New Hope for Cycle 25? p. 3

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CQ Amateur Radio

COMMUNICATIONS & TECHNOLOGY

AUGUST 2020

75 ANNIVERSARY

- "Peanut" for Amateur Radio, p. 12
- Results, 2020 CQ WW 160-Meter Contest, p. 16
- *CQ Reviews*: Midnight Design Solutions "Phaser" Transceiver, p. 26

On the Cover: Stephen Cruse, K3WHC, and William Koch, W2RMA, take part in a group microwave activity from rural central Pennsylvania. See pages 77 and 100.

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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.

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>.

AVON, INDIANA — Ham Emergency Radio Operation's (HERO) will hold its **Tailgate-Hamfest** from 9 a.m. to 1 p.m., Saturday, August 8 at the Avon Methodisty Church, 6850 East Highway 36. Contact: Ken Kayler, KC9SQD, (317) 874-7068. Email: <kakayler64@hotmail.com>. Website: <http://hendricksares.org>.

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.

SINKING SPRINGS, PENNSYLVANIA — The Reading Radio Club will hold its **Hamfest** beginning 8 a.m., at Heritage Park, 992 Clemantis Street. Contact Harry Hoffman, W3BVY, (610) 678-8976. Email: <harryhoff-manjr@juno.com>. Website: <www.qsl.net/w3bn>. Talk-in 146.91- (PL 131.8). 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).

JOPLIN, MISSOURI — The Joplin Amateur Radio Club will hold the **JARC Tailgater** from 7 a.m. to 2 p.m., Saturday, August 22 at the Joplin Convention Center Parking Lot, 3535 Hammons Boulevard. Email: <chairman@joplinhamfest.org>. Website: <www.joplinhamfest.org>.

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>.

SEPTEMBER

LANCASTER, NEW YORK — The Lancaster Amateur Radio Club will hold the **Lancaster Hamfest** on Saturday, September 12 at the Bowen Road Grove, 3845 Bowen Road. Website: <http://w2so.org>. Talk-in 147.255 (PL 107.2).

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).

WYOMING, MICHIGAN — The Grand Rapids Amateur Radio Association will hold the **GRAHamfest 2020** from 8 a.m. to 1 p.m., Saturday, September 12 at The Home School Building, 5625 Burlingame, SW. Contact: Steven Provost, AC8QE, <stprovost@provtechs.com>. Website: <http://w8dc.org>. Talk-in 147.26+ (PL 94.8). VE exams.

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@smarts-fest.org>. Website: <www.smartsfest.org>. Talk-in 147.165. VE exams.

REVLOC, PENNSYLVANIA — The Cambria Radio Club will hold the the **First Annual HAM FEST** from 9 a.m. to 4 p.m., Saturday, September 19 at the Revloc Fire Grounds, 547 Cambria Avenue. Website: <http://cambriaradio.com>. Talk-in 145.210- (PL 123).

SEVIERVILLE, TENNESSEE — The Sevier County Amateur Radio Society will hold the Sevier County Hamfest from 8 a.m. to 4 p.m., Saturday, September 19 at the Sevier County Fairgrounds, 754 Old Knoxville

(Continued on page 28)

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HAM RADIO NEWS

New Hope for Cycle 25?

A group of scientists is challenging the current consensus among solar researchers that Sunspot Cycle 25 will be similar to the now-ending Cycle 24, and predicting a cycle "of major proportions." According to the *ARRL Letter*, the scientists, associated with a variety of institutions in the U.S. and the U.K., including NASA's Goddard Space Flight Center, the National Center for Atmospheric Research, and the University of Maryland, say their calculations, using a mathematical technique known as a *Hilbert transform* to analyze 270 years of monthly sunspot numbers, suggest "that Sunspot Cycle 25 will have a magnitude that rivals the top few since records began."

The group's paper, posted online on Cornell University's arxiv.org website, says their best estimate for Cycle 25 is a maximum level of 233 sunspots, predicting "with 95% confidence that the Cycle 25 amplitude will fall between 153 and 305 spots." The consensus prediction of a NOAA / NASA-led panel of experts is for a relatively weak cycle, with a peak between 95 and 130 sunspots. This group is basing its far sunnier prediction on the expectation that 2020 will see an end to both sunspot and magnetic cycles on the sun, as well as evidence from the latitude of early Cycle 25 spots (higher than usual) that suggests a very active solar cycle. However, they conclude, "only time will tell."

The full paper is online at <https://arxiv.org/pdf/2006.15263.pdf>.

Developing a "Sun Clock" to Predict Solar Storms

Some of the same researchers who are predicting a higher-than-average Sunspot Cycle 25 have also developed a "sun clock" to help predict periods of high solar activity, including solar flares and other events that can impact communications on Earth. The *ARRL Letter* reports that the group, led by Professor Sandra Chapman of the Centre for Fusion, Space, and Astrophysics at the University of Warwick in England, used the Hilbert transform to create a standardized map of a solar cycle. Their research, according to a paper published in *Geophysical Research Letters*, determined that transitions between quiet and active periods on the sun tend to be quite sharp, and their "sun clock" can provide information on when an active period may "switch on" or off.

More Than 70 Speakers Scheduled for "Virtual Ham Expo"

As we reported here last month, *QSO Today* podcast host Eric Guth, 4Z1UG, is trying to fill the vacuum left by cancelled hamfests by organizing an online "QSO Today Virtual Ham Expo," which will be accessible via your computer or mobile device on the weekend of August 8th and 9th. The event has drawn many major manufacturers and other vendors (including *CQ*) as participants, and the forums will feature more than 70 speakers on a variety of topics for both new and experienced hams. There will also be a youth track, led by Carole Perry, WB2MGP. The keynote speaker will be Dr. Scott Wright, KØMD, a well-known contester and Editor of the *National Contest Journal* who is also one of the leaders of the Mayo Clinic's study on using blood plasma from recovered COVID-19 patients to help others fight the disease. Admission is free and pre-registration is encouraged at <www.qsotodayhamexpo.com>.

2021 Events Shaping Up as Mix of Online and In-Person Gatherings

Planning is under way for major ham radio events in 2021, despite continued uncertainty over the course of the coronavirus pandemic and restrictions associated with it. Both ARRL and the Orlando Amateur Radio Club are hoping that large gatherings will again be permitted by the time of next year's Hamcation in mid-February. ARRL has announced that the Orlando event will also be its 2021 national convention. Hamcation 2020 was the last big ham event held prior to the shutdowns resulting from COVID-19.

Organizers of the International DX and Contesting Convention, normally held in Visalia, California, have decided that their 2021 event will be held online and span two "3-day weekends" in April. According to the *ARRL Letter*, next year's "Virtual Visalia" will be held from April 16-18th and April 23rd-25th, with no duplication of forums or other activities.

The Dayton Hamvention is hoping that we'll all be able to get together in person again next May in Ohio. The Dayton Amateur Radio Association announced in June that Rick Allnut, WS8G, and Jim Storms, AB8YK, have been named 2021's General Chairman and Assistant General Chairman, respectively.

CQ 40 … MHz, Not Meters

Hams in three European countries — Ireland, Slovenia, and Lithuania — now have access on a secondary basis to frequencies in the 40-MHz, or 8-meter band. According to EI7GL's blog <ei7gl.blogspot.com>, Irish hams have had permission to operate on the band since 2018, but were limited to crossband contacts with amateurs in other countries. With Slovenia and Lithuania coming aboard, actual DX on the band became possible. The first international contact was in late April of this year, between EI4GNB in Ireland and LY2YR in Lithuania. That was followed by a QSO on June 13th between LY2YR and S5ØB in Slovenia, and a June 15th contact between EI4GNB and S50B, using FT4, JT65, and single sideband. The latter QSO followed a 6-meter opening between Europe and North America.

Rescue Radio

Ham radio has once again proven its value in emergencies, with three different stories this month of rescues coordinated via amateur radio. All three come courtesy of the *ARRL Letter.* In mid-June, Alden Jones, KC1JWR, was hiking with a group on the Long Trail near his home in Vermont when he suffered a medical issue and lost consciousness. Fortunately, an EMT with Appalachian Mountain Rescue was nearby, but could not get a cell phone signal to call for help. Jones regained consciousness and was able to use his 2-meter handheld to get help via a nearby repeater. It took eight hours to get Jones off the mountain and to a hospital, due to its remote location. He reportedly made use of the time to talk up ham radio to the EMT, other rescuers and the helicopter crew that finally flew him to safety!

In May, Richard Tashner, N2EO, suffered a medical emergency in his Massapequa, New York, home. He couldn't get to his phone but he could reach his DMR handheld, on which he put out a call for help. His call was answered by Maxis Johnston, GMØMRJ, in Scotland, who immediately put out a call for "anyone in the States." He was answered by Ken Dix, KB2KBD, in Delaware, who contacted emergency services on Long Island and got help on its way, via a dispatcher who was amazed at the route the call took.

Finally, on June 25th, the Maritime Mobile Service Net helped arrange a tow for a disabled sailing vessel off the coast of Florida. Skipper Ian Cummings, KB4SG, turned to the 20-meter net for help because he was too far offshore to be heard on his VHF marine radio. The boat was drifting toward a shallow area where it would have been in danger of running aground. Net members were able to connect Cummings with a marine tow service. The Pacific Seafarers' Net, which operates on 14.300 MHz after the MMSN secures for the night, kept in contact with Cummings until his boat was safely back in port.

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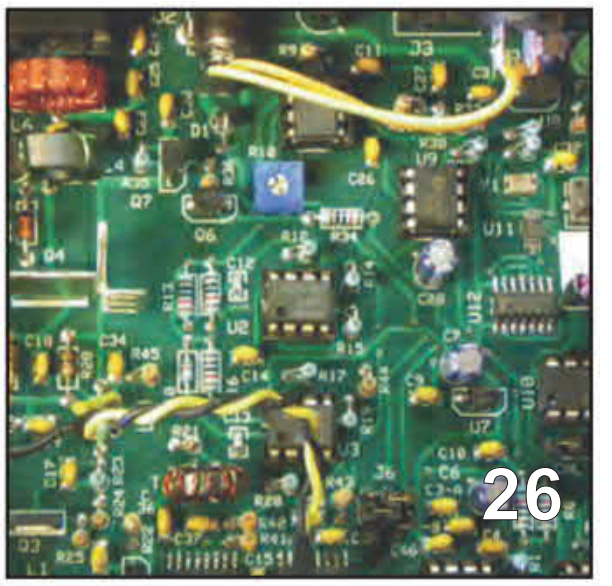
77 COVER: VHF PLUS:

NDØB Earns Fred Fish Memorial Award)FFMA) #10

By Tony Emanuele, K8ZR

Stephen Cruse (L), K3WHC, and William Koch (R), W3RMA, are testing out a new system on the 24-GHz, band that turned into a microwave operating party. You can find more information on their operation on pages 77 and 100. *(Photo by David Petke, K1RZ)*



FEATURES

FOCUS ON: The 2020 running of the CQWW 160-Meter Contest took place during the transition between solar Cycles 24 and 25. See how you stacked up on pages 16 & 102. Plus N1IXF puts the new Midnight Design Solutions Phaser Transceiver digital-mode kit through its paces on page 26.

COLUMNS

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As per FCC rules, the US consumer versions have cellular frequencies blocked and the analog voice descrambler function deactivated by hardware.
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ZERO BIAS: A CQ Editorial

BY RICH MOSESON,* W2VU

Let's Go Exploring!

Feeling a bit bored? Still mostly stuck at home, with mostly quiet HF bands (or rather, mostly noise)? Luckily for you, your monthly dose of ham radio therapy is here! Let's do some exploring together, both in the pages of this issue and on your radio.

We can start with our cover, joining K3WHC and W2RMA as they explore Blue Mountain in central Pennsylvania, where they set up their portable stations (with proper social distancing) to work some microwave DX. Part of a group of about a dozen microwave enthusiasts, their contacts on three bands covered distances of up to 200+ miles. You can read all about their adventures in "On the Cover" on page 100, and in this month's "VHF+" column on page 77. You can also read there about amazing conditions this summer on 6 meters, including openings criss-crossing the United States and even some from western North America into Europe!

As W2RMA explains in "On the Cover," the microwave bands offer a wide range of propagation fun, including ducts, tropo, rain scatter, and even airplane scatter. Bill says he keeps his 10-GHz gear in his car during the summer to be able to quickly take advantage of rain scatter opportunities. Worried about the cost of getting on a new band like 10 GHz? Check out this month's Antennas column, in which WA5VJB shows us how to put together an "X-band" receive station for the "cheap-ham-happy" sum of roughly $40!

Our next few stops can be at the other end of the radio spectrum. The results of this year's CQ World Wide 160-Meter Contest (p. 16) show that "Top Band" is the place to be at the bottom of the sunspot cycle. For the (slightly) more adventurous, KB5NJD is here every three months to guide us through the amazing things that are possible on our newest bands, 630 and 2200 meters. And you don't need acres of land for antennas, either.

Hams with few or no antenna options might enjoy exploring modes and apps that blend ham radio and the internet, such as "Peanut," the subject of our lead feature this month on page 12. Peanut was developed by a Dutch ham to link different digital voice networks, such as D-STAR, DMR, and System Fusion, which normally can't talk with each other. It also provides antenna-restricted hams with the ability to join on-air ragchews through their computers.

Speaking of digital, have you explored digital keyboard modes recently, such as FT8 and its variants? These weak-signal modes are keeping DXers busy even when their ears suggest that bands are dead. And have you checked out related modes such as WSPR (Weak Signal Propagation Reporter) and RBN (the Reverse Beacon Network)? These incredible DX aids can alert you to band openings you might otherwise never have imagined, on bands the "common wisdom" tells you aren't even worth listening to. That same "common wisdom" tells us it's pointless to flip the band switch on our HF rigs to the "28" position at the bottom of a sunspot cycle. Yet, we've been seeing reports of excellent openings on 10 meters … even without a sunspot in sight.

The next stop on our ham radio safari is in your own shack, specifically the workbench part of it. If you can't get out as much as you'd like to soak up the summer heat, heat up your soldering iron instead! Have you built a kit lately? How about a project from a magazine article for which you have to lay out the circuit yourself? Or one that requires you to dip your toes (figuratively only, please) into surface-mount soldering? There's a whole chunk of ham radio that has very little to do with making contacts. It's the technological "sandbox" in which we can build, design, and experiment.

Tim Shoppa, N3QE, of Bethesda, Maryland, will be CQ's Contesting Editor as of next month's issue. (Photo courtesy N3QE)

Bottom line: There's never "nothing to do" in ham radio as long as you're willing to explore everything our hobby has to offer. Try something new. Who knows? You might get hooked!

73 to K3ZJ and Welcome to N3QE

This month's Contesting column marks the completion of five years as Contest Editor for Dave Siddall, K3ZJ. It is also his final column. As Dave explains in his column, his work demands have been increasing but he also felt the five-year mark was a good time to turn the column over to someone from a younger generation, as he puts it. At Dave's recommendation, he will be succeeded as Contest Editor, starting next month, by Tim Shoppa, N3QE.

Tim is very active in the Potomac Valley Radio Club (PVRC), which he has served as secretary for several years. He also closely tracks individual contester and contest club activities worldwide. While Tim is a frequent guest operator at big multi-multi stations, the "antenna farm" at his home station in the Washington, DC suburbs consists of a single wire antenna. He is regularly at the top of the charts in the Tri-Bander / Wires category of the CQ WPX contests, and he had the top U.S. 80-meter score in the 2018 CQ DX Marathon. This gives Tim the benefit of a dual perspective on contest operating, both from "big gun" and "little pistol" stations, which he will begin sharing with our readers as of next month.

I want to thank Dave for carrying on the tradition of excellence in *CQ*'s contesting column for the past five years, and for adding his perspective to a variety of matters. I also look forward to working with Tim. 73, Dave, and welcome, Tim!

– 73, Rich, W2VU

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OUR READERS SAY...

Violet is Not Red

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

Hi Irwin,

I am a retired senior optical engineer, electro-optics physicist and was working with HeNe lasers. The wavelength was 632.8nm which translates to 474 terahertz (THz), so your statement that 484 terahertz is violet is wrong; that is in the red light frequency range.

Longer wavelength equals lower frequency and shorter wavelength equals higher frequency. Or …

Lower = Longer / Higher = Shorter (LLHS)

My calculations are that
Wavelength = frequency
700 nm = 429 THz, and
400 nm = 750 THz.

– 73 de Phil Karras, KE3FL

WA2NDM responds:

Hello Phil,

Thank you for your comments. Sometimes I work a little too fast. In the future I will be sure to recheck my calculations. I, too, have worked in the THz region but my company manufactures fiber optic transmission systems and we use the common wavelengths of 850, 1310, 1550, and 1610 nanometers. My main goal in the column is to try to convince technically-oriented amateurs experiment in this region. The main reason for the wavelength to frequency calculation is to indicate that other than the fact that some wavelengths happen to be visible, they are still electromagnetic radiation and the possibilities are not completely known. Remember what Hertz and the others had when they started experimenting with the so called "Hertzian waves." In fact, I have a copy of a college physics textbook from 1902 that describes Hertz's experiments and states "while these experiments are interesting there is probably no real practical application."

Again, many thanks for your feedback. I appreciate it.

– Irwin, WA2NDM

Remembering KS4AA

Editor, *CQ*:

It was with sadness that I read about Eddie DeYoung, KS4AA, becoming a SK.

I met Eddie, his son (Raj) and wife (Mina) during the summer of 2004, a few days after they moved to Prescott, Arizona from Australia. Eddie and his wife were relocating to this area to be with their son who was entering as a freshman student at Embry-Riddle Aeronautical University. We quickly became friends and enjoyed hearing about his being a U.S. Air Force veteran and moving to Australia decades earlier, as well as the many DXpeditions in which he participated.

At that time, my Arizona ham shack was a 25-foot x 25-foot detached room with a full bathroom, storage, couch-bed, workshop, and two complete HF stations as well as a 2-meter / 70-centimeter operating position. Also, there was a large concrete slab on which antennas could be assembled. The ham building had its own heat-pump air conditioning system and natural gas. Needless to say, Eddie fell in love with the property and wished to make it his own. We reached an amenable selling price, but unfortunately because Eddie had lived outside the U.S. for many years, he didn't have a U.S. credit history and the bank wouldn't provide a loan, even with his substantial down payment.

Hence, Eddie and family purchased a mobile home; we ended up moving to Virginia to be close to my son; and KS4AA worked in Glacier National Park during the summer months.

We miss you, Eddie; Raj and Mina, you are in our prayers.

– Dick Diddams, W7QHE

Thanks, Jeff!

The following letter was directed to "Magic in the Sky" editor Jeff Reinhardt, AA6JR:

Dear Jeff,

The Estero Radio Club would like to thank you for the wonderful article you wrote about our club for the April issue of *CQ* magazine ("The Monday Morning Breakfast Club"). We shared the article with the ham community in our area and it was warmly received.

We also copied it to our contacts with (Pacific Gas & Electric) and the (San Luis Obispo) County Office of Emergency Services, whom we support with emergency response activities. They were very complimentary of the article.

Thank you for this great article and we appreciate your support.

– 73, Bill Bailey, AE6EQ
Estero Radio Club President

(Continued on page 99)

NEWS BYTES

Anchorage VEC Goes to All-Electronic Testing

Over the past few months, we've been reporting on a variety of innovations in administering amateur radio licensing exams in a time of lockdowns and social distancing. Here's the next step …

The folks who conducted the first volunteer-administered FCC amateur license exams 36 years ago now bring you the first totally online exam program. As of July 1st, all exams conducted by the Anchorage Amateur Radio Club VEC (Volunteer Examiner Coordinator) have been using a web-based platform for both the tests themselves and the documents normally filled out on paper by both candidates and examiners.

The entire process is paperless, according to an announcement by the group. "Examinees will take their examinations on a computer that is connected to the internet. All documents will be electronically completed and signed by the examinee and VEs."

"The system not only renders one-time-use examinations for each individual examinee," the announcement continues, "but also can provide a live video / audio feed using the examinee's webcam / microphone. This feature has been utilized extensively during (the Anchorage VEC's) remote testing effort" as a result of in-person test session cancellations due to COVID-19.

In addition, the group says, "(e)xaminations are graded immediately and automatically. When video and audio monitoring is used, those data streams are recorded and become a permanent part of the examination record."

The Anchorage ARC is also able to file test results directly with the FCC almost immediately after the end of a test session, with new licenses or upgrades issued as quickly as one hour later.

[Tnx Craig Bledsoe, KL4E]

From Top to Bottom:

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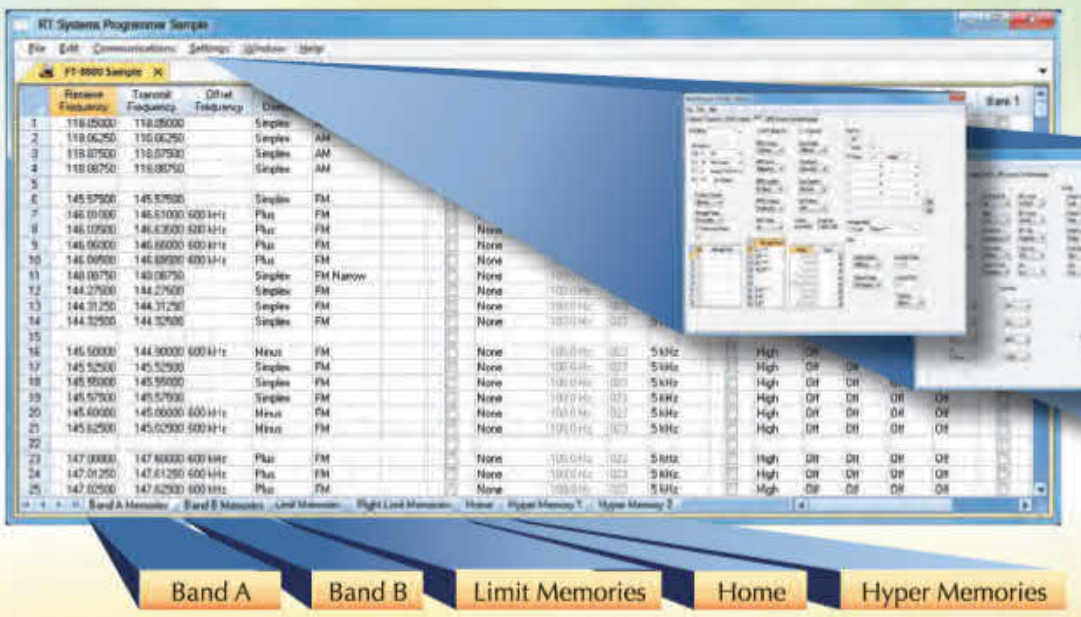

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KD8YVJ is 2020 Young Ham of the Year

Christopher Brault, KD8YVJ, of Liberty Township, Ohio, has been named the 2020 Amateur Radio Newsline Young Ham of the Year. *CQ* is a proud co-sponsor of the YHOTY program, along with Yaesu USA, Heil Sound, and Radiowavz. Brault, 18, is a 2020 graduate of St. Xavier High School in Cincinnati. Among his many activities and accomplishments, Chris operated from Costa Rica in 2017 as part of the Dave Kalter Memorial Youth DX Adventure program; he mentors other young hams in contesting as a leader of the Youth Contesting Program, is social media chair for the Youth on the Air (Americas) program and was supposed to be Assistant to the Director for this summer's (now-cancelled) inaugural YOTA camp in Ohio. Chris has also been very active with the West Chester Amateur Radio Association, WC8VOA, at the National Voice of America Museum of Broadcasting in West Chester, Ohio, where he has acted as a tour guide, operator, and contester for the club. He received the ARRL's Hiram Percy Maxim Award for young hams in 2015.

Chris was also pictured (right) in the October 2018 issue of *CQ*, along with 2018 YHOTY winner Bryant Rascoll, KG5HVO, remotely operating a contest from the lobby of the Embassy Suites Hotel in Huntsville, Alabama, during a power blackout!

The Bill Pasternak, WA6ITF, Memorial Amateur Radio Newsline Young Ham of the Year Award is normally presented each year at the Huntsville Hamfest, which has been cancelled this year due to COVID-19 restrictions. Alternate presentation plans were being made as we went to press. Congratulations, Chris!

2020 Amateur Radio Newsline Young Ham of the Year (YHOTY) Chris Brault, KD8YVJ (foreground), remotely operates a contest with 2018 YHOTY winner Bryant Rascoll, KG5HVO (rear), from the lobby of the Embassy Suites Hotel in Huntsville, Alabama, during a power blackout! (Photo by and courtesy of Bob Heil, K9EID)

For the purist, no, this isn't "real" ham radio. But for the amateur living with significant antenna restrictions, it provides a way to stay in contact with other hams around the world … for peanuts! K3BEQ takes us on a tour.

"Peanut" for Amateur Radio

BY MURRAY GREEN,* K3BEQ

If you are interested in communicating with radio amateurs worldwide with noise-free audio rich in high definition (HD) quality, may I recommend trying a relatively new program and app entitled "Peanut for Amateur Radio"? Developed by Dutch radio amateur David Grootendorst, PA7LIM, it allows voice communications using Windows™, an Android™ phone or network radio.[1] It also permits QSOs between DMR and D-STAR as well as offering gateways to P25, NXDN, Fusion, and WiresX. Designed exclusively for radio amateurs, it can be especially useful to those who reside in facilities with antenna restrictions.

The dynamic audio coupled with a very quiet noise floor virtually guarantees you will hear everything, even if you have hearing problems. It can also be used for mobile and portable operation with your Android phone or network radio. Similar in ways to Echolink (e.g., a D-STAR version perhaps), there is no comparison, however, to the Peanut HD audio quality when communicating with other Peanut users. It is addictive and once you engage in it, other audio systems will seem so much less.

Figure 1. Peanut receive mode screen. See text for details.

Operating the Peanut Network Via Windows

Let's take a look at how you can operate the network from your desktop, Android, or radio. After registering (more on this below) and downloading the program, you will see an image similar to *Figure 1* on your monitor screen. If a QSO is in progress in the "room" you join, the callsign and first name of the transmitting station will appear on the screen (*Figure 1* shows what another ham would see when logging into a room in which I was already in a QSO), along with the "room" name and other information. A room on a chat site is kind of like a special interest net, where people sharing a common interest "hang out." A drop-down list (*Figure 2*) shows all of the rooms available. The English Room, for example, is one of the more active rooms and has a host of DX stations who use it. It is not unusual to hear JA, VU, G, and A4 amateurs

* *email: <k3beq@verizon.net>*

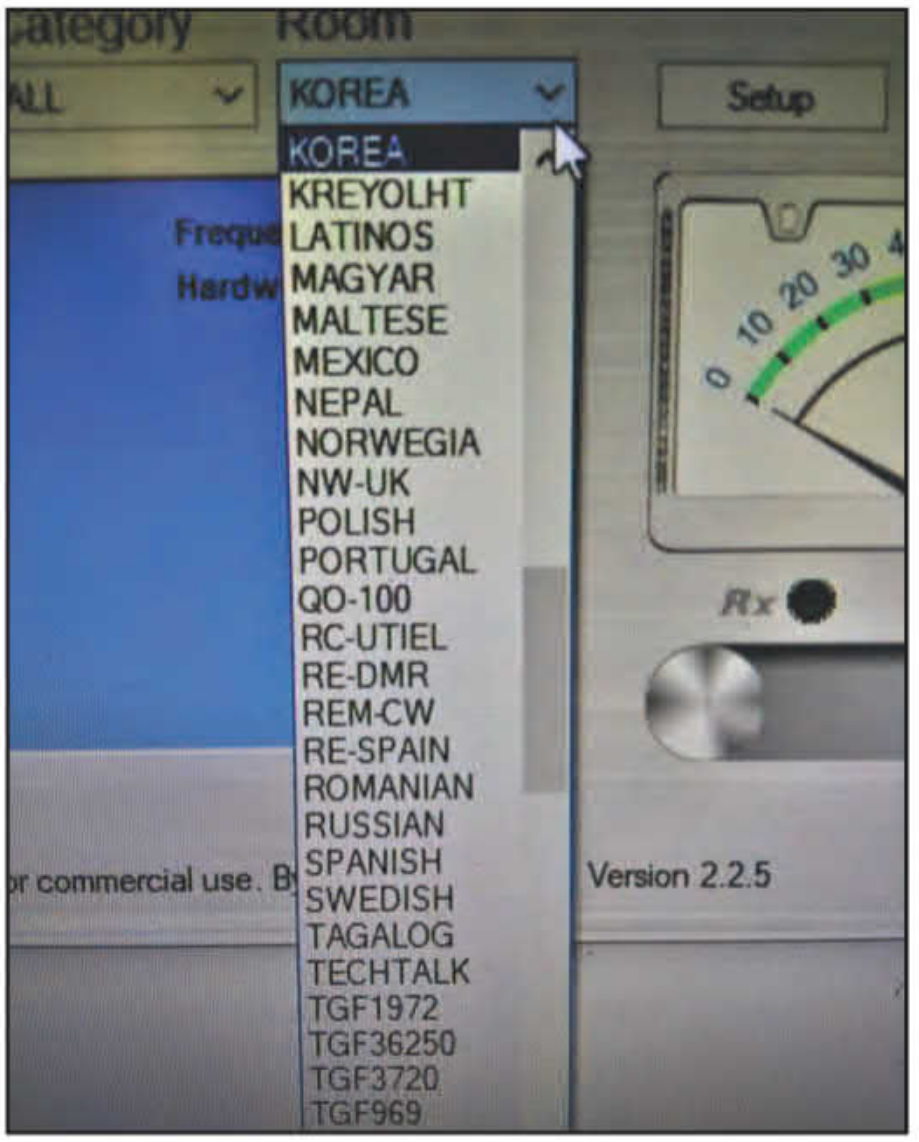

Figure 2. A list of available "rooms" for QSOs may be accessed through a drop-down menu.

Registration

Since the Peanut network also provides access to D-STAR and DMR, a registration process is required for all three systems: To see if your call is already registered with either DMR or D-STAR, go to <https://www.pa7lim.nl/callcheck/>.

1. Peanut Registration:

a. To get access to the Peanut network, you need to register at <https://register.peanut.network>. A copy of your amateur radio license is required. Once you receive your Peanut code, you can use all HD local rooms and multiple D-STAR connected rooms.

b. Free Windows and Android software can be downloaded at: <www.pa7lim.nl/peanut/> (Windows 7 or higher with minimum .NET 4.5; Android 4.X or higher.)

2. DMR:Registration:

European users may register at: <https://register.ham-digital.org>; non-European users may register at: <https://radioid.net/register#!>.

3. D-STAR, D-PLUS Registration:

To access and see the D-STAR and D-PLUS reflectors (rooms starting with REF, REF 084C, etc.) you need a D-STAR USTRUST registration. You may register at: <https://tinyurl.com/5l3m4h>.

It Isn't Complicated!

Don't be intimidated by the registration processes. It is not that difficult. Just follow the instructions at each site. It may not always be immediate, so be patient. Once you are registered, you will receive applicable registration codes and be on your way to operating in the Peanut network.

there, calling or having a QSO. It is not a constant stream of activity but enough to satisfy many amateurs' desire to communicate.

After the QSO ends, you can call one of the stations by simply sliding the toggle switch under the meter to the right or by pressing your keyboard. The reverse applies as well. The meter shows incoming and outgoing audio strength. A 3-minute reverse countdown timer appears when the toggle switch is turned to transmit and the screen turns to a different color, as seen in *Figure 3*.

If there are no QSOs in progress, no callsigns will be shown. Calling CQ is okay but most stations simply say: *"This is (callsign) listening for a call,"* as is common on analog repeaters.

There are over 20,000 hams registered to the Peanut network. In my operating experience, I find more activity on Peanuts than my local repeaters and Echolink. And where else can you call CQ and have an amateur radio operator from an exotic country answer you in HD audio quality absent of white noise, fading, and interference?

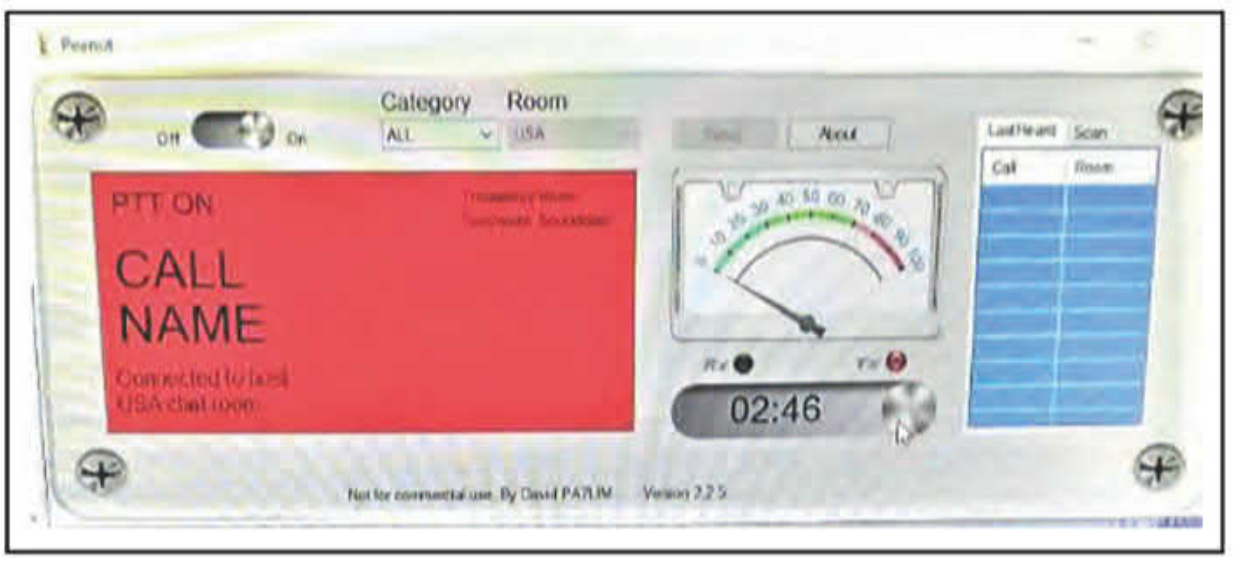

Figure 3. The Peanut display changes color when in transmit mode.

The listing to the right of the meter contains the rooms you select to automatically scan. (Scanning is available only on the Windows version.) The operator has the option of scanning or viewing the last stations heard via an icon at the top of the scan listing.

The local (within Peanut only) language-based rooms like English, Dutch, Spanish, Japanese, USA etc., are in HD quality. The rooms marked REF030C, XRF076C. etc., are linked to D-STAR and are transcoded with AMBE3000 chips located around the world. Referred to as "reflectors," they are simply computer-based central points for repeaters and amateur operators to go to for communicating with each other.

A complete listing of all Peanut rooms and locations can be found at: <http://peanut.pa7lim.nl/rooms.html>

Android and Network Radio

The basic operation is the same as Windows except the images may vary to accommodate the unit's size. On the

There are over 20,000 hams registered to the Peanut network. In my operating experience, I find more activity on Peanuts than my local repeaters and Echolink.

Android there will be a push-to-talk (PTT) touch icon on the screen for transmitting and receiving (see *Photo A*). For network radios (*Photo B*), the microphone push-to-talk feature is used, just like on a traditional radio.

Dashboard

There is also a separate listing that shows amateur radio stations connected to specific rooms. This is a valuable tool to find out where the activity is. The listing updates every 10 seconds and is normally referred to as a *dashboard* (*Figure 4*). The listing can be accessed at: <http://peanut.pa7lim.nl/>. Place it next to the Peanut image in a split-screen view on your desktop monitor for ease of operation.

In Conclusion…

In my use of the Peanut network, I not only found incredible audio quality but instant contact with amateurs around the world who like to converse and exchange information. I have been licensed in the amateur radio service for 70 years and have yet to come across anything close to the HD audio experience of the Peanut network.

Peanut and other types of amateur digital systems are very sophisticated and maintained by very talented ama-

Photo A. An Android phone using the Peanut app. As shown, it is in the receive mode.

Things to Know from the Developer

Peanut developer David Grootendorst, PA7LIM, offers the following tips and information nuggets about the system:

- *Peanut is beta. Use it at your own risk.*
- *Do not use Peanut to interlink other systems!*
- *You do not have to disconnect to change a room! Just keep connected and select a room.*
- *Peanut for Android uses port 6667 UDP to the internet. It is NOT necessary to open ports from the internet to the Peanut device.*
- *You do not need an AMBE3000 vocoder (voice encoder) for Peanut to do D-STAR and DMR. So you have free digital voice.*
- *There is no iPhone / iPad version of Peanut. Apple does not support experimental projects.*
- *Peanut runs very nice on network radios like the Inrico TM-7.*
- *Do not drive and Peanut. Always watch the road!*
- *The app does not work in the background!*
- *You can also use Peanut on Windows with a DVAP (use an analog radio).*
- *I am not a company! I write code when I return from work and mostly at night.*
- *DSTAR reflector administrators can add their reflectors if they have an AMBE3000 server with ThumbDV or DVStick30. Complete solutions are from ZUM AMBE board and Japanese XLX team. see: <www.pa7lim.nl/ambeserve>.*

Photo B. A mobile "network radio" using Peanut. The screen shows no activity at the moment this photo was taken.

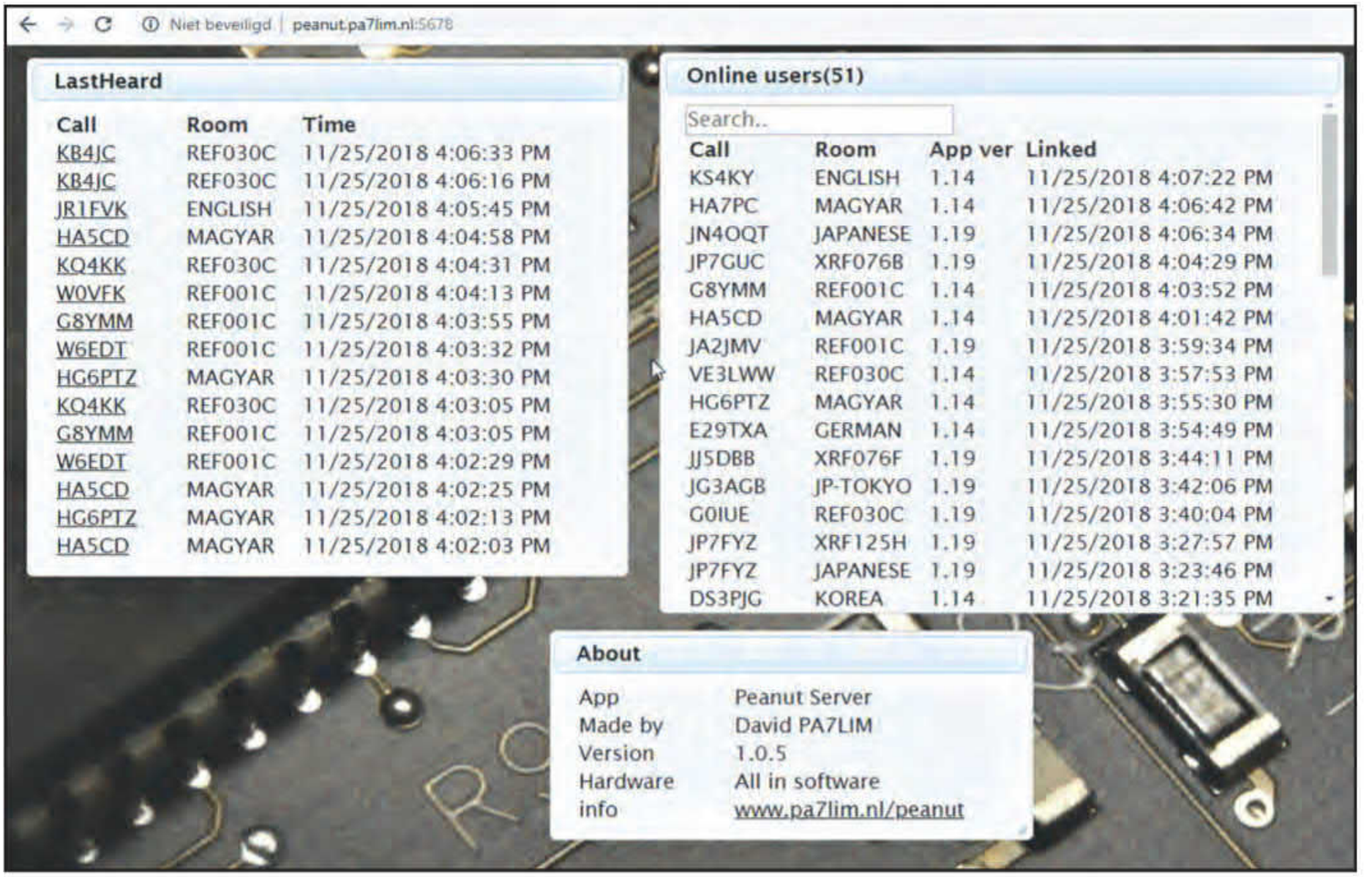

Figure 4. The Peanut dashboard displays lists of stations recently heard (top left), currently active (top right) and other information.

teur radio operators who have dedicated equipment, time, and funds so that you can enjoy the fruits of their labor, gratis. I am certain that once you try Peanut, you will reap the benefits of the digital world, find new friends to converse, and have an outstanding audio experience. Let's talk…

Acknowledgement

I would like to thank Ian, G3ZHI, for his support and input to this article. Ian is a regular user of the Peanut network and can usually be found in the English room. He is a new and good friend.

Notes:

1. Network radio is a hybrid between traditional RF radios and the internet. Designed to look, feel and operate like a traditional two-way radio, network radios use Bluetooth or WiFi to connect to the internet through the cellular network.

About the Developer of the Peanut Network

David Grootendorst, PA7LIM, is a Linux / Network / Cloud consultant for a company in the Netherlands. He holds the Full Amateur license of the Netherlands, which is similar to the U.S. Extra Class. Peanut was an experiment that now has over 20,000 registered amateurs worldwide. For more of David's experiments on video and additional bio, go to: <www.pa7lim.nl/about/>.

On behalf of the amateur community, I want to thank David for his untiring efforts in developing the Peanut network. I consider him to be a pioneer in digital experimentation.

Results of the 2020 CQWW 160 Meter Contest

Topband Can Be a Wonderful Obsession

BY ANDY BLANK,* N2NT

Few people would disagree that VY2ZM and K1LZ have a couple of the biggest 160-meter stations in the world. So where did they operate the 2020 CQ 160 Meter contest? Why, Mongolia, of course!

Chak, JT1CO, invited Jeff and Krassy to operate Multi-Op along with Roman, RN5M, and Sergey, UAØSC, at his fine station at JT5DX. With a 4-square and two Beverages, the team made 1.3M points with over 1,400 QSOs. I am sure they made a lot of people happy with a great multiplier and some All-Time New One (ATNO) QSOs.

Of course, that didn't stop Velimir, K3JO, from operating the K1LZ super station and taking top U.S. honors on CW, just edging out Jeff's brother Peter, K3ZM, by only 1.5%. The same results occurred on SSB with K1LZ and K3ZM, but conditions were not nearly as good as CW.

The top score in Multi-Op CW was earned by the S5 team with an amazing story of a "Field Day" setup on Lampedusa Island as IG9/S59A. With only 700 watts to the transmit antenna, and no in-band receiving capability, it was a challenge. They fought the elements and still scored nearly 3M points. Congratulations guys! Coming in second was the seasoned team of TAs and Ukrainian ops at TCØX, which were edged by less than 1%. A great job by both teams.

The Ironman Award goes to Stan Stockton, K5GO/ZF5T, who grabbed the combined score trophy on both modes. Stan's seaside QTH in the Cayman Islands is a 160-meter hot zone and his booming signal is quite amazing.

Many thanks again to the Bavarian Contest Club (BCC), which had 214 entries this year, which topped last year's 195. They almost doubled the next club down, Potomac Valley Radio Club (PVRC) at 22M points. Additionally, the 40M point total is a full 25% higher than 2019. Congratulations to the BCC and thanks for your fantastic support of the contest. Clearing 10M total aggregated score are the Frankford Radio Club, Rhein Ruhr DX Association, Ukrainian Contest Club, and the Yankee Clipper Contest Club.

The CQ 160 Committee is proud that the rules have been changed to allow Low-Power operation in the immensely popular Assisted categories. Until now, the rules only allowed High-Power operation. All scores are sorted in our official database, located at CQ160.com and can be sorted by categories.

A new record of 3,051 logs was received for CW. Single-Op Assisted was the most popular category with 1,362 entries, followed by 1,276 Unassisted entries.

Here is Chak, JT1CO, with his good friend Krassy, K1LZ, having a great time with Chak's excellent station.

CW Results

I always love quoting from the #2 U.S.A. Single-Op entrant Peter, K3ZM, who has a unique perspective on the CQ160 competition: "Did anybody manage to get the elusive Maine multiplier? :)"

There were 11 entries from Maine, with three scores over 1M points. K1LZ, K1DG, and K1A all did it, but K1DG was the only one of the three who was actually there! Bill, KO7SS, operated K1A from Arizona.

The conditions were fantastic on CW this year. Not quite a repeat of the once-in-a-lifetime conditions of 2009, but quite good. Propagation across the Atlantic was solid both nights. There were so many scores in the millionaires club, there are too many to list here.

It's a sign of the times that there are so many remote operations in use these days. K3JO's operation from K1LZ was done remotely to earn first place in the U.S.A. 2018 Single-Op winner N5DX returned to the category as a remote operator from N2QV, this time placing third in U.S.A. N2TTA and K4BAI both operated remotely as NP2P and PJ4A. They placed third and fifth, respectively, in the highly competitive Single-Op DX category. They couldn't overtake Uli, DL5AXX, who traveled to CR3W for the top spot, or Stan, ZF5T, for second place in the world; both operating the traditional way at the station sites. Stan is the father of N5DX, so remote operation can't be too far off for him as well.

In Single-Op Low Power, five stations were able to make over 1,000 QSOs: 3V8SF, MU2K, LY4L, KD4D, and 4O3A. Ash, KF5EYY, operated 3V8SF to the top World spot from

* *director@cq160.com*

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Donor: Juan Carlos Munoz, TG9AJR

CW

SINGLE OPERATOR
World
Ulf Ehrlich (DL5AXX)
CR3W
Donor: Paul Newberry, N4PN Memorial (by N4RJ)

U.S.A
VELIMIR DERIC (K3JO)
K1LZ
Donor: Milt Jensen, N5IA, Memorial by Arizona Outlaws Contest Club

Canada
John Sluymer
VE3EJ
Donor: VE2XAA Memorial by Thor Stefansson, TF4M

U.S.A. - Zone 3
John Barcroft
K6AM
Donor: Bruce Butler – W6OSP Memorial

U.S.A. - Zone 4
Bryan Bydal
W5MX
Donor: Steve Schmidt, K4WA

U.S.A. - Zone 5
Peter H Briggs
K3ZM
Donor: Jim Monahan, K1PX

Africa
Luca Aliprandi (IK2NCJ)
D4C
Donor: James "Skip" Riba, WS9V

Asia
Pavel Kukushkin
UN9L
Donor: Missouri DX/Contest Club, K4SX

Europe
Pavel Prihoda (OK1MU)
OK6W
Donor: Emir-Braco Memic, E77DX

South America
John T. Laney III (K4BAI)
PJ4A
Donor: John Rodgers, WE3C

Oceania
Akito Nagi (JA5DQH)
KH7A
Donor: Will Angenent, K6ND

European Russia
Igor Avdeev
UA2FZ
Donor: CQ 160 Contest Committee

Japan
Shige Tsukeshiba
JH2FXK
Donor: Alabama Contest Group

North America
Stan Stockton (ZF9CW)
ZF5T
Donor: N4IN Memorial CQ Magazine

Southern Hemisphere
Osvaldo A. Santarone (LU5DF)
LU8DPM
Donor: Robert Kile, W7RH

World Assisted
Mathias Kolpe (DL4MM)
P4ØAA
Donor: Andy Chesnokov, UA3AB

Asia Assisted
Sergey Moskaev
R8TT
Donor: Jon Zaimes, AA1K

Europe Assisted
Krzysztof Sobon
SN7Q
Donor: DK5DC Memorial by DX-Hotel DM9EE

U.S.A. Assisted
Dennis Egan
W1UE
Donor: Akito Nagi, JA5DQH

U.S.A. Assisted – Zone 3
Larry Pace
N7DD
Donor: Larry Pace, N7DD

U.S.A Assisted – Zone 4
Victor A. Kean, Jr.
K1LT
Donor: Pete Michaelis, N8TR

Assisted – Zone 5
Bill Straw (KO7SS)
K1A
Donor: Potomac Valley Radio Club

World Low Power
Ashraf Chaaname (KF5EYY)
3V8SF
Donor: Akito Nagi, JA5DQH

U.S.A. Low Power
Mark Bailey
KD4D
Donor: Rich Kennedy, N4ESS

Asia – Low Power
Valery Strelchenok
UA9QM
Donor: Robert Kile, W7RH

Europe Low Power
Oleg Borisov (RL5D)
MU2K
Donor: DL1RK Memorial Petr Ourednik, OK1RP

Canada Low Power
Ric Guidone
VE3XL
Donor: Contest Club Ontario

World QRP
Arunas Vaglys
LY5E
Donor: Wayne Mills, N7NG

U.S.A. QRP
Marty Ray
N9SE
Donor: Bob Raymond, WA1Z

U.S.A. QRP - Zone 4
Charlie Hansen
NØTT
Donor: K9JWV Memorial by (WC7S)

Europe QRP
Rudolf Rueffer
DK7HA
Donor: Peter Voelpel, DJ7WW

MULTI-OPERATOR
World
Drago Turin S59A
IG9/S59A
(S51V, S52OT, S56N, S57DX, S59A ops)
Donor: Paul Newberry, N4PN Memorial (by N4RJ)

U.S.A.
John Crovelli
W2GD
(K2TW, KU2C, KZ2I, KS3F, N2HM, N2OO, W2CG, W2GD, W2NO, W2RQ, ops)
Donor: WØCD Memorial (by K8GG and W8UVZ)

U.S.A. Zone 3
Lee Finkel KY7M
NA7TB
(KY7M, NA2U, KC7V, AA7A ops)
Donor: Tom Whitted, N7GP

Europe
Petr Clupny
OK7K
(OK1BN, OK1GK, OK1NS, OK3RM, ops)
Donor: Bob Evans, K5WA

ASIA
Ali Riza Ozsaran TA3EL
TCØX
(TA3A, TA3AER, TA3EL, TA3LHH, UA9CDC, URØMC, US2YW, UT5ECZ, UT5EL, UW8SM, UZ5DX ops)
Donor: Nodir Tursoon-Zadeh, EY8MM

SSB

SINGLE OPERATOR
World
Jeffrey T. Briggs
VY2ZM
Donor: Nodir Tursoon-Zadeh, EY8MM

U.S.A.
Velimir Deric (K3JO)
K1LZ
Donor: W4PZV/W4SVO Memorial (by NQ4I)

Canada
Peter Barron
VE3PN
Donor: Tom Haavisto, VE3CX

U.S.A. - Zone 3
Robert C. Lee
N7AU
Donor: Nate Moreschi, N4YDU

U.S.A. - Zone 4
Karl Brandt
ND8DX
Donor: Alabama Contest Group

U.S.A. - Zone 5
Peter H. Briggs
K3ZM
Donor: Brent Scott, WR5O

Asia
Vladimir Falshunov
R8WF
Donor: Jessica Beckling, KN4JJA

Europe
Branko Zemljak
S57C
Donor: James "Skip" Riba, WS9V

Asiatic Russia
Boris Khakimzyanov
UA9CAW
Donor: Steven "Sid" Caesar, NH7C

North America
Stan Stockton (ZF9CW)
ZF5T
Donor: CQ magazine – K2EEK Memorial

South America
Sergio Lima De Almeida
PP5JR
Donor: John Rodgers, WE3C

Oceania
Dave Sullivan
ZL2OK
Donor: Steve "Sid" Caesar - NH7C

Southern Hemisphere
Mario Raul Andraca Rivera
LU8DPM
Donor: John Rogers, WE3C

World Assisted
Petr Clupny (OK1BN)
OK7K
Donor: K9HMB Memorial by Ray Sokola, K9RS

Asia Assisted
Sergey Moskaev
R8TT
Donor: Chuck Dietz, W5PR

Europe Assisted
Rolandas Jokubauskas
LY4A
Donor: Curtis Rose, N2ZX

U.S.A. Assisted
Bud Governale
W3LL
Donor: Pete Michaelis, N8TR

U.S.A. Assisted – Zone 4
Bud Foster
K4ISV
Donor: Pete Michaelis, N8TR

World Low Power
Brian Campbell
VE3MGY
Donor: Steve Molo, KI4KWR

U.S.A. Low Power
George Verciuc
W8CO
Donor: Tim Duffy, K3LR

Europe Low Power
Andrzej Lysakowski
SP5CJY
Donor: Contest Club Ontario

Canada Low Power
Kevin Smith
VA3AC
Donor: Rudy Bakalov, N2WQ

World QRP
Maksim Kesic
E77Y
Donor: John Rodgers, WE3C

MULTI-OPERATOR
World
Noah Gottfried (K2NG)
PJ4G
(K2NG, NE9U, KK9K, PJ4NX ops)
Donor: Southeastern DX Club

U.S.A.
Steve Kostro
N2CEI
(KØDI, N2CEI, K4SME ops)
Donor: Jerry Rosalius, WB9Z

Europe
Pavel Prihoda OK1MU
OL7M
(OK1CDJ, OK1CID, OK1JD, OK1MU, OK2ZAW ops)
Donor: South Jersey DX Assocation, N2CW

Zone 3
Lee Finkel
N7T
(KY7M, N7NR, KC7V @NA7TB ops)
Donor: Paulo, PV8DX

This fine station belongs to Cort, K4WI, who was first place in Alabama on SSB Low Power.

Here is John, K4BAI, operating PJ4A remotely from the comfort of KU8E's QTH. He has a fast internet connection.

Tunisia, while RL5D traveled to MU2K for second place World. Mark, KD4D, used the super station of W3LPL for his U.S.A. victory.

This was the first year that we have been able to separate Low- and High-Power rankings in the Assisted category, a long overdue change. CQ160 regular Low-Power winner Brian, VE3MGY, pointed out he has the new North American record for Single-Op Assisted Low Power. It occurred to me that EVERYBODY has set a new Low-Power record for Single-Op Assisted. There will be a listing on our official website to reflect all these as well.

Of special note, and a tribute to the conditions, is the effort by Osvaldo, LU5DF, operating at the fine station of Mario, LU8DPM. Normally, QSOs from Argentina to the U.S.A. or EU are difficult due to the distance. But with a full size vertical and array of Beverages, they were able to make 488 QSOs and approximately 500K total score. Well done, guys!

In the most competitive category of Single-Op World Unassisted, there were no less than 16 scores over 1M points. But the top score of CR3W by DL5AXX really stands out, the only one over 2M points. However, that is nothing com-

2020 CQWW 160M CONTEST TOP SCORES

CW

USA

K1LZ 1,128,548
K3ZM 1,112,238
N5DX.....1,065,912
K1DG.....1,023,435
W5MX 729,270
NA8V.....703,948
N4XD.....667,584
W4CB 666,600
W3BGN 633,204
W5ZN 590,117

VE

VE3EJ.....1,240,070
VE3DZ 962,016
VE3AT 831,512
VE3VN.....512,627
VE3PN.....474,117
VE6BBP.....419,616
VE3YT 283,283
VE3KP 237,830
VE3XL 178,160
VE3BR.....167,165

Zone 3

K6AM 414,468
W7QM.....358,992
K7RAT.....323,904
WJ9B 235,969
AA6AA.....231,413
W6AYC.....204,952
AC6DD 199,890
N7GP.....163,891
N7ZG.....153,840
N6RK.....146,219

Zone 4

VE3EJ.....1,240,070
VE3DZ 962,016
VE3AT 831,512
W5MX 729,270
NA8V.....703,948
W5ZN 590,117
W9RE.....530,292
VE3VN.....512,627
N2IC.....492,366
VE3PN.....474,117

QRP

LY5E 388,275
DK7HA 290,958
YL2QN.....232,532
HA8BE.....216,794
S52P 207,309
S57M 205,261
OL4W.....187,885
OK1LL.....164,800
N9SE.....159,100
EU1AA.....143,468

DX

CR3W.....2,272,064
ZF5T.....1,956,080
NP2P.....1,523,162
OK6W.....1,516,020
PJ4A 1,474,667
KP2M 1,448,912
D4C 1,358,012
XE2X 1,352,124
NP2J 1,322,752
LY7Z 1,297,032

Zone 14

EI5DI 1,014,328
CR6K.....904,818
DL1AUZ.....903,540
DF9LJ.....706,414
MU2K.....574,752
OZ1LO.....563,530
GM3POI 444,136
DL5SE 409,590
SMØT.....386,863
DK6XZ.....341,360
EI7KD.....341,352

Zone 15

OK6W.....1,516,020
LY7Z 1,297,032
S53A 1,183,005
OHØR.....1,056,438
OM7RU 778,146
HG5D 756,276
9A2AJ 728,178
LY4L 545,776
4O3A.....502,980
OM5CD 499,668

Zone 16

UX2X.....1,014,253
R7NW 978,588
R8WF 726,732
RA3XM.....489,552
RU3UR.....448,154
UT7NY.....435,288
EW1I 400,932
RN1A.....385,360
UX1HW 352,968
R3ST 329,751

Russia

R7NW 978,588
R8WF 726,732
RT9A.....690,074
RA3XM.....489,552
RU3UR.....448,154
RN1A.....385,360
RA9MA.....373,503
R3ST 329,751
R3FX 309,463
RD4F 264,180

LOW POWER World

3V8SF 956,970
MU2K.....574,752
LY4L 545,776
KD4D.....525,100
4O3A.....502,980
NØNI 412,794
OK7Y.....382,120
9A1AA.....367,567
LY9A 323,068
DL6KWN 321,925

LOW POWER W/VE

KD4D.....525,100
NØNI 412,794
WB8JUI.....270,300
N8II 263,637
K1EP 254,800
K5KU.....241,020
K3JT.....231,500
K1DC.....187,376
VE3XL 178,160
VE3VSM.....157,960

QRP W/VE

NØTT.....130,950
N3CZ.....65,670
KØPK.....35,964
WB4MSG 30,438
KKØU 27,979
W9CC.....20,610
KEØTT 19,395
K3TW 19,366
KI4IO.....16,605
WB2CPU 12,002

MULTI-OPERATOR WORLD

IG9/S59A.....2,941,390
TCØX.....2,746,668
P33W 2,730,192
OK7K.....2,153,792
PJ2T.....2,141,644
EW5A 2,041,068
RL3A 2,016,540
4X2M 2,005,560
UA7K.....1,937,250
9A1P 1,822,620

MULTI-OPERATOR W/VE

VO2AC.....1,704,417
W2GD 1,395,468
K3LR 1,072,804
NR4M.....890,960
KØDI 842,656
KM3T 798,840
N1LN.....696,828
N3EB 660,625
K2AX 627,792
NA7TB.....588,672

ASSISTED WORLD

+P4ØAA.....2,156,011
+SN7Q.....1,659,711
+SN2M.....1,601,380
+OM7M.....1,501,360
+LX2ØI.....1,479,226
+MX5A.....1,438,490
+UA2FZ.....1,433,295
+LY4A.....1,367,380
+YL2SM.....1,314,036
+LY7M.....1,313,820

ASSISTED W/VE

+VA2WA.....1,191,360
+W1UE.....1,044,669
+K1A 1,010,152
+AA1K.....979,104
+K3WW.....826,344
+K1LT 807,380
+N3HEE.....784,655
+VE3RZ.....771,948
+K2AV.....709,800
+KVØQ 693,328

SSB

USA

K1LZ 338,548
K3ZM 302,736
ND8DX 213,891
NA8V.....199,827
W3BGN 183,440
W1XX.....181,645
K2XA 160,290
W3TS 114,595
W1OC.....112,995
K3ZO 109,340

VE

VY2ZM 745,461
VE3PN.....205,190
VE3MGY.....203,112
VE3DZ 140,882
VA3AR.....117,355
VA3AC.....99,603
VA3NW 38,581
VE3KP 29,930
VE3VY 19,807
VE3TW 14,790

Zone 3

N7AU.....23,970
N7RK.....18,179
W6AFA 14,250
K7IU 10,560
W7ZB 7,887
VA7EU.....7,056
AI6LY 6,975
K7HP.....5,478
NG7M.....4,524
K7STO.....4,228

Zone 4

ND8DX 213,891
VE3PN.....205,190
VE3MGY.....203,112
NA8V.....199,827
VE3DZ 140,882
VA3AR.....117,355
KØIDX 105,690
ND4Y.....104,082
VA3AC.....99,603
KØTT 89,962

QRP

E77Y 61,440
HA8BE.....54,264
R2FI 24,570
EU1AA.....23,698
WB4MSG 22,320
DLØAZ.....21,276
UT1WW.....20,628
YO8BSE.....19,314
OK1LL.....18,172
HA1TI.....14,924

DX

ZF5T.....623,370
ZF2AM.....465,360
S57C 371,853
IK2YCW.....336,490
ES5RW.....301,000
SN7D.....260,455
YL7X 223,040
SP9N.....204,544
SQ7CL.....164,777
LY5W 159,689

Zone 14

EA3IBV 76,750
SB6A.....64,920
DF2DJ 64,100
DL2SAX.....58,056
M3D 56,212
MIØM.....52,962
EG2CAI.....51,696
DLØESA 47,360
DK1KC.....45,360
DG5MLA 45,150

Zone 15

S57C 371,853
IK2YCW.....336,490
ES5RW.....301,000
SN7D.....260,455
YL7X 223,040
SP9N.....204,544
SQ7CL.....164,777
LY5W 159,689
LY2BVB.....147,732
SN6M.....144,990

Zone 16

UX1UA 149,292
US5D.....125,856
UT2AA.....87,400
R8WF 84,398
RA3XM.....70,460
UA4LCH 48,258
UR5TM.....47,463
RA1ZZ.....40,303
RC5Z.....39,780
UZ1U.....38,556

Russia

R8WF 84,398
RA3XM.....70,460
UA4LCH 48,258
RA1ZZ.....40,303
RC5Z.....39,780
UA9CAW 36,735
RK3E.....33,966
RC2SB.....30,400
RA3RA 25,806
UA1CUR.....25,760

LOW POWER WORLD

VE3MGY.....203,112
LY4L 131,663
SP5CJY 103,831
VA3AC.....99,603
W8CO.....89,205
OK1LRD 84,832
LY9A 84,214
SQ9ZAX.....80,388
HA8WY 63,102
OM5WW 60,952

LOW POWER W/VE

VE3MGY.....203,112
VA3AC.....99,603
W8CO.....89,205
KB4OLM.....51,832
N2HMM.....51,747
W8GP.....51,012
N4XL.....48,730
NGØC.....40,698
VA3NW 38,581
KS3D.....36,608

QRP W/VE

K3TW 5,208
N8LJ 4,825
K2MIJ 4,290
W7BAK.....4,248
WB8DC 2,720
W1RGA 676
WØYJT.....630
VE6EX 520
W1IG.....60
VA3MYC.....30

MULTI-OPERATOR WORLD

PJ4G 538,164
OL7M 533,808
EW5A 496,524
HG8DX 431,730
US1Q.....358,179
SP8R.....352,577
UA7K.....317,900
N2CEI.....311,115
N2CW.....306,976
S56P 273,428

MULTI-OPERATOR W/VE

N2CEI.....311,115
N2CW.....306,976
WU2X.....267,145
W5MX.....169,338
W8PR.....154,356
K2AX.....100,809
N3DPB 85,413
WR5O 79,168
NE3F 66,642
K3CCR.....66,300

ASSISTED WORLD

+OK7K.....650,743
+LY4A 610,416
+KP4KE 479,412
+S54ZZ 302,808
+LX2ØI 286,556
+EA9/DL1MGB 270,776
+MI5K 267,064
+DK6WL.....262,352
+DK2OY 233,064
+W3LL 194,292

ASSISTED W/VE

+W3LL 194,292
+N4RV.....164,410
+K4ISV.....140,466
+AA1K.....139,410
+K4XL 135,660
+VE3CX.....131,089
+W1EQO 129,244
+N2ZX.....115,024
+VE3CV 114,895
+W3FOX.....99,162

**Low Power*
+Assisted

pared to the High-Power Assisted category where 25 scores topped 1M. Again, the standout score is from another German: Mathias, DL4MM, operating from P4ØAA. Mat's score is the only one above 2M points on that list. The next 24 stations above 1M are mostly from Europe, with VA2WA, W1UE, and K1A all sneaking into the millionaire's club.

In the hugely popular Multi-Op category, there were a whopping 49 scores over 1M points, and eight over 2M! There were six 1M-plus scores in the Czech Republic alone. The crew at OK7K took the top EU spot with 2.15M points and EW5A at 2.04M points. OK7K has 11 receiving antennas and managed over 500 U.S.A. QSOs. A surprise entrant into the CQ160 was the K3LR super station. They made a fantastic effort of over 1M points, but the seasoned N.J. shore crew at W2GD was victorious in the end.

Of special note is VO2AC who have tried to operate from a shore lighthouse QTH for the past 3 years. The weather finally cooperated, and their effort is the third highest Multi-

2020 CQWW 160M CONTEST CLUB SCORES

(Minimum of 3 three entries required for listing)

SCORE	#ENTRIES	CLUB
40,734,353	214	BAVARIAN CONTEST CLUB
22,814,744	170	POTOMAC VALLEY RADIO CLUB
19,076,095	131	FRANKFORD RADIO CLUB
12,335,632	52	RUSSIAN CONTEST CLUB
11,453,408	64	RHEIN RUHR DX ASSOCIATION
11,367,691	101	UKRAINIAN CONTEST CLUB
10,587,525	83	YANKEE CLIPPER CONTEST CLUB
9,877,921	54	CONTEST CLUB ONTARIO
8,423,716	21	CROATIAN CONTEST CLUB
8,110,266	20	BALTIC CONTEST CLUB
7,054,444	42	KAUNAS UNIVERSITY OF TECHNOLOGY RADIO CLUB
6,910,185	89	SOCIETY OF MIDWEST CONTESTERS
6,598,828	15	BELOKRANJEC CONTEST CLUB
6,012,255	19	SLOVENIA CONTEST CLUB
5,745,296	19	MAD RIVER RADIO CLUB
5,475,575	47	ARIZONA OUTLAWS CONTEST CLUB
5,166,850	42	SP DX CLUB
5,070,981	20	CONTEST CLUB FINLAND
4,816,285	24	EA CONTEST CLUB
4,467,047	15	LATVIAN CONTEST CLUB
4,461,210	15	HUNGARIAN DX CLUB
3,834,226	25	ITALIAN CONTEST CLUB
3,824,308	13	URAL CONTEST GROUP
3,779,536	13	BELARUS CONTEST CLUB
3,733,725	16	CONTEST CLUB SERBIA
3,369,738	11	UA2 CONTEST CLUB
3,332,506	28	FLORIDA CONTEST GROUP
2,684,913	18	DANISH DX GROUP
2,678,443	18	NORTH COAST CONTESTERS
2,653,497	7	WORLD WIDE YOUNG CONTESTERS
2,630,001	12	VYTAUTAS MAGNUS UNIVERSITY RADIO CLUB
2,534,313	57	DEUTSCH AMATEUR RADIO CLUB
2,438,712	12	SOUTH URAL CONTEST CLUB
2,334,034	9	THRACIAN ROSE CLUB
2,167,420	28	TENNESSEE CONTEST GROUP
2,044,593	42	MINNESOTA WIRELESS ASSN
1,999,619	12	SOUTH EAST CONTEST CLUB
1,985,101	18	KENTUCKY CONTEST GROUP
1,965,301	8	MARITIME CONTEST CLUB
1,883,714	10	ALRS ST PETERSBURG
1,880,204	12	RUSSIAN CW CLUB
1,761,851	15	ALABAMA CONTEST GROUP
1,725,190	9	VERON
1,624,395	12	GRAND MESA CONTESTERS OF COLORADO
1,596,003	3	CENTRAL SIBERIA DX CLUB
1,573,302	7	GIPANIS CONTEST GROUP
1,533,470	3	MILARA CONTEST CLUB
1,502,911	3	FLORIDA WEAK SIGNAL GROUP
1,362,726	3	CLIPPERTON DX CLUB
1,294,469	10	CONTEST GROUP DU QUEBEC
1,290,695	11	CENTRAL TEXAS DX AND CONTEST CLUB
1,114,978	21	SOUTHERN CALIFORNIA CONTEST CLUB
1,113,114	31	NORTHERN CALIFORNIA CONTEST CLUB
1,040,998	7	GM DX GROUP
1,030,536	18	HUDSON VALLEY CONTESTERS AND DXERS
1,022,859	4	RIIHIMAEN KOLMOSET
1,017,550	5	TALL TREES CONTEST GROUP
986,935	4	SHAKHAN CONTEST CLUB
888,926	5	LU CONTEST GROUP
870,654	3	FAZENDA ACTIVITY CONTEST GROUP
843,335	10	KANSAS CITY CONTEST CLUB
829,413	10	NIAGARA FRONTIER RADIOSPORT
755,679	13	WILLAMETTE VALLEY DX CLUB
708,069	5	IOWA DX AND CONTEST CLUB
654,916	3	VERULAM ARC
641,475	7	DEEP DIXIE CONTEST CLUB
628,238	7	CAROLINA DX ASSOCIATION
620,394	6	CHILTERN DX CLUB
611,299	4	RIO DX GROUP
604,156	3	OMSK REGION RADIOCLUB
591,604	8	CTRI CONTEST GROUP
472,061	3	OK1KMU
468,511	4	CZECH CONTEST CLUB
466,080	3	UR-QRP-CLUB
460,051	5	BRISTOL (TN/VA) ARC
452,719	4	LA-DX-GROUP
393,793	13	DFW CONTEST GROUP
393,310	15	WESTERN WASHINGTON DX CLUB
392,752	5	BIG SKY CONTESTERS
352,420	4	NORTH CAROLINA DX AND CONTEST CLUB
321,823	6	CATALONIA CONTEST CLUB
318,910	4	R4F-DX-G
307,256	9	ROCHESTER DX ASSOCIATION
298,798	3	OK1KQJ CONTEST CLUB
293,646	5	NOT QUITE WORKABLE CONTEST CLUB
292,097	3	RADIO AMATEURS OF NORTHERN VERMONT
252,542	9	ORCA DX AND CONTEST CLUB
231,004	4	YO DX CLUB
230,638	3	SRR
224,827	4	DONBASS CONTEST CLUB
218,505	6	MOTHER LODE DX & CONTEST CLUB
213,286	3	LOMA DEL TORO DX CLUB
200,526	9	SWAMP FOX CONTEST GROUP
199,182	5	CSM Craiova
190,461	4	BLACK SEA CONTEST CLUB
185,580	5	ARAUCARIA DX GROUP
179,537	3	IRKUTSK RADIO CLUB
174,315	8	VRHNIKA CONTESTERS
167,290	6	TEXAS DX SOCIETY
146,168	7	WEST PARK RADIOPS
129,827	4	NORTH TEXAS CONTEST CLUB
120,288	3	GERMAN DX FOUNDATION
115,235	3	GREAT SOUTHERN DX ASSOCIATION
112,907	3	SPANDAU DXERS
112,886	7	RU-QRP
110,247	3	HILLTOP TRANSMITTING ASSOCIATION
109,726	3	RCWC
108,320	4	BERGEN AMATEUR RADIOASSOCIATION
107,702	5	PORTAGE COUNTY AMATEUR RADIO SERVICE
106,831	4	599 DX ASSOCIATION
101,343	4	CENTRAL VIRGINIA CONTEST CLUB
94,760	6	ARKTIKA
86,209	3	VORONEZH RADIO CLUB
83,271	4	GRANITE STATE ARA
77,028	3	SHENANDOAH VALLEY WIRELESS ASSOCIATION
72,468	4	METRO DX CLUB
65,804	8	SPOKANE DX ASSOCIATION
63,958	3	SK5AA VASTERAS RADIOKLUBB
56,700	3	KRIVBASS
56,554	3	WOBBLERS
56,469	3	BADGER CONTESTERS
55,229	3	RADIO AMATEUR ASSOCIATION OF WESTERN GREECE
54,949	3	SOUTHWEST OHIO DX ASSOCIATION
46,474	8	NEW PROVIDENCE ARC
43,458	3	VK CONTEST CLUB
41,682	3	THE VILLAGES AMATEUR RADIO CLUB
35,876	9	KEYMEN'S CLUB OF JAPAN
33,868	3	ARCK
27,017	3	NORFOLK AMATEUR RADIO CLUB
22,026	4	TURKISH RADIO AMATEUR CLUB
21,292	4	URE BAIX CAMP
20,675	3	BLRCI
8,068	3	CALABRIA DX TEAM
6,448	3	PACIFIC NORTHWEST VHF SOCEITY
2,171	16	YB LAND DX CLUB
438	9	ORARI LOKAL KEDIRI
168	7	ORARI LOKAL BOGOR
158	9	SINGLE FIGHTER DX GROUP
114	4	ORARI LOKAL BLITAR
76	3	CDR GROUP
45	4	CABREUVADX

Op in North American history. Congratulations to VE9CB and VO1HP, along with Chris, VO2AC, for their great dedication to the contest.

Conditions were good enough this year to produce some big scores in the QRP section. World winner Arunas, LY5E, commented that the new rules allowing assisted operation for all QRP entries was a welcome change. He made an incredible 990 QSOs, breaking the K9AY record of 801 QSOs dating back to 2009. Marty, N9SE, had the highest QRP score in the U.S. with 714 QSOs. Well done, guys!

SSB Results

There were 1,471 logs submitted for SSB this year, up from 1223 in 2019. The transatlantic conditions on SSB were nowhere near as good as the CW portion.

The Multi-Op team at OL7M fought bad weather and bad propagation to North America and almost won the world. They almost doubled the winning total of QSOs from PJ4G, but the lack of 10 pointers and states for OL7M made the scoring difference. The margin of victory was on only 5K points.

In the U.S.A., the shore station of N2CW (the same location as W2GD on CW) was surprised by the Northern Florida team of N2CEI (who operates as KØDI on CW). N2CW had a slightly higher claimed score, but the positions changed after log checking. It is very unusual to win this category from southeastern part of the country. Congratulations, guys!

Jeff, VY2ZM, decided to return to the superstation on Prince Edward Island to operate SSB, and pilot it to the top World score in Single-Op High Power. He managed to squeak by the Cayman Island tag team of ZF5T and ZF2AM.

With depressed conditions, the U.S. competition was a bit tougher. But once again it was K3JO at K1LZ and K3ZM battling for the top spot. It was Velamir operating remotely from the new Maine superstation of K1LZ who was victorious again. The amazing unpredictability of Topband means that in any given year the places can change. This was "Maine's year" for sure.

And in Europe, only 35K points separated Branko, S57C, operating from S5ØC, and Gabry, IT9RGY, operating from the fine station of IK2YCW. Operating this contest from Europe is always a challenge due to the enormous QRM from the big guns. Congratulations to all the participants for sticking it out to the end.

In the Single-Op Low Power category, our friend Brian, VE3MGY, blew away the competition with a score of

David, HC5DX, made some people happy on SSB with a fine multiplier from his mountaintop QTH at 8,300 feet in elevation in Ecuador.

Multi-Op Asia winner is the crew from Ukraine and Turkey of (not listed in standing order) TA3A, TA3AER, TA3EL, TA3LHH, UA9CDC, URØMC, US2YW, UT5ECZ, UT5EL, UW8SM, and UZ5DX.

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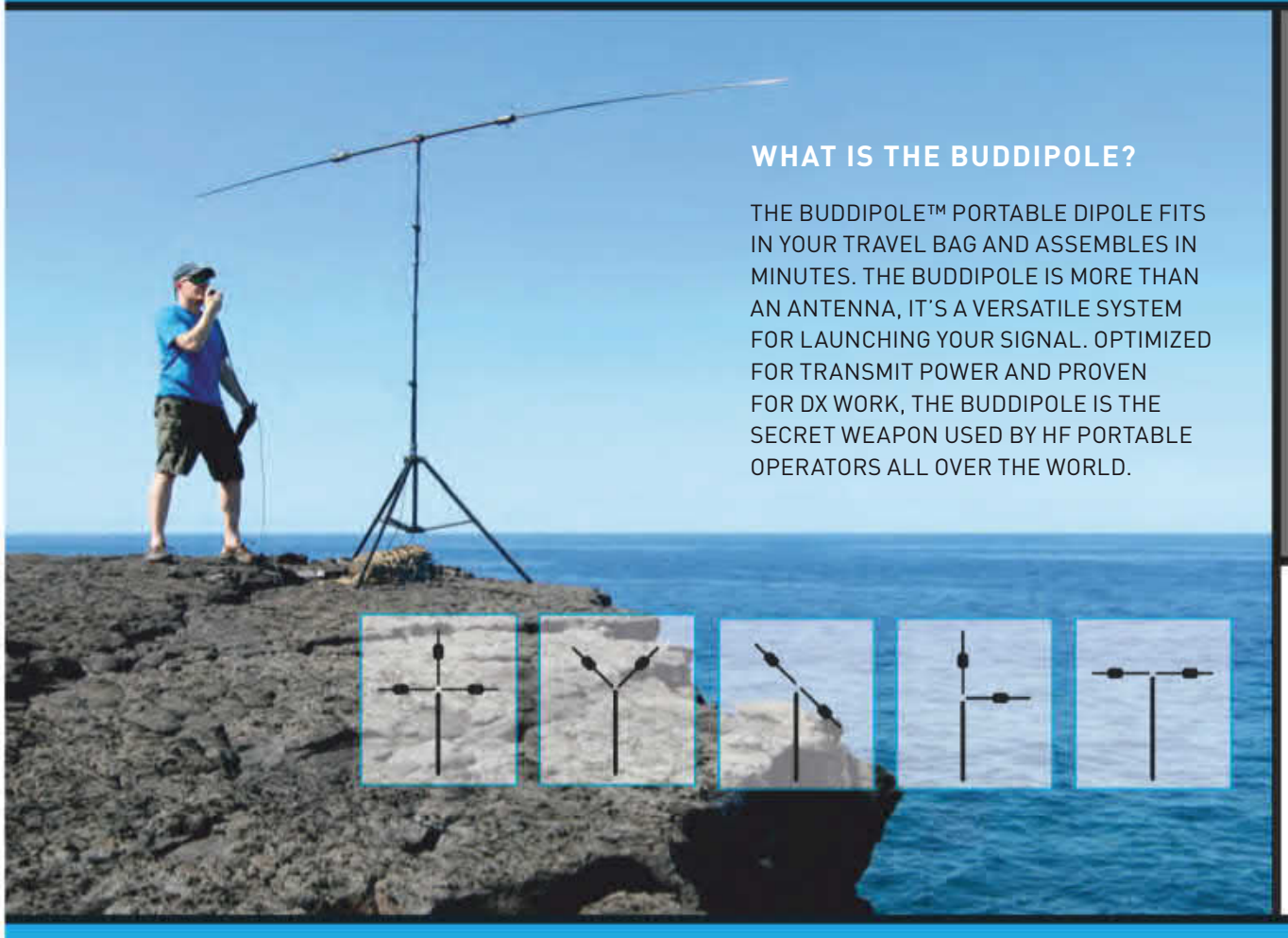

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203K; the next station was LY4L at 131K. George, W8CO, repeated his 2019 U.S.A. Low-Power victory as well. In Europe, only two stations were able to crack 100K points: LY4L and SP5CJY.

In the wildly popular Assisted category, Petr, OK1BN, operating as OK7K, piloted the station to first place in the world. Coming in second was Rolandas, LY4A, with only 40K fewer points than Petr. The U.S. battle in Assisted resulted in Bud, W3LL, outlasting Rich, NN3W, operating at N4RV, by only 30K points. In the new Low-Power Assisted category, Glenn, K2FF, operating at NA5NN, took top U.S. honors. His only comment was "CQ Wyoming, CQ Wyoming … where are you?" He just edged out N4BAA by only 2K points.

And Slavko, S57DX, who took top Low-Power World Assisted, makes this comment: "As expected LP is hard work!" Imagine if he tried QRP?

Speaking of QRP, somehow Max, E77Y, managed to make 302 QSOs with under 5 watts. This was a fantastic job given the conditions. Next was Bela, HA8BE, a long-time 160M regular, with 250 QSOs. Operating QRP on 160-meter SSB has to be one of the hardest things to do in a contest. Congratulations to all who stuck it out. Unfortunately there was no trophy sponsored for top USA QRP, but congratulations to Gene, WB4MSG, on taking first place!

The CQ160 Committee would like to take a moment to honor long time Topband enthusiast Herb Schoenbohm, KV4FZ. Herb became a Silent Key (SK) in April 2020 at age 84. He was a fixture on 160 meters and in most 160-meter contests as well. RIP Herbie, we will all miss you.

Obeying the Rules

This year it was necessary to disqualify one station (US1Q on CW). We have proof that a remote receiver located on another continent was used to receive stations. This is a clear violation of the rules and spirit of the contest. While not all violations are as blatant as this, the committee receives many complaints from entrants every year. We wish to point out these violations in the hopes we can keep a level playing field in the future.

• Use of remote receivers outside 100 kilometers (inside 100 kilometers allowed in Multi-Op only)
• Use of excessive power
• Use of QSO finding assistance by Single-Op who claims Unassisted
• Excessively wide signals, including key clicks and splatter.
• Operating outside band limits (below 1810 in IARU Region 1, and using band edges)
• Unsportsmanlike conduct (such as frequency fights).

In closing, I would like to give special thanks to all those assisting me in making the contest a success, including: N6TR (log checking), K1DG (trophies), and K5ZD (webmaster).

Certificates for everyone are available for printing on our website at CQ160.com. If anyone would like a Log Checking Report, send an email to me at <director@CQ160.com>. Please specify which mode you are asking for and the callsign used.

Trophies will be mailed shortly. Thanks to all for participating and see you in 2021. Remember all CQ Contests have a 5-day deadline for submitting logs. Check out the rules on CQ160.com for the latest information.

– 73, Andy, N2NT, Director CQ160 Contest

(Scores on page 102)

Announcing:

2020 CQ World Wide DX Contest

***SSB:* October 24-25 *CW:* November 28-29**
Starts 0000 UTC Saturday; Ends 2359 UTC Sunday

***Log Deadlines:* SSB – 2359 UTC Oct. 30 / CW – 2359 UTC Dec. 4, 2020**

Join more than 30,000 participants from over 200 DX entities and all 40 CQ Zones in the world's largest DX contest.

The CQ World Wide DX Contest (CQWW) offers 48 hours of nonstop DX-chasing fun with activity taking place from virtually every part of the world! Whether you are competing for awards, looking for a few new band-countries, or simply filling up your logbook, the CQWW offers something for everyone. Check out the Classic and Rookie Overlay Categories for even more chances to enjoy ham radio's premier operating event. Even though we are at the bottom of the sunspot cycle, the HF bands magically light up in the CQWW with activity levels that are unlike any other radio competition.

Some Contest Basics

Each mode is a separate operating event that runs for 48 hours from 0000 UTC Saturday until 2359 UTC Sunday. SSB is the last full weekend of October. CW is the last full weekend of November.

Working stations is easy. Exchange and log a callsign, signal report, and your CQ Zone number (e.g., 59 05 on SSB or 599 05 on CW). If you're not sure which zone you're in, visit <http://bit.ly/1BHtmsP> for more information. Generally speaking for U.S. operators, the west coast is in Zone 3, the east coast is in Zone 5, and the rest of the lower 48 is in Zone 4. Western Europe is mostly Zone 14 and Japan is in Zone 25.

Contacts are valid only on the 1.8-, 3.5-, 7-, 14-, 21-, and 28-MHz amateur bands (there is no contest operation on the 60-, 30-, 17- or 12-meter bands, nor on the 630- and 2200-meter bands).

Scoring

Your final score is based on QSO points earned for each contact times the number of multipliers worked. Contacts with other continents count three points each. Contacts with the same continent, but different country, count one point (except in North America where they count two points). Same-country contacts earn zero points, but do count for multiplier credit.

Multipliers are the number of DXCC entities and Worked All Europe (WAE) countries, plus IG9/IH9, worked on each band plus the number of CQ Zones worked on each band.

Don't worry about calculating your score; the CQWW Contest Committee's contest log checking software will do that for you when you submit a log. Most participants are using readily available contest logging software to help as well (e.g., N1MM+, Win-Test, etc.).

Entry Categories

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

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

- 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) – One operator may use DX spotting or other tools to help find contacts. Note that a CW decoder is considered assistance. The one operator must make and log all contacts in the following power categories:

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

Classic Category – Allows the use of only one radio (e.g., Single Operator, 2 Radio operation is not permitted), 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 Category – Open only to operators who were first licensed as radio amateurs less than three (3) years before the date of the contest. Be sure to indicate date licensed in the soapbox field of your log.

Multi-Operator – more than one person is involved in operating the station.

Multi-Single: This category allows one transmitter to work any station. It may only change bands after 10-minutes on a band. 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

(There is no QRP category for any multi-op classification)

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

Multi-Multi: Allows the use of one transmitted signal on each band.

Awards

Electronic certificates will be made available for everyone who submits an entry, provided that entry is submitted before the log deadline. Plaques are awarded to top finishers in major categories.

Submitting Your Log

Effective with the 2020 contest, paper logs will no longer be accepted. Logs should be in the Cabrillo format. Most logging software generates this file automatically. Upload your log on the Web at <www.cqww.com/logcheck>. The website also includes a utility to convert an ADIF-formatted log file if needed.

All entries must be sent **WITHIN FIVE (5) DAYS** after the end of the contest: No later than 2359 UTC **October 30**, **2020** for SSB and 2359 UTC **December 4**, **2020** for CW. Resubmitting an entry after the deadline will result in it being considered as a late log.

Only one entry is permitted for each callsign. If you submit a log multiple times, the latest log submission will replace any previous attempts.

Full Rules

The complete rules of the CQWW DX Contest are available in 18 different languages on the web at <www.cqww.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 DX Contest main page). In addition, there is a rules FAQ that provides additional answers to commonly asked questions.

You are strongly encouraged to review the rules and the frequently asked questions before the contest, especially for possible minor changes in some rule details from previous years. Any questions may be submitted via the online contact form at <http://cqww.com/contact>.

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In February, we brought you a "first look" at the Midnight Design Solutions Phaser transceiver, written by its designers, who explained the process that went into its development. Now, N1IXF shares his experiences building and using the kit to explore radio concepts, seek new contacts, and boldly go where digital modes can take you!

CQ Reviews:

The Midnight Design Solutions "Phaser" Transceiver Kit

BY RICH CADY,* N1IXF

I have been a fan of Midnight Design Solutions[1] since I purchased and constructed its Scaler Network Analyzer (SNA) kit to augment the test equipment I use to build and maintain my station. That kit provided a great tool to analyze my antennas, draw SWR curves, tune bandpass filters and plot their response curves, and add a variable frequency generator, an LC meter, and a crystal tester to my bench. When I bought the SNA kit, I joined Midnight's Groups.io discussion forum[3] and that's how I recently learned of the company's latest kit offering and the subject of this article … the "Phaser," a QRP digital mode transceiver.

Just before Christmas 2019, George Heron, N2APB, at Midnight Design Solutions announced that he had teamed with Dave Benson, K1SWL, of Small Wonder Labs fame, to offer a simple transceiver to operate in FT8 or another digital mode of your choice. Dave is well known in QRP circles and this is his first foray into kit design after retiring and moving to New Hampshire some years back. Dave and George provided a "First Look" at the Phaser in the February 2020 issue of *CQ*.[2] Since I love to build radio kits and enjoy learning about new aspects of ham radio, I thought about purchasing one of these kits.

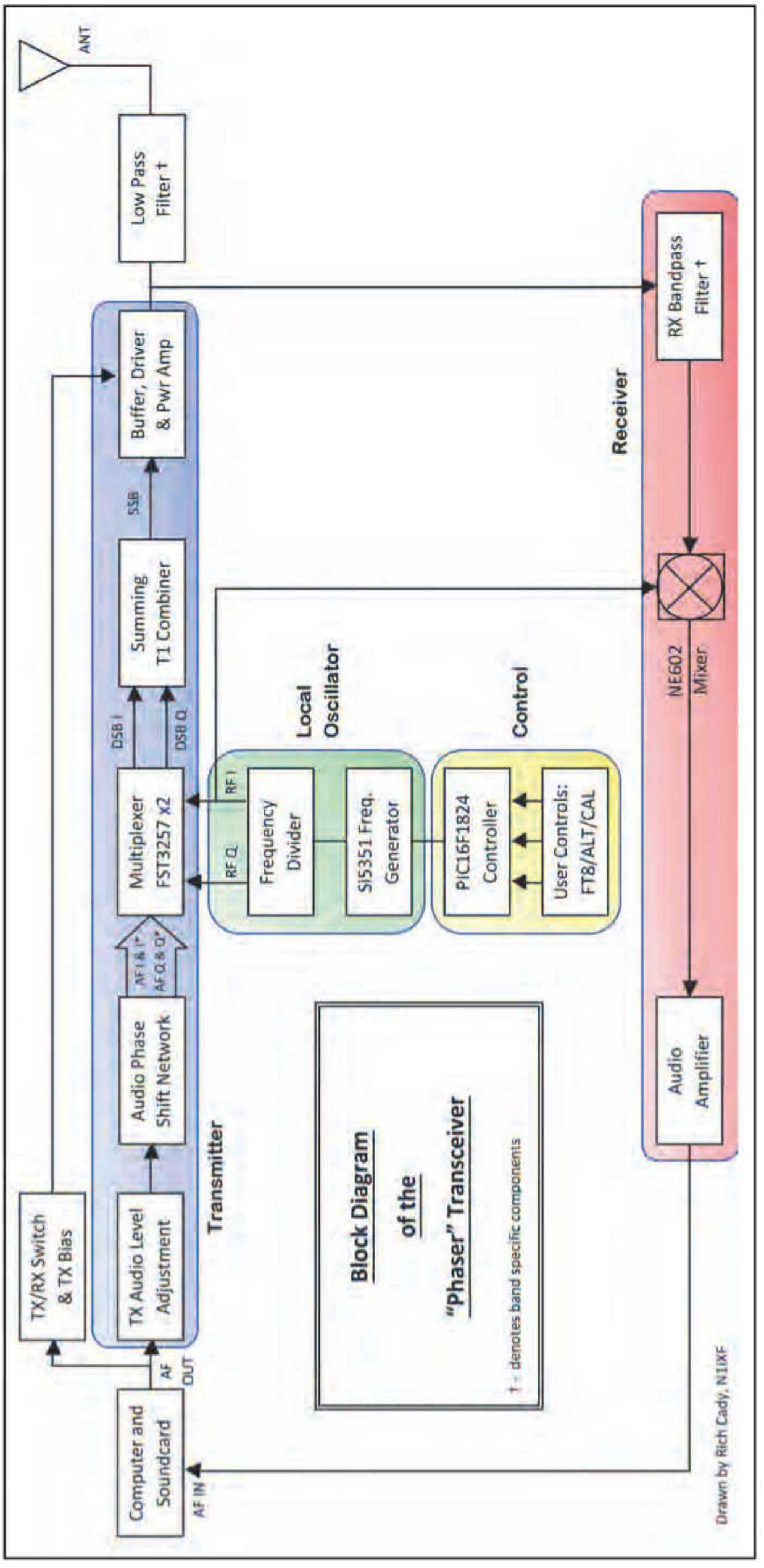
I still find it "magical" that you can take a bunch of discrete electronic parts, hook them together, and then communicate around the world. While I have been active in digital radio using RTTY, I hadn't yet played with the recently popular FT8 mode. This kit, I thought, might give me the motivation I needed to try FT8 on the air with a QRP radio. After all, FT8 is supposed to be a weak-signal mode and operating QRP seemed like the perfect mate to that. The discussion forum was abuzz with interest and Rick, K3IND, posted a note asking whether anyone there was interested in building his Phaser kit. I jumped at the chance to do that.

What is the Phaser?

The Phaser is a digital-mode transceiver using a simple direct-conversion receiver coupled with a 4-watt single-sideband (SSB) transmitter. This differs

Photo A. The Phaser transceiver kit came packed in three bags, two for the radio and one for the optional enclosure kit. Note the "parts card" in the package on the upper right to which various components are attached after sorting. (Photos / illustrations by the author)

** 5 Gregory Lane*
Simsbury, CT 06070
n1ixf@arrl.net



from other simple digital-mode radios using a double sideband (DSB) approach to both the receive and transmit circuits. Dave used this DSB RX / SSB TX combination in his design criteria so that two Phasers could communicate with each other. As Dave explains, the SSB transmitter "… eliminates the issue of out-of-phase signal cancellation at the [other] Phaser's direct-conversion receiver." (See the block diagram in *Figure 1* for an overview of the Phaser's design).

As I write this, the Phaser is sold in single-band versions for 80, 40, 30, 20, and 17 meters, although Dave may be designing 10- and 60-meter versions as well. Each version differs only in the band-specific components required for their low-pass and bandpass filters; the core design is identical for all. As a measure of their success, in the two months since announcing availability of the Phaser, more than 300 kits have been sold.

The Phaser generates its SSB transmitted signal using a phasing method to suppress the unwanted sideband, hence the name. This phasing design departs from the more traditional SSB transmitter that uses a fixed-frequency filter and more complicated circuitry to suppress or eliminate the unwanted sideband and carrier. Instead, the Phaser's circuitry creates and sums "out of phase" DSB waveforms to produce a SSB signal that is then amplified and transmitted through a low-pass filter. The phasing design employed here can result in better than 30-dB attenuation of the lower sideband. This helps ensure that the transmitter suppresses the carrier and the unwanted sideband to the point that they don't create interference to others operating on those frequencies. For the interested reader, Dave has provided a theory of operation section in the assembly manual appendix. For those who would like details of the principles behind the I & Q (in-phase and quadrature) signals and summing that is the basis for the phasing design, I recommend viewing W2AEW's YouTube video #170 on that topic <https://tinyurl.com/kbfe3pz>.

With simplicity in mind, the Phaser employs two momentary switches and associated LEDs so the operator may select either the default FT8 "watering hole" frequency, 7074 kHz for the 40-meter version I was building, or an alter-

Figure 1. Block diagram of the Phaser transceiver from Midnight Design Solutions.

BEHIND THE BYLINES...

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

Murray Green, K3BEQ ("'Peanut' for Amateur Radio," p. 12), shifted his hamming earlier this year to internet-based remote systems (such as "Peanut") after nearly 70 years of traditional on-air operation from his home station. Murray cites family health issues as the main impetus for this change, allowing him to stay in touch with fellow hams without needing to maintain a station and antenna system.

Rich Cady, N1IXF ("*CQ Reviews*: Midnight Design Solutions Phaser Transceiver Kit," p. 26), has been licensed for nearly 30 years and primarily enjoys contesting, either as a "little pistol" from his home station in Connecticut or as a guest operator at bigger stations. He's a member of the Yankee Clipper Contest Club.

Stew Gillmor, W1FK ("CQ Classic: Amateur Radio – A Hobby for All Seasons" plus update, p. 36), tells us a lot about himself in the 1980 "Classic" article we're reprinting as well as his update on what he's been doing for the past 40 years. Among many other things, Stew has made two working visits to Antarctica (where there's a mountain named for him!) and now occupies himself with growing grapes and making small batches of wine! Stew is a frequent contributor to *CQ*.

Phil Karras, KE3FL ("Build an Adjustable Voltage Add-On for Your Power Supply," p. 42), has been a ham since 1992, with primary interests in emergency communications, QRP, portable operating, building, and antennas. Phil holds bachelors and masters degrees in physics and is currently working on DNA identification databases and applications at the Armed Forces DNA Identification Laboratory.

William Minikiewicz, W4FSV ("A Vintage Foxhunt, or … Two Hams in Crash Helmets," p. 46), has been a ham for over 52 years. He is retired from a career in emergency services and owns and operates breadboardradio.com, a ham radio kit company specializing in QRPp kits.

ANNOUNCEMENTS *(from page 2)*

Highway. Phone: (865) 446-4535. Email: <n4jtq@live.com>. Website: <http://seviercountyars.com>. 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.

PLYMOUTH, MINNESOTA — The Twin Cities FM Club will hold the **Last Chance Tailgate Swap Fest** beginning 8 a.m., Saturday, September 26 at the West Medicine Lake Community Club, 1705 Forestview Lane North. Contact: AJ or Mike <nopvc@outlook.com> or <trustee.tcfmc@gmail.com>. Website: <http://tcfmc.org>. Talk-in 146.76 (PL 114.8).

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) CLE-FEST (253-3378). Website: <www.hac.org>. VE exams.

OCTOBER

TOWAMENCIN TOWNSHIP, PENNSYLVANIA — Special event station **W3T** will be on the air from Thurday, October 8 through Friday, October 16 to commemorate the 243rd anniversary of the Tiwamencin Encampment by George Washington and the Continental Army. Frequencies include 7.074 MHz on FT 8; 75, 40, and 20 meters for SSB and CW. Website: <www.w3t.info>.

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, October 18 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).

native "ALT" frequency that can be operator-programmed to any desired HF frequency. If that alternate frequency is in the band you've selected for your model, circuitry in the transceiver allows for operation of other digital soundcard modes, such as JS8 (default), PSK31, FT4, RTTY, and SSTV. For HF frequencies *outside* of the ham band version purchased, the Phaser may still serve as a simple yet accurate signal generator.

Dave designed this kit to be a basic yet highly effective transceiver when coupled with a computer and its soundcard, thereby enabling audio modulating / demodulating of digital signals. He achieves this by keeping parts count and cost down, and by using time-tested components, like the NE602 mixer, while capitalizing on value performance parts, such as the Silicon Labs Si5351 frequency generator and the simple PIC controlling it.

The Kit

One day, kit #89 arrived via USPS in a small Priority Mail shipping box. Though I wouldn't be able to start building the kit for a few days, I couldn't wait to open the box. Inside I found three small plastic envelopes: Two of those contained all the transceiver parts for the 40-meter version of the Phaser, and the third contained all the pieces and parts for the optional enclosure (*Photo A*). There was no printed documentation, and that turned out to be a good thing. While I was building the kit, the documentation was revised several times and would have made a printed manual quickly out-of-date. All the documentation for the kit is available online[4]. The documentation includes band-specific assembly manuals, schematics, an excellent troubleshooting guide, and the assembly manual for the optional enclosure.

The manual I used was Revision A.8 and I found that both Dave and George do a great job keeping the documentation current based on feedback from builders posting their experiences, issues, comments, and questions at the Phaser discussion forum. I would encourage anyone thinking about purchasing or building this kit to peruse the messages posted on the forum. The messages posted there contain a wealth of pertinent information and kitbuilders can benefit from the experience and mistakes of others. Perhaps the biggest benefit of the forum is that Dave and George are there to provide answers to many questions. It's a great customer service. Thinking back to my

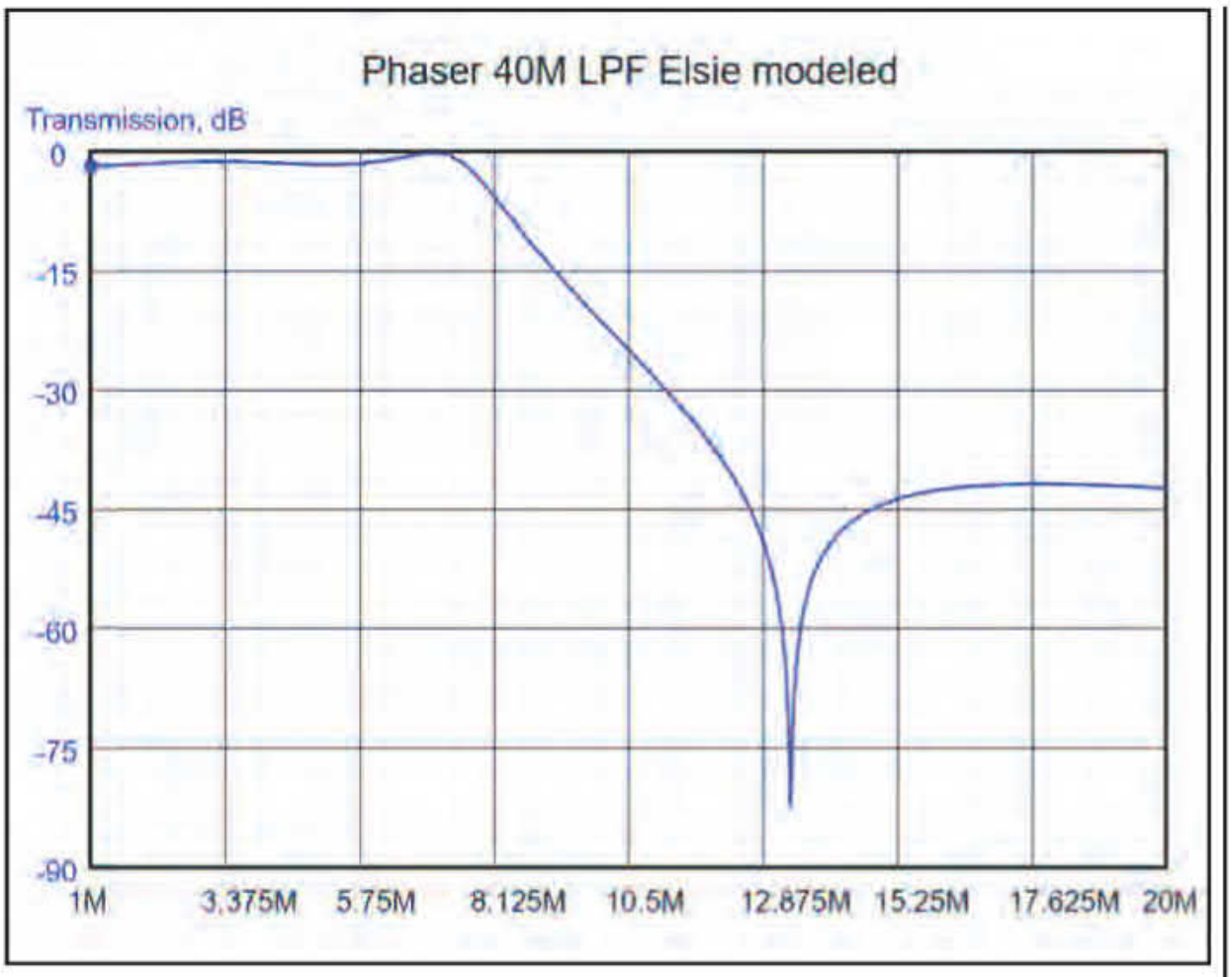


Figure 2. Modeled frequency response for the Phaser's 40-meter low-pass filter. The X-axis shows frequency (the "M" stands for megahertz, not meters!). Note the predicted sharp dropoff above 7 MHz. See Figure 3 for the measured frequency response.

early days building Heathkits and other designs, I am reminded that we easily take for granted the rapid access to relevant information we have today. It would have helped me better solve problems and issues that I encountered in constructing those kits if I had a forum where I could receive almost immediate feedback and suggestions.

A lot of attention has been paid to making the Phaser documentation and the kit itself "builder-friendly." For example, the assembly manuals are designed so that if they are printed in a double-sided format, the instruction steps are enumerated on the left-hand page while the component placement for that step is graphically illustrated on the right-hand page. No searching around a silkscreen layout for the parts locations and I found it helpful to use a highlighter to "check-off" the parts on the pictorial as they were installed.

An even better example of the care and attention that Midnight Design Solutions has shown is demonstrated by the "Parts Cards" used to package the kit's numerous parts. With the many other kits that I've constructed over the years, I am used to receiving bags of parts that are only sometimes organized by component type. Never have I seen the "kitting" method used by Midnight Design Solutions. Each component is secured with tape to a heavyweight paper card with corresponding part number(s). This virtually eliminates, or at least speeds, the first step encountered with all kits, the tedious inventory and sorting of bags of parts. I understand this is the brainchild of Larry, K3PEG, and in this kit, he has created separate cards for capacitors, resistors, semiconductors, band specific components, connectors, enameled wire, and miscellaneous components. However, I did find that the kit I received was missing one 2-pin male header and two of the 2-pin female jumpers. Based on forum comments, I knew that George would readily replace these missing components but, since I had these on hand in my "junk box," I didn't bother to ask for them. As recommended in the manual, I placed all the "parts cards" upright in a small cardboard box for safekeeping and pulled components from the index-like cards as I progressed through each assembly step.

Anticipating that some builders will need more help than provided in the assembly manual, Dave and George authored an excellent troubleshooting guide (available online). That guide also provides general suggestions to ensure the best possible kit construction. Since it contains additional step-by-step suggestions to narrow down problems and

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3CX1200D7	4CX10000A	845
3CX1200Z7	4CX15000A	6146B
3CX1500A7	4CX20000B	3-500ZG
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their potential solutions, the builder may use this troubleshooting guide to dive deeper if encountering initial testing issues. Also included are versions of the Phaser schematic diagrams calling out the DC and AC voltages that should be present at various test points on the PCB. Of course, if a builder is still having problems after using the guide to troubleshoot, they can obtain almost immediate help by either reading about the problems / solutions other builders have encountered or posting their specific issue / question to the discussion forum. In the rare situation in which the problem is narrowed down to a defective component or mis-programmed PIC, replacement parts have been provided to the builder.

The printed circuit board (PCB) is roughly 4- x 4- x 1/16-inch fiberglass with etched copper cladding on both sides for an effective ground plane; holes are through-plated, a solder mask is provided with a silk-screen layout of component part numbers and critical orientations, including electrolytic capacitor polarity, diode cathode bands, and indexing for the semiconductors. The PCB has seven surface mount components that have already been factory installed, so the builder needn't worry about difficulty soldering fine pitched component leads.

While looking over the parts, I initially thought I might also be missing Q4 but found it on the "band specific" parts card with the heatsink already soldered onto its tab. That meant I wouldn't need to break out my large 3/8-inch chisel-style soldering iron to quickly heat and solder those parts together. I was also briefly confused when checking the 78L33 3.3-volt regulator (U8) as the component number on the package was 89M110E KY5033 TI. A quick search verified that part was correct, as did forum comments from others encountering the same confusion. By the way, the builder will find it helpful to read these component values using an LED flashlight, illuminating the part at an oblique angle to make the lettering stand out. The kit provided a pair of #28 AWG wires already twisted together for construction of the bifilar wound toroid (T1), so there would be no need to use my hand drill to twist those.

Building the Kit

I found that assembly can be done with the usual kit-building tools, including small conical-tipped soldering iron, small diameter rosin core solder, diagonal cutters to snip the component leads flush with the PCB, a pair of tweezers, needle-nosed pliers, and a multimeter. I also found a small hobby knife helpful in removing the tape holding components to the "Parts Cards." While optional to the builder, using a PCB vise to hold the board was very helpful when I placed the parts and then flipped the board over to solder and clip leads. These days, I also take steps to avoid electrostatic discharge (ESD) when I construct circuits, using a static dissipative mat and properly grounded wrist strap as I work. While this is always good practice, it is especially important in the winter when the dry air and carpet in my station conspire to generate large static "shocks" as I move around.

Beyond the tools to build the kit, anyone constructing a Phaser with plans to use a laptop computer ought to consider purchasing a 4-pin TRSS (tip-ring-sleeve-sleeve) to dual 3-pin TRS (tip-ring-sleeve) audio adapter. My laptop has a single 4-pin TRSS jack to access both the headphone and microphone soundcard connections and I needed to adapt that

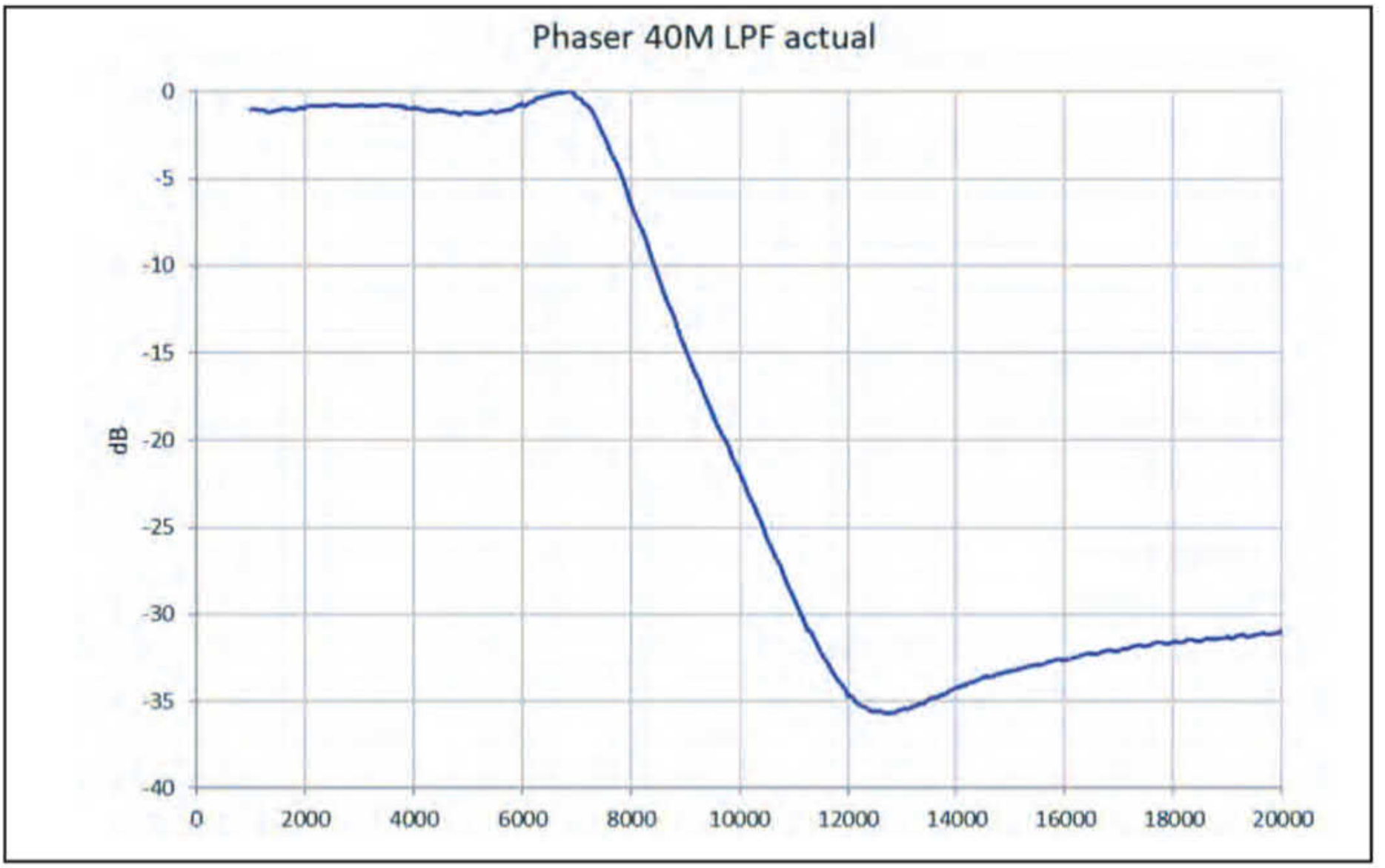

Figure 3. Actual frequency response for the 40-meter low-pass filter, showing the steep cutoff of frequencies above the 40-meter band.

connector type to the Phaser's two stereo 3-pin TRS audio connectors. Also, if you purchase the enclosure, I'd recommend using a longer 2.1-millimeter diameter male DC power connector. The one I had on hand was 10 millimeters long and I found that was too short to reliably mate to the Phaser's female power jack once the PCB was installed in the enclosure. The antenna connection is BNC, so plan accordingly if you use UHF connectors on feed lines as I do.

Based on the early comments from builders, I knew that some were having difficulty obtaining the expected 4 watts output from their fully-constructed kits and their solution may have involved removing turns from low-pass filter (LPF) toroidal inductors. Because of that, I decided that I would deviate from the recommended step-by-step instructions in the manual. I knew from other RF filter projects I had constructed that poor winding and turn spacing of the LPF toroids could result in lower power output and performance at the transmitter's operating frequency. So, I decided to build and test the LPF circuit on the PCB without any other circuitry and ensure that its response was optimal for 40 meters. Dave had included a nice description of the filter design in the theory of operation section of the assembly manual. To aid my further understanding, I used ELSIE filter simulation software[5] to model the LPF's predicted response, given specific 40-meter kit component values (see *Figure 2*). Then I wound and installed toroidal inductors L5 and L6, capacitors C22 – 25 and the BNC jack. This gave me convenient and isolated circuit connections so that I could use my SNA to sweep the filter with RF in to the power amplifier (PA) side of the circuit and measure the RF out of the filter at the BNC jack. I used a 16-ohm resistor across the PA side to simulate the 12.5-ohm impedance of the PA collector circuit that wasn't yet installed. After doing this, I found that compressing and expanding the toroid turn spacing on L5 and L6 did little to change their inductance or the filter's center frequency. The LPF response I measured with my SNA is graphed in *Figure 3*. While this approach did help me learn and validate that the filter's predicted and actual responses are very similar, I decided that with careful attention to the number of turns in construction of L5 and L6 as outlined in the manual's appendix, it was really unnecessary to test the LPF in this manner. I think the builder can just proceed with the construction sequence as recommended in the assembly manual and obtain effective results.

Photo B. One mod the author made in building the kit was the addition of a red "transmit" LED on the front panel. See discussion in text.

When installing any of the toroidal inductors on the PCB, be sure to carefully scrape off the enamel coating and pre-tin the wire with solder to ensure a good electrical connection. It also helps avoid future problems if you test the PCB pads to ensure there is continuity through the inductor, as an open connection here can be hard to find later.

Step-by-Step Assembly and Testing

The assembly manual groups the construction of the Phaser into six circuit blocks with each block tested before moving on to the next.

The first group focuses on constructing and testing the PCB's regulated +5 volts DC and +3.3 volts DC power supplies for the various semiconductor requirements. This step, like the subsequent ones, involves placing parts in their proper locations and paying careful attention to the orientation of the IC sockets and the flat sides of the voltage regulator TO92 packages against their corresponding silk-screened outlines. One thing that would have been helpful for the placement of the 19 – 0.1-µF capacitors is a check-box listing of each of these part numbers. As mentioned earlier, I instead used my highlighter to "check off" the capacitors on the manual's pictorial. After completing the Group 1 assembly, you test the voltages at various PCB test points called out on the pictorial before moving to the next step. Since the kit uses sockets for the ICs that are installed by the builder, I decided to also measure the VCC voltages at each socket. Note: my schematic didn't detail the +5 volt DC for U4 @ pin 8.

The second circuit block to be constructed is the transmit-receive (T-R) switching circuitry. Audio from the computer soundcard's speaker / headphone output serves to "key" the Phaser into transmit mode by sensing the audio-in voltage with a comparator (U9) and switches the transmit bias to drive the power amplifier (PA). Construction of the circuit is straightforward, though it would have been helpful here — and throughout the manual — to call out the resistors that are installed vertically in a separate listing from those that are installed flat on the PCB as the builder will want to bend the leads accordingly. The silkscreen makes this clear, but I like to bend the part leads before searching for their PCB locations. It is also helpful to straighten the pins on each IC, in this case U9, before trying to insert them into the sockets. That helps avoid bending a pin(s) under or away from the IC and it also makes it easier to insert the chip into its socket. To do this, I set the IC on its side with one row of pins against my static mat and roll it slightly to bend those pins into a more vertical orientation. I then do the same with the pins on the other side. I'd also suggest that as you line up the IC with the socket, you ensure that all pins rest between the two contact fingers of each socket location before pressing the IC down into the socket. That will ensure good contact mating for all the IC's pins and help avoid a bent pin. A

similar hint for installing other ICs is provided later in the manual.

When testing the T-R switching and measuring voltages, the builder toggles the "TUNE" button in the WSJT-X software to generate an audio tone that is fed into the Phaser and activates the T-R switching and TX bias. So, at this point in the assembly, I suggest downloading and installing the WSJT-X software.

Since I had zero experience with FT8, it took additional study to learn how to properly configure the software and adjust the soundcard settings. Reviewing the WSJT-X documentation and the Hinson tips, as suggested in the Phaser manual, really helped jumpstart my ability to understand and use FT8. While the WSJT-X download[6] is straightforward, I also had to change my laptop computer soundcard's speaker / headphone advanced properties setting to utilize 16-bit, 48000-Hz (DVD Quality) with no audio enhancements; mute system sounds in the volume mixer; set the speaker level to mid-scale and my microphone level to 10%; install Meinberg NTP software[7] and configure it so that my system clock was accurately synchronized. Fortunately, the Phaser assembly manual provides some key links and information in its appendix under "Quick Start."

I also had to configure the WSJT-X software using its File>Settings menu and enter my callsign, IARU region, set the mode to FT8, change band to 40 meters, and most importantly for the T-R switching test — set the PWR slider on the right side of the WSJT-X window to full scale (uppermost position). I found, with my laptop's soundcard output, when initially setting the PWR slider to mid-scale, my Phaser would not go into transmit. To ensure that I didn't have an issue with my laptop, I tested its audio out by connecting my headphones and listening while I activated the "TUNE" button in WSJT-X. That worked fine, so I removed my headphones and connected the Phaser. A TX LED indicator would have been helpful at this point (more on that later). Placing the PWR slider at full scale provided enough audio voltage to trigger the Phaser into transmit for the voltage test.

Warning: Once you complete the kit, avoid overstressing the PA … do not put the Phaser into transmit for more than 15 seconds. That will be plenty of time to measure the voltages and simulate an FT8 transmit cycle. Also, the builder should note that when the manual references the "top" pad test point, that is a reference to the rear of the board where the various jacks are located.

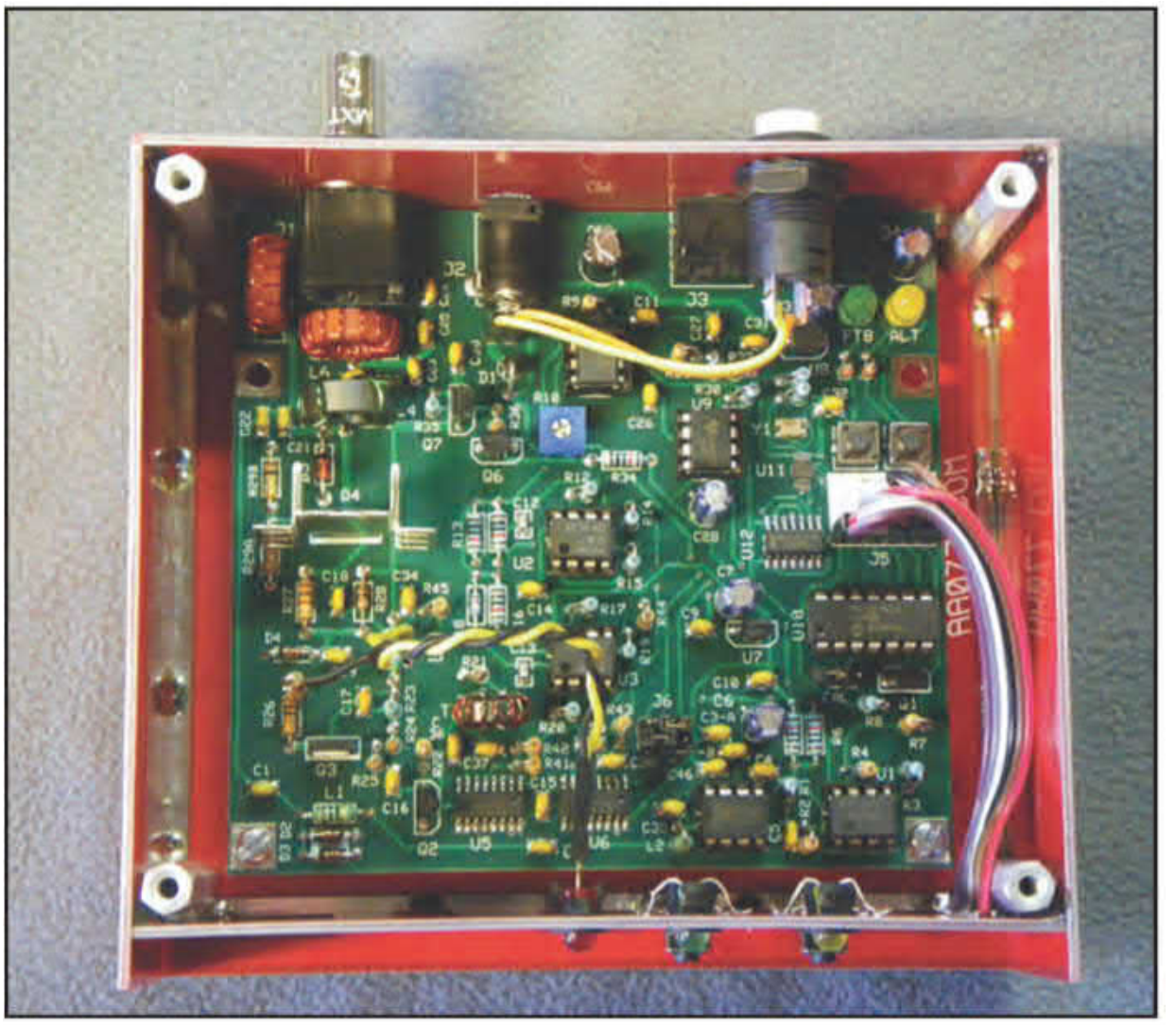

Photo C. The LED wiring is visible to the front left and center of the photo (see the twisted black and yellow wiring).

This orientation is later clarified in the manual when it calls for installation of the LEDs. When you measure the voltage according to the "Test #2 T-R Switching" instructions, the test point voltage should change from 0 volts DC to roughly the voltage level of whatever power supply you've connected to the Phaser's power input jack. When you stop the "TUNE" function in the WSJT-X software, the voltage will slowly drop as there is no bleeder load on the circuit to bring that voltage down quickly (your multimeter has a high impedance, so it will only slowly drain off the voltage). This test result was a source of confusion for several builders posting to the discussion forum.

The next construction phase involves the circuitry for the local oscillator. The builder places all the components necessary for an operational frequency generator on the PCB. The Phaser uses a PIC16F1824 microcontroller IC to pass the frequency instructions to the Silicon Labs Si5351A frequency generator. The PIC comes pre-programmed for the particular band version of the kit, using code written by Craig, AAØZZ, and monitors the two momentary switches, S1 and S2, for operator inputs to: 1) change the Phaser's frequency between FT8 default and the default "ALT" setting (originally the JS8 frequency); 2) place the Phaser into a user-programmable alternate frequency mode, allowing the "ALT" default frequency to be changed to any HF frequency; or 3) place the Phaser into a one-time calibration mode to set the Si5351A for an exact output frequency. In the case of the 40-meter version, the FT8 default frequency should be set at 7047.0 kHz and you'll use the "Calibration" procedure detailed in the manual appendix to fine-tune the output of the frequency generator circuit to place the carrier on that frequency. This procedure is easy to complete if you have access to an accurate frequency counter, but the assembly manual also provides alternate instructions to get close to the proper frequency by listening on another radio or by "peaking" the activity seen in the WSJT-X waterfall display. Some builders were not familiar with using a second radio to zero-beat the Phaser's frequency generator. More detailed instructions were provided in the discussion forum in response to these questions, explaining how to set the second radio in CW mode, tune to the desired frequency for the Phaser's carrier and then, using the CW sidetone, match the audio pitch of the Phaser's carrier by pressing S1 and S2

accordingly to either lower or raise the carrier frequency. It is important that once the Phaser's carrier is set to the proper frequency, you remove the "CAL" jumper BEFORE removing power to the Phaser. The Phaser's PIC stores the calibration parameters in its EEPROM memory only when the "CAL" jumper is removed with the Phaser powered "on."

Next, the builder focuses on adding all the components for an operational receiver … bandpass filter, NE602 mixer, audio amplifier, audio-out muting, and, in my case, the already installed LPF. While this construction was straightforward, I did find that I had to make my own audio hookup diagram to keep straight which jack was used for the computer's speaker / headphone output and which was used for the computer's microphone input. The manual labels these connections in terms of the Phaser's audio in and audio out, not the computer's audio in and audio out. Relabeling these connections in the manual's "Quick Start" instructions so they read speaker / headphone and microphone / line-in would be clearer … at least the way my brain works.

The next assembly step details the construction of the audio phasing network and the transmit buffer amplifier. While the construction was straightforward, I encountered a thorny issue with the testing of this section. When I commanded the WSJT-X software to "TUNE," I couldn't hear any output on my second radio. I checked that I had installed all the parts correctly with the proper component values and checked for obvious soldering defects. Upon finding that all was as it should be, I reviewed the schematic and realized that R10, the trimmer potentiometer controlling the audio level, would affect the TX signal. I found the trimmer was fully counterclockwise and I wasn't getting enough audio into the phasing network to create any signal at the transmit buffer amplifier. I confirmed the operation of the T-R switching by using my multimeter to measure the voltage change as described in the earlier test procedures for that circuit. Adjusting R10 fully clockwise, I could hear the upper sideband (USB) output at 7075.50 kHz, just where it should have been with WSJT-X set to "TUNE" with a transmit frequency of 1500 Hz.

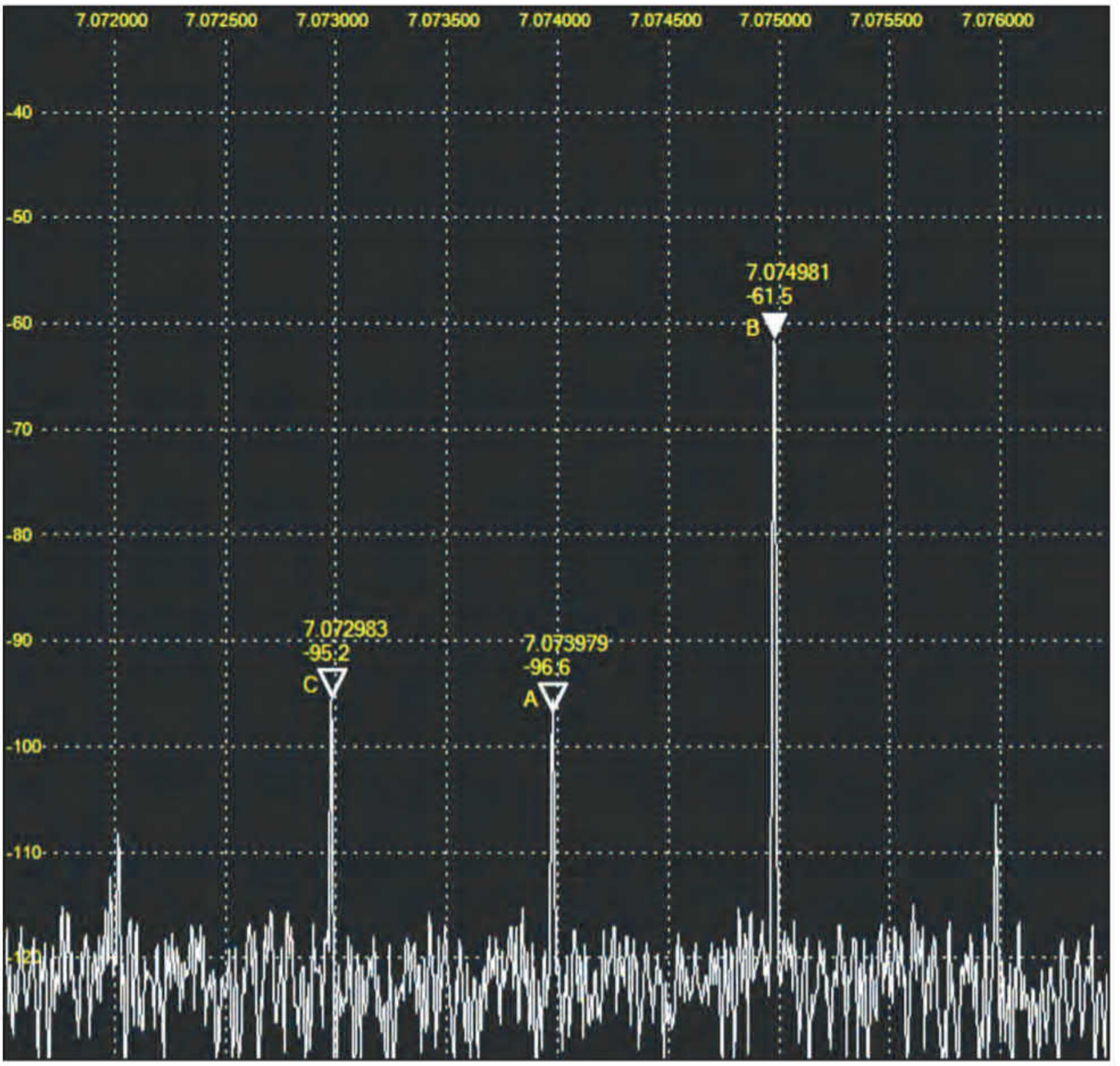

Figure 4. Spectrogram showing the more than 30-dB attenuation of the Phaser's carrier and lower sideband signal vs. the (desired) upper sideband signal.

Photo D. Rear panel of the Phaser enclosure. It is made from PC board material. Note the notches on the bottom and sides that help the pieces fit together more precisely.

At several points, I had issues with the level of the audio driving the radio. The soundcard settings are very critical to the Phaser's operation and this seems to be a common issue for others. As I alluded to earlier, I think these issues would have been easier to troubleshoot if the Phaser had a TX LED as a standard feature. That LED would provide an immediate visual indication that the Phaser's circuitry was being switched into TX-enabled mode. Later, when constructing the enclosure, I added a TX LED to the front panel as was suggested on the discussion forum. That modification will also help prevent inadvertently keying the Phaser in TX for more than 15 seconds. You can see this modification in *Photos B* and *C*.

The final assembly places all the remaining components on the PCB and completes the transmitter section. On the 40-meter version of the kit, the driver collector choke (L3) is placed in the PCB so that it is parallel to the left edge of the board. There is a second set of holes at the L3 PCB pads that is used in higher frequency band versions of the Phaser. Conveniently, this provided a TX enabled voltage pad that I later used to wire to the TX LED anode, with its cathode connected to a 1k-ohm resistor soldered to the ground side of nearby R26. Beyond the TX indication, who doesn't like blinking LED indicators?

Final Adjustment, Enclosure, and On-the-Air Testing

With the now completely assembled Phaser, I set about adjusting the TX audio levels as detailed in appendix 5 of the manual. Using a 13.8-volt DC power supply and with the R10 trimmer now fully counter-clockwise, I found that I had to adjust the WSJT-X "Pwr" slider on the right-hand side of that window to 90% to reliably place the Phaser in TX enable mode. Then, adjusting R10 to its fully clockwise position, I could obtain about 3 watts out, less than the expected 4 watts. In the discussion forum,

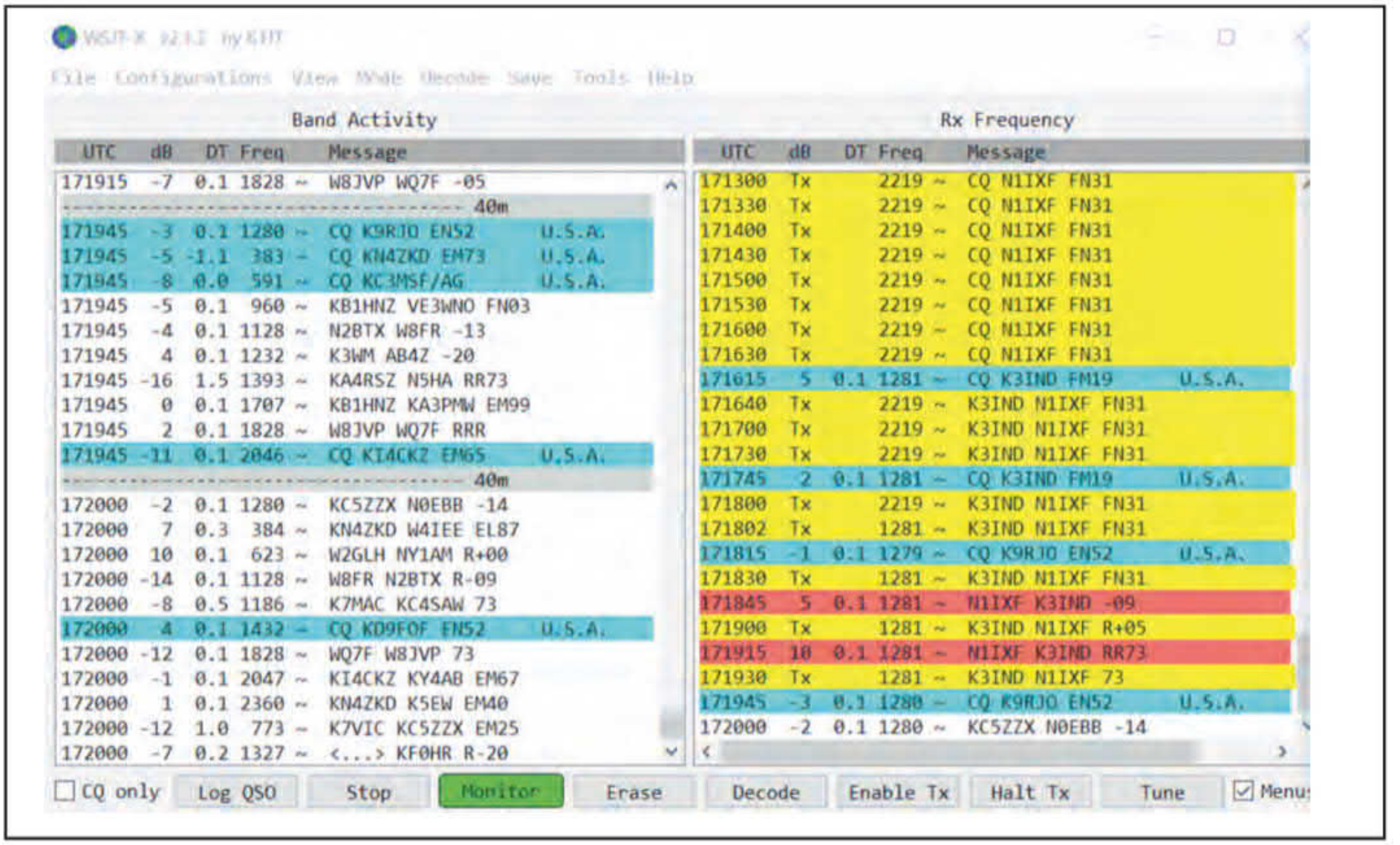

Figure 5. Screenshot of FT-8 QSO between K3IND, whose radio the author built, and N1IXF using that radio … proof that K3IND worked his own radio!

Dave had suggested using a parallel 10k resistor across R9 to lower that resistance to 5k ohms. I pulled the 10k resistor supplied with the kit and replaced it with a 5.1k-ohm resistor I had on hand. That modification gave me some needed adjustment range with the R10 trimmer and I was able to set the power output to 4 watts PEP without turning the trimmer fully clockwise. Success with building and adjusting the kit. Now I just needed to see if and how it works on-the-air.

Enclosure

The kit I constructed included the optional enclosure. I highly recommend that enclosure since it provides an attractive finished kit, shields and protects the Phaser's circuitry, and is easily assembled. I had never assembled a PCB enclosure that had mating slots cut into the edges. These slots not only help the builder ensure accurate alignment of the sides, they make for a much sturdier construction (see *Photo D*). One suggestion I would make to improve the enclosure would be to provide a hole or two in the bottom panel so that the builder could more reliably secure the PCB to the enclosure. The enclosure is designed so that the board is held in place only by the BNC panel-mount hardware and the board intentionally "floats" on stand-offs that are not attached to the enclosure. I found that the PCB moved too much when I inserted audio cables into their jacks and it was hard to get a reliable insertion. Over time, I think that might lead to problems so, if I were building the enclosure for myself, I would drill at least one hole in the bottom panel, add an appropriate stand-off and firmly secure two points of the PCB to the case. I also found that the additional thickness of the rear panel made it difficult to get a reliable power connection using my 10-millimeter-long, 2.5-millimeter male coaxial power plug. The finished Phaser kit installed in its enclosure measures about 5 inches wide by 4.5 inches deep and 2 inches high.

I own an RSP2/Pro SDRplay receiver and have recently coupled that with Steve Andrew's software[8] to have a very nice spectrum analyzer without spending any additional money. I thought it would be the perfect test tool to view the Phaser's transmit spectrum and see how much attenuation of the carrier and the unwanted LSB I was achieving. Since I wasn't sure what the power input limit of the RSP was and I didn't want to blow out the front end of my SDR, I used a small whip antenna on the SDR to pick up a sample of the Phaser's RF signal without any direct connection. I set the WSJT-X to send a 1000-Hz audio tone with the Phaser output connected to my 50-ohm dummy load. My results are detailed in *Figure 4* and they show the suppression of the lower sideband by almost -34 dB. While my test results are not absolute measurements, they still confirm the carrier and LSB suppression achieved by the Phaser's summing of the I and Q waveforms.

Summary

Beyond the fun and learning of the kit-building experience, I believe the Phaser represents a truly cost-effective way for a ham to engage in FT8 and other soundcard digital modes. This is especially the case for newer hams with HF privileges but not a lot of money to invest in radio or antennas. If they are willing to invest some time in kit building, they can experience the fun of DX. Additionally, the kit could easily form the basis for a club or instructor-led class in basic electronics or help hams looking to better understand radio.

The kit has plenty of modification possibilities … use an Arduino instead of the supplied PIC microcontroller to set the radio's frequency, provide a small frequency readout, change the user control interface, provide multiband capability with plug-in bandpass / low-pass filters, or serve as a signal generator with panel output of a wide range of frequencies. This transceiver could also form the basis of the perfect Field Day / portable FT8 station … easily battery / solar-powered and carried to any site.

On the Air

So, how did I do operating FT8 with the Phaser on the air for the first time? Well, my first FT8 contact was with VO1CH in Newfoundland and, within the first hour of some off-and-on operating, I had worked 10 stations in four countries. With a few hours over the next few days, I worked 50 more stations and 13 countries, and I even managed to work a sked with Rick, K3IND, the ham for whom I built the Phaser, so he could say he had worked his own radio (see WSJT-X screenshot in *Figure 5*). Pretty good for an FT8 noob.

The Phaser described here costs $90 ($55 for the kit; $25 for the optional enclosure, and $10 for USPS Priority shipping within the U.S.). Details for overseas buyers are on the Midnight Design Solutions website.

Notes:

1. <https://midnightdesignsolutions.com>
2. Benson and Heron, "First Look: Midnight Design Solutions Phaser Transceiver," *CQ*, February 2020, pp. 32-37
3. <https://groups.io/g/cwtd>
4. <https://midnightdesignsolutions.com/phaser>
5. <http://tonnesoftware.com/elsie.html>
6. <www.physics.princeton.edu/pulsar/k1jt/wsjtx.html>
7. <http://satsignal.eu/ntp/setup.html>
8. <www.sdrplay.com/spectrum-analyser>

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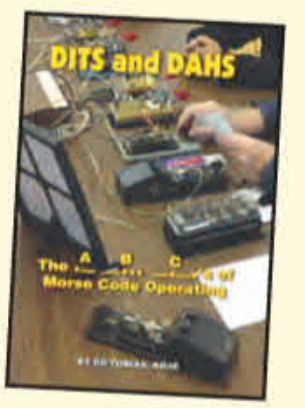

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CQ CLASSICS

Over the course of our 75th anniversary year, we have occasionally brought you personal stories of readers for whom amateur radio has had a big impact on their lives and careers. Here's one more, but with a twist … frequent *CQ* contributor Stew Gillmor, W1FK, shared this story of how ham radio helped shape his career back in our July, 1980 issue! We're reprinting it here as this month's "CQ Classic," followed by an update from Stew on the 40 years since! – W2VU

The author with his first amateur rig, a National SW-54 all-band receiver and a homebrew 807 transmitter, in 1953. →

The author on a tower with 10 and 20 meter beams in 1955. ↓

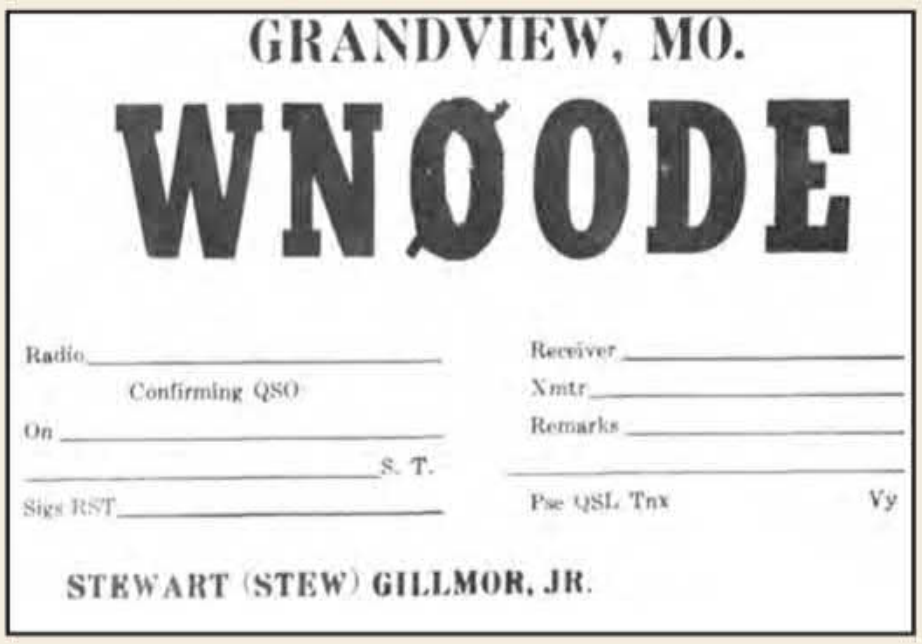
Amateur radio has led some of us into very active careers in electronics. Many of us can relate to WIFK's start in amateur radio and many newcomers today are experiencing a form of it now. . . all with the same excitement.

Amateur Radio. . . A Hobby For All Seasons

BY C. STEWART GILLMOR, W1FK

I first became interested in radio about 1947 as a Cub Scout, when I got a Morse Code buzzer and built a crystal set. Later, as a Boy Scout, I built a three-tube regenerative receiver and earned a radio merit badge. While working on the Scout badge I learned something about the existence of amateur radio. It seemed very exciting to be able to talk to other persons around the world from your own room. One day my dad told me that his cousin Charles, who lived in Independence, Missouri, was an amateur operator (WØHKC). I was an eighth grader at the time and my first visit to cousin Charles' shack was like a fantasy vision. His car had a mobile rig, and his basement study seemed to be full of exotic gear, including a "bug" key, a chrome-plated microphone, and several radios with more meters and dials than I had ever seen.

The result of this visit was that one Saturday morning I went from my home in Grandview, Missouri down to Burstein-Applebee Radio on McGee Street in Kansas City. There I bought the ARRL "how to" manuals—"How to Become a Radio Amateur," "The Radio Amateur's License Manual," and "Learning the Radiotelegraph Code"—which cost 25¢ and 50¢ in those days. Armed with these I studied the code and radio theory and tried to listen to code on our RCA Victor record player and radio console. Unknown to me, one Fall day in 1952 my dad went over to Burstein-Applebee on his lunch hour and talked to a salesman, Clyde Fritz, WØDXE about an amateur receiver for a beginner. So on Christmas Day 1952 my folks surprised me with a National SW-54 all-band receiver. This fixed me for good and within six weeks I went to the Federal Building in Kansas City, went up to about the 2000th floor, and stepped off the elevator into a large, nearly deserted room. I remember the floors were highly polished, there were several long tables with chairs, lots of ceiling lights, and offices off to



The author's first QSL card, circa 1953, with the Ø printed from a linoleum block.

the side. I was in the Kansas City District Office of the FCC, I was there on the wrong day, and I was terrified!

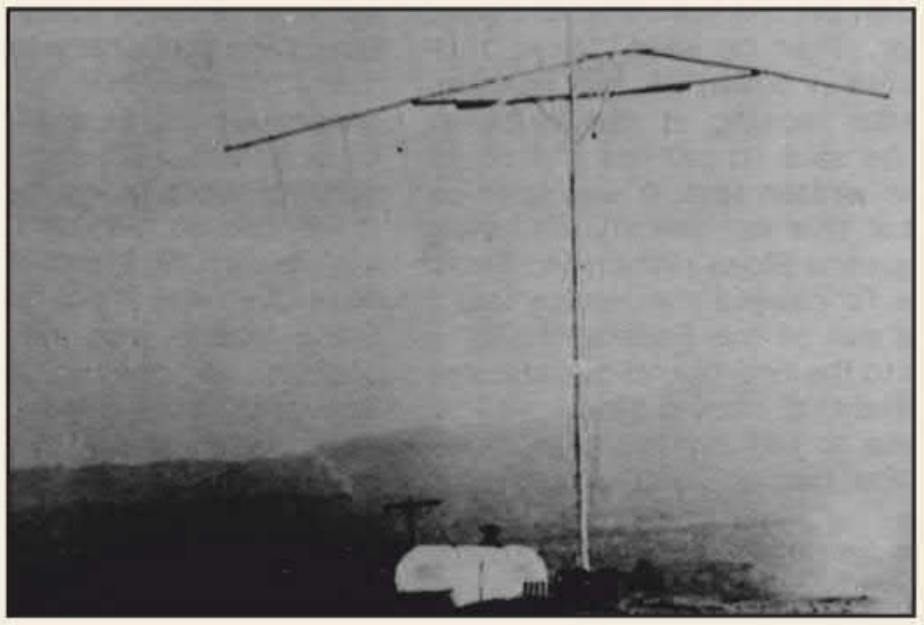
A man appeared after a few minutes and asked me what I wanted. Since I had the ARRL code and license manuals in my hand, it was pretty obvious why I was there. I said I had heard that one could take the test for a Novice radio license and that I thought maybe.. ."Well," he said, "You're here at the wrong time, but sit down anyway, put on these earphones, and listen to this code." He played it through once; the paper tape slowly ran off the machine and onto the floor. Then he said, "Now, this time, write it down." A few minutes later, after looking at my scribbled words, he said I'd passed and could take the written test. (I was later to learn that this wonderfully kind man was Clarence Bloss.) When Mr. Bloss told me I'd passed the Novice test I skipped out of the Federal Building and ran to the Greyhound bus station, so excited that I could hardly wait to get home to tell my folks. In those days, you had to wait about four months for your ticket to come through, and there was no such thing as instant upgrading.

In the meantime, I poured over catalogs and wondered what kind of transmitter I could afford to build. Finally, it appeared that my cousin Charles had a homebuilt 807 rig with an output of about 50 watts. It needed some modifications, and crystals and coils for bands other than 80 meters, but it worked. It was a three-tube rig built on an old TV-set chassis, with oscillator tube, buffer-multiplier, and final tube. So I was all set. I put my station up in our attic and ran 65 feet of 600 ohm open-wire tuned feeders out the window to a 130-foot-long end-fed wire about 25 feet off the ground. This antenna was known as a half-wave Zepp because it had been used on the German Zeppelin airships. I was now all set, with r.f. ready to spray all over our property, since I had no decent r.f. ground. The transmitter chassis and key jack were always good for an r.f. burn, helped no doubt by the 52 ohm coax piece I ran from the 807 output to the antenna switch and open-wire feeders. Doubtless this scenario is familiar to many of you—that is, the probable consequences of a 14-year-old who knew all about d.c circuits and nearly nothing about r.f.

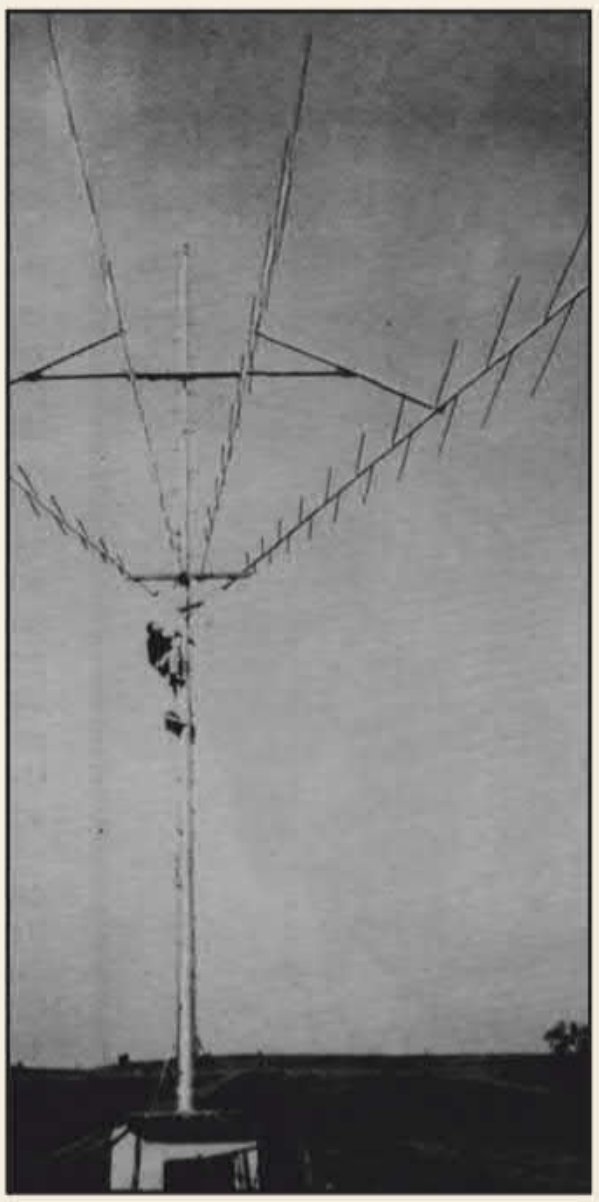
We had gotten our first TV set in the Fall of 1952 and its rabbit ears were just one floor below my rig. Since there was no bottom nor cabinet on my rig except for a fibreboard front panel, I was a good source of local TVI. Our nearest neighbor was about 200 yards away, and no one seemed to be bothered save for my own family. No operating during "I Love Lucy," "Mr. Peepers," and the Saturday night "Rassling With Russ" from the Chicago Amphitheatre!

I had great respect for OOs (Official Observers) and for FCC Inspectors, who I suspected monitored each amateur's every word. I scrupulously kept the rig off the air until the day in May 1953 when I received my Novice call, WNØODE. Once 80 meters opened up at night, the little National SW-54's quarter inch of Novice band on the dial kept my beginner's ear from being able to read anybody, since I heard about six signals at a time. My first several evenings were a great disappointment, since I didn't succeed in working anybody. I then decided my best chance was to get up at dawn and try early mornings. This paid off; my first QSO was with "Red" (WØANK) in Diagonal, Iowa. I was so excited I barely got any of the QSO, but Red sent me a card saying I was 589. Red was using a Harvey- Wells TBS-50 transmitter with 40 watts out of a single 807, and a Hallicrafters S40B receiver to a half- wave off-center fed wire.

I hadn't received any QSL card samples through the mail and I didn't realize there were commercial QSL printers, so I got our grade school principal to print some QSL cards for me on a little press in his basement, but I had to carve the zero-slash (Ø) sign out of a piece of linoleum block for him. In an attempt to improve my reception, my cousin loaned me a receiver he'd built, but it worked no better for me than it did for him and I went back to the SW-54. I put in a Summer working mostly 80 meters, although I occasionally tried 40 meters, the only other h.f. band available at that time to Novices. Novices were, however, allowed phone privileges on 2 meters. For a few days at a Boy Scout Jamboree I got to use a 2 meter Gonset Communicator, but talking over two or three miles didn't seem too exciting. So in the Fall I planned to get ready for my General Class exam.



The 84 element, 4 boom log periodic array and trailer, with the antenna in operation, 1960.



The log periodic array with the antenna in the storage position.

To prepare for the General Code test I debated whether or not to enroll in the Candler Code System course. Ted McElroy was the world champion at receiving c.w. (75.2 w.p.m. in a 1939 test in North Carolina, so the ads said) and he endorsed the Candler System. I figured that I was okay at the code, and so instead of the Candler course I rented a spring-wound paper tape machine for one month from the Instructograph Company of Chicago. This machine could produce code at from 3 to 40 w.p.m. Now this was probably a pretty good idea, but it took so long for the machine to arrive that I used it only one day before I went down again to see Clarence Bloss at the FCC office. I remember Mr. Bloss really had to stretch to find 13 words in a string. In fact, I lacked one letter of having the minimum 13 word string. I had the word "BE—R." Bloss said to me, "Well, what letter do you think might go there?" I first thought of BEER but then decided the government probably wouldn't put the word beer into an exam, so I said "BEAR." Fortunately, I was right! I barely snuck by the code but I did okay on the written part, except that I think I missed all the schematic questions. (In those days, about 10% of the questions involved actually drawing circuit diagrams on the exam sheets.)

I had been earning money working as a soda jerk at Lyons Drug Store in a nearby hamlet called Hickman Mills. One day, while goofing up on his order for a cherry coke, no ice, I met Bill, (WØZZV), who invited me over to see his shack. The result was that Bill loaned me a homebrew single-band 807 rig for 40 meter phone. Bill usually operated a beam on 20 meters but he also loaded his steel tower and got onto an evening farmer's net on 160. I never worked 160 in those days, but daytime 40 meter AM phone was about the same as nighttime 160 and I really enjoyed gassing away on 40. Bill's loaned rig was crystal controlled.

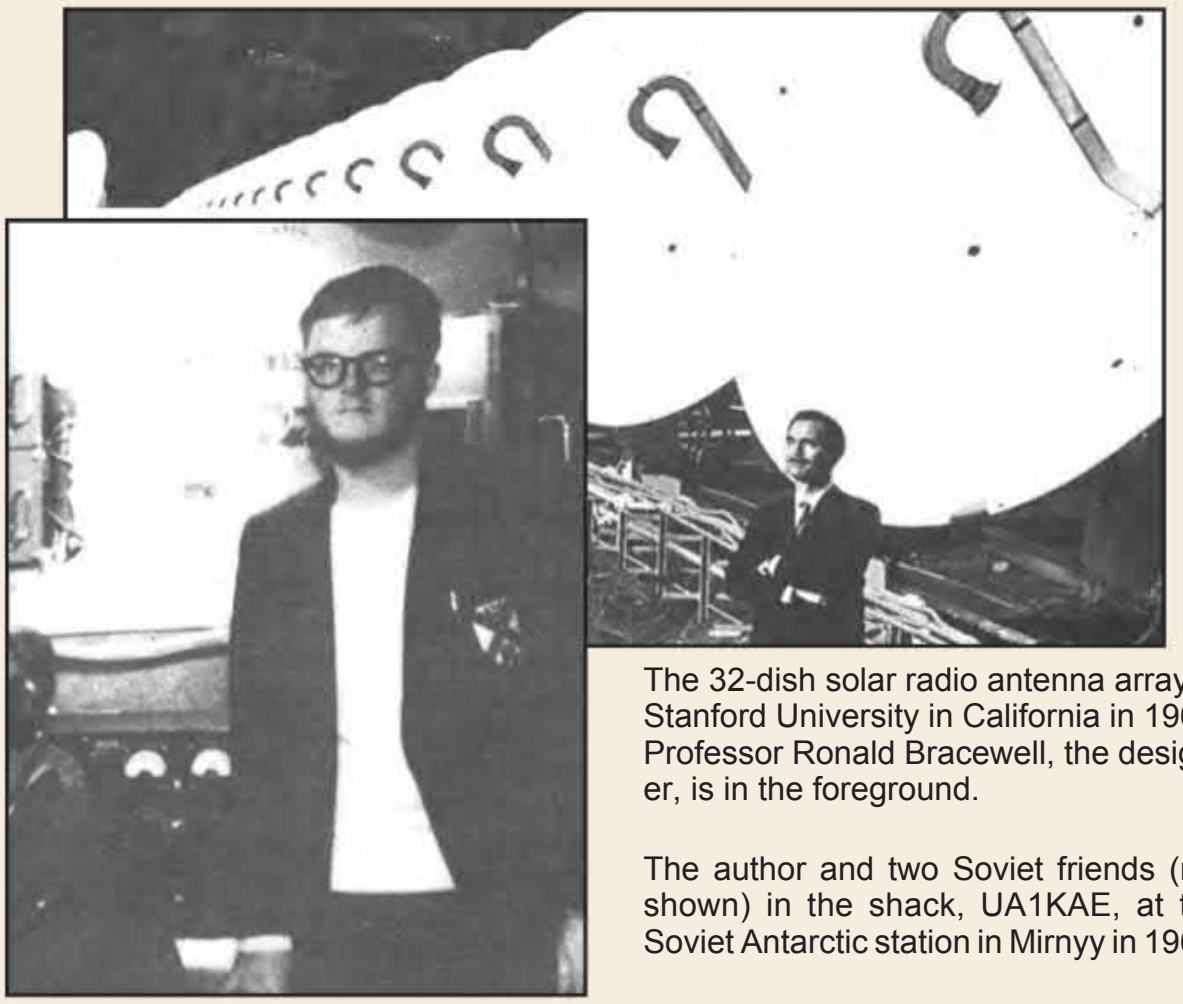
For those of you new to amateur radio it might seem difficult to believe today, but 25 years ago not only were Novices required to operate crystal-controlled rigs, but most other amateurs operated with crystals also, regardless of license. V.f.o.'s were sold separately, almost the way "linears" are sold separately today. Along the way I tried to build two v.f.o.'s, but neither ever worked quite right. At least part of this was my fault. I saved my money and the Viking Mobile V.F.O. Kit was the least expensive I could find. The trouble was that the mobile v.f.o. was about one-half as big as other v.f.o.'s and the only soldering iron I owned was a 200 watt job that was almost as big as the v.f.o. box. I *really* made a mess of it trying to solder the miniature tube sockets. Also, I had never heard of tools such as "solder suckers," etc. But it didn't matter all that much for, living in Missouri, I was not far from the center of the quartz crystal industry. Dozens of little outfits sold surplus crystals that oscillated in fundamental mode at frequencies up to about 10 MHz. Most amateurs purchased them in FT-243 holders, either playing safe and ordering them several kHz inside the band edges, or regrinding them.

Fooling around with crystals was fun and you had less than a buck to lose if you ruined one. Several methods of crystal grinding existed but most people followed instructions in the ARRL handbook. First you unscrewed the three screws on the cover of the little crystal holder, removed the crystal blank, and marked one corner with a pencil. Then you placed some grinding powder, or even toothpaste, on a piece of glass. Next you placed the crystal on the glass, put your index finger on a

corner of the crystal, and proceeded to make several "figure eight" motions with each corner of the crystal. After doing the four corners on each side, this would suffice to raise a 7 MHz crystal, for example, several kHz in frequency. You could even lower the frequency a little by rubbing the corners with a lead pencil. Too much of this fiddling, however, and you would end up having a crystal with uneven edges and corners and it would stop oscillating. 80 meter crystals doubled into the 40 meter band. 40 meter crystals doubled into 20 meters and sometimes tripled into 15 meters.Some people used 10.5 MHz crystals to double to 15 meters. Being "rock bound" wasn't too much of a handicap since most people called CQ and then listened up and down the band 10 kHz or so. Transceivers were almost unheard of, and nearly everyone was working "split," as we say today.

My family later moved to Kansas City, and I eventually upgraded to a used National NC-183D receiver and a Globe King 400 watt transmitter. I put up 3-element beams for 10 and 20 meters. I caught antenna fever about then and my beams were the first in a long series of h.f. antennas which I would build over the years. I worked mostly 40 and 20 meters in those days. I totaled a meager 16 countries in confirmed DX but I was more concerned with getting all 48 states. I still had three or four states to go for WAS when I sold my gear to go to college.

Once I got to Stanford University in California I started to hang around a part of the electrical engineering department called the Radio Propagation Lab (later called the Radio-science Lab). Several of the professors there were amateurs, the most famous being Mike Villard, W6QYT. Villard was instrumental in putting the first hi-power amateur s.s.b. transmitter on the air and was the inventor of the famous "Select-O-Ject" audio filter circuit, which the National Company sold as an accessory and also put into some of their receivers. Owen Garriott, the first amateur/astronaut, was a graduate student there when I was a student. Besides Villard, there were several other interesting professors. Ronald Bracewell was in the midst of constructing a 32-dish cross-shaped interferometer



The 32-dish solar radio antenna array at Stanford University in California in 1968. Professor Ronald Bracewell, the designer, is in the foreground.

The author and two Soviet friends (not shown) in the shack, UA1KAE, at the Soviet Antarctic station in Mirnyy in 1961.

antenna array on centimeter wavelengths to measure micro-wave radiation across the sun's disk each day. I worked for Bracewell for a time helping clean earwig insects out of the waveguides with a long pole and a rag.

The secret to Bracewell's 32-dish array was transmission line theory and the use of Fourier analysis, a fascinating but difficult mathematical technique that is part of all engineering and physics majors' curricula today. My work, though conceptually not too difficult, was important, since an apparent change in signal from the array could be, for example, a change in noise from the sun or noise interference from a local ground source. Or, it could be due to a change in the dielectric constant within the waveguide caused by a family of earwigs strolling down the inside on their way to a nest!

The experience of being an amateur put me in good stead with Bracewell as it did also when I got a part-time job at Stanford Research Institute, where Professor Allen Peterson of Stanford was a consultant. At SRI I got to build lots of gear and antennas, including 10 meter yagis flown on a large airplane, v.l.f. antennas, and other interesting projects. While working for SRI one summer as a student I was sent to the Azores Islands. While there I noted strange (to me) noise phenomena on the h.f. bands. Upon my return to Stanford, Professor Peterson suggested I had observed some solar radio bursts and said I should look into it further. To make the story short, Professor Bracewell and a colleague, Professor Von Eshleman, helped me with advice and materials when I decided to build a radio astronomy telescope for solar and Jupiter radio studies in the frequency range 20-60 MHz. Villard loaned me two 50 foot towers and I started to build a large 50 foot by 100 foot corner reflector at Bracewell's solar astronomy field site. I designed the corner reflector feed to receive circularly polarized waves, so my corner reflector mesh had to have both horizontal and vertical wires. I didn't have any mesh so I started to solder copper wire, joint by joint, to make a mesh with squares about one-half meter on a side. (Reflecting surfaces on such antennas, if not solid, should have mesh no larger than 1/16 to 1/10 wavelength to keep losses low and front-to-back ratio high.) When the mesh was well along in construction, it was destroyed by dairy cows which were allowed to roam over the Stanford field sites. I can still remember coming up one morning and seeing a giant tangled ball of copper wire which a cow had dragged all over the field.

Professor Eshleman bailed me out of this by offering me the use of an old

Looking Ahead...

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

- Memories of JY1
- Results: 2020 CQ WPX SSB Contest
- An Old-School Counter and Digital Dial

Plus…

- The Texas Star Multiband Antenna
- The HexBeam Revisited
- Antennas During the Pandemic

Upcoming Special Issues:

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

Do you have a hobby radio story to tell? Something for one of our specials? *CQ* covers the entire radio hobby. See our writers' guidelines on the CQ website at <http://bit.ly/2qBFOdU>.

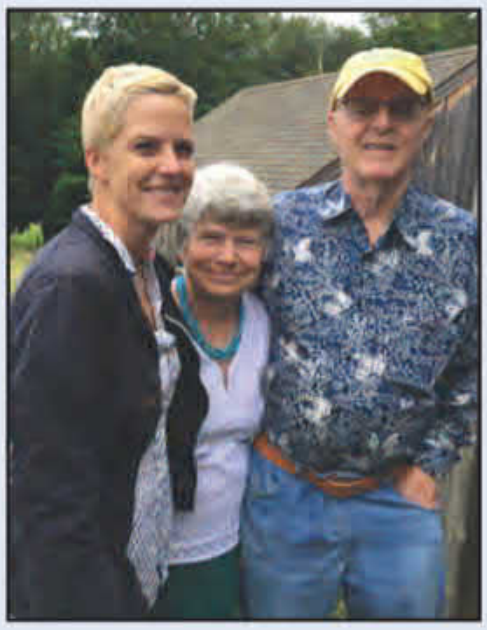
So What Have You Done for the Last 40 Years?

BY STEW GILLMOR,* W1FK

We asked Stew to give us a brief update on his life and career from the time his now-classic article was published in 1980 until the present. Here's his update. –W2VU

Following up on my activities after the early 1960s, as described in my *CQ* article of 40 years ago, I continued my education with graduate work at Colorado and then Princeton Universities. During graduate school, I was surprised to learn that "Mt. Gillmor" in the Antarctic had been named for me. Finishing my Ph.D., I began a career of 40 years teaching at Wesleyan University in Middletown, Connecticut. I retired in 2007 as Professor of History and Science.

One of the rewards of university teaching is the chance to work at other locations on research leave, which I was able to do in Paris (twice); Cambridge, England; and NASA, among others, as well as four years at Stanford. Another life interest of mine has been music. In the '80s and '90s, I led an 11-piece jazz orchestra. I also recorded and played with others around New England, in New York City, and New Orleans. The most musical fun was being the volunteer advisor to the Wesleyan University Pep Band for almost four decades.



The Gillmor family today … from right to left, Stew, W1FK; his wife, Rogene, and their daughter, Alison, all standing in front of the family vineyard in Connecticut. (Photo courtesy W1FK)

Most of my publications (two books and four edited books, plus over 50 papers) concerned physics and engineering and their history. These included a lot of ionospheric and magnetospheric physics, as well as sociological and survey studies of the composition and growth of an international science community. My last book, *Fred Terman at Stanford*, (Stanford U. Press, 2004), is supposed to come out in a Chinese edition this winter.

The most rewarding thing for me as a teacher has been following the careers of my students. This list contains the chief medical director of a national children's medical system, a U.S. state governor, a very wealthy Silicon Valley engineer, newspaper editors, a U.S. national security intelligence executive, lawyers, writers, teachers, and more.

I have enjoyed writing occasional articles for *73* and *CQ* magazines over the past 40 plus years. My 100-foot cedar antenna pole and its six long "v" beams (*CQ*, Oct 2007) have survived the woodpeckers, but I lost several of the homemade 600-ohm feedlines in a hurricane about 7 years ago and the XYL wouldn't let me climb the pole after I turned 70. I have enjoyed telling *CQ* readers about my contact with hams while visiting Chile, Mexico, arctic Sweden, Jordan, and Cornwall, England over the past dozen years. At my retirement in 2007, I joined my wife's long interest in gardening by working with her to design and build a one-acre wine vineyard where we produce about four or five wines each year for self-enjoyment and for charity.

And finally, circling back to my boyhood, I clearly remember my early interest in physical sciences and my introduction to radio through the Cub and Boy Scouts and ham radio and its continuing influence on my career over the decades.

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trailer and a rotating steel pole which had formerly been used for meteor radar studies. Since I now had the possibility of building a moveable antenna, I designed a log periodic array to go along with my sweep receiver—oscilloscope—film camera setup. I cajoled various student friends to help me. These were usually amateurs who simply couldn't resist helping on antenna projects. Somehow the chance to help cut off the top of a 6-inch steel pipe with a welding torch while 40 feet in the air seemed irresistible. Professor Eshleman mentioned that, instead of my making a large array from scratch, he would loan me some extra parts left over from a big log periodic string array he was constructing for solar radar studies. I gladly accepted his offer. I extended the steel pole from 40 to 60 feet in height and added a large crossbar. I then joined four aluminum booms each with 21 elements to form a vertically polarized, 84 element log periodic array moveable in azimuth by motor and in elevation by hand pulley and ropes.

This array received well except near 26 MHz. This was attributed to coupling of the 26 MHz quarter-wave element sections, which were positioned extremely close to the steel pole. The antenna had approximately a 13 db gain from 20 to 100 MHz, and beam-widths of 40 degrees in the E-plane and 60 degrees in the H-plane. Each of the four booms was 40 feet long. This tied in with amateur radio again when I used the array in the Fall of 1960. *QST* magazine cooperated with me in securing the assistance of amateurs in the western U.S. and Canada to monitor radio noise before, during, and after a solar eclipse. One of my fellow students worked on the analysis of this data after I left Stanford.

I left the university in late Fall 1960 to join the Upper Atmosphere and Space Physics group at the National Bureau of Standards at Boulder, Colorado. In this capacity I went as a guest ionospheric physicist with the Sixth Soviet Antarctic Expedition to Mirnyy, Antarctica, where I measured cosmic noise absorption at 30 MHz with a self-balancing receiver called a Riometer (See *73* magazine, June 1979). As in my previous jobs at Stanford University and at Stanford Research Institute, I am sure that my years of experience as an amateur helped me. There are many technical areas in which actual field experience is quite valuable. And amateur radio is a hobby in which one can gain this experience. For example, no one wanted to hire geologists in 1960, difficult as that may be to believe in 1980. Two of my friends, geology graduates, succeeded in getting good employment primarily because they were amateurs.

Young readers today might feel that ionospheric radio propagation and antennas don't offer the excitement they once did. Quite possibly true... but think of the other exciting areas into which you can be led by amateur radio: Solid-state electronics, micro-electronics design, noise and information theory, computers, environmental design (including consideration of TVI and other electromagnetic pollution problems), medical and space electronics, energy storage and transmission.... The list is *very* long and amateur radio can help you gain entrance into these areas.

The 12-volt power supply in KE3FL's garage is well used, but it could be even more useful, he thought, if there was a way for it to produce various lower voltage levels for projects with different power needs. A little digging and — voilà! – a new project for Phil, and now for you, to build …

Build an Adjustable Voltage Add-On For Your Power Supply

BY PHIL KARRAS,* KE3FL

Photo A. My garage Astron power supply.

This project started when I was looking at my Astron power supply that I use in the garage for various jobs (*Photo A*): Recharging batteries, running amateur radios, running a DC battery drill, etc. I was thinking that it would be nice if the Astron could also have an adjustable output voltage for things that don't require 12.0-13.8 volts DC.

With this in mind, I went web-diving to search for adjustable power supplies and I came across the following description: "DC 4V-40V to 1.25-36V Buck Converter 200W 8A Module,"[1](*Photo B*; less than $6 on Amazon) which I thought would fit the bill by giving me an adjustable power supply up to around 13 volts and up to 8 amps.

If you want to find a buck converter, try searching on "Buck Converter 200W 8A Module," If you leave off the power / amp limits, you'll find larger versions up to 20 amps, but most of those that I've seen do not have the large variable resistor to adjust the voltage. Instead, they have smaller resistors requiring a screwdriver to adjust the output voltage.

I also bought Volt-Amp display-meters (*Photo C*) to see the output voltage and current. They're available on eBay for less than $3. The ones I bought — listed as "DC 100V 10A LED Digital Display Volt Amp Meter" — required a minimum of 4 volts to run them and, since I wanted to see down to 1.2

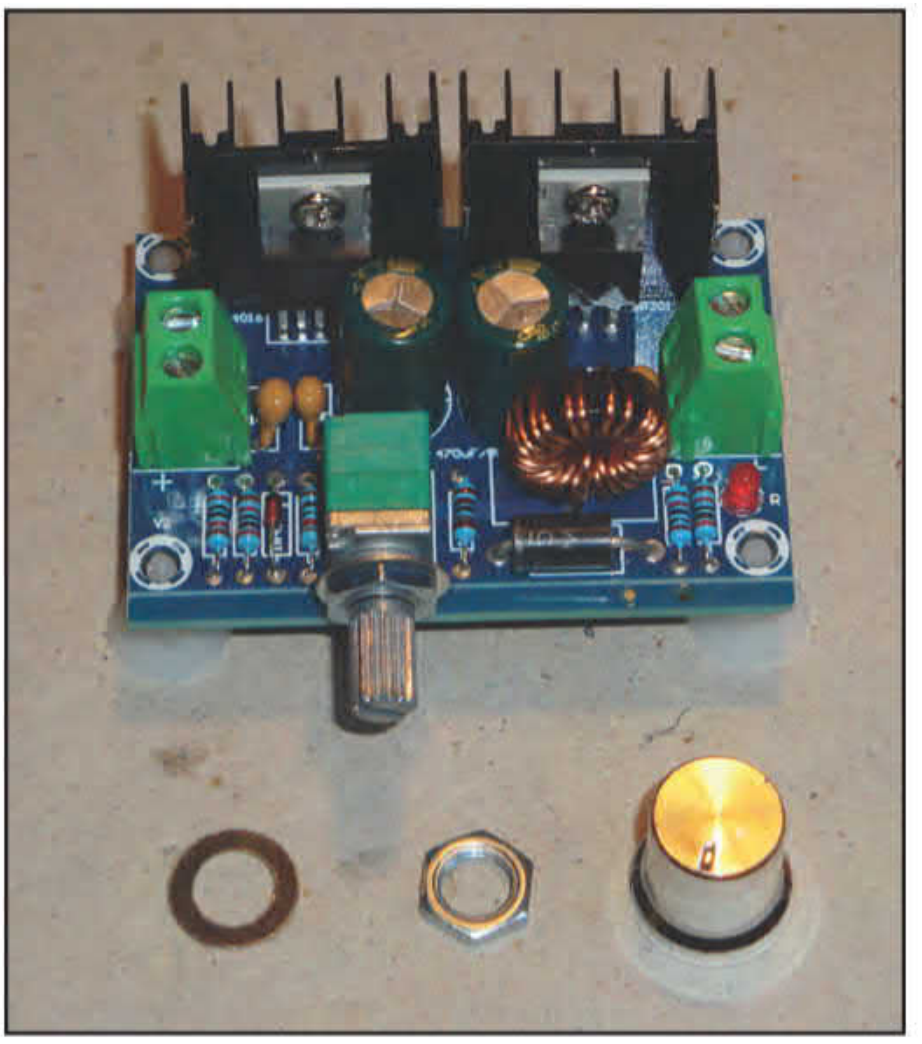


Photo B. The buck converter I purchased from Amazon.com.

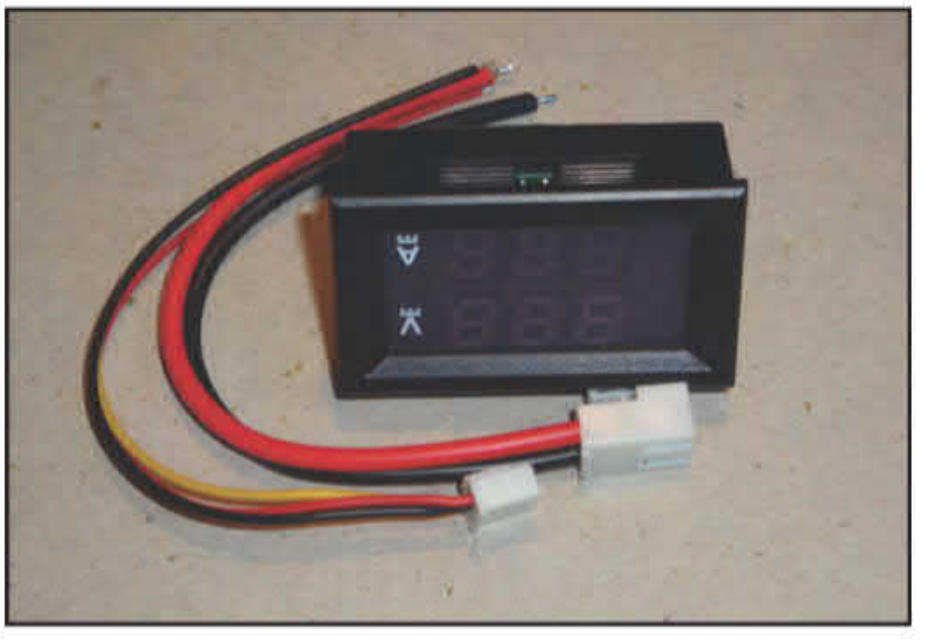


Photo C. A voltage and current display, available on eBay for about $3.

*Email: <ke3fl@yahoo.com>
KE3FL Website: <http://cs.yrex.com/ke3fl>
Karras' Corner: <http://blog.solidsignal.com/author/philk/>

Photo D. I needed to modify the voltage control knob in order to make it fit in my enclosure.

Photo E. Assembled buck converter and meter. →

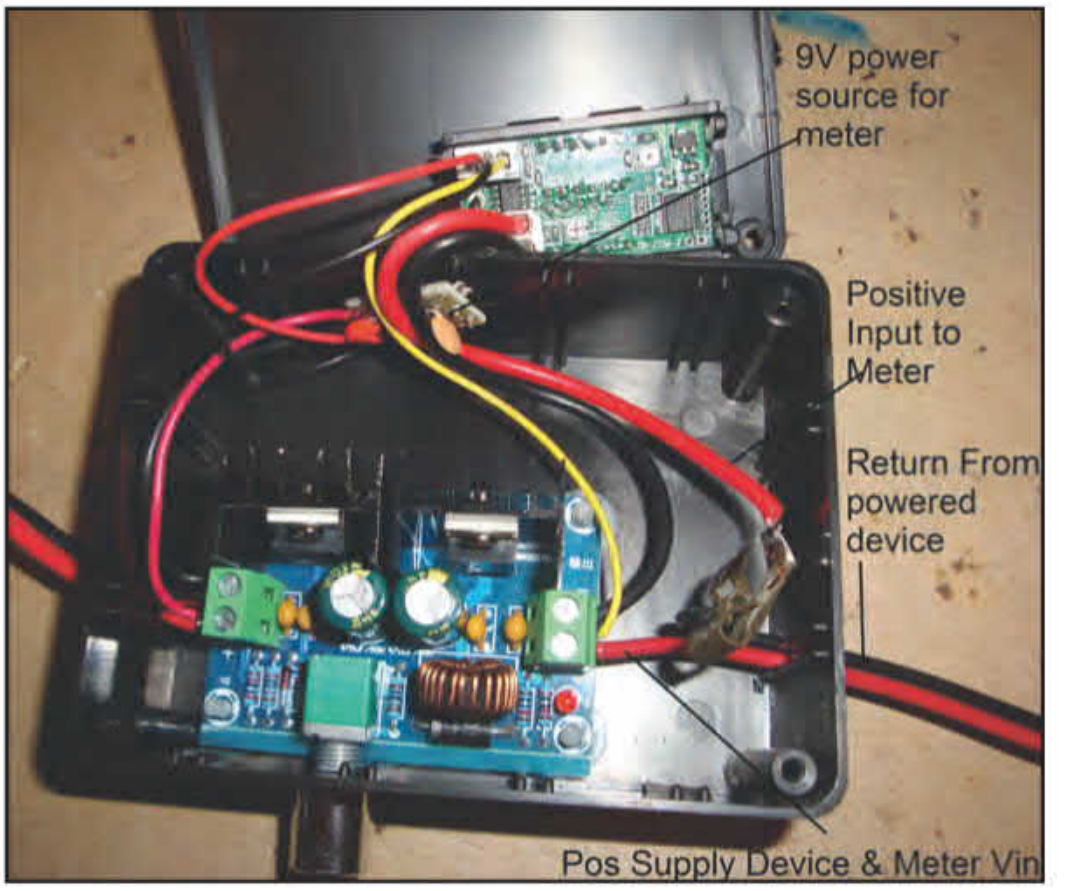


Photo F. Tools I used to modify the box included a file, a Swiss Army knife, and a Dremel® tool.

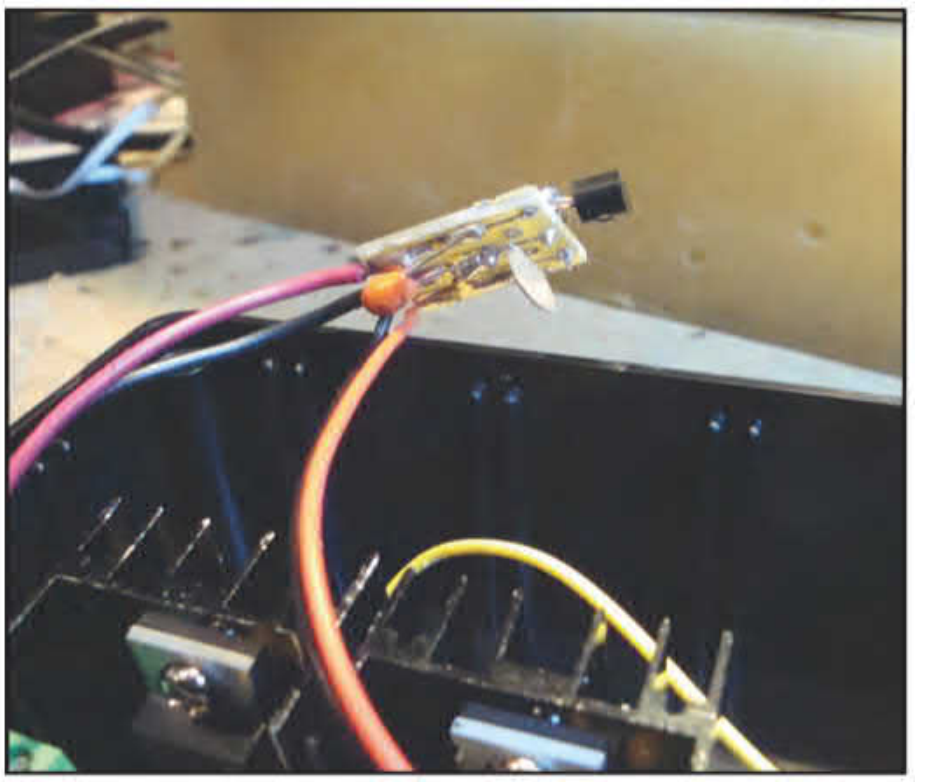


Photo G. Close-up of the 9-volt power supply board needed to power the display.

volts, I also built a 9-volt, 100-mA supply using a small 7809 regulator. If you want to find the displays on eBay, try searching on "Digital LED DC Voltage / Current Display / Meter."

The one mistake the manufacturer made with the boards I purchased was that the resistor pot was recessed on the board and so I had to come up with a work-around. I chose to modify the knob as seen in *Photo D*. The newer boards now have the pot closer to the edge of the board so it can be mounted inside a box without any modifications.

Measure Twice, Drill Once

Putting this all together took me about four hours of measuring, drilling, cutting, and filing. I also wanted to be able to replace any of the parts / boards, so I modified a few things to allow all wires coming in to be either screwed or clamped to other wires or boards. In *Photo E*, the buck converter is in the box, the display is attached to the lid of the box, and the 9-volt board is tucked safely behind some large power wires. I also labeled some of the wires in this photo. You can see that all wires are either screwed or clip-connected for easy removal and replacement of any of the boards, if needed.

To attach the display to the top cover, I used a Dremel® tool to cut the basic rectangle for the display. I then had to use a sharp knife to whittle away most of the excess and, last, a file to get it to fit as closely as I could make it (*Photo F*). *Photo G* is a close-up of the 7809 board, which provides 9 volts DC for the meter.

A Head-Scratcher

During my tests, I ran into a bit of a problem. The Volt-Amp display meter did not seem to be working correctly and it was measuring both the voltage and current much higher than they really were. It took me another day of testing to find the problem. In the end, I tripped over the problem by building a test setup for the displays using a 9-volt battery to supply power to the displays rather than my 9-volt circuit. All dis-

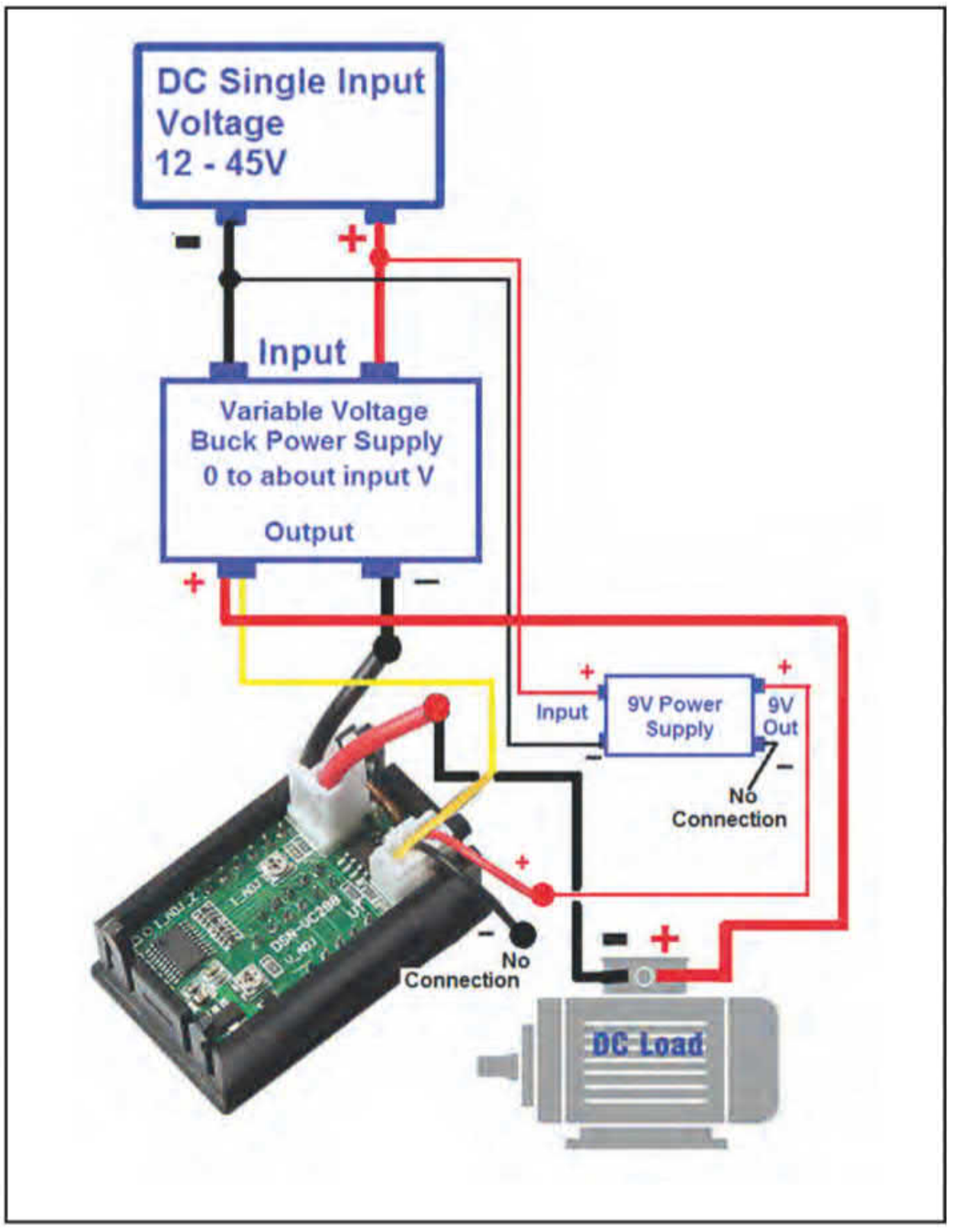


Figure 1. Common input power wiring for the buck converter, with my modifications to prevent a ground loop.

plays tested this way measured both voltage and current correctly within very reasonable errors. If they measured correctly with a battery but not my circuit, the problem had to be my circuit. But when tested, the circuit was working correctly and it was very stable.

This finally got me to thinking about ground loops. I disconnected the output return from the display that was going to the output return of the buck converter. This was easy to do because the display return wire was screwed into the output return of the buck converter. This fixed the problem of bad voltage and current readings. See the wiring diagram in *Figure 1*. In this version of the wiring diagram, you'll see where I have the wiring disconnected from the display's return.

To finish up, I used Anderson power connectors for both the input and output lines from the converter box so it can now be used with any of my larger single-voltage power supplies.

The last test was to adjust the output power to about 12 volts to run a 12-volt fluorescent lamp. In this test (*Photo H*), we see the meter showing that the voltage is 12.2 volts and the current is 0.54 amps.

The final image, *Photo I*, is of the converter box connected to my Astron SR-20A supply, and set to 9 volts output.

A possible enhancement I'm thinking about is attaching a flexible fiber to the buck converter's power-on LED and bringing it out to the top of the box to show when the converter is actually on.

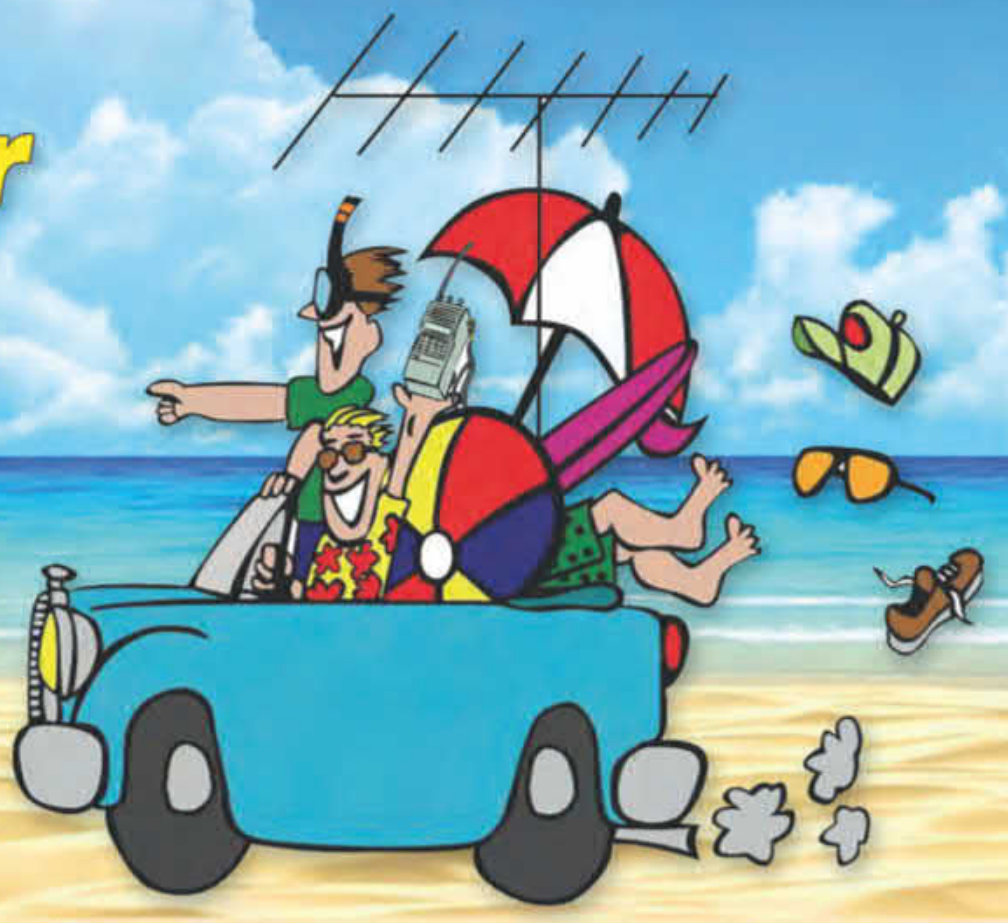
Notes:

1. The buck converter is used in SMPS (Switching Mode Power Supply) circuits where the DC output voltage needs to be lower than the DC input voltage. Read more at: <https://tinyurl.com/ybmvgxjtv>.

Photo H. Final test — setting the output to operate a 12-volt fluorescent lamp.

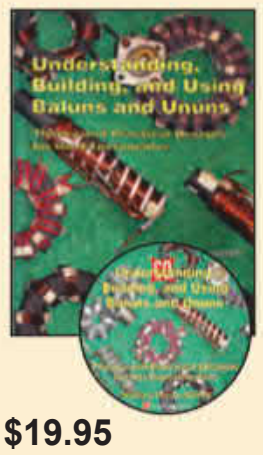
Photo I. Astron power supply and adjustable converter set to about 9 volts.

Get Ready for Summer!



Understanding, Building & Using Baluns & Ununs

by Jerry Sevick, W2FMI



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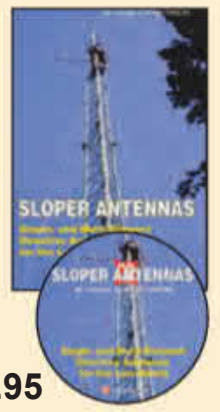

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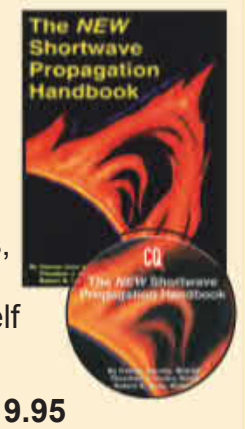

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Participants in the 1978 foxhunt in Schenectady, New York that included the author. Note the two participants wearing crash helmets … they were in the pickup truck with an 11-element beam and compass. And yes, they won! (Photo courtesy of Peter Miller)

Amateur radio direction finding, better known as "foxhunting," enjoys a long history. W4FSV writes about a recent foxhunt that triggered memories of another one 42 years earlier!

A Vintage Foxhunt, or … Two Hams in Crash Helmets

BY WILLIAM F. MINIKIEWICZ,* W4FSV

One of our local ham radio clubs recently held a foxhunt. It all started when a guest speaker at a recent club meeting gave an interesting and enlightening program detailing methodology and technology required in the 21st century quest for the elusive radio-fox. In recent times, there has been a good deal of interest in the "radio sport" of foxhunting, also known as hidden transmitter hunting or radio direction finding. It seems that the interest has spawned more than a few magazine articles (*including a regular column in* CQ *–ed*), as well as electronic gadgets to aid in the search for the RF-emitting *Caninae Vulpes* (Latin for fox).

It seems that today's premise is to find a tiny QRPp transmitter well-hidden in a location where nobody is likely to look. Our club foxhunt was so successful that the fox was never found. Yes, some hunters were close, but the prey survived to radiate another day. However, I think the event was a success. The most important thing about the hunt was that a few lessons were learned, a good meal was shared, and we got to work together. That fox won't get away next time.

* *Email: <w4fsv@breadboardradio.com>*

The Way We Were

Contemplating the day's activities, I started to reminisce about a foxhunt that I had organized with my good friend Howie, W2AFD (SK) about 42 years earlier. It was the beginning of spring in upstate New York and the snow had melted, the trees were budding and hams were ready to emerge from the winter captivity of their shacks. I was employed by the local ham radio store and was able to get the owner to

donate a few nice prizes to be awarded to the first three teams to locate the fox. The event was scheduled and advertised mostly by word of mouth and via 2-meter nets. By the day of the event, there were 11 teams signed up for our hunt. Each team consisted of two or three participants. It would have been difficult to be a lone fox hunter in 1978. We were hunting in an urban concrete jungle in an area of about 20 square miles. In a time without GPS, cell phones, laptops or miniaturization, teams used paper maps, a compass and 2-meter beams to triangulate the fox. When a team got close enough, they used attenuation and handheld transceivers to close in. In this case, the fox was operating from a parked car sitting in a secret location.

Gentlemen, Start Your Engines

All of the foxhunting teams started at the same time from a pre-designated location. The fox transmitted on a 2-meter simplex frequency and kept transmissions short and on schedule. Precisely at 9:00 a.m., the teams were eagerly waiting to get their first directional fix from the "fox." The rules stated that the "fox" would transmit for one minute every 10 minutes and decrease power by half every third transmission. This allowed teams time to obtain three triangulation fixes to zero in a little closer before the power reduction. We did not disclose who the fox was until he first came on the air at exactly 9:00 a.m. There was a sense of excitement and amusement when the first 1-minute message was transmitted: "Welcome to the hunt from your fox, WA2FOX!"

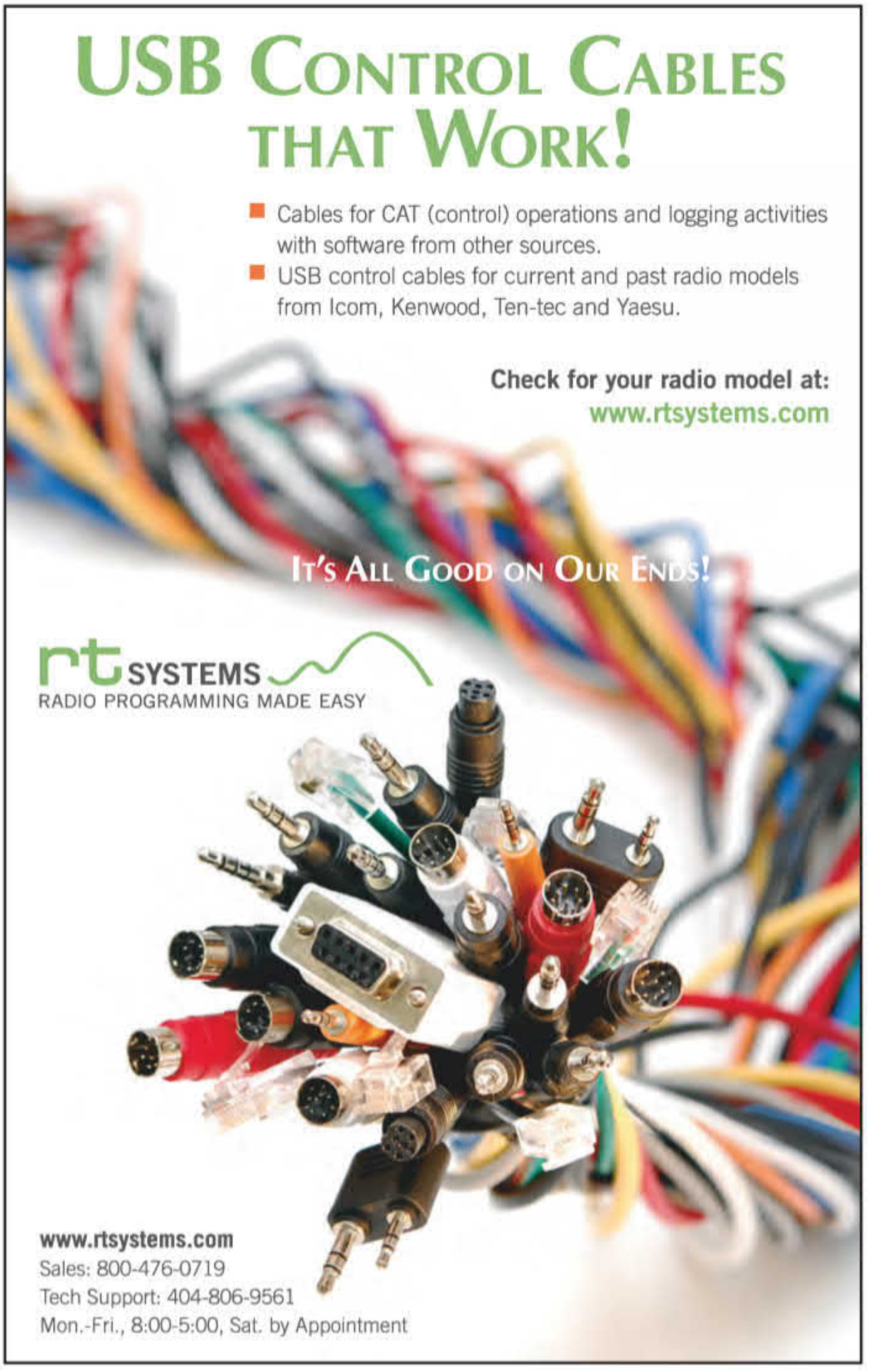
WA2FOX was a friend of mine who was not very active except on high frequency and so his call was new to most, if not all, of the hunters. After a few chuckles and "where did you find him" comments, the hunt was on. It was quite a scene to watch as teams worked to find their first heading. Most used two- and three-element handheld Yagis, but there was also a loop or two, a two-element quad, and one very interesting 11-element beam mounted on the back of a pickup truck. I am not sure how safe it was for the ham operating the beam and compass from the truck bed while the driver plotted headings on the map and drove at the same time, but at least they were wearing crash helmets! (see photo)

For the next two hours or so, the streets of Schenectady must have drawn some very interesting looks, comments and concerns from drivers and pedestrians alike, although, I am not aware of any police reports.

Winners, But No Losers

About 10:30 a.m. the first foxhunting team arrived to greet the fox and claim first-place glory. Sure enough, apparently there is some truth in the old adage, "size matters." The team with the 11-element beam mounted on the bed of the pickup truck was indeed the first to arrive. It was only a couple of minutes before the next several teams joined us in the parking lot of a city park, our secret location. By 11:00 a.m., all of the teams were present and accounted for. To celebrate our event, everyone was invited to a nearby Italian restaurant, where we all feasted on pizza and liquid refreshments while the winners received their prizes and we all shared team stories.

When I think about this vintage outing compared to today's foxhunts, one thing is apparent to me ... nothing changes, but nothing remains the same.



MATH'S NOTES

BY IRWIN MATH,* WA2NDM

Balanced Video

Many experimenters are well aware of the characteristics and benefits of both the balanced and unbalanced configurations for audio signals. Normal unbalanced audio can suffer from electrical noise induced in the transmission line while a balanced configuration tends to reject common-mode noise while preserving desired signal fidelity. *Figure 1* shows a comparison of both examples to indicate how they are wired. This month, we would like to expand on this topic but in the area of conventional analog *video* since the use of similar balanced transmission techniques for conventional unbalanced baseband CCTV video offers some interesting and unique opportunities for the experimenter. As many amateurs who enjoy amateur television (ATV) are still involved with "old fashioned" analog video, this technique may come in handy to some.

The most common and familiar method for transmitting a conventional analog video signal is with coaxial cable. In addition, conducting the actual video signal using coax is relatively inexpensive and provides some degree of shielding from outside noise sources due to the shielded center conductor. Coax does suffer from one problem, however. When you have to route an analog video signal from one point to another, the physical job of routing the coaxial cable can sometimes be a real headache, especially if you want a permanent, neat installation. This was the case in my home when we wanted to install a small closed-circuit television (CCTV) camera to monitor the front door from my shack in the basement. We had no way to route the coax from the camera (not to mention the camera power) through the brick wall that constitutes the front of my house since the only wires at all were the push-button

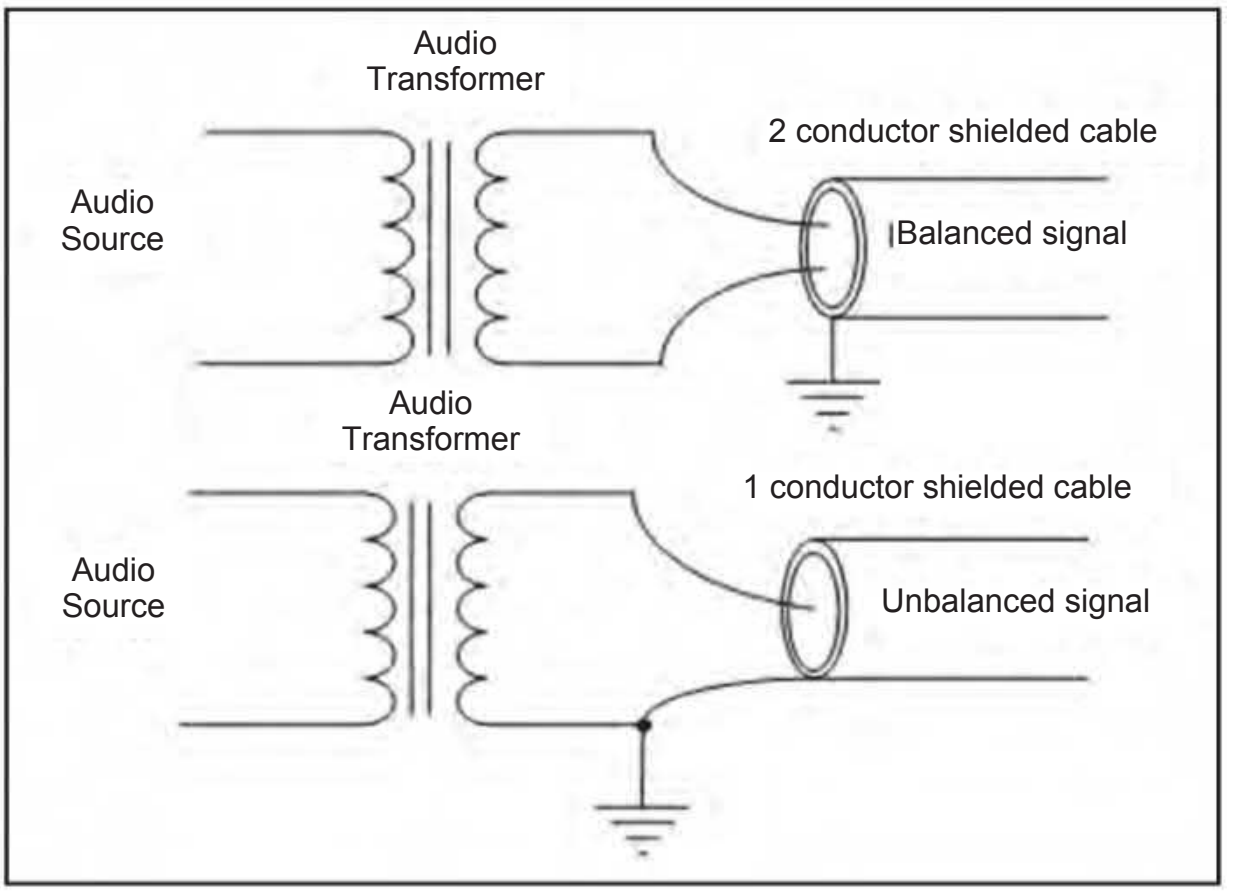


Figure 1. Balanced audio vs. unbalanced audio

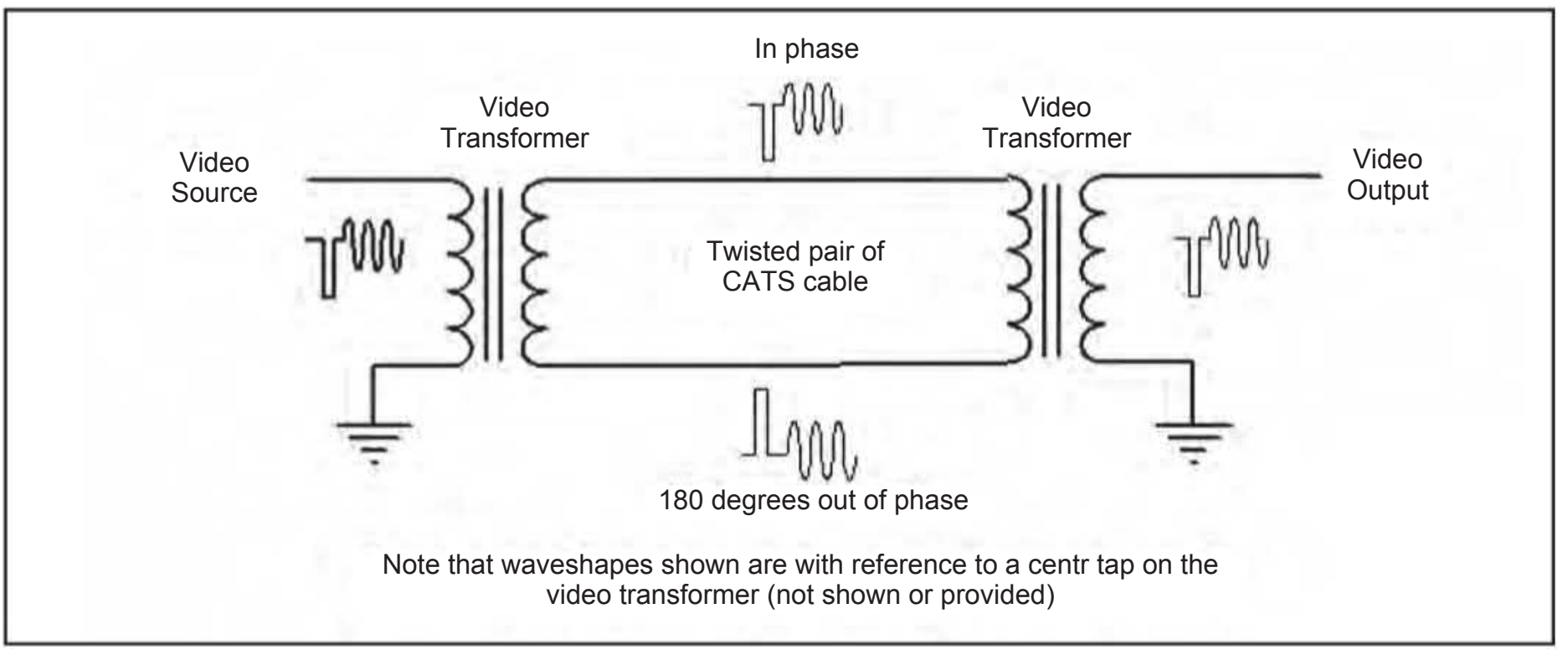


Figure 2. Balanced video showing typical waveshapes

*c/o CQ magazine

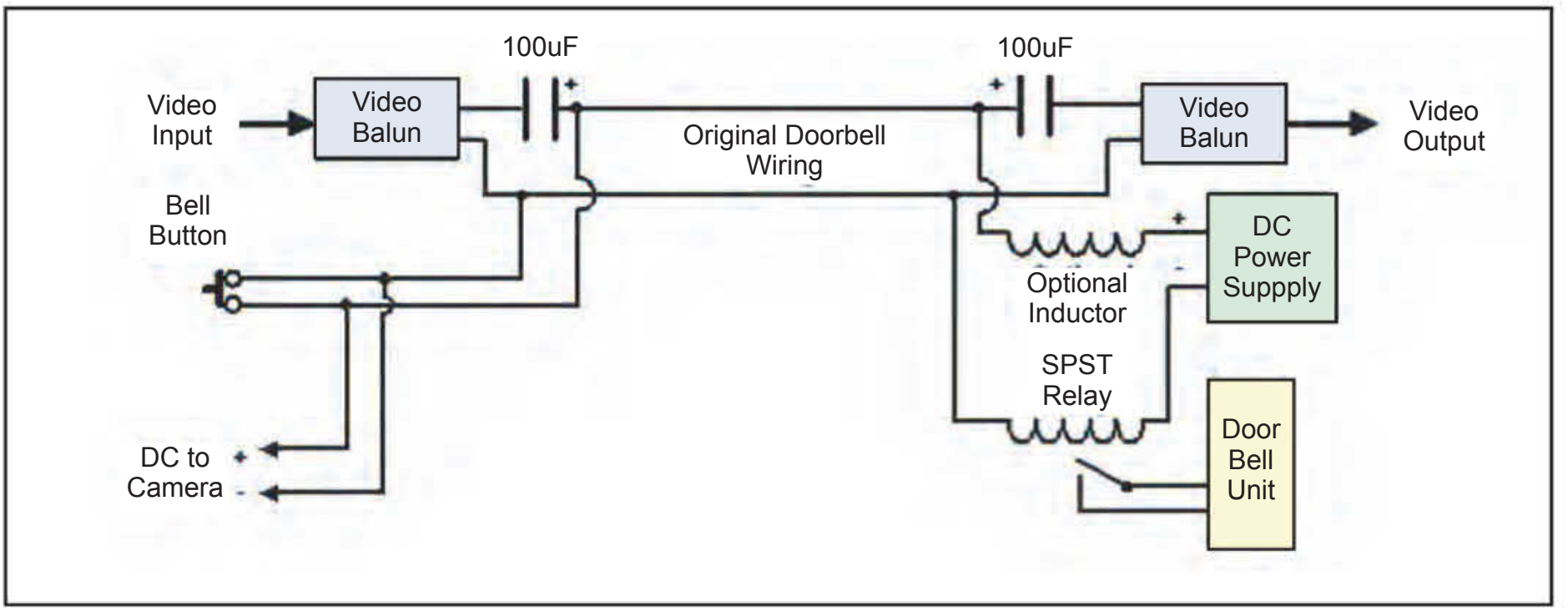


Figure 3. Final video doorbell circuit

leads from the existing doorbell button. However, those happened to be located in just the right place. After a bit of thought, I came up with a method of how to use these leads for both the doorbell and camera which resulted in the following neat solution.

There is a technique in use today with some CCTV installations that employs a simple twisted pair of wires, such as conductors in CAT5 cable or common telephone grade cable, for the transmission of video. This technique is similar to the audio scheme described above and operates by first converting the normally unbalanced video signal into a balanced differential signal. This is easily done with readily available transformers. The balanced signal is then applied to two copper conductors. At the receiving end another transformer converts the balanced signal back into a single-ended one. *Figure 2* shows this arrangement with the input and output unbalanced video and shows the two 180° out-of-phase in-between signals. Obviously, the transformer must have enough bandwidth to pass the 4- to 5-MHz baseband video signal, operate at the 75-ohm system impedance, and handle the 1-volt pp signal level. Fortunately, as I mentioned, such transformers exist. These transformers are called "video baluns," are fairly inexpensive, and are stocked by most of the larger security and CCTV accessory dealers. They are also readily available on the internet by a simple search. The connectors on these devices are BNCs on the video ends and RJ-45 type connectors or terminal blocks on the balanced ends. They are designed to work with non-shielded twisted pair cable and installation is simply "plug and play," as they say. Inexpensive "under $10" baluns (per pair) can often transport video signals hundreds or even thousands of feet, depending on the quality of the wire and the actual transformers used. Since we will be using two-conductor doorbell wire instead of a carefully manufactured twisted pair cable, this will be a real experimenter's project so the end results can be anything from spectacular to miserable. Obviously, this will require video baluns with terminal blocks instead of RJ-45 CAT 5 connectors.

Now to our final circuit. *Figure 3* shows the video camera / doorbell system. First, we modified the connections to the doorbell portion of the circuit by using a separate DC power supply and a small SPST normally-open relay. Note that the voltage from the power supply that is applied to the transmission line wires (in addition to the video) is DC. If the common AC doorbell voltage were to be used, this would interfere with the video signal so we had no choice but to use only DC. In addition, the camera also needs DC to operate, which simplified the camera end. Two terminal block style video baluns were used for the actual video signal and these were isolated from each other with two 100-µF capacitors, one on each end, so as to conduct the video but not short-circuit the DC. These capacitors could be increased in value if the low frequency portion of the video signal causes distortion or loss of stability with the monitor used. The relay and DC voltage were then chosen so that the normal current drawn by the video camera would not trigger the relay but was low enough to operate the camera properly. When the button is pushed, however, the additional current will short the camera but it will also increase it to the point where it will activate the relay and the doorbell will ring. Note that the impedance of the relay coil prevents shorting the video from the negative end of the power supply and the optional inductor prevents shorting the video from the positive end. These must be determined by experimentation for the parts you plan to use. The camera used was a low-cost device normally used for an automobile back-up camera (at 12 volts) but operated properly with less than a few mA at about 9 volts. The camera and relay power was obtained from a small low-power plug-in DC power supply.

The tiny video camera (which came with a hole saw for installation purposes) was mounted in a small plastic housing that also held the doorbell push-button and balun, and the result was a compact front door video monitor that did not require any coax over the 25-foot span to the monitor. The only actual "negative" with this setup is that the video is cut off temporarily when the push-button is pressed since it shorts the video line, but this did not cause any problem with our system. If you have a longer run, this "pseudo twisted" cable scheme may not work properly for you. You will then have to do some experimentation with relay coils, inductance values, and even capacitor values but you should be able to get it to work properly.

In my case, it did take a bit of work to get everything operating properly but the final result was just what I wanted. For those interested, the actual cost for everything including the camera did not exceed $35. – *73, Irwin, WA2NDM*

THE LISTENING POST

BY GERRY DEXTER

COVID-19 and Other Causes Keep Some Stations Off the Air

Other Stations Return, While Canadian CFVP Fixes a Water-Damaged Antenna Site

~ Radio Exterior de España had its foreign language services interrupted by the COVID-19 pandemic, but broadcasts resumed in early June. English begins at 2200 UTC, French at 2230 UTC, and Portuguese at 2300 UTC. REE uses 9690, 11685, 11940, and 12030 kHz.

~ Radio Nyawa Sarawak, a "new" one just a few months back, is now said to be off the air due to virus concerns. RNS used 11890 kHz and says it'll be back.

~ Denmark's World Music Radio (WMR) is back. The station is airing from 0700-2000 UTC on 15805 kHz. The broadcaster, based in Randers, is active Saturday and Sunday. Additionally, WMR has changed its reporting policy and will not confirm reports from receptions made on remote receivers.

~ The rumors about Radio Vanuatu, mentioned a column or two back, turned out to be true. RV is in operation 24 hours a day, namely at 0000-0700 UTC on 5040 kHz, 0700-1000 UTC on 3945 kHz, 1000-1830 UTC on 2485 kHz, 1830-0000 UTC on 3945 kHz, all of it in English.

~ All India Radio's site at Kuresong is in line to receive a 50-kilowatt transmitter. The previous 10-kilowatt facility ended its run at the end of July.

~ Harold Sellers has received word from an engineer at CFVP that the ground around the station's shortwave tower was found to be completely underwater. The engineer said that the station would have to replace a couple of grounding rods and the associated wire. Management hopes to be back on the air with their 100-watt Calgary station on 6030 kHz ASAP.

~ Egypt's Radio Cairo has been inactive for sometime, presumably because of transmitter problems

All India Radio is upping the power of its Kuresong outlet to 50 kilowatts.

~ Albania's Cerrik transmitter site, already inactive for several months, won't be on the air for some time, at least through the end of the A-20 broadcast period. No reason for the temporary closure of this CRI Relay was given.

~ Raydo Pilipinas has cancelled registrations for the A-20 season. And, in fact. it has not been noted active of late.

~ Islamic Republic of Iran Broadcasting's English schedule is currently on the air from 1520-1620 UTC on 7410 kHz from the Sirjan site, and from 1920-2020 UTC, also from Sirjan. There's also a report of 9665 kHz at just after 2020 UTC so the 2000+hour may not be fully accurate.

Reader Logs

Remember, your shortwave broadcast station logs are always welcome. But *please* be sure to double or triple space between the items, list each logging according to the **station's home country** and include your last name and state abbreviation after each. Also needed are spare QSLs, station schedules, brochures, pennants, station photos, and anything else you think would be of interest. The same holds for those amateur radio operators who also listen to shortwave broadcasts. I know you're out there. You, too, are most welcome to contribute!

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

ALASKA—**KNLS**, Anchor Point, 7355 with English sign-on at 1200 with announcements; it started out poor but was improving. (Sellers, BC) 9580 at 1128 in Russian, woman giving address, back to same man with an English hymn, 9735 at 1237 with man speaking in Mandarin with an apparent religious message. (Taylor, WI) 9730 at 1530 with woman speaking in Russian, 9760 also noted at 1530 with woman speaking in Chinese. (Barton, AZ)

**c/o CQ magazine*

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ALGERIA—**Radio Algerienne**, 7295 via **France** at 0520 with Qur'an recitations in Arabic. (Barton, AZ)

ASCENSION—**BBC-North Atlantic Relay**, 12095 at 2051 with promos and into program start with the usual Ascension squeal. (Taylor, WI) 15490 at 1945 in Hausa. (Brossell, WI)

BOLIVIA—**Radio Mosoj Chaski**, Cochabamba, 3310 at 1010 in Spanish, woman and man talking into indigenous music; reception was weak. (Taylor, WI)

BOTSWANA—**VOA Relay**, Mopeng Hill, 9885 at 1953 in Kinya, 15580 at 1939 on an endangered Hawaiian language. (Brossell, WI)

BRAZIL—(*All in Portuguese –GLD*)

Radio Clube do Para, Belem, 4885 at 0058 with ballads, man giving station ID and solid S-7 level. (Wood, MA)

Voz Missionaria, Florianapolis, 9665 at 2334 with an impassioned talk. (Brossell, WI)

Radio Nacional Amazonia, Brasilia, 11780 at 2230 with woman reading the news. (Barton, AZ) 0118 with Brazilian pop music, //6180. (Sellers, BC) 2040 with man and woman talking. (Brossell, WI)

CANADA—**CFRX**, Toronto at 1212 om 6070 with an interview on the pandemic and its impact on golf courses in Ontario. (Sellers, BC)

CHINA—**China Radio International**, 9415, Beijing at 2340 in Vietnamese; 9600-Kashi with news at 2104; 9630, Jinling at 2306 in Cantonese. (Brossell, WI) 9730, Beijing with drama program in English at 1316, //9870. (Sellers, BC) 11640, Jinhua at 0815 with man and woman speaking in Chinese; 12015 at 0815 with a powerful signal on an otherwise quiet band (at 1:15 a.m. local); 12015, Beijng with woman on schools in China. (Barton, AZ)

CNR-1 jammer, 6105 at 0113 from an unknown location and Radio Taiwan, with the jammer on top, woman and man alternating speaking in Mandarin, both //6180, CNR-1 was also //9555; Also 9555 with RTI-Kouhu at 2202 both in Mandarin and

China Radio International has (at least) suspended use of its Cerrik relay in Albania.

woman speaking over music; 1206 recheck had only the jammer. Others on 9680, 9585, and 15510. (Taylor, WI)

CUBA—Radio Progresso, 7465, Bejucal with jazz vocals from the '40s / '50s and male announcer in Spanish. (Barton, AZ)

Radio Havana Cuba, 6060, Bauta (frequency messed-up) at 0139 in English with *Mailbag* program, //6000 and 6145 were not on; 6060 in Spanish at 0205; 11800, Quivican (another mess-up), in Spanish at 0153 with Cuban music and spurs on 11810 and 11790. (Sellers, BC) 13780 at 1317 with Spanish station ID, several short bits by different people and several nearby interference "blobs." (Taylor, WI)

ECUADOR—HCJB / Radio Akhbar Mufriha, 7300 via **England** with man and woman speaking in Arabic at 2124. (Brossell, WI)

ENGLAND—BBC, 5930 via **Austria** at 0033 in Dari with a radio play. (Taylor, WI)

FRANCE—RFI, 7205, Issoudun in French at 2125. (Brossell, WI)

GREECE—Voice of Greece, 9420, Avlis at 2102 in Greek with music and announcements. (Brossell, WI); 2305 chant-like Greek vocals, female announcer with rechecks up to 0430. (Barton, AZ)

GUAM—Trans World Radio / KWTR, 9910, Medorn in Assamese with IS, station ID, and Southeast Asian music and male announcer. (Taylor, WI) 12035 in Thai at 1351. (Brossell, WI)

GUINEA—Radio Guineene, Conakry, at 2140 with commentary and announcements. (Brossell, WI)

INDIA—All India Radio, 9445, Bengaluru at 1905 ending news, then sub-continental music; 11560 at 1646 with talks in Russian. (Brossell, WI)

JAPAN—NHK Radio Japan, 7355 at 1100 switched to Russian at 1110; 12045 with pops at 1530 and man and woman speaking in Japanese. (Barton, AZ) 9820 via **Uzbekistan** at 0207 in Hindi man hosting South Asian music program. (Taylor, WI) 9855 via **Madagascar** at 2044 in French. (Brossell, WI)

Radio Nikkei One, 3925, Nagara at 1155 in Japanese but nearly buried by North Korean QRM from Voice of the People. (Sellers, BC) 6055 at 1144 with woman speaking in Japanese at length. (Taylor, WI)

MADAGASCAR—African Pathways Radio, 11825 at 0425 followed by a Bible message. (Sellers, BC)

Light of Life Radio, 11610 at 2123 in Mandarin. (Brossell, WI)

World Christian Broadcasting, 11610 at 2150 in Chinese, man preaching and a second closing transmission at 2158* (D'Angelo, PA) 11965 in Portuguese at 2110. (Brossell, WI)

MEXICO—Radio Educacion, 6185, Mexico D.F. in Spanish at 0530, female vocals, Cuban rhythms, and jazz piano. (Barton, AZ)

NEW ZEALAND—Radio New Zealand International, 5945, Rangtitaiki at 1210 with female announcer and man giving news reports. (Barton, AZ) 6170 with Pacific news at 1305; 13840 at 0113 on relaxation of pandemic restrictions there. (Sellers, BC) 9700 at 0500, woman reading the news; 13840 at 0424 relaying BBC, RNZ station ID at 0432. (D'Angelo, PA)

NORTH KOREA—Voice of Korea, 9435, Kujang at 1309 with man reading the news in English. (Sellers, BC) 9665 at 1306 in Korean with a woman in a harangue; 11710 at 1251 in French with DPRK opera; annoying ringing sound, apparently from the transmitter, made it hard to listen. (Taylor, WI)

Pyongyang Broadcast Service, 3320 at 1145 with choral, soprano vocal, by 1300 was still audible, but too weak to determine the language. (Sellers, BC)

OPPOSITION—Voice of Oromo Liberation (via Germany to Ethiopia), at 1721 with man speaking in Oromo, poor reception with deep fades. (D'Angelo, PA)

Dandal Kura (via France to Nigeria), 11830 at 1855-1859* ending broadcast in Kanuri with an instrumental close. (D'Angelo, PA)

Radio Exterior De España has restarted foreign language broadcasts, including English.

Voice of the People (South Korea to North), 3930 at 1254 with commentary by woman in Korean. (Sellers, BC)

Nippon No Kaze (via Taiwan to North Korea), 9465 in Korean at 1300 sign on. (Taylor, WI)

Voice of the People (South Korea to North), 3480 at 1029 in Korean with male announcer, second male perhaps giving station ID, contemporary South Korean music. (Taylor, WI)

Eye Radio (via Vatican [or Madagascar] to South Sudan), 7340 at 0429 in English. (Sellers, BC) 15410 via England at 1644 in Arabic. (Brossell, WI)

Radio Tamazuj (via Madagascar to South Sudan), man and woman speaking in Arabic, vocals at 0356, station ID and news. (D'Angelo, PA)

Denge Welat (via France to Turkey), 9525 in Kurdish at 0448 with domestic music. (Sellers, BC) 11530 at 2032 in Kurdish and non-stop Kurdish vocals, carrier cut at top of the hour. (D'Angelo, PA) 2048 man speaking in Kurdish and A cappella Kurdish music. (Taylor, WI)

"Radio Sana'a" (Saudi Arabia to Yemen), 11860 at 0115 with recitations, lively Arabic pop music. (Wood, MA) 2202, man speaking in Arabic, then an interview and a long talk. (Taylor, WI)

PHILIPPINES—Radlo Liangyou, 9400, Iba, in Mandarin at 1204 with male announcer, hymn and into a sermon. (Taylor, WI)

Radio Veritas Asia, 9700 via **Vatican** at 0013-0028* man speaking in Kachin, ending with flutes; woman closing the broadcast. (D'Angelo, PA) 0015 in Kachin jazzy bridge to Southeast Asian vocals, mand and woman talking. (Taylor, WI)

Far East Broadcasting, 9895, Iba at 1243 in Bahnar with Southeast Asian music and male preacher. (Taylor, WI)

PIRATES—Zeek's Attic, 6932u at 0004. **WTF Radio** at 0055 with rock. **Damn Skippy**, 6955u at 0000 with music and SSTV/FAX. **Ballsmacker Radio**, 6960u with station ID just before 0121, SFX of bowling ball hitting pins, progressive rock music, seemed to be a rain-themed program, woman gave email address: <ballsmackrr@protonmail.com>, still going at 0400. **Nordic Wind Radio**, 6925 at 2358, Animal songs, fade out by 0017. **KIND**, 6873u at 0018 weak with soft pops. **Wolverine Radio**, 6955u at 0039 with "baby"-themed program, station ID at 0112. **KDOG**, 6925u 0241 with 60 seconds of wolf SFX at 0144. **Evil Penguin Radio**, 6925u at 0230 with blues / rock and SSTV / FAX. **WDOG**, 6950u at 0034 with howling dog SFX, Elvis, seemed a canine-themed program, pop music from the '50s on. Seemed to go off at 0229. (Hassig, IL)

WTF Radio Worldwlde, 6955 at 0042 with Jethro Tull, parody ads, final station ID, someone else closing. **Ballsmacker Radio**, 6960 at 0131 with Friday program, station IDs over bowling ball SFX. **Virus Radio 19**, 6907u at 2345, with Zeeky and mellow rock, talking about FM programming into older album rock and off at 0113. **WJAN**, 6925 at 0000 with barely audible rock, man speaking at 0104, then more. **Radio Free Mars**, 6872 at 0013 techno stuff, generally poor with a het. **Damn Skippy**, 6930 at 0153 with SSTV, more rock. **KINK**, 6933 at 0133 with a couple of station IDs and more numbers. **Captain Morgan Shortwave**, 6950 at 0129, MOR, station ID and off at 0145. **KDOG**, 6925u at 0122 progressive rock music, SSTV psychedelic rock, more SSTVs. Off at 0147. **Evil Penguin**, via Mix Radio, 5050u at 0111 with '60s / '70s things. **Robin Hood Radio**, 6930u at 0115 with rock, mostly indistinct talk, station ID at 0154. **WDOG**, 6950u, '60s / '70s things, barking dogs, all songs were about dogs or related to. **Mix Radio International**, 12030 at 2316 with flutes at 2316 but barely audible and gone by 2353. **Best Smooth Jazz**, via Mix Radio, 5050 at 0111, including several by a group from Prague. (Taylor, WI)

SWBC DXers at one of their periodic meetings.

ROMANIA—Radio Romania International, 7310, Galbeni at *2200-2237 with English service features; 7375, Tiganesti at 0120 man and woman speaking in French, station ID at 0123, more features. (D'Angelo, PA)

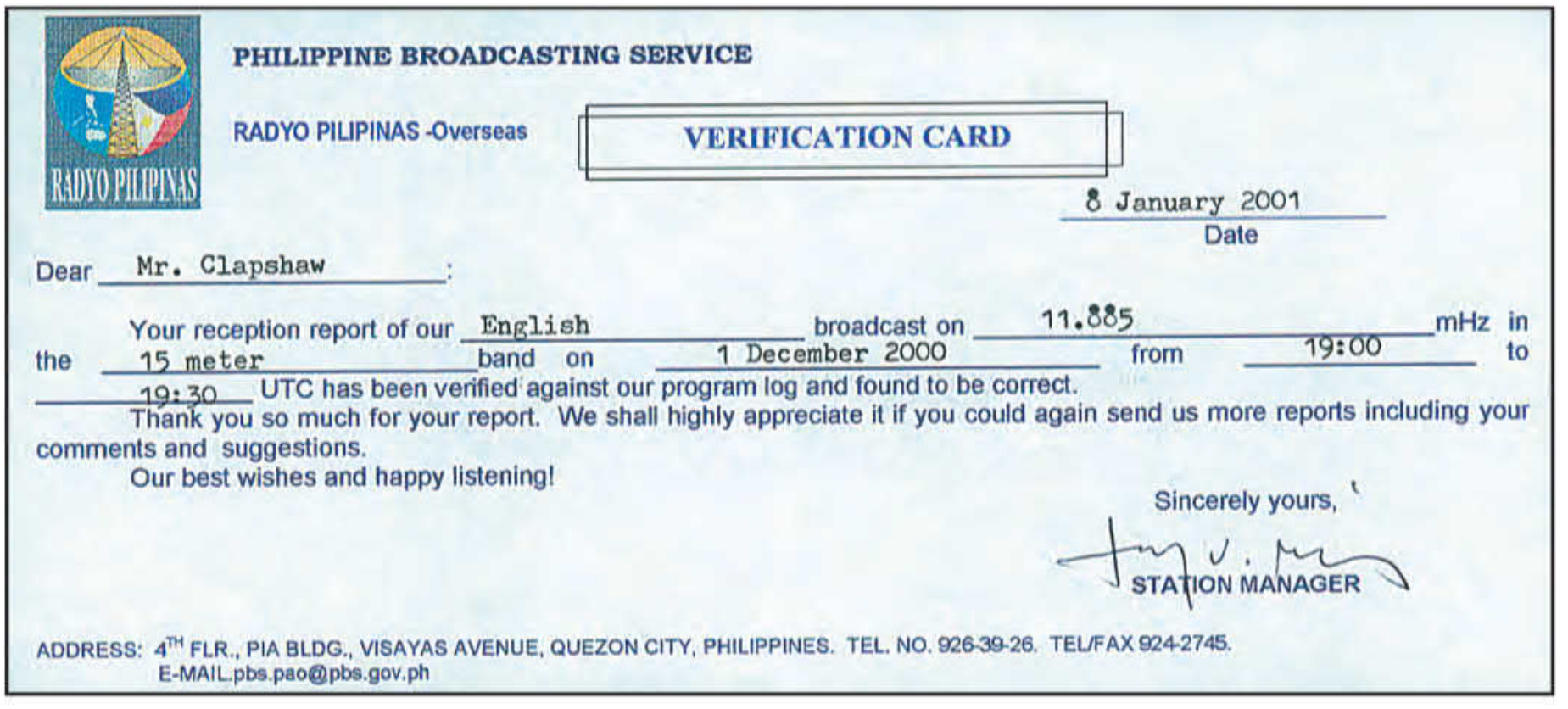
SAO TOME—VOA Relay, Pinheira, 12075 in Hausa at 2030. (Brossell, WI)

SAUDI ARABIA—BSKSA, 9555, Riyadh at 2217, long Arabic talk and vocals. (D'Angelo, PA) 9675 in Arabic at 2045. (Brossell, WI) 13710 at 1700 with the *Call to Prayer*. (Barton, AZ)

SINGAPORE—BBC-Far East Relay, 7465, Kranji, at 1440 with news in Dari. (Barton, AZ)

SPAIN—Radio Exterior España, 12030, Nobeljas at 2040 two men speaking n Spanish. (Brossell, WI)

ESWANTINI (Swaziland) — **Trans World Radio**, 9940, Manzini at 1927 in Lingali. (Brossell, WI)



PHILIPPINE BROADCASTING SERVICE

RADYO PILIPINAS -Overseas

VERIFICATION CARD

8 January 2001
Date

Dear Mr. Clapshaw :

Your reception report of our English broadcast on 11.885 mHz in the 15 meter band on 1 December 2000 from 19:00 to 19:30 UTC has been verified against our program log and found to be correct.

Thank you so much for your report. We shall highly appreciate it if you could again send us more reports including your comments and suggestions.

Our best wishes and happy listening!

Sincerely yours,

STATION MANAGER

ADDRESS: 4TH FLR., PIA BLDG., VISAYAS AVENUE, QUEZON CITY, PHILIPPINES. TEL. NO. 926-39-26. TEL/FAX 924-2745.
E-MAIL.pbs.pao@pbs.gov.ph

The Radio Philippine Broadcasting Service seems to have suspended shortwave broadcasting.

what's new

Eton Elite 750

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 every radio wavelength including, AM, FM, long wave, shortwave, SSB, 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>.

TAIWAN—**Radio Taiwan International**, 9740, Paochung at 1240 with local pop in Japanese and female announcer. (Taylor, WI)

THAILAND—**Radio Thailand**, 5875, Udon at 1112, Thai bells, English station ID then into Khmer. (Taylor, WI) 15590 at 0005-0030 with their English news program, nice station ID at 0011, PSA and commercials. (D'Angelo, PA)

TURKEY—**Voice of Turkey**, 9770 at 0415 with man speaking in Turkish and Turkish music. (Barton, AZ)

UNITED STATES—**Voice of America**, 7375 Woofferton, **England**, at 0437 with news and a station ID. (Sellers, BC) Deewa Radio / VOA Dhabbaya, 9840, **UAE** Relay in Pashto at 0215 with woman speaking at length. (Taylor, WI)

Radio Free Asia, 9800, Biblis, **Germany** Relay at 0212 in Uighur, man and woman speaking. (Taylor, WI)

Adventist World Radio, 9610 at 0047-0130* man giving long religious talk in Hindi, station ID, and contact info in Dzongkha. (D'Angelo, PA) 9800 via Nauen, **Germany** at 2111 in Nigerian English, hymn, man giving contact info. (Taylor, WI) 11985 via **Madagascar** giving contact info, closed at 1959; 15360 via **Sri Lanka** in Dindi at 1637. (Brossell, WI)

Trans World Radio, 7465, **Moldova** at 0047-0139*, man giving long religious talk in Dzongkha, station ID, and contact info. (D'Angelo, PA)

WBCQ, 6160 at 0127 man bragging about the U.S.A. and slamming China. (Sellers, BC)

WJHR, Milton FL, 15555 at 1710 with long-winded preacher then another on the Catholic Church and the Communist Party. (D'Angelo, PA)

Overcomer Ministry, 11600 via **Bulgaria** at 1606 with whatisname over-preaching. (Taylor, WI)

RAE, *Argentina to the World* program via WRMI at 0109 in English on cancelled concerts in Buenos Aires. (Sellers, BC)

Radio Prague, 5800 via WRMI at 0130. Quick sign then right into news headlines, //9395. (Sellers, BC)

World's Last Chance, 6015 via Woofferton, **England** at 2356 in Arabic with male preacher. (Taylor, WI)

VATICAN—**Vatican Radio**, 11625 via **Madagascar** in Amharic at 1746. (Brossell, WI)

VIETNAM—Voice of Vietnam, 9840 at 1130 with woman reading the news in English. (Barton, AZ)

QSL Quests

Rich D'Angelo reports results from Norddeutscher Randfunk (6145) in Germany and VOA-Thailand Relay on 9880 kHz.

Back in the Day

Radio Clube do Lobito, Lobito, Angola, 4707 at 2156 on November 26, 1966 with its Portuguese domestic service.

Just Sayin' (…Continued from July)

Other SWLs got into studying antenna design and wrote several books on the subject. A few others got turned on exploring propagation mysteries, later giving speeches or seminars on the subject. Other authors wrote on utility transmissions, radioteletype, scanning. In short, if something is on the air, DX listeners have either written about it, collected listings on it, or investigated it. (*To be continued next month …*)

Thanks For Your Logs

Much thanks to Harold Sellers, Vernon, BC; William Hassig, Mt. Pleasant, IL; Mark Taylor, Madison, WI; Bob Brossell, Pewaukee, WI; Steven C. Wood, East Dennis, MA; Rick Barton, Sun City, AZ; and Rich D'Angelo, Wyomissing, PA.

Until next month ... Keep on keepin' on, and ... Celebrate Shortwave!

KIT-BUILDING

BY JOE EISENBERG,* KØNEB

Shields Up and More Building Time

As many of you know, the highlight of my year is the annual trek to Dayton for Hamvention®. I'm sure that many of you who attend regularly feel the same way. The hard decisions made by the Hamvention committee and the health directives issued by many states and localities made it impossible to hold this year's Hamvention, as well as nearly every other hamfest planned for this spring. I truly miss seeing my friends and all my readers when I travel to hamfests both near and far. With no hamfests to attend and many hams spending a lot more time at home, I have heard lots more on-air activity and have fielded a lot more email and online questions from kit builders. I am just glad that we are taking advantage of these trying times and using them for building our skills.

Face Shield Project

My 3D printer face shield project described in recent columns has continued, and the problems associated with running a basic-level 3D printer around the clock have given me an opportunity to learn more troubleshooting and repair skills. I think my Amazon / UPS / FEDEX / USPS delivery couriers have gotten to know me very well. The biggest problem I have encountered so far is the replacement of what is often called the "hot end" or extruder. This is the part that heats up the filament and delivers it through the nozzle. The failure of my first extruder was caused by a malfunctioning integrated temperature sensor and heating element. I woke up one morning to an unholy mess of plastic looking nothing like what I was trying to print. Because the extruder wiring travels through a flexible wiring guide and into the main circuit board, the repair took a long time. It involved uninstalling the old hot end, tipping over the printer and removing the main board assembly, then fishing the wires out.

The reverse procedure of mounting the new hot end and passing the wires back through the guide and reconnecting them to the main board was followed by reassembly and using a number of zip ties to replace the ones removed during the process. The result of this experience was a new hot end, a new Bowden tube that feeds the filament from the extruder drive to the extruder, and a return to optimum per-

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

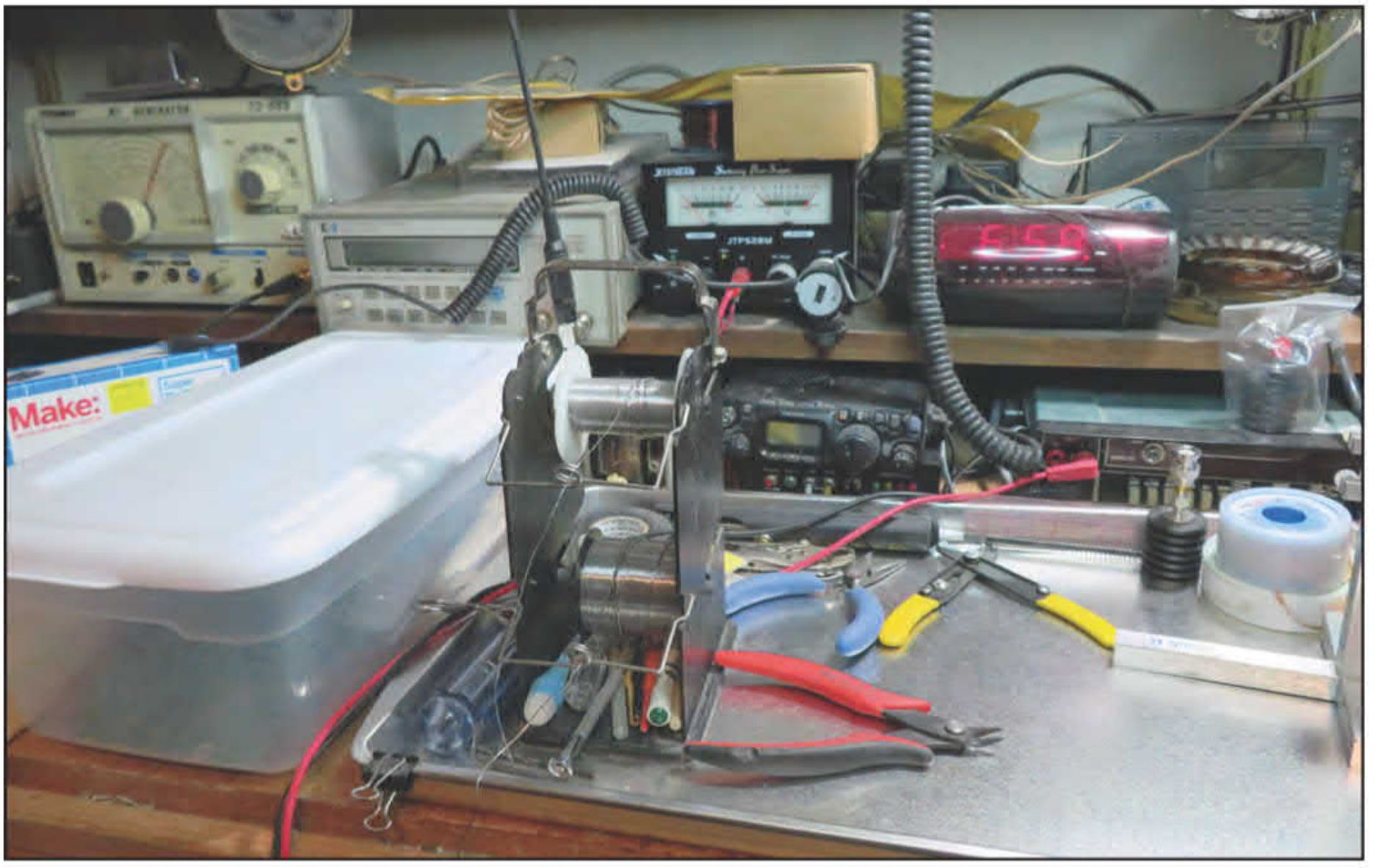


Photo A. The core work area of my kit-building bench is ready for a new kit! I always use a cookie sheet to prevent loss of parts and protect the wooden tabletop. The FT-817 serves as a test and reference receiver as well as a source of SSB or CW signals for testing. Nearby are a signal generator and an HP frequency counter.

formance. At least this model of 3D printer, the Ender 3 Pro, lends itself not only to repairability, but the ability to use improved parts and third-party enhancements to the parts to make significant improvements to the original printer.

Cleaning House

My additional bench time has also resulted in some improvements, allowing me to clear out the junk that has accumulated over 35 years, do some rewiring, and utilize lots of plastic storage tubs for keeping needed parts and tools neatly under the bench. A couple of relatively recent flea market finds have made their way to the bench, including an HP frequency counter and a couple of simple signal generators. There is a bit more work to be done, primarily fine-tuning the arrangements and addressing RF coax/dummy load/antenna switching issues and grounding issues, but for the most part,

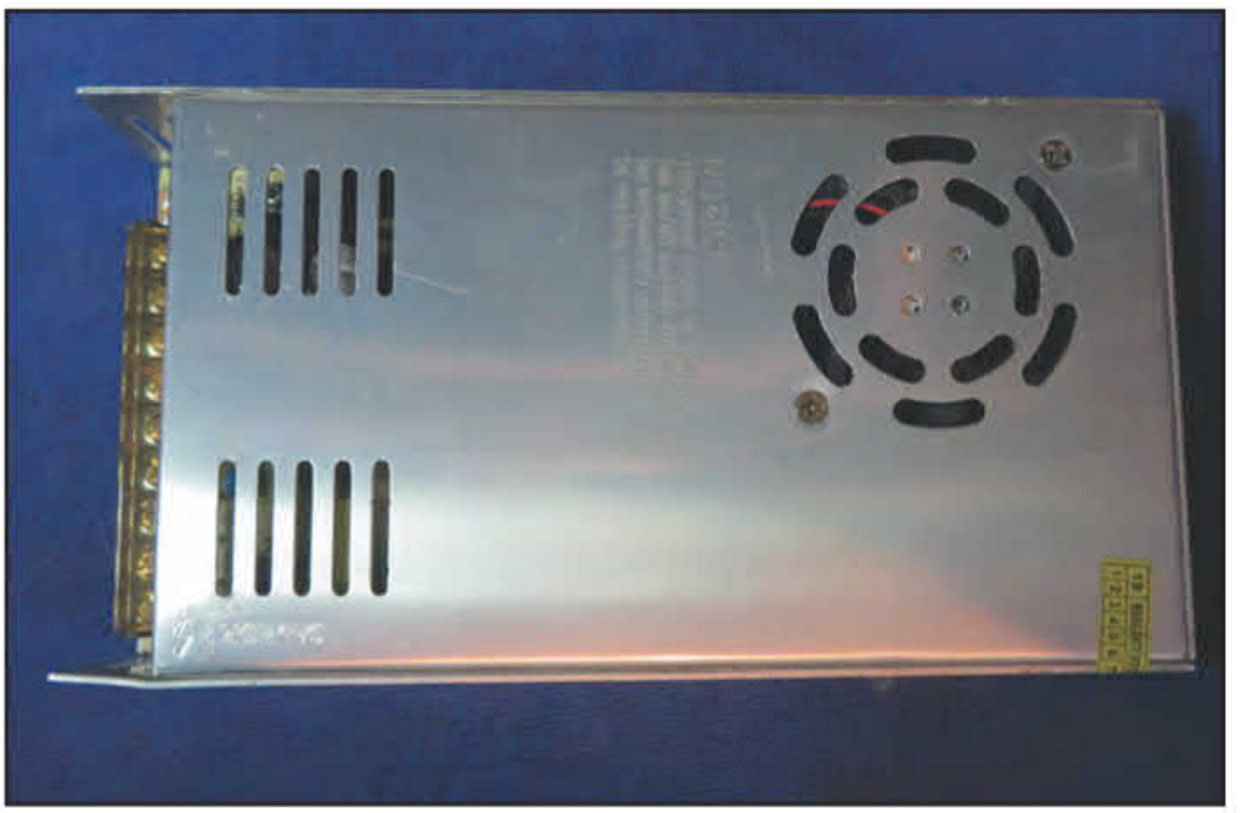


Photo B. The mail order surplus / returns store has a few gems of interest to hams, like this 30-amp, 12-volt DC power supply.

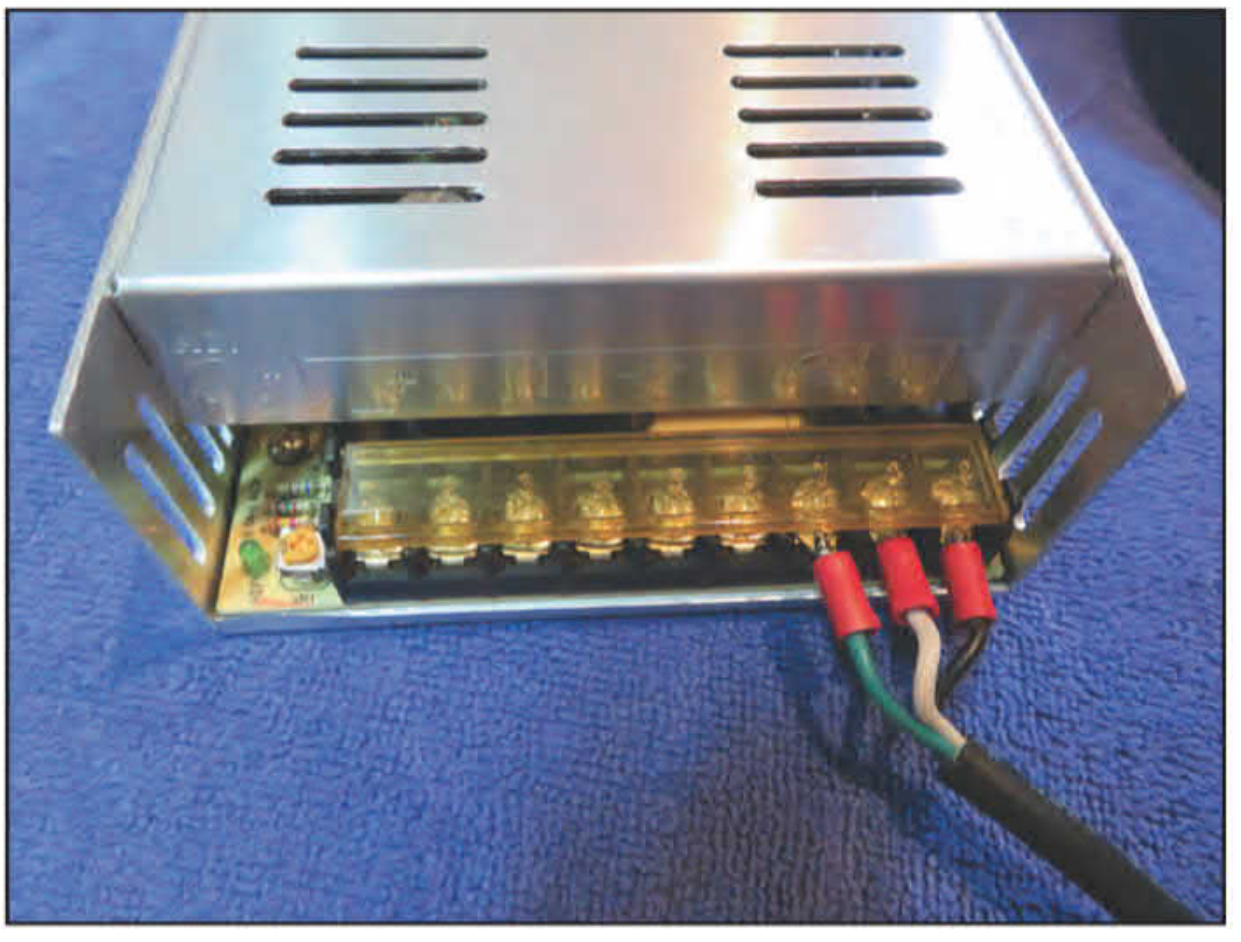


Photo C. The end terminal strip is marked, showing the AC input and the DC output terminals. The trimpot on the left adjusts the output voltage.

"Construction of the Phaser is stage by stage... the kit is supplied with all the parts carefully and clearly marked, and attached to nine cards"

I haven't been more comfortable at my own bench in over 30 years than I am now (*Photo A*). The Tektronix 465 oscilloscope still works, and now can feed its sample output directly to my counter. I placed a rubber bathmat under my bench stool to allow me to find dropped parts a lot more easily than in the carpet.

An item I found this past fall at a local surplus outlet has also begun its testing on my bench. It is a small industrial type switching power supply (*Photo B*). I have seen this type of power supply show up at hamfests and online, and so I will be looking into its performance. The supply looks like it was meant to be built into another enclosure and it is marked as capable of putting out 30 amps at 12 volts. There was a trimpot next to the terminal screws, and a tiny adjustment brought the output to 13.8 VDC. I used a surplus computer power cord and removed the end from the cord and exposed a couple inches of the three wires inside the jacket. I crimped and soldered the wires to spade lugs and connected the wires to the corresponding terminals on the power supply (*Photo C*). The three terminals were marked with a ground symbol (green wire), an "N" neutral position (white wire), and an "L" line or hot position (black wire). On the left were three positive DC output positions followed by three negative output positions. I paid only $5 for this power supply which was still sealed in the box, so time will tell if this was a really good deal or not.

Phasers Up!

Of course, with the bench in a lot better shape, I was ready to dig into a brand new kit. The kit I have started on is the Midnight Design Solutions Phaser 40-meter SSB / digital mode / FT8 transceiver kit (*Photo D*). Similar to many other kits I have reviewed, this kit utilizes PC board material to form a very strong, predrilled and marked case for the finished kit. This kit was designed by Dave Benson, K1SWL, who is famous for his Small Wonder Labs kits. The transceiver puts out 4 watts of SSB, making for a nice power level suited both for use at home and while portable. These HF digital mode kits are available for 80, 60, 40, 30, 20, and 17 meters.

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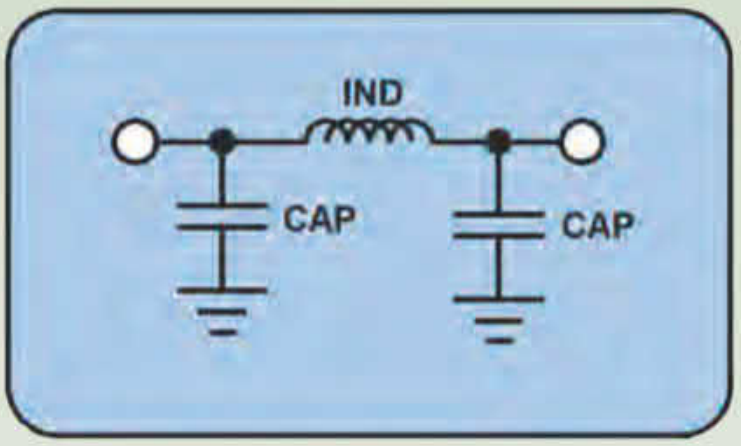
Engineers of LDG Mini-Notebook

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.

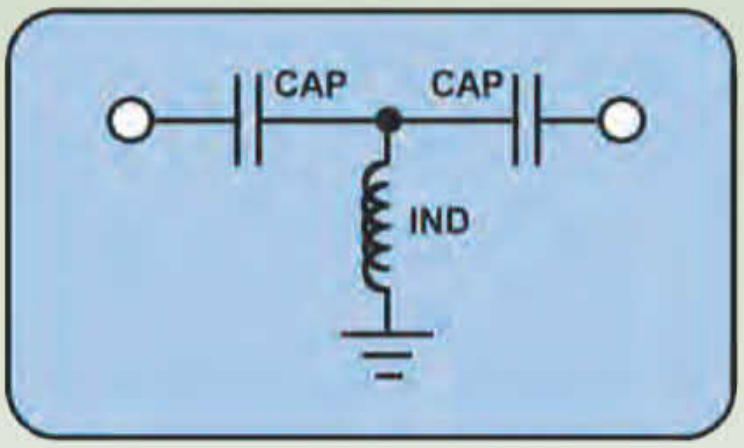
Pi Network

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



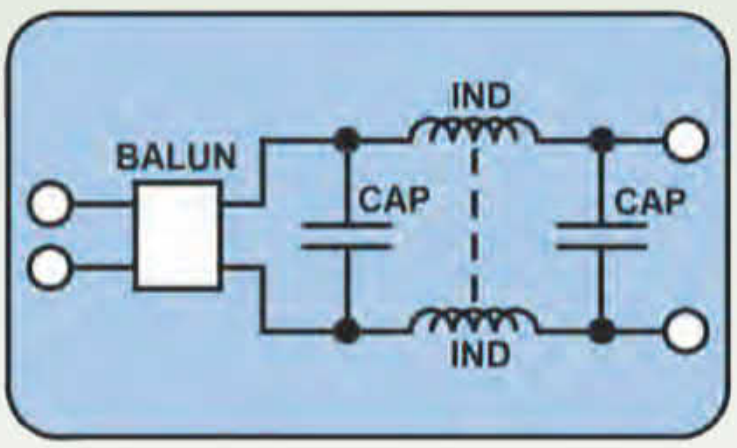
T-Match

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.



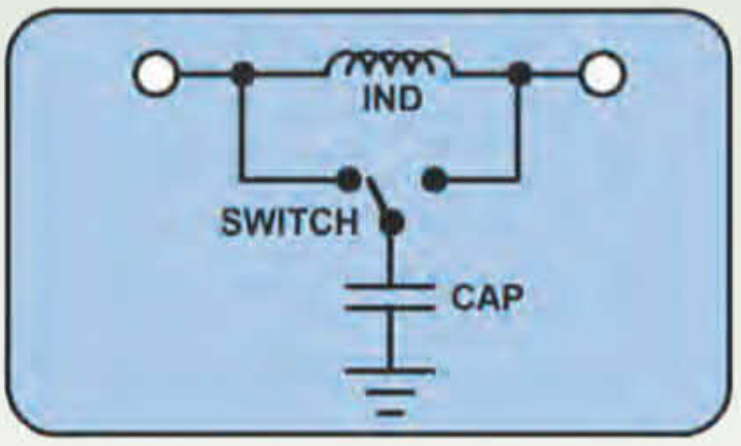
Balanced

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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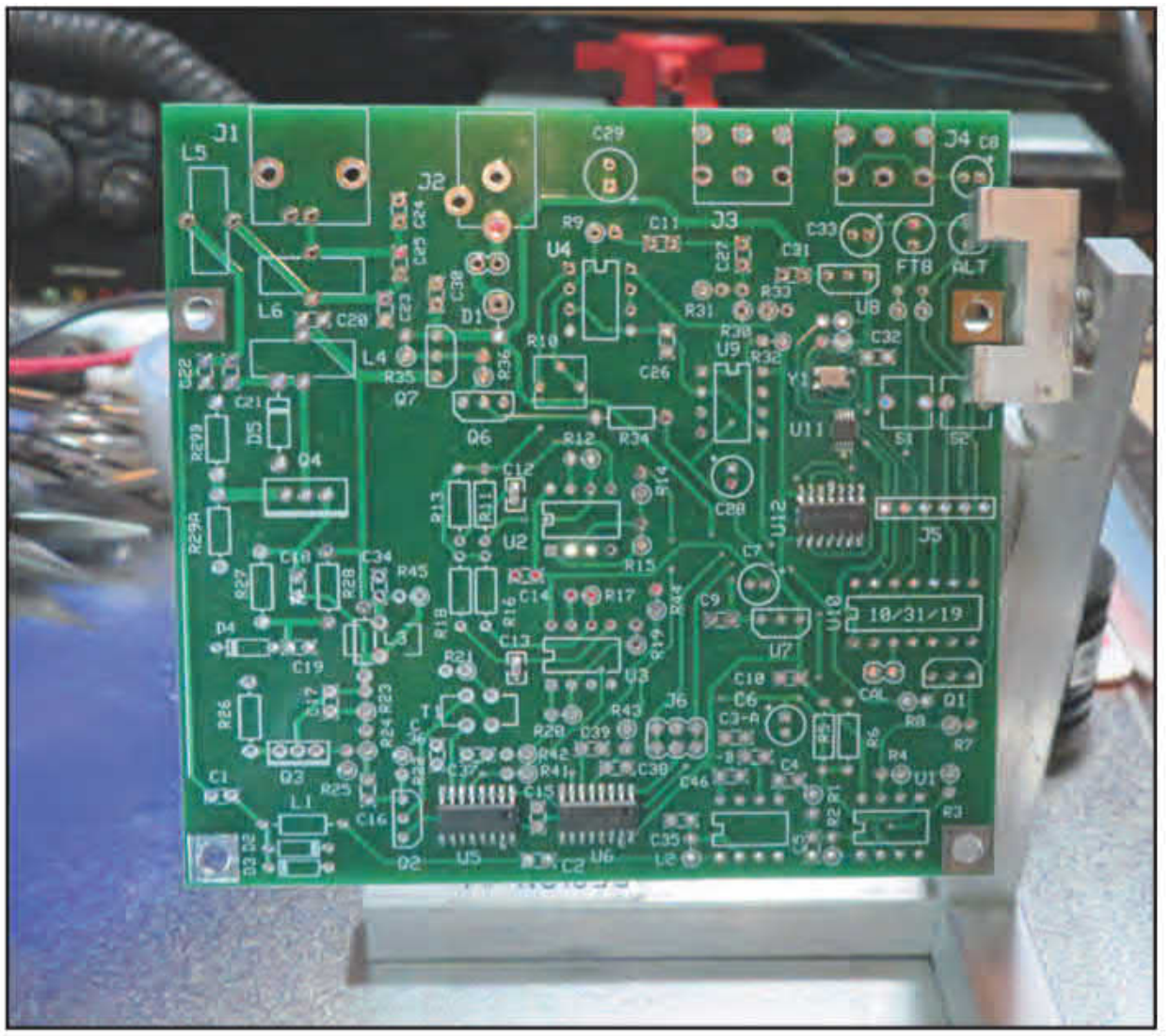

Photo D. The PC board for the Midnight Design Solutions Phaser 40-meter HF digital mode transceiver kit. Notice the surface mount components are preinstalled, leaving just the through-hole components for the builder.

With a current draw of just 1 amp on transmit, these kits are ideal for taking to the field.

Construction of the Phaser is stage by stage. Normally, I suggest sorting your parts so that each step has its parts in one place, but the kit is supplied with all the parts carefully and clearly marked, and attached to nine cards (*Photo E*). All the resistors are together on one card separated by values to minimize any confusion. All the band-specific parts are together on one card. Dave's suggestion is to place the cards into a small storage box so that they can be easily retrieved as needed. I happened to have an extra one of those after my bench-cleaning project, so that was a great starting point. The instructions include testing procedures for each stage of construction to maximize your chance of success. Be sure to have the proper test gear and power supply available before you perform each test. The Phaser kit may be ordered at <https://midnightdesignsolutions.com/phaser>.

N1IXF has an extensive review of the Phaser elsewhere in this issue and I will share my experiences with building it next month, so stay tuned!

– *Until next time, 73 de KØNEB*

Photo E. All of the parts for the Phaser kit are already sorted and identified on nine cards. See N1IXF's review of this rig elsewhere in this issue. I'll be sharing my impressions next month.

EMERGENCY COMMUNICATIONS

BY CQ STAFF

The ABCs of EmComm Abbreviations

Help Wanted – EmComm Editor

CQ is looking for a new Emergency Communications editor! If you belong to an EmComm group or have experience in all manners of emergency communications and can string together a few sentences explaining it to your fellow hams on a monthly basis, feel free to contact Editor Rich Moseson at <w2vu@cq-amateur-radio.com>.

Continuing our "back to basics" theme from last month, when we covered the basics of emergency and public service net operation, our focus this time is on the "alphabet soup" of abbreviations and acronyms that an amateur radio emergency communicator is likely to encounter. There are quite a few, since much ham radio EmComm work is done in cooperation with government agencies, and government agencies *love* their abbreviations and acronyms! For ease of reference, we'll run through them in alphabetical order. (Advance apologies for any that we miss. Local and regional groups generally are not included.)

ACS – Auxiliary Communications Service, also often known as AuxComm — structure within local and county emergency management agencies under which volunteer communicators and communication groups, including ARES / RACES, CERT, and REACT, fit into the agencies' overall structure.

ARC – American Red Cross <www.redcross.org> – The Red Cross is the primary non-governmental disaster relief organization in the United States, with affiliates around the world. Many amateur radio EmComm groups work closely with their local ARC chapters, and the ARRL (see below) has a memorandum of understanding with the Red Cross on a national level. Many hams are cross-registered as Red Cross volunteers.

ARES – Amateur Radio Emergency Service <www.arrl.org/ares> – This is the emergency communications arm of the American Radio Relay League (ARRL). ARES groups are organized on local, regional, and section levels, under the supervision of ARRL Emergency Coordinators (ECs), District Emergency Coordinators (DECs), and Section Emergency Coordinators (SECs), all of whom are appointed by an elected ARRL Section Manager (SM).

ARRL – American Radio Relay League <www.arrl.org> – the national association for amateur radio in the United States. The ARRL represents amateur radio interests on a nationwide scale, administering ARES (Amateur Radio Emergency Service) and NTS (the National Traffic System) and making cooperative agreements (memoranda of understanding) with other national organizations and government agencies. Elected division directors and section managers represent amateur radio interests on state and regional levels.

CAT (1-5) – Description of the strength of a hurricane on the Saffir-Simpson Hurricane Wind Scale, from Category 1 (CAT 1) through Category 5 (CAT 5), depending on the maximum sustained wind speeds. Here's the breakdown from the National Hurricane Center: CAT 1: 74-95 MPH; CAT 2: 96-110 MPH; CAT 3: 111-129 MPH; CAT 4: 130-156 MPH; CAT 5: 157 MPH and higher. Categories 3 and above are considered major hurricanes. For more information, see <https://tinyurl.com/y9qvmmfq>.

CERT – Community Emergency Response Team <www.ready.gov/cert> – Community-based groups of trained volunteers to help supplement emergency responders in meeting a variety of needs. Organized nationally through FEMA and coordinated locally by municipal and county offices of emergency management.

DEC – District Emergency Coordinator – ARRL Field Organization volunteer who coordinates ARES response over an area encompassing one or more counties. Reports to the Section Emergency Coordinator.

EC – Emergency Coordinator – ARRL Field Organization volunteer who coordinates ARES response over an area encompassing a municipality or a county. Reports to the District Emergency Coordinator and Section Emergency Coordinator.

ECARS – East Coast Amateur Radio Service <http://ecars7255.com> – A service net primarily serving the U.S. eastern states. According to its website, "ECARS offers service to mobiles and fixed stations, including weather information, road conditions, emergencies, and signal reports." The net meets daily on 7255 kHz, from 7:30 a.m. to 2:00 p.m. eastern time on weekdays; 8:00 a.m. to noon on weekends.

EF (0-5) – The Enhanced Fujita Scale of tornado intensity, ranging from EF0 to EF5. Here's the breakdown from the National Weather Service <www.weather.gov/oun/efscale>: EF0: 65-85 MPH; EF1: 86-110 MPH; EF2: 111-135 MPH; EF3: 136-165 MPH; EF4: 166-200 MPH; EF5: Over 200 MPH.

EMA – Emergency Management Agency – Generally a state-level agency coordinating response to emergencies and disasters on a statewide level. Known in some states as the OEM, or Office of Emergency Management.

EmComm – Emergency communications

EOC – Emergency Operating Center or Emergency Operations Center – State, county, or municipal facility from which responses to emergencies and disasters are coordinated. Generally, representatives of all government agencies and voluntary groups involved in emergency response are all in the same room and may communicate directly with each other.

FEMA – Federal Emergency Management Agency <www.fema.gov> — Part of the U.S. Department of Homeland Security, FEMA is the primary agency responsible for federal response to large-scale disasters. In addition to providing direct assistance to disaster victims, it works with state and local emergency response organizations and provides a wide array of training to emergency responders, including amateur radio operators.

H&W – Health and Welfare – A category of amateur radio message either inquiring about the welfare of an individual in an emergency or disaster zone or reporting out on a person's status from an emergency zone. Abbreviated "W" in priority field on ARRL radiogram headers.

HSEEP – Homeland Security Exercise and Evaluation Program – described by FEMA (see above) as "a common approach to exercise program management, design and development, conduct, evaluation and improvement planning." (See this column in the April 2020 issue for more on HSEEP)

HWN – Hurricane Watch Net <www.hwn.org> – A net that is activated whenever an Atlantic hurricane is within 300 miles of expected landfall. Main frequencies are 14.325 MHz during the day and 7.285 MHz at night. Purpose is to both disseminate storm information to people in areas likely to be affected and to gather reports from affected areas. Communicates regularly with the amateur station at the National Hurricane Center, WX4NHC.

ICS – Incident Command System – A standardized approach to emergency response now used throughout most of the United States. It is highly recommended that any amateur interested in emergency communications become familiar with ICS structure and forms, as amateur radio activity will likely be organized within that structure. FEMA offers various levels of training in ICS operations. Many of these courses may be taken online.

MARS – Military Auxiliary Radio System – MARS is a communications auxiliary to the U.S Army <https://netcom.army.mil/mars> and U.S. Air Force <www.mars.af.mil>, performing a variety of functions including emergency communications as needed.

MIDCARS – The Midwest Amateur Radio Service <www.midcars.net> – A service net aimed primarily at providing contact and information for mobile stations in the Midwest. It meets daily on 7258 kHz between 8:30 a.m. and 2:00 p.m. eastern time.

MMSN – Maritime Mobile Service Net <www.mmsn.org> – Service net focused on ships, boats, and sailors. Meets daily on 14.300 MHz between noon and 7:00 p.m. EST and between noon and 8 p.m. EDT.

NGO – Non-governmental organization – Umbrella term for private organizations involved in emergency and disaster response, including such groups as the American Red Cross, the Salvation Army, and Doctors Without Borders. Amateur radio groups generally are not included under this umbrella because they usually work with or as part of these larger organizations.

NHC – National Hurricane Center <www.nhc.noaa.gov> – Part of the National Weather Service, the NHC is the focal point for forecasting and disseminating information on tropical weather systems in the Atlantic, Caribbean, and eastern Pacific. Amateur station WX4NHC is located there and is active when a tropical storm or hurricane is threatening populated areas.

NIMS – National Incident Management System <https://tinyurl.com/ybya48fm> – Broad structure for consistent emergency response on national, regional, state, or local level. The Incident Command System (ICS) is part of NIMS.

NOAA – National Oceanic and Atmospheric Administration <www.noaa.gov> – Part of the U.S. Department of Commerce, NOAA includes the National Weather Service, National Hurricane Center, National Severe Storms Center, and other weather-related federal agencies.

NTS – National Traffic System <www.arrl.org/nts> – The ARRL's nationwide system of message-handling (traffic) networks, including local VHF nets, sectional and regional HF networks, and the Transcontinental Corps. NTS nets generally operate daily in a structure that is parallel to ARES nets, which meet less frequently.

NWS – National Weather Service <www.weather.gov>

OEM – Office of Emergency Management – Government agency coordinating response to emergencies and disasters. May function on a statewide, county, or municipal level. Known in some states as the EMA, or Emergency Management Agency.

RACES – Radio Amateur Civil Emergency Service <www.usraces.org> – A separate service within FCC Part 97 rules, RACES functions as part of local emergency management agencies and may be activated only by authorized government officials. It is administered nationally by FEMA. FCC rules limit the scope of RACES operations and training nets.

REACT – Radio Emergency Associated Citizen Teams <https://reactintl.org> – Frequently associated with CB, REACT teams also use amateur radioand GMRS to prive public service and emergency communications.

SATERN – Salvation Army Team Emergency Radio Network <www.satern.org> – The amateur radio arm of the Salvation Army's emergency and disaster response organization.

SEC – Section Emergency Coordinator – Chief emergency communications manager for each ARRL section (generally a state or portion of a state). Reports to the Section Manager and is responsible for the ARES organization throughout the section.

SKYWARN <www.weather.gov/SKYWARN> – The volunteer storm spotter network of the National Weather Service. Many SKYWARN volunteers are hams and there are many SKYWARN nets on amateur frequencies. All SKYWARN volunteers are trained to identify and report potentially dangerous weather conditions, with a focus on severe thunderstorms.

SM – Section Manager – Elected ARRL official who coordinates the League's field organization in a state or portion of a state. Appoints the Section Emergency Coordinator (SEC) and other ARES leadership officials.

South-CARS – South Coast Amateur Radio Service <http://southcars.com> – Service net similar to ECARS and MIDCARS, South-CARS meets daily on 7251 kHz between 8:00 a.m. and 1:00 p.m. eastern time.

Please let us know who and what we've missed and we'll do our best to provide a supplement in an upcoming issue. Send your updates to <cq@cq-amateur-radio.com> and put "Acronym Update" in the subject line.

Remember — We're heading for the peak of hurricane season. Keep emergency net frequencies clear for storm-related traffic and don't check into a net unless you have relevant information to offer or need assistance.

QRP: Low-Power Communications

BY R. SCOTT ROUGHT,* KA8SMA

Have Radio – Will Travel

Earlier this year, I asked readers what topics they would like covered in future columns. To my surprise, several readers (newer hams) requested tips for setting up a successful portable QRP operation. Although some of this information has been covered in past columns, rather than push our new comrades to hunt for it, I have summarized several tips for making a successful QRP outing in this issue. If anyone has additional thoughts or tips, send them to me and I will include them as a sidebar in a future column. Also, we feature Jim Larsen, AL7FS, of Anchorage, Alaska in QRP Spotlight, our monthly segment dedicated to those QRPers who do a little more with less. Operating QRP from Alaska is nothing to scoff at and I think you will agree that what AL7FS has accomplished with milliwatts from the "Land of the Midnight Sun" is truly amazing.

Tip No. 1 – A Little Forethought

Before setting out on your QRP adventure, put some thought into your destination and setup. Operating from a picnic table at a local park is much different from hiking a trail to a remote area and setting up beneath a stand of tall pine trees. Perhaps you plan to operate from the tailgate of a truck, open hatch on an SUV, or from the trunk of a vehicle. My preference is the picnic table at the local park (yes, I am getting old). Whatever you decide, consider whether a chair or table is necessary for your type of operation. I made this mistake previously. After driving an hour to my lakeside destination, I discovered there were no picnic tables or benches to sit on. There was only a sandy beach to stretch out on and get a tan. Fortunately, there was a box store nearby where I purchased a collapsible table and bag chair. This debacle cost me over an hour of operating time and hit my wallet, too, since I already had a table and chair back home. As my wife periodically reminds me, I now have two chairs and two tables.

The type of portable operation will also dictate the size and style of your go-kit (items needed for your portable operation). If you intend to hike to your destination, a backpack equipped with lots of pockets for stashing items such as pens, paper, electrical tape, connectors, etc. and a main compartment for your radio equipment, battery, and antenna is probably your best option. Use a backpack that has zippered pockets. Pockets that close with buttons or latches may open while hiking, allowing items to fall out and be lost. My first backpack for portable operation had a single button for fastening each pocket shut. The buttons were always coming unfastened and I had to use safety pins to keep the pockets closed. This worked, but trust me, pockets with zippers work much better.

If you plan to operate from a local park or your vehicle's tailgate, consider using a tote as your go-kit. Some larger totes are equipped with wheels and a handle for towing. It probably goes without saying that it is much easier to tow your equipment in a tote behind you as opposed to carrying it. I use a 64-quart sized tote (approximately 24 inches long, 16 inches wide and 14 inches high) for transporting my gear. This is a good size and is not too difficult to handle if you do not have far to walk. If I had anything larger than my current tote, I would want it on wheels with a tow handle.

Photo A. This is dedication! AL7FS with his K2 on a wintry day in Alaska.

Other options for transporting your equipment include hard-sided waterproof cases, surplus ammunition boxes, and commercial grade enclosures designed for portable radio operations. The possibilities are endless, especially for QRP-sized equipment. Do what is right for you, but whatever you use to transport your equipment, ensure that it is sturdy, can be easily transported, and is / can be equipped with handles or a carrying strap to make transport safe.

Tip No. 2 – Pack It and Leave it!

Although this is my second tip, it is my number-one tip as far as importance. After assembling a go-kit, NEVER remove any items from the kit, except your transceiver and those accessories that may be needed in the ham shack (if you do not have a dedicated trail radio). Believe me, if you remove something from your go-kit, you will not have it when you

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Photo B. WAØLPK (now AL7FS) in 1966 operating from his Atlantic, Iowa, ham shack.

need it because you will forget to put it back. Sometimes the items left behind are not too crucial and a successful operation can still be had; however, if the power cord for your transceiver, or the microphone or key is left behind, your operation is finished before it started.

I suggest making a checklist and reviewing it before leaving your QTH. This also applies to repacking your kit before you leave the site. If using a tote, tape the checklist to the underside of the lid so it cannot get misplaced. If using a backpack, roll up the checklist, place a rubber band around it, and stash inside the main compartment. Be sure your checklist includes everything you need (and may need — like a table and chair), for your portable operation. Think through each step in setting up your portable operation. Remember, radio is only part of the equation. Human elements such as sunscreen, insect repellent, bottled water, snacks, etc., also need a place in your go-kit for a successful field operation.

Tip No. 3 – Up and Away

I believe the heart of any portable setup is the antenna and feedline. This is especially true for a QRP operation since no power can afford to be lost along a feedline. I use 300-ohm twin lead or 450-ohm window line as both are low loss, lightweight, and roll-up nicely for easy transport. Good quality coaxial cable is also fine if short lengths are used. Do not take a 100-foot roll of coaxial cable when only 30 feet of it is needed to connect the radio to the antenna. You would be surprised at how much power is lost in that extra 70 feet of coaxial cable rolled up next to your operating position, especially at QRP levels. If you use coaxial cable, pick a length (i.e. 40 feet or less) that will work for most situations and make a dedicated feedline. If the feedline is not long enough, then adjust to your surroundings by moving your operating location (i.e., picnic table) closer to the antenna's feed point so you do not need a longer run of cable.

There are many antenna options for portable setups. For the October 2018 column, I pitted an inverted-V, an end-fed

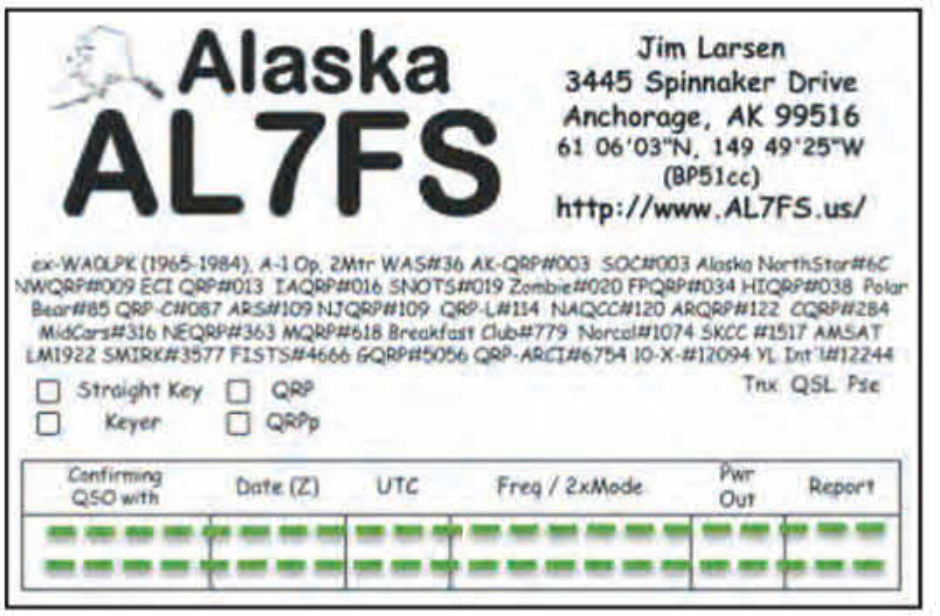


Photo C. Sample AL7FS QSL card listing his achievements and memberships. Note the check box for QRPp.

wire, ground plane, and a portable magnetic loop antenna against one another to determine which antenna performed the best. Although this was not a completely scientific study, my results identified the inverted-V as the best performer, followed by the end-fed wire, ground plane, and finally the magnetic loop. A subsequent antenna test showed the same results. If you have not selected an antenna for portable use, it is worth considering the inverted-V or an end-fed wire. These antennas are easy to make and require only one support. I am a proponent of using trees (when available) for supporting antennas; however, if no trees are available, a portable mast may be necessary. I use the SOTABEAMS Tactical 7000hds, a heavy-duty telescopic mast that extends to 23 feet, when I am operating beachside or surrounded by barren land. What I like best about this mast is that it collapses to 23 inches for easy transport. If you are unsure about the availability of antenna supports at your destination, a portable mast belongs in your go-kit.

Tip No. 4 – Putting a Signal into the Ether

If you do not already have a QRP transceiver in mind for portable operation there are a lot of options available on the new and used market. Determining which modes (CW, SSB, digital) you plan to operate will help you quickly narrow your search. Also, before you begin researching transceivers, make a list of those options that are a must. This will vary from ham to ham depending on personal preference.

In my opinion, all-mode transceivers such as the Yaesu FT-817 / 817ND / 818, ICOM IC-703, Elecraft K2 and KX2, and the Ten-Tec 539 Argonaut VI will do most everything you need in the field. If CW will be your only mode of operation, then do not overlook LNR Precision's line of Mountain Topper transceivers. These little gems are a favorite among many Summits on the Air (SOTA) activators (*hence the name Mountain Topper –RSR)* because they are lightweight, small enough to fit into a coat pocket, and pull very little current *(a very important consideration since your power supply will likely be a battery –RSR*). Kit-built or homebrewed transceivers are also an option. Although these transceivers are typically CW only, kit-built SSB rigs are available and gaining popularity.

Do not forget the "non-QRP" radios that can be simply turned down to QRP levels (*power knobs do turn to the left –RSR*). There are many hams who take their more robust and often larger and more power-hungry radios into the field. ICOM's IC-7300 and the Yaesu FT-991A are two radios that

are gaining popularity in the field. The IC-7300 is small and light (less than 10 pounds) enough that it can be placed into a go-kit and taken to a park for an afternoon of operation. The IC-7300 can also be turned down to two watts, well within the realm of QRP.

Some transceivers come with electronic keyers, antenna tuners, digital mode interfaces, etc. already built-in. Think about your needs and operating habits and what you will need in the field. I know several QRPers who take a minimalist approach and work portable with a kit-built CW transceiver, earbuds, miniature hand key, and a resonant antenna cut for a single band. Some hams (including myself) pack a little more for their excursion including an external speaker, hand mic for SSB operation, and a portable antenna tuner so that one antenna (i.e., 40-meter inverted-V) can be used as a multiband antenna.

Tip No. 5 – Powering It Up

Be sure to choose a battery that provides the appropriate amount of power (current) to run your transceiver. Knowing the current demands of your transceiver and the duty cycle (how much time you will spend transmitting [pulling more current] versus receiving [pulling less current]) will help determine how much power is needed for your intended operation. Bioenno Power's website <www.bioennopower.com> has a lot of helpful information regarding battery considerations, including a duty-cycle table that can be used to identify the proper size battery for your operation.

Batteries do come with a price tag. Gel cell batteries (i.e. AGM, sealed lead-acid, etc.) are less expensive but much heavier than a lithium iron phosphate battery that is rated at the same power level. Do your research. Although lithium iron phosphate batteries are more expensive, they are better performers (have a longer runtime), have a much longer life span (number of charging cycles), and weigh a lot less (50% or more) than the average gel cell battery.

QRP Spotlight – AL7FS

This month we highlight Jim Larsen, AL7FS, of Anchorage, Alaska. AL7FS was licensed 55 years ago on March 7, 1965 with the Novice callsign WNØLPK. By November 1st of that year, he had upgraded to General Class and the "N" in his callsign was replaced within an "A" (WAØLPK). "I consider that I have been a QRP operator since about 1970. I may not have operated 5 watts way back then but I also have never operated an amplifier in the 54 years I have been licensed," says AL7FS. This is no small feat as ionospheric and geomagnetic conditions near the auroral zone greatly affect the HF bands, making all radio communications difficult, much less QRP. Although he has not used an amplifier on HF, he states "I did use an amplifier on 2 meters for EME. Even that was QRP of a sort, as I only operated with about 650 watts output. WAS #36."

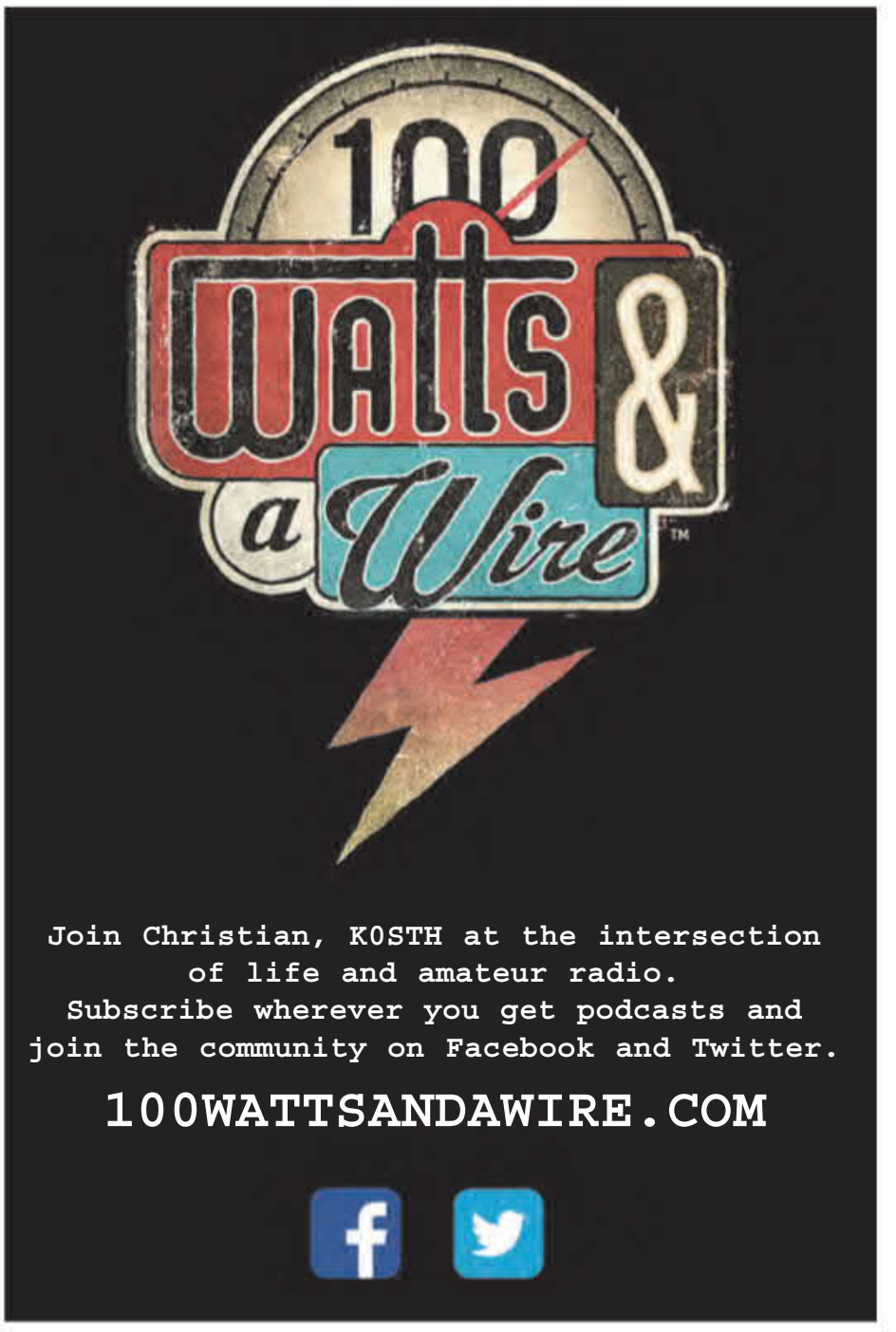
AL7FS was lured to QRP because of the challenge low power presents. "The lowest (power) so far is 10 milliwatts CW. My first big contact was K7CT for 202,300 miles per watt." This contact earned AL7FS the 1,000 Mile Per Watt award offered by QRP Amateur Radio Club International. His best QRP DX contact to date was with ZL1MH (Waima, New Zealand) in August 2000. This contact was made with 450 milliwatts CW and equates to 1,549,111 miles per watt (yes, you read it correctly — over 1.5 million miles per watt). "ZL1MH was excited about the contact, too, and he reduced his power as low as he could get it. It was fun for him, too." Another memorable QRP contact recalled by AL7FS was when he worked W1AW. "I was pleased to work W1AW on 20 meters, my QRP to their QRPp. W1AW was using a tuna tin on 20 meters. Later the staff (at ARRL) gifted me the actual tuna tin used in that event."

AL7FS's ham shack consists of a Kenwood TS-570D and two Elecraft K2s. "I built the first one (CW only) and the second was purchased because it had SSB and the DSP included. I purchased that rig from Lyle Johnson, KK7P, the inventor of the K2 DSP. I use a two-band 80/40 inverted-V at 35 feet and a KLM KT34A at 40 feet. I also have the Cushcraft WARC beam at 40 feet. All feedlines are RG-8. My 100-watt radios will all turn down to under 5 watts for QRP. I also have my TenTec Omni 6+, Elecraft KX1 and KX3, and a Kenwood TS-450S."

Although AL7FS has a true passion for QRP, as of November 2019 he is only operating with 100 watts until this lull in the solar cycle improves. "I rarely try to operate QRP from Alaska during this part of the sunspot cycle. It can be done on very rare occasions, but my QRP right now is at 100 watts. This is the lowest power level to support communications and that is often a challenge." AL7FS also indicates that due to poor solar conditions he often hears no signals on 20 meters and occasionally he can hear W1AW's high-power CW practice come through, but even that is not assured.

I would like to thank AL7FS for sharing some of his QRP achievements with us. His awe-inspiring 1,549,111 miles per watt QSO is an amazing feat and has given me inspiration to push the limits of QRP as we begin solar cycle 25.

In our next column, we will explore Parks on the Air (POTA), a program that many QRP operators are becoming involved with, and discuss how you can be part of the fun too, QRP-style, of course! *– Until October, 73, KA8SMA*



MOBILING

BY JEFF REINHARDT,* AA6JR

Something New

It's amazing to see the continuing evolution of amateur radio gear suitable for mobile installation and operation. If you think you've been staying up with technology, you may be surprised at what's now available. All you need to do is look at the many ads found in this magazine, particularly if you currently own gear that's five or more years old. Ever more capabilities are being incorporated into smaller radio packages, HF, VHF, UHF, digital + analog mode combinations, and more. Many new transceivers now come with detachable control heads and remote microphone mounts; not that long ago, only a few rigs had remote capabilities and those "separation kits" often came at considerable extra cost.

For those who want to get updated on the ham gear marketplace, the catalogs that are mailed to us and, of course, the websites of both retailers and manufacturers offer in-depth descriptions of transceivers that offer incredible coverage "from DC to light". As the old saying goes, though a bit exaggerated, today's mobile-ready transceivers are only limited by the number of antennas the operator chooses to place on the vehicle. And there's an ever-growing array of antenna and mounting choices to accompany today's newer multi-band rigs. Added features such as SSB operation on 6 meters, 2 meters, and 70 centimeters open a new world of mobile possibilities for many, especially during these summer months when Sporadic-E (E_s) and meteor scatter opportunities often appear. When you also consider the same rig might have HF and / or digital capabilities, the bevy of choices on which band and mode to use might compare to a lotto winner considering his or her next purchase.

The added prospect of a new solar cycle further sharpens the appetite for new adventures. During a previous solar peak, it was my pleasure to have an Australian contact while I was operating mobile on 10 meters, *using low power.* Conditions were just right and he sounded as though he was next door. I also bagged a gray-line contact with a ham who was mobile in Buenos Aires. The thrills abound, but only if you have the capability and willingness to experiment.

I have nothing against the 2-meter FM ragchew during the commute, but changing things up a bit by venturing into new territory can expand or rejuvenate your interest in mobile operations and give you some great stories to share on your *next* ragchew.

If you have not shopped for a new rig in some time, take some time to become familiar with the many versatile offerings to be found. The good news is that each manufacturer has something to offer and the quality of most gear is top notch. In what amounts to *great* news for you and me, once you've identified your desired operating profiles, it's difficult to make a bad choice. With many of this year's hamfests cancelled or postponed, you may also find retailers offering gear and accessories at enticing prices, in an attempt to move inventory that might have been sold at ham gatherings.

Something Old

Yes, there's a lot of new gear available, but let's take a look at a classic piece of gear that's still in use by many operators. The Kenwood TM-742A was (and for many still is) an amazing transceiver. Usually sold with two bands already installed, frequently 2 meters and 440 MHz, it offered the

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A 110-volt outlet found in the back seat of the author's 2016 Ford Fusion. A 12-volt port is located to the left.

The TM-742A/E programming kit from WA7YLI brings some much-needed memory management utility to Kenwood's vintage triband transceiver.

buyer the option to add a third band, which could have been 6 meters, 220 MHz, or even 1.2 GHz. The "extra" band came in the form of an optional module that was easily installed in the transceiver and *voilá,* you had a tri-band mobile or base radio with 100 memory channels on each band. I own three of these now-aged units and they have provided great service across two decades, going on three. The TM-742A was designed before the internet exploded into its current state and it's difficult to recall the technical limitations of those days when compared to the ease of interfacing today's new rigs with computers. What would have made the TM-742 "perfect" in my humble opinion would have been alpha-numeric channel labeling and the ability to upload / download channel data from the transceiver through a computer. To say the least, manually programming the radio's many memory channels is an unpleasant, tedious task.

To the rescue came Larry Anderton, WA7YLI, who came up with a partial solution to the problem of programming a TM-742A/E. It turns out that "back in the day," Kenwood designed the TM-742 to accept tone commands through its microphone port and Larry developed a hardware and software package that makes it possible to load the radio's memory channels from a computer database.

The limitation is, you can only upload; it is not possible to download data from the radio into a database. Nevertheless, building the database once can save hours of manual programming in the event memories are lost due to a dead backup battery or other malfunction. It's also handy for keeping multiple radios "in synch" with one another when it's necessary to add or delete memory channel data. If you're interested in seeing it work, there is a YouTube video showing how the package functions. Full disclosure: I do not know Larry and I was referred to his program by a friend who is also the (still) happy owner of the same transceivers.

Another Mobile Power Option

As we have discussed in previous columns, connecting a transceiver to your vehicle's electrical system can be a challenge to do properly, given the power monitoring systems found in newer cars and trucks. In case you missed it, going directly to the battery with your rig's power leads (as was done in the good old days) can be detrimental to the vehicle's power management systems, so getting guidance from the manufacturer or dealer on how to correctly connect your ham gear to your vehicle's 12-volt system is an important step. They may be able to provide you with a tech bulletin on how to proceed. You might think that would be easy, given the number of vehicles in public safety or commercial service that use two-way communications. However, on several occasions, I have requested this information from the manufacturers via phone, through dealers, or manufacturer's websites and sadly, continually run into bureaucratic brick walls that take on the endless loop of "ask the dealer" and the dealer replies, "ask the manufacturer."

However, many newer vehicles offer another option for powering your gear — that is, a 110-volt AC outlet. Check to see if your newer vehicle has one of these, as they are becoming more common. The one found on my 2016 Ford Fusion plug-in hybrid is accessed in the back seat atop the center tunnel in a difficult-to-see location. Some SUVs and minivans have outlets located in the rear storage compartment.

By using a small but properly sized portable switching power supply, you may be able to operate your rig off the vehicle's 110-volt system, of course being sure to remain within the wattage specifications of the plug found in the vehicle. The maximum wattage specs can be found the owner's manual. This option also offers the ability to power a remote setup when you're in the field. So consider this clever work-around if you're unsure how to connect your rig to your vehicle's electrical system for DC accessories, or unable to route power cables through the vehicle due to obstructions. However, when using the AC outlet to power a ham rig, ensure the transceiver is properly grounded to the vehicle chassis using a good bonding method. Also be mindful to route coax antenna cables and antenna mounts away from the vehicle's computer modules.

The "lazy days" of summer abound with great mobiling opportunities. I hope you can take advantage of adding to your open road enjoyment with some contacts you'll enjoy telling others about at a later time.

– Happy Mobiling! Jeff, AA6JR

HOMING IN

BY JOE MOELL,* KØOV

Socially-Distanced Radio Foxhunting

"I have to say that hunting foxes has made the self-quarantine days much more bearable, and it gets me outdoors to boot!" Bill Curlew, KC1JTS, happily wrote that to the Connecticut Foxhunters email reflector. Gregory Vinci, N1ZXL, added, "This adventure is amazing. Besides playing radio, it has led me to some new and beautiful hiking places."

Finding transmitters that your fellow hams have hidden, known as radio foxhunting, is different nowadays. Some forms of it may not be possible at this time due to COVID-19 restrictions, but socially distanced foxhunting can be done and it has been a welcome respite from days of isolation at home for many hams.

Foxhunting in the Nutmeg State

Connecticut's foxhunters are a hardy bunch. They started 2020 with their traditional New Year's Day mobile event, organized by Paul Gibson, N1TUP. They gathered at an old schoolyard in their radio direction finding (RDF) equipped vehicles, checked in, and then set out to find Paul within a 20-mile radius and within two hours. His fox squawked occasionally on the input to a local repeater as Paul prepared for a tailgate party to take place after the hunters arrived.

That would be the last time these hunters were all together in a group for many months. But it wasn't the last foxhunt. Everyone had so much fun that Paul decided to bring back unattended foxhunting. On January 16th, he deployed his foxbox in the woods of Manchester. Hunters could cause it to transmit by sending a DTMF "1" on the fox's simplex frequency, 146.55 MHz. That would tell the fox to transmit tones and ID for 30 seconds, then go back to sleep until commanded again.

Paul encouraged hams to see where they could bring up the foxbox and to report that on the email reflector[1] to help other hunters know where to start their quest. "Do not reveal its location," he wrote. "Just give the location from which you are able to hear it and the direction if possible. You do not actually have to touch the box to claim finding it. Eyeball contact is sufficient."

Lots of "heard it" and "can't hear it" reports followed on the reflector. It was five days later that the first hunter spotted the foxbox. This hunt-when-you-can opportunity was so well liked that Paul put the box in another spot on January 31st.

To prove that they found the fox, hunters posted close-up photos that did not give away the location. The photos showed a waterproof military ammunition box with a whip antenna on top. Inside the box was a handi-talkie powered by a pair of 7-amp-hour sealed lead-acid batteries. The fox's brain was a PicCon by Byonics.[2] PicCon is a versatile controller that can be programmed for single transmissions on command. It also can provide continuous signals, cycles of short transmissions, and even the transmission sequence for international-rules, on-foot hunts.

These unattended hunts continued through the winter, with the box being recharged and moved every two weeks or so. Snowy weather wasn't much of a deterrent as more and more hams joined in. Social distance in a car wasn't practical, so hunters sought the fox by themselves or with close family members.

On April 4th, a second foxbox was deployed in Connecticut, made by N1ZXL. Ten days later, there were four foxes available for hunters, including a new box by Dan Thayer, W1CDT, and a second by N1TUP. All were on the same simplex frequency, but each required a different subaudible tone. Hunters could listen to all if desired, or use their radio's CTCSS function to concentrate on one at a time.

There are plenty of wooded areas in Connecticut and that's where most of the hiding places have been. W1CDT wrote, "We don't go near commercial property, private property (or) school playgrounds." Usually the foxbox has been on the ground, concealed by brush, which limits its radio range.

Foxes Are Multiplying

As word of the Connecticut COVID-time foxhunting fun spread, foxboxes began to appear elsewhere in New

The snow-proof foxbox of Paul Gibson, N1TUP, lured Connecticut foxhunters to many wooded sites during the winter and spring months. A bicycle chain and lock prevents theft. (Photo by Dale Whitney, WA1UUU)

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From January 16th to June 11th, Connecticut foxhunters tracked down unattended foxes in 37 locations north, south, and east of Hartford. (Compiled by Joe Moell, KØOV)

England and beyond. In mid-May, Hampden County Radio Association members built a box and began to deploy it in western Massachusetts. The Woodmont Amateur Radio Association launched its first fox in New Haven County, Connecticut, on May 20th.

Jack Robinson, KA1GCZ, explained how the next generation of radio foxhunters is getting started: "Back in late February when the fox was hiding in Nevers Park, my son and his family were up from Maryland for a visit and I suggested that we go hunting. My oldest grandson, Edwin Robinson, KC3JBY, was very impressed. Since then, he worked with his dad, Michael, KB1DDS, to make his own fox and release it into the wild. With help from his Mom, Donna Dietz, N2SZ, he put up a web page with information on his fox.[3] You never know what is going to grab a youngster's interest."

Unattended foxhunts like those in New England are a good alternative to the usual mobile hunt in which the hunters all start at a common site, then see which team can find the fox first or with least elapsed mileage. Hunters like to gather at the fox's location to chat, then go to a restaurant for a meal or dessert. With restaurants closed or offering only take-out, and with social distancing mandated, some of the fun is absent. Many clubs around the country stopped mobile hunting for these reasons. Others were concerned about local mandates that prohibited gatherings of more than a few persons.

Los Angeles and San Francisco Bay area mobile transmitter hunters had lengthy email discussions about an order that prohibited leaving one's residence except for certain approved purposes, one of which was "... to engage in outdoor activity and recreation." Some saw this as approval for T-hunting, while others, particularly those in high-risk groups, decided to wait.

Chicago is one of the few localities that have continued a monthly series of weekend mobile hunts.[4] Hunters stay socially distant at the start and finish, flashing their headlights to signal that they have found the hider. At the restaurant,

COVID-safe, on-foot foxhunters in the Cincinnati area on May 30th. Left to right are Matt Robbins, AA9YH; Brian DeYoung, K4BRI; Marji Garrett, KJ4ZKC; Cesi Dibenedetto, KD8OOB; Julie Dibenedetto, KE8IUU; Dick Arnett, WB4SUV; and Mike Minium. (Photo by Bob Frey, WA6EZV)

each family gets its own take-out food and everyone stays distant as they eat and chat in the parking lot.

Gathering While Staying Apart

Some stuck-at-home foxhunters are reviving a form of RDF contesting that dates back to the Mt. Wilson Repeater Association (MWRA) days in the 1980s. Part of each MWRA hunt was the beam-bearing contest, where both mobiles and those at home would take bearings on the hidden transmitter and submit to the hider. The winner was the listener whose bearing in degrees was most accurate.

A variation of this RDF contest is for all bearings to be shared among the participants and for each to use it to guess where the transmitter is hidden. The SigTrax app[5] for iOS and Android is an easy way to determine the winner of either type of contest. Joe Domaleski, KI4ASK, of the Fayette County Amateur Radio Club in Georgia announced that such a hunt would take place there on May 9th.

KI4ASK wrote that there was only one rule: "Do not attempt to drive to the fox. We are only triangulating bearings, not doing close-in work to find it. You must stay at your home or within a 1/4 mile if you want higher ground."

For those who prefer their foxhunts to be all on foot, it has been difficult to find opportunities. Most park officials consider a gathering for Amateur Radio Direction Finding (ARDF) to be an "event" and most localities have cancelled all permits for events. This has been a challenge around the world as it prevents radio athletes from gathering for the training they need to prepare for ARDF championships.

Radio-orienteers in Australia are trying unattended ARDF sessions. The first was in Wattle Park in Melbourne. Five transmitters were set out in 137 acres, timed to send the classic ARDF transmission sequence each day from 2 to 4 p.m. for eight days. Participants could come out on any convenient day, run the course, then turn in their GPS track and time to be included in the tabulated scores reported on the Web.

After a five-month hiatus, the Cincinnati Foxhunters Group finally assembled for a 2-meter practice and training session at Rentschler Park in Hamilton Ohio on May 30th. "We used a slightly different format," wrote Bob Frey, WA6EZV. "Rather than have one individual place all of the transmitters, five of us drew numbers to determine which transmitter to hide and drew again to decide an area or zone in the park to hide their transmitter. This gave everyone a chance to hunt at least four transmitters."

The annual CQ Worldwide Foxhunting Weekend (FW) was May 9-10th. COVID caused the cancellation or postponement of most of the annual FW events, including the Surrey Amateur Radio Club foxhunt in British Columbia; the Antennas-in-the-Park foxhunt in Fullerton, California; the San Diego Area T-Hunters on-foot session; and the family picnic and foxhunt of the Ski Country Amateur Radio Club in western Colorado. My email announcement of FW brought this response from Jaliya Jayampathi Lokeshwara, 4S7JL, in Sri Lanka: "Thank you very much. Our country is still on lockdown. Wishing you good health."

No one knows what the future holds, so FW won't be rescheduled to later this year. But when local restrictions permit it and it can be done safely, foxhunt gatherings will resume and I will be eager to get your reports and photos.

Same Time Next Year

The COVID-19 pandemic caused postponement of the 20th annual USA Championships of ARDF, originally scheduled for June 9-14th in the Boston area. A firm decision has not been announced, but it is likely that these championships will take place in the same forests in June 2021. The ARRL ARDF Committee will decide and announce a decision later this year.

USA's ARDF Championships are qualifying events for the biennial World ARDF Championships. The World Championships were scheduled to take place August 30th through September 5th in Zlatibor, Serbia but were also postponed. It is the current plan of the international committee to hold them in September 2021 in the same locations. The three IARU regional ARDF Championships that would have taken place in 2021 will move to 2022, and so forth.

Some RDF fans have used their stay-at-home time to work on foxhunting gear. An example is Jerry Boyd, WB8WFK, of Albuquerque, who is collaborating with Charles Scharlau, NZØI, on Arduino-based ARDF transmitters. They have published details of an Arduino script that will create timing and tones for classic ARDF, foxoring, and other sprints. Also included are plans for a simple 80-meter ARDF micro-fox. The software is open source. For more information and to participate in the project, visit the Open ARDF website.[6]

Has hidden transmitter hunting resumed in your hometown? How have the foxhunters in your area adapted to COVID-19 restrictions? Are you using this time to improve your foxhunting equipment? "Homing In" readers want to hear about it, so keep sending your RDF-related news to me. Happy Hunting!

NOTES

1. <https://groups.io/g/ctfoxhunter>
2. <http://byonics.com/piccon>
3. <www.donnadietz.com/fox>
4. <https://tinyurl.com/ydaewdwe>
5. <www.amcept.com/sigtrax>
6. <https://tinyurl.com/y9wppskl>

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LEARNING CURVE

BY RON OCHU, KOØZ

Hollow-State, Solid-State Primer

CQ is in the middle of celebrating its 75th year of serving the Amateur Radio Service. Within those 75 years, technology and ham radio experienced tremendous change. Arguably, one of the biggest changes involved the transition from vacuum tube technology, which was state-of-the-art in 1945, to transistor, or solid-state, technology. Even though today's state of the art has progressed to integrated circuits and microcontrollers, tubes and transistors are still major components of ham radio technology. Let's take a closer look.

Hollow State

Vacuum tube technology, also fondly referred to as "hollow-state" because of the vacuum inside a tube's glass enclosure, revolutionized the field of communications. Before the advent of tubes (valves if you're from the UK), spark gap transmitters and cat's whiskers (crystals) were the primary means of generating and receiving radio signals. For many radio experimenters of the early 20th century, distances were limited to a few miles. "Brute force" was the rule de jour. More power output equated to a few more miles. However, positive changes were on the horizon. The first vacuum tube, invented in 1904, is credited to John Ambrose Fleming (*Photo A*), a British electrical engineer. Fleming's diode vacuum tube consists of two electrodes: The cathode is negative, and the anode, or plate, is positive (*Figure 1*). The diode tube will let electric current flow in only one direction (negative to positive), so it is used as a rectifier. In 1906, a brilliant inventor from Council Bluffs, Iowa, Lee De Forest (*Photo B*), invented the triode vacuum tube. De Forest discovered that by inserting a third electrode called a control grid between the cathode (negative electrode) and the anode (positive electrode) of the existing diode tube (*Figure 2*), he could amplify a signal! This new tube, he called the Audion (*Photo C* and *Figure 3*), revolutionized electronics and communications. The triode's ability to amplify signals made it possible to increase power outputs, but even more importantly, allowed receivers to detect and amplify weak signals. Communication range for radio amateurs increased tremendously.

Basic Tube Theory

Vacuum tubes are glass enclosures with electrodes. The entire enclosure is in a near vacuum. The three basic electrodes in a tube are the cathode (negative), grid and anode (positive), also called the plate. Tubes require much higher voltages than solid-state electronics. When a signal is applied to the tube's grid there is a large, corresponding swing on the tube's plate supply voltage as the electrons leaving the tube's cathode rush past the grid and

Photo A. British physicist John Ambrose Fleming, the inventor of the diode vacuum tube. (Except as noted, all illustrations courtesy of Wikimedia Commons)

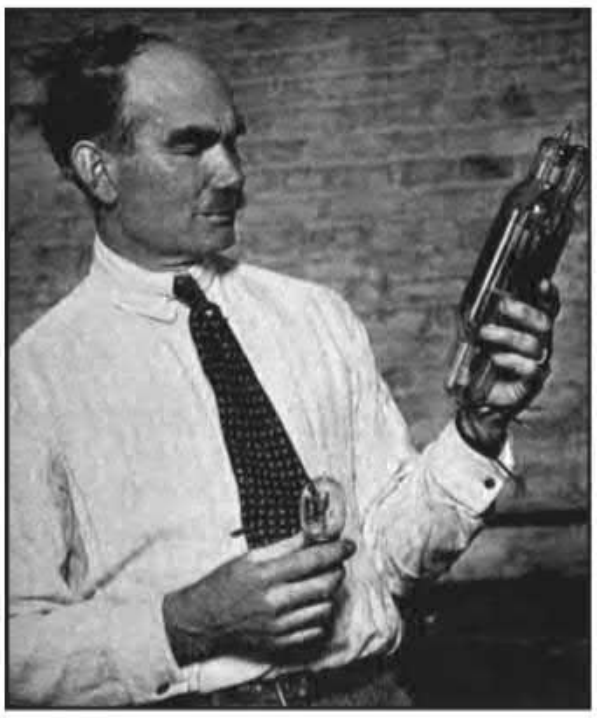


Photo B. Lee De Forest, inventor of the triode vacuum tube.

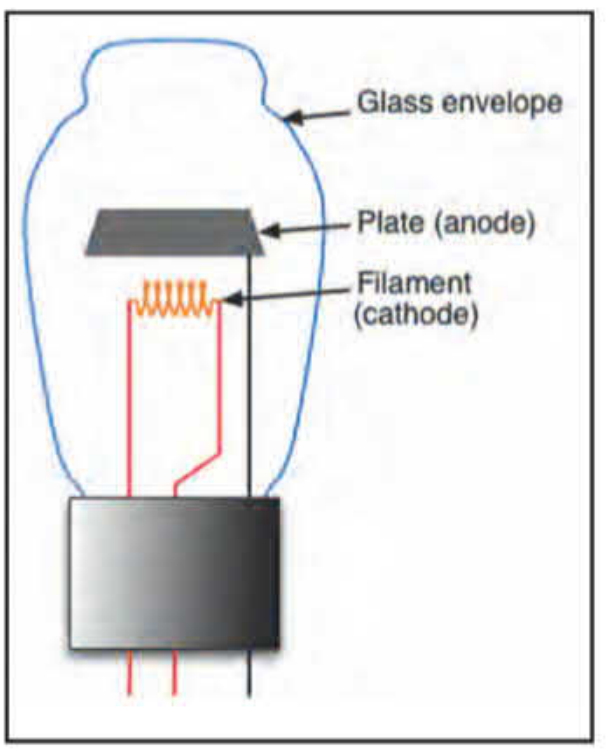


Figure 1. The first vacuum tube was the diode. Note the two electrodes the cathode (negative) and anode (positive).

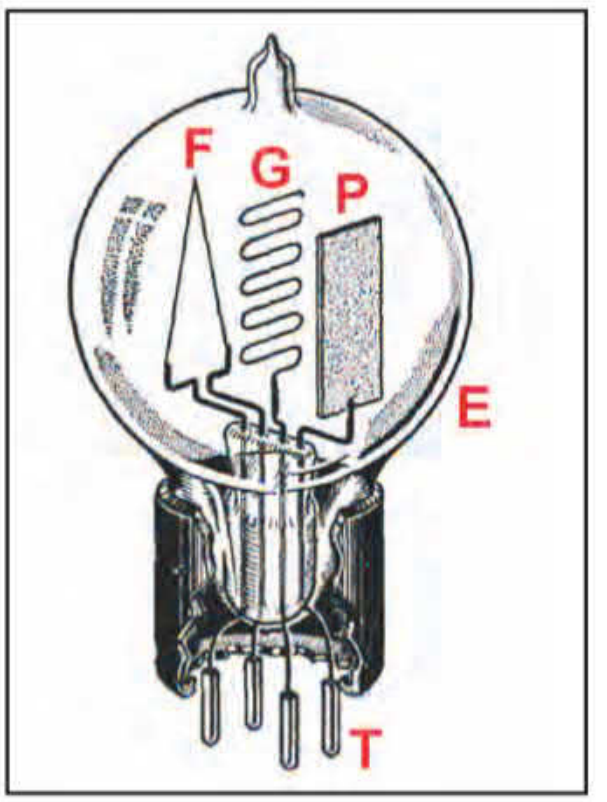


Figure 2. Illustration of the Audion tube, which is a triode. The filament acts as a cathode and there's a grid for signal input and an anode.

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

Photo C. An old tube from a 1920-era receiver mounted for display. (KOØZ photo)

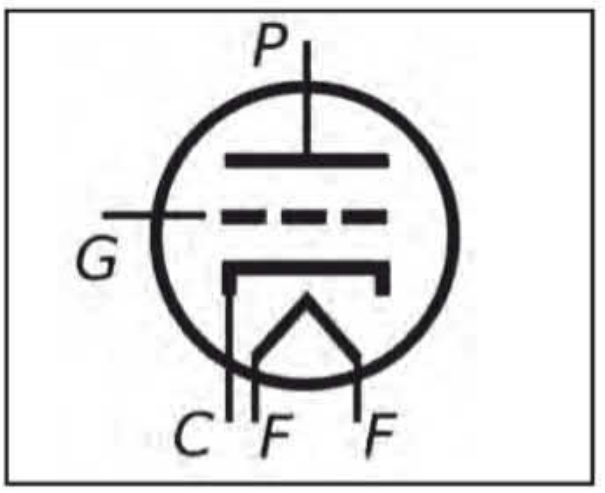


Figure 3. Schematic symbol for a triode. In addition to the cathode, grid, and anode, there's a filament that is used to heat up the cathode and speed up electron emission.

Photo D. A 3-500 C vacuum tube used in many HF amplifiers today.

collect at the anode's positive electrode. As the electrons pass through the grid, a voltage applied to that element modifies the electron flow on its way to the anode. This is how a vacuum tube amplifies a signal. Hollow-state technology relies on high voltages to produce signal amplification.

Hollow State Still Exists

Tubes are still utilized in electronics today; especially, when the application involves RF (radio frequency) power amplification. Popular RF power tubes still in use today include the 4CX250, 6146, and the 3-500C. The popular Ameritron AL 80 amplifier uses a single 3-500 C tube (*Photo D*). Although tubes are still employed for higher RF power levels, it's important to note that RF power transistors are rapidly replacing tubes in ham radio legal limit (1.5-kilowatt) amplifiers. Tubes tend to be more "forgiving" of higher SWR (standing wave ratio) values, as well as open and shorted antenna circuits. By more forgiving, I mean they will, for the most part, not self-destruct when confronting

Photo E. Elecraft's new solid-state KPA 1500 HF amplifier. Like many solid-state amplifiers, it requires no manual tuning and it can deliver full, legal limit power output. (Photo from Elecraft website)

Photo F. Bell Laboratories physicists John Bardeen, Walter Brattain, and William Shockley, inventors of the transistor. Their invention revolutionized electronics and changed the world.

these conditions for short time periods. On the other hand, earlier solid-state amplifiers were far less tolerant. Recently, protective circuitry makes solid-state amplifiers far more forgiving and the declining prices associated with RF power transistors makes these amplifiers (example in *Photo E*) as affordable as their hollow-state cousins.

Advent of Transistors

Beyond a doubt, tube technology revolutionized radio communications in the first half of the twentieth century. Almost mid-way through the same century, a group of physicists working for Bell Laboratories turned electronics on its head with the invention of the transistor. Physicists John Bardeen, Walter Brattain, and William Shockley (*Photo F*), in 1947 invented the bipolar point-contact transistor. The tiny transistor led to the miniaturization of electronic circuitry. In addition, since transistors use much less power than tubes, they generate far less heat, thereby extending the life, usefulness, and ruggedness of components.

Photo G. An assortment of commonly used transistors.

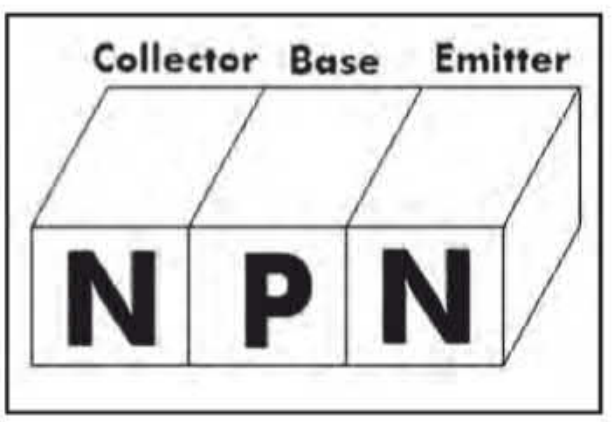


Figure 4. Diagram of an NPN transistor.

Basic Transistor Theory

As we've seen, tubes use voltages to amplify. Transistors (*Photo G*), on the other hand, use current to amplify a signal. A signal placed on a transistor's input electrode will cause a subsequent rise in current that mimics the signal input. Like the triode tube, the transistor (*Figure 4*) has three electrodes: The emitter, base, and collector. These are analogous to the cathode, grid, and anode / plate, respectively, in a tube. Upon closer inspection we see a transistor is really two diodes placed back-to-back. Voltages are substantially lower with solid-state electronics (typically 5 to 50 volts DC) as compared to hollow state (300 to 2,000 volts DC). But as noted above, while tubes use higher voltages, transistors have higher current demands than tubes.

Bipolar Transistor Leads

A very common solid-state device is named the bipolar transistor. According to Wikipedia, "A bipolar transistor allows a small current injected at one of its terminals to control a much larger current flowing between two other terminals, making the device capable of amplification or switching." Bipolar transistors come in two flavors: NPN and PNP. NPN (*Figure 5*) refers to the three sandwiched layers which make up the transistor: Negative, positive, and negative. Conversely, PNP (*Figure 6*) refers to positive, negative, and positive layers. Although the leads to NPN and PNP transistors are the same (base, emitter, and collector), how they are attached in a circuit is critically important. If the emitter of an NPN transistor is connected to a positive power source, the NPN transistor won't function for very long. Likewise, if an emitter of a PNP transistor is connected to a negative power source, it won't function.

Circuit Functions

Ham radio equipment uses bipolar transistors for a variety of functions. RF signal amplification, for both transmit and receive, is a common function, but so is switching circuitry off and on. Virtually every aspect of modern transceiver circuitry involves transistors in some way.

In addition, computers heavily rely on solid-state switching circuitry to operate. Switching power supplies use transistors to convert household AC (alternating current) voltages and current to DC (direct current) voltages that we can use with our radios. The list goes on.

Scratching the Surface

This brief primer on tubes and transistors is only scratching the surface. There's a lot more to learn about both hollow-state and solid-state electronics. The semiconductor field has exploded in growth since the advent of the transistor. For example, integrated circuits (ICs) are made up of hundreds to thousands of microscopic transistors; thereby, further reducing the size of an electronic device. Multiple ICs, in turn, are packed into microcontrollers, which are essentially specialized computers on a chip.

The next time you gaze upon an electronic circuit, take a moment to contemplate and appreciate all the history within the past 75 years that went into making current electronics possible and functional. Thank you for reading *CQ* and 73!

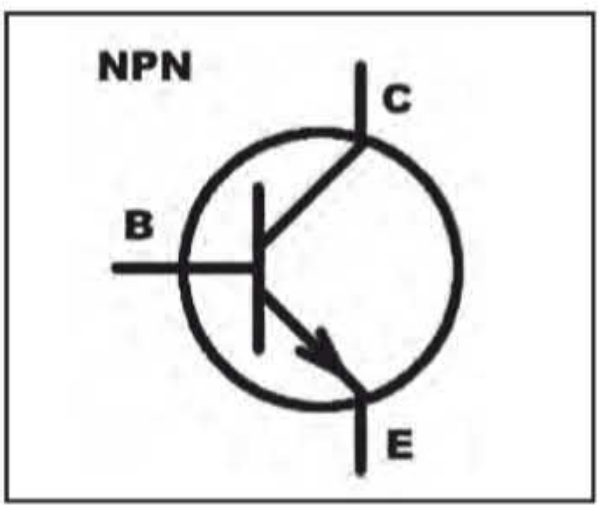


Figure 5. Schematic symbol for an NPN transistor. Note the emitter (the lead with an arrow) is Not Pointing iN towards base.

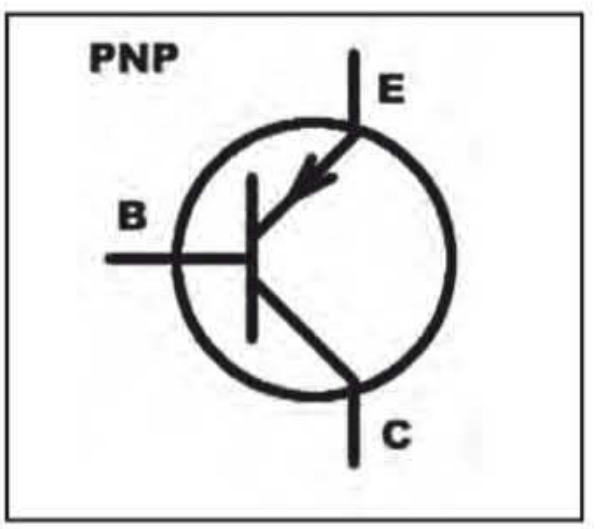


Figure 6. Schematic symbol for a PNP transistor. In this schematic the emitter is pointing in towards the base.

ANALOG ADVENTURES

BY ERIC P. NICHOLS,* KL7AJ

Ye Olde Gilbert Cell

HOW I DO IT

Coffee, coffee in my veins
Stimulate this writer's brains
Course right through my every artery
Make my verse more terse and smartery
By the teacup, by the mug,
Inspiration by the jug
Word and page, there's aught between us,
Time for caffeine intravenous
Is it madness? Do I sorta
Feel a throb in my aorta?
No, it's nothing, just a twinge
Time to start another binge

– *Eric P. Nichols, KL7AJ, 2004*

As promised, we will explore the Gilbert Cell, or "four quadrant multiplier," in this exciting episode of Analog Adventures. The Gilbert Cell is quite similar in function to the double balanced mixer (DBM) described in previous installments, but is capable of operating clear down to DC (0 Hertz). While the conventional DBM is capable of producing a DC *output*, the transformers on the RF (radio frequency) and LO (local oscillator) ports have lower frequency limits. These can, likewise, put a lower frequency limit on receivers that rely on the DBM. If you're interested in exploring our lowest-frequency ham band, 2200 meters, you will probably want to investigate the Gilbert Cell.

The Gilbert Cell is a recent innovation as far as analog circuits go, and unlike most other analog circuits, it really had no direct vacuum tube ancestry. It was invented by English engineer Barrie Gilbert in 1967 … practically just yesterday in technological terms. There are a few variations of the Gilbert cell, but *Figure 1* shows the generic form of the circuit.

While you can certainly build the Gilbert Cell with discrete components (and we encourage you to do so, as always), it usually comes in the form of an integrated circuit, or *part* of an integrated circuit such as the famous NE602, SA602, NE612, and SA612 series of "radio on a chip" devices.

From a cursory inspection of the circuit, we see that, just like the DBM, it has three ports: IF (intermediate frequency), RF, and LO. However, all three of these ports are inherently balanced.

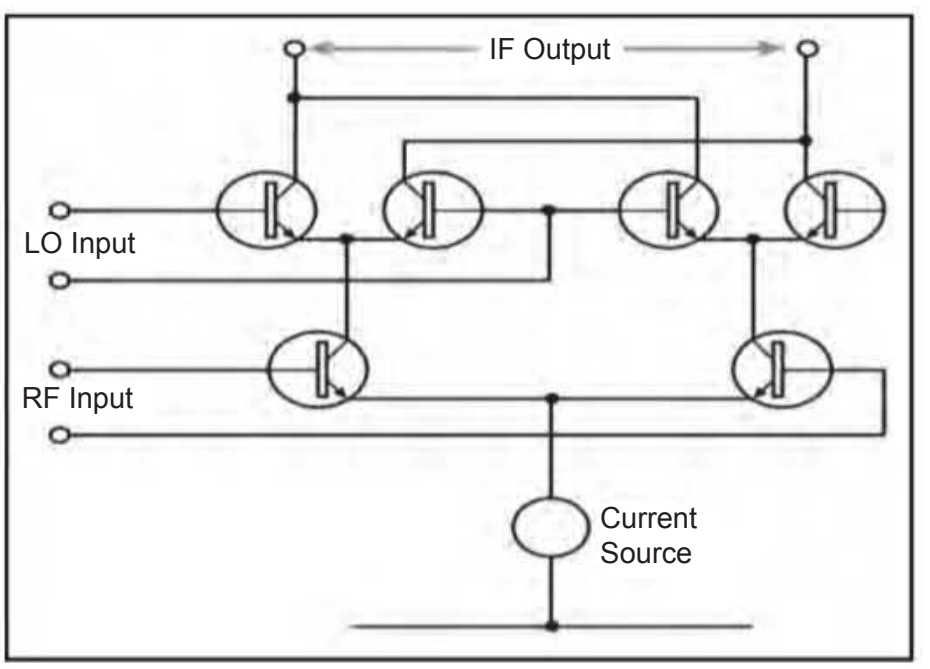
When properly constructed and biased, the Gilbert Cell is a true multiplier; the IF output voltage is always the perfect arithmetical product of the (instantaneous) RF and LO voltages. Naturally, this is a useful property for nearly any modulating or demodulating process. It also serves nicely as an ideal *voltage-controlled amplifier*, or VCA. One can use the RF input as a control port to control the gain of the LO to IF path. This makes the device a great choice for automatic gain control (AGC) of a receiver, either in an audio stage or an IF stage (or even RF stage). By the way, since the Gilbert Cell *is* an amplifier, you don't encounter the losses you would when using a passive DBM, although the gain is usually very moderate.

Being an arithmetical *operational amplifier*, it can also be used as the core of an *analog computer*, should you be inclined to build one. Actually, analog computational methods are experiencing a major renaissance … not so much as stand-alone computers but as integral components of numerous signal-processing devices, from "DC to daylight." We will be exploring these functions in detail in future installments, but I'd like to touch on just one manifestation here: The *logarithmic detector*.

The logarithmic detector has been used for ages in radar receivers, because of the necessity of detecting (demodulating) signals with huge differences of amplitude. Typical radar returns can have dynamic ranges of well over 200 dB. The logarithmic detector also finds use in cellphones and other communications systems.

Now, confining our thinking to AM signals, we know that an AM detector is essentially a rectifier. The detection is usually considered to be a separate function from whatever RF or IF amplification precedes it. But a logarithmic amplifier will also serve as an AM detector. Let's look at the log-amp from a strictly arithmetical standpoint. As we know, an RF signal is AC … it has both positive and negative amplitudes, relative to some "ground" voltage. Well, if we take only the positive excursions of an RF signal and apply them to the input of a log-amp, we get the simple logarithm of the RF voltage. But what about the negative voltage excursions? Pull out your scientific calculator, punch in -2, and hit the LOG function. You will get an invalid input error. What does a log-amp do with an invalid input, i.e., a negative voltage? It gives you *nothing* out. So, by virtue of the characteristics of the logarithm itself, you have built-in (half wave) rectification … or AM detection. Pretty slick.

Now, remember my passing comment about the Gilbert Cell being inherently balanced? It can be used as a *differential* or *push-pull* logarithmic detector … or stated more obviously, a FULL WAVE detector. Even slicker. Full-wave detec-



Basic Gilbert Cell

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North Pole, AK 99705
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tors can have significantly less distortion than single-ended detectors. Are we having fun yet?

Cascades

As with any operational amplifier, VCAs (constructed with Gilbert Cells) can be cascaded to aid and abet the performance of a single device. Vast quantities of AGC control can be achieved by cascading multiple VCAs in a receiver's "gain chain." While there may not be too much demand for "extreme AGC" in the average ham transceiver, when it comes to instrumentation, such as measuring field strength, having a huge variation in available gain can be really handy.

Baseband

If I may be permitted to once again (very briefly) waltz into the digital domain, we can reiterate that *any* form of digital modulation can be created with a pair of double balanced mixers driven in phase quadrature. This is part and parcel of every modern digital signal processing (DSP) method. A pair of Gilbert Cells in quadrature is the ideal (and nearly universal) method of creating modern digital baseband signals. These baseband digital signals can be used to modulate another set of Gilbert Cell modulators at a higher frequency. In *theory*, there is no limit to how many tiers of modulation you can produce by such methods. For instance, you can modulate a carrier, use the result to modulate another higher frequency carrier, and use *that* result to modulate yet another, even higher frequency, carrier. While the *legality* of such methods might be questionable in amateur radio applications, there is no absolute physical limitation to the number of modulation tiers one can achieve.

Furthermore, while having just two balanced modulators in quadrature allows you to create any modulation scheme, it is sometimes more practical to use multiple balanced modulators with smaller amounts of phase shift … quite commonly used in modern digital modes. I could go into that in great detail here, but our beloved digital columnist has probably covered this already, or at least will at some time. So I will return to my proper analog bailiwick.

Locking Things Up

We haven't forgotten our friendly local lock-in amplifier. Next installation we'll reconfigure our lock-in amplifier to take advantage of the Gilbert Cell, and learn a few other tricky tricks in the process.

Until then, keep the soldering iron hot, and the coffee pot full.

73, Eric KL7AJ

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ANTENNAS

BY KENT BRITAIN, WA5VJB

Ground Planes and Gigahertz

Let me start by saying that the quarter-wave vertical is a horrible antenna that can't talk much farther than you can throw your transmitter!

OK, now that I have your attention … a quarter-wave vertical over a ground plane is a good antenna with a long history of excellent performance.

The difference is that ground plane. A proper ground plane needs to be about a half-wavelength across and in *Photo A*, we have a 1/4-wave 2-meter vertical with a good ground plane, in this case the roof of a van. Yet it is amazing how many hams will call that little PC board on the end of a 150-MHz, 1/4-wave whip in *Photo B* a ground plane. Wishful thinking!

You will be very disappointed putting just a quarter wavelength of wire on a small transmitter like that. The difficult part is that I can't tell you exactly how long it should be. Ideally it would be a half wavelength of wire, but a half-wave dipole fed at one end has an extremely high impedance. We are talking 1,000+ Ohms.

The ideal length depends on what impedances the transmitter can deal with, what inductors and / or capacitors are in the transmitter output, and just how big that PC board really is.

The only way I know to optimize the antenna is to put a long wire on the transmitter, a bit over one-half wavelength long is a good starting point. Turn on the transmitter, set up a receiver or spectrum analyzer 10 to 20 feet away. Get out your wire cutters and start trimming. Cut it off twice and it's still too short? That's why you have a soldering iron. Most of the time you will find max signal strength is with the wire about 0.4-wavelength long.

For you guys (and gals) who like to play with multiband HF dipoles, you can think of this PCB transmitter and 4/10th monopole as an offset feed dipole. I know, you would like something smaller, but physics is physics.

Photo A. Quarter-wave vertical over a good ground plane.

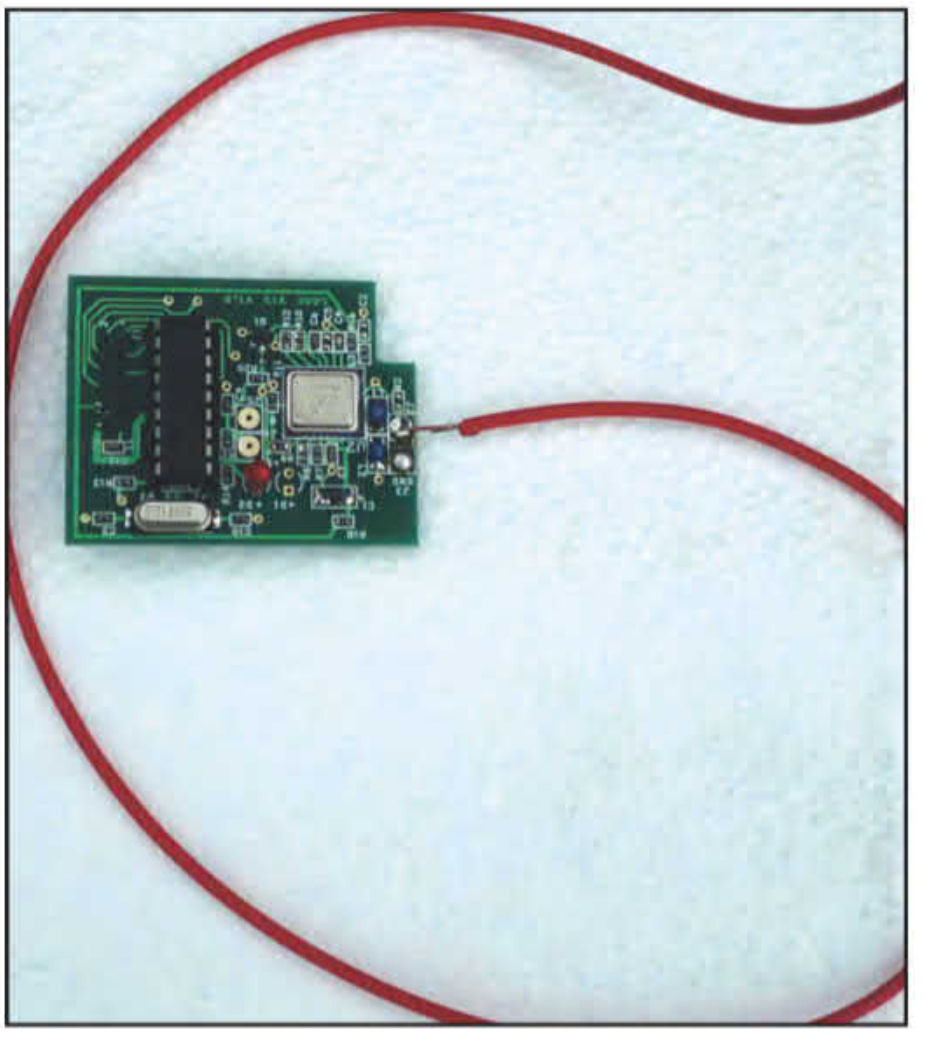

Photo B. Quarter-wave antenna NOT over a good ground plane.

Satellite Antennas

Going to talk about AMSAT antennas for a bit here. In *Photo C* are some X-Band antennas for the AMSAT GOLF-T 3U satellite downlink. I can see the panic growing now. "10 GHz! I was going to use that Mad Money to buy a K4, but even that won't be enough!" Come on, we're cheap hams, too! How does about $40 sound for a 10-GHz receive setup?

Back to *Photo C*. The center antenna is on Rogers 4350 PCB material, the end ones are on Arlon 25N material. Both are "space-qualified" PCB materials. In this case, the most important material specification is outgassing. In short, if the material has any smell, it flunks! If the PCB material has any oils or volatiles that can evaporate in a vacuum, it's a problem. These volatiles tend to condense on solar cells, reducing power. They also collect on optics, messing up star trackers and camera lenses, and even on the body of the spacecraft, reducing heat dissipation. In short, bad news, so these antennas are on materials that won't do that.

email: <wa5vjb@cq-amateur-radio.com>

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

NEW!

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!

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- QUICK BAND SELECTION
- AUTO-TUNING BASED ON SWR
- 80m - 10m COVERAGE AVAILABLE
- NO COMPROMISE SPOT-ON TUNING
- MAX POWER: 100 W PEP*

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.

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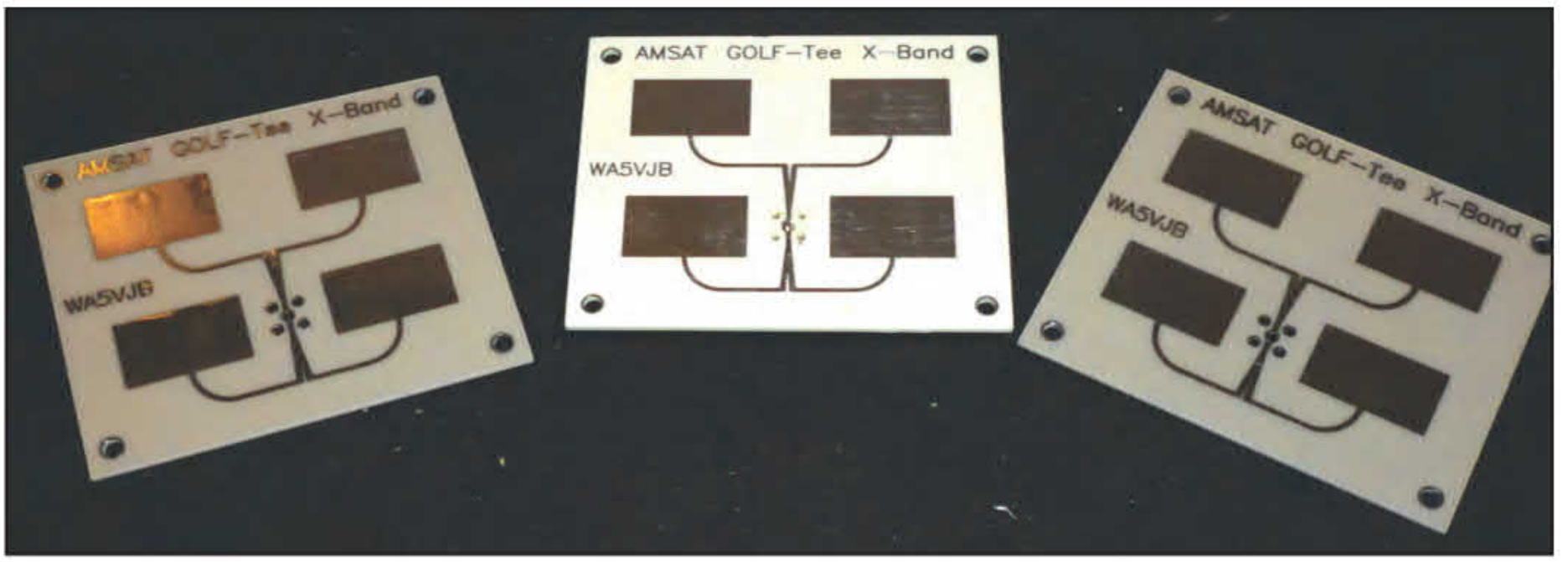


Photo C. AMSAT GOLF-T 10.45-GHz antennas (see text for details).

Most U.S. satellite TV systems use 30-MHz-wide channels with the different programs using different packets in that 30-MHz bandwidth. To downconvert those wide channels, a simple voltage-controlled oscillator (VCO) with some kind of AFC (automatic frequency control) circuit is good enough. Great for satellite TV, but of no use for our purposes. In other countries, there are still quite a few narrow-band services on the direct broadcast birds. Now you have to have a converter with much higher frequency accuracy. In *Photo D*, in the upper right corner of the photo, is an OCTAGON crystal-controlled LNB (low-noise block downconverter). These are very popular with European hams using the QO-100 geostationary satellite. The downlink at 10,450 MHz comes out at 739 MHz. Now you can use a wideband receiver that covers 739 MHz or one of the $10 USB dongles that picks up UHF TV stations.

The other two LNBs in the photo are ASPEN Eagle DTV36LNBs, which are also crystal controlled. In their case 10,450 MHz comes out at 463 MHz. A quick scan of eBay shows them selling in the $10-$20 range. Add a DC power source inserted to send power up the coax, and some coax, and we're looking at a 10-GHz receive system in the $40 class. Hey, not as bad as you thought it was going to be.

But don't go out and buy a DTV36LNB just yet. We are looking at several other brands to see if any might work better in an AMSAT 10-GHz downlink. Now, at least, you have a good idea at what you need for one of these stations.

I have been active on 10,368.1 MHz SSB for many years, so I did some testing to see just how good one of these antennas might be for weak-signal

Photo D. Low-cost 10.45-GHz system for receiving 10.45-GHz AMSAT satellite downlinks.

work. From 1 to 15 minutes, it only drifted 9 kHz. And I wouldn't argue how much of that was in the signal generator, or the little spectrum analyzer looking at the CW signal. Certainly, these have possibilities for CW / SSB use. For AMSAT use, worst-case Doppler shift would be ±200 kHz for an overhead pass at 10,450 MHz. The software guys are looking at digital modulators and demodulators for SDRs that can deal with this kind of frequency shift. Now that 9 kHz of drift is not an issue.

We are still looking at some of the path loss numbers, and hoping we can get away with just a modest horn on the LNB. I know the QO-100 geostationary satellite can be heard with just the LNB looking up at the bird. Very, very, weak, but I've given 59s to weaker signals HIHI! We really don't want to go to a dish. Using something like a Direct TV dish means you have to track the bird to an accuracy of 3° or 4° while moving across the sky at about 20° a minute. GOOD LUCK!

Talk to Me!

Feel free to contact me with your antenna questions or suggestions for column topics. You folks do come up with some doozies at times and are always good fodder for a future column. Email your questions to <wa5vjb@cq-amateur-radio.com> or snail mail to my QRZ.COM address. For other antenna projects, visit <www.wa5vjb.com>.

VHF PLUS

BY TONY EMANUELE,* K8ZR

NDØB Earns Fred Fish Memorial Award (FFMA) #10

VHF Plus Calendar

ARRL 222 MHz and above Contest: August 1st & 2nd
ARRL 10 GHz and Above Contest: August 15th & 16th
Perseids Meteor Shower: Predicted peak August 11th – 12th
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
ARRL EME Contest 50 to 1296 MHz: October 11th & 12th

The Fred Fish Memorial Award[1] was established by the ARRL in 2008 to honor Fred Fish, W5FF, for his many VHF accomplishments, most notably being the first to work and confirm all 488 grid squares in the 48 contiguous United States on 6 meters. His other accomplishments included Worked All States (WAS) on 50 MHz – 432 MHz.[2] Fred and his wife, Lee, K5FF, were fixtures on 6 meters and considered the quintessential 6-meter operators. W5FF was awarded FFMA #1 and since the award's inception, the following have earned FFMA: W5OZI (2010), K5UR (2010), KMØA (2011), WD5K (2011), NØLL (2015), W7GJ (2015), AA5AM (2019), and W4UDH (2019.) This June, Bill Ockert,

Photo A. Bill Ockert, NDØB, the tenth person to earn the Fred Fish Memorial Award for working all 488 grid squares in the continental U.S. on 6 meters. (Photo courtesy NDØB)

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

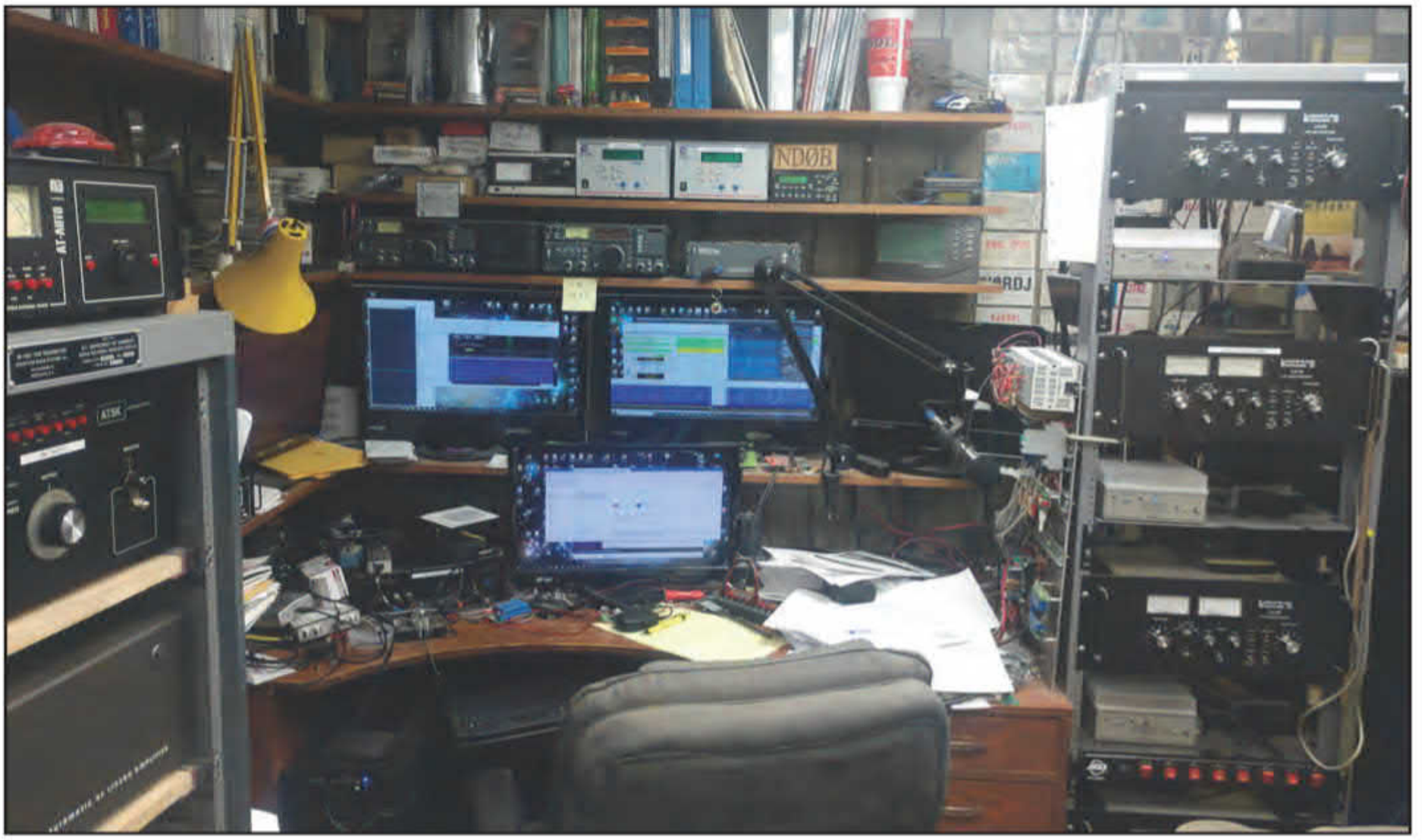


Photo B. NDØB's shack today. (Photo courtesy NDØB)

NDØB, in EN07 Cathay, North Dakota (*Photo A*), confirmed his last grid and was awarded FFMA #10.

Bill got started on 6 meters in 2004 when, on a whim, he loaded his ICOM 756 Pro III into his 160-meter G5RV dipole. Reading that the 6-meter calling frequency was 50.125 MHz, he called CQ a few times over the course of a few days with no answer. Unbeknownst to Bill, it was just the start of the sporadic-E (E_s) season and a few days later, when the band did open, he made 180 QSOs over a 12-hour period and concluded that "it was pretty darn fun!" He was hooked, and set out to earn WAS on 6 meters.

A day or two later, Bill received a telephone call from Rick Roderick[3], K5UR, requesting a schedule. As Bill recalls, Rick stated that he was trying to duplicate W5FF's achievement and work all 488 grids in the lower 48 states. Bill's response was "sure, but who is Fred Fish and what is a grid?" K5UR patiently explained both and they worked the next day. Bill went back to chasing states and managed to work 37 states and 240 grids with the G5RV before erecting a seven-element 6-meter Yagi. By the end of his first season, Bill had completed WAS and when discussing his achievement with his good friend, NTØV, Dennis joked, "What's next? Fred Fish?" The idea was planted and soon afterwards, Bill began his FFMA quest.

A second fortuitous QSO occurred a bit later when Bill saw a posting that David Schaubert, NJØW, while making his way from Arizona to Fargo, North Dakota, would be activating nearby EN15 on MSK441[4]. They worked initially on MSK441 but switched to SSB where David suggested that Bill follow his travels on PingJockey[5] so that he could work him in other needed grids as he made his way to Fargo. He took David's advice, becoming a frequent visitor to the site where he was coached by the regulars on how to operate meteor scatter. To this day, meteor scatter continues to be one of Bill's favorite modes.

Initially Bill did not pay too much attention to collecting QSL cards, concentrating only on obtaining cards from new states worked. That all changed in pursuit of FFMA and he found himself sending out nearly 100 QSLs with SASEs, with a return rate at approximately 60%, for grids he had worked previously. He marks 2010 as the starting point with 240 confirmed grids. He surpassed his first-year goal of 400 worked by 20 grids. Learning from his early QSL experience, he made sure that cards were sent immediately and, by the close of 2014, had worked and confirmed 485 of the 488 grids necessary for the award.

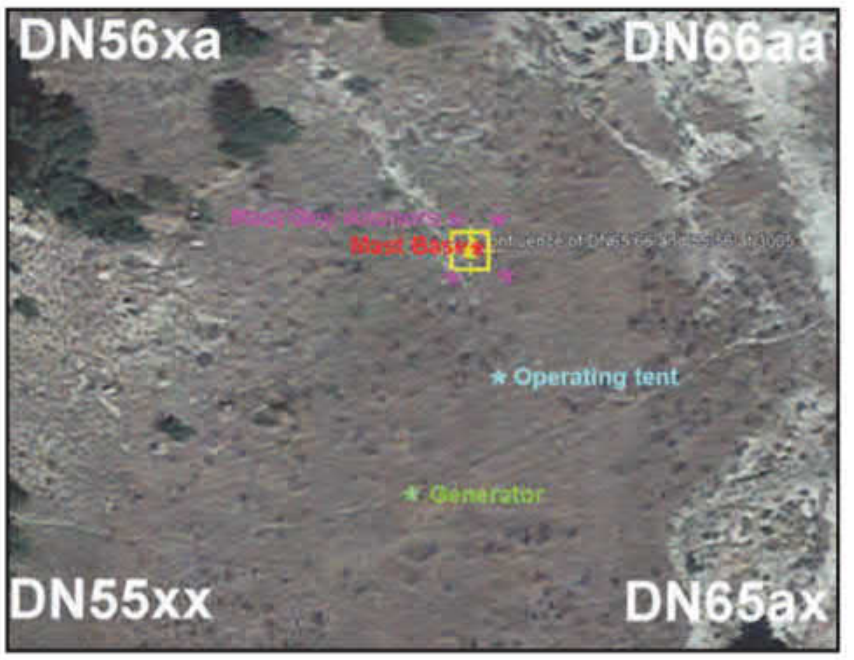


Figure 1. Grid confluence of DN55, DN56, DN65, and DN66. (Courtesy of W7GJ)

In 2015, FN67 Maine / New Brunswick was worked, leaving only CM79 and CM93. Grid CM79 along the northern California coast is mostly water, with just a tiny speck of land within its boundaries. It can only be accessed on foot with the nearest road a couple of kilometers inland in CM89. In 2017, Frank Letton, W6JTI, packed up his 6-meter gear and hiked to CM79, working Bill and leaving only one remaining grid to be worked.

The "toughest nut" to crack according to Bill was his last — grid CM93 Santa Rosa Island, approximately 100 kilometers off the coast of Los Angeles. There had been several DXpeditions to the island over the years but not a hint of propagation to North Dakota during any of those outings. However, on one of his several trips to the island, Peter Suchomel, AG6EE, reported that he had been hearing NDØB for several hours. After spending 18 hours over two days at the operating position (referred to as BIC[6]), AG6EE came up out of the noise just long enough to complete the QSO which was logged at 0016z on 20 June 2020.

After that QSO completing his long-awaited goal of achieving FFMA, Bill thought he would be jubilant — "bounc-

Photo C. Lance Collister, W7GJ, operating at the grid confluence of DN55, DN56, DN65, and DN66. (Photo courtesy KB7Q)

Photo D. W7GJ sheltered from the rain. (Photo courtesy W7GJ)

ing off the walls" but he reports he was mostly numb and still in disbelief of completing the task.

An Evolving Station

The equipment at NDØB has evolved over the past five years and today, a Flex 6700 drives a legal-limit amplifier (*Photo B*). A significant factor in the last two contacts was Simon Brown's SDR Console program with a NOOELEC RTL dongle and, more recently, with an Airspy R2. On both the CM79 CW contact and the CM93 FT8 contact, the combination resulted in being able to hear / decode signals on SRD Console before they were detected with the transceiver.

Bill would like to thank everyone who helped him in achieving his goal including David, NJØW, for 29 of the 488 grids worked; Gene, KB7Q, who was logged from 12 grids; and Marshall, K5QE, and his crew for activating a number of rare grids along the southern border. Of course, there were many others. Bill made special mention and is grateful for the assistance of Sharon Taratula, ARRL awards manager, during the application process.

Figure 2. The 6-meter band at the conclusion of June's ARRL VHF Contest. (Courtesy of DX Maps)

W7GJ & KB7Q GriDXpedition

Veteran international DXpeditioners Lance Collister, W7GJ, and Gene Shea, KB7Q, recognizing the need by a large number of operators for several rare grids in their home state of Montana, decided to stay close to home and activated grids DN55, DN56, DN65, and DN66 at their confluence (where all four grids meet — see *Figure 1*) from June 19th to June 22nd. All DXpeditions, domestic or international, require some level of planning and this effort started at the end of 2019 with discussions with the property owner, eventually leading to permission to operate from the site for a few prime days around the Summer Solstice.

KB7Q would operate 2-meter meteor scatter from DN65 and the DN56/66 line, and assist W7GJ with setting up the 6-meter station at the four corners (*Photo C*). Arriving late on the morning of the 19th, the respective stations were ready to go the next morning, Saturday June 20th. Starting the day before 1200z on MSK144, Lance switched modes to FT8 later when E_s made the mode viable. Most of the E_s was single-hop and because of the higher ground immediately to the northwest, most of the contacts into the Pacific Northwest were made by using E_s backscatter while W7GJ was aiming toward the southeast.

It rained several times on Sunday, requiring the equipment to be covered (*Photo D*) and Lance to take shelter. Despite the occasional rain, operation continued until the band faded out after a double-hop opening into southern Mexico. Over 300 contacts were logged on 6 meters using MSK144 and FT8. KB7Q managed 19 meteor scatter QSOs on Saturday from DN65 and 24 QSOs on Sunday from what Gene characterized as "an outstanding location" on the DN56/66 line (*Photo E*) with his best DX at 1,223 kilometers (760 miles). The duo made sure that they left the site as they found it and, other than the rain and Gene narrowly missing stepping on a rattlesnake, the effort went off as planned.

On the Bands

The conditions during ARRL June VHF Contest were very good to excellent for most of North America with many hours of E_s on 6 meters. There was a bit of

Photo E. Gene Shea, KB7Q, operating 2-meter meteor scatter on the DN56/DN66 grid line. (Photo courtesy KB7Q)

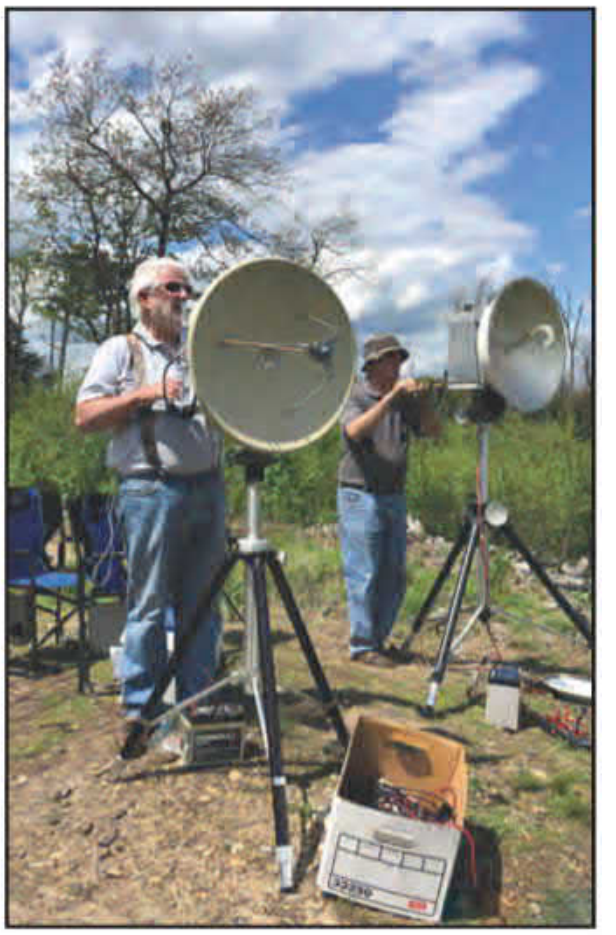


Photo F. K3WHC (L) & W2RMA (R) operating 10 GHz in FN10fe09pf. (Photo by K1RZ)

everything on 6 meters: CW, SSB, MSK144, FT8, and FT4 (with DX for some via digital or SSB / CW), requiring the most competitive stations to continuously reassess their mode / frequency decisions throughout the contest. See *Figure 2* for a snapshot of 6 meters at the closing bell of the contest at 0300z June 15th.

A week after the contest, when conditions had seemingly cooled off, the chatter on the chat pages quickly turned to the state of the E_s season with many lamenting that the 2020 season was not measuring up to past seasons. Activity reports from several operators underscore that 6-meter E_s is all about location, location, location. Mario Karcich, K2ZD, in FN21 filed a report a week after the ARRL contest that the 6-meter E_s season began for him on April 14th and as of June 22nd it was one the best seasons he has experienced during his 54 years on the magic band. He reports working or copying 71 DXCC countries on CW, FT8, or SSB including A92, KG4, KH6, OD, OHØ, UN8, and YT, to name a few of the more exotic DX entities. On June 8th, Mario worked TA1BM (Turkey) for 6-meter DXCC #212 and a day later, bagged TT8SN (Chad) for 6-meter DXCC #213. Tony Everhardt, EN81, reported that 6-meter conditions in northwestern Ohio were very good as he worked over 25 countries in Asia, Europe, South America, and the Caribbean in just a few days.

While anecdotally the post-contest E_s openings seemed fewer than earlier in the season, there were several notable exceptions. From June 24th through the 26th, the magic band was open from the West Coast of North America into Europe. Steve McDonald, VE7SL, in CN88iu worked Crete (SV9) and Sardinia (ISØ).

A sampling of West Coast-to-Europe QSOs include: Phil Krise, W6UC, in DM05jl worked EA7M IM76sr at approximately 9,500 kilometers (5,900 miles); and Hector Garcia, AD6D, in DM22rp worked OZ2PBS JO55xj at approximately 9,000 kilometers (5,600 miles) and S57RR in JN65um at an amazing distance of approximately 9,900 kilometers (6,100 miles.)

Not all the activity has been on 6 meters. A group of 12 10- and 24-GHz operators took advantage of good weather and spent the last Saturday in May exercising their equipment, trying new paths and enjoying the day. Participants included: W3SZ, W2RMA, K3WHC, and W3HMS on 24 GHz, with K1TEO, W3IP, KM3G, N9ZL, WA3PTV, W3EKT, and N3RG on 10 GHz with K1RZ functioning as ringmaster. Best 10 GHz DX was approximately 350 kilometers (217 miles) — not bad given the time of year. This group will be out throughout the summer with their focus on learning, tweaking, and strategizing in anticipation of the first weekend of the ARRL 10 GHz and above contest in August (see *Photo F*).

And in the "I am not surprised" department, veteran millimeter-wave pioneer Barry Malowanchuk, VE4MA, reports that he worked VE4DDZ for what he believes is the first Canadian 122-GHz QSO. Using bare mixers and 12-inch dish with a subreflector at one end and an 18-inch offset feed dish at the other, the pair easily completed the QSO on SSB over a 1-kilometer path. The next step is to replace the bare mixer assemblies with VK3CV 122-GHz boards which will significantly improve both the transmit path (more power) and the receive path (lower noise figure.) Now that all the VK3CV 122-GHz boards have shipped, expect additional reports of 122-GHz activity from various operators in North America.

– 73 and CU on the Bands. Tony, K8ZR

Notes:

1. FFMA rules dictate that all QSOs must be made from within the same 200-kilometer circle. There are no tiers of progression or endorsements.
2. Source: ARRL FFMA Announcement 2008 PDF.
3. Current ARRL President and avid VHF operator.
4. The predecessor of the meteor scatter mode MSK144.
5. Meteor scatter website: <www.pingjockey.net>
6. Contesters' and DX chasers' term for "butt in chair."

AWARDS

BY JIM HOUSER,* WA8JIM

The Ham Radio Honor System

Plus, Awards from Ireland, Canada, Ohio and Maine

During my time off on Memorial Day weekend, I had some free time to go back to my childhood. I sat and watched television episodes from my past. They reminded me of my younger years and where I used to live. All the neighbors knew your name, they were good friends, and were willing to help if you needed assistance.

In one of the televisions shows, a character said that "a stranger is just a friend we've never met." That immediately made me start thinking about how that line is a perfect fit for ham radio.

While watching another TV show, it was mentioned that one of the characters was considered to be the most trusted person in the area, not only by his friends but also by his foes. Think about how long (if it were a real person) it would take to be trusted like that. That person would be considered very honorable. Which brings us to the "honor system" in the ham community.

Many award programs use the honor system for most applications. A general example: If you claim you followed all of the award rules and have the required confirmations to qualify, your word is accepted. However, the sponsoring group has the right to request your QSL cards or other certification of confirmations when you're applying for the group's certificate.

Keep a Log

If you are a paper chaser or plan to be, even though it is not required by the FCC, it's a good idea to keep an accurate logbook and note the QSL cards that you receive. There are many sponsored awards that have rules that say, "QSL cards not needed," but there's nearly always another provision that says they may be requested. So, make the contact, put it in your logbook, send for the card, keep the QSL card when you receive one, obtain the award, and have fun doing it all.

Awards of Interest

Moving on to specific awards, we've got five sponsoring groups to spotlight this month:

We start off in Ireland with some of the many awards offered by, the Irish Radio Transmitters Society (IRTS), which is the national organization that represents hams in Ireland <www.irts.ie>. For the full history of the IRTS, follow the above link.

The Worked EI Counties ("WEIC") Award (*Photo A*) is a good starting point. You would think the name would be self-explanatory; however, the rules need to be read to fully understand the title. The prefixes of the callsigns for this hunt are EI or EJ. All worldwide amateur radio operators and SWLs are welcomed to chase after this wallpaper. QSL cards are not needed but a certified log extract is required.

The log extract information will include dates, times, modes, stations worked, and the station's county. An officer of a radio club or two amateur radio operators must certify the extract before forwarding it to the awards manager.

Photo A. The Irish Radio Transmitters Society's Worked EI Counties award.

Contacts for this award are valid starting January 1st, 1982. There is small fee of 5€, 5£ UK, or $10 U.S. . The site reads, "Band endorsements will be available at the time of first application." If your home station is other than Ireland, then your home station, mobile, and portable contacts are all accepted.

The requirement is to work 20 out of 26 counties in order to earn the certificate. There is a sticker that can be obtained by confirming all 26 counties. Carlow, Cavan, Clare, Cork, Donegal, Dublin, Galway, Kerry, Kildare, Kilkenny, Laois, Leitrim, Limerick, Longford, Louth, Mayo, Meath, Monaghan, Offaly, Roscommon, Sligo, Tipperary, Waterford, Westmeath, Wexford, and Wicklow are the counties on the award list.

Once you have confirmed contacting the stations and following all the award rules, send your request to the awards

Photo B. This certificate can hang on your shack wall if you contact hams in each of the 18 townships of Delaware County, Ohio. (Courtesy Delaware Amateur Radio Association)

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

Photo C. The Radio Amateurs of Canada offers the St. Lawrence Seaway Award for contacts with stations along the shipping route between the Great Lakes and the Atlantic Ocean. (From RAC website)

manager, who is currently Jim Holohan, EI4HH, 7 Hiltons Garden, Balinteer Avenue, Balinteer, Dublin 16, IRELAND. Jim's email address is <awards@irts.ie>.

State QSO Parties

Back in May of this year, I mentioned that contests are a good way of making contacts for award credit (*see also last month's article, "Contesting Your Way to DX Success" by K5FUV. –ed*), so you might want to join in. One specific type of contest is the state QSO party. A good example this month is the Ohio QSO Party, which will occur on August 22nd. The rules can be found at <www.ohqp.org>. Most state QSO parties use their state's counties as multipliers, and counties with small ham populations are frequently on the air. You can use these QSOs to build up contacts for domestic awards such as ARRL's Worked All States (WAS) or CQ's USA-Counties Award (USA-CA). In addition, the club sponsoring the party usually has awards for the top winners.

When you're on the air chasing Ohio counties, there is an additional award you want to keep in mind. The Delaware Amateur Radio Association (DELARA), K8ES, sponsors a year-round certificate. The WADCO – Worked All Delaware County – award (*Photo B*) requires at least one QSO in each of the 18 townships of Delaware County, Ohio.

All contacts must be made after June 30th, 2012. All bands and modes, including repeaters, are allowed. No QSL cards are needed since you will be applying electronically at <www.k8es.org/wadco.htm>. You will also receive the award electronically and it is free of charge. There are endorsements for single modes, single bands, or for any five bands.

The townships that are in Ohio's Delaware County are: Berkshire, Berlin, Brown, Concord, Delaware, Genoa, Harlem, Kingston, Liberty, Marlboro, Orange, Oxford, Porter, Radnor, Scioto, Thompson, Trenton, and Troy.

Radio Amateurs of Canada Awards

The Radio Amateurs of Canada (RAC) is the national organization that represents hams in Canada. Its awards program offers plenty of certificates. See <https://tinyurl.com/y7bqtk3x> for a complete listing. There were two RAC awards that caught my attention. The first one was the Provincial Capitals Award and the second was the St. Lawrence Seaway Award (*Photo C*), which is the first I want to cover.

The St. Lawrence Seaway Award rules are as follow: Any contact from July 1950 to the present is valid for this certificate. Any band and mode is allowed. The fee is $10 CDN for Canadian stations and $10 U.S. for stations outside of Canada. Write your check or money order to Radio Amateurs of Canada.

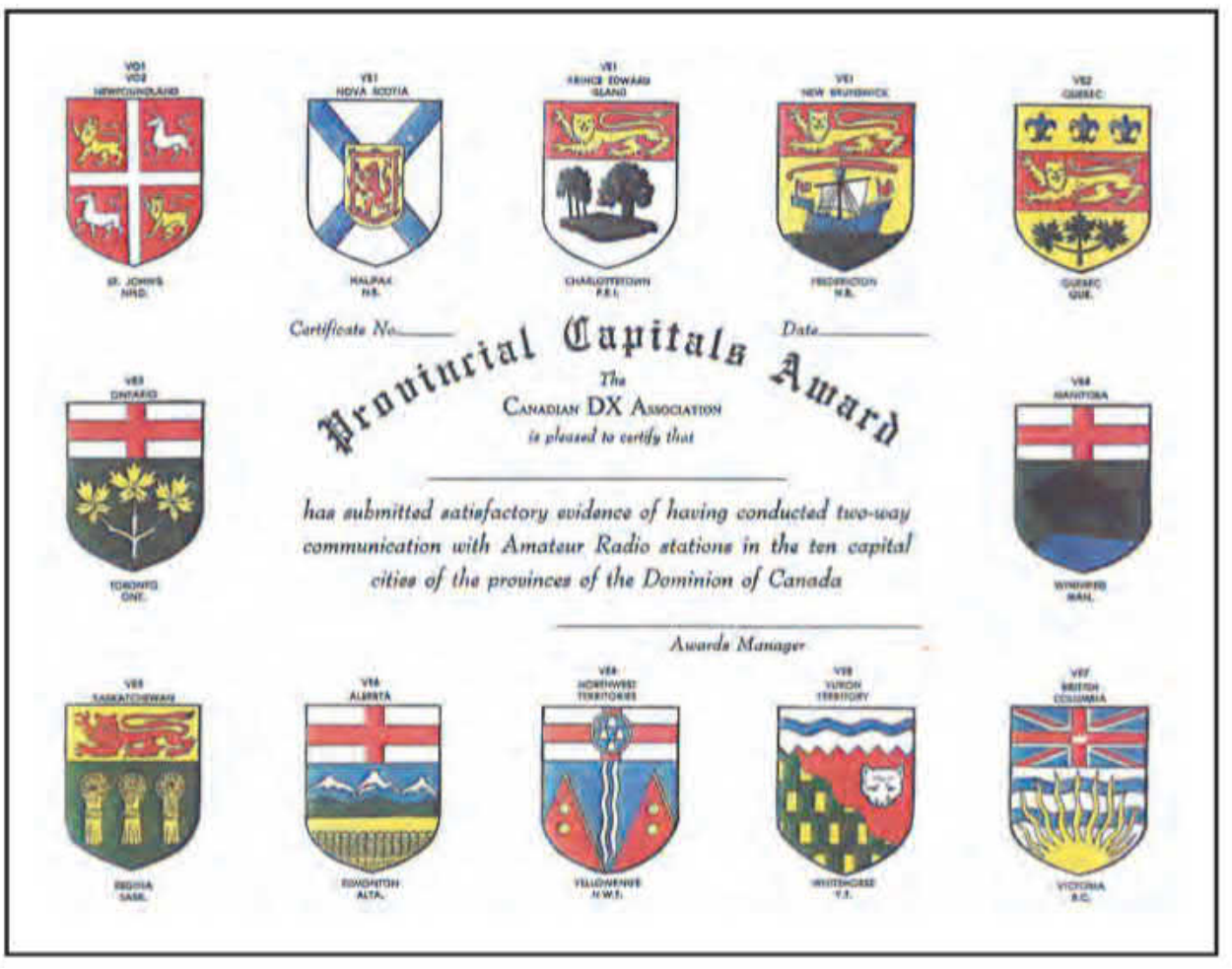


Photo D. RAC's Provincial Capitals Award requires that you make contacts with hams in the capital city of each of Canada's 10 provinces. (From the RAC website)

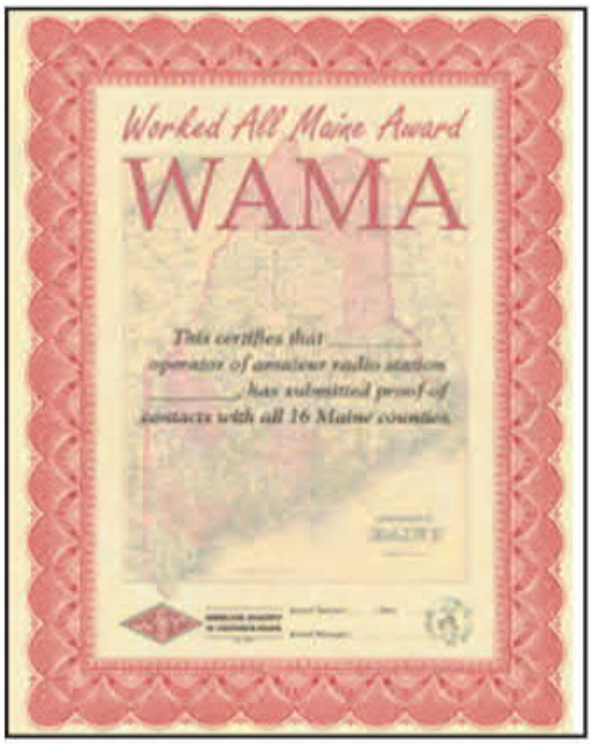


Photo E. Maine has 16 counties and you need to work all of them to qualify for the Wireless Society of Southern Maine's Worked All Maine Award (some of these counties have more moose than people so earning this award may be tougher than it looks!). (From WSSM website)

The following requirements come directly from the website: "Ten (10) contacts in different locations with VE stations along the route of the St. Lawrence Seaway. Of the 10 required, one (1) must be in each of the following areas: Thunder Bay, Greater Toronto, Greater Montreal, and Greater Quebec City. The remaining six (6) may be from any municipality located along the route."

Send a list of contacts with the date, time, mode, and location of the worked station. The list needs to be certified by one radio club officer or two other amateurs. Therefore, do not send in QSL cards but ensure you have them in case they're requested. You can find the application for this award at this website: <https://tinyurl.com/y98vagj3>. You can also send a SASE to the RAC requesting an application.

Switching over to the Provincial Capitals Award (*Photo D*), many of the rules are the same as the St. Lawrence Seaway Award. They include band, mode, cost, where to send your payment, how to write your checks or money orders, and how to get the QSL cards certified for the award.

However, there is one rule that is different, which is that one contact is needed in each of the 10 Canadian provincial capitals. They include the following: St. John's, Newfoundland; Charlottetown, Prince Edward Island; Halifax, Nova Scotia; Fredericton, New Brunswick; Quebec, Quebec; Toronto, Ontario; Winnipeg, Manitoba; Regina, Saskatchewan; Edmonton, Alberta; and Victoria, British Columbia.

Again, you need two other amateurs to certify that you have the required confirmations, and you need to keep the QSLs on file. The RAC website states that "QSL cards must be in the applicant's possession and are subject to random check."

Applications for all RAC awards should go to: John Scott, VE1JS, RAC Awards Manager, 324 Church Hill Road, Sandy Cove, NS B0V 1E0, CANADA. Email: <scotts@sandycove-ns.ca>

And While We're Up North

You hardly hear anything out of the State of Maine in the ham world. So I did some investigating and found the Wireless Society of Southern Maine, WS1SM. The link <www.ws1sm.com/Awards.html> delivers you directly to their awards program. They have some interesting opportunities for the paper chaser with seven different awards. There are general requirements and then each award has its own specific guidelines that need to be met.

Send your application to: WSSM Awards Manager, P.O. Box 6833, Scarborough, ME 04074, USA. Send questions by snail mail, I did not locate an email address for questions. All awards have a fee of $8 U.S.

The club offers the Worked All Maine Award (*Photo E*) for all radio amateurs but not for SWLs. Confirmed contacts with stations in all sixteen (16) counties of Maine are required. All bands and modes are allowed. All dates are accepted. Do not use repeaters, IRLP, or Echolink for this award. Only three mobile or portable stations may be used for credit toward the award. Contacts with ships, aircraft, or via satellite are not allowed.

The 16 counties of Maine are: Androscoggin, Aroostook, Cumberland, Franklin, Hancock, Kennebec, Knox, Lincoln, Oxford, Penobscot, Piscataquis, Sagadahoc, Somerset, Waldo, Washington, and York.

The New England Writers Award was created because of New England being the birthplace and homeof many famous writers, so it was designed to celebrate that heritage. Ten contacts are needed for the award, each from different towns associated with famous writers. The complete list of some two dozen locations is on the website. Modes, bands, date limits, and land station rules are the same as Work All Maine Award, except that contacts via repeaters, IRLP, and Echolink DO count for this award. Sorry to report, no SWLs for this certificate.

There is also an "Activator" version of this award. Hams who initiate transmissions from at least ten (10) of locations on the list can receive an Activator certificate. I suggest that you go to the club website to print out a copy to have on hand. You can use it to easily mark off the locations once you have them confirmed.

Don't Assume

A recommendation to all amateur radio operators and SWLs. Before you start chasing a certain award, contact the sponsor to ensure it is still being offered. During my wallpaper hunts, I have found that information can be spotty, or that different sites have different information for the same award. Sometimes there is no contact info, or not enough data for the rules. Therefore, I cannot stress enough, never assume. If there is a question about the rules, ask it. You will not regret it.

Looking Ahead

In September alone, seven state QSO parties are coming up should they stick to the calendar. They are Maine, New Hampshire, Texas, Iowa, Tennessee, New Jersey, and the Washington State Salmon Run. I repeat again that these are good times to be on the air in order to make U.S. contacts.

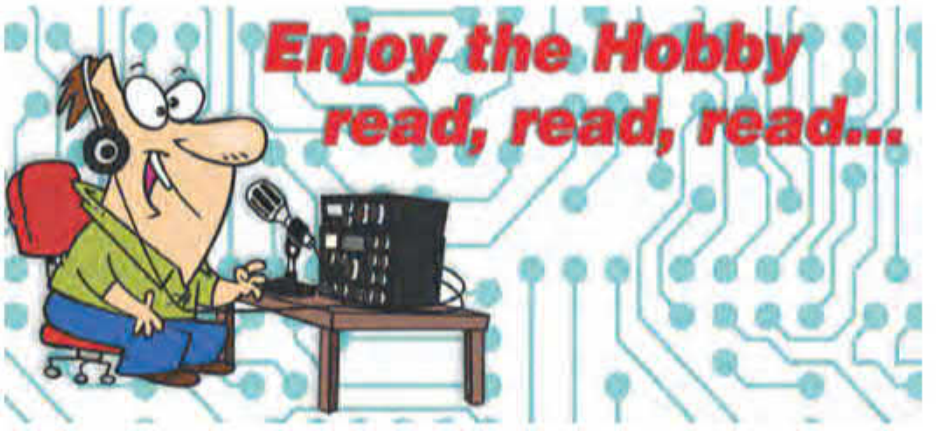
For a comprehensive list of upcoming contests, see the CQ Contest Calendar in each issue and on the CQ website (link from the highlights page for each issue), or the WA7BNM contest calendar at <https://tinyurl.com/ya8w2pf4>. You will start seeing a good collection of stations in your logbook and be able to apply for those awards even sooner.

Of course, chewing the rag, or having a long conversation over the air, is not bad either. It just depends on what your cup of tea is. If you don't want to do voice, then there are other facets of the hobby to try, such as CW, digital, or satellites, just to name a few.

Note to award sponsors: *CQ* readers are interested in your short-term or year-round sponsored award. Get your information in early enough for *CQ* to publish for your award in order to make it known across the ham community. Send your information (at least three months ahead of time for short-term awards) to <wa8jim@cq-amateur-radio.com>. Please include a valid email address and a phone number should we have questions. A sample picture of the award (high resolution, please) and a link to the rules will also be needed.

I will see you on the air.

– Jim Houser, WA8JIM



BY BOB SCHENCK, N2OO

KP2A/D Desecheo 1981 … A Look Back

In the current reality of COVID-19, DXpeditions have all but stopped. We can probably expect this "pause" to last a while longer. In the meantime, I thought it might be fun to look back at some past DXpeditions so that we can all appreciate how DXpeditioning has evolved over time. This month, I will be looking back at the 1981 KP2A/D DXpedition to Desecheo. This was my third (ever) DXpedition, and my first "mega" DXpedition. If any of you faithful DXpeditioners would like to write up anything similar, let me know!

Here is a little history on Desecheo. The island lies about 13 miles off the coast of Puerto Rico and has a land area of approximately 360 acres, with a maximum elevation of 683 feet above sea level and no permanent supply of fresh water, according to the U.S. Fish and Wildlife Service, which administers the island as a national wildlife refuge (for more info, see <https://tinyurl.com/y9rhchc2>). In the past, it has been used for a variety of purposes, including military bombing practice. It is currently closed to the public due to the presence of unexploded ordnance and visits may be made only by arrangement with the Fish and Wildlife Service. It is currently considered a separate DX entity under the ARRL's DXCC program, although this was not always the case.

The first DXpedition to the island was KV4KV/D in 1978. The operators were John Ackley, KV4KV (KP2A), and Bob Denniston, WØDX. Unfortunately, this operation only counted for Puerto Rico since Desecheo did not become a separate DX entity until March 1, 1979. The first DXpedition that counted would be the KP4AM/D operation in March 1979. Operators were N4EA, KP4Q, N4ZC, KP4DSD, KV4KV (KP2A), and KP4AM (W4DN). Although I don't know the final QSO totals for this operation, it was clear at that time that another larger DXpedition was warranted. This became KP2A's vision for the 1981 reactivation of Desecheo.

I first met KP2A while I was on the 1S1DX Spratly DXpedition. I originally was only acting as "support," helping coordinate things for the team led by Harry Meade, VK2BJL. But at the last minute, I asked Harry if I could join them, and he welcomed me along. I won't rehash the Spratly DXpedition. However, it was during this trip that John asked if I could help him answer the backlog of KV4KV/D QSL cards for him. I agreed, and advised him the South Jersey DX Association members would happily assist. At a point after the Spratly DXpedition was over, John came down to our local (small) airport where we gathered at the home of Gary Medford, N2CW. John brought along with him a trunk full of

Gary, N2CW; Steve, WB2VFT (now KZ2I); and Pat, K0OO, sign release paperwork the night before departure for Desecheo.

* Email: <n2oo@comcast.net>

WB8ZJW and K8HV negotiate gasoline drum to Desecheo.

Bob, WØDX, manning the low-band station at operating site 2.

An exhausted team takes a break on the beach. (N2CW, KZ2I, WB2KXA, N5ADC, K8CW, and N2OO).

5 Band WAZ

As of June 15, 2020
2225 stations have attained at least the 150 Zone level, and
1056 stations have attained the 200 Zone level.

As of June 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
RW0LT	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
K0DEQ	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
NX0I	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
RC2A	2217	2020-05-20	150
WZ8P	2218	2020-05-22	194
OH3OJ	2219	2020-05-27	200
OE1WEU	2220	2020-05-29	195
WB7QXU	2221	2020-05-31	186
IZ0BVU	2222	2020-05-31	176
JL1BTJ	2223	2020-06-01	164
K6KLY	2224	2020-06-06	192
UR5FEO	2225	2020-06-12	173

Updates to the 5BWAZ list of stations:

Callsign	5BWAZ #	Date	# Zones
SP8HKT	1793	2020-05-26	196
JR3UIC	1835	2020-05-28	194
W7AH	1311	2020-05-28	192
RC2A	2217	2020-06-03	160
W6WF	2213	2020-06-03	152
K3EA	2194	2020-06-10	180
N0VVV	1990	2020-06-12	162

New recipients of 5 Band WAZ with all 200 Zones confirmed:

5BWAZ #	Callsign	Date	All 200 #
2219	OH3OJ	2020-05-27	1056

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).**

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KV4KV cards that were not answered, as well as the logs and blank cards. Our members divided up the work and processed thousands of cards. I am not particularly aware of the politics of the time, but I can say that there was some "discussion" about whether these would eventually count for Desecheo or for Puerto Rico. But the cards needed to be processed in any event and our team was up to the challenge.

John had organized a non-profit called the "International DX Foundation" (IDXF). He was in need of a group

18AVQ vertical on the rocks.

The WPX Program

CW

3961	HS8HEX
3962	AA8R
3963	PG9HF
3964	WB7QXU
3965	4X1VF
3966	NF5KF (REMOTE)
3967	S53ØAZV
3968	AKØMR

SSB

4294	KP4NRA
4295	DL3SKY
4296	IK3GBG
4297	EA4CUN
4298	WB7QXU
4299	GM7NZI
4300	NJ4Z
4301	MØPTZ
4302	N6DHZ
4303	KØLB
4304	AKØMR

Mixed

4009	HS8HEX
4010	N6YQ
4011	JHØJVA
4012	VK5UR
4013	KZ4M
4014	WA6YOU
4015	N1XAU
4016	WB7QXU
4017	VK4COZ
4018	IK2GOQ
4019	KB4DE
4020	NJ4Z
4021	NA6US
4022	EI2JC
4023	MØPTZ
4024	N6DHZ
4025	KA5VVI
4026	N8ADO
4027	E76MB
4028	E24OYI
4029	F4KKE
4030	KØLB
4031	AA6DY
4032	IU8LMC
4033	KJ4EBE
4034	K7HPN
4035	N1JL
4036	I1YDT
4037	K9XT

Digital

1251	KN4AMX
1252	VK5UR
1253	KZ4M
1254	N3VEZ
1255	K3HPA
1256	IKØAOC
1257	N1XAU
1258	JJ1BDX
1259	KK8ZZ
1260	ER1VS
1261	NA6US
1262	AC8GY
1263	KA5VVI
1264	N8ADO
1265	E24OYI
1266	KB4DPH
1267	NR9H
1268	NUØY
1269	KØLB
1270	IU8LMC
1271	N1JL
1272	JF1ENF
1273	JK1OSG
1274	N2JNR
1275	KX7N
1276	W4DWS
1277	F4KKE

CW: 350: W5UJ, NF5KF, AKØMR. **400:** KB4DE, HB9BOI, S53ØAZV. **500:** SV7CUD, WB7QXU. **550:** HS8HEX. **700:** 4X1VF. **800:** MMØDXH. **1100:** AA8R. **1200:** F5PBL. **1300:** K1PL.

SSB: 350: KP4NRA, MØPTZ, GM7NZI, KØLB, KW4OV. **650:** AKØMR. **700:** DL3SKY. **750:** HB9EFK. **800:** NJ4Z. **850:** DD9WL. **950:** WB7QXU. **1100:** SV7CUD, HB9BOI. **1550:** MMØDXH. **2250:** K1PL.

Mixed: 450: KZ4M, N1XAU, KA5VVI. **500:** KB2S, N6DHZ, KM4VI, W5AFY, N1CEO. **550:** HS8HEX, F4KKE. **600:** NA6US. MØPTZ, IU8LMC, N2JNR. **700:** WA6YOU, W6NCB, N8ADO, KE8FMJ, IUØAWH. **750:** W5UJ, I1YDT. **800:** WA6YOU. **850:** LX2SM, KO8V, NA5WH. **900:** NJ4Z. **950:** IW9DNI, DD9WL. **1000:** K7CTV, E24OYI. **1050:** JJ1BDX, JF2OHQ. **1100:** AKØMR. **1150:** WB7QXU, KØLB. **1200:** NS4P. **1350:** HB9BOI. **1400:** JA7FVA. **1750:** CT7ANG. **1800:** MMØDXH. **1900:** JR3UIC. **1950:** HB9EFK. **2050:** SV7CUD. **2150:** IZØFUW. **2400:** WO7R. **2900:** K1PL. **6100:** ON4CAS.

Digital: 350: JJ1BDX, KK8ZZ, IK2GOQ, N1JL, JK1OSG, K9XT, DG2PX. **400:** KA5VVI, N2JNR. **450:** N3VEZ, W6NCB, N1XAU, N1CEO. **500:** W3LMC, IU8LMC, JF1ENF, W5AFY. **550:** LX2SM, NA6US. **600:** WQ7F, IUØAWH. **700:** WA6YOU, N8ADO, KE8FMJ. **750:** JF2OHQ. **800:** WA6YOU. **850:** KO8V, NA5WH. **950:** KN4AMX. **1000:** K7CTV, E24OYI. **1050:** JA7FVA. **1150:** NS4P. **1250:** K1PL. **1300:** KØLB, IZØFUW. **1500:** CT7ANG. **1600:** JR3UIC. **1700:** HB9EFK. **1800:** SV7CUD.

160 Meters: WB7QXU, N8ADO, NF5KF, IU8LMC, AKØMR
80 Meters: SV7CUD, KZ4M, MMØDXH, N8ADO
40 Meters: JA7FVA, KB4DE, NJ4Z, NA6US, KA5VVI, N8ADO, NF5KF, F5PBL, AKØMR, F4KKE
30 Meters: JA7FVA, W3LMC, WQ7F, N8ADO, KE8FMJ, K9XT
20 Meters: JA7FVA, KN4AMX, W6NCB, N1XAU, WB7QXU, MMØDXH, NJ4Z, 4X1VF, NA6US, MØPTZ, N6DHZ, WQ7F, N8ADO, E24OYI, KØLB, AA6DY, IUØAWH, DD9WL, AKØMR
17 Meters: DL6JZ, IZØFUW, NS4P
15 Meters: JA7FVA, IW9DNI, LX2SM, CT7ANG, DL6JZ, NS4P, AKØMR
12 Meters: DL6JZ
10 Meters: MMØDXH, WR7X, NS4P, DD9WL

Africa: WB7QXU, I1YDT
Asia: HS8HEX, JHØJVA, VK5UR, JJ1BDX, WB7QXU, MMØDXH, 4X1VF, NA6US, MØPTZ, E24OYI, KØLB, IU8LMC, JF1ENF, JK1OSG, I1YDT, N2JNR, AKØMR
Europe: HS8HEX, JHØJVA, KN4AMX, DL3SKY, PG9HF, N3VEZ, WA6YOU, WB7QXU, ER1VS, IK2GOQ, NJ4Z, 4X1VF, EI2JC, W3LMC, MØPTZ, WQ7F, N8ADO, E76MB, E24OYI, F4KKE, KØLB, S53ØAZV, AA6DY, IU8LMC, I1YDT, AKØMR, N1CEO, F4KKE
Oceania: HS8HEX, VK5UR, JJ1BDX, WB7QXU, VK4COZ, NS4P, E24OYI, HB9EFK, JF1ENF, N2JNR, AKØMR
North America: JA7FVA, N6YQ, KN4AMX, KZ4M, N3VEZ, WA6YOU, K3HPA, N1XAU, WB7QXU, K3HPA, KB4DE, NJ4Z, NA6US, AC8GY, N6DHZ, KA5VVI, N8ADO, KB4DPH, NR9H, NF5KF, KØLB, N1JL, KW4OV, IWØAWH, K7HPN, N1JL, N2JNR, DD9WL, K9XT, AKØMR, KX7N, W4DWS
South America: WB7QXU, MMØDXH, KØLB, AKØMR

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 – SSB

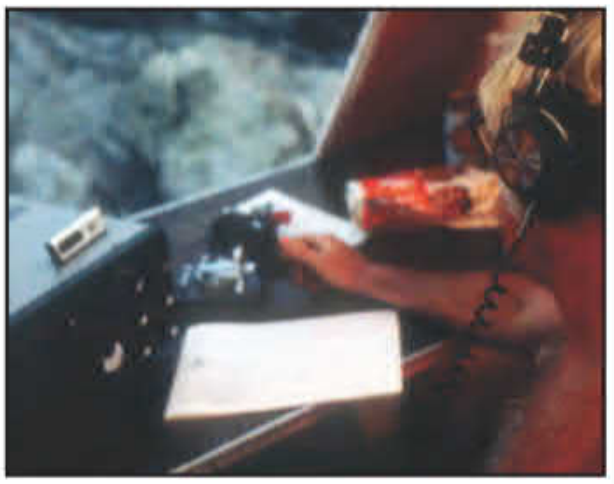
N2QL	2662
KP2/N2QL	2663

Endorsements – CW

W2OR	320

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.

to manage it publicly and he asked if we would be interested. So, SJDXA became the sub-organization that helped manage IDXF until the mid-1980s. One thing we were encouraging was for IDXF to fully sponsor DXpeditions, rather than provide funds to others. KP2A traveled around the globe quite a bit under the IDXF banner. But actual sponsorship of IDXF-funded DXpeditions began with the 1980 DXpedition to 9M6MU and VS5OO / VS5GM / VS5KV with operators N2CW, N2OO, VS5TX, and KV4KV (KP2A). At that time, 9M6 (East Malaysia) was especially rare and VS5 was as well, although not quite as much. But John's dream was to reactivate Desecheo with



John, KP2A, operating.

N2OO logging. Yes, we used high-tech paper logs.

Barbara, WA2KCL.

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Dinghy arrives on calm day with more ops.

a large team and multiple radios. Thus KP2A/D was planned for June 1981.

Being that it has been 39 years since the DXpedition, I will admit that the memory is a little fuzzy. But I'll try to present the story as best as I remember.

John, KP2A, along with local KP4 ops and Pat, KØOO, worked locally in Puerto Rico to collect the necessary gear required for the two weeks needed to set up and run the DXpedition. John flew gear from his home in Saint Croix to a staging area in Mayaguez, Puerto Rico. John borrowed a boat that he used to transport gear as well. The boat was about a 35- or 40-foot cabin cruiser. Because of the size of our team, it would need to make two trips but with Desecheo only about 15 miles off the coast, it wasn't too much of a problem. We also swapped out a couple of ops midway through the operation. In total, we had 18 on-island team members along with a lot of local support in Puerto Rico. Since this would actually be my very first "uninhabited island landing," I was ready to get wet. However, it was so calm upon arriving that when the dingy was beached, I was able to step right off onto dry beach sand. Didn't even get the bottom of my sneakers wet.

The first team would carry the generators, radio setups, and tent gear dropped off on the beach up to a helicopter pad that was about 20-25 feet above the beach. It required navigating a narrow dirt path uphill. We decided to set up our food area on the beach below the helicopter pad. Several of us set up our pup tents and air mattresses in the food area as well. Each operator was responsible for providing his / her own sleeping quarters. Some had pup tents. Some just had an air mattress laid out on the helicopter pad. Some may have forgotten to bring something?

There really wasn't a specific plan for where exactly to set up most of the radios. It was understood that three would be set up near the helicopter pad. This would include a 20-meter station with a 4-element monobander, a 15-meter station with a 3-element monobander and a 20-15-10-meter station with a TH3 and a 5-element 6-meter beam stacked above it. All of these antennas had rotors installed. The 15-meter station also had access to an 18AVQ vertical mounted DOWN the hill out on a rock near the surf. The vertical was used primarily on 75-meter phone.

Another radio site was located at a cove southeast of the helicopter pad. It required a long difficult hike down the beach. At this second location, one site would be for the 160-meter station handled mainly by Bob, WØDX. Another site was probably for 40 and 80 meters. The last site was one I remember well. By the time the other five stations were set up, everybody was exhausted. But we still had one full station to set up. We had a radio, a 20-15-10 TH3 tribander, and an appropriate tent. But it was a long hot hike down to that site. I remember "encouraging" Jim, WB2KXA, and a couple of others to help lug the gear to the site from the helicopter pad. This was to become a 20-15-10 CW station primarily. As such, we had a total of six tents with seven radios operational. (*The station on the helicopter pad was actually two, with one radio on 20-15-10 SSB and the other being a 6-meter station –BS*).

OK, now you are thinking that compared to today's DXpeditions, this all sounds kind of normal for any mega DXpedition. But let's look at this a little more carefully. The radio of choice at the time (remember, this is 1981) was the Yaesu FT901DM <www.yaesu-museum.com/ft-901.htm>. This fine

The WAZ Program

SINGLE BAND WAZ

6 Meter

153 ..... JA7MSQ, 25 Zones

20 Meter Digital

17 ..... JAØMRW
18 ..... LX2SM

160 Meter

638 ..... RZ1OA, 40 Zones
639 ..... KH6KG, 30 Zones
640 ..... UR5FEO, 30 Zones
641 ..... OE1WEU, 40 Zones

160 Meter Update

295 ..... K5RK, 40 Zones
599 ..... I1EIS, 39 Zones

ALL BAND WAZ

CW

1084 ..... WU4B
1085 ..... PV8DX
1086 ..... SP3MKS
1087 ..... WØUY
1088 ..... UR5FEO
1089 ..... DL8TG

Digital

160 ..... JA5DBE
161 ..... JH7QLR
162 ..... W7AH
163 ..... JA1BOQ
164 ..... IZØMYH
165 ..... SO4O
166 ..... KØLB
167 ..... YL3KW

Mixed

9862 ..... IW2JBB
9863 ..... EA3GEO
9864 ..... OK1UU
9865 ..... F8AOF
9866 ..... S57AX
9867 ..... LA9VBA
9868 ..... WA4USA
9869 ..... WØRMS
9870 ..... EA5GVJ
9871 ..... DDØVU
9872 ..... KØLB
9873 ..... UU8JW
9874 ..... W2SKI
9875 ..... LZ1VVV
9876 ..... IW9DNI

RTTY

303 ..... I8IEQ
304 ..... IWØBYL

SSB

5477 ..... WB7QXU
5478 ..... F8ARK

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>.

N2OO in our cook area. Notice all the cans of SpaghettiOs, etc.

radio had 6146B tubes in the finals, but a solid-state receiver. It weighed in at 40 pounds. We also had external VFOs, Yaesu FT101Es, and Dentron amplifiers and tuners. Let's not forget at least three generators and drums of gasoline. I think you get the idea. We had a huge amount of heavy gear that had to be stowed onto the boat, offloaded from the boat, lugged up a hill to the helicopter pad, and about half had to then be hand-carried or boated about 3/4-mile down the beach to our second operating site. Then everything had to be assembled, operated 24/7 for about 10 days, and then dismantled in reverse order, being careful not to leave anything behind. Looking back on this one brings back some great memories overall.

Here are a few vivid memories that I would like to share about this DXpedition. Our food was not luxurious. The 2009 DXpedition actually heli-

CQ DX Honor Roll

The CQ DX Honor Roll recognizes those DXers who have submitted proof of confirmation with 275 or more ACTIVE countries. With few exceptions, the ARRL DXCC Countries List is used as the country standard. The CQ DX Award currently recognizes 340 countries. Honor Roll listing is automatic when an application is received and approved for 275 or more active countries. Deleted countries do not count and all totals are adjusted as deletions occur. To remain on the CQ DX Honor Roll, annual updates are required. All updates must be accompanied by an SASE if confirmation of total is required. The fee for endorsement stickers is $1.00 each plus SASE. (Stickers for the 340 level and Honor Roll are available.) 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.

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HB9DDZ 339
K4IQJ 339
K9MM 339
N4MM 339
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WS9V 339
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Desecheo Hilton by N2OO.

coptered in refrigerators and freezers full of food so that their sous chef could prepare meals. The 1981 DXpedition had the following variety of canned food to choose from, including SpaghettiOs, Dinty Moore beef stew, Hormel chili, and MORE SpaghettiOs. You had a choice of opening a can and trying to light a Sterno stove on the windy beach to heat it up in a pan, or just eat right out of the can, eliminating the need to attempt to turn on the stove and dirty a pan that would need to be cleaned. Most opted for the open and eat method. The only beverage I remember having was warm Carta Blanca Beer. But I'm sure we also had plenty of water. One vivid memory I have is that John, KP2A, would swim out to the boat and sleep there every night. One day he came ashore with ice cream from the boat! We all shared melting ice cream. Not many DXpeditions can relate to that, I bet. Not even the 2009 team. But later, as I recall the story, John had not originally planned on sharing the ice cream. However, the freezer on the boat was malfunctioning and rather than it going to waste, he brought it onshore to share with us! Did I forget to tell you how hot it was? Yeah, it was hot.

As I mentioned, sleeping arrangements were left to each operator. Gary, N2CW, and I brought small pup tents and cheap vinyl air mattresses. I remember that Gary's burst one night, leaving him sleeping on the broken coral on the beach where we had set up. He wasn't happy. On particularly hot evenings, we slept in the open on the helicopter pad. That was an experience! Hermit crabs would come out at night and crawl over you. Our "potty" arrangements were of especially poor design. We had one of those little portable toilets that you would place a bag underneath. We eventually discovered a nice blowhole down the beach, which served us well. One of our operators was Barbara, WA2KCL, who was a real champ. I'm not sure how she managed except that I am pretty sure someone would stand guard whenever she needed to use the facilities.

When we first started setting up radios down at the second location, we had considered using a small old cable building for one. It was right on the beach, had a roof and was relatively cool inside since it was all concrete. After starting to set up inside, we quickly discovered that it was full of fleas! Argh! So, we couldn't use it. It would have been pretty nice without the fleas.

We had a ceremony for the first QSO. George, W1GKK, had worked every DXCC entity out there at the time except for Desecheo. So, John decided that we would start the DXpedition off by having each operator work George with our home calls / Desecheo. We all lined up on the helicopter pad and one after the other worked George. It was quite a scene, and I remember how excited George was when it was all over.

These are the things still in my memories about this fine DXpedition. The final tally was 43,000 QSOs which, for that time, was pretty darned good (I have the logs and can still confirm QSOs). Remember, we did not have WARC bands yet, and the radios took twice as long to set up as those in today's world. Even the generators were real tanks.

I hope this gives some of you a little insight into what the earlier days of DXpeditioning were all about. Remember one thing, the farther back you go, the bigger and heavier the gear. I can't even imagine what it was like to go to Navassa in the 1960s. Crazy stuff.

So, special kudos to the KP2A/D DXpedition team, many of whom are now SK. John, KP2A; Jim, K1MEM; Gary, N2CW; Dan, N2DT; Barbara, WA2KCL; Jim, WB2KXA; Stu, WA2MOE; Gary, K2UQ; Steve, WB2VFT (now KZ2I); Al, KQ4Z; Ron, N5ADC; Al, K8CW; Charlie, K8HV; Al, WB8ZJW; Bob, WØDX; Pat, KØOO; John, WØUN, and your author, N2OO.

If anyone has any stories that you would like to share, drop me an email at <n2oo@cq-amateur-radio.com>.

Looking down at the main three operating sites around the helicopter pad.

CONTESTING

BY DAVID SIDDALL,* K3ZJ

A New Contest QSL Strategy for the Fall Season …

… and K3ZJ Says 73

Plus: Upcoming Contests: North American QSO Party (CW and Phone), DARC Worked All Europe FX Contest (CW and Phone), World Wide Digi DX Contest, JARL All Asia Phone Contest, ARRL September VHF Contest

I ordered a large stack of blank QSL cards when I began contesting. I filled out each card by hand, then sorted the hundreds of cards by country, found a box of appropriate size to pack them in, and lugged the box off the post office for shipment to the ARRL Outgoing QSL Bureau. It was labor-intensive, time-consuming, and relatively costly. Why some contesters have given up QSLs altogether is understandable.

But today there is a better method. Now I just create a log to answer QSL requests, check my master log for each QSO with one click, and then either copy the information into my QSL log or type it in. Periodically I upload the "QSL log" to a website, select the card that I designed for the correct location, make a couple of clicks — and done. Whether hundreds or thousands, my QSLs are printed in color on both sides, produced with the QSO information and addressee, and dispatched to bureaus, most of which are within easy reach of the QSL service itself in Europe.

This type of electronically-produced printed QSL was, I believe, pioneered by GlobalQSL operating in Israel. As noted below, that service appears to be continuing. Since most of my DX QSOs these days are during contests and predominantly with European stations, and I believe in supporting our national societies, I personally use QDURE in Spain. This saves months of time getting my QSLs into the European system and to the operators who requested a paper QSL or from whom I am requesting one.

Although the Spanish QDURE and similar German DARC QSL-Service were initiated in 2016, their availability is not widely known among American contesters. So below I make the argument for why even veteran contesters should answer QSLs and provide information on how to do so quickly and efficiently using an online QSL printing and delivery service. Tim Duffy, K3LR, has always led by example on QSLing, and below I tell a story about Tim and a young 12-year old contester.

The summer antenna season is coming to a close, and now the time is arriving to test out repairs and improvements. Below also are notes on the August and early September contests.

One final note: This is my last column. I have enjoyed exploring some of contesting's interesting facets with you over the past five years, from receive vertical arrays (which were under-appreciated as compared to Beverages back in 2015) and using audio predistortion to eliminate some of the sideband intermodulation products (still mostly a pipe dream, but with awareness building) to recounting the events leading up to and at the WRTC2018 in Germany.

My work pressures have increased during the pandemic, mostly due to clients who put trust in my work and find themselves short-handed or unable to handle some of the legal matters usually performed by their staffs. But it also is an opportune time to introduce someone with different and new ideas from a younger generation.

Tim Shoppa, N3QE, has been appointed your new contesting columnist and will start with next month's column. He was introduced back in the April 2018 column. I have observed his wise analyses after some of the contests he participates in, and I think that he will bring a fresh and interesting perspective to this column. I look forward to what is coming!

Tim operates many weekends in a variety of contests, doing so with a kilowatt but no beam antenna. If there were a world record for the most QSOs per foot of wire, he would own it. He has made tens of thousands (if not hundreds of thousands) of QSOs sent into the ether by $20 worth of wire (a single 130-foot wire suspended by trees). This has required Tim to cultivate his operating skills rather than relying on hardware, and his accomplishments in this regard are noteworthy. He should inspire each of you to make the most of what you have and develop the operating skills to enjoy contesting no matter what your antenna situation may be. Most operators cannot have their ideal station, whether the limitations are location, antenna, available time, health, equipment, RFI, or some other factor. The most important element is to get on the air with what you have. Don't wait until you get that new antenna, or transceiver, or move, or whatever.

Welcome, Tim!

August Contests

North American QSO Party (NAQP): The CW NAQP kicks off the month starting at 1800 UTC on August 1st and running through 0559 UTC on August 2nd. The phone version follows from 1800 UTC on August 15th through 0559 UTC on August 16th. These events provide plenty of action without taking up the whole weekend, and several of the major contest clubs turn out their members for an inter-club competition tied to the event. Check the rules at <https://tinyurl.com/zwsq9ek>.

Worked All Europe DX Contest (WAEDC): The CW WAEDC occupies the weekend between the NAQP events. This is a qualifier contest for WRTC2022, so expect most of the big guns to be on. The contest runs from 0000 UTC on August 8th through 2359 UTC August 9th. The Phone weekend is from 0000 UTC September 12th through 2359 UTC on September 13th. The rules are at <https://tinyurl.com/yykzpj7v>.

World Wide Digi DX Contest (WW Digi): This contest, discussed in last month's column, is focused on FT4 and FT8 activity and will be held from August 29th beginning at 1200

email: <k3zj@cq-amateur-radio.com>

Calendar of Events

All year	**CQ DX Marathon**	**http://bit.ly/vEKMWD**
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	www.qrparci.org/contests
Aug. 8-9	Worked All Europe CW Contest	http://bit.ly/2vufgcb
Aug. 8-9	Maryland-DC QSO Party	www.w3vpr.org/node/325
Aug. 10	SARL Youth Sprint	http://bit.ly/H0IqQf
Aug. 15-16	ARRL 10 GHz and Up Contest	www.arrl.org/10-ghz-up
Aug. 15-16	CVA DX Contest CW	http://cvadx.org/regulamento
Aug.15-16	KCJ Contest	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	www.sartg.com/index.html
Aug. 16	ARRL Rookie Roundup RTTY	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	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	www.ksqsoparty.org
Aug. 29-30	YO DX HF Contest	www.yodx.ro/en
Aug. 29-30	ALARA Contest	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. 2	UKEICC 80m Contests SSB	http://bit.ly/2MbaURB
Sept. 5	Colorado QSO Party	http://ppraa.org/coqp
Sept. 5	AGCW Straight Key Party	http://bit.ly/1T5SC05
Sept. 5	LZ Open SES Contest	www.lzopen.com
Sept. 5	Russian "Radio" RTTY WW Contest	https://bit.ly/3eWEtDl
Sept. 5-6	All Asian DX Phone Contest	http://bit.ly/2TUaDqj
Sept. 5-6	IARC Region 1 Field Day	http://bit.ly/3cC0HKf
Sept. 5-6	RSGB SSB Field Day	https://bit.ly/3dGfjZv
Sept. 5-6	PODXS 070 Club Jay Hudak Memorial 80M Sprint	http://bit.ly/2MkaaNt
Sept. 6-7	Tennessee QSO Party	https://tnqp.org/rules
Sept. 7	RSGB Autumn Series SSB	https://bit.ly/2XF8mSB
Sept. 7-8	MI QRP Labor Day CW Sprint	www.miqrp.net/contest
Sept. 12	OSPOTA Contest	http://ospota.org
Sept. 12-13	Alabama QSO Party	www.alabamaqsoparty.org
Sept. 12-13	ARRL EME Contest	www.arrl.org/eme-contest
Sept. 12-13	SARL Field Day	http://bit.ly/H0IqQf
Sept. 12-13	Russian Cup Digital Contest	www.qrz.ru/contest/detail/86.html
Sept. 12-13	Veron SLP Contest	http://bit.ly/2L9eT1L
Sept. 12-13	Worked All Europe SSB Contest	http://bit.ly/2vufgcb
Sept. 12-14	ARRL September VHF QSO Party	www.arrl.org/september-vhf
Sept. 12-15	Texas QSO Party	http://txqp.net
Sept. 13	North American CW Sprint	http://ncjweb.com/Sprint-Rules.pdf
Sept. 16	RSGB Autumn Series CW	https://bit.ly/2XF8mSB
Sept. 17	Bavarian Contest Club QSO Party	https://bit.ly/2MDzviG
Sept. 18	AGB NEMIGA Contest	https://bit.ly/2AWBbRK
Sept. 19	Feld Hell Sprint	http://bit.ly/2JcbOwW
Sept. 19	FOC QSO Party	www.g4foc.org/qsoparty
Sept. 19-20	All Africa Int. DX Contest	http://bit.ly/H0IqQf
Sept. 19-20	ARRL 10 GHz and UP Contest	www.arrl.org/10-ghz-up
Sept. 19-20	Iowa QSO Party 2017	www.w0yl.com/IAQP
Sept. 19-20	New Hampshire QSO Party	www.w1wqm.org/nhqso
Sept. 19-20	New Jersey QSO Party	http://bit.ly/1nDlf8V
Sept. 19-20	QRP Afield	http://bit.ly/2QACxFu
Sept. 19-20	SARL VHF/UHF Digital Contest	http://bit.ly/H0IqQf
Sept. 19-20	Scandinavian CW Activity Contest	www.sactest.net/blog
Sept. 19-20	Washington State Salmon Run	www.wwdxc.org
Sept. 20	BARTG Sprint 75	http://bartg.org.uk/wp/contests
Sept. 20	North American RTTY Sprint	http://ncjweb.com/Sprint-Rules.pdf
Sept. 21	144 MHz Fall Sprint	http://svhfs.org/wp
Sept. 24	RSGB Autumn Series Data	https://bit.ly/2XF8mSB
Sept. 26	AGCW UHF/VHF Contest	http://bit.ly/292ubSX
Sept. 26-27	**CQWW RTTY DX Contest**	**www.cqwwrtty.com**
Sept. 26-27	Maine QSO Party	www.ws1sm.com/MEQP.html
Sept. 26-28	Nancy Kott-Fists Memorial KNOWCW	http://fistsna.org/operating.html
Sept. 28	RSGB FT4 Contest Series	http://bit.ly/38xg9V7
Sept. 30	UKEICC 80m Contests CW	http://bit.ly/2MbaURB

UTC through August 30th at 1200 UTC. I would only note that experiences during the recent ARRL VHF contest and Field Day indicate continuing operator uncertainty and confusion about some aspects of using these modes in a competitive environment. All participants are urged to download the latest version of WSJT-X software before the contest begins and to become familiar with its operation. There are FAQs and other helpful information on the contest website. Rules, FAQs, etc. are at <https://ww-digi.com>.

JARL Phone All-Asia Contest (AA Phone): The 61st All Asia DX Phone Contest is coming from 0000 UTC on September 5th through 2400 UTC on September 6th. This contest is also a qualifying event for WRTC2022. Rules are at <https://tinyurl.com/yc6by9qv>.

ARRL September VHF Contest: The ARRL September VHF contest overlaps the WAEDC Phone contest. It will take place beginning at 1800 UTC on September 12th and run through 0300 UTC on September 14th. This will be another chance to gain experience with FT4 and FT8 in the contest environment, while also encouraging SSB and CW when the band will support the signal strengths necessary. Generally, when the digital signals are showing is the -5 to -10 dB range, CW should be possible. (*Note that the dB range in the digital modes relates to a 2.5-kHz bandwidth. It does NOT indicate that the signals are "below the noise floor" or that they "cannot be heard on your receiver". –DS*)

Time for a New QSL Strategy

Maybe you started out as I did. When I began contesting, I had ordered a large stack of blank QSL cards. After the contest I hand-wrote the cards and sent them via the bureau to most contacts. Then, after a couple of years, I reduced this to sending to the rare stations and answering the cards that I received from the bureau.

By the late 1980s, I started saving time by aggregating my electronic logs into a single file to find the QSOs for received cards and generate a paste-on label. Eventually I experimented with printing directly on cards, and also with printing the entire card, complete with QSO information, but these efforts were abandoned in favor of the simplicity of labels.

Looking at my latest cards received from the bureau, I can see that many operators still hand-write or use labels for their

Kids Love QSL Cards!

Kids still love to receive physical QSL cards from faraway places. Something about having the physical card in hand excites the imagination in a way that an electronic line item just doesn't do. With thousands of QSOs made during modern contest weekends, many contesters have migrated to electronic QSL services such as ARRL's LoTW, eQSL.cc, or ClubLog for their primary QSL chores.

As described in this month's column, paper QSLs can be generated from electronic logs and sent via the IARU bureau system inexpensively and with much less work than many contesters may realize. Sending paper QSLs in response to requests is relatively easy using one of the services that will print and send your card via the bureau. The cards can be printed in color on both sides at very reasonable cost and little work by the operator.

The photos here show Frederik (age 8) and Klara (age 7), the children of Tom Dauer, DM9EE. Under the German regulatory system, for educational training purposes non-licensees, including children of any age, are permitted to operate under a licensee's supervision. A distinctive callsign is assigned for training. The supervisor's privileges apply, so all modes, bands, and even high power are permitted. The special callsigns are recognized by their "DN" prefix. Tom's children use the educational / training callsign DN5HR under his supervision.

In the first photo, Klara and Frederik are checking out the exotic cards delivered by the mailman. In the second, Frederik is holding a card from well-known contester Fred Laun, K3ZO. Frederik has participated in some contests and is a budding DXer, with over 100 DX entities worked at age 8. His dad says Frederik is really happy when direct QSLs arrive from all over the world, such as Fred's after the Worked All Germany (WAG) contest last fall.

QSLing. Others run the card through their printer. But there is a new method that even speeds up the bureau process: Download a file of QSOs for which you want a QSL — which can be extracted from contest electronic logs — and transmit that file to a QSL service that will print cards and deposit them in the bureau, all for substantially less cost and time than having cards printed, filled out, and sent to the bureau.

I always try to be considerate of the different interests that operators have in making the effort to work me in a contest. Sure, every contest has its "big guns" who very adeptly make a quick QSO within seconds and then disappear into the ether. These guys definitely do not want to exchange QSL cards. And there are many operators who get on just to enjoy the moment and to see if their 100-watt transceiver and wire still get out. Many of these operators either don't want QSLs anymore or they upload to Logbook of the World (LoTW) or one of the other electronic QSL websites and consider it done.

But then there are those operators who follow up a contest QSO with a paper QSL card, usually via the bureau but sometimes by direct mail with a self-addressed stamped envelope or, if DX, with a "green stamp" (dollar bill) or two. Often (not always) these are newer operators just starting out and looking to begin a collection of cards and still in wonder that a little radio and wire in a tree can traverse such distances.

Clearly the interest in QSLs continues among a portion of operators who get on the air and make contest QSOs. Some of those are new kids and operators who are working toward this-or-that award. See the pictures of Frederik and Klara, who are being introduced to ham radio and contesting by their dad, Tom Dauer, DM9EE. One can almost sense the excitement in their smiles. An example of a simple QSL leading to other things is the story of veteran operator Tim Duffy, K3LR, receiving a hand-written card in 2016 from brand new operator Bryant Rascoll, KG5HVO, who was 12-years old at the time. The K3LR operator had patiently completed and logged the 0-point QSO. See the sidebar for more. There's also a short video at <https://tinyurl.com/ydbjasjt>.

We all want the amateur contesting population to renew itself on a continual basis, and QSL cards are part of the attraction for some substantial portion of those operators whom we would like to become more involved with contesting, or at least show up and work us on certain weekends. Many of the QSOs I make — and probably even more so for the more serious competitors with multiple thousands of QSOs logged in a weekend — are with non-contesters.

Reality is that most contest QSOs are not with other ardent contesters, but rather, with non-contesters who happen to tune across the band and decide to try to work some of the stations. Some call just to see if they are being heard with their 100-watt transceiver and wire, or some such. Others got on for the contest with an interest in trying to work the specific states, counties, or DX entities on this or that band need-

25 Records Shown (1-25)
Sorted by QSL Date (0.013560 seconds elapsed)

Next

	Call sign	Worked	Date/Time	Band	Mode	Freq	QSL
Details	W8I	W7JAX	2020-06-07 00:21:00	20M	SSB	14.30200	UNITED STATES OF AMERICA
Details	W8I/STAYSAFE	DM3PKK	2020-06-06 23:04:00	40M	CW	7.02000	FEDERAL REPUBLIC OF GERMANY
Details	W8I/STAYSAFE	DM3PKK	2020-06-06 14:30:00	20M	CW	14.00100	FEDERAL REPUBLIC OF GERMANY
Details	W8I/STYSAFE	IK4LZH	2020-06-07 02:34:45	40M	FT8	7.07636	ITALY
Details	W8I	KB9LLD	2020-06-07 04:05:00	20M	SSB	14.20000	UNITED STATES OF AMERICA
Details	W8I/STAYSAFE	IU4FLP/4	2020-06-06 22:45:00	20M	SSB	14.19800	ITALY
Details	W8I/STAYSAFE	2E0NQA	2020-06-07 02:15:00	40M	CW	7.02900	ENGLAND
Details	W8I/STAYSAFE	KE7ZAC	2020-06-06 15:44:00	20M	SSB	14.26200	UNITED STATES OF AMERICA
Details	W8I/STYSAFE	K8QKY	2020-06-07 03:13:30	40M	FT8	7.07636	UNITED STATES OF AMERICA
Details	W8I	2W0DOE	2020-06-06 22:47:00	20M	SSB	14.19800	WALES
Details	W8I/STAYSAFE	N0ORQ	2020-06-07 02:34:00	20M	SSB	14.28800	UNITED STATES OF AMERICA
Details	W8I/STYSAFE	N8MRB	2020-06-07 03:08:15	40M	FT8	7.07636	UNITED STATES OF AMERICA
Details	W8I/STYSAFE	N8MRB	2020-06-07 02:10:45	40M	FT8	7.07636	UNITED STATES OF AMERICA
Details	W8I/STAYSAFE	W7WIA	2020-06-06 16:28:00	20M	SSB	14.26200	UNITED STATES OF AMERICA
Details	W8I/STAYSAFE	K8TED	2020-06-06 11:31:00	40M	CW	7.03500	UNITED STATES OF AMERICA
Details	W8I/STAYSAFE	K4JAF	2020-06-06 13:20:00	20M	CW	14.02000	UNITED STATES OF AMERICA
Details	W8I/STAYSAFE	WA7AA	2020-06-06 22:36:00	20M	CW	14.03200	UNITED STATES OF AMERICA
Details	W8I/STAYSAFE	AB1EP	2020-06-06 11:49:00	20M	SSB	14.16400	UNITED STATES OF AMERICA
Details	W8I/STAYSAFE	2E0WND	2020-06-06 23:04:00	20M	SSB	14.19800	ENGLAND
Details	W8I	ZL1MTO	2020-06-06 10:02:33	40M	FT8	7.07612	NEW ZEALAND
Details	W8I	N8PDX	2020-06-06 10:38:45	40M	FT8	7.07628	UNITED STATES OF AMERICA
Details	W8I	N7RYP	2020-06-07 02:14:00	40M	FT8	7.07636	UNITED STATES OF AMERICA
Details	W8I	S52D	2020-06-07 02:05:45	40M	FT8	7.07636	SLOVENIA
Details	W8I/STYSAFE	WK8A	2020-06-07 03:17:45	40M	FT8	7.07636	UNITED STATES OF AMERICA
Details	W8I/STYSAFE	TA1CM	2020-06-07 03:12:45	40M	FT8	7.07636	TURKEY

Next

Most recent QSO record received 2020-06-11 19:55:36Z

ARRL's Logbook of the World allows one to easily QSL for different locations and all possible callsign variations. In the case of the recent W8I/STAYSAFE operation, five locations were used. Four of the five have QSLs on this page, indicated in green. Some QSLed to just the callsign "W8I" while others included the voluntary indicator "/STAYSAFE," so logs were entered under both variations. Because of limitations on letters using FT8, our digital operation had to drop a letter so that variation also was entered and the digital logs were uploaded for that variation too. All this was done in about 30 minutes of setup, which is pretty reasonable.

ed to increase their award totals. They will need the QSL to get their award. Many of the "major" awards accept electronic QSLs, but others require the physical QSL cards.

As noted above, I always tried to QSL requests, bureau and direct. This was time-consuming, and for several years I fell behind. With a family and demanding job, was I going to spend my limited time operating, or doing paperwork?

Electronic QSLs — For me, the advent of electronic QSL services therefore was viewed in a very positive light. As soon as possible after a contest, I submit my log to the contest sponsor and then also upload it to ARRL's Logbook of the World (LoTW) and to e-QSL.cc. That way, those who need only an electronic QSL for awards are less likely to send me theirs by mail or the bureau. The e-QSL provides a picture of an actual QSL card, which can be downloaded and printed on demand. This satisfies those still looking for "paper" QSLs. Two additional services for which I sometimes receive queries are Clublog and QRZ logbook. All of these options employ relatively quick and painless methods to upload standard contest logs compared to the hand-writing of QSL cards in years past. None charge money for the service (although there are fees for retrieving QSO credits from LoTW and eQSL requests voluntary donations to help keep it afloat). And, of course, the QSLs reach their destinations instantly, rather than weeks, months, or even years later.

J-P Sampola, OH6RX (OH6STAYHOME), and Tom Morton, K2GO (W8I/STAYSAFE) in South Korea after Tom was released from quarantine. See main text for more about the W8I/STAYSAFE operation.

Stay Home … or Operating Remotely

For 24 hours on June 6-7, contesters and DXers participated in a special operating event to call attention to the "stay home" and "stay safe" health messages during the COVID-19 pandemic. Tom Morton, K2GO, had recently arrived in South Korea at the time of the COVID-19 contest. Confined to a mandatory 14-day quarantine for travelers, Tom used his hotel room Wi-Fi to connect to W4RN's station in the Virginia countryside to operate W8I/STAYSAFE. (Mike, W4RN, ex-W4AAW, constructed the first all-remote multi-multi contest station. See the *CQ*'s Contesting column for June 2016 at pages 95-99.)

Meanwhile, J-P Sampola, OH6RX, was also in South Korea, remotely operating OH6STAYHOME. After the contest, Tom and J-P realized they were nearby, and when Tom finished his quarantine period, the two ops met for an eyeball, properly masked of course. (Both are in South Korea for work.)

For some, the downside of electronic QSLs by LoTW is that no physical cards or personal notes are included — it is just a bare electronic record confirming the QSO and showing station location, band, etc. Not having even an electronic representation of a traditional QSL card has made this option unattractive to some who found viewing the various QSL designs to be interesting for its own sake. The LoTW system also is based on matching callsign, band, and time. So if you copy one letter of the callsign incorrectly, or somehow seriously goof up on the time or band (which I have done when my PC crashed during a run), the match will not be made and neither you nor the other operator will know of the mismatch.

Since my purpose is to provide confirmations to others wanting them and there is no incremental cost of doing so, I upload my contest log as soon as I have submitted it to the contest sponsor. Since I operate in a rural area with limited to no internet, often it is several days later before I am home and submitting my log after a contest. Some operators delay until after the contest deadline for log submissions to, in their opinion, prevent another operator from confirming or correcting a QSO record related to the competition. As they say on social media, YMMV (your mileage may vary). I do not delay because I trust the honesty of other competitors and, in any event, my life is busy and this works better for me.

It is still amazing to me to see that as many as 20% of QSOs are QSLed on LoTW and e-QSL just a couple of days after the event. My confirmation rate has approached 10% within 24 hours and 30% of all QSOs within a week. (*My overall QSL average of all uploaded QSOs is 58-60% on LoTW. –DS*)

eQSL is different from LoTW in several respects. First, eQSL provides an electronic card that can be printed, and may include a message and a description of the other operator's station or some interesting facts about the other operator's life or location. Second, operators can view QSL requests, so like when we relied solely on bureaus and the postal service, one-letter miscopied in a callsign or incorrect QSO times (such as use of local time instead of UTC) will be seen and can be corrected. Third, some operators forget to change their settings and send their contest call QSL using their primary account and callsign. Not infrequently, when I check an unmatched QSL request against my log, I see what looks like a contest call at the same time / frequency from the same country. A quick check of the call on QRZ.COM often finds that the contest call is used by the same operator as sent the QSL, so I return a note reminding the operator to select the correct call when downloading contest logs. And finally, there are a few bogus QSL requests, about the same as I used to get in by mail before we had electronic QSLing. I usually just respond with by clicking "reject" and sending an NIL (not-in-log) message.

QSL locations and callsigns — It is not unusual for contesters to use their callsign at another station for a weekend contest. I have noticed, however, that too frequently the electronic log is entered into ARRL's Logbook of the World (LoTW) or e-QSL without first setting up the new location. Even if within the same state, the county and Maidenhead ("grid") locator can be different for the contest weekend QTH. So be sure to take care that your log is being entered with the correct grid locator, county, and state (at least!). Other operators depend upon correct information for awards.

By the way, one thing I learned in doing the QSLs for the recent W8I/STAYSAFE contest is that ARRL's LoTW

accommodates different locations when simultaneously used with the same callsign. (*e-QSL is difficult to impossible for this, because each location must not overlap with another for the same callsign with the same date and time period. –DS*) In this process, I also observed that some operators drop everything after the "slash" when QSLing and some do not. This makes matching in the LoTW system difficult because "K3ZJ/p" will not match with just "K3ZJ." So now if I operate with what is a "voluntary indicator" such as "/8" or "/" anything, I enter the log under two callsigns: One with the "/" designation and one without. This captures the full set of those looking for QSLs, and either version is technically correct for U.S. operations.

The accompanying picture of the LoTW entry for the W8I operation illustrates this. There was no apparent pattern to those who added the "/" information and those who didn't. But entering the log under each variation (yellow highlighted) and for each different location used that weekend (green highlighted) allows everyone to receive a QSL tied to the actual location of the station worked. If you are on the other end — you need a confirmation from a station that signed "/" something — try submitting with and without the "/".

New strategy for sending and answering QSLs, several national societies — such as Spain's URE service, "QDURE" <https://qsl.ure.es/en/comenzar> and Germany's DARC QSL-Service <https://qslservice.de/shop> — offer to print and send your QSL cards via the bureau system at a very reasonable cost. Both offer a discount to members, but even for non-members, the cost is reasonable — around $110 U.S. for 1,000 cards, depending upon the Euro-dollar exchange rate at any particular time. Even for non-URE members, members of another national society (such as the ARRL) obtain a 10% discount off list price.

I have started to use URE, principally because their interface is in English as well as Spanish and easily understood, whereas that of the DARC appears to be only in German at this time. Their service appears to be in cooperation with the French and Argentine bureaus in addition to that of Spain. The service also provides for multiple different cards to be used within the same account, which for me is very useful. So, for example, I can create a card for my OZ/K3ZJ operations and another for K3ZJ at home and send QSLs from either of them, all within the same account and at the same price. This eliminates the need to have stacks of paper QSLs for each different location and separate accounts for each location or special operation.

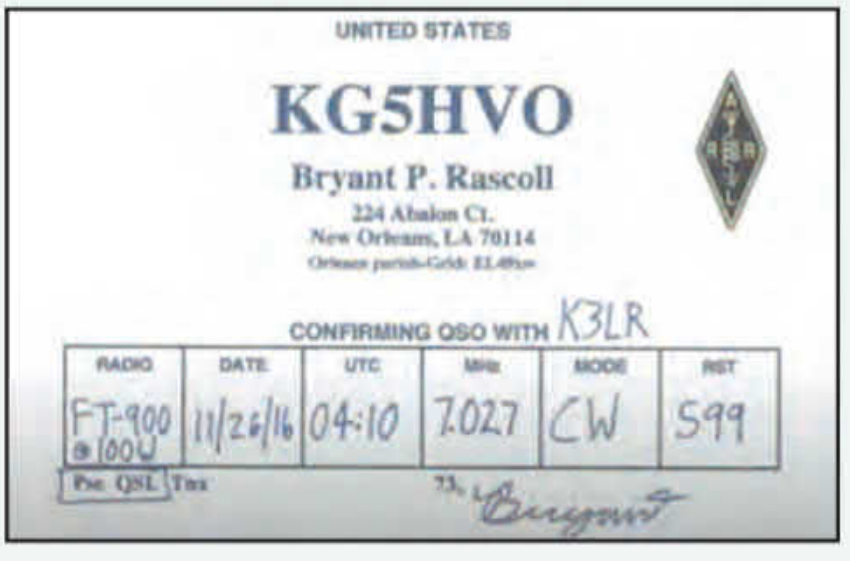
The cards themselves are VERY nice. Both the Spanish and German services offer two-sided color printing for the same base price. The user creates a card using the tools and templates provided (if desired) and uploads the log in ADIF format. Finished. The QSLs will be printed and entered into the bureau system. Since this is being done in Europe, delivery is much faster than sending cards to the European bureaus though the ARRL bureau. For U.S. contesters, at least on the East Coast, upwards of 80% of all QSOs generally are with European stations. The ADIF log can be the whole contest log, any selected QSOs from the log, or be an ADIF format log constructed just to answer cards received.

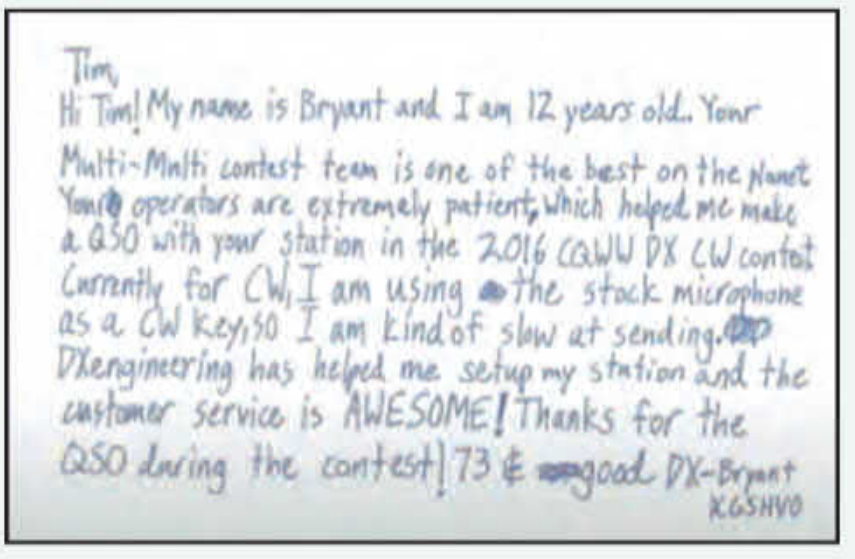
The pioneer in electronic QSL services was GlobalQSL. While I have not had personal experience with them, they appear to be in business and offer comparable QSLs and prices. The link to their QSL information page is here: <https://tinyurl.com/yakzud5x>.

Using any one of these services is a big improvement. No more having to order printed QSL cards, fill out each one by hand, sort hundreds of cards by country, box, and send them to the ARRL bureau, etc. The electronic services do all the printing, sorting, and mailing for me, and at less cost than possible using the old methods. The electronic QSL services are almost as revolutionary as the introduction of electronic logging. And hopefully this new ease for responding to the hundreds of QSL requests for contest QSOs will result in more operators helping build the new generation of contesters by responding to their QSL requests, one QSL at a time.

(*Editor's note: As this issue goes to press in July, several postal agencies around the world are restricting international mail service with various countries due to COVID-19. As of the end of June, the U.S. Postal Service listed over 100 countries with which mail service is temporarily suspended. An updated list is at <http://tinyurl.com/sxvuqwb>.*)

– Until We Meet Next, 73, Dave K3ZJ





The High Value of a Zero-Point QSO

Contest QSOs and QSLs can lead down unexpected roads, even 0-point DX contest QSOs. Tim Duffy, K3LR, received a hand-written card from brand new operator Bryant Rascoll, KG5HVO, after Bryant worked K3LR in the 2016 CQWW CW contest. Notwithstanding that in CQWW, U.S. stations are trying to work DX, not 0-point stateside contacts, the K3LR 40-meter operator spent considerable effort to copy Bryant's weak signal and logged the QSO. Less than two years later, Bryant was operating in a tent in the German countryside next to a huge sunflower field — at WRTC-2018! And today we hear Bryant on the air in many contests. This short video tells the story, and even includes a recording of the original QSO: <https://tinyurl.com/ydbjasjt>. Bryant was also the 2018 Newsline Young Ham of the Year.

PROPAGATION

BY TOMAS HOOD,* NW7US

Solar Wind and Coronal Holes

A Quick Look at Current Cycle 24 / 25 Conditions
(Data rounded to nearest whole number)

Sunspots:
Observed Monthly, May 2020: 0
12-month smoothed, November 2019: 2

10.7-cm Flux:
Observed Monthly, May 2020: 69
12-month smoothed, November 2019: 69

A_p Index:
Observed Monthly, May 2020: 6
12-month smoothed, November 2019: 6

***One Year Ago:* A Quick Look at Solar Cycle Conditions**
(Data rounded to nearest whole number)

Sunspots:
Observed Monthly, May 2019: 6
12-month smoothed, November 2018: 4

10.7-cm Flux:
Observed Monthly, May 2019: 71
12-month smoothed, November 2018: 70

A_p Index:
Observed Monthly, May 2019: 7
12-month smoothed, November 2018: 7

Space is not a vacuum, at least in our solar system. The sun's atmosphere, which actually extends extremely far out from the sun, fills space in our system with plasma, a low-density gas in which the individual atoms are charged.

The temperature of the sun's atmosphere is so high that the sun's gravity cannot hold on to it. The plasma streams off of the sun in all directions at speeds of about 400 kilometers per second (about 1 million miles per hour). This is known as the *solar wind*.

The speed of the solar wind fluctuates, and carries with it magnetic clouds. These magnetic clouds are interacting regions where high-speed wind catches up with slow-speed wind. The solar wind speed is high (on average 800 kilometers per second) over coronal holes and low (300 kilometers per second) over streamers. These high- and low-speed streams interact with each other and alternately pass by the Earth as the sun rotates. These wind speed variations buffet the Earth's magnetic field and can produce storms in the Earth's magnetosphere.

Coronal holes are an extended region of the corona that have exceptionally low density and have "open" magnetic field topology. Coronal holes are largest and most stable at or near the solar poles, and are a source of high-speed solar wind. However, coronal holes situated at or near the solar equator tend to have the greatest impact on the Earth.

Coronal holes follow the rotation of the sun, taking about 27 days for a full revolution around the sun. This means that if the coronal hole lasts long enough, we'll see an influence on space weather every 27 days. When a coronal hole survives long enough to make it around a second time, the coronal hole is said to be *recurrent*. Coronal holes, then, are typically long-duration features, and since they spew out plasma at elevated speeds, they degrade ionospheric propagation for days at a time.

The Earth has a magnetic field with a north and a south pole that is enclosed within a region surrounding the Earth called the *magnetosphere*. As the Earth rotates, its hot core generates strong electric currents that produce the magnetic field, which reaches 36,000 miles into space. The magnetosphere prevents most of the particles from

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LAST-MINUTE FORECAST

Day-to-Day Conditions Expected for August 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 August 1 through 3, while August 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.

the sun, carried in solar wind, from impacting the Earth.

The solar wind distorts the shape of the magnetosphere by compressing it at the front and causing a long tail to form on the side away from the sun. This long tail is called the *magnetotail*.

Let's look at the relationship between coronal material and magnetic fields. The corona is so hot that the gases in it lose some of their electrons in the powerful collisions between atoms. This plasma is a mixture of positively charged ions and negatively charged electrons.

An example of plasma can be seen by looking at a neon light. You are looking at plasma, energized to the point where light is emitted. Because plasmas are electrically conductive, they can steer magnetic fields. And they are steered by magnetic fields. These loops of magnetic force are stretched and dragged into interplanetary space by the inertia of the expanding plasma that spirals out as the solar wind. When these magnetic forces impact the Earth, they are either diverted by or combined with Earth's magnetic field.

The speed of the solar wind fluctuates. During this year, we're seeing a range of solar wind speed of between 300-600 kilometers per second on average. When the solar wind picks up speed, and when the magnetic field lines that are stretched out on the solar wind pass the Earth, geomagnetic storms may be triggered. For radio signals, this could be a good thing or a bad thing, depending on the frequency and radio path.

The majority of geomagnetic disturbances are generated by the encounter with the magnetic fields, and the volume and speed of the solar wind. The ability of the solar wind to disturb the Earth's magnetosphere is a function of its speed and the strength and orientation of the magnetic fields. In the presence of a strong southward magnetic field component, a *connection* is made between the solar wind's magnetic fields and the Earth's magnetic fields (picture two bar magnets, where the north pole of one connects with the south pole of the other).

The Earth's magnetosphere is formed from two essential ingredients, the Earth's magnetic field (which has much the same form as that of a bar magnet, and is from pole-to-pole), and the solar wind. When the solar wind and magnetic fields combine with the Earth's magnetic field, they alter the shape and intensity of this shield around the Earth.

The ionosphere is affected by these changes, either by an increase of ionization, or a decrease or even a depletion of ionization. Depressions in ionospheric density cause major communications problems because radio frequencies that previously had been refracting off the ionosphere now punch through. The Maximum Usable Frequency (MUF) on a given radio signal's path can be decreased by a factor of two during an ionospheric storm event. Storm effects are more pronounced at high latitudes.

During the periods of minimal solar activity of a solar cycle, like the current solar cycle, we see far fewer coronal mass ejections than during the peak years of the cycle. However, we still see frequent recurring coronal holes. These coronal holes produce fast solar wind streams and at times spew out enough plasma to cause minor geomagnetic storms.

Low sunspot counts combined with coronal hole activity often contributes to days of very poor propagation on the high frequencies (30 MHz and below). When the solar wind speed is high (over 650 kilometers per second), when there's a release of solar plasma on that wind stream, and when the orientation of that wind stream is aligned to combine with the magnetosphere, the geomagnetic field will *open* to the incoming plasma, and aurora (the northern and southern lights) occurs. And that is when VHF comes alive for the exotic Aurora-mode propagation.

During August, we'll see days when coronal holes could dominate space weather. Solar activity will be low to moderate, too, as we are at the end of Solar Cycle 24 — possibly at the very beginning of Cycle 25. Major shortwave broadcasters have taken this into consideration, and have chosen frequencies that, with the high power and gain of their transmitting facilities, will overcome tough propagation into their target areas. But there may be days when it will be a challenge to hear the station you're hunting for. Amateurs, of course, don't have the high-power options available to broadcasters.

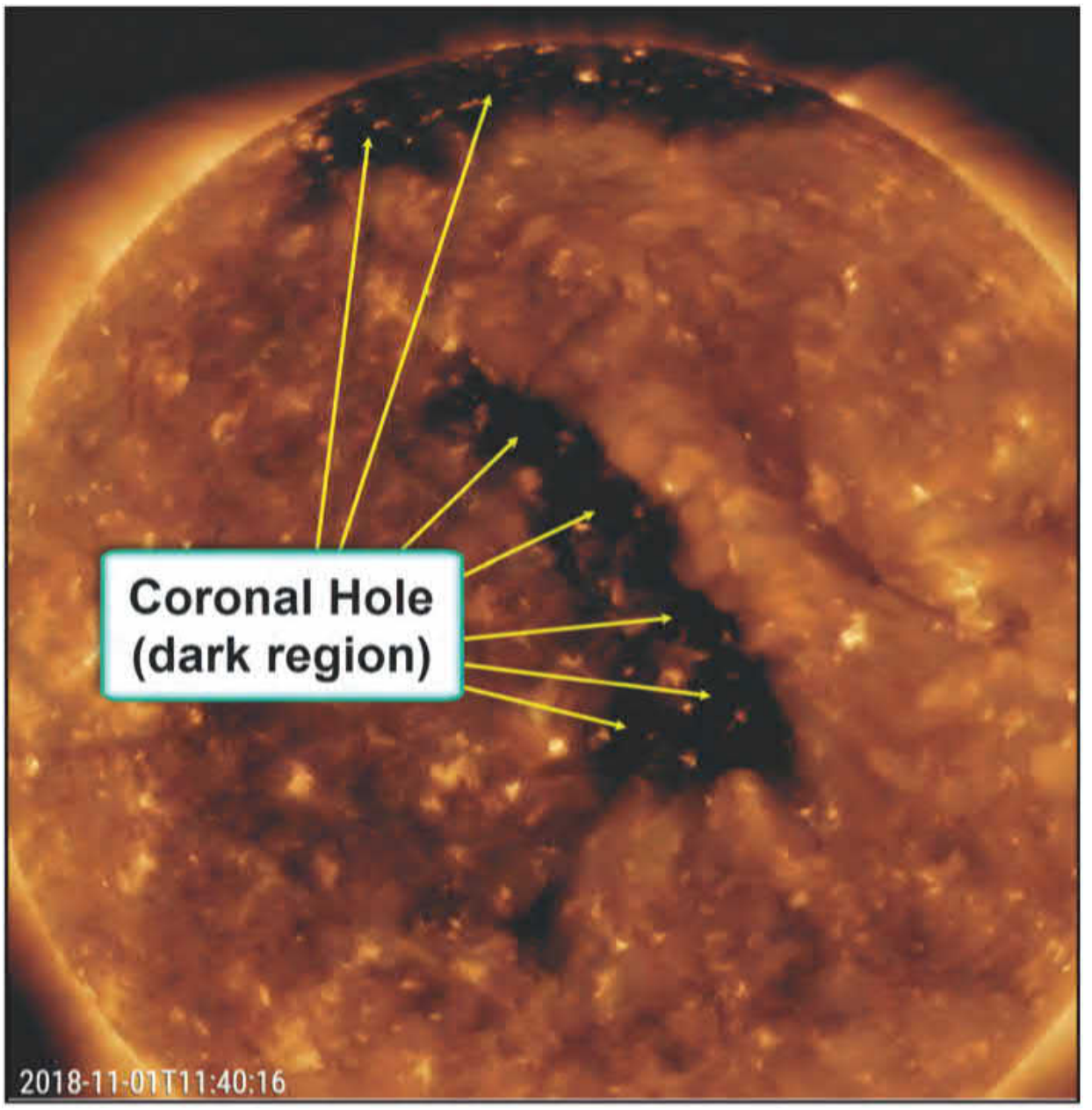


Photo A. The most distinctive feature on the sun in recent weeks, other than the surprise M1-class flare and some sunspots, is good-sized coronal holes. This slanted one is nearly centered on the face of the sun (this was during the period of Oct. 31st through Nov. 2nd, 2018). They appear darker in this wavelength of extreme ultraviolet light at 193 Angstroms. (Courtesy of SDO/AIA)

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>.

August Shortwave (HF) Propagation

Late August and early September are a difficult time of year to make accurate band predictions because conditions can change drastically from day to day. On many days, typical summertime conditions will continue much as they were during June and July.

On other days, conditions may be typically fall-like, with somewhat higher daytime usable frequencies and somewhat lower nighttime usable frequencies. When you add *equinoctial* conditions that can begin as early as late August, we often experience optimum openings between the Northern and Southern Hemispheres on the one hand, but periods of active to stormy conditions on the other.

Despite being at the start of Solar Cycle 25 with low solar activity, during the daylight hours good DX conditions should be possible on several bands: 15, 17, and 20 meters. Expect signals on the 17- and 20-meter bands to peak approximately during the 2-hour window immediately following sunrise and again during the late afternoon. These two bands, and to a lesser degree, the 15-meter band, will see openings for DX throughout the daylight hours. Fairly good DX openings should occur along an arc extending across central Africa, Latin America, and into the far Pacific area. Peak conditions should occur during the afternoon hours, but an increasing number of earlier openings should be possible by early September.

Between sundown and sunrise, 20 meters is expected to be the best DX band. However, with lower solar activity, the band in general will suffer. Openings might be possible to many areas of the world, some with surprisingly strong signal levels — albeit those openings will be rare. Until midnight, good DX conditions should be found for openings toward Latin America, the far Pacific and into Asia. You might even catch some activity on 17 or even 15 meters.

Fairly good conditions are also expected on 30, 40, 60, and 80 meters despite the high static level at times. Openings should be possible before midnight along an arc extending from northern Europe through Africa and into Latin America, the far Pacific, and Asia after midnight.

By late August it should be possible to work some DX on 160 meters during the hours of darkness. Conditions on this band, as well as on 40, 60, and 80 meters, will tend to peak just as the sun begins to *rise* on the *light*, or easternmost, terminal of a path.

For *short-skip* openings during August and early September, try 80 meters during the day for distances less than 250 miles, with 60 and 40 meters also usable. During the hours of darkness, both 80 and 160 meters should provide excellent communications over this distance.

For openings between 250 and 750 miles, use 30 and 40 meters during the day for distances up to 500 miles, and 20 and 17 meters between 500 and 750 miles. At night, 40 and 30 meters should be the best bands for this distance until midnight, with 80 meters optimum from midnight to sunrise. Try 60 meters, as well.

For openings between 750 and 1,300 miles, try 20 and 17 meters, as they should provide optimum propagation during the hours of daylight. Optimum conditions should continue on

OUR READERS SAY... *(from page 10)*

Gain vs. Amplification

The following letter was directed to QRP Editor Scott Rought, KA8SMA.

Dear Scott,

This letter is in regards to your recent article about operating QRP.

You do realize that antenna "gain" is not amplification, right? You don't get more than five watts out of any antenna you put 5 watts into. I don't know where you got this idea, but it's flat WRONG. I hope before you write another article about "high-gain antennas" that you take some time to research what you're talking about. When you write for a publication, it should certainly be factual information you present; otherwise you're doing a huge disservice to the ham community by giving WRONG information. Here's a definition for you:

Antenna gain and effective radiated power. The term antenna gain defines the degree to which an antenna concentrates radiated power in a given direction, or absorbs incident power from that direction, compared with a reference antenna.

It doesn't amplify!

Please learn your subject.

– Sincerely,
Brian Lewis, N8XCO

KA8SMA responds:

Hello Brian:

Thanks for your comment. I assume this is in reference to June's QRP column regarding the true meaning of QRP. I could not agree with you more on the definition of antenna gain. The column highlighted a debate between two hams, KS4AA (now SK) and KR2Q, who disagreed over whether a ham operating with 5 watts or less should be considered "QRP" if a high-gain antenna system is used. As you noted, antenna gain is the degree to which an antenna concentrates radiated power in a given direction or absorbs power from that direction in comparison to a reference antenna (isotropic radiator or dipole). The question is whether the intensification (antenna gain) produced by the high-gain antenna should still be considered QRP since the 5 watts has been "intensified" into a more robust, stronger signal for the receiving station. As KS4AA indicated in his email (reprinted in the column) and noted by KR2Q, an antenna with around 13-dB gain would make the 5-watt signal *sound like* a 100-watt signal. A 13-dB antenna would be a monster and challenging to build, but even an 8.5-dB gain antenna (like some Yagis) would make a 5-watt signal sound more like 35 or 40 watts.

I do agree with your statement that 5 watts out is 5 watts out — no new energy is created, but the amount of intensification in a particular direction makes the signal sound much stronger. As they say, don't spend your money on an amplifier until you have spent money on the antenna. For obvious reasons, more antenna gain is better.

I do hope this helps to clear the air.

– 73, Scott, KA8SMA

Unplug!

Editor, *CQ*:

I found Ron Ochu's article on lightning protection (*CQ*, March 2020) to be excellent reading and packed with great information.

One comment I would like to make is that even in a station that is properly grounded and surge-protected, disconnecting the antenna cables from all equipment AND unplugging all equipment (radios, rotor control box, computers, etc.) from AC power is still a critical layer of protection from lightning. It is also *vitally important* to unplug the AC power to the rotor control box from a power strip that is shared by other equipment. Don't just unplug the power strip from the wall because this still leaves a path between the rotor control box (which, of course, is still connected to the rotor outside) and the other equipment plugged into the power strip, which can result in a lightning-induced surge reaching that equipment.

I should also mention that all of this disconnecting must be done in advance of the storm (or when you are going to be away from home). When the storm has started, don't touch anything — at that point, it's not worth risking your life to save your station from damage!

– 73, Gary Cachules, N2AMC

On the Cover...

Here's an example of how one thing can lead to another … and another … in ham radio. Stephen Cruse, K3WHC (L), and William Koch, W2RMA (R), wanted to test out new systems they'd assembled for 24 GHz. They scouted out a spot in central Pennsylvania to set up their gear and got John Jaminet, W3HMS, and Roger Behr, W3SZ, to listen for them at the other end of their planned patch, about 30 miles / 50 kilometers away. Next, David Petke, K1RZ, got involved and turned it into a microwave activity event with a dozen participants as described by VHF+ Editor K8ZR in his column (on page 77). Contacts were made on 5.7 and 10 GHz, as well.

According to Koch, "The objective was to make a 24-GHz QSO, so we set up at modest distances. W3HMS at 50 kilometers (31 miles) was worked by W2RMA and K3WHC." He said the longest distance covered on 10 GHz was with N3RG at 230 kilometers / 143 miles, and their best DX on 5760 MHz was W3SZ at 135 kilometers / 84 miles. Bill notes that the site was chosen using images from Google Earth but adds that it's important to check sites out in person as well, since "green attenuators" (leaves!) tend to grow up quickly.

Koch has been operating microwaves for about six years — he says his first QSO on 10 GHz was 75 kilometers (46.5 miles) across Lake Erie using 75 MICROwatts of power. He's now working on building an 11-band rover setup that will let him operate portable from 50 MHz to 24 GHz. Cruse has been on VHF / UHF for 45 years, adding 10 GHz two years ago "for a new challenge."

Koch concluded, "10 GHz is a wonderful band. Outside, enjoying the sun in places with great views; guys and gals who cooperate to make the Q; propagation fun: Ducts, tropo, airplane scatter, and rain scatter. Who could ask for anything more?" (*Cover photo by David Petke, K1RZ*)

these bands for this distance range after sundown and until midnight. Between midnight and sunrise, the best band should be 40 meters, but check 60 meters, too.

For openings between 1,300 miles and the one-hop short-skip limit of approximately 2,300 miles, try 20 and 17 meters during the day, with 15 meters also usable. After sundown, try 30, 40, and 60 meters, with 80 meters also providing good propagation conditions for this distance range.

VHF Propagation

Sporadic-E (E_s) propagation usually begins to taper off during August, but it should continue to occur fairly frequently. Some 6-meter E_s openings are expected during the month over distances of approximately 750 to 1,300 miles. During periods of intense and widespread E_s ionization, two-hop openings may be possible considerably beyond this range. Also check the 2-meter band for an occasional E^s short-skip opening between approximately 1,200 and 1,400 miles. While E_s short-skip openings may occur at any time, there is a tendency for them to peak between 8 a.m. and noon, and again between 6 and 9 p.m. local daylight time.

The Perseids meteor shower covers the period of July 17th to August 22nd. The peak is expected to occur between August 11th and 13th, and will be most observable in the Northern Hemisphere. The maximum hourly visual rate typically reaches 50. It is not expected to be a major shower, however.

Aurora? You would think that aurora would not be a frequent player at this point in Solar Cycle 25, but, with the continued expulsion by the sun of coronal mass into the solar wind, we have been observing occasional moderate auroral activity in the highest latitudes. Some of these have occurred even during the late spring and early summer this year. Auroral-scatter-type openings, on both the 6- and 2-meter bands, can range from a few hundred up to about a thousand miles, and they are usually characterized by very rapid flutter and Doppler shift on SSB signals.

For the very patient, check the six-meter band for possible trans-equatorial (TE) openings between 8 and 11 p.m. local daylight time. This type of propagation favors openings from the southern tier states into deep South America, with the signal path crossing the magnetic equator at a right angle. TE openings during August are rare, but they can occur. Very weak signals and severe flutter fading usually characterize them.

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 May is 0.0. The 12-month running smoothed sunspot number centered on November is 0.8. A smoothed sunspot count of 6, give or take about 6 points is expected for August 2020.

The Dominion Radio Astrophysical Observatory at Penticton, BC, Canada, reports a 10.7-cm observed monthly mean solar flux of 70.1 for May 2020, is 69.2. The 12-month smoothed 10.7-cm flux centered on November is 69.4. These low numbers staying steadily low is the clear indication of the minimum period between Cycle 24 and the new Cycle 25. The predicted smoothed 10.7-cm solar flux for August 2020 is 68.

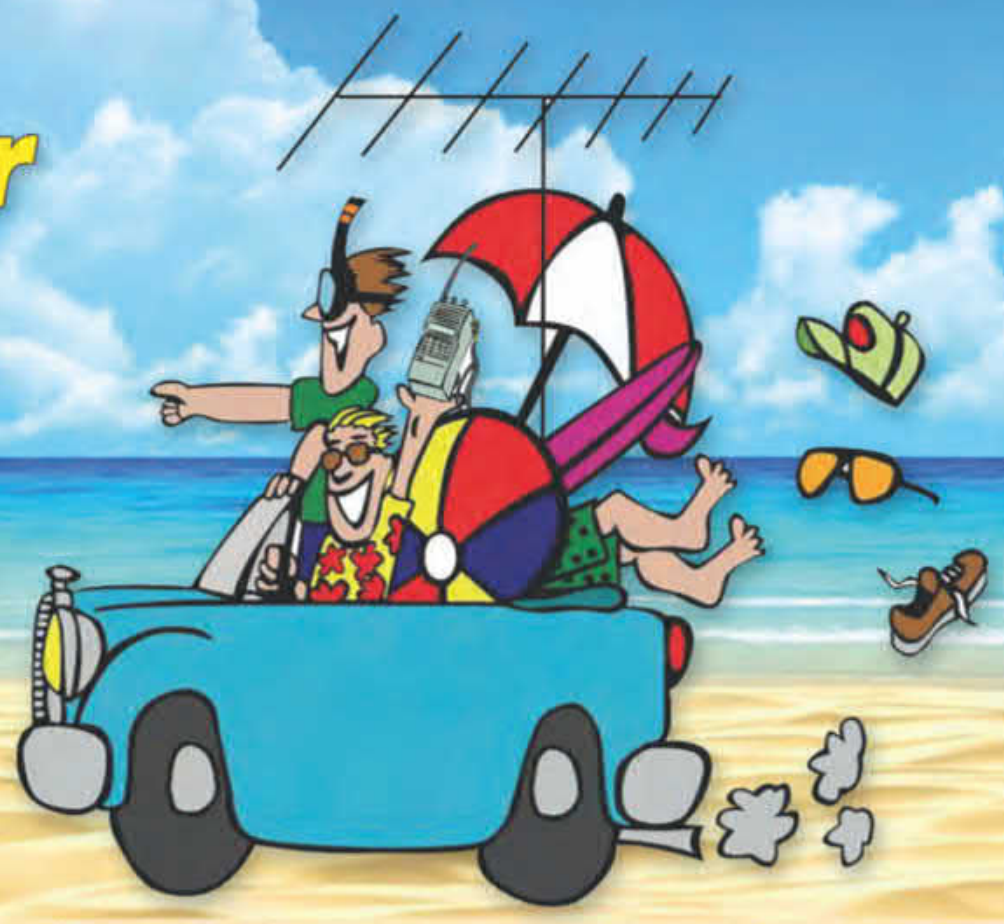
The observed monthly mean planetary A-Index (A_p) for May is at 6. The 12-month smoothed A_p index centered on November 2019 is 6.1.

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

Get Ready for Summer!



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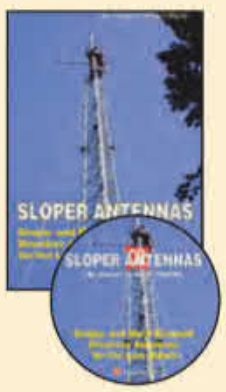

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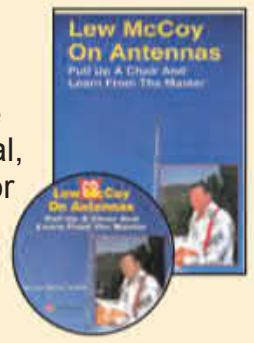

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2020 CW RESULTS
SINGLE OPERATOR
NORTH AMERICA
UNITED STATES

CONNECTICUT

K1ZZ	**119,850**	**326**	**41**	**44**
***W1ARY**	**55,205**	**350**	**43**	**18**
*W1QK	48,849	328	43	14
KA1J	40,199	184	39	22
K1KI	31,752	211	33	16
K1BUK	25,440	208	38	10
*W1EQ	18,204	198	33	4
*KC1ERO	10,272	125	29	3
*KC1SA	8,883	135	25	2

MAINE

K1LZ	**1,128,548**	**1414**	**55**	**79**
K1DG	**1,023,435**	**1497**	**56**	**77**
KA1IS	235,818	575	48	51
***W1LQ**	**73,219**	**308**	**40**	**33**
*N1CGP	32,120	304	39	5
*KK7A	2,684	52	21	1

MASSACHUSETTS

K5ZD	**341,223**	**868**	**52**	**55**
***K1EP**	**254,800**	**881**	**54**	**46**
N1PGA	**155,038**	**523**	**49**	**40**
N1QY	70,448	387	45	23
*K1VUT	66,468	479	45	13
*N1DC	51,015	369	46	11
*K1SX	43,407	227	43	20
*N2AN	26,977	192	43	10
*KU1N	26,531	265	41	2
*N1NN	5,174	86	25	1
*NG1I	1,728	45	16	0
*N1AW	1,411	34	17	0
*WO1N	550	26	10	0
*WB1AEL	540	21	12	0
*N1YL	138	10	6	0

NEW HAMPSHIRE

K1TR	**222,775**	**763**	**53**	**42**
***N1IX**	**49,350**	**389**	**40**	**10**
*K1QO	39,540	241	45	15
*WA1T	21,266	137	32	17
AA1QD	14,491	132	36	7
*N1IMW	5,887	90	26	3
*KG1V	3,560	77	20	0
K1KXN	360	12	12	0

RHODE ISLAND

W1XX	**308,053**	**813**	**54**	**53**
***K1MD**	**79,268**	**339**	**48**	**28**
*AJ1DM	2,300	47	18	2

VERMONT

N1UR	**411,840**	**856**	**54**	**63**
K1VMT	47,276	366	44	9
***K1ARR**	**1,683**	**42**	**17**	**0**

NEW JERSEY

***N2GM**	**81,508**	**424**	**47**	**24**
*N2HMM	25,474	179	32	15
*WA2ALY	24,544	178	40	12
*KC2WUF	24,000	187	38	10
*KD2JC	12,771	155	27	6
*W3PR	7,359	91	31	2
*W2IOC	1	0	1	0

NEW YORK

N5DX	**1,065,912**	**1611**	**57**	**81**
W2XL	**244,812**	**865**	**52**	**40**
WS9M	218,296	551	54	50
K2NV	213,885	688	53	44
N2MF	163,210	522	50	45
***N2YB**	**147,846**	**725**	**54**	**28**
NS2N	104,380	411	53	32
*AI2S	53,170	312	49	16
K2UF	50,700	346	49	11
WU2M	43,615	326	43	12
*K2QO	40,370	292	43	12
*AG2AA	31,115	269	43	6
W4IPC	23,220	209	40	5
*N2BEG	19,881	182	44	3
*N2RI	18,720	196	34	6
WB2WPM	10,527	141	32	1
*NY2H	8,288	127	26	2
*K2NPN	6,496	94	28	1
*AC2OC	5,572	86	28	0
*W2YK	5,423	76	27	2
*W2EG	3,795	69	22	1
*KX1W	1,065	34	15	0
*N2JJ	920	20	20	0
*KQ2N	174	-2	0	6

DELAWARE

***N8NA**	**37,760**	**236**	**45**	**14**
*WA3V	9,636	121	29	4
*W3ASW	1,890	42	18	0

DISTRICT OF COLUMBIA

***W3DQ**	**21,360**	**169**	**39**	**9**

MARYLAND

***KD4D**	**525,100**	**1038**	**52**	**66**
K3ZO	**498,220**	**1016**	**55**	**61**
WG3J	**402,192**	**862**	**52**	**60**
K3TC	216,800	607	52	48
AA3S	180,084	671	47	39
W3KL	142,080	546	47	33
*W3UL	64,377	292	41	28
*K3KU	57,950	392	49	12
*WK3A	55,638	311	48	18
*WA3FAE	54,936	418	44	12
NC3Y	46,386	365	45	9
KG4USN	38,254	157	36	26
*W3IUU	35,670	226	44	14
W3PH	20,726	206	38	5
*N3TE	19,932	183	38	6
*K3NDM	5,239	68	28	3
*W3VKD	392	10	4	4
*W3WTD	296	17	8	0

PENNSYLVANIA

W3BGN	**633,204**	**1189**	**56**	**67**
K3UL	**546,608**	**1030**	**57**	**70**
W3TS	419,682	1099	56	57
WK2G	213,691	682	53	44
K3SWZ	145,209	382	47	50
N3XZ	90,446	301	44	38
K3JGJ	70,818	214	49	38
***WS3C**	**62,985**	**389**	**48**	**17**
KY3W	45,920	354	47	9
KW3A	35,695	236	45	14
*N2EM	33,418	294	42	7
*WA1HEW	25,380	213	40	7
*N3LT	14,445	139	41	4
K3VZ	14,310	128	39	6
KA2C	10,260	91	27	9
*K3HW	3,570	67	20	1
*N3SW	1,944	33	23	1
*ND3R	1,620	39	18	0
NT2DR	1,204	17	9	5
*WB3LHD	1,139	32	17	0

ALABAMA

AG4W	**329,346**	**820**	**52**	**55**
***K1DC**	**187,376**	**614**	**53**	**45**
N4NO	61,540	356	49	19
*W5NZ	14,208	98	35	13
*KS4L	1,628	34	21	1
*W4MTM	432	15	11	1

FLORIDA

NE8P	**202,445**	**617**	**51**	**44**
KJ4QHL	**142,105**	**486**	**48**	**49**
N4UM	76,032	421	48	24
***WB4TDH**	**73,264**	**328**	**47**	**29**
AE2DX	46,830	255	47	23
*N4EK	45,656	364	39	13
N4FP	42,021	220	40	23
N4TB	39,061	192	45	22
*N4EH	28,072	197	45	13
W8IM	16,524	110	39	15
*W3USA	12,685	110	33	10
*K4SXT	12,212	100	33	10
*K8MR	11,600	118	33	7
*KM2T	9,912	93	34	8
*K2ZR	9,184	90	32	9
*K8RGI	9,158	96	30	8
*N4T/45	4,180	22	16	3
NA4CW	1,680	15	0	14
*KN4DXT	160	10	7	1

GEORGIA

NO9E	**272,200**	**818**	**54**	**46**
KU8E	**249,696**	**797**	**54**	**48**
NE4EI	77,049	524	48	15
W4AN	56,100	333	51	17
K4ZMV	50,890	236	45	25
***N4JVP**	**35,802**	**283**	**43**	**11**
*KJ4UC	13,200	123	39	5
*KK4WX	2,725	50	24	1
*W4EMI	574	19	14	0
*K8LBQ	160	10	8	0

KENTUCKY

W5MX	**729,270**	**1374**	**58**	**77**
K4WW	**159,456**	**643**	**52**	**36**
***KC4WQ**	**70,840**	**396**	**49**	**21**
*K4CMS	38,805	203	44	21
KD4EE	24,864	212	41	7
*KM4FO	24,610	226	41	5

NORTH CAROLINA

N4XD	**667,584**	**1290**	**56**	**66**
N4AF	**583,892**	**1192**	**57**	**65**
WG8Y	34,099	175	42	19
W3DQS	28,860	180	39	21
***N3CKI**	**20,840**	**229**	**36**	**4**
*AD8J	20,160	182	37	8
WE6C	19,257	162	39	10
*K4KAY	13,407	103	29	12
*K4BSK	10,404	127	33	3
K4KZ	9,984	98	33	6
*WA2JLW	4,384	50	26	6
*W4GHV	3,100	56	24	1
*K6RM	1,014	36	13	0

SOUTH CAROLINA

NN4SS	**69,615**	**464**	**49**	**14**
K7OM	55,096	249	45	26
NI7R	25,168	182	40	12
***N4XL**	**13,386**	**129**	**42**	**4**
*WA8OJR	12,455	100	39	8
NJ4F	4,830	50	22	8
*KD4S	390	11	7	3

TENNESSEE

K4RO	**346,170**	**789**	**56**	**54**
AC4G	**186,147**	**416**	**54**	**57**
***K4OAQ**	**103,530**	**637**	**52**	**18**
W4UT	100,110	593	51	20
*WA5POK	72,829	418	47	20
*KB9DKR	53,100	485	43	7
WB4YDY	42,160	263	48	14
W4NZ	28,875	202	43	12
*KS4X	25,428	210	45	7
*W3TB	24,888	207	43	8
*WD8RYC	6,888	64	36	5
*K4DXV	24	3	4	0

VIRGINIA

K3ZM	**1,112,238**	**1627**	**58**	**71**
W4CB	**666,600**	**1361**	**56**	**64**
WA4JUK	140,302	601	50	32
***K4ORD**	**108,978**	**406**	**48**	**34**
NG2H	106,110	301	50	40
KØZR	94,536	488	49	23
K4ZW	75,960	345	48	24
*K2WK	59,340	420	47	13
K4RDU	44,793	270	46	17
N4DJ	41,958	343	49	5
*N4FX	40,512	217	45	19
*N4UA	34,485	153	32	23
*K4FTO	33,804	234	40	14
W4WWQ	30,566	185	41	17
*K8LF	19,943	153	35	14
*W4PJW	18,446	177	42	4
*K4HQK	14,760	168	31	5
NR4C	14,564	121	33	11
N3KN	11,628	130	33	5
N8AID	9,345	77	25	10
WN7S	8,587	128	29	2
*K4YCR	8,349	110	31	2
N3JB	6,897	58	23	10
*WR4I	6,090	72	27	3
*NN4RB	4,023	63	25	2
*K4MI	3,278	64	21	1
*W2YE	1,005	26	15	0
*K4MIL	992	28	16	0
W4ZYT	714	22	11	3

ARKANSAS

W5ZN	**590,117**	**1250**	**57**	**64**
WD5R	**421,689**	**1138**	**56**	**55**
***N5EE**	**65,142**	**448**	**51**	**12**
*KH6KG/W5	61,346	280	47	27
*WA5SOG	56,100	348	50	16
W9JEF	40,356	303	49	10
WA5BDU	25,036	259	42	2
KD5J	22,419	207	42	5
K9OZ	21,930	172	41	10

LOUISIANA

***K5KU**	**241,020**	**808**	**55**	**48**
*KV8S	54,360	391	50	10
*W5ZZ	10,988	121	37	4

MISSISSIPPI

N4OGW	**303,632**	**715**	**53**	**59**
WQ5L	**104,480**	**424**	**50**	**30**
***N5CW**	**47,253**	**337**	**45**	**12**
*K5XU	8,288	103	35	2
*N5RB	4,185	57	28	3
K2FF	40	2	0	4

NEW MEXICO

N2IC	**492,366**	**1240**	**57**	**57**
K7IA	**106,480**	**445**	**53**	**27**
N5UL	76,206	347	51	27

OKLAHOMA

***N5XE**	**12,831**	**118**	**42**	**5**
WD5CSK	**6,039**	**93**	**32**	**1**

TEXAS

K5WA	**263,292**	**662**	**55**	**56**
WA2VYA	95,616	541	52	20
N3BB	92,229	530	50	21
W5JMW	55,725	256	49	26
K5LY	39,438	259	48	15
***KF5ALL**	**31,720**	**276**	**46**	**6**
*AA5TB	23,856	219	43	5
*K5LH	22,984	191	44	8
K5MV	20,400	171	42	8
*K5ME	20,188	177	42	7
*K5TDA	18,050	167	45	5
*N5KWN	13,815	144	43	2
KZ5J	13,728	136	38	6
*N5KF	5,740	63	30	5
*K5IX	1,377	42	16	1
*KD5MMM	1,139	28	15	2
*K5MBA	588	23	11	1
*WB5K	182	13	7	0
*N5ZN	1	4	4	1

CALIFORNIA

K6AM	**414,468**	**1069**	**58**	**58**
W6AYC	**204,952**	**753**	**54**	**34**
AC6DD	199,890	589	52	38
N6RK	146,219	632	56	17
K6NA	80,586	327	48	26
N6RO	68,288	293	49	15
***W6JTI**	**53,632**	**324**	**50**	**14**
*KØXP	48,360	294	48	17
N6TQ	39,258	280	44	10
W6RKC	29,016	157	47	15
*N6VI	25,758	189	41	12
N6XI	25,056	230	44	4
W6EU	20,208	169	41	7
*WA6URY	17,730	156	36	9
WØYK	12,915	132	37	4
K6MM	12,051	109	31	8
N3ZZ	7,455	97	33	2
K6XX	7,334	75	33	5
*K6EM	6,400	81	28	4
*N6LL	6,003	85	24	5
*KA9A	5,221	91	19	4
KE6QR	5,073	116	17	2
*N6SN	3,432	62	19	3
W6BIV	3,080	76	19	1
AJ6V	2,941	79	16	1
*W6JK	2,720	70	15	2
W6JBR	2,240	53	19	1
WB6BET	1,012	43	11	0
*W6NKR	540	27	10	0
W6ENZ	497	8	0	7
*K6CSL	336	21	8	0
*K8TR	110	11	5	0
*NC6Q	4	2	1	0

ARIZONA

W7QM	**358,992**	**1050**	**56**	**52**
N7GP	**163,891**	**554**	**53**	**38**
***N7IR**	**118,888**	**604**	**52**	**25**
KH7X/W7	75,831	460	52	17
N6VR	69,312	286	49	27
*W8JH	59,961	320	50	19
K7HP	51,348	304	50	16
*AC7A	45,140	293	50	11
N7RK	40,068	225	50	13
N6BT	28,514	199	42	11
KE2VB	24,745	224	45	4
K7HI	12,314	92	36	11
*NØUD	10,920	111	38	4
W7ON	8,295	96	29	6
N7WS	7,344	48	22	12
*KE6K	6,270	78	29	4
*AA7V	3,510	60	24	2
*W9CF	344	20	8	0

IDAHO

WJ9B	**235,969**	**832**	**55**	**28**
N7UVH	24,225	170	43	8
W7MEM	6,876	81	34	2
K7OVG	3,984	68	23	1
***K7ARJ**	**1,442**	**44**	**14**	**0**
*N7ESU	923	28	12	1
*K7JAN	726	27	11	0
*W7TX	520	26	10	0

MONTANA

N9RV	**160,588**	**702**	**54**	**22**
KS7T	17,680	194	39	1
AB5ZA	16,720	185	35	3

NEVADA

AA6AA	**231,413**	**675**	**54**	**37**
NF7R	24,915	184	48	7
***N7XCZ**	**1,820**	**64**	**12**	**1**
KM6CQ	1,800	47	17	1
WU6W	1,320	33	19	1

OREGON

K7RAT	**323,904**	**1003**	**56**	**40**
W7YAQ	93,951	444	52	21
***AK6A**	**65,758**	**364**	**48**	**13**
W7EW	26,892	143	40	14
*W7ZI	14,500	93	36	14
*W7MTL	6,496	94	27	2
*W7VO	6,386	84	29	2
*AE7EU	2,852	59	22	1
*W7GF	1,442	44	12	2

UTAH

NG7M	**21,328**	**221**	**40**	**3**
NN7ZZ	7,743	98	24	5
***WA7YAZ**	**3,344**	**66**	**21**	**1**
*KBØYD	50	5	5	0

WASHINGTON

N7ZG	**153,840**	**602**	**56**	**24**
W7FI	61,831	292	54	19
***K7QBO**	**26,880**	**187**	**47**	**9**
W7WR	20,808	162	42	9
*N7MU	6,851	85	27	4
K7IU	5,271	98	20	1
*NN7M	2,812	61	15	4
*KC7ITP	1,288	39	13	1
*KB7AK	962	30	12	1
K7II	780	23	11	1
*W7VAS	24	-3	0	3

WYOMING

W6KGP	**39,556**	**288**	**50**	**8**
***KA7PNH**	**154**	**8**	**7**	**0**

MICHIGAN

NA8V	**703,948**	**1400**	**57**	**67**
K8BKM	**163,473**	**658**	**53**	**34**
W8TWA	101,177	400	50	33
K8BZ	89,896	532	49	19
***WA1UJU**	**75,864**	**583**	**53**	**5**
*KB8TL	32,489	223	42	11
KO8Z	30,738	295	41	6
*K8GVK	29,870	189	43	15
*KB8TYJ	28,435	259	42	5
*AC8CE	24,225	151	44	13
*W8CO	19,635	143	38	13
*K7DR	19,125	186	42	3
WA8UPB	18,240	156	42	6
*K8SIA	17,190	160	43	2
*WM8Z	12,880	121	42	4
*K8MJZ	10,413	113	36	3
W8YV	8,246	89	36	2
W8RU	4,440	54	25	5

OHIO

W8CAR	**364,605**	**1063**	**57**	**52**
K8RR	**296,331**	**929**	**57**	**46**
KI8R	281,602	773	55	48
***WB8JUI**	**270,300**	**838**	**57**	**49**
K8RYU	265,431	747	53	50
N8BJQ	218,400	772	54	42
K8PK	103,806	570	53	20
*W1NN	74,834	402	53	18
*W8MET	61,152	526	45	7
KA8YGL	51,546	246	45	21
KB8O	42,445	144	32	33
*N8HP	40,426	253	43	15
*AB8OU	33,660	227	43	12
*K8SVT	33,350	226	46	12
*W8XY	32,079	266	45	6
*N8KQ	27,683	260	44	3
*W1PDI	15,876	160	37	5
*W8PN	15,352	178	36	2
*K8G	13,035	175	33	0
*KC8J	5,050	95	25	0
*N8TCP	4,530	65	29	1
*K8VUS	4,154	58	30	1
*WB8JAY	2,070	50	18	0
*WB8PIY	1,649	47	17	0
*WB8WUA	1,020	27	17	0

WEST VIRGINIA

***N8II**	**263,637**	**797**	**53**	**46**
***K3JT**	**231,500**	**737**	**52**	**48**
K8JQ	**134,862**	**649**	**52**	**26**
WA8KAN	66,365	399	48	17

ILLINOIS

K9ZO	**336,600**	**898**	**55**	**55**
***WB9HFK**	**115,748**	**608**	**51**	**25**
N9TK	83,304	439	49	23
K9BGL	65,208	297	52	24
*N9TF	59,598	380	50	13
KG9N	55,380	342	50	15
*W9FY	39,300	351	48	2
*W8LVN	38,772	322	50	4
*KC9UJS	25,864	196	46	7
*K9CW	20,930	195	44	2
*N9LYE	17,243	164	38	5
*K9PMV	11,704	136	37	1
*WR9L	10,374	100	38	4
*K9KMD	6,468	80	33	0
*KA9CAR	6,020	74	33	2
W9SE	5,673	78	28	3
*WQ9T	2,346	45	22	1

INDIANA

W9RE	**530,292**	**1183**	**55**	**63**
W9TC	99,434	372	48	35
KØTQ	97,236	472	49	25
***WD8DSB**	**87,837**	**508**	**51**	**18**
*KJ9C	73,612	317	49	28
K9WWT	70,006	536	54	4
*W9GT	55,860	376	46	14
*K9IG	32,552	264	47	5
*W9CWO	18,174	203	36	3
*W9MRH	13,892	132	44	2
*KA9FQG	12,408	107	38	6
*WB9NOO	8,880	105	36	1
N4TZ	2,808	39	25	2

WISCONSIN

K9MA	**175,736**	**706**	**55**	**33**
***N7ZZ**	**47,850**	**380**	**51**	**4**
ND9Z	25,806	215	46	5
KW9R	14,352	127	42	4
N9GH	8,832	84	44	2
*K9CPO	6,144	90	32	0
*KB9S	2,838	60	22	0
*W9KHH	1,575	33	24	1

COLORADO

NØKQ	**40,439**	**337**	**48**	**5**
***KØUK**	**24,336**	**191**	**44**	**8**
*WØETT	16,950	123	42	8
*AFØE	14,696	151	40	4
*KV5Y	8,930	100	34	4
*AAØCW	6,665	97	30	1
WØKU	1,239	25	19	2

IOWA

***NØNI**	**412,794**	**991**	**57**	**57**
NG7A	**270,369**	**894**	**56**	**43**
WØODS	97,088	430	52	30
*KØSRL	49,996	379	51	7
*NØAC	19,236	212	41	1
*WIØWA	16,192	172	43	1
*N1XK	13,420	125	37	7
AD4OS	9,758	98	38	3
*KØWOI	1,869	43	21	0
*ADØH	32	4	4	0

KANSAS

ADØAB	**26,796**	**187**	**47**	**11**
KEØEK	16,330	151	43	3
***KØHNC**	**372**	**14**	**12**	**0**

MINNESOTA

NEØU	**281,705**	**932**	**56**	**47**
NØOK	80,028	336	53	28
K9DU	72,002	260	50	24
***ACØW**	**60,756**	**442**	**55**	**6**
KØEA	59,414	414	51	10
NØUY	45,144	239	45	21
*NGØC	23,108	181	49	4
KØVG	9,828	117	38	1
NØAT	8,316	99	36	0
*WAØLIF	5,805	94	27	0
NUØW	3,132	49	26	1
*WAØLJM	2,275	41	25	0
*KJØP	1,900	38	19	0
K0TC	1,386	30	21	0
*WBØU	162	12	6	0
*KØJP	8	2	2	0

MISSOURI

KIØI	**156,975**	**592**	**53**	**38**
NWØM	55,224	410	51	8
***NZØT**	**53,955**	**444**	**48**	**7**
*WO7U	11,439	129	41	0
*WØTY	396	15	11	0
*KØPHP	273	15	7	0

NEBRASKA

NFØN	**11,572**	**117**	**42**	**2**
***KØKPH**	**9,000**	**101**	**37**	**3**
*WDØBGZ	6,517	45	43	6
*WNØL	2,808	49	25	2
*KVØI	2,254	49	23	0

NORTH DAKOTA

KEØKDX	**216**	**9**	**8**	**0**

SOUTH DAKOTA

***WDØT**	**51,789**	**358**	**50**	**11**

CANADA

NOVA SCOTIA

VA1MM	**43,164**	**200**	**34**	**10**
VA1RST	39,100	115	23	27
VE1ANU	25,720	129	32	8

QUEBEC

***VE2QV**	**4,950**	**58**	**18**	**0**

ONTARIO

VE3EJ	**1,240,070**	**1535**	**58**	**72**
VE3DZ	**962,016**	**1281**	**59**	**73**
VE3AT	831,512	1162	56	65
VE3VN	512,627	826	53	56
VE3PN	474,117	769	56	51
VE3YT	283,283	744	55	22
VE3KP	237,830	549	52	33
***VE3XL**	**178,160**	**541**	**51**	**17**
VE3BR	167,165	511	53	14
***VE3VSM**	**157,960**	**591**	**50**	**5**
*VE3AQ	100,278	391	48	6
*VE3WG	90,654	326	48	10
*VA3EC	62,694	305	39	4
VE3FJ	62,036	243	39	13
*VA3SY	55,926	303	38	1
*VA3FN	25,320	134	37	3
*VE3LC	24,087	165	29	2
*VA3FF	15,035	100	31	0
*VA3EON	14,558	106	26	3
*VA3TTB	10,395	80	27	0
*VA3ZNW	7,040	70	22	0
*VE3MA	1,586	31	13	0
VA3AR	748	16	10	1

MANITOBA

***VE4VT**	**73,337**	**260**	**52**	**7**

SASKATCHEWAN

***VE5SF**	**47,088**	**203**	**44**	**4**

ALBERTA

VE6BBP	**419,616**	**836**	**56**	**38**
VE6TK	10,530	75	30	0
***VA6RCN**	**5,214**	**51**	**21**	**1**
*VE6UM	5,037	45	21	2

BRITISH COLUMBIA

VA7ST	**15,652**	**126**	**25**	**1**
***VE7XF**	**3,552**	**47**	**13**	**3**

NORTH AMERICA

Bahamas

C6AEI	**349,140**	**688**	**50**	**42**

Belize

***V31YN**	**28,750**	**103**	**33**	**17**

Cayman Islands

ZF5T	**1,956,080**	**1977**	**58**	**82**
***ZF2BJ**	**38,324**	**139**	**35**	**17**

Cuba

***CO2RQ**	**70,235**	**253**	**45**	**10**
***CO2JD**	**63,954**	**220**	**43**	**14**
*CO8NMN	1	0	1	0

Dominican Republic

***HI8A**	**20,425**	**84**	**26**	**17**
*HI8DL	648	12	1	8

Grenada

J35X	**156,000**	**321**	**42**	**38**

Martinique				
FM5BH	**762,600**	**919**	**53**	**71**
FM4LV	1	1	0	0
Mexico				
XE2X	**1,352,124**	**1545**	**59**	**79**
***XE2NBW**	**1,632**	**20**	**14**	**2**
Puerto Rico				
KP3MM	**778,848**	**1030**	**52**	**62**
***KP4MD**	**630**	**18**	**7**	**0**
St. Lucia				
***J68HZ**	**102,480**	**193**	**40**	**44**
U.S. Virgin Islands				
NP2P	**1,523,162**	**1510**	**57**	**82**
KP2M	**1,448,912**	**1467**	**57**	**80**
NP2J	1,322,752	1494	56	72

AFRICA

Canary Islands				
EA8/EA4BQ	**649,143**	**663**	**39**	**60**
***EA8BQM**	**6,480**	**35**	**4**	**16**
*EA8CN	3,375	24	5	10
*EA8TH	312	7	0	6
*EA8DHV	164	9	0	4
Cape Verde				
D4C	**1,358,012**	**1178**	**49**	**67**
Cueta & Melilla				
EA9/DL2JRM	**1,099,082**	**1093**	**32**	**69**
Madeira Islands				
CR3W	**2,272,064**	**1741**	**51**	**80**
Tunisia				
***3V8SF**	**956,970**	**1031**	**28**	**65**

ASIA

Asiatic Russia				
R8WF	**726,732**	**973**	**7**	**74**
RT9A	**690,074**	**954**	**8**	**69**
RA9MA	373,503	681	0	61
R9DX	195,316	492	0	44
***UA9QM**	**160,816**	**387**	**0**	**46**
***RA9CCK**	**114,504**	**333**	**0**	**39**
RØNN	90,597	352	3	36
RM9M	74,999	236	0	37
*UI8C	53,400	214	0	30
*RØWC	50,368	203	0	32
*RJ9M	44,440	125	0	40
RKØUN	32,220	143	4	32
R9OK	24,955	111	0	31
RW9WT	19,359	82	0	27
*RT9YA	17,138	103	0	22
*UA9ADG	16,416	58	0	32
*R8MB	13,050	115	0	15
RDØL	10,488	56	0	23
*RUØSN	9,425	55	0	25
*R9QQ	6,195	55	0	15
*UAØLCZ	2,222	31	5	6
*RZ9P	1,712	41	0	8
R9TO	1,664	24	0	8
China				
***BD7OB**	**5,680**	**38**	**2**	**18**
*BG1WNU	476	25	0	4
*BD7JNA	468	23	0	4
*BH6KWC	10	2	0	1
*BA4QO	5	1	0	1
India				
***VU2BGS**	**1,850**	**20**	**0**	**10**
Japan				
JH4UYB	**521,248**	**690**	**30**	**61**
JA6BZI	96,690	223	13	42
JA7ACM	60,368	165	12	37
JK1OLT	46,665	145	12	33
JA7QVI	38,070	88	14	33
JR2PMT	34,390	124	10	28
JH6QFJ	33,841	93	11	32
JA6ELV	31,707	115	10	29
***JA6GCE**	**31,413**	**161**	**8**	**29**
JA6LCJ	30,765	102	3	32
JR1IJV	25,789	84	10	27
*JA7KPI	25,095	88	11	24
JA6FFK	23,265	95	6	27
JA8DNV	23,010	68	12	27
JI1AVY	22,630	113	7	24
*JE1SPY	22,120	152	9	19
JR3KQJ	18,645	64	7	26
JH2KKW	13,025	88	9	16
JA4OPW	12,350	79	9	17
JG3LGD	12,168	79	3	23
JA1LZR	11,284	50	12	16
JA9FHB	11,250	50	9	16
JI4WHS	10,534	98	11	12
JA3IBU	10,396	63	10	13
JF1RYU	9,480	47	4	20
*JA7BEW	9,093	76	4	17
*JF2VAX	8,274	73	9	12
JA1JAT	8,088	41	9	15
JE2OTM	6,864	39	6	16
JA4CZM	5,800	37	2	18
JA1IXY	5,405	28	4	19
JL4DJM	4,875	43	0	15
*JF2FIU	4,592	65	2	12
*JK1LSE	4,275	75	1	14
JA1PIG	3,960	27	9	9
*JF2WXS	3,264	20	6	11
*JH2GZY	2,170	19	5	9
*JR2ALA	2,140	47	0	10
*JR6CSY	2,100	55	1	9
JH1HDT	1,800	13	2	13
JQ1CIV	1,450	19	0	10
JA6BWH	1,330	25	1	9
*JA1EMQ	1,320	14	7	3
*JK8PBO	984	32	1	7
*JA6GPR	945	15	0	9
JR2UBS	920	12	0	8
JA1AYO	720	21	0	8
*JN1MSO	700	32	1	6
JI1FOE	600	36	1	5
*JH4CES	558	14	0	9
*JH9CEN	420	22	0	6
*JA2AXB	300	7	0	6
*JH2XQY	300	7	0	6
*JH8DHV	270	10	0	6
*JE4URN	140	6	0	4
*JM7GTK	87	10	0	3
*JN1BBO	58	13	0	2
*JQ1COB	50	2	1	4
*JF3ROH	38	8	0	2
*JA2QVP	20	2	0	2
*JA3GZE	12	6	0	1
*JR1BVP	12	3	0	2
*JG5JXW	8	4	0	1
*JF1OPO	6	3	0	1
*JE1ILP	2	1	0	1
Kazakhstan				
UN9L	**1,201,612**	**1410**	**12**	**80**
***UN7CN**	**121,334**	**344**	**0**	**38**
*UN7LDR	15,542	98	0	19
*UN6G	231	13	0	3
Kyrgyzstan				
***EX8MJ**	**39,725**	**135**	**0**	**35**
Mongolia				
***JT1BV**	**11,688**	**64**	**0**	**24**
Republic Korea				
DS2JJV	**22,368**	**144**	**0**	**24**
DS3HWS	16,236	69	8	25
HL2WA	1,791	34	1	8
HL4CEL	1,173	80	0	3
***HL2CFY**	**465**	**19**	**0**	**5**
*HL4CFN	78	9	0	2
Thailand				
***HS6MYW**	**24**	**3**	**0**	**2**
Uzbekistan				
UK7AL	**101,850**	**256**	**0**	**42**

EUROPE

Andorra				
OHØR	**1,056,438**	**1583**	**37**	**77**
Austria				
OE2BZL	**273,632**	**768**	**11**	**57**
***OE2E**	**89,440**	**335**	**0**	**52**
*OE6CUD	57,276	260	0	43
*OE1CIW	25,410	143	0	35
*OE8MOS	10,440	72	0	29
Balearic Islands				
EA6SX	**119,568**	**431**	**3**	**50**
EA6NP	820	10	0	10
***EC6DX**	**423**	**10**	**0**	**9**
*EA6ZS	245	7	0	7
Belarus				
EW1I	**400,932**	**885**	**15**	**69**
EW2A	**256,244**	**852**	**0**	**58**
EW3LN	151,038	534	2	52
***EW2ES**	**132,296**	**565**	**0**	**46**
EW8OM	90,680	438	0	40
*EW1TO	82,368	415	0	39
*EU8N	66,276	307	0	42
*EU1FQ	64,974	238	0	51
*EU8U	33,004	169	0	37
*EU1LR	21,510	142	0	30
*EW7DK	1,358	19	0	14
Bosnia-Herzegovina				
***E79D**	**162,864**	**586**	**0**	**54**
***E74UK**	**148,115**	**517**	**0**	**55**
Bulgaria				
LZ1YE	**276,780**	**740**	**10**	**60**
LZ5N	75,208	247	6	50
Crete				
***SV9MBH**	**12,506**	**92**	**0**	**26**
Croatia				
9A2AJ	**728,178**	**1284**	**24**	**78**
***9A1AA**	**367,567**	**989**	**9**	**62**
***9A3SM**	**112,812**	**435**	**0**	**51**
*9A3PM	99,984	410	0	48
*9A2JK	5,175	38	2	23
*9A4W	488	14	0	8
Czech Republic				
OK6W	**1,516,020**	**1850**	**44**	**88**
OK1HFP	**424,745**	**925**	**19**	**66**
***OK7Y**	**382,120**	**868**	**20**	**62**
OK8AU	373,312	950	15	61
OK1OA	333,600	858	17	58
OK1AUC	294,579	814	14	57
OK1KPU	264,880	979	4	51
***OK1YM**	**253,704**	**828**	**8**	**54**
*OL5Y	196,106	622	11	51
OK2EQ	193,675	624	6	55
*OK6N	179,096	578	8	53
*OK1DKR	164,862	612	0	54
*OK2MBP	156,927	630	4	47
*OK2BYH	152,728	404	12	56
OK1DWF	149,124	598	1	50
*OK2VWB	148,070	429	11	54
OK1EP	142,241	376	15	52
*OK1FGD	125,190	568	1	44
*OK8AW	117,404	484	2	47
OK1XC	107,830	542	0	41
*OLØA	107,408	454	0	49
*OK2QX	101,552	475	0	44
OK1AXB	98,118	434	0	46
*OK1MMN	97,848	360	6	48
*OK1MAW	91,227	392	0	47
*OK1DWQ	89,433	290	9	48
*OK2LF	87,984	390	0	47
OK1P	83,970	372	2	43
OK1PI	73,986	223	16	41
*OK2SGY	69,388	333	0	44
*OK2BRQ	65,188	313	1	42
*OK2PBG	62,604	267	3	44
OK1KTI	60,764	279	0	44
*OK1GS	58,040	302	0	40
*OK2BRS	56,320	295	0	40
*OK1LO	48,551	209	1	46
*OK2BOB	44,075	218	1	40
*OK2DIK	35,360	180	0	40
*OK1FU	32,523	187	0	37
*OK1DOZ	26,432	181	0	32
*OK2ABU	24,854	151	0	34
*OK7T	23,562	145	0	34
*OK1DPU	20,181	131	0	31
*OK6TW	17,545	131	0	29
OK1DW	5,640	24	6	18
*OK1FUK	3,654	34	0	21
*OK2BH	3,540	35	0	20
*OK1DXW	2,686	34	0	17
OK1DWJ	490	7	0	7
Denmark				
OZ1LO	**563,530**	**893**	**34**	**75**
***OZ1AAR**	**180,000**	**567**	**9**	**51**
OU2V	**177,576**	**601**	**9**	**47**
*OZ8SW	54,692	239	2	42
*OZ7BQ	36,080	171	0	41
*OZ5UR	10,017	76	0	27
*OZ5DX	4,410	42	0	21
England				
G5U	**265,032**	**611**	**23**	**58**
G3T	**137,034**	**357**	**17**	**52**
***G2X**	**97,008**	**404**	**1**	**46**
G3VYI	53,922	246	1	42
G4AFJ	35,966	142	5	44
*MØSAR	32,382	155	4	38
*G4FEV	31,752	177	1	35
*M3X	31,122	162	0	39
*G4DDL	23,380	137	0	35
*MØMPM	21,235	141	0	31
MØWLF	14,518	88	0	34
*G3ZRJ	13,497	77	1	32
*MØORH	12,180	88	0	28
G3TDH	9,800	73	0	28
*G3WCB	3,960	45	0	20
*G4BEE	2,788	37	0	17
*G1SCT	660	15	0	10
European Russia				
R7NW	**978,588**	**1351**	**30**	**93**
RA3XM	**489,552**	**972**	**22**	**72**
RU3UR	448,154	842	24	74
RN1A	385,360	903	20	60
R3ST	329,751	799	15	66
R3FX	309,463	804	6	71
RD4F	264,180	700	5	69
UD4C	212,184	676	2	61
RA1AL	209,950	649	1	64
RZ3MM	205,969	715	3	56
***RT3K**	**174,000**	**601**	**3**	**57**
RM6Y	141,596	566	4	48
***RU4I**	**132,096**	**559**	**0**	**48**
*RN3KK	128,775	517	1	50
*UA1CUR	120,246	500	2	47
R3OM	117,404	506	2	47
*RN5AA	116,450	492	2	48
RK7X	110,484	420	0	54
*RA6FYL	108,250	441	0	50
*RT4P	103,827	400	0	53
UA4K	93,196	403	0	46
*RA1WZ	88,219	387	0	47
*UA6AUA	87,006	342	0	51
R4MM	84,105	374	0	45
RN4W	82,532	357	0	47
*UA6AX	81,488	384	0	44
R1NW	77,616	335	1	47
*R7KX	76,884	381	0	43
*RM7C	73,542	377	0	42
UA6JQ	72,240	294	0	48
R3OQ	68,754	334	1	41
UA4PAQ	68,006	385	0	37
*RC7B	66,192	279	1	47
RA4HPI	65,550	186	1	56
*R1CK	64,848	309	0	42
*RA6GW	63,357	261	0	49
*RA3YDA	62,780	292	0	43
RW4HD	61,147	242	0	47
*R2UZ	61,060	292	0	43
*UA4FER	58,292	320	0	38
R5AK	56,452	249	0	44
*RQ4F	56,400	217	0	50
*RU6CO	48,547	232	1	42
*RK4R	48,222	259	0	38
RJ3A	47,320	245	0	40
RK3LC	45,948	215	1	41
*RU6AI	45,240	140	7	51
*UA3DCE	44,640	233	0	40
*RX3VF	41,755	260	0	35
RA3NC	41,218	231	0	37
*UA3RBR	39,814	244	0	34
*RN4ZT	39,000	204	0	39
R6HV	37,536	247	3	31
*RK4S	37,222	201	0	37
*R2PU	34,400	220	0	32
*RU3WR	31,968	213	0	32
*UA1F	31,598	181	0	37
*RA3XCZ	29,920	182	0	34
UA6AH	28,786	152	0	37
*RV3YR	26,169	172	0	33
*UA6HFI	25,534	150	0	34
*RN1CW	23,940	106	2	40
*UA4PRU	22,250	182	0	25
*R2VM	17,434	158	0	23
RC2A	17,320	74	0	40
UA1CGS	17,244	84	2	34
RN3P	16,512	103	0	32
*UA3YDI	15,990	136	0	26
*RX3MM	15,808	123	0	26
*RA4HL	15,475	126	0	25
*RV3ZN	14,370	91	0	30
*RC5Z	13,122	100	0	27
*RT4O	12,478	162	0	17
*UA6AIR	11,781	59	0	33
*RM2P	11,613	130	0	21
*R7NA	10,385	57	1	30
*RK4NB	9,861	108	0	19
*R2AHS	8,802	66	0	27
*R3SV	8,670	46	0	34
*R4RM	8,400	100	0	16
*R6BT	8,274	86	0	21
*UA1OM	7,680	50	0	30
*UA3GDU	5,670	58	0	21
*UA4FDL	5,010	76	0	15
*RQ7R	3,961	51	0	17
*RA3VE	2,128	36	0	14
RU3SD	1,455	13	3	12
*RM2R	1,099	27	0	7
*RA3SS	900	9	3	7
*RA6WF	630	25	0	6
*R2PT	600	8	1	7
*RX6AOB	305	13	0	5
*UB5MBA	222	25	0	3
*UC5D	14	2	0	2
R7KW	10	1	0	1
*RK7KO	10	1	0	1
*R1ZM	6	3	0	1
European Turkey				
***TA1NAI**	**11,550**	**106**	**0**	**21**
Finland				
OH1VR	**335,987**	**799**	**14**	**65**
***OH/M0CFW**	**263,310**	**749**	**9**	**58**
OG30YL	**176,784**	**596**	**0**	**58**
*OH5TS	75,388	303	0	47
OH1MA	62,370	203	7	47
OH2BJ	54,950	300	0	35
OH1LAR	50,267	222	2	41
*OH5C	19,680	118	0	32
OH3WW	12,644	83	0	29
*OH1MAR	10,292	63	0	31
*OH7LZB	3,791	47	0	17
*OH5MQ	2,512	32	0	16
OH8CW	1,524	29	0	12
France				
F5PBM	**104,391**	**307**	**12**	**51**
***F5PLC**	**49,900**	**190**	**2**	**48**
*F5SGI	2,380	27	0	17
*F1MLN	970	20	0	10
Germany				
DL1AUZ	**903,540**	**1462**	**42**	**69**
DF9LJ	**706,414**	**1198**	**34**	**73**
DL5SE	409,590	975	23	59
DK6XZ	341,360	865	23	57
***DL6KWN**	**321,925**	**837**	**16**	**63**
***DK5DQ**	**274,536**	**650**	**22**	**60**
*DL4TJ	213,638	595	18	56
DKØTP	207,144	456	24	60
*DK3YD	128,370	506	4	51
*DL3RHN	112,360	445	6	47
*DF1DT	98,448	360	5	51
*DQØZ	97,570	381	7	48
*DL4ZA	95,872	348	8	48
*DL4DZ	88,938	341	7	47
DL5IAH	86,516	461	1	42
*DJ2IA	80,478	333	2	49
*DL5CL	77,880	273	8	52
*DL5YL	74,676	397	0	42
*DJ6TK	73,536	211	11	53
*DH7TNO	69,930	349	1	44
*DL6ZB	68,748	250	2	49
*DL6IAK	68,172	407	0	38
DL3AO	67,730	174	8	57
*DL8DWW	61,965	242	5	46
DL7VMM	61,292	293	0	44
DL9GFB	53,280	252	0	45
*DD7NT	52,900	234	1	45
*DD2CW	50,666	207	0	49
*DL3ARM	44,967	251	0	39
DL1VDL	44,298	193	0	46
DJ7OQ	43,900	157	5	45
*DL1HSI	43,638	226	0	42
*DL2ZA	41,652	244	0	39
*DK6OR	40,905	177	0	45
*DL4JU	40,291	197	0	43
*DKØMN	38,950	230	0	38
*DL2LSM	38,786	190	3	40
DK3AX	38,228	218	0	38
*DO4OD	38,227	188	2	41
*DM5JBN	37,842	196	0	42
*DFØBV	37,596	213	0	39
*DL3HAA	36,660	204	0	39
*DK7GH	33,292	177	0	41
*DL7YAD	32,706	141	2	44
DF6PB	26,875	116	0	43
*DF7CB	25,632	178	0	32
*DJ3TU	25,375	156	0	35
*DK5SF	24,928	132	0	41
*DM3BN	24,645	70	6	47
DK6CQ	24,552	137	0	36
*DK4YJ	23,397	164	0	33
*DL2FQ	22,608	134	0	36
*DL1DWW	22,017	110	0	41
*DK1LRS	20,640	101	1	39
*DL5SDN	19,912	116	0	38
*DLØAVH	18,000	108	0	36
*DL1GWS	17,760	128	0	32
*DH6YAG	16,625	100	2	33
*DL6RBH	15,624	113	0	31
*DL1DQJ	15,572	97	0	34
DL7LX	14,058	81	3	30
*DL7RV	14,010	93	0	30
*DF3IS	13,984	90	0	32
*DL8ZU	13,800	98	0	30
*DL1KVN	13,792	93	0	32
*DG7EE	13,662	83	0	33
DK3GI	13,543	98	0	29
*DL3DRN	13,250	118	0	25
*DL2GPK	12,488	101	0	28
*DL1DWR	12,270	83	0	30
*DJ3CS	11,340	96	0	27
*DL6MFK	10,266	69	0	29
*DL1RPR	10,071	83	0	27
DJ8QA	9,802	76	0	26
*DH7AMF	8,275	72	0	25
*DF4HA	8,208	65	0	27
*DJ5AM	7,436	61	0	26
*DK2AMS	6,994	57	0	26
DKØSU	6,720	58	0	24
*DB8AH	6,578	62	0	23
*DM3ZF	5,460	30	0	26
*DD2EG	5,270	68	0	17
*DL4JLM	4,977	55	0	21
*DL8ULO	4,708	47	0	22
DP7A	4,158	40	0	22
*DL6EZ	4,080	45	0	20
*DF2FM	2,750	28	0	22
*DL8KFO	2,509	47	0	13
*DL8ULF	1,890	26	0	15
*DL8WJM	1,856	25	0	16
*DH8MS	1,368	27	0	12
*DL9MFY	1,235	19	0	13
*DL3HR	510	12	0	10
*DC1UH	441	15	0	7
*DL2VN	329	10	0	7
*DJ2MX	246	10	0	6
*DL2JST	68	4	0	4
Greece				
***SV3AWG**	**23,065**	**127**	**0**	**35**
*SV1CKZ	13,167	74	0	33
*SV1CEI	1,806	22	0	14
*SV2RZJ	5	1	0	1
Guernsey				
***MU2K**	**574,752**	**1083**	**27**	**69**
Hungary				
HG5D	**756,276**	**1267**	**30**	**77**
HA7SBQ	**140,910**	**501**	**2**	**53**
***HA4YF**	**103,243**	**418**	**1**	**48**
HA5JP	60,104	268	0	44
*HA2MN	16,530	115	0	29
Iceland				
***TF3EO**	**23,800**	**135**	**0**	**34**
Ireland				
EI5DI	**1,014,328**	**1366**	**45**	**73**
EI7KD	**341,352**	**673**	**30**	**58**
Italy				
IK3SWB	**136,409**	**248**	**26**	**65**
IK2AOO	79,000	315	3	47
***IV3EAD**	**66,493**	**276**	**1**	**48**
*IZ2FLX	54,755	235	0	47
IK2AHB	42,978	224	0	39
IZ2EWR	25,160	121	1	39
*I6FDJ	16,414	114	0	29
*IZ5WTV	12,369	81	0	31
*IK6BAK	10,695	70	0	31
*IK0EIE	9,006	42	0	38
*IW1CBG	3,232	44	0	16
*IK2IKW	2,688	36	0	16
*IU5ICR	2,512	32	0	16
IW5DPF	2,074	17	0	17
*IZ5IOS	1,445	15	2	15
*IK2SYK	666	16	0	9
*I4JEE	650	12	0	10
*IZ1ANU	1	1	0	0
Kaliningrad				
***RN2FQ**	**14,610**	**97**	**0**	**30**
*UA2FBQ	4,503	48	0	19
Latvia				
YL2GM	**233,024**	**689**	**4**	**60**
YL2EM	**140,085**	**476**	**3**	**52**
***YL5W**	**93,869**	**422**	**0**	**43**
YL2EA	47,800	232	0	40
*YL2PP	6,160	50	0	22
Lithuania				
LY7Z	**1,297,032**	**1658**	**45**	**87**
***LY4L**	**545,776**	**1154**	**20**	**68**
LY4T	**494,019**	**1150**	**14**	**67**
***LY9A**	**323,068**	**914**	**9**	**59**
LY9Y	298,935	785	10	63
LY2BVB	269,344	640	12	64
*LY3KI	237,735	541	9	72
*LY5XX	187,833	723	4	47
*LY7W	109,788	528	1	41
*LY3DA	100,800	453	0	45
*LY2OM	68,224	332	0	41
*LY2N	21,024	124	0	36
LY1WR	15,405	68	0	39
Luxembourg				
***LX75V**	**91,891**	**418**	**0**	**43**
Moldova				
***ER5DX**	**66,664**	**228**	**0**	**52**
*ER2OZ	990	15	0	11
Montenegro				
***4O3A**	**502,980**	**1131**	**15**	**68**
Netherlands				
***PE2JMR**	**55,522**	**234**	**3**	**43**
*PAØTCA	32,718	153	4	37
*PAØMIR	23,142	118	0	38
*PAØVDV	22,200	147	0	30
*PA4EL	18,864	66	6	42
*PA8KW	17,344	110	0	32
*PA3GVI	4,332	48	0	19
*PA3JB	900	19	0	10
North Macedonia				
***Z3ØA**	**7,800**	**78**	**0**	**20**
Northern Ireland				
***MI5K**	**295,301**	**464**	**36**	**67**
*GI5NI	26,460	118	3	39
Norway				
LB6GG	**326,040**	**915**	**16**	**50**
***LA9XGA**	**280,000**	**819**	**14**	**50**
***LB4UH**	**237,864**	**658**	**8**	**60**
LC5W	99,720	306	8	52
*LA2XNA	32,523	174	0	37
LAØFA	29,986	80	3	55
*LA6DW	8,004	72	0	23
*LA/DL4HCF	10	1	0	2
Poland				
SP2LNW	**493,458**	**958**	**23**	**70**
SP4BEU	**302,936**	**756**	**14**	**62**
SN9C	253,624	897	4	52
SP5AUC	250,452	920	0	54
***SO3O**	**204,875**	**741**	**0**	**55**
***SP3JUN**	**173,179**	**560**	**8**	**53**
*SP2TMT	163,444	549	1	57
*SQ3WW	160,455	550	6	51
*SP3VT	138,006	533	5	46
*SP6IHE	137,769	471	5	52
SP3HLM	90,757	376	1	46
*SP8HWM	84,880	427	0	40
*SQ9I	66,994	307	0	43
*SP2GCE	62,760	324	0	40
SP6AEG	62,586	216	8	46
*SP9FMP	60,944	228	1	51
*SP2GUB	44,536	235	0	38
*SP3AMO	39,220	223	0	37
*SP9GFI	39,200	226	0	35
*SP9ENV	32,893	187	0	37
SN5V	30,155	166	0	37
*HF5WIM	25,760	150	0	35
*SN8U	22,736	175	0	28
*SP1KV	21,504	96	0	42
*SP3JIA	19,000	97	1	37
SQ7NSN	17,290	81	0	38
*SP1DMD	14,252	106	0	28
*SP9DTE	8,970	80	0	23
*SP8FB	8,130	49	0	30
*SP9BRP	7,340	80	0	20
*SP5GDY	5,200	55	0	20
*SP5BYC	4,096	53	0	16
*SP4AAZ	3,587	44	0	17
SP2EFU	1,232	14	0	11

SP2Y	1,210	11	0	11
SP1JQJ	650	12	0	10
Portugal				
CR6K	**904,818**	**1201**	**46**	**68**
***CT2JXU**	**90,720**	**204**	**25**	**45**
Romania				
YO5AJR	**247,616**	**902**	**2**	**51**
YO9RIJ	**174,648**	**590**	**5**	**52**
***YO8DOH**	**148,272**	**596**	**0**	**48**
***YO8WW**	**134,046**	**375**	**6**	**60**
*YO8BSE	90,800	348	0	50
*YO2CEQ	82,224	335	0	48
YO6FNA	80,950	312	2	48
*YO7ARZ	76,130	326	0	46
*YO8BDQ	70,110	304	0	45
*YO5DAS	47,151	242	0	39
*YO5BIM	35,364	167	0	42
*YO4SI	21,930	126	0	34
*YO6DBL	18,306	135	0	27
*YO4RST	14,040	117	0	24
Scotland				
GM3POI	**444,136**	**866**	**32**	**56**
GM4Z	**310,343**	**591**	**33**	**56**
MMØZBH	193,968	485	17	55
***MM1E**	**103,510**	**363**	**9**	**46**
*MM3T	27,580	156	0	35
Serbia				
***YT4T**	**185,252**	**614**	**5**	**53**
YT5R	**19,437**	**114**	**0**	**33**
Sicily				
***IT9VJO**	**37,392**	**177**	**1**	**40**
Slovak Republic				
OM7RU	**778,146**	**1303**	**30**	**76**
OM5CD	**499,668**	**1208**	**12**	**66**
OMØWR	313,920	825	10	62
***OM2XA**	**307,512**	**784**	**14**	**58**
OM3IAG	290,675	707	13	64
***OM3ZWA**	**258,552**	**886**	**3**	**54**
*OM5WW	234,684	857	2	52
OM3CPF	228,060	692	10	53
OM6AL	219,735	744	3	54
OM3PA	197,813	481	14	63
*OM7AG	71,380	335	0	43
*OM7PY	70,266	280	2	47
*OM2DT	53,397	195	0	51
*OM3CQ	43,329	227	0	39
OM5VS	36,900	172	1	40
*OM4DU	35,682	191	0	38
*OM8VL	34,782	211	0	34
*OM3CDN	19,499	131	0	31
*OM7AT	3,944	50	0	17
Slovenia				
S53A	**1,183,005**	**1535**	**43**	**84**
***S5ØX**	**239,223**	**665**	**13**	**56**
***S53AR**	**143,744**	**429**	**12**	**52**
*S57NAW	119,168	410	5	51
S53JW	**114,480**	**422**	**0**	**53**
*S58RU	45,756	234	0	41
Spain				
EA4KD	**85,800**	**206**	**18**	**48**
EC3A	78,520	290	4	48
***EA1JO**	**41,650**	**149**	**6**	**44**
*EA5/RV2A	24,000	111	5	35
*EA4IE	13,160	79	0	35
EA3OH	12,045	58	7	26
*EA4GOY	3,401	36	0	19
*EA1DFP	20	1	0	2
Sweden				
SMØT	**386,863**	**892**	**21**	**58**
SM4W	**285,566**	**729**	**15**	**59**
SM5EPO	261,300	596	17	61
SM2CEW	211,264	613	11	53
SMØHRP	159,515	480	12	49
***SM6BZV**	**95,354**	**374**	**1**	**48**
SM6IQD	70,012	298	2	44
SM5CCE	65,394	306	1	41
*SM5CSS	60,858	287	0	42
*SE6K	26,220	177	0	30
*SM5DXR	23,316	162	0	29
*SM2OTU	18,600	120	0	31
*SE4E	14,225	114	0	25
*SM5MX	11,304	93	0	24
SM5Q	7,840	53	1	27
*SM5LW	4,788	45	0	21
*SE5L	2,983	32	0	19
SM5ENX	225	5	1	4
SM5LNE	10	1	0	1
Switzerland				
***HB9DDZ**	**23,712**	**78**	**0**	**52**
HB9FBG	**145**	**6**	**0**	**5**
Ukraine				
UX2X	**1,014,253**	**1593**	**33**	**74**
UT7NY	**435,288**	**989**	**19**	**65**
UX1HW	352,968	791	17	67
***UX1UX**	**302,744**	**845**	**8**	**63**
US8UA	259,770	728	10	60
***UR8GZ**	**226,926**	**708**	**1**	**62**
*US6IKT	225,692	610	11	57
*UT5UT	211,919	549	12	61
*UR5MM	200,529	608	8	55
UXØLL	192,984	554	11	55
*UR5F	190,588	725	1	52
UX3UW	180,897	712	2	49
UT5VX	168,952	609	7	49
*UR5KO	166,155	600	6	49
UZ1U	161,392	587	9	47
*UY2UQ	120,604	569	0	44
*UW4SU	119,328	497	0	48
UZ5ZV	117,264	414	1	55
UX2MF	116,229	402	1	52
*UT3IA	113,787	487	2	45
*UT4EK	112,010	506	0	46
*UT2QQ	112,001	484	1	46
*US1VM	107,550	492	0	45
*UR7EC	107,000	418	0	50
*UR5IRM	104,811	430	0	49
UT7QF	99,855	296	0	63
US7IA	94,820	432	0	44
UT1QQ	93,412	417	0	44
*UY7RR	78,360	391	1	39
*UX3UV	77,727	418	0	39
*US3IZ	75,235	375	0	41
*UT1IR	69,137	292	0	47
*UR6QS	66,680	341	0	40
UY3AW	61,899	252	0	47
*UT5UIA	60,876	190	12	45
*UW5Q	60,438	295	0	42
*UR8GX	57,076	309	0	38
*UT4RZ	56,406	275	0	42
UR4IZ	56,082	286	0	39
*UR4CW	49,404	211	0	46
*UTØCK	47,249	274	0	37
UT3UV	38,776	216	0	37
*UY2ZZ	35,388	196	0	36
UR3UW	33,462	174	2	37
US3LX	33,300	188	0	36
*UT7IA	31,349	120	3	44
*UR3GO	29,790	220	0	30
UT9EZ	28,342	153	0	37
UR5R	25,710	173	0	30
UT5UGQ	24,832	153	0	32
*UT5EPP	22,876	173	0	28
*UT1KT	20,239	104	0	37
*US5ABI	17,888	136	0	26
UT3QU	16,480	54	11	21
UR5AO	15,408	81	0	36
UY2UR	15,400	82	0	35
*UY5TE	14,904	134	0	24
*UT8IT	14,610	95	0	30
*UT7MR	14,472	122	0	24
*US6CQ	13,300	102	0	28
*UX8IA	12,644	80	0	29
*UX2HB	10,920	84	0	28
*UT7KF	9,792	52	0	34
*UT5IZ	6,405	100	0	15
UY5ZZ	4,704	33	0	24
*UR3QTN	2,769	49	0	13
*UT7EL	2,295	16	0	17
*UY5OO	1,792	16	1	15
Vienna Intl. Ctr.				
***4U1A**	**233,700**	**788**	**1**	**56**
Wales				
GWØFZY	**27,830**	**90**	**16**	**30**
***GW4TSG**	**1,105**	**17**	**0**	**13**

OCEANIA

Australia

VK6LW	**42,750**	**123**	**6**	**32**
VK3IO	10,656	52	6	18
***VK3MI**	**1,088**	**21**	**1**	**7**
VK2GR	448	8	2	5
East Malaysia				
***9M6YBG**	**10**	**1**	**0**	**1**
Hawaii				
KH7A	**595,894**	**733**	**54**	**28**
***KH6AQ**	**6,960**	**38**	**18**	**2**
Indonesia				
***YB1TIA**	**1,507**	**28**	**0**	**11**
*YC7YGR	80	7	0	4
*YBØNSI	50	11	0	2
*YC1COZ	44	13	0	4
*YB1BA	40	10	0	2
YB9UA	**32**	**5**	**0**	**2**
*YB1UUN	26	5	0	2
*YCØSAS	18	9	0	1
*YC1JCD	16	8	0	1
*YC1TJJ	12	6	0	1
*YB3BGM	10	5	0	1
*YC2YIZ	8	4	0	1
YE3AA	4	2	0	1
YB2VMC	2	1	0	1
*YC9WOF	2	1	0	1
Tonga				
A35JP	**630**	**9**	**6**	**1**

SOUTH AMERICA

Argentina

LU8DPM	**499,695**	**488**	**45**	**60**
LU5YF	6,888	31	8	20
***LU6DOT**	**150**	**9**	**0**	**5**
*LU1II	30	2	0	3
Bonaire				
PJ4A	**1,474,667**	**1134**	**54**	**77**
Brazil				
PY9MP	**3,940**	**23**	**4**	**16**
***PP5VX**	**84**	**6**	**0**	**4**
*PU2USK	1	0	0	1
*PU4YJS	1	-1	0	0
Ecuador				
HCØE	**25,802**	**72**	**29**	**9**
***HC2AO**	**17,094**	**49**	**23**	**14**
Venezuela				
YV1DIG	**971,334**	**781**	**49**	**77**
YV4ABR	4,883	28	9	10

QRP

NORTH AMERICA

UNITED STATES

MAINE

KQ1P	**1,232**	**35**	**14**	**0**
W1CEK	624	17	12	0

MASSACHUSETTS

WB2CPU	**12,002**	**153**	**30**	**4**
W1TW	4,788	69	26	2
W1UU	3,427	57	19	4

NEW HAMPSHIRE

KN1H	**7,112**	**103**	**26**	**2**

RHODE ISLAND

W1WBB	**15,124**	**162**	**33**	**5**

NEW JERSEY

K2YG	**7,801**	**115**	**28**	**1**
K2AL	2,680	52	20	0
W2JEK	1,800	57	17	1

NEW YORK

N2WK	**27,342**	**225**	**41**	**8**
WO2N	440	17	11	0

PENNSYLVANIA

K2XR	**75,003**	**412**	**49**	**20**
W3RGA	1,106	35	14	0
KZ3I	858	39	11	0

FLORIDA

K3TW	**19,366**	**180**	**39**	**7**
KQ4KX	2,550	37	19	6

KENTUCKY

K4TO	**6,141**	**32**	**0**	**23**

NORTH CAROLINA

N3CZ	**65,670**	**396**	**49**	**17**
WB4MSG	30,438	197	44	13

VIRGINIA

KI4IO	**16,605**	**174**	**34**	**7**

NEW MEXICO

AC5BX	**60**	**6**	**5**	**0**

OKLAHOMA

WG5F	**1,596**	**35**	**19**	**2**

CALIFORNIA

K2GMY	**1,078**	**49**	**11**	**0**
W6MZ	972	35	11	1

ARIZONA

KX6X	**2,877**	**64**	**19**	**2**
N6HI	8	2	2	0

OREGON

KF7WNS	**1,391**	**45**	**12**	**1**

MICHIGAN

W8GP	**67,555**	**500**	**50**	**9**
K2YAZ	35,370	280	50	4

OHIO

K8ZT	**39,648**	**274**	**48**	**11**
KD8CGH	6,572	94	31	0
KC9LA	5,363	66	29	2
W8PU	1,924	34	26	0
AB8FJ	192	12	8	0

ILLINOIS

WB9AYW	**2,369**	**47**	**23**	**0**

INDIANA

N9SE	**159,100**	**714**	**56**	**30**
W9CC	20,610	198	41	4

WISCONSIN

K9TY	**15,386**	**132**	**46**	**3**
KØCD	1,008	27	16	0

KANSAS

WØYJT	**5,814**	**81**	**33**	**1**

MINNESOTA

KØPK	**35,964**	**289**	**49**	**5**
KEØTT	19,395	198	44	1
W6GMT	136	7	8	0

MISSOURI

NØTT	**130,950**	**732**	**56**	**19**
KKØU	27,979	263	46	3

CANADA

ONTARIO

VE3KQN	**4,446**	**53**	**19**	**0**
VA3RKM	343	11	7	0

ALBERTA

VE6EX	**11,991**	**122**	**20**	**1**
VE6LB	630	15	10	0

ASIA

Asiantic Russia

RM8Y	**2,232**	**51**	**0**	**9**
R9CX	64	4	0	2

Asiantic Turkey

TA2TC	**10**	**1**	**0**	**1**

China

BG1REN	**2,412**	**48**	**0**	**9**

Japan

JH1GNU	**1,742**	**18**	**4**	**9**
JA6WFM	1,146	67	0	6
JH7UJU	350	28	0	5
JK1TCV	300	7	2	3
7K1CPT	156	23	0	3
JR1NKN	18	9	0	1
JH1NXU	14	2	0	2
JA1GZK	12	6	0	1
JK7DWD	2	1	0	1

West Malaysia

9M2CDX	**2**	**1**	**0**	**1**

EUROPE

Belarus

EU1AA	**143,468**	**539**	**4**	**48**
EU6DX	26,877	173	0	31

Croatia

9A5M	**16,632**	**100**	**0**	**33**
9A4AA/MM	240	8	0	6

Czech Republic

OL4W	**187,885**	**722**	**2**	**51**
OK1LL	**164,800**	**680**	**0**	**50**
OK2PVX	67,804	292	1	45
OK2FD	45,881	225	0	43
OK1GSB	27,520	184	0	32
OK1DU	648	18	0	9

England

G5Q	**111,872**	**338**	**9**	**55**
MØHMJ	34,960	175	2	38
2EØFFT	810	18	0	9

European Russia

RM5F	**116,688**	**520**	**0**	**48**
UA3DJG	56,278	307	0	38
RT4W	51,127	250	0	41
RU6MO	31,031	221	0	31
RW3AI	27,900	194	0	30
RM5O	27,027	165	0	33
R4ZZ	18,096	154	0	26
UA3WF	15,800	129	0	25
RA3DJA	5,022	60	0	18
Germany				
DK7HA	**290,958**	**849**	**12**	**59**
DK1VD	94,230	371	6	48
DM2DZM	44,954	280	0	38
DM3F	16,616	115	0	31
DL6UKL	11,128	89	0	26
DJ8OG	5,964	63	0	21
DJ3GE	4,522	59	0	19
DL7UKT	2,512	35	0	16
DL6GCE	1,199	26	0	11
DD7CW	847	19	0	11
DL2LDE	820	19	0	10
DO7CX	14	2	0	2
Finland				
OH3KQ	**53,391**	**291**	**0**	**37**
Hungary				
HA8BE	**216,794**	**690**	**4**	**57**
HA1TI	71,190	342	0	42
HA7JQK	13,338	104	0	26
Italy				
IZ3NVR	**18,208**	**115**	**0**	**32**
IZ3QCH	12,905	90	0	29
IZØORT	11,088	80	0	28
IK1XPK	10,948	81	0	28
Kaliningrad				
UD2F	**46,472**	**249**	**0**	**37**
R2FI	13,166	92	0	29
RA2FB	12,216	100	0	24
RU2F	6,912	78	0	18
Latvia				
YL2QN	**232,532**	**723**	**6**	**55**
Lithuania				
LY5E	**388,275**	**990**	**14**	**61**
LY5G	93,456	429	0	44
Netherlands				
PA3DAT	**17,280**	**109**	**0**	**32**
North Macedonia				
Z39A	**520**	**10**	**0**	**8**
Norway				
LA8OKA	**3,570**	**42**	**0**	**17**
Poland				
3ZØX	**71,712**	**297**	**0**	**48**
SP9W	62,995	285	5	38
SP3IOE	62,496	305	0	42
SP2MHC	61,664	305	0	41
SP8D	1,417	23	0	13
SP5ELA	690	16	0	10
SP2HMY	5	1	0	1
Portugal				
CR6A	**3,300**	**22**	**0**	**22**
CT1DBS	195	7	0	5
Romania				
YP6C	**86,802**	**366**	**0**	**46**
YO2AQB	29,412	161	0	36
YO3GNF	17,736	148	0	24
YO8RIX	7,014	71	0	21
YO4AAC	5,508	61	0	18
Scotland				
MM3AWD	**38,098**	**175**	**0**	**43**
GM4M	34,476	204	0	34
Serbia				
YU1LM	**13,080**	**112**	**0**	**24**
Slovak Republic				
OM3WZ	**50,320**	**253**	**0**	**40**
Slovenia				
S52P	**207,309**	**728**	**4**	**53**
S57M	205,261	690	7	52
S55N	69,531	335	0	43
S53X	62,181	253	3	46
S58MU	26	5	0	2
Spain				
EA2AZ	**48,031**	**224**	**0**	**43**
EA5ICL	14,256	81	2	31
EA2AFV	4,796	45	0	22
EA5EX	135	6	0	5
Switzerland				
HB9CPS	**58,617**	**298**	**0**	**39**
HB9AYZ	28,342	155	0	37
Ukraine				
UT1DX	**141,804**	**521**	**0**	**54**
UR5UJ	92,460	401	0	46
UT4UBZ	71,016	339	0	44
UT5EOX	39,590	212	0	37
US5VX	26,908	187	0	31
UR5WIF	21,627	166	0	27
UR6LAF	16,060	165	0	22
UT2EF	13,176	122	0	24
USØU	12,720	111	0	24
UX8IX	10,764	98	0	23
US1UU	7,245	73	0	21
UV1IW	3,952	52	0	16
Wales				
GW4W	**15,225**	**104**	**0**	**29**

OCEANIA

Indonesia

YC1HBP	**4**	**2**	**0**	**1**

ASSISTED

NORTH AMERICA

UNITED STATES

CONNECTICUT

W1CTN	**102,671**	**421**	**49**	**34**
W1VT	23,828	220	40	6
W1NK	9,360	55	23	17
***K3IB**	**5,133**	**75**	**27**	**2**
WV1M	3,300	50	23	2
W1UK	1,605	17	5	10
*W1TJL	90	6	6	0

MAINE

K1A	**1,010,152**	**1363**	**58**	**85**
K1JB	**107,624**	**341**	**47**	**41**
***W1DYJ**	**34,320**	**208**	**33**	**22**

MASSACHUSETTS

W1UE	**1,044,669**	**1440**	**58**	**83**
W1GD	**229,944**	**514**	**49**	**55**
AA1ON	208,969	641	52	49
W1HIS	91,087	365	45	34
N1RR	89,872	218	34	48
W1TC	82,119	197	47	46
AK1MD	54,188	246	45	31
WJ1R	49,713	155	36	37
K1RV	47,630	367	46	9
AA1V	45,333	118	30	43
W1TO	32,193	261	39	10
K1DJ	31,625	197	37	18
KB1W	25,056	170	31	17
***K1XM**	**6,448**	**99**	**22**	**4**

NEW HAMPSHIRE

K1RX	**452,271**	**836**	**54**	**69**
WX1S	**201,712**	**329**	**44**	**68**
NF1O	76,960	310	46	34
K1KA	61,712	228	43	33
NE1B	55,683	280	46	23
***W1LJD**	**32,292**	**255**	**45**	**7**
K1QX	18,524	138	31	13
*AE1T	8,642	125	27	2
NE1F	64	4	3	1

VERMONT

W1SJ	**216,936**	**854**	**53**	**39**
AA1SU	60,417	386	49	14

NEW JERSEY

N2NT	**670,020**	**1086**	**55**	**75**
K2RET	**274,398**	**551**	**51**	**63**
N2MM	231,150	519	51	64
K3OX	158,100	468	51	51
AB2E	130,767	351	47	44
WA2FZB	102,726	460	45	33
W2TT	74,720	308	48	32
***K2SDS**	**68,376**	**312**	**47**	**27**
WO2T	65,100	289	42	33
WW2Y	59,792	139	30	44
W2IRT	59,600	207	47	33
N2SR	38,927	171	37	30
W2LE	26,854	137	38	20
WR2G	20,784	163	38	10
K2QPN	15,840	47	2	34
KC2LSD	13,182	127	32	7
N1IBM	12,540	111	27	11
*KE2D	6,734	107	26	0
*N2UU	6,396	104	24	2
N2CG	4,914	58	17	9
K2CJ	4,325	50	19	6
WX2S	40	2	0	2

NEW YORK

N2CU	**345,332**	**797**	**54**	**62**
AB3CX	**268,800**	**741**	**55**	**57**
N2GC	263,235	623	53	62
W2GDJ	236,363	676	52	55
KB1EFS	188,697	767	53	40
N2RC	122,728	415	47	45
N2NI	119,802	503	48	34
WA2CP	85,520	391	51	29
AI2N	73,695	240	47	38
AA2GF	57,670	249	45	28
K2QMF	43,558	164	26	32
***N2SO**	**41,520**	**274**	**47**	**13**
N2SQW	38,744	251	45	13
K2MK	34,162	185	42	16
WA3AFS	32,294	128	41	26
*K2YR	24,581	186	34	13
*W2LB	20,475	191	41	4
*AC2RL	17,776	171	40	4
*W2VM	13,338	156	38	0
*K1NY	5,908	86	25	3
*KB2URI	3,612	67	21	0

DELAWARE

AA1K	**979,104**	**1414**	**57**	**84**
NW3Y	**336,980**	**741**	**54**	**62**
K3WI	302,842	734	53	53
***N3TTT**	**5,180**	**57**	**20**	**8**

DISTRICT OF COLUMBIA

4U1WB	**4,301**	**80**	**23**	**0**
***KE3X**	**3,618**	**62**	**24**	**3**

MARYLAND

W3LL	**615,657**	**1088**	**58**	**75**
NA3M	**520,044**	**1054**	**57**	**66**
K3MM	484,266	703	56	73
N3QE	455,889	968	55	64
K3AJ	438,712	721	55	67
K3RA	283,856	682	52	61
K3ZU	219,600	346	48	72
AB3CV	153,525	200	50	65
K3TN	138,795	398	47	48
N4ZR	134,046	393	49	50
W3OU	122,123	346	49	48
K3STX	107,548	347	47	45
K3AU	89,216	353	48	34
N3AM	69,576	251	40	38
K1BZ	63,364	279	48	25
W3NRJ	38,528	203	39	25
***NS3T**	**26,768**	**107**	**30**	**26**
W3ICM	26,455	152	45	20
*WB8YYY	19,992	114	30	19
N3XL	17,056	167	36	5
WX3B	5,900	88	22	3

PENNSYLVANIA

K3WW	**826,344**	**1293**	**58**	**80**
KF3B	**679,936**	**1107**	**55**	**73**
NY3A	674,652	1251	56	76
AA3B	654,227	998	57	76
N3RD	626,076	1068	58	74
NN3Q	539,532	1056	57	69
W8FJ	488,243	782	56	77
K3MSB	326,480	736	55	55
NB3I	304,416	715	52	60
K3MD	250,393	665	55	48
WY3A	224,070	532	51	59

W3FV	218,463	561	51	50
WW3S	208,110	532	51	54
K3WJV	194,194	797	54	37
K3OO	158,304	294	37	59
*W3KB	153,024	409	50	46
K3PP	146,448	392	50	58
K3UA	140,490	451	49	41
K3RL	106,893	210	52	59
W3FIZ	102,706	291	43	46
*NJ3K	98,276	442	50	29
NF3R	78,150	347	47	28
K3FMQ	77,088	194	38	50
KD3TB	66,456	245	43	35
KB3Z	53,889	251	43	26
KU2C	46,008	188	41	30
K6ND	41,544	154	38	34
AG3I	39,900	248	45	15
N3RJ	31,955	197	39	16
WØBR	31,080	174	43	17
N3ZA	22,372	177	38	9
W3WH	21,522	153	41	10
W3EA	21,360	69	15	33
WA3AAN	14,796	174	35	1
*KN3A	8,070	108	27	3
K3WGR	5,076	32	12	15

ALABAMA

N2NL	334,278	691	54	72
KR4F	211,258	599	53	53
AB4B	118,176	307	48	48
KX4X	70,585	183	52	43
W4RYW	67,040	240	49	31
W4UAL	49,840	239	46	24
K4CWW	34,272	207	47	16
K8KI	23,922	163	41	13

FLORIDA

N4BP	478,728	1048	57	65
N4EXA	374,604	835	55	69
K5KG	313,408	716	53	65
WO4O	276,424	704	49	60
WX4G	163,696	248	42	62
K3SV	138,944	291	50	54
K9OM	105,984	293	46	46
KM4HI	81,012	262	45	41
NN7CW	60,789	299	41	28
K4QD	47,310	346	43	14
AC2AC	32,067	134	35	28
WS4Y	28,912	222	42	10
*AA4NP	14,852	128	38	9
N4UU	13,508	110	33	11
*K2SG	264	12	11	0
*NØSMX	48	6	4	0

GEORGIA

AA5JF	49,206	349	45	14
*N4TOL	24,450	208	43	7
K4ZRJ	22,410	97	30	24
*NI4Y	6,612	73	33	5
*K4VBM	2	1	1	0

KENTUCKY

N4QS	276,533	717	54	55
ND4Y	150,241	616	52	39
K4FT	83,640	313	47	35
KB4QZH	48,620	238	46	22
*K4FN	29,224	241	46	6
*W4PF	7,920	92	33	3

NORTH CAROLINA

K2AV	709,800	1320	57	73
WJ2D	218,922	484	52	55
*N4IJ	194,040	432	50	60
N4YDU	145,606	486	50	44
N4GU	98,784	263	46	50
K1KK	34,038	176	41	20
*K3TD	8,283	102	29	4
N3ND	3,096	57	24	0

SOUTH CAROLINA

AA4V	353,760	797	54	66
K4YYL	87,300	294	50	40
W4MEL	26,106	177	43	14

TENNESSEE

AD4EB	426,878	1039	58	64
K3IE	306,820	728	53	63
N4VV	198,275	411	49	54
AA4DD	153,648	411	51	46
N4ZZ	59,414	408	46	15
N4NA	51,389	295	51	16
*N4ARO	47,519	327	48	13
K3JWI	46,428	227	48	25
K4AFE	18,411	138	40	11
NS4X	10,728	130	32	4
KC4NX	1,045	11	0	11

VIRGINIA

N4RV	649,306	1203	57	76
K4XL	581,406	1036	56	71
WS6X	439,125	870	56	69
W3IP	297,965	696	52	63
W4PK	263,304	646	51	55
N3UA	216,134	512	47	59
N3CW	191,586	512	54	57
W3YY	183,261	490	51	60
KE4S	176,027	411	50	53
N3JT	161,095	502	51	50
KG3V	114,312	302	44	44
N4CF	107,485	413	51	32
*W4PM	75,663	474	45	18
KA4RRU	66,171	292	45	24
K5VIP	63,376	357	49	19
NX3A	45,864	332	44	12
N6DW	45,085	180	42	29
W4VIC	43,680	233	33	23
KA4CDN	37,504	196	45	19
AD4TJ	21,744	185	40	8
KSØCW	14,036	127	35	9
W1IE	12,528	107	47	1
*N2QT	9,648	99	32	4
KG4W	5,664	28	2	22
*AB4SF	495	24	11	0

ARKANSAS

W5KI	39,345	256	50	11
K5RM	32,433	242	47	10

LOUISIANA

W5WZ	20,240	114	38	17

MISSISSIPPI

W2GS	50,610	230	47	23

OKLAHOMA

W5TM	202,752	788	56	43
K5UV	34,132	284	48	5
N5UM	32,025	205	47	14

TEXAS

N5RZ	396,060	1134	58	57
K5BG	190,183	561	53	48
K5NA	145,537	299	54	65
K5KJ	124,614	574	55	31
K5NZ	119,691	460	56	37
AD5A	108,158	459	50	32
N5XZ	88,642	398	51	31
WØVX	34,928	234	43	16
N5XJ	32,835	244	45	10
N5WNG	19,451	139	44	9
W5PR	12,384	89	37	11
K5HTE	5,544	57	25	8
*WBØTEV	3,706	50	32	2
*KE5LQ	3,190	49	26	3
N5DD	742	17	12	2

CALIFORNIA

WD6T	120,360	524	54	31
W6DR	70,226	353	53	20
N6IE	69,509	348	51	20
K6SRZ	51,813	276	42	15
N6CW	40,832	244	39	19
K6RC	38,114	239	45	14
N5ZO	30,840	193	48	12
NC6K	28,037	222	44	9
WE6Z	22,000	148	44	11
KF6I	14,440	149	34	6
N3RC	9,952	135	28	4
AF6SA	3,668	50	23	5
W6MOB	1,950	33	20	6
*K9YC	1,908	42	15	3
N6GEO	1,560	42	13	2
N6PM	1,312	26	11	5
*WQ6X	1,001	44	11	0
W6KC	344	20	7	1
NE6I	5	1	0	1

ARIZONA

N7DD	482,632	1020	57	65
WØRIC	215,919	778	56	43
N7AT	157,505	640	53	32
AB7E	142,560	545	53	37
WA7AN	108,320	533	54	26
W6XI	102,600	342	50	40
*W7RH	79,200	378	51	24
K7FA	44,525	264	48	17
W7GES	37,944	217	45	17
K7WP	23,100	190	41	9
W6RW	19,581	107	46	15
K6LL	13,052	99	44	8
N7RQ	13,000	80	40	12
*K7GA	9,789	103	33	6
K3WYC	4,950	87	24	1

IDAHO

KG7CW	183,222	749	55	32
KØIP	10,879	106	39	4

MONTANA

N7IP	69,993	319	52	25

NEVADA

K7XC	54,384	277	48	18

OREGON

KA6BIM	177,177	676	54	23
K4XU	88,627	396	54	23
KU1CW	85,085	436	49	16
KN7K	19,760	217	34	4

UTAH

K7NJ	410,193	1015	59	60
W7CXX	119,510	671	55	19
W7CT	105,120	498	53	19
K7UT	96,114	402	54	29
NS7B	6,370	72	31	4

WASHINGTON

K7RL	80,580	349	53	26
W6OAT	40,114	214	46	16
K7SS	37,449	215	44	13
N7BV	37,164	267	47	10
K7BTW	19,504	126	35	11
*W7CD	14,491	102	34	9
KK7PW	7,260	92	26	4
NR7RR	3,536	52	22	4
K7EG	2,204	32	15	4
N7EPD	798	21	13	1

MICHIGAN

W8MJ	544,000	1303	58	67
N8LJ	128,427	481	54	35
*KØACP	46,970	315	51	10
*KE3K	33,496	263	47	6
W8/UT5UDX	30,085	224	47	8
K8VT	23,904	215	43	5
*NF8M	22,313	152	41	12
*K8GT	4,131	63	26	1
W8PI	3,741	47	25	4

OHIO

K1LT	807,380	1375	58	82
N8TR	324,632	630	56	68
W3HKK	274,716	726	56	61
ND8L	167,388	427	52	59
*K8BL	71,610	293	49	28
*K8AJS	53,020	415	45	10
KA8G	51,520	211	43	27
W8EH	39,650	219	41	20
*K4YJ	32,016	204	43	15
N8IW	31,140	139	36	24
*K8LY	26,364	188	43	9
*W8KNO	24,795	237	41	4
*N8VV	15,795	150	41	4
N9RC	11,808	59	29	19
*K8CR	4,572	45	30	6
N8NB	4,320	31	20	12
K8ALM	3,556	43	24	4
*AA8SW	2,266	50	22	0
*AF8C	1,387	33	15	4

WEST VIRGINIA

N3HEE	784,655	1284	57	82
NW8U	164,016	372	49	53

ILLINOIS

KG9X	484,470	1109	58	68
N9CO	457,454	959	58	69
K9NR	382,104	1033	57	59
K9XD	328,782	1044	58	53
N9LQ	207,684	546	57	51
ND9G	178,398	592	56	43
AC9S	164,208	664	55	33
K9MMS	162,552	424	52	52
K9XW	137,804	501	54	40
K9NO	115,526	318	49	45
K9IUQ	114,205	335	48	43
*K9CS	52,765	374	52	9
*AB9YC	47,849	364	52	7
N2BJ	43,248	356	50	3
*K9PG	40,820	178	42	23
AI9T	39,813	199	47	22
*WA9LEY	37,620	270	47	10
W9YK	35,300	310	47	3
*N7US	31,104	241	49	5
*KG9IL	26,622	176	46	12
NQ6N	21,684	107	33	19
*KØPG	16,500	168	41	3
K9PY	14,828	140	41	3
*WB8BZK	12,600	121	39	3
*K9IJ	9,963	108	40	1

INDIANA

WT9U	178,293	597	56	47
KK9V	76,674	246	46	32
W9PA	75,520	301	49	31
KR9U	51,430	164	41	33
KT9L	29,640	208	50	10
N9DR	27,384	174	43	13
*AE9LL	4,309	68	31	0

WISCONSIN

WØAIH	523,404	1189	58	68
K9IMM	300,699	867	58	53
NE9U	153,504	417	49	47
*W9XT	143,792	652	57	29
WE9V	125,922	262	40	53
W9AV	119,760	557	55	25
*N9CK	80,216	408	51	23
*WT9Q	74,580	540	50	10
W9RN	71,760	315	49	29
*K9GS	32,547	233	49	8
*N9UA	21,792	194	45	3
NS9I	2,880	20	2	18
WI9WI	2,840	23	8	12

COLORADO

KVØQ	693,328	1273	58	78
KØRF	597,622	1219	58	73
WØMU	58,824	316	52	20
K7TD	45,885	233	49	20
WØLSD	10,750	96	39	4

IOWA

WØFLS	238,875	640	53	52
W7II	94,860	236	52	41
NØAV	59,360	311	49	21
KDØZV	34,074	276	48	6
*KEØIAT	7,720	79	35	5

KANSAS

ACØC	387,435	983	57	58
KØAP	102,660	408	53	34
NSØR	97,838	568	52	19
ABØS	58,692	364	53	14
*KØVBU	16,403	147	42	5

MINNESOTA

KØYR	99,840	463	53	27
*WØSEI	53,820	339	54	11
*KIØF	34,858	249	52	6
WBØN	33,984	225	47	12
*KØPC	11,817	132	39	0
K4IU	9,538	115	37	1

MISSOURI

WØTT	71,000	408	54	17
*KØXM	26,510	217	52	3
NIØG	9,633	65	23	16
*WX5CW	2,430	48	27	0

NORTH DAKOTA

*WØTUP	2,266	44	22	0

CANADA

NEW BRUNSWICK

VE9AA	102,102	246	46	31
*VE9ML	60,202	179	38	24

QUEBEC

VA2WA	1,191,360	1416	57	79
VA2UR	240,657	445	47	50
VA2AM	39,690	80	30	40
VE2FK	6,992	71	23	0
*VE2GT	20	2	2	0

ONTARIO

VE3RZ	771,948	1144	57	66
*VE3MGY	623,732	1019	57	59
VE3NZ	268,560	680	54	26
VE3NE	233,844	596	49	29
*VA3DF	218,500	429	51	44
VE3CV	206,141	373	50	51
VE3MV	101,367	333	50	13
*VE3VY	80,288	322	43	9
VE3NNT	52,828	231	40	7
*VA3WB	50,784	218	39	9
*VE3DS	24,435	122	41	4
*VE3XAT	22,270	137	31	3
VE3VHB	7,752	44	33	5
*VA3PM	4,826	55	19	0

ALBERTA

VE6WZ	548,352	857	57	62
VE6SV	541,688	841	59	60
VE6TL	47,630	175	46	9
VE6KC	32,208	152	41	3
VE5UA	9,765	35	0	31

BRITISH COLUMBIA

VE7ACN	119,826	376	48	15
VE7XT	24,790	137	31	6
VE7IO	3,555	50	14	1
*VA7UI	1,224	29	9	0

NORTH AMERICA

Alaska

KL7SB	270,400	497	49	31

Costa Rica

TI7W	170,765	316	43	42

Guatemala

*TG9ADM	450	10	7	2

Mexico

XE2S	102,896	341	47	12

AFRICA

Canary Islands

EA8RM	262,504	304	27	61
ED8M	243,786	302	23	59
EA8TZ	5,300	27	1	19

Madeira Islands

*CQ3J	20,406	56	0	38

ASIA

Afghanistan

T6AA	158,515	346	0	49

Asiatic Russia

R8TT	811,680	966	15	74
RG9A	664,480	908	4	76
R9CW	616,140	956	0	70
RT9S	548,118	794	4	70
RW9JZ	531,790	843	0	70
UC9A	493,794	842	0	63
UA9CTT	456,892	741	4	64
RØSR	419,832	687	2	70
RK9UE	399,722	698	0	67
*UA9W	388,341	731	1	56
RX9WN	369,880	706	0	56
*UA9BA	311,740	523	2	63
RK9AX	269,824	470	0	62
*UA9AX	203,775	416	0	55
UAØSR	169,860	362	0	57
RK8I	150,430	360	0	49
UA9R	141,660	355	0	45
RW9QA	130,254	298	0	51
*R9MA	126,454	316	0	46
*RU9AC	110,688	252	0	48
*RA9MX	104,199	265	0	47
*RA9AU	98,026	236	0	46
*RW9DX	83,287	257	0	37
RT8U	83,006	234	7	42
*R9HAG	67,377	224	0	37
*RU9I	59,090	199	0	38
*RC9A	58,971	208	0	33
RK9AY	58,378	188	0	34
RUØA	50,901	133	0	47
UA9TF	33,388	100	0	34
*R9SS	32,942	146	0	26
RAØWU	28,594	144	0	29
UA9LAO	20,502	152	0	18
UA9UX	17,475	104	0	25
RWØLT	10,752	50	1	23
RAØSMS	10,080	85	0	20
*R9LM	8,925	48	0	21
RAØACM	7,950	46	0	25
UA9OC	7,224	46	0	21
*R9AB	6,156	40	0	19
*RF9C	3,822	20	0	21
*RX9UK	2,024	25	0	11
RKØUT	1,608	53	0	8
RUØLL	1,358	38	0	7
*UAØSE	252	15	0	4
*RK9DO	135	9	0	3

Asiatic Turkey

*TA4SO	4,624	30	0	17

China

BA7QT	28,764	97	0	34
*BD4SS	24,128	158	3	23
*BH4TVU	6,875	120	0	11
*BA5AB	3,424	27	0	16
*BG4GOV	3,240	81	0	8
*BG7IWZ	30	2	0	2

Cyprus

*5B/RN3QO	711,834	841	17	70
5B6ØAIF	14,091	44	0	33

Israel

4Z5LY	225,981	462	1	50
4X1IM	42,688	140	0	32
4Z4KX	26,356	64	2	42

Japan

JH2FXK	312,243	416	31	56
JE1BMJ	163,880	308	26	42
JH7XMO	129,960	281	14	46
JE1CKA	115,904	269	24	40
JR4OZR	74,888	229	7	39
JA4CUU	66,198	151	12	39
JF3LOP	53,415	176	10	35
JN7FAH	43,475	118	12	35
JAØFVU	38,588	102	13	31
JA6MWW	31,939	126	5	36
JH4UTP	29,260	132	10	28
JA5FDJ	24,846	73	10	31
JF2XGF	24,040	76	11	29
*JG6JAV	21,793	129	8	23
JA1XEC	20,825	63	9	26
JHØKHR	20,340	67	12	24
JA1PTJ	19,285	71	11	18
JH5MXB	18,150	65	9	24
JA9NFO	13,500	43	12	24
*JA1SVP	12,905	64	10	19
JO7KMB	11,556	64	6	21
JHØGHZ	11,310	47	15	11
JA7GYP	9,875	46	10	15
JE1DXC	8,734	54	7	15
JH1RFM	8,250	45	3	19
JR2AWS	6,460	80	5	12
JM4WUZ	5,796	30	10	13
JH8GEU	4,944	45	3	13
JF7PHE	4,680	53	4	14
JA2HYD	4,658	40	0	17
JN1BMX	3,840	30	9	7
JH1OAI	3,800	22	6	13
*JA7ZP	3,072	27	2	14
JA7MSQ	2,660	23	6	8
JAØGCI	1,680	20	1	11
JF1RPZ	1,390	39	2	8
JG1LFR	594	24	1	5
*JK2VOC	564	60	0	4
JO4CFV	402	13	1	5
*JE8KGH	345	16	0	5
JR4VEV	285	13	0	5
*JF2IWL	168	25	0	3
JA1JYS	100	4	1	3
*JH6QIL	38	8	0	2

Kazakhstan

UP4L	668,100	944	1	74
*UN4Q	283,668	477	0	66
*UN7ZAF	80,094	219	0	42
UN5J	14,680	95	0	20

Republic of Korea

HL2VXK	23,328	139	4	23
*HL3AMO	7,552	80	6	10
*HL1VAU	1,780	33	1	9

Saudi Arabia

7Z1SJ	358,080	582	9	55

United Arab Emirates

*A65BB	6,600	34	0	22

EUROPE

Austria

OE8TED	514,848	984	22	71
OE2S	416,841	707	27	76
OE1TKW	318,864	623	20	71
*OE6MMD	129,415	457	1	54
*OE4VIE	126,624	514	0	48
OE2LCM	119,621	435	4	49
OE3KAB	18,690	102	0	35

Baleric Islands

EA6FO	959,523	1243	45	78

Belarus

EU1WW	1,203,300	1578	32	94
EU4A	710,976	1320	24	72
EW8R	448,232	935	17	69
EU1A	343,570	714	15	71
EU3A	298,551	644	14	69
*EU8R	151,850	578	0	50
EU3AA	125,952	356	9	55
EU8A	88,275	300	1	54
*EU4T	42,355	189	0	43

Belgium

OR3A	865,530	1254	39	79
ON6NL	342,090	704	22	68
OQ5M	229,075	472	24	61
ON6SAS	149,600	292	25	60
*ON5JT	58,440	289	1	39
ON4LG	14,276	45	6	37
*ON4TTT	11,795	61	3	32
*OO9O	750	15	0	10

Bosnia-Herzegovina

*E7CW	529,438	1069	20	71
*E77D	88,746	416	0	42

Bulgaria

LZ2JE	791,545	1168	31	84
LZ3ZZ	197,820	626	2	58
LZ3FN	189,360	600	1	59
*LZ2ZG	151,641	434	9	54
LZ4A	49,392	224	0	42
*LZ5QZ	31,119	184	0	33

Crete

*SV9RGI	17,860	81	0	38
SV9COL	3,990	34	0	21

Croatia

9A3TR	1,264,128	1642	41	87
9A4C	1,256,411	1658	41	86
9A5Y	1,230,656	1570	42	92
9A3JB	521,904	1181	7	76
*9A2NO	127,499	400	0	59
*9A9R	62,452	230	2	50
*9A2R	33,856	138	2	44
*9A2GA	29,610	144	0	42
*9A9J	5,543	47	0	23
*9A7ZZ	456	11	0	8

Czech Republic

OK1DX	635,688	985	35	74
OK1CRM	545,864	1165	14	74
*OK2BFN	475,740	1006	24	66
*OK1FPS	369,450	964	12	63
*OL6T	363,870	883	14	64
OK1FPG	322,764	787	14	64
OK1JR	282,816	770	13	59
OK5ET	269,698	607	16	66
*OK1AY	181,598	627	5	53
OLØW	175,088	555	2	60
OK3M	122,094	428	5	52
OK1ATP	111,884	228	15	68
*OK6DJ	69,322	305	0	46
OK1XV	52,680	151	11	49
*OK2DM	47,334	208	0	46
OK2RU	28,954	71	5	57
*OK1SI	14,750	130	0	25
*OK2HIJ	6,325	51	0	25
OK7X	1	-510	5	38

Denmark

OZØB	492,947	991	22	69
OZ8AE	469,200	921	24	68
OZ2TF	222,700	616	9	59
OU4N	120,543	303	13	56
*OZ4CG	87,600	358	2	46
OZ1NF	70,577	205	7	54
OZ1HX	26,235	79	1	54
OZ7DK	12,488	90	0	28
OZ4MD	4,032	21	1	20

England

MX5A	1,438,490	1665	52	82
G5W	1,249,560	1555	45	85
G3TXF	1,169,797	1562	48	79
G3UJE	859,050	1282	40	75
G4FAL	785,788	1073	44	80
G4BYG	708,852	1085	39	75
G3P	657,664	998	39	73
M3A	613,440	966	37	71
G4RGK	564,100	997	33	67
G3XTT	553,956	904	36	70
G4PIQ	424,413	738	29	70
G3SJJ	421,465	795	30	67
GØBNR	369,559	627	28	73
G3OLB	262,861	566	30	53
*G3RLE	213,213	516	14	63
G8AJM	199,122	476	15	62
G6T	167,504	385	20	56
G4PVM	132,111	410	6	57
*M7V	124,272	322	14	58
G3PHO	68,928	198	7	57
*G4UJS	67,056	185	12	54
G4DRS	34,822	146	1	45
G4DBW	32,550	123	0	50
*M1X	28,840	174	0	35
M4J	24,012	132	2	34
*G3V	22,681	119	6	31

*G3RKF	21,640	112	2	38
*MØSQC	18,496	115	0	32
G4LPP	13,311	96	0	29
GØDWV	8,036	47	0	28
*G4NXG/M	6,168	52	0	24
*MØMDX	2,736	34	0	18
G3ZGC	200	5	1	4
	Estonia			
ES5RY	**610,812**	**1179**	**15**	**79**
***ESØDJ**	**292,629**	**784**	**10**	**59**
***ES4NY**	**241,536**	**713**	**7**	**57**
ES3TI	99,123	318	6	51
ES1BH	25,160	143	0	34
	European Russia			
UA5C	**716,240**	**1172**	**26**	**86**
RM4F	**632,854**	**1064**	**24**	**85**
R1DX	626,913	1112	20	87
UA1OMS	591,840	1138	11	85
RA3W	541,911	1121	14	79
RV1CC	540,423	1098	17	76
RC3FL	487,458	915	23	79
RK3ER	471,060	1024	14	76
RG5A	431,431	888	15	76
UB3A	414,792	986	8	76
***RL6M**	**413,402**	**909**	**18**	**68**
R4KO	343,064	895	2	74
RK3DK	333,756	902	8	65
RA6A	330,429	653	21	72
RA4FW	328,212	778	12	69
***UA5F**	**324,923**	**893**	**10**	**63**
RT2D	321,750	869	10	65
R5DT	317,623	861	9	64
RD4A	312,206	839	5	69
R3KM	302,952	736	5	73
RA1QD	299,250	783	8	67
RW1C	260,700	889	1	59
R3AP	259,594	661	8	71
UA3QGT	256,425	680	10	65
*UG4I	248,755	759	4	61
RV3YM	224,332	650	9	59
*UA3MIF	219,240	800	0	56
RT3M	209,712	615	4	64
RK4FM	208,906	606	1	66
UF4S	202,125	506	3	72
*RA6C	197,312	608	7	57
*UA5R	196,029	560	5	64
*RQ6A	189,420	630	6	54
RG7M	188,676	727	0	54
RU4PU	185,648	409	5	77
RA3S	183,961	490	9	62
R6CC	183,820	516	5	65
UA6CC	179,950	591	1	60
RT3N	178,860	656	0	55
UA6LCN	175,160	616	0	58
R7AW	172,900	534	0	65
UA3A	167,454	530	0	63
R6AP	163,840	499	7	57
RL5A	161,892	612	0	54
RK3BX	149,682	536	0	57
RA3SI	148,608	465	0	64
R4BZ	145,210	422	3	62
RU6K	141,520	465	1	60
R7RF	138,681	478	0	57
RU6AV	138,000	391	4	65
*RV3A	137,982	474	1	57
R5AJ	136,701	445	0	61
R3EA	123,422	540	0	47
RK2M	120,204	457	2	51
*RO1M	117,264	425	0	56
*RW7F	110,717	429	0	53
RC9F	110,450	442	0	50
RQ3M	110,000	406	3	52
R4ACY	102,700	407	0	50
R3RR	99,328	250	5	59
*RA3Y	98,527	364	2	51
RA6MQ	85,583	265	9	52
*RZ4AG	85,468	398	0	46
RT5C	73,248	352	0	42
UI3A	70,518	312	0	46
RZ2A	58,656	206	1	51
*R3ZJ	55,200	229	4	46
RL4A	50,866	159	0	58
RC1W	49,518	242	0	42
*R4FD	48,594	260	0	39
*R4WT	45,760	295	0	32
*R7KZ	43,600	223	2	38
R3QF	43,110	185	0	45
RM4R	41,560	204	0	40
*UA4CNJ	40,120	266	0	34
RT2C	36,816	195	0	39
RU4SS	35,052	147	0	46
R6AF	34,816	73	1	67
*UA3R	31,770	234	0	30
RK4PA	31,240	136	0	40
RG4A	30,084	124	0	46
*RA4DR	29,376	152	0	36
RM3DA	25,898	101	0	46
*RX3AEX	18,984	148	0	28
*RT6C	18,760	104	0	35
*UB3D	18,356	158	0	26
*RA3QUA	16,064	98	0	32
RA7KW	14,471	100	0	29
*RA4PBE	13,804	91	0	28
*UA6EED	12,512	111	0	23
RA3DNC	11,784	101	0	24
*R2EA	11,206	103	0	26
UA3AIF	8,500	40	0	34
*RA6AAW	7,130	64	0	23
*UA3AAJ	6,575	50	0	25
RD3K	6,356	34	0	28
RM3O	3,150	26	0	18
*RC3D	3,021	22	0	19
RV6ASU	2,475	17	1	14
*R3PJN	1,820	18	2	11
*RW4NH	312	12	0	6
RV3FT	140	4	3	1
R1AC	120	4	1	2
*R7FK	10	1	0	1
*UA7T	10	1	0	1
UA9FBC	10	1	0	1
	European Turkey			
***TA1L**	**9,430**	**40**	**0**	**41**
	Finland			
OG7A	**689,325**	**1213**	**16**	**85**
OH3RB	**463,712**	**995**	**17**	**69**
OG4T	396,695	862	13	72
OH8A	356,824	917	8	65
OH3OJ	287,494	887	7	55
OH3FM	259,434	787	5	58
OG6N	256,275	724	6	61
OH2XX	250,588	759	7	54
OH2BO	205,722	298	24	75
OH1F	203,931	613	3	60
OH1XX	186,533	271	26	77
OH1JD	165,540	504	1	61
OH1Z	111,153	305	7	60
OH3JR	99,153	261	3	66
OH7MFO	74,677	266	0	53
OH7KBF	70,312	306	0	44
OH6DX	63,954	206	3	54
OH6TN	31,710	141	2	40
***OH2BFP**	**20,856**	**130**	**0**	**33**
*OH8WR	11,745	85	0	27
	France			
TM5EE	**981,045**	**1332**	**44**	**73**
F6GCP	**277,290**	**547**	**19**	**71**
F4FFZ	191,596	463	15	61
F6EZV	145,665	420	5	60
TM4X	91,991	238	11	56
F5NBX	37,758	173	0	42
***F5DRD**	**18,166**	**117**	**0**	**31**
	Germany			
DL7ON	**1,050,400**	**1450**	**40**	**90**
DK6WL	**1,005,576**	**1372**	**43**	**89**
DJ2YA	992,125	1353	43	82
DQ4Q	912,022	1369	39	79
DL2SAX	735,423	1288	33	76
DL7URH	721,280	1149	38	77
***DF1MM**	**654,656**	**1210**	**33**	**73**
DK2OY	604,800	1167	27	73
DL6ZBN	566,485	1145	29	66
DL6MHW	558,054	1044	30	73
DL4CF	549,814	1061	29	74
DK3WW	521,586	828	34	83
DL8UAT	514,995	1039	27	68
DJ9AO	502,736	919	33	71
DJ5AN	499,296	795	37	75
DL6FBL	474,331	714	41	66
DK9IP	449,226	925	24	70
DL3DTH	436,914	1009	20	67
DL8QS	400,257	801	28	71
DJ8QP	396,495	757	24	75
DL4HRM	374,374	809	25	66
***DL1WA**	**372,762**	**963**	**16**	**65**
DL5WW	360,810	756	25	65
DL9GTB	349,048	721	20	72
DL7AT	334,320	776	21	63
DJ9DZ	312,661	738	19	64
DK1X	308,853	784	19	62
DL5XJ	298,312	561	30	68
DL5YM	293,440	867	15	55
DL1BUG	289,614	768	15	64
DL1NKS	285,168	748	16	62
DL1RTL	280,588	727	14	63
DL4ME	280,539	811	16	57
DL4UNY	279,183	592	19	68
DF6QV	278,250	781	11	64
DJ5MW	265,136	757	9	64
DK2LO	263,508	596	18	66
DK3UA	262,773	423	27	70
DF4XX	256,641	650	18	59
*DL7ANR	243,846	719	13	56
*DK1KC	239,118	747	10	56
DL6DCD	238,666	451	23	71
DL1NEO	235,752	607	14	62
DL1IAO	204,750	528	12	66
DL8MKG	204,680	450	17	69
DK8FD	202,998	599	13	56
*DJ3HW	194,568	622	7	59
DF8AA	192,731	491	16	61
DL1DTL	176,652	588	5	58
DL1MGB	171,826	265	38	68
DL3DW	156,984	534	7	55
DL5MFF	154,502	460	7	60
DJ2BC	151,168	495	4	60
DL5JS	150,863	545	8	51
*DL8TG	147,312	451	6	60
*DM7W	147,084	431	12	56
DR2C	146,382	489	2	60
*DL4WA	146,135	575	2	53
DL2CC	145,800	411	10	62
DL3UB	142,821	473	3	60
DJ5IW	140,605	481	5	56
*DL1TS	140,085	551	1	54
DHØGHU	137,529	450	8	55
*DL5SFC	137,516	467	2	60
DL1QW	133,632	501	0	58
*DJ9MH	131,880	469	6	54
*DL1HBT	131,271	496	6	51
DJ7YP	121,380	328	13	57
DK8ZZ	117,150	356	5	61
DJ8EW	115,197	421	1	56
DL5LYM	114,956	398	1	57
DL4LAM	114,378	322	9	57
DL6JZ	114,010	330	11	54
*DL5ARM	111,720	410	6	51
DL5XAT	110,264	421	6	50
*DF4XF	109,285	425	0	55
DF1LON	105,860	298	12	55
*DL3TU	104,371	348	8	53
*DJ1SL	98,073	380	2	49
DF2CK	98,000	415	0	49
*DL4KUG	96,720	311	6	54
*DJ3WE	92,973	384	1	50
DL7VEE	86,400	200	14	61
*DL7NDS	85,968	384	0	48
DL5ST	85,358	383	0	49
*DO6LE	83,472	400	0	48
*DL7ALM	82,350	347	4	46
DK2CX	78,516	299	0	54
DJ8RS	77,682	205	11	55
*DK3DUA	77,328	299	0	54
*DL2RMC	76,704	369	0	47
DO4DXA	76,076	329	0	52
*DF8AE	75,068	332	0	49
*DJ1YFK	74,612	366	0	46
*DD2ML	73,268	295	2	50
*DF7RG	67,527	363	0	41
DL6ON	63,600	269	3	47
*DL9NEI	63,425	333	0	43
*DL3YM	61,614	225	0	54
*DF1LX	60,528	262	3	49
DF2RG	57,936	237	2	49
*DP5L	57,800	243	1	49
*DJ3RA	55,890	248	0	46
*DJ6TB	55,776	245	1	47
*DJ3JD	53,350	216	1	49
*DL7UGN	52,626	211	0	49
*DL1RNN	52,503	270	0	43
DM5TI	51,048	124	7	65
DK1TW	48,576	228	1	45
*DM2DXA	47,753	152	5	48
DF3UB	47,277	191	2	49
DF4PD	46,500	128	8	54
DL1ATZ	46,080	199	0	45
DL3AMI	44,680	247	0	40
*DK2CC	43,381	182	3	44
DJ9RR	43,332	191	0	46
DL1STG	39,216	163	0	48
*DL3OH	38,478	141	3	50
*DL4SZB	37,990	123	3	55
*DL9NDW	37,620	184	0	45
*DJ1MM	37,398	164	1	45
DL8DBW	36,572	197	0	41
*DAØDOM	35,530	206	0	38
*DK8AX	35,505	156	0	45
*DF2LH	34,944	111	6	50
DK5JM	34,944	113	5	47
DLØWW	34,245	137	1	44
DP6K	33,800	175	1	39
*DK1FT	33,516	173	0	42
*DL8ZAJ	32,554	170	0	41
DL5DBY	32,412	198	1	36
*DL5ALW	30,644	120	0	47
*DL4FDI	29,785	177	0	37
*DL4SDW	27,720	125	1	43
*DJ4MX	24,453	130	0	39
*DL1QQ	24,198	146	0	37
*DL4RCK	23,736	102	0	43
*DM4MN	23,436	109	1	41
*DL2OE	22,134	100	3	39
*DK6QW	22,040	129	0	38
DF1HF	17,658	55	2	52
DF5MA	17,204	102	0	34
DL7UPN	17,000	54	2	48
DK7MD	16,965	48	14	25
DC2VE	15,136	105	0	32
DF2TT	14,960	61	0	44
*DK9TN	14,420	94	0	35
*DG1HXJ	13,172	73	0	37
DJ1AA	11,550	50	0	42
DKØAE	11,550	50	0	42
DL5CW	10,263	48	8	25
*DL6WA	10,115	56	0	35
DG8HJ	9,960	47	0	40
*DM2XM	8,764	66	0	28
*DL2GAN	8,372	71	0	26
*DM8T	6,371	68	0	23
*DK8XX	5,000	40	0	25
*DL4DRW	4,940	41	0	26
*DL1PAN	4,579	50	0	19
DL7JRD	2,720	19	3	14
*DA3T	1,918	31	0	14
DL2VNL	1,649	16	0	17
*DJ1XT	576	11	0	9
DL5ZB	468	7	0	9
*DG7RO	175	7	0	5
	Greece			
SV2DSJ	**928,855**	**1388**	**33**	**82**
SV2JAO	**664,930**	**1172**	**21**	**77**
SV8BHN	79,278	181	4	69
***SV2AEL**	**54,943**	**225**	**1**	**46**
SV1JG	54,920	263	0	40
SV2KF	5,481	51	0	21
	Hungary			
HA8FK	**840,112**	**1319**	**36**	**76**
HG8K	**829,678**	**1380**	**25**	**82**
HG3N	767,124	1253	28	80
HA7I	748,656	1236	30	78
HA4XH	622,188	1020	33	75
HA8BT	378,014	753	21	70
***HA6NL**	**305,432**	**792**	**13**	**60**
***HA8WY**	**274,494**	**797**	**10**	**56**
HA5MA	218,205	632	9	56
HG6O	162,958	536	7	52
*HA7MF	150,040	528	2	53
*HA6PJ	144,850	579	2	48
*HG8C	134,550	529	0	50
HA8JV	53,920	259	1	39
*HA8TKS	3,893	50	0	17
*HA1WD	950	21	0	10
	Isle of Man			
MD2C	**325,350**	**610**	**27**	**63**
	Italy			
IKØYUT	**1,058,037**	**1432**	**37**	**90**
IQ2CJ	**542,325**	**826**	**35**	**70**
IKØXBX	284,544	533	25	71
4U25B	240,410	810	1	57
***IK4DCX**	**225,820**	**618**	**9**	**61**
IK3ORD	223,192	425	27	65
IK7JTF	179,394	356	17	70
I2SVA	173,451	600	3	54
IV3AZV	173,128	497	5	62
IZ8VYU	170,640	561	3	57
IK4ZGO	162,932	348	24	53
IKØYVV	153,657	469	9	54
I2WIJ	153,010	446	4	61
***IV3FPX**	**149,513**	**566**	**0**	**53**
IZ5DIY	141,757	321	20	57
IZ5NFD	139,776	423	5	59
I1JTQ	136,620	395	8	58
IV3BCA	93,704	364	0	53
IZ2MGN	92,512	318	7	49
IC8POF	71,852	153	15	56
*I3FDZ	71,687	297	0	49
*IV3CYT	62,373	240	0	51
*IK2XDE	61,088	268	0	46
IZ8DVD	60,060	204	4	51
IZ5MOQ	30,753	117	1	50
*IV3JCC	26,280	111	0	45
IK2TDM	23,691	83	0	53
I3FIY	20,416	130	0	32
IK5ZAA	9,126	68	0	27
*IKØUUM	5,336	47	0	23
*IK2CLB	2,080	16	9	4
*IZ2CSX	1,335	18	0	15
*IUØITX	960	16	0	12
IWØSAF	804	12	0	12
*IZØEHL	18	3	0	2
	Kaliningrad			
UA2FZ	**1,433,295**	**1733**	**41**	**94**
***RN2FA**	**109,074**	**422**	**1**	**48**
*RT2F	63,058	297	0	41
*RA2F	51,714	248	0	39
UA2CZ	44,960	215	0	40
	Latvia			
YL2SM	**1,314,036**	**1553**	**46**	**92**
YL3FT	**648,549**	**1152**	**19**	**80**
YL9T	319,200	735	7	73
***YL3GAZ**	**270,814**	**757**	**10**	**57**
YL2KO	211,992	525	4	69
YL2GD	168,920	353	12	70
YL2VW	143,960	441	2	59
YL2AO	46,481	151	1	52
YL2BJ	42,893	123	1	58
	Liechtenstein			
HBØ/HB9LCW	**205,200**	**486**	**17**	**59**
	Lithuania			
LY4A	**1,367,380**	**1638**	**45**	**95**
LY7M	**1,313,820**	**1610**	**43**	**92**
LY2MM	959,484	1489	26	85
LY5W	681,590	1292	19	79
***LY4ZZ**	**525,976**	**1107**	**18**	**70**
LY2K	469,033	1066	15	68
LY3BN	431,694	907	17	70
***LY2TS**	**390,000**	**993**	**10**	**65**
*LY3B	320,106	994	5	57
LY7T	312,228	947	4	59
LY2BKT	290,000	984	4	54
LY5O	244,764	587	11	67
LY2OU	154,560	543	3	53
LY5R	131,936	405	1	61
*LY2DX	120,096	494	0	48
LY2AX	109,270	438	2	47
LY2CX	105,798	302	9	57
LY2FN	63,932	278	0	44
*LY1CT	56,832	312	0	37
LY2MC	30,044	158	0	37
LY2BAW	28,120	148	3	34
*LY5YY	16,678	116	0	31
	Luxembourg			
LX20I	**1,479,226**	**1848**	**44**	**90**
LX1ER	75,530	207	6	59
	Moldova			
ER4A	**229,451**	**746**	**1**	**58**
***ER3DX**	**72,944**	**290**	**0**	**47**
	Netherlands			
PA9M	**741,762**	**982**	**42**	**84**
***PC3T**	**524,892**	**936**	**28**	**74**
PA5KT	**416,097**	**713**	**36**	**63**
PAØO	413,393	634	34	67
PA3AAV	335,329	590	31	66
PA3FQA	315,115	491	33	74
PA3C	242,154	416	29	70
PA5WT	205,288	584	10	57
PAØJLS	122,554	410	3	55
PA2RG	92,928	409	1	43
PG3N	62,608	209	3	53
*PG4I	52,972	257	0	41
*PA4Y	49,049	190	3	46
PA5TT	38,958	174	4	39
PA3EVY	35,084	129	5	44
PF5X	22,850	81	0	50
*PE1RDP	17,028	103	0	33
*PAØJED	16,388	99	0	34
PA1T	10,914	59	4	30
PA3DCU	405	8	0	9
*PA3OES	252	9	0	6
	Northern Ireland			
***MI4I**	**50,556**	**229**	**0**	**44**
	Norway			
LA7THA	**313,050**	**772**	**16**	**59**
LA3MHA	**297,344**	**573**	**17**	**75**
LAØCX	135,140	440	7	51
LA5LJA	125,097	327	10	59
LA7GIA	108,180	336	9	51
LB2TB	72,402	183	7	59
LB5WB	21,255	100	0	39
LA2US	14,672	105	0	28
***LA3ZA**	**9,870**	**52**	**0**	**35**
*LC9T	5,000	50	0	20
LA5SJA	3,135	31	0	19
	Poland			
SN7Q	**1,659,711**	**1873**	**46**	**95**
SN2M	**1,601,380**	**1783**	**48**	**97**
SN5Y	1,118,852	1530	40	84
SP3GTS	796,176	1193	35	79
SP1NY	770,196	1273	28	78
SP2EBG	767,760	1202	25	87
SN1W	659,600	1208	23	77
SP2HNF	588,714	982	24	83
***SN7O**	**549,056**	**1108**	**24**	**68**
SP2EWQ	521,703	1028	20	71
SP4Z	519,443	936	22	79
SP9JZU	327,780	648	17	73
SP1D	298,683	721	12	65
SP9HZW	278,559	622	18	63
***SP6GCU**	**264,348**	**821**	**2**	**61**
SP9DWT	231,990	681	4	62
SP1GZF	150,670	472	9	52
*SP8LBK	141,372	427	6	57
SP5WA	139,562	430	8	54
SQ8N	131,924	430	1	58
SP4W	131,040	494	1	51
SP4G	118,800	511	0	45
SP3JDZ	100,724	382	0	52
*SP9DNO	80,704	291	1	51
SP9RCL	76,260	232	10	50
SP5XO	67,466	112	13	66
SP1C	61,318	289	0	43
SP5TT	60,150	231	1	49
SP9MRO	54,824	183	1	55
SP7IWA	54,300	203	1	49
*SN2W	52,264	219	2	45
*SN1ØØBY	32,760	186	0	35
SN3A	31,220	70	1	69
*SQ4O	30,780	203	0	30
*SP2WGB	26,414	102	3	44
SP3ZHP	22,338	135	0	34
*SP5TAT	19,646	71	3	44
SP3QDM	6,120	29	5	19
*SP3BBS	5,820	60	0	20
*SP6FXY	1,725	26	0	15
*SP7CXV	420	7	0	7
	Portugal			
CT7ANO	**64,446**	**145**	**18**	**51**
***CT7AUP**	**45,031**	**172**	**1**	**48**
	Romania			
YO5LD	**916,902**	**1410**	**34**	**80**
YQ6A	**559,000**	**1028**	**22**	**78**
YO9HP	224,664	647	7	59
***YO4RDW**	**209,774**	**771**	**1**	**52**
***YO7CW**	**185,055**	**539**	**3**	**62**
YO7WC	153,282	486	8	51
YO4DW	137,484	495	1	53
YO8AXP	133,728	454	1	55
YO3FRI	117,104	431	0	52
YO7SR	99,498	269	6	63
YO2GL	96,096	360	4	48
*YO6FGZ	69,160	341	0	40
YO9BPX	3,885	34	0	21
	Scotland			
MM2N	**392,832**	**804**	**25**	**63**
GM3YEH	**274,720**	**592**	**17**	**68**
	Serbia			
***YT8A**	**607,110**	**1031**	**21**	**84**
***YU5R**	**436,020**	**928**	**21**	**65**
YT6T	**432,341**	**869**	**21**	**70**
YU7BW	**249,200**	**663**	**13**	**57**
*YU6DX	247,390	733	8	57
*YT5IVN	184,288	699	1	51
*YU5W	183,122	575	6	55
*YT1HA	127,200	467	0	53
*YU7D	92,412	343	3	48
*YU1ED	82,302	376	0	43
*YU1FG	50,740	229	0	43
*YT5N	9,680	98	0	20
	Sicily			
***IT9RWB**	**107,818**	**239**	**17**	**57**
*IT9RZU	37,802	180	0	41
	Slovak Republic			
OM7M	**1,501,360**	**1744**	**46**	**94**
OM3GI	**967,954**	**1417**	**33**	**85**
OM8AA	726,648	1287	26	76
OM7JG	581,210	1114	22	73
OM7LM	209,475	639	6	57
OM3BH	177,171	395	22	51
***OM7LW**	**157,829**	**641**	**0**	**49**
OM8LA	113,787	479	0	47
	Slovenia			
S53O	**1,261,362**	**1610**	**42**	**87**
S5ØK	**1,125,410**	**1483**	**43**	**87**
S5ØG	1,028,960	1507	33	85
S57Q	890,880	1344	33	83
S52W	869,414	1305	37	82
S56X	745,576	1243	30	77
S51YI	729,098	1227	31	76
S54X	451,758	964	24	62
S51RE	369,765	863	18	63
***S53V**	**348,257**	**722**	**23**	**66**
S5ØR	329,892	848	13	61
S57L	325,350	670	11	79
S59AA	194,292	603	4	59
***S56A**	**193,500**	**641**	**2**	**58**
*S51F	180,499	574	4	57
S53K	162,590	419	11	60
S58J	154,112	468	4	60
S54O	145,915	523	0	55
*S53MM	133,938	414	3	60
*S53FO	115,614	422	3	51
*S57EA	94,141	411	0	47
*S53F	71,665	255	3	52
*S57KM	62,952	298	0	43
*S57S	26,796	117	3	41
*S52WW	26,784	154	0	36
*S51RJ	24,752	147	0	34
*S51Z	23,220	99	0	43
S51DX	5,566	46	0	23
*S51CQ	120	5	0	4
	Spain			
EA7X	**1,207,305**	**1324**	**52**	**83**
EA5KA	**543,660**	**702**	**42**	**81**
EA5WU	470,288	691	40	72
EA2W	227,360	340	38	74
EF1A	214,550	570	9	61
EA1DAV	193,901	510	11	60
***ED1R**	**142,990**	**309**	**14**	**65**
EA3E	137,360	376	10	58
***EA3M**	**119,130**	**319**	**13**	**53**
*EA4AOC	101,750	236	21	53
EA5BY	77,180	198	8	60
EA7TG	65,136	150	19	50
EA5O	52,038	140	10	53
*EA1R	47,444	150	4	54
EA7AQR	6,699	44	0	29
EA1BNF	6,048	44	0	27
*EA1AIW	2,375	24	0	19
	Sweden			
SM4HCM	**725,305**	**1032**	**31**	**88**
SEØX	**415,249**	**914**	**15**	**68**
SM6M	395,703	678	26	73
SF1Z	279,381	766	11	58
***SD6F**	**217,769**	**713**	**6**	**53**
SM7PEV	74,589	307	0	47
*SM5EFX	54,474	252	0	42
*SK6QA	46,560	230	0	40
SM5C	39,104	151	2	45
*SM6A	18,305	102	0	35
SKØMT	7,980	38	0	35
*SF5O	6,501	35	0	33
*SM3OMO	3,100	30	0	20
	Switzerland			
HB9FBM	**468,480**	**1092**	**17**	**63**
HB9FKK	**190,976**	**569**	**6**	**58**
HB9TSW	167,360	501	6	58
HB9JOE	146,497	477	4	55
HB9DUR	41,405	162	0	49
HB9CZF	26,796	71	4	54
HB9FKL	13,212	67	2	34
	Ukraine			
UW1M	**946,296**	**1428**	**31**	**86**
UX1UA	**875,955**	**1302**	**32**	**83**
UT6UD	820,344	1277	29	85
UW5ZO	662,223	1060	29	78
UYØZG	624,901	1094	24	79
UT7CR	551,424	1101	20	76
UY1HY	539,320	1019	22	75
UT4U	537,471	1133	16	73
UT2AB	378,670	718	22	73
***UR5QU**	**283,410**	**831**	**7**	**60**
UXØFF	255,948	594	8	76
***UY7C**	**246,415**	**744**	**7**	**58**
*UW1U	237,575	718	8	57
UR7LY	211,919	523	13	60
EN5V	188,964	656	2	56
*UR7MZ	186,517	494	7	64
UR8RF	176,770	633	1	54
*UT6CW	164,224	512	7	57
UX6IR	133,454	476	1	52
UV2V	125,832	508	0	49
*UX3I	120,636	429	2	52
*UR2Y	115,950	446	1	49
*UY2RA	113,322	442	0	51
UT3N	102,088	361	6	50

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US5IQW	94,986	328	3	51
*UZ1WW	84,329	339	0	49
*UR1HR	81,046	317	0	49
UR5E	78,318	257	0	57
UW3U	63,408	273	1	47
*UT8IM	55,960	296	0	40
*UX1UF	41,697	192	0	41
UW3HM	41,412	200	0	42
UT5C	39,292	159	0	47
*UT4WA	31,040	154	0	40
US1UP	27,775	73	7	48
*USØKW	26,765	90	2	51
UY5QZ	24,990	158	0	34
*UR3PA	21,870	151	0	30
US6EX	21,340	55	12	32
*UTØNT	17,280	118	0	30
*US5EOI	9,558	83	0	27
*UT3EK	7,155	50	0	27
*UT3WX	4,674	49	0	19
UW5U	4,280	38	0	20
US7VF	4,085	22	0	19
*UT2HC	2,934	36	0	18
*UT4EO	1,716	30	0	12
*UT1US	1,560	14	2	11
*US3EO	570	11	0	10
US0LW	330	6	1	5
*UX7UU	75	3	1	2

OCEANIA

Australia

VK3TZ	**260**	**10**	**0**	**5**

Indonesia

***YC2VOC**	**1,000**	**25**	**0**	**8**
YCØOSX	**78**	**8**	**0**	**3**
*YC1JGE	28	7	0	2
*YC1BIQ	24	10	0	2
*YB8RW	14	2	0	2
YC3ATK	8	4	0	1
YC6JRT	8	4	0	1
*YC9WH	2	1	0	1
*YE3WIL	2	1	0	1

Philippines

DU6/N6SS	**66,951**	**161**	**9**	**34**

SOUTH AMERICA

Argentina

***LU2DX**	**13,134**	**47**	**18**	**15**
***LW8DQ**	**378**	**9**	**1**	**6**

Aruba

P4ØAA	**2,156,011**	**1518**	**56**	**87**

Bonaire

PJ4DX	**75,772**	**104**	**23**	**53**

Brazil

PY1NX	**21,960**	**60**	**4**	**36**
***PY2KC**	**968**	**14**	**2**	**9**
*PV8ABC	60	3	0	5
*PV8AAS	2	1	0	1

Chile

CE2LR	**140,400**	**187**	**41**	**37**

Colombia

HK1MW	**32,625**	**75**	**34**	**11**

Paraguay

ZP9MCE	**22,260**	**58**	**7**	**35**

Uruguay

CX6VM	**735,000**	**597**	**50**	**75**

MULTI-OP

NORTH AMERICA

UNITED STATES

MASSACHUSETTS

NF1A	**61,841**	**303**	**43**	**28**
N1SOH	48,792	356	48	9

NEW HAMPSHIRE

KM3T	**798,840**	**1334**	**58**	**82**

RHODE ISLAND

W1OP	**68,524**	**287**	**50**	**24**

NEW JERSEY

W2GD	**1,395,468**	**1780**	**58**	**88**
K2AX	**627,792**	**1139**	**56**	**76**

DELAWARE

N3DXX	**472,160**	**891**	**55**	**75**

MARYLAND

KØOO	**339,480**	**779**	**52**	**71**
K3CCR	**279,912**	**616**	**52**	**57**

PENNSYLVANIA

K3LR	**1,072,804**	**1760**	**58**	**76**
N3EB	**660,625**	**1304**	**57**	**68**
NJ3I	333,375	642	53	74
NE3F	250,560	587	51	57
W3MF	248,292	708	54	54

FLORIDA

K0DI	**842,656**	**1443**	**59**	**77**
AD4ES	**577,654**	**1125**	**55**	**66**
N4WW	433,810	834	57	73
K2DM	30,576	201	37	19

NORTH CAROLINA

N1LN	**696,828**	**1370**	**57**	**75**

TENNESSEE

WK9M	**37,314**	**276**	**46**	**8**

VIRGINIA

NR4M	**890,960**	**1391**	**58**	**82**
KC4D	**525,624**	**1119**	**57**	**64**
N4HB	369,600	951	52	58

OKLAHOMA

K5CM	**391,878**	**1059**	**58**	**60**

CALIFORNIA

NX6T	**151,293**	**632**	**55**	**32**
N6DZ	**128,612**	**483**	**53**	**26**
W6YX	115,672	536	51	25

ARIZONA

NA7TB	**588,672**	**1262**	**59**	**67**

MONTANA

K7QA	**194,618**	**891**	**57**	**29**

WASHINGTON

W7VJ	**117,290**	**629**	**54**	**20**

MICHIGAN

W8RT	**378,078**	**786**	**54**	**68**

OHIO

WB2RPW	**77,088**	**450**	**50**	**46**

ILLINOIS

N9EP	**95,120**	**419**	**54**	**26**
WS9V	69,441	383	49	30

WISCONSIN

W9FZ	**16,928**	**156**	**43**	**3**

COLORADO

NØKE	**94,380**	**489**	**54**	**24**

CANADA

LABRADOR

VO2AC	**1,704,417**	**1621**	**58**	**85**

QUEBEC

VE2OJ	**330,967**	**717**	**54**	**37**

BRITISH COLUMBIA

VA7MM	**51,975**	**236**	**40**	**5**

NORTH AMERICA

Dominican Republic

HI3AA	**212,040**	**381**	**45**	**45**

AFRICA

African Italy

IG9/S59A	**2,941,390**	**2152**	**48**	**89**

Madeira Islands

CR3V	**962,452**	**836**	**43**	**73**

ASIA

Asiatic Russia

RA9Y	**1,173,600**	**1295**	**17**	**83**
RD8D	**1,026,348**	**1249**	**8**	**81**
RW0A	810,495	1099	9	74
R8IZ	385,786	658	1	66
RZ9L	195,572	425	0	52
RK9CYA	85,444	250	0	41
R9WXK	35,950	169	0	25
RCØL	20,463	195	4	15
RØMM	1,315	55	0	5

Asiatic Turkey

TCØX	**2,746,668**	**2250**	**41**	**88**

Cypress

P33W	**2,730,192**	**2076**	**41**	**97**

Israel

4X2M	**2,005,560**	**1718**	**36**	**84**

Japan

JA3YBK	**566,280**	**691**	**38**	**61**

Mongolia

JT5DX	**1,318,812**	**1446**	**21**	**82**

Republic of Korea

6LØNJ	**1,484**	**76**	**0**	**4**

Thailand

E2X	**148,911**	**367**	**0**	**49**

West Malaysia

9M4COO	**2**	**1**	**0**	**1**

EUROPE

Aland Islands

OHØZ	**1,557,080**	**1859**	**44**	**96**

Austria

OE6U	**145,310**	**506**	**3**	**52**

Belarus

EW5A	**2,041,068**	**2101**	**47**	**101**
EU1XX	**472,149**	**1084**	**9**	**72**

Belgium

OT6M	**1,277,328**	**1498**	**46**	**92**

Bosnia-Herzegovina

E7DX	**1,576,740**	**1933**	**40**	**92**

Bulgaria

LZ9W	**1,403,928**	**1666**	**44**	**92**
LZ5R	**1,240,248**	**1675**	**35**	**89**
LZ7A	585,480	990	31	74

Croatia

9A1P	**1,822,620**	**1970**	**49**	**99**
9A7T	**544,946**	**1027**	**23**	**74**

Czech Republic

OK7K	**2,153,792**	**2260**	**48**	**98**
OL4A	**1,804,498**	**2035**	**46**	**93**
OK5Z	1,713,712	1975	47	96
OL1R	1,367,534	1701	46	91
OL1A	1,247,400	1616	42	90
OK1KSO	1,011,024	1442	41	77
OK7O	705,240	1174	34	74
OK6O	654,168	1230	27	70
OL1C	603,243	1159	30	67
OL1B	25,020	140	0	36

Denmark

OZ5E	**854,778**	**1362**	**34**	**75**

England

G4AQG	**584,592**	**892**	**37**	**77**
G4IIY	426,384	667	33	75
GØAZH	23,636	116	5	33

European Russia

RL3A	**2,016,540**	**2089**	**51**	**102**
UA7K	**1,937,250**	**2094**	**48**	**102**
UA4M	1,227,590	1576	40	93
RC3W	1,093,125	1530	32	93
RT4F	969,493	1419	27	92
RY6Y	740,272	1273	20	84
RA5G	725,328	1223	24	84
R7GU	1,729	30	0	13

Finland

OH5Z	**900,315**	**1386**	**31**	**86**
OH4A	**740,025**	**1335**	**19**	**80**
OG9W	606,300	1097	19	81
OG70AD	44,360	219	0	40

France

TM6M	**1,681,425**	**1835**	**51**	**90**

Germany

DM7C	**1,214,019**	**1697**	**38**	**91**
DR5X	**1,131,000**	**1549**	**43**	**87**
DP7D	1,048,452	1597	38	85
DA2X	1,030,478	1495	40	87
DQ4W	947,422	1498	33	85
DR5L	748,000	1266	36	74
DP6A	743,301	1163	41	76
DR4W	621,191	1067	34	75
DL7AU	589,710	970	33	77
DL7A	436,220	1036	19	66
DK7A	432,060	878	28	67
DLØHMK	399,076	851	23	66
DFØBW	176,755	722	0	53
DKØTU	165,048	475	14	55
DM5A	26,381	150	0	37

Hungary

HG8DX	**1,568,160**	**1871**	**44**	**91**
HG7T	**961,491**	**1344**	**39**	**84**
HG5A	904,591	1473	32	77

Ireland

EI0R	**1,422,560**	**1651**	**48**	**88**

Italy

IK2YCW	**1,407,672**	**1757**	**45**	**88**
IZ4BOY	**974,259**	**1432**	**39**	**78**
IQ3RK	533,208	929	33	71
IZ2KXC	486,214	879	26	75
IQ3ME	80,406	289	4	50
IQ5ZP	58,128	198	7	49
IK8YFU	3,888	43	0	18

Kaliningrad

UA2FW	**1,620,462**	**1997**	**39**	**95**

Latvia

YL7X	**1,194,480**	**1634**	**40**	**86**

Lithuania

LY2XW	**912,600**	**1465**	**28**	**80**
LY2J	**403,875**	**1025**	**9**	**66**
LY4O	363,545	1066	9	56

Netherlands

PI4DX	**1,498,902**	**1772**	**46**	**85**
PA8AD	**873,600**	**1368**	**38**	**74**
PA6NB	866,484	1318	36	77
PA6X	850,164	1291	42	74

Poland

SP8R	**1,578,067**	**1811**	**47**	**92**
SN2B	**1,128,596**	**1627**	**38**	**81**
SO7M	459,440	1100	13	67

Romania

YP5A	**254,910**	**847**	**2**	**56**
YO4KAK	2,760	36	0	15

Scotland

GM6NX	**144,152**	**338**	**11**	**63**

Serbia

YTØA	**806,725**	**1206**	**33**	**82**

Slovak Republic

OM2Y	**1,440,789**	**1796**	**40**	**93**
OM4Q	**450,140**	**1224**	**11**	**60**

Slovenia

S5ØW	**1,221,400**	**1691**	**38**	**86**
S53M	**1,159,375**	**1574**	**42**	**83**
S5ØC	1,101,244	1556	37	87
S53DIJ	770	12	0	11
S59T	550	10	0	10
S59EIJ	245	6	0	7

Spain

EA2RCA	**56,264**	**202**	**8**	**44**

Sweden

SK3W	**1,732,290**	**1865**	**50**	**96**
SJ2W	**1,150,248**	**1498**	**43**	**89**
SC7DX	415,096	873	20	68
SB3W	1,500	18	2	10

Switzerland

HB7X	**886,170**	**1406**	**37**	**72**

Ukraine

UZ3A	**1,054,446**	**1491**	**33**	**89**
EM3ØUCC	**466,908**	**1113**	**12**	**70**
UR4RWW	208,494	767	0	54
UW4U	84,667	401	0	43
UW6M	27,510	183	0	30

OCEANIA

Hawaii

KH6LC	**173,873**	**302**	**45**	**14**

Indonesia

7A2A	**23,760**	**107**	**0**	**27**
7B1B	12,272	67	2	24
7A1A	11,725	63	0	25

Philippines

4D2X	**78,329**	**218**	**3**	**34**

SOUTH AMERICA

Brazil

ZW5B	**78,864**	**137**	**23**	**39**

Curacao

PJ2T	**2,141,644**	**1519**	**57**	**85**

CHECK LOGS

4K6FO, 9A7Y, AA7G, DF2SD, DF8V, DL1EMY, DL1HUH, DL2RUG, DL6KVA, DL6UAA, DL6UD, DL7CX, DM5EL, DM6WAN, E74SL, EA1AF, EA1YO, EA3O, EA6NB, EA7BJ, EC5A, EW6F, GM4OSS, GU4EON, HA1DAE, HG1G, HG2DX, HG4W, IK5BOH, IZ3GNG, JA5EXW, JA5FNX, JH9DRL, JI3BFC, LA1U, LA9OI, LZ6E, M3M, N3IQ, N8OO, NB3R, OK1BLU, OK1HEH, OK2BZ, OK2OHA, OK2PAY, OK2SG, OK4MM, OK4RQ, OL6M, ON4CT, OT4A, OZ6GH, OZ6KS, PY2RO, R2PA, R3AT, R4DK, R6YY, R7AB, RA9DZ, RD3R, RK3T, RK6AQP, RM3M, RN4WA, RTØF, RU6L, RW3LL, RW6AF, RW7M, RY9C, RZ3AUL, RZ3DW, S53R, S57WJ, SMØMPV, SM3CZS, SM3EVR, SM5GLC, SM7IUN, SP3FAR, SP3J, SP3P, SP6CC, SP6GJY, SP6NZ, SP7HOV, SP8HKT, SP8MVC, SP9CVY, SP9FOW, SQ5NRY, SQ8L, SV1PMQ, SV3RF, SV9DJO, TF3SG, UA1AIR, UA3EDQ, UA4W, UA9CNX, UB5QBB, UC7M, UK9AA, UN2G, UN3GX, UN4PD, UR3EZ, UR5WA, UR6EA, UR7EY, USØTA, US3EZ, US3IW, US4IDY, US5WE, UT3NF, UT5CB, UT5EA, UT5EO, UT5UGR, UT7E, UT7LW, UY8IF, VE3XO, VK2CCC, VR2EH, W7UB, WS7L, XE2B, YO8SEP, YO8TTT, YT6W.

SSB RESULTS

SINGLE OPERATOR

NORTH AMERICA

UNITED STATES

CONNECTICUT

K1KI	**98,928**	**475**	**48**	**24**
***KC1SA**	**2,128**	**50**	**19**	**0**
K1BUK	1,440	42	15	0
*KB1EHE	1,305	39	15	0

MAINE

K1LZ	**338,548**	**736**	**55**	**52**
K1WHS	64,396	253	39	29
N1FR	1,746	44	18	0
***WA1MJS**	**1**	**-4**	**0**	**0**

MASSACHUSETTS

K5ZD	**19,035**	**133**	**37**	**10**
***W1IZZ**	**13,158**	**127**	**38**	**5**
*W1FJ	3,240	57	22	2
*KB1VXY	2,840	59	19	1
W1AST	2,214	54	18	0
*W4FEB	552	23	12	0

NEW HAMPSHIRE

W1OC	**112,995**	**532**	**55**	**26**
***W1LJD**	**36,015**	**322**	**43**	**6**
W1FKF	15,120	140	36	6

RHODE ISLAND

W1XX	**181,645**	**785**	**52**	**33**
***N1EYE**	**2,200**	**46**	**19**	**1**
*WA1LAD	1,035	30	15	0

VERMONT

N1UR	**103,180**	**485**	**51**	**26**

NEW JERSEY

***N2HMM**	**51,747**	**470**	**41**	**6**
WO2T	**26,356**	**258**	**39**	**5**
*KC2WUF	9,999	129	31	2
*W2NMI	8,398	104	32	2
W2TT	6,720	83	29	3
*W3PR	4,108	67	24	2
*W2IOC	1,650	52	15	0
*N2CJ	1,445	41	17	0
KC2G	1,395	39	15	0
*NB2F	605	26	11	0
*WA2ALY	468	18	12	0
*K2YG	341	14	11	0
*KD2DVW	126	9	7	0
*WA2ACV	98	7	7	0
*K2AL	2	1	1	0

NEW YORK

K2XA	**160,290**	**814**	**54**	**24**
WS9M	21,070	164	40	9
***WA2JQK**	**19,608**	**201**	**41**	**2**
*KV2X	11,760	137	31	4
NS2N	10,138	118	34	3
*WB2NFL	5,950	101	23	2
*KX1W	4,450	74	23	2
*N2BEG	3,892	65	27	1
*N2MTG	3,300	57	23	2
*N2NOM	3,078	72	19	0
*W2TE	2,100	45	18	2
*AC2VE	1,326	33	17	0
*AC2OC	1,207	31	16	1
*K2KU	90	6	6	0
*KC2SYF	24	4	3	0

DELAWARE

***KS3D**	**36,608**	**304**	**45**	**7**
*N8NA	11,544	138	35	2

DISTRICT OF COLUMBIA

4U1WB	**17,990**	**239**	**33**	**2**
***KE3X**	**714**	**21**	**13**	**1**

MARYLAND

K3ZO	**109,340**	**586**	**46**	**25**
K3TC	41,157	360	44	7
W3KL	25,427	230	42	5
***W3MBC**	**22,043**	**181**	**37**	**10**
K1BZ	20,034	205	38	4
KG4USN	13,923	156	37	2
N3TE	9,928	124	31	3
NC3Y	7,080	99	27	3
*WA3FAE	6,780	97	27	3
*W3IUU	5,796	90	26	2
*K3KU	2,618	52	20	2
N3XL	1,710	40	18	0
*KC3JPP	1,200	30	16	0

PENNSYLVANIA

W3BGN	**183,440**	**821**	**49**	**31**
W3TS	**114,595**	**769**	**54**	**11**
N3XZ	26,070	182	44	11
***AJ3T**	**25,830**	**284**	**39**	**2**
K3UA	22,058	251	40	1
*WS3C	21,882	231	38	4
K3SWZ	17,190	147	38	7
K3PP	11,760	140	32	3
K3VZ	10,185	122	32	3
*K3FAZ	9,324	116	34	2
N3RD	8,466	100	30	4
*KT3RR	6,360	88	28	2
*K3HX	2,838	57	22	0
*WA3ADI	2,176	55	17	0
*WA3GM	162	9	9	0
*KA3KSP	144	9	6	0

ALABAMA

AG4W	**51,590**	**426**	**47**	**8**
***K4WI**	**10,080**	**110**	**36**	**4**
*N4UC	5,882	76	32	2
*AE4M	2,500	44	24	1
*KY4G	1,139	32	16	1
W4BXI	480	16	14	1

FLORIDA

KM4HI	**22,491**	**196**	**38**	**11**
K9QLL	16,468	140	38	8
WX4US	16,350	140	44	6
KT3V	8,092	107	31	3
***WA3LXD**	**7,280**	**88**	**32**	**3**
*WB4OMM	1,020	23	15	2
*K8RGI	333	14	7	2
*K3SV	306	10	7	2

GEORGIA

KU8E	**77,280**	**464**	**49**	**20**
***K4GTR**	**12,054**	**125**	**37**	**4**
*AA4LR	9,520	121	31	3
*N4JVP	8,715	111	33	2
K4BAI	2,664	48	23	1
*N4ZRA	728	23	14	0
*KN4DLS	120	5	0	4

KENTUCKY

ND4Y	**104,082**	**693**	**51**	**15**
N4ZY	27,542	266	45	2
***K4TG**	**21,956**	**228**	**42**	**2**
*WR4F	13,464	134	40	4
*KJ4AOM	10,880	140	31	3
K4WW	10,116	120	34	2
W4KP	6,270	94	28	2
*WA4ZKO	4,840	53	38	2
AB4IQ	2,832	53	22	2

NORTH CAROLINA

N4XD	**88,920**	**444**	**49**	**23**
NG4C	54,264	483	45	6
***K4TMC**	**23,000**	**261**	**37**	**3**
*KK4RV	20,080	228	35	5
W3DQS	9,633	105	35	4
*N1XL	7,887	106	31	2
*N3CKI	2,926	59	20	2
WE6C	2,254	39	20	3
K4KZ	2,090	43	20	2
N4YDU	1,700	47	17	0

SOUTH CAROLINA

***N4XL**	**48,730**	**401**	**47**	**8**
K3DNE	**41,219**	**407**	**38**	**9**
*WA4LDU	24,300	215	45	5
*NU4E	6,815	99	25	4
*KM4RK	4,930	73	27	2
*WN4AFP	352	13	11	0

TENNESSEE

KC4NX	**46,800**	**412**	**48**	**4**
K4RO	40,975	332	47	8
***AC4G**	**17,766**	**163**	**43**	**4**
*KZ4TN	16,440	185	37	3
*KB9DKR	13,448	145	38	3
WB4YDY	12,804	125	40	4
*KS4X	10,947	120	39	2
KØEJ	6,169	95	30	1
K4HWS	5,518	76	28	3
KJ4JPV	4,147	67	27	2
*N4NT	3,700	65	24	1
*WF7T	1,280	29	19	1

VIRGINIA

K3ZM	**302,736**	**981**	**55**	**47**
***KB4OLM**	**51,832**	**546**	**42**	**2**
W4WWQ	26,100	219	44	6
N4DJ	16,716	171	39	3
*K4FJW	15,621	168	39	2
*N4CF	15,351	152	40	3
K4CGY	14,706	161	41	2
KG3V	12,348	143	31	5
AF4CD	11,507	128	32	5
*AD4TJ	6,750	96	28	2
*K4FTO	6,380	98	28	1
K4YCR	6,303	83	30	3
NN4RB	5,376	81	26	2
N8AID	4,929	58	26	5
KI5FJ	3,696	64	19	5
*N2QT	2,430	59	17	1
*KG4WOJ	2,156	40	20	2
*N9NB	1,547	44	17	0
*W4VG	810	24	15	0

ARKANSAS

W5KI	**8,568**	**87**	**40**	**2**
***K5PO**	**4,900**	**64**	**33**	**2**

LOUISIANA

***KV8S**	**11,792**	**115**	**41**	**3**

MISSISSIPPI

***W5RCG**	**4,464**	**63**	**28**	**3**
*K1JHS	3,456	51	23	4
*K5XU	2,332	50	21	1
KF5BA	**1,530**	**38**	**16**	**2**
*N5YW	242	11	11	0

NEW MEXICO

***W5RJJ**	**7,600**	**89**	**40**	**0**
AF9O	**1,752**	**35**	**23**	**1**
*NM5S	1,520	38	20	0
K5TBA	1,024	32	16	0

OKLAHOMA

WD5CSK	**26,936**	**214**	**51**	**5**
***W5TMC**	**17,460**	**184**	**43**	**2**
K5LAD	14,535	148	42	3
N5QIM	756	21	18	0

TEXAS

***N1XS**	**24,365**	**186**	**47**	**8**
W5PR	**5,082**	**61**	**27**	**6**
*KR5G	4,521	63	30	3
*K5RX	3,050	45	23	2
K5AVY	986	26	16	1

*NN5T	735	23	14	1
*WA5DSS	162	9	9	0
KF5NRS	50	5	5	0
CALIFORNIA				
W6AFA	**14,250**	**167**	**33**	**5**
AI6LY	6,975	108	29	2
***N6LL**	**3,197**	**55**	**20**	**3**
KE6QR	3,094	85	17	0
*WN6K	1,460	35	19	1
KW6S	864	33	10	2
*KA9A	360	20	9	0
*WB6KDH	175	11	6	1
*W6REK	36	6	3	0
*K7XE	32	4	4	0
*W6JK	30	5	3	0
AG7JQ	24	4	3	0
ARIZONA				
N7RK	**18,179**	**148**	**46**	**7**
K7HP	5,478	70	30	3
W7ON	1,615	38	17	2
KB7AZ	1,152	29	16	2
***K7HKR**	**340**	**17**	**10**	**0**
IDAHO				
KØIP	**3,366**	**72**	**22**	**0**
***KJ7YY**	**768**	**21**	**16**	**0**
*W7TX	174	13	6	0
MONTANA				
***K7VIC**	**6,688**	**72**	**35**	**3**
*AB5ZA	2,340	39	26	0
NEVADA				
WU6W	**910**	**35**	**13**	**0**
***N7XCZ**	**112**	**8**	**7**	**0**
OREGON				
W7ZB	**7,887**	**99**	**30**	**3**
***AF7NX**	**1,717**	**51**	**16**	**1**
*W7MTL	576	26	9	0
*KF7RSF	1	0	0	0
UTAH				
NG7M	**4,524**	**72**	**28**	**1**
KF7ZN	480	20	12	0
WASHINGTON				
N7AU	**23,970**	**221**	**44**	**3**
K7IU	10,560	145	31	2
K7STO	4,228	73	25	3
N7QOZ	1,590	47	15	0
***N7GCO**	**1,552**	**41**	**15**	**1**
WX7P	1,513	37	17	0
*N7ZUF	1,260	45	12	0
KB7BTO	688	36	7	1
WG7X	590	25	10	0
KI7DG	584	32	8	0
*KE7ZAC	238	14	7	0
*KG7DAB	16	4	2	0
*KJ7LAN	12	3	2	0
*W7FZY	1	0	0	0
MICHIGAN				
NA8V	**199,827**	**1016**	**55**	**26**
***W8CO**	**89,205**	**694**	**53**	**4**
*W8GP	51,012	446	49	3
N8OL	48,510	395	50	5
WN8HCV	8,584	110	37	0
*K8ZO	5,888	83	32	0
*K8MJZ	3,075	54	24	1
*KD8GBK	2,304	45	23	1
WM8Z	2,139	42	22	1
*K7DR	340	17	10	0
OHIO				
ND8DX	**213,891**	**1031**	**55**	**28**
K8RR	86,800	622	54	8
N8BI	78,660	613	50	7
W8MET	50,094	491	44	2
KW8N	40,700	364	46	4
***KA8CNI**	**26,673**	**240**	**46**	**5**
*K8MJH	26,010	270	44	1
*WB8JUI	17,983	163	46	3
*KD8BB	15,951	185	37	2
*AB8OU	12,558	143	37	2
*W8KNO	10,450	124	37	1
*KG9Z	10,413	113	36	3
*N8HP	10,260	119	36	2
*K8VUS	10,222	118	37	1
*K8SVT	10,138	116	35	2
*N8IW	6,420	85	27	3
W8BI	6,048	87	30	2
*W8TB	5,730	85	28	2
*W8XY	5,490	84	29	1
*KB8UUZ	5,332	71	29	2
KE8NBC	4,340	64	30	1
*N8VWY	3,429	59	27	0
WA8ZIP	2,394	54	18	1
*WO3X	1,843	41	19	0
*KD8MXE	1,258	34	17	0
*WB8PIY	994	31	13	1
*KA8BSA	765	21	17	0
*WB8WUA	432	18	12	0
WD8E	261	10	8	1
WEST VIRGINIA				
K8JQ	**29,600**	**369**	**36**	**1**
***N8II**	**14,134**	**166**	**33**	**4**
K8GQ	10,000	103	37	3
N4RA	5,952	84	29	2
WA8KAN	5,239	74	29	2
*KA9NJW	1,230	38	15	0
ILLINOIS				
K9ZO	**89,536**	**624**	**54**	**10**
***N9LYE**	**17,252**	**215**	**37**	**1**
*WB8BZK	14,534	148	41	2
*WR9L	12,600	129	40	2
*WO9I	10,920	122	38	1
*WB9HFK	9,082	103	36	2
*KØPG	7,092	88	34	2
N9TO	4,256	64	26	2
WA9KIA	672	21	14	0
*KC9YDV	280	11	10	0
*KD9MS	2	1	1	0
INDIANA				
***KB9OZI**	**13,079**	**137**	**39**	**2**
KJ9Z	**9,842**	**113**	**36**	**2**
*W9RE	9,028	100	34	3
K9LA	8,588	101	37	1
*K8VGL	8,512	100	37	1
*K9GX	7,750	118	29	2
*W9TC	5,053	70	29	2
N9MR	4,768	67	31	1
KJ9C	4,544	65	30	2
*AC9EZ	3,818	68	22	1
*WB9NOO	2,645	50	23	0
*W9MRH	2,400	47	24	0
WISCONSIN				
N9GH	**22,896**	**184**	**50**	**4**
***W9AV**	**14,196**	**151**	**41**	**1**
ND9Z	13,735	145	39	2
*K9VER	3,744	66	26	0
NN9C	3,591	59	27	0
*AC9TO	208	13	8	0
COLORADO				
NØKQ	**2,150**	**40**	**25**	**0**
AKØBC	1,407	32	21	0
***AAØCW**	**768**	**24**	**16**	**0**
*WAØEJX	8	2	2	0
IOWA				
NG7A	**25,965**	**264**	**42**	**3**
***NØGZ**	**20,972**	**196**	**47**	**2**
KDØZV	14,760	149	44	1
NØDQS	10,620	93	40	5
*KØSRL	4,608	63	31	1
*KIØEO	1,121	28	19	0
*ADØH	504	18	14	0
KANSAS				
WØNO	**70,943**	**525**	**53**	**8**
WØBH	11,172	129	41	1
***NØYO**	**9,374**	**96**	**39**	**4**
NØYET	5,742	80	31	2
NZØF	3,654	63	29	0
KDØEZS	2,314	43	25	1
KØAP	2,280	40	23	1
MINNESOTA				
KØTT	**89,962**	**638**	**54**	**8**
KØYR	59,177	450	54	5
***NGØC**	**40,698**	**366**	**49**	**2**
KØMD	28,150	256	50	0
NØOK	15,980	151	44	3
NØUY	10,692	102	41	3
WBØVAK	10,542	99	39	3
K9WN	384	16	12	0
MISSOURI				
KIØI	**66,154**	**483**	**54**	**8**
***KØPHP**	**19,635**	**181**	**48**	**3**
NØLBY	10,878	115	39	3
NWØM	2,398	50	22	0
K8MCN	944	28	15	1
NEBRASKA				
WDØBGZ	**17,484**	**173**	**45**	**2**
***WB9QAF**	**4,096**	**61**	**31**	**1**
NFØN	1,273	32	19	0
NORTH DAKOTA				
KØIDX	**105,690**	**697**	**54**	**11**
SOUTH DAKOTA				
***WDØT**	**18,277**	**173**	**47**	**2**

CANADA

NEW BRUNSWICK				
***VE9RLW**	**1,274**	**20**	**14**	**0**
NOVA SCOTIA				
VA1RST	**7,272**	**62**	**21**	**3**
PRINCE EDWARD ISLAND				
VY2ZM	**745,461**	**1033**	**56**	**57**
QUEBEC				
***VE2HAY**	**6,720**	**70**	**21**	**0**
*VA2LGQ	1,365	21	12	1
*VE2QV	1,183	20	13	0
*VE2GT	174	7	6	0
ONTARIO				
VE3PN	**205,190**	**555**	**48**	**23**
***VE3MGY**	**203,112**	**671**	**54**	**8**
VE3DZ	**140,882**	**499**	**48**	**10**
VA3AR	117,355	488	44	5
*VA3AC	99,603	403	45	6
*VA3NW	38,581	192	38	3
VE3KP	29,930	154	39	2
*VE3VY	19,807	145	27	2
*VE3TW	14,790	108	28	1
VE3KZ	14,728	113	27	1
VA3SK	10,943	72	28	3
*VA3TTB	10,206	78	26	1
*VA3RKM	8,664	77	23	1
*VE3EUR	8,234	77	21	2
VE3MT	6,600	63	21	1
*VE3VN	5,612	50	22	1
*VE3SST	5,523	55	21	0
VE3BR	5,302	50	22	0
VE3EJ	5,103	50	18	3
*VE3LC	5,061	53	21	0
*VE3LMS	3,648	39	18	1
*VA3FN	550	11	10	0
*VE3BK	520	13	8	0
MANITOBA				
***VE4VT**	**10,268**	**64**	**33**	**1**
SASKATCHEWAN				
***VA5KMG**	**203**	**7**	**7**	**0**
ALBERTA				
VE6TK	**2,640**	**27**	**20**	**0**
***VA6RCN**	**252**	**9**	**6**	**0**
BRITISH COLUMBIA				
***VA7EU**	**7,056**	**82**	**18**	**0**

NORTH AMERICA

Cayman Islands				
ZF5T	**623,370**	**988**	**56**	**54**
ZF2AM	**465,360**	**792**	**56**	**49**
Dominican Republic				
***HI8DL**	**240**	**7**	**1**	**5**
Mexico				
XE1RF	**3,003**	**30**	**17**	**4**
Puerto Rico				
***WP3UX**	**8,520**	**51**	**19**	**11**
*WP4RF	2,268	20	0	14

AFRICA

Canary Islands				
ED8W	**21,132**	**60**	**12**	**24**
***EB8AYA**	**4,536**	**27**	**0**	**18**
Ceuta & Melilla				
***EA9E**	**2,112**	**20**	**0**	**11**

ASIA

Asiatic Russia				
R8WF	**84,398**	**240**	**0**	**38**
UA9CAW	36,735	131	0	31
R9CS	21,950	96	0	25
RZ9WU	5,148	47	0	13
RW9QA	4,411	51	0	11
***RZ9YN**	**1,232**	**25**	**0**	**8**
RA9AEA	660	11	0	6
*R8MB	120	8	0	3
RKØUN	40	6	0	2
Asiatic Turkey				
***TA3LHH**	**7,416**	**43**	**0**	**18**
*TA2LP	300	6	0	5
*TA4RC	260	6	0	5
Georgia				
4L2M	**42,900**	**152**	**0**	**30**
Isreal				
4Z5LY	**34,110**	**118**	**0**	**30**
Kyrgystan				
***EX8MK**	**150**	**7**	**0**	**3**

EUROPE

Austria				
***OE3WMW**	**53,655**	**309**	**0**	**35**
OE1HHB	**18,734**	**131**	**0**	**29**
*OE2GEN	7,824	67	0	24
OE1XTU	1,890	27	0	14
*OE2IJL	288	7	0	9
Balearic Islands				
***EA6SA**	**3,060**	**36**	**0**	**17**
Belarus				
EU4E	**33,726**	**200**	**0**	**33**
EW8R	29,977	185	2	29
Bosnia-Herzegovina				
***E77EE**	**13,857**	**88**	**0**	**31**
Bulgaria				
LZ1YE	**17,520**	**113**	**0**	**30**
LZ2XF	16,744	127	0	26
Croatia				
***9A3SM**	**2,400**	**40**	**0**	**12**
Czech Republic				
OK1KPU	**119,790**	**544**	**2**	**43**
***OK1LRD**	**84,832**	**396**	**2**	**42**
OK1HFP	43,396	237	1	37
OK1OA	42,066	225	0	38
*OK2BRQ	35,013	221	1	32
*OK1K	29,222	156	2	36
*OK1BJ	22,214	164	0	29
OK2IUH	19,285	141	0	29
*OK2TS	14,796	115	0	27
*OK1MJA	11,676	90	0	28
*OK2AK	9,880	82	0	26
*OK1FU	8,568	86	1	20
OK2EQ	7,820	71	0	23
*OK1XC	6,292	62	0	22
*OK6AB	4,921	56	0	19
*OK1KMU	3,920	55	0	16
*OK2QA	3,774	45	0	17
*OK2VIR	3,616	50	0	16
*OK1FUK	968	20	0	11
Denmark				
***OZ4NA**	**26,272**	**166**	**0**	**32**
OZ1ZD	**17,984**	**111**	**1**	**31**
OZ1D	11,882	90	0	26
OV1RR	2,325	31	0	15
England				
M3D	**56,212**	**204**	**9**	**43**
G4AFJ	26,896	127	3	38
G0OIK	18,795	104	3	32
G4L	6,440	56	0	23
MØMCV	4,940	52	0	19
G1VWC	330	11	0	6
Estonia				
ES5RW	**301,000**	**809**	**14**	**56**
***ES2DJ**	**176**	**10**	**0**	**4**
European Russia				
RA3XM	**70,460**	**267**	**6**	**46**
UA4LCH	48,258	231	4	38
RA1ZZ	40,303	203	2	39
RC5Z	39,780	209	1	38
***RK3E**	**33,966**	**214**	**0**	**34**
RC2SB	30,400	162	1	37
*RA3RA	25,806	156	1	33
*UA1CUR	25,760	165	1	31
*R7KR	24,563	178	0	29
*R2AL	23,220	181	0	27
RA4FUT	16,632	124	0	28
RM4HZ	15,680	114	0	28
*RD3DS	12,825	107	0	25
*RV6ARZ	12,098	109	0	23
*R5RC	11,840	126	0	20
RG7M	11,040	99	0	23
RA3EA	9,526	91	0	22
*R6BT	8,337	96	0	21
*UA6AUA	7,128	57	0	24
R3OM	6,327	73	0	19
*UA1OM	4,968	60	0	18
RM4W	4,505	50	0	17
*R2PT	4,048	52	0	16
*UD4C	3,108	44	0	14
*UG3G	2,782	47	0	13
*RV3X	2,652	46	0	12
R4RB	2,000	43	0	10
R3OQ	1,391	31	0	13
R5QQ	1,232	23	0	11
*UA4FER	952	25	0	7
*R4FCJ	810	16	0	10
RK7T	531	15	0	9
*R5GR	322	11	0	7
RA3NC	205	10	0	5
*R2EL	148	11	0	4
Finland				
***OH6ECM**	**20,160**	**145**	**0**	**28**
OH1LAR	**2,445**	**32**	**0**	**15**
*OH1XFE	2,015	31	0	13
*OH6EPM	60	4	0	3
Germany				
DF2DJ	**64,100**	**272**	**4**	**46**
DL2SAX	58,056	330	0	41
DLØESA	47,360	267	1	39
***DK1KC**	**45,360**	**274**	**1**	**39**
*DG5MLA	45,150	263	3	39
*DH4RJ	42,439	268	1	36
*DP3P	42,294	245	2	40
DF1TB	40,373	193	4	43
DL1GWS	32,301	202	1	36
*DL2OE	31,198	195	2	36
*DO4OD	30,693	182	3	36
*DL8DSL	30,400	184	1	37
DL5AWE	30,340	165	3	38
*DL4ZA	28,980	205	2	33
*DM5SB	26,705	173	0	35
*DJ1WF	23,555	153	0	35
DK7AM	23,528	163	2	32
*DQØZ	23,086	160	3	31
*DL5ALW	22,671	151	0	33
DK6CQ	21,248	156	0	32
DJ6NL	17,816	134	1	33
*DL8BZ	17,391	137	0	31
*DKØBM	17,360	157	0	28
*DL2TOS	17,052	140	0	29
DM4X	16,071	113	0	33
*DJ4MH	15,720	130	0	30
*DL8UV	15,500	115	2	29
DJ7OQ	14,756	97	0	31
*DAØDOM	14,580	112	0	30
*DL9RDM	13,830	101	0	30
DL1AX	13,608	111	0	28
*DL2NBJ	13,543	104	0	29
*DK4ZZ	13,496	123	1	27
*DB4LL	12,987	110	0	27
*DFØBV	12,852	114	0	27
DL8LAS	12,628	101	0	28
*DLØAVH	12,557	100	0	29
*DL8BF	12,428	116	0	26
*DL8ZU	11,882	119	0	26
DL6MFK	11,310	95	0	26
*DO1UKR	11,116	94	0	28
*DM2AWM	10,488	100	0	24
*DK1RU	10,323	74	0	31
*DB8AH	10,314	91	0	27
*DL6RBH	9,750	85	1	24
*DKØABT	9,372	105	0	22
DF6RI	9,288	87	0	24
*DO1DKX	7,925	73	0	25
*DL9NEI	7,420	90	0	20
*DF2FM	7,260	78	0	22
*DL2LSM	7,200	63	0	25
*DL8BFV	7,125	64	0	25
*DL2SWR	6,980	79	1	19
*DL1HSI	6,940	88	0	20
*DK3GI	6,314	70	0	22
DL1DWW	5,859	63	0	21
*DB9OH	5,640	63	0	20
*DM5Z	5,523	61	0	21
*DB4RG	5,275	43	0	25
DH6BAI	4,608	61	0	18
*DK3YD	4,410	58	0	18
DL1ATZ	4,332	54	0	19
*DB5ABS	4,300	55	0	20
*DL7UAI	4,212	57	0	18
*DD5MA	3,757	55	0	17
*DL1RV	2,944	44	0	16
*DL5RMH	2,366	40	0	13
*DL7NDS	2,265	32	0	15
*DL3ARM	2,041	35	0	13
*DL3DRN	2,002	35	0	13
*DO4MTB	1,872	24	0	16
DKØSU	1,740	25	0	15
*DL6WA	1,560	22	0	15
*DH2UAK	1,368	30	0	12
*DL4ML	1,177	28	0	11
*DLØEB	1,020	20	0	12
*DC9BG	913	19	0	11
DK1LRS	869	17	0	11
DL7LX	780	18	0	10
*DO6LE	639	16	0	9
*DM4KR	459	12	0	9
*DL1ONI	343	11	0	7
*DH8DR	329	13	0	7
*DL2RCH	273	9	0	7
*DL1AOB	245	7	0	7
*DL1PAN	225	9	0	5
*DO9HC	80	4	0	4
*DF4HA	5	1	0	1
*DLØMBG	5	1	0	1
Greece				
SV2JAO	**25,776**	**147**	**0**	**36**
SV6JHA	14,518	83	0	34
***SV1/SV3QUY**	**2,635**	**38**	**0**	**17**
*SV3AUW	2,592	29	0	18
Hungary				
***HA8WY**	**63,102**	**321**	**1**	**38**
Iceland				
TF2LL	**2,850**	**30**	**0**	**19**
Ireland				
***EI3ENB**	**6,785**	**57**	**2**	**21**
EI5GUB	**2,560**	**32**	**0**	**16**
Italy				
IK2YCW	**336,490**	**824**	**20**	**57**
***IK4LZH**	**50,274**	**273**	**0**	**38**
IK2SYI	34,476	181	0	39
IZ2BVC	16,389	124	0	27
*IU4JIC	8,928	77	0	24
*IK4DCX	7,587	60	0	27
*IZ8FBU	5,170	49	0	22
*IV3BCA	3,542	34	0	22
IZ1LAY	2,640	35	0	16
*IK8YFU	2,208	30	0	16
*IU8GUK	1,972	25	0	17
*IU4JHC	1,820	29	0	14
*IUØAPU	1,224	24	0	12
IX1CLD	836	17	0	11
*IK2IKW	522	14	0	9
*IK2SAR	246	10	0	6
Latvia				
YL7X	**223,040**	**662**	**11**	**53**
***YL2QG**	**32,490**	**215**	**0**	**30**
*YL2PP	6,216	50	0	24
*YL3KW	3,696	54	0	14
Lithuania				
LY5W	**159,689**	**595**	**4**	**49**
LY2BVB	**147,732**	**557**	**3**	**49**
***LY4L**	**131,663**	**540**	**2**	**47**
*LY9A	84,214	414	1	40
*LY2MM	34,683	217	1	32
*LY2OM	16,350	116	0	30
*LY5CB	14,375	122	0	25
*LY3BRA	3,600	57	0	15
*LY3S	3,417	48	0	17
*LY2DX	2,352	41	0	14
*LY3I	1,500	31	0	12
*LY2TS	1,050	27	0	10
*LY3ZM	175	10	0	5
Netherlands				
***PE2JMR**	**44,198**	**214**	**2**	**39**
PI4DX	**13,775**	**97**	**0**	**29**
*PA1HD	12,093	87	0	29
*PA3DTR	7,705	66	0	23
*PAØJBK	847	16	0	11
Northern Ireland				
***MIØM**	**52,962**	**248**	**2**	**40**
Norway				
LB9RE	**10,819**	**70**	**0**	**31**
***LA8OKA**	**1,960**	**28**	**0**	**14**
Poland				
SN7D	**260,455**	**783**	**12**	**53**
SP9N	**204,544**	**625**	**12**	**52**
SQ7CL	164,777	625	6	47
SN6M	144,990	536	7	47
***SP5CJY**	**103,831**	**426**	**6**	**43**
*SQ9ZAX	80,388	379	1	43
SQ2OFS	44,905	265	0	35
*SQ4JEN	29,645	175	1	34
*SP2TMT	27,545	161	1	34
*SP9TKW	23,975	143	1	34
*SP6A	23,002	157	0	31
*SO9P	21,000	159	0	28
*SP3IOE	20,736	117	4	32
*SP2GR	19,830	139	0	30
*SP8OV	16,578	129	0	27
*SP8TZ	15,800	135	0	25
SN95IARU	14,056	106	0	28
*SQ2EAN	11,500	109	0	23
*SP4GAP	9,192	81	0	24
*SP2DMZ	8,400	73	0	24
*SQ8T	6,644	63	0	22
*SP2IWL	5,548	62	0	19
*SP9HZW	4,320	50	0	18
*HF7ST	3,960	50	0	18
*SP8CHI	3,933	45	0	19
*SP9DEM	3,825	48	0	17
*SQ9PPT	3,808	50	0	16
*SQ5PMB	1,104	19	0	12
Portugal				
CS5SS	**19,705**	**106**	**0**	**35**
Romania				
YO6FNA	**45,991**	**246**	**1**	**36**
YO6OBK	37,126	189	1	37
***YO5IA**	**12,225**	**98**	**0**	**25**
*YO8RZJ	8,660	89	0	20
*YO3GSK	6,292	56	0	22
*YO8BDQ	5,859	57	0	21
*YO7LDT	1,224	21	0	12
*YO2LXW	520	13	0	8
*YO7ARZ	400	10	0	8
Serbia				
***YU1VG**	**26,796**	**158**	**0**	**33**
*YT2SMS	2,384	30	0	16
Sicily				
***IT9VJO**	**1,872**	**22**	**0**	**18**
*IT9EWR	60	4	0	3
*IT9ESW	4	2	0	1
Slovak Republic				
*OM5WW	60,952	320	0	38
OM7RU	41,790	235	0	35
OM3IAG	**36,408**	**197**	**2**	**35**
***OM4IK**	**29,430**	**198**	**0**	**30**
***OM2DT**	**26,301**	**158**	**0**	**33**
***OM7OM**	**17,690**	**120**	**1**	**28**
***OM7PY**	**3,672**	**42**	**0**	**18**
***OM1AJT**	**3,000**	**40**	**0**	**15**
***OM1ALT**	**970**	**20**	**0**	**10**
***OM7AT**	**420**	**14**	**0**	**6**
Slovenia				
S57C	**371,853**	**869**	**22**	**57**
***S57NAW**	**56,703**	**279**	**1**	**40**
*S52NR	25,632	164	0	32
Spain				
EA3IBV	**76,750**	**304**	**6**	**44**
EG2CAI	51,696	226	6	42
***EA3CI**	**35,264**	**191**	**1**	**37**
EB3A	13,888	92	1	30
EA2XR	11,726	100	0	26
*EA1BXJ	10,556	79	0	29
*EA4JR	7,868	60	2	26
EA3OH	4,136	42	0	22
*EA4LU	3,002	36	0	19
*EB2DJ	20	5	0	2
Sweden				
SB6A	**64,920**	**324**	**1**	**39**
SM5EPO	25,024	147	0	34
***SM6IQD**	**6,622**	**62**	**0**	**22**
*SE6K	4,864	62	0	16
SE5S	4,494	44	0	21
*SE4E	4,272	54	0	16
*SM5DXR	2,924	35	0	17
*SB5X	2,590	37	0	14

*SM7ATL	1,488	26	0	12
*SE5N	1,125	25	0	9
*SA6SKA	520	13	0	8
Switzerland				
***HB3YXD**	**2,808**	**32**	**0**	**18**
Ukraine				
UX1UA	**149,292**	**505**	**10**	**48**
US5D	**125,856**	**536**	**2**	**46**
UT2AA	87,400	349	3	47
UR5TM	47,463	250	0	39
UZ1U	38,556	222	0	36
***UW1U**	**29,104**	**184**	**1**	**33**
*UY2UQ	28,736	196	0	32
*UX2MF	26,268	162	0	33
UT4RZ	20,336	144	0	31
*UR4CW	17,893	129	1	28
UR3QFB	16,325	140	0	25
US7IA	15,444	126	0	26
*UT4EK	15,025	137	0	25
*UX2QL	11,799	108	0	23
*UT7QL	10,304	102	0	23
*UR4QFP	9,867	102	0	23
*UR5QU	9,576	96	0	21
*UV5EEO	9,093	94	0	21
UXØLL	7,098	74	0	21
UT3UV	6,080	67	0	19
*UR6QS	5,764	57	0	22
*UTØZT	4,830	83	0	14
*US6IKV	4,208	55	0	16
*UTØCK	4,110	63	0	15
*UR5ZIW	3,280	46	0	16
*UY3U	2,277	48	0	11
UY3AW	1,456	23	0	13
*US3LX	990	20	0	11
*USØUB	240	11	0	6
*UR3QTN	204	8	0	6
Wales				
***GW4W**	**935**	**17**	**0**	**11**

OCEANIA

Australia

VK3IO	**520**	**12**	**4**	**4**
***VK3XV**	**2**	**1**	**0**	**1**
Indonesia				
***YB2MM**	**204**	**26**	**0**	**3**
YCØSFS	**126**	**13**	**0**	**3**
*YB3BLJ	92	19	0	2
YC7YGR	56	10	0	2
*YCØSAS	46	23	0	1
*YB1PAG	44	22	0	1
*YB1BA	42	21	0	1
*YB3BGM	40	20	0	1
*YC1JCD	40	20	0	1
*YB4MDL	36	18	0	1
YB3OIR	30	15	0	1
*YF4ICC	28	14	0	1
*YB1UUU	26	13	0	1
YB9UA	26	5	0	2
*YC1EXR	26	13	0	1
*YB1HBO	24	12	0	1
YC1LIQ	22	11	0	1
YB1ELP	20	10	0	1
*YB9ATS	20	10	0	1
*YC1TJJ	20	10	0	1
*YB1DO	18	9	0	1
*YE3CGG	18	9	0	1
YB3AA	16	8	0	1
*YC1EXS	14	7	0	1
*YB1HDR	12	6	0	1
*YC1DAH	12	6	0	1
*YC3GOQ	12	6	0	1
*YC2TDP	10	5	0	1
*YC2YSW	10	5	0	1
*YF3FBV	10	5	0	1
*YB2VMC	4	2	0	1
*YC1PZ	4	2	0	1
New Zealand				
ZL2OK	**3,552**	**28**	**11**	**5**

SOUTH AMERICA

Argentina

LU8DPM	**78,276**	**127**	**33**	**33**
***LU3HS**	**14**	**2**	**0**	**2**
Brazil				
***PU3KNG**	**99**	**11**	**0**	**3**
*PU2KNM	50	11	0	2
*PU2USK	24	6	0	2
*PP5DZ	22	4	0	2
*PU2LRZ	18	9	0	1
*PU2UAF	16	8	0	1
*PY2JCM	8	7	0	1
Ecuador				
HC5DX	**8,550**	**36**	**17**	**8**
Venezuela				
YV2IF	**14,040**	**41**	**15**	**21**

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NORTH AMERICA

UNITED STATES

CONNECTICUT

W1IG	**60**	**6**	**5**	**0**
NEW HAMPSHIRE				
W1RGA	**676**	**23**	**13**	**0**
NEW YORK				
K2MIJ	**4,290**	**87**	**21**	**1**
W7BAK	4,248	78	23	1
KB2HSH	18	3	3	0
FLORIDA				
K3TW	**5,208**	**71**	**27**	**4**
NORTH CAROLINA				
WB4MSG	**22,320**	**259**	**37**	**3**
CALIFORNIA				
K2GMY	**2**	**1**	**1**	**0**
MICHIGAN				
N8LJ	**4,825**	**83**	**24**	**1**
OHIO				
K8ZT	**7,910**	**101**	**34**	**1**
WB8DC	2,720	59	19	1
ILLINOIS				
N9LQ	**1,520**	**35**	**20**	**0**
KANSAS				
W0YJT	**630**	**21**	**14**	**0**
MINNESOTA				
W6GMT	**12**	**3**	**2**	**0**

CANADA

ONTARIO

VA3MYC	**30**	**2**	**3**	**0**
ALBERTA				
VE6EX	**520**	**13**	**8**	**0**

EUROPE

Belarus

EU1AA	**23,698**	**139**	**0**	**34**
EU6DX	399	12	0	7
Bosnia-Herzogovina				
E77Y	**61,440**	**302**	**0**	**40**
Czech Republic				
OK1LL	**18,172**	**140**	**0**	**28**
European Russia				
UA3OQ	**1,740**	**30**	**0**	**12**
RW3AI	1,485	28	0	11
R3UBY	624	17	0	8
RA3DJA	76	5	0	4
Germany				
DLØAZ	**21,276**	**134**	**0**	**36**
DJØMY	11,408	83	0	31
DG1EAD	1,464	31	0	12
DL2LDE	145	7	0	5
Greece				
SV1BJY	**385**	**14**	**0**	**7**
Hungary				
HA8BE	**54,264**	**250**	**1**	**41**
HA1TI	14,924	119	0	26
HA7JQK	852	16	0	12
Italy				
IZ1ANK	**1,170**	**21**	**0**	**13**
Kaliningrad				
R2FI	**24,570**	**164**	**1**	**29**
Lithuania				
LY2NK	**336**	**9**	**0**	**8**
Poland				
SQ2NNN	**13,364**	**109**	**0**	**26**
SP4LVK	3,808	53	0	16
SQ2HCK	1,932	34	0	12
SP3CMX	513	12	0	9
Romania				
YO8BSE	**19,314**	**132**	**0**	**29**
YO8WW	11,925	95	0	25
Slovenia				
S55N	**5,940**	**57**	**0**	**22**
Ukraine				
UT1WW	**20,628**	**164**	**0**	**27**
UTØNB	7,752	65	0	24
UT5EOX	4,626	51	0	18
USØUX	1,540	25	0	14
Wales				
GW9Z	**5,830**	**53**	**0**	**22**

OCEANIA

Indonesia

YB1BML	**8**	**4**	**0**	**1**
YC3VRY	4	2	0	1
YE3AA	2	1	0	1

SOUTH AMERICA

Brazil

PU2NBI	**18**	**9**	**0**	**1**
PU2USL	**4**	**1**	**0**	**2**

ASSISTED

NORTH AMERICA

UNITED STATES

CONNECTICUT

W1CTN	**55,140**	**367**	**45**	**15**
***W1ARY**	**3,276**	**69**	**21**	**0**
*KI1U	3,036	54	21	1
*K3IB	900	24	13	2
*KA1VMG	816	25	15	1
MAINE				
K1JB	**30,384**	**269**	**39**	**9**
***W1DYJ**	**5,050**	**89**	**24**	**1**
MASSACHUSETTS				
W1EQO	**129,244**	**601**	**54**	**25**
KB1EFS	44,115	379	43	8
N1RR	23,568	176	34	14
NF1A	9,471	108	28	5
***W1SIP**	**7,770**	**106**	**27**	**3**
*KC1G	8	2	2	0
NEW HAMPSHIRE				
K1RX	**54,435**	**405**	**48**	**9**
N9NC	4,425	70	22	3
NF1O	3,192	52	21	3
RHODE ISLAND				
W2DAN	**2,205**	**31**	**17**	**4**
VERMONT				
AA1SU	**14,744**	**166**	**34**	**4**
NEW JERSEY				
W2MKM	**44,206**	**426**	**43**	**3**
K2RET	29,068	217	41	11
***KA2K**	**24,639**	**253**	**39**	**4**
WR2G	15,190	177	31	4
WA2FZB	6,090	88	29	1
N1IBM	4,266	69	24	3
N2VW	3,861	54	23	4
*KD2SGM	2,289	47	21	0
*KE2D	1,358	44	14	0
NEW YORK				
N2ZX	**115,024**	**521**	**51**	**28**
WA2CP	89,981	541	50	17
KE1IH	50,868	389	41	13
WU2M	28,495	299	37	4
W2GDJ	27,489	229	42	7
W2JV	23,760	292	32	4
WA2MCR	11,700	138	32	4
N2SQW	10,804	124	34	3
***K2SI**	**10,605**	**129**	**33**	**2**
*WB2KLD	8,787	123	27	2
K4RUM	7,872	107	29	3
NO2C	7,105	95	25	4
WA3AFS	2,976	32	28	4
N2NKX	1,920	39	18	2
N2RC	1,360	34	15	2
*K2YR	207	10	8	1
*K2PAL	168	9	8	0
DELAWARE				
AA1K	**139,410**	**530**	**55**	**35**
K9RS	37,184	249	40	16
***N3TTT**	**3,171**	**65**	**20**	**1**
MARYLAND				
W3LL	**194,292**	**878**	**53**	**31**
W3FOX	99,162	684	47	16
K3AJ	65,100	400	44	18
K3MM	41,406	215	49	18
N3QE	41,031	379	43	4
W3ICM	38,857	350	41	8
AB3CV	38,500	396	41	3
AA3S	27,734	214	37	12
W2CDO	27,060	275	40	4
N3ALN	20,920	229	37	3
N3DUE	17,178	178	40	2
K3AU	14,256	167	33	3
K3TN	12,207	114	31	8
***WK3A**	**11,400**	**128**	**35**	**3**
*W3FA	7,316	100	29	2
W3OU	6,634	94	28	3
NX3Z	3,250	56	23	2
W3GVX	2,499	52	20	1
K3ZU	240	8	7	1
PENNSYLVANIA				
K3WW	**80,160**	**550**	**44**	**16**
K6ND	64,680	376	48	18
AB3AH	61,380	420	50	12
NY3B	45,485	353	43	12
K3MD	40,434	364	40	6
W3FV	35,231	304	42	7
KU2C	35,046	248	40	14
AG3I	31,046	364	35	3
AA3B	30,160	334	38	2
***K2XR**	**25,755**	**193**	**41**	**10**
*W3FIZ	22,591	239	37	4
*W3KB	22,310	202	40	6
K3WJV	20,900	201	40	4
WØBR	19,693	176	42	5
WY3A	19,320	216	37	3
K3OO	14,076	145	25	11
KB3Z	13,120	129	33	7
*K3ATO	12,546	127	37	4
W2GD	11,152	104	35	6
K3RL	9,485	112	32	3
N3ZA	8,547	110	30	3
*KN3A	5,040	65	27	3
*N3EYF	2,109	51	18	1
WA3AAN	1,080	33	15	0
K3WGR	1,040	25	15	1
WB3BJU	615	19	14	1
ALABAMA				
KX4X	**35,046**	**178**	**46**	**20**
W4RYW	12,012	109	38	6
***KN4PHS**	**1,120**	**25**	**18**	**2**
FLORIDA				
N6AR	**70,503**	**354**	**42**	**29**
WO4O	10,070	103	31	7
***KA3EHL**	**60**	**6**	**5**	**0**
GEORGIA				
N4DU	**12,358**	**151**	**34**	**3**
NI4Y	3,612	57	25	3
KENTUCKY				
K4ISV	**140,466**	**665**	**53**	**29**
KB4QZH	21,726	184	44	7
***K4FT**	**7,802**	**64**	**43**	**4**
NORTH CAROLINA				
N1LN	**82,715**	**401**	**44**	**27**
WJ2D	47,748	253	50	19
AD8J	11,063	121	32	5
W1AJT	10,620	131	34	2
N4TL	7,750	113	29	2
***N4MIO**	**6,240**	**92**	**29**	**1**
K4NC	5,070	61	24	6
*KE4YOG	3,618	54	24	3
SOUTH CAROLINA				
K4YYL	**25,114**	**169**	**47**	**11**
W4GE	24,920	162	42	14
TENNESSEE				
W4KW	**63,484**	**498**	**52**	**7**
K3IE	27,120	249	42	6
AA4DD	24,221	188	47	6
***KEØL**	**19,305**	**197**	**41**	**4**
VIRGINIA				
N4RV	**164,410**	**804**	**55**	**27**
K4XL	**135,660**	**698**	**53**	**23**
W3IP	74,958	499	47	15
K1GG	40,194	237	52	14
KK4ODQ	22,280	250	34	6
KC4D	22,078	274	38	0
KG4W	18,800	98	28	22
KE4S	18,495	148	34	11
W4NF	16,761	205	35	2
K5VIP	16,464	160	36	6
W4JAM	11,396	136	34	3
WC4J	8,580	104	29	4
KA4RRU	4,563	74	26	1
***W4TG**	**2,134**	**38**	**20**	**2**
NX3A	1,377	33	16	1
W4PM	1,216	26	14	2
*W4VIC	147	12	7	0
ARKANSAS				
K5VR	**1,197**	**27**	**18**	**1**
MISSISSIPPI				
***NA5NN**	**59,520**	**455**	**52**	**8**
W5THT	**4,386**	**50**	**30**	**4**
N5TF	140	5	0	4
OKLAHOMA				
KF5GTX	**7,831**	**85**	**39**	**2**
TEXAS				
N5RZ	**30,160**	**230**	**50**	**8**
WBØTEV	11,137	115	41	2
KE5MMT	10,560	110	36	4
***KS5Z**	**3,690**	**57**	**28**	**2**
N5DD	1,824	32	23	1
K5KJ	1,428	27	19	2
*KE5LQ	112	8	7	0
CALIFORNIA				
NX6T	**32,754**	**276**	**46**	**7**
K6RC	6,728	100	25	4
KG6AO	1,344	26	20	1
W6MOB	1,328	40	15	1
ARIZONA				
AB7E	**26,620**	**216**	**48**	**7**
WA7AN	3,248	50	27	2
N9NA	2,862	40	22	5
K7WP	1,720	40	18	2
IDAHO				
KG7CW	**43,955**	**324**	**52**	**7**
***KA7T**	**1,836**	**48**	**18**	**0**
MONTANA				
K7QA	**17,526**	**161**	**43**	**3**
OREGON				
KA6BIM	**44,400**	**309**	**52**	**8**
KI7M	33,201	283	47	4
KK7YC	17,845	180	37	6
K7ZS	13,684	128	40	4
***AK6A**	**2,916**	**75**	**18**	**0**
UTAH				
W7CXX	**46,177**	**338**	**52**	**9**
***W7DBA**	**440**	**20**	**11**	**0**
WASHINGTON				
KK6ZM	**63,180**	**375**	**54**	**11**
W6OAT	18,513	151	45	6
KE7SW	4,060	62	26	2
***K7SS**	**3,096**	**74**	**16**	**2**
N7SJM	2,856	55	24	0
MICHIGAN				
K2PM	**87,054**	**563**	**55**	**11**
W8MJ	68,860	543	46	9
OHIO				
N8HMG	**50,380**	**417**	**49**	**6**
***W8WTS**	**24,068**	**248**	**42**	**2**
KA8G	22,593	189	46	5
*K4YJ	18,361	191	41	2
W8GNM	12,423	131	37	4
*KD8MQ	6,688	94	30	2
*AF8C	3,807	66	27	0
*K8LY	2,662	50	21	1
*N8EV	360	15	9	1
K8ALM	242	11	11	0
ILLINOIS				
AC9S	**78,588**	**607**	**54**	**5**
K9CT	43,732	323	52	6
N2BJ	31,680	299	45	3
ND9G	18,659	182	45	2
K9NO	16,513	139	43	6
***WA9LEY**	**8,316**	**105**	**35**	**1**
*NQ6N	5,890	92	31	0
W9YK	2,928	52	23	1
*K9PG	1,640	31	17	3
INDIANA				
***N4BAA**	**57,078**	**477**	**49**	**5**
W9VW	**28,184**	**243**	**48**	**4**
N9DR	16,254	164	40	3
*KB9RDS	9,065	109	36	1
*AJ9C	4,650	70	29	1
*AE9LL	3,275	61	25	0
WO9Z	2,000	38	18	2
WISCONSIN				
K9MU	**24,150**	**262**	**41**	**1**
K9TY	21,298	208	43	3
KN9P	2,898	54	21	2
IOWA				
W7II	**4,914**	**42**	**34**	**5**
***KEØITC**	**216**	**12**	**9**	**0**
KANSAS				
ADØAB	**7,960**	**95**	**39**	**1**
K3PA	1,936	41	22	0
MINNESOTA				
KØRJW	**14,711**	**143**	**46**	**1**
WAØMHJ	5,460	66	33	2
KØKX	2,492	29	24	4
***WØSEI**	**1,786**	**38**	**18**	**1**
NUØW	960	27	16	0
*KØJP	70	7	5	0
MISSOURI				
WØMB	**51,870**	**421**	**53**	**4**

CANADA

NEW BRUNSWICK

***VE9ML**	**7,238**	**71**	**20**	**2**
VE9CB	**1,806**	**27**	**14**	**0**
QUEBEC				
VA2WA	**30,564**	**177**	**34**	**2**
VA2AM	12,816	65	26	10
***VE2CJR**	**6,160**	**59**	**22**	**0**
ONTARIO				
VE3CX	**131,089**	**446**	**55**	**6**
VE3CV	**114,895**	**432**	**50**	**5**
VA3WW	39,039	208	36	3
VE3SS	10,943	73	31	0
***VE3JI**	**3,366**	**38**	**18**	**0**
*VE3HED	1,411	16	17	0
BRITISH COLUMBIA				
VE7DX	**15,000**	**105**	**26**	**4**
***VA7IR**	**1**	**0**	**0**	**0**

NORTH AMERICA

Alaska

KL7SB	**2,800**	**43**	**11**	**3**
Dominican Republic				
***HI6LT**	**100**	**4**	**1**	**3**
Mexico				
XE2S	**495**	**11**	**9**	**0**
Puerto Rico				
KP4KE	**479,412**	**737**	**55**	**53**

AFRICA

Canary Islands

EA8RM	**4,770**	**27**	**2**	**16**
Ceuta & Melilla				
EA9/DL1MGB	**270,776**	**401**	**18**	**50**

ASIA

Asiatic Russia

R8TT	**155,272**	**317**	**1**	**51**
***RA9AU**	**41,786**	**133**	**0**	**34**
RM8A	29,125	125	0	25
UA9MA	23,225	108	0	25
RW9CQ	22,906	96	0	26
*UA9BA	13,708	70	0	23
UA9R	13,540	77	0	20
RAØACM	4,046	39	0	14
RTØF	3,641	44	3	8
Asiatic Turkey				
TA7OM	**139,095**	**319**	**0**	**45**
***TA3EL**	**1,560**	**13**	**0**	**12**
*TC3B	576	8	0	8
*TA9J	96	4	0	3
China				
***BD4SS**	**78**	**6**	**0**	**3**
*BG4GOV	6	3	0	1
*BG5TOX	6	3	0	1
Cyprus				
P3X	**31,650**	**108**	**0**	**30**
Israel				
4X1IM	**12,694**	**61**	**0**	**22**
Kazakhstan				
UNØOA	**30**	**2**	**0**	**2**
Oman				
A44A	**1,755**	**16**	**0**	**13**
Saudi Arabia				
7Z1SJ	**5,015**	**31**	**0**	**17**

EUROPE

Austria

OE1TKW	**47,614**	**248**	**1**	**37**
OE2LCM	13,203	99	0	27
***OE6MMD**	**12,454**	**97**	**0**	**26**
Belgium				
OR3A	**51,584**	**178**	**13**	**39**
ON6NL	48,552	227	2	40
ON8BN	38,430	174	3	39
OT5L	37,138	241	0	31
***ON6VJ**	**13,804**	**96**	**0**	**29**
Bulgaria				
LZ5I	**91,248**	**367**	**2**	**46**
LZ3FN	336	8	0	8
***LZ2ZG**	**280**	**7**	**0**	**8**
Crete				
***SV9MBH**	**2,831**	**26**	**0**	**19**
Croatia				
9A5AAX	**131,664**	**484**	**4**	**48**
9A4MX	42,732	233	1	35
9A2EU	32,642	165	1	37
Czech Republic				
OK7K	**650,743**	**1129**	**28**	**73**
***OK2BFN**	**104,664**	**428**	**3**	**46**
***OK6AA**	**104,346**	**406**	**5**	**46**
*OK1DPU	60,690	296	3	39
*OK1AY	47,878	270	1	36
*OK1YM	40,394	221	1	37
*OK2VV	33,056	217	0	32
Denmark				
OZ5E	**47,696**	**210**	**2**	**42**
OZ7DK	22,144	140	1	31
***OU2V**	**14,645**	**98**	**2**	**27**
*OZ1KVM	12,750	101	0	25
England				
GØBNR	**157,410**	**451**	**16**	**50**
G4PIQ	52,430	208	5	44
***GØDTX**	**14,229**	**102**	**2**	**25**
*GØAZE	10,290	50	5	30
GØDWV	5,670	52	2	19
G4PVM	5,187	50	0	21
Estonia				
ES3TI	**19,096**	**133**	**0**	**28**
ES1BH	4,626	52	0	18
European Russia				
RC3FL	**80,750**	**325**	**2**	**48**
RZ3EC	80,340	304	2	50
RU1AB	51,480	229	1	44
RN3OG	47,784	224	2	42
UF4S	42,600	212	1	39
UA6YI	33,600	169	4	36
RL5A	20,040	137	0	30
R4ACY	15,810	111	1	29
RU6K	9,288	69	0	27
RM3DA	3,225	45	0	15

RL4A	2,640	36	0	15
RK2M	1,683	33	0	9
RC1W	531	13	0	9
***R2EA**	**510**	**21**	**0**	**6**
RA1QD	469	15	0	7
RG6G	88	4	1	3
*RA4Y	84	6	0	4
European Turkey				
***TA1CM**	**56,760**	**243**	**6**	**37**
Faroe Islands				
OY1R	**16,830**	**101**	**0**	**33**
Finland				
OH1Z	**52,159**	**238**	**2**	**41**
OG6N	7,680	62	0	24
***OH1LEG**	**6,279**	**57**	**0**	**23**
OH3FM	5,346	60	0	18
OG7F	5,058	58	0	18
OH7MFO	2,055	27	0	15
OH1XX	1,680	14	5	9
*OH3D	1,680	23	0	14
France				
F6EZV	**35,014**	**168**	**1**	**40**
F5NBX	1,150	23	0	10
F5PHW	825	15	0	11
Germany				
DK6WL	**262,352**	**742**	**20**	**56**
DK2OY	**233,064**	**719**	**17**	**55**
DF2F	173,166	648	12	50
DL8OH	103,044	352	16	46
DJ5AN	79,200	313	8	47
DJ8QP	78,260	334	6	46
DL7CX	74,942	322	7	46
DF6QV	58,265	321	1	42
***DK2CC**	**55,728**	**291**	**2**	**41**
DJ9DZ	55,470	296	2	41
DL1NEO	53,406	285	2	41
DK1X	52,822	231	8	41
DK7A	51,742	303	0	41
DL7URH	49,455	249	3	42
DL1NKS	40,560	244	3	37
DL5JS	37,872	263	1	35
DL5LYM	36,160	213	1	39
DK9IP	35,690	179	1	42
*DL6UAA	34,447	208	0	37
DL5AXX	33,934	201	0	38
DL6MHW	31,707	190	4	35
DL8DBW	30,742	183	1	37
DK1AX	28,665	203	0	35
DL6JZ	28,006	169	0	38
DK2TG	27,540	173	1	35
DJ5MW	27,234	194	0	34
DJ9UN	26,052	161	2	37
DL1MP	25,493	166	1	36
DM9EE	24,605	159	2	35
DJ1AA	24,013	143	3	34
DJØIF	22,952	135	0	38
*DH2IF	22,785	186	0	31
DF2RG	19,278	125	2	32
DJ6TB	18,600	143	1	29
DL1STG	16,704	114	1	31
DM5TI	16,096	118	2	30
*DL1BUG	15,810	124	0	30
DG2NMH	13,770	104	0	30
*DJ5IW	13,140	94	1	29
DL5ST	12,690	107	0	30
DL3DW	12,339	106	0	27
DK4VW	12,090	111	0	26
DK2CX	12,000	89	1	29
*DL2RMC	11,700	105	0	26
DP5L	11,284	102	1	25
DL7VEE	10,716	55	4	34
*DO7CX	10,672	91	0	29
*DL6RAI	10,276	82	0	28
DF5MA	8,188	88	0	23
*DO4TP	6,994	58	0	26
*DJ1MM	5,670	57	0	21
*DJ5CT	5,654	58	0	22
*DJ9MH	3,534	40	1	18
*DL4KUG	3,280	33	0	20
DJ8EW	3,211	38	0	19
DN5HR	2,831	35	0	19
*DL2MLU	2,601	36	0	17
*DG1HXJ	1,937	37	0	13
DL/OZ1AA	1,386	21	0	14
DL7UPN	924	20	0	11
*DO4DXA	748	16	0	11
*DF1LX	650	16	0	10
DF8AA	416	11	0	8

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Greece				
SV2GJV	**59,163**	**288**	**1**	**40**
SV2BXZ	22,671	137	0	33
***SV1ONV**	**5,060**	**45**	**0**	**23**
SV1EJD	4,136	39	0	22
*SV4NYZ	1,442	23	0	14
SV2BXA	828	15	0	12
Hungary				
HA4XH	**157,294**	**519**	**9**	**50**
HG2DX	90,475	374	5	42
HA5PP	78,056	343	4	40
***HA5DDX**	**385**	**10**	**0**	**7**
Italy				
IK7YTT	**188,695**	**568**	**13**	**52**
IC8POF	23,720	111	5	35
IKØXBX	21,852	127	1	35
4U25B	17,284	123	0	29
I2WIJ	12,064	80	0	32
IU4FLO	5,456	55	0	22
I4VEQ	4,356	41	0	22
***IU1IPB**	**2,265**	**32**	**0**	**15**
IZ3VTH	1,972	25	0	17
*IU4JJP	935	20	0	11
*IZ5OQX	408	12	0	8
*IK4VET	68	4	0	4
Kaliningrad				
***RN2FA**	**3,825**	**51**	**0**	**15**
Latvia				
YL2KO	**13,442**	**100**	**0**	**26**
Liechtenstein				
HBØWR	**23,940**	**119**	**4**	**34**
Lithuania				
LY4A	**610,416**	**1017**	**21**	**87**
***LY4ZZ**	**94,848**	**398**	**1**	**47**
LY2OU	89,408	414	1	43
LY7M	43,710	173	4	43
LY5R	15,090	102	0	30
LY2BAW	8,671	80	0	23
LY1R	5,478	53	0	22
*LY2FN	5,220	67	0	18
*LY4Z	225	15	0	5
Luxembourg				
LX2OI	**286,556**	**769**	**18**	**53**
Netherlands				
PHØAS	**46,293**	**237**	**1**	**38**
***PA4EL**	**21,840**	**107**	**2**	**38**
*PE1EWR	140	4	0	7
Northern Ireland				
MI5K	**267,064**	**604**	**23**	**53**
***GI4T**	**26,955**	**110**	**9**	**36**
Norway				
LA9TY	**37,269**	**173**	**5**	**36**
***LC1P**	**10,634**	**82**	**0**	**26**
Poland				
SP3P	**98,560**	**458**	**4**	**40**
SP8DIP	94,662	341	8	46
SP2V	68,580	310	1	44
SP3GTS	52,458	251	2	40
SP9MRO	51,065	289	1	34
SP9QMP	42,360	213	1	39
***SP8FB**	**31,248**	**176**	**1**	**35**
SP90PZK	19,520	125	0	32
*3Z90PZK	14,148	114	0	27
SQ1OD	11,125	93	0	25
*SP9JZT	9,450	84	0	25
*SO5MAX	9,312	81	0	24
SO3F	6,125	48	1	24
*SP7MW	3,082	28	0	23
*SQ3M	2,768	37	0	16
*SO95IARU	567	15	0	9
Portugal				
CT2HKN	**27,729**	**138**	**1**	**38**
***CT7AGE**	**1,962**	**22**	**0**	**18**
CT1ENV	1,905	18	5	10
CT1DSV	1,200	14	4	8
Romania				
YO7WC	**69,454**	**327**	**1**	**40**
Scotland				
MM1E	**2,450**	**35**	**0**	**14**
Serbia				
***YT8A**	**123,543**	**456**	**4**	**49**
YT0W	**111,188**	**494**	**2**	**42**
YT6T	72,726	300	1	45
Sicily				
IT9RBW	**138,322**	**414**	**10**	**52**
***IT9VCE**	**27,852**	**165**	**1**	**32**
Slovak Republic				
***OM4AQP**	**39,970**	**225**	**0**	**35**
Slovenia				
S54ZZ	**302,808**	**781**	**18**	**56**
***S57DX**	**138,118**	**519**	**3**	**50**
S56B	71,643	374	0	39
*S56A	13,857	91	1	30
S53MM	12,662	101	0	26
*S57S	10,902	98	0	23
S53F	10,125	77	0	27
*S57KM	3,760	50	0	16
*S59T	1,128	20	0	12
*S57EA	22	4	0	2
Spain				
EC1T	**67,256**	**225**	**15**	**41**
***EA3O**	**64,224**	**266**	**4**	**44**
EA1I	44,820	156	11	43
EA1X	14,384	97	0	31
*EA7JXZ	11,616	73	1	32
EA1HV	7,000	57	0	25
EC4T	5,568	50	1	23
*EA2AFV	3,570	40	0	21
*EC1A	2,320	31	0	16
EA5WU	2,000	30	0	16
Sweden				
SM5X	**54,280**	**265**	**1**	**39**
8SØC	26,670	151	0	35
SEØX	23,660	133	0	35
***SM6MVE**	**19,830**	**133**	**0**	**30**
*SA6BET	11,847	70	1	32
*SK6QA	7,429	67	0	23
*SM4W	1,610	23	0	14
Switzerland				
HB9CXZ	**159,680**	**474**	**16**	**48**
HB9DHG	**124,352**	**409**	**11**	**47**
HB9TOC	90,898	386	1	46
HB9DUR	22,110	147	0	30
***HB9OCR**	**4,020**	**41**	**0**	**20**
Ukraine				
UYØZG	**113,792**	**396**	**6**	**50**
UX5IS	75,060	332	1	44
***UR2Y**	**67,240**	**337**	**1**	**40**
UT7CR	56,322	275	1	41
UY5ZZ	53,580	234	2	45
UY1HY	48,312	217	5	39
*UR5RP	30,974	189	0	34
UT5ECZ	24,928	165	1	31
*UV7E	18,270	129	0	29
*UT8IM	14,794	125	0	26
*UT7HA	14,430	95	0	30
*US6IKF	9,752	91	1	22
*UZ1RM	5,540	60	0	20
*UR5STI	4,730	47	0	22
*UZ1WW	4,693	53	0	19
UT7NY	4,275	45	0	19
*UT5EDX	3,808	50	0	17
US6IKT	2,941	39	0	17
*UW3HM	1,452	25	0	12

OCEANIA

Indonesia				
***YC2VOC**	**760**	**52**	**0**	**5**
YCØLOU	**176**	**14**	**0**	**4**
YC3ATK	56	28	0	1
*YF3DFB	52	26	0	1
*YC2YIZ	50	25	0	1
YC1JGE	40	20	0	1
YC3RJL	32	16	0	1
*YC9FZ	30	15	0	1
YF3CYT	20	10	0	1
*YE3WIL	8	4	0	1
YC9WH	2	1	0	1
*YC9WOF	2	1	0	1

SOUTH AMERICA

Brazil				
PP5JR	**105,524**	**156**	**37**	**37**
***PY2KC**	**96**	**13**	**0**	**3**
Paraguay				
***ZP9MCE**	**10**	**1**	**0**	**1**

MULTI-OP

NORTH AMERICA

UNITED STATES

MASSACHUSETTS				
W1FM	**13,212**	**150**	**31**	**5**
NEW HAMPSHIRE				
NE1F	**2,289**	**47**	**19**	**2**
NEW JERSEY				
N2CW	**306,976**	**948**	**54**	**52**
K2AX	**100,809**	**601**	**49**	**20**
NEW YORK				
WU2X	**267,145**	**911**	**56**	**45**
W2YV	33,405	278	43	8
MARYLAND				
N3DPB	**85,413**	**504**	**50**	**21**
K3CCR	66,300	444	44	16
PENNSYLVANIA				
NE3F	**66,642**	**473**	**46**	**12**
W3MF	12,636	138	37	2
FLORIDA				
N2CEI	**311,115**	**1033**	**56**	**49**
K2DM	11,058	124	30	8
GEORGIA				
AD4XT	**14,784**	**152**	**41**	**3**
KENTUCKY				
W5MX	**169,338**	**916**	**54**	**24**
MISSISSIPPI				
W5SGL	**31,518**	**284**	**45**	**6**
K5GDX	9,225	101	39	2
NEW MEXICO				
K5LRW	**1,242**	**33**	**17**	**1**
TEXAS				
WR5O	**79,168**	**566**	**54**	**10**
K5GN	58,616	324	50	18
W5RTA	25,000	236	46	4
CALIFORNIA				
K6YA	**1,932**	**63**	**14**	**0**
ARIZONA				
N7T	**52,094**	**374**	**51**	**10**
W7MRF	47,820	346	49	11
MICHIGAN				
W8MO	**23,511**	**207**	**47**	**4**
OHIO				
W8PR	**154,356**	**882**	**56**	**20**
KANSAS				
ACØRL	**4,495**	**68**	**30**	**1**

CANADA

BRITISH COLUMBIA				
VA7MAY	**11,136**	**97**	**21**	**3**

NORTH AMERICA

Costa Rica				
TI1T	**26,038**	**98**	**29**	**18**
Mexico				
XE1RCS	**22,134**	**105**	**36**	**6**

ASIA

Asiatic Russia				
RD8D	**108,805**	**250**	**0**	**47**
RZ9L	2,124	34	0	9
R9WXK	408	15	0	4
Asiatic Turkey				
TC3D	**12,474**	**61**	**0**	**21**

EUROPE

Austria				
OE2S	**152,195**	**481**	**12**	**49**
Belarus				
EW5A	**496,524**	**954**	**25**	**67**
Bosnia-Herzegovina				
E7CW	**243,012**	**696**	**13**	**53**
E71EEE	54,327	276	1	38
Bulgaria				
LZ5R	**243,830**	**603**	**18**	**56**
Czech Republic				
OL7M	**533,808**	**1123**	**27**	**61**
OL1R	**188,760**	**560**	**15**	**51**
OK1KDO	159,624	595	6	48
European Russia				
UA7K	**317,900**	**720**	**19**	**66**
R7NP	51,643	244	1	42
RT3E	13,440	96	0	28
Germany				
DP7D	**238,533**	**768**	**17**	**52**
DR4W	**204,680**	**659**	**16**	**52**
DA2X	152,271	540	14	49
DLØWX	136,000	498	14	50
DL7A	89,700	418	6	44
DKØTP	70,092	368	0	44
Greece				
SZ3P	**54,074**	**294**	**0**	**38**
Hungary				
HG8DX	**431,730**	**968**	**22**	**60**
HG5A	**240,264**	**652**	**12**	**59**
Italy				
IK2TDM	**201,056**	**657**	**11**	**50**
Lithuania				
LY7Z	**271,859**	**739**	**14**	**57**
LY5AA	**146,544**	**605**	**1**	**47**
LY5XX	89,913	445	1	40
LY2XW	71,595	313	3	42
LY7T	69,360	347	1	39
LY2ZO	50,190	298	1	34
LY2J	41,055	243	0	35
Luxembourg				
LX8M	**70,658**	**281**	**2**	**47**
Poland				
SP8R	**352,577**	**847**	**21**	**58**
SP2ZIE	51,636	276	1	38
SQ9ØPZK	19,584	118	1	33
Romania				
YR8D	**226,422**	**687**	**7**	**56**
YO6KGS	11,775	95	0	25
Serbia				
YU7ADY	**47,390**	**271**	**0**	**35**
Sicily				
IQ9UI	**248,724**	**524**	**25**	**59**
Slovak Republic				
OM3KHT	**11,208**	**94**	**0**	**24**
Slovenia				
S56P	**273,428**	**770**	**14**	**54**
Spain				
EC7WR	**154,078**	**315**	**29**	**53**
EF1R	61,714	194	15	44
EA4RKN	51,136	221	5	42
Switzerland				
HB9NFB	**103,532**	**477**	**1**	**43**
Ukraine				
US1Q	**358,179**	**763**	**19**	**68**
UZ2I	68,593	343	1	40
UZ5P	54,873	295	1	38
UR4RWW	36,992	244	0	32
UW6M	4,032	60	0	16

OCEANIA

Indonesia				
7A2A	**798**	**45**	**0**	**7**
7A1A	648	42	0	6
7C1B	496	46	0	4
7A3A	425	33	0	5
7B1B	318	45	0	3
7E3E	180	37	0	2
7AØD	138	15	0	3
7E1A	68	34	0	1
YE2T	40	20	0	1

SOUTH AMERICA

Argentina				
LU2DX	**14**	**2**	**0**	**2**
Bonaire				
PJ4G	**538,164**	**552**	**51**	**48**
Ecuador				
HCØE	**1,177**	**13**	**2**	**9**

Check Logs

DG3RAP, DKØLH, DL3VL, DL4CF, DL4TJ, DL8MV, E74SL, E77EA, EA6FO, EU1XX, EU6RO, HA6NL, HG8C, IV3EAD, J35X, KA2QWC, LY2AX, LY2BKT, MU2K, N1LZF, N7ESU, N8OO, OH7KC, PA3EVY, S53O, SO9I, SP5XSD, SP6TRX, SQ2IHP, SQ9NFC, SV1PMQ, SV3DCX, UA3WF, UN3M, UT2AB, UT5EO, UZ5DX, W7NIK.

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CRANK-A-WATT Power & More via KE5NYS. Visit <www. FactorReady.com>

FMTV ARTICLES: Comprehensive transmitter and receiver deviation calibration, standards, intermodulation, power amplifier calculations. WB9OQM, http://mathison.freeshell.org

Wanna ham in the **CAYMAN ISLANDS**?" Go to <www. martykaiser.com/24a.htm>.

www.SecondHandRadio.com

HF Mobile or Fixed Virtual X Antenna Patent: For Sale or License. Request Free Power Point Presentation file. Shows design details, pictures, prototype tests. Design applies to a broad frequency range for mant antenna arrays/beams/verticals. <lgslay@sbcglobal.net>. Larry Slay, K5WUL

FOR SALE: Samlex Power Supply Model SEC 1223, 13.8V @ 25 amps. Not working. Includes operating manual and schematic. Price $50 or best offer. Contact Harry, W9HRQ, at <harrygraziano@gmail.com> or phone 1-773-334-4492.

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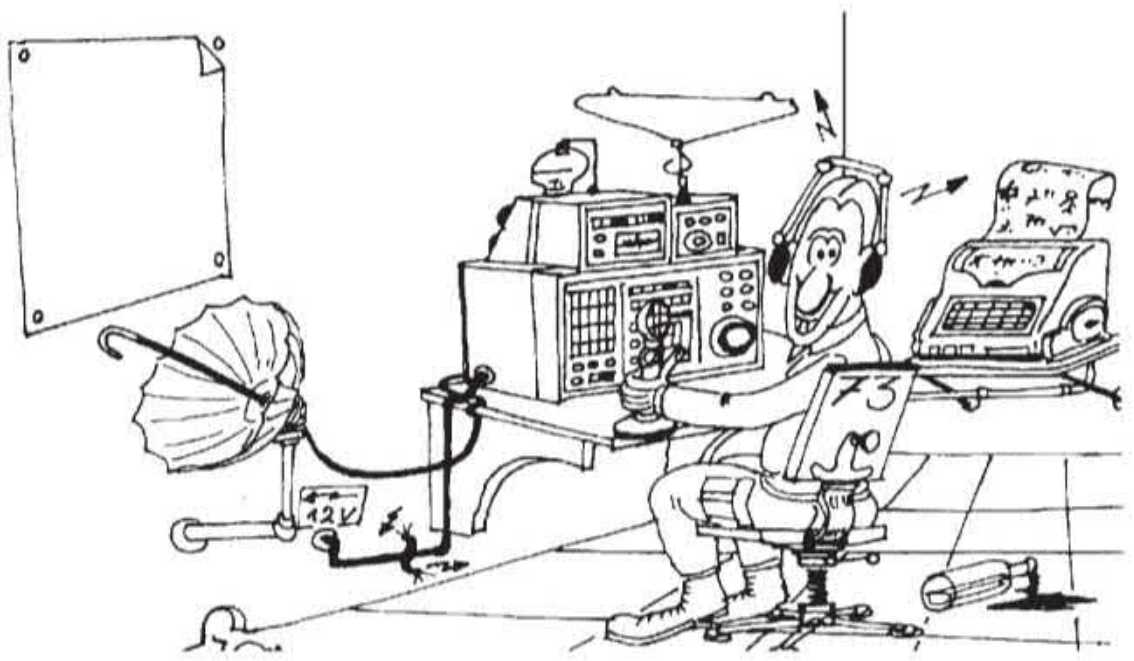

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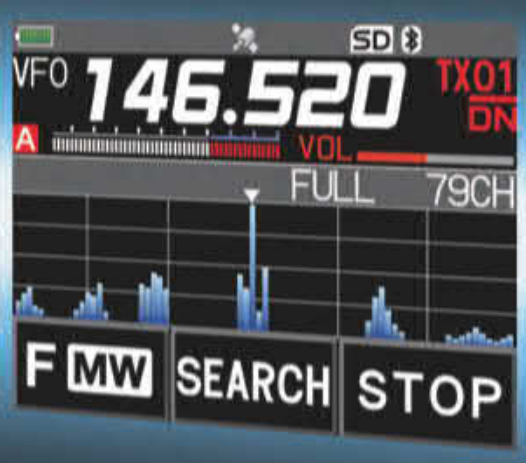

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