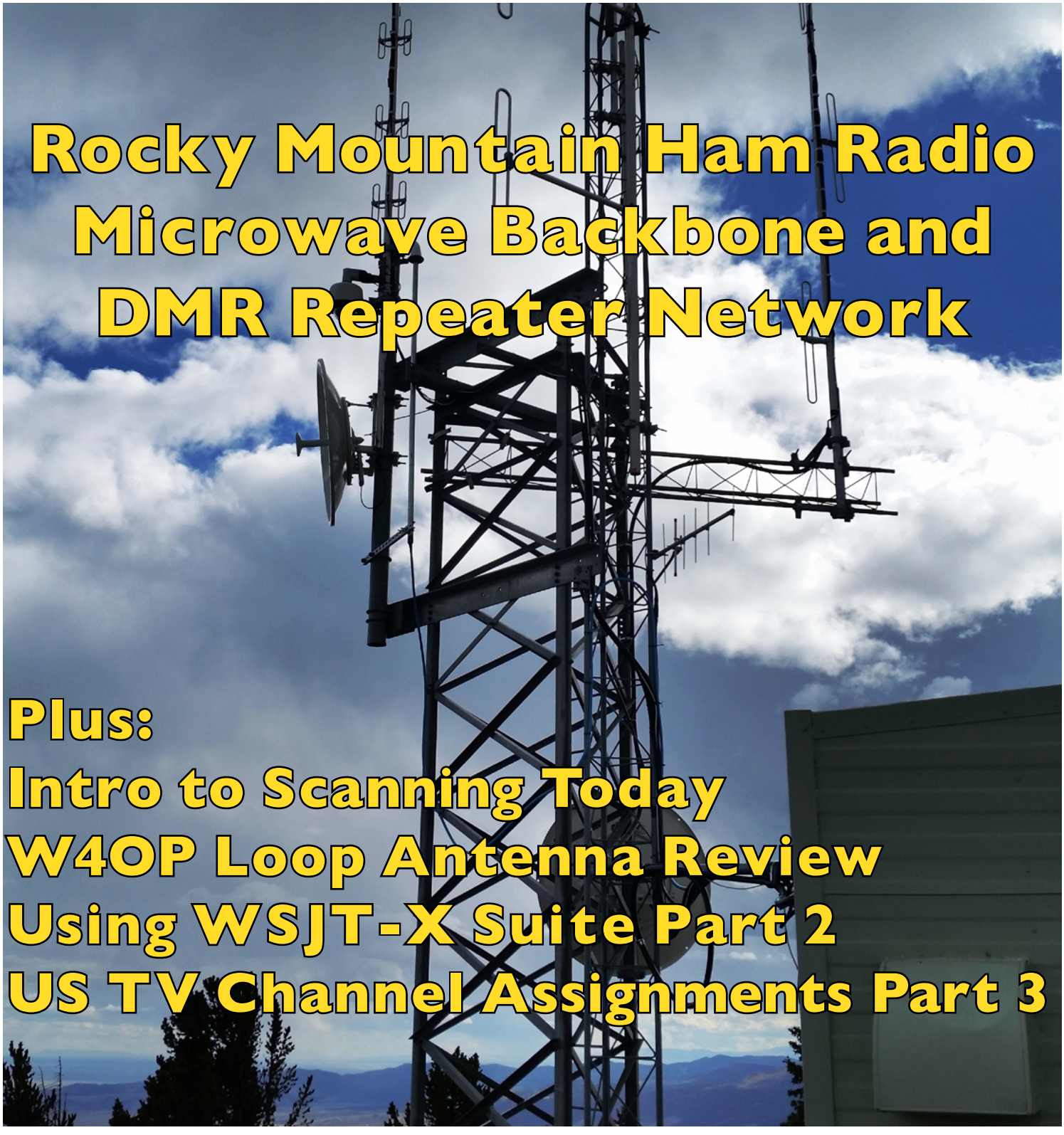
The Spectrum Monitor®

Amateur, Shortwave, AM/FM/TV, WiFi, Scanning, Satellites, Vintage Radio and More

Volume 4 Number 8 August 2017



Rocky Mountain Ham Radio Microwave Backbone and DMR Repeater Network

Plus:

Intro to Scanning Today

W4OP Loop Antenna Review

Using WSJT-X Suite Part 2

US TV Channel Assignments Part 3

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Volume 4 Number 8 **Table of Contents** **August 2017**

Cover Story:

RMHAM microwave relay in the Rocky Mountains of Colorado on Methodist Peak at 11,700 feet. (Photo by Jeff Carrier K0JSC)

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Dear TSM:

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Anonymous comments will not be published.

Comments, Advice, Kudos and Questions from Readers

Unused National Telecommunications and Information Administration (NTIA) issued $40 coupon intended to offset purchase price of a digital converter box used during the 2009 FCC digital TV transition. (KS4ZR photo)

Grace Digital Wi-Fi radio model Mondo, regularly $200, can be found at a substantial discount—batteries extra. (Courtesy: Grace Digital)

Digital TV/Radio Blues

"After reading the latest articles concerning 'Repacking the US TV Band' on top of my perils in trying to describe to people basic antenna theory for UHF *vs.* VHF antenna size in a market that is woefully entrenched in the VHF band with one station at the bottom of UHF band, the closest tower no longer transmits from its home station, at 180 degrees, and now transmits from two locations (FCC rules regarding station ownership and proximity to others in the market), tower group at 90 degrees and tower group at 270 degrees; looking up data sheets showing RF plots for antennas advertised as VHF/UHF reception only to see the specs roll off pretty fast at the bottom of UHF, if anything is published at all, and one manufacturer replied back 'We do not disclose proprietary information.' Huh?

"OTA receiver boxes with a USB port for a memory stick or HDD for recording are advertised for less than $100, but the box needs to re-scan if a rotor is used or no program guide or no this and no that...When looking at the back of these boxes the connections look the same like they all use the same PCB with different brand names and get a mixed bag of reviews for each model. Also, 'out of stock' or 'discontinued' on everything at Solid Signal which has been a great source of information in my on and off (mostly off as of late) research.

"I never did have the opportunity to cash in the free $40 coupon for a converter box when this all started, way back when. It was very obvious then the industry and regulators wanted to let free OTA go away (die on the vine). I remember buying a Sony XDR-F1HD FM tuner, and two days after UPS delivered it, I received a $50 coupon on a sales promotion to help kick start HD FM radio nationwide, needless to say, 'You bought it before the start date of the promo,' says the salesman who wrote up my order. Great tuner, still have it, but I live in a market now that hasn't heard of HD FM, rabbit ears will pick up TV, and I make things sound too complicated for people to believe, so it is clear (to them) I don't know what I am talking about, and all the while they're complaining about cable/satellite bills." – Troy Neal

A Less Expensive Way into Wi-Fi Radio

"I wrote some time ago about your choice for Wi-Fi Radios under $200 and the Grace Mondo seemed to be a good choice, but at $179 was still almost $200 for a radio I wasn't yet convinced I wanted or needed. At that time I did a little research and found the Grace Mondo was available refurbished for $119 but still didn't pull the trigger to purchase one.

"Well, last week my wife said she was tired of the local radio station and wished she could find some more choices for her background music in her studio. The Grace Digital Mondo came back into my mind that it was the best digital radio for the money and guess what? I found that Amazon was selling the radio refurbished and direct from Grace Digital Factory Direct for only $79.99. My trigger finger was ready and so I pulled it and now own one of those cool little

Power your Grace Digital Mondo for portable listening with this replacement battery pack ($20 with free shipping). (Courtesy: ABC products)

radios. It was a piece of cake to setup and get those sounds emitting from the speaker and my wife couldn't be happier.

"Of course being a normal ham radio operator I also wanted the radio to be portable and so I started looking for deals on a battery for the radio since the OEM battery was $39.99. I know batteries of that type don't cost that much if you use a lot of batteries like I do. I found ABC Products Replacement Grace Rechargeable Battery Pack for Mondo ACC-IRCLI for $23.69, almost a 50% savings. The replacement battery is Lithium Ion and has a little less capacity (4,400 mAh). I charged the battery, since it came the day before the radio, so when the radio came, I installed the battery and it fit and had the radio is working as it should—instantly.

"Needless to say I am a happy camper, the wife is happy and I saved $100 on the radio and $16 on the battery. So, when I look at it and see that I could have two for only $12 more than the full retail price of one with battery, I just might get another one for myself. Thanks a bunch for your magazine and all the content anyone could ever want related to radio." – Bob Earl KD6U

You may have to look a while before finding such a bargain as Bob found, but Grace Digital sells refurbished Mondo Wi-Fi radios regularly on their website for $120: ***https://gracedigital.com/shop/rfb-mondo***

Grace Digital Mondo replacement battery ($20 with free shipping) can be found here: ***https://www.amazon.com/ABC-Replacement-Rechargeable-GDI-IRC6000R-GDI-IRC6000W/dp/B003QOQM6I*** *-- Editor*

Radio in a Radio Shack-less World

Frequent TSM contributor, Mario Filippi N2HUN, sent these observations on a routine antenna installation in an era without a local Radio Shack:

Covering 25 through 3000 MHz, Diamond D3000N discone antenna ($135) can also transmit on 6-meters, 2-meters, 430, 900 and 1200 MHz ham bands. Antenna is 67 inches tall and mounts on any standard 0.98-2.05 inches (25-52 mm) mast with two supplied U-bolts. Shown here attached to a chimney-mounted PVC pipe. (Photo courtesy of Mario Filippi N2HUN)

"I decided to retire my old, worn Radio Shack discone after many years up on the roof. The new Diamond D3000N (25 MHz - 3 GHz) was purchased from Universal Radio, the new RG/6 coax from Casey at Hypermegasat.com, and the chimney mount hardware from RWantennastore.com (on eBay). Without a local Radio Shack all the items were bought on line. Only thing I did out of the ordinary was to mount the antenna on PVC pipe instead of a metal mast, again, no more Radio Shacks around for items like that.

"The Diamond has an N-connector so I had to purloin an N-to-F adapter from the junk box, and seal it with Coax-Seal, that's the best sealer in my opinion. Assembly went well, all parts were included—instructions consisted of an exploded diagram in Chinese.

"Initial testing of the Diamond based on reception of the NOAA WX radio channels reveal it is working much better than the old RS discone using an RTL-SDR.com dongle. Signals are much stronger. It'll take a few weeks to check out though. This antenna is also useful for hams, as it covers 6 and 2-meters as well as 440 and others. Price of the Diamond was $135, plus shipping." – Mario Filippi N2HUN

The July Mystery Movie Radios appear in the 1945 Universal serial Secret Agent X-9. In Chapter 13 "Zero Hour," foreign agent Nabura (Victoria Horne) and her henchman Takahari (Clarence Lang) confer by radio with one of Nabura's agents. Good views of both radios are provided as the action shifts back and forth between Nabura's headquarters (frame #1 left) and the agent's hideout (frame #2 right). (Screen captures courtesy of Eric Beheim)

July Mystery Movie Radio

There were no takers on the July Movie Mystery Radio. But that didn't stop *TSM* vintage radio guru Rich Post KB-8TAD from taking a stab at it.

"I only recognize the nice big National ACN dials (or equivalents) so I assume those are good studio mockups. Since the pictured agents are playing Japanese spy villains in mid-1945, the movie serials would not want to use recognizable American-made radios."

August Mystery Movie Radio

That brings us to this month's Movie Mystery Radio, seen at right. Avid old-time movie serial watcher and frequent *TSM* contributor, Eric Beheim, sets the scene:

"The August Mystery Movie Radio from the 1941 Republic serial 'The Adventures of Captain Marvel.' While in Asia, seeking knowledge of the ancient Scorpion Dynasty, the Malcolm Scientific Expedition runs afoul of a local native tribe while working in the forbidden 'Valley of the Tombs.' In this frame enlargement, expedition leader John Malcolm (left, played by Robert Strange) and radio operator Billy Batson (right, played by Frank Coghlan, Jr.) react to the hostile tribesmen."

August Mystery Movie Radio (Courtesy: Eric Beheim)

Editor's Note

If you are a new subscriber, back issues of *TSM* are available on the *TSM* homepage at **www.thespectrummonitor.com**. Issues are available individually at $3 each or by the year for $24 (a $12 savings). Payment can be made with credit card or via PayPal. An index listing each feature article and column in each issue is posted separately for each year. To see the index, just click on the yearly icon in the left-hand column of the homepage and you'll be taken to the page where you can see the index and/or purchase that particular year. To see the Table of Contents for any published issue, just click on the "more info" button under the image of each individual issue's cover.

Subscribers who read *TSM* on a Windows 10-based operating system should make sure they're using the latest version of Adobe Reader in order for the PDF file to display correctly. Recent Windows upgrades have made earlier versions of Adobe Reader unable to display PDF files correctly. Apple and Android systems and those using earlier versions of Windows are not affected.

TSM

RF CURRENT

News from the World of Communications

RF Current is compiled and edited by Ken Reitz KS4ZR from various news sources and links supplied by TSM readers. If you find an interesting story pertaining to amateur, shortwave, scanning, broadcasting or satellites, send a link to editor@thespectrummonitor.com

(Courtesy: ARRL)

ARRL Urges Support for S 1534

The American Radio Relay League (ARRL), in a press release from July 25, is calling on League members to urge their US Senators to support the Amateur Radio Parity Act of 2017, S. 1534. The League notes that it has opened a RallyCongress page to simplify the task: **https://arrl.rallycongress.net/ctas/urge-us-senate-to-support-amateur-radio-parity-act**

"'[W]e are at a crossroad in our efforts to obtain passage of The Amateur Radio Parity Act,' ARRL President, Rick Roderick K5UR, said. The campaign to secure passage of the bill scored a major victory earlier this year when H.R. 555 passed unanimously in the US House of Representatives. Obtaining passage of the companion Senate bill, S. 1534, is the final legislative hurdle.

"'Now is the time for all hams to get involved in the process!' Roderick said. 'Many of you already live in deed-restricted communities, and that number grows daily.' He urged radio amateurs now restricted by a Homeowners Association from installing effective outdoor antennas to visit the RallyCongress site and e-mail their two US Senators. He also encouraged those not now affected by deed covenants, conditions, and restrictions (CC&Rs) to support their fellow radio amateurs by doing the same.

"'If you want to help create an opportunity - not available before now - for amateurs who live in deed restricted communities to install effective outdoor antennas on property that you own or lease, send these e-mails today!' Roderick said. 'We need you to reach out to your Senators today. Right away.'"

The ARRL press release noted that, "S. 1534 was introduced in the US Senate on July 12, marking another step forward for this landmark legislation. Senators Roger Wicker (R-MS) and Richard Blumenthal (D-CT) are the Senate sponsors. The measure will, for the first time, guarantee all radio amateurs living in deed-restricted communities governed by a Homeowners Association (HOA) or subject to any private land-use regulations, the right to erect and maintain effective outdoor antennas at their homes, while protecting the aesthetic concerns of HOAs."

Highest Ranking DPRK Defector Praises VOA

According to a press release from the Broadcasting Board of Governors (BBG), Thae Young-ho, former Deputy Ambassador to the North Korean embassy in the UK and the highest ranking diplomat to defect from the DPRK, has repeatedly commented on the importance of U.S. international media's Korean programming.

"At his first press conference after defecting on December 27, 2016, he said, 'When I was immersed in the regime of North Korea, I was encouraged by Radio Free Asia's articles written by a defector and read every single one….These, I can say confidently, inspired me in making the decision to come to South Korea with my family.'

"A few months later, he told VOA's Seoul Correspondent that '…Voice of America has been playing very important role to bring back the human rights to every citizen of the world, and so far, VOA played a very important role to push the world to better world…The North Korean regime also pays great attention on the contents of VOA, so I think it is very important that VOA should further strengthen its activity, and also its contents so that, one day, I hope VOA is remembered by North Korean people as … the main player who contributed a lot for the reunification of the Korean peninsula.'"

TV Repack Costs to Exceed Available Funds

A report July 18 on the public media website, Current.org, explains that broadcasters involved in the TV band repack procedure in the great TV Spectrum Auction, have collectively requested $2.2 billion to cover the costs of

moving to their new channels as a result of the repack. But Congress has allotted only $1.75 billion to pay back participants in the repack. These are by no means the final tallies as broadcasters may be asked to cover unexpected expenses when stations actually move.

An example cited is WETA-TV, Washington, DC, which will move from channel 26 to channel 14. The station is asking to be reimbursed for $48 million for their move. The problem is that channel 14 at 470-476 MHz is in the lower end of the Land Mobile Radio band. The report, quoting WETA-TV's vice-president for engineering, noted, "With its headquarters in Arlington, Virginia, WETA is surrounded by 1,500 individual frequencies and 11,000 licensed devices within 100 kilometers of the station…universities, hospitals, hotels—anyplace that uses walkie-talkies for communication."

While the FCC gave the station permission to file for another channel assignment, the station says it has reviewed other channel possibilities without finding anything better. WETA-TV, under repack rules, is scheduled to complete the transition by August 2019.

Nearly 700 radio stations could be impacted by the TV band repack because of sharing tower space with TV stations. Such radio stations may have to leave the air while the TV station transitions to another channel assignment or find a new home for their antenna if the TV station had opted to go off the air or share a channel. The original repack funding didn't allow compensation for radio station expenses incurred by the TV station repack. This will no doubt hit noncommercial radio stations hardest because their funding is always precarious.

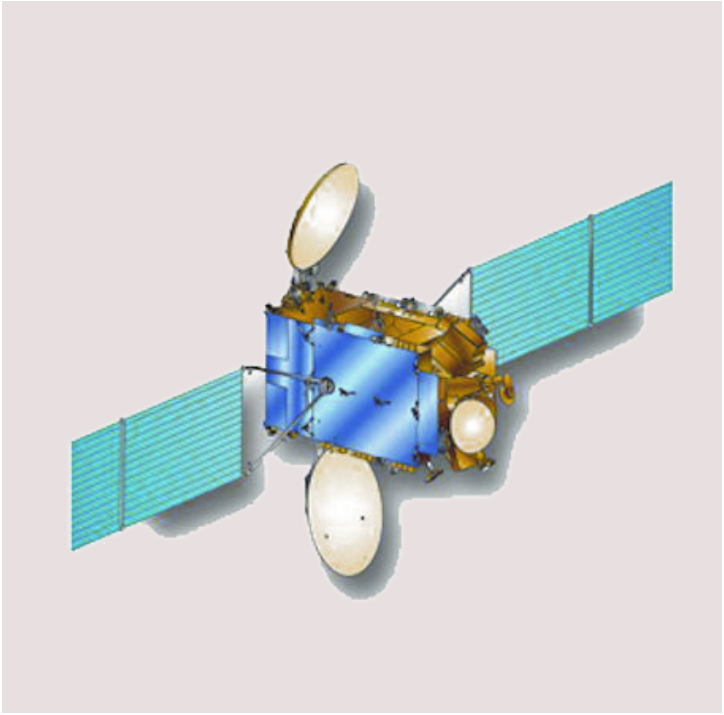
Help for beleaguered stations may be coming from an otherwise dysfunctional source: the US Congress. Several sources report that both houses could approve additional funding to cover unexpected TV station and radio station costs. But, such approval will require more than just action from both the House and Senate—they'll have to pass such legislation.

In a surprise move, repacking big-spender, T-Mobile, and PBS made a joint announcement June 29 that T-Mobile had committed to covering the costs for local public television low-power translators that are required to relocate to new broadcasting frequencies following the spectrum auction. Of course, T-Mobile will leverage the new spectrum it acquired in the auction to expand its wireless network in those areas it plans to help.

As might have been expected, the FCC moved ahead on repacking the entire TV band to allow mobile broadband to take over the frequencies without providing funding for low-power broadcast translators or radio stations or amateur radio repeaters affected by the spectrum auction.

The Case of the Disintegrating Satellite

AMC-9, a C/Ku-band satellite located at 83 degrees West, was launched June 7, 2003 with a life expectancy



AMC-9 (Courtesy: SES)

of 15 years. It served as a communications satellite with coverage across North America from Mexico to Canada. Fourteen years after its launch, the satellite experienced "a major anomaly" and the operator lost control of the satellite. Customers were shifted to other satellites in the SES group within 24 hours of the event. On July 1, contact was restored but there was still something wrong. Speculation in the satellite industry press ranged from a possible battery explosion to a possible hit from a meteor and there were fears that parts of the satellite had broken free, posing a possible threat to other satellites in geostationary orbit. While satellite owner SES said there would be no danger to any other satellites, video released from ExoAnalytics, a private space tracking service, appears to show four objects around AMC-9, that the company labeled as debris.

Survey Says: Telco Providers Lag Behind Tech Industry in Customer Privacy Protection

The Electronic Frontier Foundation (EFF), **https://www.eff.org**, released its annual survey July 10, "Who Has Your Back?" which showed that, "While many technology companies continue to step up their privacy game by adopting best practices to protect sensitive customer information when the government demands user data, telecommunications companies are failing to prioritize user privacy when the government comes knocking…Even tech giants such as Apple, Facebook, and Google can do more to fully stand behind their users.

"EFF evaluated the public policies at 26 companies and awarded stars in five categories. This year EFF included two new categories: 'promises not to sell out users,' and 'stands up to NSL [National Security Letter] gag orders.'

"The first reflects our concern about the stated goal of

several members of government to co-opt tech companies to track people by their immigration status or religion. We awarded stars to companies that prohibit developers and third parties from capturing user data to assist governments in conducting surveillance.

"NSLs are secret FBI demands for user information issued with no oversight from any court and permit the FBI to unilaterally gag recipients, a power EFF believes is unconstitutional. Facebook, Google, and Microsoft have failed to promise to step up and exercise the right to have the government put NSL gag orders before a court.

"Nine companies earned stars in every category this year: Adobe, Credo, Dropbox, Lyft, Pinterest, Sonic, Uber, Wickr, and Wordpress. Each has a track record of defending user privacy against government overreach and improved on their practices to meet the more stringent standards in this year's Who Has Your Back. Two tech companies lagged behind in the industry: Amazon and WhatsApp, both of which earned just two stars. EFF's survey showed that while both companies have done significant work to defend user privacy—EFF especially lauds WhatsApp's move to adopt end-to-end encryption by default for its billion users around the world—their policies still lag behind. Online retail giant Amazon has been rated number one in customer service, yet it hasn't made the public commitments to stand behind its users' digital privacy that the rest of the industry has. AT&T, Comcast, T-Mobile, and Verizon scored the lowest, each earning just one star. While they have adopted a number of industry best practices, like publishing transparency reports and requiring a warrant for content, they still need to commit to informing users before disclosing their data to the government and creating a public policy of requesting judicial review of all NSLs."

The full report can be found here: **https://www.eff.org/who-has-your-back-2017**

According to its website: "The Electronic Frontier Foundation is the leading nonprofit organization defending civil liberties in the digital world. Founded in 1990, EFF champions user privacy, free expression, and innovation through impact litigation, policy analysis, grassroots activism, and technology development. We work to ensure that rights and freedoms are enhanced and protected as our use of technology grows."

Robocaller Apparently Made Almost 100 Million Illegally-Spoofed Calls

In a press release from June 22, The Federal Communications Commission proposed a $120 million fine against an individual who apparently made almost 100 million spoofed robocalls in violation of the Truth in Caller ID Act.

"The law prohibits callers from deliberately falsifying caller ID information to disguise their identity with the intent to harm or defraud consumers. Mr. Adrian Abramovich of Miami, Florida, apparently made 96 million spoofed robocalls during a three-month period. Mr. Abramovich's operation apparently made the spoofed calls in order to trick unsuspecting consumers into answering and listening to his advertising messages. The proposed fine is based on 80,000 spoofed calls that the Commission has verified.

"Consumers reported receiving calls that appeared to come from local numbers but, if they answered, they heard an automated message prompting them to 'Press 1' to hear about 'exclusive' vacation deals from well-known travel and hospitality companies such as Marriott, Expedia, Hilton and TripAdvisor. Consumers who did press the button were then transferred to foreign call centers where live operators attempted to sell vacation packages often involving timeshares. The call centers were not affiliated with the well-known travel and hospitality companies mentioned in the recorded message.

"TripAdvisor contacted the FCC in 2016 after receiving complaints from consumers claiming the company had been robocalling them. TripAdvisor independently investigated these complaints and identified Abramovich as the source. In addition, Sp?k, a medical paging provider that serves hospitals, emergency rooms, and physicians, complained to Commission staff that an illegal robocalling campaign was disrupting its network. From the information provided by Sp?k, the Commission traced the calls to Adrian Abramovich.

"The FCC also received numerous consumer complaints that appeared to be in response to calls made by Mr. Abramovich. Mr. Abramovich apparently used what has been called 'neighbor spoofing' in hopes of gaining the trust of those receiving the call and increasing the likelihood of their answering. Neighbor spoofing takes place when the caller falsifies the caller ID to match the area code and first three digits of the recipient's phone number, instead of the caller's number or the number where the call was actually originating. The FCC received numerous consumer complaints about this practice. For example, one consumer stated: 'I have daily – sometimes multiple times [a] day – inbound spoofed calls (same area code and prefix as my own phone number) purporting to be from [Marriott] . . .' The Truth in Caller ID Act of 2009 and the Commission's rules prohibit spoofing with the intent to cause harm, defraud, or wrongfully obtain anything of value.

"Consumers rely on caller ID information to make decisions about what calls to accept, ignore, or block. Accurate caller ID information is a vital tool that consumers use to protect their privacy, avoid fraud, and ensure peace of mind. Earlier today, the FCC's Enforcement Bureau also issued a citation to Mr. Abramovich for apparent violations of the Telephone Consumer Protection Act's robocall limits and the federal wire fraud statute. Under the Act, the Commission must first provide a warning—in the form of a citation—to TCPA violators if the person or entity in question does not possess a license or authorization is authorization issued by the FCC. If these violations continue, they may be subject to additional fines."

TSM

RMHAM microwave relay on Methodist Peak at 11,700 feet. (Photo by Jeff Carrier K0JSC)

Rocky Mountain Ham Radio Microwave Backbone and DMR Repeater Network

By Wayne Heinen N0POH

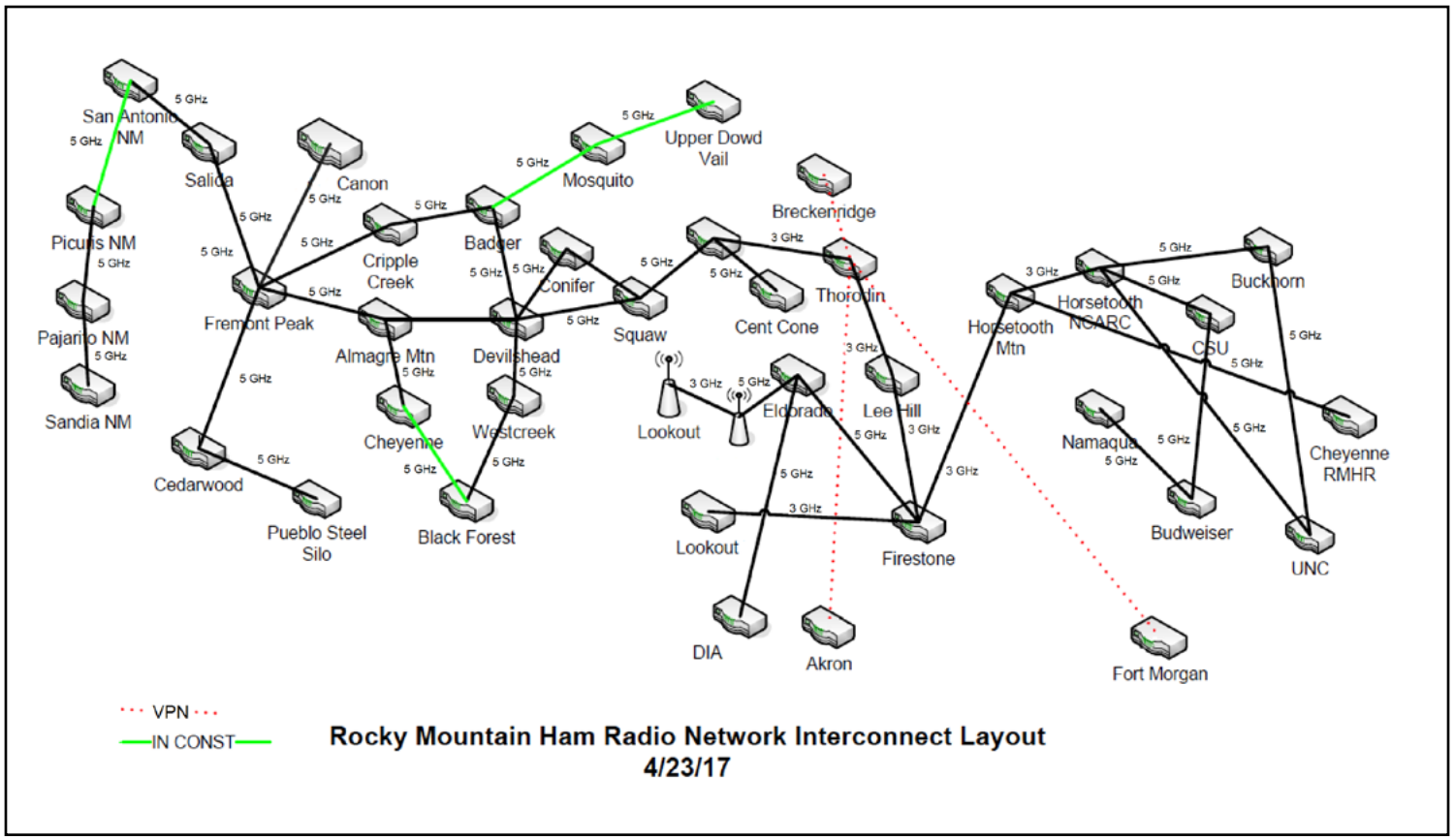
Use it or Lose it – Making good use of our microwave bands

With the advent of all of the new digital technologies, hams have to rely on the Internet more and more for their communications backhaul. Many clubs are moving their linking channels off radio links and onto Voice over IP technology (VoIP). This technology is opening up the world by allowing hams to put repeaters wherever there is access to an Internet connection. Over the last 15 years, VoIP based technologies have been creeping into amateur radio and have firmly taken hold with systems like IRLP, D-STAR, All Star, and MotoTRBO radio systems, just to name a few

Rocky Mountain Ham Radio Inc. (RM Ham) deployed analog repeater sites all along the Front Range of Colorado and had been linking them via IRLP on commercial Internet for years. Due to the cost and reliability factors of commercial Internet, RM HAM had been looking for a ham radio spectrum-based transport method for their IP needs which have been steadily growing over the years.

RM Ham was a pioneer user of the MotoTRBO technology (also referred to as Digital Motorola Radio or DMR) in Colorado. UHF DMR repeaters were added to a few of RM Ham's analog mountain top sites. These original repeaters were located at sites that had commercial Internet available. The Internet connections cost money and at times had intermittent connectivity. What we needed was a better way to link these repeaters.

What was needed was a digital link that could be created between the various mountain top sites, an IP based



(Courtesy: RMHAM)

network of our own design, which would be controlled by RM Ham as the end user. Current linking of repeater systems in Colorado utilized dedicated UHF analog voice links. The ideal solution was to move higher in the spectrum. The 2.4, 3.4 and 5.7 Gigahertz (GHz) amateur bands are all available for linking however; the available amateur radio equipment is limited to transverters and would require considerable time and effort to construct and configure.

While doing some shopping on the Internet, some interesting items were discovered, including commercially available microwave point-to-point systems that were listed as "For Export Only." They were for export because there are no commercial allocations in the U.S.A. in the portions of the 3 GHz band where these units operate. RM HAM found Ubiquiti Networks, which is a commercial manufacturer that produces radio equipment in the 900 MHz, 2.4 GHz, 3.4-3.8 MHz, 5.2-5.8 GHz and 10 GHz point-to-point and point-to-multipoint IP radio equipment.

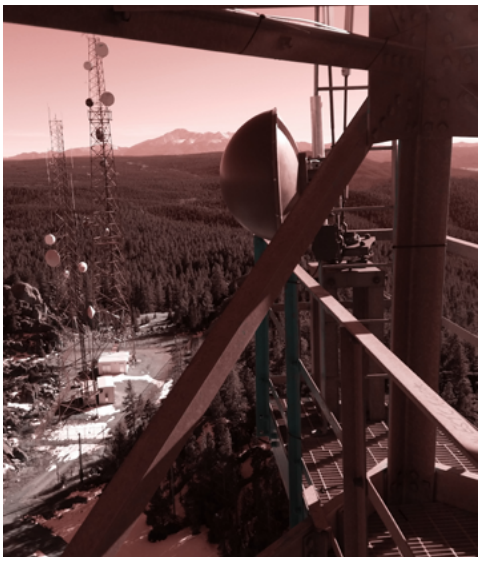
This radio equipment can be purchased for export in the 3.3 GHz to 3.5 GHz frequency range and it works perfectly on the ham frequencies where amateurs are the primary licensees. Dealers were very happy to sell us these units after we were able to show them that we were licensed to operate within these bands. The network management tools are impressive for the microwave backbone equipment too. Ubiquiti provides a full network management server that allows you to constantly monitor the signal strength and alarms on any radio connected to the network on any browser as well as an application for iDevices as well as the Android OS.

The next step in the creation of the DMR system is the use of Motorola IP Site Connect (IPSC), this requires a master repeater and can accommodate up to about a dozen peers. Each IPSC on the system is a talk group and is assigned a talk group number. Since we're discussing the creation of the microwave backbone, we'll leave the particulars of the creation of the DMR operating system for another time. A key component of the network is the c-Bridge. The c-bridge is an IP gateway between the repeaters and the network. This allows the backbone control operators to bridge voice and data throughout the multiple IPSC's that are connected on the backbone. The c-Bridge allows the control operators to monitor the traffic on the entire system.

The routers are very important components in the system. They are not only the link between the repeaters and the microwave backbone system but allow RM HAM to remotely control the sites. We have the ability to use the backbone to control our hardware using IP enabled devices. Equipment can be rebooted remotely and power sources can be monitored and switched remotely with IP enabled power distribution equipment. This is very important to RM HAM as most of our repeater sites are either inaccessible or accessible with great difficulty in winter. There have been times when our members have gone in on tracked vehicles and even snowshoed the last ½ mile into some sites.

RM HAM acquired a few microwave units to begin our testing to see if indeed we would be able to use the amateur radio spectrum to build out a suitable network of our own. After a Christmas breakfast in 2009 the group set up





Left: Cripple Creek, at just below 11,000 feet. Center: Rob Wright KC0UUO works on Westcreek. Right: Another view of Westcreek at 9,300 feet. (Photos by Jeff Carrier K0JSC)

two sites in the back of pickup trucks on the north side of the metro area. Tests were made using 3.4 GHz units with two-foot dish antennas and we had success aiming the dishes and obtained very good data rates. Our first link was from Firestone to our Lee Hill site a distance of approximately 22 miles. This confirmed that we could create a backbone to carry our voice and data to our repeater sites. Over the course of a few months we created links to our Mount Thorodin and Squaw Mountain sites. These links comprised the first fully connected repeaters in our DMR system.

Our initial tests and our first links were in the 3 GHz band but there was a drawback as we started to expand and build out our paths. The equipment for 3 GHz proved to be rather expensive and difficult to set up. Our more recent expansion paths operate in the spectrum 5835 MHz – 5925 MHz. This frequency range is not part of the commercial allocation at 5 GHz. The equipment in the 5 GHz band is much easier on the pocketbook.

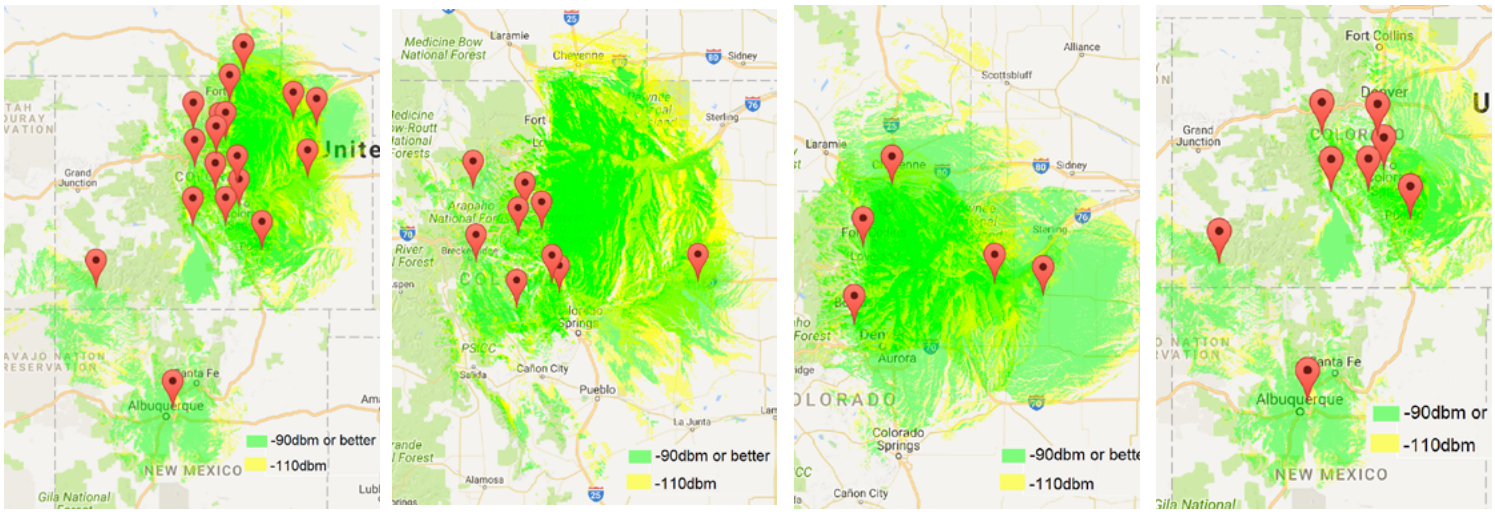
DMR repeaters use a two-slot time division multiple access (TDMA) scheme supporting two channels per frequency (See *TSM* January 2017 "Scanning America" page 32 for more on this technology) The backbone supports the talk group 700 in time Slot 1 which was called Colorado Wide and was renamed Rocky Mountain Wide, after the inclusion of the New Mexico and Wyoming repeaters to the group. (Figure 1 next page) Talk Group 720 was the Denver Talk Group and has since been renamed Central Colorado Talk Group (Figure 2 next page) since it serves the central part of the state on the I-70 corridor after the addition of repeaters in Breckenridge and Genoa.

What started as a plan to link a few metro Denver area sites together soon mushroomed. There was considerable interest in the DMR technology and a variety of radios were becoming available, both used and new, at prices that were affordable. Rocky Mountain Ham Radio's innovative microwave backbone drew interest and some other interested amateurs wanted to help expand DMR sites into their areas. These amateurs became RM HAM members and "stakeholders" in the buildout of the RM HAM backbone and DMR system. This was a great help as neither repeaters nor microwave units grow on trees. There was a need to "share the load," both in terms of money and labor, in order for the network to continue to expand throughout Colorado's Front Range and beyond.

The expansion to the north of the Denver Metro area began with a partner who installed a link back to Firestone from Horsetooth Mountain. In 2015 RM HAM began working with partners in the Northern Colorado Amateur Radio Club and the Colorado State University Radio Club. This allowed the backbone to be extended into the cities of Fort Collins and Greeley. Also, later in that year, a link was established north into Cheyenne, Wyoming, adding another state to the Rocky Mountain Wide Talk Group 700. Talk Group 721 the Northern Colorado Regional talk group is in time slot 2. (Figure 3 next page)

The RM HAM backbone is not 100 percent amateur microwave. There are areas where we have been unable to locate line of sight paths between an existing site and the site that we are interested in expanding to. When this is the case, we still rely on the Internet when it is available. We can establish a VPN (Virtual Private Network) connection between one of our existing sites that has Internet and the expansion site. This was the case when we moved out on the Eastern Plains with our North East All Hazard region partners. We have a VPN to the site in Fort Morgan and VPN links to sites located in Akron and Genoa.

Moving on south of the Denver Metropolitan area, RM HAM established a link between Devil's Head and Squaw Mountain. This allowed us to link further south to Cheyenne Mountain and Almagre Peak. A redundant path from Devil's Head to Badger Mountain was created. This path would allow us to work around any outages that might occur on Almagre, which is not accessible in winter. The repeaters located on Almagre have excellent coverage of Colorado



RMHAM microwave backbone up-close: Figures 1-4 (Courtesy of RMHAM)

Springs and the Pike's Peak Region. Badger provides wide area repeater coverage to the South Park Region and the Town of Fairplay. From the Almagre and Badger sites we have links to Fremont Peak. These links connect the backbone to Cañon City, Pueblo and Salida, which gives us DMR coverage for these cities. These repeaters have talk group 720 Rocky Mountain Wide in time slot 1 and talk group 719 the Southern Colorado Regional talk group in time slot 2. (Figure 4 above)

RM HAM has also been able to assist other groups with their linked repeater systems. RM Ham operates what is essentially a UHF digital system. Our partners to the south in Cañon City operate an analog UHF system nicknamed the Fun Machines. The southern portion of the backbone allows the Fun Machines to be linked using the All Star VoIP linking technology. We've also established a link to our central region allowing one of RM HAM's Denver Metro area analog UHF repeaters to join the Fun Machine network. On the VHF side our partners at the Colorado Connection and the Colorado Repeater Association are now using dedicated audio links over the backbone to give a higher quality and more reliable audio streams to their VHF repeaters systems in sites where we have co-located installations.

Some very like minded amateurs from our neighbor to the south became interested in the concepts of our backbone and in the structure of RM Ham, which makes it a different kind of amateur radio organization. They met with us and shared their desire to extend the RM Ham concept to New Mexico. So Rocky Mountain Ham Radio – New Mexico was formed. This group has a DMR repeater in Albuquerque, which is currently linked to Colorado with a VPN. RM HAM-NM is creating a New Mexico backbone that is designed to meet up with the RM HAM Colorado backbone when the link between Picuris Mountain and San Antonio Mountain in New Mexico is completed.

Current expansion plans include linking Badger Mountain to Mosquito Peak and from Mosquito to Upper Dowd overlooking the Vail Valley which will move the microwave portion of the backbone across the Continental Divide and allow us to find partners to extend to the Western Slope.

Our goal over time was to create a flexible system of repeaters that would be available for general amateur use. This system can be configured to serve groups, such as ARES, who need to supply communications in emergencies to their served agencies. On May 13, 27 men and women, members of RM HAM, volunteered in support of the Broomfield Rotary Club's Triple C Bike Ride. This event raises money for their many charitable causes. They manned the Start/Finish line, rest areas and drove the course. RM HAM's Northern Colorado Regional talk group was utilized for a Rest Area net and simultaneously we used the Central Colorado Talk Group to conduct a Course net. That's what Rocky Mountain Ham Radio is about, Service to Our Community.

About the Author

*Wayne's introduction to radio came from his Dad, Bill W2SIC (SK). He became an avid SWL and BCB DXer, joining numerous clubs including the National Radio Club, where he serves on the Board of Directors. First licensed in 1991 Wayne currently holds an Extra class amateur radio license. He became active in many amateur radio clubs in Colorado, and has served as an officer, repeater trustee with the Aurora Repeater Association. He serves as Treasurer and "The Swapfest" chairman for the Aurora Repeater Association, Rocky Mountain Ham Radio Inc. and Cherry Creek Young Amateur Radio Club, as well as Treasurer of the Colorado Council of Amateur Radio Clubs, Colorado's frequency coordination body. He's an avid VHF+ contester and grid chaser, as well as a founding member of Rocky Mountain VHF+ (***www.rmvhf.org***).*

Wayne wrote "Rocky Mountain Ham Radio Communications Trailer" as featured in the May 2014 The Spectrum Monitor and has previously written a variety of feature articles for Monitoring Times the most recent one being "Frequency Coordination in the Amateur Radio Service" (May, 2009) Wayne can be reached at n0poh@arrl.net **TSM**

Left: Simpler times. Electra Bearcat III crystal controlled scanner was available in one or two-band configurations with 8 crystals (which were sold separately) and could scan 25 channels per second—a big step up from analog-tuning. Right: Whistler WS1098 Scanner (sale priced as of this writing at $400 at Universal Radio) covers 25-1300 MHz (less cellular frequencies) automatically programmable by ZIP code, capable of receiving APCO P25 Digital Phase I & II, Multi-system analog trunking (Motorola, EDACS and LTR), with recording function and 2GB SD card preloaded with US and Canadian public service frequencies. (Both photos courtesy: Universal Radio)

An Introduction to Scanning Today

By Bob Grove W8JHD

While TSM attempts to examine wide aspects of monitoring the radio spectrum, we know that our readers who are new to the hobby need basic orientation to massage their interests.

But, First, a Little History

Looking back a half century, we find that the easiest way to get VHF/UHF reception was to acquire a frequency down-converter that could be attached to the antenna input of a general coverage shortwave receiver. The main tuning dial of that receiver could then slew across the higher frequencies, but the receiver's tuning dial would still show the original shortwave calibration, not the frequencies being down-converted, so mental math was necessary to calculate the actual monitored frequencies.

With interest in two-way communications growing, frequency-tunable VHF/UHF receivers began to appear on the market. Since they could only display and receive one selected frequency at a time, all sorts of activity on other frequencies went on without the listener's knowledge. Hence, the birth of the scanning receiver.

Although there were several early entrants, the strongest brand to emerge was the Bearcat, affectionately named by Electra founder Al Lovell after his favorite Stutz automobile. In those days, scanners were crystal controlled -- the listener would have to order a separate crystal for each frequency he or she wanted to monitor.

The need for more channels, coupled with the inconvenience of changing crystals, was met by a new technology: frequency synthesis. Now frequencies could be rapidly and automatically changed just by proper digital coding activated by the listener at the press of a key.

Eventually, Electra closed their manufacturing operation and handed production to a new industry leader, Uniden Corporation.

Issues Now Faced by the Hobbyist

If you live in a small town, chances are good that most communications are still conducted by analog modulation; in other words, simple frequency modulation (FM). But the abundance of radio signals in larger metropolitan areas demands narrow channel widths and frequency sharing (trunking).

To address the situation, two-way radio manufacturers such as Kenwood, Motorola, Yaesu, among others, use an array of digitized modes, unreceivable on early-model scanners. Such encoded transmissions include NXDN, P25, DMR, Astro, D-Star, MotoTRBO, and more.

While scanner manufacturers are gradually incorporating these digital modes into their new models, privacy modes

Useful scanners don't have to be expensive. This BC-75XLT hand-held scanner tunes 25-512 MHz and utilizes CloseCall RF Capture Technology for $90. (Courtesy: Universal Radio)

On the other hand, this Whistler TRX-1 does it all (Motorola P25 Phase I, X2-TDMA, Phase II and DMR) for $500. (Courtesy: Universal Radio)

(scrambling) are not legally allowed in scanners.

More Issues

With untold numbers of simultaneous transmissions occurring, a scanner must be able to race through its frequency-synthesizing algorithms rapidly so as to move on to the next active channel without delay.

Early scanners crawled along searching at half a dozen channels per second, meaning that a busy spectrum wouldn't be rapidly scanned, and important communications would be missed. Modern designs permit rapid channel sampling on the order of dozens, approaching 100, per second.

Two other serious blights affecting early model scanners were poor image rejection ("birdies") and strong-signal overload (intermodulation – "intermod") resulting in interference on desired signal frequencies. To reduce this conflict, some manufacturers chose to reduce sensitivity, the side effect of which limited the distance of reception.

Used or New?

If cost is key to your purchase, then you may wish to consider a used model. Keep in mind, however, that performance has improved on newer models, and digital modes now used by many two-way licensees are not all receivable on early model scanners.

The Federal Communications Commission (FCC) has narrowed the spacing between channels, and the widths of each channel as well. Newer scanner models have accommodated those changes; older scanners may suffer some performance reduction in the form of distortion, reduced sensitivity, and co-channel interference.

There may be some cosmetic and performance attrition due to age and prior use. Some surface wear and expired warranty are normal, but scratches, worn-off labels, dim or defective displays, depleted internal memory batteries (on older models), scratchy volume or squelch controls, and missing accessories (belt clip, antenna, power supply, instruction manual) are not.

Hands-on testing is always preferable before buying, but is not always available. Watch for a hamfest announcement nearby; these radio hobby flea markets are fun, bargain filled, and you can at least see, if not hear, what you're buying.

If you are willing to take a chance, you can check newspaper and magazine ads, as well as sale papers like craigslist. On line, Amazon always has scanners for sale, and eBay listings state each seller's reputation.

Although radio hobby stores are not as profuse as they once were, there are still admirable examples like Universal Radio.

We have seen the extinction of major manufacturers including Lafayette, Allied (Knight), Drake, and Heathkit, as well as the reduction of radio offerings from Radio Shack, GRE, Regency, and other brands. With the disappearance of the manufacturer, replacement of parts and accessories becomes a challenge.

What do You Want to Hear?

Our listening interests vary. Scanner transmissions include law enforcement, fire calls, medical emergencies, air-to-ground, businesses, personal communications, ship-to-shore, ham radio, wireless microphones, and more. If two-way radio is being used, a good scanner will receive it.

Several models now offer automatic reception of any transmission nearby, whether in the scanner's memory bank or not. Uniden calls this feature "Close call." This function is useful for capturing transmissions when you don't know the frequency, such as out-of-town emergency and law enforcement transmissions, or walkie-talkies used in businesses

When money is no object and listening is everything, consider going all in on a professional-style fully flexible communications receiver. Left: The AOR AR5001DB ($4,400) wideband communications receiver covers 40 kHz to 3150 MHz (less cellular) in: USB, LSB, CW, Wide FM, Narrow FM, AM and AM Synchronous modes. APCO P-25 mode is available optionally. Right: Icom IC-R8600-02 ($2,600) covers 10 kHz to 3000 MHz (less cellular) in AM, USB, LSB, CW, FM and decodes multiple digital protocols, including Baudot RTTY, D-STAR NXDN dPMR DCR (Digital Communication Radio) and APCO P25. (Photos courtesy: Universal Radio)

or along construction sites.

Radio Scanner or Scanning Receiver?

While these two terms sound synonymous, there is a difference. Most hobbyists hoping to listen to local two-way communications are looking for a radio scanner, the familiar squawk box with a keypad, volume, and squelch knobs. No fine-tuning control, no signal strength meter, and frequency coverage above 30 MHz.

A scanning receiver, on the other hand, is one that includes frequency coverage beginning below 30 MHz (shortwave and even AM broadcast), single sideband (SSB) mode, and a continuous-tuning knob, basically, a shortwave radio with upward-extending frequency coverage, narrow FM mode, and programmable memory channels that can be scanned.

Hand Held or Base/Mobile?

Both types of radio receivers described above are available in either base/mobile (desktop) or hand-held configurations. If you're continuously on the go, and frequently away from your vehicle, you'll want the portability of a hand-held scanner. If your travels confine you mostly to a car or truck, then a base/mobile unit can be installed.

Very few hand-held scanners have coverage below 30 MHz; notable among these are the Icom IC-R6 and AOR AR-8200.

Some portables are specialized, such as Racing Radio's auto track scanners. In addition, several import models, handy-talkies, offer transmitting as well as receiving over the VHF and UHF ranges. Most of these are made in China, and are remarkably low priced.

Base/mobile scanners are designed for 12 VDC car-battery power, but come with 120 VAC adapters. While many early Bearcats had custom, rechargeable battery packs, most modern, hand-held scanners use replaceable batteries, usually AA cells. Be sure to use alkaline or rechargeable replacements for better lifetime.

The Bottom Line

With due reverence for early scanner models, designs have evolved into better performance in virtually every aspect. Decide what service frequencies you are interested in monitoring, whether or not trunking is being used, and which digital schemes are being used for modulation. Then start shopping!

Scanner Frequency Band Plan

There is a plan for frequency classification. VHF (Very High Frequency) is from 30-300 MHz, and UHF (Ultra High Frequency) is from 300-3000 MHz. Modes are narrowband FM, wideband FM, or AM.

30.000-49.990 NFM LAND MOBILE/FEDERAL GOVERNMENT/MILITARY
50.001-53.990 NFM AMATEUR (6 meter band)/MILITARY
54.000-72.000 WFM TV CHANNELS 2-4
72.010-74.990 NFM RELAY/REMOTE CONTROL
75.000 AM AERONAVIGATION
75.010-75.990 NFM RELAY/REMOTE CONTROL
76.000-88.000 WFM TV CHANNELS 5-6
88.100-107.900 WFM BROADCASTING
108.000-117.950 AM AERONAVIGATION
117.950-136.975 AM AIRCRAFT
136.980-137.980 NFM SATELLITE

Looking for something a little more user friendly? Uniden's HomePatrolII ($480) might be for you. With coverage from 25-54, 108-512 and 758-960 MHz (less cellular) in AM, FM and FM wide modes. TrunkTracking EDACS(N/W), LTR, Motorola (analog/mixed/digital) and APCO P25 Phase I and II is supported. (Courtesy: Universal Radio)

138.000-140.000 AM MILITARY AIRCRAFT/FEDERAL
140.025-143.975 NFM MILITARY MOBILE
144.000-148.000 NFM AMATEUR (2 meter band)
148.025-150.775 NFM MILITARY MOBILE
150.775-154.445 NFM LAND MOBILE
154.45625-154.47875 NFM POWER LINE TELEMETRY
154.490-156.255 NFM LAND MOBILE
156.275-161.975 NFM MARITIME/LAND MOBILE (159.810-161.550 railroads)
162.000-173.9875 NFMLAND MOBILE/FEDERAL GOVERNMENT
174.000-216.000 WFM TV CHANNELS 7-13
216.0125-216.9875 NFM AMTS SIMPLEX
217.0125-217.9875 NFM AMTS COAST
218.0125-218.9875 NFM INTERACTIVE VIDEO
219.0125-219.9875 NFM AMTS SHIPS
220.0025-221.9975 NFM LAND MOBILE
222.000-224.980 NFM AMATEUR (1.25 METER BAND)
225.000-379.975 AM MILITARY AIRCRAFT
380-399.9875 FM LAND MOBILE
400.000-406.000 FM SATELLITE/RADIOSONDE
406.1125-410.9875 NFM FEDERAL REPEATER OUTPUT
411.0000-415.1000 NFM FEDERAL SIMPLEX
415.1125-419.9875 NFM FEDERAL REPEATER INPUT
420.000-450.000 NFM AMATEUR (70 CENTIMETER BAND)
450.0125-454.6875 NFM LAND MOBILE
454.675-454.975 NFM AIR-GROUND TELEPHONE (GROUND)

A far cry from the crystal controlled BearcatIII. The latest Bearcat BCD436HP features TrunkTracker V technology, offers APCO Project 25 Phase I and Phase II, X2-TDMA, Motorola EDACS LTR Trunked Radio Systems and supports DMR and Ericsson ProVoice (with paid upgrades) for $490. (Courtesy: Universal Radio)

455.000-459.6875 NFM LAND MOBILE
459.675-459.975 NFM AIR-GROUND TELEPHONE (PLANE)
460.000-511.9875 NFM LAND MOBILE
512-608 WFM TV CHANNELS
608-614 NFM LAND MOBILE
614-698 WFM LANDMOBILE
698-763 WFM TV CHANNELS
763-769 NFM LAND MOBILE
769-775 NFM PUBLIC SAFETY
775-793 WFM TV CHANNELS
793-799 NFM LAND MOBILE
799-809 NFM PUBLIC SAFETY
809-824 NFM LAND MOBILE TRUNKED
824-849 NFM CELLULAR MOBILE
849.-851 AM AIR-GROUND PHONE (GROUND)
851-854 NFM PUBLIC SAFETY
854-869 NFM LAND MOBILE BASE TRUNKED
851.0125-868.9875 NFM LAND MOBILE BASE TRUNKED
869.040-893.970 NFM CELLULAR BASE
894.002-895.996 AM AIR-GROUND TELEPHONE
896.0125-900.9875 NFM BUSINESS MOBILE
901-902 NFM PCS
902.0125-927.9875 NFM CT-2/ISM/AVM/AMATEUR
928.00625-928.99375 NFM MAS REMOTE TRANSMIT
929.0125-929.9875 NFM VOICE AND DIG. PAGING
930-931 NFM PCS

If you know where to look and your timing is right, you can get a good deal on a capable used scanner. This GRE PSR-700, which covers VHF Low, VHF High, VHF Air, UHF, 800 MHz public service (less cellular) and 1.2 GHz including analog trunking, recently sold used for $90 at Universal Radio. You can check out their current used offerings by going to their homepage (http://www.universal-radio.com/index.html) and clicking where it shows "Used List." (Courtesy: Universal Radio)

931.0125-931.9875 NFM MAS REMOTE TRANSMIT
932.00625-934.9875 NFM GOVT/PRIVATE MICROWAVE
935.0125-939.9875 NFM BUSINESS BASE TRUNKING
940-941 NFM PCS
941.00625-943.9875 NFM GOVT/PRIVATE MICROWAVE
944.500-951.500 MFM BROADCASTING STL
952.00625-952.9875 NFM ALARM/PRIVATE MICRO-WAVE
953.000-956.050 MFM PRIVATE/LCL GOVT MICRO-WAVE
956.25625-956.4375 NFM SIGNAL AND CONTROL
956.600-959.150 WFM PRIVATE/LCL GOVT MICRO-WAVE
959.85625-959.9875 NFM PAGING

A Sample of Current Digital-Capable Scanners
(Listed by model, approximate cost, features, and frequency range in MHz)

Uniden
BCT-15X $179 Close Call, 9000 channels, 25-512/764-956/1240-1300
BC-75XLT HH $99 Close Call, 300 channels, 25-54/108-174/400-512
BC-125AT HH $129 Close Call, 500 channels, 25-54/ 108-174/225-380/400-512
BCD-325P2 HH $399, (Replaces BCD396XT) Close Call, 25-512/758-960
BCD-996P2 $369 Close Call, P-25, trunking, 25-512/754-956/1240-1300
BCD436HP/536HP ($479/$531) Close Call, trunking, 25-512/758-960/1240-1300; includes P-25, DMR/MotoTRBO); NXDN coming at additional cost.

Whistler (formerly GRE)
WS-1040 HH $290 25-54/108-174/216-512/764-960/1240-1300
WS-1065 $290 25-54/1080174/216-512/764-776/795-805/849-960/12-1300
WS-1080 (P-25, U.S. database on SD card); replaced by WS-1088 with keypad
WS-1088 HH $450 25-54/108-512/764-960/1240-1300
WS-1095 $420 25-54/108-174/216-512/764-960/1240-1300
WS-1098 $520 25-54/108-174/216-512/764-960/1240-1300
TRX-1/TRX-2 ($485/$497) 25-54, 108-174, 216-512, 764-960, 1240-1300; P25, DMR MotoTRBO, NXDN (Good reviews) (No direct frequency entry)

Radio Shack (rebranded Whistlers)
PRO-649 HH $119; 200 ch., preprogrammed; 26-54, 108-174, 380-512 MHz
PRO-650 Base $120 " "

PRO-651 HH $299; 25-54, 108-174, 216-512, 764-960, 1240-1300 MHz
PRO-652 Base/mobile $400 25-54, 108-174, 225-380, 400-512, 764-960, 1240-1300
PRO-668 (Rebranded Whistler 1080/GRE PSR800)

AOR AR-DV-1: $1200 Compact mobile receiver 100 kHz-1300 MHz, zip code loads automatically. Receives D-STAR, GMSK, P-25 Phase), DMR, 2X-TDMA. No trunking.

ICOM IC-R8600: 10 kHz-3000 MHz; 4.3" color touch screen with spectrum display; decodes D-STAR, NXDN, dPMR, APCO P25; I/O output for SDR, external decoding.

Though snow had subsided, winds were still strong at the New River Gorge as the chilly New River itself raced by. The W4OP loop (in foreground) performed admirably and truly saved this activation. (Photo by Thomas Witherspoon K4SWL)

W4OP Magnetic Loop HF Antenna

By Thomas Witherspoon K4SWL

What can one say about portable antennas? They're up, they're down, they're basic in design—they either work for an intended purpose or they don't. But, I wondered, could they provide their service easily and conveniently, even in the field?

Last year, I decided to purchase a portable field antenna, and at the Dayton Hamvention I became the owner of the three-band (40/20/10) EFT Trail-Friendly antenna from LnR Precision.

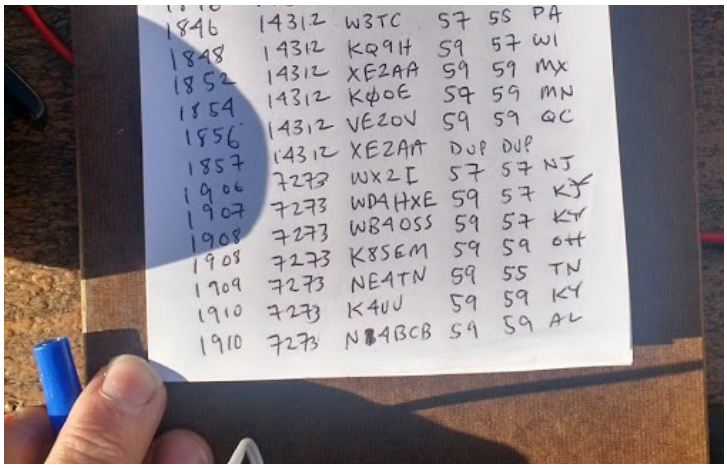
Then, I caught a bug: the National Parks on the Air (NPOTA) bug. And, wow, I caught it in a bad way...! Having activated seven sites during the 2016 Dayton Hamvention with my buddy Eric McFadden WD8RIF, I found NPOTA the perfect excuse to play radio outdoors. Last year, from August to December, I activated all but that initial seven of my ninety-one NPOTA park activations. All of these activations were QRP and all of them were "field" activations; meaning, I set up my field antenna each time; no activations were made with a mobile (vehicle) HF installation. And I made 85% of all of my activations using LNR's EFT Trail-Friendly antenna.

The EFT Trail-Friendly antenna is end-fed and requires some sort of support system to raise the end of the 33-foot radiator. Most of the time, I simply hung the lightweight EFT from a sturdy tree branch. On a few occasions, I hung the end on a 31 or 22-foot fiberglass telescoping pole and I was altogether pleased with its performance. Indeed, I can't recommend it enough for someone who wishes to have a simple, roll-up, resonant antenna for QRP fieldwork. But it does have one limitation: it requires that source of external support, which I worried could undermine some NPOTA activations.

In December 2016, my buddy Eric WD8RIF and I organized a mini NPOTA DXpedition in Ohio. I decided that en route to Ohio, I'd make a run through West Virginia and activate some relatively rare parks along West Virginia's mighty river gorges.

Eric had made the same activation run earlier that year, and had advised me that when I seek permission to activate these parks, I would be asked to apply for and pay at least one, sometimes more, "special use permit" fees merely to drape the lightweight EFT antenna over a tree branch or to stake a fiberglass support pole in the ground. Even if my equipment is less invasive in the great outdoors than the poles and stakes of a basic pup tent, I understood US park trees and shrubs can be delicate, rare, or endangered, and even park soil can be, for example, geologically or archaeologically sensitive, so of course I didn't want a mere antenna to bring about any harm—however minor—to the parks I was enjoying.

Eric had simplified this step by strapping a fiberglass pole antenna to his vehicle, thus avoiding either penetrating the ground or using park vegetation as a support. So as not to potentially harm sensitive park environs, nor be obliged to



With only 30 minutes on the air, the W4OP loop snagged stations from across the continent on its maiden deployment at the Blue Ridge Parkway. (Photo by Thomas Witherspoon K4SWL)

hop through time-consuming (and expensive) administrative hoops, I decided I would adopt an option similar to Eric: I would use a portable antenna that could stand on its own, thus not requiring external support from park property.

Enter the W4OP magnetic loop antenna. LnR precision had just a few weeks before announced their new portable, self-supporting, magnetic loop antenna: the W4OP loop.

I contacted LnR in November to tell them about my upcoming December NPOTA DXpedition, and inquired whether they thought the W4OP loop would be a good fit. They responded by sending me a loaner unit to both use and review. After all, what better way to evaluate an antenna than by using it in the field? I said I'd be happy to give it a test drive.

The W4OP loop arrived in early December, about one week before my trip.

Contents of the loop package are straightforward:

- The main loop assembly and support
- The coupling loop assembly and clamp
- The tuning box
- The support feet assembly
- An owner's manual

The main radiator is a sturdy, flexible-yet-rigid shielded cable. The tuning box is a heavy PVC box, and the tuning knob has an appropriate amount of brake and drives a 6:1 reduction drive on the tuning capacitor.

The overall package feels well built and of very decent quality. The only piece of the equipment package I didn't like are the four support feet: these feet attach to the bottom of the tuning box with red thumb screws, a very basic way of supporting the unit, since the red screws are challenging to tighten and almost any movement from the feet loosens the screws. Since my review, however, LnR has designed a tripod mount for the W4OP loop, which promises to make it much, much easier to deploy this antenna in the field (**http://bit.ly/2oz1Rwu**). With the tripod mount, one would only need to pack a sturdy (camera) tripod, and then toss out the included stabilizing feet.

The manual (**http://bit.ly/2nAauJG**) is fairly simple and concise, but certainly provides enough information to get you on the air in short order.

Admittedly, this wasn't an ideal or tidy setup, but the W4OP performed admirably on this park picnic table. (Photo by Thomas Witherspoon K4SWL)

On the air with NPOTA

I'm a bit embarrassed to admit that I was something of a newbie when it comes to passive mag-loop antennas. I've used a number of wideband mag loops over the years—receive-only versions, to be precise—but had never used one specifically designed for amateur radio transmitting.

My first proper NPOTA activation using the loop was on the Blue Ridge Parkway at the Folk Art Center in the mountains of western North Carolina. The loop operates best when raised off the ground and sitting on a dielectric base.

Having no tripod mount at that point, I simply sat the antenna on a plastic storage bin, which in turn sat on top of a picnic table where I operated. It's not ideal to be so close to the antenna, of course, but I thought I'd give it a go.

And go I did. What truly surprised me was how many contacts I racked up in relatively short order on the twenty and forty meter bands using SSB at QRP levels. I've always been a wire antenna guy in the field who believed in getting antennas up as high as possible; it still blows my mind that an antenna so compact, in such a compromised position, could rack up the contacts thousands of miles away.

This first activation was the only chance I had to properly learn the dos and don'ts of this antenna before I had to deploy it in the field on my river run through West Virginia. There, I simply didn't have the time to worry about the process. I did take a few notes, however:

LnR Precision's LD-11 (see October 2016 TSM for review) pairs beautifully with the W4OP loop. The lack of an internal LD-11 ATU is no problem since all of the tuning/matching is accomplished on the loop. (Photo by Thomas Witherspoon K4SWL)

The W4OP loop is high gain and very narrow band; if you move off frequency even a few kHz, you'll certainly need to re-tune;

The bandwidth is so narrow that, if you're turning the capacitor too quickly in the field, especially in windy conditions, you'll miss hearing the audio level increase when you make the loop resonant;

Sometimes being near the loop while tuning the capacitor can affect the results;

Loop antennas are not terribly practical for hunting and scanning for DX across the bands due to frequent re-tuning;

For NPOTA or SOTA type activations where you operate on one frequency, the loop performance is downright amazing!

Mini DXpedition

My excursion into the three river gorges of West Virginia—the Bluestone, New River and Gauley—took an amazing amount of planning for such a short trip. First, I only had a limited amount of time to activate each site, yet these were rare sites and I wanted to log as many stations as possible at each site. Second, I had to announce my activation times and frequencies well in advance so chasers could find and spot me. Also, I knew a number of west coast chasers who really needed one or more of these sites, so had to plot on-air times to maximize 20 meter propagation. Finally, an actual valid activation site has a lot of requirements and is not easy to find on a map! And—oh, yes—the weather was really dodgy.

With wind chills nearing single digits, I operated at the New River Gorge from the back seat of my minivan. I managed to hold the Elecraft KX3 on my log. (Photo by Thomas Witherspoon K4SWL)

As soon as I hit the West Virginia state line on I-77, the snow started. Despite being from the southeast, I've no fear of driving in snow, but this was a bit unexpected and no roads had been prepared in advance. Also, I was driving into some pretty remote areas with my least snow-capable vehicle: a minivan. The snow was bad enough that I knew I would not attempt to activate the New River Gorge at the site I originally planned, which required negotiating a very long, steep, and winding road deep into the gorge. Instead, Eric advised me of another New River site option that was more easily accessed. I readily took him up on his suggestion.

And it was at the alternate New River site where the loop antenna truly saved the activation.

The activation site was essentially a one-car off-pavement parking spot next to a river access for small boats. Space was tight, but plenty big for the loop antenna.

It was about 20 degrees F with sharp wind, and spitting snow; wind gusts were high. I set up two plastic storage bins with the W4OP antenna on top, only about four feet off the ground; fortunately it did not blow over. I tuned the loop quickly to my pre-announced frequency of 14.312 MHz. I made a couple of calls, was answered by a chaser who spotted me...and whoosh! In less than an hour, as I sat there in the freezing wind, I worked 70+ chasers with 15 watts SSB with my Elecraft KX3. It was exhilarating.

As I packed up my station to move to the next site, I quickly scanned over my log sheet: I found I had worked much of the east coast of North America, almost all of the west coast states, several Canadian provinces, Italy, Slovakia and Croatia. All with this incredibly modest antenna.

Signal reports were averaging about S7.

Of course, I was a DX target, which, as any ham will tell you, gives you an automatic 30 dB of gain! Still, people could hear me clearly even though I was at a fairly low elevation in a gorge.

Impressive. I was really beginning to appreciate this antenna.

Problems at Gauley River

My next destination, the Gauley River, was about a seventy-minute drive from the New River and at a much higher altitude. The light rain turned into snow again accompanied by more very strong winds. I was really feeling chuffed about the easy loop setup ahead of me at the site.

After arriving on site, I set up the loop quickly, my Elecraft KX3 quickly followed, and started the tuning process. Unfortunately, I could not get the antenna to find a match on the 20-meter band. No doubt, the cold, the wind, my frozen hands, and a desire to stay on the tight schedule all influenced my ability to tune the antenna.

After ten minutes of trying to tune the loop, I initiated Plan B, pulling out the trusty EFT Trail-Friendly antenna and launching it into a nearby tree. The EFT didn't fail me: once I was on the air, I worked almost 100 stations in a little over one hour.

I felt a little badly about hanging an antenna in a tree limb since I did not seek permission from the NPS in advance. Still, I was the only person at the park that day. No one in their right mind would have been hanging out by the roadside, save your author. I took comfort in the fact that the mature tree that aided me was entirely unharmed, and by the fact that not only do I strictly adhere to the No Trace Left Behind philosophy, I also clean up other visitors' trash in the vicinity of all of my activation areas, as a means of honoring the park. I don't think even the CSI would be able to find evidence of my activation.

Back to the loop. When I finally arrived at the Eric's QTH, we took the loop out and he hooked his antenna analyzer up to it. Again, we were not able to get the excellent match I had on 20 meters earlier that day at the New River. Eric and I both assumed (incorrectly, it turns out) that something had happened to the capacitor inside the tuning box.

Once I returned home, I called Larry with LnR and described what was happening. He quickly identified the problem: the coupling loop wasn't positioned and clamped correctly. Whoops...I should have considered that. Once I adjusted the coupling loop an inch or so, it worked fine again.

Summary

Every radio, accessory, and antenna has its pros and cons. When I begin a review of a product, I take notes from the very beginning so that I don't forget some of my initial impressions. Here is the list I formed over the time I've spent evaluating the W4OP.

Note that, since this was my first proper experience with a loop antenna for QRP operations, many of these items are indicative of loops in general, not just the W4OP.

Pros:

- Excellent build quality and overall value
- Excellent gain when tuned to a frequency (see bandwidth con)
- Overall impressive performance in the field and super fast and simple setup
- Excellent choice for those living in high-density neighborhoods with antenna restrictions
- LnR telephone customer support is excellent

Cons:

- Bandwidth is very narrow and the loop requires re-tuning on frequency changes (see gain pro)
- Supplied support feet are very basic; splurge for the new tripod mount
- Not always convenient and accessible to tune the antenna on the antenna base (though LnR will soon produce a remote tuning W4OP loop)

Larry Draughn at LnR Precision has confirmed with me that they will soon release a remote tuning W4OP loop and a 6m kit for the current loop now. I think a remotely-tuned W4OP loop would make this an excellent antenna for amateur operators who wish to set up the antenna as a semi-permanent home installation; certainly a bonus for those living in restricted neighborhoods. Without a remote tuner, you would need to go to the antenna to make frequency adjustments.

Of course, this first version of the W4OP loop isn't designed as a permanent home antenna; it's designed for field use.

And am I impressed with the W4OP loop? Absolutely.

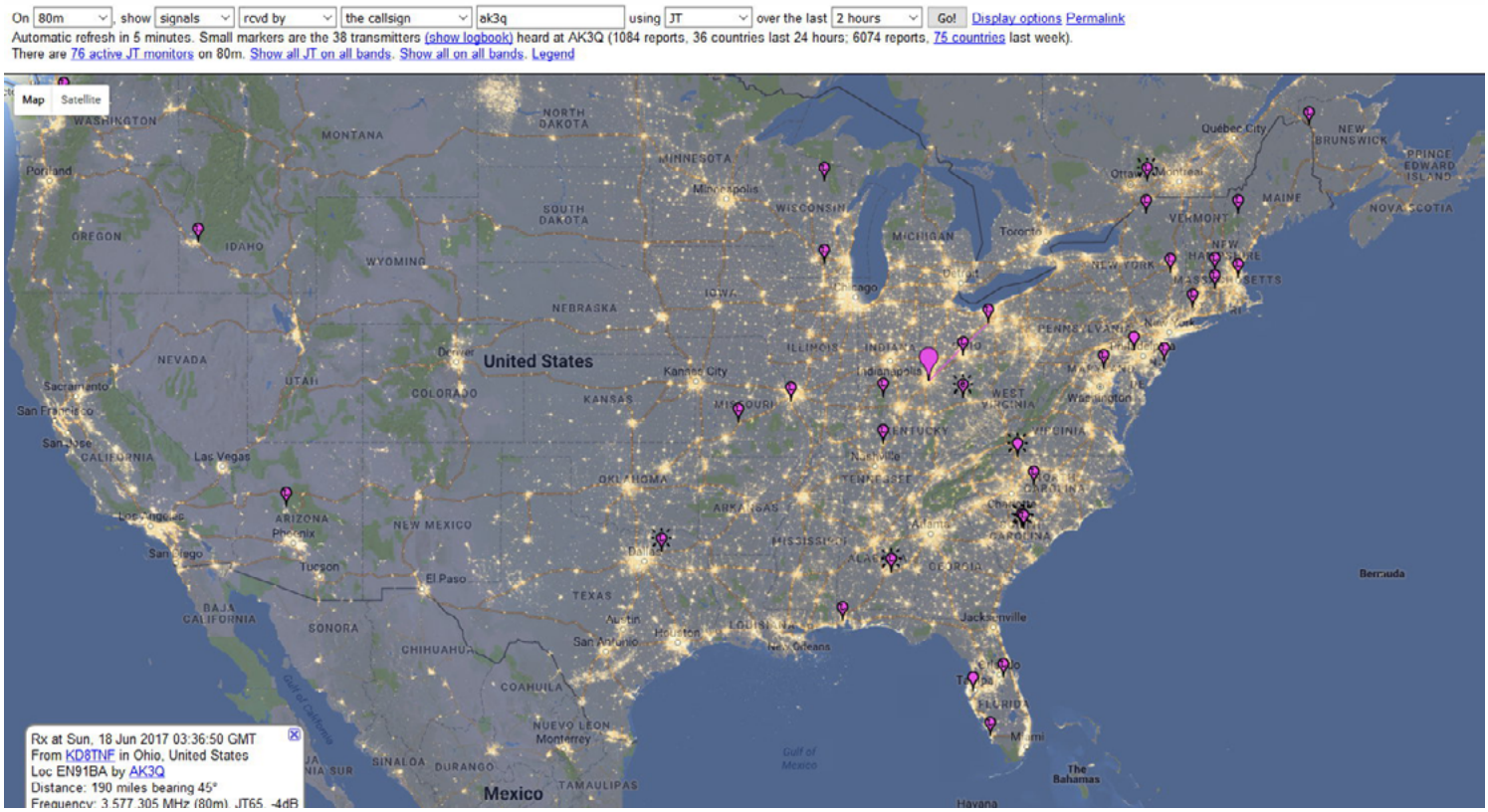
Like me, if you've never used a mag loop antenna for field operations, spend a little time at home learning how to deploy it and tune it in advance.

Most of the criticisms of the W4OP loop I mention in this review are simply indicative of passive mag loops in general: narrow bandwidth, sensitivity to nearby metal objects, and the need for frequent re-tuning.

I understand that the W4OP may have even narrower bandwidth than other similar field-portable antennas. While some may consider this a disadvantage, I think I prefer it; in fact, I would rather be inconvenienced by re-tuning in exchange for higher overall gain. After all, even broader bandwidth loops require re-tuning if you move frequency more than a few kHz.

The W4OP antenna meant that my mini NPOTA DXpedition was a success, especially at the super-restrictive New River access point. Though I've used it in the field on a number of occasions now, I'm still in awe when such a compact antenna performs so well on such little power. I unhesitatingly recommend it. Great job, LnR Precision!

The W4OP lists at $320 and is made in the USA by North Carolina manufacturer LnR Precision. The loop, and its accessories, can be ordered directly from LnR: ***http://www.lnrprecision.com/loop-antennas*** TSM



You don't have to be an amateur radio operator to make use of this software or sites such as PSKReporter.info or WSPRnet.org for reception testing of antennas. Since WSJT-X can upload received signals to the Web, these maps will show who is being heard by a station. The small balloons on the map indicate stations I was hearing, while the larger balloon is my station. (Courtesy of the author)

Using Weak Signal Modes for Propagation, RFI, and Antenna Analysis

Robert Gulley AK3Q

Over the last 6 months I have been exploring weak signal modes using WSJT-X software, which includes JT65, JT9, MSK144 and other specialized transmission modes for moonbounce, meteor scatter, and the aircraft scatter. Along the way, I have discovered these programs are an excellent resource for identifying and studying propagation, RFI, and antenna characteristics.

In this article I describe various logistical conditions, equipment, and propagation patterns which have influenced my findings, as well as providing numerous images to illustrate how the software is indispensable for this analysis. If a picture is worth a thousand words, these images spoke volumes to me about RFI and propagation conditions, challenging some of my preconceptions and beliefs concerning both topics. This software is useful for both the shortwave listener as well as the Amateur Radio operator. There are many lessons to be learned in both reception and transmission.

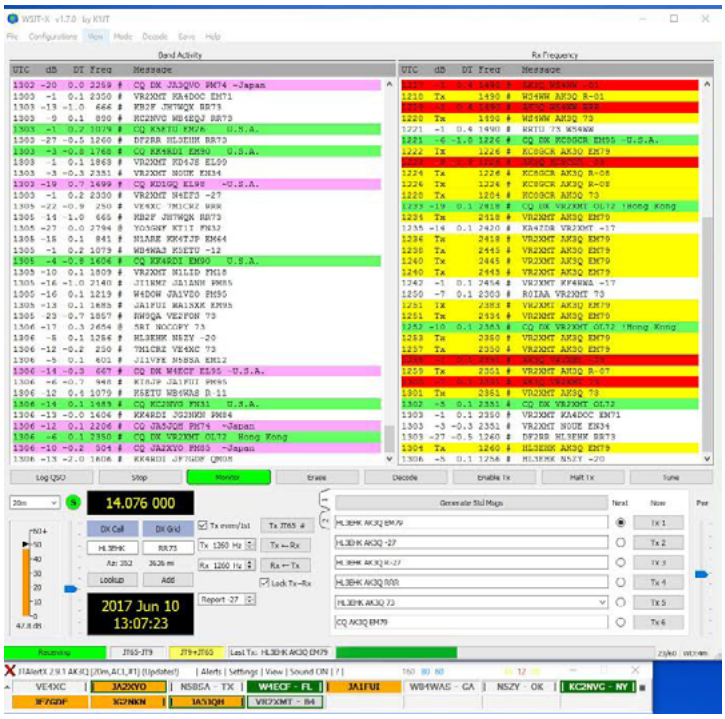
Perhaps far greater than their contribution to working signals around and even out of this world, will be what these modes teach us about propagation and antenna analysis. If, as I have come to suspect, we have only scratched the surface of these topics, software such as WSJT-X will usher in a new era of research, theories and scientific application.

So, What Makes this Software so Special?

Digital modes have been around for some time, and many folks are familiar with spectrum/panadapter displays and waterfalls. I too have used digital modes for reception of all kinds of signals, and as an amateur radio operator I have made my share of digital contacts. What is different using WSJT-X is the detail present in the waterfall and the ability of the various modes to measure accurately signal strength in decibels.

Unlike traditional scale readings of S-meters which are loosely calibrated and vary widely between radios as there is no real standard, this software uses a much more accurate means of signal reporting, and even slight changes in strength are readily noticeable.

Here's an interesting observation I have made repeatedly: 5 watts can and does make a difference when transmitting weak signal modes. Why do I mention this? In the typical HF world of SSB/CW we are often told a doubling of power (3 dB) causes only a 1/2 S-meter shift, hardly noticeable. A



I recently worked Hong Kong on 20-meter JT65, an all-time new contact for me. (Courtesy of the author)

6 dB gain (4x power) is only one S-unit change, which will not make a really significant change in the receiving station's ability to hear one's signal. I have said this myself.

Weak signal work has turned that belief into a myth. (Hardcore QRP operators are laughing right now because they have known this all along!) Numerous times scratching out 5 more watts of power by tweaking my transmatch has made the difference between working a station or not working a station. Really.

Over the last 6 months I have made well over 1100 contacts on JT65/JT9 with quite a few of those contacts requiring everything my station could put out to complete the contact. Yes, I know we typically work low power when using weak-signal modes, but with propagation the way it has been, the minimal sun-spot cycle activity, and my greatly compromised location/antenna farm, sometimes I need all 95 watts my station can produce. This is how I have learned there can be a real difference between 90 watts and 95 watts.

A perfect example of this was when I recently worked Hong Kong on 20-meter JT65, an all-time new contact for me (above screen shot) I felt like Scotty on the Enterprise, "I'm givin' her all I got, Captain!" If I could have increased my Warp drive with more anti-matter I would have! As it was, I tuned and tweaked and cajoled my power output to get that last 3-5 watts and it worked! VR2XMT came back to me and we made our full official contact. This has happened more times than I can count. (I use an external manual tuner which allows me to squeeze out the last ounce of power from my system, perfect for times like this when working a rare DX.)

If you notice at the bottom of the image on the right-hand side, Korea had also popped up (another first for me) but alas I was not able to work him. Clearly there was a great path open to Asia that day with stations from Japan all around, and the elusive Hong Kong and Korea stations coming in.

I do not pretend to know all the math, algorithms, and voodoo behind how the software calculates signals for decoding, but I do know even a slight 1 dB increase of power can make a difference. One does not see this under normal operation of an analog radio, the meters simply are not that accurate.

Hearing Them vs. Working Them

The old amateur radio adage says "if you can't hear 'em, you can't work 'em." Do not worry, this still holds true in digital modes. Perhaps more accurately "if you can't see 'em, you can't work 'em." Usually. What I have found strange at times is how a signal can look strong enough on the waterfall to decode yet not show up, and other times even the faintest blip on the screen with nothing before or after it, can generate a decode.

Again, I know little of the complex math behind the decoding process, but I must assume seemingly strong signals can get jumbled by other strong stations and confuse the software, while the slightest decode in an otherwise quiet cycle can achieve the decode threshold. This is rather fascinating to watch, and it keeps me on my toes to not assume anything. This also helps me understand why sometimes my signal goes unanswered—I simply cannot know what is going on at the other end of the transmission.

Here's a curious thing. In a six-minute cycle of back-and-forth transmissions, my signal or the other person's signal can vary the equivalent of 2 to 3 S-units within that transmission window. I have regularly seen signals go from -2 dBm to -20 dBm or more, only to return on the third pass to be back at -2 dBm. Propagation is doing some strange things indeed!

I realize we are at a lower point in the sunspot cycle, and geomagnetic storms have been relatively common in the last year, but these shifts happen regularly, and under seemingly modest conditions. Obviously something is going on with the propagation, but just what is happening is a bit of a mystery waiting to be solved. Just today I was receiving someone at a -2, quite a strong signal as these things go, and I was not being heard by the other person. Since the software can easily work JT65 signals down to -28 dBm or more, this condition reflected a -24 or more dB difference between us, or the equivalent of 4 S-units.

I have also used this software to compare two different antennas, one a vertical, and one a fan dipole. With differing polarities, I have sought to see differences in coverage as well as signal strength. Sites like PSKReporter.info are invaluable for seeing both coverage and signal strength, and the graphical representations of the map are quite illuminating.

This holds true for transmitting or receiving—one does

not have to be an amateur radio operator to make use of this software or sites such as PSKReporter.info or WSPRnet.org for reception testing antennas. Since WSJT-X can upload to the Internet received signals, these maps will show who is being heard by a station (see image at beginning of this article). The small balloons on the map indicate stations I was hearing, while the larger balloon is my station.

On this image I have zoomed in on North America, but this same night I was also hearing RI1ANO, South Shetland Islands (Antarctica), some 7100 miles from me. Unfortunately he never heard me that night, but I will get him, I have faith!

On the topic of hearing them and working them, this software has provided some very interesting propagation studies regarding my inability to work stations in Europe for most of the first six months of this year. Bands are now opening to Europe, but for the longest time I could hear them but they could not hear me.

This similar experience was also happening to a friend of mine (Jim WB4CTX) about 30-40 miles from my location. In comparing notes, texting, and talking on the phone during these times we saw a pattern to propagation which was new (at least to us!): signals were going westward, but not eastward, from our part of the country. We would receive reasonably strong signals from Europe, but upon trying to answer back, silence. (These conditions were confirmed using PSKReporter.info where we could see Europe was not hearing us.)

A similar thing was happening with our signals to the south. In our location (northern Kentucky) we typically have a pipeline into the south, i.e. Florida, Caribbean, almost anywhere into South America. But not this year, or at least not until recently as the bands have started opening up there.

Using the software tools provided in WSJT-X as well as the PSKReporter.info site, we could determine signal strength levels and where our signals were being heard (or not, as the case might be!). Working together on this also provided us both with some assurances that there was nothing wrong with our stations. I am a "small gun" station with some serious limitations, whereas Jim has a modest but super-performing station (he is rapidly closing in on 300 DX entities worked).

Without the details provided by this software and the reporting sites, I would have just assumed my station was under performing. Our teamwork on the propagation studies assured me my station was not the culprit. When I am pumping out 90 watts to Europe on weak signal software and still not being heard, these are curious propagation times indeed! Normally you can just about yell across the pond and work Western Europe!

One last point about this curious propagation state. Apparently, this west-to-east propagation block was relatively localized to the states, because we could hear plenty of Australian, New Zealand, and Hawaiian stations, and even a fair amount of west coast stations. The "half" of the world represented by the eastern United States and points eastward into Europe and Russia was a wall of one-way propagation. The "half" of the world from Asia eastward across the Pacific Ocean over to the Midwestern U.S., two-way signal propagation was pretty much as we would expect. I hope my description makes more sense than the propagation pattern itself!

First You See It, Now You Don't!

Another interesting aspect of working digital modes is the sudden appearance and disappearance of signals. I sometimes refer to them as "one hit wonders" because they swoop in, make a contact, and fly off to who knows where. Sometimes the reason may be as simple as they got the call to dinner, and hey, dinner comes first! Other times propagation is the likely culprit, especially when working or hearing distant stations.

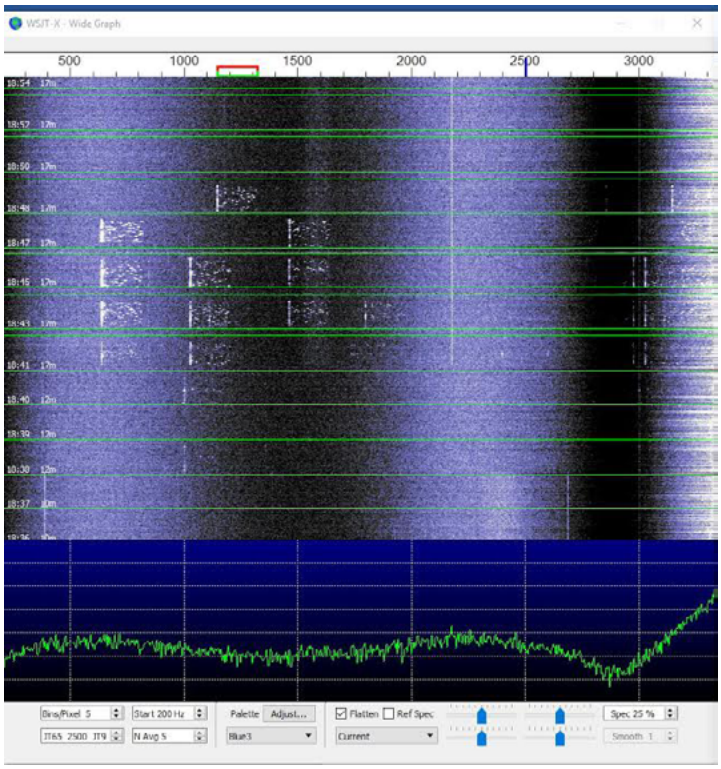
I have seen many stations show up for only one cycle of the three full contact cycles. As an example, Easter Island popped up on the screen one day and of course I was ready to pounce on it like a hungry lion going after a gazelle on the Serengeti! But no sooner did he show up than he was gone. I called several times over the next few minutes, but no response.

What appears to happen are short propagation shifts, or waves, which act a bit like E-skip (just by way of analogy). Like signals received by E-skip, their duration can last for a few moments to several minutes or more, but they are completely unpredictable. While I have not tried to follow the reception pattern of a particular station besides my own, the mapping sites are a good way to check both who has heard a signal and how long ago said signal was received. For some of these in and out stations it would be very interesting to see where they have been heard.

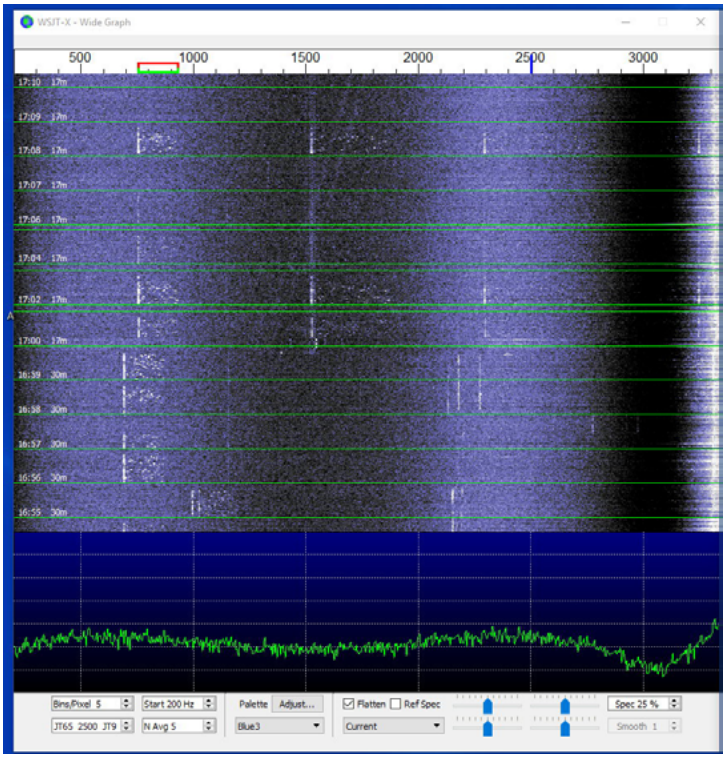
Along with the disappearance of a signal there is sometimes the disappearance of an entire band (see screen shot next page). Notice in the image there is activity on 17 meters from 18:41 to 18:48, and then nothing! Dead! The propagation window simply slammed shut. Typically, when there is weakening of propagation on a band it will show less activity, but the fading out is gradual. Experiencing the sudden shutdown in propagation using the digital modes is more dramatic than when listening on AM or SSB, simply because the waterfall clearly indicates what is happening across the band—there is no guessing if the band is dead or not.

The Waterfall

The waterfall is one of my favorite tools these days because it can show a lot of information not as easily detectable on the spectrum trace. While the trace shows signal strength/amplitude across the bandwidth, the waterfall shows signals across the bandwidth over time.
Some of the benefits of the waterfall display include:



Death of propagation. (Courtesy of the author)



Splatter. (Courtesy of the author)

- Identifying RFI from various sources – each type of interference creates a different image on the waterfall, and after a bit you begin to recognize shapes and patterns, and instantly know your neighbor has turned on their plasma TV again.
- Identifying local noise sources, such as a computer monitor or a leaky switching power supply.
- The ability to compare antenna performance as well as how different antennas react to interference
- Identifying such things as distortion, the effects of lightning strikes, hiccups in power, etc., which show up as momentary horizontal elements

We can also see very clearly the effects of applying various filters, tightening up or loosening band filters, as well as the effects of other signals across the band. The waterfall has become the most useful tool in signal analysis for me, right up there with the dBm measurements.

Splatter

Before I move on to talk about RFI, I thought it might be useful to show what over-modulation, or splatter can look like with digital modes. Again our friend the Waterfall is most revealing (screen shot at top of next column)!

Notice in the center of the image, starting at 17:00 through 17:08 there is a repeating pattern across the band. The original signal is on the left side, aligned with the red bracket at the top left of the image. The repeating signals occur at 750 Hz intervals. Notice how the patterns repeat in intensity, varying with the original signal strength. The operator is not changing power, but rather propagation is shifting between the one minute signal cycles as noted above.

Just as with SSB, FM, or any other transmission mode, we must be careful not to cause interference to others by over-modulating. Likely in this case the sender has not checked his ALC settings and the signal is blowing out the ALC meter. This kind of splatter not only interferes with other signals, it usually makes the original signal unreadable as well.

RFI and Weak Signal Software

As interesting as all the propagation and antenna studies are to me, perhaps the most intriguing has been what this software has shown me regarding RFI, or Radio Frequency Interference. This is also sometimes referred to as EMI, or Electromagnetic Interference. This is where a disturbance in the electromagnetic field from an outside source causes coupling or induction to an existing signal.

For the most part I will demonstrate this with screen captures I have made when such interference has been encountered. I can identify some of the sources of interference, but others I cannot. As they are random, and not being caused by local sources within my house, I can only speculate where they might be coming from, or what is actually causing the interference.

On a mobile setup it would be quite interesting to see if these sources of interference could be tracked down. Since I have shut off all power to my house during some of these times of interference, I can safely say at least some of these interfering signals are definitely not being caused by anything in my house!

A common source of local interference is the TV. Both

my TV and my neighbor's TV can cause interference. My TV is easy to control -- I simply turn it off when operating! (screen shot top right) Notice in the image how on 40 meters (bottom half) the plasma TV does not cause noticeable interference. However, at 05:51 when I switched to 80 meters, there is the interference. At 05:56 I turned off the TV, and now the interference is gone. Simple enough, until the interference is coming from another source!

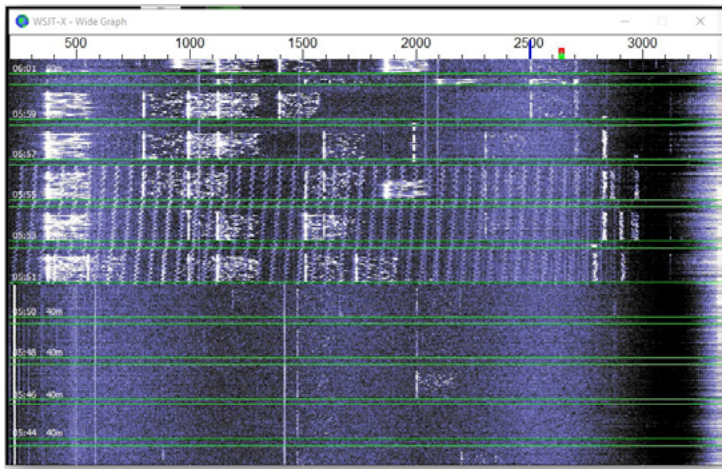
Apparently, my next-door neighbor also has a plasma TV, but her interference affects 40 meters (screen shot middle of next column). Notice the squiggly lines throughout the band. While the RFI certainly looks bad, many signals still come through (a testament, no doubt, to the software's capabilities) and even weaker stations make it through. Of course I cannot know how many stations I am not hearing, but it is nice to know I can work through the interference using these digital modes, since phone (voice) communications would likely be too far mangled for comprehension.

When the RFI is gone things are much better, if only visually. These are the easy culprits to identify, whereas other sources may be much more difficult. Nearby transformers (as in even several blocks away) can cause significant hash if they are arcing or connections have become corroded. Routers, power cubes, even dimmer light switches can cause RFI, and plant growth lights are becoming more and more common sources of RFI.

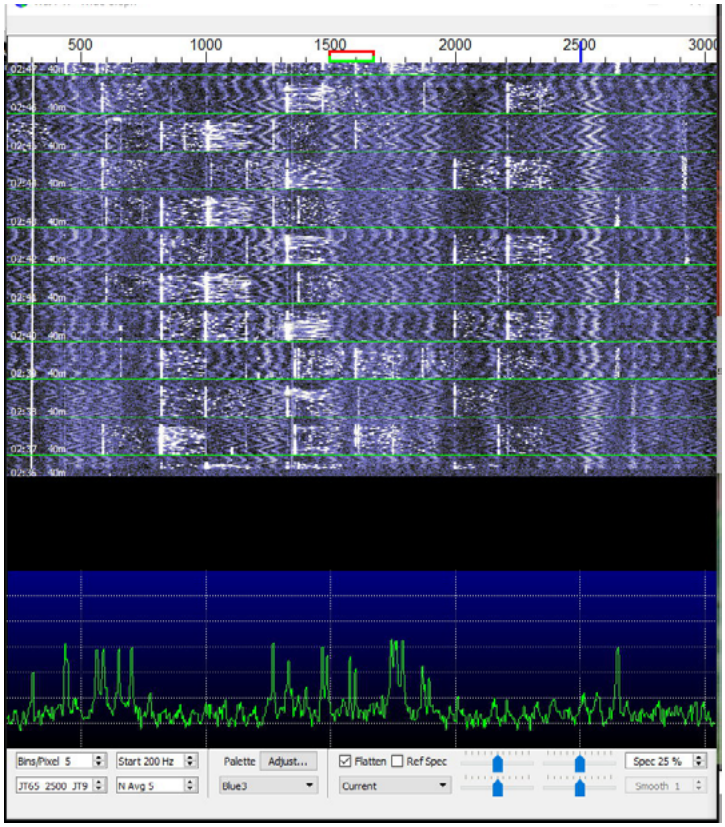
Even if the source or cause of the RFI cannot be located, just being able to identify the existence of RFI is a useful function of this software. I have used other digital modes with waterfalls in the past, but the sensitivity of this software seems able to indicate the presence of RFI more readily.

Over time I hope to be able to identify more source/causes of RFI so I can learn to recognize more patterns in the waterfall. Even if I cannot fix the source of RFI, I would like to be able to identify it and know when it is affecting my radio operating. I suspect some of the more unusual sources will remain a mystery, however, and may be seen in some of the accompanying images.

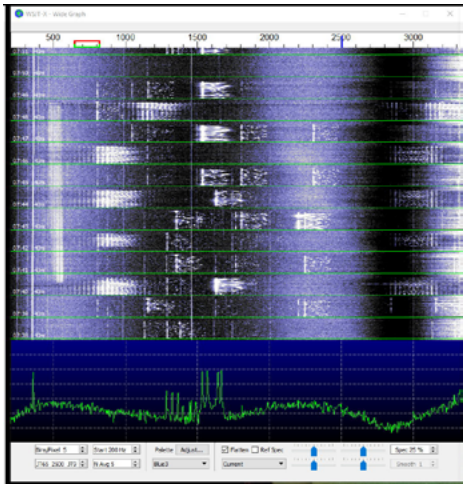
The more tools we have to study signals and the effects

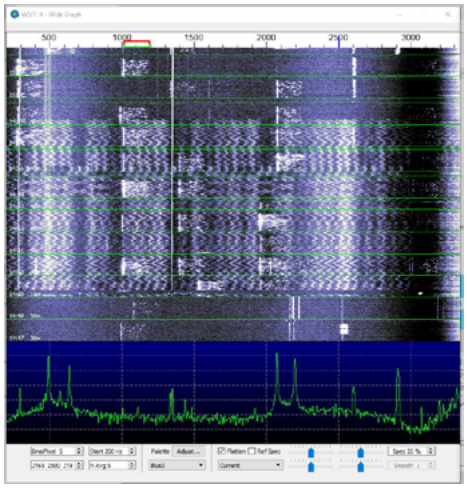


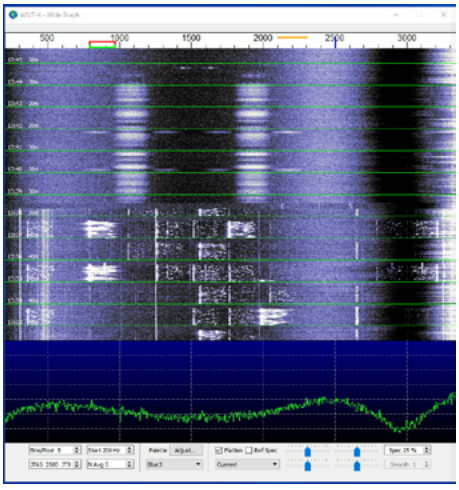
Above: Plasma, no plasma TV. Below: RFI 40 meters. (Courtesy of the author)

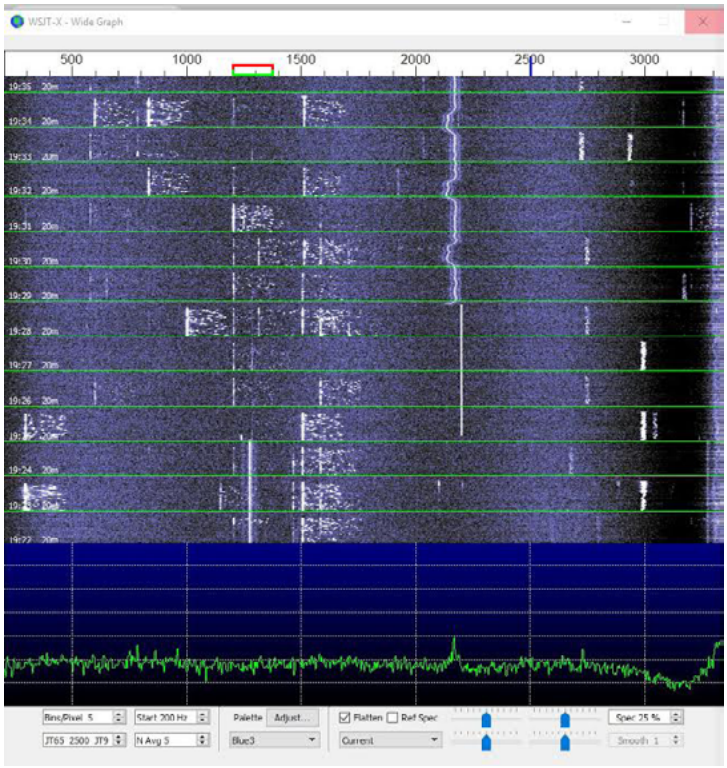


Below left: One of my computer monitors causing RFI on an outdoor antenna - RFI is on left side of the image. Below center: Local 80-meter RFI--my plasma TV. Below right: Notice death of propagation as a new RFI pattern emerges with splatter across the band on 30-meters. (Courtesy of the author)

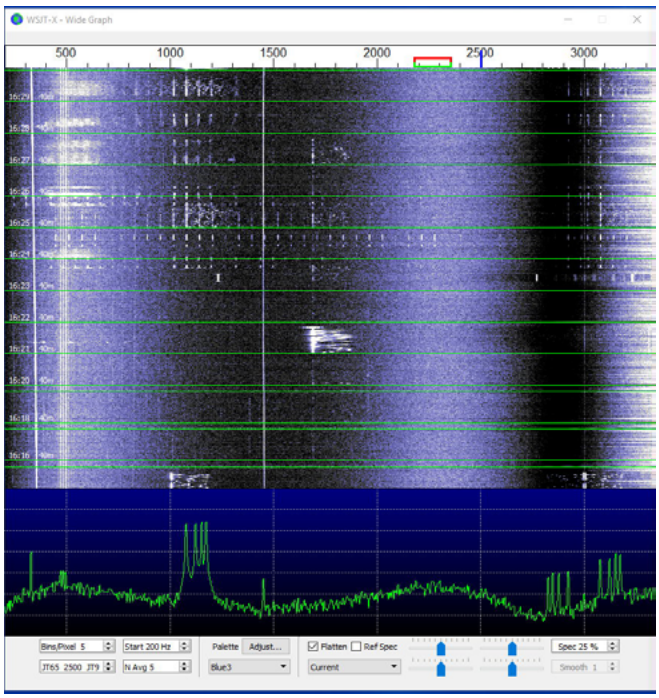






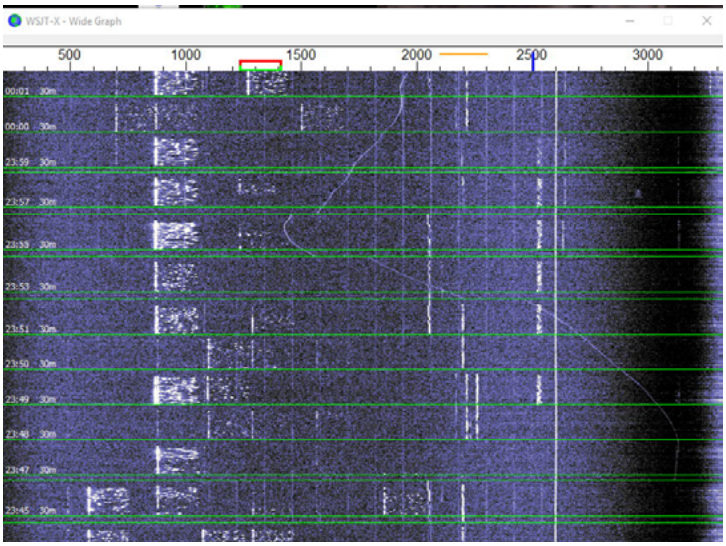


Here is one I like to call flat-line pulse, because it looks like someone came back to life on a heart monitor!

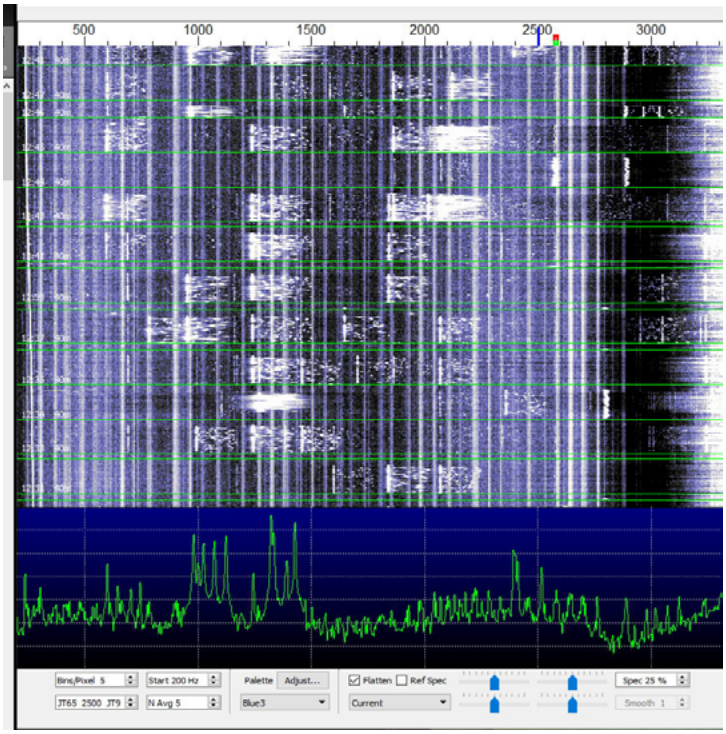


Notice hash marks in top half of screen. Waterfall moves vertically, so each row of ticks is separate, yet the ticks repeat across the bandwidth.

of antennas, propagation, and interference the better prepared we will be to combat these challenges and to make the most of every opportunity. The weak-signal software we have now is a big step in that direction, and I suspect our understanding of propagation, reciprocity, E-field and H-field radiation patterns will only grow as the software matures and as people start taking advantage of the capabilities such software provides.



No, I did not draw the crazy squiggle in the middle of the screen capture - it's RFI (Courtesy of the author)



I like to call this image "Now That's RFI!" - again, source unknown and pattern different than typical. (Courtesy of the author)

While there is no doubt my passion in the amateur radio hobby is for meeting and communicating with people from all over the world, I am so glad I did not miss out on what these structured digital modes can teach us. Even when excellent propagation conditions return I know I will still study those conditions, compare antennas, and look for RFI issues affecting my station. I will also keep an eye on advances in the software to enhance those studies and deepen my understanding of how radio waves travel around the globe.

Give this software a try. It is easy to set up, there is a reasonably short learning curve, and the benefits will be almost immediately obvious to both amateur and shortwave listener alike!

WSJT-X Addendum

Developments in this new digital mode are moving quickly. So quickly, in fact, that since the previous article was written, there was added a new mode for WSJT-X enthusiasts to explore. The new version of the program just out in Beta (release candidate 1), adds some significant new features including a brand new mode, as well as improvements to existing modes.

The new mode is FT8 which is, in essence, a speeded up version of JT65/JT9/MSK144, taking some of the best features of each to create a mode capable of 15 second cycles. These shortened cycles allow for rapid signal exchanges, with full contacts lasting only 1.5 minutes rather than six minutes. Like the MSK144 mode, once a contact cycle has started, the software auto-syncs to complete the contact.

For example, when someone answers your CQ, the software will automatically send the signal report and the 73, and then place you back into CQ mode. This is quite useful since signals decode at 14 seconds and the cycle is done at 15 seconds.

This new mode is an answer to those looking for a weak signal mode suitable for DXpeditions, or where propagation is weak and/or will not hold out for more than a minute or two (think 6-meter skip!). This new mode, when fully ready for standard release, should encourage more DX contacts around the world.

One interesting thing I have noticed in the new version of JT65/JT9 is the ability to copy signals far below what was possible previously. I copied a JT65 signal recently which started out at -31 dB, and then went to -35 dB, both numbers lower than I have ever seen before, even with JT9. The lowest I recall seeing for a JT65 signal has been -28 dB, and the lowest JT9 signal has been -30 dB. This is a significant advancement in weak signal recognition!

The beta is available at: https://physics.princeton.edu/pulsar/k1jt/wsjtx.html

So far everything has been very stable, but of course, remember it is still test software, so you install it at your own risk!

The Mac-World and WSJT-X

For Mac users (OS X 10.7 and later) there are native versions of WSJT-X for both WSJT-X 1.70 stable release and version 1.80 rc1 (beta), which includes the new FT8 mode. Two notes on program installation:

Use the Mac's Audio MIDI Setup utility to configure your sound card for 48000 Hz, two-channel, 16-bit format.

Use System Preferences to select an external time source to keep your system clock synchronized to UTC.

The extensive OS X install notes may be found here: **http://www.physics.princeton.edu/pulsar/K1JT/wsjtx-doc/wsjtx-main-1.7.1-devel.html#INSTALL_OSX**

There is also a program called JT-Bridge which allows communication between WSJT-X and one's logging program, similar to JT-Alert on the Windows side.

The latest version of JT-Bridge is v2.1.2 and is written by Anders Östlund (SM0THU). The program may be found here: **http://jt-bridge.eller.nu** and is free, but donations to support his coffee consumption and will be gladly accepted (something has to keep these brilliant programmers going!)

Features include:

- Displays CQs from WSJT-X
- Double-click on a CQ to reply in WSJT-X
- Check QSO and QSL status of calls, DXCC entities, CQ zone, ITU zone, State, IOTA, Grid and Continent in your logging application
- Send logged QSOs from WSJT-X to your logging application
- Support for Aether, MacLoggerDX and RUMlogNG logging applications
- Send notifications to OS X Notification Center for unworked or unconfirmed items.
- Send a notification to OS X Notification Center when you are called
- Read transceiver frequency from your logging application
- Set transceiver frequency via MacLoggerDX or RUMlogNG
- Control the PTT via your logging application
- QRZ or HamQTH call book lookup
- Show LoTW and eQSL users
- Show distance and bearing to CQ caller
- Show information about the station worked with WSJT-X
- Macro buttons with information about the station being worked

Another program of interest is JT-Mapper which produces real-time maps for JT65 and JT9 on Mac or Linux (no Windows support). The program's author is Carl, WG1V, and he has a GitHub space at: **https://github.com/cdhowe/JT-Mapper** where there is reference material with screenshots, as well as the libraries needed to run the program. There is the need for installing libraries and doing some compiling, but the reference material explains the necessary steps.

Repacking the US TV Band: New Channel Assignments by TV Market Part 3

By Mike Kohl

Our third installment in a series of three charts continues with the identification of significant communities within each designated marketing area (DMA). Markets numbering from 151 to 248 are covered this month. As indicated earlier, there will be a constant turnover of information. In fact, even since the first edition printed in early May, we have found some stations shifting sub-channels and frequencies already.

This coincides with our early decision to not list sub-channels at all in these first efforts, and confirms that a crazy quilt of changes awaits us, probably with little warning once things get going on a national scale. Simply be prepared for change, and if anything significant happens in your local market, the author would greatly appreciate an Email. Please send contributions on spectrum changes to global-cm@mhtc.net Information subject to change without notice.

Legend

- <11> indicates RF channel continues, with no changes.
- <11>off indicates present RF channel going off the air, with no scheduled replacement channel.
- <11>off (24sh) indicates present RF channel going off the air, second number indicates that station has made arrangements to share frequency on that channel.
- (33 to 36) indicates old RF channel moving to second channel.
- (33 to ??) indicates new channel not yet assigned

Market #151 Lincoln, NE (covers Eastern Nebraska, including some Omaha stations)
Lincoln: 8.1-KLKN <08> 10.1-KOLN <10> 12.1-KUON <12> 18.1-K18CD-D <18> 27.1-KFDY-ld <26> 51.1-KFXL <15>
Beatrice: 21.1-KWBE-ld <21>
Omaha: 6.1-WOWT <22> 15.1-KXVO (38 to 29) 42.1-KPTM (43 to 26) 48.1-KMJF-ld (48 to ??)
Superior: 4.1-KSNB <04>

Market #152 Wilmington-Jacksonville, NC
3.1-WWAY (46 to 24) 6.1-WECT (44 to 23) 10.1-WILM-ld (40 to ??) 18.1-WADA-ld (43 to ??) 20.1-WDZA-ld <20> 21.1-WTMV-ld (39 to ??) 24.1-WILT-ld <24> 26.1-WSFX (30 to 29) 35.1-WPXU (34 to 16) 39.1-WUNJ (29 to 21)
51.1-W51CW-D (51 to ??)

Market #153 Odessa-Midland and Big Spring, TX
2.1-KMID <26> 7.1-KOSA <07> 9.1-KWES <09> 18.1-KUPB <18> 22.1-KMDF-ld <22> 24.1-KPEJ <23> 30.1-KWWT <30> 32.1-KFAW-ld <32> 36.1-KPBT (38 to 28) 42.1-KMLM (42 to 15) 62.1-KZOD-lp <36>
Big Spring: 7.1-K31KJ-D <31> 9.1-KWAB <33>

Market #154 Amarillo, TX
2.1-KACV <09> 4.1-KAMR <19> 7.1-KVII <07> 10.1-KFDA <10> 14.1-KCIT <15> 15.1-KAUO-ld <14> 16.1-K16HB-D <16> 17.1-K17HI-D <17> 22.1-KLKW-ld <22> 28.1-KEAM-ld <28> 31.1-KEYU <31>
51.1-K51JN-D (51 to ??)

Market #155 Sherman, TX- Ada / Ardmore, OK
Ada: 10.1-KTEN (26 to 17)
Ardmore: 19.1-K19II-D <19> 22.1-K22JQ-D <22> 24.1-K24IW-D <24> 36.1-K36KE-D <36> 41.1-KCYH-ld (41 to ??)
Sherman: 12.1-KXII <12> Durant, OK: 46.1-K46AI-D (46 to ??) Hugo, OK: 15.1-K15AA-D <15>
Paris, TX: 12.1-KXIP-ld <24>

Market #156 Wichita Falls, TX-Lawton, OK
3.1-KFDX <28> 6.1-KAUZ <22> 7.1-KSWO <11> 10.1-K18IZ-D <18> 18.1-KJTL <15> 20.1-K20DN-D <20>
24.1-K24HH-D <24> 30.1-K30LD-D <30> 36.1-K36AB-D <36> 38.1-K38GL-D (38 to ??) 43.1-K43LK-D (43 to ??)
Durant, OK: 47.1-K47KI-D (47 to ??) Frederick, OK: 34.1-K34IM-D <34>

Market #157 Lubbock, TX
5.1-KTTZ (39 to 25) 11.1-KCBD <11> 13.1-KLBK (40 to 31) 14.1-KMYL-ld <22> 22.1-KLCW (43 to 23) 28.1-KAMC <27> 29.1-KNKC-ld <29> 32.1-KJTV-cd <33> 34.1-KJTV <35> 42.1-KABI-ld <42 to ??) 44.1-K31MX-D <31> 46.1-KXTQ-cd (46 to 24) 48.1-KLBB-ld <19> 51.1-KBZO-ld (51 to ??)

Market #158 Kennewick (Tri Cities)-Walla Walla, WA and Pendleton, OR
Tri Cities: 11.1-KBWU-ld <36> 15.1-KVVK-cd <15> 19.1-KEPR <18> 25.1-KNDU <26> 31.1-KTNW (38 to 22) 42.1-KVEW (44 to 27) Walla Walla: 8.1-K46FL-D (46 to ??) 16.1-KORX-cd <16> 21.1-K21JQ-D <21> 28.1-K31KL-D <31> 33.1-K33EJ-D <33> 36.1-K36EW-D <36> 47.1-KWWO-ld (47 to ??) Pendleton, OR: 6.1-K32DE-D <32> 8.1-K36DP-D <36> 11.1-KFFX <11> 12.1-K49MI-D (49 to ??) 13.1-K42IT-D (42 to ??) 49.1-KRLB-ld (49 to ??) 54.1-K31KW-D <31>

Market #159 Yuma, AZ-El Centro, CA and Mexicali-MX, Yuma, AZ-El Centro, CA: 7.1-KVYE <22> 8.1-K19CX-D <19> 9.1-KECY <09> 11.1-KYMA <11> 13.1-KSWT <13> 15.1-KYUM-ld <15> 33.1-K33MD-D <33> 39.1-K39KW-D (39 to ??) 42.1-K42KZ-D (42 to ??) 54.1-KAJB <36> Mexicali: 1.1-XHAQ <28> 2.1-XHBM <34> 3.1-XHCTME <17> 4.1-XHBC (47 to 14) 5.1-XHMEX (44 to 18) 20.1-XHEXT <25> 38.1-XHMEE (45 to 15) 66.1-XHILA (46 to 20)

Market #160 Binghamton, NY
12.1-WBNG (07 to 08) 20.1-WBGH-cd <20> 34.1-WIVT (34 to 27) 40.1-WICZ (08 to 07) 46.1-WSKG (42 to 31)

Market #161 Jackson, TN
7.1-WBBJ (43 to 35) 11.1-WLJT (47 to 14) 16.1-WJKT (39 to 21) 27.1-WYJJ <27> 39.1-WNBJ-ld <16>
Adamsville: 18.1-W18BL (18 to 32)

Market #162 Sioux Falls, SD
Sioux Falls: 7.1-KTTW <07> 11.1-KELO <11> 13.1-KSFY <13> 23.1-KCSD <24> 36.1-KWSD <36> 46.1-KDLT (47 to 21) 56.1-K56GF-D <23>
Brookings: 8.1-KESD <08> Vermillion: 2.1-KUSD <34>
Worthington, MN: 20.1-KSMN <15>
Rock Rapids, IA: 27.1-K43LX-D (43 to ??)

Market #163 Harrisonburg, VA
Harrisonburg: 3.1-WHSV (49 to 20) 29.1-W30CT-D <30> 43.1-WSVF-cd (43 to 36)
Front Royal: 42.1-WVPY <21>off Staunton: 29.1-W41DT-D (41 to ??) 51.1-WVPT (11 to 12)
Mathias, WV: 24.1-W09CT-D <09>

Market #164 Bluefield, WV
Bluefield: 6.1-WVVA (46 to 17) 40.1-WLFB (40 to 25)
Grandview: 9.1-WSWP (10 to 08) Lewisburg: 59.1-WVNS (08 to 11) Oak Hill: 50.1-WOAY (50 to 31)
Summersville: 16.1-WZTS-ld <16> Welch: 9.1-W29DP-D <29>
Grundy, VA: 23.1-WJDG-ld <23> Tazewell, VA: 35.1-WJDW-ld <35>

Market #165 Utica, NY
2.1-WKTV <29> 12.1-WWDG-cd <28> 13.1-WTKO-cd (36 to 32) 20.1-WUTR <30> 24.1-W22DO-D <22> 33.1-WFXV (27 to 34) 40.1-WVVC-ld <33>

Market #166 Idaho Falls-Pocatello, ID
Idaho Falls: 3.1-KIDK <36> 8.1-KIFI <08> 28.1-K28LE-D <28>
Pocatello: 6.1-KPVI <23> 6.1-K40MS-D (40 to ??) 8.1-K21JC-D <21> 10.1-KISU <17> 15.1-KPIF <15> 31.1-KVUI <31> 34.1-KXPI-ld <34> 47.1-K47JK-D (47 to ??)

Market #167 Medford, OR
5.1-KOBI <05> 8.1-KSYS <08> 10.1-KTVL <10> 12.1-KDRV <12> 18.1-K18GB-D <18> 26.1-KMVU <26> 28.1-K28GG-D <28> 30.1-K23EX-D <23> 30.1-K25IM-D <25> 40.1-K40KR-D (40 to ??) 48.1-KB-FI-ld (48 to ??)

Market #168 Bangor, ME
Bangor: 2.1-WLBZ <02> 5.1-WABI <13> 7.1-WVII <07> 13.1-WEXZ-ld <05> 16.1-W16DG-D <16> 22.1-WFVX-ld <22> 33.1-WBGR-ld (33 to 18)
Orono: 12.1-WMEB <09>

Market #169 Albany, GA
Albany: 10.1-WALB <10> 31.1-WFXL <12> 48.1-W48DU-D (48 to ??)
Cordele: 22.1-WSST (22 to 34) Dawson: 25.1-WACS

(08 to 07) Pelham: 14.1-WABW <06>
Tifton: 5.1-W30DW-D <30> Valdosta: 44.1-WSWG (43 to 31) Waycross: 8.1-
WXGA (08 to 07)

Market #170 Bowling Green, KY
13.1-WBKO <13> 24.1-WKYU <18> 39.1-WCZU-ld (39 to ??) 40.1-WNKY (16 to 24) 53.1-WKGB (48 to 29)
Scottville: 31.1-WPBM-cd (46 to 15)

Market #171 Panama City, FL
Panama City: 7.1-WJHG (18 to 16) 13.1-WMBB <13> 18.1-WECP-ld <29> 22.1-WPFN-cd <22> 28.1-WPGX <09>
45.1-W45DJ-D (45 to ??) 46.1-WPCT (47 to 33) 56.1-WFSG (38 to 28)
DeFuniak Springs: 24.1-WWEO-ld <24> Marianna: 51.1-WBIF (51 to 26) Wewahitchka: 17.1-WEWA-ld <17>
Dothan-AL: 4.1-WTVY <36>

Market #172 Missoula-Kalispell, MT
Missoula: 7.1-K08PR-D <08> 8.1-KPAX <07> 11.1-KUFM <11> 13.1-KECI <13>
Kalispell: 9.1-KCFW <09> 18.1-KAJJ-cd (39 to 18) 42.1-KTMF-ld (42 to ??) 46.1-KUKL (46 to 15) 46.1-KEXI-ld <35>
Ronan: 27.1-KSKC-cd <27> 34.1-KMJD-ld <34>

Market #173 Abilene-Sweetwater, TX
Abilene: 9.1-KRBC <29> 15.1-KXVA <15> 32.1-KTAB (24 to 30) 40.1-KTES-ld (40 to ??) 42.1-KIDZ-ld (42 to ??) Sweetwater: 12.1-KTXS <20>
Market #174 Alexandria, LA
Alexandria: 5.1-KALB <35> 25.1-WLPA (26 to 33) 31.1-KLAX <31> 38.1-K38NR-D (38 to ??) 41.1-KBCA (41 to 26)
47.1-K47DW-D (47 to ??) Natchez, MS: 48.1-WNTZ (49 to 15)

Market #175 Charlottesville, VA
Charlottesville: 16.1-WVAW-ld <16> 19.1-WCAV (19 to 32) 27.1-WAHU-cd (40 to 35) 29.1-WVIR (32 to 02) 41.1-WHTJ (46 to 26) Staunton: 51.1-WVPT (11 to 12)

Market #176 Hattiesburg, MS
Hattiesburg: 22.1-WHLT <22> 23.1-WHPM-ld <23>
Biloxi: 19.1-WMAH <16>
Laurel: 7.1-WDAM <07> Meridian: 14.1-WMAW (44 to 28)

Market #177 Duluth, MN – Superior, WI
3.1-KDLH <33> 6.1-KBJR <19> 8.1-WDSE <08> 10.1-WDIO <10> 21.1-KQDS (17 to 18) 27.1-KCWV <27>

Market #178 Jonesboro, AR
8.1-KAIT <08> 19.1-KTEJ <20> 39.1-KJNB-ld (39 to ??) 48.1-KVTJ (48 to ??)

Market #179 Grand Junction, CO
4.1-KFQX <15> 5.1-KREX <02> 8.1-KJCT-lp <20> 8.1-K39AF-D (39 to ??) 11.1-KKCO <12> 18.1-KRMJ <18>
18.1-K41AE-D (41 to ??) 20.1-KGBY <07>
20.1-K36LM-D <36> 22.1-K22JN-D <22> 27.1-KGJT-cd <27>
38.1-K38JX-D (38 to ??)

Market #180 Yakima, WA
2.1-KUNW-cd <30> 5.1-K24LR-D <24> 19.1-K19JX-D <19> 20.1-K20LQ-D <20> 23.1-KNDO <16> 29.1-KIMA <33>
35.1-KAPP <14> 38.1-KYPK-ld (38 to ??) 39.1-KWYT-lp (39 to ??) 41.1-KCYU-ld (41 to ??) 45.1-KDHW-cd <35> 47.1-KYVE <21> 51.1-K51JG-D (51 to ??)

Market #181 Lima, OH
Lima: 8.1-WLIO <08> 25.1-W23DE-D <23>
35.1-WOHL-cd (35 to 15) 44.1-WTLW (44 to 02)
Bowling Green: 27.1-WBGU (27 to 22) Maplewood: 16.1-W32DS-D <32>

Market #183 Dothan, AL
Dothan: 4.1-WTVY <36> 18.1-WDHN <21>
23.1-WRGX-ld <23> 49.1-WJJN-ld (49 to ??)
Dozier: 2.1-WDIQ <10> Louisville: 43.1-WGIQ (44 to 30) Ozark: 34.1-WDFX <33>

Market #184 Grand Island and Central Nebraska, NE
Grand Island: 11.1-KGIN <11> 13.1-KHGI <13>
21.1-KMLF-ld <21>
Bassett: 7.1-KMNE <07> Hastings: 5.1-KHNL <05>
29.1-KHNE <28>
Lexington: 3.1-KLNE <26> Superior: 4.1-KSNB <04>

Market #185 Quincy, IL – Hannibal, MO
Quincy, IL: 10.1-WGEM <10> 16.1-WTJR <32>
18.1-W18CJ-D <27> 27.1-WQEC <34>
Macomb, IL: 22.1-WMEC (21 to 36) Hannibal, MO: 7.1-KHQA <07>

Market #186 Laredo, TX – Nuevo Laredo, MX
Laredo, TX: 4.1-XHBR <25> 8.1-KGNS <08>
13.1-KYLX-ld <13> 15.1-KLMV-ld <15> 27.1-KLDO <19>
31.1-KETF-cd <31> 39.1-KXOF-cd <27>
Nuevo Laredo, MX: 1.1-XHLNA (50 to 23) 7.1-XHLAT (51 to 33) 12.1-XHNAT <32> 17.1-XEFE <17>
28.1-XHNAN <22> 57.1-XHLAR (38 to 29)

Market #187 Redding-Chico, CA
Redding: 7.1-KRCR <07> 8.1-KVFR-ld <08> 9.1-KIXE

<09> 10.1-KMCA-ld <10> 16.1-K16IW-D <16>
21.1-KRVU-ld <21> 23.1-KRDT-cd <23> 26.1-KGEC-ld <26> 41.1-KRHT-ld (41 to ??) 51.1-K51LK-D (51 to ??)
Chico: 9.1-K18IS-D <18> 11.1-K11VZ-D <11> 12.1-KHSL (43 to 36) 15.1-K15HV-D <15> 20.1-KCVU (20 to 17)
22.1-KZVU-ld <22> 24.1-KNVN (24 to 20) 28.1-KK-PM-cd <28> 30.1-KKTF-ld <30> 51.1-KBIT-ld (50 to ??)

Market #188 Meridian, MS
Meridian: 11.1-WTOK (11 to 13) 14.1-WMAW (44 to 28) 21.1-W21DB-D <21> 24.1-WMDN <24> 30.1-WGBC <31>
Demopolis, AL: 41.1-WIIQ <19>

Market #189 Greenwood, MS
Greenwood: 6.1-WABG <32> 23.1-WMAO <25>
Clarksdale: 12.1-WPRQ-ld <12>
Cleveland: 8.1-WHCQ-ld <09> 17.1-WFXW-ld <17> 38.1-WPYM-ld (38 to ??)
Grenada: 13.1-W13CS-D <13> 33.1-WNBD-ld <33>

Market #190 Bryan – College Station, TX
3.1-KBTX (50 to 14) 15.1-KAMU <12> 20.1-K20KJ-D <20> 23.1-KAGS-ld <23> 28.1-KYLE (28 to 29) 40.1-KRHD-cd (40 to 15)

Market #191 Mankato, MN
12.1-KEYC <12>

Market #192 Parkersburg, WV
Parkersburg: 15.1-WTAP (49 to 35) 22.1-WOVA-ld <22> 33.1-W51EG-D (51 to ??) 47.1-WIYE-ld (47 to ??)
Weston: 5.1-WDTV <05> Athens, OH: 20.1-WOUB (27 to 32)

Market #193 Marquette - Escanaba, MI
Marquette-Ishpeming: 6.1-WLUC <35> 6.1-W14EM-D <14> 10.1-WBUP <10> 13.1-WNMU (13 to 08) 19.1-WZMQ <19>
Calumet: 5.1-WBKP <05> Escanaba: 3.1-WJMN (48 to 32) 11.1-W40AN (40 to ??)
Fence, WI: 36.1-W45CD-D (45 to ??) Sister Bay, WI: 38.1-W15DJ-D <15>

Market #194 Hays-Salina, KS
Hays: 7.1-KBSH <07> 9.1-KOOD <16> 30.1-K25CV-D <25>
Salina: 6.1-KSNL-ld (47 to ??) 17.1-KAAS <17> 51.1-KHDS-ld (51 to ??)
Great Bend: 2.1-KSNC <22> 30.1-KGBD-ld <30>
Hoisington: 17.1-KOCS <14>
Hutchinson: 8.1-KPTS <08> 12.1-KWCH Russell: 30.1-K38GH-D (38 to ??)
Wichita: 33.1-KSCW <12>

Market #195 Elmira, NY
Elmira: 18.1-WETM (18 to 23) 28.1-W28DO-D <28 36.1-WENY (36 to 35)
Corning: 30.1-WSKA (30 to 25) 48.1-WYDC (48 to 30)

Market #196 Rapid City – Black Hills, SD
Rapid City: 3.1-KOTA <07> 7.1-KEVN-ld <23> 9.1-KBHE <26> 15.1-KCLO <16> 21.1-KNBN <21> 23.1-KHME <02> 33.1-KRPC-lp <33>
Eagle Butte: 13.1-KPSD <13> Lead: 5.1-KHSD <05> 10.1-KQME <10> Martin: 8.1-KZSD <08>

Market #197 Bend, OR
7.1-KBNZ-ld <07> 11.1-KOAB <11> 17.1-KABH-cd <17> 19.1-KQRE-ld <20> 21.1-KTVZ <21> 28.1-K49KT-D <28>
39.1-KFXO-cd (39 to 15) 39.1-K45KM-D (45 to ??) 39.1-K27DO-D <27> 49.1-KUBN-ld (43 to ??) 51.1-KOHD <18>

Market #198 Billings, MT
Billings: 2.1-KTVQ <10> 6.1-KSVI <18> 6.1-K25BP-D <25> 8.1-KULR <11> 14.1-KINV-ld <14> 16.1-KBGS <16> 24.1-K24IQ-D <24> 28.1-K28LF-D <28> 33.1-K33KP-D <33> 38.1-K38LU-D (38 to ??)
Hardin: 4.1-KHMT <22> 43.1-KQHD-ld (43 to ??)

Market #199 Farmington, NM – Durango, CO
Farmington: 2.1-K23KL-D <23> 2.1-KFNM-ld <34> 5.1-K40FI-D (40 to ??) 5.1-K43AI-D (43 to ??) 6.1-K29HR-D <29> 7.1-K19CM-D <19> 7.1-K24IV-D <24> 12.1-KOBF <12>
Durango: 2.1-KREZ-ld (39 to ??) 2.1-KRTN <33> 6.1-KREZ <15> 20.1-KRMU <20>

Market #200 Roswell, NM
2.1-K15FT-D <15> 2.1-KTEL <25> 8.1-KOBR <08> 10.1-KBIM <10> 21.1-KRWB <21>

Market #201 Northeastern South Dakota
Aberdeen: 9.1-KABY <09> 16.1-KDSD <17> Florence: 3.1-KDLO <03> Huron: 12.1-KTTM <12>
Lowry: 11.1-KQSD <11> Mitchell: 5.1-KDLV <26>

Market #202 Twin Falls, ID
7.1-KTFT-ld <20> 11.1-KMVT <11> 13.1-KIPT <22> 14.1-KSVT-ld <14> 17.1-KYTL-ld <17> 27.1-KBAX-ld <27>
32.1-K32JM-D <32> 42.1-K42JJ-D (42 to ??) 51.1-KSAW-ld <15>

Market #204 Victoria, TX
17.1-KMOL-ld <17> 19.1-KVCT <11> 21.1-KUNU-ld <28> 25.1-KAVU (15 to 20) 38.1-KQZY-lp <33> 41.1-KXTS-ld <19> 45.1-KVTX-lp (45 to ??)

Market #205 Eureka, CA
3.1-KIEM <03> 13.1-KEET <11> 17.1-KVIQ <17> 17.1-K10FS-D (10 to 14) 19.1-K19IC-D <19> 23.1-KAEF <22> 28.1-KBVU <28> 29.1-KECA-ld <29> 52.1-K35LF-D <35>

Market #206 San Angelo, TX
3.1-KSAN <16> 6.1-KIDY <19> 8.1-KLST <11> 12.1-KTXE-ld (38 to ??) 41.1-KEUS-ld (41 to ??)

Market #207 Watertown, NY and Ontario-Canada border area
Watertown: 7.1-WWNY (07 to 08) 16.1-WPBS (41 to 26) 28.1-WNYF-cd <35> 45.1-WVNC-ld (45 to ??) 50.1-WWTI (21 to 31) Bancroft-ON: 2.1-CIII 2 (08 to 11) Belleville-ON: 26.1-CICO 53 (26 to 22) Brighton-ON: 30.1-CKWS 1 (30 to 23) Cloyne-ON: 44.1-CICO 92 (44 to 21) Deseronto-ON: 6.1-CJOH 6 (06 to 16) Kingston-ON: 11.1-CKWS (11 to 13)

Market #208 Great Falls, MT
Great Falls: 3.1-KRTV <07> 5.1-KFBB <08> 16.1-KTGF (45 to 17) 21.1-KUGF <21> 50.1-KBGF-ld <19> Helena: 12.1-KTVH <12>

Market #209 Pullman, WA-Lewiston, ID (includes Clarkston, WA)
Pullman-Lewiston: 2.1-K21CC-D <21> 3.1-KLEW <32> 4.1-K44JC-D (44 to ??) 4.1-K38KK-D (38 to ??) 6.1-K35BW-D <35> 7.1-K24JN-D <24> 10.1-KWSU <10> 10.1-K17JR-D <17> 12.1-KUID <12> 12.1-K25NZ-D <25> 24.1-KQUP <24> 28.1-K18LH-D <18> 42.1-KVBI-cd (42 to 17) Clarkston: 49.1-K49EV-D (49 to ??)

Market #210 Garden City - Dodge City and SW Kansas, KS
Garden City: 11.1-KSNG <11> 13.1-KUPK <13> 17.1-KAAS-lp <31> 23.1-KGCE-ld (44 to ??) Dodge City: 17.1-KSAS-lp <29> 21.1-KDCK <21> 23.1-KDDC-ld <32> Ensign: 6.1-KBSD <06> Lakin: 3.1-KSWK <08> Liberal: 23.1-KSWE-ld (39 to ??) Sublette: 23.1-KDGL-ld <23> Ulysses: 23.1-KDGU-ld <33>

Market #211 Hibbing and Iron Range, MN
11.1-KRII <11> 13.1-WIRT <13> 21.1-K15GT-D <15> 31.1-WRPT <31>

Market #212 Zanesville, OH
Zanesville: 18.1-WHIZ (40 to 30) Newcomerstown: 29.1-WIVN-ld <29> Cambridge: 44.1-WOUC (35 to 06)

Market #213 Ottumwa, IA and Kirksville, MO
Ottumwa, IA: 12.1-K18GU-D <18> 15.1-KYOU <15> Kirksville, MO: 3.1-KTVO <33> 15.1-K30MG-D <30> Keosauqua, IA: 12.1-K24IM-D <24>

Market #214 Mansfield, OH
Mansfield: 34.1-W43CZ-D (43 to ??) 41.1-WOHZ-cd (41 to 20) 68.1-WMFD <12> Sandusky: 52.1-WGGN (42 to 03)

Market #215 Cheyenne, WY
Cheyenne: 5.1-KGWN <30> 8.1-K36JO-D <36> 16.1-KKTQ-ld <16> 27.1-KLWY <27>39.1-KQCK <11> 47.1-KGSC-ld (47 to ??) Laramie: 8.1-KWYP <08> Fort Collins, CO: 22.1-KFCT <21>

Market #216 Bismarck, ND
3.1-KBME <22> 5.1-KFYR <31> 12.1-KXMB <12> 17.1-KBMY <17> 26.1-KNDB <26>

Market #217 Klamath Falls, OR
2.1-KOTI <13> 10.1-K15KE-D <15> 22.1-KFTS <33> 30.1-K48HV-D (48 to ??) 31.1-KDKF <29> 39.1-K39DP-D (39 to ??) 48.1-K41ID-D <41 to ??)

Market #218 Fairbanks, AK
2.1-KATN <18> 4.1-KJNP <20> 7.1-KFYF <07> 9.1-KUAC <09> 11.1-KTVF <26> 13.1-KXDF-cd <13> 22.1-KFXF-ld <22>

Market #219 Scottsbluff, NE (includes Sidney and Alliance)
4.1-KNEP <07> 4.1-K09YH-D <09> 10.1-KSTF <29> 13.1-KTNE <13>

Market #220 Minot, ND
6.1-KSRE (40 to 15) 10.1-KMOT <10> 13.1-KXMC <13> 14.1-KMCY <14> 24.1-KNDM <24>

Market #221 Bozeman, MT
6.1-KDBZ-cd (42 to 29) 7.1-KBZK <13> 7.1-K26DE-D <26> 9.1-KUSM <08> 28.1-KWYB-ld <28>

Market #222 Alpena, MI
6.1-WCML <24> 11.1-WBKB <11>

Market #223 Silver City, NM
2.1-K25DI-D <25> 4.1-K12QW-D <12> 7.1-K10QY-D <10> 13.1-K30KU-D <30> 28.1-K28LK-D <28>

Market #224 Norwood, NY
Norwood: 18.1-WNPI <23> Massena: 28.1-WWNY-cd <18> Prescott-ON: 26.1-CKWS 2 (26 to 28)

Market #225 Clovis and Portales, NM
3.1-KENW <32> 8.1-K16EX-D <16> 10.1-K49BY-D (49 to ??) 10.1-K29HB-D <29> 12.1-KVIH <12> 26.1-KZBZ-cd <26>

Market #226 Casper, WY
2.1-KTWO <17> 4.1-K47MW-D (47 to ??) 6.1-KPTW <08> 13.1-KCWY <12> 14.1-KGWC <14> 20.1-KFNB <20>
27.1-KWYF-ld <27> 49.1-K49LJ-D (49 to ??)

Market #227 Elko, NV
10.1-KENV <10>

Market #228 Sault Ste Marie, MI and Ontario, plus eastern UP of Michigan
Sault Ste Marie, MI: 8.1-WGTQ <08> 10.1-WWUP <10>
Sault Ste Marie, ON: 2.1-CHBX (02 to 13) 12.1-CIII 12 <15> 38.1-CHCH 5 (38 to 18)
Alpena, MI: 6.1-WCML <24> Cheboygan, MI: 4.1-WTOM (35 to 16) Vanderbilt, MI: 45.1-WFUP (45 to 21)

Market #229 Sheridan, WY
2.1-K09XK-D <09> 4.1-K15HK-D <15> 12.1-KSGW <13> 14.1-K26LW-D <26>

Market #230 North Platte, NE
North Platte: 2.1-KNOP <02> 9.1-KPNE <09> 10.1-KNPL-ld <25> 11.1-KIIT-cd <11> 27.1-KHGI-cd <27> 30.1-KMBB-ld <30> 49.1-K49LK-D (49 to ??)
Hayes Center: 6.1-KWNB <06> Merriman: 12.1-KRNE <12>

Market #231 Presque Isle, ME and border areas in New Brunswick, Canada
Presque Isle: 8.1-WAGM <08> 10.1-WMEM <10> Edmundston, NB: 9.1-CIMT 1 <04> 29.1-CFTF 1 (42 to 18)
Florenceville, NB: 3.1-CKLT 1 <03 to 24> Woodstock, NB: 38.1-CIHF 11 (38 to 15)

Market #232 Butte, MT
4.1-KXLF <05> 6.1-KTVM <06> 9.1-K43DU-D (43 to ??) 18.1-KWYB <19> 39.1-K39JC-D (39 to ??)

Market #233 Helena, MT
7.1-KJCX-ld <07> 9.1-KXLH-ld <09> 10.1-KUHM <29> 12.1-KTVH <12> 21.1-KHBB-ld <21>
49.1-K49EH-D (49 to ??)

Market #234 Montrose, CO
8.1-K28AD-D <28> 8.1-K21JK-D <21> 10.1-KREY <13> 11.1-K49JX-D (49 to ??) 18.1-K39MK-D (39 to ??) 18.1-K32CW-D <32>

Market #235 Williston, ND
Williston, ND: 4.1-KWSE <11> 8.1-KUMV <08> 11.1-KXMD <14> 38.1-KXND-ld (38 to ??)
Sidney, MT: 5.1-K13IG-D <13>

Market #236 Goodland and Colby, KS
Goodland: 10.1-KBSL <10> Colby: 4.1-KLBY <17> 19.1-KWKS <19>

Market #238 Key West, FL
6.1-WFIB-ld <06> 8.1-WGEN <08> 8.1-W12DI-D <12> 10.1-WFSF-ld <10> 19.1-WEYW-lp <19> 22.1-WSBS <03>
36.1-WCAY-cd <36> 49.1-WKIZ-ld (49 to ??)

Market #239 La Grande, OR
2.1-K47NR-D (47 to ??) 2.1-K35GA-D <35>
6.1-K29EL-D <29> 6.1-K45ME-D (45 to ??)
7.1-K39FD-D (39 to ??)
8.1-K26FV-D <26> 8.1-K43NR-D (43 to ??) 11.1-KFFX <11> 12.1-K41MU-D (41 to ??) 12.1-K33FS-D <33>
13.1-KTVR <13> 13.1-K50CI-D (50 to ??) 16.1-KUNP <16> 32.1-K31GN-D <31> 49.1-K23DB-D <23>

Market #240 Pierre, SD
Pierre: 4.1-KPRY <19> 5.1-K27HJ-D <27> 10.1-KTSD <10> 12.1-K14IO-D <14> 34.1- K34GM-D <34>
Reliance: 6.1-KPLO <13>

Market #241 Dickinson, ND
2.1-KXMA <19> 7.1-KQCD <07> 9.1-KDSE <09> 38.1-KNDX-ld (38 to ??)

Market #242 Juneau, AK
3.1-KTOO <10> 5.1-KATH-ld <35> 8.1-KJUD <11> 24.1-KXLJ-ld <24>

Market #243 Sitka - Ketchikan, AK
Ketchikan: 4.1-KUBD <13> 9.1-K09YQ-D <09> Sitka: 7.1-KTNL <07>

Market #244 Saint John, NB Canada
Saint John, NB: 9.1-CKLT <09> 12.1-CHNB <12>
Fredericton, NB: 4.1-CBAT <31> 44.1-CIHF 1 (44 to 16)
Saint Stephen, NB: 21.1-CIHF 12 <21> Calais, ME: 13.1-WMED <10>

Market #245 Jackson, WY
4.1-K19FG-D <19> 8.1-K29HG-D <29> 8.1-K36JD-D <36>

Market #246 Central Nevada
All translators

Market #247 Glendive, MT
5.1-KXGN <05>

Market #248 Rural Alaska
All translators and low power relays

Scanning America

By Dan Veeneman dan@signalharbor.com

Winnebago County (IL), Broward County (FL)

Operating a public safety radio is expensive, technically challenging, and fraught with a variety of risks. In addition, operators typically need to hire and manage a staff of specialists to design, install and maintain repeater sites, backhaul links, and all of the associated equipment necessary to provide reliable, round-the-clock service.

As an alternative, Motorola Solutions, a major equipment manufacturer now headquartered in Chicago, Illinois, has reduced a great deal of that complexity and risk by operating radio networks on behalf of public agencies and other organizations.

Winnebago County, Illinois

Last December, Winnebago County approved a 10-year contract to move from their existing radio system to the StarCom21 network. The contract with Motorola Solutions includes a total of 405 new digital radios, additional equipment and maintenance. The radios will be used by the Sheriff's department, Corrections, Juvenile Detention, Coroner's office, Forest Preserve police, Health Department, Animal Services and other county agencies.

Winnebago County is located on the Wisconsin border in northern Illinois, roughly half way between Lake Michigan and Iowa. It has a population of about 300,000, about half of whom live in the county seat of Rockford.

The county's existing Motorola Type II system carries a mix of analog and digital voice traffic as the county has already begun the transition to Project 25 radios in anticipation of the new network. The existing system is reaching end-of-life and costs more than $10,000 per year for the backhaul network between repeater sites and the dispatch center, along with an average of $45,000 for repeater site hardware maintenance and repairs.

The existing system also has gaps in coverage where first responder radios are unable to reliably communicate with dispatchers.

StarCom21

Motorola Solutions owns and operates StarCom21, a statewide Project 25 trunked radio network serving public safety agencies across Illinois. It was originally designed to serve the needs of the Illinois State Police and the Illinois State Highway Authority, but has grown to serve dozens of

agencies and organizations totaling more than 43,000 users. About 270 repeater sites operating in the 700 and 800 MHz bands provide coverage across the state.

Agencies using the system pay on the order of $50 per radio per month, with discounts depending on the number of radios and the geographic area where the radio will be used. For most municipalities, StarCom21 offers improved radio coverage and increased equipment reliability.

Rockford

In 2007, the City of Rockford transitioned to StarCom21 and currently operates on 851.4125, 852.3875, 853.3875, 851.2625, 851.7125, 852.0375, 852.8375, 853.2375, 853.6375 and 853.8875 MHz. Two additional StarCom21 repeater sites are located in Winnebago County:

Repeater Site	Frequencies
Pecatonica	851.4625, 852.4625, 853.0625 and 851.1625 MHz
South Beloit	851.5750, 851.8625, 853.4875, 853.9625 and 851.1000 MHz

(Courtesy: Starcom)

Unfortunately for scanner listeners, much of the law enforcement radio traffic in Rockford is encrypted. It appears this choice will likely carry over onto the new county system, having been touted in StarCom21 literature this way:

"Transmission encryption prevents criminal discovery of and interference in police operations, as well as personal identification information that may inform identity theft activities"

Talkgroups already in place for Rockford and the county are listed below. Additional talkgroups are expected as county agencies transition to StarCom21.

Decimal	Hex	Description
1714	6B2	County Law Enforcement Operations
1715	6B3	County Law Enforcement Operations
1716	6B4	County Law Enforcement Operations
1717	6B5	County Law Enforcement Operations
1719	6B7	County Law Enforcement
1720	6B8	County Law Enforcement Operations
1724	6BC	County Law Enforcement
1725	6BD	County Law Enforcement Operations
1728	6C0	County Law Enforcement
1729	6C1	County Law Enforcement Operations
1735	6C7	County Law Enforcement Operations
1736	6C8	County Law Enforcement Operations
1743	6CF	County Law Enforcement Tactical Operations
1701	6A5	Rockford Police (West Dispatch)
1702	6A6	Rockford Police (East Dispatch)
1703	6A7	Rockford Police Vehicle Information
1705	6A9	Rockford Police Detectives
1706	6AA	Rockford Police
1707	6AB	Rockford Police
1709	6AD	Rockford Police
1751	6D7	Rockford Police
1726	6BE	Rockford Fire Paging (Simulcast of 151.1750 MHz)

(Courtesy: Motorola Solutions)

District 2 of the Illinois Department of Transportation includes Winnebago County and can be heard on the StarCom21 system.

Decimal	Hex	Description
1407	57F	Illinois Department of Transportation (Operations A)
1408	580	Illinois Department of Transportation (Operations B)
1414	586	Illinois Department of Transportation (Operations C)
1415	587	Illinois Department of Transportation (Operations D)
3733	E95	Illinois Department of Transportation (Local 3733)
3734	E96	Illinois Department of Transportation (Dixon Yard)
3735	E97	Illinois Department of Transportation (Rock Island County)
3736	E98	Illinois Department of Transportation (Local 3736)
3737	E99	Illinois Department of Transportation (Rock Falls Yard)
3738	E9A	Illinois Department of Transportation (Eleroy Yard)
3739	E9B	Illinois Department of Transportation (Rockford Yard)
3740	E9C	Illinois Department of Transportation (Oregon Yard)
3741	E9D	Illinois Department of Transportation (Lee Yard)

Numerous other state and Federal agencies can also be heard on the StarCom21 repeater sites in Winnebago County. Until the new system is up and running, the following conventional (non-trunked) analog VHF (Very High Frequency) and UHF (Ultra High Frequencies) frequencies should con-

tinue to carry public safety traffic. These can be monitored on nearly any scanner:

Frequency	Description
151.3850	County Siren Warning System (80 sites)
151.5050	County Sheriff (Explorer Program 1)
151.5350	County Courthouse
153.6350	County Courthouse
154.1150	County Courthouse Operations
154.1900	County Fire (Suburban Dispatch)
154.2350	Fire Dispatch
154.7550	County Sheriff (West Dispatch)
155.1900	County Sheriff (Central Dispatch)
155.2200	Metro Medical Services
155.4150	County Sheriff (East Dispatch)
155.5650	County Sheriff
156.2100	County Juvenile Detention Center
158.4000	County Sheriff (Explorer Program 2)
453.1125	County Courthouse Operations
453.7875	County Sheriff (Operations 2)
453.8000	County Sheriff (Operations 1)
458.9875	Rockford Fire (Digital)
460.1500	County Sheriff (Tactical Teams)
460.1750	County Sheriff Bomb Disposal
460.3000	County Sheriff (Corrections)
460.5000	County Sheriff (Jail Operations)
465.0000	EMS (Digital Paging)
857.9375	County Sheriff Mobile Data Terminals
859.9375	County Sheriff Mobile Data Terminals

Broward County, Florida

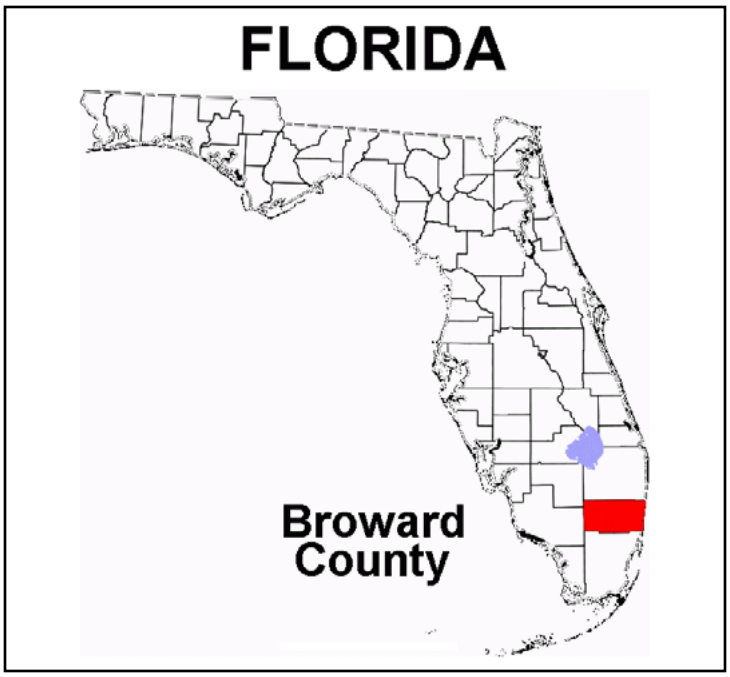
Broward County recently chose Motorola Solutions for a new Project 25 radio system, intended to provide better interoperability with nearby municipalities, improve coverage, and be more resilient against hurricanes and other types of severe weather.

Broward County is located in southeastern Florida on the Atlantic Ocean, just north of Miami, and covers more than 1,300 square miles. It is home to nearly two million residents, most located between the Atlantic Ocean on the east and the Everglades to the west.

In May, Broward County commissioners approved a plan to replace their current radio system, now more than 25 years old, for a new Project 25 system from Motorola Solutions costing a total of $59.5 million. The system itself will cost $30.4 million, twenty years of support maintenance will run another $26.4, and $2.7 million for optional services and additional training.

The county currently operates a Motorola Type II SmartNet trunked radio system from eight repeater sites and two receive-only locations. More than 10,400 radios are active on the system, operating in the 800 MHz band. The county's three dispatch centers handle about 1.7 million emergency calls each year.

The current system is organized into three subsystems



operating on the following frequencies:

Subsystem	Frequencies
Primary	851.1875, 851.6875, 852.0375, 852.7125, 853.0625, 853.1875, 853.7625, 854.4625, 855.2375, 855.5625, 855.6625, 856.4875, 856.7375, 857.1875, 857.3625, 857.4875, 857.7375, 857.9875, 858.3625, 858.4875, 858.7375, 858.9875, 859.3625, 859.4375, 859.4875, 859.7125, 859.7375 and 859.9875 MHz.
Hollywood:	851.0875, 851.3375, 851.5875, 851.7125, 851.8375, 852.0875, 852.3375, 853.2125 and 853.7125 MHz.
Fort Lauderdale	851.2625, 851.4125, 851.9125, 852.2625, 852.6125, 852.8625, 853.0375, 853.0875 and 853.5875 MHz.

There are more than 800 active talkgroups on the system. A handful of them are listed here:

Decimal	Hex	Description
4144	103	County Sheriff Dispatch (Districts 2, 3, 14)
4176	105	County Sheriff Dispatch (Districts 8, 9, 16)
4208	107	County Sheriff Dispatch (Districts 1, 28)
4240	109	County Sheriff Dispatch (District 21)
4304	10D	County Sheriff Dispatch (District 29)
4368	111	County Sheriff Dispatch (Districts 4, 5, 12)
4400	113	County Sheriff Dispatch (Districts 7, 15, 17)
4432	115	County Sheriff Dispatch (District 10)
4464	117	County Sheriff Dispatch (District 23)
8208	201	County Fire Dispatch
8496	213	County Fireground 1
8528	215	County Fireground 2
8560	217	County Fireground 3

8624	21B	County Fireground 4
10288	283	Broward General Medical Center
12400	307	Fort Lauderdale-Hollywood International

Airport Operations

The current system is reaching end-of-life and is becoming more difficult to maintain. It has also suffered several outages in the past few years, causing some police departments to switch to two-officer patrols and implement hourly check-ins. There are also gaps in coverage, including dead zones in high rise buildings.

An additional factor in favor of a more capable system came from the mass shooting incident at the Fort Lauderdale-Hollywood International Airport in January. The overwhelming law enforcement response caused the radio system to quickly overload, delaying communication and preventing many officers from transmitting.

Under the plan, Motorola Solutions will manage the new system for ten years, assuring users of having the latest software and operating on an expertly maintained network.

The new system will be based on Project 25 Phase 2 standards and operate in the 700 MHz band. It will also use a new Internet Protocol (IP)-based microwave backhaul network. The Project 25 Phase 2 technology includes an improved voice encoder/decoder (vocoder) that is better able to reduce background noise, like blaring sirens and pulsing alarms.

Broward County hopes to have the new system up and running by the end of next year. Under the plan, seven new repeater sites will be built, including two in Hollywood and the remainder in Fort Lauderdale, North Lake, Pompano Beach and along I-75 in the Everglades area.

The county is also using new computer-aided dispatch (CAD) consoles, allowing dispatchers to better manage emergencies and share information with other agencies.

The consoles have additional features that are not currently in use, including the ability to distribute on-scene video and quickly identify the nearest first responder to an event. New P25 radios contain a Global Positioning System (GPS) receiver, enabling dispatchers to immediately determine the location of each first responder.

Alternate System

Although located in Broward County, the municipalities of Coral Springs, Plantation and Fort Lauderdale have their own radio system. These communities have chosen to operate their own system apart from the county.

Repeater Site	**Frequencies**
Coral Springs	851.0500, 851.3000, 852.3000, 853.6250, 853.8750, 855.1125, 856.1625, 858.8125, 851.5500, 852.5500, 855.9125, 856.9375, 857.9375, 858.9375, 859.9375
Fort Lauderdale	851.2125, 851.2375, 851.6625, 852.1875, 852.2625, 852.6375, 853.2875, 853.3375, 853.5375, 853.5625, 853.7875, 853.9125
Plantation	856.4125, 857.1375, 857.5125, 858.2625, 858.5125, 859.2625

Courtesy: City of Ft. Lauderdale, Florida)

Decimal	**Hex**	**Description**
1873	751	Fort Lauderdale Police District 1 (Patches)
1875	753	Fort Lauderdale Police District 2 (Patches)
1877	755	Fort Lauderdale Police District 3 (Patches)
2053	805	Fort Lauderdale Police interoperability with Sheriff
5035	13AB	Coral Springs Fire (Dispatch)
5027	13A3	Coral Springs Fire Tactical 1
5029	13A5	Coral Springs Fire Tactical 2
5031	13A7	Coral Springs Fire Tactical 3
5005	138D	Coral Springs Fire Tactical 4
5021	139D	Coral Springs Fire Administration
5033	13A9	Coral Springs Fire Inspections
5091	13E3	Coral Springs Fire Training 1
5093	13E5	Coral Springs Fire Training 2
5095	13E7	Coral Springs Fire Training 3
5097	13E9	Coral Springs Fire Prevention
5099	13EB	Coral Springs Police (Dispatch)
5019	139B	Coral Springs Police Information
5055	13BF	Coral Springs Police Patrol Tactical
5011	1393	Coral Springs Police Traffic Tactical
5007	138F	Coral Springs Police Special Events 1
5009	1391	Coral Springs Police Special Events 2
5013	1395	Coral Springs Police Vehicle Information 1
5015	1397	Coral Springs Police Vehicle Information 2
5017	1399	Coral Springs Police Criminal Investigations Unit 1
5079	13D7	Coral Springs Police Special Events 3
5081	13D9	Coral Springs Police Special Response Team-1
5083	13DB	Coral Springs Police Special Response Team 2
5085	13DD	Coral Springs Police Criminal Investigations Unit 2
5089	13E1	Coral Springs Police (Juvenile)
5133	140D	Coral Springs Police Vehicle Information 3
5265	1491	Fort Lauderdale Fire-Rescue (Dispatch)
5275	149B	Fort Lauderdale Fire-Rescue Tactical B ("Bravo")

5276 149C Fort Lauderdale Fire-Rescue Tactical C ("Charlie")
5277 149D Fort Lauderdale Fire-Rescue Tactical D ("Delta")
5278 149E Fort Lauderdale Fire-Rescue Information E ("Echo")
5279 149F Fort Lauderdale Fire-Rescue Tactical F ("Foxtrot")
5258 148A Fort Lauderdale Fire-Rescue Battalion Chief 2
5259 148B Fort Lauderdale Fire-Rescue Battalion Chief 13
5260 148C Fort Lauderdale Fire-Rescue Battalion Chief 16
5261 148D Fort Lauderdale Fire-Rescue Battalion Chief 35
5262 148E Fort Lauderdale Fire-Rescue Department Chief
5257 1489 Fort Lauderdale Fire-Rescue Inspectors
5272 1498 Fort Lauderdale Fire-Rescue Ocean Rescue 1 (Dispatch)
5273 1499 Fort Lauderdale Fire-Rescue Ocean Rescue 2 (Car-to-Car)
5297 14B1 Fort Lauderdale Police District 1 (North Dispatch)
5298 14B2 Fort Lauderdale Police District 2 (Central Dispatch)
5299 14B3 Fort Lauderdale Police District 3 (South Dispatch)
5313 14C1 Fort Lauderdale Police District 1 Tactical ("Bravo")
5314 14C2 Fort Lauderdale Police District 2 Tactical ("Bravo")
5315 14C3 Fort Lauderdale Police District 3 Tactical ("Bravo")
5329 14D1 Fort Lauderdale Police Special Events
5330 14D2 Fort Lauderdale Police Criminal Investigations 1
5331 14D3 Fort Lauderdale Police Criminal Investigations 2
5364 14F4 Fort Lauderdale Police Information
5367 14F7 Fort Lauderdale Police Traffic
5369 14F9 Fort Lauderdale Police District 1 Operations
5370 14FA Fort Lauderdale Police District 2 Operations
5371 14FB Fort Lauderdale Police District 3 Operations
5373 14FD Fort Lauderdale Police Detectives (North)
5374 14FE Fort Lauderdale Police Detectives (Central)
5375 14FF Fort Lauderdale Police Detectives (South)
5388 150C Fort Lauderdale City Hall Security
5393 1511 Fort Lauderdale Police District 1 (Car-to-Car)
5394 1512 Fort Lauderdale Police District 2 (Car-to-Car)
5395 1513 Fort Lauderdale Police District 3 (Car-to-Car)
5901 170D Plantation Police (Dispatch)

(Courtesy: Broward County, Florida)

5903 170F Plantation Police Information ("Bravo")
5905 1711 Plantation Police Car-to-Car ("Charlie")
5907 1713 Plantation Police Tactical 4 ("Delta")
5909 1715 Plantation Police Tactical 5 ("Echo")
5911 1717 Plantation Police Tactical 6 ("Foxtrot")
5913 1719 Plantation Police Tactical 7 ("Golf")
5915 171B Plantation Police Canine Operations ("Hotel")
5917 171D Plantation Police Tactical 9 ("India")
5919 171F Plantation Police Tactical 10 ("Juliet")
5921 1721 Plantation Police Tactical 11 ("Kilo")
5923 1723 Plantation Police Tactical 12 ("Lima")
5925 1725 Plantation Police Tactical 13 ("Mike")
5927 1727 Plantation Police Tactical 14 ("November")
5929 1729 Plantation Police Tactical 15 ("Oscar")
5933 172D Plantation Fire-Rescue (Fire Dispatch)
5935 172F Plantation Fire-Rescue (Emergency Medical Services Dispatch)
5937 1731 Plantation Fire-Rescue Tactical 1
5939 1733 Plantation Fire-Rescue Tactical 2
5941 1735 Plantation Fire-Rescue Tactical 3
5943 1737 Plantation Fire-Rescue
5945 1739 Plantation Fire-Rescue
5947 173B Plantation Fire-Rescue
5949 173D Plantation Fire-Rescue
5951 173F Plantation Fire-Rescue
5953 1741 Plantation Fire-Rescue
5955 1743 Plantation Fire-Rescue

TSM

Federal Wavelengths

By Chris Parris **cparris@thefedfiles.com**

Joint Base Lewis McChord, Washington

Continuing the theme of monitoring various military facilities that I started in last month's column on Fort Huachuca, Arizona, we now move up to the north and the military base known as JBLM, or Joint Base Lewis McChord.

Located just south of Tacoma, Washington, in Pierce County, Joint Base Lewis McChord is the most recent iteration of the various military facilities that have been located in the area since 1917. The current base combines the Army and Air Force facilities into one large military reservation.

Nestled immediately next to JBML is Camp Murray, the Washington National Guard headquarters. Originally Fort Lewis and McChord Air Force Base were two facilities separated by a two-lane county road. The two bases were conjoined as Joint Base Lewis McChord in February 2010.

Technically, the base consists of four geographical areas: Lewis Main, Lewis North, McChord Field, and the Yakima Training Center. Lewis Main, Lewis North and McChord Field cover over 86,000 acres, while the Yakima Training Center covers 324,000 acres. Fort Lewis began as Camp Lewis back in 1917. After World War I, the army established a military airfield in 1930, called Tacoma Field. It was renamed McChord Field in 1940 and became a separate military base in 1947 with the establishment of the U.S. Air Force.

McChord is currently the home of the Western Air Defense Sector, or WADS. This is one of two Sectors reporting to the North American Aerospace Defense Command, also known as NORAD. If you hear military aircraft talking with someone using the call sign of BIGFOOT, they are talking with WADS.

Beginning in 1942, the U.S. Army leased land in the south-central Washington region for the Yakima Anti-Aircraft Artillery Range. In 1951 the Army purchased additional acreage for the Yakima Firing Center, which would eventually become the modern Yakima Training Center. The training center provides support for visiting military units and organizations by sustaining training lands, range complexes, and support facilities. The installation's customers include U.S. Special Operations Command, Marine Corps, Air Force, Navy, and Coast Guard units, plus local and federal law enforcement agencies and allied forces from foreign allies.

In addition to its role as a military training facility, the Yakima Training Center has been known to play a major role in ECHELON, the global surveillance network operated by an alliance of various members of the intelligence community.

The signals intelligence, or SIGINT portion of the facility is referred to as Yakima Research Station. For some time, the small Yakima satellite intercept station was an important means of intercepting communications passing through international communications satellites orbiting above the Pacific Ocean. In April 2013, news reports indicated that the Yakima Research Station was going to be shut down with its function moving to a facility in Colorado. The functions of the Yakima facilities were eventually moved to the Aerospace Data Facility at Buckley Air Force Base in Aurora, Colorado.

Most of the routine base radio communications at Joint Base Lewis McChord have moved over to a multi-site 380 MHz P-25 trunked radio system. However, parts of JBLM continue to utilize conventional VHF and UHF frequencies in addition to the trunked radio system. And both the Fort Lewis and McChord facilities have airfield and Unmanned Aerial Vehicle (UAV) operations that require VHF and UHF air band and air-to-ground frequencies.

Although much of this frequency data has been around for a while, and may not all be currently in use, I present my database listings for the facilities at Joint Base Lewis McChord here. Low band frequencies (used mostly out on Lewis and Yakima ranges) will be wideband FM with the standard military CTCSS squelch tone of 150.0 Hz. By the way, scanners programmed to use the 151.4 Hz squelch tone will open on the military 150.0 Hz tone just fine. Many of the VHF band land mobile frequencies were used for base operations before trunked systems came into operation. But many VHF frequencies continue to be used for range operations as well as paging and medivac support at Madigan Hospital.

Fort Lewis

32.4500
36.5500
36.8500
38.9000
40.1500
46.7500
49.7000
49.8000

138.0250		148.0250	Paging System	
138.1000		148.2000		
138.9250	Fire Alarm Data	148.5750	Paging System	
139.0000		148.6000	AM BULLSEYE Radio	
139.0750		148.6250		
139.1000		148.6500		
139.1250		148.6750		
139.2500		148.7000		
139.2750		148.7250		
139.3000		148.8250		
139.3250		148.8500		
139.3750		148.9000		
139.4250		149.5750		
139.4500		149.6500		
139.4750		149.7000	AM BULLSEYE Radio	
139.6000		149.7250		
139.7000		149.7750		
141.0250		149.8750		
141.1000		150.4250		
141.1250		150.5000		
141.1500		150.5250		
141.1750		150.5500		
141.2000		150.5750		
141.2250		150.6000		
141.2750		150.6250		
141.3000		150.6500		
141.3250		150.6750		
141.3500		150.7000		
141.3750		150.7250		
141.4000		150.7500		
141.4250		150.7750		
141.4500		165.0625		
141.4750		165.0875	Range Control	
141.5000		165.1875	Range Control	
141.8000		171.3875		
142.2500		172.3000		
142.3250		173.4125		
142.4000		173.4625		
142.4500		173.4875		
142.4750		173.5125		
142.8750		173.8125		
142.9000		173.9125	Range Control	
142.9250				
142.9500		231.5000	AM	
142.9750		233.5500	AM	Army National Guard Operations
143.0250		237.2000	AM	
143.0500		237.6500	AM	
143.1000		237.7000	AM	
143.1250	Range Control/Safety	237.7500	AM	
143.1500		239.0000	AM	
143.2000		240.6500	AM	Army National Guard Operations
143.3000		246.3750	AM	
143.3500		247.7500	AM	
143.3750		256.8000	AM	
143.4750		265.7000	AM	Army National Guard Operations
143.9750		267.1000	AM	

267.1500	AM	
267.2000	AM	
267.2500	AM	
267.3000	AM	
267.3500	AM	
280.3750	AM	Range Operations
286.2000	AM	
286.3750	AM	Range Operations
287.6250	AM	Range Operations
290.6000	AM	
299.0500	AM	
299.1000	AM	
299.1500	AM	
300.1000	AM	MEDEVAC
300.3750	AM	Range Operations
301.6250	AM	Range Operations
304.2500	AM	Range Operations
304.6000	AM	MEDEVAC
308.8000	AM	Army National Guard Operations
312.8750	AM	Range Operations
315.1250	AM	Range Operations
319.2000	AM	
319.8750	AM	Range Operations
325.5000	AM	Range Operations
337.5000	AM	Range Operations
339.0000	AM	Range Operations
339.8500	AM	
339.9000	AM	
339.9500	AM	
340.0500	AM	
340.1000	AM	
340.1500	AM	
340.6000	AM	
341.0000	AM	Range Operations
341.5000	AM	
342.3000	AM	
343.0500	AM	Army National Guard Operations
344.3750	AM	Range Operations
345.6250	AM	Range Operations
347.3000	AM	
347.3750	AM	Range Operations
347.7000	AM	MEDEVAC
351.1000	AM	Range Operations
352.7500	AM	Range Operations
356.2500	AM	Range Operations
356.3000	AM	
356.4000	AM	
356.4500	AM	
356.5500	AM	
356.6000	AM	
356.7000	AM	
356.7500	AM	
356.8000	AM	
356.8500	AM	
356.9000	AM	
356.9500	AM	
359.5000	AM	Range Operations
362.2500	AM	Range Operations
365.0000	AM	Range Operations
366.1000	AM	
366.5000	AM	
366.6250	AM	Range Operations
367.2000		
367.4000	AM	MEDEVAC
368.2500	AM	Range Operations
370.1250	AM	Range Operations
372.8750	AM	Range Operations
375.0000	AM	Range Operations
386.3000	AM	
386.3500	AM	
386.4000	AM	
386.6000	AM	
406.9500		
407.2250		
407.2500		
407.2500		
407.3000		
407.3250		Madigan Hospital Paging
407.4750		
407.5250		Paging System
407.5750		
408.1250		
408.5500		
409.1250		
409.1500		
409.3500		
410.1500		
412.8250		
412.8750		
412.9000		
412.9250		
413.2500		Madigan Hospital Paging
413.4250		
413.4750		
413.5250		Paging System

Gray Army Air Field (KGRF)

30.5000150.0 PL		Army Operations
32.3000150.0 PL		BULLSEYE Radio
32.6000150.0 PL		Army National Guard
34.6000150.0 PL		BULLSEYE Radio
38.4500150.0 PL		Grey AAF Weather
41.5000150.0 PL		Gray AAF Tower
119.3250	AM	Grey AAF Tower
120.1000	AM	Approach/Departure
121.9000	AM	Grey AAF Ground
123.0750	AM	Army National Guard Helicopters
124.6500	AM	Grey AAF ATIS
126.2000	AM	Grey AAF Tower

126.5000	AM	Approach/Departure
128.2000	AM	Approach/Departure
134.1000	AM	Grey AAF Weather
138.6000	AM	Grey AAF Operations
139.0250	AM	Grey AAF Operations
141.5000	AM	BULLSEYE Radio
142.0000	AM	Grey AAF Tower
142.7000	AM	Lewis Range Status
229.5000	AM	Grey AAF Clearance Delivery
239.0000	AM	Approach/Departure
241.0000	AM	Army Operations
242.4000	AM	Army Operations
245.5000	AM	Army Operations
248.2000	AM	Army Operations
256.8000	AM	Grey AAF
276.4000	AM	Grey AAF Tower
290.2000	AM	Grey AAF Ground
290.9000	AM	Approach/Departure
306.2000	AM	Grey AAF ATIS
317.4000	AM	Grey AAF SFA
334.1000	AM	Grey AAF
379.1000	AM	BULLSEYE Radio
384.5250	AM	Lewis Range Status
391.9000	AM	Approach/Departure
393.3000	AM	BULLSEYE Radio
395.2250	AM	Grey AAF Operations

McChord Field (KTCM)

32.3500		
32.8500		
34.1750		
34.2000		
36.8250		
38.6500		
41.4500		
41.9300		
49.8500		
109.6000	AM	McChord ATIS
118.1750	AM	McChord Ground Control
121.6500	AM	Ground Control
124.8000	AM	McChord Tower
126.5000	AM	Approach/Departure
134.1000	AM	McChord Air Mobility Command CP
138.0750		
138.1000	AM	
138.1750		
138.3250		Base Paging System
141.6250		
142.2000		
143.9250		
148.1000		
148.1250	AM	NORAD Air-to-Ground BIGFOOT
148.2250		
148.4500	AM	Squadron Operations
148.4750		
148.5250	AM	Squadron Common
148.5500		
149.1500		
149.1750		
149.2000		
149.3250		
149.4750		
150.1500		
150.2000		
150.2500		
150.3500		
163.4625		
163.4875		
163.5375		
163.5875		
165.0125		
165.1125		
165.1375		
166.2000		
173.4375		
173.5375		
173.5625		
173.5875		
225.5250	AM	
225.7000	AM	SOF (Supervisor of Flying)
228.6000	AM	NORAD Air-to-Ground BIGFOOT
235.9000	AM	NORAD Air-to-Ground BIGFOOT
236.6000	AM	
238.6000	AM	
239.7000	AM	NORAD Air-to-Ground BIGFOOT
252.0000	AM	NORAD Air-to-Ground BIGFOOT
253.4000	AM	
259.2000	AM	
259.3000	AM	McChord Tower
260.9000	AM	
261.9000	AM	McChord Maintenance
265.4000	AM	NORAD Air-to-Ground BIGFOOT
267.0000	AM	McChord Operations
270.1000	AM	McChord ATIS
271.0000	AM	NORAD Air-to-Ground BIGFOOT
275.8000	AM	Ground Control
279.6500	AM	McChord Ground Control
277.6000	AM	NORAD Air-to-Ground BIGFOOT
279.6500	AM	McChord Tower
282.6000	AM	NORAD Air-to-Ground BIGFOOT
287.7000	AM	McChord Supervisor of Flying
288.4000	AM	NORAD Air-to-Ground BIGFOOT
290.9000	AM	McChord Approach/Departure SFA
293.6000	AM	NORAD Air-to-Ground BIGFOOT
293.8000	AM	
296.2000	AM	Air-to-Ground Training
298.1000	AM	NORAD Air-to-Ground BIGFOOT
298.4000	AM	Air-to-Ground Operations
308.8500	AM	Squadron Common

311.0000 AM McChord Command Post
311.3000 AM
324.2500 AM
328.0000 AM NORAD Air-to-Ground BIGFOOT
337.4000 AM
333.8000 AM McChord Operations
340.3000 AM McChord Operations
340.6000 AM Drop Zone Air-to-Ground
341.5000 AM Combat Control Operations
341.8000 AM McChord Operations
342.3000 AM McChord PMSV
342.5000 AM
348.2000 AM NORAD Air-to-Ground BIGFOOT
349.4000 AM McChord ALCP (RAINIER OPS)
351.5000 AM NORAD Air-to-Ground BIGFOOT
353.4000 AM McChord ALCP
355.2000 AM NORAD Air-to-Ground BIGFOOT
359.8000 AM NORAD Air-to-Ground BIGFOOT
364.2000 AM NORAD Air-to-Ground BIGFOOT
370.9500 AM McChord Maintenance Dispatch
372.2000 AM Pilot-to-Dispatcher
374.0000 AM NORAD Air-to-Ground BIGFOOT
377.1500 AM
379.4000 AM McChord Operations
379.8500 AM

407.4250
407.4500
407.4750
413.0000
413.0750
413.1000
413.1250 Air Mobility Command Operations
413.1500
413.1750
413.2000
413.3000
413.3750
413.4000
413.4500
413.5000
413.8250

As I mentioned previously, the introduction of a multi-site, digital trunked radio system around 2005 meant that most of the day-to-day base operations abandoned the VHF and UHF conventional radio systems. This trunked system has 4 sites at JBLM near Tacoma and 5 sites at the Yakima Training Center.

Here is the current radio system information for the trunked sites located at Joint Base Lewis McChord (JBLM):

System ID 14C
WACN BEE00
Site 101 – JBLM Main
Site NAC - N104
380.0750
380.1750
380.2750
380.3875
380.4250
380.5375
380.5750
380.8750
380.9875
381.0875
381.1750
381.2375
381.3125
381.4250
381.6250
381.8250
381.8500

Site 102 – JBLM North
Site NAC - N140

380.2125
380.5500
380.8375
381.0125
381.2875

Site 103 – JBLM South
Site NAC - N140
380.7250
380.9375
381.7375
Site 109 – McChord Field
Site NAC - N140
386.2250
386.6125
386.8250
388.0000
388.1750
388.4875
388.7000
388.8500

Yakima Training Range

Here is a listing of the 380 MHz P-25 trunked radio sites that are utilized by the Yakima Training Center. I was able to monitor Sites104 and 108 from the west side of the facility in Yakima. Site 108 seems to be located closest to Yakima, with Site 104 somewhere on the northwest side. Site 105, 106 and 107 were only barely audible from the eastern side of the Training Center property. My visits to the area have only revealed the control channel frequencies for some of the trunked sites on base:

System ID 14C
WACN BEE00
Site 104 – Yakima, Washington area
NAC – N140
380.2125

Site 105 – Yakima Training Center
NAC – N140
308.0750

Site 106 – Yakima Training Center
NAC – N140
380.1750

Site 107 – Yakima Training Center
NAC – N141
380.2750
380.5375

Site 108 – Yakima, Washington area
NAC – N141
380.7250
380.9375
381.7375
381.9250

In addition to the P-25 trunked system, there are conventional VHF and UHF channels used by units at the training center. Here is a list of frequencies that have been confirmed as used at the Yakima Training Center and Vagabond Army Airfield (KFCT):

30.0250150.0 PL RATTLESNAKE Radio
31.3000
31.4000
31.7500
32.4000
34.6000
36.1000
36.5000
36.7000
40.2000150.0 PL Yakima Training Center Range Control
41.5000
126.2000 AM Yakima (KFCT) Common Traffic Advisory
139.1250 AM
139.7000 AM
142.3000 AM Yakima Training Center Range Control
241.0000 AM
248.2000 AM KFCT Ground
256.8000 AM
257.8000 AM Yakima (KYKM) Tower
263.1500 AM
269.3500 AM Yakima (KYKM) Approach/Departure
290.6000 AM
296.9000 AM
363.4000 AM RATTLESNAKE Radio
393.3000 AM
395.2250 AM Yakima Training Center Range Control

Next month we'll focus on another military base located in Washington state, Fairchild Air Force Base. Until then, keep the emails coming!

TSM

Utility Planet

By Hugh Stegman **mtutilityworld@gmail.com**

Watching the Eclipse with the Radio

By now, everyone's probably aware that a truly epic solar eclipse will cross the entire contiguous United States on August 21, 2017. This may go down in the history of such things as the most watched eclipse ever. Viewing begins on the Oregon coast at 1021 Pacific Daylight Time, and exits the Atlantic coast of South Carolina at 1448 Eastern. In between, it goes through narrow strips of Idaho, Wyoming, Nebraska, Kansas, Missouri, Illinois, Kentucky, Tennessee, Georgia, and North Carolina. Its path of totality is about 70 miles wide. As always, however, a partial eclipse will cover a far wider area, with some degree of obscuration everywhere in North America.

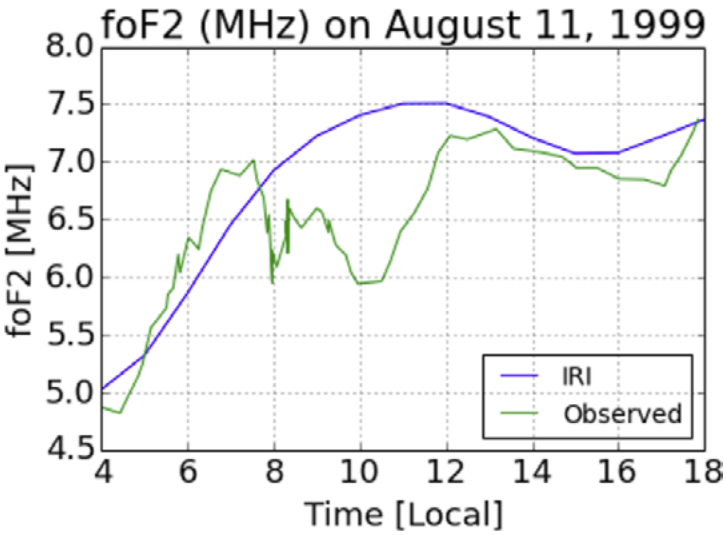
The only large cities along this path are Nashville, TN and Charleston, SC, though parts of metro St. Louis and Kansas City get in. Most of the remaining U.S. population will either have to take a trip or watch it on TV to see the whole show. Even that depends on clear weather. However, another interesting option exists. This is to follow the eclipse on the radio. A large number of people plan to do just that.

It's about Propagation

Most radio geeks know that the ionosphere undergoes strong diurnal variations. In the daytime, extreme UV and X-rays from the Sun increase its density. The F-region, which is the one causing long-distance HF skip, splits into two layers. Lower down, the E-region thickens. This is sometimes affected by high-level weather, as sporadic-E chasers know well. Lower still, a D-region forms in daytime. Its major effect is to absorb signals below approximately 10 MHz, which would otherwise be propagated by higher regions. This absorption increases at lower frequencies. It is what makes AM broadcast skip a night pursuit, since the D-region rapidly disappears after local sundown.

Now, common sense would indicate that a two-minute eclipse would not cause even a bump, compared to a long winter night. Common sense is wrong, and eclipses affect it a lot. D and E-region absorption drops off quickly, and stations at the low end of HF or even on medium wave can suddenly fade in. The transmitters most affected are those nearest the totality path. These changes are not linear, and they persist for several hours past totality.

There's not much good data on these propagation effects. Eclipses happen where they happen, and usually there



Divergence of observed from predicted propagation following a solar eclipse. (Courtesy: hamsci.org)

aren't a lot of observing sites. That won't be a problem this time. Thousands of locations will return data of all sorts. Some of this will come from advanced instrumentation run by heavy-duty researchers. Some of this will come from you and me. There are many opportunities to participate, and return real data that will advance science. That is pretty cool.

Observing WWV

WWV is the U.S. time and frequency standard station, located in Fort Collins, Colorado. It transmits continuously on 2.5, 5, 10, 15, 20, and 25 MHz, all from the same location. It'll give you the right time of day, and its frequencies are stable enough by HF standards to reliably calibrate radios. For these and other reasons, it makes a good propagation reference. The experiment here is to record signal strengths before, during, and after the eclipse. S-meter readings will suffice. Fort Collins isn't in the path of totality, but scientistsare interested in its signal changes anyway. Since WWV-carrier levels are extremely steady, any changes will be due to propagation.

Due to this interest in WWV for propagation checks, its engineers have changed the antenna used on 25 MHz. On July 7, a vertical antenna was replaced by a "turnstile" with circular polarization. This polarization has some special characteristics for propagation studies around the eclipse.

Photos show a much smaller antenna than the impressive towers used for other frequencies. It's appears to be a crossed array resting on PVC pipe, with its two elements fed out of phase by coax lines.

A lot of people will remember that 25-MHz WWV was revived during a solar peak in 2014. It has the same accuracy as the other frequencies. At the time, it was pretty much a daily afternoon presence here in California. That was then, and this is now. In the summer doldrums, in California, it would be a nice catch any day. Other listeners might be luckier. If so, WWV is looking for any and all signal reports. They go to its NIST e-mail address wwv@nist.gov, or by snail mail to the famous 2000 E. County Road 58, Ft Collins, CO 80524.

The NIST has another call sign at the Fort Collins antenna farm. This is WWVB, on the relatively fade-proof frequency of 60 kHz. In the U.S., the millions of "atomic clocks" that sync to radio transmissions are using WWVB. It sounds like a series of different-length beeps. Actually, the information is in the silences between the beeps. They're not really silences, but 17 dB amplitude reductions. Their duration can mean a digital one or zero, or a marker pip. Similarly, a binary phase shift keying occurs 0.1 seconds after the downward AM.

A group of VLF enthusiasts has started an effort called the Eclipse Mob. Its primary signal under study is WWVB. Whether or not one participates, this will be an interesting experiment to watch. Homebrewers can use directions at their web site to breadboard a simple, inexpensive standard receiver. This down-converts the received signal to audio frequency, for a cell phone app that will be used by registered accounts. Details on this or another inexpensive receiver are available at their web site at the end of this month's column.

Of course, one can also track the amplitudes of VLF signals themselves. Propagation is steady down there, without as much selective fading as HF. Observations during a previous eclipse gave a weird double notch looking like a "W" on the charts. It will be interesting to see what happens this time.

Ham Radio

The North American continent has a huge number of hams, in all regions. Every transmission between the 160 and 6-meter bands is being treated as a data source for the eclipse. One interesting experiment has turned data acquisition into yet another of the contests that some hams seem to love. That's right, it's a Solar Eclipse QSO Party (SEQP). It goes from 1400 to 2200 UTC on the 21st. While stations are in competition with each other, they will also send logs to the experiment at Virginia Tech. Preferred modes are CW, RTTY, and PSK31, but they'll accept anything. The preferred ones will be monitored by several automated networks that already exist for propagation study. They'll also be following the data that's already being collected by WSPR

Experimental antenna for 25-MHz WWV. (Courtesy NIST)

(Weak-Signal Propagation Reporting). I've done WSPR here, and it's interesting to watch the reports come in from practically inaudible signals. Anyone can follow this 24/7 at wspr.org.

D-Region AM Band Absorption

As noted, the AM broadcast band changes dramatically between day and night. This is because the D-region disappears quickly after solar illumination ceases. This region absorbs AM broadcast signals. The well-known result is that it's a local band in daytime, but a DX band at night.

At one time, this sky wave propagation was used to address large regions of the country without local service. A number of omnidirectional flamethrowers had "clear channels" to themselves at night. Everyone else on-frequency had to shut down around the time of their local sunset. Just about anyone with even a halfway decent radio could hear giants like KFI (Los Angeles), KOA (Denver), WLW (Cincinnati), and a bunch of others. These stations would usually even QSL. But that was then, and this is now. The AM band degenerated into a zoo, though some people still like to DX it. Personally, I get a headache even trying.

Be that as it may, some radio people are suggesting that we check for any effect on AM. I doubt I could really do this through the din in California, but those in quieter areas might have some fun with it. The experiment here is

to see if the big nighttime stations, which still exist, pop in during the daytime due to the eclipse. First, determine the direction to the totality path from your own QTH. Then, in the nights before the eclipse, find some of the old clear channel stations off that direction. There may be QRM and weird mixes, due to increased nighttime local broadcasting. Log times and signal quality of any big stations you find. Then try again during the eclipse, and log anything audible. Expect increased QRM from daytime stations. Any sky wave reception will be due to the eclipse. Report your results to someone who can use them.

Happy eclipse "viewing." I guarantee that these weak radio waves will not hurt your eyes. For the visual thing, take all the well-known precautions. Here, I prefer projecting pinhole images. Have fun!

Expanded FCC "Emergency Waiver?"

And now for something completely different. Shipcom and Global HF Net have jointly filed a request that U.S. land stations be granted increased use of high seas maritime service frequencies for bona fide emergencies and limited monthly tests and exercises. The FCC has put this out for public comment as of July 13. From the FCC document:

"In 2010, the Wireless Telecommunications Bureau's Mobility Division (Division) granted Shipcom, LLC (Shipcom), a waiver of section 80.123 to permit the use of HF public coast frequencies by first responders during catastrophic situations when normal communications systems are not available. The Division concluded that this limited use of HF maritime spectrum would enhance public safety during catastrophes. The waiver permits service to land-based (base and mobile) Public Safety stations on HF frequencies in the event of a natural or man-made disaster that renders the normal communications infrastructure inoperable, and monthly testing/training to familiarize personnel with how to operate the equipment and make sure it is operable.

"Shipcom and Global HF Net, LLC (GHFN), which is licensed for other HF public coast stations, are commonly owned. On February 28, 2017, they filed requests that the waiver be extended to GHFN as well as Shipcom, and amended to permit service to land-based Federal stations as well as Public Safety Pool eligibles. They argue that extending and amending the waiver request will further the public interest by enlarging the coverage of the current waiver, and by including Federal agencies that commonly participate in disaster communications."

FCC footnotes state that Shipcom holds licenses for KDD, KLB, KLK, KNN, WDA, WDI, WHD, WHU959, WLO, WRN, and WSC. WLO and KLB are heard daily, but the other calls are rarely or never used. GHFN holds licenses for KEJ, KEM, KFS, KHF, KLN, KPH, WCC, and WNU. Those who have been at this a while will associate these calls with what used to be Globe Wireless. That company was absorbed into Inmarsat some years ago, with the HF passing to various successor ventures. Most of the associated

Global HF Net logo. (Courtesy GHFN.LLC)

stations have gone for real estate and scrap metal. KPH and KFS calls are currently used, by permission, in Point Reyes, California, by the Maritime Radio Historical Society. Along with Point Reyes National Seashore, they have preserved the KPH facility and gotten some of it back on the air. We would therefore have a rather sticky situation were the owners of these calls to want them back.

This waiver has been used mostly to secure a few frequencies for an emergency network planned by Rockwell Collins. Many promotional documents have claimed a huge future for this net, which is occasionally touted as a complement to their successful COTHEN used by federal law enforcement. So far, however, it's been pretty much stagnant. Except for some occasional testing, all we hear is a small pilot project at a few Los Angeles County Sheriff stations. Presumably, operation under this waiver would gain some more frequencies if the change is approved. It will be interesting to read the public comments and see what's really going on here. The matter is called "WT Docket No. 17-184," and the comment deadline is August 14. Look for more on this interesting issue in a future column.

Resources:

Interactive maps for August 21 eclipse:
https://eclipse2017.nasa.gov/eclipse-maps

Eclipse QSO Party:
www.hamsci.org/seqp

Eclipse Mob:
www.hamsci.org/article/eclipsemob-low-frequency-effort

FCC Request for Comments:
http://transition.fcc.gov/Daily_Releases/Daily_Business/2017/db0713/DA-17-670A1.pdf

TSM

Shortwave Utility Logs

Recent Shortwave Utility Logs Compiled by Mike Chace-Ortiz

Frequency	Callsign	Time	User, Location	System Details
9015.00	???	0423	NATO MIL, ???	75bd/850 STANAG4481 FSK, KG84 crypto
9050.00	???	0124	UK MIL DHFCS, Akrotiri	Link-11 CLEW, 2 channels tfc (on DSB)
9130.70	OVK	0050	Danish Navy, Aarhus	600bps/L STANAG4285 HF modem, crypto tfc (on USB)
9192.00	???	0050	Russian MIL, ???	AT3004D 12 tone HF modem, tfc (on USB)
9248.00	???	2154	Russian MIL, ???	AT3004D 12 tone HF modem, tfc (on USB)
9317.60	???	0112	US Navy, ???	75bd/850 STANAG4481 FSK, crypto tfc
10182.50	???	0127	NATO MIL, ???	STANAG4285 HF Modem, crypto tfc (on USB)
10186.10	FUG	2140	French Navy, La Regine	1200bps/L STANAG4285 HF modem, crypto tfc (on USB)
10195.20	DHJ59	0015	German Navy, Wilhelmshaven	600bps/L STANAG4285 HF Modem, crypto tfc (on USB)
10312.60	???	2220	NATO MIL, ???	75bd/850 STANAG4481FSK, crypto tfc
10400.00	???	0130	Russian MIL, ???	75bd/250 FSK UNID System, sync, cont, ACF=0
10452.00	RIT	0120	Russian Navy, Severomorsk	50bd/200 BEE, tfc on sync=[0x1414bebe952]
14365.00	???	1333	???, ???	600bps/L MIL-188-110A/B HF modem, crypto tfc & 141C link control (on USB)
14380.00	105001***	1908	UN MINUSMA Peacekeepers, Mali	125bd/1750 MIL-188-141A, ALE sounding (on USB)
14380.00	231301***	0320	UN MINUSMA Peacekeepers, Mali	125bd/1750 MIL-188-141A, ALE sounding (on USB)
14390.00	???	1245	UK MIL DHFCS, Ascension Island	1200bps/L STANAG4285 HF Modem, crypto tfc QRV @2100UTC (on USB)
14393.00	???	1245	Russian Navy, Moscow	50bd/250 BEE, short tfc
14421.00	???	0100	Russian Intel, Moscow	200bd/500 Baudot, off line crypto
14436.00	RCV	2140	Russian Navy, Sevastopol	50bd/200 BEE, tfc on sync=[0x1eb41eb2952]
14436.10	616***	1125	Chinese MIL, ???	125bd/1750 MIL-188-141A, ALE LQA with “220" (on USB)
14436.20	XJN714	2230	SailMail, Lunenburg Nova Scotia	PacTOR-III HF modem, tfc to yacht WDI3504
14445.70	???	2340	Egyptian Embassy, Washington DC	100bd/170/I SITOR-A, in IRS mode with MFA Cairo
14445.70	SSE	1451	Egyptian MFA, Cairo	100bd/170/I SITOR-A, selcals “RCVB” (Embassy Washington)
14453.00	???	2227	Russian Navy, Khabarovsk	50bd/250 BEE, tfc
14508.50	XSS***	1208	UK MIL TASCOM, Forest Moor	125bd/1750 MIL-188-141A, ALE sounding (on USB)
14538.00	???	2100	Russian Intel, Moscow	XPA2, 5FGs with first groups "01189 00093 43982 42353 28942 10392"
14697.00	???	1400	Russian Navy, Europe	50bd/250 BEE, tfc
14704.00	???	1400	Russian MIL, ???	50bd/500 BEE, tfc
14737.00	???	1225	Russian Intelligence, Moscow	50bd/500 FSK UNID System, ACF=128 tfc
14759.00	VC6***	1220	Venezuelan Navy, ???	125bd/1750 MIL-188-141A, ALE LQA with “VC1" (on LSB)
14813.50	OLZ88	1833	Czech MFA, Prague	PacTOR-II HF modem, tonecall mode
14850.00	???	1253	North Korean Embassy, Europe/Africa	1200bd/1200 FSK UNID ARQ System, tfc (+1500Hz on LSB)
14922.00	5KM***	2145	Colombian Navy, ???	125bd/1750 MIL-188-141A, ALE LQA with “KM2”, ”KN2” (on USB)
14922.00	LFC***	2145	Colombian Navy, ???	125bd/1750 MIL-188-141A, ALE LQA with "5KM" (on USB)
15586.00	RCV	1241	Russian Navy, Sevastopol	CW, WX information
15648.00	RCV	2212	Russian Navy, Sevastopol	50bd/200 BEE, tfc
15897.00	???	2201	Russian Navy, ???	CW, hand sent
15963.50	???	1842	???, ???	250bd/170 CHX200 HF modem, ALE mode (+1600Hz on USB)
16011.70	SSE	2101	Egyptian MFA, Cairo	100bd/170/E SITOR-A, Calling selcal "TVXS" (Manama), "KKVU" (Accra)
16015.00	ARICA***	1930	Chilean Gendarmerie, Arica	125bd/1750 MIL-188-141A, ALE calling “CMC” (on USB)
16015.00	CMC***	2117	Chilean Gendarmerie, HQ ???	125bd/1750 MIL-188-141A, ALE sounding, LQA with “COCHRANE” (on USB)
16015.00	IQUEQUE***	0430	Chilean Gendarmerie, Iqueque	125bd/1750 MIL-188-141A, ALE sounding (on USB)
16015.00	ATACAMA***	2315	Chilean Gendarmerie, Atacama	125bd/1750 MIL-188-141A, ALE sounding (on USB)
16015.00	PUERTOAYSEN***	2200	Chilean Gendarmerie, Puerto Aysen	125bd/1750 MIL-188-141A, ALE sounding (on USB)
16015.00	CALAMA***	2315	Chilean Gendarmerie, Calama	125bd/1750 MIL-188-141A, ALE sounding (on USB)
16156.00	???	1241	Russian MFA, Moscow	75bd/500 Baudot, 5FGs offline crypto in blocks of 10 (QSX 18726kHz)
16156.00	???	1300	Russian MFA, Moscow	50bd/500 Baudot, 5FGs offline crypto after “11100 70103 25384 14099 04009”
16181.50	OLZ88	1806	Czech MFA, Prague	PacTOR-II HF modem, tonecall
16216.00	???	1426	Russian MFA, Moscow	150bd 4FSK UNID System, tones at 4kHz spacing
16321.00	???	0200	Russian Intel, Moscow	200bd/1000 FSK UNID System, sync, cont, ACF=288 with tfc on link ID=[60146]
16321.00	XSS***	1510	UK MIL TASCOM, Forest Moor	125bd/1750 MIL-188-141A, ALE sounding (on USB)
16334.70	SSE	2219	Egyptian MFA, Cairo	100bd/170/E SITOR-A, hex offline crypto to Washington DC (QSX 14667.7kHz)
16358.00	???	1507	???, ???	PSK63, tfc
16611.00	???	1300	Russian MIL, ???	AT3004D 12 tone HF modem, tfc and idle (on USB)
16619.00	???	1400	Brazilian Navy, ???	125bd/1750 MIL-188-141A, ALE sounding (on USB)
16856.00	RDL	1215	Russian Navy, Moscow	50bd/200 BEE, tfc sync=[0x1414bebe952] & [0x1414bebe64c]
16966.00	FUB	1627	French Navy, Saissac	600bps/L STANAG4285 HF modem, crypto tfc (on USB)
17030.00	???	0018	UK MIL, Ascension Island	2400bd UNID 8PSK HF Modem, tfc (on USB)
17063.40	FUG	1131	French Navy, La Regine (Saissac)	1200bps/L STANAG4285 HF modem, crypto tfc (on USB)
17146.40	NMG	2000	US Coast Guard, New Orleans	120lpm/576/800 Fax, WX pix
17341.00	SVO	1955	Olympia Radio, Greece	USB, OM/GG or YL/GG with weather and navigation info
17442.00	UAL	1248	Russian Embassy, ???	50bd/500 Baudot, 5FGS offline crypto after “11100 80103 63892 14104 04003”
18365.00	6WW	1900	French Navy, Dakar	1200bps/L STANAG4285 HF modem, crypto tfc (on USB)
18726.00	???	1242	Russian Intel, Moscow	75bd/500 Baudot, 5FGs after “11100 70103 63892 14104 04003” (QSX 16156kHz)
19565.00	???	1229	???, ???	MIL-188-110A/B HF modem, crypto tfc (on USB)

Shortwave Utility Logs

Recent Shortwave Utility Logs Compiled by Hugh Stegman

Frequency	Callsign	User, Location	Time	System Details
4153.00	Unid	Japanese Navy	2021	PSK idler, also 4231.5, 6250, 6445, 6418, 8314, 8589, 8703.5, 8751
4247.00	KPH	MRHS, Pt. Reyes, CA	0031	CW, Night of Nights message, also 6477.5, 8642, 12695.5
4870.00	377	Polish Intelligence (S11a)	1955	USB, Russian null-message callup 377/00
5140.00	WNUW213	OK Emergency Management	1402	USB, state SECURE command net with WPFY721, others
5202.00	6KF	U.S. Military Auxiliary Radio System	1314	USB, Region 6 net with 6TV
5253.50	NF82SS	USCG Auxiliary	0150	USB, voice and PSK125 messages for NF82RR
5303.50	Dangerous Dan	U.S. National Guard, AL	1400	USB, weekly net with Dixie Control, Toledo Trooper, others
5732.00	Z38	USCG, Humboldt Bay, OR	2059	ALE, LQA with K08, USCG MH-65D #6508
6365.50	KFS	MRHS, Pt. Reyes, CA	0030	CW, Night of Nights message, also 17026
6383.00	NMC	USCG, Pt. Reyes, CA	0010	CW, Night of Nights message
6607.00	4XZ	Israeli Navy, Haifa	2042	CW, ID "VVV DE 4XZ" and into numbered messages
6685.00	Korsar	Russian Air Force, Pskov	1854	USB, working 94296, aircraft landing at Buntar (Orenburg)
7535.00	Freedom's Torch	U.S. Navy USS *Bulkeley* (DDG-84)	1336	USB, testing with SESEF Norfolk, VA
7795.00	JMH2	Japan Meteorological Agency	2018	FAX (120/576), several very clear charts
8297.00	ZLM	Taupo Maritime Radio, NZ	2214	USB, robot "male" with weather and navigation warnings
8414.50	229771000	Maltese flag tanker *Astipalaia*	1915	DSC, working 005030001, Charleville / Wiluna, Australia
8425.50	XSG	Shanghai Radio, China	2258	Sitor-A, CW ID in burst marker, also 12613
8431.00	TAH	Istanbul Radio, Turkey	1732	Sitor-A, CW ID in burst marker, also 12624 and 12654
8439.00	Chinara	Russian Pacific Fleet, Strelok	1220	USB, also Greyder (HQ, Vladivostok), Defeder, Tambor
8682.00	NMC	USCG, Pt. Reyes, CA	0307	FAX (120/576), very clear Pacific Surface Analysis chart
8819.00	Tashkent Meteo	Tashkent Volmet, Uzbekistan	1928	USB, aviation weather and sign-off in Russian
8912.00	Z16	USCG Sector Mobile, AL	2237	ALE, link check with N01, USCG HC-144A #2301
8942.00	PGT23D	Pegasus Air A320 reg TC-DCJ	2114	HFDL position for extremely busy Shannon ground station
8950.00	351013	Turkish Civil Defense	1840	ALE, automated 2-way link check with 338013
8992.00	Tone Deaf	USAF Global HF System	2048	USB, with echoey EAM, then possible French Air Force
9032.40	Hip Bone	U.S. Military E-6B TACAMO	0138	USB, working Noon Tide (or Time), another TACAMO
9347.00	Unid	Russian Intelligence (E07)	2156	AM, English numbers in progress, Firedrake QRM from 9355
10000.00	BPM	Chinese time station, Xian	1630	CW, repeating ID, heard through WWV & WWVH
10057.00	San Francisco	Pacific oceanic air control (CEP-1)	2224	USB, selcal AQ-FL with United 8 (B777 reg N59034)
10194.00	WFGY901	U.S. FEMA, MA	1353	ALE chat and USB voice tests with WGY932 and WGY952, both USVI
10242.00	T2Z285	U.S. Army National Guard, AZ	1938	ALE, 2-285 Assault Helicopter Bn, working REDHWK, 1-285 Avn, AZ
11190.00	Dozor	Ukrainian Air Force	1055	USB, radio checks with aircraft 72292
11220.00	Presidio	U.S. Military	1946	USB, phone patch to Aloe Oil via Ball Foot
11246.00	173	Israeli Air Force	1843	ALE, link check with 175
11300.00	Qatari 1437	Qatar Airways A320	1900	USB, working Mogadishu, possible regional control
11354.00	Izluchatel'	Russian Navy, Nikolayevka	0107	USB, working aircraft 90054 and ground Monolog (Vladivostok)
11430.00	New Star Radio Station	Taiwan Intelligence (V13)	0600	AM, music and Chinese voice messages
11435.00	Unid	Cuban Intelligence (HM01)	1629	AM, Spanish callup and RDFT file transfers, weak
11462.00	Unid	Cuban Intelligence (HM01)	0514	AM, Spanish "86672 48764 06622 10845 51775 14056" and RDFT
11530.01	Unid	Cuban Intelligence (HM01)	1729	AM, Spanish "90242 10667 72074 82851 06228 11581" and RDFT
11635.00	Unid	Cuban Intelligence (HM01)	2100	AM, Spanish"90242 10667 72074 82851 06228 11581" and RDFT
12222.00	SFENG	U.S. Army National Guard, NM	1943	ALE, link check with helicopter R23449
12850.00	674	Russian Intelligence (E17z)	0810	USB, English "674 238 5" and message, came from 16780
13435.00	Unid	Cuban Intelligence (HM01)	0657	AM, Spanish "86672 48764 06622 10845 51775 14056" and RDFT
13563.00	512	Russian Intelligence (V07)	0700	USB, null-message callup "512 512 512 000"
13907.00	PAC	USCG Commcom, Pt. Reyes, CA	0220	ALE, calling N10, USCG HC-144A #2310
14575.00	330	Polish Intelligence (E11)	1645	USB, English callup 330/32 and 5-figure-group message
14582.00	WRLNG	U.S. Army National Guard	1715	ALE, calling R23449, UH-60A helo #80-23449
14763.00	273	Russian Intelligence (E07)	1920	USB, English null-message callup "273 000"
14923.70	Unid	Egyptian MFA, Cairo	1100	Sitor-A messages to XBVM, Bonn, Germany embassy
14984.00	Unid	Russian Intelligence (XPA2)	1920	MFSK-16/20 Polytone, 5-figure-group message, same on 14384
15964.00	Unid	Russian Intelligence (F06)	1100	RTTY (200/1000) message number 2/7 on Link 50046
16015.00	ANTOFAGASTA	Chilean Gendarmerie (GENCHI)	0151	ALE sounding, also many others heard
16804.50	004310001	Tokyo Sea Patrol Radio, Japan	1416	DSC self test
17130.00	HLW	Seoul Radio, Korea	2348	CW, marker "CQ DE HLW QSX 16 MHZ K"
17411.00	OMEGACERO	Chilean Emergency Mgmt. (ONEMI)	2114	ALE, calling ECO11, also 17426, 17440, 17450, 17454
17430.00	9VF	Kyodo News, Singapore area	2345	FAX (60/576), sports report in Japanese newspaper
18594.00	R26863	U.S. Army National Guard	0142	ALE, UH-60L #00-26863, calling R23916, UH-60A #83-23916
19252.00	242	Russian Intelligence (E07)	1100	USB, English "242 1 7936 117" & message, later 17452 and 16252
21866.00	FC6FEM	U.S. FEMA Region 6, TX	1529	ALE sounding, also FR5FEM (Region 5, Chicago)

Digitally Speaking

By Cory GB Sickles WA3UVV **wa3uvv@gmail.com**

It Feels Like the First Time

First of all, allow me to thank those of you who let me know my column was missed last month. Such sentiments and the comments I received let me know that my efforts are noted and appreciated. Continued interest in the column's Facebook page is encouraging, as well. Obviously, "Digitally Speaking" is back this month, although I must tell you that its status is unsure—more about that, later.

I have been following the developments of DV (digital voice) since the mid 1990s. About the only thing of interest that could be applied to amateur radio at the time was P25. Its development was the result of an act of Congress, following a tragic commercial aircraft crash where first responders from different areas and departments could not talk to each other. Of note, the crash itself was also the result of inadequate communications between air traffic controllers and the airplane's cockpit crew.

P25 was (and has been) an expensive means to communicate – priced for government entities and geared more toward multi-site trunking environments. As time went by and some of those entities transitioned from VHF (136-174 MHz) to UHF (450-512 MHz), some of those P25 portables and mobiles ended up on the used market at (somewhat) more reasonable prices.

However, the relatively high cost (in terms of a ham's budget) of repeaters and repeater networking solutions kept P25 more of a curiosity. It may have sounded better and had increased reliability, but not any sort of "killer app" features to justify the investment.

Just before the new millennium, the JARL (Japanese Amateur Radio League) made it known they had been working on a means to create a DV methodology that was developed specifically for amateur radio. Published in 2001, D-STAR (Digital Smart Technologies for Amateur Radio) was born—at least in concept. Icom decided to develop a product line that supported D-STAR. As the JARL required more than one manufacturer to be in the game, a small number of ID-800 transceivers with Kenwood labels (TMW-706) were produced—satisfying the requirement (with a corporate wink and a roll of the eyes).

In 2004, the first of Icom's "D-STAR Optional" transceivers was released. The optional board didn't appear until the next year. The reason seems to be that while Icom was working on hardware, JARL was busy changing the specifications, so it seemed prudent to put things on hold for a while.

When D-STAR arrived (fully) in the marketplace, initial acceptance was slow. In time, the pace picked up and D-STAR became the *de facto* DV methodology. If someone was talking about digital voice radio, then the presumption was that they were talking about D-STAR—not P25.

Original D-STAR ID-RP2000V 2-Meter repeater digital voice module. Developed by the Japanese government and by the J A R L, Icom was at one time the only company manufacturing D-STAR-compatible radios. (Courtesy: Universal Radio)

With D-STAR's emerging line of portable, mobile and repeater options, plus Call Sign Routing, the ability to directly connect one radio through the Internet to another, the product line gained a little acceptance. But it was really the concept of reflectors—ways to join multiple repeaters together—that caused D-STAR to gain wider acceptance.

Some may think that Icom or JARL came up with the idea of reflectors, but it was really an independent third-party solution. Robin Cutshaw AA4RC developed software known as DPlus. Robin had to reverse engineer, then further enhance the Call Sign Routing features plus other things. We have Robin to thank for the surge in growth and widespread acceptance of D-STAR, as we know it today.

From a European directive, another DV methodology emerged in 2006, by the name of DMR (Digital Mobile Radio). DMR is unique in that it uses something called TDMA (Time Domain Multiple Access) scheme to switch rapidly (30 ms) between two data streams, thus allowing the support of two simultaneous conversations on the same repeater pair. DMR was developed for government and private industry use but not amateur radio.

In fact, using such LMR (Land Mobile Radio) technologies for ham radio presents many "square peg in a round hole" challenges. Embedded call signs are not used, as the radios identify themselves with subscriber ID numbers. This requires user registration before being able to get on the air, if you want to use any of the networks offered.

DMR remained an obscure methodology in amateur radio circles until recently, when two things happened. First,

non-Motorola networking schemes began to appear that worked and could be integrated into the existing (and tightly controlled) DMR-MARC network. Even more so, the introduction of a low-cost portable from China—an alternative to LMR-derived radios—caused a rapidly increased interest in DMR. I'm not sure that simply finding a cheap radio is a good reason to embrace something, but it is a reason to try it.

The downside of DMR, P25 and other LMR designs is that user programming is forbidden by law. Thus, in order to change something (add a new repeater, change memories, etc.) you need a computer, programming cable and software. Also, operation is entirely memory driven. There is no VFO operation offered in the specifications.

Propelled by price though, DMR continues to grow and the number of home brew repeaters now enabled is steadily increasing. The vast majority of DMR users do not know how to set up a code plug (needed specifications to make the radio do something useful) themselves. They hunt around for someone else to come up with one that they can copy, insert their Subscriber ID and upload to their radio. Better yet, just ask that same person to do it all for them—effectively learning nothing in the process.

Also in 2006, Icom and Kenwood eventually did join hands in creating yet another DV methodology—NXDN. This too, represents another technology designed for the LMR world. Kenwood markets their version as NEXEDGE and supports 12.5 kHz and 6.25 kHz bandwidth specifications. Icom markets their version as IDAS and only supports the 6.25 kHz spec. Both company's radios can communicate with each other, as long as both are configured to operate at 6.25 kHz.

As a side note, a comparison of Icom's early NXDN and D-STAR monoband portables show they share a common bond. The major difference seems to be what DV option board each will support.

NXDN has been picked up and used by a relatively small group of enthusiasts, who created an inexpensive networking scheme—NXREF—that inexpensively joins NXDN repeaters (with an appropriately configured Raspberry Pi single board computer) together. While the NXREF started as a singular (backbone) network, development has progressed to expand the talk group options.

For some years, it has been relatively easy to find Icom FR-5000 (VHF) and FR-6000 (UHF) repeaters for less than $1,100. Some radio clubs, looking for an inexpensive way to replace a failing repeater, opted for one of these machines, without giving much thought to the DV possibilities contained therein. As used NXDN radios are becoming more available and less expensive, some of those same clubs are enabling the DV option and exploring NXDN.

The most recent entry into the world of DV radio has been Yaesu, with System Fusion. A product line including a dual-band portable, mobile and repeater was released in 2014. Starting with a beta testing program incorporating the DR-1 repeater, select clubs were offered the opportunity to explore the latest in DV technology and report on what was working and what was not. In short order, the production model DR-1X was released. Yaesu, in order to gain a foothold in the market as quickly as possible, began offering the DR-1X for just $500. That's a significant discount off the $1,900 MSRP.

The plan worked. Many clubs and individual repeater owners jumped at the chance to upgrade their older machines to something new—incorporating the most "FM Friendly" DV methodology going. As more and more repeaters were purchased and installed, more and more radios were purchased and put on the air. In less than a year, there were more System Fusion repeaters installed, than there had been D-STAR repeaters in five years. Within a relatively short period of time thereafter, the number of System Fusion repeaters sold surpassed the number of D-STAR repeaters.

What was at one time synonymous with "digital radio" now moved to third place. To be sure, D-STAR is still popular, but System Fusion offered some things D-STAR did not. Most important of those is perhaps found in System Fusion's ability to include legacy analog FM on the same repeater and within the WIRES-X networking design.

When D-STAR repeaters were introduced, it became clear that they offered DV, but no support for FM. That meant that either you upgraded immediately or found another repeater to use with your analog FM radios. That also meant that in most areas D-STAR activity was much more likely to be found on UHF, as the vast majority of clubs did not want to give up their 2-meter repeater pair to a digital-only solution no matter how good the new technology might be.

Other DV methodologies, such as DMR, NXDN and P25 allow for "mixed mode" operation—continuing support of analog FM on the local level—but not when it comes to networking. With some of these repeaters, enabling them for networking disables any sort of analog support whatsoever—even on a local level.

Hams purchase their own equipment out of their own pockets. Telling some of us that we "must" upgrade, does not sit well. Part of the brilliance in the design of System Fusion is that is allows everyone to upgrade at their own pace; even if that pace is stagnant.

Yaesu's AMS (Automatic Mode Select) operation also means that the repeaters are designed to support external controllers. Analog controllers can be used to enhance such operations, while leaving DV operation alone. Also, external digital controllers can make the DR-1X repeater increasingly versatile, supporting the addition of D-STAR, DMR, and possibly other methodologies, for a net amount that's far less than buying all of those different repeaters.

In my hometown, we now have a DR-1X that also supports D-STAR, through a UDRC board set from NW Digital Radio. There's also work in progress to support DMR operation on a different DR-1X. Again, it's indicative of the level of inclusion built in to the repeater.

Now, Yaesu has added another dual-band portable to the line and has a UHF monoband entry level mobile due

out in a few months. Plus, they've announced the DR-2X, which will be shipping soon. It offers higher full-time power output ratings and a second receiver for control and priority communications. Further, there's a new networking scheme, known as IMRS, which I hope to explore in the future.

In the above, I've attempted to quickly cover how DV got started on ham bands and where it is today. There are a lot of details I've had to leave out, but I invite you to do some research on you own, if you want to learn more.

For those of you who just recently became aware of DV, I hope this background information is helpful. Those of us who have experienced DV over the years can easily forget what it is like to experience such things for the first time. I was recently reminded of that through an email shared by a friend of a friend.

The person writing the email was excited and enthusiastic with his discovery of just the beginnings of what can be done with DV. His initial experiences reminded me of some earlier comments I wrote about a few months back, with a long-time ham feeling like a kid again. Above all else, he is having fun. The specific methodology involved is not important, although the person's belief that this was the only DV methodology in existence is.

They have a lot to learn, but in some way, that is secondary to the enjoyment they are experiencing right now. I recently gave a presentation about DV to a group of fairly technical individuals. While I am confident that most of them understood every technical aspect of what I covered, I did not sense any real enthusiasm toward the subject matter.

On the other hand, I've given similar presentations to groups that were very inexperienced in the technical aspects of DV, but expressed a great deal enthusiasm and truly wanted to learn more. In addition, I walked away feeling that they were excited and motivated to try one of the methodologies I discussed with the purchase of a repeater and radios.

Both types of radio amateurs are important, but it is certainly more fun for a presenter to have some feeling of accomplishment and an understanding that what you talked about will help others make a difference. Sometimes, the best compliments come from a non-ham spouse who is in attendance. When you hear that they know very little about the subject, but that you made it interesting and they now think they understand at least some of what was being said, you know your communications was effective.

In communicating with all of you, I have tried at every turn to present as broad a coverage of the DV radio landscape as I could. Certainly, while I enjoy all methodologies and the opportunities they give me to meet new hams on the air, I do have my favorites. I think my objectiveness and fairness has been evident. Reader feedback confirms this. I have embraced some favorites and that has slowly taken me to where I am today with a new position with one of the manufacturers of DV gear.

While I benefit greatly from the new position, it comes with several costs. One of them means that my writing must discontinue, at least in its current form, as my objectivity is

Yaesu FT-991A HF/VHF/UHF transceiver ($1,350 on sale this month from Universal Radio) is compatible with System Fusion C4FM digital modes. (Courtesy: Universal Radio)

made much more difficult. No matter what I say, someone will find a way to twist my thoughts into something that appears biased to them. Usually, that will take the form of a perception that I am not covering their favorite methodology as much as the others. For my employer, promotion of a competing brand or model is not what I'm being paid to do. From just about every aspect, it's a lose-lose scenario.

I've spoken to the publisher and editor of this fine publication about the situation. The only situation we could come up with that could continue to provide you with information about at least some of this exciting aspect of amateur radio and still satisfy the requirements of my position is one where the column becomes an occasional feature article that is focused on some aspect or new product of just one manufacturer.

I'm in the process of considering that possibility, as is my employer. My question to you, my faithful audience, is if this would be acceptable to you? Would you be receptive to such a thing, knowing it's going to be somewhat biased toward one brand—without being anything more than a "sales pitch." Now please, answer that question for yourself, before you read any further.

Hopefully, you've thought it out, without first wanting to know who this company is and what their products are. But now, I will tell you.

I have been hired as the General Manager of the Amateur Radio Division of Yaesu USA. Thus, I would be writing about Yaesu's System Fusion product line and related topics. (With a new repeater, new additional networking options, new transceivers, and the quickly moving evolution of the "system" in System Fusion, I will certainly have much to write about.)

Did your decision change? Is your opinion different? What are your thoughts? I really would like to know, as this will steer what I do next in the pages of *TSM*. So that you don't have to look around for it, my email is wa3uvv@gmail.com. I look forward to hearing from you.

TSM

VHF and Above

By Joe Lynch N6CL **n6cl@vhfandabove.com**

Honey, I shrunk the Loop!

I created the title for this section of my column with a nod to the 1989 grammatically incorrect movie title: Honey, I Shrunk the Kids. My moment of brilliance came after I shrank (grammatically correct) one of my 2-meter loops to the appropriate length for 222 MHz. Unlike the movie, however, where the scientist father accidentally shrinks his two kids and two neighbor kids, I purposely shrank the loop to the size I need to operate on 222 MHz. Incidentally, the "honey" in my title is my wife, Carol Lynch, W6CL. When I told her the title, she laughed and told me that she thought it was very clever. She is always making nice comments like that one to me.

I chose the loop that did not have a balun so that I did not have to destroy a perfectly good balun in the process of shrinking the loop. As with the other loop antennas with baluns, I created this balun from RG-6 coax. To get the end that connects to the feedline through the CPVC Tee connector on the spreader, I bent the coax and coaxed it through the center hole on the connector and then I attached the F-connector to the coax. Because I am using N-connectors, I added a female F-to-female-N adapter to the male F-connector.

For the connection to the loop, I connected each end of the loop to a chassis mount female N-connector. I connected a female F-to-male-N adapter to the opposite end of the balun. Then, I screwed the adapter onto the chassis mount female N-connector.

When I tested the loop with my MFJ 269C antenna analyzer, I found resonance to be very near to 222 MHz and the SWR acceptably low. The caveat was that the antenna was resting on top of the analyzer. I will have a more accurate reading when I connect the antenna in free space to the coax line.

In shrinking my 2-meter loop so that it works on 222 MHz, I also redesigned how the other 2-meter loop connects to the 70-cm loop. I installed ½-inch threaded CPVC connectors on each end of the mast for the 222 MHz antenna and corresponding ½-inch threaded CPVC connectors on both ends of both the 2-meter antenna and on one end of the 70-cm antenna. Threaded together, band-over-band, the three-band antenna array looks like a bare Christmas tree.

My new version of my VHF and above loop antennas now includes a 222 MHz antenna. (N6CL photo)

Current Contest: The ARRL's 222 MHz and Up Distance Contest

You may wonder why I went to all the trouble to create an antenna for a little-used band. I did so that I would have an antenna for the ARRL's new 222 MHz and Up Distance Contest. Replacing the old ARRL UHF contest, this year's version adds the dimension of distance competition.

This new competition is a bit complicated; therefore, it is a good idea to thoroughly read the rules (see: **http://www.arrl.org/222-mhz-and-up-distance-contest**). The band factor makes for interesting challenges. Here is how it works:

When computing your point value for a QSO, you take the center-to-center distance in kilometers and multiply that value by the band factor. The rules have a chart for the band factor. For example, 222 MHz has a band factor of 2. By contrast, 432 MHz has a band factor of only 1. However, 902

MHz has a band factor of 4 and 1296 MHz has a band factor of only 2. You begin to see the incentive.

I have a Yaesu FT 736R, with a rare 220 MHz module, along with a 1296 MHz module, and the standard, non-removable 144 and 432 MHz modules. I sacrificed 50 MHz to equip this transceiver for this contest.

Concerning the interest in this contest, I called my friend, Steve Kostro N2CEI, the owner of Downeast Microwave, to get his take on it. I asked him specifically about any uptick in his sales of his 222 MHz transverter. He replied that he noticed a little more interest in it. He also stated that local guys in the Live Oak, Florida, area were encouraging him and his wife Saundra Estevez K4SME, to be a rover during the contest. He was not sure he would be able to do so because he will be returning from the Central States VHF conference in New Mexico the week before the contest.

The guys from the 14er SOTA group will be activating several SOTA sites during the same weekend as the ARRL's 222 MHz and Up contest. Bob Witt K0NR, is encouraging his guys to know their six-digit grid square so that they can also participate in the contest while giving out SOTA contacts.

Next, knowing that Steve is from the New Jersey area, I asked him for some pointers for me if I choose to go rover from my QTH. He told me that nearby Bear Mountain straddles two grids— FN31 and FN21. He added that another location he has operated from is on the edge of the Hudson River in Alpine, New York. He stated that this location is just inside FN30. In total, I will have three grids to operate from on three bands during this month's new contest.

For the contest, I will remove the 144 MHz loop and mount the 222 and 432 MHz loops on the Buddipole. My antenna for 1296 will be an M2 23CM22EZA that I ordered from DX Engineering for the occasion. I will let you know how it played in next month's column.

The other VHF and above contest this month is first weekend of the ARRL 10 GHz and Above Cumulative Contest, which is scheduled for August 19-20. The second weekend is September 16-17, 2017. Complete rules for this contest can be found here: **http://www.arrl.org/10-ghz-up**.

Meteor Showers: The Perseids Meteor Shower

By far, the annual Perseids meteor shower is the most popular meteor shower because it takes place in the summer. Its popularity owes to its visibility. You can go outside in your lawn chair, look up and see a good number of meteors. This year, however, the moon will provide evening interference to the otherwise visible enjoyment.

For us amateur radio operators, however, we are not interested in watching the shower. Rather, we are interested in using the ionization caused by the tiny grains of sand igniting as they enter the atmosphere.

According to those who make the predictions, the mornings of August 11, 12, and 13 will be good for random meteor scatter (MS) contacts on 2-meters SSB. While there are software programs, such as WSJT (https://physics.princeton.edu/pulsar/k1jt/), old timers will remember when MS contacts were made using CW or SSB.

If you wish to try random SSB contacts on 2 meters, then start near 144.200 MHz and call CQ MS. Because bursts can last less than a second, make your call very brief, such as CQ MS. November 6 Charlie Lima. Or simply, CQ MS N6CL Break. The person calling you may respond, N6CL W4VHF FM26 or N6CL W4VHF S2. The S2 is a signal report.

Depending on the way the station called you, you should respond accordingly. If W4VHF gave me his grid square, I should respond with my grid square, W4VHF N6CL FN31. If the person gave me a signal report of S2, I should respond with the following: Roger, S2. If the station heard me, then, whether we exchanged grid squares or signal reports, he would respond, Roger 73. At this point, the QSO is considered to be completed.

Because MS contacts are best in the morning, the chances of your completing a random contact are enhanced by the mix of random meteors with Perseids meteors. You can have some fun with random MS by getting on 6 meters and calling CQ MS early in the morning almost any day of the week. Chances are that if you yell long enough, you will work someone.

You can know that you have some MS propagation by putting your receiver on a known beacon frequency. When you hear bursts of the beacon signal, you know that you have the potential of working someone in that direction.

Another way of observing MS propagation is to place your FM-band radio on a clear frequency in your area. You will be less likely be splattered by loud signals in your area if you tune around the low end of the FM band, such as between 88.1 and 89.9 MHz, in order to find that clear spot. Once you find that clear spot, sit back, relax and listen for bursts from those distant FM stations. If you get a long burn, you might be fortunate to receive enough information to identify the station you are receiving.

You can do the same thing with any VHF and above receiver, such as the SDRplay SDR receiver I describe below. Simply tune to your choice of a frequency, such as an aircraft channel, and again, sit back, relax and wait for the signals to burst through your speaker or headphones.

Other meteor showers include the following: The κ-Cygnids meteor shower is expected to peak on August 17. The α-Aurigids is expected to peak around September 1. For more information on the above meteor shower predictions please see the American Meteor Society website: **http://www.amsmeteors.org/meteor-showers/2017-meteor-shower-list/**.

Using the (Relatively) new SDRplay RSP2pro with the Raspberry Pi 3

Late last year SDRplay, the makers of the RSP1 SDR receiver, introduced the RSP2 and the RSP2pro. The differ-

ence between the RSP2 and the RSP2pro is that the pro is encased in a metal case, which should cut down on external interference—and it does so.

The differences between the RSP1 and the RSP2 are as follows: The RSP1 has eight built-in front-end pre-selection filters; whereas the RSP2 has ten. The RSP1 has a single SMA antenna socket. The RSP2 has two SMA software selectable antenna inputs, plus a high-impedance input for long wire antennas. The RSP2 goes down to 1 kHz coverage. This video gives you an overview of the RSP2: **https://www.youtube.com/watch?v=Irb7k1rOJ-M**.

The RSP2 has the following additional features: software selectable MW/FM notch filters; highly stable 0.5 PPM TXCO that is trimmable to 0.01 PPM; 24 MHz reference clock input/output connections; and a 4.7 V bias-T on port B. More information on both units can be found on this datasheet: **http://www.sdrplay.com/docs/RSP2_Datasheet.pdf**. I purchased my units from Ham Radio Outlet online (**http://www.hamradio.com**).

After obtaining my RSP2pro, I connected it to my PC using the SDRuno I previously installed for the RSP1. With a little adjustment to the software, It played great.

My personal challenge was to get the RSP to play using a Raspberry Pi 3. This video (**https://www.youtube.com/watch?v=WvcbnoaYnL8**), narrated by Jo Hudson G4ABQ, one of the co-founders of SDRplay, takes you through the process quite easily. The important steps are to go to the SDRplay website (**http://www.sdrplay.com**) and download the Raspberry Pi software, the RPI 3 pre-built image. From there, you will be instructed on how to format your micro SDR card using your PC. Once formatted, it is ready to use with the Raspberry Pi.

For my installation, as instructed on the video, I connected the Raspberry Pi to the keyboard, mouse, and power supply. I connected and HDMI cable between the Pi and a digital television. Then, I connected the RSP2pro to an antenna and to the USB cable. Finally, I connected the USB cable to the Pi.

With everything connected, again, I followed the instructions on the video to access CUBIC SDR, the software used to power the RSP2pro. The instructions were thorough and the RSP2pro worked great from the start.

SDRplay has uploaded several videos at this You Tube channel: **https://www.youtube.com/channel/UC4JD-q3US2eb1N4dRCT45_Zw**. I mentioned above about using the RSP for MS work. This video gives a vivid demonstration of MS bursts: https://www.youtube.com/watch?v=MY-8loG1NiX4. While its example is an analog TV carrier, as mention above, you can choose a frequency that works for you.

The Solar Eclipse

Last month I mentioned that on August 21, the Sun will be eclipsed over North America from 1609 to 1838 UTC. Special event station W7E will be on from Camano Island,

My new RSP2pro that I got to work using my Raspberry Pi 3. (N6CL photo)

Washington between 0000 and 2359 UTC. This is the first full solar eclipse to cover North America in 98 years. While several stations will be transmitting on HF. However, some will be on 6 meters. For more information on spots, see the Reverse Beacon Net at: **http://www.reversebeacon.net/main.php**.

Ward Silver N0AX has authored an article about the Solar Eclipse QSO party, which will take place between 1400 and 2200 UTC on August 21. To participate in the party, exchange a signal report and your six-digit grid locator on the contest frequencies between 160 and 6 meters, which do not include 60, 30, 17 or 12 meters. You can make duplicate contacts after a ten-minute waiting period. CW, RTTY, and PSK31 are the preferred modes because of the automated receiving networks that will be recording the contacts. For more information about the contest scoring, see: **http://www.hamsci.org/seqp**.

Environmentally-Friendly Satellites

Decades ago I worked as an electronic mechanic at North Island Naval Station's Naval Air Rework Facility. One day I heard the story of a pilot who entered an aircraft repair hangar, holding a wrench and angrily yelling, "I'm looking for Mr. Crescent." The mild humor of the pilot's ignorance of the tool manufacturer was dreadfully overshadowed by the knowledge that someone's leaving Mr. Crescent's wrench in the pilot's plane cost the Navy multi-millions of dollars and almost cost the pilot his life.

I tell this story because as it goes with foreign objects inside aircraft, so it also goes with space junk. NASA estimates that there is more than one-half million pieces of debris floating around in space.

Now comes word that scientists and satellite developers are tackling the problem from two fronts.

In an online article titled "UK scientists to tackle increasing problems caused by space junk," published by Eureka! magazine (**http://www.eurekamagazine.co.uk/design-engineering-news/uk-scientists-to-tackle-increas-**

ing-problems-caused-by-space-junk/157862/), author Tom Austin-Morgan reports on the Daedalus experiment. This experiment is exploring the effect on satellites of so-called Icarus 'de-orbit sails,' made of 25 micrometer-thick aluminum-coated Kapton, a high heat-resistant polyimide film. When deployed, the sail increases drag, causing a controlled descent into the Earth's atmosphere where the satellite will burn up.

Austin-Morgan adds that the experiment is already underway, that a Canadian satellite, CanX-7, deployed its de-orbiting sail last May. The satellite's gradually decaying orbit should cause it to safely burn up about two years from the time of the sail's deployment.

Concerning the other front, Alessio Fanfani IU5CRE spent three years working with an Italian aerospace company, D-Orbit, developing a three-unit CubeSat mission called D-SAT. One of the three cubes is dedicated to the deorbiting feature. That feature uses a dedicated solid rocket motor to guide its deorbit to a designated landing in an ocean.

The D-SAT was launched on June 23, 2017 and is fully operational. Information on accessing it for amateur radio use can be found at this website: **http://www.dsat.space/radiohams**.

These two efforts to save the lives of astronauts and to protect the more than 5,000 active satellites reminds me of the story of the boy at the beach throwing starfish back into the ocean. An old man happened upon the boy and asked him what he was doing, to which the boy responded, "Saving the stranded starfish."

The old man replied, "There must be hundreds and hundreds of stranded starfish along these beaches. You can't possibly expect to make a difference by tossing just one starfish back into the ocean."

Picking up one more starfish and hurling it back into the ocean, the boy exclaimed, "Made a difference to that one."

Thankfully, there are scientists and satellite developers who are starting to make a difference for all of the thousands of stars shining (working satellites) in orbit around earth.

Current Hamfest

The annual Huntsville, Alabama, Hamfest will be August 19-20, 2017, in the usual South Hall of the convention center. There are several VHF-related forums scheduled. For more information, see: **http://www.hamfest.org/**.

Calls for Papers

Calls for papers are issued in advance of forthcoming conferences either for presenters to be speakers, or for papers to be published in the conferences' Proceedings, or both. For more information, questions about format, media, hardcopy, email, etc., please contact the person listed with the announcement. The following organizations and/or conference organizers have announced calls for papers for their forthcoming conference:

My new M2 23CM22EZA 1296 MHz rover antenna spread out across my dining table just after I assembled it. (N6CL photo)

Microwave Update

Technical papers are solicited for Microwave Update 2017 conference to be held at the Biltmore Hotel in Santa Clara, California, October 26-29, 2017. Deadline information can be found here: **http://www.microwaveupdate.org/call_papers.php**. Questions concerning submissions to the Proceedings are to be sent to mud2017.papers@gmail.com. Deadline date is September 12, 2017.

TSM

Amateur Radio Insights

By Kirk Kleinschmidt NT0Z **nt0z@stealthamateur.com**

RG-6: It's Still a Steel!

As many of you know, I'm a staunch supporter of several key amateur radio practices (so much so that a few of you are probably tired of me beating the drums!). The first is the horizontal loop antenna. I'm just crazy about these things—and so is *TSM*'s editor!—and I will twist your arm in an attempt to get you to put one up and try it (especially if you need a killer multiband wire antenna for HF). Go ahead—stick your arm out and see what I do!

Next comes open-wire line. This stuff is the real "coax killer" if you can muster a truly balanced antenna tuner and you don't need to fish your feed line through conduits, walls or other RF unfriendly structures.

Antenna tuners? Put 'em at the antenna feed point and keep 'em out of your shack (if you want them to really work, anyway!).

And if you must use coax? Unless you have a pile of cash just sitting around, forget about expensive 50-ohm cables and use 75-ohm cable TV coax instead. It works great, it's inexpensive and universally available, and it costs about 20 cents on the "50-ohm dollar." (See chart at right.)

As detailed a bit down the page, I have been using the stuff for at least 15 years for every antenna I've erected, with fantastic results, RF-wise and pocketbook-wise. But if you study something long enough, new details emerge every now and then. Today's revelation is that, instead of using a solid copper center conductor, most modern 75-ohm coax has a copper-coated steel core!

This cable spec is called CCS, short for copper-clad steel or copper-coated steel (see the photo on the next page).

Typical Coaxial Cable Signal Loss in dB per 100 ft for Matched Loads

Freq.	RG-58	RG-8X	RG-8U	RG-6	RG-11
1 MHz	0.4	0.5	0.2	0.2	0.2
10 MHz	1.4	1.0	0.6	0.6	0.49
50 MHz	3.3	2.5	1.6	1.4	0.8
200 MHz	7.3	5.4	3.3	2.8	2.3

Note: If your feed line SWR is significantly higher than 1:1 (matched), losses will be greater than those listed above.

Yikes! Steel, as you may remember, isn't a fantastic conductor of RF. It's better than bailing twine and paper clips, but it isn't even in the same conductivity ZIP code compared to copper or aluminum.

Yes, steel towers are used as vertical antennas all the time, even by broadcasters, and fine stainless steel wire makes for strong invisible dipoles (it's hard on the bird population, however), but it's definitely not our first choice when it comes to RF. (Steel towers have huge conductive surfaces which makes them much better than steel wire for antenna purposes.)

Still, it's copper-coated steel, just like Copperweld antenna wire, so that makes everything OK, right?

Yes—mostly! To dive in further we need to mention the skin effect.

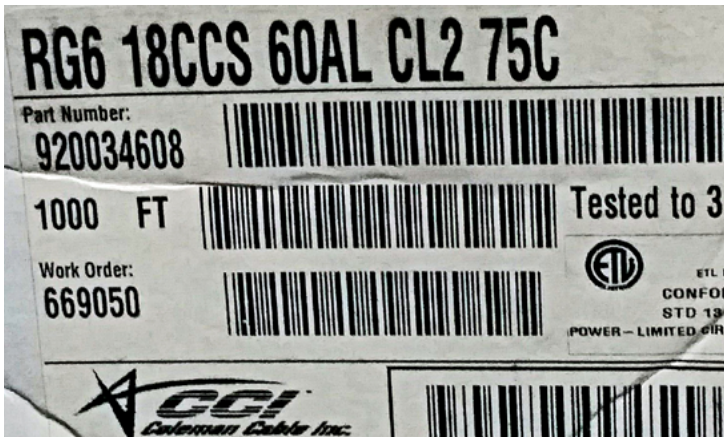
Unlike DC, when RF energy flows through a conductor, current flows primarily on the surface of the conductor and not the core. (That's why we can use tubing instead of solid rods to make Yagi antennas.) So, if the copper coating is thick enough, almost all of the RF energy will flow only through the copper coating and almost no RF will be impeded by the RF-lossy steel core.

The devil in the details is the thickness of the copper coating. Copper is expensive while steel is practically free by comparison, so to make their desired margins, manufacturers tend to make the copper coating only as thick as "financially necessary."

And because most 75-ohm coax—and I'm talking about RG-6 and RG-11 exclusively—is designed for satellite and cable TV applications, ironically, it's the low-frequency performance we're concerned about, not the cable's upper-frequency specs!

You see, the frequency of the RF determines how thick the copper coating must be to avoid unnecessary loss. That's why modern RG-6 and RG-11 usually show design specs for 50 MHz through 3 GHz. Those are the frequencies used by typical cable TV and satellite installations (with absolutely no consideration for what happens at 1.8 MHz!).

Regardless of who manufactured the 75-ohm CCS cable, it may have performance issues on 160 meters. Below 3 MHz or so, some CCS cables might have added losses because of "skin depth" issues caused by a too-thin copper coating.



As shown on the label attached to my last 1,000-foot box of RG-6 CATV coax, the "18CCS" indicates that the center conductor is 18-gauge copper-coated steel. Who knew? Is this a problem for amateur radio use? Possibly, but only on 160 meters. See text. (NT0Z photo)

(To work the emerging VLF ham bands, use 100% copper!)

Losses related to copper thickness are easy to measure with a transmitter, a dummy load, a power meter, and a sufficient length of the cable in question (many antenna analyzers will work, too). I haven't made these measurements yet, but I may do so in the future when I get another 1,000-foot box of RG-6.

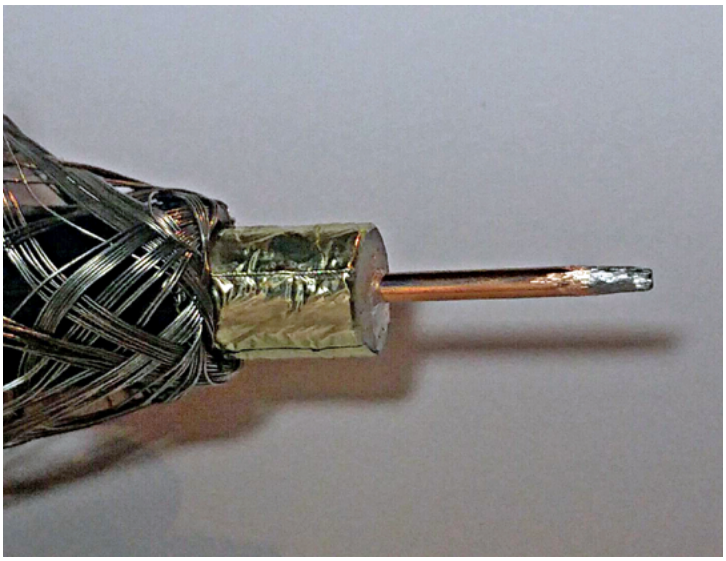
I worked stations from coast to coast on 160-meters last winter with my 80-meter inverted-L, shack-mounted antenna tuner, and a 110-foot length of RG-6 feed line. That setup is a recipe for disaster, performance-wise, however, so a little extra loss (from the CCS cable?) added to the massive SWR-mismatch loss probably went unnoticed! Regardless, although it did "work," I didn't consider the antenna to be "good" on 160!

For all bands above 160 meters there is no issue, so if you want to work 160 with CCS RG-6 or RG-11 cable, find the right cable (some manufacturers spec low-frequency losses and even copper thickness), test your particular cable at 1.8 MHz, or just use the cable you have and investigate if the antenna performance seems off. I recommend testing, but that involves work!

DC losses on CCS Coax

Now that we've determined that—save for some cables at 1.8 MHz—it's safe to use CCS RG-6 and RG-11 coax for almost any amateur radio application, we may need to consider the cable's DC loss if we're feeding a bias tee, remote antenna switch, a remote relay, or a remote antenna tuner through the same CCS coax.

In these applications, RF flows freely, but DC may suffer from the increased resistance of the steel core! You may "inject" 13.6 VDC at your shack, but if your CCS cable is long enough or the core material cruddy enough, only 10-12 VDC may make it to the far end where it's recovered through the bias tee, or whatever. A simple test will suffice. Make sure to operate the DC circuit under load when testing



Shown here is the business end of a beautiful length of beefy RG-11, 75-ohm CCS coax. Obtained free from my friendly local cable TV installer (200 feet!), this stuff performs much like LMR-400 (which costs about $1 a foot). One caveat? You must respect the fact that the center conductor has a steel core (easy to do). I ground the copper off the tip with a small rotary tool to illustrate. See text. (NT0Z photo)

the voltage at the remote end, as your multimeter alone probably won't load the cable sufficiently to provide meaningful results.

For years I powered my SGC autocoupler at the far end of a 75-foot length of CCS RG-6 coax. I didn't use a bias tee, but I did use the external "pilot wire" to carry 12 VDC from the shack to the tuner, with the coaxial cable's external shield serving as the DC return.

In the interest of full disclosure, I didn't know at the time that the external pilot wire was made of steel and was supposed to be used to support the coax on horizontal runs between the cable company's telephone pole and the side of your house! The "extra" wire was there, it was well insulated, and it was pressed into service! I did measure the voltage at the autocoupler, however, and it was just fine. YMMV, so be sure to test.

Coaxial Cable Specs in General

From WWII through the 70s and 80s, the performance, electrical characteristics, and physical characteristics of most coaxial cables conformed to a known set of standards. RG-8 was RG-8 no matter who made it, and the same went for the other common coaxial cable standards as well.

This is no longer true.

These days you must refer to the manufacturer's data sheet to have any chance of determining how a particular cable is made and what its characteristics are, especially with 50-ohm cable. RG-8 is no longer RG-8. "Nothing is nothing" anymore, so don't make the mistake of thinking that a modern cable that's marked with an old-school designator is exactly like the stuff you think it is—or is even in the same ball park.

With these affordable tools, connectors and adapters, inexpensive RG-6 "cable TV" coax can become just about any RF or audio cable you might need for your shack or your antenna farm. The compression tool (back left) costs about $15 at Harbor Freight Tools or elsewhere online. The cable prep tool costs as little as $2.99 online. (Photo by NT0Z)

Ironically, today's RG-6 and RG-11 probably run "closer to spec" than most 50-ohm cables! There is plenty of excellent 50-ohm coax out there, but you'll have to study the specs and buy from trusted and well-reviewed sources.

Making Connections

Many ops are leery about using 75-ohm cables because they think it's difficult to install connectors on the cable ends. If you have to solder everything—old school all the way—it can be quite a chore. Most of us use high-quality cable TV "compression connectors" made by Belden (and others), which simply and easily results in a cable with a rugged, water-resistant "F" connector on each end.

Coaxial adapters transform the F-connectors into whatever is needed—PL-259, BNC, Type-N, etc. If you have a decent quality adapter (admittedly, not always easy to find), there's no muss and no fuss. Losses are trivial, and F-connectors routinely handle high-power ham radio RF, even the full legal limit.

But many of us want to use traditional PL-259s with RG-6 and RG-11, but the cable's double-aluminum foil and shield braid can make that all but impossible. Actually, it can be done quite easily with the use of special aluminum solder paste. See www.ad5x.com/images/Articles/Connectorizing%20RG6.pdf. I've never done it, but Phil is the real deal, so I'd trust his method without reservation. I use (and will use) the two following methods because they're easier (for me, at least).

The 'YouTube Method'

Bob Sumption developed a simple hack for installing PL-259 connectors onto RG-11 (large 75-ohm coax) and RG-6 (smaller 75-ohm cables) and has been using it for decades without issue. Do a Google search for "RG11 PL259" and Bob's video is the top listing.

Essentially, Bob's method involves prepping the cable so that the center conductor can be conventionally soldered while the shield braid is "compressed" as the connector body is screwed onto the cable. The shield braid isn't soldered.

The comments accompanying the video are pretty harsh, and it's apparent that a lot of people can't imagine that this might work—or are completely sure it won't work. This method is controversial, but I suggest that you ignore the negative comments, as the method does work. At least for the past month, as a pair of "Bob's connectors" are on either end of the 80-foot run of RG-11 coax that feeds my 2-meter beam!

I was leery of this method at first. But when I prepped my RG-11 cable as described, I noticed that the wires that comprise the shield braid are big, beefy and plentiful, especially when compared to the wires typically used in 50-ohm cables and "cheap" RG-6/RG-59. The connector body isn't going to break or rip them apart during installation. Heck, I could barely cut them cleanly with my side cutters!

You have to seal the connectors against moisture, of course, as you do with any outdoor connection, but if Bob says they work for years at a time, I'm inclined to believe him. RG-11 has fantastic performance characteristics—better than most 50-ohm cables you'd want to pay for— and is practically (or actually) free, so it's worth a bit of experimentation. I will keep you posted. So far, my 2-meter Yagi works as expected.

One critical tip: When removing the heavy, white insulation that surrounds the center conductor of any CCS cable, don't nick or cut the center conductor in any way! The copper coating is very thin and your knife or blade could slash right through it without the cut being visible to the naked eye. Such a cut essentially severs a copper-coated wire! Go slow and be careful. And if you do nick the center conductor, cut off a few inches and start over.

Crimp on PL-259s

Crimp-on PL-259 connectors made for a variety of

50-ohm cables are plentiful and easy to find, but crimp-on PL-259s designed expressly for RG-6, 75-ohm cables, are rare and often thought to be nonexistent! I thought they were the stuff of myth and legend for decades, but they do exist! And they're not even expensive!

The best I've found to date have Teflon insulation, require the center conductor to be soldered (desirable), and can be purchased from The RF Connection (**www.therfc.com**). Specify model PL-259/RG-6-TSS ($2 each). I need to ask the techs there if similar crimp-on PL-259 connectors sized for RG-11 are available.

If you search on Google, these connectors won't come up. Lots of other stuff will, however, but until that stuff is purchased and evaluated, you probably have to consider it to be of questionable quality. Much of it is junk. The RF Connection connectors, however, are the real deal.

RG-6: Really Catching On!

Performance-wise, you really can't go wrong with beefy, high-quality, 50-ohm RF cable made by name brand makers such as Belden, Andrew, or Times Microwave (other quality brand exist, too), but there's a huge amount of knock-off, counterfeit and just plain junky 50-ohm RF cable in the marketplace, and that stuff will exact a heavy toll. Avoid it at all costs!

To save money, headaches and frustration, many ops—me included—standardize on good ol' RG-6. For most ham applications below 2 meters, 75-ohm RG-6 "satellite cable" works just as well—or better—than "ham cables" and has many additional advantages.

If you compare the number of people who watch TV with the number of ham operators, you'll understand why RG-6 is produced in huge quantities and how that contributes significantly to its affordability. A 1,000-foot spool of 50-ohm Belden RG-8/U or RG-213 costs about $800, while a similar spool of 75-ohm Belden RG-6 costs about $120. And that's a top-tier cable sold by an "expensive" commercial jobber. A 1,000-foot spool of "still better than RG-8" from Home Depot costs about $80. That's bizarre, especially considering that RG-6 offers better RF performance than RG-8!

Because it's used in cable TV and satellite systems, RG-6 is reasonably low-loss up to 700 MHz, while low-cost 50-ohm cables often perform miserably at frequencies above 7 MHz! And you probably can't buy decent 50-ohm coax at odd hours, but you can easily stock up on RG-6 in 50- and 100-foot lengths at any Wal-Mart.

Inexpensive 50-ohm coax often has a skimpy, RF-leaky, 65% braided outer shield, while RG-6 is at least double-shielded (having a continuous aluminum foil shield and an outer woven braid), with "quad-shielded" versions readily available. Cable TV operators are fined if their systems leak RF, and money talks, so RG-6 doesn't leak!

Dogmatic types may do their best to convince you that F-style compression connectors will add "impedance bumps" to your feed line or complain about the cable's "unsuitable" 75-ohm impedance, but unless you're making phasing harnesses or coaxial impedance-matching lines, it doesn't matter. Really!

Conventional crimp-on PL-259 connectors for 50-ohm cables are available for a few bucks apiece, but the crimpers and the cable prep tools can cost as much as $700! K4AVU's PL-259 crimp tool ($39.95), however, crimps standard "solder on" PL-259s to half-inch (or smaller) 50-ohm cables. Not every connector can survive being crimped with this tool, but when you find one that can, stock up and enjoy! See www.k4avu.webs.com.

For RF feed lines, 75 ohms is close enough to 50 ohms for just about any purpose, and many "50-ohm antennas" are actually closer to 75 ohms in reality. Your rig (or SWL receiver) won't care, and neither should you! A typical RG-6 feed line (including compression connectors and any necessary adapters) can easily handle 300 watts of RF at almost any feed line SWR (and probably more).

If your feed line SWR is low, 500 W should be fine, even up to 6 meters. Some ops run a cool kilowatt through RG-6 from 160 through 10 meters. If you need more power or reduced losses, switch to RG-11 (RG-6 on steroids). It offers nearly double the performance, especially at higher frequencies. Again, see chart at the beginning of this column. I was initially reluctant to give RG-6 a try, but it's been more than 15 years since I've even thought about soldering a PL-259 to a piece of RG-8. With the newest connector techniques detailed above, I just can't find a reason to not use RG-6 and RG-11 for all of my ham, SWL and scanner needs. If you haven't done so already, check out RG-6/RG-11. It's a steel and a steal!

TSM

Radio 101

By Ken Reitz KS4ZR **ks4zr1@gmail.com**

Connection Complications: Troubleshooting 101

(Photos courtesy of the author)

Last month, for some unknown reason, my cleverly designed satellite radio system stopped working. Well, except for the XM radio part—it never stops. It never suffers from "rain fade," misalignment, or even poor connections. It can be snowing like crazy outside and the big C-band dish and smaller Ku-band dishes will have long passed the reception threshold, but the signal from XM at L-band, still comes through.

It was the rest of my satellite radio system that was not working and I really didn't want to take the time to troubleshoot the issue. But, if I was to have the use of the three dishes in the back yard that I use for my music sources, in addition to monitoring world news and other Free-to-Air satellite offerings, I had no choice.

As seen in the photo, the hub of my system is an old (and inexpensive) Onkyo home theater receiver/amplifier. I like it because it was not only cheap, but also very flexible. It has HDMI and fiber optic as well as standard RCA audio inputs and outputs. With 5.1 Dolby surround sound, I have it connected to four speakers here in the office, which surrounds me with an amazing variety of sound, which really helps me get things done.

Audio/video center at the home office with the Onkyo Dolby surround-sound receiver/amplifier (bottom shelf right) connects XM satellite radio receiver (lower left); Sangean HDT-1X AM/FM/HD receiver (middle shelf left); Manhattan FTA satellite receiver for Ku-band reception (above Sangean) using a DiSEqC switch; Motorola 4DTV analog satellite receiver/dish mover; LinkBox 8000i Local FTA satellite receiver for C-band reception; Sony Blu-Ray player (for Pandora). TV on top shelf displays selectable screens for all except the XM satellite receiver. C.Crane Part-15 FM transmitter is behind the TV. All receiver audio outputs are toggled from the Onkyo's universal remote.

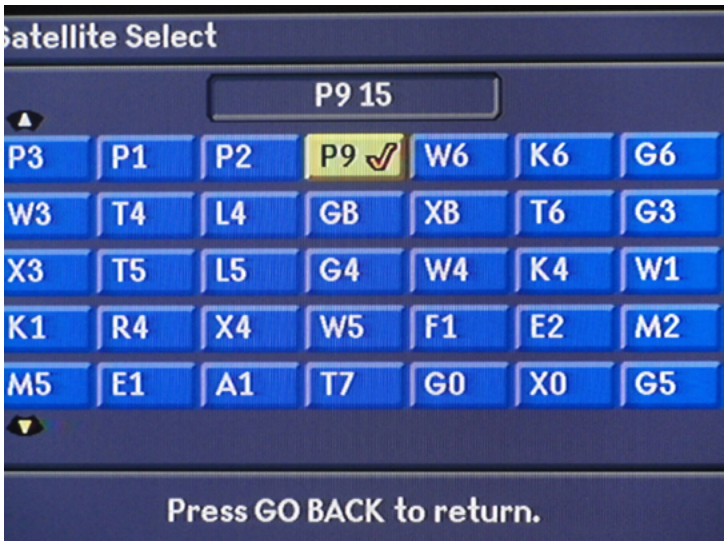
Not Exactly Simplicity Itself

Plugged into the Onkyo is the aforementioned XM satellite radio tuner (attached via 20-foot RG/176 coax to a 2-inch square L-band antenna that sits on a south-facing window ledge); a Sangean HDT-1X AM/FM/HD tuner (attached to an outside dedicated FM antenna and indoor Radio Shack AM loop antenna); a LinkBox 8000 Free-to-Air satellite receiver (dedicated to C-band reception, through a steerable 10-foot C-band dish, but also used to tune VHF/UHF TV through an outside, dedicated Over-the-Air TV antenna); a Manhattan 1997 Free-to-Air satellite receiver, dedicated to Ku-band reception linking three dishes (two separate small Ku-band dishes and the Ku-band LNB on the 10-foot dish) connected through a DiSEqC (Digital Satellite Equipment Control) switch; a Sony Blu-Ray CD/DVD player (used for streaming Pandora) and a Motorola 4DTV receiver, which is used to drive the 10-foot dish, and monitor the last remaining analog satellite-TV channel (CSPAN), and serve to rotate the polarizer for the Manhattan, to change polarity through the big dish (the smaller dishes are configured to electronically change polarity through the DiSEqC switch).

The output of any individual input can be heard by simply pressing the appropriate button on the Onkyo's remote and secondarily pressing the appropriate buttons on any one of the other five remotes that control the sources. This is the part that causes my wife to throw her hands up in despair. Why should anyone need the use of six remote controls (one of which is a universal remote that does many more functions) just to listen to the radio? Unfortunately, there is no single "super universal remote" that can do all of the functions needed to make this system work including moving the dish; changing polarity; changing audio subcarriers; tweaking the dish position; scrolling through reception parameter options and C and Ku-band "favorites" lists.

One of the things I like best about the Onkyo is the addition of a second amplifier intended to drive additional speakers, apart from the main system, called "Zone 2."

The audio output fed through the Zone 2 subsystem



4DTV satellite screen moves the dish to the programmed location on this satellite map, which is decades out of date and can't be updated. P9 (highlighted) is actually now known as Intelsat 21 at 58 degrees W—the location of many international channels including Korean Central TV (Ministry of Post and Telecommunications) Pyongyang, DPRK.

amplifier goes into a C.Crane Part-15 FM transmitter, so that whatever is selected for Zone 2 can be heard throughout the house on any FM radio regardless of what is being fed through the office speakers.

The video from the two FTA satellite receivers, OTA-TV, Blu-Ray and the 4DTV receiver (which is how you to steer the dish) is displayed on a TV set that also lets me monitor the signal output of any particular device though an on-screen signal meter.

When Something Goes Wrong

After looking at the cables behind the audio shelf, a rather tangled mess, which includes five coax cables for FM/OTA-TV and FTA satellite-TV; audio/video and power cables, I was reluctant to troubleshoot the fact that, for some reason, there was no signal from the dedicated Ku-band dishes. Naturally, I did the usual quick stuff: check the RG/6 coax coming from the various LNBFs and LNBs. All appeared to be in order.

So, with no other recourse, I hauled a spare FTA receiver out to the dish farm to investigate, which required plugging in a 50-foot extension cord, TV and short length of coax to go from the LNB to the receiver. The receiver uses an HDMI cable that goes to the TV to monitor the satellite receiver's display.

First, I disconnected the DiSEqC switch to check the output of each dish. I checked the output from the Hispasat dish—no problem. Then I checked the WCPE-FM dish—no signal. Next, I checked the big-dish Ku-band LNB (all three are connected to the DiSEqC switch, which goes in to the house)—no signal.

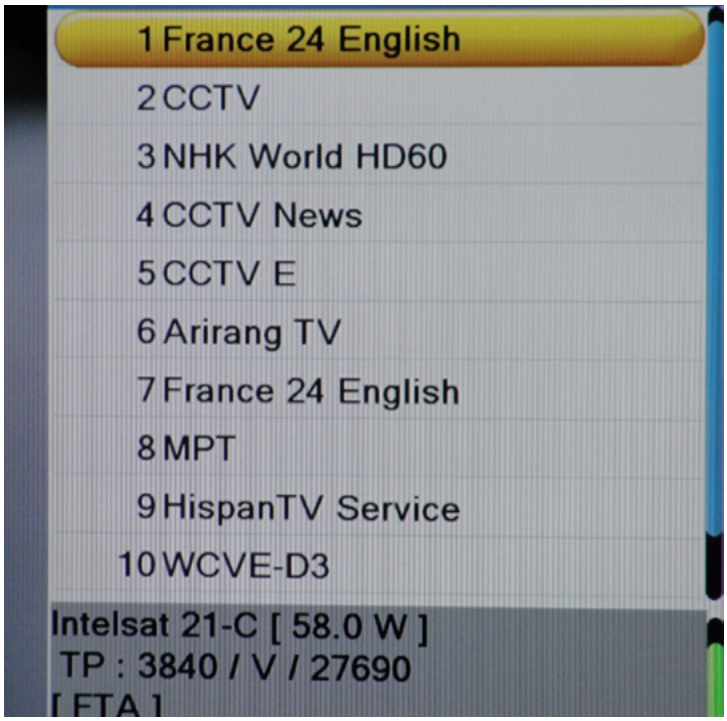
After swapping out extra LNBFs on the WCPE dish, I determined that the LNBF for that dish had died—who

DPRK leader Kim Jong-un relaxes atop an anti-aircraft gun during an inspection tour as seen on North Korean TV (MPT-Ministry of Post and Telecommunications) on Intelsat-21 at 58 degrees West. A coterie of officers follows him everywhere, dutifully taking copious notes on everything he says.

knows why. After installing the new LNBF I hooked everything back up and went inside to check on the signal. Nothing.

I had a spare DiSEqC switch, which I had earlier ordered, believing that the old switch might have been damaged. After installing the new switch I went back inside to try it again. Nothing. Back at the dish farm I took the DiSEqC switch out and individually tried the dishes. Only the Hispasat dish appeared to work. Attached directly to the WCPE dish, there was no signal, even with the new LNBF. So I double-checked the parameters used in the "Dish Setup" mode. The new LNBF was not functioning, because it had somehow defaulted to a different local oscillator (LO) frequency. Low-Noise Block Downconverters (LNBFs) these days are often "universal" meaning that they can be used in a wide variety of satellite installations. You have a wide choice of LO frequencies when setting up each dish. This particular new LNBF was 10.650 GHz, not the more typical 10.750 GHz. When I entered that in the set up, the signal came right through on the WCPE dish. So, I went back inside to check reception. Nothing.

By this time I suspected everything, but first I needed to check the coax fittings. In my initial investigation, I didn't pull off each connection to examine the condition of the fitting and the coax—now I did. The coax conductor was not the bright copper you like to see of a coax, and some fittings seemed loose and suspect. From an earlier column by Kirk Kleinschmidt N0TZ, I had come to appreciate the Klein coax fitting tool that gives you perfect coax fittings every time. I had earlier ordered the tool and now set about with a pair of wire cutters, clipping off every single coax fitting (while all of the receivers were unplugged from wall power). I re-plugged all the coax with their new fittings into the new DiSEqC switch. I went back into the house to check on reception. Perfect. Only the Ku-band LNB from the big dish was not working. Suspecting that the old (at least 15 year-old) Ku-band LNB had finally bitten the dust, I ordered a replacement from Hypermegasat for $60.



Line-up of English language TV channels found on Intelsat 21 (58 degrees W) include France 24, CCTV (China), NHK (Japan), Arirang (South Korea), and MPT (North Korea).

In a few days the "new" Ku-band LNB arrived and I discovered that it was actually "New Old Stock" (NOS). The LNB, while the same brand and model, had a lower serial number than the newer LNB and a .6 dB rating instead of a .5 dB—not a big issue, just interesting to note.

Installing the new LNB and connecting it to the DiSEqC switch, I went back inside, configured the parameters and sent the dish to Galaxy 19 (known as W4 on my 4DTV receiver) where all the interesting international radio channels are found.

Within seconds I was listening to Soukous dance music from Radio Congo. All was right!

But, the main reason for having a Ku-band dish is World Radio Network (WRN), a one-stop satellite channel for all of your favorite former and current shortwave radio broadcasters.

Here's the English language programming line-up for WRN North America service (G19 97 degrees W 12.177 GHz 23000 Symbol Rate) heard daily in a rotating schedule: Radio Prague, Radio Slovakia International, Radio New Zealand International, Israel Radio, Radio Sweden, KBS World Radio (Korea), Polish Radio External Service, Radio France International, Deutsche Welle, NHK World Radio Japan, Radio Sweden and Vatican Radio World News. A current PDF schedule is found here:

http://www.wrn.org/listeners/assets/PDFs/WRN_English_North_America_A16.pdf

Aside from the WRN lineup, you'll find a 'round the clock presence from Sputnik Radio (formerly Voice of Russia); Radio Congo (in French) and Voice of Turkey World Service in various languages including English.

A complete Ku-band system for receiving WRN is very

DiSEqC switch allows up to four dishes to be controlled by one receiver. Here, I have all new coax fittings with Coax-Seal as a little insurance and room for one more dish!

inexpensive and installation is something almost anyone can do. There are several sources of such complete systems and I recommend you check them out:

Hypermegasat: **http://hypermegasat.com/Package%20Deals.html**

Mike Kohl (*TSM* satellite/TV writer) **http://www.global-cm.net** email: globalcm@mhtc.net

A Plethora of Problems

It turns out that the problems with my satellite radio scheme were many. First, the DiSEqC switch had died and needed to be replaced. Second, the LNBF on the WCPE dish had died and needed to be replaced, but the installation setting on the LO had to be changed. Third, the coax fitting on the main coax going from the DiSEqC switch to the house was bad and needed to be replaced. Fourth, the Ku-band LNB on the big dish had also gone bad and needed to be replaced. Even if I had discovered the bad coax connector from the dish farm to the house first, I would have soon discovered the DiSEqC switch issue and the faulty LNBF. I hadn't tried using the big dish Ku-band LNB in a very long time, so wasn't aware that it also needed to be replaced.

So, what had caused all of these issues? Most likely many years of severe heat and cold, rain and snow—always foes of coax fittings and other connections left out in the elements year after year—everything has a shelf life. I also suspect a recent nearby lightning strike, that had caused a power outage but no damage to any devices inside the house, might have caused the DiSEqC switch and one LNBF to die, but that's speculation.

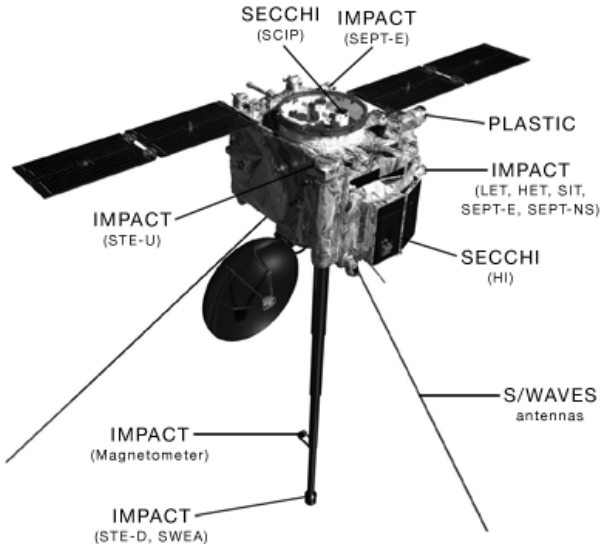
This particular exercise had to do with satellite reception but everyone can learn from my connection foibles. It applies equally to all radio gear: scanners, amateur radio HF/VHF/UHF; shortwave listening—everything. Check your connections, especially if they've been out in the weather for decades. You may be surprised at what you're missing!

TSM

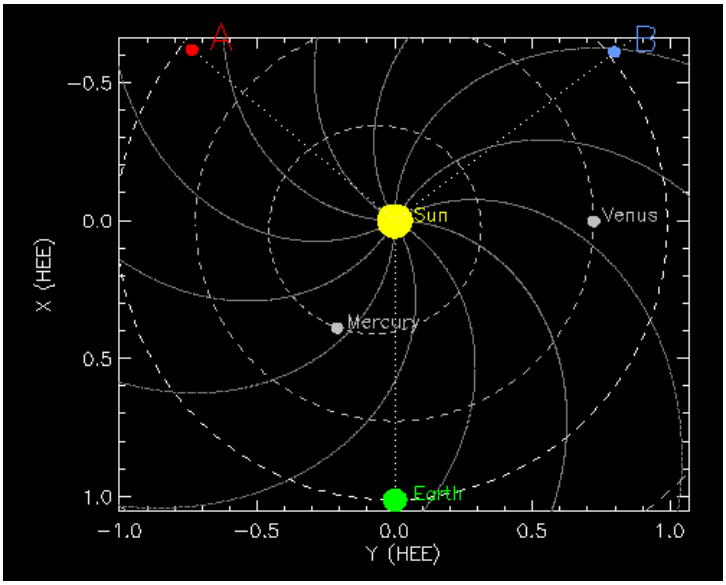
Radio Propagation

By Tomas Hood NW7US **nw7us@nw7us.us**

Coronal Mass Ejection Science



The two STEREO observatories are nearly identical with selective redundancy. The building of the spacecraft bus and the integration of the instruments were done by the Johns Hopkins University Applied Physics Laboratory (APL). (Diagram courtesy of NASA)



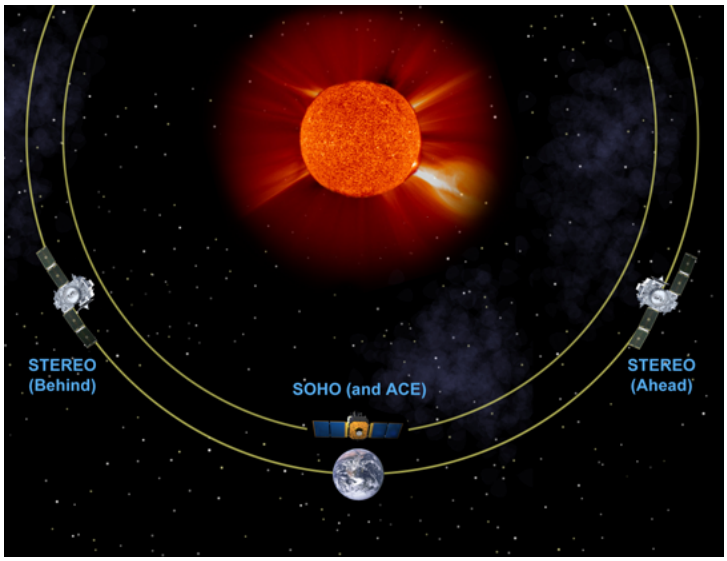
The position of STEREO Ahead (A—which denotes the spacecraft that sees what is coming around, with the rotation of the Sun), and STEREO Behind (B—which denotes the spacecraft that is seeing what has already rotated away from Earth's view), on August 15, 2017. (Credit: NASA/STEREO)

The NASA STEREO mission (see **https://stereo.gsfc.nasa.gov**), named STEREO because of its two-spacecraft deployment—one spacecraft positioned at a point in Earth's orbit so that it can see "ahead" in the rotation of the Sun, and the other spacecraft positioned to see what has already rotated around, away from Earth's view, resolved a forty-year mystery about how coronal mass ejections (CMEs) change shape over their journey from the Sun, to the Earth. Plasma from solar flares or coronal mass ejections travel along solar wind to ultimately produce auroras in Earth's Polar Regions, and affect satellites and power grids and other man-made electronics. Of course, we know that CMEs also adversely affect the propagation of shortwave signals, because of how a CME can cause geomagnetic storms. When Earth's magnetic fields become very active, they cause the ionosphere to lose energy (through a process known as recombination), which lowers the usable frequencies over any given radio path.

For many years, the idea that coronal mass ejections launched from the Sun could strike the Earth was inferred from an indirect chain of evidence collected from multiple satellites. Now, the Heliospheric Imagers aboard the STEREO-A spacecraft has managed to view a CME propagate from the surface of the Sun to the Earth. NASA's STEREO spacecraft and new data processing techniques have succeeded in tracking this CME from the origin in the Sun's ultra-hot corona to the final impact with the Earth 96 million miles away. This resolves the mystery lasting forty years about each of the involved structures that cause space weather: how the structures that impact the Earth relate to the corresponding structures in the solar corona.

Despite many instruments that monitor the Sun and a fleet of near-Earth probes, the connection between near-Earth disturbances and their counterparts on the Sun has been obscure, because CMEs and the solar wind evolve and change during the 96,000,000-mile journey from the Sun to the Earth.

STEREO includes "heliospheric imager" cameras that monitor the sky at large angles from the Sun, but the star field and galaxy are 1,000 times brighter than the faint rays of sunlight reflected by free-floating electron clouds inside CMEs and the solar wind; this has made direct imaging of these important structures difficult or impossible, and limited understanding of the connection between space storms and

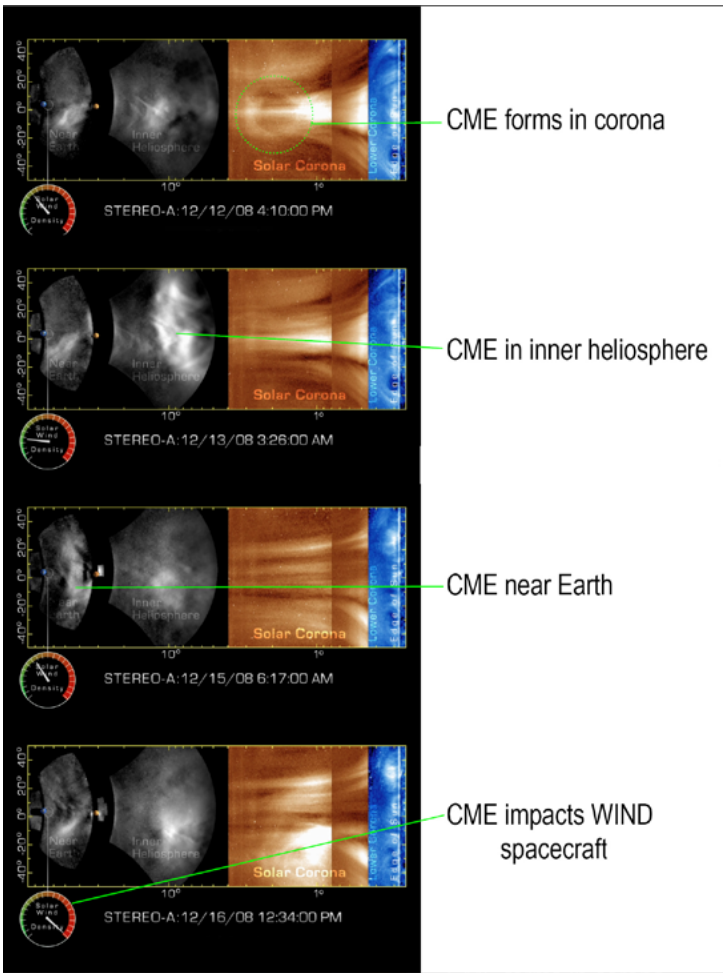


STEREO spacecraft orbits generally along the Earth's orbit path. SOHO is about 1 million miles towards the sun from Earth at the Lagrangian Point L1. This diagram shows the relative positions of SOHO and both the two spacecraft, STEREO A (Ahead) and STEREO B (Behind), on November 24, 2009. (Credit: NASA/ STEREO)

the coronal structures that cause them.

NASA released imagery that reveals absolute brightness of detailed features in a large geo-effective (Earth-directed) CME, connecting the original magnetized structure in the Sun's corona to the intricate anatomy of an interplanetary storm as it impacted the Earth three days later. At the time the data were collected, STEREO-A was nearly 45 degrees ahead of the Earth in its orbit, affording a very clear view of the Earth-Sun line.

Finally, scientists could methodically piece together the entire three-dimensional view of the entire trip of this CME, from Sun to Earth. Now that this has been accomplished, they know how to do this for new events as they unfold. This empowers them to understand, and better predict, solar storms and space weather. Combined with the ability to predict sunspots days before they emerge, solar researchers and forecasters will be better able to help us prepare for space weather.



STEREO-A tracks a coronal mass election from the sun to Earth. The ability to now see a coronal mass ejection in three dimensions, as it makes its way from the Sun toward Earth, can help space weather forecasters predict space weather and how it will affect power grids, satellites, and radio communications. (Credit: Southwest Researcher Institute/Boulder, Colorado)

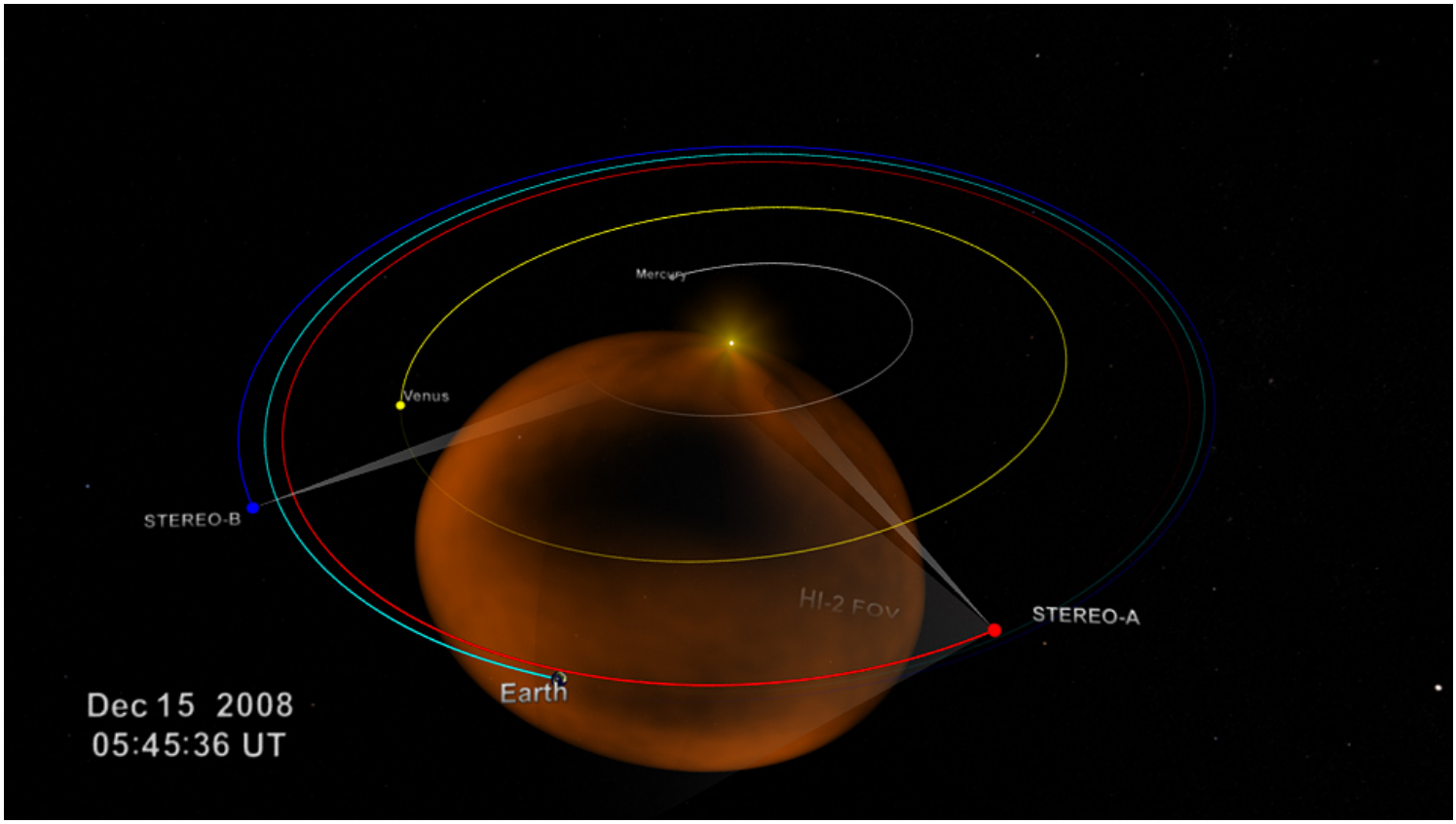
HF Propagation for August

Late August and Early September are a difficult time of year for which 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 the other days conditions may sound 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 Solar Cycle 24 continuing with low solar activity, during the daylight hours good DX conditions should be possible on 17 and 20 meters, with 15 meters having some strong openings. Expect signals on these bands to peak approximately during the two-hour window immediately following sunrise and again during the late afternoon. These bands 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. Openings might be possible to many areas of the world, some with surprisingly strong signal levels, especially when using digital and CW modes. 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 Ameri-



Still image from a video of the orbital positions and fields of view of the STEREO spacecraft during the December 2008 CME. The orange area represents the CME. (See movie here: http://nw7us.us/trackcme.html) (Source: NASA/Goddard Space Flight Center/Scientific Visualization Studio)

ca, 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.

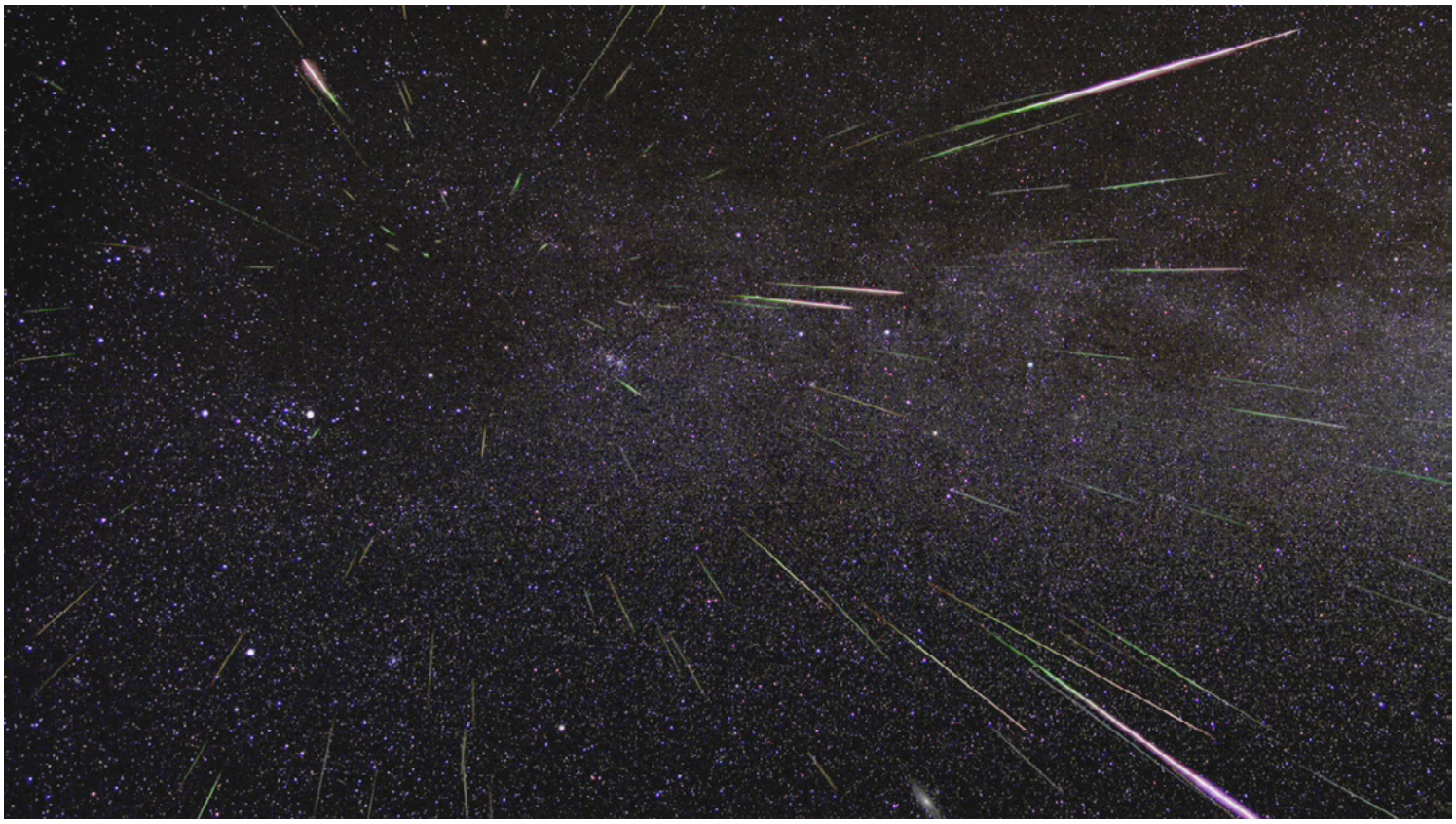
At night, 40 and 30 meters should be the best bands for this distance until midnight, with 80 meters optimum from midnight to sunrise. Try 60 meters, as well. For openings between 750 and 1300 miles, try 20 and 17 meters, as they should provide optimum propagation during the hours of daylight. Optimum conditions should continue on 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 1300 miles and the one-hop short-skip limit of approximately 2300 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 Conditions

Sporadic-E propagation usually tapers off during August, but it should continue to occur fairly frequently. Some 6-meter sporadic-E openings are expected during the month over distances of approximately 750 to 1300 miles. During periods of intense and widespread sporadic-E ionization, two-hop openings may be possible considerably beyond this range. Also check the two-meter band for an occasional sporadic-E short-skip opening between approximately 1200 to 1400 miles. While sporadic-E short-skip openings may occur at any time, there is a tendency for them to peak between 8 AM and noon, and again between 6 PM and 9 PM local daylight time.

The Perseids are expected to be a fair event, this year. Many consider this the best meteor shower of the year. Radio observation is more sensitive than visual observation, and with the predicted 60 meteors per hour peak, this will play well for radio propagation off the resulting plasma trails left by each meteor (traveling at approximately 37 miles per second!). Be particularly vigilant from August 10 through August 20. The best time of day is about an hour before midnight, through the following hours.

For the very patient, check the 6-meter band for possible trans-equatorial (TE) openings between 8 and 11 PM local daylight time. This type of propagation favors openings from the southern tier states deep into South America, with the signal path crossing the magnetic equator at a right angle.



An outburst of Perseid meteors lights up the sky in August 2009 in this time-lapse image. Stargazers expect a similar outburst during next week's Perseid meteor shower, which will be visible overnight on Aug. 11 and 12. (Credits: NASA/JPL)

TE openings during August are rare, but they can occur. Very weak signals and severe flutter fading usually characterize them.

Solar Cycle 24 Today

The Royal Observatory of Belgium, the world's official keeper of sunspot records, reports a monthly mean sunspot number of 11.6 for June 2017. The mean value for June results in a 12-month running smoothed sunspot number of 17.1 centered on December 2016. Following the curve of the 13-month running smoothed values, a smoothed sunspot level of 18 is expected for August 2017, plus or minus 14 points.

Canada's Dominion Radio Astrophysical Observatory at Penticton, British Columbia reports a 10.7-cm observed monthly mean solar flux of 74.8 for June 2017. The twelve-month smoothed 10.7-cm flux centered on December 2016 is 80.0. A smoothed 10.7-cm solar flux of about 78 is predicted for August 2017.

The geomagnetic activity as measured by the Planetary-A index (Ap) for June 2017 is 7. The twelve-month smoothed Ap index centered on December 2016 is 11.4. Geomagnetic activity this month should stay level at about the same activity as seen in July 2017. Refer to the Last-Minute Forecast for the outlook on what days we might witness degraded propagation (remember that you can get an up-to-the-day Last-Minute Forecast at **http://SunSpotWatch**.com on the main page).

Feedback Requested

Do you have propagation-related questions, or a topic related to the Sun, the Ionosphere, or the Sun-Earth connection, that you'd like answered? Please send in your questions and comments, for possible inclusion in this column. If you are interested in a space weather and radio propagation forecast self-study course, visit **http://SunSpotWatch.com/swc** for details.

Your columnist has a website dedicated to space weather, at **http://SunSpotWatch.com** and also provides a Facebook page at https://www.facebook.com/spacewx.hfradio which features daily updates with solar images, space weather graphs, data, and educational tidbits, all day long, so please take a look. There are quite a few space weather and radio videos on this columnist's YouTube channel at **https://YouTube.com/NW7US**. Be sure to check out the Tumblr blog, http://blog.nw7us.us, in which daily space weather posts are available.

On Twitter, radio propagation and space weather Tweets are provided in regular updates by @hfradiospacewx (**https://Twitter.com/hfradiospacewx**). Your columnist is on Twitter, as @NW7US (**https://Twitter.com/NW7US**).

TSM

The World of Shortwave Listening

By Rob Wagner VK3BVW **robvk3bvw@gmail.com**

The Use and Abuse of SINPO

Rating scale	S	I	N	P	O
	Signal strength	Degrading effect of			Overall rating
		Interference	Noise	Propagation disturbance	
5	Excellent	Nil	Nil	Nil	Excellent
4	Good	Slight	Slight	Slight	Good
3	Fair	Moderate	Moderate	Moderate	Fair
2	Poor	Severe	Severe	Severe	Poor
1	Barely audible	Extreme	Extreme	Extreme	Unusable

The SINPO code is usually found included in a shortwave listener's reception report to a broadcaster. And the code is often quoted in listings of stations logged when contributed to DX club newsletters, Facebook groups and other shortwave listener forums. But often, we find a few misunderstandings in the way the numbers are compiled for the code.

Useful in describing the quality of radio transmissions, SINPO is an acronym for Signal Strength, Interference (from other radio stations and includes man-made interference), Noise (atmospheric), and Propagation (e.g. fading). Overall quality of reception is calculated after taking into account the previous four reception components (S, I, N and P). The five components are given a ranking from 1 (the worst) to 5 (the best).

You can also find variations on the standard SINPO code. SINPFEMO adds complexity by including F (Frequency of fading), E and M (relating to the quality and depth of modulation). SWLs will sometimes also see SINFO, replacing the easily misunderstood 'P' for Propagation with the more relatable 'F' for Fading. And in recent times, some shortwave broadcasters have encouraged the use of the much simpler SIO (Signal, Interference and Overall) code. Indeed, SIO is about all that is required for most situations, given that there are usually some types of atmospheric noise and propagation characteristics attached to the reception of radio signals on the shortwave bands. Broadcasters are most interested in the signal strength at the receiving location and, importantly, any interference suffered from other stations on the same or adjacent frequencies.

SINPO is occasionally referred to as one of the 'Brevity Codes'; a term used to collectively group together codes in a variety of radio communications for the purpose of delivering detailed information in short messages. Other brevity codes include the RST code used by ham radio operators and SWLs, the Ten Code developed for the CB band, the Q-code originally developed for telegraphy communications back in the early 1900s, and a variety of military codes.

Interestingly, the SINPO code appears to have been one of the later additions to the brevity code category. It first appeared in the early 1950s under the CCIR (Consultative Committee on International Radio), a forerunner to the current ITU-R (the International Telecommunications Union - Radio Communications). In the most recent (2011) ITU-R Spectrum Management document on the code, it is described as an "....accurate description of the transmission quality and is easy to use." It can also be found in the eighth edition (2010) of the International Civil Aviation Organization (ICAO) Abbreviations and Codes document. So, SINPO is still very much used today in a variety of applications.

However, there are three problems with SINPO:

1) Obviously, it is open to the subjective interpretation of the listener. One listener's idea of a "good" signal is probably quite different from another SWL.

2) As already mentioned, the interpretation of each component of the code, e.g. the I, N and P, can easily be confused by a non-technical listener, hence the reason for the simpler SIO code.

3) Even the very definitions of the SINPO code can be unclear. In some references on the subject, Interference (I) has been described as both interference from other stations and man-made noise (e.g. local electrically produced static). Yet other sources lump man-made interference in with the Noise component. So what hope do non-technical listeners have if the sources can't agree on accurate definitions?

Although there is still widespread use of SINPO throughout the SWL hobby, it is clear that many listeners are still not comfortable with how to use the code. Correct practice would dictate that a ranking on the Overall component would not be higher than any number given to one or more of the other components. If the lowest ranking of any of the other components was, say 3, then the overall ranking should not be higher than a 3. Yet, we regularly see overall rankings not relating to the other components. For example:

SINPO = 42344 Even if Interference is rated as 2 (severe), then there is no way that Overall should be given a good ranking (4). Considering that it was combined with a Noise ranking of 3 (moderate), one would expect the overall reception to be, at best, probably a 2 (poor).

SINPO = 54323 Described here is a strong signal at the listener's location, some slight interference, but with moderate atmospheric noise and severe fading. Again, although the signal strength may have been very strong on this occasion, the combined presence of interference, noise and propagational disturbances would demand that this Overall ranking be marked down to probably a 2 (poor reception). Indeed, you would have to question the accuracy of this SINPO report of 54323 when the listener is claiming that the signal strength is excellent but the fading on the signal is severe!

SINPO = 45444 Along with the SINPO rating, this SWL wrote in his report that the reception was good with no atmospheric noise. So why did he give a rating of 4 for the Noise component?

SINPO = 55555 or 11111 There may be opportunities to give a station "all fives," especially if it is China Radio International which seems to have a booming, laser-like, mile-wide signal on many occasions. But for many other broadcasters, there is usually some form of degradation to the signal in the form of even slight pulsating fades. And if you are telling the station that it is "all ones," then I don't know how you even heard the station if the signal was barely audible, while interference, noise and propagation disturbances were extreme!

So, is it any wonder that over the years a few broadcasters have expressed frustration and confusion at the accuracy of some reception reports? It has even been suggested by a few listeners that some broadcasters look more kindly on higher SINPO ratings, and hence are more likely to reward the listener with a QSL card! Wrong!

While many international stations are familiar with the SINPO code, not all broadcasters prefer its use. And with those stations offering only a relay of their domestic service on shortwave, such as South American or smaller Asian stations, the fully written out description of reception is much more easily understood and possibly more reliable. These days, many experienced DXers have taken to providing both SINPO and a written description of the quality of reception.

An additional word of advice here: Providing information on any observed interference from other broadcasters operating on or adjacent to the desired station's frequency is of particular interest to broadcasters. It can be most helpful if the listener can identify the interfering station that he is hearing at his location, so close attention should be paid to this component of the code.

Back in the day, shortwave broadcasters ran large international services to many target areas around the globe. All operations were done "in house" with the

listeners letters department sending along feedback about reception quality to the engineering or technical division. A station relied on listener feedback and reports to ensure that their signal was reaching the target zone with good strength and no interference on the once over-crowded shortwave bands. In those days, there was a feeling that the reception report held some importance and provided valuable information on reception conditions.

In the last twenty years, there has been a distinct change in the way that shortwave radio stations operate their services and deliver their content. Many broadcasters use commercial transmission brokers to make decisions about frequency management in the shortwave spectrum. Independent organizations such as WRMI, Babcock Communications, TDF (Télédiffusion de France), Broadcast Belgium, SpaceLine Ltd. and others provide services that allow the station to focus mainly on content and leave the worry of transmission to separate frequency management organizations and brokers who either own or rent air time from transmitter sites and relay stations.

This has enabled broadcasters such as Radio Japan to offer a better service using a variety of "tailor-made" transmitter sites scattered around the globe beaming strong signals into target zones, instead of relying solely on their own Yamata site in Japan to deliver the signal. In addition, stations can now assess the successful transmission of their broadcasts through the use of their own remote receivers or the many independent remote online SDR receivers scattered around the world.

What this means for the faithful shortwave listener is that their reception report could perhaps be viewed by some stations as being less about a way of communicating technical information on reception conditions and more about the station maintaining a connection with their "customer"—the listener. As transmissions are now commonly being outsourced, the station is more focused on gaining feedback on the programs they air. And the information on reception conditions is not always being passed onto the engineering department (if indeed a technical division still exists within the broadcasting organization!).

Yet, some listeners provide scant, if any, comments on programs in their reports. Recently, I've seen some pretty horrible examples of what are euphemistically called reception reports! Their details consist of "man talking," "woman talking," "music," and then the demand for a QSL card. A colleague of mine calls this approach the "Gimme QSL" syndrome! The very things that stations want these days—comments and feedback on programs—are not being supplied by many listeners. Could this be the reason why some broadcasters don't issue QSLs anymore, or at best offer only an "acknowledgement" card or letter without details of date, time or frequency of the reception? This opens up a whole new discussion for a future column!

Returning to the SINPO code then, we can see its use, along with the declining value of the traditional reception report format, are becoming less important these days. So, when writing a report for an international broadcaster, I suggest that you use the SINPO code, ensuring that the Overall rating relates correctly with the other four components that make up the code. You may also like to consider using the somewhat easier SIO in place of SINPO, as it is the components of Signal Strength, Interference and Overall Quality that are the most important here. I also suggest that a written description of the reception quality is a valuable inclusion, in case the person reading your report is not familiar with SINPO. And, above all, try to provide feedback on the programs heard during your listening session. The station will thank you for it!

In wrapping up this discussion, I came across a monograph from the BBC Engineering Division back in September 1962 titled, "Propagational Factors in Short-Wave Broadcasting," by L. J. Prechner, B.Sc. Published about 10 years after the initial introduction of the SINPO code, the article discusses fading, ionospheric disturbances, maximum and minimum useable frequencies, and the problems of accuracy in short and long term predictions. It also mentions statistical analysis

(From the author's collection)

of SINPO. Although our understanding of the ionosphere is greatly enhanced these days, this monograph is still worth reading for inquiring minds wishing to delve deeper into the subject. You can download it at: **http://downloads.bbc.co.uk/rd/pubs/archive/pdffiles/monographs/bbc_monograph_43.pdf**

Station News
(All times in UTC and frequencies in kHz.)

A very interesting video was posted recently on the HamRadioConcepts YouTube page. Some radio enthusiasts got the opportunity to visit the shortwave transmitting site of WRMI, Okeechobee, Florida. There are some very impressive rhombic antennas and 14 powerful transmitters featured in the video tour. The visual footage is sometimes a bit shaky and fast, but the information on this powerful and very active broadcaster will be of interest to amateurs and SWLs. There's also some humorous commentary at times. Worth checking out at **https://youtu.be/rKlic5e47ek**

Many long-time DXers will remember Radio Sutatenza in Bogotá, Colombia. Operating on 5075, 5095 and 6075 kHz up until the early 1990s, it was forced to close due to financial problems. This station also transmitted on a number of mediumwave outlets in Bogotá, Cali, Barranquilla, Magangue, and Medellin. Its primary focus was educational broadcasting, especially to rural communities throughout the country. A website has been set up to remember the work of Radio Sutatenza, and it has several interesting videos. Although written entirely in Spanish, Google Translate does a pretty decent job of interpreting the texts. The link is: **http://proyectos.banrepcultural.org/radio-sutatenza**

Radiodifusión Argentina al Exterior (RAE) has apparently been having difficulties with its senders at the General Pacheco transmitter site recently. While they are being repaired, the station has decided to outsource its international service to WRMI. This makes great sense! And it enables this broadcaster to still keep in touch with listeners. It is unclear just how long this arrangement will continue. But if you hear the broadcasts via the Okeechobee FL transmitters, it would be a nice courtesy to drop them a note to say you heard the broadcasts and value the efforts they have made to keep the service going while repairs are under way. The address is:

RAE Argentina to the World P.O. Box 555 1000 CABA Buenos Aires ARGENTINA

Or you can contact them via email at conexionrae@radionacional.gov.ar or via Twitter @conexionrae

Here's the schedule for RAE broadcasts via WRMI, as it currently stands:
0000-0100 on 7730 to Mexico in Spanish on Tue-Sat
0100-0200 on 9395 to ENAm in English on Tue-Sat
0100-0200 on 11580 to WeEu in English on Tue-Sat
0600-0700 on 7730 to Mexico in Japanese on Tue-Sat
0700-0800 on 5850 to WNAm in English on Tue-Sat
0700-0800 on 7730 to Mexico in English on Tue-Sat
0800-0900 on 5850 to WNAm in Mandarin on Tue-Sat
0900-1000 on 5850 to WNAm in Japanese on Tue-Sat
1100-1200 on 9955 to SAm in Portuguese on Mon-Fri
1300-1400 on 11580 to WEu in French on Mon-Fri
2100-2200 on 11580 to WEu in German on Mon-Fri
2200-2300 on 5950 to Cuba in Spanish on Mon-Fri
2200-2300 on 11580 to WEu in Italian on Mon-Fri

DX Quick Tips

5910.26 - R. Alcaravan, Puerto Lleras, Colombia at 0600.

6070 - CFRX Toronto, Canada makes the distance to Australia quite well in our winter months considering it's 1 kW output. The other low-powered Canadian, CKZN St John Newfoundland has also been making its way to our shores, a rare occurrence indeed,

7205 - Republic of Sudan Radio, Al-Aitahab at 0330.

9635.8 - Voice of Vietnam, Son Tay. Although it beams for around 18 hours a day, it can be heard be heard in both the US and Australia on numerous occasions during that time period. This is not the International Service but rather its national program in Vietnamese.

9745 - R. Bahrain was noted at 0400 with its domestic service in Arabic.

For more of Rob's shortwave listening, amateur and vintage radio activities, as well as equipment reviews, visit his Mt. Evelyn DX Report blog at: ***http://medxr.blogspot.com***

TSM

The Shortwave Listener

By Fred Waterer **programming_matters@yahoo.ca**

Radio from Four Continents via Shortwave and Internet

Welcome to the August edition of The Shortwave Listener. This month we will visit the four corners of the Earth, by way of radio. Europe, Africa, Asia and the Americas will all be visited.

The way we listen to radio programming has certainly changed over the years. As I close in on my fifth decade of listening to international broadcasting, it occurs to me that we have so many platforms to listen to.

A case in point: The other day I took someone to a medical appointment. As we entered the office, I noted a number of details. The building exuded prosperity. This doctor had a few coins to put together. The waiting area was busy but not overly so. The nature of the doctor's practice resulted in a lot of rather stressed out people, as they awaited tests or test results.

A very nice stereo system was playing what I took to either be a local FM station or perhaps a satellite channel. The music was rather calming and light, no doubt by design. Imagine my surprise when an announcer started speaking with a distinctive Irish accent. Several commercials followed, mostly for establishments in Dublin! Yes, the office was listening to Sunshine 106.8, a radio station in Dublin, via the Internet. How cool is that. I would imagine this sort of thing will, or could become quite commonplace going forward. We live in a great time for programming options!

Sunshine 106.8, a radio station in Dublin, via the Internet, heard in my local doctor's office in Canada. (Courtesy: Sunshine 106l8 MF)

RFI, Radio Dandal Kura and Radio Ergo

Radio France International (RFI) is one of those radio stations that is a shadow of it's former self. Nevertheless, some very good programming continues to emanate from its headquarters in Paris. One very popular program from RFI is The Sound Kitchen, hosted by Susan Owensby. This is a really fun program heard every Saturday during the 0600-0700 English broadcast on 9675 kHz. The program is very user friendly, with quizzes and contests, and lots of social media activity. Susan is active on Facebook and other platforms. Check it out and be sure and take part in this interactive program. They are very interested in knowing who is listening, and where. Drop them a line at english.service@rfi.fr or by post to Susan Owensby, RFI – The Sound Kitchen, 80, rue Camille Desmoulins, 92130 Issy-les-Moulineaux, France

"It's easy to overlook the power of radio, when being hit by a fire hose of apps, websites, video and social media. But when you're out in the sticks, especially if there's crisis or unrest, radio saves lives." This is a quote from an article about Radio Dandal Kura, a radio station employed in the fight against Boko Haram in Africa. Radio Dandal Kura can be heard at 0500-0700 on 7415 kHz and from 0700-0800 UTC on 15480 kHz. Finally, check them out at around 1800-2100 UTC on 12050 kHz.

Radio Ergo is a reliable source of humanitarian information on air from 3-4pm each day on shortwave 16 Meter Band (17845 MHz) and via 15 local radio stations across Somalia. It provides, "valuable life-saving information and analysis to the Somali speaking population through programming on issues that include agriculture, health, education, conflict prevention, protection, gender equality, livelihoods and employment opportunities, and environmental protection. This diverse set of topics enables the Somali listeners to make better informed decisions in their communities and for their families."

Speaking of Radio Ergo, have you ever wondered what the qualifications were, to work at a station like this? They recently had a job posting up on their website for a Somali speaking producer. "The Somali Producer we are seeking will be a dynamic journalist to work as part of our production team in Nairobi. S/he will report on humanitarian issues, gather material from stringers, and produce and present high quality programming to serve the Somali audience.

Main responsibilities include Research and report on humanitarian issues; Conduct interviews; Liaise with local freelance correspondents; Record, edit, mix, and present original radio programming; Produce material for the website and social media sites; Contribute ideas for programme

The Sound Kitchen is heard Saturdays on Radio France International (Photo courtesy: RFI)

Uncle Bill's Melting Pot is an eclectic music show on WBCQ among others. (Photo courtesy Bill Tillford)

planning; Plan programme cycles; Work with the editor and production team on special projects.

"The ideal candidate should have a solid education (university degree an advantage); 3-5 years demonstrated experience in journalism; Excellent speaking and writing skills in Somali and English; Good knowledge of the Somali media and wider environment; Creativity, determination, curiosity; Ability to live and work in Kenya an advantage."

Unfortunately I don't speak Somali and relocating to Kenya is problematic, but it sounds like an interesting job indeed!

Isle of Music, Radio Rebelde, CRI and Radio Romania

Friend of the column Bill Tilford continues to produce two of the more fun shows on shortwave. If you love music check out From the Isle of Music, the best of Cuban music. This show will get your foot tapping for sure. There are four opportunities to listen on shortwave:

1. For Eastern Europe but audible well beyond the target area in all directions with 100Kw, Sunday 1500-1600 UTC on SpaceLine, 9400 KHz, from Kostinbrod, Bulgaria (1800-1900 MSK).

2. For the Americas and parts of Europe, Tuesday 0000-0100 UTC on WBCQ, 7490 KHz from Monticello, ME, USA (Monday 8-9PM EDT in the US).

3 & 4. For Europe and sometimes beyond, Tuesday 1900-2000 UTC and Saturday 1200-1300 on Channel 292, 6070 KHz from Rohrbach, Germany.

More on Cuban music in a moment. The other program that Bill hosts is called Uncle Bill's Melting Pot, a musical variety program that features everything from everywhere except music that you are probably familiar with. The show airs on WBCQ the Planet, 7490 KHz, Thursdays, from 2300-2330 UTC (7:00pm-7:30 pm EDT in the Americas). You never quite know what to expect on this entertaining show. It's well worth a listen.

And speaking of Cuba, great music can be heard via Radio Rebelde (5025 kHz) and Radio Habana Cuba itself. Check them both out as well.

China Radio International (CRI) is still probably the shortwave radio station that is most easily heard here in North America, with multiple frequencies and times. It carries an eclectic mix of factual and entertainment programs. Two that have caught my eye are relatively newish, in the last year or so. Chinese Theater is one, presenting dramas in the English language. It has always been hit and miss to catch this program—more often than not I stumble across it when I least expect it. I have been a fan of radio drama all my life and this is a nice diversion from the usual programming on CRI. Try mornings during the 1300 UTC hour. The other program one might want to check out is Alight On Literature. No it is not about burning books. It's a 25-minute "journey through the world of books and stories you won't miss." This literature series can be heard on weekend broadcasts. Try at 0100 UTC on 9580 kHz and at 1300 UTC on 9570 kHz.

Radio Romania International has always had interesting programs. I am rather fond of Traveler's Guide, which is a weekly travelogue from different regions of Romania. Depending on the show you tune into, one might hear about cruising tours of the Danube, Spa Tourism, Tourism in Transylvania and much more. Romania is both a modern and ancient nation and Traveler's Guide will take you to all the places of significance in the country, whether your interest is historical, or if one is interested in nature, or just fun in the sun. Check it out on Thursday transmissions. Listen at 2030 UTC on 9610 and 11850 kHz; at 0000 UTC on 7375 and 9730 kHz, and at 0300 UTC to the West Coast on 7375 and 9730 kHz.

Programming Notes

If You're Going To San Francisco

Fifty years ago, during a few short weeks in the summer

of 1967, thousands of hippies descended on San Francisco. It was a moment that changed popular culture forever.

The small suburb of Haight-Ashbury became a magnet for young people seeking sexual freedom, freedom to experiment with mind blowing drugs, to debate social and economic utopias and freedom to listen to new types of music. Peace and Love were the mantras of the day, and the Flower People embraced psychedelic kaftans, music and all things floral.

Marco Werman looks back at those hedonistic times through the music and recollections of people who were there 50 years ago and hears why, after 1967, the world was never quite the same place again. It's a Ruth Evans Production for BBC World Service, which will air Saturday, July 22, 2017 7-8 pm. While this program will be over by the time you read this, most BBC programs are archived online indefinitely. Check it out!

BBC Radio 4 Extra – The Lives of Harry Lime

One of my all time favorite movies is The Third Man, starring Orson Welles. In the film he plays a rather unsavory character named Harry Lime. After the success of the film, Welles took the character of Harry Lime to radio for a rather successful run. A few years ago when I had an Internet radio show, dedicated to Old Time Radio shows (The Radio Time Capsule), I often played episodes of this series. During August, on Mondays, BBC Radio 4 Extra, available online, will present an episode of this show each week, from the early 1950s. For example: Orson Welles returns to Radio 4 Extra for a third time, with five stories that have never been broadcast on the BBC.

"Harry Lime: the charming villain, the man who observed that 500 years of democracy and peace in Switzerland had only produced the cuckoo clock, and the man who was memorably chased by the police through the sewers of Vienna.

"In 'Blackmail Is A Nasty Word,' Harry is in 1947 Marseilles – 'a tough town, one of the toughest in the world'- with a sailing boat distributing cigarettes. Late one cold, foggy night, Harry encounters a dying gangster and does him a good turn."

This series is a real treat and I would encourage you to check it out via the Radio 4 Extra website. And, while there, have a look around at all the other great programs available. Classic comedies. Classic dramas. Radio 4 Extra is a treasure trove of old favorites.

"Decoding The News" is another program available on Mondays during the month of August. This one can be heard on BBC Radio 4. Another of the terrific radio networks of the BBC this one more resembles the BBC World Service we remember from yesteryear. The home of "factual" programming and some music and drama, it is a very informative and entertaining network.

Aditya Chakrabortty, a senior economics writer for *The Guardian* as well as BBC, decodes the news with his compendium of phrases and words that shape our society, economy and politics.

Traveler's Guide is the weekly travel program introducing the listener to the sights and sounds of Romania (Photo courtesy of Radio Romania International)

These are the strange, sometimes amusing but true tales by which the reigning ideas of our time came to be the words you hear at 8.10 am, on the drive time news and late-night current affairs discussions.

"A kind of guide to the Today program, what do words like 'narrative' and 'transparency' bandied around by politicians and experts mean? We'll find out where these terms came from, how they have changed and how are they shaping our world, in this unexpected journey from a simple word to an expose of modern life.

"Under investigation in the first programme: 'narrative'. On hand to find out when and why telling stories beyond the world of fiction became so important are former New Labour spin doctor Alastair Campbell, story guru Robert McKee, cognitive linguist George Lakoff and Clifford Soffield from the Oxford English Dictionary." Check out Radio 4 programming at **bbc.co.uk/radio4**

Johnnie Walker's Sounds Of The 70s

If you like the music of the 1970s, this is the program for you. During a recent episode, KC from KC & The Sunshine Band shared his 70s memories, including his international success with singles like Get Down Tonight and That's The Way I Like It. Lots of memories and great music played. Each week Johnnie delves into the BBC archive to unearth what was happening this week in music in the 70s, and another classic seven-inch single will be added to Johnnie's Jukebox. You can check out this and other great music shows at **bbc.co.uk/radio2**

Finally, back to Ireland for a moment. Traditionally the All-Ireland Hurling final has been heard on shortwave each September. I am trying to confirm that it will indeed be on the international bands again this year. Update to follow in September's column. Also it appears CKZN in Newfoundland, Canada has gone silent and may or may not return. Too bad, it was one of the last shortwave voices from Canada.

TSM

Amateur Radio Astronomy

By Stan Nelson KB5VL stan.nelson@RoswellMeteor.com

New Callisto Devices

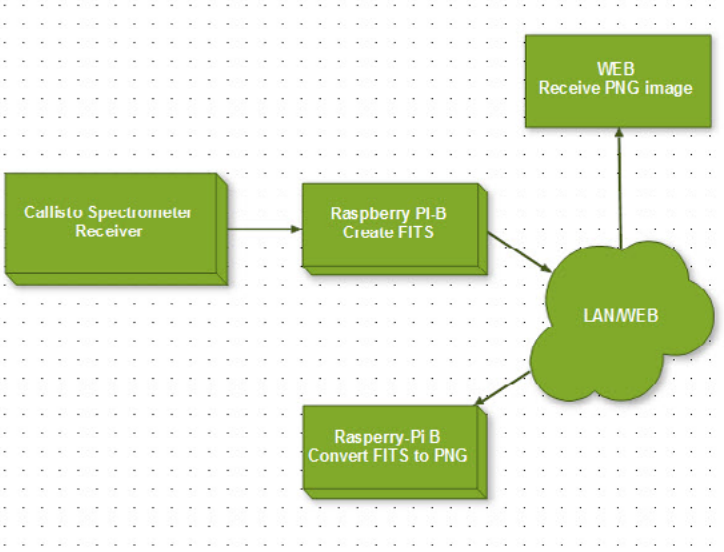
A recent article by Whit Reeve in the March/April edition of the Society of Amateur Radio Astronomers' Journal highlighted a new offering that is designed to be used by the Callisto radio spectrometer. The new add-on, a Raspberry-Pi B, runs with modified software that performs several of the functions normally run on a PC. I am always trying to find ways to save power by reducing the number of PCs running the radio astronomy projects that I've 'adopted.' I ordered one and plan to have it up and running by July. Check out his website at **www.Reeve.com** for complete details.

What the Raspberry Pi software does is listen to a Callisto receiver's serial port and converts the data to a Flexible Image Transport System (FITS) file and transmits it to the E-Callisto network. It also can send the FITS file to another network location. In my case, I send them to another Raspberry-Pi device that converts the FITS file into a flux density spectrogram as a PNG image. The FITS files are sent to the converter every 15 minutes and the flux density PNG image is created within 5 minutes after it is received. This Raspberry-Pi can also send the new PNG file via FTP to another location. The basic layout of how this works is seen at right.

The two Raspberry-Pi devices will replace one computer. They are fairly low powered and small. Whit Reeve's setup instructions are top-notch. But, you will need to tailor the Linux program for your setup using a remote access. I use the free 'Putty' terminal program on a Windows machine. It helps to be familiar with Linux commands, and particularly, using one of its text editors. The setup instructions contain all of the detail. The Callisto receiver, the Raspberry-Pi devices, and software are available through www.Reeve.com. You can download the documents related to each device. Details on the Callisto program can be found at **www.e-callisto.org**. I'm currently running three Callisto receivers and plan to convert them to the Raspberry-Pi solution, anticipating a significant reduction in power consumption.

SuperSID (Sudden Ionospheric Disturbance)

SuperSID is an inexpensive Very Low Frequency (VLF) monitoring project that listens to high-powered stations used for primarily submarine communications. The software that comes with the SuperSID receiver, a high-gain audio amplifier, logs the spectrum from 10 to 40 kHz. The principle station NML that I hear in Roswell is located in LaMour, North Dakota, transmitting on 25.2 kHz. The SuperSid software can monitor several stations, which are



Basic Callisto Raspberry Pi setup. (Courtesy of the author)

defined in the configuration file which looks like this:

```
[PARAMETERS]
site_name = RoswellMeteor
longitude = -104.515086142
latitude = 33.443819303

utc_offset = -7
time_zone = MDT
monitor_id = 00455

audio_sampling_rate = 96000

log_interval = 5
log_type = filtered
scaling_factor = 1.0

automatic_upload = Yes
ftp_server = sid-ftp.stanford.edu
ftp_directory = /incoming/SuperSID/

number_of_stations = 3

[STATION_1]
call_sign = NAA
color = r
frequency = 24000

[STATION_2]
```

The author's 4-foot VLF loop (left) and close-up of cross-arm that holds the wires. (Courtesy of the author)

```
call_sign = NLK
color = b
frequency = 24800

[STATION_3]
call_sign = NML
color = g
frequency = 25200
```

I usually monitor 6 stations but show only three in the list above.

The SuperSID project is supported by S.A.R.A. and the data you generate is uploaded daily to Stanford's website at: **sid.stanford.edu/database-browser/** where the charts are posted.

One of the challenges of working with the frequencies in the VLF end of the spectrum is interference and 60 Hz hum. I was experiencing more lately with my 4-foot loop located not too far from power lines. I decided to move the loop to a tree to get further away from power lines. See picture of my loop above.

I deviated from the original construction plans for the end of the cross arm that hold the wires by cutting a slot in the tee fitting. It worked well and keeps the wires in place.

I used 73-ohm coax to feed the loop into the house. I noticed the signal was even worse with lots of interference. After some experimenting, I noticed the SuperSID receiver has the BNC connector's shell isolated from the round metal enclosure. The amplifier is also insulated from the enclosure. I remembered that I was feeding the coax through a Type-F lightning protector that I had dutifully grounded to a ground rod. I removed the ground and alas the noise level was dramatically reduced and the signal from NLM was now a strong peak. That will need a bit more investigation for a better fix but if you attempt to hook up a loop keep that in mind. There are more suggestions in the SuperSid document, which you can download from: **http://solar-center.stanford.edu/SID/DOC**

See below left for current a spectrum window taken while SuperSid is running.

You can find the project information at: **solar-center.stanford.edu/SID/sidmonitor/**. It's a great starter project to learn about the influence of the Sun on our ionosphere. For more information and to order the SuperSID monitor go to **http://www.radio-astronomy.org/node/210**.

Revisiting Spectrograph

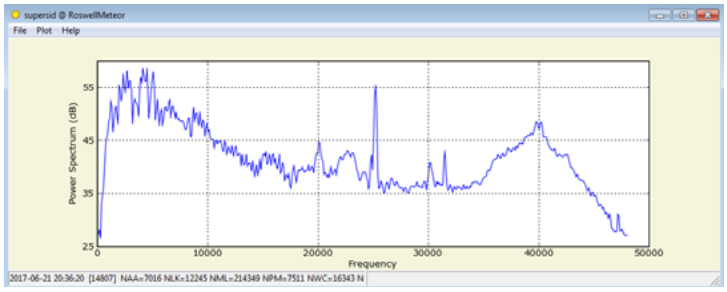
Spectrograph by *Radio-Sky Publishing* has been around for a number of years and is now at version 2.8.30 as I write this in June 2017. The early versions featured the ability to display a spectrum width of nearly 30 MHz using RF-Space's SDR-14. As other receivers became available features have been added. The latest version supports the R820T USB receiver in an easier to install update that has an RTLW button that brings up the setup screen.

The image on the next page shows the Spectrograph running and scanning the 20 to 27 MHz segment.

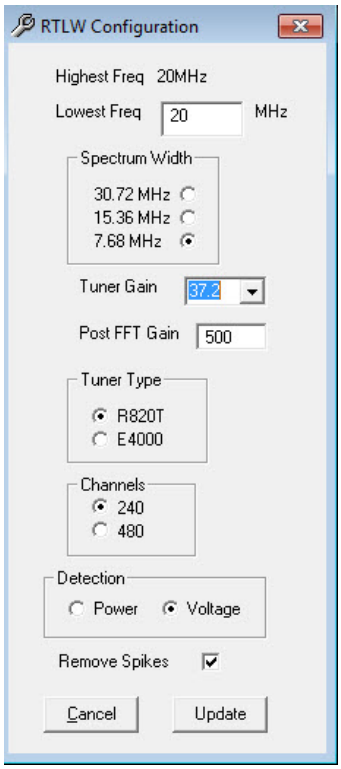
The RTLW setup is quite easy (see above). Once you make changes after stopping Spectrograph, you won't see the upper and lower frequency change until you restart. The USB (Software Defined Radio) SDR is a NooElec and is advertised to operate from approximately 25 to 1700 MHz. In the example above I have it set for 20 MHz. It runs but may not be as sensitive down there. They do make an up-converter called Ham-It-Up that takes it down to 100 kHz that sells for $42 (NESDR RTL2832 + R820T2). The NooElec is selling for about $22.

When you restart Spectrograph, the RTLW Configuration window flashes up and is reading the configuration file that was created with the previous window for the RTLW. If all goes well, it will show 'reading samples now.'

SuperSID spectrum chart. (Courtesy of the author)



R820T USB receiver in action. (Courtesy of the author)



RTLW setup window. (Courtesy of the Author)

When I mention 'goes well' there is one problem I often ran into installing Spectrograph on Windows 7. I am still not sure why but it probably relates to permissions. I've tried most of the tricks. I was using the default install to the c:\Program Files (86) directory (see below). I finally tried putting it into a directory called c:/tools/spectrograph and all works fine. What usually happened was an error message that said it couldn't find SolarSweeper.exe which is in a subdirectory. Anyway, it works fine when installed in c:/tools/spectrograph.

The picture above shows a limiter that I have begun using on my radio

Limiter (Courtesy of the author)

astronomy receivers. It is from MiniCircuits. This 50-ohm broadband coaxial RF limiter, model VLM-33W-2W-S+, is designed to operate from 0.2 to 3000 MHz. It has a low insertion loss of 0.4 dB. The spec sheets indicate the limiter has a limiting range of +12 to +33 dBm or converted, 0.15 to 3.16 watts. They cost $50 each, which is twice as expensive as the SDR in this case. But the SDR# and Airplay devices cost over a $100 and worth protecting. And maybe keep out strong RF out of the USB ports! Another good practice is to install ferrite filters on the USB cables near the PC.

TWEETS…for Radio Astronomy

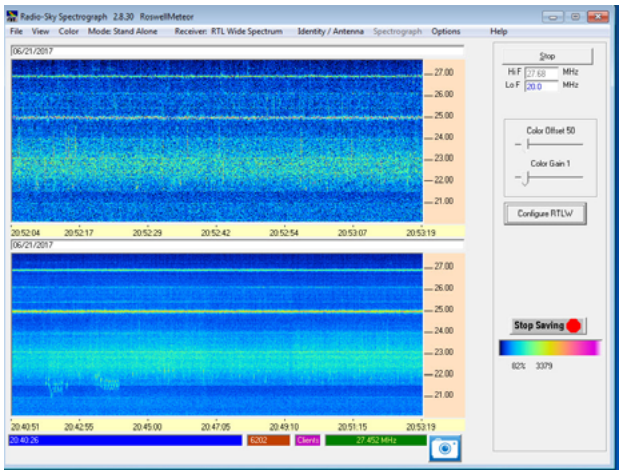
You might find these Tweets related to radio astronomy interesting.
Jim Sky, @radiosky
Green Bank Telescope, @GrnBnkTelescope
NRAO, @theNRAO

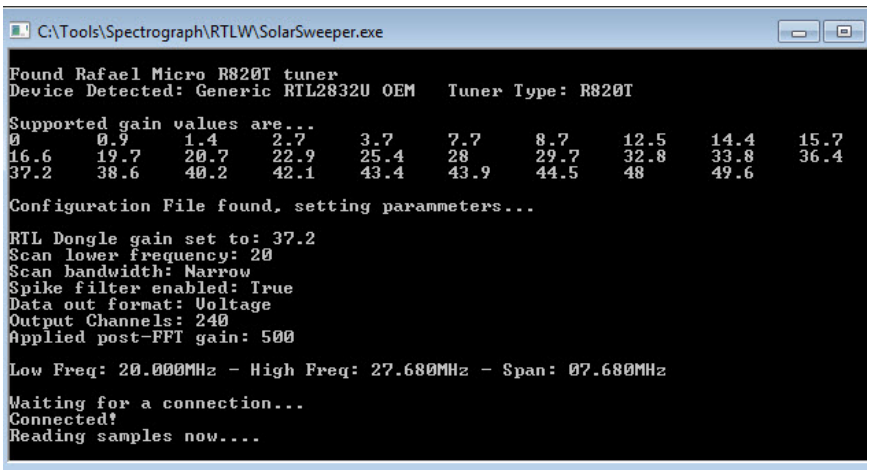
Solar Eclipse – August 21, 2017

A total eclipse will occur on August 21, 2017 beginning its US crossing in Oregon at 2017 UT. Complete details can be found at **www.eclipse2017.nasa.gov**. I plan to watch it visually here in New Mexico though not a total eclipse this far south. Weather is always a factor so it's nice to have a plan B. VLF signals could be monitored if you're set up for WWVB, a 60 kHz carrier broadcast from Boulder, Colorado. There is a day/night variation at sunup and sundown usually associated with distant reception. It would be interesting to see what a total eclipse would do. I do monitor WWVB here in Roswell, New Mexico, and upload the charts using SkyPipe II. You can view them at **www.roswellmeteor.com/wwvb/skypipedata.htm**. If you get setup with SuperSid perhaps some activity related to the solar eclipse could be captured. The Callisto users have discussed monitoring for any effect the eclipse may have on their solar monitoring at VHF-UHF frequencies. The 'Handbook of Geophysics and the Space Environment,' Air Force Geophysics Laboratory, 1985, states on page 10-28 regarding Long-Range VLF/LF propagation: 'Very low and low frequency (VLF/LF) waves are reflected from the lowest regions of the ionosphere (the D region during daylight and the lower E region at night), and apart from the sunrise and sunset periods, exhibit propagation characteristics that are very stable in both phase and amplitude.' The book goes on to discuss various prediction methods. If you want to dig a bit deeper, you can obtain a free copy online at **http://www.cnofs.org/Handbook_of_Geophysics_1985/Handbook.pdf**.

TSM

Below left: Spectrograph showing 20-27 MHz segment. Below right: Installing spectrograph (Courtesy of the author)





The Longwave Zone

By Kevin O'Hern Carey WB2QMY **wb2qmy@arrl.net**

630-Meter Band Plan Taking Shape

This proposed band plan for the 630 meter band was recently presented in The ARRL Letter. (Courtesy: ARRL)

My first introduction to band planning actually came before I became a ham. It was in the mid-1970s when I was a 12-year old CB enthusiast. My father was an avid CBer well before the big "craze" hit, and in those days, there were only 23 authorized channels for Class D Citizens Band, the vast majority of which were used for conventional AM communications. Two channels in particular—16 and 17—were used here in the Rochester, New York, area for Single Sideband (SSB) communications. Channel 16 was used for lower sideband (LSB) and Channel 17 was used for upper sideband (USB). Channel 16 seemed to have the most activity in our region.

With rapidly growing use of the band came conflict between AM and SSB operators. We knew little about the SSB world at that time, but those operators seemed to have a legitimate case in wanting a pair of channels devoted to SSB use; AM and SSB are incompatible modes on CB. My father enjoyed studying people and what motivates them. He was also skilled at building relationships with diverse groups, and getting them to talk with each other. (Wow, could we ever use that today!) It was in this vein that he invited prominent representatives of local AM and SSB operators to a "summit" of sorts held right at our home.

It was quite an experience for me as a kid to see all of these people come together to talk and work out solutions. The SSB operators made their case first, explaining what their corner of the activity was all about. They explained in basic terms about how their emissions were narrower than AM, and that they didn't require the entire band, but wanted two channels they could count on for use of SSB.

AM operators also expressed their views, and after discussions, there seemed to be a general consensus that a more organized use of the band was to everyone's benefit. An agreement was reached to respect each other's needs for channels, and these representatives went home to pass the word on to their fellow operators. There was a noticeable improvement on the band, and in the rare event that someone caused problems, another person was there to gently remind them of the gentleman's agreement that existed.

This brings us to band planning for the soon-to-be opened 630-meter band (472-479 kHz). A 7 kHz wide band might even be called a "sliver band" by some, but whatever the case, such a narrow slice of spectrum will definitely need careful planning if it is to be used to its fullest potential.

The ARRL Letter for July 6, 2017, announced a proposed band plan offered by ARRL 630-Meter Experiment Coordinator Fritz Raab W1FR, and LF/VLF enthusiast John Langridge KB5NJD. Once U.S. radio amateurs are granted access to 630 meters, Raab plans to move stations operating under the blanket WD2XSH FCC Experimental (Part 5) license to 461-472 kHz. According to Raab, "This will clear the amateur frequencies, while allowing the experimenters to run unattended propagation beacons without using the limited bandwidth that will be available to amateurs. The new 630-meter band will have a very limited amount of spectrum (7 kHz)." We will continue to follow developments on this band plan and share the results here in TLZ.

Portable Picker-Upper Update

Last month we covered a simple ferrite rod/wire-assisted antenna built by Carl Schmidt WA8ZTZ (MI) that can be coupled to any portable longwave receiver. This was met with great interest by many readers because LW portables, while plentiful, usually have less than desirable sensitivity on longwave when using just their internal ferrite rod antenna. Carl reported dramatic results when using the new antenna, which turned his Tecsun PL-600 portable into a

respectable DX tool.

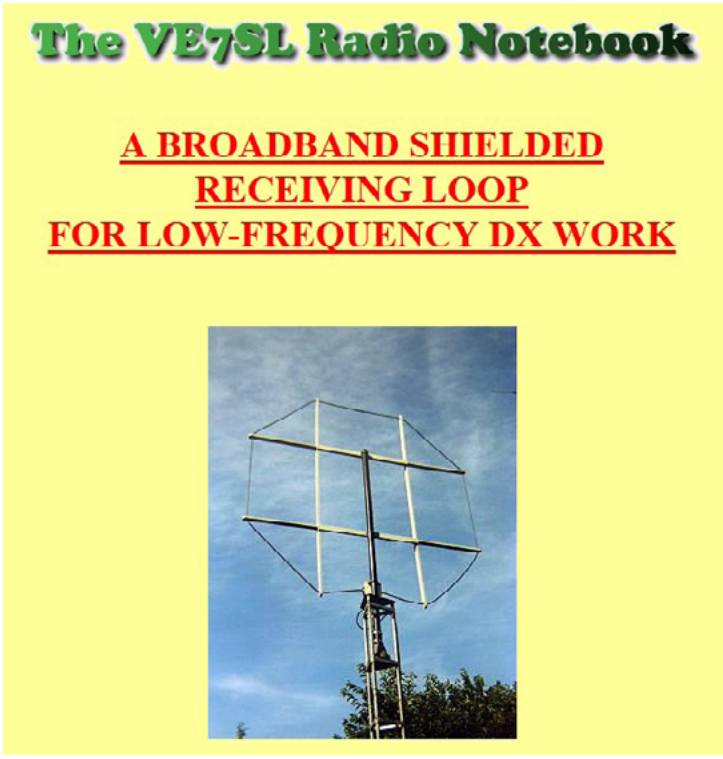
Carl offers the following additional information for those looking to use this antenna in the field: "I just cruised through the NDB band with my Tecsun PL-600 using my loopstick antenna that was written up in your July 2017 TLZ column. I hooked it up to just 50 feet of wire strung through some trees only 5 to 10 feet above the ground. I did an experiment with the grounding, comparing a driven 4-foot piece of ¾-inch galvanized pipe to just a corkscrew style dog stake twisted about a foot into the ground. There was absolutely no difference between grounds, the simple dog stake worked just as well as the driven pipe. I should mention that the soil conductivity around here is pretty good... clay soil on the side of a moraine facing Lake St. Clair. Other locations, especially those with sandy soil may not be so good and more effort will be required to get a good ground. On the other hand, if you live on a salt bog or marsh the soil conductivity will be excellent.

"In all, I logged 34 NDBs, of which only five could be heard using just the internal antenna in the PL-600. The loopstick with a simple wire antenna with a quick dog stake ground accounted for 29 more beacons. No real DX, all were 'local' with some out to about 250-300 miles, but not bad for daytime listening. Obviously, the little bit of effort it takes to deploy the antenna and ground is well worth it. Note that the ground is necessary. Many beacons could not be heard without it. My experience has been that portable radios all need some help in the antenna department on all bands, but especially on LW. However, with a proper antenna, a seemingly deaf portable can be turned into an effective receiver. This is good information to know because the selection of new tabletop communications receivers is very limited, whereas the market is loaded with portables, a number of which have LW capability."

Mailbag

Robbie Spain KD7CJO (WY): "Hi Kevin, I hope all is well there. While DXing the basement band around 04:30 local time this morning, I heard a data signal on 517 kHz! Very interesting coming across that! Wonder if you`ve heard of anything like that? I heard PNA as well. But that was about it for this morning. 73, and best DX to you."

Hello Robbie, and great to hear from you. There's a good chance what you were hearing was the Coast Guard's NAVTEX service which has a carrier frequency of 518 kHz. Try loading one of the many software programs that allow you to decode these signals right off the air, and let me know what you are seeing. For more info on NAVTEX than you ever wanted to know, check out the paper by Alan Gale G4TMV that can be read at **http://www.bclswl.it/wp-content/documents/navtex_guide.pdf**. You can pretty much disregard the info on standalone hardware-based decoders at this link, as most everyone now uses a software program on their PC to read NAVTEX. It couldn't be easier, as you just hook your receiver's audio to the PC's microphone input, tune



Looking for ways to get on one of the experimenter bands, or to build a longwave receiving antenna? Check out Steve McDonald's excellent Radio Notebook page at http://qsl.net/ve7sl/

the signal in on USB mode, and start reading the bulletins. Please keep us posted on what you're able to hear in Wyoming.

Don Tomkinson KPC6NDB (CA) wrote to address reports I received that beacon PBT/338 kHz (Red Bluff, CA) may have been heard briefly within the last year. "Hi Kevin, PBT has not been back on the air. PBT was a very strong nightly regular here, sharing the frequency and offsets with another very strong nightly regular, RYN over in AZ. You can imagine two strong identifiers with the same offsets/cycle mixing with each other. Everyone out here on the west coast would quickly notice if that happened again! We are always sad to see another NDB decommissioned."

Selected NDB Loggings

Our contributors for this month are Dick Palmer W7KAM (MO), and Dan Srebnick K2DLS (NJ). In addition to NDB logs, I am pleased to see some new loggings of 630-meter experimental stations in this month's column Additional loggings of experimental stations or others are welcome. This column is not restricted to just aviation beacons, and never has been. Any longwave signals below 535 kHz are welcome!

kHz	ID	Location	By
206	RA	Racine, WI	R.P. (MO)
208	YSK	Sanikiluaq, NU	R.P. (MO)
212	YGX	Gillam, MB	R.P. (MO)
218	YUY	Noranda, QC	R.P. (MO)

223	YKA	Kamloops, BC	R.P. (MO)
227	GW	Auburn, IN	R.P. (MO)
227	SQ	Connersville, IN	R.P. (MO)
230	VG	Vermilion, AB	R.P. (MO)
233	BR	Brandon, MB	R.P. (MO)
243	YVB	Bonaventure, QC	R.P. (MO)
253	GB	Marshall , MN	R.P. (MO)
257	XE	Saskatoon, SK	R.P. (MO)
261	2H	Lebel-sur-Quevillon, QC	R.P. (MO)
263	GR	Grand Rapids, MI	R.P. (MO)
264	ZPB	Sachigo Lake, ON	R.P. (MO)
275	RF	Rockford, IL	R.P. (MO)
290	TYV	Jacksonville, AR	R.P. (MO)
293	FBY	Fairbury, NE	R.P. (MO)
299	HW	Wilmington, OH	R.P. (MO)
305	OI	South Sioux City, NE	R.P. (MO)
309	GPI	Guapi, CLM	R.P. (MO)
315	AT	Dayton, OH	R.P. (MO)
320	TY	Tyler, TX	R.P. (MO)
323	EBS	Webster City, IA	R.P. (MO)
323	OUK	Calhoun, GA	R.P. (MO)
326	PKZ	Pensacola, FL	R.P. (MO)
329	CH	Charleston, SC	R.P. (MO)
335	BK	Brookings, SD	R.P. (MO)
335	BV	Batesville, AR	R.P. (MO)
341	CQN	Chattanooga, TN	R.P. (MO)
344	TKH	Tallulah, LA	R.P. (MO)
345	GF	Grand Forks, ND	R.P. (MO)
359	SDY	Sidney, MT	R.P. (MO)
362	SUR	Fitzgerald, GA	R.P. (MO)
379	LRR	Oakdale, LA	R.P. (MO)
380	UMB	Milledgeville, GA	R.P. (MO)
385	TKL	Tikal/Flores, GTM	R.P. (MO)
391	EFW	Jefferson, IA	R.P. (MO)
400	AHQ	Wahoo, NE	R.P. (MO)
414	CSS	Washington, OH	R.P. (MO)
420	TU	Tupelo, MS	R.P. (MO)
432	IZN	Lincolnton, NC	R.P. (MO)

630-Meter WSPR Loggings

kHz	ID	Location	By
474.2	WH2XXP	Tonopah, AZ	D.S. (NJ)
474.2	WH2XXC	Hollywood, MD	D.S. (NJ)
474.2	WI2XQU	Flat Rock, NC	D.S. (NJ)
474.2	WH2XZO	Inman, SC	D.S. (NJ)
474.2	VE3CIQ	Carlton Place, ON	D.S. (NJ)
474.2	WG2XKA	Pittsford, VT	D.S. (NJ)
474.2	WG2XXM	Shawnee, OK	D.S. (NJ)
474.2	C6ABO	Bahamas	D.S. (NJ)

*Note: Above loggings are WSPR experimental stations copied using WSJT software (**https://physics.princeton.edu/pulsar/k1jt/wspr.html**)*

Contributor's Information

R.P. (MO) Richard D. Palmer (MO), Foristell, MO
Receiver: ICOM R-75
Antenna: Clifton Z1501 active, base up 25 feet (7.62m), 10-foot (3.05m) whip
Audio Processors: Timewave DSP-599zx and a Ratzlaff 9Hz in series
R.P. Comments: I logged 276 beacons this month, 9 less than last month. Conditions were poor again this month, with no new ones for the year. Lots of static, and band noise limited my listening time.

D.S. (NJ): Dan Srebnick K2DLS, Aberdeen, NJ. Receiver: Kenwood TS-2000, Antenna: 132' Inverted L with four radials.
Comments: I've been doing some WSPR monitoring using WSJT-X on 630 meters. Arizona isn't bad for mid-July. I received a QSL card from WH2XGP in WA for a coast-to-coast reception in May!

Longwave Link of the month:

http://www.radioworld.com/news-and-business/0002/longwave-broadcasting-retains-listeners/335387

This article from Radio World magazine explores the enduring relevance of longwave broadcasting even today for listeners in Europe (and for DXers elsewhere).

TSM

Adventures in Radio Restoration

By Rich Post KB8TAD **kb8tad@gmail.com**

Heathkit HG-10B VFO

As noted for the past two columns, the Heathkit DX-60 transmitter and the matching HR-10 receiver were marketed primarily to the Novice amateur radio operator. A Novice license at the time was only valid for one year. It was expected that the Novice would increase both his or her code speed and knowledge during that year enabling passing of the exam and code speed requirement for the General license.

A Novice was "rock-bound," limited to use of crystal control. After passing the requirements for the General, most Novices looked forward to the ease of tuning their transmitters to all the new frequency privileges afforded by the General license. That required a VFO, short for Variable Frequency Oscillator. For those who had operated with the DX-60 and HR-10, the next logical Heathkit was the matching HG-10. The HG-10 was introduced at a price of $34.95 but the price increased even though the DX-60 and HR-10 stayed at $79.95 each, even through the "B" versions. The HG-10 remained at $34.95 through 1967, but the HG-10B, which was essentially just a cosmetic upgrade, was priced at $37.95 in 1968, $39.95 in 1969, and $44.95 in 1971.

The HG-10 uses a dual section 6CH8 vacuum tube as both a series-tuned Clapp oscillator and a cathode-follower buffer. A 0B2 is used as voltage regulator. Output is 5 volts RMS open circuit. The VFO requires an external source of power for both filament and B+. The DX-60 transmitter can supply both at its accessory socket. The 0B2 regulates the voltage at a nominal value of 108 volts, but the available DX-60 B+ is about 335 under load, requiring a 10K-ohm 10 watt resistor to soak up the 227 volt difference at a current draw of about 25 mA. Although the HG-10 is designed to match the DX-60, instructions for connecting it to an earlier Heathkit, the DX-40, are included in the manual[1]. The two transmitters differ in the type of keying with the DX-60 using grid-block keying and the DX-40 using cathode keying. Since the HG-10 makes provision for either method of keying, other transmitters that use those keying types can also be used with the VFO.

In addition to the 80 through 10 meter bands covered by the DX-60 and HR-10, the HG-10 can also be used for the 6 or 2-meter ham bands. A range of 8.333 to 9 MHz is provided for 6 meters with the typical transmitter doubling and then tripling those frequencies for 6 times VFO output. A range of 8 to 8.222 MHz is provided for 2-meter operation at 18 times VFO frequency. Of course, drift is also multiplied by the same amounts on those bands. In the October 1963 review of the VFO in *QST* magazine, it was reported that Edward Tilton W1HDQ gave it "the acid test" operating on VHF at up to 432 MHz, 54 times VFO fundamental, which was well beyond what Heath intended. The article reports, "Our observations were that the temperature compensation was extremely good, and the quality of the note was acceptable... Even with 54 times frequency multiplication, on 432 MHz, there was little drift and the note was only slightly fuzzy."

All Heathkit station; DX-60, HR-10B, HG-10B and HS-1661 speaker. (KB8TAD Photo)

The HG-10 and its "B" paint upgrade were well regarded in their day. Drake, which never developed a matching VFO for its 2-NT transmitter, specifically lists the HG-10B as one of two VFOs in its 2-NT manual as "quite suitable for use with the 2-NT". Heath issued one bulletin regarding the HG-10 and that was to replace the plate RF choke, which was 28 uH with a 350 uH choke in order to solve a problem of hum on 40 meters. My manual for the HG-10B shows the choke at the proper 350 uH.

Given its positive review and acceptance, the major failing with the HG-10 appeared to be that it did not have

HG-10B ad in the 1968 Heathkit catalog. (KB8TAD collection)

its own power supply and must thus rely on power from the transmitter. Different dropping resistors would be required depending upon which transmitter provided power. That resistor would of course heat up the VFO. Power could also come from a custom power supply built or supplied by the user. Heath included a schematic and specifications for a possible homebrew power supply in its HG-10 and HG-10B manuals.

First Looks Inside

This HG-10B was very well designed and constructed. Mechanical construction of the VFO uses a relatively heavy steel chassis and base plate for stability. There were no tubular capacitors inside. It was also obvious the builder followed the Heath instructions closely with very clean soldering and connections. It also looked nearly new inside with no corrosion spots as had plagued the DX-60 and HR-10B. I was ready to power it up but wanted to test and calibrate it independently of the DX-60.

An Alternate Heathkit Power Supply

I studied that Heath-suggested homebrew power supply schematic, thinking to build a homebrew version when it suddenly dawned on me that the schematic looked awfully familiar. It was nearly identical to that of the Heathkit EF-1, a little power supply kit that Heath included with its course on "How to Use and Understand Your Vacuum Tube Voltmeter". Those are often seen at hamfests but draw little demand. I have found the little supplies to be very handy and every time I see one at a hamfest for a few dollars, it has come

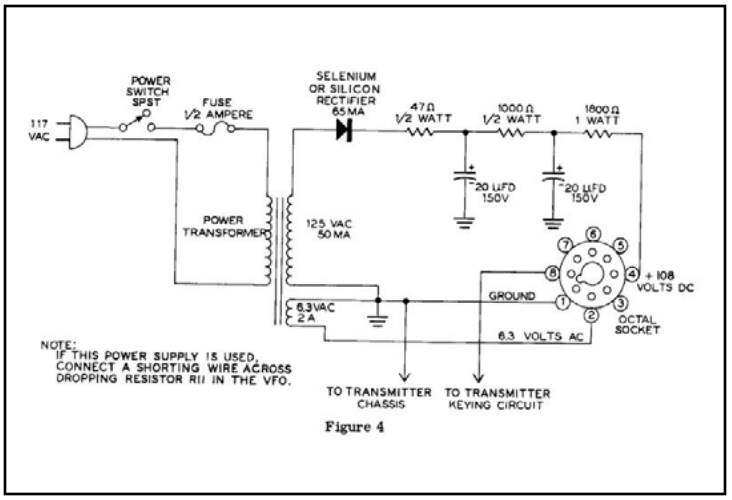


Figure 4

HG-10 power supply schematic as suggested by Heath in the manual. (KB8TAD collection)

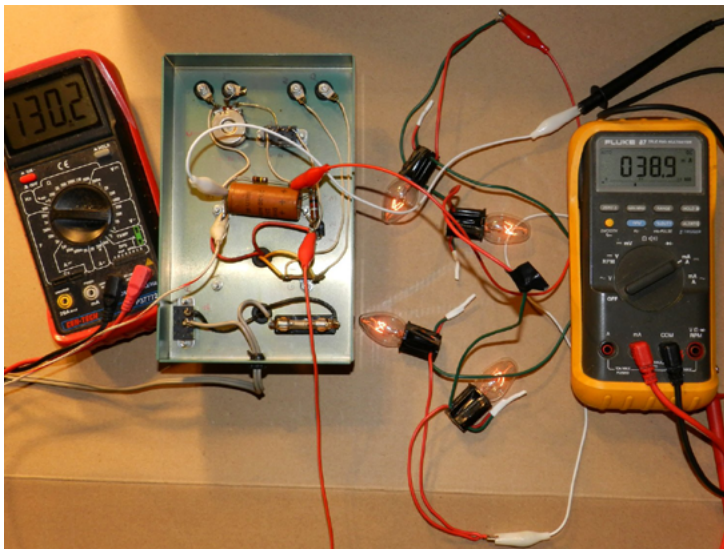
home with me. I have collected four thus far, using one to power a 1930s homebrew regenerative receiver copied from a 1937 ARRL Handbook. Another was used for the B+ power for a farm set[2], adding a rectifier, capacitor and an LM-317 regulator to the 6.3 volts AC filament output in order to also supply the DC filament needs for what was normally a battery-powered tube radio. Could the little EF-1 handle the load of the HG-10? About the only schematic difference[3] between the EF-1 and the suggested power supply was the use of an 1800-ohm one-watt resistor in place of the potentiometer voltage control in the EF-1.

I load-tested the EF-1 by using series pairs of C-7 incandescent night-lights. Concerned about the power handling capacity of the transformer, I measured its AC secondary while loading the DC output. With 120 volts line in, the no-load secondary measured at 149 volts. With a 24 mA load, the secondary dropped to 136. At 35 mA, voltage dropped to 132 and at 52 mA, 126 volts. Note that the Heath-suggested power supply transformer was rated at 50 mA at 125 volts as shown on the schematic. That seemed to match the little transformer in the EF-1. My suspicion is that the Heath EF-1 transformer was a standard stock item used in some other Heathkits and was likely used at Heathkit itself as a proof-of-concept or test-bed prior to publishing the suggested homebrew schematic in the manual.

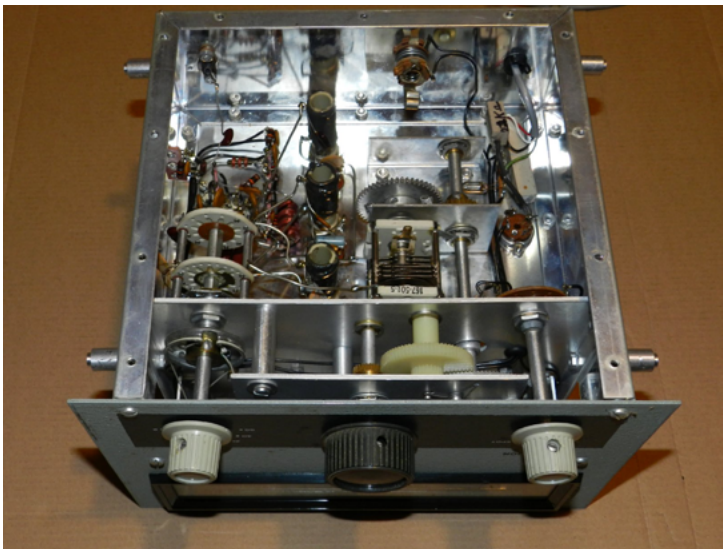
According to the specifications, the VFO only requires 25 mA at 108 volts. With the 0B2 inside, that regulator would require some current depending upon the actual input voltage. After my load tests, I suspected that the EF-1 could quite easily handle the power needs of the VFO assuming a proper resistor for the 0B2 voltage drop.

Powering the HG-10 without a Transmitter

The first thing I did was to hook up an octal female socket with wire pigtails that were color-coded to match those of the HG-10, red for B+, white for 6.3 VAC filament and pilot lights, green for transmitter keying, and a couple



Load testing the EF-1 power supply, 39 mA output with 130 volts AC at the transformer secondary. (KB8TAD photo)



HG-10B showing a nearly pristine chassis. The extra parallel resistor is in place. (KB8TAD photo)

of black wires tied together for filament ground, keying ground and B-. As expected, the HG-10 pilot lights lit when I hooked it up to the EF-1. However, the 0B2 did not show any characteristic glow. A quick check of B+ showed 170 volts at the EF-1, very lightly loaded.

Was the VFO not drawing power? A quick check with my hand-held frequency counter near the 6CH8 oscillator/buffer showed not only that it was working but actually quite accurate. The stop on the low side of 80 meters was very close to 3.500 MHz. With the VFO working on frequency, I suspected that the 10K-ohm resistor designed to drop the B+ voltage from the transmitter was dropping the voltage below the striking point of the 0B2, the voltage needed to ionize the gas inside the regulator tube before regulation takes place. A failure of the 0B2 was possible, but in my experience that is a rare occurrence. Checking further revealed that the voltage at the 0B2 was 114.

I shunted a clip lead across the 10K resistor and powered the EF-1 again, this time ramping up with my Variac while watching the current draw and the voltage at the 0B2. The 0B2 voltage climbed to about 122 and then dropped to its nominal 108 as expected after the tube fired. According to the tube data sheet, that 122-volt striking voltage point was well within the expected range although in complete darkness that voltage could be higher. Taking a cue from the 1800-ohm series resistor in Heath's suggested schematic, I tacked a 2200-ohm resistor across the existing 10K-ohm for a combined parallel resistance of 1800 ohms.

The EF-1 easily handled the load at a voltage output of 140 and the 0B2 as well as the rest of the VFO was working well with the result. That extra resistor could be easily removed later if I chose to power the VFO directly from the DX-60, but for now the HG-10 was not dependent upon transmitter voltage. The manual includes a nonograph for selecting a proper series resistor and its power handling capability to match other B+ source voltages that might be used with the HG-10.

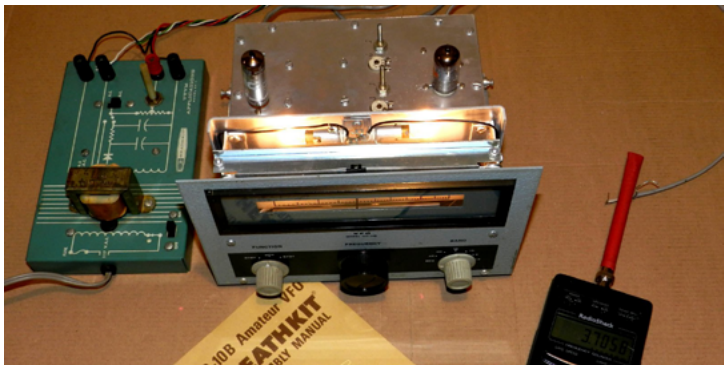
Calibration

The calibration of the HG-10 calls for an accurate receiver to listen to the expected frequencies of the VFO. With a modern digitally tuned receiver, that is now a lot easier than in the tube-era of the 1960s. It can also be accomplished using a good frequency counter. Checking the output with a counter after a proper warm up and the bottom plate back in place revealed that the 80 and 40 meter ranges were close, just needing a bit of tweaking for accuracy but the 6 and 2-meter positions appeared to have never been aligned. It was the HG-10's VHF capability that was my major reason for independently powering the VFO. I was impressed by the QST review which had given it high marks for its performance on VHF and saw it as an option for use on the local 6 meter AM net or similar fun on 2 meters.

As in most alignments, the coil adjustments and the corresponding trimmer capacitor adjustments interact and must be successively repeated until there is no more improvement. The HG-10 has three alignment coils and four trimmer caps. It pays to follow the sequence of alignment steps as listed in the manual. One coil and trimmer adjust the 80-meter range. The 40-meter coil and trimmer, once aligned, are also used harmonically for 20, 15 and 10.

According to the manual, the dial scale is not quite harmonically lined up in order to account for wiring capacitance. A separate coil and trimmer are used for the 6-meter range with two additional trimmers to tweak the 2-meter range. I found the trimmer caps to be very tight, needing a firm initial twist with a screwdriver to loosen them. They also moved the frequency by quite a bit relative to a slight movement.

One of the two caps for the 2-meter band reacted to the presence of the screwdriver as if it were added capacitance but required too much torque to use my alignment tool. I ended up just lifting the screwdriver after each slight adjustment and actually doing a bit of quick mental math relative



Getting ready to align the HG-10B using a frequency counter. . (KB8TAD photo)

HG-10B on the 6-meter range. The 8.400 MHz multiplied by six is intended for a transmitter for 50.4 MHz. (KB8TAD photo)

to how much the screwdriver was shifting the frequency. Adjusting the two-meter range might try one's patience a bit in the absence of a frequency counter.

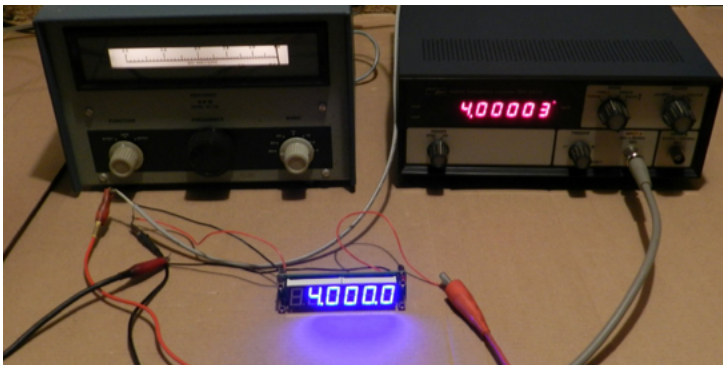
An Asian Frequency Counter Module Visits the VFO

A ten dollar (including shipping) "Made in China" frequency counter module with bright blue LEDs arrived in my mailbox the day before I did the alignment so I checked to see how well it might work with the Heath VFO. As usual with such modules there were no instructions. Two red and black wire-pigtail connectors were included in the package.

Since one side had a 5-volt surface mount regulator chip, I knew that was the power input side, needing a bit more than 5 volts. The other identical connector and wire pair was for counter input. After I determined that the black wire was the counter input and the red wire was to be connected to coax ground, it tracked very well with my little hand-held "daily driver" Radio Shack counter on its most precise range and refreshed a lot faster.

I then connected it in parallel with my very accurate Heathkit SM-2420 counter. It equaled that counter within its one-tenth of a kHz resolution but caused the SM-2420 counter to double on certain frequencies, probably because the little module has a couple of back-to-back diodes across the input to limit voltage, thus likely acting as a mixer.

Isolating the module input with an additional small capacitor should provide more isolation. I suspect that the little counter module will come in handy for monitoring the HG-10B output especially during warm-up. The documentation



Testing a low-cost frequency counter module with the HG-10B. Power for the counter is supplied by a 9-volt battery. (KB8TAD photo)

for the counter is not needed for simple frequency measurement but can be found on the Net[4].

Performance

Once warmed up, the Heathkit impressed me as much as it had the *QST* reviewer. For a tube-era analog VFO, it was solid, stable and sturdy—an impressive performer for the price in the 1960s. I can see why Drake recommended it to go with their 2NT.

It was time to pull the entire Heathkit package—DX-60, HR-10B, and HG-10B—together for some fun. If you used that very popular combination in the 1960s, tell us your story. Comments and questions? **kb8tad@gmail.com**

Notes:

(1) **http://www.rsp-italy.it/Electronics/Kits/index.htm** Click on "Heathkit HG-10 VFO Manual"

(2) For more on powering Farm sets, see the *TSM* June and July 2015 issues of this column: "First Look at a Zenith 5K037 'Farm' Set" and "AC Power and a Dial Cover for the Zenith 5K037."

(3) **http://www.rsp-italy.it/Electronics/Kits/index.htm** Click on "Heathkit EF-1 power supply" for the schematic

(4) Chinese documentation for the frequency counter module has disappeared from the web, but Jay Moore has a very informative YouTube clip on the piece complete with a written list of instructions for programming it with an upper or lower IF frequency offset for use with typical older single-conversion radios." **https://www.youtube.com/watch?v=1_neC5Z_wEg**

Antenna Connections

By Dan Farber AC0LW **ac0lw@att.net**

Stealth: A Philosophy and a Methodology

Welcome back, my friends. Everyone enjoying the summer? We've been baking here in Kansas City, in between torrential rains….on the other hand, there's been a few days and nights with good propagation on some of the HF bands, mainly 30 and 20 meters…

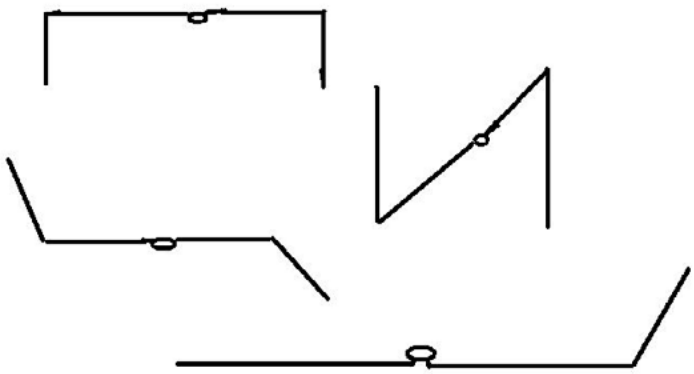
We've discussed stealthy antennas before, but I feel it's a good time to look at this issue again. The great injustice against amateur radio operators, who have passed a test and received a Federally issued license but are constrained from having visible antennas where they live, is to me totally unacceptable. For that matter, it is a great wrong against shortwave listeners too. Aren't the airways free to all? Did we not have the freedom for many years to erect and use antennas? Now they are considered an eyesore, while satellite dishes dot the landscape like an alien mushroom infestation. Apparently these particular antennas aren't ugly. To-MAY-to, to-MAH-to.

Anyway, we can't knock out the injustice at one fell swoop, but we can fight back. No visible antennas, say the Antenna Gestapo? Very well, mein Fuhrer, then we'll use antennas you can't see. We're going to use our licenses, and our equipment, and listen to distant broadcasters, and communicate with each other, and you can't stop us.

Using stealth accepts as a given that results are liable to be less spectacular than those attained by someone with a big beam on a tower, or a big dipole high in the air. That's not the point. The point is that stealth allows us to operate at all.

Opinions vary, but to my way of thinking, any operation is better than none. In fact, stealth antenna operation is even a developable skill to take pride in, like the QRP operators who stubbornly fight on to acquire WAS and DXCC with five watts or less, knowing full well that they are up against big guns running a kilowatt. "Anyone can do it with a thousand watts," they sniff disdainfully. It takes real skill to pull it off with very low power. In the same way, stealth antenna mode forces us to maximize our results, and maybe learn a few tricks about antennas in the process.

I know I must at times sound like a salesman for the companies that make tuners, but realize that stealth, by its nature, often results in some really crazy antenna impedances. Fed with a single wire or with a balanced line such as twin-lead or window-line, these random antenna loads are often, even usually, harnessable with the use of a tuner. If you must use coaxial cable for one reason or another,



A dipole can be bent in various ways to fit into an attic or upper floor room. (Drawing by author)

be aware that you'll need some sort of matching device at the antenna end to make any non-resonant antenna a workable proposition—and stealth often cannot accommodate a resonant antenna. There are situations where we can obtain "stealthy resonance," of course. A number of operators, banned from using outdoor antennas, have put up anywhere from one to a whole farm of full-sized VHF and/or UHF Yagis in their attic, another example of the trade-off between frequency and size (try to fit a 20-meter Yagi in an attic.) The point is, they ARE able to feed these resonant antennas with coaxial cable.

To my thinking, stealthy antennas fall into two broad categories: Actually Hidden, and Hidden in Plain Sight.

Ich sehe kein Antennen, Herr Leutnant!

The easiest way to beat the Antenna Gestapo is by way of true concealment. Stories are legion of antennas installed in an attic, or an upper floor room. It seems counter-intuitive; won't being confined indoors seriously degrade an antenna's performance? Well, maybe, but not for the instinctively found reason that the roof and walls of the house are in the way. If you think about it, cell phones and portable radios routinely work inside of a building. The real cause of reduced efficiency for indoor antennas is the same as that affecting outdoor antennas; reduced size, and limited height above ground. To give this viewpoint a bit of perspective,

One front corner of my loop on the roof. The green wire all but disappears against the green shingles. (Author's photo)

realize that these limitations also affect many of us who can freely use outdoor antennas. At my QTH, for example, the very tallest trees available are 50 feet or less in height, and the greatest distance between usable trees on my property is about 90 feet. Therefore, at all frequencies below about 30 meters, any antenna I put up between two trees will be less than a half-wave above ground, and less than a half-wave long. But I don't let it feel like a limitation. Instead, it becomes a challenge: Work the nation and the world at the lower end of HF with small, low antennas. The stealth operator needs to keep a similar positive mindset. Remember: ANY operation is better than NO operation.

Another advantage to indoor antennas is that they are impervious to the effects of weather (well, if your roof doesn't leak). All the careful waterproofing and wind proofing we do to make outdoor antennas able to survive suddenly becomes a non-issue when you move everything inside. When it's howling wind and rain outside, the operator with indoor antennas is free to work on them in dry and safe comfort. And to find them, the Antenna Gestapo must force their way into the house—one reason I keep a .45 automatic under my pillow.

One common trick with indoor antennas is to squeeze or otherwise deform a conventional antenna so that it will fit in an attic, or on a ceiling. An old and still popular method is to fold a conventional dipole into a Z, or other shape, so that it will fit a reduced space. Yes, deforming the straight line of the dipole does affect its performance, as well as its impedance; experimentation is in order here. My own results, as well as the results of many others, indicate that the degradation in pattern and impedance of such a "bent" dipole is not serious, if the dipole's overall length is a half wavelength. Of course, such a bent dipole can be fed with balanced line and a tuner; now we're stealth multi-banding! (Recall that such a balanced line-and-tuner-fed dipole generally works well on all frequencies where the dipole's length is at least a quarter wavelength.)

One of my readers sent me this shot of his stealthy DX500 active antenna, on the back fence with an LED solar-powered lamp on top. (From author's photo archive)

I have related before the tale of my days living in a large apartment that was the entire second floor of a building. I was able to put up a dipole nearly 40 feet long on the ceiling of two rooms and a connecting hallway. Fed with ladder line and a tuner, this humble—but invisible to the outer world—antenna gave me access to all HF above 7 MHz! Just outside the window near my operating position, a chimney made of 4-inch metal tubing vented the first floor furnace. I ran a short piece of #12 insulated wire out the window, screwed it to a convenient spot on the chimney, and fed the assembly as a random wire. That night, I worked four states on 160 meters, a dozen on 80 meters…and several European and African entities on 40 meters. The outer world was never the wiser—but I had full access to HF with these two very humble, and very well hidden, antennas. The chimney wasn't exactly indoors, which leads us to our next set of observations…Hidden In Plain Sight.

Ich sehe immer noch keinen Antennen, Herr Leutnant!

Outdoor stealth, or as I have called it here, Hidden in Plain Sight, is the real art form when it comes to stealth antennas. There are two basic subsets of this notion. We can endeavor to make an outdoor antenna invisible; or we can put an antenna that doesn't look like an antenna in plain sight.

The simplest way to produce invisibility is to make a wire antenna using either very small gauge wire, or insulated wire with a jacket color that "blends in." Really small wire, like #30, is all but impossible to see against the sky and other background when in midair; it's just too small. The trade-off here is that the wind blowing can break this antenna rather easily, so you may have to accept that you'll be putting the antenna back up from time to time. Realize that birds can't see it either, and may break the wire by flying into it. The obvious advantage is that, with sufficient room and the right

28 gauge enameled copper magnet wire. A 507-foot roll is $7.60 at Amazon.com and can make a very big, nearly invisible, though somewhat, fragile loop antenna. (Courtesy: Amazon.com)

This MFJ 929 tuner ($200)is very versatile. It lets you connect several antennas to one rig and can remember settings for all antennas and bands you program. (Courtesy: Universal Radio)

trees, a full-sized yet invisible dipole or other wire antenna can be erected this way.

Color camouflage from insulated wire is a bit more iffy, and not always intuitive. You might expect blue wire jacket to be hard to see against a blue sky; actually, blue wire jacket stands out fairly well. Surprisingly, the color that usually disappears best is black! The height at which you can install this antenna will affect this camouflage issue more than anything; down very low, just about any color of wire insulation is pretty visible. Another tradeoff: Insulated wire is bound to be much more resistant to breakage than the tiny #30 enameled wire.

When we swing over to antennas that don't look like antennas, a world of possibilities open up to us. Like many, I have fed metal rain gutter as a random wire and had very good results. Obviously, height and perimeter length will likely have a strong effect on how good results are. I was lucky enough to be living in a large three-story house at the time; the second floor rain gutter, right outside the window at my third floor operating position, was a complete loop around the house—a perimeter of over 120 feet—and about 25 feet above the ground. Fed as a random wire, this made for a very effective antenna; my very first QSO with it was with a station in Slovenia, on 20 meters. From all that I have heard and read, first floor gutters work well enough too.

What's that? You say your newer home has plastic guttering? Even better! Simply lay insulated wire in the gutter, where no one can see it. If your gutter goes all the way around the house, you can even make a loop, and for small, hidden antennas, a horizontal loop is mighty hard to beat for performance.

Live in a high rise? Try hanging a length of wire out a window, with a small, soft weight like a child's plastic ball at the end to keep it hanging down. If you are on the tenth floor, and hang 70 feet of wire out the window, the end, with ball attached, will be over 30 feet above the ground, which will make it very hard to spot. Fed as a random wire, this should be a very effective performer.

Another way to make an invisible loop forms my main antenna right now. Green #12 wire, laid right on my green shingles, follows the roof perimeter to make a loop 105 feet long. You can hardly see it even if you know where to look! Fed with a short piece of window line from my tuner, it gives me every band between 1.8 and 54 MHz.

There are many other ways to create an antenna in plain sight. One reader pointed out to me that a conventional three-wire extension cord, complete with female receptacle on one end, can be hung out a back window on an upper floor, and the receptacle end allowed to dangle just above the ground. The neighbors see the cord hanging there every day, although they never see anyone plugging into it. After a while, this humble extension cord becomes a normal part of the scenery. Meanwhile, you're top-feeding it as a random wire!

Another reader—they both asked me if they could remain anonymous—sent me this picture of his stealthy SWL antenna. Living in a subdivision with a "No Outside Antennas" restriction, he mounted a RF Systems DX500 active antenna on his backyard fence, and mounted a sun powered garden lamp on top as camouflage. "I have received no complaints," he told me cheerfully.

These few examples should whet your appetite. There are many ways to create a stealthy antenna, limited only by your imagination. Realize that your average Antenna Gestapo trooper is a tank-minded muscle brain intent on upholding the Fuhrer's directives to round up any lawbreakers. He's not bright enough to find a hidden antenna, or to recognize one in plain sight that doesn't look like an antenna.

That's all for this month. Join me here in September for more antenna adventures. Stay safe, and happy operating!

TSM

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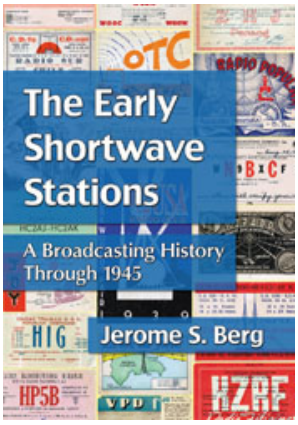

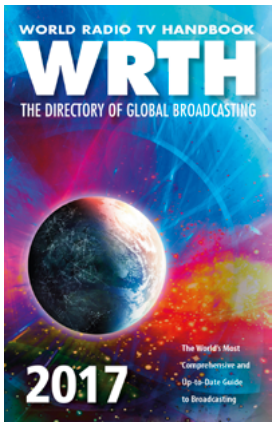

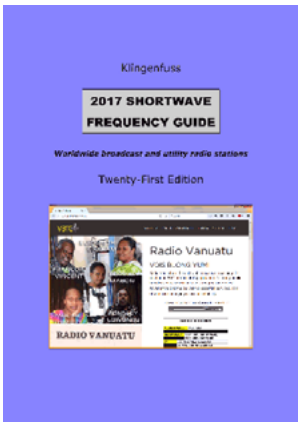

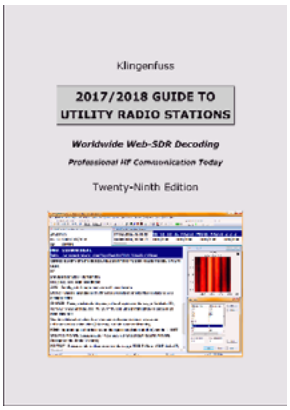

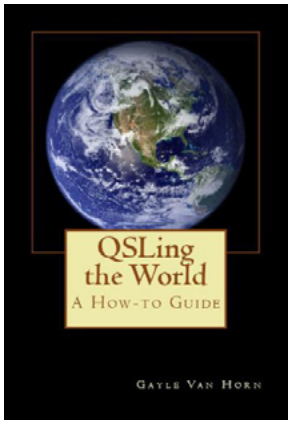

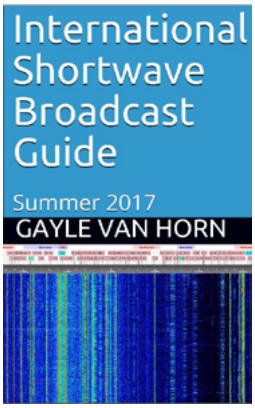

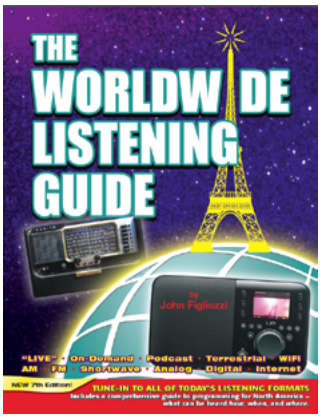

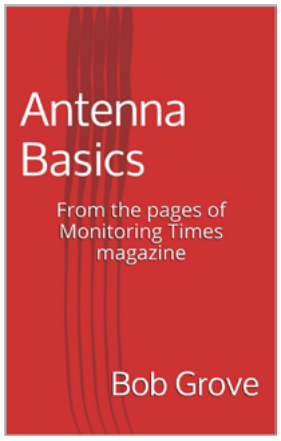

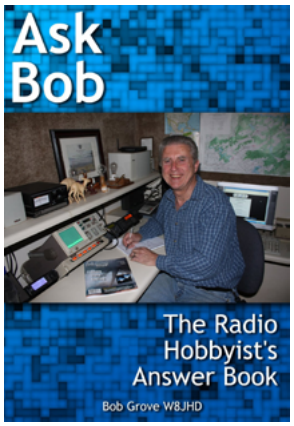

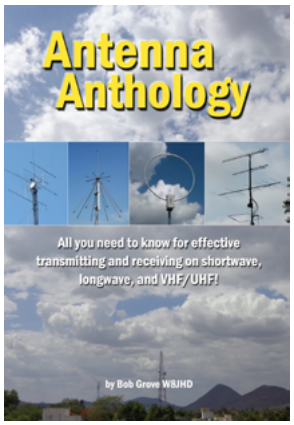

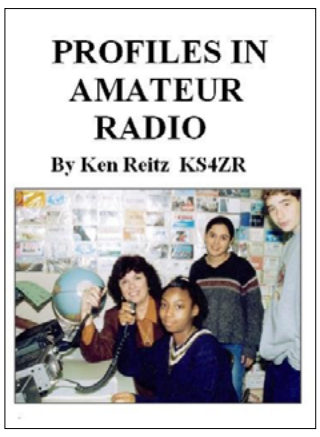

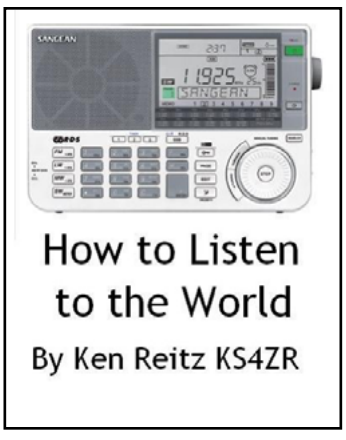

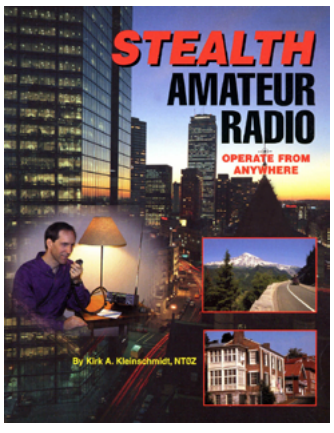

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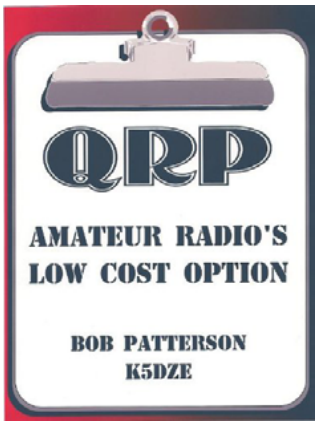

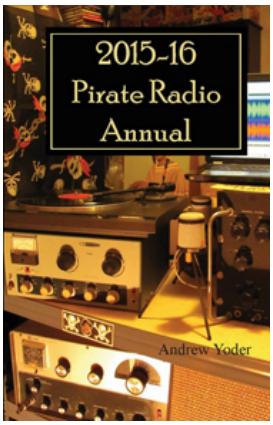

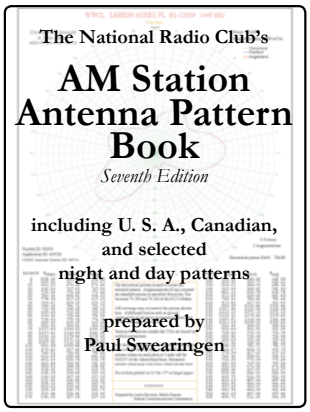

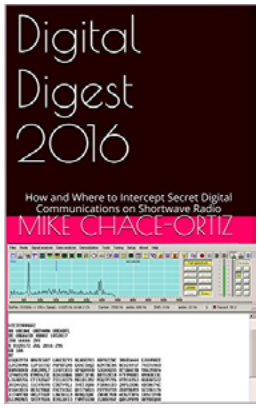

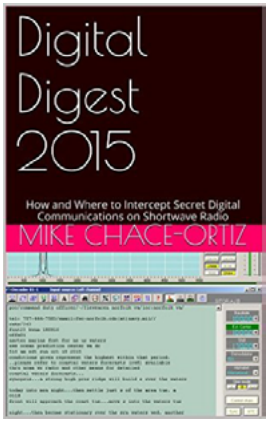

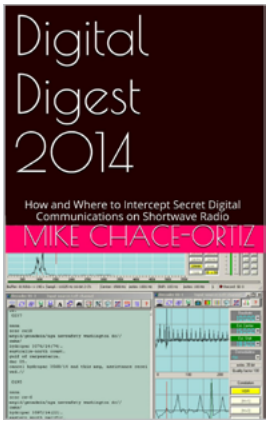

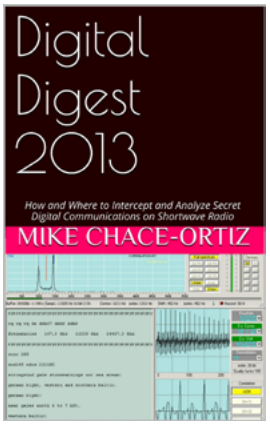

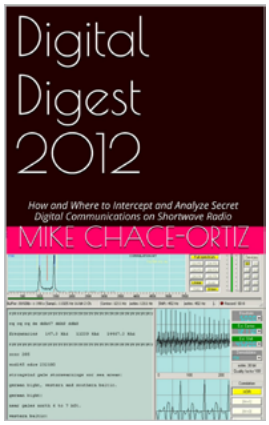

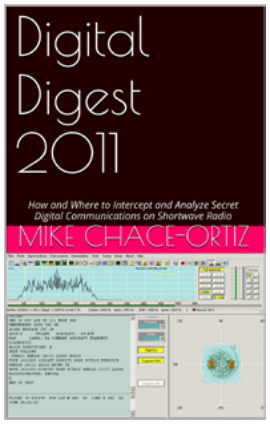

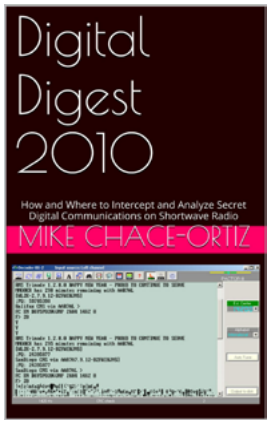

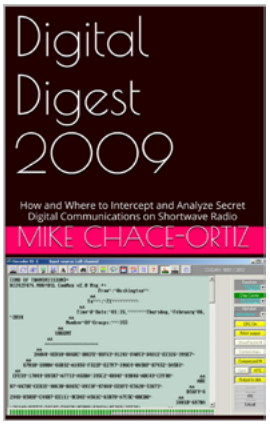

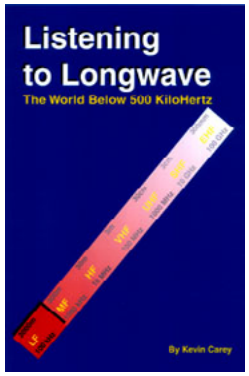

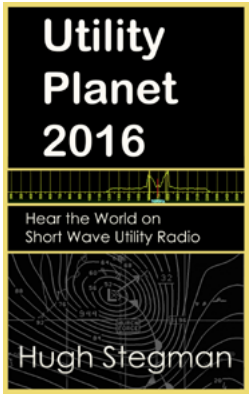

About Us

The Spectrum Monitor Writers' Group

The Spectrum Monitor is edited and published by Ken Reitz KS4ZR, former managing editor, features editor, columnist and feature writer for *Monitoring Times*. Former feature writer and columnist for *Satellite Times*, *Satellite Entertainment Guide*, *Satellite Orbit*, *Dish Entertainment Guide, Direct Guide;* contributing editor on personal electronics for *Consumers Digest*. Author of the Kindle e-books "How to Listen to the World" and "Profiles in Amateur Radio." E-mail: editor@thespectrummonitor.com

The Spectrum Monitor Writers' Group consists of former columnists, editors and writers for *Monitoring Times* and *Popular Communications* magazines. Below, in alphabetical order, are the columnists, their amateur radio call signs, the name of their column in *The Spectrum Monitor,* a brief bio and their websites and contact information.

Keith Baker KB1SF/VA3KSF, "Amateur Radio Satellites"

Past president and currently treasurer of the Radio Amateur Satellite Corporation (AMSAT). Freelance writer and photographer on amateur space telecommunications since 1993. Columnist and feature writer for *Monitoring Times*, *The Canadian Amateur* and the *AMSAT Journal*. kb1sf@hotmail.com **www.kb1sf.com**

Kevin O'Hern Carey WB2QMY, "The Longwave Zone"

Reporting on radio's lower extremes, where wavelengths can be measured in miles, and extending to the start of the AM broadcast band. Since 1991, editor of "Below 500 kHz" column for *Monitoring Times*. Author of "Listening to Longwave" (http://www.universal-radio.com/catalog/books/0024u.html). This link also includes information for ordering his CD, "VLF RADIO!," a narrated tour of the longwave band from 0 to 530 kHz, with actual recordings of longwave stations. E-mail: wb2qmy@arrl.net

Mike Chace-Ortiz AB1TZ/G6DHU "Digital HF: Intercept and Analyze"

Author of the *Monitoring Times* "Digital Digest" column since 1997, which follows the habits o f embassies, aid organizations, intelligence and military HF users, the digital data systems they use, and how to decode, breakdown and identify their traffic. **www.chace-ortiz.org/umc**

Dan Farber AC0LW, "Antenna Connections"

Monitoring Times antenna columnist 2009-2013. Building ham and SWL antennas for over 40 years. E-mail: ac0lw@att.net.

Richard Fisher KI6SN

A veteran journalist with a 35-year career in daily newspapers, and an amateur radio operator living in Riverside, California, Richard has been an editor and writer for *Popular Communications, WorldRadio Online*, and *CQ Amateur Radio* magazines. Among his previous responsibilities have been the monthly "Emergency Communications," "Trail-Friendly Radio" and "Easy Does It" columns for *CQ*, and has written for several QRP publications, including *QRP Quarterly* and *QRPp* magazine. An avid homebrewer, he is a co-founder of The Adventure Radio Society. Write to him at ki6sn@aol.com.

Tomas Hood NW7US, "Radio Propagation"

An Extra Class operator since 1990, Tomas enjoys CW and digital modes on all HF bands. He is a contributing editor to *CQ Amateur Radio*, the former *Popular Communications* and *CQ VHF* magazines, an ARRL publication on QRP communications, and *Monitoring Times*. He runs the Space Weather and RadioPropagation Center at **http://SunSpotWatch.com**. Web site: **http://nw7us.us** Twitter: **https://twitter.com/NW7US**.

Kirk Kleinschmidt NT0Z, "Amateur Radio Insight"

Amateur radio operator since 1977 at age 15. Author of "Stealth Amateur Radio." Former editor, "ARRL Handbook," former *QST* magazine assistant managing editor, columnist and feature writer for several radio-related magazines, technical editor for "Ham Radio for Dummies," wrote "On the Ham Bands" column and numerous feature articles for *Monitoring Times* since 2009. Web site: **www.stealthamateur.com**. E-mail: nt0z@stealthamateur.com

Joe Lynch N6CL, "VHF and Above"

Currently Director of Religious Education for the Army at West Point, New York. He holds a Doctor of Ministry, Master of Divinity, an MBA and is an adjunct instructor for four colleges and universities and a retired United Methodist minister. He served as the editor of *CQ VHF* magazine for 12 years and the VHF editor for *CQ* magazine for 22 years.

Stan Nelson KB5VL, "Amateur Radio Astronomy"

Amateur radio operator since 1960. Retired after 40-plus years involved in mobile communications/electronics/computers/automation. Active in radio astronomy for over twenty years, specializing in meteor monitoring. He wrote the "Amateur Radio Astronomy" column for *Monitoring Times* since 2010. A member of the Society of Amateur Radio Astronomers (SARA). **www.RoswellMeteor.com**. E-mail: Stan.Nelson@RoswellMeteor.com

Chris Parris, "Federal Wavelengths"

Broadcast television engineer, avid scanner and shortwave listener, freelance writer on federal radio communications since 2004, wrote the "Fed Files" column for *Monitoring Times*. h**ttp://thefedfiles.com http://mt-fedfiles.blogspot.com** Twitter: @TheFedFiles E-mail: cparris@thefedfiles.com

Rich Post KB8TAD, "Adventures in Radio Restorations"

As a teenager Rich Post repaired radios and TV sets. He passed the exam for a First Class FCC license when he was told he needed one to repair his CB. He later received his amateur radio license as KB8TAD. Rich now holds a University Emeritus title having retired from Ohio University as Assistant Dean and Director of the Instructional Media and Technology Services. One of his hobbies is collecting and restoring "boat anchors." He maintains the web site Boat Anchor Pix at **www.ohio.edu/people/postr/bapix**.

Tony Roper, "Military Air and Naval Reception"

A Civil Air Traffic Controller in the UK as well as previously being in ATC in the Royal Air Force, totaling 25 years experience. He has worked as a part-time aviation photographer/writer and has been published worldwide. He also provides photos and research for IHS Jane's, principally Jane's Fighting Ships. His photography website is **www.rogdabbit.co.u**k and his blog is **http://planesandstuff.wordpress.com**

Cory GB Sickles WA3UVV, "Digitally Speaking"

First licensed as a Novice over 40 years ago, he enjoys exploring various facets of amateur radio, from the latest state of the art technologies, to the elegant simplicity found with a one-tube transmitter and straight key. He has an extensive background with computers and likes to restore 8, 12 and 16-bit classics from the 1970s. He owns a television production company and creates series programming, as well as marketing and training videos. wa3uvv@gmail.com.

Hugh Stegman NV6H, "Utility Planet"

Longtime DXer and writer on non-broadcast shortwave utility radio. Former "Utility World" columnist for *Monitoring Times* magazine for more than ten years. Web site: **www.ominous-valve.com/uteworld.html** Blog: **http://mt-utility.blogspot.com** /email: mtutilityworld@gmail.com Twitter: @UtilityPlanet

Dan Veeneman, "Scanning America"

Software developer and satellite communications engineer writing about scanners and public service radio reception for *Monitoring Times* for 17 years. Web site: **www.signalharbor.com** E-mail: dan@signalharbor.com

Ron Walsh VE3GO, "Maritime Monitoring"

Retired career teacher, former president of the Canadian Amateur Radio Federation (now the Radio Amateurs of Canada), retired ship's officer, licensed captain, "Boats" columnist and maritime feature writer for *Monitoring Times* for eight years. Avid photographer of ships and race cars. E-mail: marinecolumn @gmail.com.

Fred Waterer, "The Shortwave Listener"

Former "Programming Spotlight" columnist for *Monitoring Times*. Radio addict since 1969, freelance columnist since 1986. Fascinated by radio programming and history. E-mail: programming_matters@yahoo.ca