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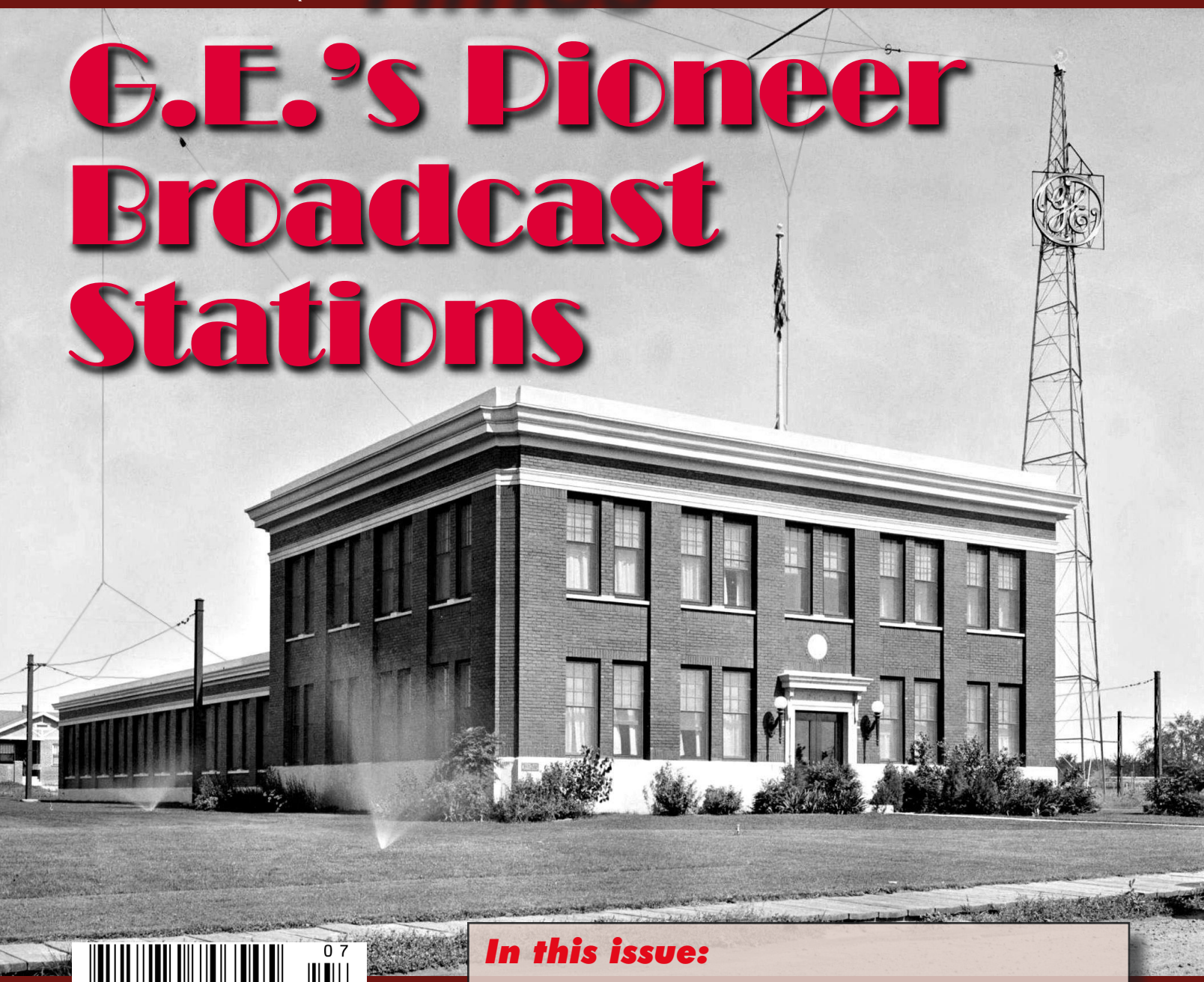
G.E.'s Pioneer Broadcast Stations



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In this issue:

- Mining the Minors for AM DX
- Antennas for VHF/UHF Reception
- MT Reviews: Signal Hound Spectrum Analyzer

AR5001D Wide Coverage Professional Grade Communications Receiver

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The AR5001D delivers amazing performance in terms of accuracy, sensitivity and speed.

Available in both professional and consumer versions, the AR5001D features wide frequency coverage from 40 KHz to 3.15 GHz, with no interruptions. Developed to meet the monitoring needs of security professionals and government agencies, the AR5001D can be controlled through a PC running Windows XP or higher. Up to three channels can be monitored simultaneously. Fast Fourier Transform algorithms provide a very fast and high level of signal processing, allowing the receiver to scan through large frequency segments quickly and accurately. AR5001D standard features include storage of up to 2000 frequencies, 45 MHz IF digital signal processing, direct digital sampling, a high performance analog RF front-end, a DDS local oscillator and advanced signal detection capabilities which can detect hidden transmitters. With its popular analog signal meter and large easy-to-read digital spectrum display, the AR5001D is destined to become the choice of federal, state and local law enforcement agencies, the military, emergency managers, diplomatic service, news-gathering operations, and home monitoring enthusiasts.*

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- Fast Fourier Transform algorithms
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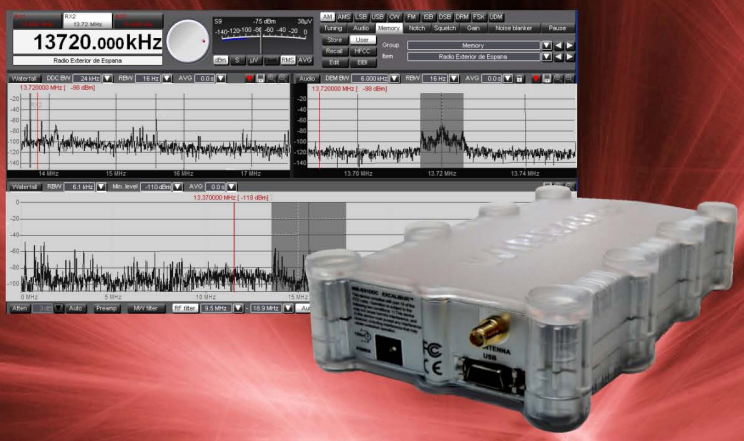


WinRadio Excalibur Pro

WRTH AWARDS 2012
WinRadio Excalibur Pro
BEST SDR

towards settled measurement protocols but it is abundantly clear that the Excalibur Pro is better than anything we have hitherto encountered. To be able to connect a full-size 6/7MHz dipole to a receiver on an autumn evening and be able to observe the sideband sets of individual broadcasters down to virtually the receiver's noise floor is – to put it mildly – an unusual position for a reviewer to find himself in! Certainly the Excalibur Pro was not remotely troubled at any time by anything our various antennas could throw at it.

CONCLUSION

The Excalibur Pro is the best SDR we have used – in some ways it is the best receiver we have used regardless of the underlying architecture –

www.wrth.com

Overall rating ★★★★★

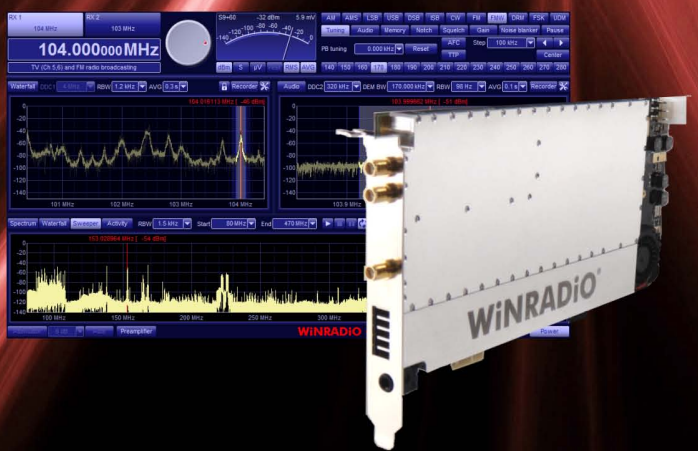
review

Mike Richards takes a look at the WiNRADiO G39DDC Excelsior, a receiver that some might consider the best software defined radio currently available.

If there's one thing that is likely to be at the top of a radio enthusiast's wish list, it's a system that can find signals quickly. The WiNRADiO G39DDC Excelsior certainly has the ability to do this and it must be something close to a dream receiver.

summary

w, the WiNRADiO G39DDC Excelsior is a stunning receiver and a dream for ew, I have only really covered the most interesting aspects of its performan



FIRST LOOK

MT Takes a Look at the Latest Tech

By Bob Grove, W8JHD

This is the most amazing receiver I've ever encountered. It employs the latest proven SDR architecture, operates well beyond the spectral range that most of us would ever think of trying to hear, and demodulates all conventional modes.

I ordinarily find something to complain about in my reviews, but trying to find something I don't like about the G39DDCe has left me at a loss, and that's a gain for this winner.

We have lots of good gear. Take a look:

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WiNRADiO® by RADIXON®: Great receivers ahead of their time.℠

Monitoring Times

Vol. 31 No. 7 July 2012

G.E.'s Trio of Pioneer Broadcast Stations 8

By John Schneider W9FGH

Ninety years ago General Electric launched WGY-AM Schenectady, New York, which received only the fortieth such broadcast license issued. With a power output of 1,500 watts, the most powerful station on the air at that time, the signal was fed into a flat-top antenna suspended between two 150 foot towers. Reports came in from listeners as far away as Cuba, England and Alaska.

GE used its station to develop new broadcast hardware, including transmitters and microphones, and pioneered live radio drama, the first play receiving 2,000 letters from fans. By Christmas of that year a special play brought in 6,000 pieces of mail.

GE went on to build two more stations, one in Denver and one in Oakland, California, that it believed would enable it to cover the entire country with quality entertainment each evening. John Schneider explains the evolution of these stations, which saw transmitter levels reaching 200 kW, and how the concept eventually led to the creation of the NBC Radio Network.

On Our Cover

KOA-AM, Denver's first transmitter building between 1934-1940 was located between 14th and Krameria Streets on the east side of Denver. It is a near duplicate of the KGO-AM building in Oakland, California. (Photo credit: Denver Public Library, Western History Collection, Harry Mellon Rhoads, 1880 or 81-1975, Rh-104)

C O N T E N T S

R E V I E W S

MT XPRESS

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Subscription Questions?
belinda@grove-ent.com

Owners
Bob and Judy Grove
judy@grove-ent.com

Publisher
Bob Grove, W8JHD
bobgrove@monitoringtimes.com

Managing Editor
Rachel Baughn, KE4OPD
editor@monitoringtimes.com

Assistant and Reviews Editor
Larry Van Horn, N5FPW
larryvanhorn@monitoringtimes.com

Features Editor
Ken Reitz
kenreitz@monitoringtimes.com

Art Director
Bill Grove

Advertising Services
Judy Grove
(828) 837-9200
judy@grove-ent.com

Table Of Contents

You may contact any MT staff writer by email by combining their ***first and last name @ monitoringtimes.com.*** By postal mail, you may write them in care of MT Headquarters in Brasstown. Please enclose a self-adressed, stamped envelope if you wish the columnist to reply.

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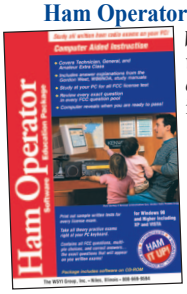

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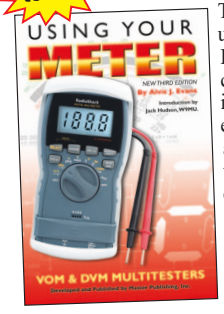

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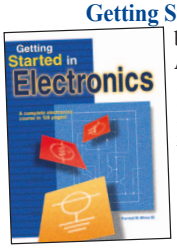

by Forrest M. Mims
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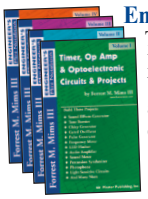

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MT

COMMUNICATIONS

by Ken Reitz

SHORTWAVE

BBG Reverses on China, Tibet

At the end of April the Broadcasting Board of Governors (BBG), which oversees the budgets of all of the U.S. foreign broadcast organizations, including Voice of America and Radio Free Asia, announced it would allocate $3 million as part of what it called a "renewed strategy" for broadcasting to China and Tibet. Earlier in its budget request for fiscal year 2013 BBG announced that it would cut services to those countries.

The wobbly policy-making and impenetrable press release language leaves plenty of room for more hesitation. Still, a meeting with the Dalai Lama to discuss the Voice of America's Tibetan service and Radio Free Asia seems to have helped, though it could not have gone down well with Chinese officials. BBG has spent years trying to rid itself of its shortwave broadcasting heritage and move toward more "social media" platforms.

Edward R. Murrow Station Rededicated

The cover story for the April issue of *Monitoring Times* featured a tour of the Edward R. Murrow Transmitting Station near Greenville, North Carolina. The story was written by Thomas Witherspoon K4SWL, founder and director of Ears to Our World, a non-profit organization that sends portable shortwave radios to third world countries. On May 2 the station was rededicated to the late Edward R. Murrow, famed broadcaster and former director of the U.S. Information Agency, then the parent organization of the Voice of America.

Re-dedication ceremony at Murrow Transmitting Station. From left to right, International Broadcasting Bureau Director Richard M. Lobo; Congressman Walter Jones; Casey Murrow, son of Edward R. Murrow speaking; BBG Governor Victor Ashe. (Courtesy: Broadcasting Board of Governors)

Taking part in the ceremony at the station, in addition to Broadcasting Board of Governors officials, were Edward R. Murrow's son Casey Murrow and North Carolina Congressman Walter Jones, representative of the district in which the transmitting station is located. Jones was influential in seeing that the site was not closed, as BBG had originally intended.

The site was first dedicated by President John F. Kennedy on February 8, 1963; Edward Murrow was in attendance during that dedication. Five years later, following the passing of Murrow, it was rededicated as the Edward R. Murrow Transmitting Station.

AM/FM/TV BROADCASTING

TV Band Repacking Nightmare

The FCC issued a *Report and Order* April 27 titled, "Innovation in the Broadcast Television Bands: Allocations, Channel Sharing and Improvements to VHF." The stated intent is helpful: "making a portion of the UHF and VHF frequency bands currently used by the broadcast television service available for new use…while also preserving the integrity of the television broadcast service." The methodology for making that happen could be a problem for viewers of conventional Over-the-Air (OTA) TV.

Specifically, the R&O first asks stations to surrender the spectrum and team up with other local stations to share spectrum; all strictly voluntary, of course. Thrown under the bus are low-power TV and translator stations which the FCC reminds us are only there on a secondary use basis anyway. Also, thrown under the bus will be picture quality. After everyone rushed out to buy expensive high definition sets as part of the 2009 DTV transition, we may now have to settle for standard definition viewing in the repacking process, as spectrum sharing on the 6 MHz-wide terrestrial broadcast channels doesn't allow 1080i HDTV broadcasting for all users voluntarily packed into a low-def future. By any reasonable standard that precludes "preserving the integrity of the television broadcast service."

Pandora: No. 1 Station in L.A.?

The *Los Angeles Times*, quoting a Media Audit survey of 54,000 L.A. radio listeners, reported this Spring that the number one radio station in L.A. in September and October of last year was not a radio station at all but Internet music service Pandora. According to the article, during that period 1.9 million people in the L.A. area listened to Pandora while the next closest station was KIIS-FM with 1.4 million. But, Wall Street says, "Show me the money!" and remains unimpressed. That's because ad revenue for the service has not generated the income investors expected. One year ago Pandora debuted as a publicly traded stock at $16, reaching a high of $20 per share. As this is written, Pandora stock trades at $8 per share.

OTR Mystery Solved

In what might have been an episode of a 1940s radio detective show, a story in the *Washington Post* from early May detailed how a life-long old-time radio historian ("Don't call him a collector") discovered the theft of nearly a thousand radio-related artifacts from the National Archives.

The life-long aficionado of old-time radio was cruising the usual Internet auction sites when he saw an item of interest. It was a radio interview with baseball great Babe Ruth from 1937. It wasn't long before he recognized the recording on offer as one he had donated to the National Archives more than 30 years earlier. After tracking down the seller through some pretty nifty detective work, the "dealer" turned out to be none other than the retired chief of the National Archives audiovisual holdings, the very guy who accepted the donation.

After an investigation, it turned out that the thief had taken 955 other items from the Archives. According to the article, the disgraced former official could get up to two years in prison for the offense to which he had earlier pleaded guilty.

PUBLIC SERVICE

Chicago PD Gives FCC a Grilling

According to Daryl Jones' weblog (**http://blog.tcomeng.com/**), "commentary on Public Safety Technology – and other things," the police department for Chicago asked FCC Chairman Julius Genachowski in a five page letter, "where Chicago might migrate its rapidly growing and quite expensive UHF T-band radio networks." The letter, signed by Captain Martin Ryczek, pointed out that replacing Chicago's 350 fixed-network UHF T-band channels would cost $75 million. He noted too that including the area's mobile network would cause the cost

to "skyrocket to the $200 million range." Says the captain, "Chicago therefore, respectfully requests the Commission's opinion as to the source of such funding."

But there were more questions from the captain: "How does the Commission propose that the City find the needed spectrum today to continue building the infrastructure for connectivity to the City's existing system for tomorrow's use? How does the Commission want the City to direct its efforts towards interoperability when spectrum availability doesn't exist in today's or the foreseeable environment?"

Santa Cruz PD offers Apps

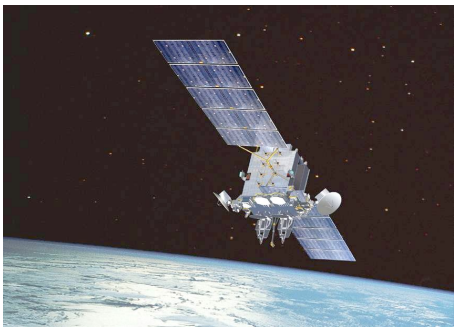
As reported in the April 19 *Santa Cruz Sentinel,* the police department in that city has made available iPhone and Android-based apps for mobile phone users that includes Santa Cruz police radio, alerts, and maps of police activity, among other things. Santa Cruz Police Chief Kevin Vogel was quoted as saying that the idea was to make law enforcement activities more transparent to the public. The apps were developed by California-based mobilePD and had 10,000 takers, according to the article. The company plans to offer the service to other police departments around the country.

SATELLITE

U.S. Satellites: Two Different Worlds

An article in the May 2 *Science* magazine, among many media outlets, noted a report from the National Research Council (NRC) that said, "The ability of U.S. scientists to monitor changes in the planet's climate, natural hazards, and land surface continues to deteriorate." The report concluded that the U.S. would be down to only 25 percent of current viewing capacity as older satellites fade out of service by the end of this decade. A similar NRC report issued in 2007 recommended 18 missions be funded and launched, but, according to *USA Today*, of those recommended missions, "only two are close enough to completion to register launch dates."

Meanwhile, things are certainly different on the military/intelligence side. May 7 an article in the *First Coast News* (Florida) heralded the launch of a second $1.7 billion, 7-ton Advanced Extremely High Frequency (AEHF-2) military satellite "designed to survive a nuclear war." There will be three more launched in the next three years for a total cost of $8.5 billion. And, according to the *First Coast News* article, the well-funded and top-secret National Reconnaissance Office plans to launch two expensive clandestine spy satellites in June alone.



U.S.A.F.'s $1.7 billion milsat launched in early May. (Courtesy: U.S. Air Force Joint Command)

According to the Office of Management and Budget, NASA's total budget for FY 2013 for "research and a robust fleet of Earth observation spacecraft" is $1.8 billion. NOAA's satellite budget request for FY 2013 is $2 billion. But Congress, unhappy with NOAA's launch pad track record, wants to move those funds to NASA. The resultant budget jockeying could result in even more program delays.

FCC ENFORCEMENT

Ham Gripes Finally Heard

On March 19 the FCC released a number of warning letters to several individuals and municipalities with which hams had reported interference problems. Among the problems noted were an Xbox 360 device, a public utility, a computer store, a bad doorbell transformer, and other "unnamed electronic devices." In most cases, the FCC noted, the amateur complaining of the interference had been unsuccessful in resolving the issue and resorted to filing an official complaint of interference.

Numbskulls on Parade

The FCC has earlier this year cracked down on unlicensed operations on various ham bands. Employees for a septic service in Washington State were caught using amateur radio 2 meter frequencies; employees for another company in California were doing the same. A licensed ham in Illinois was warned about his roommate using his ham gear without a license. Two other individuals from Texas and Florida were similarly warned. All were told that fines from between $7,500 and $10,000 could result from continued unlicensed activity.

Office of Inspector General

New York Crackdown

An FM pirate operator in Bronx, New York was interfering with FAA frequencies as was an FM pirate in Yonkers, New York; both were warned. FM pirate operators in Springfield Gardens and Brooklyn New York as well as a Pennsylvania pirate were issued Notices of Unlicensed Operations (NOUOs).

Fine Reduced in EPIRB False Alarm

Four years ago the U.S. Coast Guard (USCG) launched a Search and Rescue (SAR) effort in response to a Search and Rescue Satellite (SARSAT) notification of an active 406 MHz Emergency Position Indicating Radio Beacon (EPIRB) which was registered to a fishing vessel out of Honolulu, Hawaii. The vessel was located at the time of the incident 150 nautical miles north by northeast of Oahu, according to FCC documents.

The USCG unsuccessfully sought to contact the vessel through urgent broadcasts on several HF frequencies. Ultimately, a USCG HC-130 aircraft contacted the ship on VHF marine channel 16 (the distress channel) and was advised there was no actual emergency. It turns out that the owner had a newer EPIRB installed while in port and instructed the crew to "take care" of the old one. A crew member put the device in a plastic bag and tossed it overboard, triggering the beacon where it continued to send out a false distress signal for several days, potentially masking real emergency calls.

The FCC issued a Forfeiture Order in the amount of $8,000 for the incident but reduced it to $5,500 on account of the ship's owner's inability to pay the full amount. It remains to be seen if the owner will face a fine or other action from the USCG. According to FCC documents the USCG expended 3.5 fixed wing aircraft hours and six Command Center hours at a cost of over $35,000 in answering the false alert.

Non-Com hit with $22,000 Fine

A Michigan non-commercial radio station owner was hit with a $22,000 fine for a number of infractions, according to FCC files, including failure to maintain operational EAS equipment, relocation of the station's transmitter without authorization, failure to maintain a local public inspection file, and not bothering to answer the previous FCC Notice of Apparent Liability for Forfeiture. The station, WHPR-FM Highland Park, Michigan, according to FCC documents, is owned by R.J.'s Late Night Entertainment Corporation.

No Staff at Studio: $10,000

The FCC is sometimes accused of nit-picking, but when a radio station – in this case WJTB-AM Elyria, Ohio, owned by Taylor Broadcasting – doesn't bother to respond to the FCC's previous Notice of Apparent Liability for Forfeiture (NAL), the Commission is left with no other choice but to issue a Forfeiture Order. According to FCC documents, the original NAL was issued because of "Taylor Broadcasting's failure to maintain a management and staff presence at the station's main studio."

No wonder the FCC didn't receive a response; there was nobody at the station! The big question is: Will anyone be around to write a check for $10,000 to cover the fine?

Communications is compiled by Ken Reitz KS4ZR (kenreitz@monitoringtimes.com) from clippings and links provided by our readers. Many thanks to this month's fine reporters: Anonymous, Rachel Baughn, Bob Grove, Norm Hill, Steve Karnes, Doug Smith and Larry Van Horn.

General Electric's Trio of Pioneer Radio Stations

By John Schneider W9FGH
(Photos courtesy of the author)

This year, 2012, marks the 90th anniversary of the entry of the General Electric Company into the field of radio broadcasting, with the dedication of its station WGY in Schenectady, New York.

The General Electric Company had been one of the giants of the electrical industry since its founding by Thomas A. Edison in 1890 under the name Edison General Electric. After conquering the worlds of power generation and transmission as well as electric lighting, G.E. became one of the pioneers in the radio field when it entered into a partnership with Westinghouse Electric Corporation in the formation of the new conglomerate, RCA – The Radio Corporation of America.

As a manufacturer of the first RCA radio receivers, G.E., like Westinghouse, saw value in operating broadcast stations to provide quality programming to the public, which would in turn promote the sale of radio receivers. The operation of radio broadcast stations also provided them with a real-world laboratory for the development of broadcast transmitters and antennas.

WGY Schenectady, New York

G.E. had dabbled with radio as early as 1912 when it operated experimental station 2XI. Then, late in 1921, the company decided to construct a new broadcasting station at its manufacturing facility in Schenectady, New York. The station received the fortieth broadcasting license issued by the Department of Commerce, authorized for a power of 1,500 Watts – which at that time was the most powerful station in the country. The call letters WGY were assigned.

In the early part of the 1920's, WGY – along with most other broadcasters – shared the single frequency of 360 meters – 833 kHz. In 1923, the station moved to 790 kHz, at first sharing time with WHAZ in nearby Troy, but by 1928 it had exclusive use of the channel. (WGY moved to its present 810 frequency in 1941 with the nationwide adjustments required by the North American Broadcasting Agreement, NARBA, treaty.)

Two 150 foot towers were constructed on the top of building 40 at the G.E. factory in Schenectady and a flat-top wire antenna was suspended between them. An experimental transmitter was built in the laboratory of building 36 – or more accurately, parts scattered around the laboratory were connected to create an operating "transmitter" – a hodge-podge of tubes, wires and transformers. The engineers continually experimented with modifications to the circuit over the next year, and would frequently ask listeners to comment about changes to the quality and reach of the signal.

In the first years of commercial broadcasting, the company used WGY for experiments with new vacuum tubes, receiving circuits, transmitting circuits, shortwave, television and many other aspects of the radio science. In August of 1922, WGY was the first station to use a condenser microphone, another new G.E. development.

G.E.'s publicity manager, Martin P. Rice, became WGY's first manager of broadcasting and Kolin Hager was the first announcer. WGY debuted on February 20, 1922, with a test concert from 7:45 to 8:50 p.m.. Hager opened the program by saying, "This is station WGY. W, the first letter in wireless, G, the first letter in General Electric, and Y, the last letter in Schenectady." The short program consisted of live music with announcements of song titles and other information.

The next day WGY made its first remote broadcast – a speech by Governor Nathan Miller from Schenectady's Union College. On June 26, WGY broadcast the first recording of a live event – an address by radio inventor Guglielmo Marconi, the first of many broadcasts that would use the G.E. Pallophotophone sound-on-film photographic recording process.

Kolin Hager, WGY's first announcer.

WGY's comparatively powerful signal reached across the continent in those early days of uncrowded radio bands and scant electrical interference; signal reports were received from Cuba, England and Alaska. WGY quickly gained a nationwide following because of the quality of its broadcasts.

Radio Plays

In addition to being a technology innovator, WGY was also an early innovator in programming concepts – especially in the broadcasting of radio plays. Early experience in the live broadcast of theater performances by other stations had not been successful. Listeners couldn't follow the story line without also seeing the stage action, which demonstrated a requirement for special radio drama techniques.

Edward H. Smith, an actor with *The Masque,* a Troy community theatre group, proposed to Kolin Hager that WGY should conduct a series of specialized dramatic broadcasts for radio. Hager agreed with the proviso that none of the programs could go over 40 minutes, which he felt was the limit of the radio audience's attention span.

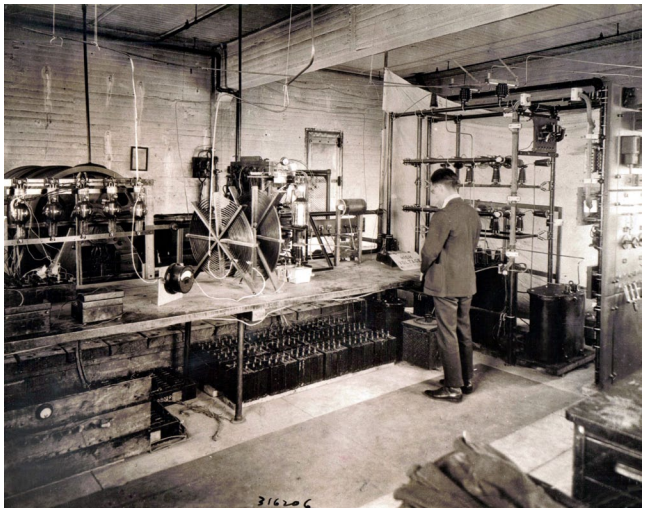
The Troy group formed the "WGY Players" and began a series of weekly Friday night dramatic broadcasts. The first one, heard on August 3, 1922, was an abbreviated adaptation of Eugene Walter's play "The Wolf," incorporating narration, specialized microphone techniques, rudimentary sound effects and live music bridges. (The microphone was disguised as a floor lamp to not frighten the actors.) "The Wolf" was a huge success, generating more than 2,000 letters from appreciative fans.

After just eight plays, the audience response was so great that the 40 minute time limit was removed. 6,000 pieces of mail were received in the four days following WGY's Christmas performance of "Sign of the Cross." By the following spring, a total of 43 radio plays had been performed.

Other early program innovations included live coverage of the Yale-Harvard football game, the WGY String Orchestra broadcast live from the State Theater, and regular radio talks on a variety of topics.

Radio Gimmicks

Not all programs on WGY were serious. Some programs were simply technical "stunts." In June of 1930, WGY broadcast the song "I Love You Truly" around the world via a series



AM transmitter technology was still being developed in 1922, and General Electric was one of the companies in the forefront of this development work. This image, dated March 17, 1922, shows the WGY "breadboard" 1 kW transmitter in Building 36 of the GE Schenectady plant. A close study of this image shows the power control panel at the far right. Behind the panel are the power transformer, reactor and eight horizontally-mounted tubes which could be early rectifier tubes. The filter capacitors are in rows underneath the table. There is one large tube in the center of the table, which may have been the modulator, and an array of at least five RF tubes on the left (a later photo shows this was subsequently increased to 14 tubes). There is an RF ammeter sitting on the table, and the output coupling transformer consists of two pancake-wound coils mounted on wooden legs. The coupling would have been adjusted by moving one of the coils. All the high voltage and RF conductors are open tubing hanging over the head of the operator.

of shortwave rebroadcasts. The Schenectady signal was repeated in The Netherlands, Java and Australia, and was finally received again back in Schenectady. The station announced, "The music you are hearing has gone completely around the world."

On one occasion, a cat placed in front of a microphone in Schenectady had a fight with dog placed in front of a microphone in Sydney, Australia. On another night, a radio bridge game was held, with the players being located in New York and Argentina.

Early Networks

In 1922, WGY was one of the first stations in the country to participate in "chain" broadcasting, connecting multiple stations together with program wire lines to broadcast a single program, which soon led to the development of the commercial radio networks.

The first network broadcasts used Western Union and Postal Telegraph lines to connect WGY, WJZ and WRC for broadcasts of the World Series. In June of the following year, WGY joined KDKA and KYW to rebroadcast a meeting of the National Electric Light Association that originated from AT&T's station WEAF in New York.

In March of 1924, an MIT Alumni banquet at the Waldorf-Astoria Hotel originating at WJZ in New York was carried by telephone lines to WGY, where it was rebroadcast on AM and shortwave. General Electric's shortwave signals over W2XAF and W2XAD were picked up by the Westinghouse shortwave station KFKX in Hastings, Nebraska, which relayed it to KGO in Oakland, resulting in a coast-to-coast live broadcast. Finally, on January 1, 1927, WGY became one of the inaugural stations of the new NBC radio network.

In 1924, WGY moved into larger studios at 1 River Road. In 1937, the station moved into an art deco studio building located on Washington Avenue, across from the G.E. plant, which it occupied until 1957.

High power

In 1924 WGY increased its power to 5,000 watts, moving its transmitter to the current location in Rotterdam. This was G.E.'s South Schenectady transmitter laboratory, a 54 acre site which also housed the company's two shortwave stations. Here, WGY broadcast from a 240 ft. high vertical "cage" antenna with ground radials instead of the usual T-type antenna of the time. (This antenna was replaced with the present 625 ft. half-wave tower in 1938.) Soon afterwards, the power was increased to 10,000 watts.

The Department of Commerce was interested in exploring "super power" broadcasting, and so authorized WGY and WJZ to be the nation's first 50 kW stations. WGY was the first station to operate at that power, more than a year ahead of WJZ, beginning its experimental high power broadcasts on July 18, 1925. Full time operation was authorized on May 8, 1926.

In 1927 WGY was allowed to operate at 100 kW from midnight to 1:00a.m. under a 30-day experimental license. In 1930 WGY operated for a short time experimentally at 200 kW, and received signal reports from as far away as New Zealand; but these powers were never formally approved and the station returned to 50 kW operations.

Reception reports from listeners were highly valued during these years of developing technology, and the engineers determined that the station was being received at a distance of 500-600 miles with the same quality as most stations were heard at 50 miles.

During these periods of high power experimentation, WGY became G.E.'s test bed for the development of crystal-controlled transmitters and high-powered tubes. Its 100 kW transmitter design used a crystal-controlled oscillator followed by five stages of amplification to reach 20 kW, grid modulated at medium power level. This in turn drove a final 100 kW linear RF amplifier using two water-cooled power amplifier tubes with a DC filament voltage of 33 volts at 210 amps. It was powered by six high voltage rectifier tubes and a motor-operated voltage regulator.

The design concepts developed for the WGY transmitter were finalized and introduced to the commercial market by G.E. and RCA in 1930 in the form of the RCA 50-B, the 50 kW transmitter used by most clear channel U.S. broadcasters during the '30s and early '40s.

General Electric Builds Two More Stations

In 1923, the companies of the "Radio Group" – GE, Westinghouse and RCA – agreed that each company would operate three high power stations in different regions of the United States. Together, these stations would provide coast-to-coast coverage and stimulate the sale of radio sets.

The group agreed that the stations would offer listeners the best possible audio quality and programming. Westinghouse was already operating its three stations –KDKA in Pittsburgh, WBZ in Springfield, Massachusetts, and KYW in Chicago. RCA was operating WJZ in New York and would soon open WRC in Washington, D.C. General Electric had only WGY, and so it took responsibility for opening two more stations to serve the Western half of the continental United States. Both new stations would be modeled after WGY.

G.E.'s director of broadcasting, Martin P. Rice, and its engineer in charge of technical operations, Harry Sadenwater, took a tour of several Western cities during February of 1923 to select a location for the two stations. They decided that one station would be either in Dallas or Denver, while the other station would be in either San Francisco or Oakland. They held meetings with the local governments of all four cities, who promised local cooperation in exchange for the prestige of being the home of the new stations. Denver and Oakland were ultimately chosen.

Howard Milholland was KGO's Studio Manager in the 1920's. Here he poses with Richard Shadburn and Marion Cramer, two young radio actors who performed in the radio play "The Volga River," 1925.

The generator room of the General Electric station contained nine motor-generator sets. These supplied current for heating the filaments of the tubes, plate potential for the power amplifiers and the 600 meter commercial transmitter, bias potential for the amplifier and modulator tubes, and excitation for the various generators. These machines were all in duplicate, thus assuring a continuous program in the event of failure.

KGO Oakland, California

The first station was KGO in Oakland, California, starting construction in June of 1923. The Bay Area was chosen because of its location midway along the Pacific Coast and due to its ample supply of musical talent. General Electric first announced plans to build the station on Telegraph Hill in San Francisco and drew up plans for several ornamental antenna structures. However, they finally settled for the expediency of building on the 24-acre site of a new G. E. power transformer manufacturing facility at East 14th Street and 55th Avenue in Oakland.

A beautiful new two-story brick studio building faced East 14th Street. The first floor held the station offices: the program manager, correspondence room, and a reception room for visitors. In the rear of the building was the power room, with its banks of storage batteries and power generators, which powered the amplifying equipment in the control room upstairs. Two studios, one large and one small, were located on the second floor, both equipped with soundproofing and a ventilation system.

The large control room was located between the two studios, equipped with a loudspeaker to monitor the broadcasts. Three operators were always on duty in the control room – two to keep the equipment running properly and to maintain a constant sound volume, and a third to listen for distress calls from ships at sea on a separate receiver. In the event of a distress call, all coastal stations of the period were required to shut down, clearing the radio bands for emergency traffic.

The transmitter building was located about a thousand feet away from the studio at the opposite end of the G.E. property. The buildings were connected by cables that carried the program audio plus a system of signaling lights and an intercom. It was a small one-story stucco building that housed three transmitters in one room and six power generators in the other.

KGO was one of the few stations then to have a duplicate of every piece of transmitting equipment so that the station could stay on the air in the event of any equipment failure. This was the purpose of two of the three transmitters. The third was for communicating with ships in distress, which was kept on standby at all times. An emergency power generator was loaned at no cost by Pacific Gas and Electric.

The two 150-foot steel towers that supported the antenna straddled the transmitter building, one on each side so that the antenna hung directly over the structure. Twelve counterpoise wires were suspended, parallel to the antenna, fourteen feet above the ground. The letters K-G-O were mounted in large illuminated figures on the side of one tower. For its time, KGO represented the epitome of technology.

The 1,000 watt transmitter ran with water cooled G.E. tubes, using high level plate modulation of the intermediate high power free-running oscillator followed by a final linear amplifier. Motor generators provided all plate and filament voltages. Two operators were continuously on duty at the transmitter, responsible for keeping the oscillator on frequency (in the days before crystal control), keeping the modulation within an acceptable range and observing the operation of all equipment.

KGO first took to the air January 8, 1924 with 1,000 watts on 312 meters (960 kHz). It was on the air initially on a schedule of 8 to 10 PM every Tuesday, Thursday and Saturday.

KGO immediately developed a reputation among its listeners for having consistently high program quality. Studio Manager Howard Milholland enlisted some of the top musical artists in the Bay Area to perform on the station. Indeed, most of the program staff itself was musically inclined. Milholland and three other staff members formed a quartet that was heard frequently over the air waves. Announcer Jennings Pierce, who later announced for NBC, was a very fine tenor. And Carl Rhodehamel, Publicity Manager, directed the KGO Little Symphony. In fact, it is quite possible that KGO required all staff members to have musical abilities.

KGO pioneered in educational broadcasts as well as music. Arthur Garbett's radio classrooms were heard daily in schools all over Northern California. This was expanded in later years to encompass radio courses in history, drawing, chemistry and other subjects, as well as broadcasts of lectures and university extension courses.

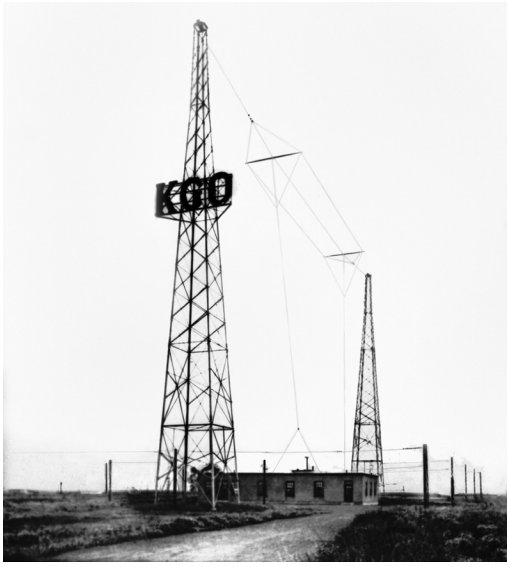
Taking its cue from its eastern sister station, KGO was immediately active in the broadcasting of radio drama. Wilda Wilson Church, who had headed the dramatic department of an all-girl's school in Berkeley and had directed early radio plays at station KRE, became KGO's full time dramatic director. She assembled and directed a dramatic company called the KGO Players, and quickly showed superior talent in developing radio drama as an entity totally separate from the theater and suited to the aural properties of radio. She would later bring her national recognition with NBC.

KGO also carried many remote broadcasts in its early years. A studio was installed in the St. Francis Hotel in San Francisco in May of 1924, which was the source of regular programs by Henry "Hank" Halstead and his Victor Recording Orchestra and the Isham Jones' Jazz Band. KGO also broadcast remote pick-ups from clubs, churches, auditoriums, hotels, theaters and dance halls on both sides of the Bay.

KGO's frequency and power were modified several times in its first years, and the station operated on 960, 1000, 830, 780 and 790 kHz. In December of 1924, KGO was authorized to increase its power to 1,500 watts under a special arrangement with the government that provided for gradual increases in increments of 500 watts as long as the station did not interfere with other broadcasters. Only five other stations in the U.S. had been allowed to broadcast at 1,500 watts up until that time. In November, 1928, KGO settled on 7,500 watts at 790 kc. and it remained at this power level until 1947, when it was authorized to raise its power to the present 50,000 watts. KGO and WGY were the only two U.S. stations assigned to 790 kHz. (Both stations moved to 810 kHz in 1941.)

KGO quickly implemented the technological improvements developed by the Schenectady engineers and in 1926 it began operating with one of the first crystal-controlled transmitters, which caused it to be recognized by the Bureau of Standards as a "constant frequency station." These and other technological advances helped

General Electric built a grand studio building for its station KGO in 1924. The station was located on the grounds of a G.E. transformer factory at 5441 E. 14th Street in Oakland. (Courtesy: Author)



This photo shows the KGO transmitter building and antenna which operated from 1924 to 1947 at 5441 E. 14th Street in Oakland, on the grounds of a General Electric transformer factory. The two 150-foot steel towers that supported the antenna straddled the transmitter building, one on each side, at a spacing of 260 feet, so that the antenna was strung directly over the structure. Twelve counterpoise wires were strung parallel to the antenna fourteen feet above the ground and covering an area of 150 x 300 feet.

make KGO one of the nation's top stations technically, as well as in programming.

On August 17, 1929, KGO put a short wave station, W6XN, on the air as part of the sixth Pacific Radio Show held in San Francisco's Civic Auditorium. The proceedings of that exposition were transmitted via shortwave to Schenectady, where they were rebroadcast over WGY and her two shortwave stations. (In 1939, General Electric would return to shortwave from the Bay Area with station KGEI at the 1939 Golden Gate International Exposition.)

An important advancement for radio took place in 1926 when the National Broadcasting Company, NBC, was formed. General Electric owned 30% of the new network, along with RCA and Westinghouse. So it was natural that GE's three radio stations (WGY, KGO and KOA) would become affiliates. In April of 1927, NBC formed its Orange Network to service the Pacific Coast, and both KGO and KPO in San Francisco became affiliates.

On October 1, 1929, KGO was selected as the key station for the West Coast network and at that time NBC took over complete management and operation of the station. From that date, all of KGO's programs originated from NBC's San Francisco headquarters at 111 Sutter Street. The KGO studio building became an office building for the General Electric factory, but the Oakland transmitter continued to be used until 1947, when the present 50,000 watt plant was built on the approach to the Dumbarton Bridge.

KOA, Denver

General Electric's third station was KOA in Denver, licensed in 1924 for 1,000 watts at 930 kHz. The first KOA studio building at 14th and Krameria on the East side of Denver was a virtual duplicate of the KGO building, and the station had an almost identical transmitter and antenna configuration. Freeman Talbot was named to the position of manager.

KOA's inaugural broadcast took place on Monday, December 15, 1924. In April of the following year the power was increased to 2,000 watts, and again in November to 5,000 watts. In April of 1927 it was briefly raised to 12,500 watts on 920 kHz, but in a quick succession of changes ordered by the new Federal Radio Commission, its power was reduced to 10,000 watts day/5,000 watts night, and then to 5,000 watts day,/2,500 watts night. Finally, in November of 1928, KOA was again permitted to operate with 12,500 watts and moved to its new frequency of 830 kHz.

KOA enjoyed only two years of stand-alone operation before it became a network affiliate. Like its sister stations WGY and KGO, the Denver station was chosen to be NBC's key affiliate in the mountain region. In fact, for the first year of its operations starting in 1926, NBC's East Coast network feeds only reached as far as Denver, and KOA broadcast programs from both the NBC Red and Blue networks.

Starting in 1929, when AT&T completed its transcontinental network quality phone lines, KOA also broadcast NBC Orange network programs fed east from San Francisco. As a result, KOA had its pick of the best programs from all three networks.

As in San Francisco, NBC formally took over the operation of KOA from General Electric in October of 1929, even though the station continued to be owned by G.E. for several more years. In 1932, a new KOA studio/transmitter building was constructed at 18500 East Colfax Avenue in Aurora, Colorado. It was an imposing art deco brick structure with the General Electric logo carved into its stone façade, and giant replicas of two radio microphones flanking the main entrance.

The new 50,000 watt G.E. transmitter installed there was a direct descendent of the transmitter first developed for WGY. A decorative water fountain on the front lawn of the building served double duty, as it was also a cooling pond for KOA's water-cooled transmitter.

The Aurora building was built to house elaborate new KOA studios, but they were in service for only two short years. In 1934, new studios were completed on the 4th, 5th and 6th floors of the NBC Building at 1625 California Street in Denver and the glorious building in Aurora became just an oversized transmitter building. In 1934, a 475 foot self-supporting tower was completed at the site, the highest self-supporting tower in the U.S. at the time.

KOA vacated the Colfax Avenue building in 1959. It is now home to the Colorado Department of Transportation and the Colorado State Patrol. It was declared to be an historic landmark by the City of Aurora.

Breakup of the "Radio Group"

For most of commercial broadcasting's first decade, the industry and its technology were controlled in large part by the big corporations that formed the "Radio Group" – General Electric, Westinghouse and RCA (which was itself owned in large part by the two companies), and to some extent AT&T. Between them, the companies controlled the nation's biggest broadcasting stations and NBC's Red and Blue Networks. They also controlled the most important radio patents, which gave them a monopoly on the design and manufacture of radio transmitters, receivers and vacuum tubes. It was impossible for others to compete effectively against "the octopus."

Finally, in May 1930, the U.S. Department of Justice brought an anti-trust suit against the four companies. The deck was about to be re-shuffled.

After more than two years of negotiations between the government and the companies, a consent decree was decided upon that resulted in General Electric and Westinghouse divesting themselves of all interest in RCA and NBC. The companies would continue to own their stations, but NBC would operate them. Shortly thereafter, G.E. would sell KGO and KOA to NBC, leaving them with WGY as their only company-owned radio broadcaster.

General Electric, the giant electrical conglomerate, would go back to its core business of power generation and transmission, and plow new ground with both heavy industry and consumer products. But it left behind a legacy in the form of three of the country's most important AM broadcasting stations. In later years it would continue to make radio waves in shortwaves and broadcast transmitter design.

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Antennas for VHF/UHF Reception

By Bob Grove W8JHD

In our initial part of this series we discussed antennas designed for transmitting and receiving in the high frequency (HF) part of the spectrum from 3 to 30 MHz. Except for Yagi beams and vertical antennas, the vast majority of those antennas are wire, especially on the lower frequency bands.

The tubular aluminum elements on Yagi beams lend themselves well to the very high and ultra high frequency ranges (VHF-UHF: 30-3000 MHz). Since appropriate element length and spacing are a function of wavelength, and these higher frequencies are shorter in wavelength, beams are in prominent use there.

Vertical elements are shorter as well, making elevated ground planes and collinear arrays (an inline series of vertical elements) popular at VHF/UHF.

Frequency allocations at these wavelengths intersperse land mobile scanner frequencies and ham bands with FM and TV broadcasting frequencies. For example, VHF-TV low channels 2-6 (54-88 MHz) are just above VHF low-band scanner frequencies (30-50 MHz) and six meter ham band (50-54 MHz). The VHF-TV high channels 7-13 (174-216 MHz) are just above VHF high-band scanner frequencies (150.8-174 MHz), the popular two-meter band (144-148 MHz), and just below the 222-225 MHz ham band. The UHF-TV channels 14-69 (470-806 MHz) are just above UHF scanner frequencies (450-470 MHz), the 420-450 MHz ham band, and just below the rapidly-emerging 800 MHz scanner band (806-960 MHz) which contains the shared 902-928 MHz ham band.

The point being made here is that there is some cross-over between antennas for the various services, and sometimes a good TV antenna is a good scanner antenna, and even works on the ham bands.

As an example, early experiments during the formative days of scanner listening led to the first product from Grove Enterprises, the ever-popular Scanner Beam™, originally a vertically-polarized TV antenna which has been refined over the decades to favor land mobile communications.

The Scanner Beam™ also makes use of parasitic elements to widen its effective bandwidth as well as increase gain, making it suitable for continuous frequency coverage from 50 MHz (or slightly lower) through 960 MHz UHF. This makes it highly effective for reception of distant FM, TV, aircraft, and land mobile scanner signals.

Scanner Beam III ($70), a multi-band beam with a TV antenna heritage covers 30 to 1,000 MHz. (Courtesy: Grove Enterprises)

Polarization

The polarization of an antenna, whether vertical or horizontal, refers to the polarity of the electric portion of the wave, not the magnetic portion. As the voltage portion of the wave travels along the antenna element, it radiates its electric field in the same plane. If the element is vertical, then the electric field will be vertical as it leaves the antenna.

Because the VHF and UHF spectrums are used largely by land mobile licensees, and mobile whips are vertically polarized, virtually all VHF/UHF antennas – base and mobile – are designed for vertical application and installation.

Broadcasting, however, is a different consideration. TV antennas are horizontally polarized. But the addition of the FM band to automobile radios after WWII dictated vertical polarization for automotive whips.

This dilemma for the broadcasters – needing both vertical and horizontal polarization – led to the development of circular-polarized transmitting antennas whose signals could be received in either plane.

But over great distance, with terrestrial and ionospheric reflections and contortions, the polarization of radio waves becomes mixed. This is why shortwave signals are often received equally well with vertical and horizontal antennas.

Similar effects distort the polarization of VHF/UHF land mobile signals, especially in mountainous regions and in metropolitan areas with all the high-rise building surfaces. The orientation of the receiving-antenna element(s) becomes more a question of which position hears signals the strongest, and often a weird angle works the best!

That characteristic is easily recalled from the days of TV rabbit ears antennas which would be rotated and adjusted in angle for best reception. If you have a weather radio, you may have noticed that, depending upon its location, the desired signal may be loudest with the antenna angled from the vertical.

AOR DA3000 ($120) wideband discone antenna covers from 25 to 2,000 MHz. (Courtesy: AOR)

Directivity

All antennas share one characteristic: They are either omnidirectional (non-directional) or directional. That is to say, their field of radiation and/or reception is either uniform in all directions, or favors one (or more) direction.

Omnidirectional antennas don't have to be rotated, since their reception is uniform in any compass direction; that's an obvious operational advantage. But directivity has two advantages over non-directional antennas: They have gain in their preferred direction, and they have nulls in other directions which reduce co-channel interference.

While it may seem feasible to manually rotate an antenna, this becomes decreasingly attractive during rainstorms and cold weather! Antenna rotators are the obvious answer.

Lightweight beams are easily turned by inexpensive TV antenna rotators, but the control boxes for such devices don't have the directional resolution desired by most hams and intent scanner listeners.

Several prominent manufacturers offer heavy-duty antenna rotators for communications antennas. They are expensive, but they are long lasting, very dependable, and offer high resolution of direction.

Those Little Whips

Most, if not all, portable transceivers and scanners come with plug-in or screw-in antennas. Even the best of these suffers the indignity of not having a resonant (suitable-length) ground plane or counterpoise to complement the antenna's feedpoint. The radio's chassis is the closest it gets to being a complete antenna system.

Without question, a complete external antenna adds considerable improvement, both transmitting and receiving. Of course, if the original antenna brings in those local repeaters just fine, then you'd have nothing to gain but range adding an external antenna.

Is one brand or model whip better than another? Generally speaking, the longer the whip, the better the performance, up to about 18 inches; after that, there isn't much difference except at the lowest VHF frequency range (30-54 MHz).

Discones

The discone is often thought of as a cluster of dipole elements at an angle. It may look that

way, but discones are actually waveguides which focus the emitted or received signal toward and away from the coax feedpoint.

An exponent of Second World War aeronautical communications, discone antennas have become endemic in scanner applications, and they work well for multiband ham radio applications as well. They do have one drawback, however; the higher in frequency on which a given discone is operated, the higher the takeoff angle above the horizon.

While this is good for ground-to-air communications, it does limit distance for terrestrial use. Nonetheless, the VHF and UHF discone remains high in popularity due to their enormous bandwidth. 100-1000 MHz is a common specification, extended even further at the bottom end by an additional 50 MHz vertical element to add amateur six-meter (50-54 MHz) coverage. This element simultaneously provides reasonable 30-50 MHz low-band VHF land mobile reception for scanner applications.

Another limitation is that due to its very design as a waveguide, the discone has no gain. For that reason its application is best found in local listening and transmitting, but over a wide bandwidth.

Multiband Dipole Clusters

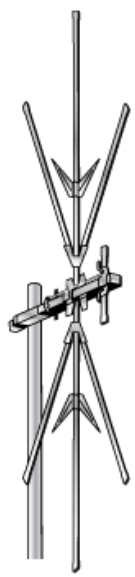
Borrowing from the early TV antenna industry, some scanner antennas, like the popular ScanTenna ™, consist of multiple elements, some of which are parasitic, reflecting and directing signals toward the active (connected to the coax) element(s). This combination is very compact and lightweight, and provides gain over a simple vertical dipole.

Ground Plane Verticals

The vertically-polarized ground plane antenna lends itself well to VHF/UHF design. While at the lower HF wavelengths the elements can be a bit unwieldy, requiring external support, at VHF/UHF the tubular aluminum elements are shorter and lighter in weight, making self support easy.

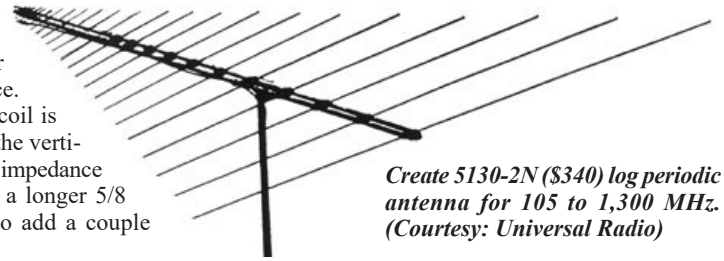
Using thicker elements like tubing helps widen the bandwidth of an antenna, but thinner, stiff-wire elements are commonly used as well. Naturally, the thinner the element, the less wind-load resistance. This is a consideration for stormy-weather-prone areas.

Multiband ground planes are also commonly available for both transmitting and receiving. They utilize the decoupling effects of coils along the vertical element to automatically choose which element is resonant for the frequency of choice.



Antenna Craft ST2 ($34) scanner antenna. (Courtesy: Solid Signal.com)

In some cases a coil is present at the base of the vertical element to act as an impedance transformer, allowing a longer 5/8 wavelength antenna to add a couple dB of gain.



Create 5130-2N ($340) log periodic antenna for 105 to 1,300 MHz. (Courtesy: Universal Radio)

Beams for VHF/UHF

The serious VHF/UHF signal hunter/DXer is likely to home in eventually on a beam antenna because such an antenna provides improvement in weak and distant signal reception as well as the reduction in interference of signals from off-center directions.

Hams commonly use vertically-polarized Yagi beams from 50 MHz on up. Gains on the order of 6-12 or more dBd can be achieved with additional directors (forward elements).

The Log Periodic Dipole Array

The LPDA derives its name from the fact that its dipole element lengths and spacing are calculated logarithmically. It is a beam in every sense including gain, and its superiority over a simple Yagi comes from its enormous bandwidth, often 10:1 or more.

Log periodics are found from the high end of the HF spectrum (notably 14-30 MHz arrays) clear up through VHF/UHF bands (1 GHz and above). They are easy to spot with their truncated triangle shape with straight edges. The best known to the monitoring hobby is the Create CPL-5130, available in two frequency ranges, 50-1300 MHz and 105-1300 MHz. It also works well as a transmitting antenna.

Preamplifiers

Boosting reception of a weak signal is a breeze with a preamplifier – provided you know where to put it. Ideally, a preamp should be mounted at the top of the mast, right at the antenna's feedpoint. This way you know you are going to boost the signal substantially, probably overcoming absorption from the loss in the coax.

If you put the preamp all the way down the transmission line just before the receiver, the weak signal may well have been lost heating the coax and are no longer available to boost. All you'll get in that case is louder "hiss."

Several models of preamplifiers are available from *MT* advertisers depending on frequency range and where you want to put them or power them. If you're interested in wide-frequency-coverage VHF/UHF scanner reception, then units from Ramsey, AOR, WiNRADiO, and GRE provide good performance. Even TV preamps work in a pinch if you're willing to sacrifice a little dynamic range and noise figure in exchange for lower cost.

A good preamp should have a low noise figure so that it doesn't add to the receiver's own self-generated noise, and wide dynamic range so that it can equitably handle weak signals as well as overly-strong signals which produce overload distortion products like "intermod" (third-order intermodulation) and images. These products expose themselves as repeated signals on various parts of the spectrum where they shouldn't be.

Intermod and images are different from self-generated phantom signals ("birdies") which are dead carriers (unmodulated signals), products of the receiver's own oscillator circuitry and are also heard in the wrong places on the tuning dial. They are present whether or not a preamplifier is used.

Filters

There are occasions when you wish you could reduce the strength of a local broadcaster, weather channel, CBer, paging transmitter, or other source of strong signal overload. Notch filters and bandpass filters are available for these instances, and some manufacturers will even provide custom frequency units.

Choosing the Right Coax

In our first article of this series, we discussed the merits of different types of trans-

AOR LN4000 ($210) low-noise antenna amplifier for 100 to 3,000 MHz. (Courtesy: Universal Radio)

mission lines. While open wires and ladder line (flat ribbon cable) have the least dielectric (insulation) loss, they are the most cantankerous to connect an antenna to a radio.

Flat cable can't lie against a metal surface; it changes impedance when it gets wet, it gets lossy as the weather dries it out and cracks it, and there are no inter-series adapters. You either hook it to an appropriate transmatch (tuner) or connect to a balun (balanced to unbalanced) transformer so that it can finally communicate with a conventional connector.

Coaxial cable is the best choice, especially if it is low-loss and well shielded. These are the two prime factors, especially at VHF/UHF since loss increases with frequency.

It's been more than three decades since *Monitoring Times* was able to convince radio hobbyists that RG-6/U 70-ohm outdoor TV coax was superior to 50-ohm RG-58/U for just about any application. It is 100% shielded, has substantially lower dielectric loss, and comes with easy-to-adapt F connectors which work well into the gigahertz range.

RG-6/U is also good for transmitting up to at least 100 watts of RF power. If higher power accommodation is necessary, more expensive and larger communications cables like RG-8/U, RG-213, Belden 9913, and LMR-400 are good considerations.

As a general rule, the transmission line, weather it is coax or open wire, should not run closely parallel to an antenna element; this distorts the pattern. For dipoles, a good rule of thumb is to run it out at a right angle at least a quarter-wavelength at the lowest critical frequency, and then it can be curved into any direction (except back toward the antenna) with minimal distortion of the pattern.

GRE Super Amplifier preamp ($54) covers 100 to 1,000 MHz. (Courtesy: Universal Radio)

Since center-fed dipole antennas are rarely used in the VHF/UHF range, most antennas are end fed, so the direction of the coax simply continues down from the end of the antenna.

And Now, the Weather...

Warm-weather storms bring hazards to radio enthusiasts that most of the public doesn't even think about. Tall metal objects (antennas and their masts and towers) present an open invitation to lightning strikes. Hundreds of millions of volts at hundreds of thousands of amps – that's a wallop!

Many of us tend to think that since it hasn't happened to us before it's not likely to in the future. The same thoughts often occur to those who haven't had a previous car accident.

Ever since Ben Franklin invented the lightning rod, bolts from the blue have been hitting those conductors and (hopefully) travelling safely to the ground.

So what happens when lightning hits an antenna that is connected to expensive radio equipment? We needn't discuss that; let's just talk about lightning protection.

Broadcasting stations have elaborate lightning protection, including extensive grounding of supporting towers, guy wires, and coaxial cable shields.

Some readers right now are recalling a lightning-strike episode. Even a nearby strike can cause serious damage through induction between the bolt and the conductive antenna system; their close spacing is like a giant air-core transformer.

The surest form of equipment protection from nearby lightning strikes is to disconnect all antennas from the radios. Early hams used to remove the connector from the rig and dangle it in an empty drinking glass for additional insulation from surrounding objects. But some storms sneak up on us, or we may be distant from our homes when an unannounced weather system moves in.

Lightning arrestors are made for a variety of applications; I'd recommend the gas-discharge type which can be inserted right in the coax line and connected to a solid ground wire. Some models of antenna switches include a grounding position to connect the antenna line directly to ground when not in use. Good idea.

Due to the speed of the lightning discharge, it has high-frequency characteristics. Wrapping a dozen or so

PolyPhaser Impulse Suppressor IS-50 ($62) from 1.5 to 400 MHz. (Courtesy: Universal Radio)

ATI EMP ($20) surge protector won't prevent a lightning hit but could protect against induced voltages from nearby strikes. (Courtesy: Grove Enterprises)

turns of the coax into a coil before it enters the dwelling isn't a bad idea, and running that coax through about ten feet of grounded metal pipe is another. Both of these measures can be thought of as RF chokes.

But what if the lightning hits house wiring? Your equipment may be disconnected from the antenna, but it's still plugged into the wall. Be sure your home electrical system is protected at the breaker box by a husky metal-oxide varistor (MOV) transient voltage suppressor.

Even your telephone wiring is vulnerable. Get yourself one of those surge protection outlets that has a modular telephone protection jack as well. Excellent units are made by Curtis, APC, and Tripplite. Just be sure it has a sticker indicating that it meets Underwriters Laboratories safety standard UL 1149.

So What is a Good Ground?

We aren't talking about an antenna counterpoise here; we're talking about electric power being able to find a conductive path. A good earth ground consists of a sizeable gauge of buried metal cable that will provide a low impedance connection to the surrounding earth. When I had our home built, I had such a cable wrapped once around the foundation of my home.

Commercial, 8 to10 foot copper-plated ground rods also work well in moist soil. Two, separated by at least eight feet, are recommended if you also plan on using your ground system for radio communication grounding (RF ground) in concert with your antenna system.

It's a good idea for all of your protective wiring to have only one attachment point to your ground. This avoids potential differences arising at different attachment points.

This brief summary of VHF/UHF antennas for transmitting and receiving applications is intended to provide a guide in selecting a system that's ideal for your applications. For details on antenna selection and design, consult the *Antenna Book* from the American Radio Relay League (ARRL), 225 Main Street, Newington, CT 06111. See the ARRL website for a description: **www.arrl.org/shop/ARRL-Antenna-Book-22nd-Softcover-Edition**.

MT

Mining the Minors for AM DX

By Ken Reitz KS4ZR

Baseball on the radio is almost as old as the radio industry itself. The first known coverage of a baseball game happened 91 years ago when the Pittsburgh Pirates played the Philadelphia Phillies on August 5, 1921.* According to **http://explorePAhistory.com**, the game was called by Harold Arlin from a box seat in the stands, talking into a telephone that was hooked up to a transmitter behind home plate. The broadcast was sent out over pioneering radio station KDKA, Pittsburgh, for which Arlin was also the industry's first full-time announcer.

Arlin is quoted as saying much later that at times the crowd noise around him drowned out his play-by-play and that he hadn't thought to say anything between pitches, leaving listeners wondering if the station had left the air. He noted too that his well known deep voice didn't modulate the phone well and that transmitter glitches also caused some unwanted dead air.

That initial broadcast was mostly a one-off; it would be several years before baseball on the radio would be a daily summer affair. That's because most owners feared that free broadcasts of games would keep fans from coming to the ball park. Once owners realized the income potential from advertising revenue, they changed their minds.

With the manufacture of better radios and play-by-play announcing of each game, many baseball fans became inadvertent DXers and more than a few DXers were turned into baseball fans. Today, AM DX in the summer remains a challenge. Atmospheric activity is at its height; days are long, meaning that DX stations won't start rolling in until quite late; and we all have a lot more outdoor activities to take us away from our radios.

The Minor League AM DX Challenge

While Major League Baseball® has been a summer broadcast staple for more than 80 years, coverage of Minor League Baseball® games has never been as solid. It's rare for a Major League team to change cities, affiliation or name, but in the Minors it's another story. Triple-A, Double-A and Single-A teams are swapped or change names, leagues, ownership and radio affiliation.

Broadcasting and the Minor Leagues is truly a whole other ballgame: the season itself gets shorter the further down the Minor League ladder you go. Funding for all things, including broadcasts, is considerably less, which means that some Triple-A affiliates' games aren't broadcast at all.

The diminutive Grundig AN200 tunable AM loop antenna ($30) can make just about any radio a better AM performer. (Courtesy: Grove Enterprises)

Many Minor League games are broadcast only on a single FM station, while others are broadcast online only. Most are broadcast on AM stations, but, unlike their Major League counterparts, these are not 50 kW clear channel outlets; they're mostly low power stations. As an example, the Cleveland Indians Triple-A affiliate Columbus Clippers are heard on WMNI-AM 920, in Columbus, Ohio, a 1 kW station during the daytime and 500 watts at night. Logging a significant number of Minor League Baseball games is not an easy task.

There are some interesting peculiarities among the Minors. Some localities absolutely adore their Minor League teams and every game is broadcast. The Portland (Maine) Seadogs, the Double-A affiliate of the Boston Red Sox in the Eastern League, have a six-station network carrying their games, more stations than the entire San Diego Padres radio network. Other Minor League teams don't fare as well. The Tampa Bay Rays have only one Minor League radio affiliate station.

One Minor League team, the Staten Island Yankees, the Single-A New York-Penn League affiliate of the New York Yankees, is carried on low power, public broadcaster WSIA-FM, 88.9 MHz, which claims to cover Staten Island with 100 watts, no commercials allowed.

Unlike Major League Baseball Gameday Audio, Minor League Gameday Audio®, which provides online broadcasts of Minor League games, is presented "as a free service to baseball fans everywhere." You can listen on an iPhone, iPad, laptop, desktop or any device capable of accessing this web site: **www.milb.com/milb/multimedia/audio.jsp**.

Major League Gameday Audio® is actually quite a bargain: $19.95 for the entire season, including post-season play. You can listen to any Major League game broadcast on any laptop or desktop here: **http://mlb.mlb.com/mlb/subscriptions/index.jsp?content=gameday_audio&affiliateId=MEDIAGUIDE**. Listening via smartphone is available only through select carriers and on certain handsets. Listening to Major League Gameday audio via stand-alone Internet radio is not available. Major League affiliate radio stations that normally stream their content are unavailable online during game times.

The only other way to tune in to Major League baseball is via Sirius/XM satellite radio, which carries a complete schedule of Major League games every day during the season. A six month subscription, which by now will let you listen well past the play-offs and World Series®, will cost about $14.50 per month plus various fees which will drive the price closer to $18 per month. Former subscribers may qualify for a six month subscription for as little as $25. If you are a former subscriber you've been bombarded by email and letters enticing you to return at that price. Take them up on the deal for the duration of the season, but watch for the automatic renewal you'll be asked to sign up for.

One other interesting aspect of listening to Minor League baseball is that it's the broadcast equivalent of the ball game the announcers are covering. Minor League baseball play-by-play is often where big league announcers come from; they are honing their skills as broadcasters in the same way that the players are. It's most evident from the publicity photos on many of the minor league teams' websites and from looking at their résumés; many of these announcers are as fresh out of college as the players.

Is this the GE SuperRadioIII? Well, kind of. GE was bought out by RCA and that company rebranded the model as the RCA RP7887 SuperadioIII ($55 at Universal Radio), but reviews are mixed. (Courtesy: RCA)

AM DX Tuning Tips

There are many sources of solid information about AM DX, including Doug Smith's *Broadcast Bandscan* column, which appears every other month in this

magazine, and his new blog **www.w9wi.com** as well as **www.am-dx.com**. In addition, an index of all the receiver reviews that have appeared in *MT* between 1994 and 2007 are found here: **http://monitoringtimes.com/html/all_reviews.html**. Access to reviews of radios and related equipment from 2008-2011 are found here: **http://monitoringtimes.com/html/index.html**.

Virtually every general coverage receiver has been reviewed by actual users over the last ten years at eham.net. Go here to find out what other hams and serious monitors have to say about the latest models available or ones from the past that you might be able to buy used: **www.eham.net/reviews/products/8**.

Any AM radio can tune in the AM band; some not as well as others. A venerable old set such as the GE Super Radio III (which, having been bought out by RCA is now the RCA RP7887), has legions of advocates despite being a clunky looking, analog dial, portable radio. Some, however, give better reviews to the older versions of this radio.

Most high-ticket, general-coverage radios which are no longer in production but are still available on the used market – such as the Drake R8 series or the Kenwood R5000 – always get nods of approval from DX veterans. I've always found that the general coverage receiver in my old Kenwood TS-140s transceiver, even at 24 years old, is a great AM band receiver. Among the reasons these work so well are superior circuitry in the receive stages and big bandspread that lets the listener get right on top of the signal.

Newer and much more sophisticated software defined radios (SDRs) will eventually take over the top slot in the DX receiver category. Their ability to digitally filter various noise and interference sources, their super sensitivity and great bandspread, make them obvious choices for those with a little more money to spend.

Another reason that the more sophisticated radios work so well is that they're usually attached to an outside antenna that's optimized for the band. Unlike small portable radios working off their small, telescoping antennas within rooms swirling with electrical interference, these sets work with the advantage of a remotely located antenna of decent size. The combination of a terrific antenna and sophisticated receiver is hard to beat.

Still, there's a lot to be said for small and cheap. I found the Kaito 1103 (under $100), when coupled with a tunable AM loop antenna (about $30) did a great job of DX on AM. In fact, the most important addition to your AM DX listening post is a tunable AM loop; it can turn just about any radio into a decent AM performer.

Don't confuse the little plastic loop that came with your stereo with the type of loop I'm referring to. The real loop, such as a Grundig AN200, can be used on any AM radio that has a built-in ferrite bar antenna. Simply place the loop near where the antenna is located in the radio and, by adjusting the tuning capacitor knob on the loop, you match the antenna to the receiver's tuned frequency. By rotating the loop one way or the other around the radio, strong signals coming from another direction can be nulled out. The loop as pictured has a cable that can be attached to the AM antenna terminals on a stereo receiver for improved reception.

Tuning in to Minor League Action

The following is a list of all of the Triple-A Minor League affiliate baseball clubs, their major and minor league affiliation and the stations that broadcast their games. Not all teams offer radio broadcasts, not all will be available online and not all games on the schedule will be broadcast. There are over 100 more Double-A and Single-A radio station affiliates for these teams. Their broadcast schedules are even less certain because Single-A seasons are sometimes only six weeks long.

Each league has its own All-Star game, which can be a very interesting game for baseball fans that showcases some of the American and National League's best prospects. The big one is the Triple-A All-Star game, which will be held this year in Buffalo, New York at the home field of the Buffalo Bisons. It pits the International League against the Pacific Coast League and may be aired by most International and Pacific Coast League stations. Check their schedules as we get closer to the game date which is July 11. Most other Minor League All-Star games (Midwest League, Texas League, California League, etc.) are held in June. The New York-Penn League All-Star game is to be held August 14.

This summer, as you listen for games from the Las Vegas 51s, the Omaha Storm Chasers, the Albuquerque Isotopes, the Lehigh Valley IronPigs or the Oklahoma City Red Hawks, let us know what your experience was in tuning in the Triple-A version of America's pastime. How successful were you? What teams did you hear and what did you use to do it?

AMERICAN LEAGUE

Triple-A Minor League Affiliates

Baltimore Orioles
Norfolk Tides (International League)
WVSP-FM 94.1 Virginia Beach, VA

Boston Red Sox
Pawtucket Red Sox (International League)
WNBH-AM 1340 New Bedford MA
WHJJ-AM 920 Providence RI
WNRI-AM 1380 Woonsocket RI

Chicago White Sox
Charlotte Knights (International League)
WRHI-AM 1340 Charlotte NC
WRHI-FM 94.3 Charlotte NC

Cleveland Indians
Columbus Clippers (International League)
WMNI-AM 920 Columbus OH

Detroit Tigers
Toledo Mudhens (International League)
WCWA-AM 1230 Toledo OH

Kansas City Royals
Omaha Storm Chasers (Pacific Coast League)
KOIL-AM 1180 Omaha

Los Angeles Angels
Salt Lake Bees (Pacific Coast League)
KFAN-AM 1320 Salt Lake City UT

Minnesota Twins
Rochester Red Wings (International League)
WHTK-AM 1280 Rochester NY
WYSL-AM 1040 Rochester NY

New York Yankees
Scranton/Wilkes-Barre Yankees (International League)
WICK-AM 1400 Scranton/Wilkes-Barre

Oakland A's
Sacramento River Cats (Pacific Coast League)
KSTE-AM 650 Sacramento CA

Seattle Mariners
Tacoma Rainiers (Pacific Coast League)
KHHO-AM 850 Tacoma WA

Tampa Bay Rays
Durham Bulls (International League)
WDNC-AM 620 Durham NC

Texas Rangers
Round Rock Express (Pacific Coast League)
KTXX-FM 104.9 Bee Cave TX

Toronto Blue Jays
Las Vegas 51s (Pacific Coast League)
KBAD-AM 920 Las Vegas NV

NATIONAL LEAGUE

Triple-A Affiliates

Arizona Diamondbacks
Reno Aces (Pacific Coast League)
No station, online only

Atlanta Braves
Gwinnett Braves (International League)
WDUN-AM 550 Gainesville GA
WDUN-FM 102.9 Gainesville GA

Chicago Cubs
Iowa Cubs (Pacific Coast League)
KRNT-AM 1350 Des Moines IA

Cincinnati Reds
Louisville Bats (International League)
WKRD-AM 790 Louisville KY

Colorado Rockies
Colorado Springs Sky Sox (Pacific Coast League)
KCSF-AM 1300 Colorado Springs CO

Houston Astros
Oklahoma City Red Hawks (Pacific Coast League)
KGHM-AM 1340 Oklahoma City OK

Los Angeles Dodgers
Albuquerque Isotopes (Pacific Coast League)
KNML-AM 610 Albuquerque NM

Miami Marlins
New Orleans Zephyrs (Pacific Coast League)
WMTI-FM 106.1 New Orleans LA

Milwaukee Brewers
Nashville Sounds
WPRT-FM 102.5 Nashville TN

Philadelphia Phillies
Lehigh Valley IronPigs (International League)
WEEX-AM 1230 Easton PA
WTKZ-AM 1320 Allentown PA

Pittsburgh Pirates
Indianapolis Indians (International League)
WNDE-AM 1260 Indianapolis IN

St. Louis Cardinals
Memphis Red Birds (Pacific Coast League)
WHBQ-AM 560 Memphis TN

New York Mets
Buffalo Bisons (International League)
WWBK-AM 1520 Buffalo NY

Washington Nationals
Syracuse Chiefs (International League)
WSKO-AM 1260 Syracuse NY

San Diego Padres
Tucson Padres (Pacific Coast League)
KXEW-AM 1600 Tucson AZ

San Francisco Giants
Fresno Grizzlies (Pacific Coast League)
No station, online only

**For the record, according to baseball-reference.com, the Pirates beat the Phillies 8-5 in a game that lasted 1 hour 57 minutes. Pirates pitcher Jimmy Zinn got the win (though he was not the starting pitcher) and helped his own cause going 2 for 3 at the plate, driving in one run.*

The Ears Have It!

By Dwight Robinson
(All Photos Courtesy the Author)

My fascination with radio didn't start with a crystal set. It really began with my Grampa's scruffy old Phillips table model radio. There, out on the farm, I was able to hear the Lone Ranger and really exciting soaps ("Ma Perkins" and "As the World Turns") when I managed to stay home sick enough to maintain the sequence. Since my mother was the teacher in that little country school, you can imagine sick calls were sparse. ***And they better be real!***

Hallicrafters S-38B radio showing tubes and original Trimm headset.

One Christmas, Santa brought me my own radio, a Cat Whisker Special kit that was activated through a coil and a germanium crystal. I was ecstatic! Then one little problem emerged. This crystal set required a set of earphones to hear anything and Grampa wasn't about to give up his headset he reserved for bad reception and important ball games. He wasn't into playing radio operator – he just wanted to hear the play-by-play.

Dad promised to bring me headphones from the store on his way home from work, but it seemed like weeks. My do-it-yourself crystal set sat there, gleaming with a wire-wrapped tuning coil, space-age crystal and shiny cat whisker. I'd even strung up a copper wire antenna from my room to a cooperative tree.

But before dad brought the earphone home, a winter storm took out my 30 foot aerial, the fifty-foot tree, and wound the antenna around Mom's clothes line. Discouragement rained – literally. (Dad's excuse for no headphones was amplified by a washout near the electronics store.) Would I ever tune in?

Then *finally*! A beautiful cardboard box from Trimm Inc. arrived. And inside, an even lovelier set of black Bakelite earpieces connected by stiff wire and a cloth covered cord ending in double phone jacks that fit into the crystal set, right *there*!

The author with his trusty Hallicrafters receiver.

A few scratches with the "cat whisker" on the crystal and YES! The 50,000 watt clear channel voice of Seattle's KOMO radio filtered into my waiting ears. Hurray! Dad was a hero. I was a hero. Trimm Inc. was a hero (until KOMO switched to a directional antenna array every day at sundown and their signal all but disappeared. Hey! The first time that happened I was devastated, until I learned about nighttime propagation).

Today that same Trimm headset still works fine! Both jacks are plugged into my ancient 1955 Hallcrafters S-38B SW receiver (AM only, of course). I tuned into Radio Havana last week on the same Hallicrafters that did so well in the 1950s.

Back to other broadcast and headset memories: Today in the sparkling chrome lobby of KCTS-9 TV, Seattle's PBS station, sits a giant B-W video camera, a relic from the 1960s. People go by and pat it. When I ran that camera, my headset used to be my link to the director in the studio's "out-of-control room."

Through the years, earphones have become high-tech, high-fit, and in many cases, high priced. The headset in my aircraft even has a little boom mike so I can talk back! The kids in my neighborhood are tuned in, plugged in and cool. But sometimes earphones are cheap and replace extreme value. Let me explain:

The other day I was enjoying a nostalgic run on Amtrak – the Empire Builder train from Seattle to Chicago. Lots of forest, snow, frozen lakes – spectacular scenery! But nostalgia isn't what it used to be. I was enjoying the landscape until an attendant sold $3.00 earphones as a pipeline to the "inflight" movie. This was later explained as crowd control.

Often what goes around comes around. My dad (original earphone provider) has a favorite Ford tractor that's *really* noisy! His headset is comfortable, classy, and transmits (you guessed it) absolutely *nothing*! They're ear guards to keep the sound *out*!

Last week, audio amplification came my way, big time, in the form of space-age hearing aids. They're terrific but what's scary is the microchip in each one that "learns" my listening pattern to increase hearing efficiency. They're even interactive with Bluetooth type cell phone attachments.

The other day, a friend asked, "Aren't you afraid people will see your hearing aids?"

Are you kidding? Half the population is plugged into something, thank you very much! These are deluxe sound – earphones *inside* my ears!

The author in 2011 in front of the Orca train.

FCC vs. ICC

How an Indiana town changed the way all licenses are granted

By Gene Wiggins W9CWG

A quick glance at the Federal Communications Commission (FCC) licenses issued for any populated area of the United States will show thousands, or tens of thousands, for every type of radio communications system imaginable. Prior to 1947, most of these licenses could not be issued by the FCC due to a stranglehold by the Interstate Commerce Commission (ICC) on types of systems the FCC could authorize.

The Valparaiso, Indiana, Police Department gets credit for forcing this issue into a U.S. District Court in 1947 and that court overruled the ICC. Mr. Cloid Patton, member of the faculty at Dodge Radio and Telegraph Institute, later renamed Valparaiso Technical Institute (Valpo Tech), installed Valparaiso's first radio communications system in 1939. This was a somewhat typical system for that era with base talk out on 2490 kHz and mobile talk out on 30.58 MHz, all AM (amplitude modulation).

World War II brought about much research and development in FM (frequency modulation) radio. Mr. Zellon Aldrich was Supervisor of the Indiana State Police communications system, stationed at the headquarters at Stout Field in Indianapolis, Indiana. Mr. Aldrich was active in the Associated Police Communications Officers (APCO), later renamed Associated Public Safety Communications Officers to better describe the wider membership and interests.

Sometime in the last years of World War II, Mr. Aldrich was working as a consultant with the FCC in setting up new rules for public safety radio systems and he was also writing rules for using this new FM mode. Those rules were included in the FCC's Rules & Regulations Part 10 which was later issued as Part 89 and is currently Part 90. Those rules covered police communications on the 30-50 MHz, 150-170 MHz, and the 450-470 MHz bands. Included in the rules was the use of 155.370 MHz as inter-system, inter-city, or point-to-point use.

Mr. Aldrich was a good friend of Valpo Tech, having hired many graduates for Indiana State Police technical services. In 1947 it was time to update the Valparaiso Police Department's radio system and go to an FM system. Mr. Aldrich stepped in and advised Mr. Patton that there was a matter of point-to-point communications on 155.370 MHz that needed to be resolved. The ICC rule was that the FCC could not issue any licenses for radio use between two points if a wire line telephone service was available. At that time the ICC was loaded with former telephone company employees and it seemed they wrote the rules protecting their telephone interests.

Mr. Aldrich had been conferring with the FCC and then Mr. Patton and the City of Valparaiso that he would help with the license application including operation on 155.370 MHz. The FCC would have to deny operation on that frequency and then he would file a lawsuit with the FCC requesting a hearing on the issue to get it into court.

In a short time, the license was received by the Valparaiso Police Department. "Operation authorized for simplex pair 155.130-154.890 MHz but operation on 155.370 MHz denied per ICC Ruling…" Mr. Patton immediately called Mr. Aldrich who then advised he would arrive in Valparaiso as soon as possible. After arrival, he immediately composed a telegram to transmit to the FCC: "License for Valparaiso Police received this date. We note that operation denied on 155.370 MHz. Please be advised that Valparaiso is operating on 155.370 MHz. What is FCC going to do about it? Signed, Eldon Kuehl, Mayor." This was all by pre-arrangement and no insults were intended.

Within about twenty minutes, Mr. Aldrich's office in Indianapolis called and informed him he was to call a gentleman at the FCC in Washington, D.C. This he did and advised them he would leave that day for Washington, D.C. He and the FCC lawyers and technicians worked all weekend preparing the case to be presented to the court. They went to court on Monday and the judge declared the ICC ruling illegal and that the FCC could now issue licenses for radio systems at their discretion. In due time Valparaiso Police, and many others who had been denied operation on 155.370 MHz, received updated licenses for full operating privileges.

At this time, in 1947, mobile radio and FM needed much more development. Mr. Aldrich and the Indiana Chapter of APCO had also worked with the FCC to ensure APCO had to approve all license applications within Indiana as well. It was not anticipated that every small village would have a police two-way system, only the larger entities. Therefore, they had set up a system that all licensees had to follow. They had four frequency pairs called "Plans." Plan A was for 155.130-154.890 MHz that most entities would operate on. Larger cities would operate on Plans B, C or D to try to cut down on interference to outlying towns that were on Plan A.

In 1953 I returned to Valparaiso to join the faculty of Valpo Tech and almost immediately "inherited" the Valparaiso Police Department radio system from Mr. Patton. In 1960 the FCC adopted their "split channel" rules which established +/- 5 kHz as 100% modulation from the

Hallicrafters Sky Buddy Model S-19 (Courtesy: Rich Post KB8TAD)

previous +/- 15 kHz. This required all new radios for the most part.

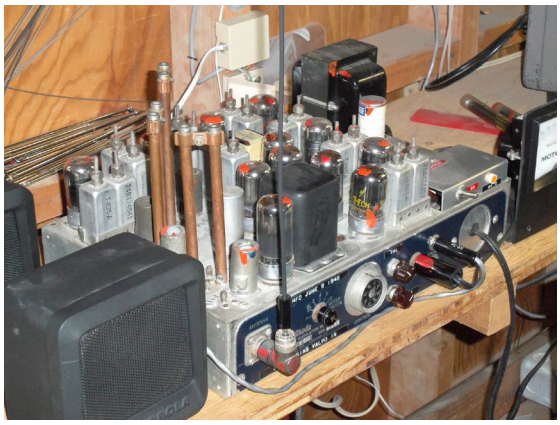
I gave up the police radio system but kept the water, sewer, sanitation and street systems until I retired in 2002. I have a receiver from that 1947 system on a shelf and use it constantly, tuned to the county fire system repeater. For you Motorola-types, it is a Deluxe, 30-D, Precision Selectivity model. It still makes 0.5 microvolts for 20 dB quieting and receives +/- 45 kHz each side of center with the same sensitivity. That's three channels each side of center on the old +/- 15 kHz system! With a short antenna it is not bothered by adjacent channel stations yet receives the repeater well.

From 1947 until the new system was put into service in 1960, Valparaiso had one or two fire vehicles on the police radio system. A little illegal but rules were not very stringent in those days. With the coming "split channel" rules in 1960 and consequent updating of most radios, a county fire system was then established. Prior to this time, Civil Defense had given a few radios to some of the local township departments. Eventually the 911 dispatch center, then maintained at the sheriff's department, became the fire dispatch center. At that time, the Valparaiso Fire Department went to its own frequency. Recently, they also began dispatching from the county 911 center.

Regarding the 1939 radio system mentioned at the start of this article, the base station talked out on 2490 kHz and received on 30.58 MHz. The base transmitter was an RCA unit housed in a 30 inch rack cabinet. The receiver was a Hallicrafters Sky Buddy Model S-19 and therein lay some interesting stories!

Fortunately, the transmitter did not have any tuning adjustments on the front panel, only a mike gain control. When installed, Mr. Patton had put a hasp-type closure and a padlock to keep inquisitive fingers out of the high voltage. The transmitting antenna system is unknown to me but there was a portion of a windmill tower on top of the local City Hall. I'd suspect that a long wire was used for transmitting. A complaint would come in of "no receive." Mr. Patton went down and there they are, listening to the Chicago baseball game on the AM broadcast band! The dial strings were cut. Same complaint, the tuning capacitor is soldered in position; the band switch is soldered in position. I never saw this Sky Buddy but it must have been a total wreck by 1947. Maybe it has appeared in Electric Radio magazine as a restoration by some ambitious person!

Another common complaint was that this base station was much distorted. A check determined someone had tuned the audio gain control on the front panel full on. They must have been thinking "we can talk further out when we turn that up." Finally, after many trips to turn the mike gain back down, Mr. Patton came up with a solution; he removed the control from the front panel and mounted it on the chassis inside the locked cabinet. He then mounted an old defunct control on the panel, set the knob to its usual position, and told them not to touch it. It would then be turned full on, he would turn it down and rant and rave. This went on for years. That idea has worked well for me over the years also having used it in broadcast stations and many times on communications systems. The 30 inch rack cabinet was used to house the carrier-current broadcast station operated by students at Valpo Tech for many years.



Motorola DeLux 30D receiver from 1947 (Courtesy: Author)

In 1939, the Valparaiso Police department was issued the call sign WMPV by the FCC. The new FM system installed in 1947 was issued a new form of call sign KSA547. Since they have now joined the county 911 system, I assume that KSA547 has now expired.

About the Author

Gene Wiggins W9CWG holds an Advanced Class amateur radio license and is a former teacher at Valparaiso Technical Institute referenced in article.

SCANNING REPORT

THE WORLD ABOVE 30MHZ

Dan Veeneman
danveeneman@monitoringtimes.com
www.signalharbor.com

Responding to Reader Requests

The deployment of new public safety radio systems often creates a need for scanner listeners to find more capable receivers. This month we take a look at several new digital systems just coming on-line and finish up with a few comments on a common encryption mechanism.

❖ Harbor Springs, Michigan

Hi Dan,

I am really enjoying your site with loads of information. I'm an older guy that is just getting into scanners and have a small handheld Uniden BC 55XLT I picked up at a garage sale. It only has memory for 10 channels. Can you please tell me what are the best 10 channels for me to use? I'm interested in fire, police, etc. I will be looking for a much better one with more channels, again in a handheld. If you know of any models that would be good, please let me know.

Thanks so much for your time,
Michael in Harbor Springs, Michigan

Harbor Springs is a town of about 1,500 people located on the northern shore of Little Traverse Bay in Emmet County, Michigan.

Much of the public safety radio traffic at "the tip of the mitt" (the northernmost part of the Lower Peninsula) originates from a shared facility that serves three counties. The Charlevoix-Cheboygan-Emmet (CCE) Central Dispatch Authority (CDA), headquartered in Petoskey, was formed in 1996 by 14 local police agencies and is the 911 Public Safety Answering Point (PSAP) for residents. In contrast to most parts of the country, 911 in this area is also used as a non-emergency number - police officials are confident that they have sufficient personnel to handle all emergency and non-emergency calls coming in on the same telephone number. The 1,600-square-mile area served by the combined center is home to nearly 84,000 residents.

The CCE system uses 18 towers to serve the three-county area. The newest tower, located off Stutsmanville Road north of Harbor Springs, is 350 feet tall and went live this spring. Its height and location also allows it to better serve the steep shoreline terrain and host a microwave link to Beaver Island, improving public safety communication there as well.

In February, the Federal Emergency Management Agency (FEMA) announced that they were awarding nearly $800,000 in grant money to 28 local fire departments, several Emergency Medical Service (EMS) agencies, and CCE Central Dispatch for upgrades to communications equipment. In many cases these departments and agencies are using old radios that have reached the end of their useful life, having become more difficult to service and repair due to a lack of parts and outdated technology.

The grant money will be used to purchase new handheld and mobile radios that will improve interoperability between local agencies and will also have the ability to operate on the statewide Michigan Public Safety Communications System (MPSCS), an all-digital APCO Project 25 network covering the state.

❖ Uniden BC 55XLT

The Uniden BC 55XLT is a mid-1980s era handheld that has 10 programmable memories and covers three frequency ranges, namely 30 to 54 MHz, 138 to 174 MHz and 380 to 512 MHz. The manual counts these as ten bands, as follows:

Band	Start	End
10-Meter Amateur Band	29	29.7 MHz
VHF Low Band	29.7	50 MHz
6-Meter Amateur Band	50	54 MHz
Military Land Mobile	137	144 MHz
2-Meter Amateur Band	144	148 MHz
VHF High Band	148	174 MHz
Federal Government Land Mobile	406	420 MHz
70-cm Amateur Band	420	450 MHz
UHF Standard Band	450	470 MHz
UHF "T" Band	470	512 MHz

The scanner is old enough that the entire operating manual fits on 16 pages; compare that to the size of modern scanner manuals! It had a street price of a little over $100 in 1988. Despite its age and lack of memory, the BC55XLT is certainly a suitable scanner for the analog activity in Emmet County.

Frequency	Description
150.995	Emmet County Road Commission
151.475	CCE Law Enforcement
154.310	CCE Fire (Dispatch)
154.400	Emmet County Fire (Dispatch)
154.740	Petoskey Police (Dispatch)
154.965	Emmet County Office of Emergency Management
154.980	Beaver Island Fire (Dispatch)
155.010	CCE Law Enforcement (Area Dispatch)
155.040	Harbor Springs Department of Public Works
155.070	Emmet County Sheriff
155.160	Emergency Medical Services (Dispatch)
155.325	Medical Services Communications System (MEDCOM)
155.340	Hospital Emergency Radio Network (HERN)
155.355	VMEDTAC Emergency Medical Services (On-scene)
155.385	Helicopter Ambulance (Dispatch)
155.520	CCE Law Enforcement
155.565	CCE Law Enforcement
155.685	CCE Dispatch
159.320	Emmet County Road Commission
461.1125	Harbor Springs School Buses
464.575	Northern Michigan Hospital Operations

As the local agencies move to Project 25 radios, it would be a good idea to eventually buy a digital-capable scanner. Keep reading for more details on what to look for and why.

❖ Wisconsin

Wisconsin Interoperable System for Communications (WISCOM) is a statewide radio system that allows first responders to "seamlessly communicate" during a major disaster or other emergency. Users include federal, tribal, state and local public safety agencies, as well as non-governmental organizations (NGOs) and private ambulance companies. Build-out of the system began after a construction contract was awarded in 2009 and the first users were registered on the system in 2011. This April the system was officially put into operation, with nearly 250 agencies and 4,600 radios already signed up.

WISCONSIN INTEROPERABILITY
SEAMLESS STATEWIDE PUBLIC SAFETY RADIO COMMUNICATIONS

WISCOM is a trunked network operating in the Very High Frequency (VHF) band using APCO Project 25 standards. Because Wisconsin was wise enough to use these public standards rather than a proprietary technology, they are able to save money in the long run through competitive equipment purchases. So far they have approved the use of radios from six different providers (EF Johnson, Harris, Kenwood,

Motorola, Relm and Tait) and are open to accepting more as long as they meet a minimum set of requirements. As opposed to some unfortunate choices made by other states and municipalities, Wisconsin is not at the mercy of a single vendor and monopolistic prices to provide radios and service.

Eighty WISCOM repeater sites provide a "backbone" of basic coverage across the state. Each of these sites transmits on as many as five frequencies using digital repeaters that are part of a distributed network. There is no central system controller - each repeater site controls channel requests and talkgroup assignments on its assigned frequencies. Individual counties sharing the system have the option to add their own local towers to provide more complete coverage for portable radios.

1	2	3	4	5	6	7
County		Prefix	Unit			

The operating frequencies used by WISCOM come from three somewhat unusual sources. First, they have access to 20 channels in the 139 MHz to 140 MHz range via the Army National Guard. The original plan was to use these primarily as control channels, so nearly all of the repeater sites use at least one of these frequencies: 139.0125, 139.0875, 139.1125, 139.1625, 139.1875, 139.2125, 139.2625, 139.3125, 139.3625, 139.4125, 139.6125, 139.6625, 139.7375, 139.7625, 139.8125, 139.8625, 139.9125, 139.9625, 140.3625 and 140.4125 MHz.

The Federal Communications Commission (FCC) has single entry for Wisconsin in their license database for these frequencies under call sign KQO228:

County	Frequencies
Sauk	139.0125, 139.1875, 139.3625, 139.7375, 139.9125
Jackson	139.0875, 139.2125, 139.4125, 139.7625, 139.9625
Rock	139.1125, 139.2625, 139.6125, 139.8125, 140.3625
Monroe	139.1625, 139.3125, 139.6625, 139.8625, 140.4125

That same FCC entry lists the following frequencies licensed for mobile operation across the entire state, but due to relatively low transmitter power you may only hear activity if you're close enough to the transmitting vehicle or portable radio: 141.5125, 141.6125, 141.6875, 141.8125, 141.9125, 142.1125, 142.1875, 142.2125, 142.2375, 142.3125, 142.3375, 142.3875, 142.4125, 142.4375, 142.4625, 142.4875, 142.8875, 142.9125, 142.9375 and 142.9875 MHz.

The following 139 MHz frequencies are active WISCOM control channels. Keep in mind that some counties have more than one repeater site but due to technical limitations the transmit frequencies at any particular site will be at least 90 kHz apart.

County	Control Channel(s)
Adams	139.2125, 139.8125
Ashland	139.0875
Barron	139.2625
Bayfield	139.1125, 139.4125
Brown	139.0875
Buffalo	139.0875
Calumet	139.3125
Chippewa	139.0125, 139.3625
Clark	139.7375
Columbia	139.7375
Crawford	139.2125
Dane	139.9125
Dodge	139.1125, 139.7625
Door	139.0125, 139.1625, 139.4125
Douglas	139.1625
Dunn	139.1625
Eau Claire	139.3125
Florence	139.0875
Fond Du Lac	139.3625, 139.9625
Forest	139.7375
Grant	139.0875, 139.6125
Green	139.1625
Green Lake	139.6625
Iowa	139.3125, 139.3625
Iron	139.2625
Jackson	139.1125
Kenosha	139.1625
Kewaunee	139.2125
La Crosse	139.6625
Lafayette	139.1125
Lincoln	139.9625
Marathon	139.0875, 139.7625
Marinette	139.3125, 139.3625
Milwaukee	139.8125
Monroe	139.6125
Oneida	139.1125, 139.3625
Pierce	139.0125
Polk	139.0875, 139.1125
Price	139.1625, 139.2125
Racine	139.3125
Richland	139.4125
Rock	139.0875
Sauk	139.1875
Sawyer	139.7375, 139.7625
Shawano	139.1125, 139.6125
Sheboygan	139.0125
St. Croix	139.2125
Taylor	139.4125
Trempealeau	139.7625
Vernon	139.1625
Walworth	139.0125, 139.6125
Washburn	139.3125, 139.7375
Waukesha	139.8625
Waupaca	139.4125
Waushara	139.1625
Wood	139.2625

A second set of WISCOM frequencies comes from the Wisconsin Department of Transportation in a frequency band usually dedicated to pagers, in a section of FCC regulations called Part 22. The channel plan under Part 22 assigned frequencies every 30 kHz rather than the 25 kHz found in most land mobile allocations. Because a single P25 channel is 12.5 kHz wide, it is possible to fit two P25 channels plus 5 kHz of "guard band" (unused space that provides separation between different spectrum users) in a single Part 22 channel.

The WISCOM plan calls for the following Part 22 frequencies, which may carry either voice or control traffic: 152.0225, 152.0375, 152.0525, 152.0675, 152.0825, 152.0975, 152.1125, 152.1275, 152.1425, 152.1575, 152.1725, 152.1875, 152.2025, 152.2175, 152.5025, 152.5175, 152.5325, 152.5475, 152.5625, 152.5775, 152.5925, 152.6075, 152.6225, 152.6375, 152.6525, 152.6675, 152.6825, 152.6975, 152.7125, 152.7275, 152.7425, 152.7575, 152.7725, 152.7875, 152.8025 and 152.8175 MHz.

The State is also using other available frequencies between 150 and 156 MHz, which are licensed under Part 90 of the FCC rules.

❖ WISCOM 800 MHz Layer

WISCOM also has several small 800 MHz systems that serve local, typically urban areas. These are also digital P25 trunked systems and allow users on the VHF system to communicate with the 800 MHz system users when operating in these areas.

One such system is in Milwaukee, transmitting from a single repeater site on 851.4750, 851.9250, 852.4250, 853.3625 and 853.8625 MHz.

❖ Monitoring WISCOM

Because WISCOM is a new system, operational details are still being worked out. Hobbyists will need a digital scanner capable of trunk tracking in the VHF band and be willing to patiently explore system activity. One factor making things easier is the P25 trunking standard -- newer digital scanners with a "control channel only" feature can track voice activity after programming just the control channel frequencies. Such scanners use information carried in the control itself to properly tune to whatever voice frequency is currently active.

Some scanners that will work on WISCOM and provide good information include:

Make	Model	Type
GRE	PSR-500	Handheld
GRE	PSR-600	Base/Mobile

GRE	PSR-800	Handheld
Radio Shack	PRO-18	Handheld
Radio Shack	PRO-106	Handheld
Radio Shack	PRO-197	Base/Mobile
Uniden	BCD396T	Handheld
Uniden	BCD396XT	Handheld
Uniden	BCD996T	Base/Mobile
Uniden	BCD996XT	Base/Mobile
Uniden	HomePatrol-1	Base/Mobile

❖ Radio Identifiers

Wisconsin has put together a numbering scheme for their radios that is intended to clearly and logically identify any radio that might use the system. Some scanners are capable of displaying this User ID (UID), either straight from the factory or with an appropriate firmware upgrade. Check your user manual for information specific to your model.

The identifier has seven digits and is laid out as follows.

The first two digits represent the county in which the radio is based. Adams County is 01, Ashland County is 02, and so on alphabetically through Wood County as 72. State agencies will use codes 81 through 90 and Federal agencies 91 through 99.

The third digit is an optional prefix to help distinguish between radios that might be assigned to the same officer or vehicle. The digit may also be used to differentiate between agencies that might use the same unit number.

Code	Meaning
0	Default or mobile radio
1	Portable radio
2	Control station (or third unit radio)
3	Fixed bases, stations, consoles
4	Police
5	Fire
6	Emergency Medical Services
7	Emergency Management
8	Department of Public Works
9	Other (Local or Non-Governmental)

The remaining four digits are the individual unit identifier for the vehicle, officer or person.

❖ Rock County, Wisconsin

Also in April, Rock County successfully completed acceptance testing for their new Project 25 system.

Rock County is a 700 square mile county located in southern Wisconsin, on the border with Illinois. About half of the county's 160,000 residents live in either the City of Beloit or the county seat of Janesville.

The new system is based on Project 25 standards and is intended to bring local and county agencies together onto a single interoperable system. The existing conventional (non-trunked) analog equipment was upgraded to P25 conventional service without the need to purchase new receivers or bases, saving the county time and money. Twenty repeater sites across the county will provide coverage after the upgrades and testing is complete. In all, the county and local agencies will spend just under $5 million to switch over to the new system.

The core infrastructure technology, called "P25net," is from Raytheon, traditionally a Department of Defense (DoD) military supplier, and is part of their "Rapid Alliance" product line. Like most other providers, they advertise "an integrated, wireless voice and data communications system." Unlike some other providers, Raytheon is encouraging the use of open standards such as P25, giving customers the ability to mix and match different vendors to get the most capable and least expensive solution. Raytheon was awarded the contract last year.

Until the new system is fully operational, the following conventional (non-trunked) analog frequencies will continue to carry public safety and municipal radio traffic.

Frequency	Description
45.08	County Emergency Siren control
45.56	Janesville Public Works
151.265	County Fire (Dispatch South)
153.830	County Fireground ("Red")
154.265	County Fireground (South)
154.280	County Fireground ("White")
154.295	County Fireground ("Blue")
154.310	County Fire (Call-out)
154.340	County Fireground (North)
154.800	Local Police Departments
155.430	Janesville Fire
155.550	County Courthouse (Security)
155.580	Janesville Police (Dispatch)
155.670	Sheriff (Operations)
155.685	Janesville Police (Tactical)
155.715	County Fire (Dispatch North)
155.940	Beloit Department of Public Works
158.730	Sheriff (Countywide)
159.090	Sheriff (Dispatch)
452.6250	Beloit Transit System
452.7500	Janesville Transit System (JTS)
452.9000	Beloit Fire (Station Call-out)
458.7000	County Juvenile Detention Center
460.0750	Beloit Police (Dispatch)
460.2000	Beloit Police (Tactical)
460.2500	Beloit Police (Events)
460.3500	Beloit Police
460.4500	Beloit Police
460.4625	Sheriff (Jail)
460.4750	Beloit Police
852.6875	County Highway Department
853.7375	County Highway Department

❖ Leon County, Florida

Hello,

I hope I have contacted the right person, as I have asked several people here in Leon County, Florida for information. First, I love to monitor frequencies with fire, police, sheriff, EMS, etc. I guess it's my military background in radio. Anyway, a short time ago, Leon County went to a digital trunking system and obviously my old analog trunking scanner PRO-95 won't do the trick. However, I'm now told that I can't buy a scanner that will pick up the signals since this area has gone to encryption. Is that true or will something like the GRE-800 work? I would greatly appreciate your input on this.

Thank in advance,
Richard

Leon County is in the panhandle section of Florida, on the border with Georgia. The county seat, Tallahassee, is also the state capitol. The county covers about 700 square miles and is home more than 275,000 people.

The P25 system was put into operation in late 2009, which was the switch from analog to digital operation. The confusion comes in when some of the new digital talkgroups are also encrypted.

Frequencies in use are 854.4375, 855.0375, 855.1625, 855.4125, 855.6375, 855.8125, 855.8875, 855.9625, 856.4625, 856.8125, 856.9125, 857.2125, 857.3125, 857.3375 and 857.4625 MHz.

You should be able to track the entire system using the control-channel-only (CCO) feature and programming just these control channel frequencies: 856.9125, 857.2125, 857.3375 and 857.4625 MHz. Keep in mind that even though you can track the system, you may not be able to hear everything due to encryption. For instance, nearly all of the law enforcement and medical service talkgroups are encrypted, while fire and public works are generally in the clear. It may also be worthwhile to continue to check the old analog frequencies - for instance, apparently the Tallahassee Fire Department still simulcasts their dispatches in analog format on 154.190 MHz as well as on talkgroup 81 on the digital system.

The following is a list of some unencrypted talkgroups on the P25 system.

Dec	Hex	Description
10	00A	Tallahassee Regional Airport (Police)
81	051	Tallahassee Fire (Dispatch)
89	059	Tallahassee Fireground
90	05A	Tallahassee Fireground
140	08C	County Jail
174	0AE	County Emergency Medical Services (Dispatch)
248	0F8	Tallahassee Electric Company
281	119	Tallahassee Regional Airport (Operations)
297	129	StarMetro Buses (Channel 1)
298	12A	StarMetro Buses (Channel 2)
299	12B	StarMetro Buses (Channel 3)
300	12C	StarMetro Buses (Channel 4)
301	12D	StarMetro Buses (Channel 5)
405	195	County Landfill (Operations)
451	1C3	Animal Control
454	1C6	County Public Works

That's all for this month. More information about scanners, Project 25 and encryption can be found on my web site at **www.signalharbor.com.** As always, I welcome your reception reports, comments and questions via email at *danveeneman@monitoringtimes.com.* Until next month, enjoy Independence Day (or Canada Day, as you prefer) and happy scanning!

ASK BOB

GENERAL QUESTIONS RELATED TO RADIO

Bob Grove, W8JHD
bobgrove@monitoringtimes.com

Q. *I have an old, tube-type radio that requires an external antenna for shortwave. What can I use for an indoor antenna?*

A. Most any random length of wire will work, but the best bet would be an attic wire, as long as the attic (30-50 feet should work), fed at one end with the center wire of coax cable (any kind). You don't need to worry about the shield of the cable at the antenna. Try to keep the antenna wire as high as possible, like along the center beam of the roof peak.

At the radio, the coax center wire goes to the antenna connection and the shield to the ground connection. If you have a nearby water pipe, or even the round ground hole in the AC wall outlet (NOT ONE OF THE FLAT PINS!), try connecting a ground wire while listening to electrical noise interference to see whether the ground helps or not.

If reception is satisfactory and you don't get a lot of electrical buzzes, you're doing fine. If you do, then you might need to consider a loop antenna which can be oriented to minimize the noise and/or maximize the signal.

Q. *Does the H-900 active antenna reduce HF interference? I have quite a bit of interference with my home random wire. (Lars de Bruin, email)*

A. I'm afraid that electrical noise is a part of the electromagnetic spectrum, and if it's present, a preamplified antenna is going to boost it just like any legitimate signal.

Some folks resort to loop antennas in an attempt to null the source of interference, others elect to install a noise canceller like the effective Timewave DSP-599zx to blank out the noise.

It's always best to use coax feed line run to an outdoor shortwave antenna mounted as far as practical from the dwelling and away from power lines.

Q. *I've been recently chasing non-directional beacons (NDBs) down in the 200-400 kHz range. Are there any currently-manufactured receivers that perform particularly well down there? (Van Wilshire, email)*

A. I've chased NDBs myself, so I understand the avocation. Some of the prior receivers did quite well there, but I've seen nothing recently in the way of current desktop radios that have received high grades in the low frequency department. This isn't a critique of their low frequency performance, it's just that very few shortwave listeners care enough about the NDBs, and manufacturers aren't specific about low frequency performance.

One way that you can tell whether a radio is likely to be good down there is to check the specifications and see what the dynamic range and IP3 (third-order intermodulation) characteristics are. The IP3 is particularly important. The ICOM IC-7800 transceiver has an IP3 in its shortwave range of +40 dBm, a remarkable figure.

Of course, in this modern era of household electronics, there is a great deal of ambient noise that directly interferes with signals from the LF range clear into shortwave. A well placed antenna is extremely important, more so than the IP3.

Q. *I have a Satellite 800 Millennium with a frequency range of 100 to 30000 kHz. I'm just a listener, but I can't seem to find the spots that most USA guys use. Could you steer me to some frequencies that I would be likely to hear conversations? (Robert Krueger, email)*

A. The shortwave ham bands are interspersed among all sorts of other services – international broadcasting, maritime, long distance aviation, government and military, and many more. Here are some of the most productive hunting grounds for ham radio single-sideband voice communications. By convention, the hams use upper sideband (USB) on the daytime (higher) frequencies and lower sideband (LSB) on the nighttime (lower) bands.

DAYTIME (USB):
14.15-14.35 MHz, 18.11-18.168 MHz, 21.250-21.45 MHz, 24.93-24.99 MHz, 28.3-29.3 MHz
NIGHTTIME (LSB):
1.8-2 MHz, 3.6-4 MHz, 7.125-7.3 MHz

Q. *I was doing some electrical work and I connected a multimeter to the hot wire and then to a nearby ground rod. I got a 120 volt reading. Does this mean that the current returned to the nearby step-down transformer through the ground rod attached to our meter base neutral as well as the ground wire on the transformer? (M.B., IN)*

A. Yes. In all regulation three-wire grounding systems, one wire goes from the "neutral" side of the transformer to the narrow flat pin of the wall socket. It also is earth-grounded. The round pin of the wall socket is earth-grounded. The hot wire will read 120 VAC touching either of these.

Q. *Why do some receiver manufacturers attenuate sensitivity on the AM broadcast band and lower rather than letting the operator choose the option manually? (Mike Tara, email)*

A. Modern communications receivers have more sensitivity than they need on those frequencies considering the size of antennas typically used with them. The attenuation is done to increase the receiver's immunity to strong signal overload in areas where there are strong broadcast stations.

While that would seem to reduce weak signal reception, it doesn't. At those frequencies, the signal-to-noise ratio is set by atmospheric noise which we hear as heightened background hiss when we connect the antenna. The weak signals do become weaker, but so does the hiss proportionately, so the net result is still the same. The signals are heard just as well, and the receiver operates within the limits of its dynamic range.

Q. *What changes will the new narrow-banding and interoperability requirements have on scanner listening?*

A. Starting January 1, 2013, all public safety and business radios in the 150-512 MHz bands must cease using the traditional 25 kHz bandwidth and switch to narrower 12.5 or 6.25 kHz bandwidth to allow adding closer-spaced channels. Formerly called "refarming," the mandate is now referred to as "narrowbanding."

While radios in the aircraft, marine, railroad, amateur, and other services may continue using 25 kHz bandwidth, the challenge meeting scanner manufacturers is how to economically handle all three bandwidths.

Depending on the characteristics of the bandwidth filters, listening to a 12.5 kHz, or even more so a 6.25 kHz signal on an older model 25 kHz bandwidth scanner, will result in low-level and perhaps distorted audio.

Questions or tips sent to Ask Bob, c/o MT are printed in this column as space permits. Mail your questions along with a self-addressed stamped envelope in care of MT, or e-mail to bobgrove@monitoringtimes.com. (Please include your name and address.)

UTILITY WORLD

HF COMMUNICATIONS

Hugh Stegman, NV6H
mtutilityworld@gmail.com
www.ominous-valve.com/uteworld.html
http://mt-utility.blogspot.com

WRC-12 Defers "Leap Second" Decision

The most contentious issue at the 2012 World Radiocommunication Conference (WRC-12) got no publicity whatsoever. It concerned whether or not to eliminate the "leap seconds" from Coordinated Universal Time (UTC).

Debate in plenary session quickly brought up issues which have divided international bodies for some years now. It became clear that the proverbial can of worms had been opened. The matter was thus kicked down the road for further study, probably all the way to the next conference, WRC-15.

The leap second is a little thing. It's that occasional extra tick on WWV, usually at the end of the year. This little thing, however, has the potential to change the very fundamentals of global timekeeping. It exposes the essential contradictions in the Universal Time system, which have grown ever since the introduction of atomic clocks. Extreme cases include the redefinition of what a day is, and how the question, "What time is it?" will be answered.

These contradictions partially explain the interest in leap seconds. They are also great for confusing news media. Since a leap second was scheduled for the middle of 2012, and since the WRC took up the matter, once again this almost apocalyptic misinformation is spewing forth.

❖ Leap Seconds Defined

The leap seconds are actually a fairly esoteric procedure that was added to UTC in 1972 to solve several problems. Had another radio body not been instrumental in adding UTC to the world's Universal Time scales in the first place, the matter would be well beyond the authority of the ITU. Instead, we see the present case, where a radio conference decision has the potential to throw an entire world into disarray.

The problem is this: atomic clocks tell a different time than our planet does. The earth's rotation was established as the standard for the length of a day starting at the 1884 Meridian Conference. This is the mean solar day, and its length changes.

However, science, consistent time measurement, and any hope of radio frequency accuracy all require that every second be the same length as every other one. Currently, this is 9,192,631,770 hyperfine transitions of a cesium-133 atom at ground state. This is the SI second, from a French acronym for International Unit System, and it is the standard unit of time.

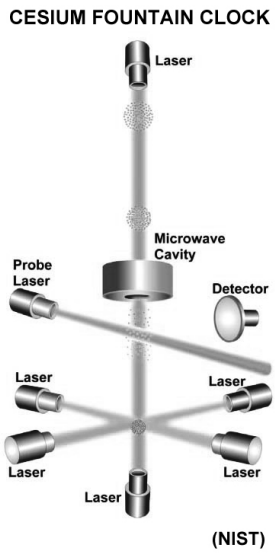
The length of a day is still the basis for most civil timekeeping. There are good reasons for noon (standard time) to come more or less when the sun is highest, and for midnight to actually be around the middle of the night. This can be determined locally by mean solar time, but railroad scheduling led to more a regional standard time.

At sea, accurate navigation required accurate chronometers, and ultimately that a Prime Meridian be adopted. While ship's time could be determined from tables corrected to latitudes, there was still a need for an absolute reference if latitude were to be reliably determined in the first place.

The story of "the meridian" is interesting, but way beyond a radio column. Suffice it to say that all of this led to the famous Greenwich Mean Time. GMT evolved slowly into our present Universal Time scales.

The measurement of time intervals, as opposed to time of day, requires not only seconds of the same length, but that this precision be carried over to the minute, hour, day, and any other such period. Currently, the atomic day is 86,400 SI seconds, and it very likely always will be.

And there's the rub. A solar day has been longer than this since the 19th century, and it's getting longer still. Furthermore, while tidal gravitation causes a fairly constant slowing of the Earth's rotation, other unpredictable changes in climate, glaciers, or even earthquakes like the one in Japan also cause tiny but significant changes. These are not known until they are observed.



The real-world condition, then, is for atomic and solar time to drift ever farther apart, and not in a predictable manner. Obviously, this can be a serious issue for standard frequency and time stations. Frequency only makes sense when based on atomic time. One can say the same thing for timing of intervals. Time of day, however, is preferably based on solar time.

❖ Enter UTC

Various meetings and conferences led to the adoption of a compromise which would allow standard time and frequency stations to deliver both. This compromise was UTC. It is kind of a composite time scale. It has atomic seconds, but it is also periodically corrected to reflect solar time.

The magic behind this is seen in the word "Coordinated." From the start, efforts were made for world coordination of UTC's time of day to reflect UT1, a Universal Time scale corrected to observations of our planet's motions. At first, these corrections were made frequently, but for several reasons the agencies responsible decided to use whole seconds. These, then, are the leap seconds, which began in 1972.

The current agency responsible for leap seconds is the Earth Rotation and Reference Systems Service (IERS), at the Paris Observatory in France. Twice a year, it issues "Bulletin C," specifying whether a UTC-UT1 deviation approaches 0.9 seconds either way, and if so, when either a positive or negative next leap second will be inserted into UTC.

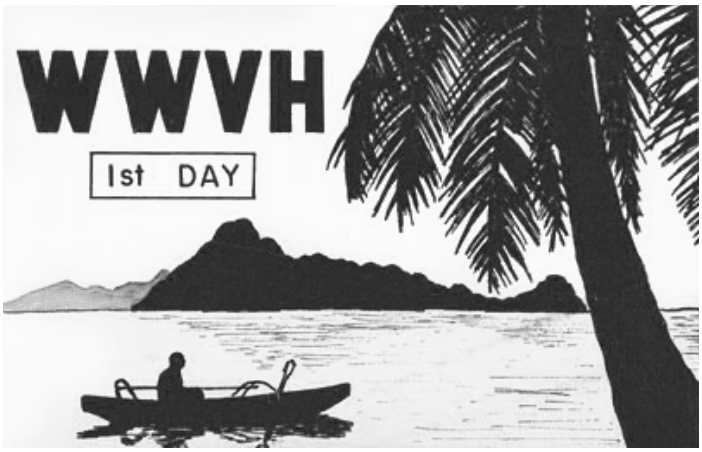
Preferred times are at the ends of December and June. So far, all 35 leap seconds have been at these times, and all have been positive. In other words, UTC is now 35 seconds behind where it was 40 years ago.

The latest leap second was published well in advance, for 23:59:59 on June 30, 2012. As a positive leap second, it called for insertion of a 23:59:60 which would otherwise not exist, before 00:00:00 on the first. While negative leap seconds are possible, there has never been one. They have all been extra ticks in WWV/WWVH, and extra beeps in WWVB.

❖ So What's All the Fuss?

The leap second issue started off simply enough. A few countries, including the United States, want to get rid of these. They claim that the adjustment of all UTC devices every year or two is a hassle, and will eventually break something. Meanwhile a few more countries, including the UK, want to keep the present system.

In the course of discussion, a number of inconvenient facts came up. The biggest problem



is that, without its "C," UTC would by necessity cease to exist. Sufficient international standards already exist for atomic time and Universal Time. There would be no framework left for reasonable timekeeping on the radio.

Consequently, the world is left with a number of options, none of which are altogether satisfactory. Standard time and frequency stations could be abolished altogether, in favor of GPS time. That would leave the broadcast time of day standard undefined, and it is not considered a serious option.

Another suggestion is to create a new time scale. This is poorly defined at present. It might use leap minutes, hours, or even days. It would be synchronized at some time in the future, such as January 1, 2022, and then left to go on its merry way for some large number of years.

The name "International Time" (TI) has been suggested for this option. This, unfortunately, is very difficult to reconcile with existing international treaties on timekeeping. Currently, it does not appear to be even close to a solution that would satisfy everyone.

There's an ultimate option, which no one really wants to talk about, as it is a definite Nuclear Option. In this case, what's getting nuked is the very concept of what a day is, negating thousands of years of civilization. Presumably, a staggering amount of money would be spent on a long diplomatic run-up to some huge international conference. Once this began, the world would for once and for all redefine the day as 86,400 atomic seconds. Following a certain date, Mother Nature would be allowed to take her course.

This would certainly be the end of the leap second problem. Also, unfortunately, it would be the end of a calendar with any consistency. Noon and midnight would move slowly but steadily around the day/night cycle. At some point, New Year's would come in broad daylight. The Times Square ball just wouldn't look as nice.

❖ Time Scales:

It might help some of the confusion regarding world timekeeping to list some of the many time scales that have been used over the sometimes chaotic evolution of this process.

LST: Local Solar Time; once the primary standard. This is based on observing the sun from the same spot every day, which becomes the local meridian. The zenith is therefore noon. This means of reckoning time creates days that are not of constant length over the period of the year. By definition, it also means that different locales have different times of day.

MST: Mean Solar Time; the first attempt to reconcile clock time, as produced by ever more refined oscillators, to planetary time, as produced by a large, wobbly body making 3-dimensional motions in space. It accounts for the yearly variations, in which clock time runs ahead of and behind absolute solar time. Mean solar times shifted from the many locales to "Standard Time," as defined in ever-larger areas as required for consistency in communications and railroad scheduling.

GMT: Greenwich Mean Time; the mean solar time on the Greenwich Meridian, which originally ran directly up the middle of the Time Building of the UK Royal Observatory in the Greenwich section of London. GMT was adopted at the 1884 Meridian Conference as the first world time. Since solar time and meridian are related, this conference was also the final adoption of Greenwich as the Prime Meridian, dividing the Eastern and Western Hemispheres.

It is essential to understand that, technically, GMT has not existed since the 1950s, when it stopped being kept at this location. The Prime Meridian has drifted to a spot well outside the Time Building, the precise location of which depends on the geodetic or space-based reference in use. While some computer networks mistakenly use this nomenclature, GMT is basically only the UK's rather nostalgic name for its standard time.

Zulu: "Z" time; as used by the military and civil aviation, is technically the time in zone Z, which centers on the Prime Meridian. The planet is divided into alphabetical "nautical time zones" corresponding to longitudes. On land, however, the time zones enacted by governments are vastly more subjective, causing something of a mess. These are, in fact, the reason that Zulu and UTC are the only sane ways to keep time in anything with the distances we see in radio or aviation. For practical purposes, these two scales have the same time of day.

Ship's Time: This is a timekeeping system that comes up quite often in discussions of exactly when the Royal Mail Steamship ***RMS Titanic*** sank. Essentially, it is a solar time based on the vessel's position, rather than corrected to standard longitudes as mentioned above. Logs kept on the ***Titanic*** have times differing slightly from those on the ***Carpathia*** which came to her rescue. Even more confusing, none of these logs correspond to the times shown at shore stations.

UT: Universal Time; the idea of a world time which originally was intended as a replacement for GMT. It eventually evolved into the various Universal Time Scales in use today.

UT0: Universal Time Scale #0; an oversimplification of which is to define it as a raw solar time loosely resembling GMT, but determined by observation of objects other than the sun in Greenwich. UT0 is not used much, as polar motion introduces errors making it slightly less than a true Universal Time.

UT1: Universal Time Scale #1; corrected for errors in UT0 introduced by polar motion. Basically the primary world solar time, although nowadays it is typically defined using distant quasars as a reference.

UT2: Universal Time Scale #2; UT1 with further attempts at correction. It is not used much.

UTC: Coordinated Universal Time; the subject of this column, and what we usually (though not always) hear on the radio. The current leap second system, with its integral seconds, has an advantage that the UTC second will usually sync fairly close to atomic time. This was not always the case in the past. WWV broadcasts the difference between UTC and UT1 in its double ticks heard near the beginning of each minute. The number of these corresponds with the absolute value of the difference, and their position in the minute indicates positive versus negative. The name "UTC" is not well understood. It is not French, where it would be "TUC" (Temps Universel Coordonné). Neither is it English, where it would obviously be CUT. The letters "UTC," therefore, were chosen to match other UT scales.

TAI: International Atomic Time, using the French acronym for Temps Atomique International. TAI is the standard for interval timing. It is kept by a weighted average of several hundred atomic standard clocks in something like 70 laboratories worldwide. There are several good reasons for doing it this way. TAI's time of day was synchronized to GMT on January 1, 1958, though its technical details have evolved since then. Lacking corrections, or any need for them, TAI is 35 seconds ahead of UTC as of July 1.

GPS Time: This is an atomic time used by the entire Global Positioning System to ensure accurate navigation. It counts seconds from its own epoch, when it was synchronized to UTC on January 6, 1980. These seconds are kept in close sync with TAI, so that GPS stays very close to a constant offset of 19 seconds behind. It is 16 seconds ahead of UTC as of July 1. Presumably, similar systems like GLONASS (Russia), Compass (China), and Galileo (Europe) have similar time scales with their own epochs.

Sidereal Time: This system is used by astronomers, to better predict when fixed sky objects will return to the same position. Its reference is based on the hour angle of the Vernal Equinox. A sidereal day is around four minutes shorter than a mean solar day. Sidereal Time can be local, or a planet wide time called Greenwich Mean Sidereal Time which is not the same as GMT. For various extremely technical reasons, UT1 and therefore UTC are no longer derived from GMST but from an observed Earth Rotation Angle.

We'll see you next… uh… time.

ABBREVIATIONS USED IN THIS COLUMN

AFB.....Air Force Base
ALE.....Automatic Link Establishment
ARQ.....Automatic Repeat reQuest
CAMSLANT....Communications Area Master Station, Atlantic
CAMSPAC.....Communications Area Master Station, Pacific
COTHEN.....US Customs Over-The-Horizon Enforcement Network
CW.....On-off keyed "Continuous Wave" Morse telegraphy
DSC.....Digital Selective Calling
E17z.....Russian numbers in English, always callup "674"
FAX.....Radiofacsimile
FEMA.....US Federal Emergency Management Agency
HFDL.....High-Frequency Data Link
HFGCS.....High-Frequency Global Communications System
MARS.....US Military Auxiliary Radio System
MFA.....Ministry of Foreign Affairs
Navtex.....Navigational Telex
NCS.....US National Communications System
RTTY.....Radio Teletype
S28.....Russian "Buzzer," probably strategic broadcasts
SHARES.....SHAred RESources, US Government frequency pool
SITOR.....Simplex Telex Over Radio, modes A & B
UK.....United Kingdom
Unid.....Unidentified
US.....United States
USS.....United States Ship
USAF.....US Air Force
USCG.....US Coast Guard
Volmet.....Formatted aviation weather broadcast

All transmissions are USB (upper sideband) unless otherwise indicated. All frequencies are in kHz (kilohertz) and all times are UTC (Coordinated Universal Time). "Numbers" stations have their ENIGMA (European Numbers Information Gathering and Monitoring Association) designators in ().

147.3 DDH47-Hamburg/Pinneberg Meteo, Germany, special CW Morse code broadcast for anniversary of ***Titanic*** sinking, then working hams crossband on 7036 and 3565 CW, at 2230 (ALF-Germany).

490.0 "S"-Canadian Coast Guard, Iqaluit, Navtex in SITOR-B mentioning L'Isle de Sable, at 0306 (Mario Filippi-NJ).

2187.5 OXZ-Lyngby Radio, Denmark, DSC safety test with OUVW2, Danish flag vessel ***Maersk Edgar***, at 2152 (MPJ-UK).

3050.0 India Foxtrot-US Navy, probable USS ***Eisenhower*** tracking net, working Golf, also on 3152, at 1620 (Allan Stern-FL).

4583.0 DDK2-Hamburg/ Pinneberg Meteo, Germany, RTTY identifier with RYs and "CQ DE DDK2/DDH7/DDK9," simulkeying 7646 and 10100.8, at 0119 (Filippi-NJ).

4625.0 MDZhB-Cyrillic identifier of Russian military control messages on "UVB-76" (S28), in Russian, at 0814 and 1329 (Ary Boender-Netherlands).

4956.0 FAV22-French military Morse code training, Favières/ Vernon, CW drill messages in 5-letter groups; also on 7823, 7966 and 9213.1; at 1754 (MPJ-UK).

6607.0 4XZ-Israeli Navy, encrypted CW message in 5-letter groups, at 0322 (Filippi-NJ).

6679.0 "San Francisco Volmet"-Actually Honolulu Radio; with aviation weather for San Francisco, Seattle-Tacoma, Los Angeles, Portland, others; at 1137 (Filippi-NJ).

6765.0 NNN0EPY-US Navy/ Marine Corps MARS, control of SHARES regional net with WGY9416, FEMA Auxiliary Station, OH, at 1602 (Jack Metcalfe-KY).

6845.0 NNN0EBC-US Navy/ Marine Corps MARS, control of SHARES Northeast Regional Coordination Net on its new frequency (old was 6844.5), working NCS042 (NCS Auxiliary), WQJI233 (American Red Cross, VA), KFD913 (US Department of Agriculture, WV), and several others; at 1600 (Metcalfe-KY).

6910.0 KHA946-US National Aeronautics and Space Administration, Michoud Assembly Facility, LA, quick SHARES check-in at 1600 (Metcalfe-KY).

7527.0 Z13-USCG Sector Key West, FL, calling J11, USCG MH-60J helicopter #6011, COTHEN ALE at 0707 (Patrice Privat-France).

7549.0 HQ703NFEMA2, US National Guard and FEMA headquarters station, passing ALE text message "from NGB" (US National Guard Bureau) to N020JNFEMA2, NJ, also on 10585, at 1657 (Metcalfe-KY).

7718.5 "Echo-1-Alpha"-US National Guard, MO, working Sierra Charlie Charlie (SCC), and calling Juliet Oscar Charlie (JOC), at 2045 (Metcalfe-KY).

7830.0 Quebec 3-Possible Moroccan Railways, calling unknown station in French, at 0105 (ALF-Germany).

7880.0 DDK3-Hamburg/ Pinneberg Meteo, Germany, FAX upper level forecast chart at 0615 (PPA-Netherlands).

8421.5 SVO-Olympia Radio, Greece, CW marker at 0143 (Filippi-NJ).

8472.0 WLO-ShipCom, AL, news stories transmitted in both RTTY and SITOR-B, at 0147 (Filippi-NJ).

8828.0 "Alaska Volmet"-Honolulu Radio; weather for Fairbanks, Anchorage, Elmendorf AFB, others; at 1158, then back as Honolulu Radio with Volmet for Hawaii, at 1200 (Filippi-NJ).

8834.0 "08"-HFDL ground station #8, Johannesburg, SA, squitters at 0504 (Hugh Stegman-CA).

8983.0 Coast Guard 2302-USCG HC-144A Ocean Sentry number 2302, calling CAMSLANT, who had also been calling the aircraft, but no joy; then calling "Coast Guard Sector Charleston," also no joy, at 1510 (Stern-FL).

9015.5 72-Singapore Navy vessel ***Stalwart***, working CN6 (navy shore station, Changi), ALE at 1730 (PPA-Netherlands).

9031.0 India Whiskey-US Navy, probable USS ***Eisenhower*** net, signal checks and tracking with Alpha, Delta, Kilo, and Tango; at 1944 (Metcalfe-KY).

9090.0 KM0-Colombian Navy, ALE link checks with BAS and SEB, at 0500 (ALF-Germany).

9165.0 HLL2-Seoul Meteo, Korea, noisy FAX satellite image of entire North Pacific, at 1635 (Stegman-CA).

9253.0 MANAUS-Brazil Navy, Manaus, working River Vessel ***Rondonia*** (P-31), in Portuguese, ALE at 0150 (ALF-Germany).

9295.0 TRYNY-US National Guard, Troy, NY, ALE sounding at 0435 (PPA-Netherlands).

10146.6 N2XE-Project Blue Horizon, trans-Atlantic balloon flight, CW position broadcast at 0400 (ALF-Germany).

10263.0 RAL2-Russian military, CW radio checks with RRHQ2, RGH2, and RBL66, at 0608 (PPA-Netherlands).

11090.0 KVM70-US government, HI, FAX schedule at 0112. KVM70, FAX Pacific Surface Analysis at 1222 (Filippi-NJ).

11175.0 Andrews-USAF HFGCS, MD, patching One Punch to Tinker AFB regarding air refueling, at 1535 (Stern-FL).

11232.0 Trenton Military-Canadian Forces, Ontario, passing weather for KVAD (Moody AFB, GA), to King 15, a C-130, at 0023 (Stern-FL).

11318.0 CSN347-China Southern Airlines A330 reg B-6532, HFDL position for Santa Cruz, Bolivia, at 0614 (Privat-France).

12222.0 VAI-USCG Cutter Valiant (NVAI/ WMEC 621), COTHEN ALE sounding at 0734 (Michel Lacroix-France).

12431.0 TARANTO-Italian Financial Police, calling GARZONE (vessel ***Garzone***, G-99), ALE at 0840 (Lacroix-France).

12577.0 3FAZ3-Panama flag vessel ***Louise Bulker***, DSC tests with Madrid, Spain, and Aarhus/Bremen, Germany, at 1338 (MPJ-UK).

12786.0 NMC-USCG CAMSPAC Point Reyes, CA, FAX Pacific Surface Analysis chart at 0341 (Filippi-NJ).

12788.0 NMG-USCG CAMSLANT Chesapeake, VA, "Iron Mike" computer voice with station announcements, at 1128 (Filippi-NJ).

13264.0 Shannon Volmet, continuous European aviation weather, observations for London Heathrow, London Gatwick, and many others, also on 5505, at 1310 (Filippi-NJ).

13303.0 P4-MES-Roman Abramovich private B767 ("The Bandit"), flight UVP4ME, HFDL position for Canarias, Canary Islands, at 1451 (MPJ-UK).

13927.0 Chill 52-Probable USAF B-52, patch to unknown number while holding for ceremonial flyover of Indiantown Gap National Cemetery, PA, spelled call sign wrong ("Shill"), but was heard spelling it "Chill" on another frequency, at 1743 (Stern-FL).

14260.0 Unid-Russian intelligence "English Lady," "674" variant (E17z), callup "674 539," then message in 8 5-number groups, ended "00000," at 0800 (Boender-Netherlands).

14396.5 NNN0VUV-US Navy/ Marine Corps MARS, control of SHARES Administration Net, working WGY9498, FEMA Auxiliary Station, WUZ, US Army Corps of Engineers, AL, and others; at 1553 (Metcalfe-KY).

14484.0 Desert Eagle-Unknown US military, working AAN4JAX, US Army MARS, Jacksonville, FL, at 1621 (Metcalfe-KY).

15034.0 Trenton Military-Canadian Forces Volmet, Trenton, Ontario, aviation weather with a strange audio tone between voice announcements, at 0156 (Robbie Spain-WY).

16898.5 XSG-Shanghai Radio, China, SITOR-B traffic list and information bulletins, at 0651 (Eddy Waters-Australia).

21982.0 VT-IEN-IndiGo A320 flight 6E0454, HFDL log-on with Al Muharraq, Bahrain, at 1502 (MPJ-UK).

22571.0 XSS-UK Defence High-Frequency Communications System control, Forest Moor, ALE sounding at 1502 (MPJ-UK).

22673.5 Unid-North Korean MFA, encrypted text in ARQ, at 0407 (Waters-Australia).

DIGITAL DIGEST

DIGITAL MODES ON HF

Mike Chace
mikechace@monitoringtimes.com
www.chace-ortiz.org/umc

The CCIR 493-4 Selcal
(and Networks You Can Hear Using It)

Have you ever had one of those times where you hear something, tune around a bit more, hear it again somewhere else, and so forth? Lately I've been bumping into many networks that all employ the selcal (selective calling) system defined by CCIR Standard 493-4 and it's provided some interesting listening as well as investigation of the users behind them.

❖ The CCIR493-4 Selcal

Sometimes called the "Aussie" 4-digit or 6-digit selcal because of its popularity in Australia, this system is more correctly known by its international standard name. The system is also closely related to the maritime standard we all know as GMDSS DSC, which is defined by the ITU standard 493-9, and allows for the expanded address range required to accommodate ship MMSI numbers.

The selcal signal is sent at 100bd using 170Hz shift, most usually (but not always) at an offset of +1785Hz from the USB point. The calls are extremely brief, usually no more than 2 to 7 seconds, which, when coupled with the narrow bandwidth, makes these signals hard to find – much harder than the equally common MIL-188-141 ALE signal, for example.

The signal starts with 2 or 6 seconds of reversals, followed by the "payload" which comprises the calling station ID, the called station ID, message, and end of message sequence. The information contained is based on the 7 bit ASCII standard and a 3 bit parity check is added to each character to enable error detection. The expanded 6-digit address system is backward compatible with the older 4-digit system, so some networks use just one type of address, whereas others use mixed identifiers.

The message part of the selcal provides for various codes that are designated for selective, individual, group or "all" calling, beaconing, GPS data, alerting and many other purposes. You can read a comprehensive review of the system in the Resources section at the end of the column.

Why "Aussie selcal"? Well, the standard has been employed by the well-known Australian radio manufacturers Codan, Barrett and Q-Mac for many years. Out in the outback, there is little by way of mobile phone infrastructure, so truckers, RVers and many other users rely on this selcal system to call others, make a phone patch, or let others know where they are. The fact that Codan is now one of the premier suppliers of radios to NGOs, police and many other organizations all over the world, and this selcal remains built-in to just about every model, accounts for the secal being so widely heard.

Sadly, despite this system being technically simple, decoding so far is limited to Hoka, Wavecom and Sorcerer.

Here are a few networks that have been monitored recently.

❖ HFoZ

With improving propagation to places "down-under", what better place to start hunting than one of the largest Australian networks?

Channels: 3885, 5734, 8043, 12,216, 15890.5 kHz USB

HFoZ has base stations in Perth (Western Base), Alice Springs (Central Base) and Newcastle (Eastern Base) and provides SMS Email and GPS services, assuming that the user's equipment allows it. Perth uses selcals from 6001-6005 to rouse operators, while Alice uses 8001-8005 and Newcastle has 2001-2005. The selcals 2010, 6010 and 8010 provide auto-logging of GPS positions.

❖ RadTel

This network shares some infrastructure with HFoZ, including their three base stations, but adds further bases in Charters Towers (Northeast) and Derby (Northwest).

Channels: 3760, 5105, 5744, 6910, 8083, 8160, 11013.5, 11016.5, 11450, 12211.5, 15968, 16104.5, 16231 and 16240kHz USB

The base station selcal ranges are:

Northwest:	7901-7904
Central:	8901-8904
Western:	6901-6904
Eastern:	2901-2904
Northeast:	3901-3904

Phone calls (also called telcalls) are sent on 2999, 3999, 6999, 7999 and 8999.

❖ VKS737 Network

This extensive Australian network is known by its allocated callsign and has been in operation since 1993. It is also used by the famous Royal Flying Doctor Service (RFDS) for emergency use.

Channels: 3995, 5455, 6796, 8022, 10180, 11612 and 14977kHz USB

The base station network and addresses are as follows (4-digit selcals in brackets are the corresponding RFDS addresses within the network):

Darwin:	94
Derby:	92 (2792, 5300, 6945)
Port Hedland:	78 (2280, 4030, 5300, 6960)
Carnarvon:	74 (2280, 2656, 4045, 5360, 6890)
Meekatharra:	75 (2280, 4010, 5360, 6825, 6880)
Port Augusta:	N/A (2020, 4010, 6890, 8165)
Broken Hill:	N/A (2020, 4055, 6925)
Perth:	05
Adelaide:	06, 96
Swan Hill:	89
Charters:	80, 95
Charleville:	81 (2020, 4980, 6845)
Newcastle:	68
St Marys:	07
Mount Isa:	82 (2020, 5110, 6965)
Cairns:	77, 86 (2020, 2260, 5145, 7465)

❖ Colombian Military Network

This network came to light as a result of following the build-up of the "KM3" ALE network in late 2011 (see *MT* March and April 2012) which shares a number of the same channels. For a long time I had this network as the "9201 Network" in my logs since that appeared to be the NCS (Net Control Station).

Channels: 5364, 6750, 7640, 8142, 8676, 11150, 12230kHz USB

Addresses: 9201, 9202, 9205, 9206, 9207, 9213, 9214, 9215, 9216, 9217, 9218, 9327, 9328, 920206, 920306, 921917

Doubtless there are more channels to be found. Modem traffic is sent using Clover-2000 preceded by a 6-digit rather than a 4-digit selcal.

❖ Unidentified Arab Network

There is an interesting network that seems to jump around a cluster of channels in the 12 and 16MHz bands and I'm sure there must be some lower frequency channels, too. So far the language has not been identified, but it does sound like an Arabic dialect. This one is fairly easy to spot as the users often spend hours and hours sending the most dreadful hand keyed CW using the +500Hz PTT release tone on their radios. I've yet to understand whether anyone can actually copy this code! The net control station appears to be "7349".

Channels: 12216, 12238, 12248, 16216, 16238, 16248kHz USB

Addresses: 1191, 1193, 1489, 1877, 2144, 3246, 3426, 3427, 4073, 4448, 4528, 5246, 5871, 7021, 7349, 9124, 9724, 972503, 972504

The users also have a habit of hopping over to an LSB channel after linking. For example, users on 12216USB flip to 12219.1LSB. This behavior has been seen on a number of channels; perhaps to avoid interference?

That's all for now. See you next month.

RESOURCES

HFLink CCIR493 Page: **hflink.com/selcal/**
Codan CCIR493 Presentation: **hflink.com/selcal/Selcal%20evolution.ppt**

ON THE HAM BANDS

THE FUNDAMENTALS OF AMATEUR RADIO

Kirk A. Kleinschmidt, NT0Z
kirk@monitoringtimes.com

Ham Radio: Killer Fun for Everyone!

I was helping a friend work on his antenna the other day, when I did something stupid that got me thinking about amateur radio's dangers, how our favorite hobby can kill us if we're not careful, and how to stay safe.

My transgression? I climbed a 20-foot section of tower without any safety gear. I wasn't working on anything on the way up, nor was I carrying anything (other than my big backside). I climbed the tower as though it were a ladder, merely to step onto a flat rooftop. But the climb set off warning sirens in my head, and I felt appropriately "bad" during my ascent.

I remembered making hundreds of such climbs in my younger days, but even then I knew that I was unnecessarily risking life and limb. I was just too young to have any real sense of mortality. Unlike today!

Some hams who might otherwise put themselves in harm's way are prevented by "interested third parties." When I visited record producer and recording engineer Tony Bongiovi, KX2Z, in the early '90s, he showed me the antennas and tower atop his Manhattan studio. The coaxial cables ran into his shack, but he wasn't allowed to actually climb his own tower because his partners had deemed him too important to their business for him to risk himself "unnecessarily." Tony seemed frustrated because, as a bona fide engineering type, he was no stranger to rolling up his sleeves and getting his hands dirty.

Most of us, me included, aren't restricted by special insurance contracts and clauses. We can do whatever crazy stuff we can imagine. And we do, usually without even thinking about the risks.

The "mortality issues" that arose from my unsafe tower climb the other day got me thinking about the ways hams can – and do – die in the pursuit of their favorite hobby. It's true that amateur radio is extremely safe, especially when compared to much more dangerous hobbies such as cliff diving, flying homebuilt aircraft, skydiving, etc. But each year several hams die or are severely injured "in the line of duty," and many of those deaths and injuries could have been prevented.

❖ Yes! The Same Boring Lecture! Pay Attention!

Unless you're a crash test dummy, work for the NTSB, or are in the process of falling from your tower or plunging off a bridge in your new car, safety is a generally boring topic (and even if you "learn" it in the milliseconds before impact, you can't really benefit). While listening to a Motorcycle Safety Foundation course in college, I was only casually listening. My eyes were open but my thoughts were focused on how much fun I'd have on my new motorcycle. Thankfully, I was (and am) a safety-conscious cyclist. That makes safety lectures all the more torturous, because riders like me don't have to be convinced to make safety a priority, while unsafe riders pretty much can't be convinced.

It's a double-edged tendency shared by motorcyclists and hams.

In the modern, media-driven age, safety just isn't sexy. It's all too easy to ignore the boring stuff that might save your life one day (or the lives of your loved ones) and focus on the fun stuff we're immersed in. But at the risk of boring you yet again, take a brief vacation from the movie that's playing in your internal cinema and realize that the practice of ham radio, interesting and friendly though it is, can kill you in a jiffy if you don't play it safe. As in kill you – dead!

Most of this stuff comes down to common sense, good habits, and observing "good amateur practice." Your parents tried to teach you these things, and now it's my turn!

❖ Towers and Antennas

These seem to be the biggies, so I'm going to focus most of this column on tower and antenna safety. As a vocation, tower climbing is more dangerous than mining or bomb disposal, and more than 30 people die each year in antenna tower accidents. Recent headlines illustrate these tragedies:

A non-ham couple and their teen-age son were killed while erecting a 50-foot vertical antenna at the Florida home of the man's mother (who is a ham). The three were installing the vertical in the dark when they lost control of the antenna and it made contact with nearby overhead high-voltage power lines. A family friend, a teen-age boy, was on the roof at the time of the accident. He and the couple's daughter, who was in the house at the time, were not injured.

At a recent Field Day outing a Michigan ham with years of experience as a professional tower installer was killed when a tower he was climbing (he was using appropriate safety gear and procedures) failed at the base and fell over.

An Ohio ham, also an experienced climber, fell from the top of his 100-foot tower when a seam on his safety belt gave way.

Following all the right procedures when installing towers and antennas can be somewhat inconvenient, but compared to injury or death they're a minor inconvenience.

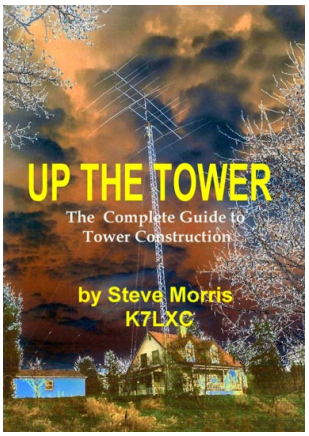
❖ Life-Saving Safety Tips

Don't work on towers and antennas by yourself. Always have someone working with you on the ground to fetch things, send up tools, offer advice and to call 911.

If the wind picks up or you hear the rumble of thunder, get off the tower *right away* (even if you're on a DXpedition, working a contest, etc).

If you're exhausted, sick, or under the influence, do something else until you're functional. Ham radio will still be here tomorrow – and if you don't do something reckless, so will you!

That special place at the top of your tower seems as wonderfully isolated as it is elevated, but keep your head out of the clouds and remember that you have a person (or people) working with you on the ground. Don't throw tools or parts in a manner that could endanger your helpers. In that light, your helpers wear should wear hardhats, safety glasses and other necessary protective gear.



With more than 200 amateur radio tower installations and dozens of commercial radio sites under his belt, Steve Morris, K7LXC, has forgotten more than most people ever know when it comes to towers and tower safety. His 220-page book** Up the Tower: The Complete Guide To Tower Construction, **is available from Universal Radio, www.universal-radio.com, for $29.95.

Make sure the area is free from electrical power dangers — high and low — before you do *anything*. Don't trust your life to a cursory examination. You won't know whether there are power lines hidden in the tree branches unless you look closely! The overhead telco service drop may be connected to the ac mains (intentionally or otherwise). Because of power faults and other electrical problems, cable and telephone lines can be deadly. An installer buddy told me several hair-raising stories about "hot drops." If the tower or antenna you're working on

could contact an electrical power source (or come too close) if it fell or moved, you need a different antenna or a different location! Period.

When climbing towers or poles, make sure you're *always* attached while climbing and working. I worked for a local TV repair shop installing towers and antennas as a teenager. My "tower mentor" was older and quite experienced, and he constantly drilled me on safety issues and safety hardware. Despite that, as was the practice of the day, our safety belts went only around our waists and we were belted onto the tower only while at height, fixed and working. The climbs were careful, but "freehand."

Those older methods are considered *deadly* these days. Modern climbing rigs use multi-point harnesses with the usual safety belt for fixed work, plus additional fall-arrest harnesses that connect the climber to the tower the whole way up. Using the new gear adds time and complexity to climbs and descents, but the extra margin of safety more than makes up for it!

Carefully inspect your climbing and safety gear before (and after) every climb. The more we do something, the safer and more confident we feel while doing it. Staying safe requires that we force ourselves to practice the basics during every outing. Tower work is a lot like skydiving in that sense, and a single moment of overconfidence can lead to disaster.

Fraying fabric or leather, cracks in metal buckles or D-rings, etc, are your cue to *immediately destroy the item and dispose of it* so you or someone else can't accidentally use it and potentially suffer the consequences! Don't try to sew it, weld it, drill it, grind it, sand it – whatever! *Break it and throw it away!*

Unless you're shipwrecked, don't modify your safety gear, drill holes in it to make the buckles and belts fit properly (or to save weight), or replace certified safety grade components with inexpensive junk from a local hardware store. A carabiner made from cheap pot metal may hold your water bottle to your belt just fine, but it may not hold you to the side of your tower, so don't risk it!

Keep your climbing and safety gear secure, dry, and protected at all times. Don't lend it to friends, neighbors or even fellow hams unless you accompany it *the whole time it's out of your custody*. You just don't know what might happen to you safety gear when it's out of your control. Your life depends on that hardware being 100%.

Let the big muscles in your legs provide the power when climbing, not your arms! If you're an average sedentary ham you'll be wobbly enough at the top without blowing out your arm and hand muscles on the way up. You'll need those for fine motor tasks, so protect them during the climb.

Crank-up towers should *never* be climbed! If the raising cable (which might be 10-40 years old) fails when you're off the ground, you're in big trouble. If you survive the fall you may find yourself missing a limb or four, as a collapsing crank-up tower can shear your body parts off as though they were butter. Considering that these cables fail regularly on their own, climbing one is "crazy dangerous."

There are many other factors (engineering, materials, soil condition, etc) that contribute to tower safety (or the lack thereof). New towers, for example, must be sized and installed correctly to be safe. But many or most ham towers are used or "acquired," which greatly increases the potential risks.

This photo of a Utah lineman repairing a damaged power line in the aftermath of Hurricane Rita always catches my attention. I'm not an expert on government regulations regarding lineman safety practices (so this may be completely compliant), but the use of the single "around the waist D-ring belt" is not suitable for antenna tower work. In this configuration, during a slip or fall it's easy to flip upside down or suffer a broken back. (FEMA photo by Marvin Nauman courtesy of Wikimedia Commons).

Is the tower base built and sized correctly? Any problems with underground corrosion? How about the condition of the nuts and bolts holding an existing tower together (for 10 to 30 years)? Are the guy anchors deep enough and of the correct size? How about the turnbuckles and guy cable thimbles?

Used towers are simply extra dangerous, but either way, check out the Resources box for more information.

❖ Car Accidents

Distracted driving is a hot-button issue for hams and non-hams alike, and despite the fact that using a typical mobile radio is almost certainly not as distracting as using a cell phone, texting, etc, it's something we need to be aware of as drivers, pedestrians *and* hams. Government regulators have so far exempted most amateur radio mobile installations from new legislations, but keeping things that way requires constant vigilance.

According to the facts and figures at **www.distraction.gov**:

- In 2009, 5,474 people were killed in crashes involving driver distraction, and an estimated 448,000 were injured. (NHTSA)
- In June of 2011, more than 196 billion text messages were sent or received in the US, up nearly 50% from June 2009. (CTIA)
- Drivers who use hand-held devices are four times more likely to get into injury-causing crashes. (Monash University)

There are additional statistics at the site, and they're sobering at best. It may be that driving is ultimately more dangerous than tower climbing because most of us do a lot more driving than climbing. And statistically it doesn't matter whether you or the "other driver" is distracted, with 448,000 injuries annually attributed to distracted driving, one in 700 Americans will be injured each year!

I have no idea whether distracted driving was involved, but in early 2007, noted QRPer and Soldersmoke podcast regular Mike Caughran, KL7R, was killed in a car-bus crash while on vacation in Hawaii. He was driving in unfamiliar territory in an unfamiliar vehicle, but he was nowhere near a tower. We still miss you, Mike.

❖ Electrical and RF Exposures

Lightning strikes, breaker box mishaps, downed power lines, power amplifier service accidents are only a few dangers encountered by hams on a regular basis, and some of those encounters are tragic. That topic, along with RF exposure safety, will likely be covered in future columns.

❖ Sedentary Lifestyle

Sitting in front of the radio (or computer) for hours on end, all the while eating genetically-modified "Frankenfood" and getting little or no physical activity probably kills more hams than all other causes combined. According to Wikipedia, a lack of physical activity is one of the leading causes of preventable death worldwide, increases risk for just about every chronic disease, and has been shown to be a risk factor that is independent of a person's body mass index (weight).

People who are inactive for more than 11 hours a day have *40 times* the risk than those who are inactive for less than four hours a day. Thankfully, five hours of exercise a week can offset that increased risk. Ironically, all other safety issues aside, the exercise value in climbing your tower five times a week would probably extend your amateur radio career more than most other behaviors!

There's a lot more to the safety picture, of course, but I hope I've gotten your attention for at least a little while. Think things through and use common sense when working on towers, using your mobile rig while in motion, or deciding whether to actually eat a Twinkie.

RESOURCES

Tower and Antenna Safety and Design

You'll obviously need a lot more information to truly be safe, so check out these resources for the whole story:

- Venerable tower-maker Rohn Products has useful information available at **www.rohnproducts.com/tower1.htm**.
- The 214-page *US Coast Guard Tower Manual* is loaded with pictures, illustrations, and easy-to-understand instructions and procedures. It's a free download at **www.uscg.mil/directives/cim/11000-11999/CIM_11000_4a.pdf**.
- The newest *ARRL Handbook* and *ARRL Antenna Book* have updated sections on tower safety. If your local library or ham club doesn't have one on hand you can obtain a copy from **www.arrl.org** or from your favorite amateur radio bookseller.
- Although it's a bit on the dry side and heavy on the math, the *Steel Tower Design Standard*, ANSI/TIA/EIA 222-G, is loaded with tower design information. You can buy a (very expensive) copy at **www.tiaonline.org**, "find" a copy somewhere online, or get lucky at a large city or university library.

GETTING STARTED

THE BEGINNER'S CORNER

Ken Reitz, KS4ZR
kenreitz@monitoringtimes.com

C-Band FTA: How small can you go?

In the March edition of the *Beginner's Corner* I mentioned that, "it may be possible to receive C-band Free-to-Air (FTA) satellite signals on a dish as small as 40 inches, roughly 101.5 cm."

Recently, long-time *MT* reader and "On the Bench" contributor, Mario Filippi N2HUN, sent this email:

"Your mention of using a small offset dish for C-band FTA reception in the March issue of *MT* spurred me on to a small dish project of my own. Your planting of the seed of curiosity in my brain had me evaluating an experimental system here.

"Initially, I set up a 90 cm motorized offset dish with a dual C/Ku LNBF, got some nibbles from 91º W and 99º W C-band birds, but the pixilation was a problem. Since I had a 100 cm dish available for Ku FTA, it was pressed into service. The picture shows my small dish set up consisting of a WS International 100 cm offset dish; Sadoun PowerTech DG-280 Horizon-to-Horizon motor; a BSC621-2D C/Ku band universal LNBF with offset bracket; a conical scalar ring (an add-on accessory to maximize C band signals) and an Openbox S9 HDPVR FTA receiver (not shown).

"First, I removed the original Ku-band LNBF from the above system and replaced it with the BSC621-2DC/Ku band LNBF as per the picture. Then a little adjustment of the dish elevation was needed to maximize the Ku-band signals, followed by several days of power/blind scanning of satellites to snag some signals.

"Having little knowledge of what C-band satellites would be available with a small dish, the shotgun approach was used, i.e., anything from about 31.5º W to about 121º W was scanned, vertical and horizontal polarization only. With this small dish setup the following satellites could be received: Galaxy 16 at 99º W, Galaxy 17 at 91º W and Intelsat 805 at 55.5º W.

BSC621-2D C/Ku band universal LNBF with offset bracket and 100 cm dish. (Courtesy: Mario Filippi N2HUN)

Galaxy 16, 99º W, C-band broadcast from Puerto Rico. (Courtesy: Mario Filippi N2HUN)

"That's about the gist of what was received with my system, a total of about 45 channels. A couple of things I learned along the way with this dual system: Adjust the skew of the dual band LNBF first for the C-band to get the highest percent signal quality. This requires slow and careful turning, as a few mm off can make a difference. Next, the conical scalar ring, at least in my case, affected the signal quality. By loosening up the ring and twisting it in different directions, the signal improved.

Gal 16, 99º W. LeSea broadcast, with program info. Adjusting the scalar ring brought this broadcast from pixilation to good picture quality. (Courtesy: Mario Filippi N2HUN)

"I hope this can be of help to you and others out there trying to accomplish the same endeavor. This was a labor intensive but worthwhile project, as I can switch over to the C-band when I get bored in Ku-land. Thanks for the inspiration, and feel free to use this info as you see fit."

Mario did a great job to get a lock on C-band FTA satellite signals from a 40 inch dish! And, there are a couple of crucial things he mentioned in his report that are worth remembering: Setting up for the best possible Ku-band reception will net the best possible C-band reception (that's true when using big dishes as well); and, this is a "labor intensive" project (it takes a tremendous amount of patience to try to get Ku-band dishes to play at C-band frequencies). And, even when you do have success, as Mario clearly demonstrated, the results can be marginal and may not be able to stand up to a little wind and rain.

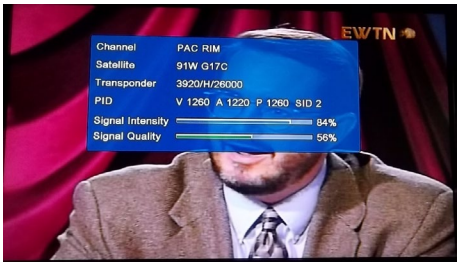
❖ Success on the Channel Master Eludes Me

While Mario was using his set-up, I was struggling with my own. I had a Channel Master 84E 40 inch offset fed Ku-band dish which I was hoping to use for C-band reception. But there were problems literally out of the box. The design of this dish isn't nearly as handy as Mario's. The molded plastic dish is heavily supported in the back to prevent warping in the heat and the mount is very heavy-duty, the opposite of many inexpensive FTA dishes. Coupled with the C-band LNBF and enlarged scalar ring, the offset LNBF mount is not as stable as Mario's bracketed support.

The enormous weight of the whole Channel Master dish (certainly compared to smaller 60 and 90 cm steel dishes) makes it difficult to set up on a mounting pole without a lot of wobble. C-band reception on such a small dish, as Mario points out, is a tedious proposition. Small changes in settings make a big difference and are time consuming. After hours of wrestling with the Channel Master 40 incher I threw in the towel. It will make a great stand-alone Ku-band antenna but not for experimenting with "small dish C-band."

From my own experience I'd encourage anyone planning to try C-band on a Ku-dish to

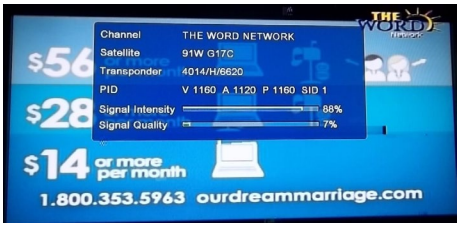
Channel Master 84E 40 inch offset fed Ku-band dish set up for C-band reception. (Courtesy: Author)



Galaxy 17, 91º W, EWTN broadcast. Good signal quality. (Courtesy: Mario Filippi N2HUN)

opt for the 100 cm Fortec Digital Star dish that Mario used (FC100CM $150) available from Sadoun Satellite (**www.sadoun.com** 888-527-9888). The dish drive, a PowerTech DG380 ($100) and the DMS BSC621 C/Ku-band LNBF ($45) with conical scalar ring ($55), complete the system. Using the BSC621 gives you both C and Ku-band reception.

While I was chasing signals on the 40 inch dish, I was also swapping LNBFs on my 10 foot C/Ku-band dish. Without a doubt, the WS DMX741 C/Ku-band feed mentioned in the February 2012 *Beginner's Corner* ($45 from Sadoun) is still the champ; easily performing as well as the traditional Chaparral C/Ku-band feed costing $250 more. What's more, by combining the big dish feed with the Manhattan RS-1933 receiver ($200, reviewed in the January *Beginner's Corner*), utilizing the loop-through feature on the Manhattan to my Motorola 4DTV receiver which drives the ten foot dish, I am able to catch C and Ku-band analog, FTA digital and Digicipher II digital signals from satellites across the U.S. and into the Atlantic Ocean Region. This brings in hundreds of free TV and audio channels from dozens of countries and as many languages.



Gal 17, 91º W, The Word Network broadcast, poor signal quality but remarkably still, a solid picture. (Courtesy: Mario Filippi N2HUN)

If you're interested in doing your own experiments in broadcast satellite TV DX, the first place to start should be Mike Kohl's Global Communications web site. He compiles four lists of programming found on all of the C and Ku-band satellites viewable from North America:

Domestic Ku-band: **www.global-cm.net/MPEGlistKuBandUS.html**
Domestic C-band: **www.global-cm.net/MPEGlistCBandUS.html**
Atlantic Ocean Region: **www.global-cm.net/MPEGlistATL.html**
Asian-Pacific Ocean Region: **www.global-cm.net/MPEGlistPacRim.html**

This is the most authoritative list of active transponders available and is updated quite regularly. The list includes only FTA channels, not pay channels or other services that are encrypted or otherwise not able to be seen on an FTA receiver. I make it a habit of printing out a new list every six months and constantly refer to it to discover new channels or to try to figure out what it is I've stumbled into. It's also handy to have in your hand when you're trying to set a separate dish up for one satellite reception.

❖ Going Against Satellite Physics

How can DirecTV and DISH Network systems get away with such small antennas? It's mostly due to power. Direct-to-Home (DTH) satellites, operating in the Ku-band, typically have power output of 120 to 240 watts, while broadcast satellites operating in the C-band typically have about 40 watts.

That was the main selling point in the beginning of DTH Ku-band reception; instead of a hulking 10 foot dish in your back (or worse, front) yard, a discreetly placed small dish only 18 inches in diameter could be used. It was a no-brainer. Within months the whole DTH industry changed and what quickly became old-fashioned C-band reception was left to the satellite TV hobbyists, where it still thrives today, though greatly diminished.

Among the problems to be encountered in small dish C-band reception are the logistics of mounting a C-band LNBF on a Ku-band mount; peaking the dish for reception of one satellite and making it good enough to stand up to travel across the arc to other possible satellite targets; having a narrow enough boresight to prevent ingress (the splash-over of signals from adjacent satellites typically placed no more than two degrees apart); coping with lower satellite output and making sure that the mount is sturdy enough to hold up to the additional weight and dish movement. Some locations, such as my own, also suffer from interference due to point-to-point microwave relays operating in the C-band. Such transmissions can wipe out a single or several C-band satellite channels.

Thinking back 28 years ago, when I installed my first satellite TV system, no one would have believed even attempting such a thing as C-band reception on a 40 inch dish. Ten feet was considered the minimum and most used 12 foot or larger dishes (it's no wonder that such systems in those days ran into many thousands of dollars). But, amazing improvements in satellite receiver and LNBF technology, higher powered satellites, and digital transmission has made it a near reality.

In the collapse of the big dish market, hundreds of thousands of big dishes were carted off to landfills across the country. Then, the recycling business made rounding up such "orphaned" dishes a profitable enterprise. There was a period of a few years between the two times that homeowners would gladly give away their big dishes if someone, anyone, would take them away. Many satellite TV hobbyists took advantage of that possibility and carted away valuable and still useful dishes.

Meanwhile, big dishes are still available, but they've become quite expensive. A 7-1/2 foot black mesh dish – about the smallest that will give satisfactory C-band reception – can be had for just under $900. A 10 foot diameter dish currently sells for $1,300; a 12 foot heavy duty C/Ku-band antenna now sells for $2,200 (all prices exclude shipping, which could cost another $100 or more). Now you can appreciate why satellite TV hobbyists might try to see just how small they can go for C-band reception.

Back of the Channel Master dish shows heavy-duty mount. (Courtesy: Author)

PROGRAMMING SPOTLIGHT

WHAT'S ON WHEN AND WHERE?

Fred Waterer
fredwaterer@monitoringtimes.com
www.doghousecharlie.com/radio

Spotlight on Asia

This month, we shine the *Programming Spotlight* on Asia, and we'll float above the Swiss Alps. Then we'll travel to Canada with an emphasis on its easternmost province for some holiday programming.; we'll look in on South Eastern Europe and its EU ambitions, and finally look at a few countries which might be thinking the EU wasn't such a good idea after all.

Radio Thailand doesn't get a lot of attention, but it is a very interesting station to listen to, for a slightly different view of Asia and the World. Broadcasts generally begin with a newscast focussing on local news. At about 10-11 minutes past the hour one can hear ***Global News.*** Often stories that get no coverage at all in North America are highlighted. In a May broadcast, stories about Australian troops in Afghanistan, a Singapore trade mission to Brazil, and the appointment of a new Haitian Prime minister were interspersed with stories about President Obama's re-election efforts and online learning programs organized by MIT and Harvard.

Other features include ***Sports, Take On Thailand*** (a trip around this exotic country) and ***Upcoming Events***, all of which mingle with frequent commercials for Thai Airlines and other businesses. In fact, the moral of the story, if one listens to **Radio Thailand**, is that the country is open for business, advertising itself as a gateway to ASEAN.

Weather forecasts are very enticing, promising warm sultry conditions ahead of the rainy season. The program concludes with a rather unexpected segment called ***Contemplation of Words*** such as "quintessence." This segment was sponsored by a (private?) school. There were lots of commercials and sponsors. Many seem to be state-run enterprises. These broadcasts, infomercials really, put a positive spin on all things Thai. Most international broadcasters try to put a positive spin on their respective countries. Thailand does it with a fast paced reminder that the country is open to investment.

You can try to listen to **Radio Thailand** on 15275 kHz at 01 and 02 UTC, or listen online at **www.hsk9.org/** and click on the "Sound Archive" icon. Here, you can listen to or download programs from the past week. Give them a listen for a fresh perspective on Asia and the World. **Radio Thailand** is also on Twitter and Facebook.

Speaking of fresh perspectives on Asia, check out the new program from **Keith Perron's PCJ Media**, called ***Focus Asia Pacific.*** Keith, based in Taiwan, launched the program in May 2012. In the first edition, Keith said that ***Focus Asia Pacific*** would be a weekly news magazine putting the focus on the Asia-Pacific region, looking at stories and topics from this vast region that aren't getting coverage in the Western media.

In his inaugural program, Keith featured reports about the effect of Australia's new carbon tax on East Timor's natural gas industry, complaints by Sri Lankan academics about pay, tensions between Sri Lanka's Buddhists and Muslims, and the death of a human rights activist in Cambodia. Most of the reports seem to come from regional broadcasters like **Radio Australia** and **Radio New Zealand**. It's a very interesting and informative program about current events in the Asia Pacific region and well worth checking out.

By the time you read this there should be a number of editions available on the program archive at **www.pcjmedia.com/fap** No word yet on whether any shortwave stations will be picking up this program. In the meantime, the PCJ Media website is a treasure trove of interesting programming on a wide variety of topics.

❖ Switzerland in Sound

Staying with **PCJ Media** programming for a moment, long time shortwave listeners can hear a very familiar voice, that of **Bob Zanotti** on the program ***Switzerland in Sound***. Bob will be remembered by many as one of the hosts of the very popular ***Swiss Shortwave Merry Go Round*** program which was heard via **Swiss Radio International** for many years. ***Switzerland in Sound*** fills the gap left by the departure of **SRI**, which has gone the way of so many broadcasters.

In early May, Bob spoke to a gentleman about seeing Switzerland from a bird's eye view, via airplanes, helicopters and balloons. He painted a word picture that had me floating through the Alps on a beautiful clear day. Radio is a magic medium that way. He also looked at the Swiss Bed and Breakfast industry. **www.pcjmedia.com/switzerland-in-sound-bob-zanotti** Go here to listen to the most recent *SIS* programs.

Also have a look around Bob's own website at **www.switzerlandinsound.com/** "When *SIS* went online on August 1, 2004 it was intended to be the continuation of the English-language shortwave radio broadcasting tradition in Switzerland that I knew and served for 32 years. That came to an end in October of that year.

"Today, ***Switzerland in Sound*** is the only source of professional, English-language audio reports and features about Switzerland and things Swiss presented in the classic radio style, enhanced by text and pictures. These include a wide range of subject matter from candid one-on-one interviews with interesting people, to entertaining, in-depth features and reports about Swiss life and society, as well as exciting, colorful, animated visits to tourist destinations and attractions all over the country." Poke around his website for lots of interesting audio, including memories of **"The Two Bobs"** on **SRI** and lots more!

❖ Canada Day

July 1 is Canada Day, the 145th anniversary of Confederation. As a special present to mark this occasion, the **CBC** in its infinite wisdom (note the sarcasm) plans to shut down **RCI** a few days before. **Radio Canada International** intends to continue online with a much reduced staff, and one supposes that there still could be some sort of last minute reprieve. For those within earshot of **CBC Radio One** and **CBC Radio Two** transmitters, there will be special holiday programming on the air throughout the day.

CKZN shortwave (6160 kHz) in St. John's Newfoundland might also be worth trying for on July 1. Newfoundland was a separate country until 1949, a self-governing Dominion within the British Empire for much of the first half of the twentieth century. July 1 is a solemn day in Newfoundland. On that date in 1916, 780 men of the Royal Newfoundland Regiment "went over the top" during the Battle of the Somme at Beaumont Hamel. Within 15-20 minutes the vast majority of these men were dead, dying or wounded. The next day 68 able bodied men answered the roll call. 68! For a colony of 250,000 people this was a devastating loss, and July 1 became Newfoundland's Memorial Day. The province then joined Canada on July 1, 1949, making the day one of mixed emotions for citizens of the province.

July 1 therefore might be the ideal day to try and hear **CKZN**. Remember also that Newfoundland has its own quirky little time zone. It is 1.5 hours ahead of EDT. So when listening "from away" as the locals might say, the top of the hour in Newfoundland is the bottom of the hour everywhere else. Listening on the First might also offer the opportunity to hear *Ode to Newfoundland*, the one-time national anthem

of Newfoundland. One can also try to listen to Newfoundland radio stations online, some of which still retain call letters beginning with V, for example VOCM and VOAR, a reminder that Newfoundland was once a separate radio country.

In the rest of the country, **CBC Radio One** programming across the country will acknowledge the national holiday. **www.cbc.ca/radio** is the place to start. Or you can try 50 kW blow torch **CJBC**, 860 kHz in Toronto for holiday celebrations with a difference…celebrations in the other Canadian official language, French. *Vive le difference*! Listen online at **www.radio-canada.ca/**

❖ Yugoslavia

During the summer months, it becomes easier to hear the former **Radio Yugoslavia**, now known as the **International Radio of Serbia**. For a long time after the country began to break up in the early 1990s, this station maintained the illusion of speaking for the whole of the former nation, as one by one the republics left, often violently, until all that were left were Serbia and Montenegro. The latter finally left the union in 2006.

In the 1980s, **Radio Yugoslavia** was a pleasant station to listen to. I recall an idyllic sounding travelogue about the Dalmatian coast in particular. Then in the early 1990s, as tensions built within the federation and the first republics declared independence, the tone of the broadcasts was both factual and impartial, giving both sides of the story. But as the situation got uglier…and bloodier…the tone of the broadcasts changed dramatically, becoming more strident and propagandistic. The station was silenced for some time after the 1999 NATO intervention. When it did return, the tone had changed again. The nation was resigned to its fate and defiant about Kosovo.

In the summer months, **International Radio of Serbia** puts a fairly good signal into North America most evenings at 0030 UTC on 9685 kHz. You can also listen to the same broadcast, as well as other languages online at **www.voiceofserbia.org** For many years, the station has provided full texts of the daily newscasts online. While perusing these news reports for this column, it was noted with amusement that among the results of the recent parliamentary elections in Serbia, three parties received one seat each including "None of the Above."

There is some really good music heard in the broadcasts from Serbia; often the last half of the transmission is completely musical in nature. Quite often there is lots of good music in the Serbian transmissions, too, which can be heard before and after the English-language programming.

Croatia is the other former Yugoslav republic which broadcasts on the international bands. You can often hear them quite well on 7375 kHz via Germany. You can also listen at **www.hrt.hr/?id=hrstream** (Click on the blue box labelled **"Glas Hrvatske")** One can also listen to other domestic radio programming including **Croatian Radio 1** which promises "24 hours of local music, all music styles from all periods". "The Second Programme of **Croatian Radio**, the Croatian time from midnight to 6 am" (2200-0400 UTC) promises a "live DJ" spinning all the music from this country. Both Serbia and Croatia long to join the EU, which may not be that good an idea…

❖ European Monetary Crisis

Watching the news in early May, it was fascinating to witness the developing story of the European debt crisis and its effect on the politics of the countries of the EU. Prominent among these stories were the elections in both Greece and France where the voters rejected the incumbents and threw out those politicians advocating austerity. PIGS is a pejorative acronym for the four perceived weakest economies in the European Union, namely Portugal, Italy, Greece and Spain. Sometimes, Ireland is lumped in with these as well (PIIGS). I was interested to see what sort of information was available via radio, concerning these countries in particular and the crisis in general.

I started in **Ireland**, as **RTE** is a favorite station. I felt sure that they would have an interesting take on things. I was not disappointed. There is a really good program on local Sunday mornings at 10am local time (1000 UTC) called ***The Business***. The program is hosted by **George Lee**, although in May when I tuned in **Richard Curren** was the presenter.

There is a little bit of everything in this program, from personal stories of people dealing with bankruptcy, to larger issues such as governmental austerity measures and their effectiveness. One segment looked at the rise of door-to-door salesmen; another examined the usefulness of customer loyalty cards and the motives behind them. It's all very interesting stuff. You can download ***The Business*** as a podcast, listen to individual segments online at the RTE website, or even follow the show on Twitter and Facebook. Check it out at **www.rte.ie/radio1/thebusiness/**

Portugal – **RDP Internacional** left shortwave some time ago. It can be heard online but only in Portuguese. Years ago I can recall listening to **RDPI** during Portuguese election campaigns. They were very lively affairs. Although I did not really understand much of what they were talking about, it was interesting to listen to the party ads which if I recall correctly, were run in half hour blocks. The following link will take you to the **RDPI** webpage. Opening it in Google Chrome will allow you to translate it into English. When they introduce technology to simultaneously translate radio programs I will be truly grateful! **http://programas.rtp.pt/EPG/radio/epg-dia.php?canal=5**

Italy – **RAI** English language broadcasts were never much to write home about. Does anyone remember the famous (infamous?) Dead Lady who used to read the news? Like Portugal, you pretty much have to speak Italian to make any use of the stations or its website. If you do speak Italian, **Radio 1** seems to be the destination for news in these perilous times. **www.rai.it/dl/rai/guidaRadio.html**

Greece – The monetary crisis is felt most acutely in Greece and this country has been the "scene of the action" so to speak. The **Voice of Greece**, like many public sector enterprises in the country has seen strikes and disruptions of normal services. 9420 kHz has usually been a pretty reliable frequency. I found this online, I'm not really sure if it links to the **Voice of Greece** or not: **http://tvradio.ert.gr/radioen/liveradio/voiceofGreece.asp** One may not speak Greek (dare I say it's all Greek to me?) but what it lacks in comprehension it makes up for in some great music.

Spain – **Radio Exterior de Espana** is the one international broadcaster that transmits daily in English. Spain reportedly had an unemployment rate of close to 25% in early May. Listen at 0000 UTC on 6055 kHz. Listen online at **www.rtve.es/alacarta/audios/emision-en-ingles REE** coverage is impressive, with both domestic issues and pan-European issues covered in depth. Much of the broadcast content looks at the pros and cons of the Spanish and European austerity policy.

France – The defeat of President Sarkozy marked the 11th defeat of a European leader at the polls. Socialists were punished in Greece, Conservatives in France. Being an incumbent is not what it's cracked up to be any more.

Maybe the best news program on the air is the **BBC's *The World Today***. Give it a listen at 0300 UTC on 9750 kHz, or online at: **www.bbc.co.uk/programmes/p002vsn9** Here you can listen to recent editions or subscribe to the podcast. Each day, the program informs one about the issues of the day in the UK, Europe and the broader world.

THE QSL REPORT

VERIFICATIONS RECEIVED BY OUR READERS

Gayle Van Horn, W4GVH
gaylevanhorn@monitoringtimes.com
http://mt-shortwave.blogspot.com
Twitter @QSLRptMT

Firecracker Special 2012

If it's July, it's time for the annual sizzling Firecracker Special, a month to forego tips and bring you the latest QSLs from across the globe. Don't forget to celebrate America's birthday on the 4th...and find some quality time at the dials.

ANGUILLA

The Caribbean Beacon, 11775 kHz. Full data antenna/transmitter card, signed by Doris Mussington. Received in 48 days for followup to: ***beacon@anguillanet.com*** (total 189 days). for an English report, and $ 2.00US (Al Muick, Whitehall, PA/HCDX).

BELARUS

Radio Belarus, 6155 kHz. Full data station card signed by Fyodor Parfenka. Received in five days for an email to: ***radio_belarus@tvr.by*** (Christian Ghibaudo, Nice, France/playdx). Streaming audio **www.radiobelarus.by**

BELGIUM

Pur Radio, 6085 kHz. Station verification on PDF form. Received in 83 days for an email to: ***purradio1@skynet.be*** (Roberto Pavanello, Italy/playdx).

BRAZIL

Radio Itatiaia 5970 kHz. Full data photo card of studio, signed by Severino Carneiro, Gerente Técnico. Received in total 660 days for a followup report and audio mp3. Station address: Rua Itatiaia 117, Bonfim, Belo Horizonte MG, Brasil (Rafael Rodriguez R., Bogotá, Colombia/HCDX). Website: **www.itatiaia.com.br/**

CLANDESTINE

Sound of Hope Radio International, 7105 kHz. Full data blue/white logo card, unsigned, plus sticker. Received in 45 days for an English report and $2.00US. QSL address: 6-4, Lane 84, Guó Tái St, North District, Taichung 404, Taiwan (Tom Banks, Dallas, TX). Streaming/on-demand audio **www.soundofhope.org**

Voice of Eritrea via Geja, Ethiopia 7235 kHz. Electronic verification letter from Filmon H. Yohannes. Received in 4-1/2 hours for an email report to ***hizbawii@gmail.com*** (Wendel Craighead, Prairie Village, KS).

FRANCE

Radio Taiwan International relay via Issoudun, 3965 kHz. Full data RTI color scenery card unsigned. Received in 45 days for an English report. Station address: 55 Pei An Road, Taipei 10462, Taiwan (Sam Wright, Biloxi, MS). Streaming/on demand audio **www.rti.org.tw** Email: ***rti@org.tw***

GERMANY

Radio 700, 6005 kHz. Full data QSL card, unsigned. Received in 60 days for email report and mp3 audio to: ***christian.milling@funkhaus-euskirchen.de*** (Francesco, Spain/playdx).

MEDIUM WAVE

KACH 1340 kHz AM. Full data verification on KACH letterhead, signed by Alan White, General Manger/Owner. Received in 24 days for CD report and SASE. Revised station address from NRC Log: 1633 No. Radio Station Road, Preston, ID 83263-5813 (Patrick Martin, Seaside, OR). Website: **www.kachradio.com** Email: ***kash@kachradio.com***

KBOI, 670 kHz AM. ***News Talk 670***. Full data transmitter building/antenna card, signed by Randall Rocks, Chief Engineer, plus studio and equipment photos. Received in 13 days for reception of DX Test, cassette and SASE (not used). Station address: Box 1280, Boise, ID 83701 USA (Bill Wilkins, Springfield, MO). Streaming audio **www.670kboi.com/**

KZDC 1250 kHz AM. ***ESPN 1250 The Zone***. Full data verification on Border Media letterhead, signed by Greg Martin, Operations Manager. Received in 20 days for an AM followup (total 1,365 days). Station address: 2700 NE Loop 410 # 300, San Antonio, TX 78217 (Martin).

WFSM 1670 kHz. ***Fox Sports Radio***. Full data station QSL, signed by James Gay, Chief Engineer. Received in 36 days for an AM report. Station address: 7080 Industrial Hwy., Macon, GA 31216 USA (Banks). Streaming audio **www.foxsports1670.com**

WMIX, 940 kHz AM. Partial data verification on station letterhead, signed by Christopher Hugo, Assistant to Chief Engineer. Received in 56 days for an AM report, $1.00US and address label (used). Station address: 3501 Broadway, Mount Vernon, IL 62864 (Wilkins). Streaming audio **www.mywithersradio.com/wmix/**

WPTF, 680 kHz AM. ***News Radio 680***. Full data E-QSL from Brian Freeman, Program Director. Received in 30 minutes for posting email report at website Contact Link. Station address: 3012 Highwoods Blvd., Suite 201, Raleigh, NC 27604 USA (Banks). Streaming audio **www.wptf.com**

WSM, 650 kHz AM, ***The Legend***. Full data Aircastle of the South folder card, signed by Robin Roberts Ladisa, plus station stickers. Received in 90 days for an AM report, $1.00US and address label (not used) (John Bankston, Ft Worth, TX). Veri signer email: ***robin@wsmonline.com*** Streaming audio **www.wsmonline.com**

MONGOLIA

Voice of Mongolia, 12085 kHz. Full data station card, signed by Densmaa Z. Mail Editor. Received in 177 days. Station address: P.O. Box 365, Ulaanbaatar 13, Mongolia (Ghibaudo). On demand audio **www.mnb.mn** Email: ***densmaa9@yahoo.com***

SÃO TOMÉ

BBG/Afia Darfur relay via Pinheira, 7275 kHz. Verification letter from Helena Menezes, plus attached full data color E-QSL of transmitter site/BBG station logos RFE/RL, VOA, Sawa and RFA, signed by Victor Guadalupe-Transmitter Plant Assistant Supervisor. Received in one week for email report to: ***HMenezes@sto.ibb.gov*** (Craighead).

THAILAND

Radio Thailand World Service, 13745 kHz. Full data color floral card, unsigned. Received in 120 days for an English report, $2.00US and souvenir postcard. Station address: Public Relations Department, Royal Thai Government, 236 Vibhavadi Rangsit Road, Ding Daeng, Bangkok 10400, Thailand (Frank Hillton, Charleston, SC). Streaming audio **www.hsk9.org** Email: ***english@hsk9.org***

UNITED STATES

Radio Slovakia International relay via WRMI, 9955 kHz. Full data Slovak Radio building in Bratislava card, signed by Juan. Received in 13 months for an English report and $1.00US sent to WRMI. QSL address: 175 Fontainebleau Blvd., Suite 1N4, Miami, FL 33172 USA (Wilkins).

UTILITY

Croatia-NDB Vrsar, 369 kHz. Full data QSL card, signed by Darko Lenz, Head of Technical Dept. Received in 16 days. Station address: Hrvatska kontrola zracne plovidbe d.o.o., Podruzanica Pula, Valtursko polje 210a, pp 238, 52000 Pula, Croatia (Patrick Robic, Austria/UDXF).

Greece-Athinai Aero, 5637 kHz. Partial data signed/stamped prepared QSL card, signed by C. Andrikopoulou, Director of Com Division. Station address: Hellenic Republic Ministry of Infrastruture, Transport & Networks, Civil Aviation Authority, General Directorate of Air Navigation, Telecommunications Division, P.O. Box 70360, 16610 Glyfada, Greece (Robic).

Japan-JJY/Time Signal Station, 40.0 kHz. Full data QSL card. Received in 32 days for a utility report. QSL address: National Institute of Information and Communications Technology, Applied Electromagnetic Research Institute, Space Time Standards Laboratory, Japan Standard Time Group 4-2-1 Nukui-Kitamachi Koganei, Tokyo 184-8795 Japan (Mauro Giroletti, Italy/UDXF).

South Africa-ZSC Capetown Radio, 19689.4 kHz. Full data Capetown Beach E-QSL from Ashraf Khan, Operations Specialist, plus station literature. Received in 51 days for a utility report and two IRCs. Station address: Telkom Maritime Radio Services, Private Bag X01, 7435 Milnerton, Rep. of South Africa (Muick). Veri signer's email: ***khana1@telkom.co.za***

How to Use the Shortwave Guide

CONVERT YOUR TIME TO UTC

Broadcast time on ① and time off ② are expressed in Coordinated Universal Time (UTC) – the time at the 0 meridian near Greenwich, England. To translate your local time into UTC, first convert your local time to 24-hour format, then add (during Daylight Savings Time) 4, 5, 6 or 7 hours for Eastern, Central, Mountain or Pacific Times, respectively. Eastern, Central, and Pacific Times are already converted to UTC for you at the top of each hour.

Note that all *dates*, as well as times, are in UTC; for example, a show which might air at 0030 UTC *Sunday* will be heard on *Saturday* evening in America (in other words, 8:30 pm Eastern, 7:30 pm Central, etc.).

Not all countries observe Daylight Saving Time, not all countries shift at the same time, and not all program scheduling is shifted. So if you do not hear your desired station or program, try searching the hour ahead or behind its listed start time.

FIND THE STATION YOU WANT TO HEAR

Look at the page which corresponds to the time you will be listening. English broadcasts are listed by UTC time on ① , then alphabetically by country ③, followed by the station name ④. (If the station name is the same as the country, we don't repeat it, e.g., "Vanuatu, Radio" [Vanuatu].)

If a broadcast is not *daily*, the days of broadcast⑤ will appear in the column following the time of broadcast, using the following codes:

Codes	
s/Sun	Sunday
m/Mon	Monday
t	Tuesday
w	Wednesday
h	Thursday
f	Friday
a/Sat	Saturday
occ:	occasional
DRM:	Digital Radio Mondiale
irreg	Irregular broadcasts
vl	Various languages
USB:	Upper Sideband

CHOOSE PROMISING FREQUENCIES

Choose the most promising frequencies for the time, location and conditions.

The frequencies ⑥ follow to the right of the station listing; all frequencies are listed in kilohertz (kHz). Not all listed stations will be heard from your location and virtually none of them will be heard all the time on all frequencies.

Shortwave broadcast stations change some of their frequencies at least twice a year, in April and October, to adapt to seasonal conditions. But they can also change in response to short-term conditions, interference, equipment problems, etc. Our frequency manager coordinates published station schedules with confirmations and reports from her monitoring team and *MT* readers to make the Shortwave Guide up-to-date as of one week before print deadline.

To help you find the most promising signal for your location, immediately following each frequency we've included information on the target area ⑦ of the broadcast. Signals beamed toward your area will generally be easier to hear than those beamed elsewhere, even though the latter will often still be audible.

Target Areas

af:	Africa
al:	alternate frequency (occasional use only)
am:	The Americas
as:	Asia
ca:	Central America
do:	domestic broadcast
eu:	Europe
me:	Middle East
na:	North America
pa:	Pacific
sa:	South America
va:	various

MT MONITORING TEAM

Gayle Van Horn
Frequency Manager
gaylevanhorn@monitoringtimes.com

Larry Van Horn, MT Asst. Editor
larryvanhorn@monitoringtimes.com

Additional Contributors to This Month's Shortwave Guide:

Thank You to …

ADXC; BCL News; Cumbre DX; DSWCI/DX Window; DX Asia; DX India; Hard-Core DX; DX Mix News; BCDX/WWDX/Top News.

Adrian Peterson/AWR; Alokesh Gupta, New Delhi, India; Bob Fraser, ME; Bill Damick/TWR; Brenda Constantino/WYFR; Claudius Dedio/AWR; Elena Osipova/VO Russia; Ivo Ivanov, Bulgaria; Jaisakthivel, Tirunelveli, India; Media Broadcast; Mike Terry, UK; Nigel Holmes/R Australia; Rachel Baughn/MT; Sean Gilbert UK/WRTH 2012; Tom Dunham, OH; Wolfgang Bueschel, Stuttgart, Germany.

SHORTWAVE BROADCAST BANDS

kHz	Meters
2300-2495	120 meters (Note 1)
3200-3400	90 meters (Note 1)
3900-3950	75 meters (Regional band, used for broadcasting in Asia only)
3950-4000	75 meters (Regional band, used for broadcasting in Asia and Europe)
4750-4995	60 meters (Note 1)
5005-5060	60 meters (Note 1)
5730-5900	49 meter NIB (Note 2)
5900-5950	49 meter WARC-92 band (Note 3)
5950-6200	49 meters
6200-6295	49 meter NIB (Note 2)
6890-6990	41 meter NIB (Note 2)
7100-7300	41 meters (Regional band, not allocated for broadcasting in the western hemisphere) (Note 4)
7300-7350	41 meter WARC-92 band (Note 3)
7350-7600	41 meter NIB (Note 2)
9250-9400	31 meter NIB (Note 2)
9400-9500	31 meter WARC-92 band (Note 3)
9500-9900	31 meters
11500-11600	25 meter NIB (Note 2)
11600-11650	25 meter WARC-92 band (Note 3)
11650-12050	25 meters
12050-12100	25 meter WARC-92 band (Note 3)
12100-12600	25 meter NIB (Note 2)
13570-13600	22 meter WARC-92 band (Note 3)
13600-13800	22 meters
13800-13870	22 meter WARC-92 band (Note 3)
15030-15100	19 meter NIB (Note 2)
15100-15600	19 meters
15600-15800	19 meter WARC-92 band (Note 3)
17480-17550	17 meter WARC-92 band (Note 3)
17550-17900	17 meters
18900-19020	15 meter WARC-92 band (Note 3)
21450-21850	13 meters
25670-26100	11 meters

Notes

Note 1 Tropical bands, 120/90/60 meters are for broadcast use only in designated tropical areas of the world.

Note 2 Broadcasters can use this frequency range on a (NIB) non-interference basis only.

Note 3 WARC-92 bands are allocated officially for use by HF broadcasting stations in 2007

Note 4 WRC-03 update. After March 29, 2009, the spectrum from 7100-7200 kHz will no longer be available for broadcast purposes and will be turned over to amateur radio operations worldwide

0000 UTC - 8PM EDT / 7PM CDT / 5PM PDT

0000	0030		Egypt, R Cairo	6270na		
0000	0030		USA, BBG/Voice of America	7555as		
0000	0045		India, All India R/External Svc			6055as
			9705as	9950as	11670as	13605as
0000	0045	DRM	India, All India R/External Svc			9950eu
0000	0045		USA, WYFR/Family R Worldwide			7520as
0000	0056		Romania, R Romania Intl	9700na		11965na
0000	0100		Anguilla, University Network	6090na		
0000	0100		Australia, ABC NT Alice Springs			4835do
0000	0100		Australia, ABC NT Katherine	5025do		
0000	0100		Australia, ABC NT Tennant Creek			4910do
0000	0100		Australia, ABC/R Australia	12080pa		15160pa
			15240pa	15415pa	17795pa	19000pa
			21740pa			
0000	0100		Bahrain, R Bahrain	6010me		
0000	0100		Canada, CFRX Toronto ON	6070na		
0000	0100		Canada, CFVP Calgary AB	6030na		
0000	0100		Canada, CKZN St Johns NF	6160na		
0000	0100		Canada, CKZU Vancouver BC			6160na
0000	0100		China, China R International			6020eu
			6075as	6180as	7350eu	7415as
			9570na	11790as	11885as	13750as
			15125as			
0000	0100		Malaysia, RTM Kajang/Traxx FM			7295do
0000	0100		Micronesia, V6MP/Cross R/Pohnpei			4755as
0000	0100		New Zealand, R New Zealand Intl			15720pa
0000	0100	DRM	New Zealand, R New Zealand Intl			17675pa
0000	0100		Russia, Voice of Russia	9665va		9800va
0000	0100		Spain, R Exterior de Espana	6055na		
0000	0100		Thailand, R Thailand World Svc			15275na
0000	0100		UK, BBC World Service	5970as		6195as
			7395as	9410as	9740as	12095as
			15335as	15755as	17685as	
0000	0100		USA, Amer Forces Network/AFRTS			4319usb
			5446usb	5765usb	7811usb	12133usb
			12759usb	13362usb		
0000	0100		USA, FBN/WTJC Newport NC			9370na
0000	0100	Sat/Sun	USA, WBCQ Monticello ME	5110am		
0000	0100		USA, WBCQ Monticello ME	7490am		9330am
0000	0100		USA, WEWN/EWTN Irondale AL			11520af
0000	0100		USA, WHRI Cypress Creek SC			5920va
			7315ca	9860na		
0000	0100		USA, WINB Red Lion PA	9265am		
0000	0100		USA, WTWW Lebanon TN	5755va		
0000	0100		USA, WWCR Nashville TN	4840eu		5935af
			6875af	9980eu		
0000	0100		USA, WWRB Manchester TN	3185na		5050na
0000	0100		USA, WYFR/Family R Worldwide			17580as
0000	0100		Zambia, CVC/R Christian Voice			4965af
0030	0100		Australia, ABC/R Australia	17750as		
0030	0100	twhfa	Serbia, International R Serbia			9685va
0030	0100		USA, BBG/Voice of America/Special English			
			6170va	9325va	9490va	9715va
			11695va	11730va	12005va	15185va
			15205va	15290va		
0035	0045		India, All India R/Aizawl	5050do		
0035	0045		India, All India R/Chennai	4920do		
0035	0045		India, All India R/Guwahati	4940do		
0035	0045		India, All India R/Hyderbad	4800do		
0035	0045		India, All India R/Imphal	4775do		
0035	0045		India, All India R/Port Blair	4760do		
0035	0045		India, All India R/Shillong	4970do		
0035	0045		India, All India R/Shimla	4965do		
0035	0045		India, All India R/Thiruvananthapuram	5010do		

0100 UTC - 9PM EDT / 8PM CDT / 6PM PDT

0100	0115	Sat	Canada, Bible Voice Broadcasting			9490as
0100	0130		Vietnam, VO Vietnam/Overseas Svc			6175na
0100	0200		Anguilla, University Network	6090na		
0100	0200		Australia, ABC NT Alice Springs			4835do
0100	0200		Australia, ABC NT Katherine	5025do		
0100	0200		Australia, ABC NT Tennant Creek			4910do
0100	0200		Australia, ABC/R Australia	12080pa		15160pa
			15240pa	15415pa	17750as	17795pa
			19000pa			
0100	0200		Bahrain, R Bahrain	6010me		
0100	0200		Canada, CFRX Toronto ON	6070na		
0100	0200		Canada, CFVP Calgary AB	6030na		
0100	0200		Canada, CKZN St Johns NF	6160na		
0100	0200		Canada, CKZU Vancouver BC			6160na
0100	0200		China, China R International			6020eu
			6175eu	9410eu	9470eu	9535as
			9570na	9580na	9675eu	9790na
			11870as	15125as	15785as	
0100	0200		Cuba, R Havana Cuba	6000na		6050na
0100	0200		Malaysia, RTM Kajang/Traxx FM			7295do
0100	0200		Micronesia, V6MP/Cross R/Pohnpei			4755as
0100	0200		New Zealand, R New Zealand Intl			15720pa
0100	0200	DRM	New Zealand, R New Zealand Intl			17675pa
0100	0200		Russia, Voice of Russia	9665va		9800va
0100	0200		Taiwan, R Taiwan Intl	11875as		
0100	0200		UK, BBC World Service	7395as		9410as
			9740as	11750as	12095as	15310as
			15335as	15755as	17685as	
0100	0200		USA, Amer Forces Network/AFRTS			4319usb
			5446usb	5765usb	7811usb	12133usb
			12759usb	13362usb		
0100	0200		USA, BBG/Voice of America	7430va		11705va
0100	0200		USA, FBN/WTJC Newport NC			9370na
0100	0200		USA, KJES Vado NM	7555na		
0100	0200	Sat/Sun	USA, WBCQ Monticello ME	5110am		
0100	0200		USA, WBCQ Monticello ME	7490am		9330am
0100	0200		USA, WEWN/EWTN Irondale AL			11520af
0100	0200	m	USA, WHRI Cypress Creek SC			9605na
0100	0200		USA, WHRI Cypress Creek SC			9840na
			9860na			
0100	0200		USA, WINB Red Lion PA	9265am		
0100	0200		USA, WTWW Lebanon TN	5755va		
0100	0200		USA, WWCR Nashville TN	3215eu		4840na
			5890af	5935af		
0100	0200		USA, WWRB Manchester TN	3185na		5050na
0100	0200		Zambia, CVC/R Christian Voice			4965af
0120	0200	mtwhfa	Sri Lanka, SLBC	6005as	9770as	15745as
0130	0200	twhfas	Albania, R Tirana	7425na		
0130	0200		Myanmar, Thazin BC Sta	6030do		
0130	0200	twhfa	USA, BBG/Voice of America/Special English			
			5960va	7465va		
0130	0200	twhfa	USA, WRMI/R Slovakia Intl relay			9955am
0140	0200		Vatican City State, Vatican R	9580as		11730as

0200 UTC - 10PM EDT / 9PM CDT / 7PM PDT

0200	0230		Thailand, R Thailand World Svc			15275na
0200	0230		USA, KJES Vado NM	7555na		
0200	0230	Sat	USA, WBCQ Monticello ME	5110am		
0200	0300		Anguilla, University Network	6090na		
0200	0300	twhfa	Argentina, RAE	11710am		
0200	0300		Australia, ABC NT Alice Springs			4835do
0200	0300		Australia, ABC NT Katherine	5025do		
0200	0300		Australia, ABC NT Tennant Creek			4910do
0200	0300		Australia, ABC/R Australia	12080pa		15160pa
			15240pa	15415pa	17750as	17795pa
			19000pa			
0200	0300		Bahrain, R Bahrain	6010me		
0200	0300		Canada, CFRX Toronto ON	6070na		
0200	0300		Canada, CFVP Calgary AB	6030na		
0200	0300		Canada, CKZN St Johns NF	6160na		
0200	0300		Canada, CKZU Vancouver BC			6160na
0200	0300		China, China R International			11770as
			13640as			
0200	0300		Cuba, R Havana Cuba	6000na		6050na
0200	0300		Egypt, R Cairo	9315na		
0200	0300		Malaysia, RTM Kajang/Traxx FM			7295do
0200	0300		Micronesia, V6MP/Cross R/Pohnpei			4755as
0200	0300		New Zealand, R New Zealand Intl			15720pa
0200	0300	DRM	New Zealand, R New Zealand Intl			17675pa
0200	0300		Palau, T8WH/World Harvest R			17800as
0200	0300		Philippines, R Pilipinas Overseas			11880me
			15285me	17700me		
0200	0300		Russia, Voice of Russia	9665va		15425na
0200	0300		South Korea, KBS World R	9580sa		
0200	0300	mtwhfa	Sri Lanka, SLBC	6005as	9770as	15745as
0200	0300		Taiwan, R Taiwan Intl	5950na		9680na

0200	0300		UK, BBC World Service	6005af	6195me	
			12095as	15310as	17790as	
0200	0300		USA, Amer Forces Network/AFRTS		4319usb	
			5446usb	5765usb	7811usb	12133usb
			12759usb	13362usb		
0200	0300		USA, FBN/WTJC Newport NC		9370na	
0200	0300	Sat	USA, Overcomer Ministry	15750af		
0200	0300	Sat/Sun	USA, WBCQ Monticello ME	5110am		
0200	0300		USA, WBCQ Monticello ME	7490am	9330am	
0200	0300		USA, WEWN/EWTN Irondale AL		11520af	
0200	0300		USA, WHRI Cypress Creek SC		5920va	
0200	0300		USA, WINB Red Lion PA	9265am		
0200	0300		USA, WTWW Lebanon TN	5755va		
0200	0300		USA, WWCR Nashville TN	3215eu	4840na	
			5890af	5935af		
0200	0300		USA, WWRB Manchester TN	3185na	5050na	
0200	0300		USA, WYFR/Family R Worldwide		5985ca	
			6115na			
0200	0300		Zambia, CVC/R Christian Voice		4965af	
0215	0225		Nepal, R Nepal	5005as		
0230	0300		Myanmar, Myanma R/Yangon		9731do	
0230	0300		Vietnam, VO Vietnam/Overseas Svc		6175na	
0245	0300		Australia, HCJB Global Australia		15400as	
0245	0300		India, All India R/Bhopal	7430do		
0245	0300		India, All India R/Delhi	4860do	6030do	
			7235do	11830do	15135do	
0245	0300		India, All India R/Gorakhpur		3945do	
			6030do	7235do	11830do	15135do
0245	0300		India, All India R/Guwahati	4940do		
0245	0300		India, All India R/Hyderbad	7420do		
0245	0300		India, All India R/Imphal	7335do		
0245	0300		India, All India R/Itanagar	4990do		
0245	0300		India, All India R/Jaipur	4910do		
0245	0300		India, All India R/Kolkata	7210do		
0245	0300		India, All India R/Kurseong	4895do		
0245	0300		India, All India R/Lucknow	4880do		
0245	0300		India, All India R/R Kashmir	4760do		
0245	0300		India, All India R/Shillong	4970do		
0245	0300		India, All India R/Shimla	6020do		
0245	0300		India, All India R/Thiruvananthapuram		7290do	
0250	0300		Vatican City State, Vatican R	6040am	7305am	
			9610am			
0255	0300	Sun	Swaziland, TWR Africa	3200af		

0300 UTC - 11PM EDT / 10PM CDT / 8PM PDT

0300	0315		Croatia, Voice of Croatia	3985am	7375am	
0300	0315		India, All India R/Imphal	7335do		
0300	0315		India, All India R/Itanagar	4990do		
0300	0315		India, All India R/Shillong	4970do		
0300	0320		Vatican City State, Vatican R	6040am	7305am	
			9610am			
0300	0325	Sun	Swaziland, TWR Africa	3200af		
0300	0330		Egypt, R Cairo	9315na		
0300	0330		Myanmar, Myanma R/Yangon		9731do	
0300	0330		Philippines, R Pilipinas Overseas		11880me	
			15285me	17700me		
0300	0330		Vatican City State, Vatican R	7360af	9660af	
			15460as			
0300	0355		South Africa, Channel Africa		5980af	
0300	0355		Turkey, Voice of Turkey	6165as	9515va	
0300	0356		Romania, R Romania Intl	9645na	11795na	
			11895as	15340as		
0300	0400		Anguilla, University Network	6090na		
0300	0400		Australia, ABC NT Alice Springs		4835do	
0300	0400		Australia, ABC NT Katherine	5025do		
0300	0400		Australia, ABC NT Tennant Creek		4910do	
0300	0400		Australia, ABC/R Australia	15160pa	15240pa	
			15415pa	17750as	21725pa	
0300	0400		Bahrain, R Bahrain	6010me		
0300	0400	twhfas	Canada, CBC Northern Quebec Svc		9625na	
0300	0400		Canada, CFRX Toronto ON	6070na		
0300	0400		Canada, CFVP Calgary AB	6030na		
0300	0400		Canada, CKZN St Johns NF	6160na		
0300	0400		Canada, CKZU Vancouver BC		6160na	
0300	0400		China, China R International		9690am	
			9790na	11770as	13750as	15110as
			15120as	15785as		
0300	0400		Cuba, R Havana Cuba	6000na	6050na	
0300	0400		Malaysia, RTM Kajang/Traxx FM		7295do	
0300	0400		Micronesia, V6MP/Cross R/Pohnpei		4755as	
0300	0400		New Zealand, R New Zealand Intl		15720pa	
0300	0400	DRM	New Zealand, R New Zealand Intl		17675pa	
0300	0400		Oman, R Sultanate of Oman		15355af	
0300	0400		Palau, T8WH/World Harvest R		17800as	
0300	0400		Russia, Voice of Russia	9665va	15424na	
0300	0400		South Africa, Channel Africa		3345af	
0300	0400	Sun	Sri Lanka, SLBC	6005as	9770as	15745as
0300	0400		Taiwan, R Taiwan Intl	5950na	15320as	
0300	0400		UK, BBC World Service	3255af	5875af	
			6005af	6145af	6190af	6195me
			9410me	9750af	12035af	12095as
			15310as	15365as	17790as	
0300	0400		USA, Amer Forces Network/AFRTS		4319usb	
			5446usb	5765usb	7811usb	12133usb
			12759usb	13362usb		
0300	0400		USA, BBG/Voice of America	4930af	6080af	
			9855af	15580af		
0300	0400		USA, FBN/WTJC Newport NC		9370na	
0300	0400	Sat	USA, Overcomer Ministry	15750af		
0300	0400		USA, WBCQ Monticello ME	7490am	9330am	
0300	0400		USA, WEWN/EWTN Irondale AL		11520af	
0300	0400		USA, WHRI Cypress Creek SC		5920va	
			7385na	9825va		
0300	0400		USA, WTWW Lebanon TN	5755va		
0300	0400		USA, WWCR Nashville TN	3215eu	4840na	
			5890af	5935af		
0300	0400		USA, WWRB Manchester TN	3185na	5050na	
0300	0400		USA, WYFR/Family R Worldwide		11740ca	
0300	0400		Zambia, CVC/R Christian Voice		4965af	
0330	0400		Australia, ABC/R Australia	15515pa		
0330	0400		Iran, VO Islamic Rep of Iran	11920eu	13650eu	
0330	0400		Vietnam, VO Vietnam/Overseas Svc		6175na	
0335	0345		India, All India R/Aizawl	5050do		
0335	0345		India, All India R/Delhi	7235do	11830do	
			15135do			
0335	0345		India, All India R/Kolkata	7210do		

0400 UTC - 12AM EDT / 11PM CDT / 9PM PDT

0400	0430		Iran, VO Islamic Rep of Iran	11920eu	13650eu	
0400	0430		USA, BBG/Voice of America	4930af	6080af	
			9855af	12025af	15580af	
0400	0430	m	Vatican City State, Vatican R	9955ca		
0400	0457		Germany, Deutsche Welle	6180af	7240af	
			9470af	12045af		
0400	0457		North Korea, Voice of Korea		7220as	
			9345as	9730as	11735as	13760as
			15180as			
0400	0458		New Zealand, R New Zealand Intl		15720pa	
0400	0458	DRM	New Zealand, R New Zealand Intl		17675pa	
0400	0500		Anguilla, University Network	6090na		
0400	0500		Australia, ABC NT Alice Springs		4835do	
0400	0500		Australia, ABC NT Katherine	5025do		
0400	0500		Australia, ABC NT Tennant Creek		4910do	
0400	0500		Australia, ABC/R Australia	15160pa	15240pa	
			15415pa	15515pa	21725as	
0400	0500		Bahrain, R Bahrain	6010me		
0400	0500	twhfas	Canada, CBC Northern Quebec Svc		9625na	
0400	0500		Canada, CFRX Toronto ON	6070na		
0400	0500		Canada, CKZN St Johns NF	6160na		
0400	0500		Canada, CKZU Vancouver BC		6160na	
0400	0500		China, China R International		6020na	
			6080na	17730va	17855va	
0400	0500		Cuba, R Havana Cuba	6000na	6050na	
0400	0500		Malaysia, RTM Kajang/Traxx FM		7295do	
0400	0500		Micronesia, V6MP/Cross R/Pohnpei		4755as	
0400	0500		Russia, Voice of Russia	13775na	15760me	
0400	0500		South Africa, Channel Africa		3345af	
0400	0500	Sun	Sri Lanka, SLBC	6005as	9770as	15745as
0400	0500		UK, BBC World Service	3255af	3955eu	
			5875af	6005af	6190af	7310af
			11945af	12035af	12095me	15310as
			15365as	17790as		
0400	0500		USA, Amer Forces Network/AFRTS		4319usb	
			5446usb	5765usb	7811usb	12133usb

			12759usb	13362usb		
0400	0500		USA, FBN/WTJC Newport NC			9370na
0400	0500	Sat	USA, Overcomer Ministry	15750af		
0400	0500		USA, WBCQ Monticello ME	9330am		
0400	0500		USA, WEWN/EWTN Irondale AL			11520af
0400	0500		USA, WHRI Cypress Creek SC			5920va
			7385na	9825va		
0400	0500		USA, WTWW Lebanon TN	5755va		
0400	0500		USA, WWCR Nashville TN	3215eu		4840na
			5890af	5935af		
0400	0500		USA, WWRB Manchester TN	3185na		
0400	0500		Zambia, CVC/R Christian Voice			4965af
0430	0500		Myanmar, Thazin BC Sta	6030do		
0430	0500	mtwhf	Swaziland, TWR Africa	3200af		
0430	0500		USA, BBG/Voice of America	4930af		4960af
			6080af	12025af	15580af	
0435	0445		India, All India R/Delhi	4860do		
0455	0500	mtwhf	Nigeria, Voice of Nigeria	15120eu		
0459	0500		New Zealand, R New Zealand Intl			11725pa
0459	0500	DRM	New Zealand, R New Zealand Intl			11675pa

0500 UTC - 1AM EDT / 12AM CDT / 10PM PDT

0500	0507	twhfas	Canada, CBC Northern Quebec Svc			9625na
0500	0527		Germany, Deutsche Welle	5925af		
0500	0530		Germany, Deutsche Welle	9470va		9800af
			9850va			
0500	0530		Japan, R Japan NHK World	5975va		6110na
			11970va			
0500	0530	Sat	Vatican City State, Vatican R	3975eu		6075eu
			7250eu	9645eu	11625af	13765af
0500	0557		North Korea, Voice of Korea			13650as
			15100as			
0500	0600		Anguilla, University Network	6090na		
0500	0600		Australia, ABC NT Alice Springs			4835do
0500	0600		Australia, ABC NT Katherine	5025do		
0500	0600		Australia, ABC NT Tennant Creek			4910do
0500	0600		Australia, ABC/R Australia	13630pa		15240pa
			15415pa	15515pa	21725as	
0500	0600		Bahrain, R Bahrain	6010me		
0500	0600		Canada, CFRX Toronto ON	6070na		
0500	0600		Canada, CKZN St Johns NF	6160na		
0500	0600		Canada, CKZU Vancouver BC			6160na
0500	0600		China, China R International			6020na
			6190na	11710af	11895as	15350as
			15465as	17505va	17730va	17855va
0500	0600		Cuba, R Havana Cuba	6010na		6050na
			6060ca	6125am		
0500	0600		Eqt Guinea, R Africa	15190af		
0500	0600		Malaysia, RTM Kajang/Traxx FM			7295do
0500	0600		Micronesia, V6MP/Cross R/Pohnpei			4755as
0500	0600		Myanmar, Thazin BC Sta	6030do		
0500	0600		New Zealand, R New Zealand Intl			11725pa
0500	0600	DRM	New Zealand, R New Zealand Intl			11675pa
0500	0600	mtwhf	Nigeria, Voice of Nigeria	15120eu		
0500	0600		Russia, Voice of Russia	13755na		
0500	0600		South Africa, Channel Africa			7230af
0500	0600		Swaziland, TWR Africa	3200af		9500af
0500	0600		Taiwan, R Taiwan Intl	5950na		
0500	0600		UK, BBC World Service	3255af		3955eu
			5875af	6005af	6190af	9410af
			11945af	12095me	15310as	15365as
			15420af	17640as	17790as	
0500	0600		USA, Amer Forces Network/AFRTS			4319usb
			5446usb	5765usb	7811usb	12133usb
			12759usb	13362usb		
0500	0600		USA, BBG/Voice of America	4930af		6080af
			12025af	15580af		
0500	0600		USA, FBN/WTJC Newport NC			9370na
0500	0600	Sat	USA, Overcomer Ministry	15750af		
0500	0600		USA, WBCQ Monticello ME	9330am		
0500	0600		USA, WEWN/EWTN Irondale AL			11520af
0500	0600		USA, WHRI Cypress Creek SC			5920am
			7385na	9825va		
0500	0600		USA, WTWW Lebanon TN	5755va		
0500	0600		USA, WWCR Nashville TN	3215eu		4840na
			5890af	5935af		
0500	0600		USA, WWRB Manchester TN	3185na		
0500	0600		Zambia, CVC/R Christian Voice			6065af
0530	0556	DRM	Romania, R Romania Intl	11875eu		
0530	0556		Romania, R Romania Intl	9700eu		17760eu
			21500eu			
0530	0557		Germany, Deutsche Welle	9800af		
0530	0600		Australia, ABC/R Australia	17750as		
0530	0600		Germany, Deutsche Welle	9850va		
0530	0600		Thailand, R Thailand World Svc			17770eu

0600 UTC - 2AM EDT / 1AM CDT / 11PM PDT

0600	0630		Germany, Deutsche Welle	13780af		15275af
			17820af			
0600	0630		Myanmar, Thazin BC Sta	6030do		
0600	0630	Sat/Sun	USA, WRMI/R Prague relay	9955ca		
0600	0645	mtwhf	Vatican City State, Vatican R	9955na		
0600	0650	DRM	New Zealand, R New Zealand Intl			11675pa
0600	0655		South Africa, Channel Africa			15255af
0600	0657		North Korea, Voice of Korea			7220as
			9345as	9730as		
0600	0700		Anguilla, University Network	6090na		
0600	0700		Australia, ABC NT Alice Springs			4835do
0600	0700		Australia, ABC NT Katherine	5025do		
0600	0700		Australia, ABC NT Tennant Creek			4910do
0600	0700		Australia, ABC/R Australia	11945pa	13630pa	
			15240pa	15415pa	17750as	21725as
0600	0700		Bahrain, R Bahrain	6010me		
0600	0700		Canada, CFRX Toronto ON	6070na		
0600	0700		Canada, CFVP Calgary AB	6030na		
0600	0700		Canada, CKZN St Johns NF	6160na		
0600	0700		Canada, CKZU Vancouver BC			6160na
0600	0700		China, China R International			11710af
			11870me	11895as	13660as	15140me
			15350as	15465as	17505va	17710as
0600	0700		Cuba, R Havana Cuba	6010na		6050na
			6060ca	6125am		
0600	0700		Eqt Guinea, R Africa	15190af		
0600	0700		Malaysia, RTM Kajang/Traxx FM			7295do
0600	0700		Micronesia, V6MP/Cross R/Pohnpei			4755as
0600	0700		New Zealand, R New Zealand Intl			11725pa
0600	0700	mtwhf	Nigeria, Voice of Nigeria	15120eu		
0600	0700		Papua New Guinea, R Fly	3915do		
0600	0700		Russia, Voice of Russia	21800pa		
0600	0700	DRM	Russia, Voice of Russia	11830eu		
0600	0700		South Africa, Channel Africa			7230af
0600	0700		Swaziland, TWR Africa	3200af		9500af
0600	0700		UK, BBC World Service	5875eu		6005af
			6190af	7355eu	9410af	12095va
			15105af	15310as	17640af	17790as
0600	0700	mtwhf	UK, BBC World Service	15420af		
0600	0700		USA, Amer Forces Network/AFRTS			4319usb
			5446usb	5765usb	7811usb	12133usb
			12759usb	13362usb		
0600	0700		USA, BBG/Voice of America	6080af		12025af
			15580af			
0600	0700		USA, FBN/WTJC Newport NC			9370na
0600	0700	Sat	USA, Overcomer Ministry	15750af		
0600	0700		USA, WBCQ Monticello ME	9330am		
0600	0700		USA, WEWN/EWTN Irondale AL			11520af
0600	0700		USA, WHRI Cypress Creek SC			5920am
			7385na	11910va		
0600	0700		USA, WTWW Lebanon TN	5755va		
0600	0700		USA, WWCR Nashville TN	3215eu		4840na
			5890af	5935af		
0600	0700		USA, WWRB Manchester TN	3185na		
0600	0700		Zambia, CVC/R Christian Voice			6065af
0602	0700		Swaziland, TWR Africa	6120af		
0630	0645		India, All India R/Guwahati	7280do		
0630	0645		India, All India R/Hyderbad	7420do		
0630	0645		India, All India R/Kurseong	7230do		
0630	0645		India, All India R/Mumbai	7240do		
0630	0645		India, All India R/Thiruvananthapuram			7290do
0630	0645	mtwhfa	Vatican City State, Vatican R	3975eu		6075eu
			7250eu	9645eu	15595eu	
0630	0700		Germany, Deutsche Welle	13780af		17820af
0630	0700		Vatican City State, Vatican R	11625af		13765af
			15670af			
0645	0700	mtwhf	Israel, Kol Israel	9955na		
0651	0700	DRM	New Zealand, R New Zealand Intl			11675pa

0700 UTC - 3AM EDT / 2AM CDT / 12AM PDT

0700 0730 Myanmar, Myanma R/Yangon 9731do
0700 0750 Austria, TWR Europe 6105eu
0700 0750 Germany, TWR Europe 6105eu
0700 0758 New Zealand, R New Zealand Intl 11725pa
0700 0758 DRM New Zealand, R New Zealand Intl 11675pa
0700 0800 Anguilla, University Network 6090na
0700 0800 Australia, ABC NT Alice Springs 4835do
0700 0800 Australia, ABC NT Katherine 5025do
0700 0800 Australia, ABC NT Tennant Creek 4910do
0700 0800 Australia, ABC/R Australia 7410pa 9475pa 9710pa 11945pa 13630pa 15240pa
0700 0800 Bahrain, R Bahrain 6010me
0700 0800 m/DRM Belgium, TDP Radio 6015eu
0700 0800 Canada, CFRX Toronto ON 6070na
0700 0800 Canada, CFVP Calgary AB 6030na
0700 0800 Canada, CKZN St Johns NF 6160na
0700 0800 Canada, CKZU Vancouver BC 6160na
0700 0800 China, China R International 11895as 13660as 13710eu 15125va 15350as 15465as 17490eu 17540as 17710as
0700 0800 mtwhfa Ecuador, HCJB/LV de los Andes 3995eu
0700 0800 Eqt Guinea, R Africa 15190af
0700 0800 Malaysia, RTM Kajang/Traxx FM 7295do
0700 0800 Micronesia, V6MP/Cross R/Pohnpei 4755as
0700 0800 Papua New Guinea, R Fly 3915do
0700 0800 Russia, Voice of Russia 21800va
0700 0800 DRM Russia, Voice of Russia 11830eu
0700 0800 South Africa, Channel Africa 9625af
0700 0800 Swaziland, TWR Africa 3200af 6120af 9500af
0700 0800 UK, BBC World Service 5875eu 6190af 7355eu 11760me 11770af 12095af 15310as 15400af 15575me 17640af 17790as 17830af
0700 0800 USA, Amer Forces Network/AFRTS 4319usb 5446usb 5765usb 7811usb 12133usb 12759usb 13362usb
0700 0800 USA, FBN/WTJC Newport NC 9370na
0700 0800 Sat USA, Overcomer Ministry 15750af
0700 0800 USA, WBCQ Monticello ME 9330am
0700 0800 USA, WEWN/EWTN Irondale AL 11520af
0700 0800 USA, WHRI Cypress Creek SC 5920am 7385na
0700 0800 USA, WTWW Lebanon TN 5755va
0700 0800 USA, WWCR Nashville TN 3215eu 4840na 5890af 5935af
0700 0800 USA, WWRB Manchester TN 3185na
0700 0800 Zambia, CVC/R Christian Voice 6065af
0730 0745 India, All India R/Aizawl 5050do
0730 0745 India, All India R/Delhi 6190do 11710do 15185do 15260do
0730 0745 India, All India R/Guwahati 7280do
0730 0745 India, All India R/Imphal 7335do
0730 0745 India, All India R/Jaipur 7325do
0730 0745 India, All India R/Kolkata 7210do
0730 0745 India, All India R/Kurseong 7230do
0730 0745 India, All India R/Shimla 6020do
0730 0800 Australia, HCJB Global Australia 11750as
0730 0800 India, All India R/Chennai 4920do
0759 0800 New Zealand, R New Zealand Intl 6170pa
0759 0800 DRM New Zealand, R New Zealand Intl 7285pa

0800 UTC - 4AM EDT / 3AM CDT / 1AM PDT

0800 0815 Nepal, R Nepal 5005as
0800 0830 Australia, ABC NT Alice Springs 4835do
0800 0830 Australia, ABC NT Katherine 5025do
0800 0830 Australia, ABC NT Tennant Creek 4910do
0800 0830 Australia, HCJB Global Australia 11750as
0800 0830 Sun Canada, Bible Voice Broadcasting 5945eu
0800 0830 France, R France International 9955na
0800 0845 Sat Canada, Bible Voice Broadcasting 5945eu
0800 0900 Anguilla, University Network 6090na
0800 0900 Australia, ABC/R Australia 5995pa 7410pa 9475pa 9580pa 9710pa 11945pa 15240pa
0800 0900 Bahrain, R Bahrain 6010me
0800 0900 t/DRM Belgium, TDP Radio 6015eu
0800 0900 Canada, CFRX Toronto ON 6070na
0800 0900 Canada, CFVP Calgary AB 6030na
0800 0900 Canada, CKZN St Johns NF 6160na
0800 0900 Canada, CKZU Vancouver BC 6160na
0800 0900 China, China R International 11620as 11895as 13710eu 15350as 15465as 15625va 17490eu 17540as
0800 0900 Eqt Guinea, R Africa 15190af
0800 0900 Sat Italy, IRRS SW 9510va
0800 0900 Malaysia, RTM Kajang/Traxx FM 7295do
0800 0900 Micronesia, V6MP/Cross R/Pohnpei 4755as
0800 0900 New Zealand, R New Zealand Intl 6170pa
0800 0900 DRM New Zealand, R New Zealand Intl 7285pa
0800 0900 mtwhfs Palau, T8WH/World Harvest R 9930as
0800 0900 Palau, T8WH/World Harvest R 17650as
0800 0900 Papua New Guinea, R Fly 3915do
0800 0900 Russia, Voice of Russia 21800va
0800 0900 DRM Russia, Voice of Russia 9850eu 11830eu
0800 0900 Sun South Africa, Amateur R Mirror Intl 7205af 17760af
0800 0900 South Africa, Channel Africa 9625af
0800 0900 South Africa, CVC 1 Africa R 13590af
0800 0900 South Korea, KBS World R 9570as
0800 0900 UK, BBC World Service 6190af 11760me 12095af 15310as 15400af 15575me 17640af 17790as 17830af 21470af
0800 0900 USA, Amer Forces Network/AFRTS 4319usb 5446usb 5765usb 7811usb 12133usb 12759usb 13362usb
0800 0900 USA, FBN/WTJC Newport NC 9370na
0800 0900 Sat USA, Overcomer Ministry 15750af
0800 0900 USA, WBCQ Monticello ME 9330am
0800 0900 USA, WEWN/EWTN Irondale AL 11520af
0800 0900 USA, WHRI Cypress Creek SC 5920am 7385na
0800 0900 USA, WTWW Lebanon TN 5755va
0800 0900 USA, WWCR Nashville TN 3215eu 4840na 5890af 5935af
0800 0900 USA, WWRB Manchester TN 3185na
0800 0900 Zambia, CVC/R Christian Voice 6065af
0820 0900 mtwhfa Guam, KTWR/TWR Asia 15170as
0830 0845 India, All India R/Aizawl 5050do
0830 0845 India, All India R/Chennai 4920do
0830 0845 India, All India R/Delhi 6190do 11710do 15185do 15260do
0830 0845 India, All India R/Hyderbad 7420do
0830 0845 India, All India R/Imphal 7335do
0830 0845 India, All India R/Itanagar 4990do
0830 0845 India, All India R/Kolkata 7210do
0830 0845 India, All India R/Shillong 7315do
0830 0845 India, All India R/Thiruvananthapuram 7290do
0830 0900 Australia, ABC NT Alice Springs 2310do
0830 0900 Australia, ABC NT Katherine 2485do
0830 0900 Australia, ABC NT Tennant Creek 2325do
0830 0900 mtwhfa Guam, KTWR/TWR Asia 11840pa

0900 UTC - 5AM EDT / 4AM CDT / 2AM PDT

0900 0910 mtwhfa Guam, KTWR/TWR Asia 11840as
0900 0930 mtwhfa USA, WRMI/R Prague relay 9955ca
0900 1000 Anguilla, University Network 6090na
0900 1000 Australia, ABC NT Alice Springs 2310do
0900 1000 Australia, ABC NT Katherine 2485do
0900 1000 Australia, ABC NT Tennant Creek 2325do
0900 1000 Australia, ABC/R Australia 6020pa 9580pa 11945pa
0900 1000 Bahrain, R Bahrain 6010me
0900 1000 w/DRM Belgium, TDP Radio 6015eu
0900 1000 Canada, CFRX Toronto ON 6070na
0900 1000 Canada, CFVP Calgary AB 6030na
0900 1000 Canada, CKZN St Johns NF 6160na
0900 1000 Canada, CKZU Vancouver BC 6160na
0900 1000 China, China R International 11620as 13790pa 15210as 15270eu 15350as 17490eu 17570eu 17750as
0900 1000 Sat/Sun Germany, Mighty KBC Radio 6095eu

0900	1000		Malaysia, RTM Kajang/Traxx FM			7295do
0900	1000		Micronesia, V6MP/Cross R/Pohnpei			4755as
0900	1000	3rd Sun	Netherlands, XVRB Radio	6045eu		
0900	1000	DRM	New Zealand, R New Zealand Intl			7285pa
0900	1000		New Zealand, R New Zealand Intl			6170pa
0900	1000	mtwhf	Nigeria, Voice of Nigeria	9690af		
0900	1000		Palau, T8WH/World Harvest R			9930as
0900	1000		Papua New Guinea, R Fly	3915do		
0900	1000		Russia, Voice of Russia	9560as		15170as
			21800va			
0900	1000	DRM	Russia, Voice of Russia	9850eu		11830eu
0900	1000		South Africa, Channel Africa			9625af
0900	1000		South Africa, CVC 1 Africa R			13590af
0900	1000		UK, BBC World Service	6190af		6195as
			9740as	11760me	12095af	15285as
			15310as	15575me	17640af	17760as
			17790as	17830af	21470af	21660as
0900	1000		USA, Amer Forces Network/AFRTS			4319usb
			5446usb	5765usb	7811usb	12133usb
			12759usb	13362usb		
0900	1000		USA, FBN/WTJC Newport NC			9370na
0900	1000	Sat	USA, Overcomer Ministry	15750af		
0900	1000		USA, WBCQ Monticello ME	9330am		
0900	1000		USA, WEWN/EWTN Irondale AL			11520as
0900	1000		USA, WHRI Cypress Creek SC			11565pa
0900	1000		USA, WHRI Cypress Creek SC			7315am
			7385na			
0900	1000		USA, WTWW Lebanon TN	5755va		
0900	1000		USA, WWCR Nashville TN	4840eu		5890af
			5935af	6875af		
0900	1000		USA, WWRB Manchester TN	3185na		
0900	1000		USA, WYFR/Family R Worldwide			9465as
0900	1000		Zambia, CVC/R Christian Voice			6065af
0905	0910		Pakistan, PBC/R Pakistan	15725as		17720as
0930	1000	Sun	Italy, IRRS SW	9510va		
0959	1000		Netherlands, R Netherlands Worldwide			
			15110as			

1000 UTC - 6AM EDT / 5AM CDT / 3AM PDT

1000	1030		Japan, R Japan NHK World	9605as		9625pa
			9695pa			
1000	1030	Sat	Vatican City State, Vatican R	9955ca		
1000	1030		Vietnam, VO Vietnam/Overseas Svc			9840as
			12020as			
1000	1057		Netherlands, R Netherlands Worldwide			
			15110as			
1000	1057		North Korea, Voice of Korea			11710ca
			15180sa	11735as	13650as	
1000	1058		New Zealand, R New Zealand Intl			6170pa
1000	1100		Anguilla, University Network	11775na		
1000	1100		Australia, ABC NT Alice Springs			2310do
1000	1100		Australia, ABC NT Katherine	2485do		
1000	1100		Australia, ABC NT Tennant Creek			2325do
1000	1100		Australia, ABC/R Australia	6020pa		9580pa
			11945pa			
1000	1100		Bahrain, R Bahrain	6010me		
1000	1100	h/DRM	Belgium, TDP Radio	6015eu		
1000	1100		Canada, CFRX Toronto ON	6070na		
1000	1100		Canada, CFVP Calgary AB	6030na		
1000	1100		Canada, CKZN St Johns NF	6160na		
1000	1100		Canada, CKZU Vancouver BC			6160na
1000	1100		China, China R International			6040na
			11610as	11635as	13620as	13690as
			13720as	13790pa	15190as	15210as
			15350as	17490eu		
1000	1100	Sat/Sun	Germany, Mighty KBC Radio			6095eu
1000	1100		India, All India R/External Svc			7270as
			13695pa	15020as	15410as	17510pa
			17800as	17895pa		
1000	1100		Indonesia, VO Indonesia	9526va		
1000	1100		Malaysia, RTM Kajang/Traxx FM			7295do
1000	1100		Micronesia, V6MP/Cross R/Pohnpei			4755as
1000	1100	DRM	New Zealand, R New Zealand Intl			7285pa
1000	1100	mtwhf	Nigeria, Voice of Nigeria	9690af		
1000	1100		Palau, T8WH/World Harvest R			17650as
1000	1100		Russia, Voice of Russia	9560as		11500as
			15170as			
1000	1100		Saudi Arabia, BSKSA/External Svc			15250as
1000	1100		South Africa, Channel Africa			9625af
1000	1100		South Africa, CVC 1 Africa R			13590af
1000	1100		UK, BBC World Service	6190af		6195as
			9740as	11760me	12095af	15285as
			15310as	15575me	17640af	17760as
			17790as	21470af	21660as	
1000	1100	Sat/Sun	UK, BBC World Service	15400af		17830af
1000	1100		USA, Amer Forces Network/AFRTS			4319usb
			5446usb	5765usb	7811usb	12133usb
			12759usb	13362usb		
1000	1100		USA, FBN/WTJC Newport NC			9370na
1000	1100		USA, KNLS Anchor Point AK	9655as		
1000	1100		USA, WBCQ Monticello ME	9330am		
1000	1100		USA, WEWN/EWTN Irondale AL			11520as
1000	1100		USA, WHRI Cypress Creek SC			7315am
			7385na			
1000	1100		USA, WTWW Lebanon TN	5755va		
1000	1100		USA, WWCR Nashville TN	4840na		5890af
			5935af	6875af		
1000	1100		USA, WWRB Manchester TN	3185na		
1000	1100		USA, WYFR/Family R Worldwide			9465as
1000	1100		Zambia, CVC/R Christian Voice			6065af
1030	1100		Iran, VO Islamic Rep of Iran	21590va		21640va
1030	1100		Mongolia, Voice of Mongolia			12085as
1030	1100		USA, WINB Red Lion PA	9265am		
1059	1100		New Zealand, R New Zealand Intl			9655pa

1100 UTC - 7AM EDT / 6AM CDT / 4AM PDT

1100	1104		Pakistan, PBC/R Pakistan	15725as		17720as
1100	1127		Iran, VO Islamic Rep of Iran	21590va		21640va
1100	1130	f/ DRM	Japan, R Japan NHK World	9760eu		
1100	1130	Sat/DRM	South Korea, KBS World R	9760eu		
1100	1130		UK, BBC World Service	15400af		
1100	1130		Vietnam, VO Vietnam/Overseas Svc			7285as
1100	1156		Romania, R Romania Intl	15210eu		15430eu
			17510af	17670af		
1100	1158	DRM	New Zealand, R New Zealand Intl			7285pa
1100	1200		Anguilla, University Network	11775na		
1100	1200		Australia, ABC NT Alice Springs			2310do
1100	1200		Australia, ABC NT Katherine	2485do		
1100	1200		Australia, ABC NT Tennant Creek			2325do
1100	1200		Australia, ABC/R Australia	6020pa		6080pa
			6140as	9475as	9580pa	11945va
1100	1200	DRM	Australia, ABC/R Australia	12080pa		
1100	1200		Bahrain, R Bahrain	6010me		
1100	1200	f/DRM	Belgium, TDP Radio	6015eu		
1100	1200	Sat/Sun	Canada, CBC Northern Quebec Svc			9625na
1100	1200		Canada, CFRX Toronto ON	6070na		
1100	1200		Canada, CFVP Calgary AB	6030na		
1100	1200		Canada, CKZN St Johns NF	6160na		
1100	1200		Canada, CKZU Vancouver BC			6160na
1100	1200		China, China R International			5955as
			6040na	11650as	11660as	11750na
			11795as	13590as	13645as	13650eu
			13720as	17490eu		
1100	1200	Sat/Sun	Germany, Mighty KBC Radio			6095eu
1100	1200		Malaysia, RTM Kajang/Traxx FM			7295do
1100	1200		New Zealand, R New Zealand Intl			9655pa
1100	1200	mtwhf	Nigeria, Voice of Nigeria	9690af		
1100	1200	DRM	Russia, Voice of Russia	12030as		
1100	1200		Russia, Voice of Russia	9560as		11500as
			12065as			
1100	1200		Saudi Arabia, BSKSA/External Svc			15250as
1100	1200		South Africa, Channel Africa			9625af
1100	1200		South Africa, CVC 1 Africa R			13590af
1100	1200		Taiwan, R Taiwan Intl	7445as		9465as
1100	1200		UK, BBC World Service	6190af		6195as
			9740as	11760me	12095af	15285as
			15310as	15575me	17640af	17790as
			17830af	21470af		
1100	1200		USA, Amer Forces Network/AFRTS			4319usb
			5446usb	5765usb	7811usb	12133usb
			12759usb	13362usb		
1100	1200		USA, FBN/WTJC Newport NC			9370na
1100	1200		USA, WBCQ Monticello ME	9330am		
1100	1200		USA, WEWN/EWTN Irondale AL			11520as
1100	1200		USA, WHRI Cypress Creek SC			7315am
			9795am			

1100	1200		USA, WINB Red Lion PA	9265am		
1100	1200		USA, WTWW Lebanon TN	5755va		
1100	1200		USA, WWCR Nashville TN	4840na	5890af	
			5935af	15825eu		
1100	1200		USA, WWRB Manchester TN	3185na		
1100	1200		Zambia, CVC/R Christian Voice	6065af		
1130	1200	f	Vatican City State, Vatican R	15595as	17590as	
1130	1200		Vietnam, VO Vietnam/Overseas Svc	9840as		
			12020as			
1135	1145		India, All India R/Aizawl	5050do		
1135	1145		India, All India R/Delhi	9595do	11710do	
			15185do			
1135	1145		India, All India R/Shillong	4970do		

1200 UTC - 8AM EDT / 7AM CDT / 5AM PDT

1200	1215		Nepal, R Nepal	5005as		
1200	1215	mtwhfa	Vatican City State, Vatican R	13730ca		
1200	1230		Germany, AWR Europe	17535as		
1200	1230		Indonesia, AWR Asia/Pacific	17535as		
1200	1230		Japan, R Japan NHK World	6120na	9695as	
1200	1230		Saudi Arabia, BSKSA/External Svc	15250as		
1200	1258		New Zealand, R New Zealand Intl	9655pa		
1200	1300		Anguilla, University Network	11775na		
1200	1300		Australia, ABC NT Alice Springs	2310do		
1200	1300		Australia, ABC NT Katherine	2485do		
1200	1300		Australia, ABC NT Tennant Creek	2325do		
1200	1300		Australia, ABC/R Australia	5995pa	6020pa	
			6080pa	6140as	9475as	9580pa
			11945as	12080pa		
1200	1300		Bahrain, R Bahrain	6010me		
1200	1300	Sat/DRM	Belgium, TDP Radio	6015eu		
1200	1300	Sat/Sun	Canada, CBC Northern Quebec Svc	9625na		
1200	1300		Canada, CFRX Toronto ON	6070na		
1200	1300		Canada, CFVP Calgary AB	6030na		
1200	1300		Canada, CKZN St Johns NF	6160na		
1200	1300		Canada, CKZU Vancouver BC	6160na		
1200	1300		China, China R International	5955as		
			9460as	9645as	9660as	9730as
			9760pa	11650as	11660as	11690va
			11760pa	11980as	13645as	13650eu
			13790eu	17490eu		
1200	1300		Ethiopia, R Ethiopia/Natl Pgm	9705do		
1200	1300	Sat/Sun	Germany, Mighty KBC Radio	6095eu		
1200	1300		Malaysia, RTM Kajang/Traxx FM	7295do		
1200	1300	mtwhf	Nigeria, Voice of Nigeria	9690af		
1200	1300		Palau, T8WH/World Harvest R	9930as		
1200	1300	DRM	Russia, Voice of Russia	9850eu	9445as	
			12030as			
1200	1300		Russia, Voice of Russia	9560as	11500as	
1200	1300		South Africa, CVC 1 Africa R	13590af		
1200	1300		South Korea, KBS World R	9650na		
1200	1300		UK, BBC World Service	5875as	6190af	
			6195as	9740as	11750as	11760me
			15310as	15575me	17790as	17830af
			21470af			
1200	1300		USA, Amer Forces Network/AFRTS	4319usb		
			5446usb	5765usb	7811usb	12133usb
			12759usb	13362usb		
1200	1300		USA, BBG/Voice of America	7575va	9510va	
			12075va	12150va		
1200	1300		USA, FBN/WTJC Newport NC	9370na		
1200	1300		USA, KNLS Anchor Point AK	7355as		
1200	1300		USA, WBCQ Monticello ME	9330am		
1200	1300		USA, WEWN/EWTN Irondale AL	11520as		
1200	1300		USA, WHRI Cypress Creek SC	9795am		
			9840na			
1200	1300		USA, WINB Red Lion PA	9265am		
1200	1300		USA, WTWW Lebanon TN	5755va		
1200	1300		USA, WWCR Nashville TN	7490na	9980af	
			13845af	15825eu		
1200	1300		USA, WWRB Manchester TN	9385na		
1200	1300		Zambia, CVC/R Christian Voice	6065af		
1215	1300		Egypt, R Cairo	17870as		
1230	1245		India, All India R/Aizawl	5050do		
1230	1245		India, All India R/Chennai	4920do		
1230	1245		India, All India R/Delhi	4860do	6085do	
1230	1245		India, All India R/Hyderbad	4800do		
1230	1245		India, All India R/Jeypore	5040do		
1230	1245		India, All India R/Kurseong	4895do		
1230	1245		India, All India R/Port Blair	4760do		
1230	1245		India, All India R/R Kashmir	4950do		
1230	1245		India, All India R/Shillong	4970do		
1230	1245		India, All India R/Thiruvananthapuram	5010do		
1230	1300		Australia, HCJB Global Australia	15400as		
1230	1300		Thailand, R Thailand World Svc	9890va		
1230	1300		Turkey, Voice of Turkey	15450va		
1230	1300		Vietnam, VO Vietnam/Overseas Svc	9840as		
			12020as			

1300 UTC - 9AM EDT / 8AM CDT / 6AM PDT

1300	1325		Turkey, Voice of Turkey	15450va		
1300	1330		Egypt, R Cairo	17870as		
1300	1330		Japan, R Japan NHK World	15735as		
1300	1330		Serbia, International R Serbia	9640eu		
1300	1357		North Korea, Voice of Korea	9335na		
			11710na	13760eu	15245eu	
1300	1400		Anguilla, University Network	11775na		
1300	1400		Australia, ABC NT Alice Springs	2310do		
1300	1400		Australia, ABC NT Katherine	2485do		
1300	1400		Australia, ABC/R Australia	6020pa	9580pa	
			11945pa			
1300	1400		Bahrain, R Bahrain	6010me		
1300	1400	Sun/DRM	Belgium, TDP Radio	6015na		
1300	1400	Sat/Sun	Canada, CBC Northern Quebec Svc	9625na		
1300	1400		Canada, CFRX Toronto ON	6070na		
1300	1400		Canada, CFVP Calgary AB	6030na		
1300	1400		Canada, CKZN St Johns NF	6160na		
1300	1400		Canada, CKZU Vancouver BC	6160na		
1300	1400		China, China R International	5995as		
			9570na	9650na	9730as	9760pa
			9765va	9870as	11660as	11760pa
			13610eu	13755as	13790eu	15260na
1300	1400	Sat/Sun	Germany, Mighty KBC Radio	6095eu		
1300	1400		Indonesia, VO Indonesia	9526va		
1300	1400		Italy, IRRS SW	15190va		
1300	1400		Malaysia, RTM Kajang/Traxx FM	7295do		
1300	1400		New Zealand, R New Zealand Intl	6170pa		
1300	1400	mtwhf	Nigeria, Voice of Nigeria	9690af		
1300	1400		Palau, T8WH/World Harvest R	9930as		
1300	1400	DRM	Russia, Voice of Russia	9850eu	12095as	
1300	1400		Russia, Voice of Russia	12065as		
1300	1400		South Africa, CVC 1 Africa R	13590af		
1300	1400		South Korea, KBS World R	9570as		
1300	1400		Tajikistan, Voice of Tajik	7245va		
1300	1400		UK, BBC World Service	5875as	6190af	
			6195as	9740as	11760me	15310as
			15420af	15575me	17640af	17790as
			17830af			
1300	1400		USA, Amer Forces Network/AFRTS	4319usb		
			5446usb	5765usb	7811usb	12133usb
			12759usb	13362usb		
1300	1400	Sat/Sun	USA, BBG/Voice of America	7575va	9510va	
			9610va	12150va		
1300	1400		USA, FBN/WTJC Newport NC	9370na		
1300	1400		USA, KJES Vado NM	11715na		
1300	1400		USA, Overcomer Ministry	15190as		
1300	1400		USA, WBCQ Monticello ME	9330am		
1300	1400		USA, WEWN/EWTN Irondale AL	15615as		
1300	1400	Sat/Sun	USA, WHRI Cypress Creek SC	9795na		
			9840am			
1300	1400		USA, WINB Red Lion PA	13570am		
1300	1400		USA, WTWW Lebanon TN	9479va		
1300	1400		USA, WWCR Nashville TN	7490af	9980af	
			13845eu	15825eu		
1300	1400		USA, WWRB Manchester TN	9385na		
1300	1400		USA, WYFR/Family R Worldwide	11540as		
1300	1400		Zambia, CVC/R Christian Voice	6065af		
1330	1345		India, All India R/Delhi	6085do		
1330	1400		India, All India R/External Svc	9690as		
			11620as	13710as		
1330	1400		Vietnam, VO Vietnam/Overseas Svc	9840as		
			12020as			
1359	1400		Netherlands, R Netherlands Worldwide			
			9800as			

1400 UTC - 10AM EDT / 9AM CDT / 7AM PDT

1400	1430		Japan, R Japan NHK World	11705as	15735as	
1400	1430		Thailand, R Thailand World Svc	9395va		
1400	1430	Sun	USA, Pan Amer Broadcasting	15205as		
1400	1455		Swaziland, TWR Africa	4760af		
1400	1457		Netherlands, R Netherlands Worldwide	9800as		
1400	1500		Anguilla, University Network	11775na		
1400	1500		Australia, ABC NT Alice Springs	2310do		
1400	1500		Australia, ABC NT Katherine	2485do		
1400	1500		Australia, ABC NT Tennant Creek	2325do		
1400	1500		Australia, ABC/R Australia	5995pa	9580pa	11945pa
1400	1500		Bahrain, R Bahrain	6010me		
1400	1500	Sun	Canada, Bible Voice Broadcasting	17495as		
1400	1500	Sat/Sun	Canada, CBC Northern Quebec Svc	9625na		
1400	1500		Canada, CFRX Toronto ON	6070na		
1400	1500		Canada, CFVP Calgary AB	6030na		
1400	1500		Canada, CKZN St Johns NF	6160na		
1400	1500		Canada, CKZU Vancouver BC	6160na		
1400	1500		China, China R International	5955as	9765va	9870as
				11665me	11675as	11765as
				13710eu	13740na	13790eu
				17630af		
1400	1500		Eqt Guinea, R Africa	15190af		
1400	1500	Sat/Sun	Germany, Mighty KBC Radio	6095eu		
1400	1500		India, All India R/External Svc	9690as	11620as	13710as
1400	1500		Italy, IRRS SW	15190va		
1400	1500		Malaysia, RTM Kajang/Traxx FM	7295do		
1400	1500		New Zealand, R New Zealand Intl	6170pa		
1400	1500	mtwhf	Nigeria, Voice of Nigeria	9690af		
1400	1500		Oman, R Sultanate of Oman	15140va		
1400	1500	DRM	Russia, Voice of Russia	12095eu		
1400	1500		Russia, Voice of Russia	4975va	9560as	11500as
				11840as		
1400	1500		South Africa, CVC 1 Africa R	13590af		
1400	1500		South Korea, KBS World R	9570as		
1400	1500		UK, BBC World Service	5845as	5875as	6190af
				6195as	9740as	11890as
				12095af	13820me	15310as
				17640af	17830af	21470af
1400	1500		USA, Amer Forces Network/AFRTS	4319usb	5446usb	5765usb
				7811usb	12133usb	12759usb
				13362usb		
1400	1500		USA, BBG/Voice of America	4930af	6080af	12080af
				15580af	17530af	
1400	1500	mtwhf	USA, BBG/Voice of America	7540va	7575va	12150va
1400	1500		USA, FBN/WTJC Newport NC	9370na		
1400	1500		USA, Overcomer Ministry	9655eu	15190eu	
1400	1500		USA, WBCQ Monticello ME	9330am		
1400	1500	Sat/Sun	USA, WBCQ Monticello ME	15420am		
1400	1500		USA, WEWN/EWTN Irondale AL	15615as		
1400	1500	Sat/Sun	USA, WHRI Cypress Creek SC	9795am	9840am	21670va
1400	1500		USA, WJHR Intl Milton FL	15550usb		
1400	1500		USA, WTWW Lebanon TN	9479va		
1400	1500		USA, WWCR Nashville TN	7490af	9980af	13845eu
				15825eu		
1400	1500		USA, WWRB Manchester TN	9385na		
1400	1500		USA, WYFR/Family R Worldwide	11540as		
1400	1500		Zambia, CVC/R Christian Voice	6065af		
1405	1435	Sat/Sun	Canada, Bible Voice Broadcasting	15270as		
1415	1430		Nepal, R Nepal	5005as		
1415	1430	mtwhfa	USA, Pan Amer Broadcasting	15205as		
1420	1440		India, All India R/Itanagar	4990do		
1430	1445		India, All India R/Aizawl	5050do		
1430	1445		India, All India R/Delhi	6085do	9575do	9835do
1430	1445		India, All India R/Jeypore	5040do		
1430	1445		India, All India R/Mumbai	4840do		
1430	1445	Sun	USA, Pan Amer Broadcasting	15205as		
1430	1500		Australia, ABC/R Australia	9475as	11660as	
1430	1500	Sat	Canada, Bible Voice Broadcasting	17495as		
1430	1500	Sat	India, All India R/Gangtok	4835do		
1430	1500		USA, WRMI/R Prague relay	9955ca		
1445	1500		Australia, HCJB Global Australia	15340as		
1450	1500		India, All India R/Itanagar	4990do		
1450	1500		India, All India R/Kurseong	4895do		

1500 UTC - 11AM EDT / 10AM CDT / 8AM PDT

1500	1515	Sun	Canada, Bible Voice Broadcasting	13740as		
1500	1525	Sun	China, Haixa zhi Sheng/VO Strait	4940do	9505do	
1500	1525	mhf	Guam, KTWR/TWR Asia	15200as		
1500	1530		Australia, ABC/R Australia	11945pa		
1500	1530		Australia, HCJB Global Australia	15340as		
1500	1530	Sun	Canada, Bible Voice Broadcasting	15275as		
1500	1530		India, All India R/Jeypore	5040do		
1500	1530		Vietnam, VO Vietnam/Overseas Svc	7285as	9840as	12020as
1500	1535	twas	Guam, KTWR/TWR Asia	15200as		
1500	1550		New Zealand, R New Zealand Intl	6170pa		
1500	1557		North Korea, Voice of Korea	9335na	11710na	13760eu
				15245eu		
1500	1600		Anguilla, University Network	11775na		
1500	1600		Australia, ABC NT Alice Springs	2310do		
1500	1600		Australia, ABC NT Katherine	2485do		
1500	1600		Australia, ABC/R Australia	5940as	5995pa	7240pa
				9475as	11660as	
1500	1600		Bahrain, R Bahrain	6010me		
1500	1600	Sat/Sun	Canada, CBC Northern Quebec Svc	9625na		
1500	1600		Canada, CFRX Toronto ON	6070na		
1500	1600		Canada, CFVP Calgary AB	6030na		
1500	1600		Canada, CKZN St Johns NF	6160na		
1500	1600		Canada, CKZU Vancouver BC	6160na		
1500	1600		China, China R International	5955as	6095me	7325as
				7395as	9720me	9800as
				9870as	11965eu	13640eu
				13740na	17630af	
1500	1600	Sat	Clandestine, Sudan R Service	17745af		
1500	1600		Eqt Guinea, R Africa	15190af		
1500	1600	Sat/Sun	Germany, Mighty KBC Radio	6095eu		
1500	1600	Sat	Italy, IRRS SW	15700va		
1500	1600		Malaysia, RTM Kajang/Traxx FM	7295do		
1500	1600	mtwhf	Nigeria, Voice of Nigeria	15120af		
1500	1600	DRM	Russia, Voice of Russia	6070as	7370as	
1500	1600		Russia, Voice of Russia	4975va	9560as	11840as
				15640me		
1500	1600		South Africa, Channel Africa	9625af		
1500	1600		South Africa, CVC 1 Africa R	13590af		
1500	1600		Uganda, Dunamis Shortwave	4750do		
1500	1600		UK, BBC World Service	5845as	5875as	6190af
				6195as	7435af	9410as
				9740as	11890as	12095af
				13820me	15310as	15400af
				17640af	17830af	21470af
1500	1600		USA, Amer Forces Network/AFRTS	4319usb	5446usb	5765usb
				7811usb	12133usb	12759usb
				13362usb		
1500	1600		USA, BBG/Voice of America	4930af	6080af	7540va
				7575va	12150va	15580af
				17895af		
1500	1600		USA, BBG/Voice of America/Special English	6140va	7465va	7520va
				9760va	9945va	
1500	1600		USA, FBN/WTJC Newport NC	9370na		
1500	1600		USA, KNLS Anchor Point AK	9655as		
1500	1600		USA, Overcomer Ministry	13810me		
1500	1600		USA, WBCQ Monticello ME	9330am		
1500	1600	Sat/Sun	USA, WBCQ Monticello ME	15420am		
1500	1600		USA, WEWN/EWTN Irondale AL	15610eu		
1500	1600	Sat/Sun	USA, WHRI Cypress Creek SC	9795am	9840am	
1500	1600	Sun	USA, WHRI Cypress Creek SC	21630af		
1500	1600		USA, WINB Red Lion PA	13570am		
1500	1600		USA, WJHR Intl Milton FL	15550usb		
1500	1600		USA, WTWW Lebanon TN	9479va		
1500	1600		USA, WWCR Nashville TN	9980af	12160af	13845eu
				15825eu		
1500	1600		USA, WWRB Manchester TN	9385na		
1500	1600		USA, WYFR/Family R Worldwide	6280as	13690as	15520as
1500	1600		Zambia, CVC/R Christian Voice	6065af		
1515	1530	Sat	Australia, HCJB Global Australia	15340as		
1515	1530	f	Canada, Bible Voice Broadcasting	15275as		
1525	1555	Sat/Sun	Swaziland, TWR Africa	4760af		
1530	1545		India, All India R/Aizawl	5050do		

1530	1545		India, All India R/Bengaluru	9425do		
1530	1545		India, All India R/Bhopal	4810do		
1530	1545		India, All India R/Chennai	4920do		
1530	1545		India, All India R/Delhi	5015do		
1530	1545		India, All India R/Guwahati	4940do		
1530	1545		India, All India R/Hyderbad	4800do		
1530	1545		India, All India R/Itanagar	4990do		
1530	1545		India, All India R/Jaipur	4910do		
1530	1545		India, All India R/Kolkata	4820do		
1530	1545		India, All India R/Kurseong	4895do		
1530	1545		India, All India R/Lucknow	4880do		
1530	1545		India, All India R/Panaji (Goa)	9820do		
1530	1545		India, All India R/Port Blair	4760do		
1530	1545		India, All India R/R Kashmir	4950do		
1530	1545		India, All India R/Shillong	4970do		
1530	1545		India, All India R/Shimla	4965do		
1530	1545		India, All India R/Thiruvananthapuram	5010do		
1530	1600		Afghanistan, RTV Afghanistan	7200as		
1530	1600		Australia, ABC/R Australia	11880pa		
1530	1600	DRM	Belgium, The Disco Palace	15775as		
1530	1600	h	Canada, Bible Voice Broadcasting	15275as		
1530	1600	Sun	Clandestine, Sudan R Service	17745af		
1530	1600	smtwa	Germany, AWR Europe	15255as		
1530	1600	mtwas	Indonesia, AWR Asia/Pacific	15255as		
1530	1600		Iran, VO Islamic Rep of Iran	11945va	13780va	13720al
1530	1600		Mongolia, Voice of Mongolia	12015as		
1530	1600		Vatican City State, Vatican R	11850as	13765as	17520as 17815as
1551	1600		New Zealand, R New Zealand Intl	7285pa		
1551	1600	DRM	New Zealand, R New Zealand Intl	6170pa		

1600 UTC - 12PM EDT / 11AM CDT / 9AM PDT

1600	1627		Iran, VO Islamic Rep of Iran	11945va	13780va	13720al
1600	1630		Australia, ABC/R Australia	9540as		
1600	1630	DRM	Belgium, The Disco Palace	15775as		
1600	1630		Vietnam, VO Vietnam/Overseas Svc	7220me	7280eu	9550me 9730eu
1600	1650	DRM	New Zealand, R New Zealand Intl	6170pa		
1600	1650		New Zealand, R New Zealand Intl	7285pa		
1600	1657		North Korea, Voice of Korea	9990va	11545va	
1600	1700		Anguilla, University Network	11775na		
1600	1700		Australia, ABC NT Alice Springs	2310do		
1600	1700		Australia, ABC NT Katherine	2485do		
1600	1700		Australia, ABC/R Australia	5940as	5995pa	7240pa 9475as 11660as 11880pa
1600	1700		Bahrain, R Bahrain	6010me		
1600	1700	Sat	Canada, CBC Northern Quebec Svc	9625na		
1600	1700		Canada, CFRX Toronto ON	6070na		
1600	1700		Canada, CFVP Calgary AB	6030na		
1600	1700		Canada, CKZN St Johns NF	6160na		
1600	1700		Canada, CKZU Vancouver BC	6160na		
1600	1700		China, China R International	6060as	7235as 7420af 9570af 11900af	11940eu 11965eu 13760eu
1600	1700		Egypt, R Cairo	15345af		
1600	1700		Eqt Guinea, R Africa	15190af		
1600	1700		Ethiopia, R Ethiopia	7235va	9560va	
1600	1700	Sat/Sun	Germany, Mighty KBC Radio	6095eu		
1600	1700		Malaysia, RTM Kajang/Traxx FM	7295do		
1600	1700		Palau, T8WH/World Harvest R	15530as		
1600	1700	DRM	Russia, Voice of Russia	6070as	7370eu	
1600	1700		Russia, Voice of Russia	4975as	7285me	11985me
1600	1700		South Africa, CVC 1 Africa R	13590af		
1600	1700		South Korea, KBS World R	9515eu	9640as	
1600	1700		Taiwan, R Taiwan Intl	9435as	15485as	
1600	1700		Uganda, Dunamis Shortwave	4750do		
1600	1700		UK, BBC World Service	3255af	5845as	5975as 6190af 9410as 11890as 12095af 13820me 15400af 17795af 17830af 21470af
1600	1700		USA, Amer Forces Network/AFRTS	4319usb	5446usb 5765usb 7811usb 12133usb	12759usb 13362usb
1600	1700		USA, BBG/Voice of America	4930af	6080af	15580af
1600	1700		USA, BBG/Voice of America/Special English	13600va	15470va	
1600	1700		USA, FBN/WTJC Newport NC	9370na		
1600	1700		USA, Overcomer Ministry	15425as		
1600	1700		USA, WBCQ Monticello ME	9330am		
1600	1700	Sat/Sun	USA, WBCQ Monticello ME	15420am		
1600	1700		USA, WEWN/EWTN Irondale AL	15610eu		
1600	1700	Sat/Sun	USA, WHRI Cypress Creek SC	9795am		
1600	1700		USA, WHRI Cypress Creek SC	9840na	11630af	
1600	1700		USA, WINB Red Lion PA	13570am		
1600	1700		USA, WJHR Intl Milton FL	15550usb		
1600	1700		USA, WTWW Lebanon TN	9479va		
1600	1700		USA, WWCR Nashville TN	9980af	12160af	13845eu 15825eu
1600	1700		USA, WWRB Manchester TN	9385na		
1600	1700		USA, WYFR/Family R Worldwide	11850as		
1600	1700		Zambia, CVC/R Christian Voice	6065af		
1615	1630		Vatican City State, Vatican R	3975eu	6075eu	7250eu 9645eu 15595eu
1630	1700		Clandestine, Sudan R Service	17745af		
1630	1700		Indonesia, AWR Asia/Pacific	11740as		
1630	1700		Turkey, Voice of Turkey	15520as		
1630	1700	mtwhf	USA, BBG/Voice of America	9490af		
1645	1700		Canada, Bible Voice Broadcasting	15215me		
1651	1700		New Zealand, R New Zealand Intl	9615pa		
1651	1700	DRM	New Zealand, R New Zealand Intl	9890pa		

1700 UTC - 1PM EDT / 12PM CDT / 10AM PDT

1700	1710		Pakistan, PBC/R Pakistan	11575eu		
1700	1715	mf	Canada, Bible Voice Broadcasting	15215me		
1700	1720	h	Canada, Bible Voice Broadcasting	15215me		
1700	1725		Turkey, Voice of Turkey	15520as		
1700	1730		Australia, ABC/R Australia	11660as		
1700	1730		Vietnam, VO Vietnam/Overseas Svc	9625eu		
1700	1750	DRM	New Zealand, R New Zealand Intl	9890pa		
1700	1755		South Africa, Channel Africa	15235af		
1700	1756	DRM	Romania, R Romania Intl	9535eu		
1700	1756		Romania, R Romania Intl	11740eu	11740eu	
1700	1800		Anguilla, University Network	11775na		
1700	1800		Australia, ABC NT Alice Springs	2310do		
1700	1800		Australia, ABC NT Katherine	2485do		
1700	1800		Australia, ABC/R Australia	5995pa	9475as	9500pa 9580pa 11880pa
1700	1800		Bahrain, R Bahrain	6010me		
1700	1800	asm	Canada, Bible Voice Broadcasting	15215me		
1700	1800	Sat	Canada, CBC Northern Quebec Svc	9625na		
1700	1800		Canada, CFRX Toronto ON	6070na		
1700	1800		Canada, CFVP Calgary AB	6030na		
1700	1800		Canada, CKZN St Johns NF	6160na		
1700	1800		Canada, CKZU Vancouver BC	6160na		
1700	1800		China, China R International	6090as	6140as 6145eu 6165me 7235as	7265af 7410as 7420as 9570af 9695eu 11900af 13760eu
1700	1800		Egypt, R Cairo	15345af		
1700	1800		Eqt Guinea, R Africa	15190af		
1700	1800		Malaysia, RTM Kajang/Traxx FM	7295do		
1700	1800		New Zealand, R New Zealand Intl	9615pa		
1700	1800	DRM	Russia, Voice of Russia	7370eu		
1700	1800		Russia, Voice of Russia	4975va	7285va	11985af 12040eu
1700	1800		South Africa, CVC 1 Africa R	4965af		13590af 17695af
1700	1800		Swaziland, TWR Africa	3200af		
1700	1800		Taiwan, R Taiwan Intl	15690af		
1700	1800		UK, BBC World Service	3255af	5845as	5975as 6190af 7565as 9410as 12095af 15400af 15420af 17640af 17795af 17830af
1700	1800		USA, Amer Forces Network/AFRTS	4319usb	5446usb 5765usb 7811usb 12133usb	12759usb 13362usb
1700	1800		USA, BBG/Voice of America	6080af	11795af	15580af 17895af

1700	1800		USA, FBN/WTJC Newport NC			9370na
1700	1800		USA, WBCQ Monticello ME	9330am		15420am
1700	1800		USA, WEWN/EWTN Irondale AL			15610eu
1700	1800		USA, WHRI Cypress Creek SC			9840na
			21630af			
1700	1800		USA, WINB Red Lion PA	13570am		
1700	1800		USA, WJHR Intl Milton FL	15550usb		
1700	1800		USA, WTWW Lebanon TN	9479va		
1700	1800		USA, WWCR Nashville TN	9980af		12160af
			13845eu	15825eu		
1700	1800		USA, WWRB Manchester TN	9385na		
1700	1800		USA, WYFR/Family R Worldwide			7395af
			17545af			
1730	1745	h	Canada, Bible Voice Broadcasting			15215me
1730	1745		India, All India R/Bhopal	4810do		
1730	1745		India, All India R/Delhi	5015do		7370do
			9575do	9835do		
1730	1745		India, All India R/Guwahati	4940do		
1730	1745		India, All India R/Hyderbad	4800do		
1730	1745		India, All India R/Jaipur	4910do		
1730	1745		India, All India R/Kolkata	4820do		
1730	1745		India, All India R/Kurseong	4895do		
1730	1745		India, All India R/Lucknow	4880do		
1730	1745		India, All India R/R Kashmir	4950do		
1730	1745		India, All India R/Shimla	4965do		
1730	1745		India, All India R/Thiruvananthapuram			5010do
1730	1800		Australia, ABC/R Australia	6080pa		
1730	1800	Sun	Italy, IRRS SW	7290va		
1730	1800	m	South Africa, Amateur R Mirror Intl			4895af
1730	1800		Vatican City State, Vatican R	11625af		13765af
			15570af			
1740	1745		India, All India R/Chennai	4920do		
1745	1800	Sat	Canada, Bible Voice Broadcasting			17515af
1745	1800	DRM	India, All India R/External Svc			9950eu
1745	1800		India, All India R/External Svc			7400af
			7550eu	9415af	11580af	11670as
			11935af	13695af		
1751	1800	DRM	New Zealand, R New Zealand Intl			9890pa

1800 UTC - 2PM EDT / 1PM CDT / 11AM PDT

1800	1830	w	Austria, AWR Europe	15325af		
1800	1830		Japan, R Japan NHK World	15720af		
1800	1830	m	South Africa, Amateur R Mirror Intl			3230af
1800	1830		South Africa, AWR Africa	3215af		3345af
1800	1830		Tanzania, Zanzibar BC/VO Tanzania			11735do
1800	1830		UK, BBC World Service	5850as		5975as
1800	1830		USA, BBG/Voice of America	6080af		12015af
			15580af			
1800	1836	DRM	New Zealand, R New Zealand Intl			9890pa
1800	1850		New Zealand, R New Zealand Intl			9615pa
1800	1857		North Korea, Voice of Korea			13760eu
			15245eu			
1800	1900		Anguilla, University Network	11775na		
1800	1900	mtwhf	Argentina, RAE	15345eu		
1800	1900		Australia, ABC NT Alice Springs			2310do
1800	1900		Australia, ABC NT Katherine	2485do		
1800	1900		Australia, ABC/R Australia	6080pa		9500pa
			9580pa	9710pa	11880pa	
1800	1900		Bahrain, R Bahrain	6010me		
1800	1900	Sat	Canada, Bible Voice Broadcasting			9430me
1800	1900	Sun	Canada, Bible Voice Broadcasting			6130eu
			15215me			
1800	1900		Canada, CFRX Toronto ON	6070na		
1800	1900		Canada, CFVP Calgary AB	6030na		
1800	1900		Canada, CKZN St Johns NF	6160na		
1800	1900		Canada, CKZU Vancouver BC			6160na
1800	1900		China, China R International			6175eu
			9600eu	13760eu		
1800	1900	mtwhfa	Ecuador, HCJB/LV de los Andes			3995eu
1800	1900		Eqt Guinea, R Africa	15190af		
1800	1900	DRM	India, All India R/External Svc			9950eu
1800	1900		India, All India R/External Svc			7400af
			7550as	9415af	9445af	11580af
			11670eu	11935af	13695af	
1800	1900	fa	Italy, IRRS SW	7290va		
1800	1900		Kuwait, R Kuwait	15540va		
1800	1900		Malaysia, RTM Kajang/Traxx FM			7295do
1800	1900		Netherlands, R Netherlands Worldwide			
			17605af			
1800	1900	mtwhf	Nigeria, Voice of Nigeria	15120af		
1800	1900	DRM	Russia, Voice of Russia	7370eu		9880eu
1800	1900		Russia, Voice of Russia	4975me		9900va
			12040eu			
1800	1900		South Africa, CVC 1 Africa R			4965af
			13590af	17695af		
1800	1900		South Korea, KBS World R	7275eu		
1800	1900		Swaziland, TWR Africa	3200af		9500af
1800	1900		Taiwan, R Taiwan Intl	6155eu		
1800	1900		UK, BBC World Service	3255af		5875me
			5950as	6190af	11810af	12095af
			15400af	15420af	17795af	
1800	1900		USA, Amer Forces Network/AFRTS			4319usb
			5446usb	5765usb	7811usb	12133usb
			12759usb	13362usb		
1800	1900	Sat/Sun	USA, BBG/Voice of America	4930af		
1800	1900		USA, FBN/WTJC Newport NC			9370na
1800	1900		USA, KJES Vado NM	15385na		
1800	1900		USA, Overcomer Ministry	9400eu		
1800	1900		USA, WBCQ Monticello ME	9330am		15420am
1800	1900		USA, WEWN/EWTN Irondale AL			15610af
1800	1900		USA, WHRI Cypress Creek SC			9840na
			21630af			
1800	1900		USA, WINB Red Lion PA	13570am		
1800	1900		USA, WJHR Intl Milton FL	15550usb		
1800	1900		USA, WTWW Lebanon TN	9479va		
1800	1900		USA, WWCR Nashville TN	9980af		12160af
			13845eu	15825eu		
1800	1900		USA, WWRB Manchester TN	9385na		
1800	1900		USA, WYFR/Family R Worldwide			5905af
			7395af	9610af	13750af	
1815	1845	Sun	Canada, Bible Voice Broadcasting			6130eu
			9430me			
1830	1845		India, All India R/Delhi	5015do		
1830	1900	f	Canada, Bible Voice Broadcasting			17515af
1830	1900	Sun	Italy, IRRS SW	7290va		
1830	1900	mtwhf	Moldova, R PMR/Pridnestrovye			9665eu
1830	1900	DRM/mtwhf	Nigeria, Voice of Nigeria	15120af		
1830	1900		Serbia, International R Serbia			6100eu
1830	1900		South Africa, AWR Africa	11840af		
1830	1900		Turkey, Voice of Turkey	9785va		
1830	1900		UK, BBC World Service	9410af		
1830	1900		USA, BBG/Voice of America	4930af		6080af
			9850af	12015af	15580af	
1837	1850	DRM	New Zealand, R New Zealand Intl			11675pa
1850	1900	DRM	New Zealand, R New Zealand Intl			15720pa
1851	1900		New Zealand, R New Zealand Intl			11725pa

1900 UTC - 3PM EDT / 2PM CDT / 12PM PDT

1900	1925		Turkey, Voice of Turkey	9785va		
1900	1930	f	Canada, Bible Voice Broadcasting			17515af
1900	1930		Germany, Deutsche Welle	9735af		11800af
1900	1930		USA, BBG/Voice of America	4930af		4940af
			6080af	9850af	15580af	17895af
1900	1930		Vietnam, VO Vietnam/Overseas Svc			7280eu
			9730eu			
1900	1945	DRM	India, All India R/External Svc			9950eu
1900	1945		India, All India R/External Svc			7400af
			7550eu	9415af	9445af	11580af
			11670eu	11935af	13695af	
1900	1950	DRM	New Zealand, R New Zealand Intl			15720pa
1900	1957		Germany, Deutsche Welle	7365af		
1900	1957		North Korea, Voice of Korea			7210af
			9975va	11535va	11910af	
1900	2000		Anguilla, University Network	11775na		
1900	2000		Australia, ABC NT Alice Springs			2310do
1900	2000		Australia, ABC NT Katherine	2485do		
1900	2000		Australia, ABC/R Australia	6080pa		9475as
			9500pa	9580pa	9710pa	11660pa
			11880pa			
1900	2000		Bahrain, R Bahrain	6010me		
1900	2000		Canada, CFRX Toronto ON	6070na		
1900	2000		Canada, CFVP Calgary AB	6030na		
1900	2000		Canada, CKZN St Johns NF	6160na		
1900	2000		Canada, CKZU Vancouver BC			6160na
1900	2000		China, China R International			7295va
			9435af	9440af		
1900	2000		Cuba, R Havana Cuba	11760am		
1900	2000		Egypt, R Cairo	15290af		
1900	2000		Eqt Guinea, R Africa	15190af		

1900	2000		Indonesia, VO Indonesia	9526va		
1900	2000		Kuwait, R Kuwait	15540va		
1900	2000		Malaysia, RTM Kajang/Traxx FM	7295do		
1900	2000		Micronesia, V6MP/Cross R/Pohnpei	4755as		
1900	2000		Netherlands, R Netherlands Worldwide	7425af	11615af	15495af 17605af
1900	2000		New Zealand, R New Zealand Intl	11725pa		
1900	2000	mtwhf	Nigeria, Voice of Nigeria	7255af		
1900	2000	DRM/mtwhf	Nigeria, Voice of Nigeria	15120af		
1900	2000	DRM	Russia, Voice of Russia	6155eu		
1900	2000		Russia, Voice of Russia	12040eu		
1900	2000		South Africa, CVC 1 Africa R	4965af	13590af	17695af
1900	2000	mtwhf	Spain, R Exterior de Espana	9665af	11620af	
1900	2000		Swaziland, TWR Africa	3200af		
1900	2000		Thailand, R Thailand World Svc	7205eu		
1900	2000		UK, BBC World Service	3255af	5875me	5950as 6005af 6190af 9410af 11810af 12095af 15400af 17795as
1900	2000		USA, Amer Forces Network/AFRTS	4319usb	5446usb	5765usb 7811usb 12133usb 12759usb 13362usb
1900	2000		USA, BBG/Voice of America/Special English	7480va	9590va	
1900	2000		USA, FBN/WTJC Newport NC	9370na		
1900	2000		USA, Overcomer Ministry	9400eu		
1900	2000		USA, WBCQ Monticello ME	9330am	15420am	
1900	2000		USA, WEWN/EWTN Irondale AL	15610af		
1900	2000		USA, WHRI Cypress Creek SC	9840na	21630af	
1900	2000		USA, WINB Red Lion PA	13570am		
1900	2000		USA, WJHR Intl Milton FL	15550usb		
1900	2000		USA, WTWW Lebanon TN	9479va		
1900	2000		USA, WWCR Nashville TN	9980af	12160af	13845eu 15825eu
1900	2000		USA, WWRB Manchester TN	9385na		
1900	2000		USA, WYFR/Family R Worldwide	7395af	9775af	18980eu
1905	1920	Sat	Mali, ORTM/R Mali	9635do		
1930	2000		Germany, Deutsche Welle	11800af		
1930	2000		Iran, VO Islamic Rep of Iran	5940eu	9540eu	9800eu 11750af 11885af
1930	2000		USA, BBG/Voice of America	4930af	4940af	6080af 15580af
1930	2000	Sat	USA, Pan Amer Broadcasting	9515af		
1945	2000	DRM	Vatican City State, Vatican R	9800am		
1950	2000		Vatican City State, Vatican R	3975eu	6075eu	7250eu 9645eu
1951	2000	DRM	New Zealand, R New Zealand Intl	15720pa		

2000 UTC - 4PM EDT / 3PM CDT / 1PM PDT

2000	2027		Iran, VO Islamic Rep of Iran	5940eu	9540eu	9800eu 11750af 11885af
2000	2030	mtwhfa	Albania, R Tirana	7465eu		
2000	2030		Australia, ABC/R Australia	6080pa	9500pa	
2000	2030		Egypt, R Cairo	15290af		
2000	2030	Sat	Swaziland, TWR Africa	3200af		
2000	2030		USA, BBG/Voice of America	4930af	4940af	6080af 15580af
2000	2030		Vatican City State, Vatican R	7365af	9755af	11625af
2000	2050	DRM	New Zealand, R New Zealand Intl	15720pa		
2000	2057		Netherlands, R Netherlands Worldwide	7425af	11615af	15495af 17605af
2000	2100		Anguilla, University Network	11775na		
2000	2100		Australia, ABC NT Alice Springs	2310do		
2000	2100		Australia, ABC NT Katherine	2485do		
2000	2100		Australia, ABC NT Tennant Creek	2325do		
2000	2100		Australia, ABC/R Australia	9580pa	11650pa	11660pa 12080pa 15515pa
2000	2100		Bahrain, R Bahrain	6010me		
2000	2100		Belarus, R Belarus	7255eu	11730eu	
2000	2100	DRM	Belgium, The Disco Palace	17875na		
2000	2100		Canada, CFRX Toronto ON	6070na		
2000	2100		Canada, CFVP Calgary AB	6030na		
2000	2100		Canada, CKZN St Johns NF	6160na		
2000	2100		Canada, CKZU Vancouver BC	6160na		
2000	2100		China, China R International	5960eu	5985af	7285eu 7295va 7415eu 9440af 9600eu
2000	2100	f	Clandestine, JSR/Shiokaze/Sea Breeze	5965as	5910al	6110al
2000	2100		Eqt Guinea, R Africa	15190af		
2000	2100		Germany, Deutsche Welle	6150af	9490af	11800af
2000	2100		Kuwait, R Kuwait	15540va		
2000	2100		Malaysia, RTM Kajang/Traxx FM	7295do		
2000	2100		Micronesia, V6MP/Cross R/Pohnpei	4755as		
2000	2100		New Zealand, R New Zealand Intl	11725pa		
2000	2100	DRM	Russia, Voice of Russia	6155eu		
2000	2100		Russia, Voice of Russia	12040eu		
2000	2100		South Africa, CVC 1 Africa R	4965af	13590af	
2000	2100		UK, BBC World Service	3255af	6005af	6190af 9410af 9855af 11810af 12095af 15400af
2000	2100		USA, Amer Forces Network/AFRTS	4319usb	5446usb	5765usb 7811usb 12133usb 12759usb 13362usb
2000	2100		USA, BBG/Voice of America	7485va	9480va	
2000	2100		USA, FBN/WTJC Newport NC	9370na		
2000	2100		USA, Overcomer Ministry	9400eu		
2000	2100		USA, WBCQ Monticello ME	7490am	9330am	15420am
2000	2100		USA, WEWN/EWTN Irondale AL	15610af		
2000	2100	mtwhfa	USA, WHRI Cypress Creek SC	21630af		
2000	2100		USA, WHRI Cypress Creek SC	17510va		
2000	2100		USA, WINB Red Lion PA	13570am		
2000	2100		USA, WJHR Intl Milton FL	15550usb		
2000	2100		USA, WTWW Lebanon TN	9479va		
2000	2100		USA, WWCR Nashville TN	9980af	12160af	13845eu 15825eu
2000	2100		USA, WWRB Manchester TN	9385na		
2000	2100		USA, WYFR/Family R Worldwide	15195af		
2030	2045		Thailand, R Thailand World Svc	9680eu		
2030	2056	DRM	Romania, R Romania Intl	9700eu		
2030	2056		Romania, R Romania Intl	11880na	13800na	15220na
2030	2100		Australia, ABC/R Australia	9500pa	11695as	12080pa
2030	2100	mtwhf	Moldova, R PMR/Pridnestrovye	9665eu		
2030	2100		Turkey, Voice of Turkey	7205va		
2030	2100		USA, BBG/Voice of America	4930af	6080af	7555as 15580af
2030	2100	Sat/Sun	USA, BBG/Voice of America	4940af		
2030	2100		Vietnam, VO Vietnam/Overseas Svc	7220me	7280eu	9730me 9730eu
2045	2100		India, All India R/External Svc	7550eu	9445eu	9910pa 11620pa 11670eu 11715pa
2045	2100	DRM	India, All India R/External Svc	9950eu		
2051	2100	DRM	New Zealand, R New Zealand Intl	15720pa		

2100 UTC - 5PM EDT / 4PM CDT / 2PM PDT

2100	2125		Turkey, Voice of Turkey	7205va		
2100	2130		Australia, ABC NT Alice Springs	2310do		
2100	2130		Australia, ABC NT Katherine	2485do		
2100	2130		Australia, ABC NT Tennant Creek	2325do		
2100	2130		Austria, AWR Europe	11955af		
2100	2130	Sat	Canada, CBC Northern Quebec Svc	9625na		
2100	2130		Serbia, International R Serbia	6100eu		
2100	2130		South Korea, KBS World R	3955eu		
2100	2150		New Zealand, R New Zealand Intl	11725pa		
2100	2150	DRM	New Zealand, R New Zealand Intl	15720pa		
2100	2157		North Korea, Voice of Korea	13760eu	15245eu	
2100	2200		Angola, Angolan National R	7217af		
2100	2200		Anguilla, University Network	11775na		
2100	2200		Australia, ABC/R Australia	9500pa	11695as	13630pa 15515pa 11650pa 12080pa 21740pa
2100	2200		Bahrain, R Bahrain	6010me		
2100	2200		Belarus, R Belarus	7255eu	11730eu	
2100	2200		Canada, CFRX Toronto ON	6070na		
2100	2200		Canada, CFVP Calgary AB	6030na		
2100	2200		Canada, CKZN St Johns NF	6160na		
2100	2200		Canada, CKZU Vancouver BC	6160na		
2100	2200		China, China R International	5960eu	7205af	7285eu 7325af 7415eu 9600eu

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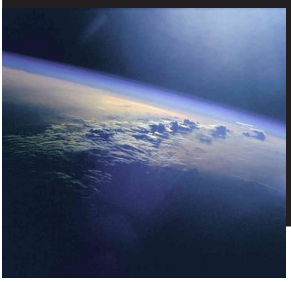
2100	2200		Eqt Guinea, R Africa	15190af		
2100	2200		Germany, Deutsche Welle	11800af	11830af	11865af
2100	2200		India, All India R/External Svc	7550eu	9445eu	9910pa
			11620pa	11670eu	11715pa	
2100	2200	DRM	India, All India R/External Svc	9950eu		
2100	2200		Malaysia, RTM Kajang/Traxx FM	7295do		
2100	2200		Micronesia, V6MP/Cross R/Pohnpei	4755as		
2100	2200	DRM	Russia, Voice of Russia	6155eu		
2100	2200		South Africa, CVC 1 Africa R	4965af	13590af	
2100	2200	Sat/Sun	Spain, R Exterior de Espana	9650eu		
2100	2200		Syria, R Damascus	9330va		
2100	2200		UK, BBC World Service	3255af	3915as	5875as
			5905af	6005af	6190af	6195va
			9410af	12095af		
2100	2200		USA, Amer Forces Network/AFRTS	4319usb	5446usb	5765usb
			7811usb	12133usb	12759usb	13362usb
2100	2200		USA, BBG/Voice of America	6080af	7555as	15580af
2100	2200		USA, FBN/WTJC Newport NC	9370na		
2100	2200		USA, Overcomer Ministry	9400eu		
2100	2200		USA, WBCQ Monticello ME	7490am	9330am	
2100	2200		USA, WEWN/EWTN Irondale AL	15610af		
2100	2200		USA, WHRI Cypress Creek SC	17510va		
2100	2200		USA, WINB Red Lion PA	9265am		
2100	2200		USA, WJHR Intl Milton FL	15550usb		
2100	2200		USA, WTWW Lebanon TN	9479va		
2100	2200		USA, WWCR Nashville TN	6875eu	9350af	9980af
			13845eu			
2100	2200		USA, WWRB Manchester TN	9385na		
2100	2200		USA, WYFR/Family R Worldwide	12070af		
2115	2200		Egypt, R Cairo	6270eu		
2130	2200		Australia, ABC NT Alice Springs	4835do		
2130	2200		Australia, ABC NT Katherine	5025do		
2130	2200	mtwhfa	Canada, CBC Northern Quebec Svc	9625na		
2151	2200		New Zealand, R New Zealand Intl	15720pa		
2151	2200	DRM	New Zealand, R New Zealand Intl	17675pa		

2200 UTC - 6PM EDT / 5PM CDT / 3PM PDT

2200	2230		India, All India R/External Svc	7550eu	9445eu	9910pa
			11620pa	11670eu	11715pa	
2200	2230	DRM	India, All India R/External Svc	9950as		
2200	2245		Egypt, R Cairo	6270eu		
2200	2255		Turkey, Voice of Turkey	9830va		
2200	2256		Romania, R Romania Intl	7435eu	9540eu	9790eu
			11940eu			
2200	2300		Anguilla, University Network	6090na		
2200	2300		Australia, ABC NT Alice Springs	4835do		
2200	2300		Australia, ABC NT Katherine	5025do		
2200	2300		Australia, ABC/R Australia	9855as	12080pa	13630pa
			15230pa	15240as	15415pa	15515pa
			21740pa			
2200	2300		Bahrain, R Bahrain	6010me		
2200	2300	smtwhf	Canada, CBC Northern Quebec Svc	9625na		
2200	2300		Canada, CFRX Toronto ON	6070na		
2200	2300		Canada, CFVP Calgary AB	6030na		
2200	2300		Canada, CKZN St Johns NF	6160na		
2200	2300		Canada, CKZU Vancouver BC	6160na		
2200	2300		China, China R International	9590as		
2200	2300		Eqt Guinea, R Africa	15190af		
2200	2300		Malaysia, RTM Kajang/Traxx FM	7295do		
2200	2300		Micronesia, V6MP/Cross R/Pohnpei	4755as		
2200	2300		New Zealand, R New Zealand Intl	15720pa		
2200	2300	DRM	New Zealand, R New Zealand Intl	17675pa		
2200	2300	Sat	Palau, T8WH/World Harvest R	9930as		
2200	2300		Russia, Voice of Russia	9800va		
2200	2300		South Africa, CVC 1 Africa R	9505af		
2200	2300		UK, BBC World Service	3915as	5875as	5905as
			6195as	7490as	9580as	9730af
			9740as	12095af		
2200	2300		USA, Amer Forces Network/AFRTS	4319usb	5446usb	5765usb
			7811usb	12133usb	12759usb	13362usb
2200	2300	smtwh	USA, BBG/Voice of America	5895va	5915va	7480va
			7575va	12150va		
2200	2300		USA, FBN/WTJC Newport NC	9370na		
2200	2300		USA, WBCQ Monticello ME	7490am	9330am	
2200	2300		USA, WEWN/EWTN Irondale AL	15610me		
2200	2300		USA, WHRI Cypress Creek SC	11775va	13620na	17510va
2200	2300	twhfas	USA, WINB Red Lion PA	9265am		
2200	2300		USA, WTWW Lebanon TN	9479va		
2200	2300		USA, WWCR Nashville TN	6875eu	9350af	9980af
			13845eu			
2200	2300		USA, WWRB Manchester TN	9385na		
2200	2300		USA, WYFR/Family R Worldwide	6115na		
2200	2300		Zambia, CVC/R Christian Voice	4965af		
2230	2300		Indonesia, AWR Asia/Pacific	9730as		
2230	2300	mtwhf	Moldova, R PMR/Pridnestrovye	9665eu		
2230	2300		USA, BBG/Voice of America/Special English	5810va	7545va	9570va
2230	2300		USA, WYFR/Family R Worldwide	6115af	11580af	15255af
2245	2300		India, All India R/External Svc	6055as	9705as	9950as
			11670as	13605as		
2245	2300	DRM	India, All India R/External Svc	11645as		

2300 UTC - 7PM EDT / 6PM CDT / 4PM PDT

2300	0000		Anguilla, University Network	6090na		
2300	0000		Australia, ABC NT Alice Springs	4835do		
2300	0000		Australia, ABC NT Katherine	5025do		
2300	0000		Australia, ABC/R Australia	9855as	12080pa	13630pa
			15230pa	15415pa	15515pa	17795pa
			19000pa	21740pa		
2300	0000		Bahrain, R Bahrain	6010me		
2300	0000	smtwhf	Canada, CBC Northern Quebec Svc	9625na		
2300	0000		Canada, CFRX Toronto ON	6070na		
2300	0000		Canada, CFVP Calgary AB	6030na		
2300	0000		Canada, CKZN St Johns NF	6160na		
2300	0000		Canada, CKZU Vancouver BC	6160na		
2300	0000		China, China R International	5915as	5990ca	6145na
			7350eu	7410as	9610as	11690as
			11790as	11840na		
2300	0000		Cuba, R Havana Cuba	5040va		
2300	0000		Egypt, R Cairo	6270na		
2300	0000		India, All India R/External Svc	6055as	9705as	9950as
			11670as	13605as		
2300	0000	DRM	India, All India R/External Svc	11645as		
2300	0000		Malaysia, RTM Kajang/Traxx FM	7295do		
2300	0000		Micronesia, V6MP/Cross R/Pohnpei	4755as		
2300	0000		New Zealand, R New Zealand Intl	15720pa		
2300	0000	DRM	New Zealand, R New Zealand Intl	17675pa		
2300	0000		Russia, Voice of Russia	9665va	9800va	
2300	0000		South Africa, CVC 1 Africa R	9505af		
2300	0000		UK, BBC World Service	3915as	6195as	7490as
			9580as	9740as	9890as	11850as
			12010as			
2300	0000		USA, Amer Forces Network/AFRTS	4319usb	5446usb	5765usb
			7811usb	12133usb	12759usb	13362usb
2300	0000		USA, BBG/Voice of America	5895va	5910va	7555as
			7575as	12150as		
2300	0000		USA, FBN/WTJC Newport NC	9370na		
2300	0000		USA, WBCQ Monticello ME	7490am	9330am	
2300	0000	Sat/Sun	USA, WBCQ Monticello ME	5110am		
2300	0000		USA, WEWN/EWTN Irondale AL	15610me		
2300	0000		USA, WHRI Cypress Creek SC	13620na	17510va	
2300	0000	Sun	USA, WHRI Cypress Creek SC	11775va		
2300	0000	mtwhfs	USA, WHRI Cypress Creek SC	7315ca		
2300	0000		USA, WINB Red Lion PA	9265am		
2300	0000		USA, WTWW Lebanon TN	9479va		
2300	0000		USA, WWCR Nashville TN	6875eu	9350af	9980af
			13845eu			
2300	0000		USA, WWRB Manchester TN	5050na		
2300	0000		USA, WYFR/Family R Worldwide	15255ca	11580sa	
2300	0000		Zambia, CVC/R Christian Voice	4965af		
2300	2330		Australia, ABC/R Australia	15240as		
2300	2330	DRM	Vatican City State, Vatican R	9755am		
2315	2330		Croatia, Voice of Croatia	3985ca	7375eu	
2330	0000		Australia, ABC/R Australia	17750as		
2330	0000		Vietnam, VO Vietnam/Overseas Svc	9840as	12020as	
2330	2345		India, All India R/Aligarh	9470do		



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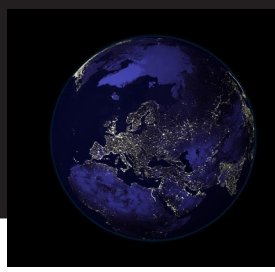

ARABIC

The following language schedule is extracted from our new MTXtra Shortwave Broadcast Guide pdf which is a free download to all MTXpress subscribers. This new online Shortwave Broadcast Guide has more than 9,100 station entries that include all languages being broadcasts via shortwave radio worldwide, sorted by time and updated monthly.

0000 UTC - 8PM EDT / 7PM CDT / 5PM PDT

0000 0045	Egypt, R Cairo	13855ca	15480ca	
0000 0100	Bahrain, R Bahrain	9745me		
0000 0100	Iran, VO Islamic Rep of Iran	3985as	6025as	12080as
0000 0100	Mauritania, R Mauritanie	7245do	4845al	
0000 0100	Morocco, R Mediterranee Intl/Medi 1	9575va		
0030 0100	Egypt, R Cairo	6270na		

0100 UTC - 9PM EDT / 8PM CDT / 6PM PDT

0100 0200	Bahrain, R Bahrain	9745me		
0100 0200	Egypt, R Cairo	6270na		
0100 0200	Iran, VO Islamic Rep of Iran	3985as	6025as	12080as
0100 0200	Morocco, R Mediterranee Intl/Medi 1	9575va		

0200 UTC - 10PM EDT / 9PM CDT / 7PM PDT

0200 0300	Bahrain, R Bahrain	9745me		
0200 0300	Egypt, R Cairo	6270na		
0200 0300	Iran, VO Islamic Rep of Iran	3985as	6025as	12080as
0200 0300	Kuwait, R Kuwait/General Svc	5960me		
0200 0300	Morocco, R Mediterranee Intl/Medi 1	9575va		
0200 0300	Oman, R Sultanate of Oman	15355af		
0200 0300	Sudan, Sudan R	7200do		
0200 0300	Sudan, Sudan R	7200do		
0230 0300	Iran, VO Islamic Rep of Iran	11660as	11760eu	
0245 0300	Yemen, Rep of Yemen R	9780me		

0300 UTC - 11PM EDT / 10PM CDT / 8PM PDT

0300 0327	Iran, VO Islamic Rep of Iran	3985as		
0300 0330	Canada, Bible Voice Broadcasting	7310me		
0300 0330	Germany, R Dardasha 7	7310me		
0300 0330	USA, BBG/Afia Darfur R	6135af	7330af	9815af
0300 0400	Bahrain, R Bahrain	9745me		
0300 0400	Egypt, R Cairo	6270na		
0300 0400	Iran, VO Islamic Rep of Iran	6025as	11660as	11760as 12080as
0300 0400	Kuwait, R Kuwait/General Svc	5960me		
0300 0400	Morocco, R Mediterranee Intl/Medi 1	9575va		
0300 0400	Saudi Arabia, BSKSA/Qur'an Pgm	9715me		15170va 17895as
0300 0400	Sudan, Sudan R	7200do		
0300 0400	Tunisia, RTV/R Tunisia	12005va		
0300 0400	UK, BBC World Service	5790eu	6040va	9425me 9915af
0300 0400	Yemen, Rep of Yemen R	9780me		
0330 0400	Iran, VO Islamic Palestinian Revol	9610me		11875me

0400 UTC - 12AM EDT / 11PM CDT / 9PM PDT

0400 0415	Clandestine, Sudan R Service	11800af		
0400 0427	Iran, VO Islamic Palestinian Revol	9610me		11875me
0400 0430	Egypt, R Cairo	6270na		
0400 0430	Vatican City State, Vatican R	9645va	11715va	
0400 0445	Germany, R Dardasha 7	9460me		
0400 0500	Bahrain, R Bahrain	9745me		
0400 0500	Clandestine, Sudan R Service	13720af		
0400 0500asmtwh	Clandestine, Sudan R Service/Darfur Pgm	11800af		
0400 0500	Eritrea, VO the Broad Masses/Pgm 2	7175do		
0400 0500	Germany, AWR Europe	15525va		
0400 0500	Iran, VO Islamic Rep of Iran	6025as	11660as	11760as 12080as
0400 0500	Kuwait, R Kuwait/General Svc	5960me		
0400 0500	Morocco, R Mediterranee Intl/Medi 1	9575va		
0400 0500	Saudi Arabia, BSKSA/Qur'an Pgm	9715me		15170va 17895as
0400 0500	Sudan, Sudan R	7200do		
0400 0500	Tunisia, RTV/R Tunisia	7275eu		
0400 0500	UK, BBC World Service	5790af	7325af	7410eu 9915af 11740af 11820me 13660me
0400 0500	Yemen, Rep of Yemen R	9780me		
0415 0430	Clandestine, Sudan R Service	11800af		
0430 0500	Chad, Natl du Tchadadienne	6165do		4905al 7120al
0430 0500	Clandestine, Sudan R Service	11800af		
0430 0500	India, All India R/External Svc	15210me		15770me 17845me
0430 0500	Vatican City State, Vatican R	11715eu		

0500 UTC - 1AM EDT / 12AM CDT / 10PM PDT

0500 0515 f	Canada, Bible Voice Broadcasting	9735me		
0500 0527	Iran, VO Islamic Rep of Iran	6025as	11660as	11760as 12080as
0500 0530	Canada, Bible Voice Broadcasting	11810af		
0500 0530 h	Canada, Bible Voice Broadcasting	9735me		
0500 0530	India, All India R/External Svc	15210me		15770me 17845me
0500 0600	Bahrain, R Bahrain	9745me		
0500 0600	Chad, Natl du Tchadadienne	6165do		4905al 7120al
0500 0600	China, China R International	9515af		9590me 11775af 17485va
0500 0600	Eritrea, VO the Broad Masses/Pgm 2	7175do		
0500 0600	Germany, AWR Europe	15225va		
0500 0600	Kuwait, R Kuwait/General Svc	5960me		15515as
0500 0600	Morocco, R Mediterranee Intl/Medi 1	9575va		
0500 0600	Saudi Arabia, BSKSA/Qur'an Pgm	9715me		15170va 17895as
0500 0600	Sudan, Sudan R	7200do		
0500 0600	Tunisia, RTV/R Tunisia	7275eu		
0500 0600	UK, BBC World Service	7325af	7375eu	9915af 11820me 13660me 15790af
0500 0600	Yemen, Rep of Yemen R	6135me	9780me	
0530 0600	Iran, VO Islamic Rep of Iran	13785as	15150as	17550as
0555 0600	Mali, ORTM/R Mali	5995do		

0600 UTC - 2AM EDT / 1AM CDT / 11PM PDT

0600 0615	Germany, R Dardasha 7	11655af		
0600 0625	Tunisia, RTV/R Tunisia	7275eu		
0600 0630	Japan, R Japan NHK World	11975me		
0600 0700	Bahrain, R Bahrain	9745me		
0600 0700	Chad, Natl du Tchadadienne	6165do		4905al 7120al
0600 0700	China, China R International	9515af		9590me 11775af 17485va
0600 0700	Clandestine, R Nacl De La R A S D	6297af		

0600	0700		Eritrea, VO the Broad Masses/Pgm 2	7175do	
0600	0700		Iran, VO Islamic Rep of Iran	13785as	15150as
			17550as		
0600	0700		Kuwait, R Kuwait/General Svc		5960me
			15515as		
0600	0700		Mali, ORTM/R Mali	5995do	
0600	0700		Mauritania, R Mauritanie	7245do	4845al
0600	0700		Morocco, R Mediterranee Intl/Medi 1		9575va
0600	0700		Saudi Arabia, BSKSA/General Pgm		17730af
			17740eu		
0600	0700		Saudi Arabia, BSKSA/Qur'an Pgm		9715me
			15170va	15380me	17895as
0600	0700		Sudan, Sudan R	7200do	
0600	0700		Tunisia, RTV/R Tunisia	7335af	
0600	0700		UK, BBC World Service	7375eu	11680af
			11820va	13660va	15790af
0600	0700		Yemen, Rep of Yemen R	6135me	
0630	0656		Romania, R Romania Intl	11790af	15180af
			15400af	17575af	
0645	0700	mtwhf	Vatican City State, Vatican R	6075eu	7250eu
			9645eu	15595eu	

0700 UTC - 3AM EDT / 2AM CDT / 12AM PDT

0700	0800		Bahrain, R Bahrain	9745me	
0700	0800		Chad, Natl du Tchadadienne		6165do
			4905al	7120al	
0700	0800		Clandestine, R Nacl De La R A S D		6297af
0700	0800		Eritrea, VO the Broad Masses/Pgm 2		7175do
0700	0800		Germany, AWR Europe	15225af	
0700	0800		Iran, VO Islamic Rep of Iran	13785as	15150as
			17550as		
0700	0800		Kuwait, R Kuwait/General Svc		5960me
			15515as		
0700	0800		Mali, ORTM/R Mali	5995do	
0700	0800		Mauritania, R Mauritanie	7245do	4845al
0700	0800		Morocco, R Mediterranee Intl/Medi 1		9575va
0700	0800		Saudi Arabia, BSKSA/General Pgm		17730af
			17740eu		
0700	0800		Saudi Arabia, BSKSA/Qur'an Pgm		9715me
			15380me	17895as	
0700	0800		Sudan, Sudan R	7200do	
0700	0800		Tunisia, RTV/R Tunisia	7335af	
0700	0800		UK, BBC World Service	13660af	15790af
0730	0800		Nigeria, Voice of Nigeria	15120va	

0800 UTC - 4AM EDT / 3AM CDT / 1AM PDT

0800	0810		Tunisia, RTV/R Tunisia	7335af	
0800	0815	w	Italy, IRRS SW	11910va	
0800	0830		UK, FEBA Radio	15280me	
0800	0900		Bahrain, R Bahrain	9745me	
0800	0900		Chad, Natl du Tchadadienne		6165do
			4905al	7120al	
0800	0900		Clandestine, R Nacl De La R A S D		6297af
0800	0900		Eritrea, VO the Broad Masses/Pgm 2		7175do
0800	0900		Iran, VO Islamic Rep of Iran	13785as	15150as
			17550as		
0800	0900		Kuwait, R Kuwait/General Svc		5960me
			15515as		
0800	0900		Mali, ORTM/R Mali	9635do	
0800	0900		Mauritania, R Mauritanie	7245do	4845al
0800	0900		Morocco, R Mediterranee Intl/Medi 1		9575va
0800	0900		Saudi Arabia, BSKSA/General Pgm		17730af
			17740eu		
0800	0900		Saudi Arabia, BSKSA/Qur'an Pgm		9715me
			15380me	17895as	
0800	0900		Sudan, Sudan R	7200do	
0830	0900		Iran, VO Islamic Rep of Iran	13740as	

0900 UTC - 5AM EDT / 4AM CDT / 2AM PDT

0900	0955		Turkey, Voice of Turkey	11750as	
0900	1000		Bahrain, R Bahrain	9745me	
0900	1000	f	Canada, Bible Voice Broadcasting		17535af
0900	1000		Chad, Natl du Tchadadienne		6165do
			4905al	7120al	
0900	1000		Clandestine, R Nacl De La R A S D		6297af
0900	1000		Eritrea, VO the Broad Masses/Pgm 2		7175do
0900	1000		Iran, VO Islamic Rep of Iran	13740as	13785as
			15150as	17550as	
0900	1000		Mali, ORTM/R Mali	9635do	
0900	1000		Mauritania, R Mauritanie	7245do	4845al
0900	1000		Morocco, R Marocaine	15349af	
0900	1000		Morocco, R Mediterranee Intl/Medi 1		9575va
0900	1000		Saudi Arabia, BSKSA/General Pgm		15490eu
			17805af		
0900	1000		Saudi Arabia, BSKSA/Qur'an Pgm		11935me
			17570as	17615as	
0900	1000		Sudan, Sudan R	7200do	
0915	1000		Kuwait, R Kuwait/General Svc		11630af
			21540va		

1000 UTC - 6AM EDT / 5AM CDT / 3AM PDT

1000	1027		Iran, VO Islamic Rep of Iran	13740as	
1000	1100		Bahrain, R Bahrain	9745me	
1000	1100		Chad, Natl du Tchadadienne		6165do
			4905al	7120al	
1000	1100		Clandestine, R Nacl De La R A S D		6297af
1000	1100		Kuwait, R Kuwait/General Svc		11630af
			21540va		
1000	1100		Mali, ORTM/R Mali	9635do	
1000	1100		Mauritania, R Mauritanie	7245do	4845al
1000	1100		Morocco, R Marocaine	15349af	
1000	1100		Morocco, R Mediterranee Intl/Medi 1		9575va
1000	1100		Saudi Arabia, BSKSA/General Pgm		15490eu
			17805af		
1000	1100		Saudi Arabia, BSKSA/Qur'an Pgm		11935me
			17570as	17615as	
1000	1100		Sudan, Sudan R	7200do	
1000	1100		Yemen, Rep of Yemen R	6135me	
1015	1100		Egypt, R Cairo	17480as	

1100 UTC - 7AM EDT / 6AM CDT / 4AM PDT

1100	1200		Bahrain, R Bahrain	9745me	
1100	1200		Chad, Natl du Tchadadienne		6165do
			4905al	7120al	
1100	1200		Clandestine, R Nacl De La R A S D		6297af
1100	1200		Egypt, R Cairo	17480as	
1100	1200		Iran, VO Islamic Rep of Iran	13785as	15150as
			17550as		
1100	1200		Kuwait, R Kuwait/General Svc		9750af
			11630af	21540va	
1100	1200		Mali, ORTM/R Mali	9635do	
1100	1200		Mauritania, R Mauritanie	7245do	4845al
1100	1200		Morocco, R Marocaine	15349af	
1100	1200		Morocco, R Mediterranee Intl/Medi 1		9575va
1100	1200		Saudi Arabia, BSKSA/General Pgm		15490eu
			17805af		
1100	1200		Saudi Arabia, BSKSA/Qur'an Pgm		11935me
			17570as	17615as	
1100	1200		Sudan, Sudan R	7200do	
1100	1200		Yemen, Rep of Yemen R	6135me	

1200 UTC - 8AM EDT / 7AM CDT / 5AM PDT

1200	1215		Egypt, R Cairo	17480as	
1200	1300		Bahrain, R Bahrain	9745me	
1200	1300		Chad, Natl du Tchadadienne		6165do
			4905al	7120al	
1200	1300		Clandestine, R Nacl De La R A S D		6297af
1200	1300		Iran, VO Islamic Rep of Iran	13785as	15150as
			17550as		
1200	1300		Kuwait, R Kuwait/General Svc		9750af
			11630af	21540va	
1200	1300		Mali, ORTM/R Mali	9635do	
1200	1300		Mauritania, R Mauritanie	7245do	4845al
1200	1300		Morocco, R Marocaine	15349af	
1200	1300		Morocco, R Mediterranee Intl/Medi 1		9575va
1200	1300		Saudi Arabia, BSKSA/General Pgm		17705eu
			21505af		
1200	1300		Saudi Arabia, BSKSA/Qur'an Pgm		15380me
			17625as	17895af	
1200	1300		Sudan, Sudan R	7200do	
1200	1300		Tajikistan, Voice of Tajik	7245me	
1200	1300		Yemen, Rep of Yemen R	6135me	9780me

1300 UTC - 9AM EDT / 8AM CDT / 6AM PDT

1300	1400		Bahrain, R Bahrain	9745me	
1300	1400		Chad, Natl du Tchadadienne 4905al	7120al	6165do
1300	1400		Egypt, R Cairo	15080af	
1300	1400		Iran, VO Islamic Rep of Iran	13785as	15150as
			17550as		
1300	1400		Kuwait, R Kuwait/General Svc 11630af	21540va	9750af
1300	1400		Mali, ORTM/R Mali	9635do	
1300	1400		Mauritania, R Mauritanie	7245do	4845al
1300	1400		Morocco, R Marocaine	15349af	
1300	1400		Morocco, R Mediterranee Intl/Medi 1		9575va
1300	1400		Saudi Arabia, BSKSA/General Pgm 21505af		17705eu
1300	1400		Saudi Arabia, BSKSA/Qur'an Pgm 17615af	17625af	15380me 17895af
1300	1400		Sudan, Sudan R	7200do	
1300	1400		Yemen, Rep of Yemen R	6135me	9780me

1400 UTC - 10AM EDT / 9AM CDT / 7AM PDT

1400	1427		Iran, VO Islamic Rep of Iran	13785as	15150as
			17550as		
1400	1455		Turkey, Voice of Turkey	9540as	17770as
1400	1456		Romania, R Romania Intl 15160af	11830af	11945af 15490af
1400	1500		Bahrain, R Bahrain	9745me	
1400	1500		Chad, Natl du Tchadadienne 4905al	7120al	6165do
1400	1500		Egypt, R Cairo	15080af	
1400	1500		Ethiopia, R Ethiopia	7235va	9560va
1400	1500		Kuwait, R Kuwait/General Svc 11630af	21540va	9750af
1400	1500		Mali, ORTM/R Mali	9635do	
1400	1500		Mauritania, R Mauritanie	7245do	4845al
1400	1500		Morocco, R Marocaine	15349af	
1400	1500		Morocco, R Mediterranee Intl/Medi 1		9575va
1400	1500		Saudi Arabia, BSKSA/General Pgm 21505af		17705eu
1400	1500		Saudi Arabia, BSKSA/Qur'an Pgm 17625as	17895af	15380me
1400	1500		Sudan, Sudan R	7200do	
1400	1500		USA, WTWW Lebanon TN	12105va	
1400	1500		Yemen, Rep of Yemen R	6135me	9780me
1430	1500		Iran, VO Islamic Rep of Iran	11815as	11995as
1430	1500		Serbia, International R Serbia		9640eu

1500 UTC - 11AM EDT / 10AM CDT / 8AM PDT

1500	1515	f	Italy, IRRS SW	15190va	
1500	1530	Sun	Clandestine, Sudan R Service		17745af
1500	1530	mwfs	Clandestine, VO Democratic Alliance 9560af		7235af
1500	1557		North Korea, Voice of Korea 11545va		9990va
1500	1600		Bahrain, R Bahrain	9745me	
1500	1600		Chad, Natl du Tchadadienne 4905al	7120al	6165do
1500	1600	mtwhf	Clandestine, Sudan R Service		17745af
1500	1600		Egypt, R Cairo	15080af	
1500	1600		Eritrea, VO the Broad Masses/Pgm 2 6170do	7120do	5060do 9710do
1500	1600		Iran, VO Islamic Rep of Iran	11815as	11995as
1500	1600		Kuwait, R Kuwait/General Svc 9750af		6080me
1500	1600		Mali, ORTM/R Mali	9635do	
1500	1600		Mauritania, R Mauritanie	7245do	4845al
1500	1600		Morocco, R Marocaine	15349af	
1500	1600		Morocco, R Mediterranee Intl/Medi 1		9575va
1500	1600		Oman, R Sultanate of Oman		15140va
1500	1600		Saudi Arabia, BSKSA/General Pgm 15435eu		15225af
1500	1600		Saudi Arabia, BSKSA/Qur'an Pgm 17615af	17895af	13710af
1500	1600		Sudan, Sudan R	7200do	
1500	1600		USA, WTWW Lebanon TN	12105va	
1500	1600		Yemen, Rep of Yemen R	9780me	
1530	1600		Vatican City State, Vatican R	11935eu	15595eu
1550	1600		Vatican City State, Vatican R	11715eu	15185eu

1600 UTC - 12PM EDT / 11AM CDT / 9AM PDT

1600	1615		Clandestine, Sudan R Service		15550af
1600	1630	Sat	Clandestine, Sudan R Service		17745af
1600	1700		Bahrain, R Bahrain	9745me	
1600	1700		Chad, Natl du Tchadadienne 4905al	7120al	6165do
1600	1700		China, China R International 11725af	12065me	9555af 13790va
1600	1700	asmtwh	Clandestine, Sudan R Service/Darfur Pgm 15500af		
1600	1700		Eritrea, VO the Broad Masses/Pgm 2 6170do	7120do	5060do 9710do
1600	1700		Indonesia, VO Indonesia	9526va	
1600	1700		Iran, VO Islamic Rep of Iran	11815as	11995as
1600	1700		Kuwait, R Kuwait/General Svc		6080me
1600	1700		Mali, ORTM/R Mali	9635do	
1600	1700		Mauritania, R Mauritanie	7245do	4845al
1600	1700		Morocco, R Marocaine	15349af	
1600	1700		Morocco, R Mediterranee Intl/Medi 1		9575va
1600	1700		Oman, R Sultanate of Oman		15140va
1600	1700		Russia, Voice of Russia 12060af	12110af	5925af 7325af
1600	1700		Saudi Arabia, BSKSA/General Pgm 15435eu		15225af
1600	1700		Saudi Arabia, BSKSA/Qur'an Pgm 15205eu	17560af	13710af
1600	1700		Sudan, Sudan R	7200do	
1600	1700		Tunisia, RTV/R Tunisia	12005va	17735va
1600	1700		USA, WTWW Lebanon TN	12105va	
1600	1700		USA, WYFR/Family R Worldwide		13645va
1600	1700		Yemen, Rep of Yemen R	9780me	
1615	1630	f	Clandestine, Sudan R Service		15500af
1630	1700		Clandestine, Sudan R Service		15500af
1630	1700		Iran, VO Islamic Rep of Iran 12080as	3985as	6025as
1655	1700	mtwhf	Canada, Bible Voice Broadcasting		13580me

1700 UTC - 1PM EDT / 12PM CDT / 10AM PDT

1700	1715	mthf	Canada, Bible Voice Broadcasting		13580me
1700	1727		Iran, VO Islamic Rep of Iran	11815as	11995as
1700	1730		Canada, Bible Voice Broadcasting		13670me
1700	1730	w	Canada, Bible Voice Broadcasting		13580me
1700	1730	th	Canada, Bible Voice Broadcasting		13810me
1700	1730		Germany, R Dardasha 7	13670me	
1700	1757		North Korea, Voice of Korea 11545va		9990va
1700	1800		Bahrain, R Bahrain	9745me	
1700	1800		Chad, Natl du Tchadadienne 4905al	7120al	6165do
1700	1800		China, China R International 11725af	13790va	9555af
1700	1800		Clandestine, R Nacl De La R A S D		6297af
1700	1800		Eritrea, VO the Broad Masses/Pgm 2 6170do	7120do	5060do 9710do
1700	1800		Kuwait, R Kuwait/General Svc 13650na		6080me
1700	1800		Mali, ORTM/R Mali	9635do	
1700	1800		Mauritania, R Mauritanie	7245do	4845al
1700	1800		Morocco, R Mediterranee Intl/Medi 1		9575va
1700	1800		Oman, R Sultanate of Oman		15140va
1700	1800		Russia, Voice of Russia 9345me 12110af	11795me	5925me 7305me 12060af 12065me
1700	1800		Saudi Arabia, BSKSA/General Pgm 15435eu		15225af
1700	1800		Saudi Arabia, BSKSA/Qur'an Pgm 15205eu	17560af	13710af
1700	1800		Spain, R Exterior de Espana	21610me	
1700	1800		Sudan, Sudan R	7200do	
1700	1800		Sweden, IBRA Radio	12045me	
1700	1800		Tunisia, RTV/R Tunisia 17735va	7225af	12005va
1700	1800		UK, BBC World Service 7375af	5875me 11680af	6195me 11820af 13660va
1700	1800		USA, WTWW Lebanon TN	12105va	
1700	1800		USA, WYFR/Family R Worldwide 15560va		13840va
1700	1800		Yemen, Rep of Yemen R	9780me	

1715	1800	mwf	Canada, Bible Voice Broadcasting	13810me
1730	1800		India, All India R/External Svc 11710me 13640me	9620me
1730	1800		Iran, VO Islamic Rep of Iran 3985as 9715as 12080as	6025as
1730	1800		Nigeria, Voice of Nigeria	15120va

1800 UTC - 2PM EDT / 1PM CDT / 11AM PDT

1800	1830		USA, BBG/Afia Darfur R 13715af	9815af 11740af
1800	1830		USA, BBG/VO America/Afia Darfur R 11615af 11740af 13715af	9805af
1800	1900		Austria, AWR Europe	11660af
1800	1900		Bahrain, R Bahrain	9745me
1800	1900		Chad, Natl du Tchadadienne 4905al 7120al	6165do
1800	1900		Clandestine, R Nacl De La R A S D	6297af
1800	1900		Eritrea, VO the Broad Masses/Pgm 2 6170do 7120do 9710do	5060do
1800	1900		India, All India R/External Svc 11710me 13640me	9620me
1800	1900		Iran, VO Islamic Rep of Iran 3985as 9715as 12080as	6025as
1800	1900		Kuwait, R Kuwait/General Svc 13650na	6080me
1800	1900		Mali, ORTM/R Mali	5995do
1800	1900		Mauritania, R Mauritanie	7245do 4845al
1800	1900		Morocco, R Marocaine	15349af
1800	1900		Morocco, R Mediterranee Intl/Medi 1	9575va
1800	1900		Oman, R Sultanate of Oman	15140va
1800	1900		Russia, Voice of Russia	7305me 9345me

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Albania, R Tirana ..... **http://rtsh.sil.at/**
Angola, Angolan National R ..... **www.rna.ao/**
Anguilla, University Network ..... **www.worldwideuniversitynetwork.com/**
Argentina, RAE ..... **www.radionacional.gov.ar**
Australia, ABC NT Alice Springs ..... **www.abc.net.au/radio/**
Australia, ABC NT Katherine ..... **www.abc.net.au/radio/**
Australia, ABC NT Tennant Creek ..... **www.abc.net.au/radio/**
Australia, ABC/R Australia ..... **www.radioaustralia.net.au**
Australia, HCJB Global Australia ..... **www.hcjb.org.au**
Austria, AWR Europe **www.awr2.org**
Austria, TWR Europe ..... **www.twr.org**
Bahrain, R Bahrain ..... **www.radiobahrain.fm**
Belarus, R Belarus ..... **www.radiobelarus.tvr.by/eng**
Belgium, TDP Radio ..... **www.airtime.be/schedule.html**
Canada, Bible Voice Broadcasting ..... **www.biblevoice.org/**
Canada, CBC Northern Quebec Svc ..... **www.cbc.ca/north/**
Canada, CFRX Toronto ON ..... **www.cfrb.com**
Canada, CFVP Calgary AB **www.classiccountryam1060.com**
Canada, CKZN St Johns NF ..... **www.cbc.ca/listen/index.html**
Canada, CKZU Vancouver BC ..... **www.cbc.ca/bc**
China, China R International ..... **www.cri.cn**
China, Haixa zhi Sheng/VO Strait ..... **www.vos.com.cn**
Clandestine, JSR/Shiokaze/Sea Breeze ..... **www.chosa-kai.jp**
Clandestine, Sudan R Service ..... **www.sudanradio.org**
Croatia, Voice of Croatia ..... **www.hrt.hr/**
Cuba, R Havana Cuba ..... **www.radiohc.cu/**
Ecuador, HCJB/LV de los Andes ..... **www.radiohcjb.org**
Egypt, R Cairo ..... **www.ertu.org**
Eqt Guinea, R Africa ..... **www.radiopanam.com/**
Ethiopia, R Ethiopia ..... **www.erta.gov.com**
Ethiopia, R Ethiopia/Natl Pgm ..... **www.erta.gov.com**
France, R France International ..... **www.rfi.fr/**
Germany, AWR Europe **www.awr2.org/**
Germany, Deutsche Welle ..... **www.dw.de**
Germany, Mighty KBC Radio ..... **www.kbcradio.eu/**
Germany, TWR Europe ..... **www.twr.org**
Guam, KTWR/TWR Asia ..... **http://nea.ktwr.net/**
India, All India R/Aizawl ..... **www.allindiaradio.org/**
India, All India R/Aligarh ..... **www.allindiaradio.org/**
India, All India R/Bengaluru ..... **www.allindiaradio.org/**
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India, All India R/Shimla ..... **www.allindiaradio.org/**
India, All India R/Thiruvananthapuram ..... **www.allindiaradio.org/**
Indonesia, AWR Asia/Pacific **www.awr2.org/**
Indonesia, VO Indonesia ..... **www.voi.co.id**
Iran, VO Islamic Rep of Iran ..... **www.irib.ir/English/**
Israel, Kol Israel ..... **www.intkolisrael.com**
Italy, IRRS SW ..... **www.nexus.org**
Japan, R Japan NHK World ..... **www.nhk.or.jp/english/**
Kuwait, R Kuwait ..... **www.media.gov.kw/**
Mali, ORTM/R Mali ..... **www.ortm.ml**
Micronesia, V6MP/Cross R/Pohnpei ..... **www.pmapacific.org/**
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Netherlands, R Netherlands Worldwide ..... **www.radionetherlands.nl/**
Netherlands, XVRB Radio ..... **www.twr.org**
New Zealand, R New Zealand Intl ..... **www.rnzi.com**
Nigeria, Voice of Nigeria ..... **www.voiceofnigeria.org**
North Korea, Voice of Korea ..... **www.vok.rep.kp**
Oman, R Sultanate of Oman ..... **www.oman-tv.gov.om**
Pakistan, PBC/R Pakistan ..... **www.radio.gov.pk**
Palau, T8WH/World Harvest R ..... **www.whr.org/**
Philippines, R Pilipinas Overseas ..... **www.pbs.gov.ph/**
Romania, R Romania Intl ..... **www.rri.ro/**
Russia, Voice of Russia ..... **http://english.ruvr.ru/**
Saudi Arabia, BSKSA/External Svc ..... **www.saudiradio.net/**
Serbia, International R Serbia ..... **http://voiceofserbia.org**
South Africa, Amateur R Mirror Intl ..... **www.sarl.org.za**
South Africa, AWR Africa **www.awr2.org/**
South Africa, Channel Africa ..... **www.channelafrica.org**
South Africa, CVC 1 Africa R **www.1africa.tv**
South Korea, KBS World R ..... **www.worldkbs.co.kr**
Spain, R Exterior de Espana ..... **www.ree.rne.es/**
Sri Lanka, SLBC ..... **www.slbc.lk**
Swaziland, TWR Africa ..... **www.twrafrica.org/**
Syria, R Damascus ..... **www.rtv.gov.sy/**
Taiwan, R Taiwan Intl ..... **http://english.rti.org.tw/**
Thailand, R Thailand World Svc **www.hsk9.org/**
Turkey, Voice of Turkey ..... **www.trt-world.com**
Uganda, Dunamis Shortwave ..... **www.biblevoice.org/stations/east-africa**
UK, BBC World Service ..... **www.bbc.co.uk/worldservice/**
USA, Amer Forces Network/AFRTS ..... **http://myafn.dodmedia.osd.mil/**
USA, BBG/Voice of America ..... **www.voanews.com**
USA, BBG/Voice of America/Special English **www.voanews.com**
USA, FBN/WTJC Newport NC ..... **www.fbnradio.com/**
USA, KNLS Anchor Point AK ..... **www.knls.org/**
USA, Overcomer Ministry ..... **www.overcomerministry.org**
USA, Pan Amer Broadcasting ..... **www.radiopanam.com/**
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USA, WEWN/EWTN Irondale AL ..... **www.ewtn.com/**
USA, WHRI Cypress Creek SC ..... **www.whr.org/**
USA, WINB Red Lion PA ..... **www.winb.com**
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USA, WRMI/R Slovakia Intl relay ..... **www.wrmi.net/**
USA, WTWW Lebanon TN ..... **www.wtww.us/**
USA, WWCR Nashville TN ..... **www.wwcr.com**
USA, WWRB Manchester TN ..... **www.wwrb.org/**
USA, WYFR/Family R Worldwide ..... **www.familyradio.com/**
Vatican City State, Vatican R ..... **www.vaticanradio.org/**
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WiNRADiO AX-24B discone antenna	ANT 63	$319.95
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Larry Van Horn, N5FPW
larryvanhorn@monitoringtimes.com
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Who ya gonna call? A Navy RDC!

It has been well documented in this column over the last several years that the Department of Defense opened up a major Land Mobile Radio (LMR) subband in the 380-400 MHz range. For those who may not know, this portion of the military aviation band has a unique mixture of aeronautical frequencies as well as conventional (simplex/repeater) and trunked radio systems.

What has not been well documented anywhere to date is the extent and scope of some of the new land mobile trunk radio systems that the military has established in this new subband. For instance, last month, we told you about operations associated with a new nationwide trunk radio system being stood up in this frequency range by the U.S. Air Force Space Command.

In this month's *Milcom* column we will take our first look at another branch of the military that is using this frequency range extensively for their LMR trunk radio systems – the United States Navy.

The Navy Enterprise Land Mobile Radio (ELMR) System

According to official Navy sources, the Navy-wide National Enterprise Land Mobile Radio (ELMR) System is a non-tactical, Commander Navy Installation Command sponsored, (Association of Public Safety Communication Officers [APCO]) Project 25 compliant, and National Telecommunications Information Agency (NTIA) conformant trunked land mobile radio system that will be installed at every non-BRAC (Base Realignment and Closure) listed Navy installation throughout CONUS.

Now that is a crazy bit of mil-speak, so let me translate that into radio hobbyists' language – they are putting P25 digital trunking systems at all of their continental United States bases that are not going to be closing due to Congressional BRAC actions.

ELMR will primarily be used for quick, coordinated responses to day-to-day incidents on each base, but it can also accommodate the capability and flexibility needed for major emergency situations effecting a wide area. While it is primarily a P25 clear digital system, there are some selected AES encryption talk groups. ELMR is being implemented throughout the Navy and will eventually interconnect all Navy sites onto one comprehensive communications network.

According to one Navy source, "ELMR technology addresses the critical shortcomings of using separate radio infrastructures – a practice that has been repeatedly proven to be inadequate." The radio system consists of all Motorola components and only Motorola parts are compatible with the system, no substitutes.

But there is more to this system than just sticking up a trunk radio system on each base. Thanks to advanced communication and computer technologies, these bases will eventually be linked to Regional Dispatch Centers (RDC) instead of relying exclusively just on local dispatch centers.

Each of the five Navy Continental United States regions will be controlled by zone cores located in Navy Region Southwest (NRSW), Navy Region Northwest (NRNW), Navy Region Midwest (NRMW), and Navy Region Southeast (NRSE) at Network Switching Centers (NSC). These NSCs and their corresponding Regional Dispatch Centers (RDC) will be located at the following facilities:

- Naval Air Station (NAS) Jacksonville supports Navy Region Southeast.
- Naval Support Activity (NSA) Crane supports Navy Region's Midwest and Middle Atlantic.
- Naval Base (NB) Pt. Loma supports Navy Region Southwest.
- Naval Base Kitsap – Bangor supports Navy Region Northwest

Each Navy facility supported by ELMR will also have local dispatch equipment and interoperability equipment to support their first responders. This equipment will be used to support local operations and provide communications between the ELMR system and local agencies.

Southeast RDC Coverage to Expand to 13 Installations

Recently, while on a trip to the Gulf coast, I had a chance to monitor several of the new 380-400 MHz trunk radio systems that are now operational. All of the systems I investigated are part of this Enterprise Land Mobile Radio System (ELMR) in the Southeast Navy Region.

Gregory Snyder dispatches an emergency call in the Navy Region Southeast Region Dispatch Center on board Naval Air Station Jacksonville. (U.S. Navy photo by Mass Communication Specialist 2nd Class Greg Johnson/Released)

Gayle and I did observe a small amount of end-to-end AES encryption that the system is certified to use to meet Federal Information Processing Standard (FIPS) 140-1. We also noted FIPS 197 P25 over-the-air-re-keying (OTAR) and P25 over-the-air-provisioning (OTAP) of these AES communications. Most communications we observed, however, used P25 digital communications in the clear.

While we were at NCBC (Naval Construction Battalion Center) Gulfport, we had a chance to monitor dispatch traffic from their new Regional Dispatch Center located at NAS Jacksonville.

The Navy Region Southeast (NRSE) is currently consolidating installation emergency dispatch services – including police, fire and emergency medical – into a single 911 call center. By the end of 2013, dispatch services for 13 southeast installations will be centralized to the Region Dispatch Center (RDC) on board NAS Jacksonville.

These efforts will include every installation throughout the southeast region except for Naval Station (NS) Guantanamo Bay and Naval Support Activity (NSA) Orlando. This consolidation is part of a larger, Navy-wide movement to consolidate each region's emergency dispatch services into a single dispatch center located at regional headquarters. According to Tom Fasanello, NRSE dispatch manager, the changes will help standardize the system.

"Previously, each installation had its own dispatch center to respond to 911 and emergency service requests," he said. "Additionally, the emergency numbers were not necessarily 911, depending on the location. As part of the RDC consolidation, a new 911 telephone routing system is being deployed."

The Southeast RDC currently dispatches for five installations, including NAS Jacksonville, NS Mayport, NSA Panama City, Naval Construction Battalion Center Gulfport and NAS Meridian. Residents at these locations will continue to dial 911 for emergency services after the consolidation. For those installations yet to consolidate, instructions for emergency notification procedures will be distributed prior to any changes.

In addition to standardizing the emergency notification process throughout the region's installations, the consolidation will also provide some technological advantages, according to Fasanello.

"The RDC also has an advanced computer-aided dispatch system that automates the exact response recommendation based on the nature

and location of the emergency.

"It also provides a mapped location of the caller. In addition, RDC dispatchers are certified to administer emergency medical instructions prior to the arrival of emergency medical technicians to the scene," added Fasanello.

"While the time frame for the consolidation will vary depending on location, the RDC will make public awareness a priority," Fasanello said.

"At about two months out, we will begin to work very closely with the installation and coordinate an aggressive public awareness campaign," he said.

Navy Region Southeast ELMR Frequencies

Table One is a list of the ELMR sites that support Navy Region Southeast. All of these trunk systems use a 2xx site number, and the majority of the talk groups we monitored came from 28xxx and 29xxx talk group series of numbers. Repeater inputs are 10 MHz higher in the 390-400 MHz portion of this subband; NAC is $140 and the predominant mode is P25 digital with some AES encryption (indicated by an (*) asterisks.

And that does it for this month. Until next time 73 and good hunting.

NAVY REGION SOUTHEAST ELMR SITES

Site #	Location/Frequencies
201	Naval Air Station Jacksonville, Florida 386.2250 386.5875 386.7375 386.9750 388.0625 388.1500 388.2625 388.3250 388.4125 388.5500 388.7000 Other reported frequencies that have not verified: 381.9625 385.5625 386.0625 386.1000 386.3750 386.4125 386.5250 386.5500 386.8250 388.2250 388.7375
202	Naval Station Mayport, Florida 380.4375 380.6375 380.7625 380.9500 381.3375 381.4250 381.8375 381.8750 Other reported frequencies that have not verified: 380.8750 380.9250 381.4375
203	Naval Support Activity Orlando, Florida 380.1750 380.2750 380.4250 380.7250
204	Naval Submarine Base Kings Bay, Georgia 386.0500 386.1250 386.2750 386.4250 386.5750 386.7250 386.9375 388.0875 388.2375 388.3875 388.5375 Other reported frequencies that have not verified: 385.0125 385.2125 385.8875 386.0375 386.1875
205	Naval Air Station Key West, Florida 380.0750 380.3875 380.5750 380.8875
206	Naval Weapons Station Charleston, South Carolina 380.0750 380.2750 380.4250 380.5750 380.7250 380.8375 380.9375 381.0125 381.0875 381.1750 381.2375 381.3125
208	Naval Air Station Meridian, Mississippi 380.5750 381.0125 381.3125 381.7375 381.9250 386.1000
209	Naval Support Activity Panama City, Florida 380.2625 380.4625 380.6250 380.8625 381.2375 381.8375
210	Naval Construction Battalion Center Gulfport, Mississippi 380.2750 380.3875 380.5500 380.8375 381.1750
212	Naval Air Station Pensacola, Florida 385.3125 386.0125 386.2500 386.5125 386.8500 388.0625 388.2375 388.3375 388.3635 388.6000 388.7875 388.8000
213	NOLF Saufley Field, Florida 386.0375 386.2875 386.7875 388.0875 388.5875
214	NAS Whiting Field, Florida 385.2125 385.9125 386.4375 386.9750 388.0375 388.2875 388.5375
215	NOLF Choctaw, Florida 386.2625 386.7625 388.4875
216	NOLF Evergreen (Middleton Field), Alabama 385.9750 387.7250 389.1500
217	NOLF Brewton, Alabama 386.0750 386.5875 388.7000
218	NOLF Barin (Foley), Alabama 385.6250 386.0500 386.5625
225	NSB Kings Bay, Georgia 385.0125 385.2125 385.8875 386.0375 386.1875
230	NAS Corpus Christi, Texas 386.1500 386.6000 388.1250 288.2750 388.4250 388.5750 Other reported frequency that has not verified: 388.7250
231	NAS Kingsville, Texas 386.2750 386.4250 386.7250 386.8875 388.0625 388.5125
233	NAS/JRB New Orleans (Alvin Callender Field), Louisiana 386.1375 386.2875 386.4375 386.5875 386.7375 386.9500 388.1125 388.2625 388.3500 388.4125
2xx	NOLF Cabaniss Texas 385.3125 385.9125 386.2000
2xx	NOLF Orange Grove, Texas 386.0375 386.3500 386.8000

NAVY REGION SOUTHEAST TALK GROUP

111	NRSE Radio Maintenance
28009	NRSE Radio Maintenance
28011	Jacksonville Dispatch
28013	Jacksonville EMS Dispatch
28027	NRSE Radio Maintenance
28028	NRSE Radio Maintenance
28050	Kings Bay Waterfront Security
28056	Kings Bay Security
28101	Jacksonville Brig (HOTEL Units) [Channel 1]
28102	Jacksonville Brig [Channel 2]
28118	Jacksonville Tower
28130	Jacksonville Police Dispatch (*)
28146	Jacksonville Fire Dispatch
28147	Jacksonville Fire Prevention Logistics
28175	NRSE Regional Dispatch Center
28150	Jacksonville Fire Tac-1
28214	Jacksonville Maintenance Control
28222	Jacksonville Fuel Truck Dispatch
28283	Mayport Police Dispatch
28452	Key West Brig / Correctional Custody Unit
28476	Key West Police Dispatch
28481	Key West Fire Dispatch
28509	Key West Ground
28538	Kings Bay Harbor Tugs/C-Tractors
28542	Kings Bay VT Griffin Electricians/ Electronic Techs
28543	Kings Bay VT Griffin Electricians/ Electronic Techs
28547	Kings Bay Unknown user/usage
28557	Kings Bay Fire Dispatch
28558	Kings Bay Fire/ EMS 2
28562	Kings Bay Police Dispatch (*)
28563	Kings Bay Police 2
28564	Kings Bay Police 3
28571	Kings Bay Transportation/Base Taxi
28580	Kings Bay VT Griffin
28581	Kings Bay VT Griffin HVAC
28586	Kings Bay Quarterdeck
28608	Kings Bay Unknown user/usage
28647	Charleston Fire Dispatch
28648	Charleston Fire Tactical
28653	Charleston Police Dispatch
28830	Meridian Fuel Support
28840	Meridian Security Net (*)
28845	Meridian Public Works
28846	Meridian VIP Net
28847	Meridian Transportation
28849	Meridian Morale, Welfare and Recreation/Public Affairs Office
28851	Meridian Expert
28857	Meridian McCain Tower 3
28870	Meridian Volunteer Net
28871	Meridian Safety Net
28910	Gulfport Fire Dispatch
28915	Gulfport Police Dispatch
28990	Panama City Police Dispatch [Channel 1]
28991	Panama City Police [Channel 2]
28995	Panama City Fire Dispatch
29211	NOLF Choctaw Tower
29212	Whiting Field Fuels Truck Dispatch
29213	Whiting Field Ground Electronics Radio Maintenance
29216	Whiting Field Ground Electronics LMR Maintenance
29217	Whiting Field Ground Electronics Maintenance
29218	Whiting Field North Tower - North ELMR Channel
29221	Whiting Field South Tower - South ELMR Channel
29223	Navy Outlying Fields (ATG)(All NOLF)
29224	NOLF Barin, AL
29225	NOLF Brewton, AL
29226	NOLF Choctaw, FL
29228	NOLF Evergreen, AL
29229	NOLF Harold, FL
29230	NOLF Pace, FL
29231	NOLF Santa Rosa, FL
29232	NOLF Saufley, FL
29233	NOLF Silverhill, AL
29234	NOLF Site 8, FL
29235	NOLF Spencer, FL
29240	Whiting Field Crash Admin Net
29243	Whiting Field Fire Dispatch
29244	Whiting Field Fire Tac 1
29246	Whiting Field Public Works
29252	Whiting Field Police Dispatch [Channel 1]
29253	Whiting Field Incident Channel
29254	Whiting Field Police [Channel 2]
29278	Whiting Field Public Works [Channel 4]
29280	Whiting Field Public Works
29282	Whiting Field Public Works
29283	Whiting Field Public Works [Channel 1]
29284	Whiting Field Public Works
29377	Pensacola Brig/ Correctional Custody Unit
29388	Pensacola Fuels (Dispatch)
29396	Pensacola Naval Aircrewman Candidate School (NACCS)
29411	Pensacola Fire Dispatch (*)
29412	Pensacola Fire Tac 2 (*)
29413	Pensacola Fire Tac 3 (*)
29426	Pensacola Police Dispatch (*)
29443	Pensacola Medical Dispatch
29445	Pensacola Security
29454	Pensacola Public Works Waste Water
29455	Pensacola Public Works Dispatch [Channel 1]
29457	Pensacola Public Works Fire Alarm Maintenance
29458	Pensacola Public Works Heating/AC Repair
29459	Pensacola Public Works Electric Shop
29465	Pensacola Public Works Boiler Maintenance [Channel 7]
29473	Pensacola Naval Air Technical Training Center (NATTC)
29479	Pensacola Initial Technical Training Quarterdeck
29488	Pensacola Initial Technical Training [Channel 1]
29489	Pensacola Initial Technical Training [Channel 2]
29498	Pensacola Sherman Tower (LMR Net)
29529	Pensacola Blue Angels [ELMR Channel 1]
29530	Pensacola Blue Angels [ELMR Channel 2]
29550	Corpus Christi Public Works
29552	Corpus Christi Fire Dispatch
29554	Corpus Christi Security Dispatch (Occasional *)
29571	Corpus Christi Air Operations Admin
29576	Corpus Christi Contractor Aircraft Maintenance MENTOR
29577	Corpus Christi Flight Support
29580	Corpus Christi Admin/Command Group
29581	Corpus Christi Security Admin (*)
29582	Corpus Christi Fire Ground / Training [Channel 2]
29587	Corpus Christi Weapons
29592	Corpus Christi Police Special Events/Ops 1
29593	Corpus Christi Security Tactical 1
29594	Corpus Christi Security Tactical 2
29595	Corpus Christi Safety Division
29596	Corpus Christi Fire Inspections/Alarm Technicians
29597	Corpus Christi Waldron Tower [Air Ops 3]
29598	Corpus Christi Cabiness Tower [Air Ops 1]
29600	Corpus Christi Truax Tower [Air Ops 2]
29601	Corpus Christi Emergency Management Office 1
29602	Corpus Christi Emergency Management Office 2
29606	Corpus Christi Environmental Office
29616	Corpus Christi Police Special Events/Ops 2
29642	Corpus Christi Fireground 3
29643	Corpus Christi Fireground 4
29644	Corpus Christi Fireground 5
29645	Corpus Christi Security Canine Unit
29647	Corpus Christi Security Investigations (*)
29648	Corpus Christi Security Training 1
29652	Kingsville Unknown user/usage
29653	Kingsville Unknown user/usage
29654	Kingsville Security
29666	Kingsville Orange Grove Auxiliary Field Operations
29691	Kingsville Tower
29692	Kingsville Orange Grove Auxiliary Field Tower

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Chris Parris
chrisparris@monitoringtimes.com
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THE IWN IN OPERATION

As I mentioned in the May Fed Files column, expansion of the federal Integrated Wireless Network (IWN or "I-Win") has been placed on hold for the foreseeable future, with no new money for growing the system beyond its current capabilities. Funding has been provided to maintenance and operation of the existing portions of the IWN radio system in the Pacific Northwest, southern California and the Washington, DC area. It is unknown at this time what the plans of the Justice Department are in regards to future updates to their radio communications systems.

The history of the IWN project actually started in the late 1990's when the Justice Department was looking to consolidate their many conventional radio systems into some sort of common, nationwide system. Around this time trunked radio technology had matured and was becoming more prevalent in public safety communications. The planning began early on and some initial field-testing of the IWN APCO P-25 technology was done at the 2002 Olympics in Salt Lake City, Utah.

The first permanent deployment of the IWN as a trunked radio system occurred in Washington State, with 15 repeater sites located along US Interstate 5. Site 1 was up near the US/Canada border near Blaine, Washington and Site 15 was located in Vancouver, Washington. The first IWN sites were all co-located with already existing Washington State Department of Transportation radio sites, with the federal IWN budget providing funds for upgrading the infrastructure at these sites to support additional equipment and network access to these sites.

Early adopters of the IWN radio system complained about coverage, especially with hand-held radios, so additional sites were added along the original I-5 corridor as well as in the metropolitan Seattle and Tacoma area. Even with the addition of more trunked sites, problems were reported when the IWN was used with airborne radios. It seemed that many of the IWN trunked sites were located at high elevations and required the antennas at many of these sites to have a slight "down-tilt" built into the antenna radiation patterns. This provided poor radio signal coverage to radios that may have been above these antennas. There were several proposals to build up some IWN sites to provide nearly exclusive coverage to airborne radios, but I've never confirmed if these sites were added or existing sites were simply adjusted to help with airborne subscriber agencies.

Here is a list of the currently operating IWN sites in the Pacific Northwest, (other IWN trunked sites in Washington DC were discussed in the March 2012 Fed Files column). Some listings on various Internet radio sites are lacking current frequencies and site locations due to the many changes that the IWN network has undergone. Many of these sites have been positively identified as to the location, but some are still best guesses. Because the system is still undergoing tweaking in some areas, some have been seen or heard as active, but a location has yet to be found. If it has been determined, the active frequency information is provided. All frequencies are in MHz, using P-25 digital mode and the site numbers are provided in both decimal and hex values.

Integrated Wireless Network, US Justice Department

System ID – 715
WACN – BEE0A

SITE 1 (101, 01) – Lookout Mtn., Bellingham, WA
167.0000
167.2375
167.6375
168.8375
172.8000

SITE 2 (102, 02) – Blaine, WA
167.3125
167.4625
167.7625
170.9375

SITE 3 (103, 03) – Bahokas Peak, Neah Bay, WA
167.7375

SITE 4 (104, 04) – Octopus Mtn., Forks, WA
171.6125
172.4125

SITE 5 (105, 05) – Striped Peak, Port Angeles, WA
170.7875
170.8875
171.6125

SITE 6 (106, 06) – Bank of America Building, Seattle, WA
167.2875
167.3875
167.4625
167.7125

SITE 7 (107, 07) – Gold Mtn., Bremerton, WA
167.3375
167.6875
170.9375
172.0625

SITE 8 (108, 08) – Grass Mtn., Enumclaw, WA
167.2625
167.3625
167.6125
168.8500
169.4125

SITE 9 (109, 09) – Marysville SR-9, WA
168.9125
170.6375
172.4125

SITE 10 (110, 0a) – Tacoma Fire Training Center, WA
167.2125
168.8875
167.3125
167.4875

SITE 11 (111, 0b) – Capitol Peak, Olympia, WA
167.5875
168.8750
170.6625
167.4875

SITE 12 (112, 0c) – Boisfort/Baw Faw Peak, WA
167.4375
167.7375
169.9125
171.6875

SITE 13 (113, 0d) – Naselle Ridge, WA
167.4125
167.7625

SITE 14 (114, 0e) – Green Mtn., Kalama, WA
168.8875
170.6750
171.9875

SITE 15 (115, 0f) – Portland International Airport, OR
167.4625
168.8250
169.4125

SITE 16 (116, 11) – Unknown (Never heard on air), WA
167.7375

SITE 17 (117, 12) – Keelers Corner, WA
171.1875
171.4375

SITE 18 (118, 13) – Cougar Mtn, WA
170.6250
170.9125
172.2125
172.6375

SITE 19 (119, 14) – Mt. Scott, Portland, OR
170.7250
170.8375
170.9125
172.0625
172.2125
172.4125

SITE 20 (120, 15) – Germantown Road, Portland, OR
168.5875
168.9125
169.2375
171.9625

SITE 21 (121, 16) – Metro Portland, OR
169.9375
170.6625
171.6625

SITE 22 (122, 17) – Lookout Mtn., Gresham, OR
170.6250
170.8625
171.6125
172.1875

SITE 23 (123, 18) – KGW-TV, Portland, OR
167.6125
168.8500
170.7875
170.9875
171.3125
171.4375

SITE 25 (125, 19) – Seattle Tacoma International Airport, WA
170.3375
170.4875
172.2375

SITE 26 (126, 1a) – Eugene, OR
168.7625
168.9250
171.1875

SITE 27 (127, 1b) – Reedsport, OR
167.5125
167.6625
168.5875

SITE 28 (128, 1c) – Coos Bay, OR
167.6125

168.8250
169.4125

SITE 29 (129, 1d) – Oregon Coast, OR
172.2375

SITE 30 (130, 1e) – Mt. Spokane, WA
172.0125
172.1875
172.6375

SITE 31 (131, 1f) – Mica Peak, Spokane, WA
168.5875
168.8750

SITE 32 (132, 20) – Sprague Lake
171.1875

SITE 33 (133, 21) – 5 Mile, Spokane, WA
168.8250
168.9250
171.6125

SITE 34 (134, 22) – Stampede Pass, WA
167.5125
168.9875
171.9625

SITE 35 (135, 23) – Sky Meadows, Elum, WA
172.2625

SITE 36 (136, 24) – Whiskey Dick Mtn., George WA
172.6375

SITE 37 (137, 25) – Terrace Heights, Yakima, WA
167.5875
170.6750

SITE 38 (138, 26) – Sunnyside Slope, Yakima, WA
170.8375
172.2375
172.4125

SITE 39 (139, 27) – Jump Off Joe Butte, Richland, WA
168.9750
171.3250
172.0625

SITE 40 (140, 28) – Salem, OR
168.8750
170.3375
171.2500

SITE 41 (141, 29) – Eagle Point, Cottage Grove, OR
170.6625
172.2375

SITE 42 (142, 2a) – Roseburg, OR
167.5875
168.8500
169.2375

SITE 43 (143, 2b) – King Lake, Monroe, WA
167.0000
167.4125
167.6625
168.7625

SITE 44 (144, 2c) – Burlington Hill, WA
171.4625

SITE 45 (145, 2d) – Sumas Mtn., WA
169.6375
167.3375
168.0000
168.9625
170.1625
171.6125

SITE 46 (146, 2e) – Burch Mtn., Wenatchee, WA
171.6625

SITE 47 (147, 2f) – Goat Mtn., Pateros, WA
167.6625
170.9875

SITE 48 (148, 31) – Waitsburg, Walla Walla, WA
171.3000

SITE 49 (149, 32) – Monument Hill, Ephrata, WA
170.6375

SITE 50 (150, 33) – Monumental Mtn., Colville, WA
170.8125
171.5875

SITE 51 (151, 34) – Mt. Defiance, OR
170.9625
172.2875

SITE 52 (152, 35) – Rattlesnake Mtn., North Bend, WA
168.5875
170.5375
172.6625

SITE 53 (153, 36) – Roosevelt Mtn., WA
168.8250
170.3375

SITE 54 (154, 37) – Schrag, Warden, WA
172.2875

SITE 55 (155, 38) – Skamania Mtn., WA
170.6375
172.0125
172.6625

SITE 56 (156, 39) – Haystack Mtn., The Dalles, OR
170.4375
172.5625

SITE 57 (157, 3a) – Steptoe Butte, WA
169.4125

SITE 58 (158, 3b) – Mt. Hebo, OR
168.7625
171.1875

SITE 59 (159, 3c) – I-5, Southern Oregon, OR
167.5875

SITE 61 (161, 3d) – Ashland, OR
167.6125
170.3375

SITE 62 (162, 3e) – Medford, OR
167.5125
171.6625

SITE 63 (163, 3f) – Grants Pass, OR
168.8875
172.6375

SITE 64 (164, 40) – ValleyCom, Kent, WA
170.7875
170.9625
171.6125

SITE 65 (165, 41) – Unknown location
168.8250

SITE 66 (166, 42) – Possibly Emigrant Hill, WA
171.4375
171.6125

Currently, the IWN in the Pacific Northwest is utilized by the various agencies of the Justice Department, including the FBI, DEA and BATFE. Some agencies of the Department of Homeland Security, including CBP Border Patrol are utilizing the IWN as a supplement to their conventional VHF networks, particularly along the US/Canada border. Other agencies that have access to the IWN include Department of Defense investigative branches and various Treasury agencies.

In addition to federal users, some local police agencies along the Canadian border are also using the IWN for its interoperability with Border Patrol units. And plans are in place for the Washington State Patrol to start utilizing the IWN radio system for its state patrol communications in some areas of the state as a supplement to 700/800 MHz trunking systems for the metropolitan areas of Seattle/Tacoma, Olympia and others.

So despite the apparent failure of the IWN project to move towards the original goal of a nationwide trunked network, the existing portions of the system continue to see additional users and will most likely not be going away any time soon.

SCANNING THE DIPLOMATIC SECURTIY SERVICE

An agency we haven't covered here much is the Department of State Diplomatic Security Service. Diplomatic Security Service Special Agents are responsible for the protection of the Secretary of State, certain foreign dignitaries during their visits to the U.S., and others as designated by the Secretary of State, as well as investigations of crimes against State Department personnel and fraud involving passports or visas.

http://www.state.gov/m/ds/about/index.htm

The security service within the State Department was first begun back in 1916, but in 1985, the current U.S. Bureau of Diplomatic Security (DS) and the U.S. Diplomatic Security Service (DSS) were officially established. Today the Bureau of Diplomatic Security has nearly 34,000 employees, 1,800 of which are Federal Agents within the Diplomatic Security Service.

In years past, it always appeared that the State DSS almost automatically provided security details for foreign heads of state and even foreign government VIPs. But in recent years, (apparently since the formation of the Department of Homeland Security) the US Secret Service has seemingly eclipsed the DSS in provided diplomatic security details. Several recent visits to the Houston, Texas area by foreign dignitaries were apparently protected by US Secret Service details. However, in other cases, foreign VIPs visiting the Boston area were protected by the State Department. No apparent rule-of-thumb had been discovered as to when the Secret Service or DSS provides security.

The Diplomatic Security Service primarily uses frequencies in the federal UHF band for their operations here in the US. Other DS agencies utilize frequencies in both the VHF and UHF federal bands, and we will cover those in the next Fed Files. Recent changes in the band plans of the federal UHF frequencies had resulted in some shifting of frequencies for domestic DSS operations. Here is a quick list of possible Department of State Diplomatic Security operational frequencies. They should be all P-25 digital and utilize a NAC of either N293 or N0F0. While they can and do use encryption, it doesn't seem to be used consistently. Be sure and let me know what you hear active.

403.1000
406.3750
407.2000
407.5000
407.6000
407.8625
408.1000
408.4000
408.6000
409.0375
409.0500
409.1500
409.3375
409.5250 – New Field Office F1
409.6000
409.6250 – Old Field Office F1
409.7000
409.7125
411.0750
411.1500
411.4250
412.0000
412.2875
412.8250 – "AGENT 5"
412.8625 – "AGENT 6"
413.1000 – "AGENT 3"
413.1250 – "AGENT 4"
413.6375 – "AGENT 1"
413.8375 – "AGENT 2"
414.5000
415.9000
416.2000
416.2250
416.6000
416.8625
417.6000
417.8500
418.0375
418.0500
418.0750
418.3375
418.4500
418.5250
418.5750
418.7125
419.3000
424.5000

Many times when monitoring DSS activity, agents will switch from the main repeater channels to simplex, low-powered channels, often referred to as "agent" channels. Because of the nature of these channels, they have often eluded monitors as they have attempted to confirm the frequencies used.

At first glance, a couple of these frequencies may appear "off". The 403.1 MHz is indeed in the DSS radios, but may be utilized outside the US. But as we have seen in other agencies, use of the 400-406 MHz band is not out of the question (see the September 2009 Fed Files, regarding the "White Whale"). The 424.5 MHz channel is most likely used outside the US, but be on the lookout for it domestically as well.

As always, please send any additions or corrections to the Fed Files at Monitoring Times magazine. And be sure to check on the Fed Files blog site for updates on information that has appeared in the Fed Files column. See you in the fall!

BOATS, PLANES, AND TRAINS

Ron Walsh VE3GO
ronwalsh@monitoringtimes.com

New and Old and New Again

❖ Dedication

It seems lately I have started each column with a dedication to a silent key. Before I left Kingston in January, I checked in to the Maritime Mobile Service Net on 14.300 MHz. I had many chats with Jim Baker, WG4MB. who lived in Myrtle Beach, SC. I said I was not able to do HF from my rental unit but did bring my QRP rig to try from the mobile. He said to come over to his shack and use his rig when I was here. This is just typical of amateur radio operators! Unfortunately, I never had the chance as he passed away suddenly during the first week I was here. This is another call I will miss on the air. 73's Jim, SK.

❖ Old and New

We often hear the statement everything old is new again. This seems to now relate to the radio world. Before writing this column, I received notice from the Radio Amateurs of Canada that the World Administrative Radio Conference had referred a new amateur radio frequency allocation to its plenary committee.

The allocation is from 472 to 479 kHz. It would appear that this will come into being and then be sent to respective countries to permit amateurs to use this allocation. Amateurs will be secondary users on this frequency allocation, sharing it with the Marine Mobile Service and the Aeronautical Navigation Service. Use of these frequencies will be on a non-interference basis to other services.

This is where radio began over 100 years ago. Amateurs can now use some of the frequencies they used when ham radio started. Frequencies here were used by marine CW stations for decades. Hopefully, this will keep some CW here for the future! With the 100th anniversary of the *Titanic* just past, this allocation seems to be quite ironic.

On January 11, Iridium Communications and KVH Industries announced they have joined forces to create the first seamless, global, broadband satellite communications service for the marine market. This service uses Iridium's companion VSAT service. It combines KVH's VSAT terminals with the Iridium Open Port System. If VSAT becomes unavailable then the system switches automatically to the Iridium Open Port System without operator intervention.

This should provide total global connectivity. It should eliminate coverage gaps, data limitations and comparatively high prices from other services. The small antennas will make the service viable even for small yachts. We have sure come a long way in 100 years.

However, we cannot forget the old reliable services. Late in 2011, an ANIK satellite lost orientation and thus shut off communications to most of Canada's north. Airlines, weather, telephone communication and more were lost for the better part of two days. No planes could fly, and that is critical in the Arctic. The CFARS system, Canada's equivalent of the US MARS system, was activated and then the government asked amateur stations to monitor several frequencies to handle traffic, if needed.

Fortunately, the satellite was realigned and communications were restored, but the need for HF backup units was shown. I am told that funds are being provided to have some HF backup established throughout the region. Everything old is new again!

❖ Sources of Marine Related Listening

When you are around a port or ship, remember that the non-marine frequencies can carry traffic related to the marine world. While I was in Myrtle Beach, I looked up some frequencies for the Port of Charleston, South Carolina. I noted the Charleston Navigations Company and pilots use 151.535 and 159.865 MHz. They also use channels 13, 14 and 18A on the marine band.

View from the bow of the Battleship

Charleston Marine Containers use 467.400 MHz. Ashley Marina uses 467.800 MHz and marine channel 71.

The Charleston Marina at Patriots Point uses channel 72, while the City Marina uses channel 68. The USCG uses channels 21A, 22A, 23A, 81A, 82A and 83A. These channels should be checked when near any US port.

In our area of Lake Ontario, the USCG uses 21A, 22A, 23A and 81A, while the Canadian Coast Guard uses channel 82A. Channel 83A is used by the St. Lawrence Seaway.

In the same way, you should always check channels 9, 10, 11, 12, 13 and 14 for traffic control near ports. These, along with channel 16 for emergency and hailing are a good place to start monitoring. Don't forget HF frequencies 2.182, 2.670, 5.696 and 8.983 MHz for the Coast Guard.

In Charleston, the USCG also uses internal frequencies for traffic. They contact aircraft on 122.8, use 122.975 and 123.1 for air to air traffic, and 135.675 MHz for SAR co-ordination. Operations at the air station in Savannah are on 150.3 MHz and Elizabeth City uses 163.400 for maintenance.

Some stations in Charleston are noted using P25 digital signals on 163.1375, 171.2375 and 413.00 MHz. USCG Sector air frequencies are listed as 237.9 MHz primary and 345.0 MHz secondary frequencies. Air to Ground comms are listed as using a primary of 326.15 and secondary frequency as 379.0 MHz.

❖ Savannah, GA

We had planned a trip to Savannah, GA and I wanted to see what frequencies were used in that port. I happened upon a site that led me to Google "FCC Registered microwave, paging, aviation ground and marine coast towers." When I searched this topic for a specific city, I got a great deal of information including the call sign, location, tower height, power service and frequencies used.

I only searched for marine frequencies and marine related businesses, but aviation radio enthusiasts will find this an interesting site as well. I have listed the main non-marine frequencies in use here. (ALL frequencies are in MHz.)

Atlantic Containers 464.725 469.725
Ceres Terminals 460.65 461.5375 465.85 451.3375 451.5875 452.1375 452.2875 452.5125 452.6875 452.7625
Colonial Terminal 151.42 152.2275 151.685 160.530 160.710 151.665 151.765 151.805 151.835 151.865 151.895

Naval Construction Bayonne New Jersey

Stevedore Services 461.350 461.600 461.675 462.025 463.575
Marine Terminals many frequencies between 450 and 470 MHz.

A visit by the USCG *Cutter Eagle* showed that marine channels 13, 14, 16 and 21A were used as well as P25 Communications on 163.1325 and 171.2375 MHz. The ship uses 450.325 for its deck operations.

This listing of towers also showed many services using the marine channels. The most interesting site was Moran Towing. They have two sites using channels 9, 16 and 18 on VHF. However, they are also shown as using 2.096, 2.182, 4.125, 6.224, 8.297, 12.356, 16.524 MHz USB. I would like confirmation of this from readers.

Many businesses and marinas are listed as using the marine VHF band. The channels the FCC says are used in the port are 7A, 9, 10, 11, 12, 13, 14, 16, 22A, 18A, 79A and 80A. This should give lots of interesting listening.

The harbor pilots use channels 9, 14, 16 and 18A. NOAA weather is on 162.400 MHz.

❖ Alaska

I wanted to see how good this site was, so I searched for towers in Alaska. The city of Cordova had many listings. Seafood Companies have 9 listings, the State of Alaska has 7 listings, electronics firms have 4 listings, and other businesses have 7 listings, while there are single listings for the State Police, Harbor Master, an aquiculture firm, a science center and an air service.

The Harbour Master uses VHF channels 9, 10, 16 and 69 as well as HF frequencies of 2.096, 2.182, 4.125 and 4.146 MHz. The State Police use channels 7A, 9 and 16, plus HF frequencies of 4.125, 6.227 and 8.294 MHz

Again I have listed the frequencies assigned to the area. Hopefully, listeners will confirm their use. Many of the stations use the same frequencies, but those listed for the State of Alaska are underlined. According to my records 5.1675 is the Alaska emergency frequency and 4.125 is used to broadcast many weather warnings etc. to ships. Viewers of *The Deadliest Catch* will see 4.125 displayed regularly. It is also a worldwide distress frequency. (Frequencies are in MHz.)

VHF Channels
7A, 9 , 10, 11, 13, 14, 16, 17, 19A, 80A, 26

HF Frequencies
(Please note the frequency given in the site is 1.4 kHz high for the HF USB frequencies, thus 2.182 shows as 2.1834)

2.096	3.118	4.125	5.1345	6.224	8.294
2.118	3.201	4.126	5.1645	6.227	8.297
2.182	3.261	4.141	5.1675	6.230	
2.256	3.384	4.146	5.2035		
2.412		4.149	5.206.5		
2.427		4.309			
2.430		4.417			
2.456		4.420			
2.509		4.423			
2.512		4.450			
2.694					

❖ New York State

My frequency research turned to New York State, my neighbor to the South. I looked up several lock stations on the New York State Canal System and found channel 13 is used for traffic control. However, all the stations seemed to have channels 9, 13, and 16 listed. The Albany Port Commission uses channels 16 and 78A.

I looked at the Port of Rochester and was interested to find the call sign WQEJ477 listed for the City of Rochester. The listing said the tower was 92 meters high. VHF channels 7A, 9, 14, and 16 wewwre listed for the call. What was unusual was the listing for several HF frequencies at this location and a current license. J3E (SSB) and F3E (FM) modulation was shown for all frequencies allowed. Many of the HF frequencies were the same as used in Alaska and elsewhere. They are listed below: have any of you readers heard anything on them? Again, frequencies are in MHz.

4.125 6.224 8.294 12.353 16.528 18.840 22.159 25.115.4 4.146 6.227 8.297 12.355 18.842 22.162

Since we have used a lot of VHF marine channel numbers in this column, I thought it would be beneficial to again list the frequencies, in MHz, associated with them for people programming scanners.

Channel	Frequency	Channel	Frequency	Channel	Frequency
7A	156.35	18A	156.9	71	156.575
9	156.45	19A	156.95	72	156.625
10	156.5	21A	157.05	78A	156.925
11	156.55	22A	157.1	79A	156.975
12	156.6	23A	157.15	80A	157.025
13	156.65	26	157.3/161.9	81A	157.075
14	156.7	68	156.425	82A	157.125
16	156.8	69	156.475	83A	157.175
17	156.85				

Please note channel 26 is a duplex ship to shore channel. The ship will be heard on the lower A frequency while the shore station will be on the higher B frequency. Remember when you are using US or Canadian frequency settings that several of the International duplex channels shift to simplex channels using the lower A frequency for transmitting and receiving. Thus, the A designation beside the channel number.

When you switch to the US (U) setting on your VHF radio, channels1, 3, 5, 7, 18, 19, 21, 22, 23, 61, 63, 64, 65, 66, 78, 79, 80, 81, 82, 83 and 88 become simplex or A channels. Channels 2, 4 and 60 are not listed as used in the US. If you switch to the Canadian (C) setting on the VHF radio channels 4, 5, 7, 18, 19, 21, 22, 61, 62, 64, 65, 66, 78, 79, 80, 81, 82, and 83 become simplex, A, channels. Channel 63 is not shown in the Canadian listings.

A reminder: the USCG uses channel 22A, 157.1 MHz, for its weather and notice to mariner broadcasts. Canada uses channels 21B 161.65 MHz and channel 83B, 161.775 MHz for its English language continuous broadcasts of weather and notices. These frequencies alternate to avoid interference from neighboring towers. A French language continuous broadcast uses channels 23B, 161.75 MHz and 28B, 162.000 MHz in a similar manner.

Remember the NOAA / Environment Canada Weather channels carry marine forecasts when the towers serve marine areas. The 7 frequencies are the same in the US and Canada.

I had a very enjoyable time in Myrtle Beach, Sc this spring. The Grand Strand Amateur Radio Club was very welcoming. I attended their meetings at Saturday breakfast and volunteered to help with communications for the Myrtle Beach Marathon. This event had over 6400 runners entered. I would like to thank the club president, Joe Markey, AJ4QM, and the club members for their fellowship while we visited. The club has four repeaters and three nets each week. They meet on the first Monday of every month.

I ask readers to send me their monitoring information at the email address listed in the column. Regular mail can be sent to my home address. I look forward to hearing what you are listening to and also to your comments for inclusion in this column. I will also be happy to chat with people on the amateur bands and on the marine VHF channel this summer, communicating from the *Canadian Empress* as we travel the St. Lawrence Seaway and the Ottawa River.

73's Ron VE3GO

GLOBALNET

Exploring the World of Internet Radio and Television

Loyd Van Horn, W4LVH
globalnetmt@gmail.com
Twitter: @GlobalnetMT

Feeling Fried? Maybe it's not just the heat...

I recently read an interesting opinion piece in the *Whistler* (British Columbia) *Pique* online newsmagazine. The piece described the writer's efforts to cut down on the wireless radio frequency exposure in their lives – just in case there are long-term health effects to prolonged exposure to these devices.

It reminded me of some of the information I studied while I was going after my Technician and General class ham tickets on the effects of RF on the human body. Growing up in a household that was enamored with all things radio, I often tried to visualize all of the radio signals passing through the house and through my body. What would it look like if we could see these visually?

Now, with an ever-increasing amount of RF devices in our homes – from WiFi routers, to WiFi radios, tablets, cell phones, computers, wireless mice and keyboards that use Bluetooth technology, WiFi-enabled TVs, Blu-Ray players, video game consoles, cable set-top-boxes, streaming mutlimedia devices – there is almost an endless amount of potential sources for RF signals.

Within a 10-foot radius of my desk where I am typing this column, I have counted 12 devices that use some form of RF transmissions to access or broadcast data. While the individual amounts of RF encountered from each of these devices might be small, cumulatively, they could add up quickly – especially for a person with sensitivity to RF.

The article brought up some excellent points, ones that fans of this column might want to ponder in relation to their own lives.

❖ Surrounded by Signals

In my apartment building alone, my iMac is able to detect at least 10 wireless routers. That means that signals from each of these routers are traveling into and out of my home on a continuing basis. Thousands of data packets on everything from stock quotes and streamed Netflix movies, to Facebook updates are passing through my couch, my books and my clothes.

On each of those wireless routers, how many devices are connected? My own home might be a bit of a stand-out, as we are a little more high-tech here than the typical home. But let's look at a case example.

Let's say your neighbor is a family of four with a husband, wife and two children above the age of 10. Well, first things first, there is likely at least one WiFi router in this home. You can count on all four of these family members having a WiFi-enabled cell phone as well. Chances are pretty high that there are two to three WiFi-enabled computers in the home, one tablet, a video game console and at least one general WiFi device (iPod, WiFi radio, streaming multimedia device, etc.). That is ten WiFi devices in one home. How many neighbors do you have?

I am not even counting the sheer volume of cell phone signals, traditional radio and TV broadcasts, Bluetooth devices, and other general RF from everything from the dryer in your basement to the flat-screen TV in your living room.

You can quickly see how we are becoming a society that is being bombarded with increasingly high levels of RF.

For most of us, this probably isn't a big deal. There haven't been any long-term studies released yet that show the effects of all of this RF on our bodies – although there is growing concern of the carcinogenic impacts RF has on a human body. Still, it doesn't hurt to at least try to minimize the amount of exposure you subject yourself to in your home.

❖ Want to get Wired?

It's not like any of us are going to give up being connected, though, right? Still, there are ways we can reduce the amount of wireless RF traveling through our bodies from devices in our homes.

One way is to wire your home for an ethernet network. You can still buy CAT-5 cable and routers that have ethernet ports. This might be especially effective for those devices that don't move very often.

For example, I am currently running my Xbox 360 gaming console through a wired ethernet connection. I have plans to wire my next home studio with an ethernet network for my iMac, WiFi radios and other devices. This way, I can probably get rid of almost all WiFi signals in my home, other than two iPhones and a Kindle Fire. Three devices compared to more than 12 will make a big difference in the RF footprint of my home.

Probably the easiest way to route the CAT-5 cable through your home is by hiding the cable behind your baseboards, under carpet, or other trim throughout the home. It won't be exactly cheap. I would probably suggest getting one main router, running CAT-5 from that router to smaller ethernet-only routers in the rooms with highest usage. This will minimize the cable clutter while still helping you achieve a reduced dependence on WiFi.

❖ One WiFi to Rule them all?

Still, it is nice to be portable with your device use, so you won't be able to get rid of all WiFi usage. But, what if there were a way to have a great WiFi signal in the sky, and make it available for everyone to use? So, instead of 10 WiFi routers in my apartment building, we would all be accessing one main WiFi signal.

That is the basic approach of the WiMAX model. Part of the 4th generation (or 4G) of wire-

less technology, WiMAX is essentially "Wi-Fi on sterioids." Imagine having WiFi connectivity from a single access point *within a 30-mile radius*! Current WiFi signals cap out at about 100 feet.

The plan was to use the spectrum space freed-up with the advent of digital television to use for WiMAX deployment. There had been some resistance from the National Association of Broadcasters, even going so far as to sue the FCC for indicating they would allow this "white space" to be used for such mobile broadband technology. Now, the NAB has withdrawn this lawsuit and the road has opened up for WiMAX to make its way to the mainstream.

Much of WiMAX is meant to serve the "last mile" in getting wireless broadband into areas that are currently limited or missing from cable or DSL coverage. Eventually, though, look for WiMAX to be the end-all-be-all for Internet connectivity. Just like Nicolas Tesla dreaming of snatching electricity from the sky through a wireless electric supply, I dream of us one day having a great Internet signal in the sky that evens the playing field in regards to Internet accessibility.

We have already seen the wireless industry start to retreat from unlimited data plans in favor of throttled plans to reduce the data consumption of their mobile customers. Perhaps a widely available WiMAX signal might make this a moot point in the long run.

❖ And then there are Lasers...

Every evil mastermind in the history of movies at some point wanted to hold the entire world hostage with the use of a laser. It is this sleek, sexy and mysterious technology that all at once brings to mind images of light sabers and phasers, but at the same time boasts the power to transform our lives.

Imagine listening to your Pandora stream through a 1 gigabit per second signal traveling from a laser to your WiFi radio. How much quicker could you download your newest copy of MTXpress at 1 gigabit per second?

Now, before you start picturing random laser beams projecting data all over town, fear not. Usage of these laser beams is almost obviously one that would be restricted to indoors, for devices that are static and wouldn't be in the line of fire of anyone's retina.

There are already tests to try out this technology, with possible applications of hospital and school usage mentioned as possible landing spots. But, someday, you may be able to rip up that CAT-5 cable running to your WiFi radio and replace it with a laser sensor to listen to your favorite Internet radio station. Pretty cool, huh? Something about lasers just speaks to my inner tech-nerd in such a loud way.

❖ Wireless the Old Fashioned Way...

Fear not, you WiFi purists. Those data signals broadcast throughout your home won't be going away anytime soon – they just may be changing channels.

NetGear has recently started selling an 802.11ac wireless router that provides WiFi signals at 1.3 gigabits per second. Seem fast to you? Me too; my current broadband plan through AT&T's U-Verse service gives me download speeds of just under 12 megabits per second. But for internal networking, this blistering speed means that data transfers, music streaming from one computer to another and other such applications would be at mind-numbing speed.

This new WiFi standard broadcasts in the 5 GHz band, with a bandwidth of 80 MHz (the 802.11n technology used 40 MHz bandwidth in the 2.4 GHz band). This extra bandwidth helps provide the speed boost.

Another thing that the band change helps with is clutter in the 2.4 GHz band, which is susceptible to interference from microwave ovens as well as a myriad of other devices using the frequency range. There was recently a study conducted by the BBC that showed that using a microwave reduced the download speed of a broadband WiFi signal from 20 mbps to 4-5 mbps.

❖ Seeing the Light?

Lasers aren't the only optical source being considered for a WiFi transmission source. There is now a developing technology to utilize LED light bulbs to transmit a "Li-Fi" signal. This does not use the standard radio frequency technology, therefore cutting down on the RF clutter. This technology takes advantage of the fact that LED bulbs turn on and off many times per second to harness this variable energy to transmit data.

Although using light to transmit data is not new, the application could prove to be groundbreaking. The inventor, Professor Harald Haas at the University of Edinburgh, is being hailed for coming up with a common solution to a growing problem. The Li-Fi signal is another option being considered for hospital and other applications where RF is not desirable, or for underwater applications!

In addition, the signal would be more secure, as it would be confined to the room where the light bulb is located.

I don't think you will be seeing Li-Fi replacing your WiFi router in your home anytime soon. However, this could be an interesting way to boost your WiFi signal, or supplement your WiFi router in larger homes.

❖ Epix Coming to Apple?

So, let's see, Apple has revolutionized the mobile phone industry, the computing industry and the music industry. What's left? How about television and movies?

We all know that Apple is rumored to be releasing their own HDTV soon. They have already released a set-top-box in the form of Apple TV that streams Netflix and other content to your current HDTV. But, now they want to change everything about how you watch television.

In addition to launching its own television, Apple is rumored to be in negotiations with Epix – a service backed by several major studios – to provide a platform for streaming current movie releases.

This could mean a native application within the Apple television: The suite of iOS devices could each have their own app for Epix streaming and the Apple TV streaming unit could also see Epix streaming.

This is obviously a big deal, but when you consider that Netflix currently has an exclusive contract with Epix for the rights to streaming content on its service, the ante is definitely upped a notch or two.

We will see how all of this works out, if Apple even releases its own TV or not. But, just the notion that this service could be coming to Apple (Netflix's contract ends in September) means there may be smoke to this fire yet.

Until next month, 73!

GLOBALNET LINKS

Alternative to WiFi - **www.piquenewsmagazine.com/whistler/an-alternative-to-wifi/Content?oid=2299824**

NetGear 5GHz router - **www.pcworld.com/article/254551/netgear_to_ship_gigabitspeed_wireless_in_may_with_80211ac_router.html**

White space can improve WiFi - **www.theinquirer.net/inquirer/news/2171009/cambridge-trial-white-space-spectrum-improve-wifi**

Electrical engineers develop LED "wands" - **http://phys.org/news/2012-04-electrical-magic-wands.html**

Inventor hailed for light bulb Li-Fi - **http://phys.org/news/2011-12-li-fi-inventor-hailed-bulb-wi-fi.html**

NAB withdraws white space lawsuit - **www.mediapost.com/publications/article/173990/nab-withdraws-challenge-to-use-of-white-spaces-for.html**

Apple in negotiations with Epix? - **http://mashable.com/2012/04/28/apple-epix/**

BELOW 500 kHz

DXING THE BASEMENT BAND

Kevin Carey, WB2QMY
kevincarey@monitoringtimes.com

Additions, Corrections, Comments, and More

In April, we covered some commonly asked questions about non-directional beacons (NDBs). In addition to NDBs, we strayed into a brief discussion of the 75 MHz marker stations often co-located with them. Unfortunately, we introduced some errors regarding these VHF stations. (That'll teach me for straying outside my area of expertise!) Reader **Patrick Griffith** contributed an excellent overview last month on how these stations actually work, clearing up the confusion.

Also writing on this topic is **Dennis Baker**, KEØQM. Dennis is an ILS (Instrument Landing System) Technician for the FAA who deals with these stations as part of his job. Many of Dennis' points echo what has already been reported, but they are carried in the interest of completeness and to present a second perspective. I'm confident these two write-ups will set the record straight concerning marker stations.

Dennis writes: "First, there are three type of ILS marker stations: Outer marker (OM), Middle marker (MM), and Inner marker (IM), all of which operate on 75 MHz AM. They are all positioned on the extended center line of the runway. The outer marker (OM) is generally located 4 to 7 miles from the threshold of the runway. If you had a 75 MHz receiver tuned to the station, you would hear a series of dashes at a 400 Hz modulated tone.

"The antenna system is composed of two Yagis in a 'V' configuration. This is to create an extended signal that is perpendicular to the extended center line of the runway. The elements of the Yagi are parallel to the course. This signal is broadcast in an *upward direction*. An aircraft will be unable to locate it until flying directly over the station. This is generally the reason for the NDB to exist. It is co-located with the OM so pilots are able to navigate to the OM station. The small dipole mentioned by the original observer is in fact a *monitoring antenna*. It samples the radiated signal and processes it to confirm proper operation of the station.

"The middle marker (MM) is located about 2000 feet from the end of the runway. It is a smaller station than the OM as the aircraft are closer to the ground at this point. It transmits an alternate dash/dot at a 1000 Hz tone.

"The inner marker (IM) is the smallest of the three stations. It is located about 700-800 feet from the end of the runway, and transmits a series of dits at a 3000 Hz tone. The exact location of these stations can be adjusted to fit the location of the airport, but they are located on the extended center line of the runway for which they are being used. Not all ILS systems have all three marker stations. Simple ILSs may have only the OM and/or MM."

Dennis echoes another point we have made in the column in recent years, though he points out it is not an official FAA statement, and merely a personal opinion. He states that as the FAA moves toward GPS-based navigation, they can be expected to decommission NDBs, and the shutdowns are likely to accelerate in the near future. This should not be a surprise to *Below 500 kHz* readers, as we've stated the same thing in recent years. In fact, many stations have already been shut down. When they are gone, we will be adding additional coverage of the exciting new ham and experimental work being done at the upper part of the band, as well as for other remaining users. These are exciting times for longwave devotees!

Jim Hastings (NY), W2RFM writes: "I saw the picture of your restoration project in *MT*. It looks like the radio I have owned since the late 1960's, a Nova-Tech Action II. I bought it new at Olson's in Cleveland, OH. It tunes from 180 kHz to 4.5 MHz, then low and high band VHF. I use it for direction finding interference although the internal loop antennas are broken and I have to keep gluing them together. I used this receiver in conjunction with a homebrew 2 MHz Marine radio many years ago."

Thanks for writing, Jim. Your unit represents yet another variation on this basic design, as it includes additional bands and is housed in a light colored enclosure (mine is black). Nevertheless, it is the same basic radio, and it appears these were made in large numbers. At a recent hamfest in Western NY, I spotted another Nova-Tech, complete with a carrying case, AC adapter, manual, and other accessories for just $25. I was tempted to buy it, but I do not need another set to add to my collection when I am trying to thin things out!

Jim Hastings'(W2RFM) Nova Tech Action II portable receiver

❖ Loggings

Our loggings this month are courtesy of Mario Filippi, N2HUN (NJ). Mario uses a Ten Tec RX-350D receiver and a 43-foot vertical antenna. A selection of his recent intercepts appear in Table 1.

Table 1. NDB Logs from NJ (various hours)

FREQ	ID	ST/PR/ITU*	CITY
344	ZOW	ON	Ottawa
348	ZUL	QC	Montreal
351	MSQ	VA	Stevensberg
353	MG	NY	Montgomery
360	PN	QC	Port-Menier
362	SC	QC	Sherbrooke
367	FVX	VA	Farmville
373	2Q	QC	Mont Laurier
373	AEA	VA	South Hill
377	YRR	ON	Ottawa
378	RJ	QC	Roberval
379	YPQ	ON	Peterborough
385	ZDH	ON	Toronto
391	OO	ON	Oshawa
400	XW	KY	Flemingsburg
407	ZHU	QC	Montreal
410	JU	NC	Jefferson
414	3U	QC	Ottawa
414	RPB	KS	Belleville
415	CBC	CYM	Cayman Brac
417	HHG	IN	Huntington
417	SLP	NC	Shelby
424	RVJ	GA	Reidsville
426	IZS	GA	Montezuma
475	WD2XSH/31	VA	Forest
475	WD2XSH/7	LA	Natchitoches

Mario also compiled a list of loggings made during *daylight hours only* (see Table 2). He finds that in the day the QRN (natural static) is low, and it gives a good idea of what can be heard on ground wave from his location in Central NJ. For this exercise, he went back to spinning a dial instead of using a mouse and he fired up his FT-101ZD and Palomar Converter instead of the RX-320D. He finds that the FT-101ZD is very sensitive in this arrangement. Interestingly, the exercise in daytime monitoring led to a few new catches for him, namely HP/281 from White Plains, NY and EUD/254 from York, PA.

Table 2. NDB Logs from NJ (daylight only)

FREQ	ID	ST/PR/ITU*	CITY
198	DIW	NC	Dixon
208	UKT	PA	Quakertown

216	CLB	NC	Carolina Beach
248	IL	DE	Wilmington
254	CAT	NJ	Chatham
254	EUD	PA	York
281	HP	NY	White Plains
328	BZJ	PA	Indiantown Gap
349	APG	MD	Aberdeen Pro Grounds
363	RNB	NJ	Millville
369	TT	NJ	Trenton
396	NEL	NJ	Lakehurst
407	FR	NY	Farmingdale
414	OGY	NY	NY-Gateway

** An online list of ITU codes is available at: http://tinyurl.com/ITU-Codes*

Monitoring station of LW DXer Bill Riches, WA2DVU (NJ)

❖ Titanic Movie

Perhaps the most significant lifesaving event ever played out on longwave was the distress call from the RMS *Titanic* and response of the brave crew from the RMS *Carpathia* some 58 miles away. ***The Last Signals*** is an independent film about the 1912 sinking of the Titanic, and you can watch the entire movie online at **www.youtube.com/watch?v=7-AWbrdNo58**. This is an excellent film, featuring realistic (but *very* rapid) Morse Code.

The Last Signals is the only film I'm aware of that focuses solely on the experience of the *Titanic*'s wireless operators. The film is said to have been made with a budget of just $2300, but is remarkable in its level of detail. Writer/Director Tom Lynskey is just 22 years old, but displays an unusual talent for historical accuracy. He plays Sr. wireless operator John Phillips in the film. I enjoyed this movie more than some made with large budgets, and I encourage you to watch it.

I was able to find more background information about the film and the producer at **www.jkiltsfilms.com/**; however the site was not accessible just before press time. It might be worth checking it now.

❖ Unidentified Beacon

Robbie Spain (WY) wrote with a question about a beacon he was hearing: JNA/392.5 kHz. He reports it to be weak but readable at his location, and it repeats its ID every 5 seconds.

My guess is that this is PNA (Pinedale, WY) on 392 kHz, and that the station is suffering from a lack of maintenance, making the signal weak and resulting in an unattended miskeying situation.

We've had one here on the East coast – CAT/254 – that has been miskeying with several different IDs for the past few months. At the moment it appears to be correct and stable, but who knows if this is a result of maintenance, or just by chance?

❖ Kindling Some Interest

Did you know that a Kindle edition of *MT* is available for your enjoyment? I've heard from a few readers who are already using it, and they all say it looks great! As for me, I'm coming up to speed on a Kindle Fire that my wife and I share (when I can get it away from her!). It will be nice to have the convenience of reading *MT* anywhere I wish.

MTXpress is yet another reading mode I want to mention. Using your PC, you will get each complete edition of *Monitoring Times*, with high resolution photos and artwork, hotlinks you click on for web resources, and full text search capability. Also, when you subscribe to *MTXpress*, there's no waiting for your issue to arrive by postal mail. Full information and a free sample issue are available online at **www.monitoringtimes.com**.

❖ Defining DX

Reader Steve Kristoff asked an interesting question: Just what constitutes "DX" on longwave?

Steve, thanks for asking this question, which many others may be thinking about as well. DX is a relative term, whether referring to shortwave or longwave radio. If you polled a large number of LW listeners, my guess is that most would consider something over 1000 miles to be "DX," but such an intercept would typically be made in the evening. Receiving a 25-watt beacon 300 miles away during broad daylight would be equally impressive in my book, and might also qualify as "DX."

Furthermore, logging a rarely heard station can also qualify as DX. For example, there are some beacons that operate only sporadically, perhaps during military training exercises or testing. The beacon "NEED" near 504 kHz is one example, and it's a station that I'd love to have in my logbook, even though it is not very far away from me.

So in summary, the term "DX" means different things to different people under different conditions. As for loggings in this column, we welcome *any and all* LW reports, and encourage readers to submit loggings even for beacons close to them. We do this for two reasons: First, it's interesting to know the "landscape" of signals around a particular receiving location, particularly on a reader's first few reports. Second, your local station might be someone else's DX, so listing it in the column provides a target to try for.

See you next month!

RADIO RESTORATIONS

BRINGING OLD RADIOS BACK TO LIFE

Marc Ellis, N9EWJ
marcellis@monitoringtimes.com

We Find an Arvin "Metal Midget"

❖ Start Up Revisited

Last month we finished our three-issue troubleshooting series, so it's time to begin a new project. But first I'd like to give you another person's view of a start-up procedure for long-idle vintage radios. (You'll recall we discussed my version in the April *MT*.) It was recently sent to me by a good friend, and while its basic framework is similar to mine, there is a lot more detail. I think it's well worth passing along. So, here goes!

1. Remove rectifier tube, leaving other tubes in place. (Not possible with a.c.-d.c. radios, of course, because of their series string heaters.)
2. Plug in, turn on, and look for: smoke, low heater voltage on tubes, excessive heat in power transformer (suggesting shorted turns). If transformer is bad, set the radio aside until you are sure you can get a proper replacement.
3. Power the radio (still turned on) from a Variac set at zero voltage, replace rectifier tube, and slowly run up Variac, in 20-volt steps, taking about an hour to reach 120 volts. Be alert for smoke, burning smell, or other signs of a possible short circuit. Troubleshoot and correct any obvious problems.
4. With any problems corrected, feel all paper- and metal-cased electrolytic capacitors for signs of heating. Replace all that are warm or hot.
5. Using a d.c. vtvm or dvm, look for positive voltages on tube grids – a tell-tale sign of leaky coupling capacitors that should be replaced. This is a common problem.
6. Check for low screen voltages on r.f. and i.f. amplifier tubes – a sign of screen dropping resistors that have increased in value with age.
7. Finally, don't assume that all mica capacitors are good. Though they rarely become leaky, it's always a possibility!

Of course, this list is more suitable for the conservative among us, who would like to keep as many original parts in the set as possible. The list begins to look more like mine if one starts with the premise all paper and electrolytic capacitors are to be replaced.

❖ Our Next Project

With the troubleshooting series completed, it was time to lean back, stare at the ceiling, and decide on a new project that, hopefully, our "Radio Restorations" readers would enjoy. I do have a large cathedral set waiting in the wings, but the condition of my workbench is daunting. Right now I'm in the process of reorganizing it to reduce the clutter – but I haven't yet finished the job and I wasn't sure I would have room to work comfortably on the large chassis.

I was very much in the mood to find an interesting set with smaller dimensions when I attended the Antique Wireless Association Spring Meet early last May. The Bloomfield, New York meet is always held in conjunction with the Association's Spring board meeting, and is a relaxed, low-key event at which I've often found intriguing items.

This year's meet did not disappoint! I found what I was looking for almost immediately. It's not just a small radio; this four-tube Arvin metal-cased superheterodyne is actually small enough to fit on the palm of one's hand!

Arvin released a wide variety of these diminutive a.c./d.c. radios between the late 1930s and the early 1950s, and they have a large following among collectors. Most had four tubes and typically were available with either a brown or cream finish, though there are exceptions. One of those is the highly prized Hopalong Cassidy motif radio, which was available in red or black. That set, in good condition can command a price of several hundred dollars.

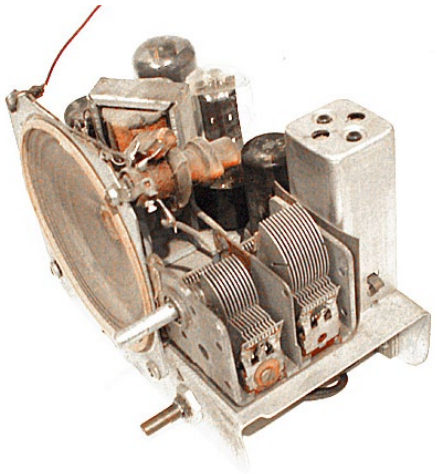
❖ Arvin History

The history of the company that manufactured Arvin products began in 1919, when Quentin Noblitt, Frank Sparks, and Albert Redmond formed the Indianapolis Air Pump Company to manufacture tire pumps. And history is still being made today by its successor company, Meritor, Inc., a manufacturer of brake, suspension, drive train and related components for heavy vehicles.

The period in between is noteworthy for aggressive management that placed a high priority on diversification, keeping the company growing and healthy, except for minor setbacks, even during the Depression.

Robert Arvin, who had patented a heater for Ford automobiles, arranged for the young company to manufacture and market it. This led to the formation of the Arvin Heater Company, with the original three partners and Arvin as the sole stockholders. By 1922, Indianapolis Air Pump was manufacturing tire pumps for Ford and Chevrolet, and Redmond had sold his interest in the company to his two partners. The company later became Indianapolis Pump and Tube in an expanded product line. They also acquired the products of Arvin Heater when Robert Arvin sold out to the two remaining partners.

The Arvin Model 444A as found. The knobs may not be correct for this model, though they appear to be Arvin.



The 444A chassis is grimy, but not rusty or pitted. It should clean up nicely.

With the decline of the tire pump business, the firm embarked on a major diversification effort, including automotive heaters, child's coaster wagons, and automobile jacks. In 1927, the company name was changed to Noblitt-Sparks Industries, Inc., and the firm was producing additional automotive parts such as brake levers and hub caps.

By 1929, now listed on the Chicago Stock exchange, the company had added automotive mufflers and automotive hot-water heaters to its product line as well as additional wheeled toys. However, the period of greatest interest to readers of this column began in the 1930s, with the reorganization that took place in response to sales slowed by the Depression.

By 1935, automotive and home radios had been added to the product line. And in view of the firm's expertise with metal forming, it's not surprising that many of these radios had metal cabinets. Annual sales topped $10 million in 1937 and the company was listed on the New York Stock Exchange the following year.

Arvin "metal midget" ad stresses tiny size, modest price.

With that, we leave our coverage of Noblitt-Sparks history except to mention that the company changed its name to Arvin Industries in 1950 in acknowledgment of the fact that so many of their products carried the Arvin brand name. And in 2000, the firm was bought out by Meritor Automotive, which then became ArvinMeritor, Inc. More recently the Arvin name was dropped and the company became simply Meritor, Inc.

Readers who would like to learn something of the later history of this extremely interesting company are encouraged to review some of the many sources of information on line.

❖ Taking a First Look

The little Arvin that I found is in a cream cabinet with the typical 4-tube configuration. The cabinet is dirty, stained and scratched, but is basically sound with no heavy rust or dents. Luckily, the bronze-finished dial plate is just about perfect. The Paper ID label pasted to the underside is heavily stained and partly rubbed away, but it was intact enough so that, with the help of a magnifying glass, I could see that I had a Model 444A.

The sheet-metal screws that would have held the chassis in place were missing, so the only obstacles to my removing it from the cabinet were the volume control and tuning knobs. Those, by the way, though cream color, may not be the right ones for this set. That would be something to investigate later.

With the set out of the cabinet I could see that the chassis, while grimy, wasn't rusted, or even pitted. A little work with dustcloths, brushes and Q-tips should have it presentable again. A check of the tube types revealed the secret of the set's compactness. The tube complement was the ubiquitous All-American Five – minus one!

There were the usual 12SA7 oscillator-mixer, 12SQ7 detector-first audio, 50L6 power audio and 35Z5 rectifier. But there was no 12SK7 i.f. amplifier, and hence no i.f. stage! Eliminating the i.f. stage also eliminated an i.f. transformer. Only one was needed instead of the usual two. With one tube and i.f. transformer eliminated, the chassis layout could be, and was, very compact indeed.

I'm not sure I've ever operated a superhet without an i.f. stage and it will be very interesting to tune this one once it is restored to operation. Another limitation is that, unlike most a.c.-d.c. sets of its era, this set has no built-in loop antenna.

The schematic for the Model 444A (which is found in *Rider*'s Volume 15) calls for an antenna hank – simply a long length of wire to be deployed along the floor, perhaps under a rug. Of course the latter strategy would seem to rather inhibit the possibility of mobility suggested by the radio's tiny size. Only a short stub remains in my set. It has the insulation stripped from the end, suggesting that perhaps a previous owner had used it to make a connection with an outside antenna.

The Hopalong Cassidy model (441T in red, 442T in black) commands serious money today.

The back of the radio is also missing. I had notions of making a fiberboard replacement until I received a picture of the back of a complete 444A from a friend of mine at the Antique Wireless Association museum. It's metal and has a louvered pattern that matches the rest of the cabinet. I hope to find one eventually!

❖ A.C.-D.C. Safety

Readers of this column have heard me dwell many times on the dangers of a.c.-d.c. radios. These transformerless sets usually have no isolation between the line and the radio circuitry. In fact, one side of the line becomes the radio's B minus connection. Most manufacturers of wood- or plastic-cased sets closed their eyes to this problem and simply wired one side of the line to the on-off switch such that it would be grounded to the chassis when the switch was closed.

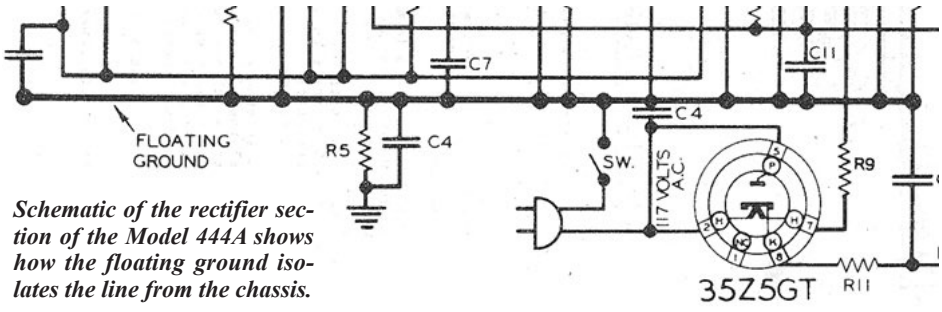
If the radio was plugged into the wall in such a way that the "hot" side of the line was connected to the on-off switch, there would be an accident waiting to happen. That is because the other side of the line is always connected to earth ground. Should a user happen to contact a grounded object such as a radiator, water pipe, or even a damp basement floor while in contact with any metal part of the chassis, he or she would receive a nasty – perhaps lethal – electric shock.

Actually, as long as the wood- or plastic-cabinet radio remained intact as shipped, the danger would be minimal. But as soon as the cabinet was compromised, say by the loss of its back or knobs, then a user is likely (guaranteed in the case of a missing knob) to come in contact with a chassis that could be hot.

So what about the little metal-cased Arvins? With the entire cabinet being a conductor and in contact with the chassis, how would anyone dare to even pick one up? The answer lies with Arvin's use of a "floating ground" as shown in Figure 1, which is a section of the 444A's schematic. The floating ground, which is so labeled, is the heavily drawn wire running across almost the entire width of the diagram.

Notice that the far end of the line switch is connected to that wire, as is every other connection that would normally be grounded to the chassis. The wire, in fact, becomes a substitute chassis that is isolated from the actual chassis except for some capacitors and a high value resistor. The result is that the actual chassis, and its surrounding metal cabinet, now become safe to handle under all conditions.

See you next month, when we will perhaps be listening to the little Arvin!



Schematic of the rectifier section of the Model 444A shows how the floating ground isolates the line from the chassis.

ANTENNA TOPICS

BUYING, BUILDING AND UNDERSTANDING ANTENNAS

Kent Britain, WA5VJB
kentbritain@monitoringtimes.com

Marvel Communications' Antenna Factory

This month I invite you to join me on a tour of Marvel Communications in Fort Worth, Texas. It's almost embarrassing: Here I am an antenna guy, and for 25 years I've been driving a few hundred yards from an antenna factory where 10,000-12,000 antennas were being built every week, and I didn't even know they were there!

Production starts at the winders. A template is used to set the start and stop points for the coils and changes between coarse and fine winds. The wire leader is soldered to the base of the whip, and away goes the winder. Note how the winder has places for two antennas so the operator can be preparing the second antenna while the first is still winding.

From the winder the antenna go to a tuning station. Here the frequency of each antenna is compared to a "Golden Standard." The screen of the frequency sweeper is marked 1/2, 1, 1-1/2 2, 2-1/2. The operator then sorts the antennas by how many turns the antenna is off frequency. Most antennas are within 1/2 to 1 turn of their design frequency. The next station uses a cut-off wheel and trims off the end of the antenna. So they don't take off a turn of wire, they just cut off about 1/16th of an inch of the antenna. More on that "Golden Standard" at the end of this tour.

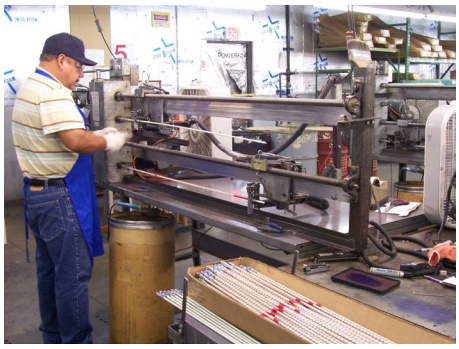


Photo A- Winders for the fiberglass whips

Next they slide on a length of heat shrink, color of your choice, and send it for 15 minutes through a pizza-type oven. Add the tip – again in the color and logo of your choice – and the antennas are ready for packaging.

In Photo B and C is the computer-controlled coax cutter/trimmer. This equipment measures out the desired length of coax, then prepares the end for the connector or termination. On a busy day the operator will go through 3 miles of coax!

After the ends are prepared, every coax section gets a frequency sweep test for continuity, length, and velocity factor in Photo D.

Photo B - Three miles of coax

Photo C - Computer controlled wire cutter and stripper

Photo D - Coax prep

Here we are at the end of the factory. In Photo E is the vacuum pack machine and examples of some of the 20 different brands the antennas are sold under. But more impressive are the fork lift pallets in Photo F. Each of those boxes has 50 antennas bulk packed. Nearly 2000 antennas are in each of those forklift pallets! Each Thursday about 10,000 of these antennas are shipped directly to Peterbuilt, Whites, International, Freightliner, Mack, and other truck manufacturers to be installed right on their assembly lines. So, less than 1% of their antennas end up in those vacuum packs.

Photo E - Vacuum pack

Photo F - Bulk packaging

❖ What's behind the technology

Self Resonance of a coil

In Figure 1 I am trying to show how one turn of the coil is also a capacitor to the next turn of the coil. This distributed capacitor means that at some frequency the coil turns into a parallel tuned circuit. This gives a frequency response as shown in Figure 2. Note that there is a frequency where the radio wave is blocked, or trapped. This can be turned into an advantage with the proper antenna design.

❖ Multibands

Many of their antennas are designed to work on multiple bands. Take for example the coil in Photo G. The turns and the capacitance between the turns form a parallel tuned circuit. If you have ever had a trap vertical, these parallel tuned circuits form a trap. In this case, the 18 turns become a 160 MHz trap.

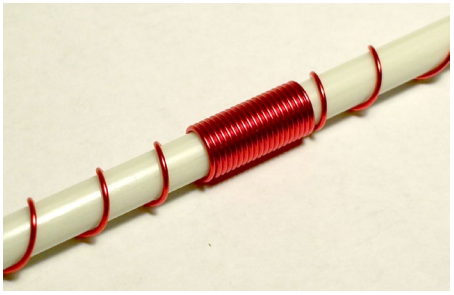


Photo G - Band trap

Many CB rigs have 160 MHz Weather band receivers built in and truckers are very interested in weather reports. By placing this coil/trap 1/4 wave up from the base of the antenna, you form a separate 160 MHz 1/4 wave whip. With similar tricks AM/FM/Weather/CB can all be gotten from the same antenna.

Of course, as a ham it didn't take me long to figure out that 26 turns of wire formed a 2 meter trap and I made up some 144/50, 144/28, and even a 144/14 MHz whip. Just for research purposes, of course!

Nearly 35 Feet

Here is where we run into some interesting physics. When the coil is a solenoid wind as in Figure 1 – that is, the turns touching each other – there is a lot of capacitance and this capacitance is bypassing the coil. In effect, the coils are shorting themselves out.

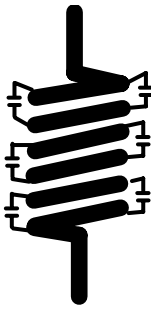


Figure 1 - Distributed capacitance in a coil

To get enough inductance for a load you have to add more turns. A 4-foot top-load fiberglass whip needs about 35 feet of wire to become a loaded 1/4 wave whip! A straight 1/4 whip would be just 9 feet long for a 27 MHz antenna, but that top loaded fiberglass whip has four times that much wire.

Three foot, 4 foot, 2 and a half foot whips; base load, center load, top load – all these require a lot of different wire lengths to wind these antennas. Here is where the marketing departments get into the act. These antennas are often marketed as 5/8th or even full wave antennas. Electrically they are just loaded 1/4 wave whips, but because the wire is about 5/8th or even full wave, they are marketed as 5/8th antennas. Sorry, but there's no extra gain from a 5/8th length of wire; electrically, they are still loaded 1/4 wave whips.

❖ The Golden Standard

Just this last week I was privileged to work with the owner of Marvel, Mr. Mike Simmons, to establish the "Golden Standard" for two new Peterbuilt trucks. Just about every truck has the antenna mounted in a different position, which involves metal vs fiberglass roofs, different ground wires, and even sleeping cabs.

We crawled over the showroom trucks tuning two antennas on each truck model. These reference antennas are marked for the truck model they were tuned on, and all future antennas for that truck will be tuned using these standard antennas as the frequency references. Yes, after 30 years of trucks, they have a *lot* of Golden Standards!

Now, the weather is pretty, so go get some more antennas in the air.

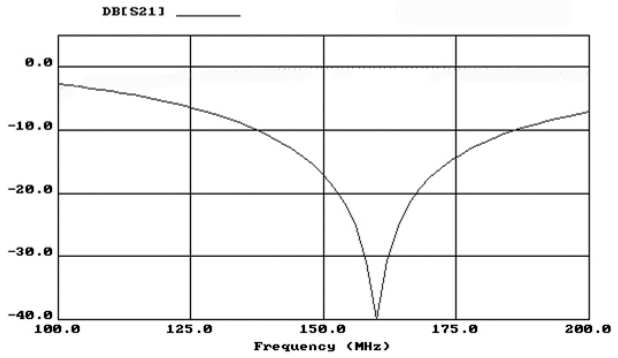


Figure 2 - Coil plot

Brian Wood, W0DZ

www.dzkit.com

SO2R and SO2V

What? Are those some exotic new ham radio DX calls? Internet slang for "Sotto Voce"? No, they stand for "Single Operator, Two Radios" or "Single Operator, Two VFOs". Hmmm, you might be thinking – Just as odd.

Turns out that many contesters use SO2R or SO2V to help increase their score in a ham radio contest. The technique involves completing a contact on one frequency while listening to another frequency, using either another radio (SO2R) or a sub-receiver or secondary VFO (SO2V) on the same radio.

SO2V is usually harder, since many transceivers that are equipped with sub-receivers do not allow that receiver to be active when the transmitter is on, called "full-duplex." When a new multiplier or other point-enhancing contact is located, the operator switches control to the secondary radio to make a contact there. Using this technique, one can reduce idle time between contacts, thus generating more contest points.

SO2R and SO2V require a lot of operating discipline. After all, you are listening to a QSO in one ear while you are actively engaged in another QSO in the other ear. This means that you realistically must learn to not listen to your CW sidetone. But since a computer is often sending the information, this is not as hard as it sounds.

There is also a fair amount of equipment needed to get the right antenna to the right radio at the right time without interference. Figure 1 shows a typical SO2R setup, courtesy of Array Solutions. Various antennas are selected via the "SixPak", which is a 6 antenna, 2 radio matrix. Band information from each rig is fed to a "Bandmaster" decoder, which translates the rig's band information to the format needed by the switch. The antenna connection on each rig is passed through selectable bandpass filters and on to an amplifier and wattmeter.

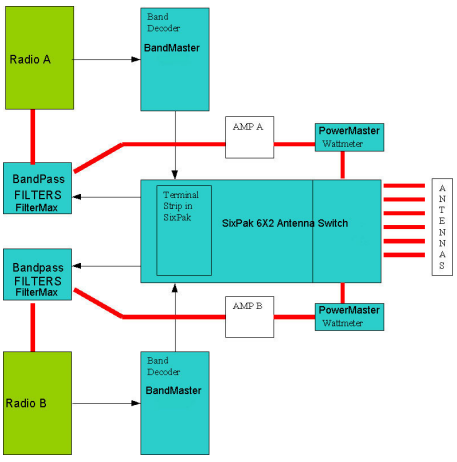


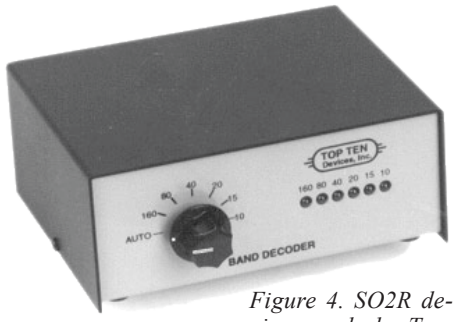
*Figure 1. A block diagram of a typical SO2R setup using equipment provided by Array Solutions (**www.arraysolutions.com**)*

Close-up views of the various instruments are shown in Figure 2. (Not shown, but implied, is computer control of much of the hardware, which we will discuss later.)

Figure 2. These are the actual boxes shown in the block diagram of Figure 1.

Several companies make bandpass filters that are capable of handling the typical power levels out of most rigs. One popular brand is made by Morgan Manufacturing (**www.morganmfg.us**) (formerly ICE), shown in Figure 3. These pass only signals for one band, such as 20 Meters. If you plan to operate on other bands, you need either an automatic or manual switch to select the appropriate one. Alpha-Delta makes some coaxial switches with built-in surge suppressors, in a SPDT or SP4T style, and they are available with SO-239 connectors for operation up to 440 MHz, or type-N for higher frequencies.

Figure 3. A Morgan Manufacturing bandpass filter



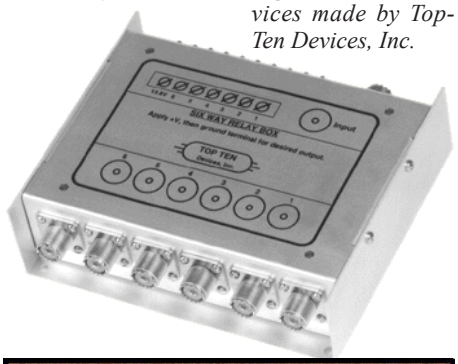


Figure 4. SO2R devices made by Top-Ten Devices, Inc.

Similar equipment is also made by Top Ten Devices, Inc. (**www.qth.com/topten**). See Figure 4.

There are several important things to remember when connecting computers, antennas, filters, rigs, mics, keys and headphones to do SO2R:

- Each transceiver is connected to antennas that are far enough apart so as not to cause receiver overload. When operating on the same band, this is very difficult, but if the transmitter and receiver are on different bands, the problem is not as great, since the bandpass filters can greatly reduce the interference. Still, it helps to use rigs that are not prone to front-end overload from nearby transmitters.
- Headphones must be connected to both receivers, so a splitter or switch is required.
- The CW key and/or microphone audio must be switched between rigs
- Amplifier keying lines and band information must be switched between rigs
- Both rigs must have their frequency remote controllable by computer

Why would anyone want to impose this much grief on themselves? The reason is scoring! It is possible to double the rate of contacts, vastly increasing your score. And although some find such operating "over-the-top," there is a certain amount of amateur spirit involved in creating something complex and then gaining the skill to pull it off.

There are several contester-friendly programs for the PC that support SO2R (with A/B output, CW keying and band information), such as CT (**www.k1ea.com**), NA (**datom.contesting.com**), TR Log (**www.qth.com/tr**) and Writelog (**www.writelog.com**). Much of the commercially available hardware is compatible with these programs. Figure 5 shows an example of how N1MM handles SO2R, with each window controlling one radio (or VFO, for the case of SO2V):

Does this all seem daunting? It can be made much simpler by using a transceiver that has full duplex capability, such as the FlexRadio Flex5000 or the DZKit Sienna. Transmit and receive paths are completely separate in these rigs, so the transmitter can go to one antenna and the receiver to another antenna, and both the transmitter and receiver can be operated simultaneously on different frequencies and modes.

In such a setup, the contest software can be told that you are using only one radio and it will send the appropriate commands to the radio to allow split mode operation on different bands and modes. Band information is available separately for the transmitter and receiver on some of these radios, which can make the antenna switching and linear amplifier control cabling much simpler. And, since only one radio is used, the CW keying, PTT, microphone and headphone audio do not need to be switched! Although it can be easier using a built-in subreceiver, it is not necessary. Simply swapping VFOs using the rig's "A <> B" switch when the transmitter is done can accomplish the same thing.

Here's an example. Let's say you are on 20M CW and have "commandeered" the frequency. You are running about three QSOs per minute. A typical CW QSO would go something like this (sent info in bold): "CQ TEST DE W0DZ K", "N6NR", "N6NR 599 122", "R 599 301", "QSL W0DZ"…

In this exchange, W0DZ called "CQ contest" (often shortened to "CQ test" or CQ followed by an abbreviation or acronym of the contest), and was called by N6NR. W0DZ then acknowledged hearing N6NR and sent the exchange, in this case a signal report (almost always 599 in contests) and a sequential number. N6NR replied with an "R", indicating successful receipt, and then sent 599 and his sequential number.

Contest software can handle incrementing of the numbering, so when you enter N6NR into the control program, it can take care of sending the information. As you receive the contest exchange information, you enter it into the software, too. But while the transmitter is sending the information in bold above, you are tuning around on the other receiver or other VFO looking for whatever is important for the contest you are operating – band openings, multipliers, new counties, new ARRL sections, whatever! When you find a new frequency that looks promising, you switch to it to grab contacts there.

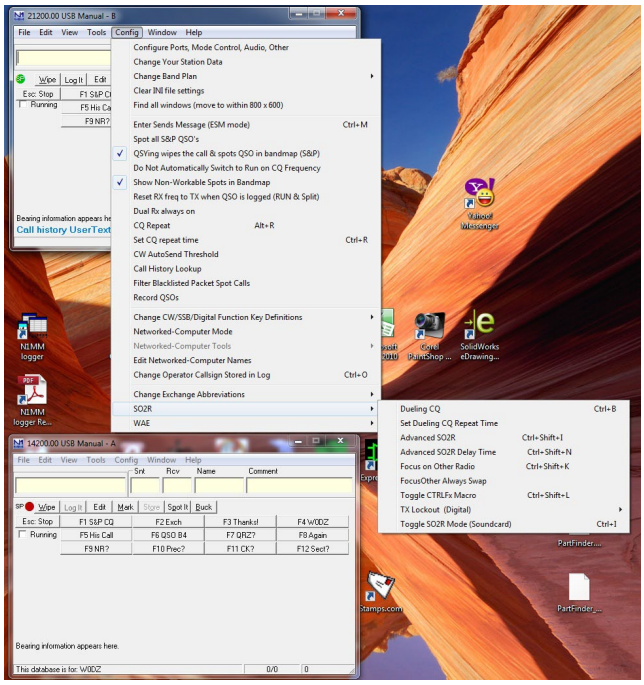


Figure 5. N1MM software creates two windows, one for each radio (or for two VFOs in the case of SO2V). Here, the Config menu has been selected to show the SO2R entry, which brings up another window to allow you to select relevant parameters for SO2R.

It is possible, if allowed during the contest, to switch back and forth rapidly, using the "Search and Pounce" method, which means that you search for a station you want to work, then "pounce" on it. This contrasts to the previously discussed method of "holding" one frequency. The latter can usually only be accomplished if you have large antennas and sufficient power. And I think you can see why so much of it needs to be automated. You'd have a difficult task flipping all the switches yourself in time!

SO2R and SO2V are challenging methods of operating amateur radio equipment, and the equipment involved can be expensive, so they aren't for everyone. Try experimenting with your radios and antenna switches manually to get a flavor for what's involved. And, if you feel so inclined, remember that much of this equipment can be homebrewed to save money.

By the way, "Sotto Voce" means to speak in a hushed tone, "under your voice" for effect. After tearing their hair out trying to make SO2R and SO2V work, hams have been known to speak in this manner, not always pleasantly.

But don't let me dissuade you from trying! It certainly can be a fun diversion from the mundane QSOs we have all come to know and love: "Rig here is a MegaQuacker, running 100 watts to a dipole at 35 feet, and you're coming in five by eight here in Podunk Hollow, Maine. Name is McFloofel. WX is sunny, and the temperature is a balmy 75 F. Back to you."

A Camping DXpedition - Part 1

Photos and Story by David Payne Sr.

Not happy with the radio reception at your home? RFI getting you down?

Get out of there!

I'm not saying that you need to sell your house and move, but maybe you *and* your radio could get out of the house once in a while. This is the first installment of a two-part column on enjoying your radio in the great outdoors.

When I was a Boy Scout, I listened to radios all the time in my tent. It was one of those things that you could do – as long as it wasn't loud enough for the Scoutmaster to hear – to pass the time after "lights out." I was listening to medium-wave AM broadcast radio at the time and was absolutely amazed by the fact that I could hear all these foreign-language stations on this little pocket AM radio. Mostly, it was Spanish from Latin America or French from Canada. Sometimes, however, I'd hear other languages from places unknown – that really blew my mind.

One advantage my Boy Scout radio adventures had was location. We were usually camping high in the mountains of Eastern West Virginia or Southwest Virginia. I spent my summers working for six-to-eight weeks on the staff of Camp Dilly's Mills in West Virginia. (elevation 2,500 feet) or Camp Roland in Bland, Virginia. (elevation unknown, but pretty high). I even took a 10-meter rig one summer.

You don't have to be in Boy Scouts to do this. Just find somewhere nice and take your radio.

If you're like most, you didn't pick your home based on how well you would receive radio signals there. This exercise is just the opposite. You'll want something that is relatively free from RF – you don't want to camp under power lines for a host of reasons – and somewhat high in elevation if possible. If you can, visit the area beforehand. Decide exactly where your antenna will be and what you're going to hang it from.

Rain can turn your SWL excursion into a disaster; besides the obvious safety risks from lightning in a thunderstorm; rain can damage your equipment. You can, of course, pack your portable radio in a re-sealable plastic bag. That should keep it dry. However, trying to use it is another matter. Keep in mind that when you're camping, virtually everything gets wet – even things you want to keep dry. So check the weather and don't be afraid to postpone.

Here's the radio gear I'll be taking on my next trip:

- A Grundig S350DL portable receiver
- 100 feet of rope
- A homemade wire antenna
- Copper ground rod
- Lightning arrestor attached to wooden stake
- Lead-in wire
- Photographer's backpack

The backpack is a remnant of the days when I did a lot of black-and-white landscape photography. The backpack was specially-made to keep camera equipment cushioned and safe. It also will protect a radio. You can still find these – try eBay – but even if you don't have the luxury of owning one, just keep in mind you'll want to have some cushioning for your radio if you're going to pack it in. Even wrapping your radio in a towel before you put it in your backpack will offer some protection.

❖ Camping Aerial

Most of my preparation was antenna building. I went with what I suppose you might call a half-wavelength fan longwire, which is something like the well-known fan dipole. It's basically an end-fed longwire with five antennas – each of them a half wavelength or so – with four of them soldered on slightly ahead of the feed point.

All together, we have almost 240 feet of wire:

- Grey Wire: 81 feet, half wavelength in the 49-meter band
- White wire: 50.9 feet, half wavelength in the 31-meter band
- Green wire: 46.6 feet, half wavelength in the 25-meter band

This is my camping antenna. It's made from 240 feet of 12-gauge insulated wire. It's pretty heavy. If you were hiking some distance, you'd probably want to go with lighter bare-copper wire.

This is my photographer's backpack. It has enough room for my bulky antenna as well as my receiver. It was made to keep fragile cameras and lenses safe, so it's heavily cushioned.

- The other green wire: 31.8 feet, half wavelength in the 19-meter band
- Green/white wire: 27.8 feet, half wavelength in the 16-meter band

I used 12-gauge insulated wire. The only reason I chose that was because I already had it lying around in the form of a 100-foot extension cord (which after you strip off the outer shield has 300 feet of wire inside).

This extension cord wire is heavily insulated. So, it's heavy. Once I get it afield, I might use a third rope to support the center.

The 49-meter antenna wire supports the other antennas, which are soldered on about a foot from one of the ends. I stripped about four inches of insulation about a foot from the end of the 49-meter and about the same amount from the end of the other wires. I wrapped the wire ends around the exposed 49-meter wire one after the other (so the main antenna has a couple of inches of contact with each wire) and soldered. Make sure you keep the main antenna wire as straight as possible while you solder – it will be under a lot of stress and you don't want a soldered-stiff bend in it.

Each of these wires runs along the length of the longer 49-meter-band wire. The shorter antenna wires are attached to the 49-meter-band wire (temporarily) with a tight cable tie. Since the 49-meter antenna is the only one under strain,

This is poison ivy, which is found throughout the U.S. and causes a terrible rash. Remember "leaves of three, leave it be."

electrical tape will ultimately work fine to attach the ends of the shorter antennas. The advantage of using cable ties is that once the antenna is up and under strain, you can make adjustments.

The green/white 16-meter-band wire is dual-colored because I made it using the leftover wire from the 31-meter-band and 25-meter-band antennas. I spliced the wire using the Western Union splice, which was developed by telegraph linemen in the 19th-Century. As far as I know, it's the strongest joint that exists for splicing wires under strain. The wrapping pattern causes the splice to tighten as the wires pull on each other (it works the same way as the fisherman's knot, which is the strongest knot for joining two pieces of rope). It's easiest to do with solid wire, but works fine on stranded wire as well. I can easily make the splice on 18-gauge wire, but I have trouble making it with anything much smaller.

To make the splice, strip about three inches from the ends. Twist the two wires together a three-quarter turn, then wrap the end of each wire tightly around the other wire, twisting at least five turns, working your way toward the insulation. After you solder it, this splice is even stronger than the wire itself.

On the ends of the antenna are two ceramic insulators I purchased at a hamfest. With insulated wire, however, it's not critical to use an insulator for a temporary antenna. A loop tied with a non-slip knot, such as a bowline, will also work for a place to attach the ropes needed for hanging the antenna.

The lead-in wire is a piece of insulated 18 gauge wire. While the Grundig does have a socket for plugging in an external antenna, I will be wrapping the lead-in wire around the telescopic antenna to avoid signal overload. To avoid signal *underload,* I'll be attaching the lead-in wire to ground. When you wrap insulated lead-in wire around the factory antenna, radio signals are transferred to the receiver via a magnetic field around the lead-in wire. Grounding that wire allows more current to flow, thus strengthening the magnetic field and the amount of signal your radio picks up – without necessarily overloading a sensitive front end as it might with bare wire from the lead-in attached.

While I have no intentions of operating the radio during a thunderstorm, I still prefer to have some lightning protection. Since I'm already taking a copper ground rod, there's no reason not to have a lightning ground. I attached a porcelain lightning arrestor to a wood stake, which I can drive in the ground immediately beside the ground rod. My lead-in wire first goes to this ceramic arrestor, then to the radio, then back to ground.

You could pack a slingshot, weight and fishing line or whatever you normally use to run your antenna ropes into trees, but it's not necessary, especially if you've picked a good location. My antenna won't be any higher above ground than the height I can throw a stick with a piece of nylon rope tied to it.

If you're in a forested area, it's going to be difficult to find a place where you can string an antenna high in a tree without obstruction. Also keep in mind that whatever antenna you put up, you'll have to take down at the end of your trip.

❖ Pick your Target

Of course, you can just tune around and see what you can hear, but if you collect QSL cards, you may want to do some homework beforehand to find which hard-to-get-station you should be tuning for. From your new location, you'll probably hear a lot of stations you can't hear at home.

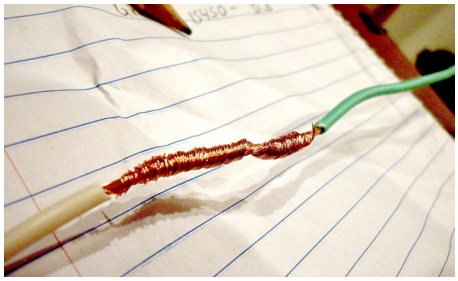
Azimuthal maps, which you can create and print at **http://ns6t.net**, are extremely helpful and you can visit **http://short-wave.info** to look up where a transmission originates and the direction of the transmitting antenna. Since you are only receiving, you want to use azimuthal maps centered on the transmitter location, not your receiving location as you might use in ham radio transmitting.

A portable such as this Grundig makes a nice camping radios.

What I've done is create regional azimuthal maps centered in Iraq for the Middle East; Kigali, Rwanda for southern Africa; south-central Brazil for South America; North Korea for that region of Asia (I would also use it for Japan and China); Moscow for Russia; southern Germany for Europe; India for South Asia; and the east coast of Australia.

You could go as far as having a separate azimuthal map for each transmitter site for more precise bearings, but I find those seven maps work well for me.

Let's say I wanted to receive Radio Serbia International. I see from the schedule included in *Monitoring Times* that they are broadcasting in English at 22:00 UTC at 6100 kHz. At shortwave.info, I see that is a 250 kilowatt transmission aimed at 310 degrees, which is west-northwest. If you look on a regular world map, 310 degrees appears to go over central Europe, Britain and Ireland before hitting the south coast of Greenland and then off the map and up the wall. Of course, the world isn't flat, so the azimuthal map comes in extremely handy. On the azimuthal, 310 degrees does cross south Greenland, but then comes straight down the east coast of North America, where I am.



Use a strong Western Union Splice to join pieces of antenna wire.

If you really want to spend some time planning, you can take it a step further by adjusting for daylight with a day and night world map like you'll find on **timeanddate.com**. Your best reception on most shortwave bands will be when it is nighttime or dusk at the transmitting and receiving locations as well as points in between.

Let's say I was planning a DXpedition for July 1. I enter the date and time of the transmission in the night and day map. During the 22:00 transmission, it's dark in Serbia, but there will be still a few hours of daylight left on the East Coast. However, I see in *Monitoring Times* that there is another English transmission from Radio Serbia at 01:30 UTC. At that time, it will be dusk in Serbia, just before dawn on the East Coast, and night or twilight along the transmission's path. So, my best bet for a good reception of Radio Serbia would be at 01:30 UTC. Do pick several possible target times and frequencies. Sometimes, there's a good reason why you can't hear a specific transmission in your particular area and even upgrading to a better reception area nearby won't help.

All I can really do in the confines of this column is help you fine-tune your radio experience outdoors – it would be impossible for me to discuss all the details of camping itself. There are many places to find camping information – a Boy Scout *Handbook* is always a great start – but do be careful and remember it's always best to have someone with you should an emergency arise. Do learn to identify poison ivy, lest an enjoyable evening of SWL turn into itchy torment. If you've never gone camping before, you might want to try a location that's not so remote – maybe even your backyard for starters.

Contact David Payne Sr. at dave@elkriver-harmonicas.com

Signal Hound Spectrum Analyzer/Measuring Receiver

By Bob Grove, W8JHD

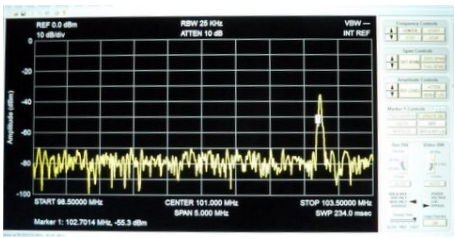
With the current spate of software defined receivers hitting the market, it would appear that the future of radio reception has been defined. And, right alongside the multi-thousand-dollar SDRs, we find the Signal Hound SA44B at under $1000. What does it do and what are its limitations? Let's take a look.

Measuring only 6-1/2" long (plus connector length) by 3" wide and 1" deep, and weighing in at a scant nine ounces, this compact receiver has four ports, only two of which are essential for operation: an SMA signal input and a USB 2.0 computer interconnect (cable included), which is the only source of power needed for the instrument to operate. Data rate is 480 MB per second.

The third port (BNC connector) provides input for an external 10 MHz time base if desired, and the fourth port (also a BNC connector) accepts a trigger signal for the sweep, and also has output for SYNC and self test.

Frequency Coverage and Receive Specs

With an extremely wide frequency bandwidth of 1 Hz to 4.4 GHz, a spectrum display span adjustable from 0 to 4.4 GHz, and real-time demodulation capability for AM, FM, SSB, and CW modes, the Signal Hound is already an attention getter.



Frequency accuracy is +/- one part per million (that's one hertz per megahertz). For even greater accuracy, an external time base (not provided) can be injected into the appropriate BNC connector mentioned earlier.

Sensitivity is quite good at the narrowest bandwidth settings, and is enhanced further by a selectable preamplifier which adds an additional 10-15 dB of low-noise gain at frequencies above 500 kHz.

Dynamic range (the ability to handle equally very weak and very strong signals) is a wide -151 to +10 dBm. The instrument enables the measurement of the dynamic range with an accuracy of 0.25 dB from 0 to -125 dBm in the

150 kHz to 1 GHz range, and 0 to -115 dBm in the 1 GHz to 4.4 GHz range. The unit exhibits 1 dB gain compression with the 15 dB attenuator invoked and with the preamplifier off is typically +16 dBm below 150 MHz and +19 dBm above.

In addition, the unit provides digital audio filtering and makes accurate AM and FM measurements including demodulation.

As a Stand-Alone Receiver

So why wouldn't this make a dandy receive system for signals surveillance? After all, it has extremely wide frequency coverage, multimode demodulation, and high sensitivity.

The fact is that the Signal Hound is first and foremost a test and measurements instrument. That means that it doesn't have the features that we would expect to find in a dedicated communications receiver, including squelch, tuning while listening, simultaneous spectrum display and audio recovery, narrow single-signal selectivity, or memory channels.

Additionally, the closer you operate near the two IF conversion frequencies, 2.9 and 10.7 MHz, images will likely be produced on the display.

If catching a brief signal spike like a pulse is a prime requirement, the sweep rate is too slow, especially over a wide span of frequencies. The fixed trace is written as slowly as once every several seconds, and never fast enough to allow the capture or recognition of brief on/off spikes.

But since the product's intended target is a continuous signal, the primary purpose of the Signal Hound as a wide-frequency coverage spectrum analyzer and test receiver with emphasis on measurement accuracy is certainly achieved. The product works with a Windows platform XP or later. A variety of colors may be custom-selected for the graphic user interface (GUI).

Utilities

A number of software sub-routines may be selected, including:

- Audio listening to a signal's contents
- Broadband signal peaking to automatically seek nearby active frequencies
- Broadcast masks to confirm response to published masks
- Channel power to reveal power levels (dBm) of selected channels
- Harmonics viewer to reveal the first 5 harmonics of the entered frequency
- Frequency difference meter to compare the variance between the time base oscillator and the frequency of the received signal.
- Self test of basic functions
- Phase noise plot

Four sweep modes

The Signal Hound has four sweep modes, including:

- Zero span: This conventional mixing of a fixed local oscillator with the RF input signal produces a stable, familiar, heterodyne product.
- Low frequency sweep: Below 6.5 kHz resolution bandwidth (ARBW) or video bandwidth (VBW), two LO frequencies are mixed to produce a trace automatically adjusted to reduce images and other spurious responses ("spurs").
- Medium frequency sweep: between 6.5 kHz and 250 kHz RBW or VBW, LO frequencies are stepped in 200 kHz intervals.
- High frequency sweep: 5 MHz RBW allows rapid sweeps in an effort to find a strong signal rapidly.

You can save a sweep and recall it later, even printing it out on your computer's printer. Once you identify a frequency of interest, you can listen to its contents in any of the modes: AM, FM, SSB, or CW. You can also type in the exact frequency of interest and the receiver will immediately respond to that direct entry.

IF bandwidths are pretty wide for communications purposes, however, with 30 kHz the narrowest demodulation BW. By direct-entering the frequency step intervals you can tune the receiver incrementally.

For technical surveillance and countermea-

sures (TSCM) applications, third party software is available on the Internet ("Kestrel" at **www.pdtg.ca**). Alternatively, the user may write his own operational and automation software with a free application programming interface (API) available from the manufacturer.

❖ A Matching Tracking Generator

Additional versatility for the Signal Hound is provided by the optional TG44A tracking generator, housed in an identical package to the SA44B. It may be used as an integrated generator for the Signal Hound, or as an independent signal generator controlled by the host computer.

Since it is also powered through its USB cable, it requires a second port from the host computer in its tracking mode. A BNC cable is also provided for the triggering and synch commands from the Signal Hound. A male-to-male SMA adapter is also provided for direct insertion into an RF circuit.

Capable of tracking the frequency settings of the mated SA44B from 10 Hz to 4.4 GHz, harmonics generated by the generator are a consideration since they may be as high as -10 dBc (decibels above the carrier level).

Typical applications include the measurement of gain, frequency response, compression, flatness, and insertion loss on equipment, systems, and components like filters. A separate CD-ROM comes with the TG44A.

The SA44B Signal Hound is available for $919 plus shipping, and theTG44 tracking generator sales for $599, from Test Equipment Plus, 35707 NE 86th Avenue, La Center, WA 98629; phone (800) 260-TEST, or visit their website: **www.signalhound.com**.

Uniden Bearcat 880 CB Radio

By Larry Van Horn, N5FPW

Uniden is well known for its legendary Bearcat brand of CB radios. Now Uniden has introduced a new standard for CB communications with the Bearcat 880. The 880 combines the power and ruggedness of a Bearcat CB radio with a stylish design and some great features.

The Bearcat 880 has four watts of transmit power (AM mode only) and 40 channels, with NOAA weather channels and an instant channel 9/19 for emergency channel access.

The Bearcat 880 has quite a few features including dynamic squelch control, Hi/Lo microphone gain control, memory channel scan, and an automatic noise limiter/noise blanker filter to reduce background noise. The 880 includes a noise canceling microphone with an extra long microphone cord.

What really sets the Bearcat 880 apart from other CB radios is the display. The large, easy-to-read channel display offers seven backlight color options to customize your radio. You can change the colors for the day and night and can adjust brightness/contrast for both settings, so you can have a red radio display at night, blue during the day, or green/blue, dim/bright, bright/bright, etc. The Bearcat 880 display also features a large signal strength/RF/SWR digital meter, day and night brightness control, and TX/RX indicators.

❖ What's in the box?

The Bearcat 880 40 Channel CB radio includes a microphone (6-pin), mounting bracket kit, DC power cord, 6-pin to 4-pin microphone adapter, owner's manual and two year manufacturer warranty. An antenna cut for the CB band is not included and is sold separately. This unit is compatible with all CB antennas in the marketplace.

Additional Features:

This CB radio is loaded with quite a few features, including some new ones we have not seen in any CB radio currently in the marketplace.

In addition to the ones listed above, here are even more 880 features:

- Adjustable RF gain
- Backlit control knobs/buttons
- Brightness Control: Dimmer switch day/night
- Color: Black or silver
- Diagnostic features like those that the Cobra LX LE CB has including: voltage (gives reading), RF power (pass/fail), and Antenna SWR (pass/fail).
- Easy to read laser etched keys
- Enhanced display graphics
- External speaker connector
- Frequency counter/Channel indicator
- Front microphone connector
- Local/DX switch
- Public address capability (PA capability)
- SWR CAL meter
- SWR calibration (SWR CAL)
- Variable microphone gain (4 levels)
- Variable talk back
- Volume control
- Weather channels (seven channels) with scan option and weather alert.
- Wireless microphone compatible

❖ Bottom Line

The Uniden Bearcat 880 has a great looking display. It reminds me of an in-dash CD player, with its huge display with seven different color options. RF output out of the box was measured right at four watts (higher than most stock CB radios I have tested in the past). Modulation was excellent with good reports from other stations in the area. The extra long microphone cord allows you to talk from anywhere in the front seat area of your car (if mounted in the center of the vehicle).

The audio is nice and clear and can be turned up to near full volume without distortion if you have a noisy vehicle. The display, though, is really what makes this CB a shining star – it is extremely easy to read and has thoughtful features like a dedicated night button which can be programmed to switch to any of the display colors you prefer for night/day.

This is one solid radio with almost everything you want built in. But as most of you know, I have not found the perfect radio in any of my reviews. The one feature I wanted to see that was missing in the 880 was single side band capability.

This is perfect for the serious CB users and night drivers, and the Uniden Bearcat 880 CB radio will be a great addition to your semi, truck, SUV, motor home or even as a base station with a suitable AC/DC power supply (not included).

The Uniden Bearcat 880 CB lists for $149.99 and is available at several outlets online, including Amazon.com, at reduced prices. I saw pricing that ranged from $119.00 to $139.00.

UNIDEN BEARCAT 880 SPECIFICATIONS

(manufacture and tested):

- 40 Channel operation (AM mode only) 26.965 – 27.405 MHz
- Antenna impedance: 50 ohms, unbalanced
- Adjacent channel rejection: 55 db
- Audio output: Five watts (max), four watts (10% distortion)
- Cable connection utilizes standard CB PL-259 connection.
- Current drain: Transmit 2.2 amps, receive (no signal): 650 mA
- Dimensions: 2.2" (H) x 6.3" (W) x 6.3" (D), Metric dimensions: 54 mm x 160 mm x 160 mm (not including knobs and jacks)
- Frequency tolerance: +/- 0.002%
- Hum and noise: Better than 40 db
- Image rejection: 65 db
- Operating temperature: -22 deg to 140 deg F (-30 deg to 60 deg C)
- PA Output power (10% distortion): Four watts
- PLL synthesizer
- Radio mounts with "U" mounting bracket to any flat surface.
- Speaker impedance: 16 ohms (internal), 8 ohms (external)
- Spurious rejection: -70 db
- Weight: 2.2 lbs.

What's NEW

Tell them you saw it in Monitoring Times

Larry Van Horn, New Products Editor

Icom America Hamvention Exhibits

As a repeat Dayton Hamvention® exhibitor, Icom continued its tradition of showcasing the latest amateur radio products and technology, such as D-STAR (Digital Smart Technologies for Amateur Radio) at Dayton. Combining key features that amateurs want in ham radio devices, Icom's recent product additions released at Dayton included:

The **ID-31A** is a UHF D-STAR portable transceiver with built-in GPS, a repeater directory and Micro SD card compatibility. This palm-size, IPX7 submersible portable affordably offers a multitude of features such as GPS location updating via D-PRS™ and Micro SD storage for recorded incoming/outgoing calls (up to 32GB; memory card not included). The backlit large dot matrix LCD, combined with a simple directional keypad, allows easy "quick menu" access. With a touch of a button, users can find and select nearby D-STAR repeaters using a preloaded D-STAR directory.

The new **IC-2300H** is a high-power 2m mobile radio with military-grade construction and streamlined interface. This 144 MHz VHF transceiver generates an impressive 65 watts of output power, contained in a compact aluminum die-cast chassis that keeps the radio cool during heavy-duty, continuous transmission. The basic panel layout, an alphanumeric LCD with three backlight color options, and a pocket beep function efficiently promote intuitive mobile operation. The IC-2300H comes standard with 207 memory channels, built-in CTCSS and DTCSS encoder/decoder and multiple scan types for maximum reception.

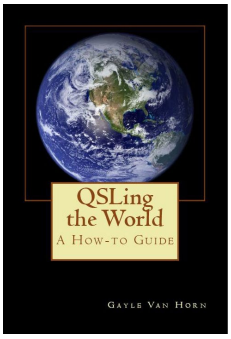
The **RS-BA1** is an IP remote control software package compatible with various Icom base stations. The RS-BA1 remotely controls Icom transceivers through an IP network and features low voice latency to provide the same operational experience of using an actual radio. The RS-BA1 consists of two components: a system configuration application that sets up IP address and audio sampling rate, and remote control software that provides a user interface similar to a radio's front panel.

And, lastly, the **RC-28** is a remote control USB encoder that may be used in conjunction with the RS-BA1 software. Utilizing the same tuning knob and encoder used on Icom HF radios, the RC-28 provides a tactile option for the RS-BA1 software. The remote tuning control also features programmable function keys.

Icom kicked off the 2012 Hamvention® as the premier sponsor for Contest University (CTU). That daylong event took place one day before the convention at the Dayton's Crowne Plaza Hotel. "Veteran contesters" provided instruction on contesting topics such as radio performance, contest rules and station optimization.

Teak Publishing Releases Kindle Book

QSLing the World - A How-to Guide by Gayle Van Horn, *Monitoring Times* columnist and shortwave frequency manager, is a comprehensive resource and reference book for any radio hobbyist who is interested in acquiring a verification of reception from almost any type of radio station, whether it is broadcast, utility, amateur radio, satellites, or clandestine!



For many radio listeners who tune to shortwave, broadcast (AM/FM/TV), VHF/UHF scanner spectrum, or the amateur radio bands, the main objective of listening is to collect stations for the listener's logbook. While some radio hobbyists are program listeners who just listen for the content being broadcast, there is a large segment of the hobby who collect written proof that they have monitored the stations they have received or talked to.

The participants in this portion of the radio hobby attempt to QSL or verify the reception of the stations they hear or work. They do this by sending them a report of reception or their verification card in the hope that the station staff will return a card or letter (a.k.a. a QSL) verifying the radio reception. Along with QSLs, some radio hobbyists also collect station memorabilia that may include such items as frisbees, bumper stickers, pennants, decals, T-shirts, or anything associated with the station logo, slogan or call sign.

This new 140 plus page Kindle eBook covers the "how-to's" of QSLing, drawn from Gayle's 30 plus years of experience. This includes best general practices in logging, reporting, and mailing a station reception report.

Should you try to send a report in a language you don't speak? What enclosure should you include with your reception report? How long should you wait for a reply from the station? Should you send a second report? This book answers these common questions and many more. Finally, Gayle addresses an often-neglected question – what do you do with your QSL cards and letters after they start to accumulate? These questions and more are now available in this new edition of *QSLing the World*.

This second edition of *QSLing the World*, now in Kindle eBook format, is the most comprehensive compilation of trends and tips on the art of QSLing ever published for the radio listening hobby. It is a must-have reference in any hobby radio shack if you want to QSL the stations you are hearing on your radios.

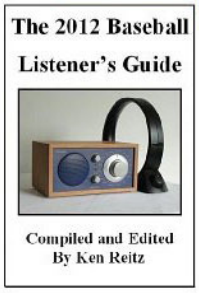
If you do not own a Kindle reader, don't worry: You can still read our new Kindle electronic reader edition or any Kindle books (such as those published by Ken Reitz) anywhere with Amazon's free reading apps.

There are free Kindle reading apps for Smartphones (iPhone & iTouch, Android, Windows Phone 7, and Blackberry); computer platforms (Windows and Mac); tablets (iPad and Android Tablet), and of course the Kindle readers including the new Kindle Fire that was reviewed in the June issue of *Monitoring Times*. You can get more detail on these apps by checking out this link to the Amazon website at **http://tinyurl.com/84wodbx**.

The new edition of *QSLing the World* is available now from Amazon.com at **http://tinyurl.com/85fh5gk** for $2.99.

2012 Baseball Listener's Guide

I love the game of baseball and I also love being able to relive a bit of my youth by listening to a major league baseball game on the radio. While television coverage of a game is great, it just can't quite compete with the play-by play coverage you hear on the radio.



The biggest problem most of us have is trying to find a AM or FM radio station that carries the game we want to hear. In that regard, *Monitoring Times* features editor and columnist Ken Reitz has just published a solution that will certainly help. Just in time for baseball season, Ken has released his third Kindle eBook – the *2012 Baseball Listener's Guide*.

The *2012 Baseball Listener's Guide* is a list of all of the radio stations in the North America that carry Major League and Minor

League Baseball play-by-play throughout the 2012 baseball season. It's intended as an aid to baseball fans and radio DX enthusiasts in finding over-the-air baseball broadcasts. The introduction explains how best to receive AM and FM radio broadcasts.

You won't need this guide if you only need to find stations for your team or just one station near you. You can find a list of radio affiliates on each team's official MLB.com® website, but you may have to hunt for it. You'll usually find such a list under the "Schedule" tab and then under "Broadcast Information." Sometimes the list will be under the "Roster" tab. Click on "Broadcast Affiliates" or "Radio Network."

One exception Ken found was the Boston Red Sox. That team's affiliate list is found on the web site of the flagship station WEEI-AM. Scroll down to the bottom of the page and click on "Network Stations."

However, if you do want a list of the stations for all Major League and Minor League teams that offer play-by-play broadcasts, this guide is a handy thing to have. You can get your copy of the *2012 Baseball Listener's Guide* for only $0.99! Yes, I said 99 cents at Amazon.com, and it may be ordered only on the Internet from **http://tinyurl.com/cubpsvd**. This book may be read on any e-reader, smart phone, laptop or desktop computer.

Police Radar Operator Error

It's easy to recognize improper radar or lidar use by first understanding basic operational procedures. Learn about microwave and laser radar limitations, errors, and misinterpretation of readings resulting from improper use or a lack of understanding.

Microwave and laser radars are precision instruments that accurately measure speed – when used properly, as designed. Design constraints limit how the radar or lidar should be located and used. Some police operate outside design limits unknowingly or to hide from motorists, resulting in unreliable readings easy to misinterpret.

Donald Sawicki has released a new book that explores microwave and laser radar systems, the *Police Radar Operator Error – Microwave and Laser Radar Protocols and Results of Improper Use*. It's a summarized version of his *Police Traffic SPEED RADAR Handbook*. This new book is 6 x 9 inches, is 84 pages, and includes a basic description of microwave and laser radars, and their differences. Correct setup procedures are explained, accompanied by possible results when protocol is not followed. Results vary from speed errors to misidentified vehicles. Many errors are predictable knowing just the general setup.

Victims of microwave radar or laser radar (lidar) and police will both appreciate the easy to follow and understand information not found in radar or lidar user manuals or specifications.

The print edition is available online at: **www.createspace.com/3846128** and sells for $7.95 plus shipping. An eBook Kindle Edition available online for $3.99 at **www.amazon.com/dp/B007UOHHYQ**.

Just the Fax!

Called by many names including radio facsimile, WEFAX, and radio fax, this method of transmission is used by weather forecasting agencies around the world to broadcast their weather maps, weather charts, satellite photos and forecasts to many users around the globe simultaneously.

With a shortwave radio or amateur transceiver that provides general coverage of the HF bands (2-30 MHz), and a computer (PC or MAC) using the proper software you can receive these entertaining broadcasts.

Steve Handler has published a 39 page 8.5" x 11" sized book for radio hobbyists interested in receiving weather facsimiles. It includes a step by step description of the author's experiences receiving these broadcasts. Beside the technical discussion and the examples of maps, charts and satellite photos, it discusses common problems you might encounter and offers suggestions.

In Appendix one, FAX stations transmitting on HF frequencies are listed in frequency order. If you hear a station on a particular frequency it is easy to look up what station uses that frequency. Appendix two of the book lists stations in time sequence. So if it is 0355 GMT and you want to see what stations are possibly on the air it is easy to do so. Appendix three provides address and QSL information for some of the stations to assist those who wish to send reception reports.

The price for this print book is $14.95 plus shipping (USPS Shipping to the USA and Canada is $1.90 and to the rest of the world it is $3.86).

You can order the book by sending payment via PayPal (address is **shortwavereport@yahoo.com.** US Residents may also order by mail with payment by check or money order sent to Steve Handler, PO Box 11, Lincolnshire, IL 60069-0011.

ARRL Digital QST Now Available

The new digital edition of the ARRL's monthly magazine *QST* debuted toward the end of May. If you are an ARRL member and you haven't yet signed up to be notified automatically when the digital edition becomes available, you can do so easily. Just click on the "Edit your profile" link on the ARRL website. Once you are in your profile, click "Edit e-mail subscriptions" and then check the box next to "Notification of monthly digital edition of QST." That's all there is to it.

A new FAQ about the digital edition has the answers to the questions ARRL members have been asking (it can also be accessed from the *QST* page on the ARRL website at **www.arrl.org/digital-qst-faq**.

The ARRL Film Collection (DVD)

A History of Ham Radio in the 20th Century

Take a journey back, as ARRL presents a series of videos beginning in the late 1950s through the early 21st century. Using the media that he knows best, noted Hollywood Producer and Director Dave Bell, W6AQ, takes you behind the scenes of each film. From the original "Hams Wide World," which aired as a segment of the Johns Hopkins File 7 in the late 1950s, to the award winning "Amateur Radio Today," you will watch the evolution of Amateur Radio unfold before your eyes. For older hams, it's a trip down memory lane and a subtle reminder of how different things were back in the 20th century. For new hams, it's a glimpse into the earlier days of this fascinating hobby.

Topics covered includes: The Hams Wide World, This is Ham Radio, Moving Up to Amateur Radio. The World of Amateur Radio, and Ham Radio Today.

Running time is 130 minutes and the DVD is available from the ARRL for $15.95 plus shipping and handling. You can purchase this and other ARRL books and products directly from the ARRL, 225 Main Street, Newington, CT 06111-1494, (860) 594-0200 or on the web via their website at **www.arrl.org**.

Books and equipment for announcement or review should be sent to What's New, c/o Monitoring Times, 7540 Highway 64 West, Brasstown, NC 28902. Press releases may be faxed to 828-837-2216 or emailed to Larry Van Horn, *larryvanhorn@monitoringtimes.com*.

When ordering or inquiring about the products mentioned in this column, be sure to tell them that you saw it in the pages of *Monitoring Times* magazine.

to the editors

editor@monitoringtimes.com

This column is open to your considered comments. Opinions expressed here are not necessarily those of Monitoring Times. Your letters may be edited or shortened for clarity and length. Please mail to Letters to the Editor, 7540 Hwy 64 West, Brasstown, NC 28902 or email editor@monitoringtimes.com

Happy monitoring!

Rachel Baughn, Editor

SCANNER SQUEEZE

Ken, Thanks for the article "*Scanner Squeeze: Taking the Public out of Public Service Radio*" (*MT* April 2012). Now that the $11 billion "Public Safety Spectrum and Wireless Innovation Act" has been passed and the "D Block" has been reassigned, will this be the driver for all future planning? It seems to me that this is going to push every system into the 700 MHz channels. If interoperability is the goal, then all of the manufacturers are going to have to drop their proprietary hardware.

Larry Wheeler W9QR

I put Larry's question to *MT*'s experts and here are responses I got from Publisher Bob Grove, *Fed Files* columnist Chris Parris, and *Scanning Report* columnist Dan Veeneman:

Bob Grove:

The FCC has required since 2004 that by January 1, 2013 all transceivers in use by public safety and industrial/business in the 150-174 and 421-512 MHz bands must be operating with a 12.5 kHz bandwidth. Fortunately all such transceivers certified after 1997 already have that capability even if they are currently operating with 25 kHz bandwidth.

All such transceivers manufactured after January 1, 2013 must also be capable of operating on a 6.25 kHz bandwidth, although an implementable deadline has not yet been set. FCC will consider some requests for waivers because of unique circumstances.

The 700 MHz bandwidths are already set at 12.5 kHz and it is reasonable to assume that a switch to 6.25 kHz would be likely in the future.

Chris Parris:

The allocation of the "D" block to public safety is in advance of developing a nationwide broadband network for public safety use. I don't know how much of this is going to end up being used for land-mobile voice or data, or they are going to keep pushing towards a sort of "smartphone" for police approach.

The goal of a lot of the federal planners is to make the idea of some sort of nationwide, interoperable system for first responders a reality. So far there has been much talk and planning, but everyone is still running their own radio systems. Some can talk to others and some can't.

The interoperability is there, as *MT* has covered many times. Plenty of analog or APCO P-25 common channels are available nationwide that everyone should have access to. But there are those who continue to push for all agencies to have some access to a common, public safety broadband network.

I personally think that first responders have all the tools they need to be interoperable. But many times what is lacking is training and coordination of these frequencies that already exist. Some agencies don't even seem to be aware that they are available."

From Dan Veeneman:

I suspect future choices will come down to money. Sure, public safety agencies would like to move to high speed broadband radio networks, with all the bells and whistles that come with such a capability. However, all that capability will come with a price tag, which may be difficult to justify with taxpayers, given the state of the economy. Perhaps police departments will become even more aggressive with asset forfeiture to help pay for the new equipment.

So far, existing VHF, UHF and 800 MHz frequencies aren't going away – they will remain available for voice (and some low-speed data) communication for the foreseeable future. To me, the 700 MHz broadband looks more like a "pull" toward new capabilities than a "push" away from current frequency bands.

On paper, interoperability has been the goal for decades. Mutual aid agreements and adjacent agency procedures have been put in place on an ad-hoc basis for a long time.

It will be difficult for manufacturers to give up the proprietary features of their hardware, since they will always be looking for a sales advantage. The trend these days is for a manufacturer to meet the minimum criteria for a standard, then add their own "special sauce" on top of that. So, some level of interoperability will come with the technology, but the more complex features are often specific to a particular vendor.

The Federal government has tried to encourage agencies toward the APCO Project 25 standard by requiring its use in order to receive grant money, but so far there is no regulatory requirement to choose a particular technology.

THERE OUGHTTA BE A LAW

Dan, I stumbled across your site (**www.signalharbor.com**) while trying to research a very puzzling situation.

I am a reporter in San Diego where, thankfully, we have a great working relationship with our local emergency responders and receive all of their emergency transmissions. In addition, we monitor everyone from Coast Guard, Life Guards etc.

Recently, I had a discussion with a friend in the business in Milwaukee. During that conversation it was brought up that they can't monitor any of the police and fire transmissions due to the trunking system in place and that the police department would not give them the 'code' needed to decode the transmissions, quoting 'officer safety' as a reason.

My first reaction was how can a public entity cut off the public from potential safety information being relayed over the airwaves? I also started thinking that there must be a way or FCC Law requiring a public/government entity to not be able to block such transmissions.

In that, I request any guidance you may have to pursue this further. Is there something specific needed from the police department to make this happen, or is it something that I can obtain via a form submission to the FCC?

Craig McKee

Hi Craig, nice to hear from you. There are really two issues here – one is the technology used by certain public safety agencies and the other is encryption.

Milwaukee is using a radio system called "OpenSky" that communicates over the air using proprietary signal formats that no consumer-level scanner can monitor. Local residents cannot monitor the system due to a lack of appropriate scanner technology…

Early on in the acquisition process for the Milwaukee system, there was a suggestion by the City authorities to lend a receive-only OpenSky radio to local news-gathering organizations. This would have allowed them to hear activity in real-time without the need for a scanner. From what I gather, this suggestion was not carried out, but it might be worth pursuing.

Encryption is a different matter. For instance, the Washington, D.C. metropolitan police use a Motorola radio system, which consumer scanners can monitor without difficulty. However, the police chief has made the decision to encrypt all transmissions. So now, local residents can no longer hear the activity even though they have the necessary technology to monitor the system.

The FCC does not control or regulate the encryption schemes a public agency might use on a radio system. I'm not sure that they even keep such basic information as which systems use encryption and which ones don't. They certainly do not keep a record of encryption keys or any codes necessary to monitor the contents of transmissions.

As far as I know there is no Federal law that requires agencies to make their transmissions available for reception by the general public. If there were such a law, it would certainly have been tested by now.

State laws vary, of course. The closest anyone came, that I recall, was an effort under Florida's "Sunshine Laws" (openness in government) to prevent that state from using encryption on their highway patrol radio system. The effort failed, but it may not have been adjudicated (that is, it might have been dismissed before a judicial opinion was rendered).

I would certainly be interested in hearing about efforts to open up such transmissions, and please let me know what happens with your friend in Milwaukee.

Dan Veeneman

Are any readers aware of any legal efforts, recent or historical, to make public safety transmissions available to the public?

A BETTER WAY TO READ EDACS

Dan, you might want to look at an article I wrote some years ago about EDACS for *MT* (June 2005 issue). The hobby and scanner makers got AFS wrong. It is 3, 4, and 4 bits not 4, 4, and 3. Since the manufacturers got it wrong, the hobby (RadioReference included) got it wrong to be consistent.

Consider 02-041 Montgomery Co. Sheriffs Office in your recent article. Instead of

02-041	0010 0100 001	is really	001 0010 0001	AFS 1 2 1
03-021	0011 0010 001	is really	001 1001 0001	AFS 1 9 1
10-021	1010 0010 001	is really	101 0001 0001	AFS 5 1 1

…which makes more sense than 10 02 1 for Montgomery Police Channel 1 (why would they be someone's Fleet 2?) Do the whole system and some other EDACS systems and you will see that I am right, as the results will make a lot more sense.

Summarizing, the talkgroup designations used throughout the scanner hobby are really not the AFS.

David L. Wilson

CW IN THE MOVIES

I have always enjoyed the use of CW in the plots in movies (Mostly WWII era) where the hero sends a message back to London and gets it done before the Germans get him on the DF and locate him. Tricky to get it right so hams don't laugh.

I recall being in a theater at Fort Devens where the movie *Fantastic Voyage* was playing. In this movie a small medical craft with a team of doctors are miniaturized down and injected into the blood stream of a famous inventor who needed an operation in the brain before a tumor killed him. Well, the craft and medical team in the body used CW to communicate with the outside... The movie audience was able to hear the CW in the soundtrack, and we could all read the code because everybody was there for Morse Code training. However, the code was very fast and most of us were only reading 10-12 words a minute, but the instructors in the audience could read the provided code in their heads as they were able to read 45-50 words a minute. Well, these instructors roared with laughter at what was really being sent... We newbies did not want to let on we could not read that fast, so we laughed just as hard. All the wives and children were just bewildered.

After the movie ended one of the instructors got up in front the audience (Army movie theaters were pretty informal) and explained what all that CW chatter was really saying. A lot of children of those instructors were pretty proud of their dads that Sunday afternoon!

One other movie was *On the Beach* where after nuclear war a Navy sub came to the surface in the Pacific able to hear no radio traffic and surmised everybody was killed. Well, one radio OP did find one CW signal still being sent that was not a channel marker but code, but no one could figure it out. The sub took a bearing and headed for the island where the CW signal was coming from.

When they got there, they found everybody dead but the CW still going. They got to the radio shack and found the generator and the radio still on, but the 'operator' was a Coke bottle bouncing through a shade pull and touching a Morse key when the wind blew in the window. CW was the star of that movie!

I am sure there are other movies where CW was used to move the story along and I wonder if there was ever an article in *MT* or book you ever read about CW in the movies?

P.S. I'm not a ham but a PRD-1 OP in Vietnam 1967-1968. Spent some time at HERZO base (Germany) as a radio fingerprinting OP during the Warsaw Pact invasion of Czech Republic in 1968.

Ron Schmidt

Ron, we've never run a dedicated story on radio/CW's use in movies and other media, but over the years several columnists have mentioned it. Most recently, Stan Nelson, who edits the quarterly radioastronomy column, has been running an occasional segment on radioastronomy in the movies. His columns appear in March, June, September, and December.

Thanks for reminding us of these two nearly-forgotten examples of CW in the movies: I know several families will now have to suffer through *Fantastic Voyage* while the family ham tests his or her proficiency in CW!

Rachel Baughn, MT Editor

In Recognition

Few publications have a record of long-term employment without staff turnover. Monitoring Times is proud to be one of those. Our Editor in Chief, Rachel Baughn, has just celebrated her 30th year of continued service to MT. The luncheon we gave in her honor was a testament to the high regard we hold for her dedication to quality journalism.

Since MT is just a little over 30 years old, it is obvious that she is also the only Editor in Chief that we've ever had! And that continuity is with good reason.

From the earliest days, when she first responded to our founding ad for someone with clerical skills, Rachel moved up the corporate ladder quickly because of her writing and editing talent. Originally an editorial extension of a Grove Enterprises equipment catalog, MT rapidly expanded into a full-fledged periodical of its own.

Starting as a bi-monthly newsprint, MT was immediately recognized as the first communications periodical that integrated scanning, shortwave, ham radio, and satellite reception into one publication. Rachel saw to it that all of these specialties were covered.

But we didn't stop there. We were the first radio publication to offer electronic editions – MTXpress and our Kindle versions are growing rapidly!

We are very proud of our reputation for fairness, authority, and honesty. While MT is a division of Grove Enterprises, we feature advertising and reviews of competitive services and products that Grove does not carry, a charge to Rachel that she accepts with integrity.

Another unusual feature is the personal attention that Rachel gives to our writers and readers. Every communication received is reviewed, then forwarded to the individual best suited for reply. That's often Rachel herself.

It is with pleasure that we welcome Rachel to her fourth decade of service to the radio communications profession and to the readers of Monitoring Times.

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Columnist Blogs and Web Sites

These blogs and web pages were created by some of our columnists to better serve their readers. While we highly recommend these resources, they are not official instruments of Monitoring Times.

AMERICAN BANDSCAN
http://americanbandscan.blogspot.com/ - by Doug Smith

ANTENNA TOPICS
www.wa5vjb.com - by Kent Britain

BELOW 500KHZ
http://below500khz.blogspot.com/ - by Kevin Carey

FED FILES
http://mt-fedfiles.blogspot.com/ - by Chris Parris

LARRY'S MONITORING POST
http://monitor-post.blogspot.com/ - by Larry Van Horn

MILCOM
http://mt-milcom.blogspot.com/ - by Larry Van Horn

SCANNING REPORT
http://www.signalharbor.com/ - by Dan Veeneman

SHORTWAVE
http://mt-shortwave.blogspot.com/- by Gayle Van Horn

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I currently subscribe to 5 magazines, all of which I receive in PDF format. One of the first I subscribed to was Monitoring Times, owned by (fellow ham) Bob Grove. In addition to offering a reduced subscription rate, those who chose the electronic PDF version contribute to eco-friendly publishing.

- Bob K.

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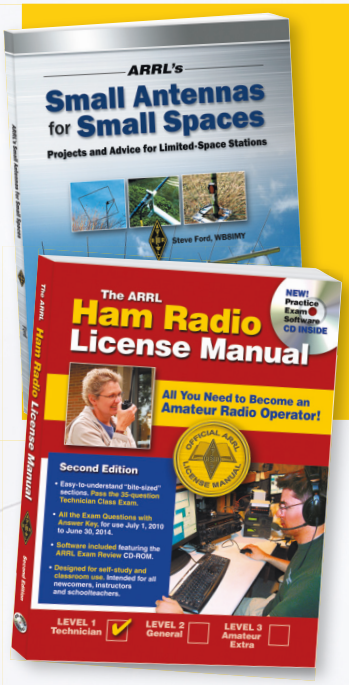

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