**
***TA7I**	**AA**	**853,520**	**596**	**376**
*TA4RC	"	115,920	189	144
*TA4SO	"	107,965	190	151
*TA3NEB	"	36,018	97	87
*TA7LZB	"	17,385	62	57
***TA4PR**	**14A**	**75**	**5**	**5**
		China		
BD3CB	**AA**	**629,322**	**628**	**318**
BG5BAA	"	68,696	212	124
BG2VIA	*"*	*27,057*	*123*	*87*
BH7PFH	"	2,697	31	31
BD5BPA	**14A**	**33,300**	**174**	**100**
***BG8DIV**	**AA**	**146,354**	**256**	**169**
*BG8TFN	"	95,310	273	135
**BA1PK*	*"*	*81,444*	*187*	*132*
*BGØCAB	"	52,109	132	107
*BH6KWC	"	45,968	156	104
*BD4QB	"	45,288	187	111
*BD7IIS	"	45,136	162	112
*BG7SFE	"	42,319	161	101
*BG7SPN	"	37,296	149	111
*BD7LMA	"	24,057	125	81
**BG3IAY*	*"*	*14,364*	*106*	*84*
*BH4WPN	"	13,552	80	56
*BI1EIH	"	9,360	52	48
*BG3UTD	"	5,208	47	42
*BH6JFR	"	735	22	21
*BI4RBD	"	468	13	12
**BD7BW*	*"*	*0*	*0*	*0*
***BD7OXR**	**21A**	**11,264**	**90**	**64**
***BA3MM**	**14A**	**179,690**	**339**	**238**
*BA5HAM	"	118,668	282	186
*BG3KKZ	"	104,664	243	196
*BH4OUF	"	16,182	129	87
**BH4AYG*	*"*	*592*	*24*	*16*
**BG6SNJ*	*"*	*40*	*4*	*4*
***BD1RX**	**7A**	**22,712**	**88**	**68**
*BH9BCK	"	16	2	2
BA4TB	**AA**	**16,800**	**94**	**70**
BD4RHV	"	6,594	56	42
BH4XBU	"	1,564	28	23
BG6JJI	"	220	12	10
BD4SDO	**14A**	**1,860**	**38**	**30**
		Cyprus		
5B6ØAIF	*AA*	*70,455*	*122*	*105*
				(OP: 5B4AIE)
		Georgia		
4L8A	**14A**	**1,153,359**	**869**	**491**
		Hong Kong		
***VR2VIY**	**14A**	**41,958**	**174**	**111**
		India		
VU2DED	**AA**	**399,500**	**411**	**250**
VU2ZMK	"	227,136	318	224
VU2MB	"	119,462	225	161
VU2IBI	"	45,080	138	115
***VU2EOJ**	**AA**	**3,200**	**46**	**40**
*VU2AE	"	750	15	15
		Israel		
***4Z5MY**	**14A**	**1,971**	**29**	**27**
		Japan-District 1		
JM1XCW	**AA**	**1,465,695**	**864**	**495**
JN1THL	"	457,995	494	285
JF1LMB	"	287,609	363	227
JA1AYO	"	269,607	361	223
JE1LFX	"	178,290	299	210
JR1EMO	*"*	*171,892*	*272*	*196*
JH1OAI	"	171,709	280	191
JA1SJV	"	149,404	255	164
JH1RFM	"	90,160	175	140
JA1PVX	*"*	*83,331*	*203*	*141*
JH1CTV	"	82,432	172	128
JQ1CIV	"	31,417	115	89
JK1LUY	"	23,738	98	83
JH1APK	"	21,840	81	70
JH1BIU	"	13,160	65	56
JI1AVY	"	12,582	68	54
JK1HIY	"	5,456	44	44
JH1LNL	"	2,268	30	27
JA1DCO	"	1,656	28	24
JS1NDM	"	36	3	3
JR1NHD	**14A**	**261,664**	**361**	**272**
JG1LHB	"	69,890	187	145

JH1XUM	"	51,483	147	131
JA1EPJ	"	988	19	19
***JH8KYU/1**	**AA**	**988,624**	**706**	**388**
*JM1MTE	"	421,686	451	274
*7N2UQC	"	352,914	452	262
*JA1MZM	"	245,735	362	245
JS1OYN	*"*	*117,305*	*199*	*145*
*JF1WNT	"	106,416	214	144
*JA1BWA	"	84,819	202	147
*JA1IZ	"	73,168	173	136
*JH1BHW	"	66,804	169	114
*JQ1COB	"	60,858	166	126
*JA1PCM	"	57,018	163	129
*JA1SCE	"	47,916	154	99
*JR1AQI	"	36,860	131	95
*JL1CNY	"	34,132	115	92
*JA1IE	"	30,794	129	89
*JJ1ENZ	"	27,508	103	92
*JA1IAZ	"	27,104	115	88
*JA3GZE/1	"	23,936	104	88
*JA1HFY	"	22,632	123	92
*JH1IHG	"	19,783	95	73
*7K1VKU	"	14,152	82	58
*JH1NVA	"	12,561	58	53
*JF1WCK	"	11,716	74	58
*JG1XIO	"	11,520	78	64
*JA1DDZ	"	10,266	71	58
*JA1CCH	"	9,450	56	45
*JF1RYU	"	4,730	47	43
*JH1TJH	"	4,410	37	35
*7N4JXR	"	378	15	14
*JH1WOY	"	330	11	11
*JE1ILP	"	300	13	12
***JS1IFK**	**21A**	**2,790**	**35**	**31**
*JG1UKW	"	1,943	33	29
*JI1BBN	"	1,403	26	23
***JF1TEU**	**14A**	**74,000**	**197**	**148**
*JH1KYA	"	65,240	174	140
*JA1QIF	"	56,658	158	133
*JE1RRK	"	47,880	147	126
*JA1UII	"	38,744	136	116
*JK1NSR	"	26,038	111	94
*JE1GZB	"	2,870	37	35
*JH1EYM	"	216	9	8
*JF1OPO	"	90	6	6
*JH8SEG/1	"	70	5	5
***JF1CKO**	**7A**	**8,820**	**48**	**42**
JK1TCV	**AA**	**30,750**	**117**	**75**
7L4IOU	"	4,180	44	38
JR1NKN	**21A**	**2,838**	**35**	**33**
JE1CAC	**14A**	**12,596**	**71**	**67**
JG1LFR	**3.5A**	**4,608**	**46**	**36**

District 2

JA2HYD	**AA**	**406,359**	**446**	**277**
JG2REJ	"	305,937	354	243
JR2PMT	"	225,354	312	213
JA2XYO	"	139,482	260	189
JH2LMH	"	30,094	90	82
JR2BCF	"	7,178	38	37
JE2PCY	"	6,912	53	48
JH2BTM	**7A**	**18,104**	**65**	**62**
***JA2AXB**	**AA**	**160,448**	**270**	**184**
*JA2ODB	"	98,384	199	143
*JA2GHP	"	55,020	169	131
*JA2FXV	"	30,080	97	80
*JF2FIU	"	15,812	85	67
*JM2LEI	"	4,674	41	38
*JI2IXA	"	819	13	13
***JE2CPI**	**21A**	**1,375**	**26**	**25**
***JA2JNC**	**14A**	**20,382**	**103**	**86**
*JR2MIN	"	6,156	68	54
JR2EKD	**21A**	**608**	**17**	**16**

District 3

JA3HBF	**AA**	**328,338**	**408**	**261**
JR3RIU	"	71,514	192	137
JR3RIY	*21A*	*3,978*	*43*	*39*
JI3BFC	**14A**	**103,664**	**227**	**176**
JH3QFY	"	37,022	135	107
JF3PNQ	"	16,898	92	71
JH3FUK	**7A**	**347,984**	**277**	**239**
***JG3WDN**	**AA**	**189,924**	**292**	**204**
*JH3WKE	"	70,250	191	125
*JE3EDJ	"	44,600	127	100
*JA3LEB	"	17,216	88	64
*JR3WXA	"	11,322	63	51
*JH3GMI	"	3,500	40	35
*JA3HKR	"	3,159	28	27
*JO3QVT	"	2,275	25	25
***JA3RAZ**	**21A**	**189**	**10**	**9**
***JF3IYW**	**14A**	**47,970**	**155**	**130**
JA3MIB	*"*	*3,515*	*38*	*37*
*JG3OML	"	2,052	33	27
***JR3GPP**	**7A**	**5,504**	**34**	**32**
JA4XHF/3	**AA**	**29,666**	**126**	**91**
JH3DMQ	**28A**	**21**	**5**	**3**

District 4

JH4UTP	**AA**	**1,947,652**	**1047**	**523**
JG4AKL	"	244,398	330	231
JR4CTF	"	80,795	195	143
JI4WAO	"	70,488	165	132
JO4CFV	"	22,849	101	73
JA4CZM	"	14,300	60	55
JR4VEV	**21A**	**65**	**5**	**5**
JR4OZR	**7A**	**1,295,400**	**607**	**425**
***JE4MHL**	**AA**	**89,835**	**202**	**159**
*JE4IVN	"	30,240	109	84
*JI4WHS	"	4,410	47	35
***JA4RMX**	**14A**	**13,064**	**74**	**71**
*JH4FUF	"	28	4	4

District 5

JA5FNX	**AA**	**48,018**	**162**	**106**
JH5MXB	**14A**	**71,916**	**186**	**156**
JE5JHZ	**7A**	**2,852**	**23**	**23**
***JA5CBU**	**AA**	**1,368**	**20**	**19**
***JH5HDA**	**14A**	**46,706**	**146**	**121**
*JA5OXV	"	6,298	49	47
***JG5DHX/5**	**7A**	**450**	**9**	**9**
JA5NSR	**AA**	**1,260**	**22**	**20**

District 6

JA6BZI	**AA**	**238,917**	**309**	**217**
JA6BCV	"	41,923	138	113
JA6LCJ	**14A**	**43,099**	**160**	**131**
JA6LJN	"	19,837	88	83
***JH6QIL**	**AA**	**91,438**	**199**	**131**
*JE6JNC	"	51,520	150	115
***JH6WHN**	**14A**	**262,544**	**370**	**269**
*JE6TUP	"	969	19	19
JA6WFM	**AA**	**25,359**	**105**	**79**
JA6GCE	**7A**	**107,520**	**181**	**160**

District 7

JA7ACM	**AA**	**558,144**	**512**	**304**
JG7PSJ	"	227,907	309	207
JO7KMB	"	128,064	243	174
JF7PHE	"	101,520	198	144
JK7CJM	"	37,944	143	102
JR7IWL	"	9,447	58	47
JH7RTQ	"	2	1	1
JH7QXJ	**14A**	**238,500**	**358**	**250**
JA7LLL	"	165,825	286	225
JG7AMD	**7A**	**16,356**	**61**	**58**
***JA7MWC**	**AA**	**28,320**	**111**	**80**
*JA7ZP	"	28,248	109	88
*JR7IWC	"	12,000	53	50
*JK7BEJ	"	9,800	66	49
*JA7FDA	"	2,106	29	26
***JI7VNJ**	**7A**	**88,320**	**142**	**120**
***JH7IQQ**	**3.5A**	**30**	**5**	**5**
JH7UJU	**AA**	**5,754**	**53**	**42**

District 8

JA8TR	**AA**	**334,017**	**415**	**267**
JA8IDS	**21A**	**10,184**	**72**	**67**
***JM8FEI**	**AA**	**45,540**	**149**	**99**
*JE8KGH	"	2,686	39	34
***JK8PBO**	**14A**	**58,904**	**200**	**148**

District 9

JA9CCG	**AA**	**72,450**	**183**	**138**
JH9CEN	"	19,275	98	75
JA9CWJ	**14A**	**253,498**	**352**	**266**
***JA9LX**	**AA**	**127,466**	**260**	**163**
*JA9EJG	"	3,007	34	31

District Ø

JHØMJY	**AA**	**33,670**	**111**	**91**
JHØGHZ	"	24,640	76	64
***JJØPJD**	**AA**	**131,378**	**236**	**163**
*JAØBZY	"	16,640	65	65
*JRØDZH	"	10,763	57	47
*JRØBNF	"	10,450	59	50
***JHØEPI**	**14A**	**147,805**	**268**	**205**
*JAØBJY	"	15,610	83	70
*JRØGXA	"	1,113	22	21

Kazakhstan

UN4PG	**3.5A**	**208,152**	**216**	**177**
***UN7ZO**	**AA**	**562,221**	**456**	**297**
*UN7PGA	"	426,800	427	275
*UN4PD	"	129,978	214	166
***UN6LN**	**14A**	**731,124**	**654**	**414**
*UN7LV	"	201,690	348	243
*UN7CN	"	97,750	221	170
UN7EG	**AA**	**126,369**	**223**	**171**

Mongolia

***JT1YL**	**AA**	**13,520**	**88**	**80**
***JT1DN**	**7A**	**4,464**	**33**	**31**

Oman

***A42K**	**7A**	**92,000**	**140**	**125**
				(OP: A41CK)

Qatar

***A71UN**	**14A**	**22,616**	**96**	**88**
A71AE	**7A**	**110,390**	**157**	**133**

Republic of Korea

DS5USH	*AA*	*151,848*	*248*	*171*
HL2VXK	**"**	**46,779**	**149**	**93**
HL2WA	"	28,684	117	101
HL2KV	"	21,870	95	81
HL4CEL	"	11,655	109	63
***HL1VAU**	**AA**	**21,964**	**81**	**68**
*DS4GQR	"	15,447	61	57
*6K2DIO	"	4,212	40	36
***HL5YI**	**14A**	**13,277**	**77**	**71**

Saudi Arabia

***7Z1SJ**	**14A**	**513,513**	**505**	**351**

Singapore

***9V1XX**	**14A**	**7,696**	**66**	**52**

Taiwan

BV1EK	**AA**	**319,467**	**441**	**249**
BV2LA	"	258,944	370	224
***BU2BE**	**AA**	**31,230**	**123**	**90**
*BV4VQ	"	27,984	140	88
***BU2BO**	**14A**	**1,775**	**28**	**25**

Thailand

HS5NMF	**AA**	**258,324**	**408**	**209**
HS6VW	"	2,001	32	29
HS3NBR	**14A**	**42,375**	**168**	**113**
***E24OYI**	**AA**	**61,716**	**238**	**139**
*HS7WMU	"	18,497	89	53
*E24OEE	"	1,771	31	23
*HS4MLV	"	1,700	33	25
*HS8JWH	"	1,122	23	22
***E21YDP**	**7A**	**353,024**	**304**	**224**

West Malaysia

***9M2TDX**	**AA**	**35,802**	**126**	**81**
*9M2TO	"	18,240	92	64
*9M2MRS	"	6,880	42	40
***9W2BDG**	**7A**	**154**	**8**	**7**

EUROPE

Austria

OE1TKW	**AA**	**72,226**	**158**	**134**
OE2LCM	"	43,524	144	108
***OE197ØWWL**	**AA**	**158,661**	**238**	**183**
				(OP: OE1WWL)
*OE1CIW	"	106,260	198	154
*OE5CYL	"	80,936	176	151
*OE7GJ	"	73,432	164	134
*OE3MCS	"	28,336	101	92
*OE3NHW	"	504	12	12
***OE2IGP**	**7A**	**602,308**	**452**	**343**
***OE4VNA**	**3.5A**	**50,160**	**123**	**110**
*OE4EIE	"	34,592	97	92

Balearic Islands

***EC6DX**	**7A**	**41,610**	**106**	**95**
EA6ZS	**14A**	**2,496**	**40**	**39**

Belarus

EW8DX	**AA**	**1,393,317**	**866**	**477**
EW8OM	"	56,023	148	121
EU1DX	**14A**	**335,909**	**453**	**329**
EU4T	"	72,068	199	172
EV1R	**7A**	**908,500**	**556**	**395**
EU8A	**3.5A**	**554,200**	**416**	**340**
***EW7BA**	**AA**	**1,601,400**	**954**	**510**
*EW6DM	"	459,025	459	301
*EW4R	"	389,818	390	286
*EU6O	"	347,928	418	266
*EW1NM	"	249,444	356	246
*EW8G	"	207,792	298	208
*EU1ST	"	69,496	150	119
EU8F	**AA**	**510,940**	**497**	**295**

Belgium

ON3AR	*AA*	*80,652*	*164*	*132*
OR3A	**"**	**26,104**	**114**	**104**
				(OP: ON6CC)
OT5Q	**14A**	**107,535**	**250**	**201**
***OO3O**	**AA**	**692,420**	**602**	**356**
				(OP: ON4FN)
*ON5GQ	"	531,944	519	322
*ON4CT	"	210,000	264	200
*ON6AT	"	155,220	255	195
*ON7BT	"	122,760	211	180
*ON4LY	"	29,458	108	103
*ON6OM	"	26,814	94	82
***OQ4B**	**14A**	**74,571**	**203**	**159**
***ON5GF**	**7A**	**38,592**	**112**	**96**
ON3LX	**AA**	**115,192**	**205**	**154**
ON3CQ	"	10,919	69	61
OP4A	**3.5A**	**896**	**15**	**14**

Bosnia-Herzegovina

***E72U**	**AA**	**31,416**	**98**	**88**
***E73KM**	**14A**	**49,335**	**165**	**143**
*E78T	"	33,522	134	111
***E74HJ**	**7A**	**33,670**	**97**	**91**
***E79D**	**3.5A**	**552,750**	**465**	**335**
*E72MM	"	986	17	17
E78CB	**AA**	**29,736**	**97**	**84**
E77T	**7A**	**92,184**	**154**	**138**
E7ØW	"	4,278	32	31

Bulgaria

LZ5K	*AA*	*622,102*	*488*	*337*
				(OP: LZ1RAY)
LZ2YO	**14A**	**692,303**	**698**	**439**
LZ4A	*"*	*584,086*	*645*	*419*
				(OP: LZ1YQ)
LZ3CB	*7A*	*1,550,808*	*802*	*476*
LZ5QZ	**"**	**259,420**	**283**	**218**
LZ1QZ	**3.5A**	**120,590**	**208**	**155**
LZ2ZG	"	66,816	133	128
***LZ1QV**	**AA**	**282,240**	**280**	**252**
*LZ1G	"	211,130	302	215
				(OP: LZ5RG)
*LZ2ZY	"	205,224	291	204
***LZ2JA**	**14A**	**343,048**	**494**	**313**
***LZ5ZI**	**7A**	**36,828**	**97**	**93**
***LZ33E**	**3.5A**	**628,320**	**469**	**340**
LZ3RR	**AA**	**1,549,301**	**866**	**481**
LZ3GW	"	32,594	102	86

		Crete		
SV9COL	**3.5A**	**39,312**	**112**	**104**
***SV9MBH**	**AA**	**135,100**	**285**	**193**
		Croatia		
9A5AAX	**AA**	**2,361,582**	**1160**	**606**
				(OP: DJ4MX)
9A1CFR	"	360,873	403	303
				(OP: 9A2NO)
9A5D	**14A**	**1,738,156**	**1142**	**644**
				(OP: 9A7Z)
***9A3ZI**	**AA**	**1,325,250**	**821**	**475**
*9A1FL	"	309,232	346	251
*9A5HZ	"	78,386	189	154
*9A6RT	"	65,826	166	138
*9A2ZI	"	51,600	138	120
*9A2R	"	17,290	73	70
***9A6KZH**	**14A**	**243,065**	**386**	**281**
***9A6NDZ**	**7A**	**8,600**	**52**	**50**
***9A9TT**	**3.5A**	**120,848**	**201**	**166**
*9A3UCA	"	8,460	52	45
		Czech Republic		
OL725PLZ	**AA**	**2,538,970**	**1225**	**581**
				(OP: OK4RQ)
OK2EA	"	938,916	668	396
OK1DOL	"	119,886	214	174
OK1YM	*"	*73,980*	*162*	*137*
OK3X	"	31,450	94	85
				(OP: OK1VK)
OK1PI	"	23,590	82	70
OK1DBE	"	7,784	63	56
OK1XC	**14A**	**101,775**	**231**	**177**
OK1DOY	"	78,052	200	158
OK2SWD	**7A**	**1,560**	**20**	**20**
OL9A	**3.5A**	**3,128,400**	**1132**	**632**
				(OP: OK2ZAW)
OL4C	"	2,211,928	960	566
***OK2HFC**	**AA**	**385,864**	**414**	**278**
**OK1MDK*	*"	*380,556*	*434*	*279*
*OK1HEH	"	373,824	414	264
*OK1PX	"	328,930	349	254
*OK2CLW	"	245,582	300	233
*OK1AY	"	199,448	278	214
				(OP: OK11AY)
*OK2PDM	"	174,125	260	199
*OK2VIR	"	120,484	203	182
*OK1ZJH	"	108,721	211	163
*OL7ØJN	"	83,261	168	139
				(OP: OK1CJN)
*OK2PAD	"	82,337	171	137
*OK1BJ	"	53,020	141	110
*OK1CT	"	36,562	128	101
*OK1MGA	"	21,528	84	78
*OK1FU	"	17,094	88	77
***OK7KW**	**14A**	**110,390**	**238**	**190**
*OK6AB	"	4,480	47	40
***OK2RU**	**7A**	**791,986**	**525**	**367**
*OK4GP	"	637,998	439	339
*OK2UHP	"	250,098	298	219
**OK1SI*	*"	*67,260*	*133*	*118*
*OK1ZHV	"	30,912	107	92
*OK1AXB	"	27,048	96	84
***OK6T**	**3.5A**	**1,115,520**	**675**	**415**
				(OP: OK1WCF)
*OK2HBR	"	476,418	413	293
*OK7T	"	79,728	156	132
				(OP: OK1FHI)
*OK6DJ	"	10,920	57	52
OK2FD	**AA**	**707,074**	**583**	**349**
OK2AP	"	49,654	155	122
		Denmark		
OOZ3ØEU	**AA**	**1,323,328**	**799**	**464**
OZ2J	"	65,262	165	149
***OZ1DAE**	**AA**	**676,280**	**563**	**319**
*OZ1AOO	"	221,761	309	211
*OZ6AGX	"	154,080	245	180
*OZ4NE	"	145,527	240	179
*OZ1QX	"	123,065	221	163
*OU4O	"	92,159	192	157
				(OP: OZ4O)
*OZ4FF	"	53,430	152	130
*OZ1LFI	"	37,830	127	97
*OZ7DK	"	12,155	71	65
*OZ4CG	"	104	9	8
***OZ1JVX**	**3.5A**	**150,696**	**227**	**182**
		Dodecanese		
***SV5DKL**	**21A**	**648**	**18**	**18**
		England		
M2G	**AA**	**1,675,085**	**1002**	**505**
				(OP: G4RCG)
M2E	*"	*929,648*	*726*	*388*
				(OP: GØRPM)
G3TXF	"	664,524	520	378
M2L	"	653,184	597	384
				(OP: MØBJL)
GØHDV	*"	*442,895*	*461*	*283*
G3T	"	309,983	360	239
				(OP: G3VGZ)
G7T	"	224,900	260	260
				(OP: MØVSE)
G3PXT	*"	*100,408*	*208*	*154*
G3WYW	"	95,628	194	156
G1SCT	"	69,138	169	138
G5EA	"	33,464	102	89
				(OP: M1DDD)
G2W	"	23,068	81	73
				(OP: G4DBW)
G8GNI	"	13,740	67	60
G4CTY	"	11,832	62	58
GX4GA	**21A**	**27**	**3**	**3**
				(OP: G4IRN)
M1KMC	**14A**	**448**	**14**	**14**
GB6ØATG	**7A**	**2,543,234**	**1024**	**571**
				(OP: GW4SKA)
MØUNI	"	193,826	250	199
***GØMTN**	**AA**	**1,029,021**	**762**	**399**
*M2J	"	671,772	557	356
				(OP: G4NBS)
*M1X	"	433,797	426	273
				(OP: GØCKP)
*G4OZG	"	335,923	404	259
*GØFGI	"	263,626	340	253
*G1P	"	251,860	345	245
				(OP: MØIEP)
*M3ECT	"	229,000	347	229
*2EØCVN	"	193,440	312	208
*MØTQR	"	165,435	293	205
*G7H	"	155,200	275	194
				(OP: G7SYW)
*GØWSA	"	149,224	250	184
*G4SGI	"	149,184	276	192
*G8GHD	"	121,987	249	199
*M3X	"	120,582	231	174
				(OP: MØIHT)
*GØC	"	105,228	209	158
				(OP: GØCER)
*G3SNU	"	92,747	204	163
**MØDPK*	*"	*91,168*	*174*	*148*
*M6XAT	"	76,260	198	155
*G3YCH	"	54,735	142	123
*M3R	"	37,269	132	101
				(OP: G3RTU)
*G4CXQ	"	29,299	98	83
*G4FEV	"	25,484	111	92
*G3KNU	"	24,206	104	98
*MØNPT	"	14,342	85	71
*G4JBA	"	10,865	59	53
*G8VPE	"	7,656	47	44
*G4AFJ	"	7,590	56	55
**M5AX*	*"	*4,920*	*43*	*41*
*MØMPM	"	3,424	33	32
*G3RSD	"	3,200	41	40
*G7RTI	"	1,298	22	22
*MØJSB	"	1,040	22	20
**MØGLV*	*"	*952*	*17*	*17*
*MØNQN	"	319	12	11
***G9D**	**21A**	**2,574**	**38**	**33**
				(OP: G6NHU)
***M5ARC**	**14A**	**33,376**	**124**	**112**
				(OP: MØCKE)
*GØSNG	"	20,056	102	92
*G4WGE	"	4,841	49	47
*M6YTU/A	"	1,764	29	28
*MØDVV	"	1,540	29	28
*G4NXG/M	"	392	14	14
*2EØGTD	"	3	1	1
***G8X**	**7A**	**1,196,972**	**628**	**434**
				(OP: G4FJK)
*G4ZOB	"	223,440	274	210
*G4ZVB	"	174,212	229	194
*G2EC	"	144,976	210	164
				(OP: GØURR)
***G6N**	**3.5A**	**253,920**	**293**	**230**
				(OP: GØGDU)
*G4SJX	"	125,510	211	163
MØHMJ	**AA**	**404,481**	**459**	**309**
G4FPA	"	48,396	146	111
		Estonia		
ES4RD	**AA**	**411,839**	**418**	**269**
ES1BH	"	26,574	96	86
***ES2DJ**	**3.5A**	**228,760**	**277**	**215**
ES5NHC	**AA**	**144**	**9**	**9**
		European Russia-District 1		
RA1QFU	**AA**	**595,284**	**621**	**339**
RV1AQ	*"	*188,580*	*287*	*210*
R1LN	"	59,736	166	131
***RA1ALC**	**AA**	**610,295**	**593**	**329**
*RX1AG	"	213,607	322	227
*R1AV	"	199,305	313	215
*RU1AT	"	188,125	306	215
*R1NO	"	28,090	126	106
*RK1NA	"	19,350	101	90
*RN1AO	"	2,581	30	29
		District 3		
RM3DA	**AA**	**2,292,388**	**1250**	**556**
R5AJ	"	2,014,272	1142	576
RT3P	"	1,932,380	1210	530
R3BB	"	437,261	489	313
RC5Z	"	292,978	339	238
RA3NC	"	264,859	361	241
RA3TT	"	190,008	306	234
RT5C	"	173,075	280	215
RV3TG	"	84,208	189	152
RW3QM	"	74,500	172	149
UF5D	"	2,943	28	27
				(OP: RW4CLF)
R3GZ	**14A**	**527,022**	**578**	**414**
RU5TT	"	422,240	557	377
				(OP: R3TE)
RG2A	**7A**	**711,744**	**475**	**352**
R3KM	"	144,092	199	163
R2ZX	"	4,736	35	32
RG5A	**3.5A**	**6**	**1**	**1**
***RA3Y**	**AA**	**1,553,630**	**978**	**494**
*RV3ZN	"	978,892	698	404
*RX3ASQ	"	568,802	581	334
*RU5X	"	458,736	484	304
*R2PU	"	328,293	387	243
*RZ3ZZ	"	192,404	292	206
*RW3LB	"	126,854	271	182
*RK3DSW	"	119,784	240	168
*RA3LJ	"	111,048	229	168
*RV3DCZ	"	104,380	219	170
*UA3XO	"	103,090	232	169
*UB5MBA	"	101,640	211	165
*R2YES	"	89,586	200	162
*R3WA	"	79,599	185	157
*RA3V	"	72,090	173	135
*R3OR	"	71,710	185	142
*RX3VF	"	56,500	151	113
*RA3SI	"	35,200	114	100
*RN3PB	"	33,744	140	111
*UA3UBT	"	24,064	105	94
*RA3VGS	"	19,866	95	86
*UA3MKI	"	16,184	80	68
*RJ3F	"	4,141	46	41
*R2SAG	"	3,224	33	31
*RZ3DZ	"	84	5	4
***R2XM**	**14A**	**89,262**	**241**	**174**
**UC5D*	*"	*78,044*	*217*	*179*
*R5ACQ	"	66,234	197	166
*R24ØS	"	38,556	155	126
				(OP: RL1I)
*R3PV	"	26,429	121	107
*RV3YR	"	11,900	86	70
*UA3UCD	"	8,509	75	67
***RQ2Q**	**7A**	**375,200**	**347**	**268**
*UA3PI	"	358,280	384	260
*R2ABM	"	260,820	312	230
*R3PKS	"	43,680	107	105
**R5FN*	*"	*6,880*	*43*	*40*
***UA5F**	**3.5A**	**369,234**	**356**	**281**
*RG5R	"	83,232	170	144
*RA3E	"	60,750	130	125
RA3DJA	**AA**	**42,714**	**136**	**113**
RV3DBK	"	24,843	112	91
RM5F	"	18,040	95	82
RA3XEV	**14A**	**10,336**	**78**	**68**
RW3AI	"	7,552	61	59
		District 4		
UA4M	**AA**	**5,183,171**	**1881**	**761**
				(OP: RL4R)
R4OF	"	339,350	442	275
RW4WZ	"	327,096	438	308
R4RB	"	274,778	389	266
R4CI	"	120,288	260	179
***RA4FUN**	**AA**	**1,119,360**	**760**	**440**
*RU4LM	"	437,162	479	341
*RA4HL	"	271,250	383	250
*RZ4AZ	"	187,200	289	200
*UA4WJ	"	138,646	249	181
*UC4I	"	67,727	163	131
*R4WT	"	39,556	141	116
**RU4H*	*"	*35,200*	*117*	*100*
*RA4L	"	22,880	103	88
*RN4ABD	"	3,180	33	30
*R4AJ	"	2,380	31	28
***RU4SS**	**14A**	**313,824**	**442**	**336**
*UA4SJO	"	68,456	206	172
***RW4HM**	**7A**	**56**	**4**	**4**
***RU4I**	**3.5A**	**211,680**	**266**	**216**
RT4W	**AA**	**212,058**	**341**	**238**
		District 6		
RA6GW	**AA**	**1,066,296**	**747**	**462**
RT7N	"	540,540	575	364
RG7M	"	193,116	283	209
R7KO	"	192,778	330	226
RV7C	"	168,198	276	194
R6DM	"	8,100	54	45
RV6ASU	"	3	1	1
RN6A	**21A**	**6,656**	**59**	**52**
UC6N	**14A**	**367,616**	**515**	**359**
UA6CE	"	8,925	62	51
R7RIB	**7A**	**100,674**	**166**	**153**
***R7MM**	**AA**	**1,011,593**	**756**	**451**
*RT6DI	"	520,665	538	337
*UD7G	"	331,264	389	256
*RK6ART	"	313,560	423	268
*R7LY	"	281,589	399	253
*RY6AAG	"	269,505	425	265
*RW6APC	"	229,586	333	217
*RV6F	"	222,250	377	254
*R7RF	"	177,270	254	190
*RM6LD	"	145,323	294	201
*R6KX	"	110,182	225	178
**R6LAQ*	*"	*88,396*	*199*	*154*
*RJ7J	"	77,420	165	140
*R7BN	"	74,124	182	142
*RT6N	"	21,437	108	97
*RJ7M	"	15,000	68	60
*UA6Y	"	544	19	17
*RA7R	"	312	12	12
*RU6C	"	200	10	10
***RA6LIS**	**14A**	**92,500**	**248**	**185**
*R7MT	"	74,132	206	172
*R6KEE	"	4,800	48	48
*R7TJ	"	338	13	13
***R6CC**	**7A**	**2,700**	**28**	**27**
***RA6C**	**3.5A**	**493,042**	**435**	**307**
RU6YJ	**AA**	**465**	**15**	**15**

RQ7R	**14A**	**66,400**	**200**	**166**
R7RAG	**7A**	**12,508**	**62**	**59**
		District 9		
***UA9FLK**	**AA**	**227,874**	**357**	**233**
***R8XF**	**14A**	**183,768**	**348**	**248**
*RA9FEL	"	65,572	198	169
*RA9XSL	"	14,094	85	81
		European Turkey		
***TA1BX**	**14A**	**532**	**20**	**19**
		Fed. Rep. of Germany		
DF8XC	**AA**	**2,332,200**	**1228**	**598**
DQ1P	"	1,949,919	1004	573
				(OP: DK1IP)
DLØHMK	"	1,663,592	925	488
				(OP: DF2HN)
DL7VOG	"	1,357,335	889	465
DH8BQA	"	1,312,869	805	499
DK1KC	"	1,246,185	791	459
DL6JZ	"	1,111,432	778	446
DJ8EW	"	1,053,846	684	461
DQ1ØØSL	*"*	*792,412*	*490*	*397*
				(OP: DJ8VH)
DF8QB	"	771,936	597	374
DL3DW	"	767,261	573	373
DJ5IW	"	681,504	564	372
DL4ME	"	676,140	552	354
DL7URH	"	667,990	505	335
DJ5MW	"	577,990	550	359
DJ9KM	"	549,824	520	352
DF2RG	"	548,574	492	338
DL6DH	"	490,960	454	323
DL5YM	"	486,700	485	314
DJ3NG	"	477,594	447	314
DG9BEO	"	429,225	463	295
DF6QV	"	362,870	384	277
DK4VW	"	355,080	393	264
DJ6TB	"	338,390	366	274
DL1IAO	"	294,556	303	211
DL4ZA	"	288,544	352	254
DK1LRS	"	284,260	341	244
DF5BX	"	282,030	365	238
DK2AT	"	250,480	343	248
DK6CQ	"	247,450	309	245
DM3M	"	224,115	299	223
				(OP: DM3XRF)
DL6KVA	"	220,388	301	238
DF1LX	"	217,833	273	231
DJ1YF	"	209,025	290	225
DH6BH	"	168,365	294	223
DL1STG	"	140,940	223	180
DL1DAW	"	140,940	224	174
DG7NFX	"	117,936	222	168
DK6WL	"	113,967	216	189
DL3XM	"	111,000	187	150
DL7CX	"	105,544	186	158
DQ6Q	"	96,228	170	162
DK2CX	"	93,969	174	159
DL5ST	"	90,882	192	162
DJ9RR	"	78,384	173	142
DF8JK	*"*	*72,520*	*186*	*148*
DL9NCR	"	71,020	169	134
DK3GI	"	67,727	149	131
DL1EMA	"	64,008	156	127
DL7UXG	"	61,650	153	137
DL8DWL	*"*	*58,968*	*149*	*126*
DK6MT	"	54,560	116	110
DK1AX	"	53,248	128	128
DJ5AN	"	47,880	116	105
DKØOF	"	32,000	119	100
				(OP: DL5BCF)
DL5SE	"	29,465	98	83
DL4ABR	*"*	*29,355*	*109*	*103*
DC2VE	"	20,504	102	88
DL9GTB	"	10,944	64	64
DK3AX	"	4,708	47	44
DM5JBN	"	4,560	30	30
DL4JLM	*"*	*1,863*	*26*	*23*
DL1DTL	**14A**	**240,240**	**373**	**280**
DK4QT	"	20,880	100	90
DL5XJ	"	9,625	61	55
DL5LYM	"	260	10	10
DL5JS	**7A**	**549,036**	**440**	**302**
DL1SWB	"	270,020	308	230
DK1FW	"	41,904	116	97
DL3BQA	**3.5A**	**1,324,320**	**755**	**465**
DJ3IW	"	289,044	286	259
DF5MA	"	180,044	243	206
***DD2ML**	**AA**	**2,055,169**	**928**	**599**
*DK9IP	"	2,002,752	961	608
*DL/KU1CW	"	1,478,598	906	521
*DL1NEO	"	1,061,888	635	488
*DL3SYA	"	1,061,202	773	411
*DR7T	"	596,980	469	380
				(OP: DF1DN)
*DJ9MH	"	478,626	459	331
*DFØBV	"	422,136	424	312
				(OP: DL1MAJ)
*DL1FCU	"	406,641	441	267
*DL5AWI	"	364,266	379	294
*DM7W	"	303,038	366	277
				(OP: DL8MAS)
*DL3DRN	"	281,856	358	256
*DGØCG	"	264,620	366	262
*DK1FT	"	261,500	351	250
*DL1GBQ	"	244,408	307	223
*DJ6OZ	"	244,036	340	247
*DAØDX	"	227,255	295	215
				(OP: DL2DCX)
*DJ7UC	"	202,270	301	226
*DD7UW	"	195,386	286	211
*DL1GWS	"	188,538	286	201
*DL6SFR	"	184,734	263	198
*DL2GPK	"	179,858	274	203
*DL5NAV	"	174,087	251	207
*DL2KWA	"	170,914	265	194
*DL6EZ	"	162,620	260	188
*DL1ARJ	"	143,100	241	212
*DJ5TT	"	135,240	223	184
*DL7YS	"	125,164	205	166
*DJ4WM	"	115,730	212	163
*DJ2AX	"	111,251	195	161
**DG2BWG*	*"*	*111,192*	*213*	*164*
*DL6FCK	"	103,777	204	157
*DK2WU	"	102,396	189	159
*DL5UG	"	90,298	187	151
*DL3OH	"	89,176	185	157
*DJ6TK	"	88,900	214	175
*DK6OR	"	87,285	198	165
*DL4FAP	"	84,315	205	165
**DJ3JD*	*"*	*84,180*	*187*	*138*
*DL5PW	"	82,026	174	147
*DL5RMH	"	72,896	173	136
*DB8AH	"	69,525	151	135
**DL2RH*	*"*	*66,679*	*161*	*131*
**DL4KW*	*"*	*66,560*	*159*	*130*
*DF3EH	"	58,476	159	132
*DL5ANS	"	58,110	149	130
*DL2ZA	"	58,000	144	116
*DF4ZL	"	54,168	150	122
*DL5MFF	"	53,193	140	119
*DF5EM	"	48,763	133	121
*DL8SDC	"	47,260	160	139
**DO4DXA*	*"*	*45,686*	*111*	*106*
*DL2LMS	"	43,776	130	114
*DK5DQ	"	41,006	116	101
*DF6JF	"	40,716	147	116
*DK5WN	"	38,315	110	97
*DL8ZAJ	"	38,250	118	102
*DM2DLG	"	34,505	127	103
*DF2LH	"	33,652	103	94
*DR3W	"	30,770	96	85
				(OP: DL6MHW)
*DL5ALW	"	30,258	93	82
*DB1KK	"	29,250	106	90
*DL8ULF	"	28,188	89	81
**DL7LE*	*"*	*28,175*	*126*	*115*
*DL9GMC	"	27,456	113	96
*DM4EAX	"	25,245	93	85
*DD2BU	"	25,024	116	92
*DL1HUH	"	23,848	92	88
*DK9ZE	"	23,670	100	90
*DL9FB	"	22,152	93	78
**DL1EJM*	*"*	*21,244*	*104*	*94*
*DL3FBB	"	20,736	100	81
*DL2OE	"	19,669	95	89
*DF2UA	"	18,640	85	80
*DL6ES	"	17,114	93	86
				(OP: SP1EG)
*DK2VM	"	16,353	81	69
*DL6RBH	"	15,960	73	70
*DC6MT	"	15,540	89	84
**DM5B*	*"*	*14,756*	*70*	*62*
				(OP: DM5RC)
*DL7NX	"	13,924	63	59
				(OP: E71DX)
**DBØDH*	*"*	*13,575*	*92*	*75*
				(OP: DL3ECQ)
*DLØGRH	"	12,483	59	57
				(OP: DJ5NN)
*DF8AN	"	11,640	64	60
*DHØGHU	"	9,776	55	52
*DL1JPF	"	9,222	59	53
*DM6DX	"	7,872	49	48
*DF2AP	"	7,791	50	49
*DL9ZWG	"	7,595	54	49
**DL2FQ*	*"*	*7,500*	*54*	*50*
*DL2RUG	"	7,348	55	44
*DL2GMK	"	5,900	51	50
*DK4EF	"	5,376	48	48
*DG1HXJ	"	5,032	39	37
*DO5HCS	"	4,440	42	40
*DJ6MK	"	4,329	39	37
*DL1DQJ	"	4,224	34	32
*DH4HN	"	4,148	37	34
*DB4LL	"	3,658	32	31
*DD5MA	"	2,112	24	24
*DL1RPR	"	1,856	29	29
*DF1HF	"	1,134	18	18
*DL1STV	"	840	23	21
*DL4EAX	"	688	17	16
*DL1PAN	"	252	9	9
**DL5BAW*	*"*	*0*	*0*	*0*
***DL3KVR**	**14A**	**153,352**	**307**	**232**
*DF4WC	"	90,424	224	178
*DL1AKL	"	27,577	129	109
*DL5ØIFM	"	10,428	69	66
				(OP: DL5GAC)
*DP4X	"	10,168	70	62
				(OP: DJ2MX)
*DL2GMI	"	1,296	27	27
*DG9AK	"	816	27	24
***DL5KUD**	**7A**	**312,120**	**321**	**255**
*DL2AWG	"	195,980	256	205
*DHØDX	"	195,584	265	191
				(OP: DK5TX)
*DL8ZU	"	102,416	180	148
*DF7JC	"	66,552	146	118
*DL6NWA	"	19,162	74	67
*DLØPCK	"	8,184	49	44
				(OP: DL2BQV)
*DL5TML	"	1,968	25	24
*DM8T	"	1,024	16	16
				(OP: DM8FW)
*DM2CYN	"	6	1	1
***DJ1MM**	**3.5A**	**227,520**	**266**	**237**
*DO4OD	"	91,770	197	161
*DM7CW	"	39,996	111	101
*DL3FCG	"	34,560	104	96
*DK3WW	"	33,696	113	104
*DG5MLA	"	7,488	49	48
*DO1TOM	"	6,232	44	41
*DO7CX	"	2,070	23	23
DK7HA	**AA**	**799,848**	**603**	**378**
DL5RK	"	285,995	349	235
DDØVS	"	125,614	212	181
DL6ABB	"	32,396	99	89
DL2DWP	"	21,648	94	82
DL2BIS	"	3,861	44	39
DL2TM	**21A**	**902**	**22**	**22**
DG3EK	**7A**	**63,196**	**140**	**122**
DJ3GE	"	59,890	136	113
DJ2GMS	"	28,884	101	87
DQ5M	**3.5A**	**2**	**1**	**1**
				(OP: DK6SP)
		Finland		
OH3OJ	**AA**	**1,485,942**	**1001**	**454**
OH3FM	"	1,181,361	878	417
OH1TM	"	806,264	628	388
OH7KBF	"	304,706	383	262
OH6DX	"	263,712	345	246
OH2BBT	*"*	*9,016*	*55*	*49*
OH1XX	"	3,875	34	31
OG2P	**14A**	**522,452**	**559**	**397**
				(OP: OH2PM)
OH3LQK	"	20,640	103	96
OH5UQ	**7A**	**474,416**	**400**	**298**
OH2K	"	5,850	49	45
				(OP: OH3NOD)
OH2PM	**3.5A**	**126,720**	**198**	**165**
***OH8EJW**	**AA**	**377,400**	**437**	**296**
*OH7L	"	249,452	338	236
				(OP: OH8TV)
*OH2EUU	"	226,512	333	234
*OH2LU	"	167,433	269	201
*OG3P	"	116,451	191	171
				(OP: OH3P)
*OH2JIU	"	108,477	208	153
*OH2LNH	"	90,376	203	158
*OH9GIT	"	62,040	182	132
*OH8GET	"	51,948	128	117
*OH6BA	"	39,744	134	108
*OH3GLY	"	33,271	112	97
*OH2ECG	"	7,525	48	43
*OG7KA	"	5,014	48	46
				(OP: OH3KAV)
*OH5EAB	"	1,736	30	28
***OH5HBA**	**7A**	**418**	**11**	**11**
***OH6RE**	**3.5A**	**22,032**	**76**	**72**
OH1LEG	*7A*	*100*	*5*	*5*
		France		
F5OAM	**AA**	**1,062,249**	**788**	**401**
F5QE	"	393,206	409	293
F6CXJ	"	251,720	319	217
F6EKX	"	205,889	296	227
F5GFA	"	184,830	297	202
F4HRM	*"*	*109,990*	*218*	*170*
F5SDD	"	87,906	167	147
F6EQZ	"	51,156	140	116
TM5J	**21A**	**2,618**	**35**	**34**
				(OP: F5TMJ)
F1RHS	**14A**	**109,228**	**241**	**188**
TM1D	"	39,861	145	129
				(OP: F4GPB)
F5JY	"	18,530	99	85
F4HJO	**7A**	**1,117,376**	**669**	**416**
F5NBX	"	147,294	213	167
***TM3Z**	**AA**	**5,311,416**	**1803**	**744**
				(OP: F4DSK)
*F6GCI	"	419,265	426	315
*F5OYC	"	405,602	446	278
*F4FDR	"	311,724	393	252
*F6BQG	"	267,794	344	257
*F1IWH	"	230,574	322	249
*F4FCE	"	225,675	313	225
*F5PVJ	"	162,540	242	172
*F4FRC	"	77,649	177	143
**F4FHV*	*"*	*53,640*	*146*	*120*
*F6AUS	"	36,045	99	89
*F8CPA	"	6,426	46	42
*F5MLJ	"	748	17	17
***F1HMR**	**7A**	**47,936**	**114**	**107**
*F1IKA	"	16,120	72	65
*F4DZR	"	420	11	10
***F5BEG**	**3.5A**	**1,013,308**	**617**	**398**
*F1AKK	"	767,808	501	372
		Greece		
SV2ESW	**AA**	**1,387,512**	**978**	**504**
SV3DCX	"	484,446	496	307
SV1ABB	"	109,802	210	161
SZ1A	**14A**	**770,868**	**747**	**483**
				(OP: SV1CIB)
SV3EXU	"	102,400	247	200
SV2HXX	*"*	*8,280*	*70*	*69*

SV2BXZ	**7A**	**72,072**	**135**	**126**
***SV1BJW**	**AA**	**135,660**	**252**	**190**
*SV1AJO	"	104,665	216	173
*SV1JFL	"	68,400	205	150
*SV1DOO	"	32,736	123	93
*SV8PMM	"	25,360	96	80
*SV2/SV7CUD	"	19,126	83	73
*SV8CYR	"	3,880	44	40
***SV1JG**	**14A**	**372,498**	**508**	**343**
*SV3QUP	"	37,859	147	131
		Guernsey		
***GUØSUP**	**AA**	**431,268**	**430**	**332**
*GUØUVH	"	7,152	49	48
		Hungary		
HG8R	**AA**	**5,172,432**	**1787**	**788**
				(OP: HA8JV)
HA2VR	"	450	10	10
HG1G	**7A**	**1,462,680**	**748**	**478**
HA2NP	*"*	*375,648*	*346*	*273*
HA7PL	"	270	9	9
HG5D	**3.5A**	**1,825,270**	**858**	**523**
				(OP: HA8QZ)
HA8BT	"	480,060	391	315
***HA6NL**	**AA**	**992,772**	**687**	**414**
*HG8C	"	686,814	592	339
				(OP: HA8EK)
*HAØMS	"	291,580	344	239
*HA7PO	"	242,663	307	227
*HA1TIB	"	216,876	302	212
**HA1TNX*	*"*	*182,039*	*273*	*209*
*HA3OU	"	37,875	127	101
*HA1LD	"	36,729	122	99
***HAØLW**	**14A**	**66,185**	**181**	**155**
*HA8BQ	"	63,840	189	160
***HA9MDN**	**7A**	**197,000**	**251**	**197**
***HA8WY**	**3.5A**	**690,120**	**491**	**355**
*HA1WD	"	22,200	80	74
HA6IAM	**AA**	**237,652**	**307**	**236**
HA7JVV	"	116,545	225	163
HG3IPA	**14A**	**118,038**	**265**	**206**
				(OP: HA3JB)
HA3HX	"	50,337	166	141
HAØGK	**7A**	**5,940**	**47**	**45**
		Iceland		
TF3AO	**14A**	**213,596**	**376**	**268**
TF3W	"	1,050	23	21
				(OP: TF3DC)
		Ireland		
***EI4GAB**	**AA**	**28,518**	**112**	**97**
***EI5KO**	**14A**	**1,200**	**25**	**25**
*EI3CTB	"	624	17	16
		Italy		
I2WIJ	**AA**	**4,338,720**	**1653**	**720**
IØWBX	"	2,892,500	1373	625
IZ1PKV	"	2,402,805	1158	615
IK2XDE	"	2,037,184	1122	556
I1NVU	"	2,010,836	1083	562
IC8SQS	"	1,699,880	1027	520
IW3FVZ	"	1,258,368	800	452
IX1CLD	"	1,078,650	707	425
I2DJX	"	630,277	553	379
IZ2BVC	"	447,024	449	268
I1JTQ	"	365,037	409	271
IK5FKF	"	340,262	396	299
IN3EYI	*"*	*322,568*	*348*	*244*
IK2AHB	"	246,694	345	263
IK2BUF	"	198,450	301	225
IZ3KUY	"	197,820	289	210
IZ4FUE	"	182,160	283	220
IKØXBX	"	110,292	198	156
IC8POF	"	86,460	157	132
IV3WMS	"	81,648	182	144
IZ2ZQP	"	63,364	157	124
IO7T	"	59,400	159	135
IZ2DII	"	52,668	136	114
IK2SAI	"	48,477	168	143
IN3EQD	"	42,158	121	107
IK4ZHH	"	31,341	103	93
IKØYUT	"	21,730	103	82
IK2TDM	"	13,975	69	65
IZ3XEF	"	7,567	47	47
IZ4COW	**21A**	**79,704**	**209**	**164**
IK3ASM	"	3,948	47	42
IQ1RY	**14A**	**2,659,589**	**1344**	**797**
				(OP: IZ1LBG)
IU4CHE	"	922,530	785	483
IU1LCU	"	175,123	322	247
IK1NEG	"	138,381	280	239
I7CSB	"	76,475	200	161
IZ4NIC	**7A**	**4,309,540**	**1226**	**755**
IZ5EME	"	433,004	355	286
IK5UAN	"	385,208	351	269
IV3AVQ	"	352,928	320	269
IZ4GOL	"	120,960	202	160
IKØLNN	"	23,856	78	71
IU3BTY	"	13,640	60	55
I4AVG	**3.5A**	**2,055,636**	**910**	**537**
IZØKBR	"	1,931,250	840	515
IK4DCX	"	477,152	422	296
IK3SSJ	"	435,088	407	284
IU1JCZ	"	395,136	368	294
IZØFWD	"	153,946	236	191
***IK6VXO**	**AA**	**5,463,707**	**1772**	**811**
*IT9RGY/4	"	5,294,496	1696	786
*IK3TPP	"	1,982,460	1083	555

*IWØGYC	"	581,434	553	349
*IZ2JQP	"	540,960	527	336
*IV3XNF	"	530,536	493	332
*IW1CBG	"	477,666	494	306
*IU4HRJ	"	471,530	452	305
*IW3IOD	"	449,970	473	318
*IK5BSC	"	436,994	445	302
*IZ4OSH	"	403,908	434	291
*I2XLF	"	288,036	351	252
*IZ4YAB	"	277,332	326	242
*IK2SAR	"	262,260	338	235
*IK6BAK	"	259,284	335	246
*IW4ECF	"	227,286	290	207
*IK2OVT	"	225,336	294	229
*IW6PWC	"	173,808	293	204
*IK2AUK	"	171,785	279	215
*I2SVA	"	157,325	255	203
*IØGIA	"	153,000	234	180
*IU3LYJ	"	134,688	240	183
*I2BZN	"	119,360	217	160
*IKØHTP	"	99,840	185	156
*IV3XPP	"	98,868	193	154
*I2BRT	"	92,584	200	163
*IW4EJK	"	77,400	176	150
**IK3MLF*	*"*	*76,720*	*150*	*140*
*IZ3EIN	"	72,076	181	148
*IK1BPL	"	68,089	149	137
*I4JEE	"	62,436	160	129
*IZ1PLH	"	57,728	158	128
*IK4ALM	"	50,760	144	120
*IW1CQ	"	48,160	164	140
*IZ6BXQ	"	46,500	156	125
*IK3YBX	"	44,042	134	122
*IK8ARF	"	42,362	144	118
*IV3HAX	"	41,870	108	106
*IK2IKW	"	39,091	114	97
*IW1CHX	"	33,500	123	100
*IK2MXM	"	31,556	105	92
*IU4JIC	"	30,544	110	92
*IU8LPU	"	27,470	99	82
*IZ2BHQ	"	26,320	101	94
*IZ3KSP	"	23,908	100	86
*IK2YSJ	"	20,382	88	79
*IU3MDI	"	19,440	78	72
*IK4XQT	"	12,012	72	66
*IK3CST	"	8,586	57	53
*IK2SBB	"	6,519	44	41
*IØ/S58Y/P	"	5,016	39	38
				(OP: IØ/S58Y/P)
*IZ5ILK	"	3,770	29	29
*I2ORX	"	3,526	45	43
*IK2EBP	"	3,219	30	29
*IV3HJB	"	3,132	29	29
**IKØEIE*	*"*	*1,020*	*17*	*17*
*IK2REA	"	980	14	14
*IZ3XNJ	"	940	23	20
*IZØZFK	"	528	11	11
***IZ5OQX**	**21A**	**96**	**6**	**6**
***IZ3IBL**	**14A**	**754,390**	**691**	**455**
*IP9IPY	"	484,058	593	391
				(OP: IT9YMM)
*IK5AMB	"	384,475	482	325
*IK1RGK	"	338,778	464	319
*IZ7XNB	"	113,160	256	205
*IK1SOW	"	66,462	193	159
*IV3AEB	"	20,020	99	91
*IK7RVY	"	11,988	80	74
*IKØPRP	"	3,999	48	43
*IW1RLS	"	1,224	24	24
*I3FGX	"	954	19	18
***IZ3NXC**	**7A**	**950,274**	**618**	**393**
*IW1PNJ	"	882,000	551	392
*IU5ICR	"	600,096	480	329
*IW2MXY	"	572,400	452	318
*IW2MYH	"	398,880	360	277
*IK8IOO	"	179,712	247	192
*IK4RVG	"	73,272	151	129
*IZ4AKO	"	44,100	104	98
*IZ7NMD	"	35,880	98	92
*IV3UJT	"	2,960	38	37
***I1WXY**	**3.5A**	**756,126**	**552**	**357**
*IW2HUS	"	318,240	332	255
*IU4FKR	"	27,880	89	82
IZ3NVR	**21A**	**990**	**23**	**22**
IZ2JPN	**14A**	**47,560**	**165**	**145**
IZ2QKG	**7A**	**5,472**	**39**	**36**
		Kaliningrad		
RN2FQ	**AA**	**58,212**	**149**	**126**
***RN2FA**	**AA**	**2,727**	**31**	**27**
***RA2FB**	**14A**	**24,205**	**117**	**103**
		Latvia		
YL9T	**AA**	**247,296**	**280**	**224**
YL3CU	**14A**	**354,688**	**462**	**326**
***YL2JR**	**AA**	**142,266**	**229**	**181**
*YL5T	"	29,250	96	90
				(OP: YL3DQ)
***YL2QV**	**14A**	**22,420**	**110**	**95**
YL3FW	**3.5A**	**45,150**	**115**	**105**
		Lithuania		
LY7Z	**AA**	**4,741,347**	**1728**	**793**
LY1R	"	1,961,859	1069	543
LY2BAA	"	208,692	301	204
LY3CY	"	12,614	57	53
LY7T	**3.5A**	**471,254**	**432**	**287**
***LY6A**	**AA**	**3,238,239**	**1409**	**661**
*LY9Y	"	1,376,970	858	474

*LY2SA	"	581,728	457	343
*LY7W	"	384,420	402	258
				(OP: LY2NZ)
*LY2TS	"	320,045	357	253
*LYØNAS	"	9,744	60	58
***LY2CG**	**14A**	**46,636**	**159**	**131**
*LY2CV	"	3,483	48	43
***LY2BBF**	**7A**	**3,422**	**31**	**29**
LY5G	**7A**	**163,812**	**234**	**187**
		Luxembourg		
LX1HD	**3.5A**	**421,680**	**387**	**280**
		Moldova		
ER4A	**AA**	**4,363,320**	**1814**	**780**
				(OP: UT5UDX)
ER/UW7LL	**3.5A**	**5,698**	**38**	**37**
***ER5LL**	**14A**	**67,890**	**200**	**155**
***ER1OO**	**3.5A**	**514,692**	**443**	**306**
		Montenegro		
4O4A	**AA**	**34,888**	**106**	**98**
		Netherlands		
PA7WW	**AA**	**313,116**	**384**	**269**
PA3I	"	202,960	311	215
PG7M	"	198,951	273	249
PG2K	"	164,010	295	210
PA4DN	"	103,463	198	157
PA75LEX	"	62,244	141	117
				(OP: PA1LEX)
PG3N	"	56,364	151	132
PA5WT	**14A**	**16,530**	**97**	**87**
PB7Z	**7A**	**91,080**	**156**	**138**
***PF6X**	**AA**	**492,900**	**520**	**310**
*PE1FTV	"	301,200	351	251
*PAØALG	"	144,632	272	202
*PDØMHZ	"	113,049	213	159
*PA3BXR	"	105,194	202	149
*PA3DUU	"	102,237	195	159
*PDØWR	"	81,989	195	163
*PBØACU	"	81,224	198	143
*PD3EM	"	71,421	173	133
*PDØJMH	"	58,800	152	120
*PG1R	"	58,716	157	126
**PG5V*	*"*	*38,784*	*124*	*101*
*PA2CVD	"	37,630	126	106
**PD9X*	*"*	*35,350*	*122*	*101*
*PA1CW	"	32,016	102	92
*PA2VS	"	31,395	101	91
*PAØCMF	"	28,704	105	92
*PAØPIW	"	27,280	98	80
*PA3DBS	"	27,090	103	90
*PC5D	"	25,298	109	91
*PAØGRU	"	23,577	104	87
*PE1CPJ	"	15,484	86	79
*PA3CXB	"	12,663	82	67
*PA1BBO	"	10,710	56	51
*PA2EJD	"	8,918	52	49
*PA2LEN	"	5,207	47	41
*PD1B	"	3,696	33	33
*PA8KW	"	2,448	25	24
*PD4L	"	828	19	18
***PA2REH**	**21A**	**351**	**13**	**13**
***PE1OYB**	**7A**	**202,000**	**274**	**200**
***PC3T**	**3.5A**	**37,128**	**102**	**91**
PE2K	**AA**	**64,779**	**189**	**143**
PC6C	"	2,844	39	36
				(OP: PC1EMR)
		North Macedonia		
Z39A	**14A**	**223,036**	**363**	**274**
***Z35Y**	**AA**	**28,490**	**97**	**77**
***Z36N**	**14A**	**111,504**	**262**	**202**
***Z32ID**	**7A**	**1,832,370**	**822**	**515**
*Z33F	"	902,480	547	389
		Northern Ireland		
***GI4H**	**AA**	**330,000**	**393**	**275**
***GI5NI**	**14A**	**665,712**	**684**	**402**
				(OP: MIØSAI)
		Norway		
LA3BO	**AA**	**458,339**	**468**	**287**
LA5SJA	"	128,800	252	200
LA7VK	"	124,080	218	176
LC5W	"	78,120	187	140
LB4FH	"	14,384	67	62
LA7JO	*"*	*286*	*11*	*11*
LN2T	"	182	14	14
				(OP: LA3WAA)
LC9S	**14A**	**70,848**	**215**	**164**
				(OP: LA9GSA)
LA8CJ	"	260	10	10
***LA5LJA**	**AA**	**243,504**	**323**	**228**
*LA6CF	"	202,400	310	230
*LA9RY	"	115,830	226	165
*LA2HFA	"	94,792	208	164
*LA8OKA	"	45,045	131	105
*LA4OGA	"	39,750	125	106
*LA9TY	"	2,112	24	24
***LA/DL4HCF**	**7A**	**13,920**	**65**	**60**
		Poland		
SN7Q	**AA**	**7,476,770**	**2274**	**854**
				(OP: SP7GIQ)
SQ9ØPZK	*"*	*1,125,764*	*743*	*458*
				(OP: SP4Z)
SP4W	"	549,208	448	316

SN5N	"	501,402	481	321
				(OP: SP5KP)
SP95IARU	"	479,080	443	290
				(OP: SP7AH)
SP9PUZ	"	256,060	326	217
SP9ØPZK	"	254,040	305	219
				(OP: SQ5JUP)
SP2KPD	"	153,054	245	198
				(OP: SP2IJ)
SP3CMX	"	36,084	108	97
SP9RQH	"	13,328	73	68
SP3A	**14A**	**91,143**	**219**	**171**
SQ2RGB	"	37,631	145	121
SP1KM	"	14,615	86	79
				(OP: SP1MVW)
SP2QCW	"	833	17	17
SQ2A	**7A**	**2,354,104**	**930**	**556**
SP5UUD	"	644,000	491	322
SP1JQJ	"	36,284	102	94
SN2M	**3.5A**	**2,510,244**	**1016**	**594**
				(OP: SP2XF)
SP5DL	"	765,002	530	371
SP6CES	"	700	14	14
***SO7T**	**AA**	**1,216,384**	**797**	**442**
				(OP: SP5JP)
*SP3LGF	"	403,836	451	292
*SQ3MZ	"	297,180	355	254
*HF1ØØPS	"	243,090	310	219
				(OP: SP9CXN)
*SP6JZP	"	200,942	297	217
*SQ9I	"	188,505	265	213
*SP5TAZ	"	186,190	280	215
*SP4BPH	"	161,308	249	196
*SP3OL	"	156,735	278	215
*HF6C	"	155,006	252	194
				(OP: SP6OPC)
*SP6EIY	"	148,986	240	186
SP3IOE	*"	*139,315*	*240*	*187*
*SO5ØWD	"	131,376	226	168
*SP5BUJ	"	129,646	222	166
*SO3O	"	125,736	204	169
*SQ6UV	"	116,960	221	172
*SP1DOZ	"	112,057	200	167
*SP6FXY	"	109,740	222	186
*SP2MKZ	"	106,848	218	168
*SP1DMD	"	79,407	175	153
*SP3MEO	"	75,587	164	131
*SP2MKI	"	64,190	146	131
*SP1ADT	"	62,928	161	138
*SO1RON	"	50,310	142	117
*SP9KB	"	45,066	130	111
*SQ9FMU	"	42,987	107	89
*SP9Y	"	33,562	124	97
*SQ8L	"	9,165	57	47
*HF2Ø2ØPZK	"	8,460	48	47
				(OP: SP9MDY)
*SP9IHP	"	5,148	43	33
*SP5ELA	"	1,602	21	18
*SP5PBE	"	80	6	5
*SN5W	"	5	3	1
*SP73VOT	"	4	2	1
***SP4DC**	**21A**	**98**	**7**	**7**
***SP6DMI**	**14A**	**85,140**	**213**	**172**
*SN8ØØWL	"	76,752	195	164
***3Z9M**	**7A**	**1,544,306**	**714**	**509**
				(OP: SQ9UM)
*SQ6ELV	"	82,560	146	129
*SP6BEN	"	79,728	151	132
*SQ7LQJ	"	63,888	136	121
*SP2TQQ	"	60,372	133	117
*SO5E	"	51,304	120	106
				(OP: SP5VIH)
*SQ9DXT	"	24,486	85	77
SP9DEM	*"	*192*	*9*	*8*
***SQ2NNN**	**3.5A**	**488,592**	**426**	**312**
*SQ5NAE	"	450,996	428	294
*SQ1BVG	"	340,560	348	258
*SP7O	"	313,600	337	245
				(OP: SP7SEW)
*SP9DTE	"	75,870	155	135
*SP1NY	"	14,518	63	61
*SQ9PPT	"	10,200	53	50
*SP6IHE	"	2,112	24	24
SQ95IARU	**AA**	**135,235**	**239**	**185**
				(OP: SP2UUU)
SP4LVK	**14A**	**31,790**	**124**	**110**
SP2UU	"	903	23	21
		Portugal		
***CR5O**	**AA**	**1,485,143**	**904**	**451**
				(OP: CT7AJL)
*CT7AUP	"	1,400,850	894	495
*CT1FKN	"	30,225	97	93
CT7APA	*"	*11,773*	*66*	*61*
CT2JMR	*"	*3,744*	*37*	*36*
***CT1FOQ**	**14A**	**32,400**	**123**	**120**
***CT1BXT**	**7A**	**245,100**	**250**	**215**
CR6A	**3.5A**	**3,078**	**28**	**27**
				(OP: CT1IUA)
		Romania		
YO9HP	**AA**	**3,379,904**	**1469**	**704**
YO3RU	"	1,647,300	1052	510
YO3LW	**21A**	**390**	**14**	**13**
YO3HOT	**14A**	**308,792**	**495**	**319**
YO9BPX	*7A*	*87,312*	*154*	*136*
YQ6A	**3.5A**	**188,538**	**244**	**201**
YO5CUQ	"	54,880	125	112
***YO4NF**	**AA**	**1,334,256**	**869**	**462**
*YO3GNF	"	601,144	548	326
*YO6HSU	"	324,542	354	263
*YO6DBA	"	278,047	356	253
*YO9CWY	"	276,018	369	257
*YO7DBR	"	146,754	248	186
*YO4SI	"	141,600	240	177
*YO2LXW	"	122,265	223	165
*YO4RST	"	114,180	214	173
*YO7LYM	"	81,490	184	145
*YO2LEA	"	53,603	137	121
*YO4BXX	"	27,180	105	90
*YO3IWZ	"	1,870	34	34
*YO6CFB	"	2	2	2
***YO2IS**	**14A**	**108,138**	**243**	**201**
***YO4BEW**	**7A**	**111,078**	**180**	**153**
*YO4DFT	"	107,700	169	150
*YO6FPW	"	25,564	81	77
***YO7CW**	**3.5A**	**394,212**	**372**	**273**
YO4AAC	**AA**	**5,610**	**53**	**51**
YO8WW	**21A**	**950**	**20**	**19**
YO9BCM	**3.5A**	**206,586**	**262**	**207**
		Scotland		
GM2V	**AA**	**240,477**	**301**	**213**
				(OP: GM3WOJ)
GM9A	"	143,620	277	215
				(OP: GM4FDM)
GM2TT	*"	*28,272*	*113*	*93*
MM1E	**3.5A**	**131,820**	**194**	**169**
				(OP: MMØGOR)
***GMØOPS**	**AA**	**667,644**	**593**	**354**
*MMØCPZ	"	78,256	183	146
*MM1PTT	"	40,512	124	96
***MM2T**	**14A**	**46,332**	**170**	**143**
*GM3A	"	18,109	96	91
				(OP: MMØJOM)
MM3AWD	**AA**	**333,788**	**372**	**262**
GMØHVS	**7A**	**34,144**	**99**	**88**
		Serbia		
YT3H	**AA**	**484,710**	**471**	**321**
YU7BW	"	14,152	62	58
YT1X	**14A**	**1,431,930**	**1002**	**590**
YT5A	"	777,975	743	451
				(OP: Z3ØA)
YU7U	**7A**	**2,589,312**	**922**	**613**
YT4TT	"	345,270	329	255
YU1UN	**3.5A**	**300,960**	**311**	**240**
YT4T	"	300,294	332	249
***YT2U**	**AA**	**947,232**	**683**	**396**
*YTØX	"	245,508	321	246
				(OP: YTØTX)
YT7AW	*"	*72,009*	*147*	*127*
***YT8A**	**21A**	**29,160**	**120**	**108**
				(OP: YU1EA)
***YU7ZZ**	**14A**	**32,096**	**139**	**118**
*YU7OM	"	434	14	14
***YU5R**	**7A**	**1,556,516**	**776**	**481**
				(OP: YT2AAA)
*YT9VM	"	740,784	525	366
*YT7E	"	107,200	189	160
***YU1KT**	**3.5A**	**298,404**	**318**	**243**
*YU8NU	"	119,316	202	163
YU1LM	**AA**	**480,384**	**476**	**288**
YT9WW	*"	*15,340*	*68*	*65*
YU1NR	**14A**	**79,980**	**224**	**186**
YU1RH	"	18,612	103	94
YT5DEY	**7A**	**108,190**	**183**	**155**
		Sicily		
IT9VCE	**AA**	**728,712**	**494**	**349**
IT9ZMX	**14A**	**2,315,193**	**1352**	**717**
***IT9CKA**	**AA**	**54,026**	**140**	**119**
***IT9RZU**	**21A**	**1,700**	**26**	**25**
***IT9WKU**	**14A**	**180**	**12**	**12**
***IR9K**	**7A**	**1,078,884**	**623**	**414**
				(OP: IT9AHI)
***IO9Z**	**3.5A**	**77,000**	**155**	**140**
				(OP: IT9KXK)
		Slovak Republic		
OM3RM	**AA**	**2,696,404**	**1018**	**646**
OM7RU	"	303,552	333	248
OM2VL	**7A**	**3,829,228**	**1175**	**698**
OM3CW	*"	*15,990*	*68*	*65*
OM3IAG	**3.5A**	**312,708**	**326**	**253**
***OM2BK**	**AA**	**298,627**	**376**	**259**
*OM2DT	"	207,460	287	220
*OM7AG	"	166,743	268	191
*OM5CM	"	101,278	198	158
*OM5NL	"	67,200	170	140
*OM2ABC	"	40,479	125	103
*OM1AD	"	35,328	120	96
*OM3TLE	"	34,596	110	93
*OM3ZBG	"	15,825	89	75
*OM2ACM	"	3,540	31	30
***OM8JP**	**14A**	**61,502**	**188**	**161**
***OM7PY**	**7A**	**191,880**	**241**	**195**
*OM5MX	"	126,390	194	165
*OM3TNA	"	42,768	114	99
***OM5KM**	**3.5A**	**358,584**	**342**	**268**
*OM3ZWA	"	79,464	161	132
OM3WC	**AA**	**61,180**	**165**	**133**
		Slovenia		
S53X	**AA**	**3,676,290**	**1495**	**670**
S5ØRY	"	1,994,039	1044	587
				(OP: S53K)
S57YK	"	346,800	383	272
S58J	*"	*150,944*	*275*	*212*
S52X	**14A**	**2,090,880**	**1206**	**704**
S51CK	**7A**	**2,210,908**	**927**	**562**
S58Q	*"	*803,640*	*523*	*370*
***S55BA**	**AA**	**673,350**	**583**	**335**
*S54Z	"	658,086	466	338
*S57SWR	"	246,768	302	212
*S56EM	"	20,910	98	82
*S57KM	"	969	18	17
***S52OT**	**14A**	**350,056**	**477**	**329**
*S51JQ	"	234,324	362	283
S51W	*7A*	*271,190*	*304*	*235*
***S56A**	**3.5A**	**642,048**	**491**	**352**
*S57X	"	143,640	214	171
S57PKT	**7A**	**1,080**	**18**	**18**
		Spain		
EA1AKS	**AA**	**3,621,024**	**1410**	**648**
EA2XR	"	1,620,254	970	523
ED1D	"	926,828	712	419
				(OP: EC1D)
EA2DLX	"	815,250	637	375
EB3A	"	576,837	495	321
EB5A	"	550,942	491	322
EA7TG	"	498,932	487	346
EF1L	"	448,757	377	281
				(OP: EA1DA)
EA1L	"	415,044	467	324
ED4T	"	409,116	436	309
				(OP: EA4R)
EB5F	"	345,015	401	255
EA7LL	"	195,888	334	264
EC5K	*"	*60,711*	*176*	*147*
EB1DMQ	"	870	30	30
EC1KR	**14A**	**1,814,652**	**1153**	**684**
EA1B	"	1,010,412	803	508
EF1C	"	204,228	357	279
EF5U	"	114,595	279	215
				(OP: EA5U)
EA3OH	"	23,040	104	96
ED1R	**7A**	**2,599,496**	**996**	**586**
				(OP: EA1TL)
EA5GIE	"	189,344	281	194
EA1WX	"	93,434	161	137
EB1IC	"	63,104	123	116
***EA4GOY**	**AA**	**2,544,750**	**1100**	**585**
*EA7KHB	"	789,859	621	371
*EA4BAS	"	574,331	577	353
*EE4A	"	492,735	476	321
				(OP: EA4IE)
*EA7RCS	"	273,500	386	250
				(OP: EC7AKV)
*EA3HCJ	"	231,975	306	225
*EA3FZT	"	204,552	292	216
*EB4GOO	"	171,045	257	189
*EC3A	"	150,060	239	183
*EA1IYK	"	116,754	232	174
*EA3HKA	"	112,988	252	188
*EA5IQO	"	98,532	212	161
*EA4Z	"	98,098	207	154
*EA4C	"	76,960	176	148
EA1DP	*"	*36,504*	*126*	*104*
*EA3F	"	33,864	109	102
EA2BJM	*"	*27,680*	*92*	*80*
*EA5ICS	"	25,075	100	85
*EA3IAZ	"	17,464	94	74
*EA1EWY	"	17,024	89	76
*EC7K	"	15,240	65	60
*EA5R	"	14,976	72	72
*EC7AT	"	12,716	79	68
EA1CM	*"	*12,360*	*70*	*60*
*EE7C	"	6,600	46	44
				(OP: EA7QL)
*EA7VJ	"	6,566	52	49
EB2DJ	*"	*4,256*	*34*	*32*
***EA1BDX**	**21A**	**180**	**10**	**10**
***AN1PM**	**14A**	**836,140**	**766**	**485**
				(OP: EC1A)
*EA1X	"	578,556	606	396
*EA2ESZ	"	300,960	458	330
EA1VT	*"	*173,922*	*315*	*246*
*EA7KI	"	117,810	285	210
*EA7K	"	86,099	212	179
*EA2BNU	"	57,815	173	155
***EA5XC**	**7A**	**149,298**	**220**	**167**
*EA3X	"	110,260	187	149
				(OP: EA3GBA)
***EA3CI**	**3.5A**	**278,756**	**323**	**227**
*EA4AOC	"	273,182	301	247
*EA3GCT	"	50,504	125	107
*EA4FJX	"	4,446	41	39
EA4U	**AA**	**14,204**	**78**	**67**
EE2A	"	3,180	31	30
				(OP: EA2SN)
EA3FHP	**14A**	**210**	**10**	**10**
		Sweden		
SM5ILE	**AA**	**846,752**	**694**	**376**
SM3OMO	"	677,908	600	341
SD5X	"	419,630	440	290
				(OP: SM5KNV)
SM7BHM	"	139,446	249	183
SM6MVE	"	121,040	233	178
SF1Z	"	33,060	98	95
				(OP: SMØHEV)
SM3LBP	"	25,398	97	83
SB7W	*"	*21,390*	*107*	*93*
SM5EPO	**7A**	**280,088**	**299**	**223**
SA6U	"	35,820	95	90
				(OP: SM6LJU)
***SE4E**	**AA**	**1,157,312**	**785**	**428**
				(OP: SM4DQE)

*SM5S	"	443,702	441	287
				(OP: SM5SIC)
*SM5IMO	"	365,200	395	275
*7S5S	"	339,948	396	266
				(OP: SM5CSS)
*SM6I	"	324,520	396	266
				(OP: SA6CMO)
*SE6K	"	268,758	346	243
				(OP: SM6FZO)
*SM6A	"	105,000	198	150
*SM5ACQ	"	65,794	166	134
*SMØLYC	"	46,443	134	113
*SE6N	"	28,836	100	89
				(OP: SA6AXR)
*SM2BJS	"	28,140	133	105
*SM5DXR	"	24,273	110	87
*SM5EFX	"	8,134	53	49
***SI6V**	**14A**	**294,828**	**420**	**311**
***SM5MX**	**7A**	**97,328**	**175**	**154**
***SM6IQD**	**3.5A**	**6,936**	**56**	**51**
SFØA	**AA**	**288,552**	**344**	**264**
				(OP: SMØLPO)
		Switzerland		
HB9DHG	**AA**	**1,350,196**	**826**	**454**
HB2U	"	210,084	315	244
				(OP: HB9EYP)
HB9TTK	"	183,260	259	196
***HB2K**	**AA**	**459,543**	**451**	**277**
*HB9TZU	"	66,856	163	122
*HB9MXY	"	36,569	117	97
***HB3YGD**	**21A**	**324**	**12**	**12**
		Ukraine		
UW1M	**AA**	**6,046,320**	**2180**	**826**
				(OP: UR5MW)
EMØI	"	3,966,304	1721	736
				(OP: UT2IZ)
UV5U	"	2,885,852	1350	629
				(OP: UX1UA)
EN5V	"	1,718,424	990	522
				(OP: UX1VT)
UY5VA	"	1,632,736	1061	518
UT4RZ	"	1,126,150	844	446
UR5CN	"	1,068,665	836	401
UR5R	"	756,820	631	395
				(OP: UTØRM)
UT7FA	"	658,950	599	345
UW3G	"	633,600	550	320
				(OP: UY5HF)
UR5FS	"	570,964	566	349
UT7EJ	"	530,292	522	321
UR4EI	"	344,832	417	256
UV2V	"	264,204	346	246
				(OP: UX1VX)
UY5UF	"	240,327	271	243
US5QUB	"	228,962	317	239
UY8IF	"	216,040	307	220
UW5U	"	209,728	286	226
				(OP: UY2UA)
UY5TE	"	183,741	314	219
US8UA	"	158,328	289	216
UT3UV	"	73,899	186	153
UX6IR	"	47,481	142	119
UY5QZ	"	39,894	146	109
USØZK	"	20,169	81	81
UT3RS	**14A**	**509,860**	**603**	**370**
UY5ZZ	"	218,202	379	246
UR7QM	"	63,448	198	154
UR3UT	"	56,736	175	144
UR5SD	**7A**	**1,023,408**	**656**	**412**
UT5YY	"	557,096	443	332
UT2AA	"	195,020	236	199
UX2X	**3.5A**	**2,139,552**	**961**	**552**
				(OP: UT2XQ)
UZ5ZU	"	369,840	381	276
UT2AU	"	326,112	340	258
UT3N	"	321,924	363	278
				(OP: UT3NK)
UR5TM	"	281,204	314	242
***US2YW**	**AA**	**3,574,208**	**1471**	**704**
*UT4LW	"	2,485,056	1310	602
*UR6EA	"	2,131,844	1093	572
*UX1UX	"	2,055,504	1120	561
*UZ1WW	"	1,556,610	887	530
*UT5EPP	"	1,475,005	1067	469
*UT7IS	"	1,473,150	951	483
*EM2G	"	1,142,784	945	558
				(OP: UR7GO)
*US6CQ	"	1,058,184	797	426
*UX7QV	"	997,770	826	395
*US7KC	"	958,870	749	379
*UR7EC	"	606,424	555	343
*UR8EQ	"	466,307	533	317
*UR4CU	"	416,292	428	307
*UT8EL	"	399,763	538	299
*UX1CL	"	397,290	442	285
*UT3SO	"	394,850	455	298
*UX3I	"	387,259	408	271
				(OP: US7IY)
*UR6QS	"	367,302	443	277
*UT3IA	"	353,376	465	288
*UR7CB	"	351,520	419	260
*UR5LY	"	311,836	342	259
*UT8IM	"	301,096	409	244
*UT5CL	"	299,031	367	263
*UR3QTN	"	278,475	349	237
*UR1MN	"	278,300	379	253
*UY7MM	"	272,568	397	246
*UT2QQ	"	264,573	374	239
*UTØCK	"	208,530	295	210
*EO3Q	"	169,362	245	194
				(OP: UR3QCW)
*UT3UIX	"	168,964	268	212
*UY5QJ	"	167,580	323	210
*UT7MR	"	165,006	288	206
*UR4MVK	"	146,610	227	181
*UX8IW	"	133,875	231	175
*UR3PA	"	131,841	220	171
*UR4MH	"	128,505	266	195
*UT3UIW	"	123,376	239	176
*US5CDH	"	116,088	234	168
*UR5EPV	"	99,056	200	151
*UT5LA	"	87,024	200	147
*UY2ZA	"	86,544	168	144
*UT4EK	"	74,022	178	146
*UW1WU	"	48,037	146	121
UY7C	*"*	*38,870*	*130*	*115*
*UT5UN	"	37,442	109	97
*UR5XMM	"	33,681	116	109
*US5EEK	"	25,317	98	87
*UT4UFU	"	24,192	98	84
*UR3QGJ	"	14,384	74	62
*UR5ZDZ	"	14,136	86	76
US5LOC	*"*	*7,248*	*53*	*48*
*UW3HM	"	1,656	25	23
***UR5QU**	**21A**	**28,560**	**124**	**105**
***UR2Y**	**14A**	**611,892**	**648**	**414**
				(OP: USØYW)
*USØMM	"	457,560	564	372
*URØHQ	"	214,542	386	261
*UT1AA	"	199,880	364	263
*US5AT	"	61,070	196	155
*UR7CT	"	55,204	165	148
***UZ4U**	**7A**	**634,752**	**449**	**342**
				(OP: UX7UW)
UR3GU	*"*	*242,004*	*285*	*201*
*UR5EPM	"	125,060	190	169
*UT5PQ	"	120,294	193	163
*UT3QD	"	73,444	149	122
***UZ2HZ**	**3.5A**	**901,472**	**601**	**394**
*EM9Q	"	356,094	386	271
				(OP: UR9QQ)
*US7IID	"	273,944	317	242
*UW7LL	"	47,652	121	114
UT5EOX	**AA**	**371,110**	**416**	**295**
UX2MF	"	153,069	254	197
UT4UBZ/P	"	1,078	23	22
UT2EF	**14A**	**157,842**	**312**	**237**
UX8ZA	"	44,415	163	135
UT1AM	**3.5A**	**103,362**	**186**	**161**
UT8UU	"	22,496	81	76
		Vienna Intl Ctr		
***4U1A**	**AA**	**726,934**	**578**	**383**
				(OP: HB9RB)
		Wales		
GW5NF	**AA**	**431,880**	**448**	**305**
GW4MVA	"	127,262	217	197
***MW6M**	**AA**	**431,864**	**439**	**296**
				(OP: GW4BVJ)
***MWØCRI**	**14A**	**298,172**	**422**	**322**
*MW9W	"	93,219	233	193
				(OP: GWØKRL)
GW7APP	**7A**	**8,280**	**46**	**46**

OCEANIA

		Australia		
VK3JA	**AA**	**73,625**	**140**	**125**
VK7BO	"	25,949	91	77
VK3FN	"	25,128	80	72
VK4SN	**14A**	**244,968**	**380**	**236**
VK2PN	**7A**	**42**	**3**	**3**
VK2DX	*AA*	*63,936*	*124*	*108*
***VK3SIM**	**"**	**8,232**	**52**	**49**
*VK4QH	"	4,674	45	38
		East Malaysia		
***9W6AJA**	**7A**	**14,040**	**53**	**52**
		Hawaii		
KH6TU	**AA**	**1,436,211**	**973**	**357**
				(OP: AD6E)
WH7W	**14A**	**10,764**	**70**	**52**
***KH6CJJ**	**AA**	**279,378**	**402**	**198**
*KH6AQ	"	76,375	188	125
***KH6GMP**	**14A**	**19,698**	**99**	**67**
***AH6KO**	**7A**	**39,520**	**91**	**76**
		Indonesia		
YB1AR	**AA**	**590,504**	**564**	**331**
YB6HAI	"	490,280	527	280
YBØRI	"	279,675	378	225
YC7YGR	"	171,684	306	171
YC6RMT	"	143,820	320	153
YBØMWM	"	71,154	203	134
YC2GBS	*"*	*61,152*	*188*	*112*
YF3FBV	"	47,571	145	101
YB3IZK	"	25,110	107	90
YB3DXG	"	16,056	106	72
YC2DSV	"	7,084	63	44
YF2UFA	"	5,628	56	42
YB3FTD	*"*	*2,548*	*32*	*28*
YB3BX	"	253	13	11
YBØNDT	**14A**	**558,657**	**557**	**363**
YB4FIK	"	41,664	142	112
YB9UA	**7A**	**24,168**	**95**	**76**
YC2EEE	"	14,560	84	56
YB2TS	"	2,952	51	41
YE3WIL	"	2,208	33	24
***YEØTUR**	**AA**	**391,952**	**434**	**272**
*YC2YSW	"	267,472	354	229
*YC1JGE	"	163,624	283	181
*YB1TQL	"	127,566	253	171
*YC1RKT	"	114,023	269	179
*YE9CDL	"	103,435	255	151
*YB1KS	"	71,148	194	132
*YC4HQ	"	41,650	148	98
*YF5YUD	"	39,376	154	92
*YB4KAR	"	38,520	123	90
*YB7SKM	"	33,174	163	97
*YD7SAL	"	24,552	105	72
*YB4KRZ	"	20,167	99	67
*YCØBAS	"	19,350	117	75
*YCØSAS	"	12,096	71	56
*YB2BNN	"	11,819	69	53
*YB1MIG	"	7,991	72	61
*YB2HAF	"	7,497	64	49
*YB3BLJ	"	7,332	53	47
*YC3FPI	"	6,960	63	40
*YF5TKN	"	6,600	59	44
*YFØFRT	"	5,382	49	39
*YD2KJC	"	5,160	66	43
*YC9GDP	"	3,024	56	27
YCØSCZ	*"*	*2,730*	*34*	*26*
*YB9BCS	"	1,474	28	22
*YB3HQM	"	1,474	32	22
*YB1DUU	"	1,147	40	31
YC2XVT	*"*	*1,007*	*25*	*19*
*YD1APO	"	990	21	18
*YC7YDB	"	864	23	18
*YB1MBA	"	810	20	18
*YB1IM	"	792	26	18
*YG3FZR	"	702	20	18
*YD1KSI	"	380	10	10
*YB3BME	"	72	6	6
***YE7SPN**	**21A**	**1,020**	**22**	**17**
***YB2MM**	**14A**	**139,380**	**261**	**202**
*YB1BML	"	108,046	224	178
*YC1PZ	"	24,300	109	90
*YB8UTI	"	24,208	122	89
*YB6DE	"	4,368	57	42
***YB2WA**	**7A**	**30,616**	**108**	**86**
*YB7OO	"	20,864	68	64
*YC1NXR	"	9,212	60	47
*YB2ECG	"	7,740	61	45
*YC1IDC	"	3,220	53	35
*YB2UFM	"	2,760	33	30
*YD1RIK	"	2,160	34	24
*YB1BA	"	1,702	27	23
*YC2DFD	"	1,218	27	21
*YB1BX	"	1,054	18	17
*YD1KTE	"	240	8	8
*YD1KRX	"	140	10	7
*YB1JUS	"	98	11	7
*YD1KVR	"	70	7	7
*YB8CMT	"	32	4	4
*YC7YCO	"	0	0	0
YB2ERL	**AA**	**192**	**8**	**8**
YC8UYJ	**21A**	**1,792**	**30**	**28**
YC8AO	**14A**	**1,147**	**37**	**31**
YCØVM	**7A**	**18,544**	**116**	**76**
YC2VOC	**3.5A**	**70**	**6**	**5**
		New Zealand		
ZM2B	**AA**	**230,560**	**305**	**220**
				(OP: ZL2BR)
ZL3P	"	186,576	267	184
				(OP: ZL3PAH)
ZL4NR	"	20,461	97	79
ZL2RX	**21A**	**4,838**	**43**	**41**
***ZL3VZ**	**AA**	**73,743**	**161**	**141**
		Norfolk Island		
VK9NK	**AA**	**593,640**	**607**	**291**
				(OP: SP9FIH)
		Philippines		
DY1T	**AA**	**70,400**	**207**	**110**
				(OP: DU1IVT)
DU1R	**14A**	**27,864**	**134**	**81**
				(OP: DU1UGZ)
DU6/N6SS	**3.5A**	**51,324**	**101**	**94**
***DU1JM**	**AA**	**97,536**	**219**	**128**
*DU1/N6HPX	"	9,660	77	60
DU1AVC	**AA**	**4,440**	**43**	**37**

SOUTH AMERICA

		Argentina		
LU4HK	**AA**	**63,784**	**170**	**134**
LU1BJW	"	11,834	74	61
LT3H	*"*	*5,453*	*43*	*41*
LU8DZJ	"	1,122	24	22
LU7HN	**21A**	**864,678**	**714**	**422**
LO7H	**14A**	**197,640**	**335**	**216**
				(OP: LU7HW)
***LU1MPK**	**AA**	**5,559**	**57**	**51**
*LU2DCU	"	4,407	42	39
*LU3EBG	"	3,108	47	37
*LU5DH	"	1,755	28	27
*LU2ESO	"	672	16	16
*LU9EKF	"	455	13	13
*LU5DKN	"	64	8	8
***L55D**	**28A**	**1,196**	**24**	**23**
***LU3MAM**	**21A**	**55,216**	**161**	**119**

*LU7DV	"	1,056	25	22
***L77D**	**14A**	**8,700**	**66**	**58 (OP: LU6DC)**
*LU5MT	"	4,095	46	39
LU1KCQ/D	**AA**	**846**	**19**	**18**
		Aruba		
P49X	**AA**	**10,752,650**	**3059**	**830 (OP: WØYK)**
		Bolivia		
**CP6UA*	*AA*	*49,861*	*164*	*119*
		Brazil		
PT2AW	**AA**	**124,200**	**257**	**180**
ZW86LABRE	"	25,456	109	86 (OP: PY2KP)
PY2EU	"	3,800	41	40
PY2GZ	"	24	10	8
PY2XJ	**14A**	**273**	**14**	**13**
PY2KJ	**7A**	**89,488**	**133**	**119**
***PQ8VA**	**AA**	**63,707**	**154**	**133**
*PY2CAT	"	18,249	93	79
*PY2KC	"	9,500	61	50
*PV8AAS	"	8,415	57	51
*PU2USK	"	2,491	58	47
*PU2MST	"	1,075	31	25
*PU2UAF	"	180	12	12
***PY2CX**	**21A**	**314,088**	**409**	**276**
*PU1JSV	"	9,672	62	62
*PU2NBI	"	8,184	70	66
*PY2XC	"	5,805	50	45
*PU7ASP	"	2,924	40	34
*PY2NM	"	525	15	15
*ZV2F	"	330	23	22 (OP: PY2SFA)
*PU7GMY	"	200	11	10
*PR4C	"	112	7	7 (OP: PY2TI)
**PU2NAX*	*"*	*10*	*2*	*2*
***PY2NY**	**14A**	**274,838**	**361**	**262**
*PY5ZHP	"	62,910	173	135
*PY4XX	"	16,576	83	74
*PV8DX	"	5,040	43	40
*PY2VTC	"	180	10	10
**PV8ABC*	*3.5A*	*54*	*3*	*3*
PU2NZO	**AA**	**30**	**6**	**3**
		Chile		
CE3DNP	**14A**	**41,480**	**135**	**122**
XQ1KN	"	5,715	52	45
***CE7VPQ**	**AA**	**72,380**	**201**	**140**
*CE3GCA	"	651	37	31
***CE3CBM**	**21A**	**79,527**	**204**	**147**
***CA3KRM**	**7A**	**16**	**2**	**2**
CA3DPV	**7A**	**56**	**4**	**4**
		Colombia		
HK3J	**AA**	**18**	**3**	**3 (OP: HGK3J)**
HK4KM	**AA**	**2,275**	**26**	**25**
		Curacao		
PJ2T	**AA**	**966,066**	**784**	**354 (OP: WI9WI)**
		Equador		
HC1JQ	**AA**	**70,620**	**188**	**132**
		Paraguay		
***ZP6ARO**	**21A**	**2,982**	**43**	**42**
***ZP5FIA**	**14A**	**87,135**	**224**	**157**
		Suriname		
***PZ5RA**	**7A**	**1,101,204**	**561**	**338**
		Trinidad & Tobago		
***9Z4Y**	**7A**	**24**	**2**	**2**
		Uruguay		
CX9AU	**AA**	**64,768**	**164**	**128**
CV7S	**21A**	**943,890**	**767**	**438 (OP: CX7SS)**
***CX1CW**	**AA**	**17,459**	**92**	**79**
		Venezuela		
YV4ABR	**7A**	**347,536**	**310**	**203**
***YV6BXN**	**AA**	**47,470**	**127**	**101**
***YV1SW**	**21A**	**28,310**	**117**	**95**
***YV5KAJ**	**7A**	**308,516**	**264**	**221**
*YV5TNT	"	144,130	182	145
*YV5EMG	"	224	8	8

MULTI-OPERATOR
SINGLE TRANSMITTER HIGH POWER
NORTH AMERICA

	United States		
	District 1		
KT1I	842,193	927	423
	District 3		
K3AJ	2,240,128	1274	592
	District 4		
K2ADA	2,005,560	1385	619
KN4BIT	1,921,360	1492	584
	District 5		
K5RZA	**2,395,214**	**1770**	**614**
	District 6		
ND2T	378,798	575	311
	District 7		
AK6A	2,602,920	1877	597
KT7E	2,122,110	1615	570
KA6BIM	1,914,405	1433	537
	District 9		
NE9A	301,840	555	280
N2BJ	22,407	134	97
	El Salvador		
HU1DL	**2,168,184**	**1279**	**488**

AFRICA

	Tanzania		
5H4WZ	**41,364**	**134**	**108**

ASIA

	Asiatic Russia - District 9		
RM9A	**76,812**	**179**	**148**

EUROPE

	Austria		
OE9R	**2,814,840**	**1313**	**630**
	Belgium		
OT7D	**2,454,660**	**1274**	**585**
	Bulgaria		
LZ6Y	**4,617,264**	**1828**	**744**
LZ7A	3,514,503	1514	723
	Croatia		
9A1CBM	**1,282,815**	**846**	**435**
	Czech Republic		
OK1KSL	**3,291,375**	**1437**	**655**
OK5SWL	380	10	10
	Denmark		
OZ11A	**2,012,358**	**1110**	**543**
	European Russia - District 3		
RK3PWR	1,023,030	829	421
RK3DXW	877,149	792	441
RK3MXT	17,280	88	80
	Fed. Rep. of Germany		
DR5N	6,626,312	2063	868
DLØCS	2,579,820	1276	589
DQ9Y	*2,572,758*	*1182*	*666*
DLØDX	2,222,120	1166	584
DN1QP	256,908	310	237
DJ1XT	96,418	175	142
DP6A	93,483	175	153
	Finland		
OG73X	**5,595,834**	**1962**	**843**
OH2T	2,100,484	1204	548
OG7ØAD	1,166,326	776	454
	Greece		
J42L	**6,616,512**	**2229**	**864**
SX2I	4,765,846	1936	751
SZ3PC2Ø	13,756	88	76
	Italy		
IQ3PN	1,004,625	790	423
	Netherlands		
PI4CG	**1,422,050**	**878**	**478**
	Poland		
HF95IARU	535,608	499	344
	Romania		
YP8VS	1,372,750	1011	475
	Serbia		
YT6T	72,144	192	144
	Slovak Republic		
OM3KFF	38,014	94	83
	Slovenia		
S5ØE	**1,432,171**	**956**	**533**
S59T	3,808	36	34
	Spain		
EC5V	**5,764,202**	**2118**	**778**
	Sweden		
SK7K	**1,256,119**	**824**	**463**
	Ukraine		
UZ2I	5,611,000	2249	775
UV2E	557,148	633	348
UZ4E	368	17	16

OCEANIA

	Australia		
VK5GR	**707,420**	**584**	**326**
	Indonesia		
7G2G	94,710	229	154
	Philippines		
4E3X	**1,317,900**	**996**	**345**

SOUTH AMERICA

	Argentina		
LS2D	**734,310**	**748**	**410**
	Brazil		
PX2A	**5,285,774**	**1892**	**773**

MULTI-OPERATOR
SINGLE TRANSMITTER LOW POWER
NORTH AMERICA

	United States		
	District 5		
*NA5NN	1,055,250	1001	469
	District 8		
*K3GP	168,181	343	221
	District 9		
*WB9TFF	227,504	518	241
	District Ø		
*WSØZ	55,151	204	131
	Canada - District 3		
*VE3/KØMKL	468,435	592	255
	Cuba		
*T43MY	347,055	478	255

AFRICA

	Canary Islands		
*EA8DED	279,210	292	205

ASIA

	Asiatic Russia - District Ø		
*UAØJGT	118,374	266	181
	Asiatic Turkey		
***TC7G**	**2,232,066**	**1078**	**474**
*TC3A	24,644	68	61
	Georgia		
***4L/DL2JRM**	**344,840**	**374**	**233**
	Republic of Korea		
***D9ØM**	**196,992**	**304**	**192**
	West Malaysia		
*9M4COO	24,056	98	62
*9M4CPS	23,360	98	64

EUROPE

	Bosnia-Herzegovina		
*E71EZC	17,485	71	65
	Croatia		
***9A7T**	**3,892,911**	**1341**	**759**
*9A7B	313,214	386	253
	Czech Republic		
***OK1RPL**	**459,900**	**487**	**292**
	Estonia		
***ES9C**	**3,318,435**	**1424**	**705**
	European Russia - District 6		
*UA6KAC	214,832	333	232
	Fed. Repulic of German		
*DF7ØDARC	1,566,720	982	510
*DQ4W	1,249,438	811	457
	Italy		
*IK4RQJ	2,477,167	1252	607
*IU3FBL	154,800	270	225
	Latvia		
***YL1ØCWO**	**3,137,197**	**1382**	**643**
	Lithuania		
*LY5W	3,048,514	1339	658
	Netherlands		
*PI4VAD	355,945	388	257
	Poland		
*SP5KCR	138,168	246	171
	Serbia		
*YU7KMN	172,825	286	223

	Slovak Republic			
*OM3KSI	147,496	239	179	
	Slovenia			
*S57ZT	882,205	651	365	
	Spain			
*ED3D	947,646	757	414	
EE5O	*135,056*	*239*	*184*	
	Ukraine			
*UT4MWM	23,280	95	80	

OCEANIA

	Philippines			
*DX9EVM	78,300	201	108	

SOUTH AMERICA

	Brazil			
*PY1NX	14,839	74	71	

MULTI-OPERATOR TWO TRANSMITTER NORTH AMERICA

	United States			
K9CT	**8,218,630**	**3207**	**959**	
W3GH	4,326,224	2295	749	
NCØDX	**3,932,544**	**2518**	**704**	
WV1K	3,667,794	1838	767	
WV4P	3,175,836	1962	691	
NB3R	3,158,400	1752	672	
AC3BU	2,474,460	1501	699	
NW8S	**2,184,655**	**1544**	**605**	
K3CCR	1,197,979	818	479	
WU5K	1,021,644	1102	444	
WA8MCD	551,150	745	365	
*W4CDA	13,832	99	76	

AFRICA

CR3DX	**21,011,400**	**4540**	**1080**

ASIA

JA6ZPR	**2,958,627**	**1389**	**623**
VR2CC	**391,206**	**640**	**226**
*JHØMUC/Ø	28,203	107	79

EUROPE

S51A	**9,846,324**	**2847**	**958**
DP7D	**9,597,284**	**2811**	**956**
DP9A	8,984,146	2614	934
LN5O	242,606	301	217
*ED2V	106,704	216	171

MULTI-OPERATOR MULTI-TRANSMITTER NORTH AMERICA

	United States		
KA4RRU	**4,317,848**	**2398**	**746**
NR6O	**4,052,545**	**2503**	**695**
N3OW	762,870	915	431

ASIA

RWØA	**6,847,632**	**2374**	**726**

EUROPE

9A1A	**16,273,408**	**3922**	**1096**
HG1S	**10,251,135**	**2940**	**963**
LY2W	**10,084,250**	**2941**	**965**
LX2ØI	**9,224,970**	**2705**	**929**
OMØM	**7,528,164**	**2413**	**868**
DKØKC	5,598,100	2018	850
*MØSQC	272,571	356	241
*DG7RO	2,485	36	35

ROOKIE

		United States		
		District 1		
***K1TIG**	**AA**	**6,854**	**49**	**46**
		District 3		
***KC3OOL**	**AA**	**66,297**	**211**	**147**
*KC3OSK	"	11,033	76	59
		District 6		
K6KM	**AA**	**51,992**	**199**	**134**
NA6US	"	43,815	205	127
		District 7		
***KB7AK**	**AA**	**23,712**	**149**	**96**
		District 8		
***AA8SW**	**AA**	**104,550**	**295**	**170**
*N8JLM	"	60,768	196	144
*AE8AT	AA	352	17	16
		District 9		
***W9JWC**	**AA**	**236,680**	**452**	**244**
				(OP: KD9LSV)
		District Ø		
***WDØBGZ**	**7A**	**125,780**	**284**	**190**
WRØJ	*AA*	*720*	*25*	*24*
		Canada - District 2		
***VA2YZX**	**AA**	**52,320**	**164**	**109**
		Canada - District 6		
***VE6PFL**	**AA**	**29,574**	**141**	**93**
		Panama		
***HP1ELV**	**21A**	**888**	**41**	**37**

ASIA

		China		
***BD4RHV**	**AA**	**6,594**	**56**	**42**
***BD4SDO**	**14A**	**1,860**	**38**	**30**
		India		
VU2ZMK	**AA**	**227,136**	**318**	**224**
		Mongolia		
***JT1YL**	**AA**	**13,520**	**88**	**80**
		Taiwan		
***BV4VQ**	**AA**	**27,984**	**140**	**88**
		West Malaysia		
***9M2TDX**	**AA**	**35,802**	**126**	**81**

EUROPE

		Belarus		
EU8A	**3.5A**	**554,200**	**416**	**340**
***EU8F**	**AA**	**510,940**	**497**	**295**
		Belgium		
***ON6OM**	**AA**	**26,814**	**94**	**82**
		Bulgaria		
***LZ2ZY**	**AA**	**205,224**	**291**	**204**
		Croatia		
9A5AAX	**AA**	**2,361,582**	**1160**	**606**
				(OP: DJ4MX)
		European Russia-District 3		
***R2PU**	**AA**	**328,293**	**387**	**243**
***R3PKS**	**7A**	**43,680**	**107**	**105**
*RZ3DZ	AA	84	5	4
		Fed. Rep. of Germany		
***DM4EAX**	**AA**	**25,245**	**93**	**85**
*DH4HN	"	4,148	37	34
*DB4LL	"	3,658	32	31
		Finland		
***OH5EAB**	**AA**	**1,736**	**30**	**28**
		Hungary		
***HA1TIB**	**AA**	**216,876**	**302**	**212**
		Italy		
IU1LCU	**14A**	**175,123**	**322**	**247**
***IU3LYJ**	**AA**	**134,688**	**240**	**183**
*I4JEE	"	62,436	160	129
*IU4JIC	"	30,544	110	92
*IU3MDI	"	19,440	78	72
*IV3HJB	"	3,132	29	29
		Lithuania		
***LYØNAS**	**AA**	**9,744**	**60**	**58**
		Poland		
SP9PUZ	**AA**	**256,060**	**326**	**217**
***SP9KB**	**AA**	**45,066**	**130**	**111**
		Slovak Republic		
***OM2ACM**	**AA**	**3,540**	**31**	**30**
		Spain		
***EA7KHB**	**AA**	**789,859**	**621**	**371**
*EA4C	"	76,960	176	148
		Ukraine		
***UR4MH**	**AA**	**128,505**	**266**	**195**
*UT4UBZ/P	AA	1,078	23	22

OCEANIA

		Indonesia		
***YC1RKT**	**AA**	**114,023**	**269**	**179**
*YD7SAL	"	24,552	105	72
***YC2DFD**	**7A**	**1,218**	**27**	**21**
*YC7YCO	"	0	0	0
***YCØVM**	**7A**	**18,544**	**116**	**76**

SOUTH AMERICA

		Argentina		
***LU3EBG**	**AA**	**3,108**	**47**	**37**
		Brazil		
***PU7GMY**	**21A**	**200**	**11**	**10**

TRIBANDER/SINGLE ELEMENT

		United States		
		District 1		
KR1CW	**AA**	**266,509**	**444**	**257**
				(OP: W1CTN)
W1TO	"	253,725	337	255
***AB1J**	**7A**	**317,328**	**448**	**264**
***WK1J**	**AA**	**47,850**	**197**	**145**
*AE1P	"	17,700	155	100
*K7RB	"	16,150	100	85
*K3IB	"	5,031	48	43
*W1MJ	"	2,552	34	29
*N1TYH	"	1,334	25	23
		District 2		
WX2NJ	**AA**	**1,260,396**	**954**	**471**
				(OP: K2RET)
WB2NVR	"	262,680	400	264
K2TW	**3.5A**	**160,792**	**334**	**199**
N2CU	**AA**	**145,824**	**279**	**217**
KG2U	"	27,776	142	112
KA2AEY	"	14,706	106	86
***K2QB**	**AA**	**373,107**	**517**	**327**
*KV2U	"	368,300	528	290
				(OP: K2AL)
*AH2O	"	213,760	400	256
*KE2D	"	209,077	314	229
*NS2N	"	198,588	366	228
*KS2G	"	131,580	366	215
***W2VTV**	**7A**	**98,010**	**220**	**165**
***AC2IK**	**AA**	**5,995**	**62**	**55**
*KB2URI	"	3,526	47	41
***K2YG**	**AA**	**301,376**	**461**	**277**
		District 3		
N3QE	**AA**	**2,960,342**	**1549**	**658**
K2XR	"	1,303,500	855	550
W2CDO	"	1,023,295	799	455
K3MD	"	797,650	814	430
NF3R	"	759,655	812	403
4U1WB	"	717,706	866	374
				(OP: AJ3M)
K3WJV	"	334,012	490	302
AA3S	"	284,416	412	256
N3ALN	"	236,924	406	244
N3XL	"	230,989	406	253
NY3B	"	195,200	361	244
***KB3LIX**	**AA**	**286,000**	**440**	**260**
*WA3AAN	"	230,808	409	236
***W3IDT**	**7A**	**85,008**	**222**	**154**
***W3RGA**	**AA**	**75,060**	**210**	**139**
*KD3HN	"	64,116	163	137
*WA3MD	"	38,522	131	103
*AI3KS	"	32,200	146	115
***NW3DC**	**7A**	**2,808**	**31**	**27**
				(OP: W3DQ)
		District 4		
K9OM	**7A**	**1,717,296**	**954**	**532**
WW5M	**AA**	**1,266,552**	**1256**	**504**
N1RM	"	615,135	713	345
K8AC	"	586,224	637	368
NY3DX	"	495,612	684	351
				(OP: K3SV)
NS4X	"	474,330	715	326
AC6ZM	"	395,400	610	300
AD4TJ	"	379,701	540	287
W4GE	"	178,304	346	224
W3DQS	"	153,750	288	205
W3TB	"	147,018	314	214
NR4O	**7A**	**59,340**	**153**	**129**
W4UT	**AA**	**45,760**	**199**	**130**
W2YE	"	30,192	112	102
AB4L	"	3,120	28	26
				(OP: N4GU)
***NU4E**	**7A**	**697,872**	**633**	**372**
***W4LC**	**AA**	**620,880**	**721**	**398**
*WA3LXD	"	404,096	677	308
***KK4HEG**	**7A**	**223,210**	**420**	**221**
***WN4AFP**	**AA**	**182,114**	**377**	**214**
*N6DW	"	151,755	304	201
*W4PJW	"	127,970	312	191
*KM4FO	"	124,432	321	176
*K2WK	"	123,045	282	195
*NN4RB	"	63,560	203	140
*NC4MI	"	56,280	195	134
*N5SMQ	"	37,840	155	110
*KJ4GK	"	36,270	195	130
***N6MA**	**14A**	**7,040**	**65**	**64**
		District 5		
AD5XD	**AA**	**1,066,362**	**1154**	**453**
WQ5L	"	384,318	548	297
NM5NM	"	162,155	369	205
				(OP: AA5B)
K5CI	"	153,510	421	210
K5QR	**14A**	**124,632**	**356**	**216**
KØGEO	**AA**	**99,337**	**299**	**161**
WA5LXS	"	55,744	198	134
***NN5T**	**AA**	**192,198**	**422**	**206**
*WA5LFD	"	127,104	336	192
***K5IB**	**7A**	**106,420**	**240**	**170**
***WB5K**	**AA**	**83,844**	**287**	**153**
*W5TD	"	3,276	51	42
		District 6		
W6SX	**AA**	**1,056,000**	**1185**	**440**

NB6U	"	816,762	1001	394 (OP: N6ZFO)
WX6V	"	642,747	806	381
AF6SA	"	391,472	687	344
WE6Z	"	234,640	544	280
AK6M	"	224,534	525	262 (OP: K6MM)
W6RKC	"	55,350	199	135
K6ELE	"	48,723	234	149
KK6VIX	**14A**	**2,520**	**57**	**45**
***KF6RY**	**AA**	**215,712**	**501**	**252 (OP: W6ZL)**
*WW6RY	"	185,055	454	219
***NG6O**	**14A**	**144,240**	**385**	**240 (OP: K6GHA)**
***KD6HOF**	**AA**	**9,177**	**89**	**69**
*WQ6X	"	918	28	27
**N6BHX*	*14A*	*280*	*14*	*14*
*AG6NS	AA	35	5	5
		District 7		
KO7SS	**AA**	**1,988,746**	**1366**	**614**
K7JQ	"	461,790	791	315
WA7LNW	"	146,412	362	196
AA7V	"	143,429	366	221
WU6W	"	58,058	220	143
K6UM	"	36,740	163	110
W7SLS	"	18,357	122	87
KB7AZ	"	5,989	61	53
***WZ8T**	**AA**	**279,522**	**589**	**293**
*N7XCZ	"	65,096	270	158
*KC7CM	"	63,945	239	147
*KB7EEG	"	59,280	237	152
*K7AZT	"	38,646	195	114
*W7SO	"	36,608	179	128
*KU7Y	"	28,482	161	101
*N7DB	"	10,368	108	81
		District 8		
K8PK	**AA**	**333,231**	**515**	**277**
K8YE	**14A**	**146,132**	**298**	**238**
W8AKS	**7A**	**23,328**	**95**	**81**
***AA8OY**	**AA**	**300,240**	**478**	**270**
*WB8JUI	"	259,075	423	241
**K8JT*	*"*	*68,949*	*224*	*163*
*N8FYL	"	41,886	171	117
*K7DR	"	13,725	108	75
		District 9		
ND9G	**AA**	**1,552,015**	**1238**	**527**
W9ILY	**14A**	**872,081**	**773**	**553**
N9SE	AA	435,686	529	358
K9UC	"	431,624	645	326
ND9Z	"	227,528	428	239
N9LQ	"	97,845	254	165
***K9CW**	**AA**	**383,724**	**588**	**306**
*WB8BZK	"	341,884	592	254
*WD9CIR	"	228,928	494	224
*N9UA	"	221,373	411	243
*KW9U	"	106,029	263	189
*WA9LEY	"	22,176	138	99
*KC9YL	"	19,136	114	92
*N9LJX	"	17,784	101	78
*NQ6N	"	6,498	64	57
		District Ø		
KI6DY	**AA**	**549,289**	**796**	**377**
NØBUI	"	249,984	514	252
KØJJR	"	231,727	317	317
NØTA	"	223,200	561	240
KØWA	"	222,398	523	242
WRØH	**3.5A**	**211,988**	**436**	**226**
WDØT	AA	89,708	296	164
W8LYJ	"	29,400	142	100
***NØGZ**	**AA**	**539,148**	**755**	**358**
*WAØLJM	"	3,024	49	42
*WAØMN	AA	124,218 (OP: NØUR)	347	206

NORTH AMERICA

		Alaska		
AL7LO	**AA**	**234,156**	**432**	**237**
		Belize		
***V31VP**	**AA**	**1,162,381**	**898**	**421 (OP: WBØTEV)**
		Canada District 1		
***VA1XH**	**AA**	**456,196**	**471**	**283**
		District 2		
VE2EBK	**7A**	**535,668**	**463**	**294**
***VE2BVV**	**AA**	**686,517**	**615**	**377**
***VE2NCG**	**14A**	**6,670**	**66**	**58**
		District 3		
VE3TW	**AA**	**507,472**	**521**	**322**
VE3SS	"	73,660	168	127
***VE3MGY**	**AA**	**622,512**	**628**	**297**
*VE3JI	"	544,289	564	317
*VE3CWU	"	126,846	246	174
***VE3TM**	**14A**	**112,800**	**256**	**188**
*VA3TTB	AA	33,504	116	96
*VE3SST	"	9,016	68	49
		District 6		
***VA6RCN**	**AA**	**62,700**	**205**	**110 (OP: VE3RCN)**
		District 7		
VE7KAJ	**AA**	**322,044**	**520**	**282**
VE7BC	"	194,788	362	209
***VE7BGP**	**AA**	**7,600**	**58**	**50**
		Costa Rica		
***TI2OY**	**AA**	**763,968**	**754**	**368**
		Cuba		
***CO8NMN**	**AA**	**570,486**	**583**	**289**
		Grenada		
***J35X**	**7A**	**1,035,414**	**627**	**369**
		Guatemala		
***TG9ADQ**	**AA**	**111,361**	**284**	**193**
		Mexico		
***XE1H**	**AA**	**58,536**	**134**	**108**
		Puerto Rico		
WP4WW	**14A**	**5,616**	**56**	**48 (OP: KP4JRS)**
***KP4JFR**	**AA**	**89,089**	**218**	**143**
*NP4TX	"	35,144	103	92
***WP4O**	**21A**	**2,178**	**37**	**33**
		Saba & St. Eustatius		
***PJ5/KG9N**	**AA**	**321,904**	**421**	**236**

AFRICA

		Canary Islands		
***EA8W**	**14A**	**390,264**	**421**	**322**
***EA8BQM**	**AA**	**140,580**	**210**	**142**
		Ghana		
***9G2HO**	**14A**	**25,470**	**95**	**90 (OP: 9G5SA)**
		Morocco		
***CN8KD**	**7A**	**664,620**	**407**	**285**

ASIA

		Afghanistan		
T6A	**AA**	**1,879,818**	**1010**	**519 (OP: S53R)**
		Asiatic Russia - District 9		
RA9AU	**14A**	**186,300**	**304**	**225**
R9VA	"	80,408	180	152
***RT9S**	**AA**	**2,639,175**	**1161**	**525**
*RO9A	"	392,445	395	285
*RZ9AD	"	109,906	226	179
***RA9UN**	**14A**	**37,800**	**130**	**120**
*RA9AFZ	"	30,294	108	102
*RX9DJ	AA	17,112	79	69
		District Ø		
***RØUT**	**AA**	**298,116**	**395**	**252**
*UAØSU	"	235,265	328	223
*RAØWHE	"	183,658	296	229
*RØWC	AA	158,826	284	206
		China		
***BD7IIS**	**AA**	**45,136**	**162**	**112**
		India		
VU2DED	**AA**	**399,500**	**411**	**250**
VU2MB	"	119,462	225	161
VU2IBI	"	45,080	138	115
***VU2EOJ**	**AA**	**3,200**	**46**	**40**
		Japan - District 1		
JR1NHD	**14A**	**261,664**	**361**	**272**
JH1CTV	**AA**	**82,432**	**172**	**128**
JG1LHB	14A	69,890	187	145
JH1APK	AA	21,840	81	70
JI1AVY	"	12,582	68	54
JH1LNL	"	2,268	30	27
***JM1MTE**	**AA**	**421,686**	**451**	**274**
*7N2UQC	"	352,914	452	262
*JA1MZM	"	245,735	362	245
*JF1WNT	"	106,416	214	144
*JA1IE	"	30,794	129	89
*JE1GZB	14A	2,870	37	35
***JE1CAC**	**14A**	**12,596**	**71**	**67**
***JG1LFR**	**3.5A**	**4,608**	**46**	**36**
		District 2		
***JA2FXV**	**AA**	**30,080**	**97**	**80**
***JA2JNC**	**14A**	**20,382**	**103**	**86**
*JF2FIU	AA	15,812	85	67
		District 3		
JI3BFC	**14A**	**103,664**	**227**	**176**
***JG3WDN**	**AA**	**189,924**	**292**	**204**
*JH3WKE	"	70,250	191	125
***JR3GPP**	**7A**	**5,504**	**34**	**32**
		District 4		
***JE4MHL**	**AA**	**89,835**	**202**	**159**
***JA4RMX**	**14A**	**13,064**	**74**	**71**
*JH4FUF	"	28	4	4
		District 6		
JA6BCV	**AA**	**41,923**	**138**	**113**
***JH6QIL**	**AA**	**91,438**	**199**	**131**
*JE6JNC	"	51,520	150	115
		District 7		
JO7KMB	**AA**	**128,064**	**243**	**174**
***JA7MWC**	**AA**	**28,320**	**111**	**80**
*JA7FDA	"	2,106	29	26
		District 8		
***JK8PBO**	**14A**	**58,904**	**200**	**148**
***JM8FEI**	**AA**	**45,540**	**149**	**99**
		District 9		
JA9CWJ	**14A**	**253,498**	**352**	**266**
JA9CCG	**AA**	**72,450**	**183**	**138**
JH9CEN	"	19,275	98	75
***JA9LX**	**AA**	**127,466**	**260**	**163**
*JA9EJG	"	3,007	34	31
		District Ø		
***JJØPJD**	**AA**	**131,378**	**236**	**163**
		Kazakhstan		
UN4PG	**3.5A**	**208,152**	**216**	**177**
***UN4PD**	**AA**	**129,978**	**214**	**166**
		Republic of Korea		
HL2KV	**AA**	**21,870**	**95**	**81**
***HL5YI**	**14A**	**13,277**	**77**	**71**
		Thailand		
***E24OYI**	**AA**	**61,716**	**238**	**139**

EUROPE

		Austria		
OE2LCM	**AA**	**43,524**	**144**	**108**
		Belarus		
EU1DX	**14A**	**335,909**	**453**	**329**
EU4T	"	72,068	199	172
***EW7BA**	**AA**	**1,601,400**	**954**	**510**
*EW6DM	"	459,025	459	301
		Belgium		
OR3A	**AA**	**26,104**	**114**	**104 (OP: ON6CC)**
***ON5GQ**	**AA**	**531,944**	**519**	**322**
*ON4CT	"	210,000	264	200
***OQ4B**	**14A**	**74,571**	**203**	**159**
***ON5GF**	**7A**	**38,592**	**112**	**96**
		Bosnia-Herzegovina		
***E72U**	**AA**	**31,416**	**98**	**88**
		Bulgaria		
***LZ1QV**	**AA**	**282,240**	**280**	**252**
		Croatia		
9A1CFR	**AA**	**360,873**	**403**	**303 (OP: 9A2NO)**
***9A1FL**	**AA**	**309,232**	**346**	**251**
*9A2R	"	17,290	73	70
		Czech Republic		
***OK2RU**	**7A**	**791,986**	**525**	**367**
*OK4GP	"	637,998	439	339
***OK2CLW**	**AA**	**245,582**	**300**	**233**
*OL7ØJN	"	83,261	168	139 (OP: OK1CJN)
***OK7T**	**3.5A**	**79,728**	**156**	**132 (OP: OK1FHI)**
*OK6DJ	"	10,920	57	52
		Denmark		
***OU4O**	**AA**	**92,159**	**192**	**157 (OP: OZ4O)**
		England		
GB6ØATG	**7A**	**2,543,234**	**1024**	**571 (OP: GW4SKA)**
M2L	**AA**	**653,184**	**597**	**384 (OP: MØBJL)**
G3T	"	309,983	360	239 (OP: G3VGZ)
MØUNI	7A	193,826	250	199
***GØMTN**	**AA**	**1,029,021**	**762**	**399**
*GØFGI	"	263,626	340	253
*G1P	"	251,860	345	245 (OP: MØIEP)
*2EØCVN	"	193,440	312	208
***G4ZVB**	**7A**	**174,212**	**229**	**194**
*G3YCH	AA	54,735	142	123
***M5ARC**	**14A**	**33,376**	**124**	**112 (OP: MØCKE)**
***G9D**	**21A**	**2,574**	**38**	**33 (OP: G6NHU)**
		Estonia		
ES4RD	**AA**	**411,839**	**418**	**269**
		European Russia - District 1		
***RA1ALC**	**AA**	**610,295**	**593**	**329**
		District 3		
R5AJ	**AA**	**2,014,272**	**1142**	**576**
RU5TT	**14A**	**422,240**	**557**	**377 (OP: R3TE)**
RT5C	AA	173,075	280	215
UF5D	"	2,943	28	27 (OP: RW4CLF)
***UA5F**	**3.5A**	**369,234**	**356**	**281**
***R5ACQ**	**14A**	**66,234**	**197**	**166**
***RA3DJA**	**AA**	**42,714**	**136**	**113**

		District 4		
RW4WZ	**AA**	**327,096**	**438**	**308**
R4RB	"	274,778	389	266
***RU4I**	**3.5A**	**211,680**	**266**	**216**
***RZ4AZ**	**AA**	**187,200**	**289**	**200**
		District 6		
RT7N	**AA**	**540,540**	**575**	**364**
UC6N	**14A**	**367,616**	**515**	**359**
R7KO	AA	192,778	330	226
***R7MM**	**AA**	**1,011,593**	**756**	**451**
*RW6APC	"	229,586	333	217
*RM6LD	"	145,323	294	201
*R6KX	"	110,182	225	178
*RJ7J	"	77,420	165	140
*RT6N	"	21,437	108	97
***R6KEE**	**14A**	**4,800**	**48**	**48**
*R6CC	7A	2,700	28	27
***R7RAG**	**7A**	**12,508**	**62**	**59**
		Fed. Rep. of Germany		
DLØHMK	**AA**	**1,663,592**	**925**	**488**
				(OP: DF2HN)
DL6JZ	"	1,111,432	778	446
DJ8EW	"	1,053,846	684	461
DQ1ØØSL	*"*	*792,412*	*490*	*397*
				(OP: DJ8VH)
DF8QB	"	771,936	597	374
DG9BEO	"	429,225	463	295
DK1LRS	"	284,260	341	244
DL1DTL	**14A**	**240,240**	**373**	**280**
DF1LX	AA	217,833	273	231
DF8JK	*"*	*72,520*	*186*	*148*
DL4ABR	*"*	*29,355*	*109*	*103*
DL5LYM	14A	260	10	10
***DK9IP**	**AA**	**2,002,752**	**961**	**608**
*DL/KU1CW	"	1,478,598	906	521
*DL1NEO	"	1,061,888	635	488
*DL3SYA	"	1,061,202	773	411
*DR7T	"	596,980	469	380
				(OP: DF1DN)
*DFØBV	"	422,136	424	312
				(OP: DL1MAJ)
***DL5KUD**	**7A**	**312,120**	**321**	**255**
*DJ6OZ	AA	244,036	340	247
*DJ7UC	"	202,270	301	226
*DHØDX	7A	195,584	265	191
				(OP: DK5TX)
*DL2GPK	AA	179,858	274	203
*DL5NAV	"	174,087	251	207
***DL3KVR**	**14A**	**153,352**	**307**	**232**
*DK2WU	AA	102,396	189	159
***DO4OD**	**3.5A**	**91,770**	**197**	**161**
*DF4WC	14A	90,424	224	178
*DL5PW	AA	82,026	174	147
*DK5DQ	"	41,006	116	101
*DL8ZAJ	"	38,250	118	102
*DL3FCG	3.5A	34,560	104	96
*DD2BU	AA	25,024	116	92
*DL5ØIFM	14A	10,428	69	66
				(OP: DL5GAC)
*DD5MA	AA	2,112	24	24
*DK7HA	AA	799,848	603	378
*DQ5M	3.5A	2	1	1
				(OP: DK6SP)
		Finland		
OH1TM	**AA**	**806,264**	**628**	**388**
***OH7L**	**AA**	**249,452**	**338**	**236**
				(OP: OH8TV)
*OH2EUU	"	226,512	333	234
*OG3P	"	116,451	191	171
				(OP: OH3P)
		Greece		
SV2ESW	**AA**	**1,387,512**	**978**	**504**
***SV1BJW**	**AA**	**135,660**	**252**	**190**
*SV2/SV7CUD	"	19,126	83	73
		Hungary		
*HA3OU	AA	37,875	127	101
***HA1WD**	**3.5A**	**22,200**	**80**	**74**
***HA6IAM**	**AA**	**237,652**	**307**	**236**
***HAØGK**	**7A**	**5,940**	**47**	**45**
		Ireland		
***EI3CTB**	**14A**	**624**	**17**	**16**
		Italy		
IK2XDE	**AA**	**2,037,184**	**1122**	**556**
IW3FVZ	"	1,258,368	800	452
IX1CLD	"	1,078,650	707	425
IU4CHE	**14A**	**922,530**	**785**	**483**
I2DJX	AA	630,277	553	379
IZ2BVC	"	447,024	449	268
IK3SSJ	**3.5A**	**435,088**	**407**	**284**
IV3AVQ	**7A**	**352,928**	**320**	**269**
IK2AHB	AA	246,694	345	263
IK2BUF	"	198,450	301	225
IK1NEG	14A	138,381	280	239
IKØXBX	AA	110,292	198	156
IK2TDM	"	13,975	69	65
***IK3TPP**	**AA**	**1,982,460**	**1083**	**555**
*IWØGYC	"	581,434	553	349
***IW2MXY**	**7A**	**572,400**	**452**	**318**
*IW1CBG	AA	477,666	494	306
*IZ4YAB	"	277,332	326	242
*IK2OVT	"	225,336	294	229
*IK2AUK	"	171,785	279	215
***IZ7XNB**	**14A**	**113,160**	**256**	**205**
*IK1BPL	AA	68,089	149	137
*IK4ALM	"	50,760	144	120
*IK3YBX	"	44,042	134	122
*IK2IKW	"	39,091	114	97
*IZ7NMD	7A	35,880	98	92
***IU4FKR**	**3.5A**	**27,880**	**89**	**82**
*IK2YSJ	AA	20,382	88	79
*IØ/S58Y/P	"	5,016	39	38
				(OP: IØ/S58Y/P)
*IKØPRP	14A	3,999	48	43
*I3FGX	"	954	19	18
*IZ3XNJ	AA	940	23	20
***IZ3NVR**	**21A**	**990**	**23**	**22**
		Latvia		
YL9T	**AA**	**247,296**	**280**	**224**
		Lithuania		
***LY2SA**	**AA**	**581,728**	**457**	**343**
*LY2TS	"	320,045	357	253
		Luxembourg		
LX1HD	**3.5A**	**421,680**	**387**	**280**
		Moldova		
***ER5LL**	**14A**	**67,890**	**200**	**155**
		Netherlands		
***PA3DUU**	**AA**	**102,237**	**195**	**159**
*PG1R	"	58,716	157	126
***PC3T**	**3.5A**	**37,128**	**102**	**91**
*PA3DBS	AA	27,090	103	90
		North Macedonia		
***Z33F**	**7A**	**902,480**	**547**	**389**
***Z36N**	**14A**	**111,504**	**262**	**202**
		Norway		
***LA6CF**	**AA**	**202,400**	**310**	**230**
*LA9RY	"	115,830	226	165
*LA8OKA	"	45,045	131	105
		Poland		
SP5DL	**3.5A**	**765,002**	**530**	**371**
SP95IARU	**AA**	**479,080**	**443**	**290**
				(OP: SP7AH)
***HF1ØØPS**	**AA**	**243,090**	**310**	**219**
				(OP: SP9CXN)
*SP3OL	"	156,735	278	215
***SP6DMI**	**14A**	**85,140**	**213**	**172**
*SP1DMD	AA	79,407	175	153
*SO1RON	"	50,310	142	117
***SQ9PPT**	**3.5A**	**10,200**	**53**	**50**
*HF2Ø2ØPZK	AA	8,460	48	47
				(OP: SP9MDY)
*SQ95IARU	AA	135,235	239	185
				(OP: SP2UUU)
		Portugal		
***CR5O**	**AA**	**1,485,143**	**904**	**451**
				(OP: CT7AJL)
*CT7AUP	"	1,400,850	894	495
CT7APA	*"*	*11,773*	*66*	*61*
		Romania		
YO3RU	**AA**	**1,647,300**	**1052**	**510**
***YO4NF**	**AA**	**1,334,256**	**869**	**462**
*YO3GNF	"	601,144	548	326
*YO9CWY	"	276,018	369	257
*YO4RST	"	114,180	214	173
***YO2IS**	**14A**	**108,138**	**243**	**201**
*YO7LYM	AA	81,490	184	145
		Scotland		
MM1E	**3.5A**	**131,820**	**194**	**169**
				(OP: MMØGOR)
***GMØOPS**	**AA**	**667,644**	**593**	**354**
***GMØHVS**	**7A**	**34,144**	**99**	**88**
		Serbia		
***YT2U**	**AA**	**947,232**	**683**	**396**
***YT9VM**	**7A**	**740,784**	**525**	**366**
*YTØX	AA	245,508	321	246
				(OP: YTØTX)
YT7AW	*"*	*72,009*	*147*	*127*
***YT8A**	**21A**	**29,160**	**120**	**108**
				(OP: YU1EA)
		Sicily		
IT9VCE	**AA**	**728,712**	**494**	**349**
***IT9RZU**	**21A**	**1,700**	**26**	**25**
		Slovenia		
S5ØRY	**AA**	**1,994,039**	**1044**	**587**
				(OP: S53K)
S58Q	*7A*	*803,640*	*523*	*370*
***S55BA**	**AA**	**673,350**	**583**	**335**
*S57SWR	"	246,768	302	212
*S57KM	"	969	18	17
		Spain		
EA1B	**14A**	**1,010,412**	**803**	**508**
ED1D	**AA**	**926,828**	**712**	**419**
				(OP: EC1D)
EA2DLX	"	815,250	637	375
EB5A	"	550,942	491	322
***EA7RCS**	**AA**	**273,500**	**386**	**250**
				(OP: EC7AKV)
***EA4AOC**	**3.5A**	**273,182**	**301**	**247**
*EC3A	AA	150,060	239	183
*EA4U	AA	14,204	78	67
		Sweden		
SM6MVE	**AA**	**121,040**	**233**	**178**
SF1Z	"	33,060	98	95
				(OP: SMØHEV)
***SE4E**	**AA**	**1,157,312**	**785**	**428**
				(OP: SM4DQE)
*SM5S	"	443,702	441	287
				(OP: SM5SIC)
*SE6K	"	268,758	346	243
				(OP: SM6FZO)
***SM6IQD**	**3.5A**	**6,936**	**56**	**51**
		Ukraine		
UR5CN	**AA**	**1,068,665**	**836**	**401**
UR5R	"	756,820	631	395
				(OP: UTØRM)
UT3RS	**14A**	**509,860**	**603**	**370**
UR4EI	AA	344,832	417	256
UT2AU	**3.5A**	**326,112**	**340**	**258**
UY5QZ	AA	39,894	146	109
***UR6EA**	**AA**	**2,131,844**	**1093**	**572**
*UZ1WW	"	1,556,610	887	530
*UT5EPP	"	1,475,005	1067	469
*US6CQ	"	1,058,184	797	426
*UX7QV	"	997,770	826	395
*US7KC	"	958,870	749	379
***UZ2HZ**	**3.5A**	**901,472**	**601**	**394**
***UR2Y**	**14A**	**611,892**	**648**	**414**
				(OP: USØYW)
*UR7CB	AA	351,520	419	260
*UT5CL	"	299,031	367	263
*UT7MR	"	165,006	288	206
*UX8IW	"	133,875	231	175
***UR5EPM**	**7A**	**125,060**	**190**	**169**
*UR5EPV	AA	99,056	200	151
*UT5LA	"	87,024	200	147
***UR5QU**	**21A**	**28,560**	**124**	**105**
*US5EEK	AA	25,317	98	87
		Vienna Intl Ctr		
***4U1A**	**AA**	**726,934**	**578**	**383**
				(OP: HB9RB)
		Wales		
***MW6M**	**AA**	**431,864**	**439**	**296**
				(OP: GW4BVJ)
***MW9W**	**14A**	**93,219**	**233**	**193**
				(OP: GWØKRL)
***GW7APP**	**7A**	**8,280**	**46**	**46**
		OCEANIA		
		Hawaii		
WH7W	**14A**	**10,764**	**70**	**52**
***KH6CJJ**	**AA**	**279,378**	**402**	**198**
		Indonesia		
YBØRI	**AA**	**279,675**	**378**	**225**
YBØMWM	"	71,154	203	134
YB4FIK	**14A**	**41,664**	**142**	**112**
YB9UA	**7A**	**24,168**	**95**	**76**
YC2EEE	"	14,560	84	56
YC2DSV	AA	7,084	63	44
***YE9CDL**	**AA**	**103,435**	**255**	**151**
*YB4KAR	"	38,520	123	90
***YB2WA**	**7A**	**30,616**	**108**	**86**
*YB1MIG	AA	7,991	72	61
*YB2ECG	7A	7,740	61	45
***YB6DE**	**14A**	**4,368**	**57**	**42**
		New Zealand		
ZM2B	**AA**	**230,560**	**305**	**220**
				(OP: ZL2BR)
***ZL3VZ**	**AA**	**73,743**	**161**	**141**
		Norfolk Island		
VK9NK	**AA**	**593,640**	**607**	**291**
				(OP: SP9FIH)
		SOUTH AMERICA		
		Argentina		
LU1BJW	**AA**	**11,834**	**74**	**61**
		Brazil		
PT2AW	**AA**	**124,200**	**257**	**180**
***PY2CX**	**21A**	**314,088**	**409**	**276**
***PY4XX**	**14A**	**16,576**	**83**	**74**
*PY2XC	21A	5,805	50	45
*PU7ASP	"	2,924	40	34
		Uruguay		
CX9AU	**AA**	**64,768**	**164**	**128**
		Venezuela		
***YV5KAJ**	**7A**	**308,516**	**264**	**221**
***YV1SW**	**21A**	**28,310**	**117**	**95**

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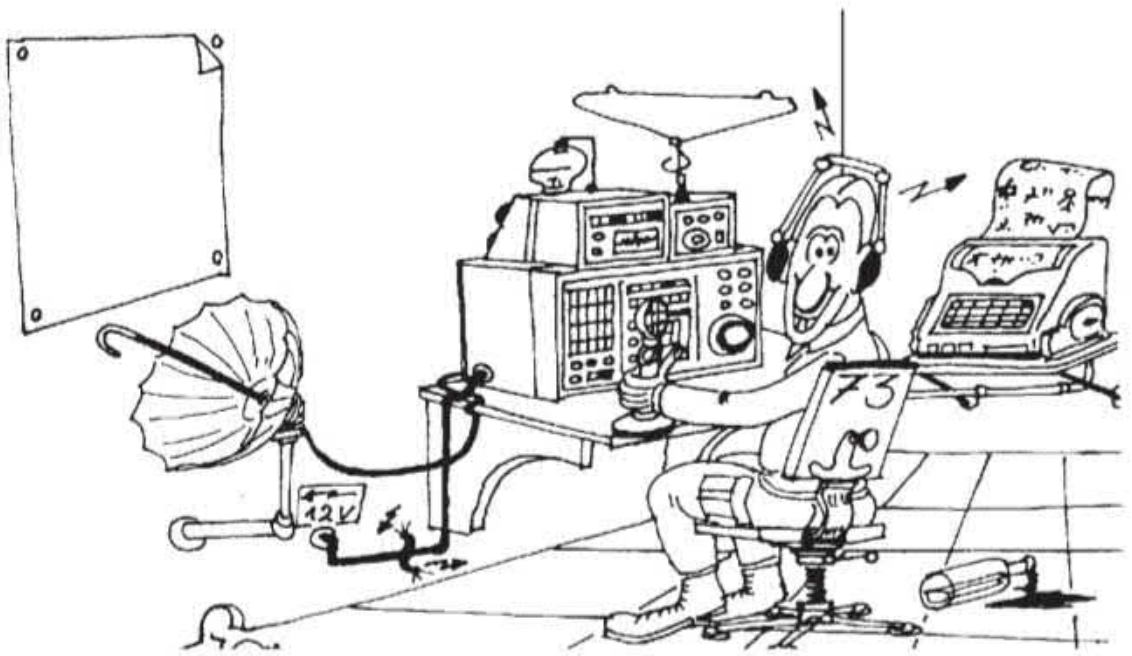

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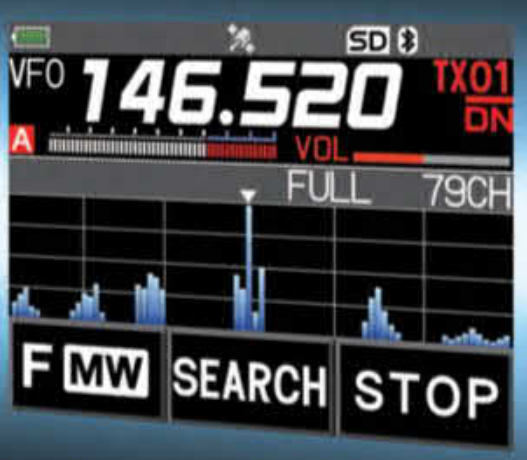

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