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Monitoring Times®

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DXing with Homemade Radios

In this issue:

- The Wild Life and Times of KAAY
- MURS: America's Hidden Citizens Band
- Obsessed by Time and Shortwave

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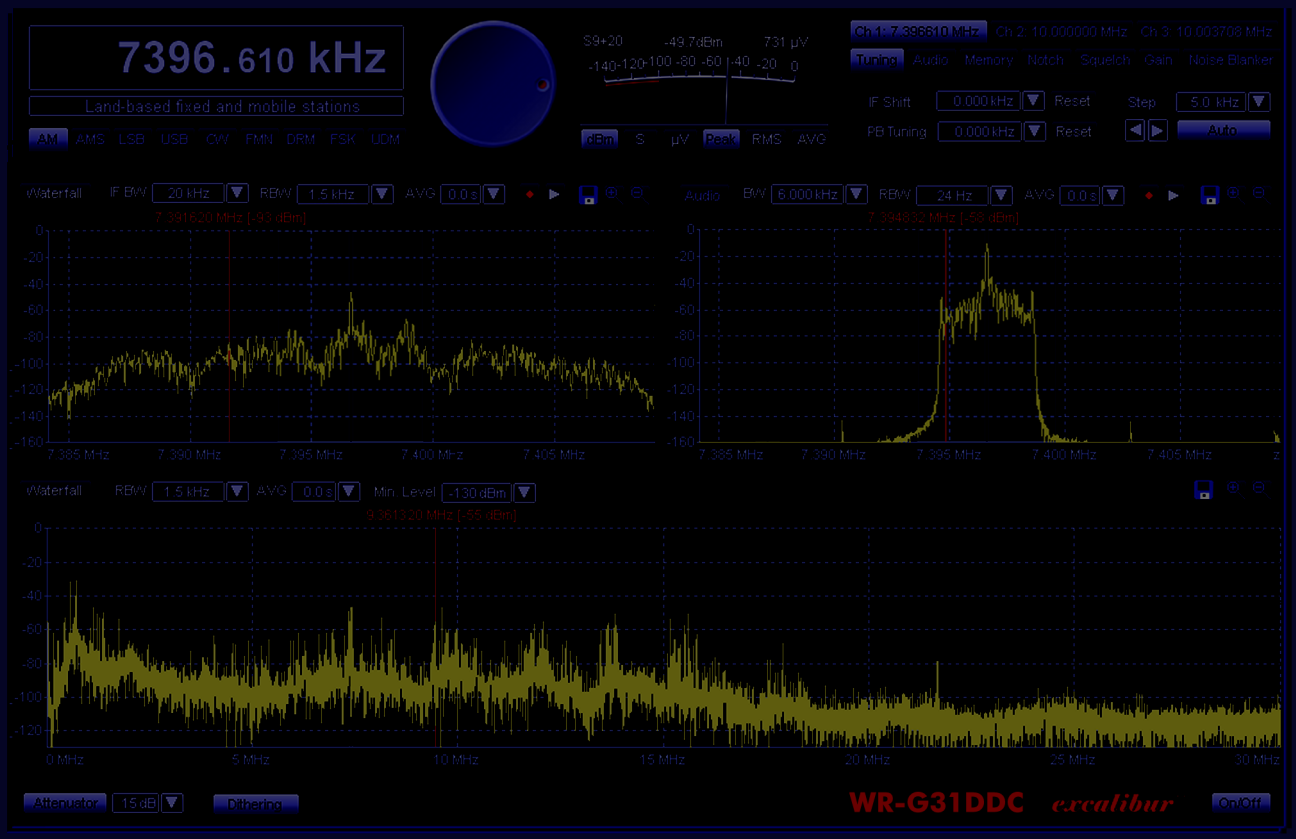

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Monitoring Times

Vol. 29 No. 2 February 2010

MW DXing with Homemade Radios

By Dave Schmarder N2DS

It's February, the perfect month for checking out the AM broadcast band. With long nights, low atmospheric noise and little happening on HF, why not take a look at AM? If you've never DXed the birthplace of American broadcasting, you're in for a treat. But, there's something you should know. There's an art to DXing the AM band. It takes a good receiver, a decent antenna and the finger sensitivity of a safe cracker to sort through the nearly 4,800 stations on the band. There's even more of an art to doing this with a radio you've made yourself.

In this month's cover story, Dave Schmarder N2DS not only shows how to build simple, small homemade radios to tune the AM band, but he shows that these radios can be works of art themselves. Styling his radios after early models from the last century, he uses antique as well as modern parts and the building techniques of a craftsman. And, even if you can't put up a good outdoor AM band antenna, Dave proves there's a lot to hear with a homemade tunable AM loop.

On Our Cover

Against a backdrop collage of many of Dave Schmarder's 100 homemade radios are the front and back of his 7c5 one-tube loctal regerative receiver. (Courtesy: Dave Schmarder N2DS)

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R E V I E W S

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WORLD RADIO TV HANDBOOK

WRTH 2010

We are delighted to announce the publication of the 2010 edition of *World Radio TV Handbook*, the best-selling directory of global broadcasting on LW, MW, SW & FM

The Features section has a fascinating look at the BBC World Service, reviews of the latest equipment, a look back at some classic Cold War receivers, as well as *Digital Update*.

The remaining pages are, as usual, full of information on:

- National and International broadcasts and broadcasters by country with frequencies, powers, languages, station addresses, email, web, phone and fax, leading personnel, QSL policy, and more
- Clandestine and other target broadcasters
- MW frequency listings by region
- International and domestic SW frequency listings as well as DRM listings
- International SW broadcasts in English, French, German, Portuguese & Spanish, listed by UTC
- Equipment reviews, *Digital Update* and more
- A further revision of TV by country
- Reference section with Transmitter Site Location Table, Standard Time & Frequency Transmissions, DX clubs, Internet Resources, and much more

Available December 2009

SOME COMMENTS ON WRTH 2009

World Radio TV Handbook consistently sets the radio hobby standards. It remains the best, most authoritative and comprehensive radio reference book in the world; one that should be in every hobbyist listening post or radio room
– Gayle Van Horn W4GVH, Monitoring Times

There is simply no better print reference for all manner of domestic and worldwide radio and television broadcasts *– Lee Badman, USA*

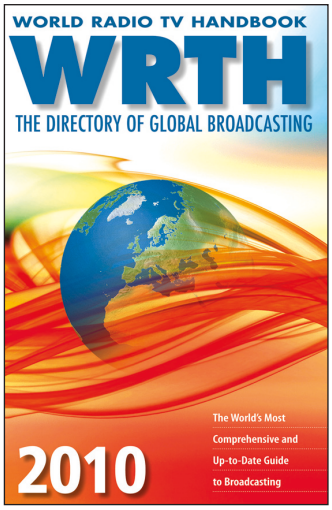
It's hard to see how much more the *WRTH could* be improved. As always, the *WRTH* is highly recommended *– Radio Netherlands Media Network*

I have just received my 2009 edition. Among the other broadcast references *WRTH* still remains the best and most comprehensive
– Hannes Gruensteidl, Germany

It's rare that a publication can fulfill so many needs – insight and information, entertainment, and reference – and so with perfection. Yet that's exactly what *WRTH* manages to do
– William Patalon III, USA

WRTH is very professionally edited and the updates on the internet are highly appreciated
– Anker Petersen, DSWCI

I have just ordered a *WRTH* for 2009 for the first time, and let me tell you: it's great! I've been a ham since 1967, and in all my years NOTHING comes close to you and your *WRTH*. Keep up the good work!
– Marc Manis K5NO, USA



COMMUNICATIONS

by Ken Reitz

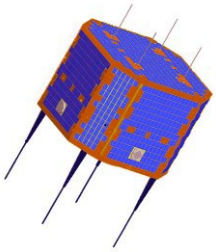
AMATEUR RADIO/SHORTWAVE

Utah Ham Aids Crash Victim

An AP report from Logan, Utah, showcased the use of amateur radio in an area with no cell phone coverage. Using his handi-talkie, a ham was able to work into a repeater and have other hams call 911 to rescue the driver of a truck that had crashed into a river in a remote area of Utah.

Chinese HamSat Launched

AMSAT China announced the launch of XW-1, China's first amateur radio satellite, December 15 from China's Taiyuan satellite launch center. The satellite, flying at an altitude of 1,200 km has a beacon and three crossband transponders operating in FM/SSB/CW and digital modes, according to AMSAT North America.



Chinese amateur radio satellite, XW-1 (Courtesy: AMSAT)

Former Radio Host Charged

The Minneapolis *Star-Tribune* reported November, 24 that Pat Kiley, host of the radio show "Follow the Money," which aired on 200 radio stations nationwide and on shortwave via WWCR, had been charged with operating a Ponzi scheme that allegedly bilked at least 1,000 people out of over $190 million. The report quotes the Securities and Exchange Commission's Chicago office as alleging that Kiley and "self-proclaimed" money manager Trevor Cook, "…went on a $40 million-plus spending spree with investors' money and lost another $40 million in risky currency trading."

BROADCASTING

Say Good-Bye to OTA-TV

Less than six months after the tortuous shift from analog to digital Over-the-Air (OTA) TV that cost taxpayers hundreds of millions of dollars, the FCC is already contemplating another switch. In an effort to find more spectrum space for its wireless broadband initiative, it is essentially looking to what's left of the terrestrial broadcast frequencies for the extra real estate.

Following an industry report that claimed that over-the-air viewership was too small to be protected, and a rebuttal from the National Association of Broadcasters disputing the claim, the FCC has decided to examine the matter. In a Public Notice dated December 2, the FCC asked interested parties to respond in just 19 days to explain what course the future holds for free, OTA TV. One prospect the FCC is considering is the possible move to yet a different digital technology, possibly MPEGII for OTA broadcasters.

HD-Radio Drifting

Meanwhile, despite innovative products such as the "transportable" Visteon Jump and hand-held portable HD-Radio receivers showing up on retail shelves in time for the holidays, without a power increase for current HD-capable stations, public indifference and a lagging economy continue to smother HD-Radio sales.

Visteon Jump portable HD-Radio receiver. (Courtesy: iniquity)

LPFM Gets Congressional Boost

Low Power FM (LPFM) advocates were celebrating at the end of December the passage of a bill, known as the Local Community Radio Act of 2009, in the House that would expand the number of LPFM stations by removing unnecessary protection to unaffected high-power FM stations. The bill, which had been vigorously opposed by major broadcast interests, including National Public Radio, passed by a voice vote in the house and awaits Senate approval, which backers believe may happen by the time this goes to press. Even after passage, the FCC will have to draw up rules for application, acceptance and authorization. There are many technical issues yet to be resolved.

There's also bad news for prior operators of unlicensed FM radio stations. The law, as passed by the House, prohibits "… any applicant from obtaining a low-power FM license if the applicant has engaged in any manner in the unlicensed operation of any station in violation of section 301 of the Communications Act of 1934 (47 U.S.C. 301)."

TV Commercials to CALM Down

Since the very first days of commercial TV, viewers have complained that the audio mysteriously increases to headache-inducing levels whenever a commercial airs. Broadcasters have traditionally swept aside such claims as imaginary. Finally, after 60 years of wearing a path between the sofa and the set and wearing out the mute button on the remote: an Act of Congress.

Yes, it would take an act of Congress to force the broadcast industry to do something about loud commercials. Of course, since the advent of the VCR, DVR, and TiVo™, it's probably less of an issue than ever before. Nonetheless, Congress sensed an issue that just about everyone, regardless of political party, religious faith, national origin or sexual persuasion could agree on.

So, we get the Commercial Advertisement Loudness Mitigation Act. Yes, C.A.L.M. What the Act actually does is instruct the FCC to adopt specific loudness standards within a year. This bill also passed the House by a voice vote.

SATELLITE

Iraqi Insurgents Tap into Drone Videos

In December numerous media outlets reported the interception of U.S. military drone video by Iraqi insurgents using off-the-shelf software costing as little as $26. According to a story in the L.A. *Times* from December 18, the group did so by capturing satellite downlinks of live feeds directly from the planes overhead.

The drones are relatively small, pilotless aircraft flown by remote control that transmit video to satellites as they fly. The downlink is received and processed through special software that allows an unencrypted downlink to be seen on a computer.

The article noted that the program, called SkyGrabber, is Russian designed software for satellite intercepts capable of working on any computer. According to most reports, the U.S. military has been aware of the fact that the unencrypted signals could be seen by unauthorized eyes and that they've stepped up encryption efforts.

Air Force Predator Drone (Courtesy: U.S.A.F.)

EPRB Saves Man from Crocs

A report in Agence France Press told of an Australian man who clung to a tree branch after his boat ran aground while crocodiles salivated in the river water below. He was eventually saved when he finally activated the emergency radio beacon on his satellite phone.

PUBLIC SERVICE

York County Radios Dysfunctional

York County (Pennsylvania) police recently responded to a survey designed to see how well their 911 system from the Harris Corporation has been functioning since it was installed in November 2008. An article published in the York *Daily Record* in mid-December noted that over a year later a lengthy list of complaints had developed. The survey revealed that not one of the officers surveyed were pleased with "…the radio system itself, the management of the radio room or the dispatchers."

According to the article, among the problems noted were that "…police radios continue to not receive and not transmit, and that the emergency help buttons on the radios malfunction." On top of that there were complaints that the system didn't work at crucial times such as alerting of a fire or needing to communicate with State Police during a joint operation. According to the article, Harris would upload new software onto the radios in January.

DHS: No More 10-Codes

The U.S. Department of Homeland Security is trying to standardize on-air communications among police agencies and is doing away with old-fashioned police 10-codes in favor of plain language. Originally intended to make on-air communications brief and understandable, the codes instead have evolved into a complex series of 100 10-codes and 80 signal-codes, according to an article in the Naples (Florida) *Daily News* from December 10. What's worse, codes can take on different meanings from city to city, or department to department, or agency to agency, even within a single jurisdiction.

While many departments may struggle with the switch to plain English, the article pointed out that the Naples police force has used plain English for years without a problem.

Navy to use SDR

An article in *Military & Aerospace Electronics* reported that the U.S. Navy will work with the Raytheon Company to develop software defined radio (SDR) systems to supplement or replace Navy satellite communications. Raytheon will get a $9.5 million research contract to check out the potential. According to the article, the research will be for RF frequencies of 2 GHz and up "…to improve Navy tactical data communications…with or without satellites."

DARPA's Twitter Success

To read the press release for the DARPA Network Challenge, sponsored by the Defense Advanced Research Projects Agency (DARPA), the group sound like a combination of frat-house/nerd-dorm pranksters, but they're actually a think-tank of the Department of Defense. In order to see how youngsters use Internet-based social networks (Twitter, Facebook, etc.), DARPA devised a plan called the DARPA Network Challenge and asked participants to locate 10 ten-foot, red, weather balloons flying tethered in public spaces all over the U.S. Over 4,000 such teams registered for the challenge.

DARPA balloon #10 at Centennial Park in Atlanta, Georgia. (Courtesy: DARPA)

The game was ostensibly to commemorate the 40th anniversary of the Internet, and the winners, a team of college students and one professor from MIT, received a check for $40,000. It took the MIT team less than nine hours to locate all ten balloons. DARPA director, Dr. Regina E. Dugan waxed rhapsodic, "The Challenge has captured the imagination of people around the world, is rich with scientific intrigue, and, we hope is part of a growing 'renaissance of wonder' throughout the nation."

Intrigue may be a good word for it. While college gamers were thrilled at the Challenge, the *Washington Post*, in an article about the experiment, noted the use of Twitter during this past summer's Iranian unrest despite government restrictions on traditional media. DARPA said it will debrief all participating teams as to their method and strategy in playing.

FCC ACTIONS

FCC Needs More Engineers

An article in *The Hill*, a D.C.-based legislative journal, noted that two Senators, a Republican and a Democrat, have introduced legislation to allow FCC commissioners to hire more engineers to look into complex technology issues. Apparently, commissioners now can have only three professional staffers to cover media, wireless and wireline issues.

The report quoted Sen. Mark Warner (D-VA), "Easing restrictions on the number of experts a commissioner can hire will provide the FCC with more tools and information it needs to make decisions." Republican Commissioner Robert McDowell was quoted in the article as saying commissioners, "…don't have engineering degrees – we're liberal arts majors."

National Broadband Plan

The Washington *Post* reported, December 17, on FCC proposals for national broadband plans including options for high-speed Internet access in rural areas of the U.S. by squeezing TV broadcasters for more spectrum to allow future expansion of services to iPhone and BlackBerry-style technology. Nearly all proposals have brought out the natural survival instincts of all parties. No one wants to lose market share.

And, cable-TV interests are among the most defensive. One plan is to allow consumers to buy their own set-top cable boxes. According to the article, a law professor from the University of Nebraska noted that, since customers buy their set-top boxes from their local cable company, "the cable companies control the market."

FCC Narrowing Freqs

The FCC issued a Public Notice December 11 reminding licensees, frequency coordinators, and equipment manufacturers of narrowband migration deadlines in the 150-174 MHz and 421-512 MHz bands. By January 1, 2013 Industrial/Business and Public Safety Radio pool licenses must operate on 12.5 kHz or narrower channels or employ a technology that achieves the narrowband equivalent of one channel per 12.5 kHz of channel bandwidth (voice) or 4800 bits per second per 6.25 kHz (data).

Resort Fined for Bootleg FRS Ops

Westin Kierland Resort & Spa, Scottsdale, Arizona, is a sprawling, green oasis with 732 guest rooms in what would otherwise be desert. It's the kind of place where weekend greens fees in December are $175 for daily play and single-occupancy rooms are $229/night. But, somehow, according to FCC documents, the resort was operating its four-repeater communications network on Family Radio Service (FRS) frequencies, even though neither corporations nor repeater operations are allowed on those frequencies.

The FCC investigated and slapped the owners, HST Kierland LLC., with a $16,000 fine. The resort objected and asked for the fine to be reduced. Despite the fact that it was operating four repeaters without a license, using, in some cases, uncertified equipment and having added external antennas that voided certification and authorization to use those frequencies, the FCC softened and reduced the fine to $12,800, the equivalent of greens fees and one-night's stay for 32 guests.

"Communications" is compiled by Ken Reitz KS4ZR (kenreitz@monitoringtimes.com) from news clippings and links supplied by our readers. Many thanks for this month's fine reporters: Anonymous, Rachel and Harry Baughn, Bob Grove, Bob Margolis, and Larry Van Horn.

DXing with Small Homemade Radios

By Dave Schmarder, N2DS

My interest in radio as a hobby started when I was a mere 5 years old. My father became a radio repairman after the Second World War and I had a lot of curiosity about the objects sitting on his work bench. Having all those radio parts around, and having someone who was willing to explain their purpose, gave me the technical basis that would last me a lifetime.

My dad also had a hobby that turned out to be even more exciting: medium wave DXing. As a pre-teen he (as many others of his day) had an interest in how far away stations could be heard on the family radio. Late at night he would sneak downstairs for a listen. Several years later he bought a new 1936 Fairbanks-Morse radio. This 6 tube, table-top radio had a colorful dial with marks every 10 or 20 kilocycles on it for easy frequency identification. He worked in his dad's pharmacy to buy *RaDeX* magazine and postage to send for QSL cards.

Following World War II, between marriage and raising a family, there was little time for radio. But, after a while it was time for him to take another whack at his teenage hobby; medium wave DXing. I still remember his excitement nearly 50 years ago when, one night, he bagged a Hawaiian station at his listening post in New York State. This memory is hard to erase because everyone in the family heard about it for the next month!

Did all this get me excited? You bet! I was always impressed that my dad memorized the location, frequency and power level of every station he had logged! He took great joy in demonstrating to his friends and neighbors the big, red, loop antenna that he had built. (This antenna surfaces again later in this story.) He would tune to a station on 1240 kHz, for example, and by rotating this big loop antenna, he would null that station and another station in the other direction would be heard. To me, my dad was a radio magician.

QSL card from COCX, Cuba, from the 1930s

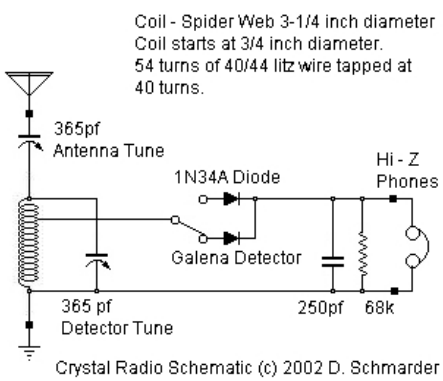
Simple crystal set No. 17

As a teen I built a lot of electronic projects. I built several crystal sets using military surplus parts, connected in all sorts of configurations. Some worked, and some didn't. But it was fun to hear Nashville's WSM all the way from New York State. I learned early that the sweetest music comes from a radio I built myself!

Reviving My Radio Building Hobby

By early 2002, I was well into my career as a counterman at an electronic parts store. One particular event at the store, relating to crystal sets, began the process of my revived radio building hobby. A parent and his child walked in the store and wanted information about crystal radios for an upcoming science fair project. That caused me to think of my happy childhood days building radios. I wondered if it would now be as fun as it was the first time around. In a word, the answer is, "Yes!"

Right away I built my first crystal set as an adult. Since I had learned how to write web pages, I thought it might be nice if I posted information on the net about my radio. Perhaps others might become interested too. Originally, I was just going to make a few radios, but this time, they had to look nice. I had seen examples of beautiful vintage radios, and I knew then that I was going to build mine like those. By my 5th or 6th set, I had accomplished this goal. But, how about those spare parts I still had? Well,



Crystal set No. 17 radio schematic

I would build "just one more" radio. Flipping ahead to the present, I am now up to 76 crystal sets and nearly 30 tube radios. So much for self restraint: I am a radio building addict!

Building a Great DX Crystal Set

By now, the bug had bit and I began to think about building some "real DX" crystal sets. But, for a DX radio, the old way of winding magnet wire on a paper tube and using hobbyist-grade tuning capacitors was not going to cut it.

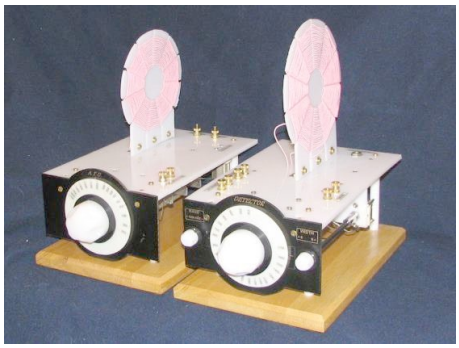
Several years before the turn of the century, builders began using *litz* wire with high wire strand count. A common example of this is the 660/46 litz. This special wire has 660 insulated strands of 46 gauge wire all woven in such a way to bring high efficiency of the wire. This litz wire has diameter the size of 18 gauge wire, or about 0.055 inches. Due to the high frequency "skin effect" around each wire strand, this litz is equal to a conductor 3 inches in diameter! This makes extremely efficient coils. Since crystal radios derive their power solely from the energy radiating from the transmitting station's antenna, having the highest efficiency is a must.

Other recent improvements in new crystal set designs include using very high quality variable capacitors. These have ceramic insulators on the fixed plates, silver plating on all the plates, as well as very high quality wiper arms, which connect the moving plates to the capacitor frame. Also, very sensitive balanced armature headphones (also called sound powered phones) are

now commonplace. High quality audio matching transformers finish the job, sending the audio to the headphones.

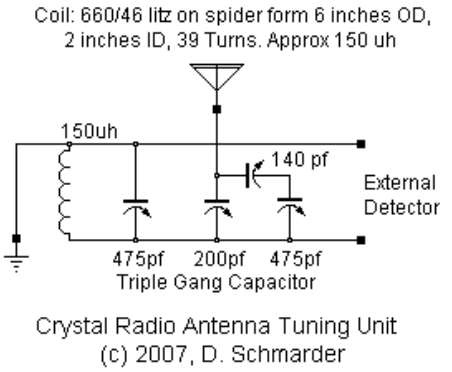
Back in the 1920s, a good crystal set might have a 25 mile range. The stations transmitted with much lower power and crystal set design was in its infancy. The modern DX crystal set now has a night-time range of more than a thousand miles.

An example of a modern DX crystal radio is my #66 set. The two platforms (antenna tuner and detector unit) can be moved so as to optimize the coupling distance between the antenna and detector coils. Being able to adjust this spacing boosts the performance greatly.



DX crystal set No. 66

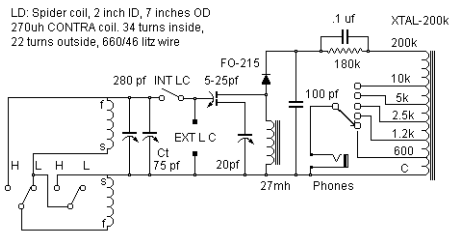
In designing and building my sets I relied on other researcher's websites, such as one written by Ben Tongue. He is the retired co-founder of Blonder Tongue Labs in Old Bridge, New Jersey. Ben's website (**http://bentongue.com**) is packed with technical details on crystal radio design and it's a must read for high performance crystal radio builders. I picked up tips and received encouragement from other builders on the builder's forums as well.



DX crystal set No. 66 antenna tuning unit schematic

My #66 radio has a detector diode best suited to match the other components, as well as a special high impedance audio transformer to match sensitive headphones. I didn't forget the mechanical design, such as one (or even two in tandem) vernier reduction drives. The frequency calibrated dials are standard fare on my DX radio receivers.

With my DX crystal set, over a 10 day listening period, I heard 100 more stations than I heard on an earlier, simpler radio. Some of the stations I struggled to hear on my early radios are now considered the low hanging fruit with the big DX radio.



DX crystal No. 66 set detector schematic

Loop Crystal Radios

Crystal radios usually require outdoor antennas to hear DX. But how about a crystal radio connected to an indoor loop antenna? I hadn't thought about it until a fellow DXer started using one. I thought this was like DXing with cotton stuffed in your ears.

I like challenges too, so I converted my father's DX radio loop antenna into a crystal radio DX loop. I don't think my dad would have minded me fiddling with his loop antenna. With the loop, 33 inches on a side, swinging in my living room, I've heard 49 stations. That is three more stations heard than with my first crystal set entry a few years before. Wow, there has to be something to this!

That year I came in second place in a receiving competition, and if I didn't plan to have to endure the shame of coming in second again, I knew I had to upgrade this radio. So, off came the 20 gauge machine tool wire and on went some large litz wire. The audio matching transformer was upgraded also. I had fire in my belly for this contest.

As it turned out, I won, but by only one station. I heard and identified 93 stations! It turns out; the other guy had also improved his radio. I can tell you that there is quite a challenge logging stations on a passive receiver, and even more challenging when the antenna is indoors.

"Active Device" Homemade Radios

Tube and solid state radios take a different approach than their passive crystal set cousins. With active device radios there is amplification when power is applied to the circuit. The first radios that were amplified used vacuum tubes. These early twentieth century devices found their way into radio designs, first by Major Edwin Armstrong. Tubes became the mainstay of radio, both transmitting and receiving until they were unseated by the transistor starting in the mid-fifties. Tubes are now mostly a curiosity for hobbyists though they're still the king of the high end audio enthusiasts.

The semiconductor is now what brings the music to most listeners via the airwaves. Semiconductor devices too, have found their way into the hearts of the homemade radio builders. The components are very inexpensive and easy to use.

The AM radio of today has integrated circuits with hundreds of transistor devices contained in its little plastic shell. This means there is a lot of voltage and power gain. With this gain it is possible to have a very small antenna built inside the radio. The sound volumes are good, sometimes covering a street with deafening sound. This is due to all the gain of the circuitry. The signal comes in at micro volts of radio frequency energy and comes out as watts of sound power.

Building a radio with one tube or transistor requires special considerations. Specifically, you aren't likely to hear much without an external, outside antenna and you can forget the speakers: sensitive headphones are needed here. So, by improving the antenna and reducing the audio requirements, a radio that will hear distant stations can be built with one tube or transistor. The

One tube DX radio.

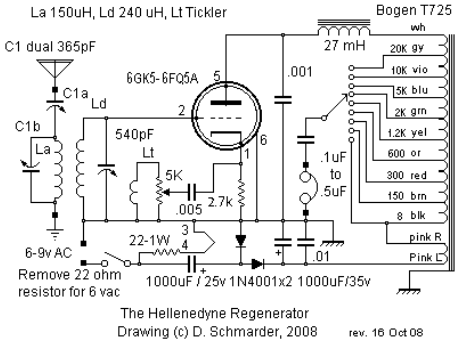
performance is surprisingly good too.

There is another trick that makes the little radio work so well and that's called *regeneration.* This is a largely forgotten radio technique, except by us small radio builders. By taking the weak signal, and with careful control, reintroducing this amplified signal back to the input, a very high amplification factor is achieved. By "turning up the regeneration" to the point just before oscillation, the highest amount of amplification is reached. With this method, even a simple one stage radio can hear great distances.

There are some examples of simple regenerative radios, using both a tube and semiconductors, shown. My little radio uses a small tube, originally made for a television set. The signals come in via the antenna; the coils and tuning capacitors decide which signal makes it to the tube. There is a small coil, called the "tickler" (Lt) that takes a portion of the signal that has been amplified and returns it to the input. There is a resistor control that determines how much signal gets passed back. The tube also helps to remove the carrier energy and separates the audio energy for transfer to the headphones.

Solid state radios built with transistors or field effect transistors (FET) are popular with many homemade radio builders. I am hooked on tubes, just as others are on the solid state devices. A good example of a single FET radio was built by Dan McGillis, WB3KBW in Pennsylvania. He chooses the bread board approach of making radios. He can do quick experiments to see if he can improve on his radio. When the contest starts, he uses what he has as his contest entry.

A few of us have built one tube super-heterodyne radios. This is the more modern type of radio receiver design. There are no adjustments that will cause the radio to start squealing as with the regenerative types. You just tune to the station, just like you do with your kitchen radio,



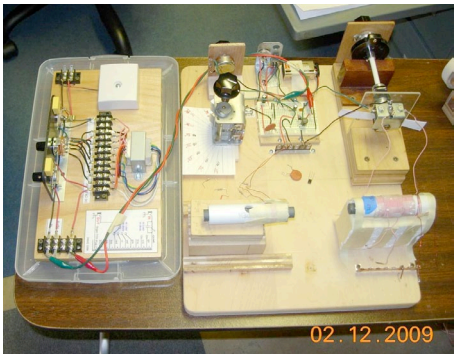
One tube DX radio schematic.

though headphones are still a requirement.

Others have built more exotic sets that combine regeneration, reflexing (using the same tube or transistor to amplify the radio frequency and then the audio frequency) all in a superhetrodyne circuit! These are electronic objects of art!

The Contests

As I assimilated into the community of radio builders, I learned that a yearly homemade radio contest is held in the fall and winter, sponsored by the Birmingham Crystal Radio Group in Alabama. The winter contest this year will be their seventh *[held this year between January 15 and March 15-Editor].*



Single FET contest receiver. (Courtesy: Dan McGillis WB3KBW)

By the time I was set to enter their next contest, I had already built 20 sets. I elected to enter my #17 set as my first contest entry. According to the rules, this was a "hobby class" entry as it was a simple radio. More complicated and better performing radios were automatically pushed in to the open class. With my hands gingerly placed on both tuning capacitors, I nudged the variable capacitors back and forth trying to pick out the stations. I did this for ten evenings. I knew about some of the stations, mostly the flamethrower 50kW ones. By the end of the contest I heard 46 stations. I was proud of my score. But that was only my beginning.

A few years later contest rules expanded the field to include radios with more active devices but the multiplier was reduced. Since I felt that I only needed one active device, I would go for the points by using a single tube radio.

There are two websites that sponsor these homemade radio contests. The oldest one, which I have already mentioned is the Birmingham club's contest site, **http://crystalradio.us**. They started with crystal sets with emphasis on extra points for kid builders 16 or younger. If you are using a genuine galena detector or pyrite, there is a multiplier for that too. There are also extra points if you built your radio with all homemade parts.

There is a point calculation based on the distance you are from the station vs. the amount of power the station uses. Your points go up as the distance increases, but go down based on the station power level. This is supposed to represent a fair amount of points awarded based on the receiving difficulty.

The other contest started a few years ago. All types of homemade radios may be entered. There are very few rules and only the cumulative number of stations received is counted. The emphasis of this contest is more about the radios that different people have built, rather than the score. This contest is held during the summer. The radio propagation isn't great at that time of year with higher static levels, but that is what gives this contest special appeal. As an encouragement to participate, pictures of the radios are published at the website, as well as their contest logs. The contest rules and past entries are shown at **http://theradioboard.com/radiocontest** .

Entering the Competition

Entering a contest is easy. There is no pre-registration. Just start listening and writing down what you must to enter. When your data is all ready, just e-mail it to the committee. The identification process is more relaxed than in typical DX logging. Not all stations identify often. Being in a limited time span contest and waiting for the top of the hour legal ID is frustrating. But if you hear a local commercial with a town mentioned, or a phone area code, you can be fairly sure of the station that you hear.

I have also signed on to the Internet to see if there is an audio stream for that station online. The audio can be compared with what you hear in your headphones, of course taking into account the delay of the internet. If there is local content, this can nail down the station heard. Other websites also help with the identification as well as the point score calculation.

Do you prefer DXing on the shortwave bands? All the contests accept shortwave DX entries too. There are contestants who listen only to the ham bands. Most of those people are hams themselves and have a good knowledge of the bands as well as the art of Morse code. The opportunities are many and the contest committees do their best to accommodate all the requests.

Getting Started In Home Brew

Building your radio is not super difficult. Look around the net for a suitable radio to make. I suggest looking at the radios on my hobby website, **http://makearadio.com**. If you find a design that suits you, then start looking for the parts. If gathering parts is too difficult, there are a number of kit makers that offer entry level radios. One vender is Peebles Originals in Vancouver, Washington (**http://peeblesoriginals.com**). Kits can be improved by adding vernier drives, audio matching transformers, as well as sound powered headphones. Many of the parts can be found in online shops or the auction venues.

Which radio you build from scratch should depend on your radio construction abilities. In the case of a crystal set, try a simple design first and work your way up to a big DX set. If you use modular construction techniques, you can improve one section at a time. Some people buy an expensive audio matching transformer and build it in a separate box. This way the transformer can be moved from radio to radio.

Your outside antenna can be modest, but you have to make sure you keep the wire away from the power lines, and try not to fall off the ladder while erecting your antenna. I use a 120 foot wire strung as high as I dared to put it.

So, if that microprocessor controlled, quad-conversion with Digital Signal Processing, LED readout, and every other bell and whistle a receiver can have, that may have cost you your credit rating and perhaps your marriage, now bores you, try DXing with a simple homemade radio. Enjoy the old days again!

Websites mentioned in this article:

http://www.makearadio.com/
My main homemade radios website.

http://makearadio.com/crystal/66.php
A true DX crystal radio using premium components.

http://makearadio.com/crystal/17.php
A simple single coil crystal radio. Great for beginners. This radio can be upgraded.

http://www.makearadio.com/loops/loops3.php
My MW loop antenna, converted to a dx crystal radio.

http://www.makearadio.com/tube/h-dyne.php
Single tube contest regenerative radio.

http://theradioboard.com/radiocontest/
Summer RadioContest site.

http://theradioboard.com/rb/index.php
The RadioContest forum

http://crystalradio.us/
The Birmingham Group contest website.

http://peeblesoriginals.com/
Tube and crystal radio kits available here.

http://www.makearadio.com/qsl/index.php
My father's QSL card collection. This is where the Cuban card came from

http://bentongue.com
Ben Tongue's site. The best place to learn technical details about building DX crystal sets.

Author's disclaimers: I am the sole owner and operator of my website, makearadio.com, dedicated to building small radios and other electronic devices. I built, but don't operate, the crystalradio.co.us website. I received no compensation for this work as the owner is a friend. I am the owner of the theradioboard.com website including the forum and contest website. I built and actively operate peeblesoriginals.com., without compensation as Mike Peebles is a friend of mine.

The Friendly Giant: KAAY, Little Rock, Arkansas

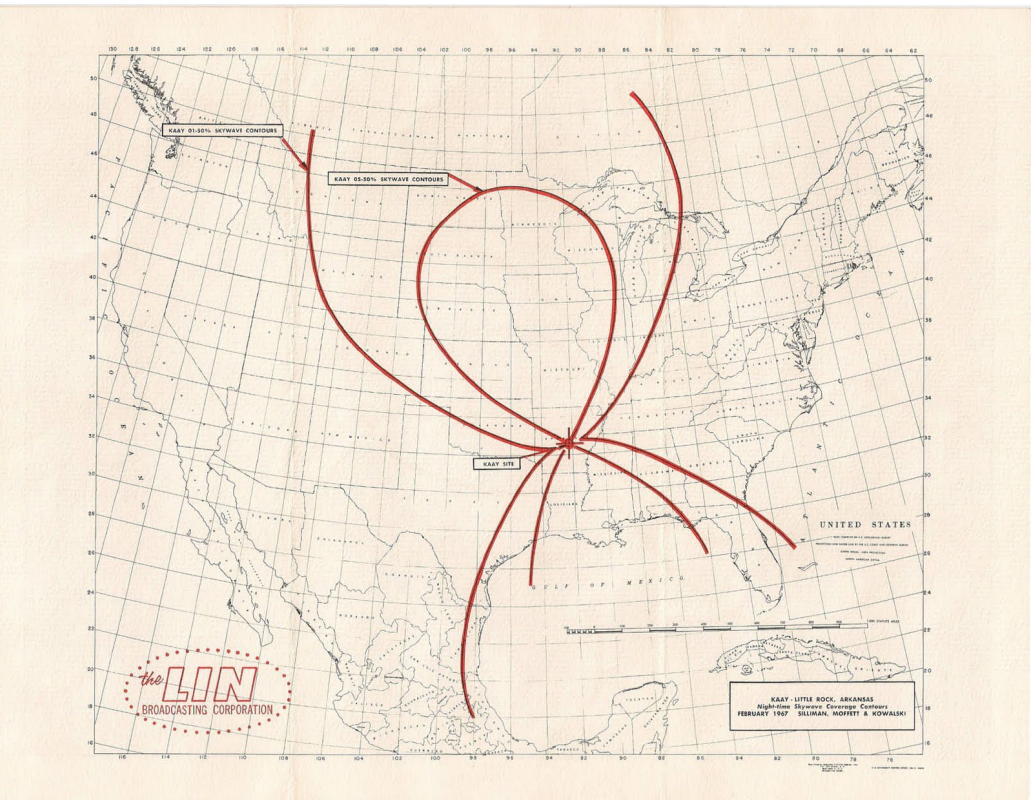
By Bud Stacey and the "Mighty1090 KAAY.blogspot.com Gang"

How many of us have tuned across the AM radio band in the evenings only to stop when something special caught our attention? Imagine hearing a station with limited and compressed audio playing Henry Mancini's "Baby Elephant Walk," a Top 40 hit in 1962, over and over again. With a booming voice, the announcer read names out of the Little Rock, Arkansas telephone directory; spots were aired which gave a hint of something even more exciting to come.

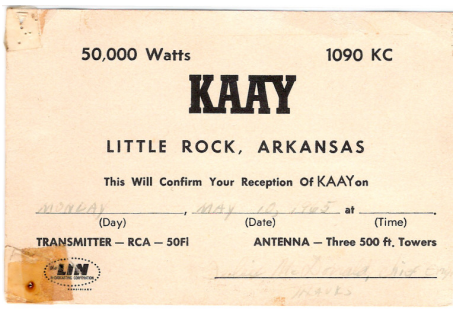
Wait a minute! This was 1090 kilocycles, where good old KTHS used to be. This station sounded as if it was local, but it couldn't be, because it occasionally faded and became distorted. It was Labor Day weekend, 1962, and we were invited to tune in again on Labor Day morning to hear a big surprise. It was the big, new, brilliant sound of ten-ninety, KAAY!

One might wonder what was so special about KAAY. Many 50,000-watt stations claimed to be mighty, but this station was more than mighty. KAAY also claimed to be "The Friendly Giant" and indeed they were! This powerful, popular, and proud station was more than just exciting; it was fun. Many stations targeted just one primary audience, but "The Friendly Giant" had something for almost everyone. If a program seemed uninteresting, one could count on something to reach out and grab his or her attention during the next programming segment.

It wasn't just rock-n-roll. Most youngsters would typically switch frequencies when they heard the beginning of a newscast, but KAAY made them want to stay tuned. There was a block of religious programming during the evenings, and many of us didn't change frequencies, because we knew something exciting would be happening next. As a result, many of us actually learned something about life. So, how did this all begin?



The 50 kW, clear channel signal from the Mighty 1090 of the 60s and 70s was (and still is) huge and listeners responded. The station collected and catalogued listener responses over a six week period from January 27 through March 7, 1964 counting a total of 14,437 cards and letters that were received during that period from 40 states, 11 countries and one U.S. Naval vessel at sea! (Map Courtesy: Richard Robinson)



KAAY promotional card (above) and QSL card (below). (Courtesy Ron Henselman and Ken Reitz)

KTHS to KAAY

KTHS came on the air in 1924 and originally stood for, "Kum To Hot Springs," where it was originally located. Fast forward to Little Rock on Labor Day weekend, 1962, with the DJs, newsmen and other staff reading the names from the phone directory over "Baby Elephant Walk." They did this in shifts, in the manner of, "This is (DJ's air name), and Big K would like to welcome Joe. K. Smith of 902 North Pine Street to The Friendly Giant!" Jim Hankins, a.k.a. Mike McCormick, had this idea. Along the way, "teasers" were interspersed in between the greetings to listeners who included a young Ron Henselman who remembers these teasers and stayed up really late listening to what would happen next. At 6 am Monday, September 3, 1962, KAAY officially took to the air.

The competition at KXLR-AM was scared out of their wits, according to A. J. Lindsey, who later became the second "Doc Holiday" and later, "Emperor Holiday"...more about him later. They knew there were some heavy players coming to town and wondered about their immediate future. As A. J. mentioned once in an interview on Tony Warner's *Timeless Tracks*: "...the later it became and the more we listened, the more we drank and the more scared we got!"

Shortly after coming on the air, KAAY voluntarily lent its services to the United States government. Due to its nighttime directional pattern, it blanketed Cuba, so the station broadcast Voice of America propaganda in the evening hours, during the Cuban Missile Crisis. Other stations also lent their time as well, at the request of the government (see sidebar).

The original line-up started with an early-morning drive-time DJ known as "Doc Holiday" (who was actually Dub Murray, the first to use that moniker at KAAY) from 6 until 9 am; Mike McCormick (Jim Hankins) was mid-morning, 9 am to noon. Following that was the first Sonny Martin (Wayne Moss) until 3 pm. Buddy Carr (who was actually Tom Bigby and the station's first music director) did the afternoon drive time show "Carpool Party" until 6 pm. There was a religious block from 6 - 8 pm, and then Rob Robbins (Tom Campbell) took over until midnight. From midnight to morning, Ken Knight (Howard Watson), a.k.a. "The Weird Beard," reigned.

Also, unheard-of at the time, KAAY employed two newsmen, John K. Anderson and George J. Jennings. The first Manager was Tom Bishop, followed by Len Carl in 1964, who also later became the vice president of KAAY's parent company, LIN Broadcasting; following him was Pat Walsh in 1966. Pat had previously been a salesman, but worked his way up to general manager.

There's an interesting fact about the KAAY DJs' names: they were the actual names of the LIN Broadcasting board of directors! These names were "recycled" as one DJ would leave and another came on. To keep listeners from becoming confused with differing voices, the last name of the departing DJ would go to the bottom of the list. As another DJ came on months later, they would be assigned the next name on the list. Listeners would think, "Hey so-and-so is back!" Later, Dale Seidenschwarz was given the name "Clyde Clifford," the name of LIN's comptroller, Dale still uses that name today.

By the way, "L-I-N" stood for the cities of Louisville, Kentucky, Indianapolis, Indiana and Nashville, Tennessee, markets in which they had stations. In a few instances, when a DJ again became employed by KAAY and their original air name was taken, they'd use their own name; one example was Wayne Moss, who was a "Sonny Martin," but came back years later and used his own name.

Posters, bumper stickers and buttons are just a few gimmicks radio stations used to promote listenership. Most such items have short lives, but KAAY listeners saved theirs for over 40 years. (Courtesy: Ron Henselman and Bud Stacey)

DJ Bill Edwards mans the KAAY "Funmobile" at a broadcast remote. (Courtesy: Bud Stacey)

A Varied Format

KAAY was not just rock-n-roll. It was a "split format" station. Their Top 40 format was driven mainly by listener feedback. There were farm reports and the aforementioned evening religious block. There was always some sort of contest going on, most times, two at a time!

KAAY also broke the rules regarding normal news formats by having about a seven-minute segment at quarter to the hour ("First at: 45!"). Later, this was also expanded to include headlines at quarter after the hour. In this way, KAAY scooped the competition, which normally broadcast the news at the top of the hour.

Later, in 1966, Beaker Street, the "underground music" program of KAAY began, breaking another barrier: long cuts of rock, blues and other music not normally heard anywhere else! Also, according to Jonnie King, a unique show, "The Breakfast Serial" (based on classic Golden Age Radio shows) began as a morning feature around 1971-72, with Sonny Martin and George Jennings. Jonnie created a new version of "The Breakfast Serial" in 1973, and this version has become a cult classic, having been in syndication since 1976 in many markets around the U.S. It continues today with its own website: **www.serial.thewwbc.net.**

Clyde Clifford was an engineer as well as a DJ, so he was able to broadcast the highly successful Beaker Street show from the transmitter site in Wrightsville, Arkansas, about twenty miles out of Little Rock. Clyde played weird background music under his voice to mask the noise of the transmitter's cooling fans. He first used Henry Mancini's music from the dream sequence of the movie *Charade*, then later *Cannabis Sativa* by Head for this purpose.

The length of the program varied, but eventually went from 11 pm until 2 am, when Beaker Theater, an hour-long mystery radio show, aired. After this "theater of the mind," Clyde would return to regular programming until 6 am. Clyde left when Beaker Street was discontinued, but the show was resurrected at times with different DJs, such as Stuart McRae, Tom Roberts, Ken Knight and Don Payne, who was the very last DJ to air the program.

There were two deep-voiced announcers opening Beaker Street: Tom Perryman and later, Gary Gears. They had amazingly deep, rich voices. In fact, Pat Walsh utilized Tom many times over the years in advertisements and announcements of all types. Many describe Tom

TALES FROM THE KAAY TRANSMITTER SITE

KAAY used an RCA BTA-50F transmitter and was noted for their on-air sound, about which former engineer Dave Montgomery noted, "Much has been said about the 'sound' of KAAY. We worked very hard to get it right and keep it right. Chief engineer Felix McDonald, my boss, kept the transmitter in as good of shape as a new one, and every year at Proof of Performance time, the ol' RCA-BTA50F gave us flat frequency response, low distortion, and a full measure of output at +100% modulation. What a sweetie she was!" Montgomery also noted, "The ceramic tube sockets are about the size of a toilet."

The KAAY transmitter site, built on the location of a former hog farm, was itself legendary. It is said that there was a grave within the enclosed three tower array that accounted for several ghostly events and sightings. KAAY engineer, Dave Montgomery, shares just a little of the flavor of what it was like off-air and behinds the scenes, back at the transmitter site:

"When we were installing the new ground system, we were working right at the base of the towers, which were very hot with RF. The two end towers, even de-tuned for daytime operation still had significant induced RF since they were only about 500ft away from the 50kW center tower! So the towers were a potential lethal shock hazard even though they were not being directly driven by the transmitter.

"To 'safety' the tower, there was a buried copper cable, about size '000' that had a crook in the end. We would take the crook end and hang it off the bottom of the tower to insure it was properly grounded and then safe to work around. (It messed up the daytime pattern when we did this, since the tower would no longer be properly detuned, but that's another story).

"On more than one hot summer afternoon, a typical thunderstorm would build in the distance and begin rumbling in. We wanted to work as long as we could, but we also wanted to be away from the towers when the lightning began to fly around. We didn't keep a portable radio with us, but we did want to hear the weather forecast. Well, the weather forecast was always right after the news at the top of the hour, so we would watch the clock to know when the next weather forecast would be on the air.

"At the right moment, Felix [McDonald] would un-ground the tower and hold the crook of the grounding cable close enough to the tower base to draw a small arc. The flame of the arc was modulated RF, and we could plainly hear the weather forecast in the flame of the arc! Audio from fire!"

as being *the* voice of KAAY. Tom was never officially employed by KAAY, but was part of LIN Broadcasting in Louisville, Kentucky. The complete role of Gary Gears is unknown.

KAAY was involved in as many community events as possible. Jerry Sims, the second "Sonny Martin" from 1962 to 1967 volunteered to attend some of these events. Before a parade, he won a bet against A. J. "Emperor Holiday" Lindsey and so got to ride a flying saucer in the parade, with A. J. towing him. Jerry mentioned to me, "...the thing had to be towed because, due to the slope of the street, it kept drifting into the crowd!" This flying saucer was akin to riding a wheel-less round vehicle with a huge lawnmower engine driving an even bigger fan blade, raising it up over the street a couple of inches.

Another time, he broadcast from a sailboat at the entrance to the State Fair; Jerry also mentioned, "KAAY gave away so many goodies, the fair officials vowed to never again let them put it at the entrance!" These were only two of many events. Often KAAY took its "Funmobile," in its various incarnations, to do remote links back to the studio from the promotional events. I personally remember them broadcasting during "Toys for Tots" rallies over numerous years.

KAAY also had its own basketball team, called the "KAAY Kommandos" and they played all over the state, in support of charities. Their comedic nature even came forth on the court. A.J. and Charlie King, a later "Sonny Martin", also mentioned on *Timeless Tracks* that the Kommandos were "a poor-man's Harlem Globetrotter team," and that they "stole all of their material – at least what we physically could do!" A.J. mentioned that Walt Sadler (Ron Owens) once grabbed the ball... and dribbled all the way down the court, yelling at the top of his lungs and went right out the door, into the parking lot!"

The RCA Transmitter

KAAY's transmitter was a tweaked and tuned monster on the airwaves! It was no wonder that they later called the station "The Mighty Ten-Ninety!" Chief Engineer Felix McDonald, Eddie Graham, Dave Montgomery and a host of other engineers lovingly tended this 50,000-watt "blowtorch" from RCA. Felix knew that transmitter like the back of his hand. He and his staff kept it in tip-top shape and made absolutely sure of its performance and also that of the audio chain and antenna system.

With this amount of power, clear-channel (not to be confused with the company by that name) stations had to be absolutely sure they didn't interfere with other stations on the same frequency – in this case, XERB to the west and WBAL to the east. To be sure, KAAY was heard all over this hemisphere, in 40 states and 29 countries!

Later, when KAAY was sold again (LIN originally sold to Multimedia, then to Citadel) to become a Christian station, on the last day of the rock-n-roll era, the old RCA transmitter was employed one last time and it sounded as if it never missed a beat. Clyde Clifford broadcast on the last hour of the last day with a one-hour

KAAY DJ Jerry Sims, known on-air as Sonny Martin, adrift in the USS Emperor Holiday atop an entrance to the Arkansas State Fair in 1963. Jerry Sims: "The appearance was a big hit and lots of fun. As always, we had our set of unforeseen problems. Hurriedly put together as it was, we did not have a sail. Some local ladies sewed together enough sheets to make a sail, and we painted the big KAAY on it. The sail helped cause our biggest problem. Ya see, the boat had to be built up on a wooden frame. I had a ladder to climb up into it in the rear. Then when the north wind came, the sail caught it enough to nearly blow boat and skinny DJ into an anxious crowd. Engineers quickly came out to cut holes in the sail. I later took down the sail when the wind blew so hard that the whole frame lifted in the rear. The whole promotion was a great success, so much so, that the Fair said 'Never again.' We kept the entire entrance stacked up." (Courtesy: Jerry Sims/Sonny Martin)

KAAY DURING THE CUBAN MISSILE CRISIS:

Broadcasting U. S. political propaganda from Arkansas to Cuba
By Richard C. Robinson, Ph.D., University of Tennessee at Martin

In October 1962, the United States came close to nuclear war with the U.S.S.R. during what was called the "Cuban missile crisis." President John F. Kennedy wanted the United States Information Agency (USIA) to get his message to Cuba in what became the first time in U.S. history that private commercial radio stations were utilized to carry propaganda programs for political purposes to a foreign country. Seven medium-wave commercial radio stations would broadcast during the crisis on Monday, October 22, 1962. One of those stations was KAAY in Little Rock, Arkansas.

Kennedy planned to address the nation and thought it vital that the Cuban people hear the position of the U.S. government. The problem facing the USIA was that the Voice of America (VOA) could reach Cuba only on shortwave frequencies, but 90% of Cubans did not own shortwave receivers. Both Donald M. Wilson, deputy director of the USIA, and VOA Director Henry Loomis knew that commercial AM 50,000-watt, clear-channel stations with north/south directional antenna patterns would be the only way to blanket the island with radio coverage.

Wilson wanted to request that the identified stations turn their facilities over to the U.S. government during the crisis so VOA programming could be heard in Cuba. Kennedy met with Wilson and the rest of his executive committee on Sunday, October 21, 1962 and approved the plan. The White House communications director arranged for direct, continuously open, telephone lines to the selected radio stations. The White House arranged for installation personnel from AT & T to go to the stations and install a line, without management's knowledge, in secret.

By arrangement, President Kennedy's press secretary, Pierre Salinger, called station managers beginning at six pm. Kennedy's speech was to be delivered one hour later. Salinger told station executives this was a matter of national emergency and he was speaking on behalf of the President. When told telephone lines had been installed at each location, every manager agreed to cooperate and Loomis gave instructions on how to hook up. By seven o'clock, when President Kennedy began speaking, the stations turned off their programming and aired the Voice of America live. They continued to air this programming for four weeks. Since the federal government, which has regulatory control over broadcast radio stations, was demanding the use of their facilities, the participation of the privately owned stations had to be entirely voluntary.

KAAY's Role

On the day after the Cuban missile crisis period began, KAAY program director James M. Hankins walked into the studios of the station around seven that morning. Jack Grady, a reporter for the station jumped out of the newsroom, holding an Associated Press release that had just come over the wire service to the station. Anderson said, "Look what's going on!" The release stated that the government had gone to a number of radio stations, primarily on the east coast of the United States, and persuaded them to broadcast programming during the night in Spanish to the people of Cuba.

When Hankins read the release, his first thought was "Why in the hell didn't they call us?" Hankins knew that KAAY, with its 50,000 watts, clear channel frequency and directional nighttime antenna, would reach Cuba easily. Hankins called the USIA in Washington, D.C. He spoke with Carl T. Rowan, the African-American journalist, who worked for the agency at that time. Rowan said there was no listing for KAAY. Hankins realized that the official's station list had not been updated to reflect the new station. "They had made a mistake by thinking that KAAY (formerly KTHS) was off the air," KAAY newsman George Jennings later recalled.

Hankins told Rowan, "We're putting a signal across Havana like you wouldn't believe." Rowan replied that he would have a "class A line" to the station within 15 minutes. In those days, getting a telephone line of that quality installed in a radio station could take up to two weeks. Hankins tried to contact the president of LIN Broadcasting, the corporation that owned KAAY, but the company president was out of town and unavailable.

Jennings also recalled that Hankins almost got fired because he unilaterally made the decision to do it, without consulting management. On that occasion he had to appeal to the higher-ups, in order to keep his job, but he ultimately did lose it a year later. The episode nearly killed his career at the time. One of the KAAY disc jockeys, Wayne Moss, said, "He (Hankins) came up with the idea." Disc jockey Tom Bigby recalls sitting in the studio on the evening of October 25, 1962. Agents from the Federal Bureau of Investigation came in and ordered him to leave. From outside, he began to hear programming in Spanish.

KAAY received newspaper coverage for its efforts during the crisis. The radio station also used their role in the Cuban missile crisis for promotional purposes. Announcements were generated and run on the station and other printed advertisements were distributed, designed to impress advertisers of the station's coverage.

President John F. Kennedy honored station executives on December 4, 1962. KAAY's manager was there to receive the award for the station. KAAY became the dominant radio station in Arkansas, and at night throughout the Western Hemisphere. But early in the station's history, it played a key role during the Cuban missile crisis by carrying the American message to the Cuban people.

Beaker Street, not from the transmitter site, as before, but in the studio and, this time, someone else ran the control board for him.

The Last Day

David B. Treadway, the last "Doc Holiday" brought as many of the former DJs and others together for one last broadcast as the switch was made from rock and roll to Christian. This was an all-day affair, with memories shared and music played from the 1962 to 1985 era. One of my close friends, and a fellow Beaker Street fan, remembers tuning in after 11pm, settling down for the evening, when he heard Clyde sign off for the last time at midnight; then, he heard what he thought was country music, which was actually gospel music.

Many folks came and went at KAAY. It was said that manager Pat Walsh had a big heart and would take DJs back twice, even three or more times, but not if they went to another station in the Little Rock market.

There was something about KAAY: the folks there had loads of fun, there were no huge egos to battle and all were like family. DJs from later years, such as David B. Treadway, express their awe of the earlier DJs and even of his peers like Phil North and Jonnie King, among others. Being a listener, I was in awe of them too, but this insight shows the closeness of this unique station's employees.

KAAY defined an era, not only in music, but also of breaking barriers and regularly accepted practices. More than once, a DJ would say something over the air and Pat Walsh would run down the hall, confirm what he heard, and then say, "Keep saying that!" He gave the DJs the freedom to be inventive.

I am honored to be associated with some of the greats of KAAY: Hot Scott Fisher, Jonnie King, Phil North, Jerry Sims, engineer Dave Montgomery, Tom Perryman, newsman Lee Frank, manager Dick Downes, Mark Larson, Don Payne, Bob Nelson, Jim Harvill and the late A.J. Lindsey, who passed away May 17, 2009. Others include Ron Henselman, Richard Robinson, John Shultz, Dave Schmidt, Bruce Murray, all of whom, together have begun a KAAY tribute blog after A.J. passed away, leaving his own blog dormant. You may log on at **http://mighty1090kaay.blogspot.com** to read more about KAAY's history and hear airchecks (actual off-air recordings made by DJs and fans) and you'll see lots more pictures as well! We occasionally link back to A.J.'s blog, where even more audio is stored.

Deep appreciation goes out to all of the above that helped and contributed, and for your friendships. KAAY will live long in many people's hearts, for it was truly a historic station, which had a tremendous impact and was a socially significant radio station in its time.

Editor's Note: Special thanks to former KAAY DJ Jonnie King (www.jonnieking.net) for allowing the use of his photos from that era. KAAY-AM is still on the air with 50 kW at 1090 kHz, broadcasting contemporary Christian music. The station is proud of its significant history and explains it all on their official web site: ***www.1090kaay.com.***

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The handheld BC246T TrunkTracker scanner has so many features, we recommend you visit our web site at www.usascan.com and download the free owner's manual. Popular features include **Close Call Radio Frequency Capture** – Bearcat exclusive technology locks onto nearby radio transmissions, even if you haven't programmed anything into your scanner. **Dynamically Allocated Channel Memory** - Organize channels any way you want, using Uniden's exclusive dynamic memory management system. 1,600 channels are typical but **over 2,500 channels are possible** depending on the scanner features used. You can also easily determine how much memory is used. **Preprogrammed Service Search (10)** - Makes it easy to find interesting frequencies used by public safety, news media TV broadcast audio, Amateur (ham) radio, CB radio, Family Radio Service, special low power, railroad, aircraft, marine, racing and weather frequencies. **Quick Keys** - allow you to select systems and groups by pressing a single key. **Text Tagging** - Name each system, group, channel, talk group ID, custom search range, and S.A.M.E. group using 16 characters per name. **Memory Backup** - When power is lost or disconnected, your BC246T retains the frequencies that were programmed in memory. **Unique Data Skip** - Allows the BC246T to skip over unwanted data transmissions and birdies. **Attenuator** - You can set the BC246T attenuator to reduce the input strength of strong signals by about 18 dB. **Duplicate Frequency Alert** - Alerts you if you try to enter a duplicate name or frequency already stored in the scanner. **22 Bands** - with aircraft and 800 MHz. The BC246T comes with AC adapter, 2 AA 1,800 mAH nickel metal hydride batteries, belt clip, flexible rubber antenna, wrist strap, RS232C cable, Trunk Tracker frequency guide, owner's manual and one year limited Uniden warranty. For more fun, order our optional deluxe racing headset part **#HF24RS** for $29.95. Order now at www.usascan.com or call 1-800-USA-SCAN.

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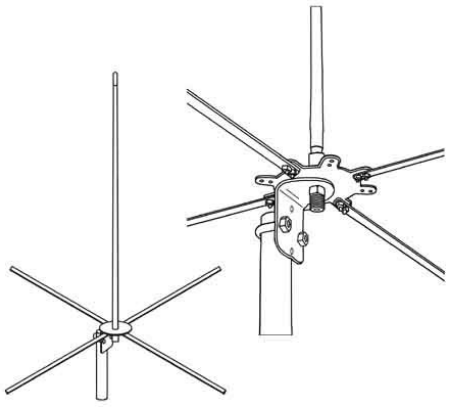
MURS: America's Hidden Citizens Band

By Ken Reitz KS4ZR

The Federal Communications Commission (FCC) is accused, by nearly everyone who has ever had occasion to deal with it, as well-intended at best, bureaucratically hamstrung or, at worst, nearly incompetent. There may be no better example of this than the commission's sixty year-long search to give the American public a set of frequencies, dreamily named the *Citizens Band*, which could be used by everyone for business or pleasure, without license and with little oversight.

Can't Decide: HF, VHF or UHF

Early history of the concept of a Citizens Band shows the fumbling side of the commission. Following World War II, the FCC set aside frequencies around 450 MHz for what it called the *Citizens Radio Service Frequency Band*. By 1947 the International Amateur Radio Union, meeting in Atlantic City, included those frequencies for amateur radio use. Walkie-talkie inventor, Al Gross*, who had patented a portable two-way radio designed to operate above 100 MHz in 1938, started the Citizens Radio Corporation in 1948 which eventually built and sold, with FCC approval, some 100,000 such radios. People might have thought that CB radio had finally come of age. Not so. Requiring a license and limited in range by low power and line-of-sight transmissions, these sets sold mostly to people in rural areas, where telephone communications was still spotty and expensive. The biggest volume buyer of these sets was the U.S. Coast Guard. Interest in the band soon waned.



Firestik's MURS base antenna ($40) boasts 6 dBi gain, a built-in PL-259 fitting and is mast-mount ready. (Courtesy: Firestik)

Fast-forward another 10 years and the commission was at it again. This time it would try the HF frequencies from 26.965 to 27.405 MHz in the 11 meter band. The commission had intended these new licensed, low power radios to transmit in the 1 to 5 mile range. But, it happened that 1958, the year the original 23 CB channels were allocated, was a whopping good year for solar activity. The band was wide open and, as any ham who has ever operated on the 10 meter band during a high sunspot count knows, a couple of watts and a modest antenna lets you work the world.

The FCC was faced with enforcing a rule that allowed CB operators to contact only people within a 250 kilometer or 155.3 mile radius of their station. Further, CB operators were (and still are for that matter) prohibited from contacting stations in other countries no matter how close they are.

Regardless of regulations, this time around many manufacturers, including Hammarlund and Hallicrafters, already big names in amateur radio, were ready with large, tube-fired, crystal-controlled, 23 channels CB sets. Still, interest was less than spectacular and, for good reason. The licensed, limited power, restrictive channel assignments and unmodifiable equipment mandate would attract only those interested in local communications. Anyone else would seek a ham radio license.

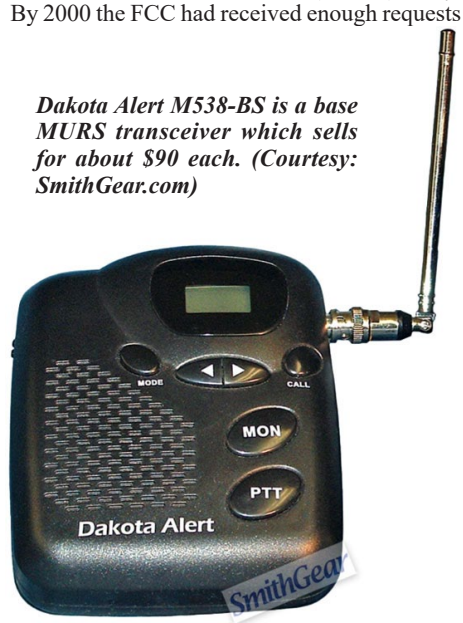
It wasn't until the 1970s with the oil crisis and the government-ordered 55 mph speed limit, that CB radio finally came into its own (see "Citizens Band at 50, Still Useful, Still Scorned,"*MT August, 2008*). So many Americans flocked to CB that the FCC was forced to drop the license requirement, expand the band to 40 channels, and even designate a frequency (channel 9) as the national highway emergency channel. Millions of new CB operators drove prices to rock bottom lows that saw two-way radios and antennas in nearly every retail outlet.

Throughout the 1980s and 90s the FCC allowed the market to explore various Part 95 (unlicensed, short-range) two-way radio alternatives. As a result we've seen all manner of two-way portable sets operating in the VHF and UHF range. It wasn't until the early part of this decade that the FCC finalized a scheme for the ultimate Citizens Band known as the Multi-Use Radio Service (MURS).

MURS: DOA

When originally introduced in 1998, the five frequencies currently used by MURS (151.820, 151.880, 151.940, 154.570, 154.600 MHz) were incorporated in the FCC's Part 90, Private Land Mobile Radio Service. This relegated it to the low-power, industrial/business frequency pool requiring a license, much like the General Mobile Radio Service (GMRS) today. By 2000 the FCC had received enough requests to drop the license requirement, adding MURS to the Part 95 Citizens Band Radio Service.

Dakota Alert M538-BS is a base MURS transceiver which sells for about $90 each. (Courtesy: SmithGear.com)



On the surface MURS seemed a good candidate for a Citizens Band. While still not allowing repeater operation, units were allowed a full two watts of transmitter output power, four times that of the popular Family Radio Service (FRS) which operates in the 462-467 MHz band. The FCC mandated that MURS radios have detachable antennas which were allowed a maximum height of 60 feet above ground or 20 feet above the highest point on the structure on which it's mounted.

High-gain antennas and tower mounting gives MURS much more flexibility than currently allowed for FRS sets. Unlike FRS, which is mandated to have permanent, fixed antennas, effective Radiated Power (ERP) of MURS radios is limited only to antenna design. In addition to allowing FM modulated phone, MURS equipment can do data transmissions in a number of

Dakota Alert MURS Alert Probe Sensor ($230) detects metal vehicles passing by. (Courtesy: SmithGear.com)

modes which has allowed some manufacturers to add useful accessories.

But, these extras made manufacturing more expensive and units failed to compete with ever-cheaper, smaller and feature-laden FRS radios. Within the space of a few years from its introduction the inventory of available MURS-capable radios dwindled to less than a handful of manufacturers while tens of millions FRS units from dozens of manufacturers filled retail store shelves coast-to-coast.

Compare Midland Radio's GTX1000VP4, their top FRS/GMRS unit which costs $90 for a *pair* of hand-held sets, against $90 for *one* Dakota Alert MURS set. But, the Midland sets also come with two boom microphones for VOX (voice operated transmit) operations, two drop-in charging cradles, rechargeable batteries, auto accessory plug-in power adaptor and scanning NOAA WeatherRadio capability. Even cheaper FRS units can be had in most discount department stores in every small town for less than $20 for a pair. MURS was doomed.

What's Left for MURS

MURS has gone from being this country's forgotten Citizens Band to being America's *hidden* Citizens Band. It hasn't exactly gone away, but it's not too easy to find. There's no way to know how many MURS units are in use today because the Consumer Electronics Association (CEA), which tracks such things for the consumer electronics industry, doesn't track small volume sales items such as Citizens Band radios.

Those manufacturers who have stuck around, Dakota Alert for example, have steadily developed these radios into something useful. Its M538-BS radio is a base unit while the M538-HT is the hand-held unit, each priced at $90 from **SmithGear.com**. These units can be used by themselves as MURS two-way radios or with various accessories in a number of private and business applications.

Dakota Alert makes several accessories including a metal vehicle detector and a driveway/trail monitor that sends a signal to the base unit alerting of activity in the area of the sensor. These accessories are designed for businesses or other places where traffic needs to be monitored. The company recommends them for warehouses, security operations and sportsmen.

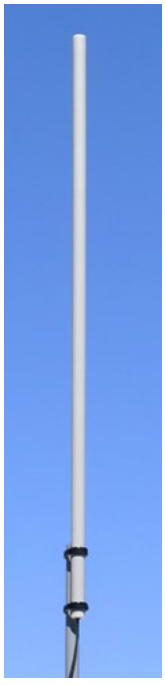
Standard Horizon makes a tri-band VHF transceiver, the HX471S ($250), which is a little deceptive. It can be used on marine VHF frequencies as well as FRS, but on MURS frequencies, it's receive-only. It has enough other features, however, to make it worth looking into. It features AM-FM broadcast reception, NOAA WeatherRadio with NOAA Alert, and you can even monitor the aircraft band with this model. The HX471S can also be attached to a GPS receiver for use as an emergency locator beacon on the marine emergency channel. It's sold primarily in marinas and other boating venues. The manual notes that operating VHF marine channels on land is prohibited by FCC rules. The manufacturer added the FRS frequencies for two-way communications on land.

One other lesser known model is from an obscure Chinese manufacturer known as Puxing. The model is the PX-777 and, according to reports on **eham.net**, covers the 2 meter amateur radio band as well as MURS frequencies. In fact, the unit is widely advertised as a walkie-talkie. The $85 price tag from Argent Data Systems (**www.argentdata.com**) would make it about the cheapest 2 meter HT available. Toss in MURS frequencies and it's a real bargain. The unit claims to be FCC certified and Argent Data Systems declares that they require proof of having an amateur radio license before they'll sell you one of these radios. All of these radios are not hard to find at the retail level, but you will have to do some searching. Unlike their FRS/GMRS counterparts, you won't find them at the nearest Target, Radio Shack or Wal-Mart.

Antenna Options

There are a few MURS-ready antenna options available which are tuned to the MURS band and are ready to install. Firestik offers a 45" long 5/8 λ ground plane for MURS for $40 (**www.firestik.com/Catalog/MURS_Base.htm**). DPD Productions has a 57" long ½ λ vertical it claims has 3 dB gain for $70 (**www.dpdproductions.com/page_murs.html**). Antennas Warehouse has a 110" collinear ground plane MURS antenna it claims has 6 dB gain for $60 (**www.antennawarehouse.com/VHF-UHF/AWH-150.htm**). You can also use Radio Shack's all-purpose VHF-UHF ground plane antenna (Cat. #20-176). At $27 and 20" high, this is definitely the cheapest and smallest option.

Most MURS antennas come with an SO-239 socket. All will require you to buy antenna feed line. At 151-154 MHz you can use RG-58 or RG-8 coax. For longer runs of cable use RG-8. Check to see which cable end you'll need: PL-259 or BNC connector. Ready-made coax cable with ends attached comes in lengths of 6 to 100 feet and can cost anywhere from $10 to $100 depending on the type of cable.



MURS vertical antenna from DPD Productions ($70). (Courtesy: DPD Productions)

Puxing PX-777 hand-held radio covers the 2 meter amateur radio band and MURS frequencies for about $80 (Courtesy: Argent Data Systems)

MURS Still in Hiding

Long since dwarfed by FRS/GMRS's staggering success, MURS still functions as a viable citizens and business band, requiring no license and offering plenty of options for private and business users. Most businesses enlisting the aid of consultants end up with GMRS units they'll use for unintentionally illegal applications because such radios are cheap. What they probably need is MURS, but many consultants may be unaware of their MURS options in the business setting. Many boaters could use a combination marine HT, CB, AM/FM/Air/WX receiver but are unaware there is an all-in-one unit available. Many hams don't realize that there's a 2 meter/MURS combo that's small enough and powerful enough to be useful for both hamming and talking with other unlicensed family members.

The MURS service has slipped quietly away, not exactly underground, but definitely under-promoted. Punch the MURS frequencies in your scanner and see what happens!

**Gross was ahead of his time and is also credited with having invented the telephone pager in 1949.*

Obsessed By Time and Shortwave Radio

By Myke Dodge Weiskopf

The story is so familiar as to be archetypal. It was late 1988, and I was twelve years old. My mother had bestowed upon me a brand-new boombox, a gargantuan affair roughly the size of an antique air conditioner. It had separate volume sliders for the left and right channels, an analog tuning display, and a superfluous number of buttons, two of which were cryptically marked 'SW1' and 'SW2.'

One evening, bored with whatever insipid late-'80s pop music I was normally playing on it, I pressed those SW buttons for the first time. From monstrous, bass-heavy speakers rattled the most unholy procession of noises I'd ever heard: strange electronic sounds that came squelching and tumbling forth, broken up by stretches of white noise and a cascade of fragmented voices. In that moment, everything changed. My sheltered suburban mind was turned inside-out, and a strange and inexplicable new space was created. In an instant, I had fallen in love with shortwave radio.

Those early exploratory tunings taught me that so much of the joys of listening to shortwave are the elements of chance and risk. I still believe that the best way to teach someone about radio is to throw them in headlong, unencumbered by technical details like frequency lists, schedules or propagation forecasts. I believe in the thrill of the random encounter, the experience of stumbling upon some fragment of folkloric music or a rolling foreign tongue, slicing through the squawk of the sidebands to unearth an aeronautical weather forecast or a spy numbers station. My relationship with radio has always been playful, exploratory, and deeply intuitive, and somehow this unstructured approach has led me down my own colorful path as a full-time radio man.

WWVH 15 MHz antenna array: Two half-wave vertical dipoles separated by a quarter-wave length and driven 90 degrees out of phase. (Courtesy: NIST)

My story is also powered, as they usually are, by a series of deeply personal experiences. Ever since I was an infant, I have had an affinity for long, droning sounds; my earliest sense-memory is of the plangent wail of an ambulance, and I recall many childhood nights drifting off to the sound of train whistles in the distance. It was kismet, then, that my first real catch on the shortwave bands was the venerable WWV, which thundered into my bedroom loud enough to vibrate the carpet fibers. WWV's methodically alternating ticks and tones touched something primeval in me, and on the rare occasions when its sister station WWVH sneaked in underneath to harmonize, the effect was mesmerizing. The whole notion of a radio station that did nothing but broadcast the time, tick by tick and tone by tone, was a source of deeply geeky joy. WWV became the first station whose broadcasts I monitored obsessively.

About a year later, I graduated to a brand-new Sony ICF-2010, which brought me into the modern world of portability and functional frequency displays. The improved circuitry also meant that I heard not just WWV, but a wealth of other time signal stations: the two Russians, RID and RWM, HD2IOA Ecuador, YVTO Venezuela, VNG Australia, and, elsewhere on the dial, CHU Canada. In the wee hours of the morning, the 5 MHz frequency was like a jam session of metronomes and robot announcers. Awestruck, I decided to form my own club: the International Time-signal DXers' Association (ITDXA).

Shockingly, the idea caught on. At its peak, the ITDXA numbered nearly 300 members from all over the world. One of my members, Lloyd Matthiesen, was an amiable retiree from Minnesota who wrote a column in which he gave his own stylized version of WWV's history. One day in 1992, Lloyd sent me a cassette filled with vintage WWV airchecks and announcements which he had recorded over thirty years. It included weird announcements about emergency power generators, barium ion vehicles, UT2 corrections, and other mysterious endeavors; hearing it felt like discovering a whole new room in the house I grew up in. Almost immediately, I gave the collection a name – *At the Tone* – and sold cassettes for a short time to members of the ITDXA, packaged with a few photocopied pages of Lloyd's carefully-written notes.

WWVH, the NIST time signal station in Barking Sands, Kauai. (Courtesy: NIST)

Program director for WWV and Tick-tock source: The clock room at WWV. (Courtesy: NIST)

By now, I was sixteen years old and becoming a quasi-serious student, so my "professional" aspirations took a back seat while I finished high school. I closed up the ITDXA, wrote two articles for a short-lived Tandy publication called *Radio!* and moved to Boston in the fall of 1995.

My Boston University years were a regrettably fallow time for shortwave listening. Dorm rooms, mid-city apartments, and the complete failure to produce a workable antenna put me on a crash shortwave diet for several years. I kept myself in the field by plundering my recordings for use in a series of pop songs and experimental music pieces, which I released on three CDs under the band name *Science Park* between 1997 and 2000.

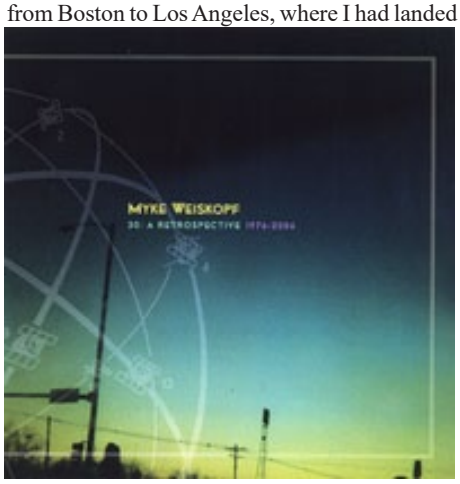
It wasn't until I quit the music business and retreated to rural Connecticut in 2001 that I really came back to radio. Bereft of social options and stinging from my traumatic experiences in the music industry, I set up a shack in an abandoned barn and returned to radio monitoring in earnest. On a farm largely without electricity, miles from the nearest city, where the next house was beyond shouting distance, the shortwave bands opened up in a way that I'd never heard before. Undaunted by the frigid New England winter, I huddled up in front of a propane heater and my Kenwood R-5000 receiver, with notepad and tape deck at the ready, and recorded hundreds of hours of radio. I'd tapped back into something essential, something fundamental to my identity, and I never realized how much I'd missed it.

Over the next three years, I continued recording religiously and even began making music again, this time using shortwave as an instrument unto itself. In my spare time, I continued to work on Lloyd's WWV project, *At The Tone*, collecting more recordings and making more notes. I digitized his original recordings and corrected the speed, pitch, and fidelity; I also had a decade's worth of my own recordings to add. I contacted WWV for their generous assistance in researching its early history, but after several months of losing all perspective on the manuscript and being unable to scrape up the funds necessary to finish the project, it fell by the wayside for a third time.

Moving back to Boston in late 2004, I found a magical, interference-free spot for shortwave listening, a scenic overlook 515 feet above the town of Brookline. There I hatched the idea for a blog which would celebrate the unique sonic characteristics of shortwave and illustrate the wide variety of music and sound heard there. The blog, *Shortwavemusic,* caught on immediately, and I found myself making ever more frequent trips to Brookline. In the winter months, curating *Shortwavemusic* outside for hours at a time was impractical, so I busied myself with freelance production for Harvard University's 60 year-old, non-commercial FM station, WHRB.

With the help of my friend and co-producer Kit Tempest, I produced three long-form shows on Egyptian singer Umm Kulthum, American artist Laurie Anderson, and a five-part special on Bulgarian folkloric music. The positive response emboldened me to spend more time on production, so in addition to editing *Shortwavemusic*, I began writing scripts for my own experimental broadcasts. I also celebrated my thirtieth birthday with a CD retrospective of my songwriting work titled *30: A Retrospective 1976-2006* (still available via iTunes and CDBaby.com).

At the end of 2007, I packed up and moved from Boston to Los Angeles, where I had landed



Cover art from 30: A Retrospective 1976-2006 (Courtesy: Myke Weiskopf)

a job working in post-production on a nationally-aired public radio show. Six months thereafter I became a full-fledged producer. Now, two years after moving to L.A. on a whim, my life is a magical alternate universe where I have a bona fide career as a radio producer, with plenty of spare time to reinvigorate my other projects, from *Shortwavemusic* to *At The Tone* (which was finally completed in December of 2009). The lesson for me is that I believe there is something greater than yourself that shines through when you fully commit to something you really love.

I find that I'm at my happiest when I am preserving long-lost aspects of the radio hobby for new and future generations of listeners to enjoy. Invariably, discussions of this sort involve some talk about the decline or demise of shortwave. Many of us within the hobby have taken counter-measures by petitioning stations who threaten closure, collecting funds to help restore ailing transmitters, or educating young people about the unique thrills of the hobby.

As someone who has devoted his life to radio, I believe my own role is to curate, catalog, and share these recordings, in order to make the case that shortwave is part of our cultural heritage and therefore worth preserving in the same way that, for example, the Library of Congress collects folk songs, field recordings, and other historic collections.

WWV 20 MHz Transmitter: Source of limitless joy for time signal enthusiasts. (Courtesy: NIST)

I have been brainstorming with my fellow producer David Goren on the vision of creating a similar national archive of collected DX recordings which would create a sonically rich and historically indispensible portrait of the hobby. To this end, David and I are in the beginning stages of creating a new organization to set this shared dream in motion. David and I would welcome your input and most importantly, your recordings, to help bring this amazing resource to fruition.

I hope you'll take a moment to get in touch with me and send your stories, comments, questions, or any other radio lore that speaks deeply to you. You can stay abreast of my work by subscribing to my blog at **www.myke.me**, which is also the home of *Shortwavemusic* and my other radio projects. And if you'd like to talk directly, my e-mail is *starsonesp@gmail.com*. Let's keep creating a future for this astonishing medium.

SCANNING REPORT

THE WORLD ABOVE 30MHZ

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Type 1 Trunking in Ontario

Improvements in performance and capability are taken for granted in the radio industry. Largely driven by computer technology, we expect scanners to become ever more powerful, easier to use, and give us a better sense of the activity around us. Unfortunately, in many cases these expectations may be unrealistic. This month we take a look at some technical details of an old trunking technology and examine the effects of political decisions on the scanning hobby.

❖ Fleet Maps

Hello,

I found your site when I was searching how to program Type 1 Fleetmaps. I have a BC898T scanner I work around for awhile and finally get the right talkgroups with the codes. But the problem is, I don't pick up any signal. Is there an easier way of putting them in so that you can hear things?

I am in Ontario, Canada and am trying to monitor systems run by CWC.

Alisa via the Internet

CWC is Christie and Walther Communications, a radio service company headquartered in Ottawa, Ontario. CWC operates a number of trunked systems in eastern Ontario and western Quebec, leasing service to various business customers.

The first CWC system in question is a Motorola Type I with analog voice traffic. It uses the following six frequencies: 853.3625, 853.6125, 853.8625, 854.8625, 855.1125 and 858.6125 MHz.

This is a list of the talkgroups that have been identified on the system.

Fleet-Subfleet	Description
005-01	Ruppert Holdings Inc. (Business)
019-01	Capital Towing
202-02	JSI Canada Cup East (Event)
203-01	St. John Ambulance
203-02	St. John Ambulance (Channel 2)
209-1	Southridge Sod Supply Inc. (Business)
306-1	Operation Red Nose
306-2	Operation Red Nose
306-3	Operation Red Nose
306-4	Operation Red Nose
306-5	Operation Red Nose
306-6	Operation Red Nose
307-1	SuperEX
307-3	SuperEX (Channel 2)
307-5	SuperEX (Channel 3)
307-6	SuperEX (Channel 4)
307-7	SuperEX (Channel 5)
602-1	Artistic Landscape Designs Ltd. (Business)

Many of the talkgroups on this system are associated with specific events taking place in the Ottawa area.

Operation Red Nose (*Nez Rouge* in French) is a free ride service for those who have had too much to drink during the holidays. It is staffed by volunteers, who drive over-imbibing revelers home in the reveler's car. These volunteers are not paid, but do accept donations and contributions that are distributed to local charities and civic organizations. The service has been in operation for more than 25 years and serves thousands of callers each holiday season in various locations across Canada.

SuperEX refers to the Central Canada Exhibition, held every August in Ottawa. The annual event runs for eleven days and, in 2009, hosted more than 420,000 visitors.

This C&W system is a Motorola Type I, which is a first generation trunking technology sometimes called "Privacy Plus." Although quite antiquated by today's standards, Type I equipment is still in use in a number by a number of agencies with limited budgets or extreme cost sensitivity.

Motorola Type I Talkgroups

Talkgroups in a Type I system are organized into levels. The highest level is a fleet, which typically divides the activity on the system into organizations or departments. Within each of these fleets are subfleets that further divide each organization's activity into smaller functional groups. The lowest level, under each subfleet, is an individual radio identifier.

Each Type I system has a fixed number of fleets, subfleets and identifiers, limiting the total number of radios that can use the system. System designers have the flexibility to mix and match the number in each level as their needs require. For instance, some systems may have many fleets, many subfleets, and just a few individual radios, while others may have just a few fleets with many subfleets and individual radios.

Each of the combinations of fleet, subfleet and individual radio has an identifying number called a "size code." There are only a certain number of possible combinations allowed in a Type I system, with each combination corresponding to a unique size code.

Code	Fleets	Subfleets	Individual IDs	Blocks
S-0	Used with Type II systems			
S-1	128	4	16	1
S-2	16	8	64	1
S-3	8	8	128	1
S-4	1	16	512	1
S-5	64	4	32	1
S-6	32	8	32	1
S-7	32	4	64	1
S-8	16	4	128	1
S-9	8	4	256	1
S-10	4	8	256	1
S-11	2	16	256	1
S-12	1	16	1024	2
S-13	1	16	2048	4
S-14	1	16	4096	8

A Type I fleet map is made up of eight "blocks," numbered from zero to seven, where each block holds a size code. For instance, the fleet map for the CWC system has the following layout:

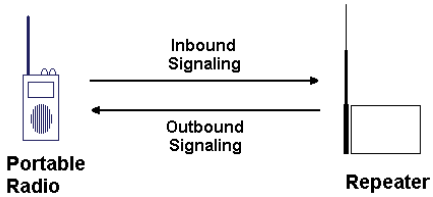
Block	Size Code
0	S-1
1	S-1
2	S-2
3	S-2
4	S-3
5	S-3
6	S-5
7	S-7

Some size codes are special. S-0 is used with Type II systems and does not have a corresponding set of fleets and subfleets. Size codes S-12, S-13 and S-14 span more than one block. In order to fit more individual radio identifiers, these codes use correspondingly more of the fleet map. S-12 uses two blocks, S-13 uses four blocks (half the fleet map), and S-14 uses all eight blocks of the fleet map.

Control Channel Signaling

Like other Motorola trunked systems, Type I uses a dedicated control channel to communicate commands and responses between a central system controller and the deployed mobile radios. The control channel has an *inbound* direction, from radios to the controller, and an *outbound* direction from the controller to the radio.

When a user wishes to communicate with other users, he or she presses the push-to-talk button. The radio sends an Inbound Signaling Word (ISW) representing a request for a voice



channel. The ISW contains the identity of the radio as well as the fleet and subfleet to which the radio is assigned.

The controller receives the ISW and assigns an idle voice channel to the fleet and subfleet combination. It then transmits an Outbound Signaling Word (OSW) message called a "channel grant" that includes the channel identifier as well as the fleet and subfleet of the requesting radio. Radios monitoring the outbound control channel receive the OSW message and check if their pre-programmed fleet and subfleet match the values in the message. If so, the radio tunes to the assigned voice channel and participates in the ensuing conversation.

The outbound control channel on this system is on 858.6125 MHz. By monitoring this channel, the scanner will also receive these OSWs. The scanner must be programmed how to interpret the OSW, and this is done via the fleet map.

Custom Fleet Maps

The Bearcat BC898T is a 500-channel base scanner introduced in 2004. It can scan Motorola, EDACS and LTR systems, including the CWC Type I system discussed here. It has 16 preset fleet maps for the most common systems that might be encountered. Unfortunately, none of these 16 matches the required fleetmap for the CWC system, so we will have to enter a custom (user-defined) fleet map. The instructions for doing this are covered on pages 42 and 43 and discussed on page 55 of the Owner's Manual.

Since we know what the size codes for each of the eight blocks should be, we do not have to scan to determine them by trial and error. Follow the ten steps under "Programming a Custom Fleet Map" on page 43, selecting the appropriate size code for each of the eight blocks. If you are unable to locate the manual that came with your scanner, you can always download an electronic copy from **www.uniden.com**.

Once those steps are complete and you have pressed **[SRC]** to begin scanning, if you are within reception range of a repeater site you should begin hearing voice traffic and seeing fleet-subfleet talkgroup identifiers on the display.

Motorola Hybrid Systems

A second CWC system also operates in the Ottawa area. It is a Motorola Type IIi hybrid, meaning it carries traffic for both Type I and Type II radios. It is divided into three subsystems:

Coverage	Frequencies
East Side	860.3125, 860.5625, 861.0625 and 863.0625
West Side	862.4625, 862.5875, 863.0875, 863.3375 and 863.5875
Central	860.3375, 860.8375 and 861.0875

The following is a list of talkgroups that have been identified on the system. Notice that the talkgroup identifiers have the form of a single number, represented here in both decimal and hexadecimal (base 16) form:

Decimal	Hex	Description
496	01F	Carl's Waste Services
1488	05D	Morin Brothers Building Supplies
2736	0AB	Sharkey's Towing
3120	0C3	Exel Contracting

Hybrid systems also require a fleet map, and for this system the following size codes are appropriate:

Block	Size
0	S-0
1	S-1
2	S-1
3	S-3
4	S-4
5	S-6
6	S-7
7	S-7

Select a new scanner bank, enter the system frequencies, then program these size codes into a custom fleet map.

❖ Orange County, California

Hello,

Fellow hobbyists here, any chance I'll ever be able to monitor Newport Beach, California Police Department?

Thank you, I enjoyed your website.

Phil via the Internet

Newport Beach is a town of 86,000 people in Orange County, California, located on the Pacific Ocean about 40 miles south of Los Angeles. Newport Beach has served as the backdrop for several television shows and movies and is home to numerous entertainment personalities.

The Newport Beach Police Department employs about 150 sworn officers who perform the full spectrum of city law enforcement duties. The local dispatch center also receives video feeds from surveillance cameras around the city, including seven thermal security cameras to enforce nighttime beach closures.

As an interesting aside, the Police Communications Center also monitors commercial and residential alarms and published a set of figures for the first 10 months of 2009. Out of a total of 2,664 alarm activations, only six were legitimate – a false alarm rate of 99.8%.

Newport Beach is part of the Orange County public safety radio system (more formally known as the Countywide Coordinated Communications System, or CCCS), a Motorola Type II SmartNet system providing service for more than 30 cities across the 950 square mile county. The system has been in operation for a decade and currently supports more than 17,000 radios in 400 talkgroups, averaging 5,500 transmissions each day.

The system carries voice traffic in both ana-

log and digital form. Five major "cells" within the county system use the following frequencies:

Countywide
851.0625, 855.7125, 856.2125, 856.7125, 856.9625, 857.2125, 857.4625, 857.7125, 857.9625, 858.2125, 858.4625, 858.7125, 858.9625, 859.2125, 859.4625, 859.7125, 859.9625, 860.2125, 860.4625, 860.7125 and 860.9625 MHz.

South
866.1250, 866.1750, 866.3750, 866.6250, 866.8750, 867.1250, 867.3750, 867.6250, 867.8250, 867.8750, 868.1250, 868.3750, 868.6250, 868.6750 and 868.9250 MHz.

North
866.1500, 866.4000, 866.6500, 866.6750, 866.9000, 867.1500, 867.1750, 867.4000, 867.6500, 867.6750, 867.9000, 868.1500, 868.1750, 868.4000 and 868.6500 MHz.

Northwest
866.3250, 866.7000, 866.8500, 867.3250, 867.7000, 867.8500, 868.3250 and 868.7000 MHz.

Southwest
866.2000, 866.3500, 866.8250, 867.2000, 867.3500, 868.2000, 868.3500 and 868.8250 MHz.

The Newport Beach Police Department has three identified talkgroups on the system:

Decimal	Hex	Description
55040	D70	Newport Beach Police (Dispatch)
55072	D72	Newport Beach Police (Tactical)
55104	D74	Newport Beach Police (Tactical)

Unfortunately, even though your scanner will accurately track the Type II control channel, you won't be able to hear the conversations. The county encrypts nearly all law enforcement activity, including Newport Beach police, putting them legally beyond the reach of scanner listeners.

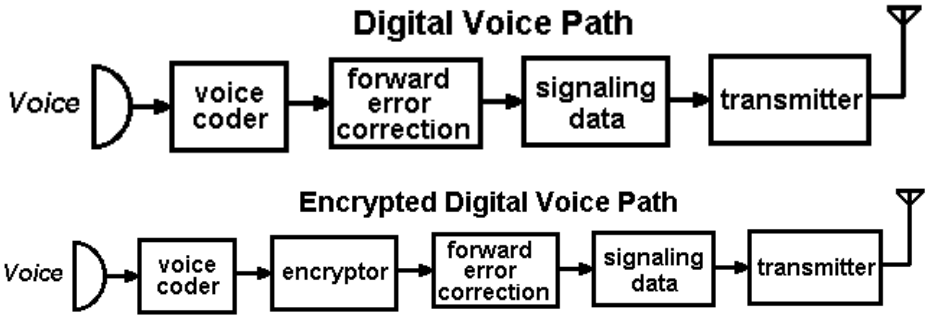
Police Encryption

Law enforcement transmissions use Project 25 digital voice with the additional step of encrypting the actual voice content. Before the widespread use of digital voice, very few systems used encryption, and those that did weren't terribly secure. Many of the old analog voice inversion systems didn't work particularly well for the users and did not have a great deal of success in hiding the content of conversations.

The introduction of digital voice changed things. Because the conversation was now in the form of a stream of digital bits (just '0's and '1's), radio manufacturers could use much more powerful and much more secure encryption algorithms. With sufficient processing power in the radio, enough to run these algorithms, the actual over-the-air content could be protected by reliable, well-tested methods.

However, times change and technology moves on.

The encryption algorithm reportedly in use in Orange County (as well as many other locations) is based on the 1970s-era Data Encryption Standard (DES), a method that is no longer used by the Federal government. DES was phased out years ago due to weaknesses in the level of protection it provides against modern cryptanalysis techniques. Even private engineering efforts, funded by individuals, have been able to crack



messages encrypted with DES.

The Federal government, along with many private organizations, moved up to the Advanced Encryption Standard (AES), a more recent and more powerful encryption algorithm that is the official replacement for DES. Although the Project 25 standards support the use of alternative encryption algorithms, it appears DES is in common use in a number of systems across the country.

Hiding from Citizens

Other California police departments encrypting their activity include Santa Monica and Santa Maria. Across the country more than 60 agencies encrypt their day-to-day operations, the largest of which is the Florida Highway Patrol (FHP). Despite Florida's "Sunshine Laws" requiring openness in government, it appears that police transmissions in that state are exempt from such disclosure.

Because of the FCC's clear prohibition against monitoring encrypted communication, there will be no technological solution marketed to the scanner hobbyist. Until laws change, either at the Federal or the State level, citizens will continue to be locked out of urgent, relevant and timely information related to critical events in their own communities.

Countless articles have run in this and other publications documenting the value of these volunteer "eyes and ears" to help catch criminals, aid the injured, and prevent potential harm to others. To add injury to insult, their tax money actually funds the very technology enforcing this government-imposed ignorance. Scanner listeners must press their elected officials to actually make good on campaign promises of openness and transparency in government operations by requiring law enforcement agencies to transmit routine, day-to-day activity in a form that citizens can monitor. Such actions should be part and parcel of a modern democracy.

Other Sources

In the meantime, Orange County-based scanner listeners are left to find alternate means of following the action. If events warrant, some area law enforcement activity may be heard on the California Law Enforcement Mutual Aid Radio System (CLEMARS). Orange County is part of the Southern Administrative Region of the Office of Emergency Services (OES), the state agency which operates CLEMARS.

Frequency	Description
39.46	CLEMARS Channel 6/7
154.920	CLEMARS Channel 1
154.935	CLEMARS Channel 2
155.475	Nationwide Law Enforcement
460.025	CLEMARS Channel 4/5
484.2375	CLEMARS (Los Angeles Basin)
868.5125	CLEMARS Channel 8/9

The Federal Communications Commission (FCC) established a set of nationwide interoperability channels recommended by the National Public Safety Planning Advisory Committee (NPSPAC). In California these channels are administered by OES.

Channel	Frequency
I-CALL	866.0125
I-TAC 1	866.5125
I-TAC 2	867.0125
I-TAC 3	867.5125
I-TAC 4	868.0125

Apart from scanners, those with access to the Internet have a means of seeing filtered summaries of police activity. Newport Beach Police operate a web site where you can view calls for service across the city, updated every 10 minutes. Go to **www.nbpd.org/crime/calls/default.asp** and select the area of the city you would like to monitor. The web site also provides general crime statistics and other related information.

Keep in mind that not all public safety activity on the Orange County system is encrypted. Fire Department activity, for instance, is carried as unencrypted analog voice.

Decimal	Hex	Description
1776	06F	Newport Beach Fire (Operations)
1808	071	Newport Beach Fire (Operations)
5648	161	Newport Beach (Interoperability)
39392	99E	Newport Beach Public Works
47264	B8A	Newport Beach Lifeguards

That's all for this month. Keep those e-mails coming to *danveeneman@monitoringtimes.com* and check my web site at **www.signalharbor.com** for more radio-related information. Until next month, happy scanning!

ASK BOB

GENERAL QUESTIONS RELATED TO RADIO

Bob Grove, W8JHD
bobgrove@monitoringtimes.com

Q. *Why is it that the current satellite TV signals are more often interrupted by bad weather than the old big-dish systems? (John Sullivan, Carlisle, IN)*

A. The old C-Band birds had a down-link frequency range in the 4 GHz (4,000 MHz) part of the spectrum, while the current Ku-band downlinks are in the 12 GHz range (12,000 MHz). Higher frequencies (shorter wavelengths) are more susceptible to atmospheric absorption, leading to what is known in the satellite TV industry as "rain fade" or "snow fade." This may be water-laden clouds as well as actual precipitation.

The 18-inch dishes are smaller than the old 10-foot B.U.D.s (Big Ugly Dishes), meaning that it doesn't take much to interrupt the digital data stream. Add to that the more critical, low-noise design of the 12 GHz low-noise block down-converter (LNB) and associated circuitry at the dish, and you have the need for a far more "perfect" operating platform for proper reception of Ku band signals.

It's no wonder that when it begins to cloud up, many of us wonder if our satellite TV reception will be affected.

Q. *I recall seeing automotive batteries in photos of Hussein's torture chambers. Is 12 volts enough to cause pain? (Mark Burns, Terre Haute, IN)*

A. The damage caused by electric shock depends on the current flowing through the body – 1 mA can be felt; 5 mA is painful; above 15 mA a person loses muscle control; 70 mA can be fatal. Ohm's law (amps = volts/ohms) shows that the higher the resistance, the less current will flow.

An electrical contact to dry skin results in up to 500,000 ohms resistance, but wetting the skin reduces the resistance considerably, and saltwater even further. I tried wetting both my hands, then measured the electrical resistance with an ohmmeter while touching two large metal electrodes. My wet skin resistance, hand to hand, was 20,000 ohms. The current flow from a 12 volt car battery would have been only 0.6 mA, not a tingle.

Puncturing the skin does allow much lower resistance contact, but the puncturing itself would be painful enough without voltage being applied.

Perhaps they put several batteries in series to increase the voltage. Of course, it's also possible that the batteries were actually used to power lights or other electrical equipment!

Q. *Wouldn't it be good advice to hams and SWLs to roll up loose cables (AC cords, coax, audio lines, etc.) in their radio rooms into coils to act as electrical interference chokes? (Richard Mollentime, WAOKKC, Overland Park, KS)*

A. In a general sense, yes, but this precaution probably won't do much for the lower frequencies, just for VHF/UHF, and that's rarely a problem. Better yet, use ferrite bead chokes on all such leads, placed close to the equipment cabinets.

Q. *The VHF/UHF discone we want to use is provided with two 2-1/8 inch spaced U-clamps, but our mast pipe is larger than that. Is there a suitable substitute clamp? (Gordon P. Wong, PE, Sacramento, CA)*

A. There sure is. Go to a hardware store and get two adjustable hose clamps that will fit the perimeter you need. If the hose clamps are still too short, you can easily unscrew them and reassemble two (or more) of them in series.

Q. *Is there any difference in mounting a VHF marine whip upward or downward on my boat? (RJ Lewis, Bethany Beach, DE)*

A. Theoretically, there should be no difference in radiation pattern between the whip pointing up or down, but there are some practical complications.

Unless the whip is mounted on a metal surface or has ground plane elements at its base, you have only half an antenna; a metal mounting surface (or base elements on the antenna) comprises an active part of the beam-forming system. Lack of this metal "counterpoise," will reduce the range of communications.

If you are mounting it under a metal roof, are the cabin walls also metal? If so, even with window ports, this partially emulates a "Faraday shield," a metal enclosure which traps radio waves from either direction, thus further restricting the communications range.

Find a location which allows the whip to be mounted either up or down on a substantial (several square feet in area), horizontal metal surface. While a sheet-metal plane is ideal, the middle of several feet of metal piping or tubing will work well, provided the metal base of the whip mount makes good electrical connection to the metal support.

In the absence of such a location, you can mount a ground plane antenna atop a metallic or non-metallic mast, or even alongside a non-metallic mast, or at least 3 feet away from a metallic mast. Try to mount it in the clear so that there are no immediate metallic obstructions within several feet of the whip.

Q. *Is it technically possible for a federal agent to routinely monitor a cell phone conversation at his discretion without a court order? (Rick Helmke, Auburn, Al.)*

A. Not without tampering with the subject's cell phone, or installing spying software into that phone. Several years ago, a law was enacted mandating that telephone companies are legally obligated to provide tap capabilities once a court order is issued. With very little exception, however, there is no intercept equipment in the U.S. that can simply be switched on and find and monitor a cellular telephone conversation without the phone company's technical cooperation.

According to one well-known investigator, there are European systems like GSM that can be tapped without the common carrier working with the agency.

Q. *What would be a good way to ground my portable shortwave radio to see if it cuts down the electrical noise I'm receiving with my indoor wire antenna? (Roger Henderson, Memphis, TN)*

A. While it's questionable whether earth-grounding the chassis of your radio will reduce electrical noise interference, it's certainly worth a try.

The easiest way to do it would be to connect the ground wire to any metal jack on the radio, like the earphone plug or the outside shell of the external antenna jack. If you are using a plug into the radio for your wire antenna, you could use the barrel of the plug for your ground connection, since the tip of the plug is the "hot" antenna connection.

Try grounding to a metal water pipe (if you have one – most are plastic now), the chassis of another electronic accessory, or a short wire to an earth ground (which should be a metal pipe at least four feet into moist soil).

No noise reduction on an indoor antenna attempted by grounding, however, will be as successful as erecting an outdoor antenna and feeding it with coax.

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

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Japan Radio: Fishing for Facts

This fall's annual long-path propagation improvements brought some more clues as to what's up with Japanese fishery radio. Unfortunately, every new fact indicates that last month's discussion of this service was accurate, but hardly adequate.

Consider a flashlight shining on the far wall of a very small, cramped cave. It's interesting, but not especially exciting. You record and share what you know about it, then suddenly the wall collapses and you're looking into a vast network of huge caverns stretching as far as anyone is able to see.

That's Japanese fishery radio. Not only is it large and interesting, but it's also very poorly documented. We're chipping away on the edges of something huge. Perhaps we should call it Japanese mystery radio.

❖ What We Do Know

The nation of Japan has organized its important fishing industry on several levels, including government and private organizations. Somewhere in between, there's the prefectural fishery.

A prefecture is a large administrative division somewhat like a county. Japan has 47 of these. Most have prefectural fishery organizations, and most of these have radios. They fit into the larger fishery radio service, which is recognized by the government. Most stations are small operations for local business, but not all. In fact, a few are huge.

❖ The Fukushima/ Kagoshima Effect

Attu Bosch, a knowledgeable listener in Alaska, described one of my blog posts as the "Fukushima Effect." The point seems to be that utility publications can't just dismiss the larger prefectural stations as just little radios for little boats.

He's right, of course. They've been heard all over HF (high frequency, "short wave") with truly world-spanning broadcasts on all bands and modes, often with information that is very much *not* for public consumption.

This all started when another DX (distant transmitter) chaser in this part of California was able to get one mysterious fax translated by a Japanese speaker. Its tabular data turned out to be market quotes for Pacific Saury catches. Identification at the top associated it with Fukushima Prefectural Fishery Radio, international callsign JFW.

Fukushima Prefecture is on the central Japanese island of Honshu. It is around 140 miles north of Tokyo.

JFW actually acknowledges reports. They send out a very fine e-mail with photos of the station. It's a nice setup, with multiple operator consoles and large transmitters. No wonder it gets to California! The public schedule also includes sea temperatures and at least one Pacific weather chart from the US National Oceanic and Atmospheric Administration (NOAA).

But wait, there's more. There's a bigger station out there. It's Kagoshima Prefectural Fishery Radio, JSC. Kagoshima is on the island of Kyushu, near the southern end of Japan. It's well located to cover the Pacific and beyond. JSC does just that, on many bands and modes. It has definitely become an important radio site worth following closely.

Last month, for example, we mentioned the frequency of 16971.0 kilohertz (kHz). It is a lot stronger in California with the Kyodo News radio faxes than the older Tokyo and Singapore sites ever were. We have conclusively identified the source as JSC. They say so right on the fax, and in documents found online.

OK, so that's no big deal. This fax is read by Japanese crews on extended fishing trips in the Pacific, so Kyodo or whoever added a powerful beam in the direction of Hawaii. But it gets better.

On March 4, 2009, JMH moved its transmitters from the closing Nazaki site to Kagoshima Fishery Radio's location. This is Japan's remaining "official" weather fax station, with charts and forecasts from the Japanese Meteorological Agency on 3622.5, 7795.0, and 13988.5 kHz upper sideband (USB). At the same time, Tokyo Volmet (JIA), a well-known aviation weather broadcast, also moved from Nazaki to Kagoshima.

The Volmet (from French "Flying Weather") is a standardized format designed so that planes in flight can get arrival weather at airports. Tokyo can be heard at 10 and 40 minutes after the hour. This alternates with Hong Kong (15/45), Auckland (20/50), and Honolulu (everything else), in the Pacific network. The frequencies are 2863.0, 6679.0, 8828.0, and 13282.0 kHz USB. When conditions permit, all of these Volmets are audible in the western US.

❖ Undocumented Transmissions

But wait, there's more still. Here's where it starts to get interesting. For a start, I've been able to find several other faxes, mostly just Japanese text, that are not on any of the various fax lists making the Internet rounds. They're from the fishery radio, but specific origins and purposes are unknown. Other listeners report similar transmissions, as copied all over the Pacific Rim.

The primary frequencies, used both by JFW and JSC, are 6414.5, 8658.0, 16907.5, and 22559.6 kHz USB. Here in California, I get daily faxes at 0030, 0650, 1500, and 1800 Coordinated Universal Time (UTC). Some are very weak, and there are undoubtedly more down there in the noise.

After this, we go off into the land of the unpublished, unknown, or even concealed. There's a lot of downright covert communication, in many different modes, and rarely decodable by the public.

This month's *Utility Logs* section contains a typical intercept. It came from Eddy Waters in Australia. He's hearing what's likely to be the fishery radio, but for various reasons there's no way to know for sure. The main reason is its mode. This is 8-channel, multiple-frequency-shift keying (MFSK), and the content is definitely encrypted.

So far, I've been able to confirm all Eddy's frequencies of 8551.0, 12383.5, 12923.5, and 16553.0 kHz, tuning in USB. There may be more. Eddy has determined that the eight subchannels are being sent at a speed of 100 baud and a shift of 240 hertz. No plaintext identifiers or other content have been found.

I've also heard encrypted radio teletype (RTTY) here. It has an 850-hertz shift. Other modes have been identified in the past, not always on these frequencies alone.

It's fun to speculate on what this and other, equally mysterious, activities might be. Perhaps

they are subscription content, solely for paying customers. Perhaps they are for boats that, for one reason or another, do not want anyone knowing where they are fishing. Perhaps they're not even about the fishing fleet. We can go off into the blue yonder here, wondering what it all means.

As with all utility mysteries, there are two pretty safe assumptions that we can make. First is that we'll probably never figure it all out. Second is that there are people out there who know, but they are not about to tell.

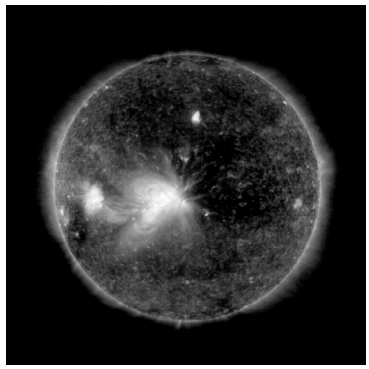
❖ Improved Band Conditions?

Readers might notice that the *Utility Logs* section has many more reception reports above 15 megahertz (MHz) than what we've gotten used to in these spotless times. Some of these are for stations that haven't been reported in many months.

This, of course, leads naturally to speculation on whether the much-argued and seldom-seen Solar Cycle 24 is finally getting underway. Let's look at what's up with the Sun.

For starters, the Northern Hemisphere autumn always brings a dramatic rise in maximum usable frequencies, especially in higher latitudes. It's known in the literature as the DX season. Hams schedule most of their big operating contests for this period.

This time around, though, we really did seem to be getting more bang for our listening bucks. It's hard to sort out the reason why. Many variables interact. The easiest one to observe from Earth is simply the daily count of the sunspots.



For a while, we actually had these. Hard to imagine, I know, but true. Better yet, they were real sunspots, with Cycle 24 polarity and location. For the first time, they came in groups and lasted longer than a day or two.

Dare we dream? Well, no. At press time, the Sun slumbers again, with many days of no observable spots at all. The daily radio fluxes are still higher than what we saw all summer, but these are the uncorrected numbers. This time of year, the Earth gets a little closer to the Sun.

We're all impatient, but 2010 will likely answer some of our questions. Cross fingers, toes, and whatever else you have, and pray to the gods of long distance radio propagation for a spottier year.

ABBREVIATIONS USED IN THIS COLUMN

AFB ..... Air Force Base
ALE ..... Automatic Link Establishment
ARQ ..... Automatic Repeat reQuest (teleprinting)
CAMSLANT ..... Communications Area Master Station, Atlantic
CAMSPAC ..... Communications Area Master Station, Pacific
CW ..... On-off keyed "Continuous Wave" Morse telegraphy
DSC ..... Digital Selective Calling
EAM ..... Emergency Action Message
E10 ..... Israeli "female," phonetic call and 5-letter groups
E10a ..... Abnormal identifier strings in callup
EOC ..... Emergency Operations Center
FAX ..... Radiofacsimile
FEMA ..... US Federal Emergency Management Agency
HFDL ..... High-Frequency Data Link
HF-GCS ..... High-Frequency Global Communication System
LDOC ..... Long-Distance Operational Control
LSB ..... Lower Sideband
M08a ..... Cuban 5-figure-group CW, cut to ANDUWRIGMT
MARS ..... US Military Affiliate Radio System
MFA ..... Ministry of Foreign Affairs
MFSK ..... Multiple frequency-shift keying
MX ..... Generic for Russian single-letter beacons/ markers
NASA ..... US National Aeronautics and Space Administration
NAT ..... North Atlantic Air Route Control, nets A-F
NDB ..... Non-Directional Beacon
SESEF ..... Shipboard Electronics Systems Evaluation Facility
PACTOR ..... Packet Teleprinting Over Radio, versions I-III
PSK ..... Phase-Shift Keying
RTTY ..... Radio Teletype
Selcal ..... Selective Calling
SITOR-A/B ..... Simplex Telex Over Radio, mode A or B
STANAG ..... Standardization Agreement
STANAG 4285 .... Military 8-state PSK
UK ..... United Kingdom
Unid ..... Unidentified
US ..... United States
USAF ..... US Air Force
USCG ..... US Coast Guard
USS ..... United States Ship
V13 ..... Taiwan live female, music and 4-figure groups
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 ().

366.0 YMW-NDB, Maniwaki, Quebec, CW at 0245 (MDMonitor-MD).
378.0 RJ-NDB, Roberval, Quebec, CW at 0305 (MDMonitor-MD).
391.0 DDP-NDB, Dorado, Puerto Rico, CW at 0302 (MDMonitor-MD).
414.0 STA-Oil platform NDB, Norway, CW at 1952 (ALF-Germany).
516.0 YWA-NDB, Petawawa, Ontario, CW at 0253 (MDMonitor-MD).
1650.0 Unid-French Coast Guard, Corsen, signed at 0739 (Ary Boender-Netherlands).
1677.0 EAF-Bilbao Radio, Spain, weather at 0808 (Boender-Netherlands).
2070.4 BPLEZS-German Customs operations center, Cuxhaven, raised ZLST in ALE, then a data modem exchange, also using 2142.5, 2505, 2673, and 3850, at 2005 (PPA-Netherlands).
2182.0 EJM-Irish Coast Guard, Malinhead, announcing navigation warning broadcast on 1677 kHz, at 0435. IPB-Bari Radio, Italy, announcing warnings on 2579, at 2021 (PPA-Netherlands).
2187.5 002442000-Dutch Coast Guard, Den Helder, all-ships DSC call for upcoming information broadcast on 3673, at 0644. 002300230-Turku Radio, Finland, answering DSC call from 230336000, Finnish cargo vessel Pasila (OJGT), at 0731. 002050480-Oostende Radio, Belgium, DSC all-ships call for new voice frequency of 2761, at 2035 (PPA-Netherlands).
2197.5 XSS-UK Defence High-Frequency Communication System TASCOMM (Terrestrial Air Sea Communications), Forest Moor; also on 2431, 2451.5, and 2537; ALE sounding at 1912 (PPA-Netherlands).
2216.0 XSS, also on 4239.5, 5268.5, 6416.5, 6691, 8107, 12297, and 14485.5; ALE sounding at 2017 (MPJ-UK).
2226.0 Unid-UK Coast Guard, Aberdeen, Scotland, live female reading weather at 1937 (PPA-Netherlands).
2410.0 LICM-Unknown Commonwealth of Independent States military, calling WFZY, CW at 1924 (PPA-Netherlands).
2456.0 ART-Israeli intelligence, identifier and 82-group message (E10), at 2002 (PPA-Netherlands).
2474.0 PBB-Dutch Navy, Den Helder, RTTY channel availability marker at 1811 (PPA-Netherlands).
2484.0 OSU-Oostende Radio, Belgium, working DQZO, German fishing vessel Prins Maurits, at 1953 (PPA-Netherlands).
2490.0 RGK37-Russian Navy, CW message in 5-figure groups for RJD75, at 2101 (PPA-Netherlands).
2510.0 "3-M-X"-Norwegian Navy vessel, working "J-W-T" at 2035 (PPA-Netherlands).
2513.5 4N7R-Polish military, ALE and voice with SR300, at 0547 (PPA-Netherlands).
2552.4 KLE446-Unknown US government, ALE sound at 1000 (MDMonitor-MD). KLE439B-Unknown US Government, working KOP629, VA, ALE at 2123 (Jack Metcalfe-KY).
2586.0 OXZ-Lyngby Radio, Denmark, navigation warnings at 1736 (PPA-Netherlands).
2598.0 VON-Canadian Coast Guard, St. John's, ice bulletin in French at 0821 (Lacroix-France).
2598.0 VCP-Canadian Coast Guard, Placentia, weather for Grand Banks at 0737 (PPA-Netherlands).
2608.4 FUO2-French Navy, Toulon, calling FV and FG in STANAG 4285, at 2047 (PPA-Netherlands).
2618.3 GYA-UK Royal Navy, Northwood, FAX upper-level chart at 2123 (PPA-Netherlands).
2643.0 A9M-Hamala Radio, Bahrain, CW identifier in SITOR-A marker, at 2201 (PPA-Netherlands).
2657.0 CTG-Alges Radio, Portugal, weather in Portuguese at 2110 (PPA-Netherlands).
2680.0 4XZ-Israeli Navy Haifa, CW marker at 2126 (PPA-Netherlands).
2720.0 SPS-Witowo Radio, Poland, navigation warnings at 1735 (Michel Lacroix-France).
2733.0 SDJ-Stockholm Radio, Sweden, CW callup and voice weather, at 0744 (PPA-Netherlands).
2743.0 ULX2-E10, identifier only at 0432 (PPA-Netherlands).
2749.0 VCO-Canadian Coast Guard, Sydney, weather at 0743 (PPA-Netherlands).
2830.0 SVK-Corfu Radio, Greece, bulletin in Greek at 1654 (Lacroix-France).
3150.0 PCD-E10, identifier and 21-group message, at 2032. PCD2, identifier only, at 2134 (Mike-West Sussex, UK).
3162.0 BRNW-Russian military tactical call, CW traffic with X4XP at 1539 (MPJ-UK).
3595.0 ZLST-German Customs Post, Cuxhaven, calling boats ZBOR and ZHEL, ALE at 1953 (Lacroix-France).
4051.0 "P"-Russian military CW single-letter marker (MX), Kaliningrad, at 1427 (MPJ-UK).
4271.0 FUJ-French Forces, Noumea, New Caledonia, STANAG 4285 test loop, also on 8646 and 16957.8, at 1017 (Eddy Waters-Australia).
4322.0 MGJ-UK Royal Navy, Faslane, Scotland, RTTY channel status at 2237 (Ken Maltz-NY).
4346.0 NMC-USCG, Point Reyes, CA, FAX chart at 1130 (Waters-Australia).
4369.0 WLO-ShipCom/ Mobile Radio, AL, synthesized voice traffic list at 2300 (Maltz-NY).
4560.0 YHF-E10, identifier and message at 2203 (Mike-UK).
4575.0 Unid-Russian FAX weather chart at 1158 (Waters-Australia).
4609.0 GYA-UK Joint Operational Meteorology and Oceanography Centre (JOMOC), Northwood, FAX surface analysis chart for North Sea, at 0400 (Prez-MD).
4618.0 BP25-German Customs boat Bayreuth, working BPLEZS, Customs Location and Operations Center, Cuxhaven, ALE at 2142 (MPJ-UK).
4701.4 PAX1B-US Navy, MD, ALE with ST2, also on 5718.4, 6746.4, and 7965, at 2059 (Metcalfe-KY).
4959.0 EQM2-Russian Air Defense, repeated "EQM2" for one minute, CW at 1730 (MPJ-UK).
5100.0 VMC-Australian Bureau of Meteorology, Charleville, also on 11030 and 20469, FAX weather map at 0707 (Waters-Australia).

5117.0 DRINI-Albanian government/ military, Drini, working MAL, Maliqi, ALE at 1705 (MPJ-UK).
5195.0 DRA5-German amateur propagation beacon, Scheggerott, CW predictions at 1707 (MPJ-UK).
5254.0 RJF94-Russian Naval Air Transport, Moscow, working RJC48, Sevastopol, at 2105 (ALF-Germany).
5347.5 Juliet-Italian Navy, tracking net with Echo and Lima, similar on 5453, at 2105 (ALF-Germany).
5403.5 TA2DWT-Turkish experimental amateur, working a Welsh station at 1435 (ALF-Germany).
5435.0 ART2-E10, identifier only at 2203 (Mike-UK).
5517.0 Tripoli-Oceanic air control, Libya, position check with unknown flight at 2350 (Prez-MD).
5532.0 Praha-LDOC, Prague, Czech Republic, selcal and voice call in Czech, at 0737 (Lacroix-France).
5550.0 New York-Oceanic air control for Caribbean, working aircraft at 0144 (MDMonitor-MD).
5649.0 Gander-NAT-C, Canada, course and position check with Ethiopian Airlines 501, at 0549 (Prez-MD).
5658.0 Mumbai Radio, India, selcal EM-FH to Qatari 611, Boeing 777 registration A7-BAE, at 1718. Mumbai, selcal AL-DJ to DLH754, Lufthansa Boeing 747-430 registration D-ABVB, at 1750 (Patrice Privat-France).
5687.0 DHM91-German Air Force, Münster, selcal and voice to unknown aircraft, at 0728 (Lacroix-France).
5696.0 CAMSLANT Chesapeake-USCG, calling HU-25B Coast Guard 2118, at 2023 (PPA-Netherlands).
5702.0 Reach 1008-USAF Air Mobility Command, calling Architect (UK Royal Air Force Flight Watch) at 0902 (PPA-Netherlands).
5714.0 FUI-French Navy, Corse, working Moulin Golf in French, at 1950 (ALF-Germany).
6510.0 GWPWNI-Brazil Navy Frigate Niterói, working GWPWZ33 (Rio de Janeiro), ALE at 0349 (ALF-Germany).
6575.0 HNCB-Abnormal Israeli identifier string (E10a), at 2205 (Mike-UK).
6655.0 DAMMAM-Saudi Arabian Border Guard, Ad Damman, working MANJOR and ERDA, ALE at 0102 (ALF-Germany).
6688.0 Marcotte 400-French Air Force, working Capitole at 1320 (Lacroix-France).
6712.0 B-6089-Hainan Airlines Airbus A330, flight CHH798, HFDL position for Reykjavik, at 1435 (MPJ-UK).
6908.5 Unid-Unknown MARS, calling nine stations in PACTOR-I, at 0503 (ALF-Germany).
6934.0 GYA-UK JOMOC, Northwood, not on usual frequency of 6834, FAX weather chart at 2130 (ALF-Germany).
7038.9 "S"-Russian Navy CW single-letter cluster beacon (MX), Severomorsk, also on 8494.9 and 16331.9, at 0832 (Boender-Netherlands).
7039.0 "C"-Russian CW cluster beacon (MX), Moscow, also 8495, 10872, and 16332, at 0832 (Boender-Netherlands).
7039.4 "F"-Russian CW cluster beacon (MX), Vladivostok, at 1125 (Waters-Australia).
7348.0 FC1-FEMA Region 1 Communications Manager, MA, calling VT1, Vermont State EOC, ALE at 1225. FC1-FEMA Region 1, MA, calling ME1, Maine State EOC, ALE at 1245 (MDMonitor-MD).
7535.0 Vanguard-Possible US military, testing with Norfolk SESEF, VA, at 1458 (Metcalfe-KY).
7600.0 "P-7-X"-Probable US military, testing voice and data with "W-3-X," "A-3-P," and "U-7-Y," at 2105 (Metcalfe-KY).
7661.0 War Hero-US Navy destroyer USS Arleigh Burke, passing EAMs with Nacogdoches, Recon Warrior, Hammering Hank (USS Elrod), Lightning Strike (USS Mitscher), Proud Victory, First Sealord, Vibrant, and Proud Eagle (USS Tarawa), at 1545 (Metcalfe-KY).
7675.5 Unid-Oceanographic charts in LSB slow-scan television, then chatter in unknown Asian language, daily at 2100 (ALF-Germany).
7842.0 MAINCOMMEX1-Possible US Marine Corps exercise, ALE to other COMMEX calls, at 2022 (Metcalfe-KY).
8097.0 Probable Cuban CW "Cut Number" station (M08a), in progress at 1309 (MDMonitor-MD). M08a, in progress at 1920 (Prez-MD).
8176.0 VMC-Australian Bureau of Meteorology, Charleville, maritime weather at 1245 (MDMonitor-MD).
8190.0 ANG-Unknown Italian Financial Police, calling TARANT (Taranto, Italy), ALE at 2020 (MDMonitor-MD).
8255.0 Unid-Whistles and male calling Radio Mexico in Spanish, at 0138 (ALF-Germany).
8294.0 Rio Miami-Unknown vessel, passing position and status to unknown station in Spanish, at 1303 (MDMonitor-MD).
8320.0 Unid-Unknown station with FAX satellite image of Southern Hemisphere, at 0245 (ALF-Germany).
8340.0 5JL1-Venezuelan Navy Frigate Mariscal Sucre, calling T5L1, Frigate Squadron Commander, also on 12510, LSB ALE at 2138 (MDMonitor-MD).
8374.0 PBB-Dutch Navy, Den Helder, RTTY channel availability marker, at 0035 (ALF-Germany).
8467.5 JJC-Tokyo Radio, Japan, Kyodo News FAX in Japanese at 60 lines per minute, also on 12745.5, 17430, and 22542, at 1131 (Waters-Australia).
8494.8 "P"-Russian CW cluster beacon (MX), Kaliningrad, also 10871.8 and 13527.8, at 0832 (Boender-Netherlands).
8551.0 Unid-Probable Japanese fishery, encrypted 8-channel MFSK, also on 12383.5, 12923.5, and 16553, at 1033 (Waters-Australia). [It's loud here, and propagation works for Japan. Their fishery and government have many such undocumented freqs. -Hugh]
8503.9 NMG-USCG, New Orleans, LA, FAX wind/wave forecast at 1900 (Prez-MD).
8682.0 NMC-USCG, Point Reyes, CA, FAX Pacific surface analysis at 1535 (Prez-MD).
8879.0 Mumbai-Oceanic air control, India, position check with unknown flight, at 2051 (Prez-MD).
8894.0 Niamey-Africa-2 regional air control, Niger, working an unknown flight in French, at 0015 (Prez-MD).
8912.0 PAC-USCG CAMSPAC Point Reyes, CA, raised 706 in ALE, then voice position report from Coast Guard 1706, an HC-130H, at 1354. Z03-USCG Sector Southeastern New England, calling F29 (HU-25 Coast Guard 2129), ALE at 1446 (MDMonitor-MD).
8971.0 Red Talon 711-US Navy P-3C, working Fiddle (Jacksonville, FL), at 1940 (Allan Stern-FL).
8992.0 Pull Over-US military airborne command post, requesting battle staff conference with back end of Door Sill, at 1853. Ditty Bag-US military, patch via Andrews HF-GCS to Offutt AFB, NE, for orderwire coordination with Dry Cell and Oil Pump, at 2131 (MDMonitor-MD).
9007.0 Trenton Military-Canadian Forces, working Ascot 1025 (UK Royal Air Force), at 1920 (MDMonitor-MD).
9025.0 190011-USAF C-5A, working ADW, Andrews AFB, MD, at 1300 (ALF-Germany).
9132.0 BRD-NASA Booster Recovery Director, Eastern Test Range, FL, advising Booster Recovery Vessel Freedom Star that shuttle has launched, at 1930 (MDMonitor-MD).
9165.0 HLL-Seoul Meteo, South Korea, FAX weather map, parallel 13570, at 0722 (Waters-Australia).
9462.0 SC4FEM-FEMA SC State Communications Manager, working MS4FEM, SC, in ALE, then voice as WGY 934 (SC State EOC), at 1800. FC6FEM008-FEMA Region 6, TX, calling COLLINS010 (Rockwell Collins), ALE at 2040 (MDMonitor-MD).
10536.0 CFH-Canadian Forces Meteorological and Oceanographic Centre, Halifax, NS, coded weather observations in RTTY, at 1150 (Waters-Australia).
10711.0 Chart Room-US Navy, transmitter check with Mayport SESEF, FL, at 2035 (Metcalfe-KY).
11155.0 RIT-Russian Navy, Severomorsk, calling RLD69 in CW, at 1526 (PPA-Netherlands.
11232.0 Trenton Military-Canadian Forces, patching Rescue 333, a CC-130H, to Rescue Coordination Centre Trenton, regarding a search by Black Fly 701, at 2113 (MDMonitor-MD).
11253.0 Drayton VOLMET-UK Royal Air Force, aviation weather at 1120 (Waters-Australia).
11300.0 Mogadishu-Regional air traffic control, Somalia, position from unknown flight at 2058. Khartoum-Air traffic control, Sudan, position from Condor 425, at 2120 (Prez-MD).
11430.0 "Star Star Radio Station"-Taiwanese AM numbers (V13), music and female in Standard Chinese, at 1219
11436.0 CAMSLANT Chesapeake-USCG, weekly Coast Guard district net with Air Station Savannah, Air Station Charleston, Sector Jacksonville, Sector Key West, Sector Miami, Sector San Juan; Air Station Miami, and Air Station Borienquen, at 1326 (MDMonitor-MD).
12577.0 VREC6-Hong Kong registry oil tanker Alpine Madeleine, DSC safety test with Pireus, Greece, at 1508 (Lacroix-France).
13152.0 WLO-ShipCom/ Mobile Radio, Gulf weather at 1627 (MDMonitor-MD).
13264.0 Shannon VOLMET, formatted aviation weather at 1345 (MDMonitor-MD).
13270.0 "06"-HFDL ground station, Hat Yai, Thailand, uplinks to various aircraft, also on 17928.0, at 1033 (Waters-Australia). New York VOLMET, Hat Yai HFDL audible underneath, at 1537 (MPJ-UK).
13282.0 Hong Kong VOLMET, aviation weather at 1115 (Waters-Australia).
13303.0 RAM643-Royal Air Maroc flight 643, HFDL position for ground station 17, Canarias, at 0659. MSR845-Egyptair flight 845, HFDL position for Canarias at 0801 (Boender-Netherlands).
13351.0 "05"-Auckland HFDL ground station, working various aircraft at 0645 (Waters-Australia).
13499.0 20111-Moroccan Civil Defense, working 2418, also on 16240.0, ALE at 1530 (MPJ-UK).
13510.0 CFH-Canadian Forces, Halifax, NS, RTTY aviation weather at 1348 (PPA-Netherlands).
13533.5 Unid-North Korean MFA, Pyongyang, encrypted ARQ messages to unknown embassy, also on 16218.4, 16233.5, and 16310.5, at 0911 (Waters-Australia).
13882.5 DDH-German Weather Office, Offenbach, FAX chart at 1150 (Waters-Australia).
13927.0 AFA5QW-USAF MARS, IN, patch to Gabreski Air National Guard Rescue Ops for NY Air Guard Air Force Rescue 101, a HC-130N, at 1714. AFA6DD-USAF MARS, patching B-1B Dark 21 to Dyess AFB Ops, TX, at 1730 (Stern-FL).
14390.0 AFA1RE-USAF MARS, opening weekly Sunday Net, at 1600 (Stern-FL).
14822.5 S1B-Lithuanian Navy, working P1G, ALE at 1301 (MPJ-UK).
14911.1 F213-Venezuelan Navy, LSB ALE callup and long text messages to CGA3, at 1808 (Metcalfe-KY).
16014.2 RFVI-French Navy, Le Port, Reunion Island, ARQ message to Djibouti at 1420 (MPJ-UK).
16060.5 Unid-North Korean MFA, Pyongyang, ARQ idler at 0621 (Waters-Australia).
16135.0 KVM70-US Government, HI, weather FAX at 1132 (Waters-Australia).
16331.7 "D"-Russian CW cluster beacon (MX), Sevastopol, at 0832 (Boender-Netherlands).
16332.1 "A"-Russian CW cluster beacon (MX), Astrakhan, at 1235 (PPA-Netherlands).
16340.1 ZKLF-Auckland Radio, New Zealand, FAX weather map at 2324 (Waters-Australia).
16807.0 WLO-ShipCom/Mobile Radio, product list in SITOR-A, at 1521 (MDMonitor-MD).
16830.5 SVO-Olympia Radio, Greece, exchange rates in Greek, SITOR-B at 1351 (MPJ-UK).
16898.5 XSG-Shanghai Radio, China, CW marker at 2350 (Waters-Australia).
16904.9 FUV-French Forces, Djibouti, STANAG 4285 test loop, also on 22447.5, at 1017 (Waters-Australia).
16907.5 Unid-Japanese fishery, possibly JSC, noisy FAX text in Japanese at 0030 (Hugh Stegman-CA).
17146.5 NMG-USCG, New Orleans, LA, FAX text giving SITOR-B weather frequencies as 6314.5, 8416.5, 12579, and 18806.5, at 1433 (MPJ-UK).
17234.5 VCS-Globe Wireless, Halifax, NS, PACTOR and Globedata traffic at 1422 (MPJ-UK).
17402.5 VCT-Globe Wireless, Tors Cove, NF, PACTOR idler at 1421 (MPJ-UK).
17919.0 "16"-HFDL ground station, Agana, Guam, working flights CES516 (China Eastern Airlines), JAL631 (Japan Airlines), and FM0816 (Shanghai Airlines), at 0633 (Waters-Australia).
18060.0 VMW-Australian Bureau of Meteorology, Wiluna, FAX weather map at 0739 (Waters-Australia).
18261.0 GYA-UK Royal Navy, Northwood, FAX weather map at 1100 (Waters-Australia).
19591.0 9HD-Globe Wireless, Malta, PACTOR and Globedata traffic at 1411 (MPJ-UK).
20047.7 "D"-Russian CW cluster beacon (MX), Sevastopol, at 1400 (MPJ-UK).
21949.0 "06"-HFDL ground station, Hat Yai, Thailand, working various aircraft at 0635 (Waters-Australia).
22461.0 FUJ-French Forces, Noumea, New Caledonia, STANAG 4285 test loop at 0651 (Waters-Australia).

Mike Chace
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Digital Digest without Borders

Some big changes here at Digital Towers. After many years of sub-par antennas, I finally got around to installing a 50ft tower from Universal Tower and a Tennadyne T11 HF log periodic antenna. This large directional antenna provides broadband coverage from 13MHz to 55MHz with some respectable forward gain in addition to substantial rejection of signals from the back and sides of the array.

Needless to say, with the propagation conditions still scraping along the bottom of the sunspot cycle, this has given my listening a new lease on life especially at higher frequencies during the daytime. I can finally hear signals above 16MHz at reasonable strength again.

❖ US Navy Shifts Frequencies

Firstly, a few updates on last month's coverage of the US Navy fleet broadcast system. Perhaps quite coincidentally, a number of the broadcasts from station NPG at Dixon, CA shifted slightly upwards at the end of October.

7593 75bd/850 moved to 7597kHz
10428 75bd/850 moved to 10430kHz
16264.5 75bd/850 moved to 16268.5kHz

The reasons for these moves are unclear, but probably due to interference from other signals or sources. The 75bd/850 outlets on 5345 kHz and 9085 kHz have stayed put.

Meanwhile, the new antenna allowed me to hear another participant in the same network. 22910 kHz appears to carry 50bd/850 traffic from NKW at Diego Garcia.

The evenings have also seen strong 50bd/850 activity on 4550 and 4466kHz. ITU direction finding fixes on these transmissions tend to point towards Diego Garcia, too.

❖ Medecins Sans Frontieres

One of the first organizations I bumped into frequently with the new antenna were the stations of the MSF, or Doctors Without Borders, as it is sometimes called. Founded in Paris in 1971, this NGO has provided humanitarian relief in many of the most troubled areas of the world. The organization operates from 19 national offices and an international headquarters in Geneva, Switzerland. It employs 25,000+ staff and spent 70% of it's nearly $1bn income in Africa.

As you might expect, the MSF makes frequent use of HF data communications and has been active on shortwave for many years, first using SITOR-A and settling on PacTOR since the late 1990s – moving through PacTOR-I, to II, and now the 3rd generation system. MSF PacTOR-II modems use a nonstandard CRC (checksum) of 44210, the "regular" amateur radio checksum being 65535.

The SITOR operations used selcals with the MSF prefix; however, with PacTOR, six letter selcals beginning with "PAC" are used, and the remaining three letters often indicate the country and location. With a little investigation they can usually be determined with reasonable accuracy. Many of the channels used by the organization have remained active for years, even if the stations using these channels have moved to different locations.

Frequencies used (center of data):

7911, 8186.4, 10824.9, 10970.6, 12142.7, 1364.2, 13907.5, 13909, 14421.3, 14657.7, 14782, 14783.7, 14785.6, 15688.4, 16274.6, 16274.8, 16277.2, 17423.7, 17432.8, 18042, 18042.1, 18054.6, 18104.5, 18526, 18527.7, 19020, 19282.6, 20107, 20535.7kHz

Selcals used (PacTOR):

PACLUDA	Luanda, Angola
PACMKNB	Nairobi, Kenya
PACMSJB	Jilib, Somalia
PACMTNB	Bassikounou, Mauritania
PACMCKB	Kabinda, Congo
PACMCIB	Iriba, Chad
PACMKBP	
PACMBBB	Bujumbura, Burundi
PACMEAB	Addis Ababa, Ethiopia
PACMKN	Kinshasa, Congo
PACMNK	Nouakchott, Mauritania
PACMNMF	
PACMRGF	
PACMPH	Port Harcourt, Nigeria
PACMPI	
PACPOS	
PACMTAF	Tanzania?
PACMZGB	Zagreb, Croatia
ZWEDRU	Zwedru, Liberia

❖ Shedding Light on Mysterious OLO32

Since around 2005, a mysterious station using standard 100bd/170Hz SITOR-B has been heard on around 40 frequencies at all times of the day and night. It uses a distinctive offset of .36 kHz. A few months ago, an enterprising listener with good connections asked one of the European direction finding stations to get a fix on this enigma. The agency reported a fix from outside Prague in the Czech Republic and gave it a callsign OLO32.

While the callsign may be a guess based on the particular frequency heard at the time and a close-by frequency registered with the ITU, propagation certainly points to a European or North African location. Here is the frequency list for this interesting station (center of data):

3508.36, 3513.36, 3805.36, 4050.36, 4060.36, 4445.36, 4489.36, 4496.36, 4517.36, 4558.36, 4754.36, 4896.36, 4933.36, 4957.36, 4959.36, 4966.36, 5019.36, 5090.36, 5102.36, 5177.36, 5189.36, 5261.36, 5273.36, 5286.36, 5345.36, 5412.36, 5474.36, 5829.36, 5853.36, 6822.36, 6844.36, 6848.36, 6895.36, 6911.36, 6946.36, 6986.36, 6987.36, 7520.36, 7656.36, 7726.36, 7746.36, 7916.36, 8004.36, 8005.36, 8016.36, 8163.36, 8176.36, 9166.36,9206.36, 9385.36, 9386.36, 9986.36, 10212.36, 10449.36, 10500.36, 13406.36, 14446.36, 14556.36 and 18571.36 kHz

Most monitors have reported another interesting feature of this station in that it comes on-air on the hour and half hour with no sign-on and leaves the air 23 minutes later, again abruptly with nothing in between but a constant stream of on-line encrypted data. Other monitors report that there are always two frequencies running in parallel.

While I've yet to discern a schedule for the station, I can confirm that the station does not appear to be using on-line encryption after all. I had been listening to another station with the "control characters" setting of the Hoka decoder accidentally enabled. This setting prints out the embedded supervisory signals in the signal (such as idles, carriage returns, line feeds and letter-to-number or vice-versa shifts). On that day, I happened to bump into OLO32.

What I noticed was a short period of idles occurring many times in the transmission. Examining the text that was saved to the disk by the decoder showed that these idles delimited fixed-length blocks of text, each of 103 characters. Each group of 8 blocks begins with the same letter, from "a" through "h," and the final block begins with "i", giving a total of 65 blocks sent over the 23 minutes that the transmissions are on air.

Here is an example, albeit with each line truncated for the sake of brevity and formatted for clarity:

AAAAAAAAAAAAahlxjwmlwlz 3zy6ov27pc 6ult6asbrkxu74
AAAAAAAAAAAAakmrwggzgy25gzse2flrvas2cbesgl3zcr6rt
AAAAAAAAAAAApuhurkccc5qqydbpyfxl6muse5hltj33ris5
AAAAAAAAAAAAatwuzdjb6wgy7u3izw6xnljzfibujzk6f36ft
AAAAAAAAAAAAaueyf77aahou5jkxtqop4tbrxfowquoaeychf
AAAAAAAAAAAAa4asppyuvopigwftzk3mw2w2htjtzgautqotk
AAAAAAAAAAAAa75b2l34yixtudm5rl7uorglj2d6jeg5ppg5r
AAAAAAAAAAAAbchjtfwou5cr2cc363vgotsgmzaq4qzswk3z6
AAAAAAAAAAAAbgthz67bmfhv7d7n7k4ofo5y5wgcw34d4bgut
AAAAAAAAAAAAbitfkhyct3njp6blfkh3oivguosmxnhdmmmlu

In this case, the uppercase "A" represents an idle. You can also see that there are 12 idles delimiting each block of the message.

Who is the user of this transmission? This is still a mystery, but it's probably a diplomatic or intelligence organization, judging by the use of a broadcast-type transmission method rather than point-to-point.

That's it for this month. Enjoy your digital listening and please let me know if you have any questions or topics you would like to see covered in the coming months.

ON THE HAM BANDS

THE FUNDAMENTALS OF AMATEUR RADIO

T.J. "Skip" Arey, N2EI
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You Want It...You Got It!

I couldn't help but notice a couple of things in the recent *MT Readers Poll*. First of all, it sounds like folks are appreciative of amateur radio in general. I was also happy to see that a great number of you are hams. With a little prodding on my part, I hope to convince the rest of you readers of *MT* to join in the amateur radio fun.

I also noted that, in addition to showing a great interest in ham radio, you folks wanted more information on kits and projects. Well, if you have been following my musings for more than a few months here in the pages of *MT*, you know that nothing gives me greater radio joy than building something ham radio related in my basement workshop.

Amateur radio remains one radio activity that encourages construction and experimentation. As a matter of fact, our legal charter to ply the airwaves mandates that we work to further the radio art. There's no better way to do that than by stringing some parts together and putting a signal on the air, right? With those thoughts in mind, let me show you a couple of projects that crossed my workbench this winter.

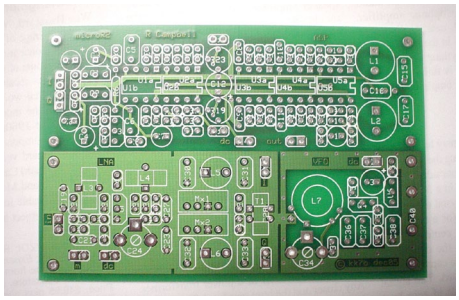
I would probably be happy building variations of basic receiver circuits for 40 meters every day of my life. Nothing is more fun than getting simple circuits to perform well where the majority of QRP (low power) radio operators in the hobby hang out. (That's down around 7030 kHz, give or take.) Here is one circuit/kit I finally got around to building and another new design that also generated tons of fun, both in the building and on the air.

❖ The MicroR2 Receiver

$95 (PC board only - $20) + $5.00 shipping
Available from: Kanga US
3521 Spring Lake Drive
Findlay, Ohio 45840
419-423-4604
kanga@kangaus.com
www.kangaus.com

Let me start out here by saying that Bill Kelsey N8ET's Kanga US operation is a top drawer place to go to join in the ham radio kit building experience. Bill makes kits based on the circuit work of some of the top designers in the world of ham radio. The MicroR2 is just such a kit.

Rick Campbell KK7B first published the design for the MicroR2 in the October 2006 issue of *QST*. You may have heard of Rick. He is one of the authors of the book *Experimental Methods in RF Design* – one of the greatest books on designing and building your own amateur radio equipment



The MicroR2 is a fairly sophisticated 40 meter receiver kit

ever published. You can dig deeper into Rick's thoughts about this design by reading his text, but all you really need to get this radio up and running is a copy of the *QST* article (supplied with the kit) and a few additional updates and construction notes provided by Bill.

The MicroR2 is a follow-up to Rick's earlier design, the MiniR2. It is a Direct Conversion receiver that uses phasing techniques to provide opposite sideband rejection. It uses a fourth-order audio phase shift network, and is designed to have selectivity very similar to the 4 pole filters in classic ham receivers such as the Drake 2B! Those are big shoes to fill, but the MircoR2 is up to the task. The design is great at rejecting interference from strong stations, especially shortwave broadcast signals.

The MicroR2 is available for 40 meters only. It will ship with filter components for either CW or SSB at the builder's direction. The kit includes a reduction drive variable capacitor, the PC board, and all electronic components. All you need to supply are the connectors, knobs, hardware, some hookup wire, +12 volts, and an enclosure… standard junk box stuff for most folks in this hobby. It makes a very nice matching receiver for any of dozens of simple transmitter circuits.

I chose to build the design to operate in the CW mode. (Big surprise there, huh?) The circuit board is just a touch too big to fit into an Altoids ™ mint tin, my preferred project form factor, but any slightly larger project box will do the trick. This kit will still build out to be a great lightweight backpacker radio.

I spent a fun evening populating the PC board and wiring in the off board components. The board work included five transistors, five op-amps, a handful of common parts, and four toroidal cores. One of these (T1) gets wound as a bifilar transformer and another (L7) gets wound with a tap and a 2 turn link. The other two are just straightforward inductors.

Some folks get nervous winding toroids. I'll let you in on a little secret: Every time you pass the wire through the hole in the center, it counts as one turn. Also, if you make sure you space the turns evenly around the core (unless directed otherwise) it is fairly hard to mess up. Make sure you tin the wire ends before installing the inductor. This is the most common failure point when winding your own cores.

This kit is just a bit above the beginner level. If you have built a few things in the past, there are no worries. If you plan to tackle this as your first project, make sure you have an Elmer looking over your shoulder.

Getting this little rig to start receiving required only four adjustments. I had to tweak the Low Noise Amplifier (LNA) tuning, the Variable Frequency Oscillator (VFO) band-set, and the phase and amplitude trim. All adjustments can be made using just a CW test signal as a reference.

I almost made the same mistake that many builders of the MicroR2 made. This receiver is extremely quiet. When you first put it on the air you may think it is not working: There is almost no background noise. This is surprising, given the component proximity, but Rick really knows his way around a receiver.

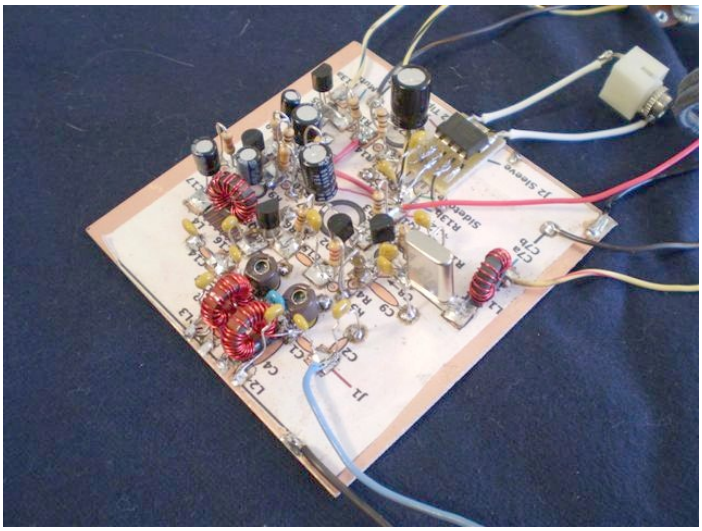
I am leaving the circuit caseless on my bench for the time being. Not because I am pouting about it not fitting into a mint tin, but because I want to go through some of the chapters (specifically 8 & 9) in *EMRFD* to see what more I can learn about basic receiver design. This is not just a kit receiver, it is a learning platform.

I have to give one more tip of the hat to Bill N8ET. Instead of wasting a lot of paper, he shipped the kit with all documentation on a CDROM. If you can't use a CD, no worries, all the documentation can be found on line at **www.kangaus.com/documentation.htm**. You might want to Web on over there and give things a look. You will also find full documentation for the other kits he sells.

❖ VRX-1 Receiver

$25
Available from:
4SQRP Group
c/o Joe Porter, W0MQY
306 East Hudson
Pittsburg, KS 66762
http://www.4sqrp.com/

You may recall that, in my May 2009 column, I was singing the praises of the NS-40 QRP Transmitter kit produced by the Four State QRP Group – an amazing little Class "E" transmitter with the inductors etched into the PC board. This QRP Club puts out a small series of kits to help



The VRX-1 is a somewhat simpler and less expensive receiver kit

finance their annual OzarkCon QRP gathering.

The designs that come out of this group are very well respected and often award winning. When I read Terry Fletcher WA0ITP and Jason Mildrum NT7S's write up about the VRX-1 project in the Fall 2009 issue of *The QRP Quarterly*, I immediately ran to my computer to place an order for this receiver kit.

This is another simple 40 meter direct conversion receiver. It lends itself to modification for other ham bands as well. All you need to make the change is a few parts from a well stocked junk box.

Jason NT7S dug deep into the aforementioned *Experimental Methods in RF Design*, as well as the earlier works of the late great Doug DeMaw W1FB, to come up with the interesting twists to this receiver's design.

One of the unique features of Jason's design is using a TDA7052 audio amplifier chip instead of the very common LM386. It works well into headphones and requires no heatsink in this application. Another unique feature is his use of a 2N7000 MOSFET instead of a JFET in the mixer. The use of this more inexpensive component is in keeping with the frugal nature of the design. The circuit as kitted up, tunes approximately 7.028 to 7.032 kHz, the "Sweet Spot" for the QRP crowd.

The construction technique used to put the VRX-1 together is known as "Manhattan" or "Ugly" construction. The PC board is not etched. Instead, you glue small pads of PC board in strategic locations and point solder all the components to the pads as directed by the schematic. It is a great, inexpensive way to prototype and build simple designs. It hearkens back to the days when hams used pieces of wood with nails driven into the surface for their designs. (Yes, there was a day when the breadboard was an actual breadboard.)

Learning Manhattan style construction will open up a whole world of experimentation and modification to any builder. This kit is a great first experience in this method of circuit construction.

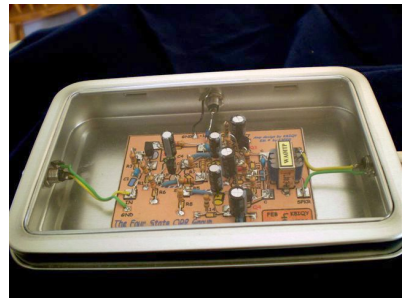
Okay, you are probably wondering where the term "Manhattan" style came from. It hearkens back to a QRP building contest about 10 years ago. The contest winner Jim Kortge K8IQY used the term, saying it came from the building style used in his son's college engineering program. The parts sticking up off the board looked a bit like the New York City skyline. The term got around the internet QRP newsgroups and stuck ever since. But I digress…

The circuit layout as shipped is also a bit broad in the beam, making it hard to cram into my favorite mint tin. However, since the construction technique is not totally bound to the layout of a traditionally etched PC board, shifting and squeezing a bit can make the smaller form factor work. That kind of juggling is well encouraged when building a rig Manhattan style.

I have built many Manhattan/Ugly projects over the years, but I can't help thinking that my old high school electronics teacher, Colonel "Blinky" Austell, is looking over my shoulder and shivering when he sees the globby solder joints. Still, the method of construction works great and my VRX-1 went into ready mode with no trouble at all, no matter how nasty the final board looked. Besides, once I cram it into a case, nobody is going to see things in there anyway, right?

As with the Kanga US kit, the Four Sates QRP Group is all about saving a few trees. Instead of shipping a bunch of paper instructions, the builder is simply referred to the club website for all documentation at **www.wa0itp.com/vrx1assembly.html**. Again, you can look things over before writing your check to the club. You will also want to keep an eye on Jason's personal blog at **www.nt7s.com/blog/** There's always something interesting going on there.

Throughout this article you have heard me lamenting that neither of these kits fit into the ubiquitous Altoids® mint tin. Well, it turns out that the Four States QRP Group has a great solution. They sell a similar little case with a clear plastic top that measures 5.5" Wide x 3.7"Long x 0.9" High. Furthermore, they sell for only $4.00 each or 3 for $10.00. I'll be writing their club yet another check as soon as I finish typing out this column. You can see the details at **www.wa0itp.com/cleartoptin.html**.



The Four States QRP "Altoids® on Steroids" enclosure

Both of these receivers are eventually going to work their way up from my workbench and go into the rotation at my operating position. I am really looking forward to using them with my classic Doug Demaw W1FB design "Tuna Tin II," the Four State QRP Group's NS-40 mentioned earlier, and a few other tiny transmitters I have pieced together over the years. Maybe I'll get a few more transmitters built up – such as the MicroT2 that is the mate for the MicorR2 – and we can pursue this kit building subject again in the near future.

So there you have it: Two great receiver kits to serve as the basis for getting on the air down where Old Uncle Skip hangs out. Build one up, and a little transmitter besides, toss a wire in the air, and I'll see you at the bottom end of 40 meters. Have fun!

GETTING STARTED

THE BEGINNER'S CORNER

Ken Reitz, KS4ZR
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Pansat 9200HD:
Keeping up with FTA Satellite Changes

New subscribers to *MT* won't know this, so I'll give those folks a quick update: I got my start writing about consumer electronics nearly 22 years ago in this magazine, with a feature article on satellite television. That piece immediately became a monthly column and I've been watching satellites in the Clarke Belt ever since.

In those days, satellite TV meant having a 10 foot dish somewhere in the yard and I've had one in my backyard since 1984. Today, most people unfamiliar with the satellite TV hobby would think it very un-cool to have a big dish anywhere near the house, but anyone who knows what you can see and hear with such a dish knows better.

Throughout the past 26 years, huge changes have made the C and Ku-band satellite TV hobby hard to keep up with. Many, who were only in it for the free HBO, dropped out when scrambling started in 1986. Many more fled the hobby when DirecTV and DISH Network made it possible to watch cable-TV fare in rural areas using only an 18" dish. But, many tens of thousands continued to explore the interesting world of live news feeds, network feeds, and dozens of radio and audio feeds, many of which were and continue to be unencrypted.

❖ Move to Digital

It's now a digital world, and that began to apply to domestic satellites as well some 15 years ago. Several different digital schemes have been used, but the one that has the most currency in the western hemisphere is the same one used most widely in Europe: the Digital Video Broadcast (DVB) standard. This standard uses MPEGII technology as the video and audio delivery system.

The vast majority of satellite TV receivers sold today are MPEGII receivers. Within that universe are a variety of ways in which MPEGII signals may be encrypted. However, generic MPEGII Free-to-Air (FTA) receivers can tune in any MPEGII channel. If the channel is encrypted, you'll see a black screen and there will be an on-screen message that says something like "unavailable," or "encrypted channel."

Traxis 3500 FTA receiver ($100 plus shipping), typical low-cost MPEGII receiver, works well on standard definition MPEGII satellite video and audio. (Courtesy: Skyvision)

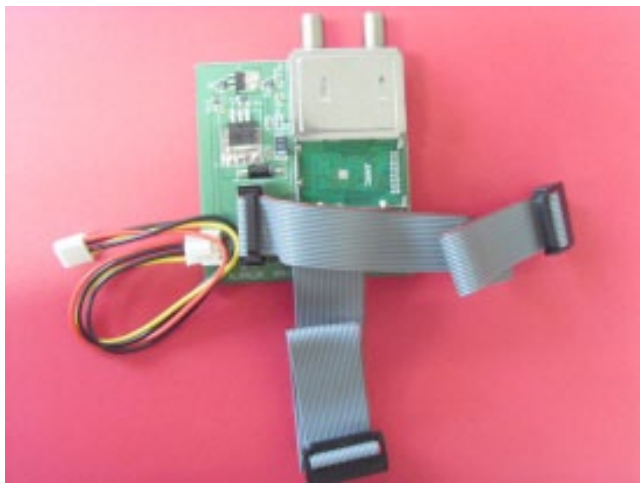
There has been a certain amount of negative publicity surrounding the use of MPEGII FTA receivers, because a number of quite clever people have found ways to reprogram these generic receivers to allow them to receive encrypted channels without having to pay the program service provider. It's illegal, and these people endure a wearisome cat and mouse game as they are chased around by various police agencies and attorneys for DirecTV and DISH Network. Quite a few are now in prison.

However, there is a huge business in retailing legitimate MPEGII satellite TV systems, for several reasons. Such services are most often used to provide programming direct from the homelands of the dozens of countries that make up America's large immigrant population. Millions of these systems are sold every year to people living in the U.S. from Africa, Asia, the mid-East, Europe and South America. Most people who buy these systems are interested in only one thing: news and entertainment in their native tongue from their homeland.

In addition to all the TV and radio broadcasters from around the world retransmitting their programming on U.S. domestic satellites, nearly every U.S. broadcast network does as well. Many commercial broadcast interests, religious broadcasters and educational institutions are also found on these satellites. Most are unencrypted and intended for reception by anyone with an MPEGII satellite TV system.

Getting started in satellite TV DXing couldn't be easier or cheaper than it is now. Some FTA MPEGII systems cost under $200 complete, including receiver, dish, and LNBF. Most come with instructions for finding popular satellites and help in programming the receiver to tune in. A big dish is still quite useful, especially if you are interested in C-band reception or tuning into satellites outside the domestic U.S. satellite constellation.

Front view of the rack-mountable Pansat 9200HD. (Courtesy: Pansat U.S.A.)



Pansat 9200 HD DVB-S2 Plus Kit (Courtesy: Pansat U.S.A)

❖ Pansat 9200HD

While most digital transmissions found on both C and Ku-band satellites are standard definition (SD) in the old NTSC format (aren't you glad you didn't get rid of your old NTSC TV set?), the trend among MPEGII FTA programmers is toward high definition (HD). That's where the Pansat 9200 HD comes in. This receiver is able to receive MPEGII FTA SD and HD channels.

But wait, there's more! It also tunes terrestrial ATSC digital channels as well. This is particularly good news for those who needed a better tuner than what was available through the local discount chains with your DTV $40 government subsidy card. That makes the Pansat 9200HD the most versatile MPEGII FTA receiver available.

Among the pluses for this receiver are AC3 Dolby digital audio, via S/PDIF optical audio output for those channels that transmit AC3 audio. That was particularly rewarding watching the PBS feeds on Nebraska Educational Television. Most broadcasts, however, use standard left/right stereo audio and extra audio channels

where available.

The 9200HD comes with the latest MPEGII data for each transponder and satellite as of the time it's sold. This is very helpful and takes out a lot of the drudgery of manually entering frequency, symbol rate, and FEC (Forward Error Correction) rate. It has a "blind search" mode during which the receiver will attempt to find every signal on each polarity of any given satellite. That takes some time, as all similar functioning receivers do, but can be worth it when the system ferrets out a channel not yet reported in the various MPEGII FTA sites.

I found that the sensitivity of the 9200HD was the best I have used, not only for satellites but for terrestrial signals as well. I was amazed at some of the channels that would be detected and displayed with very little signal. Video output can be done either via HDMI or component (YPbPr). The receiver displays 480p, 720p or 1080i resolution, and on those channels that were using 1080i the video was excellent. Video resolution is changed by one button on the remote.

This receiver will hold 10,000 channels of TV and radio programming in its memory. That may seem like a lot, but when you're scanning Galaxy 19, for example, you'll import hundreds of video and audio channels (you'll get both FTA and encrypted channels when you scan a satellite) into the receiver, and there are dozens of satellites you may be searching for channels. Despite the seemingly high numbers, it's not hard to keep track of the few dozen or so channels you like to watch (or listen) to. As with all MPEGII FTA receivers, your favorites can be placed into different folders so that they're easily accessed.

The 9200HD is DVB-S2 compliant, which means that, with the addition of the Pansat DVB-S2 Plus kit, the receiver will display MPEGII HD channels. Right now there are very few MPEGII FTA HD channels on either C or Ku-band satellites. But, that number appears to be growing. And, with the acceptance of HD programming in terrestrial, cable and pay satellite-TV, and the prevalence of HD screens in everyone's homes, I expect more MPEGII FTA channels to be showing up with HD feeds.

Among the current crop of MPEGII FTA HD feeds are various broadcast networks, NASA, Fashion TV, some religious broadcasters and shopping channels. Keep in mind that a lot of programming on the big networks and cable-TV channels is still done in standard definition, so there'll be a lot more MPEGII HD activity in the future.

❖ Among the 9200HD Pluses

The relatively small infra-red remote control is a universal remote that can be used to control most of the equipment currently in your entertainment cabinet. There is an optional UHF remote. This receiver is equipped to operate a DiSEqC switch which is used to control the feed from one or more dishes. Video output may also be done via "S" video cable.

The receiver has a picture-in-graphic that allows you to see the programming in a segment of the screen as you scroll through your "favorites" list. It has a USB input that can use a memory stick to update various software functions. It has a 950-2150 MHz loop-through feed to take the feed from your LNBF and use, daisy-chain style, with a master receiver, if you're using it in addition to another satellite receiver such as a Motorola 4DTV.

85 cm (about 33.5") Ku-band dish comes with LNBF and mount for about $120. For best results with all MPEGII receivers, install the biggest dish you can afford. (Courtesy: Skyvision)

❖ The 9200HD Down Side

Into each high tech product a little rain must fall, and it's the same for the Pansat 9200HD. Some users report that the receiver runs hot and have rigged up muffin fans to blow away the excess heat. I had originally placed my demonstration unit in a cabinet wedged in between two other major heat producers and the top of the 9200HD was hot to touch. But, after placing it in a spot with plenty of air circulation the cabinet was no hotter than any of the other various electronics I have. Still, in the interests of saving electricity, it's good practice to shut the receiver off when not using it, by flipping the on/off switch behind a drop-down front panel on the receiver.

The receiver does not have an active on-screen program guide for terrestrial channels as most such DTV tuners do. That's an inconvenience that I found frustrating.

Perhaps the biggest problem that consumers will confront is in reception of satellite delivered MPEGII FTA HD channels. Pansat recommends that reception signal quality be at least 80% in order to display MPEGII FT HD. That means you'll need as much gain as you can get from your dish. If you're watching C-band delivered MPEGII HD, you'll need at least a 10 foot dish and it'll need to be peaked to near perfection to achieve 80%. Still, it can be done. Achieving 80% on Ku-band is much easier, because such dishes are easier to peak and, if the signal is still not where it should be, it's easier to upgrade to a larger Ku-band dish to get the extra gain.

There is a certain amount of "learning curve" experienced with using this receiver. I've been playing with MPEGII FTA receivers for nearly 15 years and am very familiar with most procedures and the general functions of the more popular receivers. Each one seems to have its own idiosyncrasies. With the 9200HD, it seemed to work quite well once it had a "warm-up" period. If I just turned the unit on and started going up and down the channels, it seemed to respond in slow motion. But, if the unit had been on for some time there was no problem. I can't really classify that as a problem, so I'll just call it an idiosyncrasy.

❖ MPEGII Here to Stay

There are hundreds of different MPEGII FTA receivers on the market today, some as cheap as $100; complete systems are typically about $200. The Pansat 9200HD is the top of the line MPEGII FTA receiver and it's available from Skyvision (**www.skyvision.com**) for about $400. You can order direct via their toll-free number 800-500-9275, or you can write for a free catalog: 1010 Frontier Drive, Fergus Falls, Minnesota 56537.

With hundreds of interesting things to see and hear on the dozen or more satellites visible in our sky, it's hard to imagine someone not wanting to explore this part of the electromagnetic spectrum. While analog satellite TV signals are virtually a thing of the past, digital satellite TV transmissions are here to stay. Next month I'll take you on a cruise of the Clarke Belt, as seen from North America, including a look at MPEGII FTA activity on the satellites over the Atlantic Ocean.

PROGRAMMING SPOTLIGHT

WHAT'S ON WHEN AND WHERE?

Fred Waterer
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The Golden Age of Radio

It's hard to believe another year is already well under way. Here in the northern hemisphere, that means one thing: winter. February is traditionally a short, gloomy month. Each year we await the decisions of Punxsutawney Phil (or in Canada, Wiarton Willy) who, tradition and tourist boards tell us, will scurry out of their holes and, upon seeing their shadows, declare six more weeks of winter.

To help fill those extra cold, wintry weeks, here are some suggestions to help transport you – at least mentally – to a less gloomy place, if not a warmer one. This month we shine the *Programming Spotlight* on the "Golden Age of Radio."

An increasing number of stations are devoting significant airtime to unearthing and bringing back to life treasures from radio's so-called "Golden Age." In Southern Ontario, Canada, where I live, 104.5 CHUM-FM in Toronto was years ahead of most stations, running two classic radio shows every Sunday night since the 1980s. They called their Sunday night programming block, *The Theatre of the Mind*. It was my first opportunity to hear many of the radio shows that I had heard my parents talk about for years (as a child of the sixties, I had missed out on the experience the first time).

I would listen to CHUM-FM every week and just absorb these programs, from the comedy of Jack Benny to the suspense of *The Shadow* or the science fiction of *X Minus One*. Often I would tape them, and to this day I still have boxes of cassette tapes (and even a couple of reel-to-reel tapes!) containing these gems.

The popularity of these classic programs is clear. Many stations are now broadcasting them on a daily basis. In 1985, I was limited to one hour on Sunday nights. Now in the digital age, one can listen 24/7 to the radio programs of the thirties, forties and fifties. (As an aside, I get more feedback from the mention of these shows than almost anything else that appears in this column.)

❖ WWCR – The Golden Age of Radio Theater

For many years, WWCR in Nashville, TN has aired **The Golden Age of Radio Theater** program from the Information Radio Network (formerly USA Radio Network).

"**The Golden Age of Radio Theater** features the programs that warmed the hearts of millions! Hosted by **Vic Ives**, Golden Age of Radio is the best of radio classics.

"**The Golden Age of Radio Theater** features programs like Bob Hope, Jack Benny, Fibber Magee & Molly, The Life of Riley, A Man Called X, The Haunting Hour, Duffy's Tavern, X Minus One and more.

"As a proven audience builder the Golden Age Of Radio helped a station in Fresno become #1 in Adults and #2 in Teens for its program daypart…These are the programs that caused America to fall in love with radio in the first place." **www.irnusaradio.com/our-programs/golden-age-of-radio**

WWCR carries these programs for the most part on weekends. You can hear them on the following schedule: Saturdays (following a brief newscast) at 1000 UTC on 5070 kHz, 2200 UTC on 12160 kHz, 2300 UTC on 3240 kHz; Sundays at 0500 UTC on 3215 kHz, 1900 UTC on 15825 kHz; Mondays at 0600 UTC on 5070 kHz and Wednesdays at 0000 UTC also on 5070 kHz.

WWCR also airs "**Unshackled,**" an evangelistic drama in the style of the old radio shows (it's been on the air since 1950) on UTC Tuesdays at 1330 on 15825 kHz and UTC Sundays at 0030 on 3240 kHz. For more on **Unshackled** see the August 2009 *Programming Spotlight.*

❖ WBCQ – Amos and Andy

According to Wikipedia, "**Amos 'n' Andy** is a situation comedy based on stock sketch comedy characters but set in the African-American community, and popular in the United States from the 1920s through the 1950s. The show began as one of the first radio comedy series, written and voiced by Freeman Gosden and Charles Correll and originating from station WMAQ in Chicago, Illinois. After the series was first broadcast in 1928, it grew in popularity and became a huge influence on the radio series that followed. The program ran on radio as a nightly serial from 1928 until 1943, as a weekly situation comedy from 1943 until 1955, and as a nightly disc-jockey program from 1954 until 1960. A television adaptation ran on CBS-TV from 1951 until 1953, and continued in syndicated reruns from 1954 until 1966."

Amos and Andy was a groundbreaking radio program, not without controversy. It was one of the earliest radio serials. It was in effect the first syndicated radio program, appearing on 70 radio stations by 1929 and attracting 40 million listeners in the 1930s. In an anecdote by Ramsey Lees in **Signing On –The Birth of Radio in Canada** by Bill McNeil and Morris Wolfe, it is noted that Hamilton, Ontario radio station CHML would actually close down for the duration of the **Amos and Andy** program.

"When the big network shows in the US began, our local audience went way down. There were complaints, too, that while CHML was on they couldn't get '**Amos and Andy**' on WBEN Buffalo, a programme everyone wanted to hear. One of our salesmen got a brilliant idea. He went out and sold fifteen minutes of blank air to one of the lumber companies. We signed off so people could hear '**Amos and Andy**'. It was incredible how much good will that provided. And the lumber company thought it was great because it seemed as if *they* were sponsoring '**Amos and Andy**'. WBEN, you see, was 930 on the dial and we were at 900 and back then there was a thing called 'wandering signals.'" (P.98)

The problem with **Amos and Andy** for many people is that it was a radio program about black people, written and performed by white actors. There were concerns that the characters were caricatures, some of them reflecting on African-Americans in a poor light. It's also true that it was well written, and very funny. I just asked my mother (b. 1921) about it. Her face lit up, as she told me she "used to listen to it. It was a good show, old fashioned but funny."

From Monday to Thursday at 2030 UTC on 7415 kHz, one can listen to recreations of "lost episodes" of the **Amos and Andy** show, done by Ed Bolton. (As an aside, in the mid-1980s, I used to tune around on a radio that couldn't get Single Side Band signals, only AM. I would listen for hours to a bunch of "old school" hams, broadcasting on AM in the 90 metre band. They would talk about the most interesting subjects, as I "eavesdropped." One of these folks was Ed Bolton.)

Ed has "meticulously recreated" early episodes of **Amos and Andy** from original scripts. Most of these programs were either not transcribed, or the recordings have been lost. I believe Ed does all the voices, too, and a very good job he does, indeed! Having listened to actual recordings of the program from a later period, I would say Ed nails the voices. Of course you can also listen online at **www.wbcq.com**

While we are talking about **WBCQ**, their website links to "Becker Broadcast Systems." Clicking on **www.scottbecker.net** takes you to a page where you can access a 24/7 internet audio stream of old time radio shows. It's a nice mix of vintage radio shows and music. As it is still December as I write this, a casual tune in to the stream featured a jazzy version of *I Saw Mommy Kissing Santa Claus*, and a Christmas episode of **The Great Gildersleeve**. I'll be checking back here often!

As has been men-

tioned in past columns, CFZM AM 740 in Toronto airs classic radio shows Monday-Thursday at 10pm Eastern (0300 UTC). "So many listeners asked for, even demanded, that we extend the number of hours dedicated to the old radio shows, that we've done just that! Brian Peroff selects, and then describes some of the greatest shows from the golden age of radio — the 1930s and 1940s — like **The Shadow** and **Fibber McGee & Molly**. A half-hour of drama, mystery or suspense is followed by a half-hour of comedy — enjoy!" (**www.am740.ca**)

Brian Smith, Don Andrews, Brian Peroff (Music Director), Fred Waterer (2003) AM 740 Fan Gathering

CHML 900, in Hamilton, Ontario, mentioned above also carries Old Time Radio nightly from 10pm-2am Eastern (03-07 UTC although they may be pre-empted by sports) CHML streams at **www.900chml.com**

Another option is to try WMKV-FM near Cincinnati, OH (89.3 MHz) or online at **www.wmkvfm.org**. Weekdays from 11-Noon EST (16-17 UTC) listen to **Theater of the Mind** with Mike Martini, followed at Noon (17 UT) by **Hollywood Radio Theater** (featuring programs from the **Lux Radio Theater**). **Mystery Theater** airs weekdays at 7pm EST (00 UTC). And finally **The Big Broadcast** is heard on Saturday nights from 7pm Eastern (00 UT Sundays), featuring Golden Age programs and music, hosted by Mark Magistrelli and Mike Martini.

Finally, the mother lode of Golden Radio nuggets can be found at **www.archive.org**. If you do a search on Old Time Radio, you can download individual episodes, single seasons or entire series of programs. Just make sure you have a decent internet connection. For instance, one can download in one shot, 2GB of Jack Benny programs, virtually every program known to still exist! Or you can download collections of historic commercials or news broadcasts, especially from World War II. A keeper from that era is **Command Performance**, a program for servicemen overseas, based on their requests.

Hopefully the preceding suggestions will give you a number of options for your listening pleasure. You will find many hours of enjoyment, riding in Jack Benny's Maxwell, uncovering the "bad guy" with The Shadow, flying to another planet with X Minus One or enjoying the misadventures of Edgar Bergen and Charlie McCarthy.

And maybe those prognosticating rodents will be wrong, and we'll have a sunny, warm February. (Yeah right!)

We get mail…

ARMED FORCES RADIO STUDIO, circa 1940s. McCadden Place, Hollywood, CA. L-R TSgt. Bill Stewart and Carole Landis, Actress. Probably a recording of "Command Performance"

1) " Thank you for the November 'Old and New Again' article in *Monitoring Times*. I am not one to reminisce, but the article did bring back happy listening moments from the nineties.

"I must disagree with you on one thing concerning the demise of Happy Station on Radio Netherlands. My source is Tom Meijer himself, as a guest on the final Happy Station broadcast. On that program he stated he disagreed with Radio Netherlands management on the future direction of the shortwave service. Management felt their future was in more news and events programs and to eliminate all entertainment programs. Tom had fought this to no avail, and decided to leave the program while it was still healthy rather than to be remembered for driving the last nail into the coffin. Tom had done the program for twenty years in both English and Spanish. So the program had had a sixty-year run.

"I recall the one weekend they did each release of the program live. This was almost a 24 hour task. We here in the United States were near or at the end of this marathon, and fatigue was showing. But as always it was interesting listening.

"Some years earlier Pete Myers did a series of programs on music of the various decades. I recall the '30s thru the '80s, and I enjoyed them thoroughly. I thought they were very well produced, and wrote Radio Netherlands telling them so. This resulted in my receiving a personal letter from Pete Myers. Somewhere along the line I asked him why he left BBC for Radio Netherlands as, in my ignorance, I thought that would be a step down. He said no. BBC was too staid and too formal for him. Radio Netherlands allowed him to do as he pleased in a free spirit atmosphere, and it was much more rewarding to him.

"Pete Myers in 1992 carefully planned out and received management approval to go to the Caribbean to originate a series on the 500-year celebration of Christopher Columbus's discovery of the New World. Less than a week before he was to leave, Pete fell down a flight of stairs and broke a leg, so the program never happened.

"Since I had written Radio Netherlands complimenting Myers' production abilities, several years later I did receive a letter from the station notifying me of his death due to cancer. Management did care about their audience. I was pleased they did this."

Allan Dunn K1UCY Holbrook, MA

2) "I enjoyed your Programming Spotlight piece in the October 2009 *Monitoring Times* on the *War of the Worlds* broadcast. I just wanted to let you know that there was also a broadcast of WOW made in 1968 (10/31/68: 40 years after the original) by WKBW radio in Buffalo, NY. That time they upgraded the attack to Grand Island, and I was able to purchase a copy of the entire broadcast on the Internet."

Chuck Ripley ka6yfw@arrl.net

(*Thanks for that, Chuck. Actually I believe WKBW did it a couple of times, in 1968 and 1971. I was working on lining up an interview with Jackson Armstrong a couple of years ago (who was the DJ on the 1971 broadcast) but sadly he passed away suddenly – fw)*

3) "Re: September column on Croatia: I received Radio Croatia on Thursday, 9/24 from 2:00 - 2:10 U.T.C. at 7.735 kHz. I was using a Sangean ATS 909 with just the telescoping antenna. I am located in Minneapolis, MN. The program was in English and it was a news program using male announcers and a female for remote report. They spoke good English with an American dialect. It was a fairly strong signal, which switched to vocal music about 2:10 and then began fading.

"I used an Icom R-71A for several years before we moved into a condominium. I miss it very much."

Charles Gustafson

(*I really enjoy listening to the mix of music on Croatian Radio, online or via shortwave when audible-fw*)

How to Use the Shortwave Guide

0000-0100 twhfa USA, Voice of America 5995am 6130ca 7405am 9455af

① ② ⑤ ③ ④ ⑥ ⑦

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 Standard Time) 5, 6, 7 or 8 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, 7:30 pm Eastern, 6:30 pm Central, etc.).

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 broadcast ⑤ 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 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

Mode used by all stations in this guide is AM unless otherwise indicated.

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Additional Contributors to This Month's Shortwave Guide:

Thank You to …

AOKI; BCL News; Ardic DX Club; DX Asia; British DX Club; Cumbre DX; DSWCI-DX Window, EIBI; HFCC; Hard-Core DX; Radio Bulgaria DX Mix News; Media Broadcast, Play DX 2003; WWDXC- BC DX, Top News; World DX Club/ Contact, World News, World Radio TV Handbook.

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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 - 7PM EST / 6PM CST / 4PM PST

0000	0020		Japan, NHK World/ Radio Japan				5960eu
			6145na	13650as	17810as		
0000	0030		Australia, HCJB Global		15400as		
0000	0030		Egypt, Radio Cairo7580na				
0000	0030		Thailand, Radio Thailand World Service				9680na
0000	0030		USA, Voice of America		7405as		
0000	0030		USA, Voice of America/Special English				6180as
			9325as	9620as	9715as		11695as
			12005as	15185as	15205as		15290as
			17820as				
0000	0045		India, All India Radio		6055as		7305as
			9705as	11645as			
0000	0045		USA, WYFR/Family Radio Worldwide				6085na
			11720sa				
0000	0057		Canada, Radio Canada International				9880as
0000	0057		China, China Radio International				6005na
			6020na	6180na	7350as		7425as
			9425as	9570as	11650as		11885as
			11730as	11790as			
0000	0100	twhfas	Albania, Radio Tirana		7425na		
0000	0100		Anguilla, Worldwide Univ Network				6090am
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, Radio Australia		9660as		12080pa
			13690pa	15240pa	17715pa		17750as
			17665as	17795pa			
0000	0100		Bahrain, Radio Bahrain		6010me		9745al
0000	0100		Bulgaria, Radio Bulgaria		5900na		7400na
0000	0100		Canada, CFRX Toronto ON		6070na		
0000	0100		Canada, CFVP Calgary AB		6030na		
0000	0100		Canada, CKZN St John's NF		6160na		
0000	0100		Canada, CKZU Vancouver BC		6160na		
0000	0100		Germany, Deutsche Welle		7265as		9785as
			15640as				
0000	0100		Malaysia, RTM/Traxx FM		7295do		
0000	0100		New Zealand, Radio NZ International				15720pa
0000	0100	DRM	New Zealand, Radio NZ International				17675pa
0000	0100		Russia, Voice of Russia		6240eu		7250eu
0000	0100		Spain, Radio Exterior de Espana				6055na
0000	0100		UK, BBC World Service		5970as		6195as
			7360as	9410as	9740as		13735as
			15335as	15360as			
0000	0100		USA, American Forces Network				4319usb
			5446usb	5765usb	6350usb		7812usb
			10320usb	12133usb	12759usb		13362usb
0000	0100		USA, EWTN/WEWN Vandiver AL				15610af
0000	0100		USA, WBCQ Monticello ME		5110am		7415am
0000	0100	Sun	USA, WHRI Cypress Creek SC		7385na		
0000	0100		USA, WINB Red Lion PA		9265am		
0000	0100		USA, WJHR International Milton FL				15550usb
0000	0100	vl	USA, WRMI Miami FL		9955va		
0000	0100		USA, WTJC Newport NC		9370na		
0000	0100		USA, WWCR Nashville TN		3230na		5070na
			9980na				
0000	0100		USA, WWRB Manchester TN		3185va		3215na
			5050va	5745va			
0000	0100		USA, WYFR/Family Radio Worldwide				5950na
			7360ca	9505na	9595na		15440na
0000	0100		Zambia CVC Intl/ The Voice Africa				4965af
0005	0100	twhfa	Canada, Radio Canada International				9755na
0010	0100	m	Greece, Voice of Greece		7475va		9420va
0030	0045	Sun	Germany, Pan American Broadcasting				9640as
0030	0100		Australia, Radio Australia		15415as		
0030	0100		Thailand, Radio Thailand World Service				12095na
0030	0100	sfa	UK, Bible Voice Broadcasting		9490as		
0030	0100		USA, Voice of America		6170va		
0030	0100		USA, Voice of America/Special English				6170as
0030	0100		Uzbekistan, CVC Intl/ The Voice Asia				7395as

0100 UTC - 8PM EST/ 7PM CST / 5PM PST

0100	0104		Canada, Radio Canada International				9755na
0100	0127		Czech Republic, Radio Prague		6200na		7355na
0100	0127		Slovakia, Radio Slovakia International				6040na
			9440sa				
0100	0128		Vietnam, Voice of Vietnam		6175ca		
0100	0130		Australia, Radio Australia		9660as		12080pa
			13690pa	15240pa	15415as		17715pa
			17750as	17795pa			
0100	0156		Romania, Radio Romania International				6145na
			9800na				
0100	0157		Canada, Radio Canada International				6040as
			6165as				
0100	0157	DRM	China, China Radio International				6080na
0100	0157		North Korea, Voice of Korea		7140as		9345as
			9730as	11735sa	13760sa		15180sa
0100	0200		Anguilla, Worldwide Univ Network				6090am
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, HCJB Global		15400as		
0100	0200		Bahrain, Radio Bahrain		6010me		9745al
0100	0200		Canada, CFRX Toronto ON		6070na		
0100	0200		Canada, CFVP Calgary AB		6030na		
0100	0200		Canada, CKZN St John's NF		6160na		
0100	0200		Canada, CKZU Vancouver BC		6160na		
0100	0200		China, China Radio International				6005as
			6020eu	6080eu	6175as		7350as
			9570na	9580as	11650as		11730as
			11885as				
0100	0200		Cuba, Radio Havana Cuba		6000na		6140na
0100	0200		Malaysia, RTM/Traxx FM		7295do		
0100	0200		New Zealand, Radio NZ International				15720pa
0100	0200	DRM	New Zealand, Radio NZ International				17675pa
0100	0200		Palau, T8WH/World Harvest		15680as		
0100	0200		Russia, Voice of Russia		6240eu		7250eu
0100	0200		Sri Lanka, SLBC	6005as		9770as	15745as
0100	0200		Taiwan, Radio Taiwan International				11875as
0100	0200		UK, BBC World Service		5940as		5970as
			9410as	9740as	11750as		12070as
			15335as	15360as	17615as		
0100	0200		Ukraine, Radio Ukraine International				7440na
0100	0200		USA, American Forces Network				4319usb
			5446usb	5765usb	6350usb		7812usb
			10320usb	12133usb	12759usb		13362usb
0100	0200		USA, EWTN/WEWN Vandiver AL				11520af
0100	0200		USA, KJES Vado NM		7555na		
0100	0200		USA, Voice of America		7325va		9435va
			11705va				
0100	0200		USA, WBCQ Monticello ME		5110am		7415am
0100	0200	sm	USA, WHRI Cypress Creek SC		5875na		
0100	0200		USA, WINB Red Lion PA		9265am		
0100	0200		USA, WJHR International Milton FL				15550usb
0100	0200	vl	USA, WRMI Miami FL		9955va		
0100	0200		USA, WRNO New Orleans LA		7505am		
0100	0200		USA, WTJC Newport NC		9370na		
0100	0200		USA, WWCR Nashville TN		3230na		5070na
			5935na	9980na			
0100	0200		USA, WWRB Manchester TN		3185va		3215na
			5050na	5745va			
0100	0200		USA, WYFR/Family Radio Worldwide				7455na
			9505na	15440na			
0100	0200		Uzbekistan, CVC Intl/ The Voice Asia				7395as
0100	0200		Zambia CVC Intl/ The Voice Africa				4965af
0105	0110	m	Greece, Voice of Greece		7475va		9420va
			12105va				
0105	0200		Canada, Radio Canada International				9755na
0130	0145	twhfas	Albania, Radio Tirana		6130na		
0130	0158	mtwhfa	Serbia, International Radio of Serbia				6190na
0130	0200		Iran, Voice of Islamic Rep. of Iran				6120na
			7250na				
0130	0200	ta	USA, Voice of America/Special English				5960ca
			7405ca				
0140	0200		Vatican City State, Vatican Radio				5895as
			7335as				

0200 UTC - 9PM EST/ 8PM CST / 6PM PST

0200	0204		Canada, Radio Canada International				9755na
0200	0227		Czech Republic, Radio Prague		6200na		7355na
0200	0227		Iran, Voice of Islamic Rep. of Iran				6120na
			7250na				
0200	0230		Thailand, Radio Thailand World Service				15275na
0200	0230		USA, KJES Vado NM		7555na		
0200	0230		Uzbekistan, CVC Intl/ The Voice Asia				7395as
0200	0257		China, China Radio International				9550as
			11785as	13640as	15435as		
0200	0257		North Korea, Voice of Korea		13650as		15100as
0200	0258	DRM	Germany, Deutsche Welle		15205eu		
0200	0300		Anguilla, Worldwide Univ Network				6090am
0200	0300		Argentina, Radio Nacional 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, HCJB Global		15400as		
0200	0300		Australia, Radio Australia		9660pa		12080pa
			13690pa	15240pa	15415as		15515pa
			17750as	21725pa			
0200	0300		Bahrain, Radio Bahrain		6010me		9745al
0200	0300		Canada, CFRX Toronto ON		6070na		

SHORTWAVE GUIDE

0200	0300		Canada, CFVP Calgary AB	6030na	
0200	0300		Canada, CKZN St John's NF	6160na	
0200	0300		Canada, CKZU Vancouver BC	6160na	
0200	0300		Cuba, Radio Havana Cuba	6000na	6140na
0200	0300		Egypt, Radio Cairo	6270na	
0200	0300		Indonesia, Voice of Indonesia	9525va	11785al
			15150al		
0200	0300		Malaysia, RTM/Traxx FM	7295do	
0200	0300		New Zealand, Radio NZ International		15720pa
0200	0300	DRM	New Zealand, Radio NZ International		17675pa
0200	0300		Palau, T8WH/World Harvest	15680as	
0200	0300		Philippines, PBS/ Radyo Pilipinas		11880me
			15285me	17770me	
0200	0300		Russia, Voice of Russia	6240eu	7250eu
0200	0300	DRM	Russia, Voice of Russia	15735as	
0200	0300		South Korea, KBS World Radio		9580sa
0200	0300		Sri Lanka, SLBC	6005as	9770as 15745as
0200	0300		Taiwan, Radio Taiwan International		5950na
			9680na		
0200	0300		Uganda, UBC Radio	4976do	
0200	0300		UK, BBC World Service	5940as	6005af
			6195me	9410as	15310as
0200	0300		USA, American Forces Network		4319usb
			5446usb	5765usb	6350usb 7812usb
			10320usb	12133usb	12759usb 13362usb
0200	0300		USA, EWTN/WEWN Vandiver AL		11520af
0200	0300	mtwhfa	USA, WBCQ Monticello ME	7415am	
0200	0300		USA, WBCQ Monticello ME	5110am	
0200	0300		USA, WHRI Cypress Creek SC	7385na	
0200	0300		USA, WHRI Cypress Creek SC	5875na	
0200	0300	twhfa	USA, WHRI Cypress Creek SC	5850eu	5875na
0200	0300		USA, WINB Red Lion PA	9265am	
0200	0300		USA, WJHR International Milton FL		15550usb
0200	0300	vl	USA, WRMI Miami FL	9955va	
0200	0300		USA, WRNO New Orleans LA	7505am	
0200	0300		USA, WTJC Newport NC	9370na	
0200	0300		USA, WWCR Nashville TN	3215na	5070na
			5890na	5935na	
0200	0300		USA, WWRB Manchester TN	3185va	5050va
			5745va		
0200	0300		USA, WYFR/Family Radio Worldwide		4985na
			5985na	6890na	7455na 9505na
			9525na		
0200	0300		Zambia CVC Intl/ The Voice Africa		4965af
0215	0230		Nepal, Radio Nepal	5005as	
0230	0258		Vietnam, Voice of Vietnam	6175ca	
0230	0300		Sweden, Radio Sweden	6010na	11550va
0230	0300		Uzbekistan, CVC Intl/ The Voice Asia		11970as
0245	0300	twhfas	Albania, Radio Tirana	6130eu	
0245	0300		Zambia, Zambia Natl Broadcasting Corp		6165do
0250	0300		Vatican City State, Vatican Radio		6040am
			7305am		

0300 UTC - 10PM EST / 9PM CST / 7PM PST

0300	0315	Sun	Swaziland, TWR Swaziland	3200af	
0300	0330		Croatia, Croatian Radio	3985va	7375va
0300	0330		Egypt, Radio Cairo	6270na	
0300	0330		Philippines, PBS/ Radyo Pilipinas		11880me
			15285me	17770me	
0300	0330		Sri Lanka, SLBC	6005as	9770as 15745as
0300	0330		Vatican City State, Vatican Radio		7360af
			9660af		
0300	0355		South Africa, Channel Africa	6120af	
0300	0357		China, China Radio International		6190na
			9460na	9690na	9790as
0300	0357		North Korea, Voice of Korea	7140as	9345as
			9730va		
0300	0400		Anguilla, Worldwide Univ Network		6090am
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, Radio Australia	9660as	12080pa
			13690pa	15240pa	15415as 15515pa
			17750as	21725pa	
0300	0400		Bahrain, Radio Bahrain	6010me	9745al
0300	0400		Bulgaria, Radio Bulgaria	5900na	7400na
0300	0400	twhfas	Canada, CBC NQ SW Service	9625na	
0300	0400		Canada, CFRX Toronto ON	6070na	
0300	0400		Canada, CFVP Calgary AB	6030na	
0300	0400		Canada, CKZN St John's NF	6160na	
0300	0400		Canada, CKZU Vancouver BC	6160na	
0300	0400		Cuba, Radio Havana Cuba	6000na	6140na
0300	0400		Germany, Deutsche Welle	11695as	17800as
0300	0400	Sun	Greece, Voice of Greece	7475va	9420va
0300	0400		Malaysia, RTM/Traxx FM	7295do	
0300	0400		Malaysia, RTM/Voice of Malaysia		6175as
			9750as	15295as	
0300	0400		New Zealand, Radio NZ International		15720pa
0300	0400	DRM	New Zealand, Radio NZ International		17675pa
0300	0400		Oman, Radio Oman	15355af	
0300	0400		Palau, T8WH/World Harvest	15680as	
0300	0400		Russia, Voice of Russia	6240eu	7250sa
			12030eu	12040eu	13735eu
0300	0400	DRM	Russia, Voice of Russia	15735as	
0300	0400		South Africa, Channel Africa	3345af	
0300	0400		Taiwan, Radio Taiwan International		5950na
			15320as		
0300	0400		Uganda, UBC Radio	4976do	
0300	0400		UK, BBC World Service	3255af	6005af
			6105af	6145af	6190af 6195as
			7255af	7445af	9410as 12095as
			15310as	17790as	
0300	0400		USA, American Forces Network		4319usb
			5446usb	5765usb	6350usb 7812usb
			10320usb	12133usb	12759usb 13362usb
0300	0400		USA, EWTN/WEWN Vandiver AL		11520af
0300	0400		USA, Voice of America	4930af	6080af
			9885af	15580af	
0300	0400	mtwhfa	USA, WBCQ Monticello ME	7415am	
0300	0400		USA, WHRI Cypress Creek SC	7385na	
0300	0400	twhfa	USA, WHRI Cypress Creek SC	5875na	
0300	0400		USA, WINB Red Lion PA	9265am	
0300	0400		USA, WJHR International Milton FL		15550usb
0300	0400	vl	USA, WRMI Miami FL	9955va	
0300	0400		USA, WRNO New Orleans LA	7505am	
0300	0400		USA, WTJC Newport NC	9370na	
0300	0400		USA, WWCR Nashville TN	3215na	5070na
			5890na	5935na	
0300	0400		USA, WWRB Manchester TN	3185va	5050va
			5745va		
0300	0400		USA, WYFR/Family Radio Worldwide		7455na
			9505na	9930ca	9985eu
0300	0400		Zambia CVC Intl/ The Voice Africa		4965af
0300	0400		Zambia, Zambia Natl Broadcasting Corp		6165do
0300	4000		Uzbekistan, CVC Intl/ The Voice Asia		11970as
0330	0358		Vietnam, Voice of Vietnam	9840as	12020as
0330	0400	twhfas	Albania, Radio Tirana	6150na	
0330	0400	Sun	Sri Lanka, SLBC	6005as	9770as 15745as
0330	0400		Sweden, Radio Sweden	6010na	
0330	0400		UK, BBC World Service	11945af	
0340	0400		Vatican City State, Vatican Radio		9545as
0345	0400	vl/Sat/Sun	Uganda, UBC Radio	4976do	

0400 UTC - 11PM EST / 10PM CST / 8PM PST

0400	0427		Czech Republic, Radio Prague	6200na	7345na
0400	0430	mtwhf	France, Radio France International		7315af
			9805af		
0400	0445		USA, WYFR/Family Radio Worldwide		7445na
			9505na		
0400	0455		Turkey, Voice of Turkey	6020va	6040me
			7240na		
0400	0456		Romania, Radio Romania International		6130na
			7310na	9690as	11895as
0400	0457		China, China Radio International		6190na
			9460na	13620as	15120as 17725as
			17855as		
0400	0458		New Zealand, Radio NZ International		15720pa
0400	0458	DRM	New Zealand, Radio NZ International		17675pa
0400	0500		Anguilla, Worldwide Univ Network		6090am
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, Radio Australia	9660pa	12080pa
			13690pa	15240pa	15515pa 17750as
			21725pa		
0400	0500		Bahrain, Radio Bahrain	6010me	9745al
0400	0500	twhfas	Canada, CBC NQ SW Service	9625na	
0400	0500		Canada, CFRX Toronto ON	6070na	
0400	0500		Canada, CKZN St John's NF	6160na	
0400	0500		Canada, CKZU Vancouver BC	6160na	
0400	0500		Cuba, Radio Havana Cuba	6000na	6140na
0400	0500		Germany, Deutsche Welle	5905af	5945af
			6180af	15600af	
0400	0500		Malaysia, RTM/Traxx FM	7295do	
0400	0500		Malaysia, RTM/Voice of Malaysia		6175as
			9750as	15295as	
0400	0500		Palau, T8WH/World Harvest	15680as	
0400	0500		Russia, Voice of Russia	6240ca	12030na
			12040na	13735eu	
0400	0500	DRM	Russia, Voice of Russia	15735as	
0400	0500		South Africa, Channel Africa	7230af	

0400	0500	Sun	Sri Lanka, SLBC	6005as	9770as	15745as	
0400	0500		Uganda, UBC Radio	4976do			
0400	0500		UK, BBC World Service	3255af	6005af		
			6190af	7255af	7445af	9410as	
			11945af	12035af	15310as	15360as	
			17790as				
0400	0500		Ukraine, Radio Ukraine International	7440na			
0400	0500		USA, American Forces Network	4319usb			
			5446usb	5765usb	6350usb	7812usb	
			10320usb	12133usb	12759usb	13362usb	
0400	0500		USA, EWTN/WEWN Vandiver AL	11520af			
0400	0500		USA, Voice of America	4930af	4960af		
			6080af	9885af	15580af		
0400	0500	twhfa	USA, WBCQ Monticello ME	7415am			
0400	0500	smtwhf	USA, WHRI Cypress Creek SC	5850eu			
0400	0500	twhfa	USA, WHRI Cypress Creek SC	5875na			
0400	0500	Sat	USA, WHRI Cypress Creek SC	9640me			
0400	0500		USA, WJHR International Milton FL	15550usb			
0400	0500	vl	USA, WRMI Miami FL	9955va			
0400	0500		USA, WRNO New Orleans LA	7505am			
0400	0500		USA, WTJC Newport NC	9370na			
0400	0500		USA, WWCR Nashville TN	5070na	5890na		
			5935na	15825na			
0400	0500		USA, WWRB Manchester TN	3185va	5050va		
			5745va				
0400	0500		USA, WYFR/Family Radio Worldwide	6915na			
			9680na	9715na			
0400	0500		Uzbekistan, CVC Intl/ The Voice Asia	11970as			
0400	0500		Zambia CVC Intl/ The Voice Africa	4965af			
			7160af				
0400	0500		Zambia, Zambia Natl Broadcasting Corp	6165do			
0430	0457		Czech Republic, Radio Prague	9855va			
0430	0500	twhfas	Albania, Radio Tirana	6100na			
0430	0500		Australia, Radio Australia	15415as			
0430	0500	mtwhf	Swaziland, TWR Swaziland	3200af	6120af		
			9500af				
0459	0500		New Zealand, Radio NZ International	11725pa			
0459	0500	DRM	New Zealand, Radio NZ International	13730pa			

0500 UTC - 12AM EST / 11PM CST / 9PM PST

0500	0507	twhfas	Canada, CBC NQ SW Service	9625na			
0500	0530	mtwhf	France, Radio France International	7425af			
			9805af				
0500	0530		Germany, Deutsche Welle	6130af	6180af		
			9755af	12045af	15600af		
0500	0530		Japan, NHK World/ Radio Japan	5975eu			
			6110na	9770va	15325as	17810as	
0500	0530		Vatican City State, Vatican Radio	7360af			
			9660af	11625af			
0500	0600		Anguilla, Worldwide Univ Network	6090am			
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, Radio Australia	9660pa	12080pa		
			13630as	13690pa	17750as		
0500	0600		Bahrain, Radio Bahrain	6010me	9745al		
0500	0600		Bhutan, Bhutan Broadcasting Service	6035as			
0500	0600		Canada, CFRX Toronto ON	6070na			
0500	0600		Canada, CKZN St John's NF	6160na			
0500	0600		Canada, CKZU Vancouver BC	6160na			
0500	0600		China, China Radio International	5960na			
			6190af	7220as	11880as	15350as	
			15465as				
0500	0600		Cuba, Radio Havana Cuba	6000na	6010na		
			6060na	6140na			
0500	0600		Malaysia, RTM/Traxx FM	7295do			
0500	0600		Malaysia, RTM/Voice of Malaysia	6175as			
			9750as	15295as			
0500	0600		New Zealand, Radio NZ International	11725pa			
0500	0600	DRM	New Zealand, Radio NZ International	13730pa			
0500	0600		Nigeria, Voice of Nigeria/External Service	15120af			
0500	0600		Palau, T8WH/World Harvest	15680as			
0500	0600		Russia, Voice of Russia	9855na	9840na		
			12030na				
0500	0600	DRM	Russia, Voice of Russia	15735as			
0500	0600		South Africa, Channel Africa	7230af			
0500	0600		Taiwan, Radio Taiwan International	5950na			
0500	0600		Uganda, UBC Radio	4976do			
0500	0600		UK, BBC World Service	3255af	3995eu		
			5875eu	6005af	6190af	7255af	
			9410as	11765af	11945af	12095eu	
			15310as	15360as	17640af	17790as	
0500	0600	smtwhf	UK, BBC World Service	15420af			
0500	0600		USA, American Forces Network	4319usb			
			5446usb	5765usb	6350usb	7812usb	
			10320usb	12133usb	12759usb	13362usb	
0500	0600		USA, EWTN/WEWN Vandiver AL	11520af			
0500	0600		USA, Voice of America	4930af	6080af		
			9885af	15580af			
0500	0600	Sat/Sun	USA, WHRI Cypress Creek SC	7385af			
0500	0600	Sun	USA, WHRI Cypress Creek SC	11565pa			
0500	0600		USA, WJHR International Milton FL	15550usb			
0500	0600	vl	USA, WRMI Miami FL	9955va			
0500	0600		USA, WTJC Newport NC	9370na			
0500	0600		USA, WWCR Nashville TN	5070na	5890na		
			5935na	15825na			
0500	0600		USA, WWRB Manchester TN	3185va			
0500	0600		USA, WYFR/Family Radio Worldwide	6915na			
			9680na				
0500	0600		Uzbekistan, CVC Intl/ The Voice Asia	11970as			
0500	0600		Zambia CVC Intl/ The Voice Africa	4965af			
			7160af				
0500	0600		Zambia, Zambia Natl Broadcasting Corp	6165do			
0515	0530		Rwanda, Radio Rwanda	6055do			
0530	0600		Clandestine, Sudan Radio Service	13720af			
			15325af				
0530	0600	mtwh	Slovakia, IRRS/Euro Gospel Radio	5990va			
0530	0600		Thailand, Radio Thailand World Service	11730va			

0600 UTC - 1AM EST / 12AM CST / 10PM PST

0600	0615	Sat/Sun	South Africa, TWR	11640af			
0600	0620		Vatican City State, Vatican Radio	4005eu			
			5965eu	7520eu			
0600	0630	Sat/Sun	Australia, Radio Australia	15180as	15290as		
			15415as				
0600	0630	mtwhf	France, Radio France International	7315af			
			11995af	13680af			
0600	0630		Germany, Deutsche Welle	5945af	7240af		
			12045af				
0600	0630		Laos, Lao National Radio	7145as			
0600	0630	mtwh	Slovakia, IRRS/Euro Gospel Radio	5990va			
0600	0630		Uzbekistan, CVC Intl/ The Voice Asia	11970as			
0600	0645	mtwhf	South Africa, TWR	11640af			
0600	0655		South Africa, Channel Africa	15255af			
0600	0657		China, China Radio International	6115af			
			11750af	11770as	11880as	13645as	
			15145as	15350as	15465as	17505va	
			17540as	17710as			
0600	0658		New Zealand, Radio NZ International	11725pa			
0600	0658	DRM	New Zealand, Radio NZ International	13730pa			
0600	0700		Anguilla, Worldwide Univ Network	6090am			
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, Radio Australia	9660pa	12080pa		
			13630as	13690pa	15160pa	15240pa	
			17750as				
0600	0700		Bahrain, Radio Bahrain	6010me	9745al		
0600	0700		Canada, CFRX Toronto ON	6070na			
0600	0700		Canada, CFVP Calgary AB	6030na			
0600	0700		Canada, CKZN St John's NF	6160na			
0600	0700		Canada, CKZU Vancouver BC	6160na			
0600	0700		Cuba, Radio Havana Cuba	6000na	6010na		
			6060na	6140na			
0600	0700		Greece, Voice of Greece	7475eu	9420eu		
0600	0700		Malaysia, RTM/Traxx FM	7295do			
0600	0700		Malaysia, RTM/Voice of Malaysia	6175as			
			9750as	15295as			
0600	0700		Nigeria, Voice of Nigeria/External Service	15120af			
0600	0700		Palau, T8WH/World Harvest	15680as			
0600	0700		Russia, Voice of Russia	9855na	9840na		
			12070na				
0600	0700		South Africa, Channel Africa	7230af			
0600	0700		Swaziland, TWR Swaziland	4775af	6120af		
			9500af				
0600	0700		UK, BBC World Service	3995eu	5875eu		
			6005af	6190af	9860af	11760as	
			11765af	12015af	12095eu	15310as	
			17640af	17790as			
0600	0700	Sat/Sun	UK, BBC World Service	15420af			
0600	0700		Ukraine, Radio Ukraine International	7440na			
0600	0700		USA, American Forces Network	4319usb			
			5446usb	5765usb	6350usb	7812usb	
			10320usb	12133usb	12759usb	13362usb	
0600	0700		USA, EWTN/WEWN Vandiver AL	11520af			
0600	0700		USA, Voice of America	6080af	9885af		
			15580af				
0600	0700	Sat/Sun	USA, WHRI Cypress Creek SC	9615me			
0600	0700		USA, WJHR International Milton FL	15550usb			
0600	0700	vl	USA, WRMI Miami FL	9955va			
0600	0700		USA, WTJC Newport NC	9370na			

0600	0700		USA, WWCR Nashville TN	3215na	5070na		
			5890na	5935na			
0600	0700		USA, WWRB Manchester TN	3185va			
0600	0700		USA, WYFR/Family Radio Worldwide	5745sa			
			6000ca	9680na	9985eu	11530va	
0600	0700		Zambia CVC Intl/ The Voice Africa	6065af			
			13590af				
0600	0700		Zambia, Zambia Natl Broadcasting Corp	6165do			
0630	0656		Romania, Radio Romania International	7370eu			
			17780pa	21600pa			
0630	0656	DRM	Romania, Radio Romania International	6020eu			
0630	0700		Australia, Radio Australia	15415as			
0630	0700		Uzbekistan, CVC Intl/ The Voice Asia	15700as			
0630	0700		Vatican City State, Vatican Radio	7360af			
			9660af	11625af			
0659	0700		New Zealand, Radio NZ International	9765pa			
0659	0700	DRM	New Zealand, Radio NZ International	13730pa			

0700 UTC - 2AM EST / 1AM CST / 11PM PST

0700	0705		Croatia, Croatian Radio	6165eu			
0700	0727		Slovakia, Radio Slovakia International	13715va			
			15460va				
0700	0730	mtwhf	France, Radio France International	11725af			
0700	0730	Sun	UK, Bible Voice Broadcasting	5945eu			
0700	0745		USA, WYFR/Family Radio Worldwide	5745sa			
			5950na				
0700	0757		China, China Radio International	11785as			
			11880as	13645as	15125eu	15350as	
			15465as	17505as	17540as	17710as	
0700	0800		Anguilla, Worldwide Univ Network	6090am			
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, Radio Australia	9475as	9660pa		
			9710as	11945pa	12080pa	13630as	
			15160pa	15240pa			
0700	0800		Bahrain, Radio Bahrain	6010me	9745al		
0700	0800	DRM	Belgium, TDP Radio	17755as			
0700	0800		Canada, CFRX Toronto ON	6070na			
0700	0800		Canada, CFVP Calgary AB	6030na			
0700	0800		Canada, CKZN St John's NF	6160na			
0700	0800		Canada, CKZU Vancouver BC	6160na			
0700	0800		Cuba, Radio Havana Cuba	6060na			
0700	0800	mtwhf	Equatorial Guinea, Radio Africa # 2	15190af			
0700	0800	Sat/Sun	Equatorial Guinea, Radio East Africa	15190af			
0700	0800	DRM	Germany, Deutsche Welle	3995eu	6130eu		
0700	0800		Greece, Voice of Greece	12105va			
0700	0800		Malaysia, RTM/Traxx FM	7295do			
0700	0800		Malaysia, RTM/Voice of Malaysia	6175as			
			9750as	15295as			
0700	0800		Myanmar, Myanma Radio	9730do			
0700	0800		New Zealand, Radio NZ International	9765pa			
0700	0800	DRM	New Zealand, Radio NZ International	9870pa			
0700	0800		Palau, T8WH/World Harvest	9930as	15680as		
0700	0800	DRM	Russia, Voice of Russia	11635eu			
0700	0800		Russia, Voice of Russia	17665pa	17805pa		
0700	0800		South Africa, Channel Africa	9625af			
0700	0800		Swaziland, TWR Swaziland	4775af	6120af		
			9500af				
0700	0800		UK, BBC World Service	3995eu	6190af		
			9860af	11760me	11765af	13820af	
			15310as	15400af	15575as	17790as	
			17830af				
0700	0800	Sat/Sun	UK, BBC World Service	15420af			
0700	0800	Sat	UK, Bible Voice Broadcasting	5945eu			
0700	0800		USA, American Forces Network	4319usb			
			5446usb	5765usb	6350usb	7812usb	
			10320usb	12133usb	12759usb	13362usb	
0700	0800		USA, EWTN/WEWN Vandiver AL	11520af			
0700	0800		USA, WJHR International Milton FL	15550usb			
0700	0800	vl	USA, WRMI Miami FL	9955va			
0700	0800		USA, WTJC Newport NC	9370na			
0700	0800		USA, WWCR Nashville TN	3215na	5070na		
			5890na	5935na			
0700	0800		USA, WWRB Manchester TN	3185va			
0700	0800		USA, WYFR/Family Radio Worldwide	5950na			
			6915na	7455na	9495ca	11580va	
0700	0800		Uzbekistan, CVC Intl/ The Voice Asia	15700as			
0700	0800		Zambia CVC Intl/ The Voice Africa	6065af			
			13590af				
0700	0800		Zambia, Zambia Natl Broadcasting Corp	6165do			
0730	0745		Vatican City State, Vatican Radio				
			4005eu	5965eu	7250eu	9645 et	
			11740eu	15595eu			
0730	0800		Australia, HCJB Global	11750as			
0730	0800		Bulgaria, Radio Bulgaria	5900eu	7400eu		
0730	0800		Clandestine, Cotton Tree News	11875af			
0745	0800	Sun	Germany, TWR Europe	6105eu			
0745	0800	Sun	Monaco, TWR Europe	9800eu			
0745	0800	f	UK, Bible Voice Broadcasting	5945eu			

0800 UTC - 3AM EST / 2AM CST / 12AM PST

0800	0815	Sat	UK, Bible Voice Broadcasting	5945eu			
0800	0827		Czech Republic, Radio Prague	7345eu	9860eu		
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		Myanmar, Myanma Radio	9730do			
0800	0845		USA, WYFR/Family Radio Worldwide	11580va			
0800	0850	mtwhf	Germany, TWR Europe	6105eu			
0800	0850	Sun	Germany, TWR Europe	6105eu			
0800	0850	mtwhf	Monaco, TWR Europe	9800eu			
0800	0850	Sun	Monaco, TWR Europe	9800eu			
0800	0857		China, China Radio International	9415as			
			11785as	11880as	15350as	15465as	
			15625as	15465as	15625as	17490eu	
			17540as				
0800	0858	DRM	Germany, Deutsche Welle	12005as			
0800	0900		Anguilla, Worldwide Univ Network	6090am			
0800	0900		Australia, HCJB Global	11750pa			
0800	0900		Australia, Radio Australia	5995pa	9475as		
			9580pa	9590pa	9710pa	11945pa	
			12080pa	13630as			
0800	0900		Bahrain, Radio Bahrain	6010me	9745al		
0800	0900	m/DRM	Belgium, TDP Radio	6015eu			
0800	0900		Canada, CFRX Toronto ON	6070na			
0800	0900		Canada, CFVP Calgary AB	6030na			
0800	0900		Canada, CKZN St John's NF	6160na			
0800	0900		Canada, CKZU Vancouver BC	6160na			
0800	0900		China, Guangxi FBS/Beibu Bay Radio	5050as			
			9820as				
0800	0900		Cuba, Radio Havana Cuba	6060na			
0800	0900	mtwhf	Equatorial Guinea, Radio Africa # 2	15190af			
0800	0900	Sat/Sun	Equatorial Guinea, Radio East Africa	15190af			
0800	0900	DRM	Germany, Deutsche Welle	9610eu	13810eu		
0800	0900		Malaysia, RTM/Traxx FM	7295do			
0800	0900		Malaysia, RTM/Voice of Malaysia	6175as			
			9750as	15295as			
0800	0900		New Zealand, Radio NZ International	9765pa			
0800	0900	DRM	New Zealand, Radio NZ International	9870pa			
0800	0900		Nigeria, Voice of Nigeria/External Service	9690af			
0800	0900		Palau, T8WH/World Harvest	9930as	15680as		
0800	0900	DRM	Russia, Voice of Russia	11635eu			
0800	0900		Russia, Voice of Russia	17650af	17665af		
			17805af				
0800	0900		South Africa, Channel Africa	9625af			
0800	0900	Sun	South Africa, SA Radio League	7205af	17860af		
0800	0900		South Korea, KBS World Radio	9570as			
0800	0900		Swaziland, TWR Swaziland	4775af	6120af		
			9500af				
0800	0900		UK, BBC World Service	6190af	9860af		
			11760me	15310as	15400af	15575as	
			17640af	17790as	17830af	21470af	
0800	0900		USA, American Forces Network	4319usb			
			5446usb	5765usb	6350usb	7812usb	
			10320usb	12133usb	12759usb	13362usb	
0800	0900		USA, EWTN/WEWN Vandiver AL	11520af			
0800	0900		USA, KNLS Anchor Point AK	6150as	9615al		
0800	0900	mtwhf	USA, WHRI Cypress Creek SC	11565pa			
0800	0900		USA, WJHR International Milton FL	15550usb			
0800	0900	vl	USA, WRMI Miami FL	9955va			
0800	0900		USA, WTJC Newport NC	9370na			
0800	0900		USA, WWCR Nashville TN	3215na	5070na		
			5890na	5935na			
0800	0900		USA, WWRB Manchester TN	3185va			
0800	0900		USA, WYFR/Family Radio Worldwide	5950na			
			6915na	7455na			
0800	0900		Uzbekistan, CVC Intl/ The Voice Asia	15700as			
0800	0900		Zambia CVC Intl/ The Voice Africa	6065af			
			13590af				
0800	0900		Zambia, Zambia Natl Broadcasting Corp	6165do			
0815	0850	Sat	Germany, TWR Europe	6105eu			
0815	0850	Sat	Monaco, TWR Europe	9800eu			
0820	0900	smtwhf	Guam, KTWR/TWR	15170as			
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	11840pa			

0900 UTC - 4AM EST / 3AM CST / 1AM PST

0900	0910	mtwhfa	Guam, KTWR/TWR	11840pa			
0900	0930		Australia, HCJB Global	11750pa			

0900	0930		Japan, NHK World/ Radio Japan				9625pa
			9825pa	11815as	15590as		
0900	0930		Uzbekistan, CVC Intl/ The Voice Asia				15700as
0900	0957		China, China Radio International				9415as
			15210va	15270eu	15350as		17490eu
			17570eu	17690va	17750as		
0900	1000		Anguilla, Worldwide Univ Network				6090am
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, Radio Australia		9475as		9580pa
			9590pa	11945pa			
0900	1000		Bahrain, Radio Bahrain		6010me		9745al
0900	1000	t/DRM	Belgium, TDP Radio		6015eu		
0900	1000		Bhutan, Bhutan Broadcasting Service				6035as
0900	1000		Canada, CFRX Toronto ON	6070na			
0900	1000		Canada, CFVP Calgary AB	6030na			
0900	1000		Canada, CKZN St John's NF	6160na			
0900	1000		Canada, CKZU Vancouver BC	6160na			
0900	1000		China, Guangxi FBS/Beibu Bay Radio				5050as
			9820as				
0900	1000		Cuba, Radio Havana Cuba		6060na		
0900	1000	mtwhf	Equatorial Guinea, Radio Africa # 2				15190af
0900	1000	Sat/Sun	Equatorial Guinea, Radio East Africa				15190af
0900	1000	2nd Sun	Germany, Blue Star Radio		6140eu		
0900	1000		Germany, Deutsche Welle		17710as		21780as
0900	1000	3rd Sun	Germany, European Music Radio				6140eu
0900	1000	4th Sun	Germany, Radio Gloria International				6140eu
0900	1000		Malaysia, RTM/Traxx FM		7295do		
0900	1000		Malaysia, RTM/Voice of Malaysia				6175as
			9750as	15295as			
0900	1000		New Zealand, Radio NZ International				9765pa
0900	1000	DRM	New Zealand, Radio NZ International				9870pa
0900	1000		Nigeria, Voice of Nigeria/External Service				9690af
0900	1000		Palau, T8WH/World Harvest		9930as		15680as
0900	1000		Russia, Voice of Russia		17605af		17665af
			17805af				
0900	1000	3rd Sat	Slovakia, IRRS/Radio City		9510va		
0900	1000	1st Sat	Slovakia, IRRS/Radio Joystick		9510va		
0900	1000		South Africa, Channel Africa		9625af		
0900	1000		Tajikistan, Voice of Tajik/Radio 2				7245as
0900	1000	DRM	UK, BBC World Service		9610eu		13810eu
0900	1000		UK, BBC World Service		6190af		6195as
			9740as	9860af	11760me		15310as
			15400af	15575as	17640af		17760as
			17830af	21470af			
0900	1000		USA, American Forces Network				4319usb
			5446usb	5765usb	6350usb		7812usb
			10320usb	12133usb	12759usb		13362usb
0900	1000		USA, EWTN/WEWN Vandiver AL				9390as
0900	1000		USA, WJHR International Milton FL				15550usb
0900	1000	vl	USA, WRMI Miami FL		9955va		
0900	1000		USA, WTJC Newport NC		9370na		
0900	1000		USA, WWCR Nashville TN		3215na		5070na
			5890na	5935na			
0900	1000		USA, WWRB Manchester TN		3185va		
0900	1000		USA, WYFR/Family Radio Worldwide				5950na
			6915na	7455na	9465as		
0900	1000		Zambia CVC Intl/ The Voice Africa				6065af
			13590af				
0900	1000		Zambia, Zambia Natl Broadcasting Corp				6165do
0930	1000		Australia, CVC International		15535as		

1000 UTC - 5AM EST / 4AM CST / 2AM PST

1000	1005		Croatia, Croatian Radio		11675va		
1000	1029		Czech Republic, Radio Prague		9955sa		15700as
			21745af				
1000	1030	Sat/Sun DRM	Bulgaria, Radio Bulgaria		11900eu		
1000	1057		China, China Radio International				5955na
			7215as	11640as	13590as		13720va
			15190as	15210as	15350as		17490eu
			17690va				
1000	1057		Netherlands, R Netherlands Worldwide				6040va
			9720as	12065as			
1000	1057		North Korea, Voice of Korea		11710sa		11735as
			13650as	15180sa			
1000	1058		New Zealand, Radio NZ International				9765pa
1000	1100		Anguilla, Worldwide Univ Network				11775am
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, CVC International		15535as		
1000	1100		Australia, Radio Australia		9475as		9580pa
			9590pa	11945pa			
1000	1100		Bahrain, Radio Bahrain		6010me		9745al
1000	1100	w/DRM	Belgium, TDP Radio		6015eu		
1000	1100		Canada, CFRX Toronto ON	6070na			
1000	1100		Canada, CFVP Calgary AB	6030na			
1000	1100		Canada, CKZN St John's NF	6160na			
1000	1100		Canada, CKZU Vancouver BC	6160na			
1000	1100		Cuba, Radio Havana Cuba		6060na		
1000	1100	mtwhf	Equatorial Guinea, Radio Africa # 2				15190af
1000	1100	Sat/Sun	Equatorial Guinea, Radio East Africa				15190af
1000	1100		India, All India Radio		7270as		13710pa
			15235as	15260as	17800as		17895pa
1000	1100		Indonesia, Voice of Indonesia		9525va		11785al
1000	1100		Malaysia, RTM/Traxx FM		7295do		
1000	1100	DRM	New Zealand, Radio NZ International				9870pa
1000	1100		Nigeria, Voice of Nigeria/External Service				9690af
1000	1100		Palau, T8WH/World Harvest		9930as		12130as
1000	1100		Russia, Voice of Russia		7205af		17650af
			17665af	17805af			
1000	1100		Saudi Arabia, BSKSA/External Service				15250af
1000	1100		South Africa, Channel Africa		9625af		
1000	1100	Sat/Sun	UK, BBC World Service		15400af		17830af
1000	1100	DRM	UK, BBC World Service		9545eu		13810eu
1000	1100		UK, BBC World Service		6190af		6195as
			9545eu	9740as	9860af		11760me
			11895as	15310as	15575as		17640af
			17790as	21470af			
1000	1100		Ukraine, Radio Ukraine International				9950eu
1000	1100		USA, American Forces Network				4319usb
			5446usb	5765usb	6350usb		7812usb
			10320usb	12133usb	12759usb		13362usb
1000	1100		USA, EWTN/WEWN Vandiver AL				9390as
1000	1100		USA, KNLS Anchor Point AK		6150as		
1000	1100		USA, WJHR International Milton FL				15550usb
1000	1100	vl	USA, WRMI Miami FL		9955va		
1000	1100		USA, WTJC Newport NC		9370na		
1000	1100		USA, WWCR Nashville TN		5070na		5935na
			9985na				
1000	1100		USA, WWRB Manchester TN		3185va		
1000	1100		USA, WYFR/Family Radio Worldwide				5950na
			6890na	6915na	7455na		9460as
			9465as				
1000	1100		Zambia CVC Intl/ The Voice Africa				6065af
			13590af				
1000	1100		Zambia, Zambia Natl Broadcasting Corp				6165do
1015	1045	Sun	UK, Bible Voice Broadcasting		5910as		
1030	1100		Australia, HCJB Global		15400as		
1030	1100		Iran, Voice of Islamic Rep. of Iran				15460as
			17660as				
1030	1100		Mongolia, Voice of Mongolia		12085as		
1030	1100	Sun	Slovakia, IRRS/Euro Gospel Radio				9510va
1030	1100		Vietnam, Voice of Vietnam		9840as		12020as
1059	1100		New Zealand, Radio NZ International				13660pa

1100 UTC - 6AM EST / 5AM CST / 3AM PST

1100	1105	mtwhf	Croatia, Croatian Radio		7370va		
1100	1105		Pakistan, PBC/ Radio Pakistan		17700eu		
1100	1112		Cuba, Radio Nacional de Venezuela				6060ca
1100	1127		Iran, Voice of Islamic Rep. of Iran				15460as
			17660as				
1100	1130		Australia, CVC International		15535as		
1100	1130	DRM	South Korea, KBS World Radio				9760eu
1100	1130		Vietnam, Voice of Vietnam		7285as		
1100	1145		USA, WYFR/Family Radio Worldwide				5950na
			6000ca				
1100	1157		China, China Radio International				5955as
			5960na	6060as	9570as		11650as
			11795as	13590va	13645eu		13665eu
			13720as	17490va			
1100	1158	DRM	New Zealand, Radio NZ International				9870pa
1100	1200		Anguilla, Worldwide Univ Network				11775am
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, HCJB Global		15400as		
1100	1200		Australia, Radio Australia		5995pa		6020pa
			9475as	9560pa	9580pa		9590pa
			11945pa	12080pa			
1100	1200		Bahrain, Radio Bahrain		6010me		9745al
1100	1200	h/DRM	Belgium, TDP Radio		6015eu		
1100	1200	Sat/Sun	Canada, CBC NQ SW Service		9625na		
1100	1200		Canada, CFRX Toronto ON	6070na			
1100	1200		Canada, CFVP Calgary AB	6030na			
1100	1200		Canada, CKZN St John's NF	6160na			
1100	1200		Canada, CKZU Vancouver BC	6160na			
1100	1200	mtwhf	Equatorial Guinea, Radio Africa # 2				15190af
1100	1200	Sat/Sun	Equatorial Guinea, Radio East Africa				15190af
1100	1200	DRM	Germany, Deutsche Welle		9545eu		13810eu
1100	1200		Malaysia, RTM/Traxx FM		7295do		

SHORTWAVE GUIDE

1100	1200		New Zealand, Radio NZ International			13660pa
1100	1200		Nigeria, Voice of Nigeria/External Service			9690af
1100	1200		Palau, T8WH/World Harvest	9930as		12130as
1100	1200		Russia, Voice of Russia	7205af		
1100	1200		Saudi Arabia, BSKSA/External Service			15250af
1100	1200	Sun	Slovakia, IRRS/Euro Gospel Radio			9510va
1100	1200		South Africa, Channel Africa	9625af		
1100	1200		Taiwan, Radio Taiwan International			7445as
			11715as			
1100	1200	Sat/Sun	UK, BBC World Service	15400af		
1100	1200		UK, BBC World Service	6190af		6195as
			9545eu	9605as	9740as	9860af
			11760me	11895as	15310as	15575as
			17640af	17790as	17830as	21470af
1100	1200		USA, American Forces Network			4319usb
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
1100	1200		USA, EWTN/WEWN Vandiver AL			9390as
1100	1200		USA, WHRI Cypress Creek SC	9865sa		
1100	1200		USA, WINB Red Lion PA	9265am		
1100	1200		USA, WJHR International Milton FL			15550usb
1100	1200	vl	USA, WRMI Miami FL	9955va		
1100	1200		USA, WTJC Newport NC	9370na		
1100	1200		USA, WWCR Nashville TN	5070na		5935na
			9985na			
1100	1200		USA, WWRB Manchester TN	3185va		
1100	1200		USA, WYFR/Family Radio Worldwide			6890na
			7455na	11725ca	11830sa	
1100	1200		Zambia CVC Intl/ The Voice Africa			6065af
			13590af			
1100	1200		Zambia, Zambia Natl Broadcasting Corp			6165do
1105	1200	Sun	Greece, Voice of Greece	9420va		15650va
1115	1130	mtwhf	UK, Bible Voice Broadcasting	5945as		
1115	1200		UK, Bible Voice Broadcasting	5945as		
1115	1200	Sat	UK, Bible Voice Broadcasting	5945as		
1130	1157		Czech Republic, Radio Prague	11640eu		17545va
1130	1200		Australia, CVC International	15535as		
1130	1200	sthf	Guam, KSDA/ AWR	15260as		
1130	1200	f	Vatican City State, Vatican Radio			15595as
			17765as			
1130	1200		Vietnam, Voice of Vietnam	9840as		12020as
1145	1200		Australia, HCJB Global	15340as		

1200 UTC - 7AM EST / 6AM CST / 4AM PST

1200	1225		Saudi Arabia, BSKSA/External Service			15250af
1200	1230		Australia, CVC International	15535as		
1200	1230	mtwhf	France, Radio France International			15495af
1200	1230		Germany, AWR-Europe	15495as		
1200	1230		Japan, NHK World/ Radio Japan			6120na
			9625as	9695as	9790eu	
1200	1245		USA, WYFR/Family Radio Worldwide			6890na
1200	1256		Romania, Radio Romania International			11970eu
			15105eu	15430af	17760af	
1200	1257		China, China Radio International			5955as
			7250as	9460as	9600as	9645as
			9730va	9760as	11650as	11690as
			11760va	11980as	12015as	13665eu
			13790eu	17490eu		
1200	1258		New Zealand, Radio NZ International			13660pa
1200	1300		Anguilla, Worldwide Univ Network			11775am
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, HCJB Global	15400as		
1200	1300		Australia, Radio Australia	5995pa	6020pa	
			9475as	9560pa	9580pa	9590pa
			11945pa			
1200	1300		Bahrain, Radio Bahrain	6010me		9745al
1200	1300	f/DRM	Belgium, TDP Radio	6015eu		
1200	1300	Sat/Sun	Canada, CBC NQ SW Service	9625na		
1200	1300		Canada, CFRX Toronto ON	6070na		
1200	1300		Canada, CFVP Calgary AB	6030na		
1200	1300		Canada, CKZN St John's NF	6160na		
1200	1300		Canada, CKZU Vancouver BC	6160na		
1200	1300	Sat/Sun	Equatorial Guinea, Radio East Africa			15190af
1200	1300	DRM	Germany, Deutsche Welle	9545eu		13810eu
1200	1300		Malaysia, RTM/Traxx FM	7295do		
1200	1300		Malaysia, RTM/Voice of Malaysia			6175as
			9750as	15295as		
1200	1300		Nigeria, Voice of Nigeria/External Service			9690af
1200	1300		Palau, T8WH/World Harvest	9930as		12130as
1200	1300		Russia, Voice of Russia	7340af		7350af
			9695af	11660af		
1200	1300	Sun	Slovakia, IRRS/Euro Gospel Radio			9510va
1200	1300		South Korea, KBS World Radio			9650na
1200	1300		UK, BBC World Service	5875as		6190af
			6195as	9545eu	9605as	9740as
			9860af	11760me	15310as	15575as
			17640af	17790as	17830af	21470af
1200	1300		Ukraine, Radio Ukraine International			9950eu
1200	1300		USA, American Forces Network			4319usb
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
1200	1300		USA, EWTN/WEWN Vandiver AL			9390as
1200	1300		USA, KNLS Anchor Point AK	6150as		6915as
1200	1300		USA, Voice of America	7575va		9640va
			11705va	11730va	11750va	
1200	1300	Sat/Sun	USA, WHRI Cypress Creek SC	9410sa		
1200	1300		USA, WINB Red Lion PA	9265am		
1200	1300		USA, WJHR International Milton FL			15550usb
1200	1300	vl	USA, WRMI Miami FL	9955va		
1200	1300		USA, WTJC Newport NC	9370na		
1200	1300		USA, WWCR Nashville TN	5935na		7490na
			9980na	15825na		
1200	1300		USA, WWRB Manchester TN	9385na		
1200	1300		USA, WYFR/Family Radio Worldwide			7455na
			11530ca	11970am		
1200	1300		Zambia CVC Intl/ The Voice Africa			6065af
			13590af			
1200	1300		Zambia, Zambia Natl Broadcasting Corp			6165do
1215	1300		Egypt, Radio Cairo	17870as		
1230	1300		Australia, CVC International	13635as		
1230	1300		Bangladesh, Bangladesh Betar			7250as
1230	1300	mtwhf	Ethiopia, Radio Ethiopia/National Service			5990do
			7110do	9704do		
1230	1300		Thailand, Radio Thailand World Service			9720va
1230	1300		Vietnam, Voice of Vietnam	9840as		12020as

1300 UTC - 8AM EST / 7AM CST / 5AM PST

1300	1330		Egypt, Radio Cairo	17870as		
1300	1345		USA, WYFR/Family Radio Worldwide			7455na
			11970na			
1300	1357		China, China Radio International			5995as
			7300na	9570na	9730as	9765va
			9870as	11760as	11885as	11900eu
			11980as	13790eu	15230na	17490va
1300	1357		North Korea, Voice of Korea	9335na		11710na
			13760eu	15245eu		
1300	1400		Anguilla, Worldwide Univ Network			11775am
1300	1400		Australia, ABC NT Alice Springs			2310do
1300	1400		Australia, ABC NT Katherine	2485do		
1300	1400		Australia, CVC International	13635as		
1300	1400		Australia, HCJB Global	15340as		15400as
1300	1400		Australia, Radio Australia	5995pa	6020pa	
			9560pa	9580pa	9590pa	
1300	1400		Bahrain, Radio Bahrain	6010me		9745al
1300	1400	a/DRM	Belgium, TDP Radio	6015eu		
1300	1400	Sat/Sun	Canada, CBC NQ SW Service	9625na		
1300	1400		Canada, CFRX Toronto ON	6070na		
1300	1400		Canada, CFVP Calgary AB	6030na		
1300	1400		Canada, CKZN St John's NF	6160na		
1300	1400		Canada, CKZU Vancouver BC	6160na		
1300	1400	Sat/Sun	Equatorial Guinea, Radio East Africa			15190af
1300	1400	DRM	Germany, Deutsche Welle	9545eu		13810eu
1300	1400		Indonesia, Voice of Indonesia	9525va		11785al
1300	1400		Malaysia, RTM/Traxx FM	7295do		
1300	1400		Malaysia, RTM/Voice of Malaysia			6175as
			9750as	15295as		
1300	1400		New Zealand, Radio NZ International			6170pa
1300	1400		Nigeria, Voice of Nigeria/External Service			9690af
1300	1400		Palau, T8WH/World Harvest	9930as		11880as
1300	1400		Poland, Polish Radio	11675eu		11860eu
1300	1400		Russia, Voice of Russia	7205af		
1300	1400		South Korea, KBS World Radio			9570as
			9770as			
1300	1400		Uganda, UBC Radio	4976do		
1300	1400		UK, BBC World Service	5875as		6190af
			6195as	9410as	9545eu	9740as
			9860af	11760me	11835as	15310as
			15420af	15575eu	21470af	
1300	1400		USA, American Forces Network			4319usb
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
1300	1400		USA, EWTN/WEWN Vandiver AL			13835eu
1300	1400		USA, KJES Vado NM	11715na		
1300	1400		USA, Voice of America	7575va		9640va
			9760va	11705va		
1300	1400	Sat	USA, WHRI Cypress Creek SC	9840na		
1300	1400		USA, WHRI Cypress Creek SC	11785na		
1300	1400		USA, WINB Red Lion PA	9265am		
1300	1400		USA, WJHR International Milton FL			15550usb

1300	1400	vl	USA, WRMI Miami FL	9955va		
1300	1400		USA, WTJC Newport NC	9370na		
1300	1400		USA, WWCR Nashville TN	7490na	9980na	
			13845na	15825na		
1300	1400		USA, WWRB Manchester TN	9385na		
1300	1400		USA, WYFR/Family Radio Worldwide		7560as	
			9310na	11830na	11620as	11560as
			11855na			
1300	1400		Zambia CVC Intl/ The Voice Africa		6065af	
			13590af			
1300	1400		Zambia, Zambia Natl Broadcasting Corp		6165do	
1310	1340		Japan, NHK World/ Radio Japan		9875as	
1330	1357	fa/ DRM	Czech Republic, Radio Prague	9850eu		
1330	1400	mtwhfa	Guam, KSDA/ AWR	15660as		
1330	1400		India, All India Radio	9620as	11620as	
			13710as			
1330	1400		Laos, Lao National Radio	7145as		
1330	1400		Sweden, Radio Sweden	7405va		
1330	1400		Turkey, Voice of Turkey	12035eu	15300as	
1330	1400		Vietnam, Voice of Vietnam	9840as	12020as	

1400 UTC - 9AM EST / 8AM CST / 6AM PST

1400	1425		Turkey, Voice of Turkey	12035eu	15300as	
1400	1427		Czech Republic, Radio Prague	11600as	13580na	
1400	1430		Australia, HCJB Global	15400as		
1400	1430	f	Clandestine, Shiokaze/Sea Breeze		6120as	
1400	1430	Sun	Germany, Pan American Broadcasting		15205as	
1400	1430	`	Japan, NHK World/ Radio Japan		5995as	
			9875as	11705na	11780eu	21560va
1400	1430		Laos, Lao National Radio	6130as		
1400	1430		Thailand, Radio Thailand World Service		9725va	
1400	1430	Sun	United Arab Emirates, FEBA Radio		12045as	
1400	1440		Guam, KTWR/TWR	9975as		
1400	1457		China, China Radio International		5955na	
			6075na	7300na	7325na	9460as
			9560as	9700as	9765va	9870as
			11665as	13675eu	13685eu	13740na
			15230af	17630af		
1400	1459		Netherlands, R Netherlands Worldwide		12080va	
			15595va			
1400	1500		Anguilla, Worldwide Univ Network		11775am	
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, CVC International	13635as		
1400	1500		Australia, Radio Australia	5995pa	6080pa	
			7240pa	9590pa		
1400	1500		Bahrain, Radio Bahrain	6010me	9745al	
1400	1500	s/DRM	Belgium, TDP Radio	6015eu		
1400	1500		Bhutan, Bhutan Broadcasting Service		6035as	
1400	1500	Sat/Sun	Canada, CBC NQ SW Service	9625na		
1400	1500		Canada, CFRX Toronto ON	6070na		
1400	1500		Canada, CFVP Calgary AB	6030na		
1400	1500		Canada, CKZN St John's NF	6160na		
1400	1500		Canada, CKZU Vancouver BC	6160na		
1400	1500	Sat/Sun	Equatorial Guinea, Radio East Africa		15190af	
1400	1500		Germany, CVC Intl-Christian Vision		17770af	
1400	1500		Germany, Overcomer Ministries		6110eu	
			13810as			
1400	1500		India, All India Radio	9620as	11620as	
			13710as			
1400	1500		Libya, LJB/Voice of Africa	17725af	21695af	
1400	1500		Malaysia, RTM/Traxx FM	7295do		
1400	1500		New Zealand, Radio NZ International		6170pa	
1400	1500		Nigeria, Voice of Nigeria/External Service		9690af	
1400	1500		Oman, Radio Oman	15140va		
1400	1500		Palau, T8WH/World Harvest	9930as		
1400	1500	DRM	Russia, Voice of Russia	5905eu		
1400	1500		Russia, Voice of Russia	7205af	7340af	
			11660af	12055af		
1400	1500		South Africa, Channel Africa	9625af		
1400	1500		Uganda, UBC Radio	4976do		
1400	1500		UK, BBC World Service	5875as	5975as	
			6190af	6195as	9410as	9545as
			9625as	9740as	9860af	11760as
			15420af	17640af		
1400	1500	DRM	UK, BBC World Service	9545eu	13590eu	
1400	1500	Sat/Sun	UK, Bible Voice Broadcasting	15680af		
1400	1500		USA, American Forces Network		4319usb	
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
1400	1500		USA, EWTN/WEWN Vandiver AL		13835eu	
1400	1500		USA, KJES Vado NM	11715na		
1400	1500		USA, KNLS Anchor Point AK	6890as		
1400	1500		USA, Voice of America	4930af	6080af	
			7575va	9760va	9930va	11985va
			12150va	15205va	15580af	17650af
			17715af			
1400	1500		USA, WHRI Cypress Creek SC	9840na		
1400	1500		USA, WINB Red Lion PA	9265am		
1400	1500		USA, WJHR International Milton FL		15550usb	
1400	1500	vl	USA, WRMI Miami FL	9955va		
1400	1500		USA, WTJC Newport NC	9370na		
1400	1500		USA, WWCR Nashville TN	7490na	9980na	
			13845na	15825na		
1400	1500		USA, WWRB Manchester TN	9385na		
1400	1500		USA, WYFR/Family Radio Worldwide		6225as	
			9485as	11560as	11855na	13695na
			11565na	17760na		
1400	1500		Zambia CVC Intl/ The Voice Africa		6065af	
			13650af			
1400	1500		Zambia, Zambia Natl Broadcasting Corp		6165do	
1400	1557		China, China Radio International		5955as	
			6095as	7325as	7405as	9435na
			9870as	13685as	13740na	17630va
1405	1500	Sat	Greece, Voice of Greece	9420eu		
1415	1430		Nepal, Radio Nepal	5005as		
1415	1439	mtwhfa	Germany, Pan American Broadcasting		15205as	
1425	1455	mtwhf	Swaziland, TWR Swaziland	6065af		
1430	1445	Sun	Germany, Pan American Broadcasting		15205as	
1430	1500		Australia, Radio Australia	9475as	11660as	
1430	1500		China, CPBS/CNR Business Radio		6155do	
			7245do	7315as	7335as	7375as
			9820as	9775as		
1430	1500		Sweden, Radio Sweden	9400va		

1500 UTC - 10AM EST / 9AM CST / 7AM PST

1500	1510	mtwhfa	Turkmenistan, Turkmen Radiosi		5015eu	
1500	1515	Sun	UK, Bible Voice Broadcasting	15680af		
1500	1527		Czech Republic, Radio Prague	9955na		
1500	1528		Vietnam, Voice of Vietnam	7285va	9840va	
			12020va	9730va		
1500	1530		Australia, HCJB Global	15340as		
1500	1530	Sun	China, Voice of the Strait	4940as		
1500	1530	Sat/Sun	Clandestine, Sudan Radio Service		17745af	
1500	1530		Guam, KSDA/ AWR	15255as		
1500	1530		UK, BBC World Service	9410af	11860af	
			15105af			
1500	1530	Sat	UK, Bible Voice Broadcasting	11880as		
1500	1530		UK, Sudan Radio Service	17745af		
1500	1545		USA, WYFR/Family Radio Worldwide		15210sa	
1500	1550		New Zealand, Radio NZ International		6170pa	
1500	1557		Canada, Radio Canada International		9635as	
			11975as			
1500	1557		China, China Radio International		5955as	
			6060as	6100as	7235as	7255as
			7420as	7435as	9435as	9525eu
			9570as	9600na	11650as	
1500	1557		Libya, LJB/Voice of Africa	17725af	21695af	
1500	1557		Netherlands, R Netherlands Worldwide		12080as	
			15595va			
1500	1557		North Korea, Voice of Korea	9335na	11710na	
			13760eu	15245eu		
1500	1600		Anguilla, Worldwide Univ Network		11775am	
1500	1600		Australia, ABC NT Alice Springs		2310do	
1500	1600		Australia, ABC NT Katherine	2485do		
1500	1600		Australia, CVC International	13635as		
1500	1600		Australia, Radio Australia	5995pa	6080pa	
			7240pa	9475as	9590pa	11660as
1500	1600		Bahrain, Radio Bahrain	6010me	9745al	
1500	1600	DRM	Belgium, TDP Radio	6015eu		
1500	1600	Sat/Sun	Canada, CBC NQ SW Service	9625na		
1500	1600		Canada, CFRX Toronto ON	6070na		
1500	1600		Canada, CFVP Calgary AB	6030na		
1500	1600		Canada, CKZN St John's NF	6160na		
1500	1600		Canada, CKZU Vancouver BC	6160na		
1500	1600	Sat/Sun	Equatorial Guinea, Radio East Africa		15190af	
1500	1600		Germany, CVC Intl-Christian Vision		17770af	
1500	1600		Germany, Overcomer Ministries		6110eu	
			13810as	17485af		
1500	1600		Malaysia, RTM/Traxx FM	7295do		
1500	1600		Myanmar, Myanma Radio	5985as		
1500	1600		Palau, T8WH/World Harvest	9905as	9930as	
1500	1600		Russia, Voice of Russia	4975me	7260af	
			9660af			
1500	1600	DRM	Russia, Voice of Russia	5905eu		
1500	1600		South Africa, Channel Africa	9625af		
1500	1600		Uganda, Dunamis Shortwave	4750af		
1500	1600		Uganda, UBC Radio	4976do		
1500	1600		UK, BBC World Service	5790eu	5875as	
			5975as	6190af	6195as	7395as
			9740as	9855as	9860af	12095eu
			15400af	15420af	17640af	
1500	1600	DRM	UK, BBC World Service	5790eu	13590eu	

1500	1600		USA, American Forces Network			4319usb
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
1500	1600		USA, EWTN/WEWN Vandiver AL			15610me
1500	1600		USA, KJES Vado NM		11715na	
1500	1600		USA, Voice of America		4930af	6080af
			7545va	9310va	9685va	9930va
			11525va	11765va	12150va	15580af
			17715af	17895af		
1500	1600		USA, Voice of America/Special English			6140va
			7520va	9760va	15460va	
1500	1600		USA, WHRI Cypress Creek SC		21640af	
1500	1600	Sun	USA, WHRI Cypress Creek SC		9840na	
1500	1600		USA, WINB Red Lion PA		13570am	
1500	1600		USA, WJHR International Milton FL			15550usb
1500	1600	vl	USA, WRMI Miami FL		9955na	
1500	1600		USA, WTJC Newport NC		9370na	
1500	1600		USA, WWCR Nashville TN		7490na	9980na
			13845na	15825na		
1500	1600		USA, WWRB Manchester TN		9385na	
1500	1600		USA, WYFR/Family Radio Worldwide			6280as
			9495as	11565na	11855na	12015as
			17760na			
1500	1600		Zambia CVC Intl/ The Voice Africa			6065af
			13650af			
1500	1600		Zambia, Zambia Natl Broadcasting Corp			6165do
1515	1530		Vatican City State, Vatican Radio			7585as
			9310as	11850as	13765as	
1525	1600	Sat/Sun	Swaziland, TWR Swaziland		6065af	
1530	1545		India, All India Radio		7255as	9620as
			9820as	9910as		
1530	1600	mtwhfa	Albania, Radio Tirana		13640na	
1530	1600		Iran, Voice of Islamic Rep. of Iran			6160as
			7380as			
1530	1600		Mongolia, Voice of Mongolia		12085as	
1530	1600		Sweden, Radio Sweden		9360me	
1530	1600	Sat	UK, BBC World Service		9410af	11860af
			15105af			
1530	1600	Sun	UK, Bible Voice Broadcasting		13590me	
1530	1600		UK, Bible Voice Broadcasting		15680as	
1530	1600	Sat/Sun	USA, WHRI Cypress Creek SC		11785na	
1530	1600	Sat	Vatican City State, Vatican Radio			7585as
			11850as	13765as		
1545	1600	mtwhfa	UK, Bible Voice Broadcasting		13590me	
1551	1600		New Zealand, Radio NZ International			6170pa
1551	1600	DRM	New Zealand, Radio NZ International			7440pa

1600 UTC - 11AM EST / 10AM CST / 8AM PST

1600	1610		Pakistan, PBC/ Radio Pakistan		7535me	15100af
1600	1615	f	UK, Bible Voice Broadcasting		13590me	
1600	1620	t	UK, Bible Voice Broadcasting		13590me	
1600	1625	Sat/Sun	Swaziland, TWR Swaziland		6065af	
1600	1627		Iran, Voice of Islamic Rep. of Iran			6160as
			7380as			
1600	1628		Vietnam, Voice of Vietnam		7220va	7280va
			9550va	9730va		
1600	1630	Sun	Germany, Pan American Broadcasting			13830as
1600	1630		Guam, KSDA/ AWR		9585as	11690as
1600	1630		Myanmar, Myanma Radio		9730do	
1600	1630	Sat	USA, Voice of America		11750af	
1600	1630		Yemen, Rep of Yemen Radio/ Radio Sana'a			
			9780me			
1600	1645		USA, WYFR/Family Radio Worldwide			11565na
			11830na	17760na		
1600	1657		North Korea, Voice of Korea		9990va	11545va
1600	1700		Anguilla, Worldwide Univ Network			11775am
1600	1700		Australia, ABC NT Alice Springs			2310do
1600	1700		Australia, ABC NT Katherine		2485do	
1600	1700		Australia, CVC International		13635as	
1600	1700		Australia, Radio Australia		5995pa	6080pa
			7240pa	9475as	9710pa	11660as
1600	1700		Bahrain, Radio Bahrain		6010me	9745al
1600	1700	Sat	Canada, CBC NQ SW Service		9625na	
1600	1700		Canada, CFRX Toronto ON		6070na	
1600	1700		Canada, CFVP Calgary AB		6030na	
1600	1700		Canada, CKZN St John's NF		6160na	
1600	1700		Canada, CKZU Vancouver BC		6160na	
1600	1700	Sat	Clandestine, Cheetah Radio		11730as	
1600	1700		Egypt, Radio Cairo12170af			
1600	1700		Ethiopia, Radio Ethiopia/External Service			7165af
			9560af			
1600	1700	mtwhf	France, Radio France International			15605af
1600	1700		Germany, CVC Intl-Christian Vision			17770af
1600	1700		Germany, Deutsche Welle		5965as	
1600	1700		Malaysia, RTM/Traxx FM		7295do	
1600	1700		New Zealand, Radio NZ International			6170pa
1600	1700	DRM	New Zealand, Radio NZ International			7440pa
1600	1700		Palau, T8WH/World Harvest		9905as	9930as
1600	1700		Russia, Voice of Russia		4975me	6130eu
			7305af	9470va	11630af	
1600	1700		South Korea, KBS World Radio			9515eu
1600	1700		Taiwan, Radio Taiwan International			9785as
			11550as			
1600	1700		Uganda, Dunamis Shortwave		4750af	
1600	1700		Uganda, UBC Radio		4976do	
1600	1700		UK, BBC World Service		3255af	3995eu
			5790eu	5975as	6190af	7255as
			9740as	11860af	12095eu	13820af
			15400af	15420af	17640af	
1600	1700	DRM	UK, BBC World Service		3995eu	5790eu
1600	1700	Sat	UK, BBC World Service		9410af	15105af
1600	1700	Sun	UK, Bible Voice Broadcasting		13590me	
1600	1700		USA, American Forces Network			4319usb
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
1600	1700		USA, EWTN/WEWN Vandiver AL			15610me
1600	1700		USA, KJES Vado NM		11715na	
1600	1700		USA, Voice of America		4930af	6080af
			15580af	17715af	17895af	
1600	1700		USA, Voice of America/Special English			9395va
			13600va	15445va		
1600	1700	mtwhfa	USA, WHRI Cypress Creek SC		21640af	
1600	1700	Sun	USA, WHRI Cypress Creek SC		9840na	
1600	1700		USA, WINB Red Lion PA		13570am	
1600	1700		USA, WJHR International Milton FL			15550usb
1600	1700	vl	USA, WRMI Miami FL		9955na	
1600	1700		USA, WTJC Newport NC		9370na	
1600	1700		USA, WWCR Nashville TN		7490na	9980na
			13845na	15825na		
1600	1700		USA, WWRB Manchester TN		9385na	
1600	1700		USA, WYFR/Family Radio Worldwide			5965na
			6085af	9445af	9795af	11740af
			11830eu	13695eu	17690eu	18980eu
			21455eu			
1600	1700		Zambia CVC Intl/ The Voice Africa			6065af
			13650af			
1600	1700		Zambia, Zambia Natl Broadcasting Corp			6165do
1600	1757		China, China Radio International			6060af
			6100as	7235as	7255as	7420as
			7435as	9435as	9525eu	9570as
			9600eu	11650va		
1605	1700		Canada, Radio Canada International			9610na
1605	1700	DRM	Canada, Radio Canada International			9800na
1615	1645	mtwhf	Swaziland, TWR Swaziland		6130af	
1615	1700	Sun	UK, BBC World Service		9410af	11860af
			15105af			
1615	1700		UK, Bible Voice Broadcasting		13590me	
1630	1700		China, Xizang People's Broadcasting Sta/Tibet			
			6200do			
1630	1700		Guam, KSDA/ AWR		9840as	
1630	1700	Sat/Sun	Swaziland, TWR Swaziland		6130af	
1640	1650	mtwhfa	Turkmenistan, Turkmen Radiosi			4930eu

1700 UTC - 12PM EST / 11AM CST / 9AM PST

1700	1704		Canada, Radio Canada International			9610na
1700	1704	DRM	Canada, Radio Canada International			9800na
1700	1727		Czech Republic, Radio Prague		5930eu	15710af
1700	1730		Croatia, Croatian Radio		6165va	
1700	1730		Sweden, Radio Sweden		7465me	
1700	1730		UK, Bible Voice Broadcasting		13590me	
1700	1745		USA, WYFR/Family Radio Worldwide			18980eu
1700	1746		UK, BBC World Service		6005af	9410af
1700	1750		New Zealand, Radio NZ International			6170pa
1700	1750	DRM	New Zealand, Radio NZ International			7440pa
1700	1755		South Africa, Channel Africa		15235af	
1700	1757		China, China Radio International			6090af
			6100as	6140as	6165af	7205af
			7255af	7335as	7410eu	7420af
			7425eu	7435va	9570eu	
1700	1800		Anguilla, Worldwide Univ Network			11775am
1700	1800		Australia, ABC NT Alice Springs			2310do
1700	1800		Australia, ABC NT Katherine		2485do	
1700	1800		Australia, CVC International		13635as	
1700	1800		Australia, Radio Australia		5995pa	6080pa
			9475as	9580pa	9710pa	11880pa
1700	1800		Bahrain, Radio Bahrain		6010me	9745al
1700	1800	Sat	Canada, CBC NQ SW Service		9625na	
1700	1800		Canada, CFRX Toronto ON		6070na	
1700	1800		Canada, CFVP Calgary AB		6030na	
1700	1800		Canada, CKZN St John's NF		6160na	
1700	1800		Canada, CKZU Vancouver BC		6160na	
1700	1800		Egypt, Radio Cairo12170af			

1700	1800		Equatorial Guinea, Radio Africa 15190af			7190af
1700	1800		Germany, CVC Intl-Christian Vision			17770af
1700	1800		Kuwait, Radio Kuwait	11990va		
1700	1800		Malaysia, RTM/Traxx FM	7295do		
1700	1800		Nigeria, Voice of Nigeria/External Service			15120af
1700	1800		Palau, T8WH/World Harvest	9905as		9930as
1700	1800		Russia, Voice of Russia 7305af	4975me	9470va	7240af
1700	1800		Swaziland, TWR Swaziland	3200af		9500af
1700	1800		Taiwan, Radio Taiwan International			11850af
1700	1800		Tajikistan, Voice of Tajik/Radio 2			7245as
1700	1800		Uganda, Dunamis Shortwave	4750af		
1700	1800		Uganda, UBC Radio	4976do		
1700	1800		UK, BBC World Service 5975as	3255af	6190af	3995eu 7355as 12095af 13820af 15400af 15420af 17830af
1700	1800	Sat	UK, Bible Voice Broadcasting	9430me		
1700	1800	Sun	UK, Bible Voice Broadcasting	13590me		
1700	1800		USA, American Forces Network 5446usb 10320usb	5765usb 12133usb	6350usb 12759usb	4319usb 7812usb 13362usb
1700	1800		USA, EWTN/WEWN Vandiver AL			15610me
1700	1800		USA, Voice of America 15580af	6080af 17895af		13710af
1700	1800	mtwhfa	USA, WHRI Cypress Creek SC	21640na		
1700	1800	Sun	USA, WHRI Cypress Creek SC	9840na		
1700	1800		USA, WINB Red Lion PA	13570am		
1700	1800		USA, WJHR International Milton FL			15550usb
1700	1800	vl	USA, WRMI Miami FL	9955va		
1700	1800		USA, WTJC Newport NC	9370na		
1700	1800		USA, WWCR Nashville TN 13845na	9980na 15825na		12160na
1700	1800		USA, WWRB Manchester TN	9385na		
1700	1800		USA, WYFR/Family Radio Worldwide 13695af 21680af	17505af	17555na	7390me 21455eu
1700	1800		Zambia CVC Intl/ The Voice Africa 13590af			4965af
1700	1800		Zambia, Zambia Natl Broadcasting Corp			6165do
1705	1800		Canada, Radio Canada International			9610na
1705	1800	DRM	Canada, Radio Canada International			9800na
1717	1730		Vatican City State, Vatican Radio 5885eu	7250eu	7290eu	4005eu 9645eu
1720	1740	fas	USA, Voice of America 15775af	4930af		12080af
1730	1757		Slovakia, Radio Slovakia International 6055eu			5915eu
1730	1800		Clandestine, Sudan Radio Service			9590af
1730	1800		UK, Bible Voice Broadcasting	13590me		
1730	1800	Sun	UK, Bible Voice Broadcasting	9430me		
1730	1800	mtwhf	UK, Sudan Radio Service	9840af		
1730	1800		USA, Voice of America 15775af	4930af		12080af
1730	1800		Vatican City State, Vatican Radio 11625af	13765af		9755af
1745	1800		Bangladesh, Bangladesh Betar			7250as
1745	1800	DRM	India, All India Radio	9950eu		
1745	1800		India, All India Radio 11935af	6180eu 15075af		7410eu
1751	1800		New Zealand, Radio NZ International			9765pa
1751	1800	DRM	New Zealand, Radio NZ International			9890pa
1755	1800		Clandestine, Radio Dialogue	3955af		

1800 UTC - 1PM EST / 12PM CST / 10AM PST

1800	1804		Canada, Radio Canada International			9610na
1800	1804	DRM	Canada, Radio Canada International			9800na
1800	1815	Sun	UK, Bible Voice Broadcasting	13590me		
1800	1827		China, China Radio International			6020eu
1800	1827		Czech Republic, Radio Prague	5930eu		9400va
1800	1828		Vietnam, Voice of Vietnam	5955eu		
1800	1830		Australia, CVC International	13635as		
1800	1830	w	Austria, AWR Europe	9515af		
1800	1830	DRM	Romania, Radio Romania International			5895eu
1800	1830		South Africa, AWR Africa 11830af	3215af		3345af
1800	1830		UK, BBC World Service 7355as	5975as		7260as
1800	1830		UK, Bible Voice Broadcasting	13590me		
1800	1830	fa	UK, Bible Voice Broadcasting	9430me		
1800	1830		USA, Voice of America 11975af 15775af	4930af 12080af	13710af	6080af 15580af
1800	1830	Sat/Sun	USA, Voice of America	4930af		
1800	1850		New Zealand, Radio NZ International			9765pa
1800	1855		Clandestine, Radio Dialogue	3955af		
1800	1856		Romania, Radio Romania International			7215eu
1800	1856	DRM	Romania, Radio Romania International			6065eu
1800	1857		China, China Radio International 7265eu	7405eu		6100eu
1800	1857		Netherlands, R Netherlands Worldwide 11655af	12045af		6020af
1800	1857		North Korea, Voice of Korea	13760eu		15245eu
1800	1859		Canada, Radio Canada International 11845af	13650af	15365af	9740af 17790af
1800	1900		Anguilla, Worldwide Univ Network			11775am
1800	1900	mtwhf	Argentina, Radio Nacional RAE 15345eu			9690eu
1800	1900		Australia, ABC NT Alice Springs			2310do
1800	1900		Australia, ABC NT Katherine	2485do		
1800	1900		Australia, Radio Australia 9475as	6080pa 9580pa	9710pa	7240pa 11880pa
1800	1900		Bahrain, Radio Bahrain	6010me		9745al
1800	1900		Bangladesh, Bangladesh Betar			7250eu
1800	1900		Canada, CFRX Toronto ON	6070na		
1800	1900		Canada, CFVP Calgary AB	6030na		
1800	1900		Canada, CKZN St John's NF	6160na		
1800	1900		Canada, CKZU Vancouver BC	6160na		
1800	1900		Equatorial Guinea, Radio Africa 15190af			7190af
1800	1900		Germany, CVC Intl-Christian Vision			17770af
1800	1900	DRM	Germany, Deutsche Welle	3995eu		
1800	1900	DRM	India, All India Radio	9950eu		
1800	1900		India, All India Radio 15075af	9445af		11935af
1800	1900		Kuwait, Radio Kuwait	11990va		
1800	1900		Malaysia, RTM/Traxx FM	7295do		
1800	1900	DRM	New Zealand, Radio NZ International			9890pa
1800	1900		Nigeria, Voice of Nigeria/External Service			15120af
1800	1900		Palau, T8WH/World Harvest	9905as		9930as
1800	1900		Poland, Polish Radio	9650eu		
1800	1900	DRM	Poland, Polish Radio	6130eu		
1800	1900		Russia, Voice of Russia 7270me	4975me 7305af	7330eu	7240af 11985af
1800	1900		South Korea, KBS World Radio			7275eu
1800	1900		Swaziland, TWR Swaziland	3200af		9500af
1800	1900		Taiwan, Radio Taiwan International			3965eu
1800	1900		Uganda, Dunamis Shortwave	4750af		
1800	1900		Uganda, UBC Radio	4976do		
1800	1900		UK, BBC World Service 5875eu 7390eu 15400af	3255af 5945as 11810af 15420af	12095af	3995eu 6190af 13820af
1800	1900	Sun	UK, Bible Voice Broadcasting	6130eu		9430me
1800	1900		USA, American Forces Network 5446usb 10320usb	5765usb 12133usb	6350usb 12759usb	4319usb 7812usb 13362usb
1800	1900		USA, EWTN/WEWN Vandiver AL			15610me
1800	1900		USA, KJES Vado NM	15385na		
1800	1900		USA, WBCQ Monticello ME	15420am		
1800	1900		USA, WINB Red Lion PA	13570am		
1800	1900		USA, WJHR International Milton FL			15550usb
1800	1900	vl	USA, WRMI Miami FL	9955ca		
1800	1900		USA, WTJC Newport NC	9370na		
1800	1900		USA, WWCR Nashville TN 13845na	9980na 15825na		12160na
1800	1900		USA, WWRB Manchester TN	9385na		
1800	1900		USA, WYFR/Family Radio Worldwide 6915na 15115af	7395af 17535na	9895af 17555na	6045na 13695na
1800	1900		Yemen, Rep of Yemen Radio/ Radio Sana'a 9780me			
1800	1900		Zambia CVC Intl/ The Voice Africa 13590af			4965af
1800	1900		Zambia, Zambia Natl Broadcasting Corp			6165do
1830	1845		Rwanda, Radio Rwanda	6055do		
1830	1900		Bulgaria, Radio Bulgaria	6200eu		7400eu
1830	1900	DRM	Bulgaria, Radio Bulgaria	9700eu		
1830	1900		UK, BBC World Service	6005af		9410af
1830	1900	f	UK, Bible Voice Broadcasting	9430me		
1830	1900		USA, Voice of America 11975af	4930af 13710af	6080af 15580af	17895af
1845	1900		UK, Bible Voice Broadcasting	11830af		
1851	1900		New Zealand, Radio NZ International			11725pa

1900 UTC - 2PM EST / 1PM CST / 11AM PST

1900	1928		Vietnam, Voice of Vietnam	7280va		7280va
1900	1930		Germany, Deutsche Welle 13780af	9735af		11690af
1900	1935	DRM	New Zealand, Radio NZ International			9890pa
1900	1945	DRM	India, All India Radio	9950eu		
1900	1945		India, All India Radio 15075af	9445af		11935af

SHORTWAVE GUIDE

1900	1945		USA, WYFR/Family Radio Worldwide	6085na
			15565as	
1900	1957		China, China Radio International	7285eu
			7295va 9440va	
1900	1957		Netherlands, R Netherlands Worldwide	7425af
			12080af	
1900	1957		North Korea, Voice of Korea	7100af 9975va
			11910af 11535va	
1900	2000		Anguilla, Worldwide Univ Network	11775am
1900	2000		Australia, ABC NT Alice Springs	2310do
1900	2000		Australia, ABC NT Katherine	2485do
1900	2000		Australia, Radio Australia	6080pa 7240pa
			9500as 9580pa 9710pa	11880pa
1900	2000		Bahrain, Radio Bahrain	6010me 9745al
1900	2000		Canada, CFRX Toronto ON	6070na
1900	2000		Canada, CFVP Calgary AB	6030na
1900	2000		Canada, CKZN St John's NF	6160na
1900	2000		Canada, CKZU Vancouver BC	6160na
1900	2000		Egypt, Radio Cairo11510af	
1900	2000		Equatorial Guinea, Radio Africa	7190af
			15190af	
1900	2000		Germany, CVC Intl-Christian Vision	17770af
1900	2000	DRM	Germany, Deutsche Welle	3995eu
1900	2000		Germany, Overcomer Ministries	6175eu
1900	2000		Kuwait, Radio Kuwait	11990va
1900	2000		Malaysia, RTM/Traxx FM	7295do
1900	2000		New Zealand, Radio NZ International	11725pa
1900	2000		Nigeria, Voice of Nigeria/External Service	15120af
1900	2000		Palau, T8WH/World Harvest	9875as 9930as
1900	2000		Russia, Voice of Russia	4975me 5985me
			7290me 7330eu	11985af
1900	2000	fas	Slovakia, IRRS/Euro Gospel Radio	6170va
1900	2000	mtwhf	Spain, Radio Exterior de Espana	9605af
			9665eu	
1900	2000		Swaziland, TWR Swaziland	3200af
1900	2000		Thailand, Radio Thailand World Service	7570eu
1900	2000		Uganda, UBC Radio	4976do
1900	2000		UK, BBC World Service	3255af 5875eu
			5955as 6005af	6190af 7390eu
			9410af 11810af	12095af 13820af
1900	2000		UK, Bible Voice Broadcasting	11830af
1900	2000		USA, American Forces Network	4319usb
			5446usb 5765usb	6350usb 7812usb
			10320usb 12133usb	12759usb 13362usb
1900	2000		USA, EWTN/WEWN Vandiver AL	15610af
1900	2000		USA, Voice of America	4930af 4940af
			6080af 11975af	13710af 15580af
			17895af	
1900	2000		USA, Voice of America/Special English	9585va
			12020va	
1900	2000		USA, WBCQ Monticello ME	15420am
1900	2000	mtwhf	USA, WBCQ Monticello ME	7415am 9330am
1900	2000	mtwhf	USA, WHRI Cypress Creek SC	15665af
1900	2000	mtwhfa	USA, WHRI Cypress Creek SC	9840na
1900	2000		USA, WINB Red Lion PA	13570am
1900	2000		USA, WJHR International Milton FL	15550usb
1900	2000	vl	USA, WRMI Miami FL	9955ca
1900	2000		USA, WTJC Newport NC	9370na
1900	2000		USA, WWCR Nashville TN	9980na 12160na
			13845na 15825na	
1900	2000		USA, WWRB Manchester TN	9385na
1900	2000		USA, WYFR/Family Radio Worldwide	3230af
			6020af 6915af	7395af 9480af
			9480af 9885af	13695na 15115af
			17535na 17555na	
1900	2000		Zambia CVC Intl/ The Voice Africa	4965af
			13590af	
1900	2000		Zambia, Zambia Natl Broadcasting Corp	6165do
1905	1915		Croatia, Croatian Radio	6165va
1905	1920	Sat	Mali, RDTV Du Mali	5995do
1905	2000	Mon	South Africa, SA Radio League	3215af
1930	1957		Slovakia, Radio Slovakia International	5915eu
			7345eu	
1930	1958		Serbia, International Radio of Serbia	6100eu
1930	2000	Sat/Sun	Germany, Pan American Broadcasting	9515af
1930	2000		Iran, Voice of Islamic Rep. of Iran	6010eu
			6040eu 7320eu	9855af 11695af
1930	2000		South Africa, RTE Radio One	6225af
1930	2000		Turkey, Voice of Turkey	6050eu
1936	1950	DRM	New Zealand, Radio NZ International	11675pa
1945	2000	mtwhas	Albania, Radio Tirana	11635eu
1945	2000	mtwhf	UK, Bible Voice Broadcasting	11830af
1951	2000	DRM	New Zealand, Radio NZ International	11675pa

2000 UTC - 3PM EST / 2PM CST / 12PM PST

2000	2005	Mon	South Africa, SA Radio League	3215af
2000	2015	Sat/Sun	Germany, Pan American Broadcasting	9515af
2000	2025		Turkey, Voice of Turkey	6050eu
2000	2027		Iran, Voice of Islamic Rep. of Iran	6010eu
			6040eu 7320eu	9855af 11695af
2000	2030	mtwhfa	Albania, Radio Tirana	7465eu 13640na
2000	2030		Egypt, Radio Cairo11510af	
2000	2030	Sat	Germany, Pan American Broadcasting	9515af
2000	2030		South Africa, RTE Radio One	6225af
2000	2030		Swaziland, TWR Swaziland	3200af
2000	2030		USA, Voice of America	4930af 4940af
			6080af 11975af	13710af 15580af
2000	2030		Vatican City State, Vatican Radio	7365af
			9755af 11625af	
2000	2045		USA, WYFR/Family Radio Worldwide	5745eu
2000	2050		New Zealand, Radio NZ International	11725pa
2000	2050	DRM	New Zealand, Radio NZ International	11675pa
2000	2057		China, China Radio International	5960eu
			5985af 7415va	7285eu 7295eu
			9440eu 9600af	11640af 13630af
2000	2057		Netherlands, R Netherlands Worldwide	7425af
			11655af 21525af	
2000	2100		Anguilla, Worldwide Univ Network	11775am
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, Radio Australia	9500as 11650pa
			11660pa 11880pa	
2000	2100	Sat/Sun	Australia, Radio Australia	6080pa 7240pa
			12080pa	
2000	2100		Bahrain, Radio Bahrain	6010me 9745al
2000	2100		Canada, CFRX Toronto ON	6070na
2000	2100		Canada, CFVP Calgary AB	6030na
2000	2100		Canada, CKZN St John's NF	6160na
2000	2100		Canada, CKZU Vancouver BC	6160na
2000	2100		Equatorial Guinea, Radio Africa	7190af
			15190af	
2000	2100		Germany, CVC Intl-Christian Vision	17770af
2000	2100		Germany, Deutsche Welle	9690af 9735af
			13780af	
2000	2100		Indonesia, Voice of Indonesia	9525va 11785al
2000	2100		Kuwait, Radio Kuwait	11990va
2000	2100		Malaysia, RTM/Traxx FM	7295do
2000	2100		Nigeria, Voice of Nigeria/External Service	15120af
2000	2100		Palau, T8WH/World Harvest	9875as 9930as
2000	2100		Russia, Voice of Russia	7330af
2000	2100	fas	Slovakia, IRRS/Euro Gospel Radio	6170va
2000	2100		Uganda, UBC Radio	4976do
2000	2100		UK, BBC World Service	3255af 6005af
			6190af 9410af	11810af 12095af
			15400af	
2000	2100		Ukraine, Radio Ukraine International	7510eu
2000	2100		USA, American Forces Network	4319usb
			5446usb 5765usb	6350usb 7812usb
			10320usb 12133usb	12759usb 13362usb
2000	2100		USA, EWTN/WEWN Vandiver AL	15610af
2000	2100		USA, WBCQ Monticello ME	15420am
2000	2100	smtwhf	USA, WBCQ Monticello ME	7415am
2000	2100	Sat	USA, WHRI Cypress Creek SC	15665af
2000	2100		USA, WINB Red Lion PA	13570am
2000	2100		USA, WJHR International Milton FL	15550usb
2000	2100	vl	USA, WRMI Miami FL	9955ca
2000	2100		USA, WTJC Newport NC	9370na
2000	2100		USA, WWCR Nashville TN	9980na 12160na
			13845na 15825na	
2000	2100		USA, WWRB Manchester TN	9385na
2000	2100		USA, WYFR/Family Radio Worldwide	6020na
			6915eu 9480af	9610af 9630af
			15115af 15195na	17535na 17555ca
			17575ca	
2000	2100		Zambia CVC Intl/ The Voice Africa	4965af
			9505af	
2000	2100		Zambia, Zambia Natl Broadcasting Corp	6165do
2000	2105		Uganda, UBC Radio	4976do
2030	2045		Thailand, Radio Thailand World Service	9535eu
2030	2058		Vietnam, Voice of Vietnam	7220va 7280va
			9550va 9730va	
2030	2100		Cuba, Radio Havana Cuba	11760am
2030	2100		Sweden, Radio Sweden	9490va
2030	2100		USA, Voice of America	7405as
2030	2100	Sat/Sun	USA, Voice of America	4940af
2045	2100		India, All India Radio	6180eu 7410eu
			9445eu 11620pa	11715pa
2045	2100	DRM	India, All India Radio	9950eu
2045	2100	DRM	Vatican City State, Vatican Radio	9800am
2050	2100		Vatican City State, Vatican Radio	4005eu
			5885eu 7250eu	
2051	2100		New Zealand, Radio NZ International	17675pa
2051	2200	DRM	New Zealand, Radio NZ International	15720pa

2100 UTC - 4PM EST / 3PM CST / 1PM PST

2100	2120		Vatican City State, Vatican Radio			4005eu
			5885eu	7250eu		
2100	2127		China, China Radio International			7250af
			11640af	13630af		
2100	2127		Czech Republic, Radio Prague	5930va		9430va
2100	2130	mtwhfa	Albania, Radio Tirana	7430eu		9895eu
2100	2130		Australia, ABC NT Alice Springs			2310do
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	9830af		
2100	2130	Sat	Canada, CBC NQ SW Service	9625na		
2100	2130		Cuba, Radio Havana Cuba	11760am		
2100	2145		USA, WYFR/Family Radio Worldwide			6915na
			15115af	17535na	17555na	
2100	2157		China, China Radio International			5960eu
			6135af	7205eu	7225af	7325af
			7405af	7415af	9600af	
2100	2157		North Korea, Voice of Korea	13760eu		15245eu
2100	2200		Angola, Radio Nacional de Angola			7217do
2100	2200		Anguilla, Worldwide Univ Network			11775am
2100	2200		Australia, Radio Australia	9500as		9660pa
			11695as	12080pa	13630pa	15515pa
2100	2200		Bahrain, Radio Bahrain	6010me		9745al
2100	2200		Belarus, Radio Belarus	6155eu		7360as
			7390eu			
2100	2200		Canada, CFRX Toronto ON	6070na		
2100	2200		Canada, CFVP Calgary AB	6030na		
2100	2200		Canada, CKZN St John's NF	6160na		
2100	2200		Canada, CKZU Vancouver BC	6160na		
2100	2200		Equatorial Guinea, Radio Africa			7190af
			15190af			
2100	2200		Germany, Deutsche Welle	7280af		9545af
			11690af	13780af		
2100	2200		Germany, Overcomer Ministries			6175eu
2100	2200		India, All India Radio	11620pa		11715pa
2100	2200	DRM	India, All India Radio	9950eu		
2100	2200		Malaysia, RTM/Traxx FM	7295do		
2100	2200		New Zealand, Radio NZ International			17675pa
2100	2200		Palau, T8WH/World Harvest	9875as		9930as
2100	2200	f	Slovakia, IRRS/Euro Gospel Radio			6170va
2100	2200		Syria, Radio Damascus	9330eu		12085as
2100	2200	DRM	UK, BBC World Service	3995eu		
2100	2200		UK, BBC World Service	3255af		3915as
			5875as	5965as	6005af	6190af
			6195as	7445af	9410af	9915af
			12095af			
2100	2200		USA, American Forces Network			4319usb
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
2100	2200		USA, EWTN/WEWN Vandiver AL			15610af
2100	2200		USA, Voice of America	6080af		7405as
			15580af			
2100	2200	smtwhf	USA, WBCQ Monticello ME	7415am		
2100	2200	Sat	USA, WHRI Cypress Creek SC	15665af		
2100	2200	Sat/Sun	USA, WHRI Cypress Creek SC	5850eu		
2100	2200		USA, WINB Red Lion PA	13570am		
2100	2200		USA, WJHR International Milton FL			15550usb
2100	2200	vl	USA, WRMI Miami FL	9955ca		
2100	2200		USA, WTJC Newport NC	9370na		
2100	2200		USA, WWCR Nashville TN	7465na		9980na
			12160na	13845na		
2100	2200		USA, WWRB Manchester TN	3185va		3215va
			5050va	5745va		
2100	2200		USA, WYFR/Family Radio Worldwide			5950na
			6240eu	9480af	15115af	15195af
2100	2200		Zambia CVC Intl/ The Voice Africa			4965af
			9505af			
2100	2200		Zambia, Zambia Natl Broadcasting Corp			6165do
21000	2200		Japan, NHK World/ Radio Japan			13640pa
2130	2156		Romania, Radio Romania International			6030eu
			6115na	7380eu	9755na	
2130	2200		Australia, ABC NT Alice Springs			4835do
2130	2200		Australia, ABC NT Katherine	5025do		
2130	2200	mtwhfa	Canada, CBC NQ SW Service	9625na		
2130	2200		China, China Radio International			7365eu
			7415as			
2130	2200		Guam, KSDA/ AWR	9625as		
2130	2200		Sweden, Radio Sweden	7425va		
2130	2200		Turkey, Voice of Turkey	9610va		

2200 UTC - 5PM EST / 4PM CST / 2PM PST

2200	2205		Zambia, Zambia Natl Broadcasting Corp			6165do
2200	2225		Turkey, Voice of Turkey	9610va		
2200	2228		Serbia, International Radio of Serbia			6100eu
2200	2230	mwf	Guam, KSDA/ AWR	11850as		
2200	2230		India, All India Radio	11620pa		11715pa
2200	2230	DRM	India, All India Radio	9950eu		
2200	2230		South Korea, KBS World Radio			3955eu
2200	2235		New Zealand, Radio NZ International			17625pa
2200	2235	DRM	New Zealand, Radio NZ International			15720pa
2200	2245		USA, WYFR/Family Radio Worldwide			17690af
2200	2257		China, China Radio International			5915na
2200	2300		Anguilla, Worldwide Univ Network			6090am
2200	2300		Australia, ABC NT Alice Springs			4835do
2200	2300		Australia, ABC NT Katherine	5025do		
2200	2300		Australia, HCJB Global	15525as		
2200	2300		Australia, Radio Australia	9660pa		12010as
			12080pa	13630pa	15230pa	15240as
			15515pa	15560pa		
2200	2300		Bahrain, Radio Bahrain	6010me		9745al
2200	2300		Belarus, Radio Belarus	6155eu		7360as
			7390eu			
2200	2300		Bulgaria, Radio Bulgaria	6200eu		7400eu
2200	2300	smtwhf	Canada, CBC NQ SW Service	9625na		
2200	2300		Canada, CFRX Toronto ON	6070na		
2200	2300		Canada, CFVP Calgary AB	6030na		
2200	2300		Canada, CKZN St John's NF	6160na		
2200	2300		Canada, CKZU Vancouver BC	6160na		
2200	2300	DRM	Canada, Radio Canada International			9800na
2200	2300		Equatorial Guinea, Radio Africa			7190af
			15190af			
2200	2300		Malaysia, RTM/Traxx FM	7295do		
2200	2300	Sat/Sun	Spain, Radio Exterior de Espana			6125eu
2200	2300		Uganda, UBC Radio	4976do		
2200	2300		UK, BBC World Service	3915as		5875as
			5910af	6135as	6195as	9740as
			9915af	12095af		
2200	2300	DRM	UK, BBC World Service	3995eu		
2200	2300		Ukraine, Radio Ukraine International			5830eu
2200	2300		USA, American Forces Network			4319usb
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
2200	2300		USA, EWTN/WEWN Vandiver AL			15610af
2200	2300		USA, Voice of America	5895va		6070va
			7220va	7405as	7425va	7480va
			9490va	11560va		
2200	2300		USA, WBCQ Monticello ME	7415am		
2200	2300		USA, WHRI Cypress Creek SC	9615af		
2200	2300		USA, WINB Red Lion PA	9265am		
2200	2300		USA, WJHR International Milton FL			15550usb
2200	2300	vl	USA, WRMI Miami FL	9955ca		
2200	2300		USA, WTJC Newport NC	9370na		
2200	2300		USA, WWCR Nashville TN	7465na		9980na
			12160na	13845na		
2200	2300		USA, WWRB Manchester TN	3185va		3215va
			5050va	5745va		
2200	2300		USA, WYFR/Family Radio Worldwide			5950na
			11740na	15440na		
2200	2300		Zambia CVC Intl/ The Voice Africa			4965af
2215	2230		Croatia, Croatian Radio	3985va		
2230	2257		Czech Republic, Radio Prague	5930na		7355af
2230	2300		Guam, KSDA/ AWR	15320as		
2230	2300	smtwh	Moldova, (Transnistria) Radio PMR			6240na
2230	2300		USA, Voice of America/Special English			5890va
			7230va	9780va		
2236	2300		New Zealand, Radio NZ International			15720pa
2236	2300	DRM	New Zealand, Radio NZ International			17675pa
2245	2300		India, All India Radio	6055as		7305as
			9705as	11645as		

2300 UTC - 6PM EST / 5PM CST / 3PM PST

2300	0000		Anguilla, Worldwide Univ Network			6090am
2300	0000		Australia, ABC NT Alice Springs			4835do
2300	0000		Australia, ABC NT Katherine	5025do		
2300	0000		Australia, HCJB Global	15525as		
2300	0000		Australia, Radio Australia	9660pa		12010as
			12080pa	13690pa	15230pa	15560pa
			17796pa			
2300	0000		Bahrain, Radio Bahrain	6010me		9745al
2300	0000	DRM	Belgium, TDP Radio	9790na		
2300	0000	smtwhf	Canada, CBC NQ SW Service	9625na		
2300	0000		Canada, CFRX Toronto ON	6070na		
2300	0000		Canada, CFVP Calgary AB	6030na		
2300	0000		Canada, CKZN St John's NF	6160na		
2300	0000		Canada, CKZU Vancouver BC	6160na		
2300	0000		Cuba, Radio Havana Cuba	13790sa		
2300	0000		Egypt, Radio Cairo	7580na		
2300	0000		India, All India Radio	6055as		7305as
			9705as	11645as		
2300	0000		Malaysia, RTM/Traxx FM	7295do		

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2300	0000	smtwhf	Moldova, (Transnistria) Radio PMR			6240na
2300	0000		New Zealand, Radio NZ International			15720pa
2300	0000	DRM	New Zealand, Radio NZ International			17675pa
2300	0000		Russia, Voice of Russia		7250na	
2300	0000		UK, BBC World Service		3915as	5875as
			6135as	6195as	7385as	9740as
			11955as			
2300	0000		USA, American Forces Network			4319usb
			5446va	5765va	6350va	7812va
			10320va	12133va	12759va	13362va
2300	0000		USA, EWTN/WEWN Vandiver AL			15610af
2300	0000		USA, Voice of America		6070va	7220va
			7265va	7405va	7480va	9490va
			9580va	11560va		
2300	0000		USA, WBCQ Monticello ME		5110am	7415am
2300	0000		USA, WHRI Cypress Creek SC		5875na	
2300	0000	smtwhf	USA, WHRI Cypress Creek SC		7315sa	
2300	0000	Sat	USA, WHRI Cypress Creek SC		5850eu	
2300	0000		USA, WINB Red Lion PA		9265am	
2300	0000		USA, WJHR International Milton FL			15550usb
2300	0000	vl	USA, WRMI Miami FL		9955ca	
2300	0000		USA, WTJC Newport NC		9370na	
2300	0000		USA, WWCR Nashville TN		3230na	5070na
			9980na	13845na		
2300	0000		USA, WWRB Manchester TN		3185va	3215va
			5050va	5745va		
2300	0000		USA, WYFR/Family Radio Worldwide			5950na
			9430ca	15400ca	15440na	
2300	0000		Zambia CVC Intl/ The Voice Africa			4965af
2300	2330		Australia, Radio Australia		15240as	
2300	2330		Cuba, Radio Nacional de Venezuela			13680ca
			15250ca			
2300	2330		USA, Voice of America/Special English			6180as
			7460va	11840va		
2300	2345		USA, WYFR/Family Radio Worldwide			9430sa
			11740na	15400sa	15440na	
2300	2345	DRM	Vatican City State, Vatican Radio			7370am
2300	2355		Turkey, Voice of Turkey		5960va	
2300	2356		Romania, Radio Romania International			5915as
			6015va	7220eu	7300as	
2300	2357		China, China Radio International			5915as
			5990na	6040na	6145na	7350as
			7415as	9610as	11790va	11970va
2315	2330		Croatia, Croatian Radio		7375va	
2330	0000		Australia, Radio Australia		15415as	17750as
2330	0000		UK, BBC World Service		6170as	
2330	0000		USA, Voice of America/Special English			6180as
			7460va	11655va	11840va	13640va
2330	2357		Czech Republic, Radio Prague		5930na	7355af
2330	2358		Vietnam, Voice of Vietnam		9840as	12020as
2345	0000		Australia, HCJB Global		15400as	

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Albania, Radio Tirana .....**http://rtsh.sil.at/**
Angola, Radio Nacional de Angola.....**www.rna.ao/**
Anguilla, Worldwide Univ Network .....**www.worldwideuniversitynetwork.com/**
Argentina, Radio Nacional RAE.....**www.radionacional.com.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, CVC International .....**www.christianvision.com/**
Australia, HCJB Global .....**www.hcjb.org/**
Australia, Radio Australia .....**www.abc.net.au/ra/**
Austria, AWR Europe **www.awr2.org/**
Bahrain, Radio Bahrain .....**www.radiobahrain.net**
Bangladesh, Bangladesh Betar .....**www.betar.org.bd/**
Belarus, Radio Belarus .....**www.radiobelarus.tvr.by/eng/**
Belgium, TDP Radio .....**www.airtime.be/schedule.html**
Bhutan, Bhutan Broadcasting Service .....**www.bbs.com.bt/**
Bulgaria, Radio Bulgaria .....**www.bnr.bg/**
Canada, CBC NQ SW Service.....**www.cbc.ca/north/**
Canada, CFRX Toronto ON.....**www.cfrb.com**
Canada, CFVP Calgary AB.....**www.classiccountryam1060.com**
Canada, CKZN St John's NF .....**www.cbc.ca/listen/index.html**
Canada, CKZU Vancouver BC.....**www.cbc.ca/bc**
Canada, Radio Canada International .....**www.rcinet.ca/**
China, China Radio International .....**www.cri.cn/**
China, CPBS/CNR Business Radio.....**www.rcinet.ca/**
China, Guangxi FBS/Beibu Bay Radio .....**www.gxradio.com/index/index.asp**
China, Voice of the Strait.....**www.vos.com.cn**
Clandestine, Cotton Tree News.....**www.cottontreenews.org/**
Clandestine, Shiokaze/Sea Breeze .....**www.chosa-kai.jp**
Clandestine, Sudan Radio Service.....**www.sudanradio.org**
Croatia, Croatian Radio .....**www.hrt.hr/**
Cuba, Radio Havana Cuba .....**www.radiohc.cu/**
Czech Republic, Radio Prague .....**www.radio.cz/**
Egypt, Radio Cairo.....**www.sis.gov.eg/**
Ethiopia, Radio Ethiopia/External Service..**www.angelfire.com/biz/radio-ethiopia/**
France, Radio France International.....**http://rfienglish.com**
Germany, AWR-Europe **www.awr2.org/**
Germany, CVC Intl-Christian Vision .....**www.christianvision.com/**
Germany, Deutsche Welle .....**www.dw-world.de/**
Germany, European Music Radio.....**www.emr.org.uk/**
Germany, Overcomer Ministries.....**www.overcomerministry.org/**
Germany, Pan American Broadcasting .....**www.radiopanam.com/**
Germany, TWR Europe.....**www.twr.org**
Greece, Voice of Greece .....**www.voiceofgreece.gr/**
Guam, KSDA/ AWR **www.awr2.org/**
Guam, KTWR/TWR .....**www.twr.org/**
India, All India Radio .....**www.allindiaradio.org/**
Indonesia, Voice of Indonesia .....**www.voi.co.id**
Iran, Voice of Islamic Rep. of Iran .....**www.irib.ir/English/**
Japan, NHK World/ Radio Japan.....**www.nhk.or.jp/english/**
Kuwait, Radio Kuwait.....**www.media.gov.kw/**
Laos, Lao National Radio .....**www.lnr.org.la**
Libya, LJB/Voice of Africa .....**www.voiceofafrica.com.ly**
Malaysia, RTM/Traxx FM.....**www.traxxfm.net/index.php**
Malaysia, RTM/Voice of Malaysia.....**www.rtm.gov.my**
Mali, RDTV Du Mali .....**www.ortm.ml**
Monaco, TWR Europe .....**www.twr.org/**
Nepal, Radio Nepal .....**www.radionepal.org/**
Netherlands, R Netherlands Worldwide ....**www.radionetherlands.nl/**
New Zealand, Radio NZ International .....**www.rnzi.com**
Nigeria, Voice of Nigeria/External Service **www.voiceofnigeria.org**
Oman, Radio Oman.....**www.oman-tv.gov.om**
Pakistan, PBC/ Radio Pakistan.....**www.radio.gov.pk**
Palau, T8WH/World Harvest.....**www.whr.org/**
Philippines, PBS/ Radyo Pilipinas.....**www.pbs.gov.ph/**
Poland, Polish Radio .....**www.polskieradio.pl**
Romania, Radio Romania International ....**www.rri.ro/**
Russia, Voice of Russia .....**www.ruvr.ru/**
Rwanda, Radio Rwanda .....**www.orinfor.gov.rw/**
Saudi Arabia, BSKSA/External Service .....**www.saudiradio.net/**
Slovakia, IRRS/Euro Gospel Radio.....**www.nexus.org**
Slovakia, IRRS/Radio City .....**www.nexus.org**
Slovakia, IRRS/Radio Joystick .....**www.nexus.org**
Slovakia, Radio Slovakia International.....**www.rsi.sk**
South Africa, RTE Radio One **www.rte.ie/radio1/**
South Africa, AWR Africa **www.awr2.org/**
South Africa, Channel Africa.....**www.channelafrica.org**
South Africa, SA Radio League.....**www.channelafrica.org**
South Africa, TWR .....**www.twr.org/**
South Korea, KBS World Radio .....**http://rki.kbs.co.kr/english/**
Spain, Radio Exterior de Espana .....**www.ree.rne.es/**
Sri Lanka, SLBC .....**www.slbc.lk**
Swaziland, TWR Swaziland .....**www.twr.org.za**
Sweden, Radio Sweden .....**www.sr.se/rs/english/**
Syria, Radio Damascus.....**www.rtv.gov.sy/**
Taiwan, Radio Taiwan International .....**http://english.rti.org.tw/**
Thailand, Radio Thailand World Service ...**www.hsk9.com/**
Turkey, Voice of Turkey.....**www.trt.net.tr**
Uganda, Dunamis Shortwave .....**www.biblevoice.org/stations/east-africa**
UK, BBC World Service.....**www.bbc.co.uk/worldservice/**
UK, Bible Voice Broadcasting.....**www.biblevoice.org/**
UK, Sudan Radio Service.....**www.sudanradio.org/**
Ukraine, Radio Ukraine International .....**www.nrcu.gov.ua/**
United Arab Emirates, FEBA Radio .....**www.febaradio.info**
USA, American Forces Network .....**http://myafn.dodmedia.osd.mil/**
USA, EWTN/WEWN Vandiver AL .....**www.ewtn.com**
USA, KNLS Anchor Point AK.....**www.knls.org/**
USA, Voice of America .....**www.voanews.com/**
USA, Voice of America/Special English.....**www.voanews.com/**
USA, WBCQ Monticello ME.....**www.wbcq.com/**
USA, WHRI Cypress Creek SC .....**www.whr.org/**
USA, WINB Red Lion PA .....**www.winb.com/**
USA, WRMI Miami FL.....**www.wrmi.net/**
USA, WRNO New Orleans LA .....**www.wrnoworldwide.org/**
USA, WTJC Newport NC.....**www.fbnradio.com/**
USA, WWCR Nashville TN.....**www.wwcr.com**
USA, WWRB Manchester TN.....**www.wwrb.org/**
USA, WYFR/Family Radio Worldwide .....**www.worldwide.familyradio.org**
Uzbekistan, CVC Intl/ The Voice Asia .....**www.christianvision.com/**
Vatican City State, Vatican Radio.....**www.vaticanradio.org**
Vietnam, Voice of Vietnam.....**www.vov.org.vn**
Zambia CVC Intl/ The Voice Africa .....**www.christianvision.com/**
Zambia, Zambia Natl Broadcasting Corp.**www.znbc.co.zm**

THE QSL REPORT

VERIFICATIONS RECEIVED BY OUR READERS

Gayle Van Horn, W4GVH
gaylevanhorn@monitoringtimes.com

Who's on first and who's on the pole?

Whether you're following sports or QSLing, staying up on current trends and news plays an important role to enjoying your hobby. Maintaining a list of current veri signers and knowing which enclosures are producing results for a particular station (currency vs. mint postage vs. IRCs) are important steps towards your verification goals. Stay attuned with *MT's QSL Report*, email newsgroups, blogs, and club bulletins for stations actively confirming reception reports. Special transmissions such as DX tests or *Last Day of Transmissions* produce excellent QSLing opportunities. Follow the news as new stations sign on or reactivate, so you'll be able to establish contact with station personnel.

Knowing who's on first is your first step to enhance your QSLing.

QSL "Bytes"

Anker Petersen, Chairman of Danish Shortwave Club International, reports he verified All India Radio via Kolkata on 4820 kHz. Mr. Animesh Chakraborty verified in 65 days via *animesh37@rediffmail.com*.

Bhutan Broadcasting Service is reported to be active again on 6035 at 0030 in Asian languages. Additional broadcast hours can be found in the *MTExtra SW Broadcast Guide*, and *MT's English SW Guide*. Send your report details with three IRC's, $2.00US or return mint postage to: Department of Information and Broadcasting, Ministry of Communications, P.O. Box 101, Thimphu, Bhutan. Streaming/on-demand audio: **www.bbs.com.bt**

Add Scott Joplin Radio, Gorilla Radio, Stairway to Heaven, and Shay Man Radio to your list of new pirate stations being logged around 6925. Maildrops have not been posted; however, station logs can be posted online at Free Radio Network website at **www.frn.net**. Pirate operators have been known to QSL posted logs, so include PLS QSL when reporting.

Free Radio Service Holland has been broadcasting on the "free" side since the 1980s. Broadcasts are irregular on selected weekends in Dutch, English and German. Programming consists of *FRS Magazine, Golden Show,* and *FRS Goes DX.* Previous frequencies have included 5810, 6325 and 7600 kHz. Email: *freeradioholland@hotmail.com* (or) *frs.holland@hccnet.nl*. Postal reports to: P.O. Box 2702, NL-6049 ZG Herten, Netherlands.

Upcoming broadcasts are posted on my *Shortwave Central Blog* at **http://mt-shortwave.blogspot.com/**

Suriname's Radio Apintie is being logged on 4990 in Dutch. Email correspondence is preferred to *apinite@sr.net* Streaming audio **www.apintie.sr/home.php** Consult *MTExtra* for scheduling.

Guatemala's Radio Cultural Coatán has announced closure of their service on 4780 kHz due to a broken transmitter. Broadcast will resume online at **www.radiocoatan.com** and FM 103.3. Send outstanding program details and return postage to: Radio Cultural Coatán, San Sebastián Coátan 13035, Huehuetenango, Guatemala.

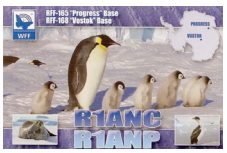
DX News reports a new clandestine station brokered by Belgium's Transmitter Documentation Project (TDP). Radio Democracia in Amharic, Sunday on 21555 kHz, 0900-1000. Email reports are not accepted, nor are details older than a month old stated by TDP. Return postage required to: TDP, c/o Ludo Maes, P.O. Box 1, 2310 Rijkevorsel, Belgium.

Radio Sarandí, broadcasting from Montevideo, Uruguay has been logged in Spanish on 6045 kHz, 1140-1200 UTC. It is reported as broadcasting 24 hours parallel with their 690 AM sister station. Uruguayan stations are notorious as airing irregularly, so let's hope this one remains active on shortwave. Streaming audio **www.sarandi.com.uy/** Spanish details and return postage to: Enriqueta Compte y Riquet 1250, 11800 Montevideo, Uruguay.

Italy's *Play DX* shortwave group reports the following two Brazilian station addresses and veri signer updates. Send Brazilian return postage to the following: Radio Novo Tempo, Mrs. Ellen Ramos, Journalista e Locutora, Sistema Adventista de Comunicacao, Rodovaria, SP 66Km 86 N 5876, Jacarei, SP CEP 12340-010 Brazil. Streaming audio **www.novotempo.org.br.** Radio Verdes Florestias, Graci Rezende, Rua Mario Lobao 81, CEP 69980-000, Cruzeiro do Sul (Acre) Brazil. Email*: florestas@nauanet.com.br.* Non-English language schedules are listed in *MTExtra.*

Need a source for mint postage to worldwide countries? *DX Stamp Service* is the number one source used by short wavers and amateur radio operators across the globe. Bill Plum provides mint postage stamps to enclose to the station or QSL Manager, to be used as return postage for their reply to you. A current price list may be obtained via email *plumdx@msn.com* or send a SASE to: DX Stamp Service, William Plum, 12 Glenn Road, Flemington, NJ 08822 USA. Bill also sells DX Supplies to complement your mail-outs. Monthly specials are posted on the first of every month at *Shortwave Central Blog*.

AMATEUR RADIO



Antarctica R1ANC, 20 meters RTTY. Full data color scenery/penguins card. Received in 63 days for $2.00US to: Alexei V. Kuz'menko, P.O. Box 599, Arkhangelsk 163000 Russia. Verifies as RTTY # 79/193 total countries. (Larry Van Horn, NC) *Very pleased!*

Desecheo Island K5D, 20 meters SSB. Full data color scenery tri-fold card for DXpedition 2009. Received in 175 days for a SASE to: N200/N9UNW Mark A. Smick-QSL Manager, N20040 US Hwy 53, Galesville, WI 54630 USA (Van Horn).

CANADA

Voice of Turkey relay via Sackville 7325 kHz. Full data *Yacht Race in Istanbul Strait-Bosphorous* card unsigned, plus CD on *Turkey's Entertainment Screen* and station booklet. Received in 22 days for an email report to *englishdesk@trt.net.tr* Postal address: P.K. 333, Yenisehir, 06443 Ankara, Turkey. (Ed Kusalik, Alberta, Canada) Streaming audio **www.trt.net.tr**

CLANDESTINE

Radio Dabanga, 13730 kHz via Wertachtal, Germany. No data red Radio Dabanga card with "thanks," but unsigned. Received in 25 days for CD Mp3. Station brokered by Media Broadcast. QSL address: Press Now, Witte Kruislaan 55, 1217 AM Hilversum, Netherlands. (Kusalik) Email: *radiodabanga@yahoo.com* Website **www.radiodabanga.org**

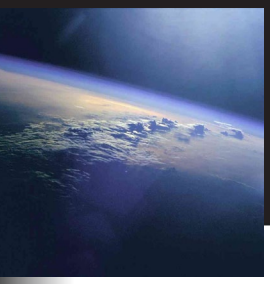
MEDIUM WAVE

BBC Scotland 810 kHz AM. No data verification letter signed by Jacqui MacDonald-BBC Information. Received in 22 days for a CD report. QSL address: BBC, P.O. Box 1922, Glasgow G2 3WT Scotland UK. Very pleased with this 3,007th confirmation and new country. (Patrick Martin, Seaside, OR)

Radio France 162 kHz AM. Allouis, France. Full data color card, "thanks" with mention of 1,000 kW, but unsigned. Received in seven months for CD report and $2.00US. QSL address: TDP 10 rue d'Oradour sur Glane, 75732 Paris Cedex 15, France (Martin).

UTILITY

VE7DXR 1998.5 kHz AM. Full data QSL card signed by Nick Hall-Patch-Owner/Operator. Received in three weeks for CD report of beacon reception. Nice stamps of ships on the envelope. QSL address: 1538 Amphion Street, Victoria BC V8R 426 Canada (Martin).



MTXtra
Shortwave Broadcast Guide

PORTUGUESE

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 - 7PM EST / 6PM CST / 4PM PST

0000	0045		Ecuador, HCJB Global	11920sa	
0000	0100	mtwhf	Argentina, Radio Nacional RAE		11710am
0000	0100		Brazil, Novas de Paz	6080do	9515do
			11725do		
0000	0100		Brazil, Radio Alvorada/Londrina		4865do
0000	0100		Brazil, Radio Alvorada/Parintins		4965do
0000	0100		Brazil, Radio Aparecida	5035do	6135al
			9630al	11855al	
0000	0100		Brazil, Radio Bandeirantes	6090do	9645do
			11925do		
0000	0100		Brazil, Radio Boa Vontade	6160do	9550do
			11895do		
0000	0100		Brazil, Radio Brasil	4785do	
0000	0100		Brazil, Radio Brasil Central	4985do	11815do
0000	0100		Brazil, Radio Cancao Nova	4825do	6105do
			9675do		
0000	0100		Brazil, Radio Capixaba	4935do	
0000	0100		Brazil, Radio Clube do Para	4885do	
0000	0100		Brazil, Radio Cultura do Para	5045do	
0000	0100		Brazil, Radio Cultura Ondas Tropicais		4845do
0000	0100		Brazil, Radio Cultura Sao Paulo		9615do
			17815do		
0000	0100		Brazil, Radio Cultura/Araraquara		3365do
0000	0100		Brazil, Radio Daqui	4905do	
0000	0100		Brazil, Radio Difusora Acerana		4885do
0000	0100		Brazil, Radio Difusora de Macapa		4915do
0000	0100		Brazil, Radio Difusora do Amazonas		4805do
0000	0100		Brazil, Radio Difusora Roraima		4875do
0000	0100		Brazil, Radio Difusora/Londrina		4815do
0000	0100		Brazil, Radio Educadora	2380do	
0000	0100		Brazil, Radio Educadora 6 de Agosto		3255do
0000	0100		Brazil, Radio Gaucha	6020do	11915do
0000	0100		Brazil, Radio Gazeta Universitaria		5955do
			9685do	15325al	
0000	0100		Brazil, Radio Globo	6120do	9585do
			11804do		
0000	0100		Brazil, Radio Guaiba	6000do	11785do
0000	0100		Brazil, Radio Guaruja/Florianpolis		5980do
0000	0100		Brazil, Radio Guaruja/Paulista	3235do	9715do
0000	0100		Brazil, Radio Imaculada Conceicao		4755do
0000	0100		Brazil, Radio Inconfidencia	6010do	15190do
0000	0100		Brazil, Radio Itatiaia	5969do	
0000	0100		Brazil, Radio Marumby	9665do	11750do
0000	0100		Brazil, Radio Minicipal	3375do	
0000	0100		Brazil, Radio Missoes da Amazonia		4865do
0000	0100		Brazil, Radio Mundial	3325do	
0000	0100		Brazil, Radio Nacional da Amazonia		6185do
			11780do		
0000	0100		Brazil, Radio Nossa Voz	4975do	
0000	0100		Brazil, Radio Nove de Julho	9820do	
0000	0100		Brazil, Radio Novo Tempo	4895do	
0000	0100		Brazil, Radio Record	6150do	9505do
0000	0100		Brazil, Radio Rural	4765do	
0000	0100		Brazil, Radio Verdas Florestas	4865do	
0000	0100		Brazil, Radio Voz Missionaria	9665do	
0000	0100		Brazil, Super Radio Deus e Amour		6060do
			9565do	11765do	
0000	0100		Brazil, Super Rede Boa Vontade		4860do
0000	0100		China, China Radio International		9560sa
			9710sa		
0000	0100	twhas	Portugal, RDP International	9455na	9855sa
			11655sa		
0000	0100		Russia, Voice of Russia	6135sa	7210sa
			7290sa	9965sa	11605sa
0000	0100		USA, WYFR/Family Radio Worldwide		7360sa
			9430sa	9690sa	11885sa
0005	0100	sm	Canada, Radio Canada International		9755na
0030	0100		Vatican City State, Vatican Radio		7305am
			9610am		

0100 UTC - 8PM EST/ 7PM CST / 5PM PST

0100	0104	sm	Canada, Radio Canada International		9755na
0100	0200		Brazil, Novas de Paz	6080do	9515do
			11725do		
0100	0200		Brazil, Radio Alvorada/Londrina		4865do
0100	0200		Brazil, Radio Alvorada/Parintins		4965do
0100	0200		Brazil, Radio Aparecida	5035do	6135al
			9630al	11855al	
0100	0200		Brazil, Radio Bandeirantes	6090do	9645do
			11925do		
0100	0200		Brazil, Radio Boa Vontade	6160do	9550do
			11895do		
0100	0200		Brazil, Radio Brasil	4785do	
0100	0200		Brazil, Radio Brasil Central	4985do	11815do
0100	0200		Brazil, Radio Cancao Nova	4825do	6105do
			9675do		
0100	0200		Brazil, Radio Capixaba	4935do	
0100	0200		Brazil, Radio Clube do Para	4885do	
0100	0200		Brazil, Radio Cultura do Para	5045do	
0100	0200		Brazil, Radio Cultura Ondas Tropicais		4845do
0100	0200		Brazil, Radio Cultura Sao Paulo		9615do
			17815do		
0100	0200		Brazil, Radio Cultura/Araraquara		3365do
0100	0200		Brazil, Radio Daqui	4905do	
0100	0200		Brazil, Radio Difusora Acerana		4885do
0100	0200		Brazil, Radio Difusora de Macapa		4915do
0100	0200		Brazil, Radio Difusora Roraima		4875do
0100	0200		Brazil, Radio Difusora/Londrina		4815do
0100	0200		Brazil, Radio Educadora	2380do	
0100	0200		Brazil, Radio Gaucha	6020do	11915do
0100	0200		Brazil, Radio Gazeta Universitaria		5955do
			9685do	15325al	
0100	0200		Brazil, Radio Globo	6120do	9585do
			11804do		
0100	0200		Brazil, Radio Guaiba	6000do	11785do
0100	0200		Brazil, Radio Guaruja/Florianpolis		5980do
0100	0200		Brazil, Radio Guaruja/Paulista	3235do	9715do
0100	0200		Brazil, Radio Imaculada Conceicao		4755do
0100	0200		Brazil, Radio Inconfidencia	6010do	15190do
0100	0200		Brazil, Radio Missoes da Amazonia		4865do
0100	0200		Brazil, Radio Mundial	3325do	
0100	0200	Sun	Brazil, Radio Nacional da Amazonia		6185do
			11780do		
0100	0200		Brazil, Radio Nossa Voz	4975do	
0100	0200		Brazil, Radio Nove de Julho	9820do	
0100	0200		Brazil, Radio Novo Tempo	4895do	
0100	0200		Brazil, Radio Record	6150do	9505do
0100	0200		Brazil, Radio Rural	4765do	
0100	0200	t	Brazil, Radio Verdas Florestas	4865do	
0100	0200		Brazil, Radio Voz Missionaria	9665do	
0100	0200		Brazil, Super Radio Deus e Amour		6060do
			9565do	11765do	
0100	0200		Brazil, Super Rede Boa Vontade		4860do
0100	0200		Ecuador, HCJB Global	11920sa	
0100	0200	twhas	Portugal, RDP International	9455sa	9855sa
			11655sa		
0100	0200		USA, WYFR/Family Radio Worldwide		7520sa
			9930eu	11825eu	

0200 UTC - 9PM EST / 8PM CST / 6PM PST

0200	0230		Brazil, Radio Educadora	2380do	
0200	0230		Ecuador, HCJB Global	11920sa	
0200	0300		Brazil, Novas de Paz	6080do	9515do
			11725do		
0200	0300		Brazil, Radio Alvorada/Londrina		4865do
0200	0300		Brazil, Radio Aparecida	5035do	6135al
			9630al	11855al	
0200	0300		Brazil, Radio Bandeirantes	6090do	9645do
			11925do		

0200	0300		Brazil, Radio Boa Vontade 11895do	6160do	9550do
0200	0300		Brazil, Radio Brasil	4785do	
0200	0300		Brazil, Radio Brasil Central	4985do	11815do
0200	0300		Brazil, Radio Cancao Nova 9675do	4825do	6105do
0200	0300		Brazil, Radio Capixaba	4935do	
0200	0300		Brazil, Radio Clube do Para	4885do	
0200	0300		Brazil, Radio Cultura do Para	5045do	
0200	0300		Brazil, Radio Cultura Ondas Tropicais		4845do
0200	0300		Brazil, Radio Cultura Sao Paulo 17815do		9615do
0200	0300		Brazil, Radio Cultura/Araraquara		3365do
0200	0300		Brazil, Radio Daqui	4905do	
0200	0300		Brazil, Radio Difusora Acerana		4885do
0200	0300		Brazil, Radio Difusora de Macapa		4915do
0200	0300		Brazil, Radio Difusora Roraima		4875do
0200	0300		Brazil, Radio Difusora/Londrina		4815do
0200	0300		Brazil, Radio Gaucha	6020do	11915do
0200	0300		Brazil, Radio Gazeta Universitaria 9685do 15325al		5955do
0200	0300		Brazil, Radio Globo 11804do	6120do	9585do
0200	0300		Brazil, Radio Guaiba	6000do	11785do
0200	0300		Brazil, Radio Guaruja/Florianpolis		5980do
0200	0300		Brazil, Radio Guaruja/Paulista	3235do	9715do
0200	0300		Brazil, Radio Imaculada Conceicao		4755do
0200	0300		Brazil, Radio Inconfidencia	6010do	15190do
0200	0300		Brazil, Radio Mundial	3325do	
0200	0300	Sun	Brazil, Radio Nacional da Amazonia 11780do		6185do
0200	0300		Brazil, Radio Nossa Voz	4975do	
0200	0300		Brazil, Radio Nove de Julho	9820do	
0200	0300		Brazil, Radio Novo Tempo	4895do	
0200	0300		Brazil, Radio Record	6150do	9505do
0200	0300		Brazil, Radio Rural	4765do	
0200	0300		Brazil, Radio Voz Missionaria	9665do	
0200	0300		Brazil, Super Radio Deus e Amour 9565do 11765do		6060do
0200	0300		Brazil, Super Rede Boa Vontade		4860do
0200	0300	twhas	Portugal, RDP International 11655sa	9455na	9855sa
0200	0300		USA, WYFR/Family Radio Worldwide		7520sa
0230	0300		Japan, NHK World/ Radio Japan		9660sa

0300 UTC - 10PM EST / 9PM CST / 7PM PST

0300	0400		Brazil, Radio Alvorada/Londrina		4865do
0300	0400		Brazil, Radio Bandeirantes 11925do	6090do	9645do
0300	0400		Brazil, Radio Boa Vontade 11895do	6160do	9550do
0300	0400		Brazil, Radio Brasil	4785do	
0300	0400	Sat/Sun	Brazil, Radio Brasil Central	4985do	11815do
0300	0400		Brazil, Radio Cancao Nova 9675do	4825do	6105do
0300	0400		Brazil, Radio Capixaba	4935do	
0300	0400		Brazil, Radio Clube do Para	4885do	
0300	0400		Brazil, Radio Daqui	4905do	
0300	0400		Brazil, Radio Difusora Acerana		4885do
0300	0400		Brazil, Radio Difusora de Macapa		4915do
0300	0400		Brazil, Radio Difusora Roraima		4875do
0300	0400		Brazil, Radio Gaucha	6020do	11915do
0300	0400		Brazil, Radio Gazeta Universitaria 9685do 15325al		5955do
0300	0400		Brazil, Radio Globo 11804do	6120do	9585do
0300	0400		Brazil, Radio Guaiba	6000do	11785do
0300	0400		Brazil, Radio Guaruja/Florianpolis		5980do
0300	0400		Brazil, Radio Guaruja/Paulista	3235do	9715do
0300	0400		Brazil, Radio Imaculada Conceicao		4755do
0300	0400		Brazil, Radio Inconfidencia	6010do	15190do
0300	0400		Brazil, Radio Mundial	3325do	
0300	0400	Sun	Brazil, Radio Nacional da Amazonia 11780do		6185do
0300	0400		Brazil, Radio Nossa Voz	4975do	
0300	0400		Brazil, Radio Nove de Julho	9820do	
0300	0400		Brazil, Radio Novo Tempo	4895do	
0300	0400		Brazil, Radio Record	6150do	9505do
0300	0400		Brazil, Radio Rural	4765do	
0300	0400		Brazil, Super Radio Deus e Amour 9565do 11765do		6060do
0300	0400		Brazil, Super Rede Boa Vontade		4860do
0300	0400		USA, WYFR/Family Radio Worldwide 7730eu		7520eu

0400 UTC - 11PM EST / 10PM CST / 8PM PST

0400	0500		Brazil, Radio Alvorada/Londrina		4865do
0400	0500		Brazil, Radio Bandeirantes 11925do	6090do	9645do
0400	0500		Brazil, Radio Boa Vontade 11895do	6160do	9550do
0400	0500		Brazil, Radio Brasil	4785do	
0400	0500		Brazil, Radio Cancao Nova 9675do	4825do	6105do
0400	0500		Brazil, Radio Capixaba	4935do	
0400	0500		Brazil, Radio Clube do Para	4885do	
0400	0500		Brazil, Radio Cultura/Araraquara		3365do
0400	0500		Brazil, Radio Daqui	4905do	
0400	0500		Brazil, Radio Difusora de Macapa		4915do
0400	0500		Brazil, Radio Gazeta Universitaria 9685do 15325al		5955do
0400	0500		Brazil, Radio Globo 11804do	6120do	9585do
0400	0500		Brazil, Radio Guaruja/Florianpolis		5980do
0400	0500		Brazil, Radio Guaruja/Paulista	3235do	9715do
0400	0500		Brazil, Radio Imaculada Conceicao		4755do
0400	0500		Brazil, Radio Inconfidencia	6010do	15190do
0400	0500		Brazil, Radio Maria	4885do	
0400	0500		Brazil, Radio Mundial	3325do	
0400	0500	Sun	Brazil, Radio Nacional da Amazonia 11780do		6185do
0400	0500		Brazil, Radio Nossa Voz	4975do	
0400	0500		Brazil, Radio Nove de Julho	9820do	
0400	0500		Brazil, Radio Novo Tempo	4895do	
0400	0500		Brazil, Super Radio Deus e Amour 9565do 11765do		6060do
0400	0500		Brazil, Super Rede Boa Vontade		4860do
0400	0500		USA, WYFR/Family Radio Worldwide		11580af
0430	0500	mtwhf	UK, BBC World Service 6145af	3380af	5940af

0500 UTC - 12AM EST / 11PM CST / 9PM PST

0500	0530	mtwhf	UK, BBC World Service 6145af	3380af	5940af
0500	0600		Brazil, Radio Alvorada/Londrina		4865do
0500	0600		Brazil, Radio Bandeirantes 11925do	6090do	9645do
0500	0600		Brazil, Radio Boa Vontade 11895do	6160do	9550do
0500	0600		Brazil, Radio Brasil	4785do	
0500	0600		Brazil, Radio Cancao Nova 9675do	4825do	6105do
0500	0600		Brazil, Radio Capixaba	4935do	
0500	0600		Brazil, Radio Clube do Para	4885do	
0500	0600		Brazil, Radio Cultura/Araraquara		3365do
0500	0600		Brazil, Radio Daqui	4905do	
0500	0600		Brazil, Radio Difusora de Macapa		4915do
0500	0600		Brazil, Radio Gazeta Universitaria 9685do 15325al		5955do
0500	0600		Brazil, Radio Globo 11804do	6120do	9585do
0500	0600		Brazil, Radio Guaruja/Florianpolis		5980do
0500	0600		Brazil, Radio Guaruja/Paulista	3235do	9715do
0500	0600		Brazil, Radio Imaculada Conceicao		4755do
0500	0600		Brazil, Radio Inconfidencia	6010do	15190do
0500	0600		Brazil, Radio Maria	4885do	
0500	0600		Brazil, Radio Mundial	3325do	
0500	0600	Sun	Brazil, Radio Nacional da Amazonia 11780do		6185do
0500	0600		Brazil, Radio Nossa Voz	4975do	
0500	0600		Brazil, Radio Nove de Julho	9820do	
0500	0600		Brazil, Radio Novo Tempo	4895do	
0500	0600		Brazil, Super Radio Deus e Amour 9565do 11765do		6060do
0500	0600		Brazil, Super Rede Boa Vontade		4860do
0530	0600		Germany, Deutsche Welle	12045af	15600af
0530	0600		Vatican City State, Vatican Radio 9660af 11625af		7360af

0600 UTC - 1AM EST / 12AM CST / 10PM PST

0600	0700		Brazil, Radio Alvorada/Londrina		4865do
0600	0700		Brazil, Radio Bandeirantes 11925do	6090do	9645do
0600	0700		Brazil, Radio Boa Vontade 11895do	6160do	9550do
0600	0700		Brazil, Radio Brasil	4785do	
0600	0700		Brazil, Radio Cancao Nova 9675do	4825do	6105do

0600	0700		Brazil, Radio Capixaba	4935do	
0600	0700		Brazil, Radio Clube do Para	4885do	
0600	0700		Brazil, Radio Cultura/Araraquara		3365do
0600	0700		Brazil, Radio Daqui	4905do	
0600	0700		Brazil, Radio Difusora de Macapa		4915do
0600	0700		Brazil, Radio Gazeta Universitaria		5955do
			9685do	15325al	
0600	0700		Brazil, Radio Globo	6120do	9585do
			11804do		
0600	0700		Brazil, Radio Guaruja/Florianpolis		5980do
0600	0700		Brazil, Radio Guaruja/Paulista	3235do	9715do
0600	0700		Brazil, Radio Imaculada Conceicao		4755do
0600	0700		Brazil, Radio Inconfidencia	6010do	15190do
0600	0700		Brazil, Radio Maria	4885do	
0600	0700		Brazil, Radio Mundial	3325do	
0600	0700	Sun	Brazil, Radio Nacional da Amazonia		6185do
			11780do		
0600	0700		Brazil, Radio Nossa Voz	4975do	
0600	0700		Brazil, Radio Nove de Julho	9820do	
0600	0700		Brazil, Radio Novo Tempo	4895do	
0600	0700		Brazil, Super Radio Deus e Amour		6060do
			9565do	11765do	
0600	0700		Brazil, Super Rede Boa Vontade		4860do
0600	0700		France, Radio France Internationale		11830af
0600	0700	mtwhf	Portugal, RDP International	7345eu	
0645	0700		Brazil, Radio Itatiaia	5969do	

0700 UTC - 2AM EST / 1AM CST / 11PM PST

0700	0800		Brazil, Radio Alvorada/Londrina		4865do
0700	0800		Brazil, Radio Aparecida	5035do	6135al
			9630al	11855al	
0700	0800		Brazil, Radio Bandeirantes	6090do	9645do
			11925do		
0700	0800		Brazil, Radio Boa Vontade	6160do	9550do
			11895do		
0700	0800		Brazil, Radio Brasil	4785do	
0700	0800		Brazil, Radio Brasil Central	4985do	11815do
0700	0800		Brazil, Radio Cancao Nova	4825do	6105do
			9675do		
0700	0800		Brazil, Radio Capixaba	4935do	
0700	0800		Brazil, Radio Clube do Para	4885do	
0700	0800	mtwhfa	Brazil, Radio Congonhas	4775do	
0700	0800		Brazil, Radio Daqui	4905do	
0700	0800		Brazil, Radio Difusora de Macapa		4915do
0700	0800		Brazil, Radio Gazeta Universitaria		5955do
			9685do	15325al	
0700	0800		Brazil, Radio Globo	6120do	9585do
			11804do		
0700	0800		Brazil, Radio Guaiba	6000do	11785do
0700	0800		Brazil, Radio Guaruja/Florianpolis		5980do
0700	0800		Brazil, Radio Guaruja/Paulista	3235do	9715do
0700	0800		Brazil, Radio Imaculada Conceicao		4755do
0700	0800		Brazil, Radio Inconfidencia	6010do	15190do
0700	0800		Brazil, Radio Itatiaia	5969do	
0700	0800		Brazil, Radio Maria	4885do	
0700	0800		Brazil, Radio Mundial	3325do	
0700	0800	Sun	Brazil, Radio Nacional da Amazonia		6185do
			11780do		
0700	0800		Brazil, Radio Nossa Voz	4975do	
0700	0800		Brazil, Radio Nove de Julho	9820do	
0700	0800		Brazil, Super Radio Deus e Amour		6060do
			9565do	11765do	
0700	0800		Brazil, Super Rede Boa Vontade		4860do
0700	0800	mtwhf	Portugal, RDP International	9815eu	
0700	0800		USA, WYFR/Family Radio Worldwide		9355sa
0745	0800	mtwhf	Portugal, RDP International	7360eu	

0800 UTC - 3AM EST / 2AM CST / 12AM PST

0800	0900		Brazil, Novas de Paz	6080do	9515do
			11725do		
0800	0900		Brazil, Radio Alvorada/Londrina		4865do
0800	0900		Brazil, Radio Aparecida	5035do	6135al
			9630al	11855al	
0800	0900		Brazil, Radio Bandeirantes	6090do	9645do
			11925do		
0800	0900		Brazil, Radio Boa Vontade	6160do	9550do
			11895do		
0800	0900		Brazil, Radio Brasil	4785do	
0800	0900		Brazil, Radio Brasil Central	4985do	11815do
0800	0900		Brazil, Radio Cancao Nova	4825do	6105do
			9675do		
0800	0900		Brazil, Radio Capixaba	4935do	
0800	0900		Brazil, Radio Congonhas	4775do	
0800	0900		Brazil, Radio Cultura do Para	5045do	
0800	0900		Brazil, Radio Cultura Ondas Tropicais		4845do
0800	0900		Brazil, Radio Cultura Sao Paulo		9615do
			17815do		
0800	0900		Brazil, Radio Cultura/Araraquara		3365do
0800	0900		Brazil, Radio Daqui	4905do	
0800	0900		Brazil, Radio Difusora de Macapa		4915do
0800	0900		Brazil, Radio Difusora Roraima		4875do
0800	0900		Brazil, Radio Difusora/Londrina		4815do
0800	0900		Brazil, Radio Educadora	2380do	
0800	0900		Brazil, Radio Gazeta Universitaria		5955do
			9685do	15325al	
0800	0900		Brazil, Radio Globo	6120do	9585do
			11804do		
0800	0900		Brazil, Radio Guaiba	6000do	11785do
0800	0900		Brazil, Radio Guaruja/Florianpolis		5980do
0800	0900		Brazil, Radio Guaruja/Paulista	3235do	9715do
0800	0900		Brazil, Radio Imaculada Conceicao		4755do
0800	0900		Brazil, Radio Inconfidencia	6010do	15190do
0800	0900		Brazil, Radio Itatiaia	5969do	
0800	0900		Brazil, Radio Maria	4885do	
0800	0900		Brazil, Radio Mundial	3325do	
0800	0900		Brazil, Radio Nacional da Amazonia		6185do
			11780do		
0800	0900		Brazil, Radio Nossa Voz	4975do	
0800	0900		Brazil, Radio Nove de Julho	9820do	
0800	0900		Brazil, Radio Novo Tempo	4895do	
0800	0900		Brazil, Radio Record	6150do	9505do
0800	0900		Brazil, Radio Rural	4765do	
0800	0900		Brazil, Radio Voz Missionaria	9665do	
0800	0900		Brazil, Super Radio Deus e Amour		6060do
			9565do	11765do	
0800	0900		Brazil, Super Rede Boa Vontade		4860do
0800	0900	mtwhf	Portugal, RDP International	7360eu	9815eu
0800	0900	Sat/Sun	Portugal, RDP International	12020eu	15555sa
			17590af		
0800	0900		USA, WYFR/Family Radio Worldwide		6105sa
			9605sa	9680va	

0900 UTC - 4AM EST / 3AM CST / 1AM PST

0900	1000		Brazil, Novas de Paz	6080do	9515do
			11725do		
0900	1000		Brazil, Radio Alvorada/Londrina		4865do
0900	1000		Brazil, Radio Aparecida	5035do	6135al
			9630al	11855al	
0900	1000		Brazil, Radio Bandeirantes	6090do	9645do
			11925do		
0900	1000		Brazil, Radio Boa Vontade	6160do	9550do
			11895do		
0900	1000		Brazil, Radio Brasil	4785do	
0900	1000		Brazil, Radio Brasil Central	4985do	11815do
0900	1000		Brazil, Radio Cancao Nova	4825do	6105do
			9675do		
0900	1000		Brazil, Radio Capixaba	4935do	
0900	1000		Brazil, Radio Clube do Para	4885do	
0900	1000		Brazil, Radio Congonhas	4775do	
0900	1000		Brazil, Radio Cultura do Para	5045do	
0900	1000		Brazil, Radio Cultura Ondas Tropicais		4845do
0900	1000		Brazil, Radio Cultura Sao Paulo		9615do
			17815do		
0900	1000		Brazil, Radio Cultura/Araraquara		3365do
0900	1000		Brazil, Radio Daqui	4905do	
0900	1000		Brazil, Radio Difusora Acerana		4885do
0900	1000		Brazil, Radio Difusora Caceres	5055do	
0900	1000		Brazil, Radio Difusora de Macapa		4915do
0900	1000		Brazil, Radio Difusora Roraima		4875do
0900	1000		Brazil, Radio Difusora/Londrina		4815do
0900	1000		Brazil, Radio Educadora	2380do	
0900	1000		Brazil, Radio Gaucha	6020do	11915do
0900	1000		Brazil, Radio Gazeta Universitaria		5955do
			9685do	15325al	
0900	1000		Brazil, Radio Globo	6120do	9585do
			11804do		
0900	1000		Brazil, Radio Guaiba	6000do	11785do
0900	1000		Brazil, Radio Guaruja/Florianpolis		5980do
0900	1000		Brazil, Radio Guaruja/Paulista	3235do	9715do
0900	1000		Brazil, Radio Imaculada Conceicao		4755do
0900	1000		Brazil, Radio Inconfidencia	6010do	15190do
0900	1000		Brazil, Radio Itatiaia	5969do	
0900	1000		Brazil, Radio Maria	4885do	
0900	1000		Brazil, Radio Marumby	9665do	11750do
0900	1000		Brazil, Radio Minicipal	3375do	
0900	1000		Brazil, Radio Missoes da Amazonia		4865do
0900	1000		Brazil, Radio Mundial	3325do	
0900	1000		Brazil, Radio Nacional da Amazonia		6185do
			11780do		

0900	1000		Brazil, Radio Nossa Voz	4975do	
0900	1000		Brazil, Radio Nove de Julho	9820do	
0900	1000		Brazil, Radio Novo Tempo	4895do	
0900	1000		Brazil, Radio Record	6150do	9505do
0900	1000		Brazil, Radio Rural	4765do	
0900	1000		Brazil, Radio Trans Mundial	5964do	9530al
			11735do		
0900	1000		Brazil, Radio Voz Missionaria	9665do	
0900	1000		Brazil, Super Radio Deus e Amour		6060do
			9565do 11765do		
0900	1000		Brazil, Super Rede Boa Vontade		4860do
0900	1000	mtwhf	Portugal, RDP International	9815eu	
0900	1000	Sat/Sun	Portugal, RDP International	12020eu	17590af
0900	1000		USA, WYFR/Family Radio Worldwide		6105sa
			9575sa 9680sa		
0927	1000		Brazil, Radio Alvorada/Parintins		4965do
0930	1000		Brazil, Radio Difusora do Amazonas		4805do
0930	1000		Japan, NHK World/ Radio Japan		6195sa
			9660sa		
0930	1000	Sat/Sun	Portugal, RDP International	9815eu	

1000 UTC - 5AM EST / 4AM CST / 2AM PST

1000	1030	Sat/Sun	USA, Voice of America	17740af	21590af
1000	1030		Vatican City State, Vatican Radio		21660am
1000	1055	Sat/Sun	Portugal, RDP International	15555sa	
1000	1100		Brazil, Novas de Paz	6080do	9515do
			11725do		
1000	1100		Brazil, Radio Alvorada/Londrina		4865do
1000	1100		Brazil, Radio Aparecida	5035do	6135al
			9630al 11855al		
1000	1100		Brazil, Radio Bandeirantes	6090do	9645do
			11925do		
1000	1100		Brazil, Radio Boa Vontade	6160do	9550do
			11895do		
1000	1100		Brazil, Radio Brasil	4785do	
1000	1100		Brazil, Radio Brasil Central	4985do	11815do
1000	1100		Brazil, Radio Cancao Nova	4825do	6105do
			9675do		
1000	1100		Brazil, Radio Capixaba	4935do	
1000	1100		Brazil, Radio Clube do Para	4885do	
1000	1100		Brazil, Radio Congonhas	4775do	
1000	1100		Brazil, Radio Cultura do Para	5045do	
1000	1100		Brazil, Radio Cultura Ondas Tropicais		4845do
1000	1100		Brazil, Radio Cultura Sao Paulo		9615do
			17815do		
1000	1100		Brazil, Radio Cultura/Araraquara		3365do
1000	1100		Brazil, Radio Daqui	4905do	
1000	1100		Brazil, Radio Difusora Acerana		4885do
1000	1100		Brazil, Radio Difusora Caceres	5055do	
1000	1100		Brazil, Radio Difusora de Macapa		4915do
1000	1100		Brazil, Radio Difusora do Amazonas		4805do
1000	1100		Brazil, Radio Difusora Roraima		4875do
1000	1100		Brazil, Radio Difusora/Londrina		4815do
1000	1100		Brazil, Radio Educadora	2380do	
1000	1100		Brazil, Radio Educadora 6 de Agosto		3255do
1000	1100		Brazil, Radio Gaucha	6020do	11915do
1000	1100		Brazil, Radio Gazeta Universitaria		5955do
			9685do 15325al		
1000	1100		Brazil, Radio Globo	6120do	9585do
			11804do		
1000	1100		Brazil, Radio Guaiba	6000do	11785do
1000	1100		Brazil, Radio Guaruja/Florianpolis		5980do
1000	1100		Brazil, Radio Guaruja/Paulista	3235do	9715do
1000	1100		Brazil, Radio Inconfidencia	6010do	15190do
1000	1100		Brazil, Radio Itatiaia	5969do	
1000	1100		Brazil, Radio Maria	4885do	
1000	1100		Brazil, Radio Marumby	9665do	11750do
1000	1100	Sun	Brazil, Radio Minicipal	3375do	
1000	1100		Brazil, Radio Missoes da Amazonia		4865do
1000	1100		Brazil, Radio Mundial	3325do	
1000	1100		Brazil, Radio Nacional da Amazonia		6185do
			11780do		
1000	1100		Brazil, Radio Nossa Voz	4975do	
1000	1100		Brazil, Radio Nove de Julho	9820do	
1000	1100		Brazil, Radio Novo Tempo	4895do	
1000	1100		Brazil, Radio Record	6150do	9505do
1000	1100		Brazil, Radio Rio Mar	6160do	9695do
1000	1100		Brazil, Radio Rural	4765do	
1000	1100		Brazil, Radio Senado	5990do	
1000	1100		Brazil, Radio Trans Mundial	5964do	9530al
			11735do		
1000	1100		Brazil, Radio Voz Missionaria	9665do	
1000	1100		Brazil, Super Radio Deus e Amour		6060do
			9565do 11765do		
1000	1100		Brazil, Super Rede Boa Vontade		4860do
1000	1100	mtwhf	Portugal, RDP International	9815eu	17590af
1000	1100	Sat/Sun	Portugal, RDP International	9815eu	12020eu
1000	1100		USA, WYFR/Family Radio Worldwide		6105sa
			9575sa 9605sa		
1030	1100		Brazil, Radio Verdas Florestas	4865do	

1100 UTC - 6AM EST / 5AM CST / 3AM PST

1100	1200	mtwhf	Argentina, Radio Nacional RAE		6060am
			11710am		
1100	1200		Brazil, Novas de Paz	6080do	9515do
			11725do		
1100	1200		Brazil, Radio Alvorada/Londrina		4865do
1100	1200		Brazil, Radio Aparecida	5035do	6135al
			9630al 11855al		
1100	1200		Brazil, Radio Bandeirantes	6090do	9645do
			11925do		
1100	1200		Brazil, Radio Boa Vontade	6160do	9550do
			11895do		
1100	1200		Brazil, Radio Brasil	4785do	
1100	1200		Brazil, Radio Brasil Central	4985do	11815do
1100	1200		Brazil, Radio Cancao Nova	4825do	6105do
			9675do		
1100	1200		Brazil, Radio Capixaba	4935do	
1100	1200		Brazil, Radio Clube do Para	4885do	
1100	1200		Brazil, Radio Congonhas	4775do	
1100	1200		Brazil, Radio Cultura do Para	5045do	
1100	1200		Brazil, Radio Cultura Ondas Tropicais		4845do
1100	1200		Brazil, Radio Cultura Sao Paulo		9615do
			17815do		
1100	1200		Brazil, Radio Cultura/Araraquara		3365do
1100	1200		Brazil, Radio Daqui	4905do	
1100	1200		Brazil, Radio Difusora Acerana		4885do
1100	1200		Brazil, Radio Difusora Caceres	5055do	
1100	1200		Brazil, Radio Difusora de Macapa		4915do
1100	1200		Brazil, Radio Difusora do Amazonas		4805do
1100	1200		Brazil, Radio Difusora Roraima		4875do
1100	1200		Brazil, Radio Difusora/Londrina		4815do
1100	1200		Brazil, Radio Educadora	2380do	
1100	1200		Brazil, Radio Educadora 6 de Agosto		3255do
1100	1200		Brazil, Radio Gaucha	6020do	11915do
1100	1200		Brazil, Radio Gazeta Universitaria		5955do
			9685do 15325al		
1100	1200		Brazil, Radio Globo	6120do	9585do
			11804do		
1100	1200		Brazil, Radio Guaiba	6000do	11785do
1100	1200		Brazil, Radio Guaruja/Florianpolis		5980do
1100	1200		Brazil, Radio Guaruja/Paulista	3235do	9715do
1100	1200		Brazil, Radio Imaculada Conceicao		4755do
1100	1200		Brazil, Radio Inconfidencia	6010do	15190do
1100	1200		Brazil, Radio Itatiaia	5969do	
1100	1200		Brazil, Radio Maria	4885do	
1100	1200		Brazil, Radio Marumby	9665do	11750do
1100	1200		Brazil, Radio Minicipal	3375do	
1100	1200		Brazil, Radio Missoes da Amazonia		4865do
1100	1200		Brazil, Radio Mundial	3325do	
1100	1200		Brazil, Radio Nacional da Amazonia		6185do
			11780do		
1100	1200		Brazil, Radio Nossa Voz	4975do	
1100	1200		Brazil, Radio Nove de Julho	9820do	
1100	1200		Brazil, Radio Novo Tempo	4895do	
1100	1200		Brazil, Radio Record	6150do	9505do
1100	1200		Brazil, Radio Rio Mar	6160do	9695do
1100	1200		Brazil, Radio Rural	4765do	
1100	1200		Brazil, Radio Senado	5990do	
1100	1200		Brazil, Radio Trans Mundial	5964do	9530al
			11735do		
1100	1200		Brazil, Radio Verdas Florestas	4865do	
1100	1200		Brazil, Radio Voz Missionaria	9665do	
1100	1200		Brazil, Super Radio Deus e Amour		6060do
			9565do 11765do		
1100	1200		Brazil, Super Rede Boa Vontade		4860do
1100	1200	mtwhf	Portugal, RDP International	9815eu	17745af
			21655af		

WANT MORE?

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SKY SURFING

RADIO FROM THE OUTER REACHES

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Working Your First Amateur Radio Satellite (Part II)

Greetings and welcome to the amateur radio satellite corner of the *Sky Surfing* column in *Monitoring Times*!

My goal in this column will be to help demystify the world of amateur radio satellites. And, best of all, you don't need to be a licensed ham operator in order to get in on the fun!

I trust my feature article in the January issue (Part I) served to "whet your appetite" about how to listen for and use these modern day wonders. However, before you progress further, there are a few more "tricks of the trade" that I need to share with you first.

❖ Additional Handheld Antenna Considerations

Let me say it right up front: In satellite work, your antennas are, without a doubt, *the* most important part of your station. That's because the power output of the majority of amateur satellites now in orbit seldom runs more than a watt or two. Indeed, 51 and AO-27 normally transmit with a power output of only about 1/2 watt or so, and SO-50 is even lower.

All of these satellites transmit into what's called a "turnstile" antenna array consisting of a set of four quarter-wavelength 70cm whips canted inward (or outward) at a 45-degree angle on the bottom of the spacecraft. But, unfortunately, even with their multiple elements, the nominal gain of these arrays is still pretty close to zero. The end result is that most of these satellites are transmitting with little more than "flea power" into a proverbial "wet noodle" for an antenna.

As if transmitting with low power weren't enough of a hurdle to overcome, these satellites will never be closer to you than about 500 miles (800 km), even when they are directly overhead. They'll be over 2,000 miles (3,200 km) distant when they are near the horizon.

So, it should go without saying that you *will* need a good receiver and some sort of gain antenna in your setup in order to hear them.

Another factor that has to be taken into account has to do with the harsh environment of space where these satellites operate. For example, when their solar panels are in full sunlight, the satellites are being "baked" at about 250 degrees Celsius. Out of direct sunlight, the external temperature rapidly cools down to a chilly *minus* 250 degrees Celsius!

Needless to say, such rapid temperature swings would soon destroy the fragile electronics onboard if something weren't done to move that heat around inside the spacecraft. That's why all these satellites are designed to spin about their vertical axis (much like a barbeque rotisserie) as they orbit the Earth. This motion helps to "cook" the satellite evenly to keep the batteries and electronics inside the satellite heated and cooled within operating parameters.

Furthermore, in order to keep their downlink antennas properly oriented toward the Earth, these birds are *also* designed to slowly tumble end over end as they move from South to North (or North to South) over the planet. While contributing to balancing those rapid heating and cooling cycles, this tumbling motion also helps keep the meager gain of their transmit antennas radiating toward the Earth.

Unfortunately, the constant tumbling motion also means that the polarity of the satellite's receiving and transmitting antennas will be constantly changing. And, as satellite work is "line of sight" work, unless you are able to change your antenna's polarity in sync with the satellite, its downlink signals will undergo some very deep fades in your receiver due to severe (>5 dB) antenna cross-polarization effects during the course of the satellite's pass.

My experience has shown that most fixed and mobile vertical antennas cannot be easily (or rapidly) tilted to match the ever-changing polarity of a satellite's transmit and receive antennas as it tumbles across the sky.

For this same reason, neither a quarter-wavelength nor a 5/8-wavelength HT-mounted whip is recommended for satellite reception. Besides being frequently cross-polarized with the satellite's antennas, such antennas aren't fully effective because most handheld radios simply don't provide the required ground plane.

And, finally, because the downlink signal strength of most of these satellites *is* so weak, most scanners (or other, so-called "broadband"

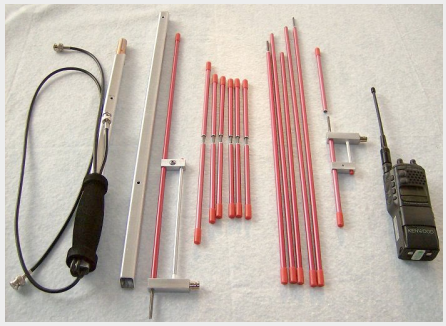
ARROW II SATELLITE ANTENNA

The Arrow II Satellite Antenna Model 146/437 provides an impressive forward gain of approximately 10.3 dBd at 70 cm and 4.6 dBd at 2 meters. Sturdily machined from aluminum arrow shafts (hence the name), this antenna actually consists of two antennas mounted at right angles to each other on the same boom…a three element Yagi for 2m and a seven element Yagi for 70cm. A removable foam handgrip and threaded horizontal and vertical photo tripod mounting holes underneath the handgrip, make this totally collapsible antenna also useful for terrestrial radio direction finding or portable emergency work.

Options include a split boom and a removable 10-watt duplexer inside the boom along with an assortment of cloth carry bags. With prices starting at about US $75 (minus the split boom and duplexer options) the antenna has, quite literally, spawned a whole new way for thousands of hams worldwide to work the "birds."

I own two of these split-boom and duplexer-equipped Arrow antennas and I remain absolutely delighted with their performance. One of them, along with my Kenwood TH-78A handi-talkie (HT), goes with me in my vehicle or suitcase whenever I travel.

Several Amateur Radio dealers offer various versions of the Arrow Satellite Antenna in their catalogs, or they can be ordered directly from the manufacturer at **www.arrowantennas.com** (911 E. Fox Farm Road #2, Cheyenne, WY 82007; 307-638-2369).



receivers that cover 436 MHz) will not be able to reliably receive the downlink with just a whip antenna.

The bottom line here is that, no matter how you cut it, satellite work is *weak signal work*. And, while whip antennas are fine for most terrestrial applications, they don't provide enough downlink gain to be useful for reliable weak signal satellite work beyond an occasional lucky contact.

However, before you say, "this isn't for me" and move along to another column, let me also say that, with the creative addition of a set of small (and relatively inexpensive!) Yagi antennas to produce a bit more uplink and downlink gain, your HT *can* be turned into a very effective Earth station for use with these satellites.

❖ Handheld Yagis to the Rescue!

If you are truly serious about routinely hearing or working through the FM birds with an HT, a hand-held Yagi antenna of some sort will be needed to provide your transceiver with effective uplink power (and downlink receiver gain).

Over the years, many amateur satellite enthusiasts have "rolled their own" hand-held Yagi antennas specifically to work these Low Earth Orbiting (LEO) satellites. Radio hams like long time VHF enthusiast Kent Britain (WA5VJB) have been freely sharing their learning by publishing numerous plans on the Internet for a series of "home brewed" hand held yagis for 2m and 70cm made out of easily obtainable materials. These materials include pieces of aluminum ground wire or brazing rod, along with scraps of left-over lumber.

In an excellent online article he's dubbed *Cheap Antennas for the AMSAT LEO Satellites* at **www.oh1sa.net/data/satellite/antenna-lna-etc/Cheap_Antennas-LEOs.pdf**, Kent shows how you can easily build a dual band hand-held Yagi to work the FM birds.

Another reliable source of plans for these "home brew" antennas can be found in an excellent series of beginner articles on the AMSAT-North America Web site at **www.amsat.org/amsat-new/information/faqs**.

However, if building your own antenna from scratch isn't your thing, fortunately, there are a number of commercial antenna manufacturers catering to LEO enthusiasts. Antennas such as the commercially manufactured Arrow Model 146/437-10 dual-band handheld beam antenna (see sidebar) or the Elk Antenna Model 2m/440 (**www.elkantennas.com;** 2680 Cherry Lane Walnut Creek, CA 94597-2161; call Ray W6FYA 925-933-3242 or Pete KA6SHE 925-934-2093) are highly recommended commercial substitutes. Either of these antennas will provide more than enough gain for you to work the FM satellites with a 3-5 watt output, dual-band HT or to hear them with a handheld VHF/UHF scanner.

❖ Other Helpful Hints

Remember that when you attempt to communicate through these satellites they will be both spinning and tumbling in orbit, so their uplink and downlink antenna polarizations will be constantly changing. If you are just using a whip antenna on an HT to try to locate a satellite, moving your HT around a bit during the satellite pass may be helpful. That motion should result in the antenna polarizations of your HT and the satellite briefly coinciding at some point. I've also found that reflections from conductive surfaces (such as a car body) will sometimes help improve your received and transmitted signals.

As also noted in my January feature article, if you are using an HT, you'll want to use a speaker-mike – or better yet, a headset with a boom mike attached – while working through these satellites. A boom headset will free you from the task of having to hold the antenna in one hand and your radio near your mouth and ears with the other. Your arm *will* get tired holding one of these antennas for a 15 minute satellite pass.) Another approach that works well is to enlist the aid of an assistant who can hold your radio (or a small external speaker connected to your HT) during the pass.

The feature article also noted that another very good reason for using some form of speaker microphone or boom headset is that, if you are communicating through the satellite using a full-duplex HT, having your microphone and speaker so close together in the same unit will usually create howls of audio feedback *through the satellite* when you transmit! Such activity will not make you a popular "camper" on the bird!

Finally, because they are so weak, AO-51, AO-27 and SO-50 downlink signals are unlikely to be strong enough to trip the squelch on most FM receivers. So, be sure to open your receiver's squelch all the way (until you hear the rushing sound) before you begin listening. When the satellite comes into range of your location, the rushing sound will "quiet," giving you a clear indication that you have, indeed, "captured" the bird's downlink.

❖ Swim with Alligators

Speaking of capturing signals... Because FM signals exhibit a very definite capture effect, there will be times when there are so many people trying to use the bird that you simply won't be able to get into the transponder, no matter how hard you try. And you will also occasionally encounter high-powered operators, dubbed "alligators," on the birds. These are people who routinely operate with "all mouth and no ears," and who, in the process, end up hogging the bird's FM uplink.

If this happens, keep trying to drop your call sign in between their transmissions. Or, failing that, simply try again on another pass when, hopefully the "alligators" will be out of the satellite's footprint…or out to lunch! I've had the best luck on these satellites during less busy mid-week passes, where the maximum elevation angle to the satellite from my location was at least 30 degrees above the horizon.

Also, if you're fortunate enough to be operating from a location within a few hundred miles of an ocean, you may find it easier to access these satellites with low power when the bird is out over the ocean than when it's passing over a continental land mass. That's because there will be fewer stations within the footprint to compete with you, and most of those competitors will be farther from the satellite than you are.

❖ What if I Hear Nothing?

This has happened to all of us, so *don't give up!* Go back and recheck the satellite's operating schedule at **www.amsat.org/amsat-new/satellites/status.php** to be absolutely sure you are listening and transmitting on the correct frequencies. Another culprit may be that your tracking software is providing you with erroneous pass data. Double check your satellite tracking program to be sure that you have a fresh set of Keplerian elements loaded, that your location file (station latitude and longitude or Maidenhead Grid Square entry) is correct, and that you *also* have the proper GMT offset loaded into the software.

It is also important to remember that transponder schedules and pass times for these satellites are all expressed in GMT and will vary from day to day…that's why you need computer software to track them. I can't begin to tell you how many times I've gone outside to work one or more of these satellites, only to find I was listening for them at the wrong time or on the wrong frequency!

For best results, your software's uploaded Keplerian Element files (also discussed in January's feature article) should be updated at least once a month. If you don't already have a computer tracking program, check out the software tracking page on the AMSAT web site at **www.amsat-na.com/store/category.php?c=Software** and obtain a copy of their SAT-PC32 software. For a small monetary donation to AMSAT, the software can be obtained either via download from their Web site or via CD-ROM directly from AMSAT Headquarters.

What's more, the AMSAT Web site sports an online tracking display at **www.amsat.org/amsat-new/tools/predict/satloc.php?lang=en&satellite=AO-51** for a number of AMSAT satellites (including AO-51, AO-27 and SO-50). Use the drop down box under the map display to select the satellite you wish to track. I routinely use it as a quick cross-reference to what my tracking software is displaying, to make sure I have everything in my computer set correctly. The orbital position of the satellite you are tracking with your computer software should roughly match what's being displayed online by AMSAT.

❖ Looking Ahead

By the time we next meet, I hope to have contacted many of you on one of our EZ Sats. In future columns, I'll be discussing some innovative ways to optimize your base station antennas to work the birds from inside your shacks, as well as to bring you up to date on the progress of AMSAT's plans to build and launch the next generation of Amateur Radio satellites. See you then.

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2010 Air Show Season Nearly Here

We are about a month away from the start of the military/civilian air show season and the *MT Annual Air Show Guide* that will appear in the March issue. In the meantime, I'm going to start the fun in this issue by presenting some military base profiles that the two top flight demo groups will appear at early in the show season this year.

THUNDERBIRDS

The U.S. Air Force Thunderbirds will start the season at the following military bases: Davis Monthan AFB, Arizona; Maxwell AFB, Alabama; Eglin AFB, Florida; Barksdale AFB, Louisiana; Dyess AFB, Texas; Altus AFB, Texas, Shaw AFB, South Carolina; Columbus AFB, Mississippi; and Grand Forks AFB, North Dakota. Here are some selected aero and Land Mobile Radio (LMR) frequencies used at each of these bases:

Davis Monthan AFB (KDMA)
PTD 372.200; ATIS 270.100; PMSV Metro 239.800 (Alt PMSV Metro KLUF 267.400)
Tucson App/Dep 119.400 125.100 269.550 297.200 318.100
Tower 118.850 253.500; Ground Control 121.800 275.800; Clearance Delivery 121.800 275.800
Command Post 381.300 (Call: Raymond 8)
LMR – P16 Mixed Mode TRS: 406.1125/415.1125c 406.1500/415.1500c 406.7625/415.7625c 406.9625/415.9625c 407.3625/416.3625 407.7625/416.8125 407.8125/416.8125 407.8875/417.8875 408.0500/417.0500 408.0875/417.0875 408.1250/417.1250 408.1500/417.1500 408.5625/417.5625 409.0250/418.0250 409.2750/418.2750 409.4500/418.4500 409.5625/418.5625 410.5625/419.5625

Maxwell AFB (KMXF)
PTD 139.300 372.200; ATIS 134.700 269.900; PMSV Metro 342.300
Montgomery App/Dep 121.200 124.000 363.025 380.225 (OT Atlanta Center 120.550 270.250)
Tower 118.150 253.500; Ground Control 127.150 289.40
42 ABW Command Post 234.600 (Call: 42 ABW Command Post)
AFRC 908AW Command Post 396.900 (Call: Hank Ops)
LMR – P16 Mixed Mode TRS: 406.1625/415.1625 407.9625/416.9625 408.7625/417.7625 409.7125/418.7125 410.7625/419.7625c [Site-1 Maxwell AFB]
406.1125/415.1125c 406.3625/415.3625c 407.2875/416.2875 410.3625/419.3625 [Site-2 Gunter Annex]

Eglin AFB (KVPS)
PTD 142.300 372.200; ATIS 134.625 273.500; PMSV Metro 342.200
App/Dep 125.100 132.100 281.450 360.600 (OT Jacksonville Center 120.200 346.400)
Tower 118.200 353.650; Ground Control 121.800 335.800; Clearance Delivery 127.700 377.200 Command Post 318.050 328.025 (Call Raymond 11)
LMR – P25 USN/USMC Enterprise LMR TRS Navy Southeast Region: 386.4625/396.4625c [Site 302 Duke Field]
386.4250/396.4250c [Site 303 Eglin]
385.0125/395.0125c 386.1250/396.1250 [Site 304 Eglin VAS]
385.0625/395.0625c 385.3500/395.3500 386.1375/396.1375 386.4125/396.4125 388.0250/398.0250 388.8875/398.8875 [Site 305 Hurlburt Field]

Barksdale AFB (KBAD)
PTD 254.425; ATIS 307.025; PMSV Metro 227.400
Shreveport App/Dep 119.900 123.750 327.000 335.550
Tower 128.250 278.300; Ground Control 121.800 275.800
Command Post 311.000 321.000 (Call Raymond 6)
LMR – P25 Digital TRS: 408.5625/417.5625c 408.9625/417.9625 409.3625/418.3625 409.5625/418.5625 409.7625/418.7625 410.1625/419.1625

Dyess AFB (KDYS)
PTD 139.300 372.200; ATIS 385.700; PMSV Metro 383.250 (Altn PMSV Sheppard 339.650)
Abilene App/Dep 125.000 127.200 282.300 338.300
Tower 133.000 257.675; Ground Control 118.350 275.800
ACC Command Post 311.000 321.000 (Raymond 37) AMCC Command Post 349.400
LMR – We need field reports to determine what TRS system, if any, is in use at this base.

Altus AFB (KLTS)
PTD 372.200; ATIS 109.800 273.500; PMSV Metro 239.800
App 125.100 257.725 290.900 (OT Fort Worth Center 128.400 269.375 290.200 133.500 350.350)
Tower 119.650 255.600; Ground Control 121.850 275.80 Clearance Delivery 120.650 284.700
Command Post 311.000 321.000 349.400 6761.0 kHz (Call Geronimo); SOF 349.400
LMR – We need field reports to determine what TRS system, if any, is in use at this base.

Shaw AFB, SC (KSSC)
PTD 139.600 372.200; ATIS 132.125 270.100; PMSV Metro 342.500
App/Dep 125.400 385.600 (OT Jacksonville Center 124.700 269.550 298.900)
Tower 126.650 254.250; Ground Control 126.100 275.800 Clearance Delivery 121.800 289.400
Command Post 381.300 (Call: Raymond 26)
LMR – P25 Digital TRS: Base Frequency: 162.0MHz, Step: 12.5 kHz, Offset: 380
Frequencies: 163.4125 163.4625 164.5000 164.9625 165.0125 165.1875 165.2250 165.4125 166.0000 166.2250

Columbus AFB (KCBM)
PTD 376.000 142.300; ATIS 115.200 273.500; PMSV Metro 354.600; SOF 252.100
App 126.075 132.025 133.250 135.600 323.275 239.250 291.650 307.80 317.500 323.275
Tower 126.650 379.925; Ground Control 121.900 275.800; Clearance Delivery 269.550
LMR – P16 Mixed Mode TRS: 406.3625/415.3625 406.5625/415.5625 406.7625/415.7625 406.9625/415.9625 407.9625/416.9625 408.7625/417.7625 410.3625/419.3625

Grand Forks AFB (KRDR)
PTD 372.200; ATIS 273.450 (Digital-ATIS, data link enabled); PMSV Metro 343.500
Radio 122.200 122.600 255.400; App/Dep 118.100 318.100
Red River Tower 124.900 349.000; Ground Control 119.150 275.80; Clearance Delivery 119.150 360.700; Command Post 311.000 321.000
LMR – P16 Mixed Mode TRS: 406.3500 406.5500 407.1500 407.3500 407.9500 408.1500 408.7500

BLUE ANGELS

The U.S. Navy Blue Angels will start the 2010 air show season at the following military bases: NAF El Centro, California; MacDill AFB, Florida; NAS Kingsville, Texas; NAS Key West, Florida; Charleston AFB, South Carolina; Andrews AFB, Maryland and MCAS Cherry Point, North Carolina. Here are some selected aero and LMR frequencies used at each of these bases:

NAF El Centro (KNJK)
ATIS 269.275; PMSV Metro 348.300
Tower 119.100 360.200 Ground Control 121.900 254.350; Clearance Delivery 340.200
LMR – We need field reports to determine what TRS system, if any, is in use at this base.

MacDill AFB (KMCF)
PTD 372.200; ATIS 133.825 270.100; PMSV Metro 344.600
Tampa App 124.950 354.000; Tampa Dep 119.650 119.90 290.30 353.575
Tower 123.700 294.700; Ground Control 118.575 275.800
6 AMW Command Post 311.000 321.000(Call Lightning Ops)
LMR – P25 Digital TRS: 406.5625/415.5625c 406.7625/415.7625c 406.9625/415.9625 407.3625/416.3625 407.5625/416.5625 407.7625/416.7625c 407.9625/416.9625c 408.1625/417.1625 408.3625/417.3625 408.5625/417.5625

NAS Kingsville (KNQI)
ATIS 276.200; PMSV Metro 344.600
App 119.900 290.450 (OT Houston Center 128.150 350.300); Dep 266.800
Tower 124.100 377.050; Ground Control 239.050; Clearance Delivery 328.400; Base Ops 274.800
LMR – We need field reports to determine what TRS system, if any, is in use at this base.

NAS Key West (KNQX)
ATIS 307.025; PMSV Metro 343.500
App/Dep 124.025 126.575 289.850 313.7000 (OT Miami Center 133.500 306.900)
Tower 118.575 305.950 340.250 361.250 (305.950 FCLP); Ground Control 121.700 336.450; Clearance Delivery 121.200 357.400; Base Ops 338.150
LMR – P25 USN/USMC Enterprise LMR TRS Navy

Southeast Region: 380.0750/390.0750c 380.5750/390.5750 380.8875/390.8875 [Site 314 NAS Key West]
380.3875/390.3875c (Key West Area)

Charleston AFB (KCHS)
Unicom 122.950; PTD 372.200; ATIS 124.750; PMSV Metro 233.950; Anderson Radio 122.200 122.500 255.400 113.500T 122.100R
App/Dep 119.300 120.700 135.800 257.100 284.000 306.925 317.450
Tower 126.000 239.000 Ground Control 121.900 348.600; Clearance Delivery 127.325 291.650 Palmetto Ops 134.100 349.400 (Have quick timing 255.500)
LMR – We need field reports to determine what TRS system, if any, is in use at this base.

Andrews AFB (KADW)
PTD 139.300 372.200; ATIS 113.100 251.050; PMSV Metro 344.600
Potomac App 119.300 335.500; Potomac Dep 125.650 348.725
Tower 118.400 349.000; Ground Control 121.800 275.800; Clearance Delivery 127.550 285.475
Command Post 141.550 378.100; AFRC Ops 143.800 351.200; Mussle Ops 141.700 292.200; 113 Wing 234.800; 201AS 314.250
LMR – P25 Digital TRS: 385.2125/395.2125c 385.3125/395.3125c 385.9000 /395.9000 385.9125/395.9125 386.0375/396.0375 386.2000/396.2000 386.3375/396.3375 386.5000/396.5000 386.6375/396.6375 386.8000/396.8000

MCAS Cherry Point (KNKT)
ATIS 127.475 244.875; PMSV Metro 343.500
App/Dep 119.350 119.750 124.100 132.575 268.700 299.600 360.775 377.175
Tower 121.300 340.200; Ground Control 128.625 239.025; Clearance Delivery 125.950 316.125 Base Ops 126.200 305.700
LMR – Analog Trunk Radio System: 407.5500 408.3500 409.1500 409.4750 409.7000 409.9500 410.5000 (Note: We believe that this system is no longer operational and they base may have switched to one of the new Enterprise 380-400 MHz trunk systems. Field reports are needed and appreciated to confirm what is currently operational on the base).

If you have additional information to share or need updates as the season moves along, I suggest you visit my personal blog the *Milcom Monitoring Post* at **http//mt-milcom.blogspot.com**.

Speaking of the *MMP*, I want to take this opportunity to thank the thousands of visitors to the site since we opened up shop in May 2006. We recently celebrated the 1,000,000th visitor to the *MMP* blog. Thanks to all who contribute and have made the *Milcom Monitoring Blog* the number one site on the Internet for military communication frequency information and news.

❖ Latest Milcom Frequency Changes

Here are the latest official frequency changes, updates, additions and corrections that I have received here at the *MT* Milcom Monitoring Post. These changes are courtesy of the Federal Aviation Administration; *MT* and MMP Blog readers; and the Department of Defense.

And that will do it for this month and the *Milcom* column. Until next time, 73 and good hunting.

Table 1: Milcom Frequency Changes

139.300 Andrews AFB MD (KADW) Pilot-to-Dispatcher (AM mode)
142.300 Eglin AFB FL (KVPS) Pilot-to-Dispatcher (AM mode), ex-139.300
226.400 Evansville IN Approach/Departure Control
239.250 Columbus MS Approach Control
239.300 Seattle/Tacoma International Airport WA (KSEA) Tower (all runways)
247.000 Fort Riley/Marshall AAF KS (KFRI) Base Operations
248.650 Fort Riley/Marshall AAF KS (KFRI) VFR Advisory
251.050 Anchorage ARTCC (ZAN) Aniak AK RCAG Low/High Altitude Discrete
252.300 Vancouver Intl (Nanaimo) BC (CYCD) Approach/Departure Control - Victoria Terminal Control (spectrum hole in North America)
254.350 Seattle ARTCC (ZSE) Horton OR RCAG Low Altitude Discrete
256.700 Minneapolis ARTCC (ZMP) Jamestown ND RCAG Low Altitude Discrete, ex-281.500
Minneapolis ARTCC (ZMP) Dupree SD RCAG Low Altitude Discrete, ex-290.350
AR-012L Aerial Refueling Track Exit, ex-290.350
257.600 Newark Liberty International NJ (KEWR) Tower (Class B airspace prior to 6.5 nm)
257.750 Denver ARTCC (ZDV) Ogallala NE RCAG High Altitude, ex-381.550
257.925 Chicago ARTCC (ZAU) Volk Field Field/Combat Readiness Training Center RCAG Low Altitude, ex-269.375
263.000 Anchorage ARTCC (ZAN) Kotzebue AK RCAG Low/High Altitude Discrete
La Guardia NY (KLGA) Tower (Class B airspace prior to 6 nm)
266.200 Boise Air Terminal (Gowen Field Airport) ID (KBOI) National Guard (ID) Operations
269.075 Boston Consolidated Tracon, Approach/Departure Control, Manchester NH (KMHT), ex-385.450
269.125 Seattle WA Approach/Departure Control
269.150 Washington ARTCC (ZDC) Wilmington NC RCAG (Sector 26) Low Altitude paired with 135.750
269.275 Dayton OH Approach/Departure Control
269.375 Chicago ARTCC (ZAU) Volk Field Field/Combat Readiness Training Center WI RCAG Low Altitude, ex-269.650
269.525 Denver Approach Control (South)
276.025 Fort Stewart/Wright AAF GA (KLHW) Base Operation/Pilot-to-Dispatcher (former spectrum hole)
279.250 William P. Gwinn Airport FL (06FA) Ground Control (this was a spectrum hole), ex-314.600
281.550 MOA Shirley-A/B/C AR MOA Control via Memphis ARTCC (ZME) Harrison RCAG, using agency ARANG 188FW Fort Smith
284.625 Pensacola NAS (Forrest Sherman Field) FL (KNPA) Ground Controlled Approach
284.700 Seattle WA Approach/Departure Control
285.400 Salt Lake City ARTCC (ZLC) Lakeside MT RCAG Low Altitude Discrete paired with 133.400
Shaw AFB SC Approach/Departure Control
285.650 Whidbey Island WA Approach/Departure Control, ex-385.600
290.200 Anchorage ARTCC (ZAN) Galena AK RCAG Low/High Altitude Discrete
290.400 Anchorage ARTCC (ZAN) Nome AK RCAG Low/High Altitude Discrete
290.800 Victoria Terminal BC Approach/Departure Control
290.900 Seattle WA Approach/Departure Control
291.600 Seattle ARTCC (ZSE) Wenatchee RCAG Low Altitude Discrete
291.650 Columbus MS Approach Control
297.775 Volk Field Field/Combat Readiness Training Center WI (KVOK) Hardwood Range Control (Call: Brochure), ex-297.100
297.900 Lambert St. Louis International MO 131FW/110FS Operations (Note: this service has been deleted from this frequency. I am very interested in receiving reports on this freq from around the country. Please plug it into your scanner and let me know what youy are hearing.)
299.850 Silver MOA Control NV (Call: Sundance)
301.000 China Lake NAWS (Armitage Field) CA (KNID) Range Control/Operations China Control
303.000 Salt Lake City International UT (KSLC) 151ARW / 191ARS Operations / Maintenance (Call: Utah Control)
306.200 Albuquerque ARTCC (ZAB) MOA Sunny AZ, ex-256.8750 (Denver ARTCC)
307.800 Tyndall AFB FL (KPAM) Tower, ex-384.400
316.050 Atlanta ARTCC (ZTL) Athens GA RCAG Low Altitude Discrete Sector 17
310.200 NAS Jacksonville FL (KNIP) Base Operations/Clearance Delivery
311.000 Salt Lake City International UT (KSLC) 151ARW/191ARS Operations / Maintenance Call: Utah Control)
314.000 Cherry Point MCAS NC R-5306 Containment/Range Control Call: Trojan Control)
316.050 Atlanta ARTCC (ZTL) Athens GA RCAG Low Altitude Discrete
316.075 Wichita Falls Approach/Departure
322.400 Jacksonville FL Approach/Departure Control
323.275 Columbus MS Approach Control
335.500 Anchorage ARTCC (ZAN) Unalakeet AK RCAG Low/High Altitude Discrete
335.600 Jacksonville FL Approach/Departure Control
338.200 Denver ARTCC (ZDV) Crawford NE RCAG Low Altitude Discrete
342.300 Hill AFB UT (KHIF) Metro
346.400 Denver Approach Control (North)
347.500 New Century Aircenter KS 158 Aviation Regiment Operations (Call: Army Ops)
348.000 Pensacola NAS (Forrest Sherman Field) FL (KNPA) Ground Controlled Approach
348.600 Jacksonville International Airport FL (KJAX) Ground Control/Clearance Delivery (Secondary)
351.800 Lubbock Approach/Departure Control
352.050 Dayton OH Approach/Departure Control
353.775 SoCal TRACON CA Approach Control
357.600 Atlanta ARTCC (ZTL) Columbus GA (RCAG) Low Altitude Discrete (part time)
358.800 Volk Field Field/Combat Readiness Training Center WI (KVOK) Hardwood Range Control Primary (Call: Brochure), ex-358.200
360.775 Cherry Point NC Approach Control, ex-314.000
372.200 Andrews AFB MD (KADW) Pilot-to-Dispatcher Keesler AFB MS (KBIX) Pilot-to-Dispatcher
377.050 Jacksonville FL Approach/Departure Control
378.400 Reno-Tahoe International NV (KRNO) 152AW/192AS Command Post/Base Operations, ex-388.8500. Also 4341.0 and 8780.0 kHz have been removed from service.
379.225 Pensacola NAS (Forrest Sherman Field) FL (KNPA) Ground Controlled Approach
379.300 Jacksonville ARTCC (ZJX) Panama City FL RCAG Low Altitude - Panama Sector: Approach/Departure Sector 27
380.350 Chicago ARTCC (ZAU) Lone Rock WI RCAG Low Altitude Discrete
381.200 Portland ME Approach/Departure Control
381.900 China Lake NAWS (Armitage Field) CA (KNID) R-2524 Range Control/Operations Echo E1 EW Range Control (Call: Echo Control)
385.500 Minneapolis ARTCC (ZMP) O'Neill NE RCAG Low Altitude Discrete

AM BANDSCAN

THE WORLD OF DOMESTIC BROADCASTING

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http://americanbandscan.blogspot.com

Twenty Years of DX

While trying (unsuccessfully..) to pull out an ID on the station I suspected to be WTMJ-620... I opened the desk drawer... and started aimlessly reading old logs. DXing sure has changed!

I got started as a DXer late in 1988. I keep a notebook in front of the radio and take notes as I DX. The notes are meant for short-term use – if I identify anything new, the details go into a spreadsheet. But the notes are interesting reading after the fact. Unfortunately, because I don't expect to need the notes for more than a day or two, I tend to forget to write down what *year* they were taken! Two trends jump off the pages:

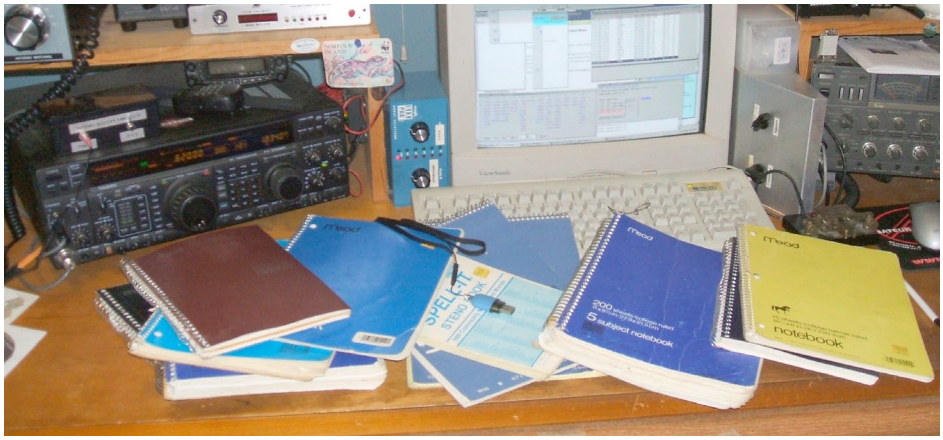
An *enormous* number of Canadian stations have gone off the air or moved to FM since 1988. In May (of 1989?) I visited Winnipeg, Manitoba. Among the stations noted were CKY-580 and CKRC-630. Neither station operates on AM today; CKY is on 102.3 FM and CKRC, I believe, went to 99.9. Another trip, to Spokane, Washington, brought in defunct CHUB-1570 and CHPQ-1370. CHPQ is now on 99.9 FM; CHUB also flipped to FM.

For my first two years as a DXer, I lived in Madison, Wisconsin. Two stations that blasted in every night were CKCY-920 and CFYN-1050, both in Sault Ste. Marie, Ontario. These stations and their FMs merged some years ago; they closed their AM operations. Other Canadian loggings that are no longer possible include CKAP-580, CHLO-1570, CFJR-840, CKTY-1110, CJNR-730, CKPR-580, CHUR-840, CHNO-550, and CKGB-750. A more recent vanishing act was Sudbury's CIGM-790, also frequently logged as CKSO.

You can still hear the CBC on the radio in Madison most nights: Winnipeg's CBW-990 is still on and plenty strong. CBK-540 is also often usable. However, several other CBC choices have disappeared. CBC stations that used to make the trip included CBL-740 (now CFZM), CBM-940 (now CINW), CBO-920 (gone to FM), and French-language outlets CBF-690 (now CINF) and CBJ-1580. (93.7 FM)

The other obvious twenty-year trend is the near disappearance of music on AM radio. I have a logging of WGKA-1190 Atlanta with classical music; oldies on KOIL-1290 Omaha; and heavy metal on WZRX-1590 Jackson, Mississippi. There were oldies and country stations all over the dial.

Defunct stations are not limited to the northern side of the border. Some U.S. stations I will never log again are: WOKJ-1550 Jackson; WLBJ-1410 Bowling Green; and WCAL-770 Northfield, Minn.. The latter station shared time with KUOM Minneapolis – it has since surrendered its airtime. Going even further south, I see a logging of Caribbean Christian Radio on 1020. This station's website suggests it's still operating, but I haven't seen a logging in quite some time. (And I note the website hasn't been updated since 2006.) Trans-World Radio, 800kHz on Bonaire, is still around but is no longer blasting into the U.S. mainland with 500 kW of power.



Twenty years of DX logs. The thumb drive contains the spreadsheet with the last few year's logs.

New stations are, for the most part, few and far between. The exception is in the expanded band, where of course *everything* is new since the mid-90s. I have a logging from December 17, 1995: "WJDM-1660 excellent with nostalgia; legal ID at 2130." At the time, this New Jersey station was the *only* station in the expanded band. Unfortunately, I can't find my logging of the 1610 station in Atlanta, Texas. This was the only full-power station to operate on 1610 in the U.S., and it, too, belongs in the "defunct stations" folder. Before the expanded band filled with full-power stations, travelers information stations provided excellent low-power DX targets. I have logs on a station in Galveston, Texas on 1620, and the two Dallas-Fort Worth Airport TISs on 1640 and 1680.

Frequency changes are fairly rare over the last twenty years. I did find two in my log: a logging of WHB Kansas City on 710 (it's since swapped frequencies with KCMO, ending up on 810) and WTAR Norfolk on 790 (swapped with WNIS-850).

West Coast reception was easier in the past decades. The notebooks show frequent entries for California stations KFI-640, KNBR-680, and KNX-1070. Also present is my only Arizona logging, KTNN-660 Window Rock. This station was logged several times and still makes occasional appearances. One page in October 1994 is half-obliterated with "WOW!" in huge letters; the defacement was the result of a logging of Sacramento's KFBK-1530.

So, what's up *today*?

❖ IBOC Power Increase

Last August, I reported the FCC was considering a 10dB across-the-board FM-IBOC power increase, and that NPR was opposed. (Let me reiterate, this proposal affects only *FM* IBOC. There are no proposals to increase AM-IBOC power.) iBiquity and NPR have sent a joint proposal to the FCC. They propose an across-the-board *6dB* power increase. That's four times the power, not ten times. The proposal also allows case-by-case increases of more than 6dB, when interference would not result. And, it calls for additional research into other ways of improving HD Radio coverage.

Proposals include allowing a station to use multiple lower-powered digital transmitters in multiple locations (similar to Distributed Transmission for digital TV). Also on the table is the idea of "asymmetrical digital sidebands." A station might be allowed to increase digital power on the side of their signal that's away from potential interference victims, while limiting their power to the existing 1% on the interfering side.

NPR Labs has also put up an "IBOC Power Allowance Calculator." Put in the call letters of an FM station, and it shows how much digital power it thinks you can run on both the upper and lower digital sidebands without interference. For example, if you put in WTIC-96.5 (Hartford, Conn.) it indicates the lower digital sideband can be increased to the originally-proposed 10% level without interfering with 96.3 stations WXNY-FM New York or WAJZ near Albany. The upper sideband will have to be limited to the 4% (6dB) figure to avoid interference to WCTZ-96.7 in Stamford.

One might ask why NPR is the opposition here? Their members are about the only stations really promoting HD these days. The answer is that the FCC regulations for station spacing are different below 92 MHz; they allow stations on nearby frequencies to be spaced closer together. For stations below 92, the chances of adjacent-frequency interference are greater.

Again, with the slow economy and tight credit markets, and the high cost of upgrading, I expect most stations won't be increasing IBOC power any time soon. However, once the economy comes around, we now have a framework for these increases. And again, I want to emphasize, this change does *not* affect AM.

❖ Trans-Pacific from the "Wrong" Coast

The "holy grail" for many an East Coast DXer is trans-Atlantic reception of European stations. "TA" reception may be commonplace for better equipped DXers (or those who live near the coast), but for us inland types, it's quite a thrill! On the West Coast, TP (trans-Pacific) reception from Asia and Down Under is the goal.

We're at the bottom of the sunspot cycle. One several recent mornings, solar activity has been extremely low, and AM conditions have been extremely good. And our trans-oceanic directions have been messed up! It's exciting enough to see Glenn Hauser reporting reception of Japan in Oklahoma, but it gets even better. In early November, three East Coast DXers, as far east as New Hampshire, reported reception from Japan.

Trans-Atlantic reception is best around sunset and continues into the evening our time. Try for trans-Pacific DX just before our sunrise.

❖ Analog TV: Dead. Finally.

Well, except for LPTVs.

There's no word this month on any consequences for WRGB's apparent unlicensed operation of their analog aural transmitter after the closure of analog TV in June. However, the Worldwide TV-FM DX Association's *VHF-UHF Digest* does report Kansas DXer Dave Pomeroy heard the wayward transmitter via sporadic-E in late July.

❖ Canadian notes

Two more Canadian AMs are asking to move to FM. CBXP, a 40-watt station, has already been granted the FM move. Another station which had applied earlier has been granted permission to move. CFWH's move will leave the Yukon with only two full-power AM stations (CBDN-560 and CKRW-610). The move was somewhat controversial, with some listeners outside Whitehorse fearing they won't be able to receive the FM station. The CBC told the government they had received a three-year extension to their AM transmitter site lease, so the CRTC gave them an unusual 3-year simulcast period. During that time they will be allowed to operate both AM 570 and FM 94.5. Most AM-to-FM moves include a simulcast period but usually only 90 days.

In Montreal, CJWI is moving from 1610 to 1410. They'd complained of interference from Toronto's CHHA. 1410 is the former home of ethnic station CFMB, which moved to 1280 a few years back. 1280, in turn, became available when CJMS went silent.

We don't hear a lot about pirate stations in Canada. This month, however, we have news of an Ottawa pirate being ordered off the air. 14-year-old Jayhaed Saade operates Mix 91.9 FM. The CBC reports the station can be heard as far as 20km (12 miles) away. Industry Canada, the "Canadian FCC," has ordered Mix 91.9 shut down unless a license is obtained. Saade has applied for the permit but plans to leave the station on the air pending action.

A license for 91.9 may not be entirely out of the question. A quick check of the Canadian database shows no stations on or near that frequency in the Ottawa area. 84,000-watt CBO-FM on 91.5 would preclude use of 91.9 under U.S. rules. In Canada, second-adjacent channels have been approved in some cases where the new station is of low power. However, just as in the U.S., there is a procedure for applying for licences. While it isn't nearly as lengthy as the U.S. procedure, it isn't fast, and for fairness' sake it offers others an opportunity to apply as well. Even if 91.9 is found technically acceptable, Saade won't necessarily get it.

❖ Letters

A few years ago, I wrote about the various ways in which you might hear a station on a frequency other than that on which it's actually intending to broadcast. One of these methods is via harmonics. Due to problems in the transmitter, the station broadcasts both on the intended frequency and on multiples of this frequency.

Mark Burns in Terre Haute, Indiana caught a harmonic in mid-November, and we managed to chase it down. He wrote: "For about a week now I've been hearing a harmonic on 4050 (1350 x 3)." The only ID he heard was "AM 1350," obviously not very useful! I could hear the harmonic here in Tennessee as well. I was getting the same useless IDs Mark was hearing.

I did, however, manage to identify the program the station was carrying: it was the Curtis Sliwa show. A bit of digging on the Web turned up KWMO "The Mouth" about 30 miles west of St. Louis in Washington, Missouri, carrying this show. Mark staked out the frequency and in a few days heard a full ID. This kind of "tag-team DXing" can yield excellent results. Two sets of ears are better than one! During FM openings, I've gone into IRC "chat" with other DXers and received (and given) a number of excellent leads.

Robert Thomas in Connecticut notes that after over 60 years, the New York *Times* is out of the broadcasting business. In mid-October, WQXR-96.3 was traded to Univision Radio for their lower-powered WCAA-105.9. The *Times* then promptly sold the 105.9 station to WNYC Public Radio, which is continuing the station's longstanding classical music format.

❖ 'Til Next Time

Write me at 7540 Highway 64 West, Brasstown NC 28902-0098, or by email to *dougsmith@monitoringtimes.com*. Good DX!

URLS IN THIS MONTH'S COLUMN

My DX blog:
http://americanbandscan.blogspot.com
Caribbean Christian Radio:
www.superpower1020.com
Ottawa pirate station ordered closed:
www.cbc.ca/canada/ottawa/story/2009/12/03/ottawa-pirate-radio-station.html
WGGH-1150 DX Test:
www.dxtests.info/2009/11/wggh-1150-marion-il-dx-test.html
NPR-iBiquity deal on IBOC power increase:
www.npr.org/about/press/2009/110509.HDRadio.html

AM BANDSCAN REPORT

NEW:

Applications for new stations

Mulberry, Fla.	780	250/250 DA-1
Easton, Calif.	1150	260/5,000 DA-N
Braham, Minn.	1160	5,000/2,000 DA-1
Mesquite, Nev.	1250	5,000/480 DA-2
Wolfforth, Texas	1560	500/235 DA-2

New station permits granted

Fayette, Ala.	1490	1,000/1,000 ND
Holt, Ala.	1340	1,000/1,000 ND
Redding, Calif.	600	1,000/1,000 ND
Glenwood Springs, Colo. 1450	180/180 ND	
Winchester, Nev.	1500	1,500/1,500 DA-N
Conway, N.H.	1340	620/620 ND

New station applications dismissed

Chowchilla, Cal.	720
Redding, Calif.	1580
Vail, Colo.	1450
June Park, Fla.	780
Sterlington, La.	1020
Roswell, N.Mex.	1580
Trentwood, Wa.	1550
W. Richland, Wa.	1600

CHANGES:

Stations requesting moves to new frequencies and/or locations

Westlock, Alta.	97.9	CFOK	from 1370
Tahsis, B.C.	90.5	CBXP	from 1240; already granted

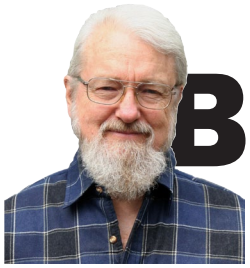
Stations granted moves to new frequencies and/or locations

Montreal, Que.	1410	CJWI	from 1610; increase power to 10kw
Whitehorse, Y.T.	94.5	CFWH	from 570

Callsign changes

Decatur, Ala.	1490	WEKI	from WDPT
Mobile, Ala.	1410	WNGL	from WLVV
Yuma, Ariz.	1400	KCYK	from KJOK
Arroyo Gde., Cal.	1060	KRGA	(new station)
Desert H.S., Cal.	1220	KPSF	from KJML
Helendale, Calif.	1450	KQTE	(new station)
Mims, Fla.	840	WGRU	from WPGS
Mulberry, Fla.	780	WXTO	(new station)
Highland, Ill.	1510	WQQW	from WXOZ
Sturgis, Mich.	1230	WBET	from WMSH
Ellenville, N.Y.	1370	WRWD	from WELG
Gresham, Ore.	1230	KRYN	from KSZN
Bedford, Penna.	1600	WAYC	from WHJB
Millville, Penna.	860	WAOB	from WAMO
Westerly, R.I.	1230	WBLQ	from WXNI
Bellville, Tex.	1090	KBAL	from KNUZ
Dalhart, Tex.	1600	KSHG	(new station)
Mineral Wls, Tx.	1110	KVTT	from KJSA
Danville, Va.	1580	WWDN	from WILA

ND: non-directional
DA-N: directional at night only
DA-D: directional during daytime only
DA-2: directional all hours, two different patterns
DA-3: directional day, night and critical hours, three different patterns



BOATS, PLANES, AND TRAINS

PLANES

Iden Rogers
idenrogers@monitoringtimes.com

What's up in Northwest Colorado?

❖ Wide-Area Multilateration (WAM)

There is a new addition to Air Traffic Control (ATC) in Northwest Colorado called Wide-Area Multilateration (WAM). It is not a term in most people's vocabulary, but it may become so for those interested in aviation.

Colorado has some very mountainous, remote areas. ATC radar has coverage gaps which result in loss of radar contact with aircraft below 13,000 feet in some areas.

WAM technology was put into operation there in September of 2009. This system is used by Denver Air Route Traffic Control Center (ARTCC) to help remedy the situation in a particular four-airport area in Colorado. The new system can now track aircraft all the way to ground level.

The Colorado Department of Transportation and the FAA shared the cost of the Wide-Area Multilateration surveillance system in Northwest Colorado.

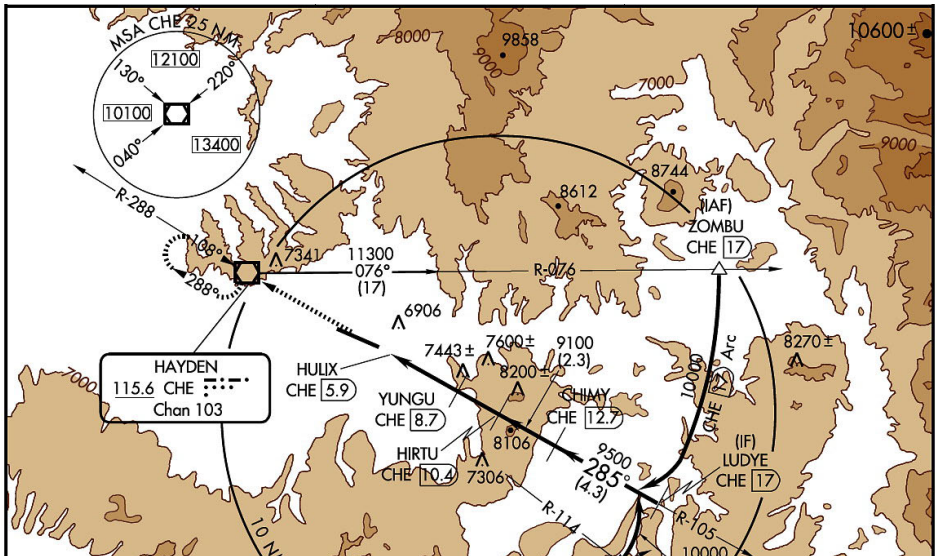
The cost for the WAM project was shared by the FAA and the Colorado Department of Transportation. This is the first FAA-Certified WAM System. The FAA will closely monitor its success to determine the extent of additional WAM system deployments.

Let's take a look!

❖ Areas Served

Using Yampa Valley (Hayden) Airport (KHDN) as a reference point to describe the airports served, Steamboat Springs Airport (KSBS) is 19 miles (statute) to the east, Craig-Moffat Airport (KCAG) is 16 miles to the west, and Garfield County Regional Airport (KRIL) is 71 miles to the SSW.

To better understand where this area is situated in Colorado, go to ***www.google.com/maps*** and enter Hayden, Colorado, in the search box and click on "Search Maps." Zoom out a few times on the road map and you will see the towns Craig, Hayden, and Steamboat Springs left to right in a horizontal row. Now zoom out one more time. Click on and drag the map upward until Hayden is near the top. Rifle, the location of KRIL, should now appear lower down and a little to the left.



This portion of the VOR/DME-B Instrument Approach Procedure (IAP) Chart for Yampa Valley Airport (KHDN) near Hayden, CO shows the extent and altitudes of the nearby mountains and peaks. The runway is depicted by the short black line right off the tip of the dark VOR 285° radial line.

For an aeronautical sectional chart view, go to ***www.airnav.com/airport/KHDN*** and click on the small Sectional chart. As the larger chart comes up, the same three airports are in a row, but the detail may be hard to see, so zoom in as desired.

On the chart, you will see large numbers like 12^{7} and 11^{2}. If you look closely on the chart, you will see squares bordered by fine graduated lines. Each square has one of these numbers in it. These are Maximum Elevation Figure (MEF) numbers for the highest terrain feature in the square. 12^{7} and 11^{2} represent 12,700 and 11,200 feet altitude respectively. The elevation of KHDN is 6,606 feet, so this helps to give an idea of the ruggedness of the terrain and how nestled in this and the other airports are in this mountainous region.

❖ Area Communications

Denver ARTCC / Denver Center is located in Longmont, Colorado, not far north of Denver. Controllers do not have the capability to talk directly to all the planes under their control in their vast coverage area. By way of remotely controlled, unmanned transceivers called Remote Communications Air/Ground facilities (RCAGs) installed at various locations, they can.

If you go to AirNav.com and look up airports KHDN, KSBS, or KCAG, you will see "APCH/DEP SVC PRVDD BY DENVER ARTCC ON FREQS 120.475/235.975 (HAYDEN RCAG)." This means that Approach Control and Departure Control functions are by way of the ARTCC on the frequencies shown. The VHF frequency is for civil aircraft and the UHF frequency is for military aircraft. The HAYDEN RCAG is no doubt at or near KHDN.

Approach and Departure for KRIL is by way of a different RCAG, one better situated for that airport area – "ASPEN RCAG" with a VHF frequency of 134.5.

❖ Surveillance Radar

Before we get to WAM, let's first review some radar and transponder basics.

An ATC Primary Surveillance Radar (PSR) sends out a beam of precisely timed microwave radio pulses from a rotating, very directional antenna. The pulses reflect off planes within range and are received back by the radar station. These radar data are used to determine the plane's slant range (the diagonal distance up to the plane rather than to an imaginary spot on the ground under the plane) and the azimuth relative to the antenna – in degrees clockwise from zero degrees magnetic North. PSR does not determine an air-

craft's altitude nor any identifying information about a plane. By itself, it just produces a "blip" on the controller's display which moves some to a new spot each time the display is refreshed.

There is often a second antenna on the same rotating antenna structure – usually wider and less tall. It is mounted above the PSR antenna and used to send signals to interrogate the transponders on planes. This is called Secondary Surveillance Radar (SSR) or "Air Traffic Control Radar Beacon System (ATCRBS)." For an antenna image, see: ***www.eldis.cz/foto/katalog/PA251740.JPG***. In the foreground, the lower antenna is PSR and the upper one is SSR.

The returned PSR and SSR data are processed by ATC computers and then used to drive the radar displays that controllers use.

Besides the PSR/SSR collocated radar systems, there are Beacon Only Site (BOS) systems. These have rotating antennas as well, but only have the SSR antenna and related equipment. For an image, see: ***www.radartutorial.eu/19.kartei/pic/img3081.jpg***

The degrees of azimuth to the various aircraft are determined just like a PSR. The antenna knows exactly where it is pointed when it sends an interrogation and receives the reply.

How does a Beacon Only Site, without an associated primary radar, determine an aircraft's slant range? Being able to do this depends on a constant reply delay time within the transponder. Transponders are designed to reply to an interrogation after precisely 128 µs (microseconds / millionths of a second). The tolerance of the reply delay is ±0.25 µs or ±0.50 µs – depending. With the built-in transponder interrogation / reply delay times constant, the slant range to an aircraft from the antenna can be accurately determined (like PSR) by the time it takes for the interrogation and the reply signals to make the round trip – and then subtracting the 128 µs transponder delay.

The upside of Beacon Only Sites is that they are far less expensive to construct and maintain. The downside is that aircraft and other objects in the airspace without operating transponders cannot be seen. For the time being, the Department of Defense and the FAA will jointly fund many of the existing collocated PSR/SSR radar systems to help satisfy homeland security requirements.

❖ Transponders

An aircraft transponder is an electronic device aboard an aircraft that will respond to Air Traffic Control electronic interrogations.

A "Mode A" interrogation will cause the transponder to send the Squawk Code assigned by an Air Traffic Controller and dialed into the transponder control head by the pilot. Squawk Codes are used to link individual aircraft flights to FAA computers. That, in turn, places information, in the form of "data blocks," by each plane on a controller's display – much like the one in the FlightAware graphic.

A "Mode C" interrogation will cause the transponder to send the plane's altitude which is derived from an altimeter onboard the aircraft. This is to say, the SSR "asks" the plane what altitude it is at rather than independently determining it.

The replies have much greater signal strength than do reflected primary returns, which improves overall system response to the existence and identity of planes – if they have operating transponders.

Mode Select or "Mode S," standardized internationally and becoming increasingly used more all the time, is part of the evolution of transponders and the associated ground equipment. Eventually, this will phase out the four-digit Squawk Codes. In their place will be unique address codes for each aircraft that will not be assigned for each flight as are Squawk Codes.

Mode S can selectively interrogate planes rather than continuously interrogate all planes in range. Also, Mode S transponders periodically squitter (transmit without being interrogated) their address code and other data to establish their presence to properly equipped ground stations and other aircraft.

Mode A, C, and S interrogations are sent out on 1030 MHz. The transponder replies on 1090 MHz.

❖ Colorado Radar Systems

The enroute radar systems in Colorado are in Eagle, Garfield, Arapahoe, and Las Animas Counties. The common collocated PSR/SSR systems used there are the Air Route Surveillance Radar Model 2 (ARSR-2) and the Air Traffic Control Beacon Interrogator Model 6 (ATCBI-6).

The ARSR-2 is 1970's technology but with upgrades along the way. The ARSR-2 has an effective range of 200 nautical miles (about 230 statute miles) – with no mountain obstructions. Typical of other ATC radar systems, it detects slant range and azimuth but not altitude.

There are eighteen ARSR-2 radars in service in the National Airspace System (NAS) and owned by the Department of Defense but maintained by the FAA. The ARSR-2 end of service date is set at year 2025.

The ATCBI-6, an accurate, more capable replacement for Models 4 and 5, can also operate as a Beacon Only Site (BOS) with no PSR. Alone, they are far less expensive to install and maintain, and like PSR, also determine range and azimuth but little help with homeland security.

❖ WAM, what is it?

Communications to the four-airport area are pretty much resolved, but what about radar? There is no radar equivalent for the RCAG – or is there? Enter WAM (sometimes referred to as WM/LAT).

WAM is not radar. WAM is an offshoot of Airport Surface Detection Equipment Model X (ASDE-X) and takes advantage of existing, reliable technology and equipment that is aboard most aircraft and all airliners: the transponder.

ATC radar is strictly line-of-sight, and in certain mountainous areas (as in this case in Colorado) a plane in a mountain shadow will go undetected, but the planes still have their transponders on and operating.

The WAM system uses a network of local-to-the-area transmitters and receivers, more officially referred to as "geographically-dispersed ground sensors." The WAM transmitters, with non-rotating (omnidirectional) antennas, interrogate transponders in the planes in the defined geographic area, the ones out of view from ATC surveillance radars. The ground sensors in the network receive the transponder replies. Computers process the returns and precisely triangulate the locations of the aircraft by the very minute differences in the Time Difference of Arrival (TDOA) of the transponder replies.

Also, a certain minimum number of ground sensors must receive the transponder replies to provide the precise aircraft locations and to qualify the system as operational and in service.

The WAM surveillance data are then conveyed to the controllers' displays along with that acquired by traditional surveillance radars covering adjacent geographic areas.

WAM has a higher refresh rate and better accuracy than traditional radar. No additional equipment is required on planes.

The WAM deployment is intended to increase safety, flow efficiency, and area flight capacity. Also, the economic benefits of more easily moving airliners in and out of the area with fewer flight diversions and fewer delays greatly assists the tourist business there in prime ski country. Airlines also save on fuel by more direct routing.

This same infrastructure will also support the upcoming Automatic Dependent Surveillance-Broadcast (ADS-B) technology, a GPS-based system, which may be fully deployed by 2013, at which time WAM systems can serve as a backup to ADS-B should there be a GPS outage.

❖ FlightAware

FlightAware, a great resource for aircraft listeners, can now provide views of the air traffic at the four airports benefiting from the new WAM system. Planes going to and coming from KHDN, the airport with regular airline service, may be viewed here ***http://flightaware.com/live/airport/KHDN*** as well as scheduled arrival and departure times. Click on the orange and white icon at the bottom right of the blue tracking screen to open a larger screen.

Aircraft Situation Display to Industry (ASDI) ***www.fly.faa.gov/ASDI/asdi.html*** provides the data feed that FlightAware and other on-line flight trackers use. Before WAM, ATC had no radar coverage near ground level for departing and arriving aircraft at KHDN and the other three airports, and thus ASDI had no data to provide to customers from these areas.

See the FlightAware image showing SkyWest Airlines Flight 6573 departing. In that image, the two numbers 172 and 226 indicate 17,200 feet altitude and 226 knots (260 mph) at that moment. The runway is at 6,606 feet. When SKW6573 first appeared on FlightAware, the first number was 67 (6,700 feet), well below what surveillance radars could detect in that terrain – but WAM caught it!

See you next time.

BELOW 500 kHz

DXING THE BASEMENT BAND

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Tuning in to Natural Radio

One of the fastest growing areas of interest in longwave today is Natural Radio – the monitoring of signals from the Earth itself. Even the general public seems to be getting a taste of things lately. For example, not long ago, I heard a program on National Public Radio (NPR) dealing with Natural Radio, and it has also been covered in the science sections of major newspapers and magazines.

Simply put, Natural Radio involves the reception of signals generated by an interaction between the Earth's magnetic field, bursts of solar energy ionizing the field, and lightning stroke energy within our atmosphere. Natural Radio signals have intriguing names like *Sferics*, *Tweeks*, *Whistlers*, and *Dawn Chorus*. While the basic mechanisms for these signals are understood in most cases, much remains to be learned about when they will occur, how they relate to our "space weather" conditions, and how best to hear them as an experimenter.

Natural Radio typically occurs on frequencies, which, when detected, fall within the audible range of the human ear. However, these are true electromagnetic (radio) signals, and *not* sound waves. But, because they occur on such low RF frequencies (≈100 Hz to 30 kHz), they can be detected directly and amplified for human hearing with basic, yet specialized equipment.

Sound energy differs from radio in the sense that it consists of *vibrations of air molecules* and changes of air pressure that are detected by our ears. Confusion often results between ELF radio and sound waves, perhaps because the frequencies for both are rated in Hertz (Hz) or kilohertz (kHz). While sound and radio are entirely different types of energy, there is an overlap of the frequencies involved, making it easy to detect and reproduce Natural Radio signals for human hearing.

This month, we'll discuss the huge number of resources that can be found on this fascinating subject, and cover equipment options for today's Natural Radio listener. We won't go into great deal about *how* these signals are created, as much has been written on this topic in the past – both here and elsewhere. A plethora of information is available online by simply entering the search terms "Natural Radio." There are also books covering various aspects of Natural Radio, some of which are listed below.

WEBSITES FOR NATURAL RADIO

Natural Radio Lab Homepage by Mark Karney, N9JWF: **http://naturalradiolab.com/**
Fascinating history of Natural Radio (which dates back to 1859!):
http://naturalradiolab.com/content/view/2/3/
AAVSO Sudden Ionospheric Disturbance (SID) info:
www.aavso.org/observing/programs/solar/sid.shtml
Radio Waves Below 22 kHz, by IK1QFK (Italy): **www.vlf.it/**
VLF_Discussion Group on Yahoo (free to subscribe):
http://tech.groups.yahoo.com/group/VLF_Group/
Stanford VLF Group: **www-star.stanford.edu/~vlf/**
Space Weather website with current solar conditions:**http://spaceweather.com/**
Stephen P. McGreevy's Natural VLF Radio Phenomena page: **www.auroralchorus.com/**
Stephen P. McGreevy's Natural Radio Sounds page: **www.spaceweathersounds.com/**
"VLF Story" on Stephen P. McGreevy's site *(If you do nothing else, I highly recommend reading this piece for an overview on Natural Radio)*: **www.auroralchorus.com/vlfstory.htm**

❖ What Can You Hear?

Sferics – The easiest Natural Radio sound for you to hear is Sferics, which derives its name from the word "Atmospherics." In fact, all you need is an AM radio tuned to a clear frequency for this one. The pops and crackles you hear (most common when lightning is active) are Sferics, and this energy can extend well into the upper HF and even lower VHF range of the spectrum. By themselves, Sferics may not be very exciting to hear, but they sometimes precede more interesting signals.

Tweeks – Sferics can give rise to Tweeks, which are short duration signals with a ringing, tonal quality. They are most commonly heard during hours of darkness and in the winter months. Tweeks have a descending note caused by frequency dispersion as the signal travels between the "waveguide" formed by the Earth and the lower reaches of the Ionosphere. Tweeks often mix with Sferics, and they increase in number as Natural Radio activity picks up.

Whistlers – These are perhaps the best known of Natural Radio signals, and they are very impressive to hear. The dispersion effect described for Tweeks also causes the characteristic "swishing" sound of Whistlers, but the duration is longer – much longer – because Whistlers travel in the magnetic field of the Earth over very long paths.

It is believed that Whistlers can travel the entire length of a magnetic line of force, reach a conjugate point in the opposite hemisphere, and reflect back over the same path, causing a longer (but correspondingly weaker) signal after each reflection. Some Whistlers have a distinct, pure note, while others sound more "breathy" when received. A huge variety of Natural Radio sounds, including Whistlers, can be heard online at **www-pw.physics.uiowa.edu/mcgreevy/#latest**. (Note that the dash after "www" is intentional for this site.)

Dawn Chorus – As an amateur birdwatcher, I can identify with the name "Dawn Chorus" as it applies to Natural Radio. This phenomenon often occurs at or near sunrise, and it sounds similar to a "chorus" of birds coming awake at the start of a new day. The number of signals and their intensity can vary widely with Dawn Chorus, but such events often make for interesting listening. Chorus is most commonly heard when solar-magnetic storms are occurring. As I write this, a major new sunspot group (1035) has developed, and we may well be seeing increased solar activity as part of Solar Cycle 24. This is the new cycle that DXers have been waiting for.

There are many other types of signals you can listen for on Natural Radio, but the above sounds are the most prominent. Be sure to explore the sound link above for more of these sounds and their variants.

❖ Receiving Gear

Let's suppose you've read this far, and would like to try hearing some Natural Radio signals of your own. The good news is that you can do so for very little cost and complexity. The March and April 2006 issues of *Below 500 kHz* carried a two-part article on constructing the BBB-4 "Bare Bones Basic" receiver, originally designed by Stephen McGreevy, a pioneer in Natural Radio listening and recording.

The BBB-4 is a very capable unit that can be used to get your feet wet in Natural Radio and perhaps go even further. I still use mine from time to time, despite having another commercially built unit available. For information on article reprints, see **www.monitoringtimes.com/**. McGreevy's original article for the BBB-4 can also be found at his Auroral Chorus website given below.

If you are more interested in a ready-to-use commercial unit, there are several on the market today. Two that I am familiar with are: The WR-3 by Stephen McGreevy (**www.spaceweathersounds.com/wr3gx.htm**), and the L-500L by

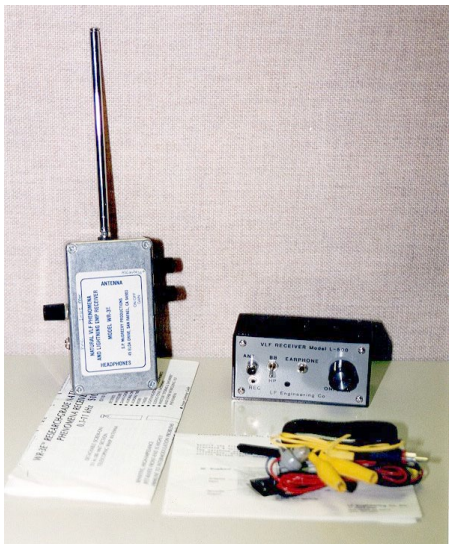

Figure 1. The WR-3 (left) and L-500L are two Commercially Made Natural Radio Receivers. (Photo by K. Carey)

LF Engineering Co. (**www.lfengineering.com/products.htm**).

Books & Publications for Natural Radio

The *Lowdown* Journal, monthly publication of the Longwave Club of America (LWCA). Contains monthly column on Natural Radio by Mark Karney, N9JWF. LWCA info at **www.lwca.org**.

Radio Nature by Renato Romero, IK1QFK. Info at: **www.universal-radio.com/catalog/books/5089.html**

Natural Radio Lab book offerings (via Amazon): **http://astore.amazon.com/natradlab-20**

Disclaimer for website URLs: *All links here have been tested at the time of writing, but as I have found before, website addresses can change rapidly, and often without notice! If you experience a link that doesn't work, try entering some key words from the topic into a search engine, and see if you can locate it that way.*

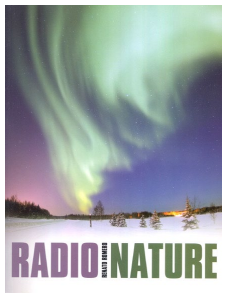

Figure 2. Radio Nature is a new book by Renato Romero, IK1QFK. (Universal-Radio.com)

❖ Mailbag

Judy May (KY) wrote: "I like building handy devices around the house using PIC microcontrollers. I recently started thinking about building a lightning detector with a PIC that would accumulate stats and display them on an LCD display. Could you point me in the right direction for a very bare-bones, basic receiver circuit that would be at the best frequency for lightning detection?"

Thanks for writing, Judy. I believe a VLF/LF receiver (0-60 kHz) would be ideal for such an application. Lightning energy is normally very strong on these frequencies. Receivers of this type have been built by many experimenters and used as "SID" (Sudden Ionospheric Disturbance) receivers.

The basic principal in SID detection lies in monitoring a known VLF station and looking for enhanced signal strength, which typically occurs right after a solar gamma burst disturbance from the Sun. You could easily adapt such a receiver to your purposes, I believe. Below are a few links with construction details. An online search of the terms "SID VLF" should yield even more information on this topic:

http://www.aavso.org/observing/programs/solar/easySID.shtml
http://www.aavso.org/observing/programs/solar/gyrator.shtml (An intriguing receiver designed to tune 17 kHz to 34 kHz, with a low parts count.)
http://sidstation.lionelloudet.homedns.org/hw-en.xhtml

Also, have you considered using your PC's soundcard to directly receive VLF? It can be done with the appropriate software and antenna. Here are some links along those lines:

http://web.telia.com/~u33233109/saqrx/saqrx.html (This one is primarily meant for receiving station SAQ [17.2 kHz], but is tunable over a range of 0-20 kHz.)
www.ukaranet.org.uk/beginnerprojects/speclab_install_use.htm
www.qsl.net/dl4yhf/speclab/natradio.htm (Wideband VLF receiver intended primarily for natural radio.)

See you next month!

ANTENNA TOPICS

BUYING, BUILDING AND UNDERSTANDING ANTENNAS

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Stealth Antennas

Now You See It, Now You Don't

"Hey, buddy, whatcha doin'? Workin' on yer truck?" called out one of my neighbors, strolling down the street and looking askance at the wires and boxes on the ground between my lawn chair and my old Chevy truck.

"You bet," I told him. "I'm installing a car alarm." He started walking faster, not looking back. I had to chuckle to myself. *I* am *working on my truck. I'm working DX, as a matter of fact!*

The boxes were my tiny battery-powered transceiver and a small tuner, and a wire from the tuner was clipped onto the truck's front left fender. With a little telegraph key on my knee and a single headphone on my ear, I was happily working stations in Europe on 10 meters, with a '78 Chevy half-ton as the antenna. When the band deteriorated, I moved around to the back yard and clipped my tuner's output onto the chain link fence, and started working stations here in the Midwest on 40 meters. Ah, those golden days at the peak of the last sunspot cycle...

Admittedly, these are extreme examples, but they point out one excellent class of stealth antennas: the objects in plain sight that no one suspects as an antenna. The neighbors found my behavior with equipment and cables a bit odd – but it didn't dawn on any of them that the truck or the fence was being employed as an antenna.

It's a shame that the modern world has forced us to these measures, but there it is, friends. Many neighborhood associations and landlords severely limit or even ban altogether any kind of visible antenna nowadays. It seems as though, with the vanishing of roof-mounted TV antennas, these kind souls are doing their bit to clean up the neighborhood. I guess the proliferation of small satellite dishes, like so many toadstools, doesn't bother their esthetic sensibilities. Hmm....

Regardless, those of us who love the hobby of radio must soldier on and find a way to have an effective antenna. Enter the stealth antenna.

❖ Hidden in Plain Sight

Let's start off with that first class of stealthers I mentioned: the object in plain sight that is not suspected of being an antenna. One of the very best in this class is the one I outlined last month – the good old rain gutter. At second or third floor level, it is high enough above ground to be quite effective, even at the lower frequencies.

Just run an insulated wire, say #12 or #14, out the window nearest your operating position, and clamp or screw the wire to the gutter at a convenient point – a joint in the guttering, if you can manage it. (Make sure your guttering isn't plastic – it's a *terrible* conductor.) Tie the inside end to the Random jack on your trusty tuner and you're in business. Very stealthy!

Some folks who have stations on the first floor or in the basement have adapted this arrangement by feeding the gutter system at the bottom of a downspout, even going so far as to use coaxial cable for their feedline and tying the coax's ground braid to a ground rod or buried radials near the feedpoint. This works, too, except that the coax's SWR will be so high at many frequencies as to make *transmitting* prohibitive, even using a tuner. However, it makes a great *receiving* antenna.

Whenever possible, I like to use ladder line or a single wire, not coax, to feed a random antenna, since a tuner will be able to match it at many frequencies without the problem of high SWR in coaxial cable. Coax quickly becomes *very* lossy once the SWR gets above about 3:1.

If your home happens to have a metal flagpole in the yard, you may be able to make an "antenna in plain sight" out of it. You'll have to be pretty subtle, though, about digging a hole near its base to bury a waterproofed *remote antenna tuner,* and making a shallow trench back to the house to hide the coax and control cables in. But if you can pull all this off, there's a lot in this one's favor – sturdy, omnidirectional, and Old Glory waving at the top is a nice touch. Of course, you can sit in the yard in a lawn chair, using portable equipment and a temporary connection to the flagpole, and the neighbors will just think you're listening to patriotic music and admiring your American flag.

❖ Behind Closed Doors

The other main class of stealth antennas is the concealed antenna. There are two basic ways to do this: indoors, and outdoors camouflaged. First let's look at the indoor version.

Indoor antennas really fall into two main groups – those which are an eyesore and those that are not. If you live alone or your spouse/family/significant other doesn't mind, you can experiment with the "eyesore" variety. Just fasten the longest dipole or longwire you can fasten to a ceiling on the uppermost floor you can use, and you're ready to go.

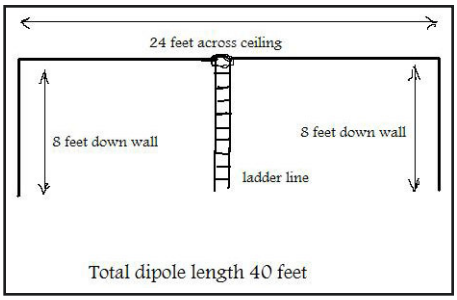
The biggest advantages of this arrangement are: (1) you can quickly take it down and hide it if you need to, and (2) it's quite accessible for adjustments. For instance, you can usually change to some extent the direction of the wire faces, something to be valued when working with dipoles or longwires, both of which tend to be fairly directional.

Since space is sure to be at a premium, always keep in mind that you can drop the ends of a dipole to fit a longer one into the available space. For example, in a room 24 feet long and 8 feet high, you can install a 40-foot dipole by bringing 8-foot ends down the walls at each end of the room (see Figure 1). You'll be surprised at how little this reduces a dipole's performance. If you run the wire in the angle formed by the ceiling and a long wall, use small gauge wire (say #30 or even smaller), and bring the ladder line down behind a bookcase or armoire, you'll reduce the eyesore effect considerably.

The "not eyesore" indoor antenna, obviously, doesn't just hang there on the ceiling like some multistranded copper spider. It's tucked neatly away somewhere. Usually this means in an attic. The same general rules apply, except that here you can make a nice, neat, *permanent* installation, with heavier wire, regular insulators – the works. And unlike an outdoor antenna, it's completely invulnerable to lightning, wind, rain, snow, and ice. Just follow the general principles for erecting a normal dipole with ladder line feed, and you're on the air. Make sure while you're banging around in the attic to avoid any electrical wiring, metalized insulation backing, and that box full of Aunt May's antique china. Trust me, breaking your wife's aunt's old dishes will seriously compromise your radio privileges.

❖ Now You See It....

The remaining main class of stealth antennas is what I called "outdoors camouflaged." There are two basic methods you can consider: true camouflage, where the antenna blends into its surroundings, and near-invisibility, where

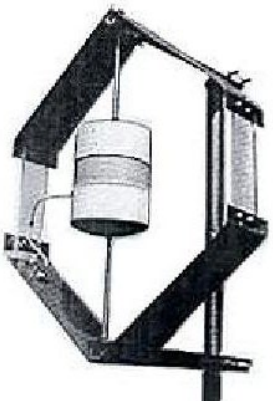


When space is at a premium, you can drop the ends of a dipole down the corners of the room, and use furniture to hide the ladder line.

the antenna, though out in the open, is all but impossible to see.

The true camouflage antenna is really coming into its own nowadays. A number of companies and some enterprising homebrewers are turning out excellent weapons in this fight against antenna suppression. One of the most distinctive commercial products is the line of HF antennas made by the Bilal Company (137 Manchester Drive, Florissant, CO 80816) marketed under the name Isotron.

Ironically, they didn't set out to produce a stealth antenna at all – they just had a brand-new



Isotron 40 meter antenna

idea about how to configure an HF antenna. But the models for 160, 80, and 40 meters look astonishingly like some sort of bird feeder (see Figure 2), which sounds like a good story for the stealth user to employ if questioned. The models for the higher frequencies are small enough and bear sufficiently little resemblance to anything

Isotron 20 meter antenna

"antenna-like," that they, too, should fool or placate just about any uninformed onlooker (Figure 3). I've never personally used an Isotron, but the ones I've heard on the air are excellent performers, and their owners seem very happy with them. I encourage you to take a gander at them, at **www.isotronantennas.com** or call 719-687-0650.

The invisible antenna is challenging, but quite rewarding. And, it's easier than you think. Ever try to spot someone else's wire antenna, like a dipole or a longwire, against the sky? Even your own antenna can be a bit elusive to see, and you know right where it is. At least, I hope you do.

These are all typically constructed with #14 wire. The laws of optics being what they are, smaller diameter wire – like #24, or even #30 – can be absolutely impossible to spot. I've heard of people using #40 magnet wire, which is hair-thin, to make a longwire antenna. Of course, it breaks much more easily than the heavier wire, but stealth is about concealment, not durability. And #40 wire, friends, is totally invisible against the sky or surroundings.

Another take on "invisibility" is to put up a fairly portable antenna – say, a shortened vertical – at night, and take it down before the light of day reveals it to prying eyes. I haven't gotten the nerve to try it yet, but someday I'm going to use a helium balloon at night to raise a full-size (130 feet) vertical made of thin wire and work some real DX on 160 meters ...

❖ Onward!

I hope these examples have given you some good ideas about stealth antennas. The important thing to realize is that there are many ways to have an effective antenna and enjoy our great hobby, without the killjoys being any the wiser. I've got years of fiddling with these oddball antennas under my belt, and I'll continue to share with you all that I know, imagine, or discover about them.

Join me when I return here in the April issue, and we'll delve ever deeper into the world of HF antennas. Happy operating!

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RADIO RESTORATIONS

BRINGING OLD RADIOS BACK TO LIFE

Marc Ellis, N9EWJ
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Capacitors and their Replacement

The BC-344 project is still very much in progress on my workbench, but – while I've done a lot of work on it – I don't yet have enough material for a column! The restoration right now is in a phase calling for some fussy and careful effort (you got a taste of that in last month's column). However, so far it's effort that can be easily summarized in a couple of paragraphs. So I thought I'd just change the subject this month to give myself a bit of a respite.

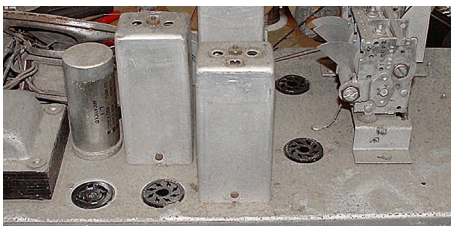
Issues about capacitor replacement, or "re-capping," easily top the list of common reader questions. Just about any radio restoration project you might want to tackle will begin with this process. That has certainly been the case with the restorations done in this column. And, while I've discussed replacement issues as they came up and answered a number of reader queries about them, I don't believe I've ever devoted a specific column to a methodical discussion of the subject.

Almost any piece of electronic gear is loaded with capacitors, and this is certainly true of the vintage sets we work on. Not all of them are types that we replace on sight as part of a restoration. But let's begin with a survey of all the types that are found – at least the ones I can think of.

Mechanical Capacitors

First let's dispose of the capacitors that we *don't* automatically replace. One such type we might call the *mechanical* capacitor. It's usually adjustable, and the best example is the *tuning capacitor* used for station selection and (sometimes) bandspread. We're all familiar with the design of interlocking plates; one set fixed (the stator) and the other adjustable (the rotor), controlled by a shaft that can be rotated.

Other capacitors in this category are the *trimmers* and *padders*. Both are generally made up of a piece of mica sandwiched between a fixed and movable plate. The distance between the plates, and hence the capacitance, is adjusted by screwdriver or, sometimes, a special tuning tool. They are named differently only to reflect their different functions in the set.



Three types of capacitors are illustrated on this vintage chassis. From left: Can-type electrolytic capacitor, i.f. transformers with top holes for adjustment trimmers, tuning/bandspread capacitor.

Trimmers are found in several places in a typical radio receiver. Perhaps their most obvious use is to tweak the tuned circuits in a superheterodyne's i.f. transformers. Commonly there are two in each transformer. They are also used in the fine adjustment of the r.f. and oscillator circuits of a superheterodyne receiver.

It's probably worth mentioning here that coils in i.f. transformers are not always tuned with trimmers. They may, instead be tuned by powdered iron slugs inserted into the coils and moved up and down by rotating them with a special tuning tool – often having a hex head.

The oscillator frequency adjustment controls the calibration of the receiver dial. Sometimes an extra trimmer is needed to spread out the calibration properly over an entire frequency band, and that extra trimmer is usually referred to as a *padder*.

In simple broadcast-only home radios, such as the "All American Fives" of the 1940s and 1950s, the screwdriver-adjusted antenna and oscillator trimmers are generally found mounted atop the frame of the main tuning capacitor. If there is an extra shortwave band, its trimmers may be found individually mounted in convenient spots on the chassis.

Each band of a multi-band receiver requires an antenna trimmer, an oscillator trimmer, and sometimes an oscillator padder. If the receiver is a ham or SWL model, which usually has a stage of r.f. amplification, a third *r.f. trimmer* is required for each band These adjustments are sometimes grouped in one spot for convenience and sometimes spread out on various parts of the chassis. One needs the manufacturer's service notes to identify them.

In extremely high quality radios (and our BC-344 is a good example) the trimmers and padders may not be of the mica sandwich type, but rather miniature versions of the "stator and rotor" type already discussed.

Before leaving the subject of mechanical capacitors, it's worth mentioning the "gimmick" capacitors. These are used in circuits where tiny capacitances are needed. They'll usually be identified on schematics as "gimmick" and shown as wire twists. If you see one of these wire twists in a radio you are working on, try not to disturb it! Its adjustment is considered a factory matter – usually not covered in the service notes.

Three new electrolytic capacitors used to replace an original can type. Note arrows indicating negative terminal on top capacitor.

Fixed Capacitors

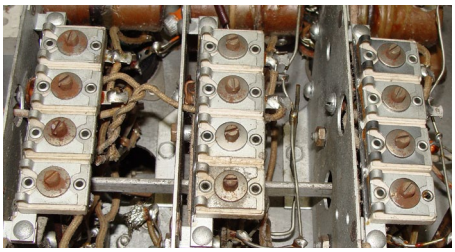
This category includes types that should always be replaced as well as those that rarely need to be replaced. Among the "always" types are paper and electrolytic capacitors.

Paper capacitors are most used in bypass and coupling applications. They commonly come in capacities measured in tenths or hundredths of a microfarad. Good examples are .01 uF, .05 uF and .1 uf. They are made of strips of foil sandwiched between strips of paper and rolled into a cylinder. The cylinder is then sealed by dipping in hot wax.

The color is generally beige, but over the years the wax surface becomes overlaid with dust and dirt and acquires a very grungy appearance. As time passes, water vapor invades the interior and degrades the paper – either shorting the capacitor or rendering it very leaky and ready to short at any moment.

Another style of paper capacitor, marketed as the "Black Beauty," is also cylindrical, but sealed in some form of hard black plastic. Black Beauties look as if they should be impervious to water vapor, but their unreliability is legendary.

Electrolytic capacitors were developed to fill the need for units with capacities in the "whole microfarad" ranges. In the older sets we work with, one might find 5 or 10 uF units used as audio bypasses; 10 or 20 uF units as power



A bank of antenna, r.f., and oscillator trimmers for a 4-band communications receiver.

supply filters. Units with much greater capacities are now possible and available.

These capacitors can be identified by their larger physical sizes and polarity markings. Under the chassis they are found in tubular form, usually encased in a cardboard sleeve. They may also be seen in large cans mounted above the chassis. The cans may be "multisection," containing as many as four individual units of various sizes.

Electrolytics use the same "rolled up" construction as paper capacitors. Their failure occurs not so much because of water intrusion as because of the breakdown of the special electrolytic paste that separates the layers of foil. It's this paste that makes possible the electrolytic capacitor's high capacities.

The electrolytics should also be replaced on sight – though some restorers try to revitalize original caps by "re-forming" them (i.e. impressing a slowly rising voltage across them until maximum voltage rating is reached). This can work, but modern electrolytics are so compact and convenient to use that I always install them.

Multi-section cans can be disconnected, but left in place for show. The replacement can be made by installing the correct individual capacitors under the chassis near the base of the original.

Ceramic disk capacitors and mica capacitors, used in applications calling for smaller capacities, rarely go bad. Ceramics are disc shaped, often tan in color, sometimes black, and may have a sandpapery surface. They began to appear in radios in (I'm guessing here) about the late 1950s. Ceramics are generally available in the .0001 uF (100 pF) to .0033 uF (3300 pF) range.

Mica capacitors have been around much longer – maybe even since the 1920s. They are oblong shaped, many about the size of a large postage stamp. Cases are of a hard plastic material. They come in various colors, including beige, black, and red. Unlike the other capacitors discussed, the capacity, voltage and other specs are not marked in plain language, but expressed as coded color dots. They are manufactured in the .000010 uF (10 pF) to .001 uF (1000 pF) range.

But beware of certain capacitors that look somewhat like micas but are not. They have black cases with a dot code – but the cases are considerably larger than micas. World War II military gear (such as the BC-344 we are working on) can be full of them. Made by Micamold, these are paper caps in disguise, and very unreliable ones at that,

❖ Checking Capacitors

I don't check capacitors as much as I used to, long since having adopted a wholesale replacement policy. But if one is going to check, then a simple ohmmeter test will not do the job. The capacitor needs to be tested for leakage with voltage impressed across it. For this you will need a proper capacitor checker/analyzer. Such an instrument can also tell you if the unit under test has its rated capacity.

I frequently find myself breaking out my capacitor checker in special diagnostic situations and in situations where I'd like to keep the original cap because it would be physically difficult to replace. If you shop radio meets for a checker, look for one made for radio service people by a capacitor manufacturer such as Sprague or Cornell Dubilier rather than by a hobby manufacturer such as a Heathkit or Eico.

❖ Replacing Capacitors

When removing paper capacitors for replacement, those new to the hobby might wonder if the replacement has to be installed with a specific polarity. That's because one side of the old capacitor may be marked "outside foil" or identified with a black band. Back in the day, that lead was intended to be grounded. But that is not an issue with today's capacitors.

Several original paper capacitors. Note black stripe denoting the "outside foil" lead (see text).

As mentioned, the old paper capacitors were rolled-up sandwiches of foil and paper. One lead was attached at the beginning of the roll, near the center; the other at the end of the roll, near the outside. In sensitive audio circuits, the outside foil had a big enough area that it might pick up hum – hence it would be better to choose that end for grounding if the circuit called for a ground.

Modern capacitors are not made that way and, in any case, are much more compact. When shopping for replacement paper capacitors, you're unlikely to find any new stock designated as "paper." Not to worry, as long as the capacitance is close and the rated voltage is at least as high as that of the original. The ones I buy are "metallized polyester film capacitors."

I've used these neat little units in many restorations, and they have been entirely satisfactory. Rated at 630 volts, they easily surpass the voltage ratings of the older capacitors. And they have axial leads. Radial lead components, which are configured for convenience in printed board work, are obviously to be avoided.

When shopping for electrolytic replacements, it is important to purchase not only a unit with capacity close to the original, but also with a voltage rating close to the original. Unlike paper capacitors, the capacity of an electrolytic will be close to its rating only if it is used at close to its voltage rating.

Also unlike paper capacitors, replacement electrolytics must be installed with the proper polarity. Reversing polarity will result in immediate failure of the capacitor. When removing the original, be sure to note the polarity. It will usually be marked with a "plus" on individual units. On cans, the metal case is usually negative, unless specified otherwise, and the individual connections at the bottom are the positive terminals of the various sections inside.

The markings on your new replacement unit will be a little different – usually an arrow or two pointing to the negative end of the unit and designated "-". This probably reflects an important difference in the thinking of the culture (Oriental I assume) that produces these parts for us.

This ends our little journey through the land of capacitors. I hope you find it useful! Next month, we should be able to report more progress on the BC-344 restoration.

"Sky-Wires & Inhalers"
Part 5: Transformers? Why?

By Walter Lindenbach

Last time, Bill had just begun to explain to Chuck how a radio signal becomes an output from a receiving antenna, and how to couple it to the lead-in cable. Chuck then looked at the clock, realized that he had to go, and made an unjustified accusation that Bill didn't like transformers.

"So, you think I don't like transformers," said Bill, "Well, we'll fix that… Actually, all I'm trying to do is protect you from your own enthusiasm, Sonny. We saw last time that a stronger signal is not necessarily a better signal. A transformer to couple the antenna to the lead-in will provide a stronger signal to the receiver, *but it will not increase the signal-to-noise ratio.*"

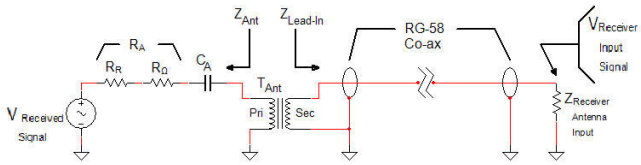
"But still," replied Chuck, "you said that there are other antenna types, and they might need transformers. So, wouldn't it be nice to make a transformer even for my little 12-foot random wire?"

❖ What's a Transformer Supposed to Do?

"Sold! Let's do it. But first we have to be sure we know what the transformer is supposed to do. Last time, we considered the distributed components that make up an antenna. This time, let's look at the antenna from the lead-in point of view."

Bill took a paper pad, and sketched what he was talking about. It is Figure 1.

"We'll assume that the receiver terminates the lead-in coax in 50 ohms so that the antenna transformer has a secondary load of 50 ohms.



"Now, the primary – and here is where the fun begins. Do you remember the simulation results that showed the impedance of your antenna over the HF band? It's Table 1."

f, MHz	R Ω	X Ω	C pF
3	0.26	-J41.7K	1.27
18	5.6	-J 6.6K	1.34
21	11.1	-J 5.52K	1.37
26	35.4	-J 4.15K	1.47
28	57.8	-J 3.68K	1.54
30	98.7	-J 3.2K	1.64

Table 1: Simulation Results

"The resistance goes from about a quarter of an ohm to almost 100 ohms, and the capacitive reactance from 42K ohms to just over 3K ohms! Now, there's absolutely no matching a thing like that!

"Furthermore, we don't have to decide what the transformer primary impedance should be, because with a broadband transformer which is to produce a flat response over the whole HF band, it is very difficult to get a good response if you attempt to produce an impedance higher than 800 ohms."

"Are you telling me that there is no point in a transformer for my antenna?"

"No, no. An 800 ohm termination is 12 dB better than a 50 ohm termination. But do remember, that is 12 dB increased signal strength only, not signal to noise ratio. Do you think your receiver needs more signal?"

"No-o, probably not," replied Chuck, "but could we make a transformer anyhow?"

"Sure we can! But we're going to have to do some math, and you don't like that."

"Oh, I'll survive if you do it first."

❖ Doughnuts?

"That's the spirit! I'm going to recommend that we use a ferrite toroid. Do you have any of those?"

"Nope. Where do you get them?"

"Well, I've gotten mine from an outfit called Amidon. The website address is **www.amidon-inductive.com**. They also have a catalog that includes lots of good information.

"The toroid that I've used for such applications is the FT50-43. It's a wee little guy, and the price was $0.75 when last I got some. 'Toroid' is a fancy name for "doughnut." This one is 0.5 inches in diameter with a hole 0.281 inches in diameter. It is 0.188 inches thick. There's no room for a part number label so, if you order some, keep them in the bag. If you have other toroid types, and they get out of the bag, it will be impossible to decide which is which, and then they're useless.

"Ferrite material is very hard and brittle, so it breaks easily. But that's not the greatest threat. If you drop a toroid on a hard surface, it's useless, even if it doesn't break, because the magnetic characteristics are changed by any shock. So the little guys have to be handled carefully.

"Type 43 ferrite material demonstrates a curious characteristic. An inductor wound on this core will not produce a decent resonant response in a tuned circuit at frequencies over 700 kHz, but transformers can operate up to at least 100 MHz.

"That's odd, but useful. The Type 43 toroids have a higher inductance-per-turn factor (A_L) than toroids made of material for use at higher frequencies."

"Do you have a toroid like this, Bill?"

"Yes, I do, right here." Bill went to his parts shelves and took out a small plastic bag with little black doughnuts inside. It looked like Figure 2.

"Now, you're proposing that we wind a transformer. Is that right? And if we're going to do that, we have to know how many turns to wind and what kind of wire to use."

$$L_H = \frac{X_{L,Pri}}{2\pi f_{-3dB}}$$

"That's so," agreed Bill. "When we know the number of turns, we can calculate the wire size to use. Hang on, here come the calculations. But actually, they are just simple arithmetic, so there's no need to get excited.

$$L_H = \frac{50}{(2)(3.1416)(4e5)} = 1.989e-5H \text{ @ } 20m$$

"First, we need to know the inductance. If we specify the transformer to work over a range of 1 MHz to 30 MHz, and if we choose a -3 dB frequency of 400 kHz, we can expect flat response from 1 MHz up.

"Let's consider the winding that goes to the lead-in to be the primary, and it is connected to a 50 ohm load. Now we can find the inductance.

"That means the minimum inductance in Henries is equal to the minimum required inductive reactance in the primary divided by 2 times π times the -3 dB frequency. The -3 dB frequency occurs when the inductive reactance is equal to the load. So,

$$\frac{N_P}{N_S} = \frac{V_P}{V_S} = \sqrt{\frac{L_P}{L_S}} = \sqrt{\frac{Z_P}{Z_S}}$$

"Now, the secondary, and the impedance should be 800 ohms."

"Uh-huh," Chuck chimed in, "and I seem

to remember some transformer relationships that would be useful here." And he pulled a page out of his notes folder which was called "Equation 1: Transformer Relationships.", where: N_P is the number of turns in the primary winding, N_S is the number of turns in the secondary winding, v_P is the primary voltage, v_S is the secondary voltage, L_P is the primary inductance, L_S is the secondary inductance, Z_P is the primary impedance and, Z_S is the secondary impedance.

$$\frac{\sqrt{L_P}}{\sqrt{L_S}} = \frac{\sqrt{Z_P}}{\sqrt{Z_S}}$$

$$L_S = L_P\left(\frac{Z_S}{Z_P}\right) = (2.0e-5)\left(\frac{800}{50}\right) = 3.2e-4H$$

$$N = \sqrt{\frac{L}{A_L}}$$

"Good stuff, Sonny! Just what we need. Now, the part we need is:

$$A_L = \frac{L}{N^2} \Rightarrow \frac{523e-3}{(1e3)^2} \Rightarrow \frac{5.23e-1}{1e6} \Rightarrow 5.23e-7$$

"And, if we square both sides, flip it around, and move things a bit so that we have the term we want on the left side, it will look like this:

Chuck grinned. "That didn't hurt – especially when you do it.

"So, it appears we need a transformer with a 20 µH primary and a secondary of 320 µH. Now all we need is the number of turns."

"True. Here's the equation:

$$N_{PRI} = \sqrt{\frac{L_{PRI}}{A_L}} \Rightarrow \sqrt{\frac{20mH}{523nH/T}} \Rightarrow \sqrt{\frac{20e-6}{523e-9}} \Rightarrow \sqrt{\frac{2e-5}{5.23e-7}} \Rightarrow \sqrt{3.824e1} \Rightarrow 6.184T$$

$$N_{SEC} = \sqrt{\frac{L_{SEC}}{A_L}} \Rightarrow \sqrt{\frac{320mH}{523nH/T}} \Rightarrow \sqrt{\frac{320e-6}{523e-9}} \Rightarrow \sqrt{\frac{3.2e-4}{5.23e-7}} \Rightarrow \sqrt{6.119e2} \Rightarrow 24.74T$$

, where N is the number of turns, L is the inductance in Henries, and A_L is the inductance-per-turn factor.

"A_L is found in the Amidon catalog and, for the FT50-43, it is 523 mH/1000 turns. Pesonally, I find a number in those terms confusing. A number in henries per turn seems clearer. So, H/T, or 523 nanohenries per turn.

"Now, the number of turns:

and,

$$\Rightarrow (0.5-0.281)+(2)(0.188) \Rightarrow 0.595$$

❖ Two Windings and Five Pieces of Wire?

"Are we ready to start winding wire now?" Chuck wanted to know.

"Just about. We have to adjust the number of turns – just a little bit. The number of turns for the primary and secondary must be in an integer multiple ratio. And, we can't wind fractions of turns. That means that the primary will have 6 turns, and the secondary will have 24 turns.

"We do that by cutting five pieces of wire to the right length, and twisting them together so that the winding will be bifilar – that's what 'bifilar' means. The bifilar winding is necessary to minimize leakage inductance, which makes it possible for the transformer to have a nice, flat response over a wide band.

"So, how long should the wire be? Well, if we subtract the inner diameter from the outer diameter, we will have the width of two of the sides of the toroid. And then, if we add the thickness times 2, we will have the length for one turn:

Length per turn = (outside diameter - inside diameter)+(2)(thickness)

inches,

and for 6 turns that's 3.57 inches, and then 5 inches each for two leads, and the total is 13.57 inches. We'll round that to 14 inches."

"Yes, but," Chuck interrupted, "we still need to know what size of wire to use that will fit into the toroid hole."

"Yes we do. First, the area of the 'doughnut hole':

$$A = 2\pi\left(\frac{inner\ diameter}{2}\right)^2 \Rightarrow 2(3.1416)\left(\frac{0.281}{2}\right)^2 \Rightarrow 0.124 inches^2$$

"Now, we need to find out what size of wire will go 30 times – 5 strands times 6 turns – through a hole of 0.124 square inches area. It would be nice to find a wire size such that 30 times the cross-sectional area would just equal the area available, 0.124 square inches. But there is something called the 'packing factor' and it is 0.6, which means that the total cross-sectional area of 30 wires of the size that we choose must not exceed the

Total Area for Wire = (0.124) (0.6)= 0.0744 square inches."

"Good gracious!" erupted Chuck. "Are you going to tell me seriously that only 60% of the area at the center of a toroid can be used for winding wire?"

"Sorry, ol' Buddy, but if you calculate wire size using a larger fraction of the hole area, the wires will be crowded, and that's not good. They will rub together, and that can take the enamel insulation off. They can also produce a pressure against the toroid. That's really bad, because any stress on the ferrite material will change its magnetic characteristics."

"Humph! Okay, let's see what wire diameter we can use. Dividing 0.0744 by 30 gives us an area per wire of 0.00248 in.² Now, the diameter –

$$D = 2\sqrt{\frac{A}{p}} \Rightarrow 2\sqrt{\frac{2.48e-3}{3.1416}} \Rightarrow 5.619e-2\ inches$$

"That's about 56 mils diameter. We're going to use enamel wire, aren't we? Yes. Have you got a wire table, Bill? Thanks. Well, No.15 gauge is 57 mils in diameter, but that's no good. What's next? No. 16 gauge is 50.8 mils. That should do, huh?"

❖ It Fits but It Doesn't Fit!

"Nope! Won't do!"

"Tsk! *Now* what's wrong?"

"Any wire in that size range is just too stiff. The characteristics of the toroid will not survive the winding."

"Aw man, now what do we do?" Chuck was not happy.

"Well, I suggest we cheat. Now here is a nice chunk of plastic-covered stranded wire which is just 50 mils in diameter. There are different colors, too, which will help later. Let's use that."

So they cut off 5 pieces of wire 14 inches long. Figure 3 shows them.

"Oh no!" moaned Chuck.

"Huh? *Now* what's your trouble?"

"Well look at that $#@ clock, Bill. Just now, when all the work is done and the fun begins, I have to go home. I'm in a mood to cheat some more!"

"Naw, that wouldn't do. I'll just have to usher you out, and we'll continue next time. Sorry. G'nite."

"Yeah, you're right. Thanks again, Bill. G'nite."

Diagrams and graphs were prepared using National Instrument's program "Multisim," gratefully received from Analog Devices Inc.

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MT REVIEW

Grundig Globe Traveler G3 Portable

By Jay Allen

I've got to tell you right up front that I put my name on a waiting list to get a G3 the moment they were available. Why? Well for one thing, I own its predecessor, the Grundig G5, which in my opinion offered the very best performance of any radio near this size and price range. The G5 (and identical Eton E5) were based on the popular (and still available) Degen DE-1103 / Kaito KA-1103, and were essentially the same radio with a redesigned user interface to include up/down volume buttons – a feature notably absent on the original 1103.

But the performance was the thing. On all bands (AM/SW/FM), these radios pull in signals like a magnet. They feature amazing sensitivity, a low noise floor, and great selectivity – there is just no other radio in its class that will "hear" as many listenable signals. In the world of smaller portable radios, that's a primary concern. They also sound very pleasant for their size and make great travel companions.

So, how could these little wonders be improved upon?

❖ Synchronous Detection

Ah, good question! Eton has come up with several ways to make a good radio even better. One of the improvements is the addition of synchronous detection, usually referred to simply as "sync."

Synchronous detection allows the radio to lock onto or sync with an AM or SW station's carrier signal, then discard that carrier and replace it with a perfectly clean and stable signal generated within the radio. This offers several advantages over traditional envelope detection. It can sometimes greatly reduce the annoying fading and distortion caused by so-called "selective fading," which often plagues AM and SW signals.

During selective fading, portions of the station's carrier signal are varying in level, leaving the audio information (contained in the sidebands) with a poor quality carrier signal to reference to. The result is mild to gross distortion varying over time. Sometimes switching to sync mode can drastically clean up such a fading signal.

Sync can also let you choose to listen to either the upper or lower sideband of a signal ignoring the opposite sideband. This can be a big help if only one of the station's sidebands is being interfered with, such as when it is adjacent on the dial to a stronger signal which is crowding it. Let's say you are trying to hear a signal on 6000 kHz, but there is interference from another signal on 6005 kHz. In that case you would engage lower sideband sync mode and completely ignore that interfering signal on the upper sideband of your desired signal. Again, sometimes the effect is dramatic.

A well designed sync circuit can sometimes make a hopelessly bad signal literally "jump out of the mud" and sound great. Of course, radios vary in terms of how well their sync circuits work. We'll see in due course how the G3 stacks up in this regard.

❖ Plethora of Features

Improved SSB: The G3 now offers switch-selectable upper and lower single sideband modes which makes tuning SSB signals much easier than in the previous models.

Civilian Air Band: The G3 adds the 118-137 MHz civilian air band. If you live near enough to an airport you can listen in on airplane and tower communications.

RDS (Radio Data Systems): A real boon to FM enthusiasts, RDS allows you to see text information broadcast by many FM stations. Typically you'll see the station's call letters or name, song title and artist.

Line output and line input lets you use your G3 as an amplified speaker for an IPOD or other audio device, in addition to feeding stereo signals out of the G3 for connection to an external audio system or recorder.

❖ Initial Problems

As is often the case with newly-introduced wideband portable radios, some of the initial G3's had problems. The G3 I had pre-ordered and waited so many months for was a disappointment – so much so that I ended up sending it back. Its synchronous detector would only lock onto very strong signals, rendering it pretty much useless. Worse, the AM band was full of birdies and spurious noises which ruined reception of virtually every signal I tuned in. SW was not bad, but not quite as good as my older G5/E5 radios.

On top of this, I was reading online that other people were experiencing similar issues. This clearly was not a case of a single bad unit, but rather a design or production problem I hoped Eton would iron out.

Luckily, it seems they have. I began reading of better-performing G3's that did not have any of these issues, so I decided to try another. In fact, I decided to try *two* others, because my second unit was serial number 29 and I wanted to try one with a higher serial number as well. The later one is serial number 1308. My guess is that serial number 29 was updated by Eton.

I'm happy to report that these G3's deliver the kind of performance I was hoping for and that the G3 offers some worthwhile advantages over the earlier models. They were worth the wait!

❖ Tests and Comparisons

My first goal was to compare the new G3 with my earlier G5 as a standard of comparison. I spent several weeks band scanning on both radios to compare their absolute overall performance, along with lots of listening to each radio to see how the overall experience compared. In terms of reception, the G3 runs neck and neck with the earlier models, with each having certain pros and cons.

On shortwave they seemed identical. As hard as I tried, I could discern no meaningful differences between the old and new models in terms of sensitivity, selectivity, and overall reception, which is good news. Swapping the positions of the two radios under test (always an important thing to do when comparing portable radios side by side) often produced bigger differences than any which may have been present in the radios themselves.

The dual bandwidths are well chosen, with the wide mode offering good sound and reasonable selectivity for most listening, and the narrow position offering increased selectivity at the expense of some audio crispness or clarity when signals are closely spaced. I checked all the active frequency bands day and night and listened to all manner of strong and weak signals: The two models always seemed identical.

However, the G3 has a slightly mellower tone quality than the older models, so any noise there seemed a bit less noticeable on the G3. Further, the G3's sync detection provided dramatic improvements on some signals. It not only reduced those annoying fades which AM and SW are known for, but it also helped separate interfering signals squashed together on the dial.

At other times things were better without sync. This is often the case because sync is not a magic elixir that can fix everything. To understand why various sync circuits may behave differently, a slightly technical discussion may be useful.

Two major specifications of a radio's sync circuit are known as sync-lock *width* and sync-lock *depth*.

Width specifies how far above or below the center-tuned frequency the circuit is capable of locking onto the signal. With other sync-equipped radios I've used, this is generally in the range of +/- 3 or 4 kHz. In other words, a signal on 5000 kHz should lock into sync mode when you are tuned anywhere between approximately 4997 to 5003 kHz. The G3, however, only locks on when *precisely* tuned to 5000 kHz. That means that, with typical manufacturing tolerances, some units will likely be off by a digit or so. I hope Eton can slightly widen the sync lock width in future production. This is not an issue so much with actual reception as much as it is an annoyance.

As for sync lock depth, that has been improved, as I mentioned earlier. The latest G3's will lock onto reasonably weak signals, but again, this could be even better. If you are listening to a signal that falls below about 1/4 on the signal strength meter, the sync loses lock. As it comes back into lock, there is usually a momentary mute that can be annoying. Still, since the sync on the G3 often helps dramatically, it's great to have the option.

AM Mode

In AM mode, the G3 was similar to but just slightly less sensitive than the older models, and it seemed to exhibit slightly less aggressive AGC (automatic gain control) action as well, so some very weak signals were received at a slightly lower volume than stronger ones. For perspective, this was not noticeable on the majority of signals I compared, but only with some very weak daytime signals, especially near the upper end of the AM band. At night, when most signals are stronger, I found it difficult to detect this difference at all. Again, the sync circuit sometimes cleaned up fading or interference-ridden signals very nicely and was a tremendous advantage.

Some AM stations now are broadcasting in HD (High Definition) using Ibiquity's IBOC (In Band On Channel) digital system. Such stations do not sound good on most sync-equipped radios, but this is not a fault of the radio. AM IBOC causes a rumbling or rushing noise when sync is engaged except on the very few radios that offer a third sync mode, Dual Sideband Sync. The only radio I own which offers this feature is the ($500) Eton E1.

Again, if sync makes the signal less listenable, simply turn it off. Consider it a tool you can use whenever it helps.

FM Mode

On FM, the G3 was slightly less sensitive than the G5, but it was also more selective and better at rejecting false images. In my suburban location, with a mix of stronger and weaker signals, each radio could receive some difficult signals clearly that were troublesome on the other radio. For the handful of very weak signals that had no strong adjacent stations, the older model pulled those in more easily, but for stations that were crowded together on the dial the G3 was easily the winner. Each radio thus received some signals that the other one couldn't.

Overall I would give a slight edge to the G3, but depending on your location either one might have a slight advantage over the other. Another improvement – the G3's signal strength meter now functions normally in FM mode, although the owner's manual incorrectly states that it does not.

SSB Mode

The G3 offers greatly improved Single Side Band performance. You can now select upper or lower sideband modes at the press of a button, which makes tuning SSB much easier. You then perform coarse tuning with the tuning knob, and finally zero in for best audio using the fine tuning thumbwheel.

Both wide and narrow filters are available in SSB mode, which is a bit unusual as well, and I suspect the less aggressive AGC I noted earlier helps SSB sound a bit cleaner on the G3.

❖ Other Comparisons

I discovered that the G3's external antenna jack does not function for AM as it did on the older models. Also, the IF wide/narrow switch that doubled as a tone control for FM on the old model does not on the G3. Finally, the G3's buttons are not lit (although the manual incorrectly says they are).

On the positive side, the scan function is much more effective on the G3. It scans more slowly than the old model, but it finds more listenable signals, making scan far more useful and a joy to use. At night, though, with many stronger signals available, I often set the DX/Local switch to local while using auto scan, and in crowded bands it may otherwise stop at virtually every frequency.

❖ Other Features

The G3 is a very full-featured radio. In addition to those we've already discussed, you also get four alarms, sleep timer, internal battery recharging, 700 randomly assignable memories in pages with eight digit alpha tagging (it was only four characters on the G5/E5), and a new copy/paste function that lets you copy memories from one location to another.

The use of any of these features is optional, but you will need the owner's manual to learn how to use them. Unfortunately, the manual makes this slightly tougher by not offering the usual diagram of the radio showing the location of all the controls, but any of the features that are important to you can be mastered with a little practice.

There are a few errors in the manual, although Eton has been known to update their manuals with new models so yours may vary. For one, there is no diagram showing the dual functions of the seven multi-function 'F' keys under the flip stand as stated (and as provided on the older models). I have provided it for you, since the functions are the same as the previous model.

F1	F2	F3	F4	F5	F6	F7	
49m	41m	31m	25m	22m	19m	16m	(Power On)
Alarm 1	Alarm 2	Alarm 3	Alarm 4	9/10 Khz	Scan Set	Charge	(Power Off)

One button that needs explanation is the scan set button, which lets you choose from three auto scanning modes: scan and stop (the default mode); scan, delay, continue; or ATS (automatic storage of the frequencies found).

❖ Conclusion

I have always been a portable radio junkie, and in my book Eton has hit another home run with the Globe Traveler G3. It offers many new features and represents the new state-of-the art in performance for smaller portable shortwave radios.

It is also intriguing that all these extra functions have been carefully fit into the identical cabinet as the older model. Even the buttons and switches appear identical although many have different functions on the new model. Wherever your travels may take you, be it overseas or just from room to room, the Grundig G3 will bring in signals as well as or better than any comparable radio, all in a neat attractive package that's fun to use. As such, it is a worthy new addition to Eton's line-up. I highly recommend it!

The Grundig G3 Globe Traveler (RCV65) is available from Grove Enterprises for $149.95 plus shipping and handling. Call toll free 1-800-438-8155 or visit **www.grove-ent.com** to order.

Manufacturer: Etón Corporation, 1015 Corporation Way, Palo Alto, CA 94303, USA
www.etoncorp.com

TABLE: FEATURES/SPECIFICATIONS

Serial numbers: 000029 and 001308
Manufactured in China
Frequency coverage
  AM/SW/LW (150-30000 kHz continuous)
  Air Band 118-137 MHz
  FM settable 76 or 87.5 - 108 MHz
Selectable 9/10 kHz AM tuning steps
Dual conversion PLL digital
RDS (Radio Data System)
Synchronous detector with selectable side band
SSB (Single sideband reception) with switch selectable modes
Dual IF bandwidths
Line In/Out
700 Randomly programmable memories
Clock, sleep timer, four alarms
Lighted LCD Display
3.5 mm stereo headphone output
Whip antenna for AM/Air/SW
Internal ferrite rod for AM/LW
3.5 mm external antenna jack for SW/FM/Air
Tuning: Direct frequency entry, scan, seek, ATS (auto tuning storage) modes, meter band selection
Power Source: 4 x 1.5 (AA, LR6, AM3); 4 Ni-MH batteries (can be internally recharged), AC Adapter 8V 200 ma center pin positive (supplied)
Size: 6.614" x 4.13" x 1.1" (168 x 105 x 28mm)
Net Weight: 345 grams
MSRP $169.95 (Generally available for about $150)
Accessories: Owner's Manual, Warranty Card, Protective Pouch, AC Adapter/Charger

GLOBALNET

Exploring the World of Internet Radio and Television

Loyd Van Horn, W4LVH
loydvanhorn@monitoringtimes.com

Internet Radio's Rising Star

The results are in and 2009 was a banner year for Internet radio. For fans of streaming audio content, the future certainly is bright and promises to only get brighter.

As an example of the growth, Radio Joint Audience Research (Rajar) recently published results from a study where nearly a third of British listeners said they have listened to an Internet radio station. This is also evidence that the explosion in the popularity of Internet radio is worldwide, not just in the U.S.

Led by the surging popularity of user-programmed streaming services like Pandora and Slacker, 2009 might go down as the year that Internet radio finally became a viable medium for both programming and advertising.

In fact, it is those personalized streaming services (especially *Last.fm,* in the UK), that have seen explosive growth. The Rajar study found that the number of Britons who had listened to such services had grown from 3 million in 2008, to 4.5 million in 2009. Also, a large part of the surge in Internet radio's popularity in Britain can likely be traced to the BBC's popular iPlayer interface, which gives listeners access to all of the network's local and national radio stations in one place. Similar studies in the U.S. have also shown that the market share of Internet radio is increasing.

As technology improves, it is poised to grow even more. That's because another surge in Internet radio popularity is anticipated as the industry moves to take Internet radio away from the tether of the computer and into mobile devices, WiFi radios, and even into automobiles.

On that front, there has been exciting news as of late. The aforementioned Pandora has been in talks with U.S. automakers to incorporate Pandora-ready radios into automobiles.

Pandora has said that nearly half their audience is already using the service through mobile phones and other devices in their cars. This would give users a hands free option that would incorporate subscription fees into the cost of the automobile, thus eliminating a per-month fee. Further announcements about the move were to be released at January's Consumer Electronics Show, too late for press time for this issue.

The past year also saw an explosion of the WiFi radio market. Developers such as Logitech released – to much fanfare – new models that expand what the WiFi radio offers consumers.

I have been testing the Logitech Squeezebox Radio for a few weeks. As one of the more recent releases from Logitech, it provides a good blueprint for how future WiFi radios will likely be designed.

For one thing, instead of the monochromatic display common to most WiFi and clock radios, the Squeezebox Radio has a full-color LCD display that will show station logos, photos and more. There is built in support for applications, allowing users to download apps like Facebook, as well as support for services such as Pandora.

The release of Logitech's much-awaited Squeezebox Touch has been pushed back to sometime this month from its December release (which was pushed back from a planned September release). Between the two, however, Logitech has given us a glimpse of what future WiFi radios should look like and what they should do.

As the technology of WiFi radios improve, especially as they further integrate with other online content, the industry is poised for even more expansive growth.

❖ Mobile Providers to Limit Data?

Several times in this column we have discussed the various Internet radio applications available on mobile phones such as Blackberry's and the iPhone. As a matter of fact, following a tip from a reader, I tried out the WunderRadio app for my iPhone recently to great success (see related mini-review below).

One part of the equation that has made such high-bandwidth services accessible for mobile phone users is that most providers give their customers unlimited data usage (usually maxing out at 5GB, however) for one flat monthly fee.

That may soon be changing for some cellular subscribers. There is speculation that AT&T may begin implementing a tier-based fee system for data usage over their Edge and 3G networks.

The company recently said that, although they are upgrading their network to handle the large amount of bandwidth that their iPhone and other smartphone customers are using, they are going to try to offer incentives to encourage those using the most bandwidth to back off a bit. The speculation is that these "incentives" are going to be fees for using more bandwidth.

There has been talk about such fees being implemented among cellular providers before, but the chatter is increasing with more and more users getting smartphones that enable video and audio streaming, thus using more bandwidth.

So what does this mean for the streaming enthusiast? It means that if you are currently doing a lot of your listening over your mobile phone, you might be paying more in the future for it.

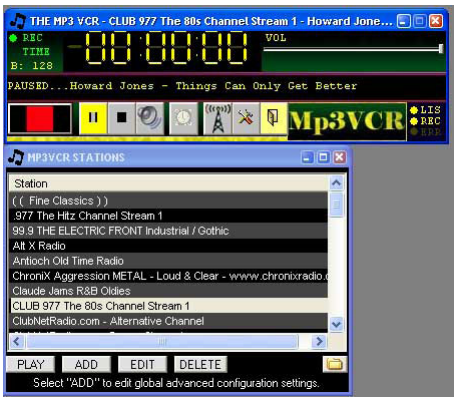
Smartphones that can utilize WiFi can offer a way for listeners to still gain access to streaming content without burdening their mobile phone provider's network. But users who rely on their cellular network for things like in-car streaming and other data-intensive applications may have to soon shell out a little more money to do so.

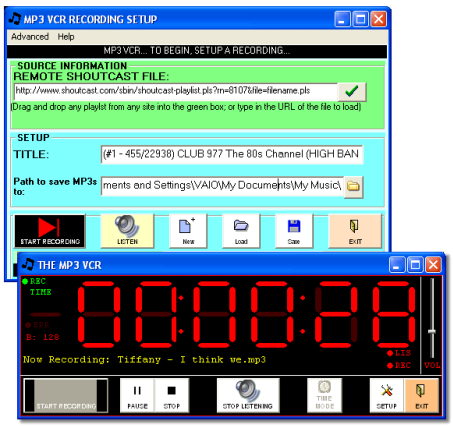
This could be shaping up to be the next great front in the smartphone wars between companies in the U.S., like Verizon and AT&T. I know that in my own personal usage, I am nowhere near approaching the 5GB maximum allowed – even with me streaming BBC and other radio stations in my vehicle on my way to work each morning. But the prospect of paying additional amounts on my monthly bill for data usage would curb even that modest amount of streaming.

❖ MP3 VCR Records Streaming Audio

For all of those streaming enthusiasts who have been looking for an easier way to record their favorite streams, archived programming, and other online audio content, a solution has presented itself: MP3 VCR.

A free, open source Windows based pro-





gram (including Windows 7), MP3 VCR allows you to set up recording times for Internet streams directly on your computer. While there are a few programs that will allow users to record streaming content, MP3 VCR is unique (as was StreamRipper before it) in that it supports mp3 streams from Shoutcast and others.

The obvious application of these types of programs is allowing you to record your favorite radio programs or even entire hours' worth of musical content for later retrieval. But these can also be helpful to AM/FM DXers, as a recording of a simultaneous digital stream can be used to help confirm details of the on-air broadcast for reception reports or it can help verify that a station ID was genuine during a DXing session.

While I haven't had a chance to try MP3 VCR myself yet (my Windows-based laptop remains on the workbench, needing a new CPU cooling fan), by all indications it should be a handy way to record Internet streams. I would love to set it to record some of my favorite music stations (RTE Chill, and world or ethnic radio stations) to finally have copies of some of my favorite, but hard to find music.

❖ The Wonderful WunderRadio App

For some time now I have been using the ooTunes app for streaming Internet radio content on my iPhone with some success. But after mentioning this in a recent column, one of our readers sent a tip that the WunderRadio app is a bit better and suggested I try it out. Normally, I am not one to fork out $6.99 for an iPhone app, but as I am a big fan of Weather Undergound (the parent company behind WunderRadio), I figured it had to be worth a shot.

All I can say is "Wow."

For starters, WunderRadio gave me quick access to all of the streams of my local stations in the Greenville, SC market. This is handy when I want to listen to local sports coverage but am not near a radio. But it's also useful when I travel to help me find radio stations I like when away from home.

Another major bonus that I loved was quick access to NOAA's National Weather Service All Hazards stations, with a search box on the main home page of the app to find any emergency station I want to hear. Not only did I program our local NWS weather radio broadcast in as a favorite, but as a storm spotter and severe weather buff I also added NWS weather radio for places like Oklahoma City, Omaha, NE, and Dallas, TX.

There are also quite a few streaming scanner options through ScanAmerica as well. I added several Tornado Alley Skywarn frequencies to my favorites list, as well as police, fire and EMS from a few cities around the country like New Orleans, Boston and New York.

But what about the radio station streams? They are fantastic, as expected. By organizing everything under favorites, it is very easy to find stations you are looking for, add them as favorites, and then access those stations later.

WunderRadio also gives you access to several subscription-based services like Sirius, stations through TUNED.mobi, LiveATC, RadioTime Scanners, RailroadRadio.net, and more. It doesn't feel as though there are as many stations as one might find in, say, a Reciva-supported device, but there are plenty here for streaming enthusiasts to enjoy for quite some time.

Since downloading WunderRadio, it has become my new favorite app. As mentioned above, I now use it to stream some of my favorite stations during my morning commute. When it's my turn to carpool, I truly blow my friends' minds when I am listening to BBC Manchester or Sea FM in Australia in my car of a morning.

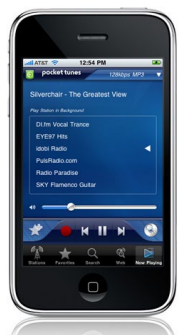
All in all, WunderRadio is a handy app for anyone who enjoys listening to streaming content. For me, it combines several different streaming apps I had previously downloaded (those that handled NWS radio, LiveATC, ScanAmerica streams, etc…). Now, almost anything I want to stream is located in one convenient app. There is even a built-in Web browser so that you can surf the web or check email while streaming your favorite stations.

Those who have iPhone or an iTouch can download the app from the iTunes App Store for $6.99 as of press time.

❖ Pocket Tunes

Another radio application I just recently heard about and cannot wait to try is Pocket Tunes from Nomsoft.

Pocket Tunes allows you to not only stream more than 16,000 streams, but you can even record streams as well directly on your smartphone for later playback. For iPhone or iTouch users, Pocket Tunes even supports background playing, so you can listen while running other apps on your phone (something that many iPhone/iTouch streamers cannot do.) There is also a built-in Web browser, much like WunderRadio has.



There is even direct support for linking artists and music to iTunes, so you can instantly download music to your iPhone/iTouch from the iTunes store.

Pocket Tunes can also be downloaded for $6.99 from the Apple iTunes store. Those who are looking to download Pocket Tunes for their Blackberry, Palm OS or Windows Mobile smartphone can do so at their official Web site, listed in the GlobalNet links at the bottom of this column. For those looking to add Pocket Tunes to these devices, the price is a bit higher than the iPhone/iTouch version. At press time, it was on sale for $19.95.

GlobalNet Links

Pandora seeks in-car radios: **www.fmqb.com/article.asp?id=1621895**
Squeezebox Touch delayed: **www.electronista.com/articles/09/12/10/new.squeezebox.delayed.for.unknown.cause/**
AT&T to charge for data usage?: **www.macdailynews.com/index.php/weblog/comments/23299/**
MP3 VCR: **www.ghacks.net/2009/11/24/internet-radio-recorder-the-mp3-vcr/**
MP3 VCR Official Site: **www.mp3vcr.com/**
StreamRipper: **http://streamripper.sourceforge.net/**
WunderRadio: **www.wunderradio.com**
Pocket Tunes: **www.pocket-tunes.com/**
Rajar study shows audience growth for UK Internet radio: **www.techwatch.co.uk/2009/12/11/a-third-of-brits-listen-to-internet-radio/**

What's NEW

Tell them you saw it in Monitoring Times

Radio Shack Pro-107 iScan Scanner

Radio Shack has a new triple conversion scanner built for them by GRE – the Pro-107. They bill their new scanner as "the one that changes everything."

The Radio Shack PRO-107 iScan is a multi-trunking scanner which boasts the ability to track Motorola type I/II, LTR, and EDACS trunk systems using a Radioreference database on an included 2GB Secure Digital card. This internal SD card has full U.S. databases for all known analog public-service trunked systems and many conventional frequencies as well.

The Pro-107 uses the radio control software and a supplied USB/power cable. Firmware updates are possible on this radio via the PC/IF to USB port connection. Full duplex support and USB connection is available using this supplied cable; however, it will not allow the user to access the SD card in the radio.

This new iScan scanner is a computer programmable scanner which uses the previously mentioned RadioReference database on an SD card. Select where you are and what you want to scan from pre-installed lists. Radio Shack claims that it's as easy to use as an MP3 player. Hit Play (not SCAN) and you are scanning local public safety services.

Some of the major features of this scanner include:

- Object oriented memory management. Number of conventional channels, trunked systems, sites-per-system, and talkgroups-per-system limited only by available file space on the SD Card. Object programmable display alert (including multi-pattern flashing) to assign to talkgroups, frequencies, agencies, etc.
- No traditional keypad. Radio uses media player style buttons to navigate to user programmed playlists.
- Stores millions of frequencies that can be categorized into 20 playlists. SD preprogrammed with entire USA Radioreference database; additionally can use high capacity secure digital cards as long as 32kB memory block clusters are used.
- Six search ranges / one user definable search range; no programming required to listen to police, fire, aircraft, marine, FRS/GMRS, CB and HAM.
- Hear Skywarn severe weather reports – Skywarn list can be programmed with any number of "objects"
- Weather band with enhanced SAME Weather Alert functions and weather priority – access weather channels and alerts with the push of a button. Does not alarm unless the weather alert is really for your specified area.
- Signal Stalker II near field frequency capture – searches for nearby 2-way radio transmissions within approximately 1,000 feet of the radio
- Follows the vast majority of local analog police/fire/emergency trunked systems
- Includes PC interface for cloning, uploading and downloading
- Frequency Coverage 25-50 MHz VHF-Lo; 50-54 MHz 6-meter Ham; 108-136.99166 MHz Civilian Aircraft; 137-144 MHz VHF Military; 144-148 MHz 2-meter Ham; 148-174 MHz VHF-Hi; 216.0025-221.9975 and 222-225 MHz; 225.025-405.975 MHz Military Aircraft and miscellaneous services; 406-512 MHz and 806-960 MHz (excluding cellular bands) UHF; 1240-1300 MHz Ham band.

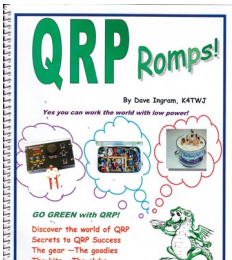
We hope to have additional information on this new Radio Shack scanner in a future *First Look* review.

QRP ROMPS

by Dave Ingram, K4TWJ

In the pioneer days of radio, two-way communications were conducted by Morse code. To facilitate speed, a system of abbreviations – "Q codes" – was developed. Many of these are still used, mostly by hams, such as QRM (man-made interference), QSL (confirmation of a contact), QTH (location), and QRP (using low power).

Many long-time hams, bored by the usual high-power assurance of steady contacts, experiment with the challenges of low power. These stalwart hobbyists have agreed on any power not greater than 5 watts to qualify as QRP.



Well-known writer Dave Ingram, K4TWJ, has assembled a neat, well-illustrated, easy (and fun) to read, 88 page manual on the techniques and equipment for QRPers. It's made me think about abandoning my 100 watt HF rig in favor of a teensy portable running on batteries!

Many of these tiny rigs are conveniently and inexpensively housed in tuna tins, Altoids™ packs, and other handy housings!

Divided into eight chapters, Dave has presented every facet of QRP operation – commercial equipment, antennas, home-brew rigs, kits, power supplies, clubs, contests, and successful QSO (contact) stories.

While most QRPers prefer CW (continuous wave – Morse code) because of the narrow bandwidth advantage of reduced noise levels, there are plenty of phone operators as well.

Imagine enjoying world-wide communications while pedaling in the great outdoors on a bicycle! It's done. Or how about mountain topping with a tiny rig, camping out with a panoramic view of the horizon? That's a treat as well, one to share with friends or family. Then there's the stalwart backpacker, rig in the pack and a whip sticking out the top! They are all being done.

I certainly enjoyed reading Dave's treatise on the fun of low-power contacts. If QRP sounds adventurous to you, this glossy, spiral-bound, photo-packed volume is the book to order. It's available for only $18 from several *MT* advertisers, including Universal Radio **www.universal-radio.com/catalog/books/3081.html** and the American Radio Relay League **www.arrl.org/catalog/?item=0160**. *– Review by Bob Grove, W8JHD*

Free Ham Radio Publication

Do you like free? Well, I sure do, and now you can get a great ham radio publication for the fabulous price of "free."

But first, let's step back a bit for a little history lesson. Back in November of 2008, CQ Communications, Inc. acquired *WorldRadio* magazine, then published by Armond Noble, N6WR. CQ Communications, Hicksville, New York, currently publishes *CQ Amateur Radio*, *CQ VHF* and *Popular Communications* magazines.

WorldRadio, based in Sacramento, California, had been published monthly since July 1971, with a primary focus on the human side of ham radio. *CQ*, a general-interest ham radio magazine best known for its support of DXing and contesting, has been in print since January 1945.

Armond Noble, N6WR, Publisher of *WorldRadio*, said that at the age of 74 the time had come for him to retire. "I wanted to be sure that *WorldRadio* found a good home, and that our readers would continue to be served by an independent voice in amateur radio," Noble said.

CQ Publisher Dick Ross, K2MGA, said, "*WorldRadio* has filled an important niche in our hobby for nearly four decades. We welcome *WorldRadio*'s readers to the CQ family, and we look forward to meeting their needs for many years to come."

Now for the good news: *WorldRadio* continues to be published online as part of the *CQ* family of magazines, with Editor Nancy Kott, WZ8C, continuing in that position. The magazine is available only in electronic Adobe PDF format.

You can access the current and all of the past electronic editions only by going to **www.cq-amateur-radio.com/WorldRadio.html**. They even have a signup service via email that will notify you when new editions are available at the website listed above.

Oh, yeah, did I mention it was "free?" Why, yes I did!

C. Crane CCRadio-2

The new CCRadio-2 has the same familiar look and layout as previous models of the CCRadio, but with improved AM reception and the addition of the 2-meter ham band. The boost in AM performance comes from a new patented Twin-Coil Ferrite® AM Antenna, and other improvements built into the CCRadio-2. For instance, AM station audio has been optimized for voice clarity. After you select a station, the CCRadio-2 evaluates the received signal for several seconds and then locks in for the highest signal possible. Early reports indicate that the FM reception is a little better in this model than in the CCRadioplus.

In addition to including the standard AM and FM bands, the CCRadio-2 has all seven of the U.S. NOAA weather radio frequencies to keep you informed of any government-issued alerts. And, addition of the 2-meter ham band – a feature we have never seen before in a portable radio of this type – may make the CCRadio-2 a life saver during an emergency like hurricane Katrina. The reason for adding this is that ham operators are usually the early responders on the scene, and they donate their time while handling traffic for emergency coordination efforts.

The CCRadio-2 can act like a simple radio scanner and search the five memories for ham operator communications. The sensitivity (squelch) can be adjusted for best results.

The CCRadio-2 comes in the original black mica or a new titanium color. It features a brighter, clearer LCD display with a full backlight and three levels of adjustable brightness, plus an "off " setting. Five years ago they made several changes to the durability of their CCRadio LCD display that have proven to be robust.

Other features include: 5 memories per band (AM, FM, Weather and 2-meter ham bands), adjustable display light, adjustable bass and treble, clock alarm, sleep timer, auto scan, stereo headphone jack, line-input jack, and line-output jack.

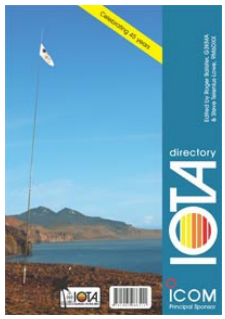
The radio has been especially designed for long-range AM reception and has now added emergency reception! Weight: 4 lbs (without optional batteries) Size: 11" W x 6.5" H x 4" D.

The CCRadio-2 sells for $159.95 plus free shipping and is available at **www.ccrane.com** or by calling toll free 1-800-522-8863.

Ham Radio Award Program Publication

One of the premier amateur radio award programs, the Islands on the Air (IOTA), has released their latest awards directory, the *IOTA Directory*. Edited by Roger Balister, G3KMA and Steve Telenius-Lowe, 9M6DXX, this new edition celebrates 45 years of island collecting.

What is island collecting? The not-so-simple act of collecting QSL cards by working the world's multitude of islands – a challenging and rewarding feat in amateur radio. The *IOTA Directory* is the essential guide to participating in the Islands on the Air (IOTA) award program. This latest edition builds on the extensive data revision seen in recent years and is fully updated. The complete, official listing of IOTA islands is here, along with many recent changes and award rules.



However, the *IOTA Directory* is much more than just a simple list. A special lead feature celebrates the 45 years of the IOTA program that is respected around the world. There are fascinating reports of IOTA operations in places as far flung as India, Alaska, Tunisia, and even Banana Island in Sierra Leone.

The *IOTA Directory* provides everything you need to participate in IOTA, from lists of islands, grouped by continent and indexed by prefix, to application forms and masses of information and advice for island hunters, award applicants, and DXpeditioners alike. The IOTA annual contest, which takes place in July each year, is fully covered along with contest rules and details of the latest IOTA Honor roll.

Whether you are already involved or are interested in earning this amateur radio operating award, this directory should be in your shack. It is a must-have for every island chaser!

Size 210x297mm, 128 pages, (ISBN 9781-9050-8651-1). The *Directory* is published by the Radio Society of Great Britain and is available at their website (**www.rsgbshop.org/acatalog/Online_Catalogue_IOTA_42.html**). It is also available in the U.S. from the ARRL website (**www.arrl.org/catalog**) for $19.95 plus shipping.

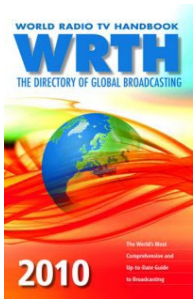
I should also point out the IOTA program website at **www.rsgbiota.org/**. Once you register for a free account, you can obtain a lot of information on this program, submit cards for the various IOTA awards, and even get IOTA credit for qualifying contacts you make during the annual IOTA contest.

This is a fun program to work and the IOTA Directory and website will help you enjoy it even more.

World Radio TV Handbook 2010

The 2010 edition of *World Radio TV Handbook*, has recently released the 64th edition, for the worldwide listening and viewing audience. This year's edition begins with *WRTH* Receiver Reviews from low-cost/low-end portables to high end table top receivers. There is also a nostalgic look back at Cold War classic receivers.

In another feature, John Nelson returns to Bush House, the home of the BBC World Service and discovers the many changes since the early days, and conducts two interviews discussing advances in technology and the future.



Digital Update continues with the regular round-up of what has been happening in the world of TV and digital radio during the past year. Is it possible the national digital radio is headed for a DMB-based (Digital Multimedia Broadcasting) future?

David Ricquish, of the Radio Heritage Foundation, first wrote on the Samoan radio scene in 1995. Since then, Radio Polynesia has expanded to four modern FM stations, and listeners as far as Europe still log the elusive signals. Follow David, as he looks back at the radio landscape from Samoa.

George Jacob explains the effects of Cycle 24 in his *HF Broadcast Reception Expected During 2010.* This year he predicts an increasing number of stations returning to the 17 and 21 MHz bands.

The *National Radio* section covers the world's domestic radio services. Listings are by-country and include all stations currently broadcasting on longwave, medium wave, shortwave, and FM with contact details.

International Radio provides details of all countries broadcasting internationally. Details include station name, personnel, postal addresses, broadcasting schedules and website information, as well as medium wave, FM, shortwave and terrestrial television. The *Clandestine and other Target Broadcast* lists stations targeting programming from Cameroon to Zimbabwe.

The frequency list contains international medium wave by-frequency listings, followed by *Shortwave Stations of the World* and a by-hour listing of *Broadcast in English, French, German, Portuguese and Spanish,* as well as *DRM International Broadcasters and Terrestrial Television.* An extensive reference section provides the listener with listening aids, transmitting information and more.

The *World Radio TV Handbook* continues to set the radio hobby standard. It remains the best, most authoritative and comprehensive radio reference book in the world, one that should be in every hobbyist's listening post or radio room. Quite simply, it is an ultimate and indispensable guide – one not to be missed.

WRTH 2010 (BOK-03-10) is available from Grove Enterprises **www.grove-ent.com** for $29.95 plus shipping and handling. To place an order by phone 1-800-438-8155, postal address: 7540 Hwy 64 West, Brasstown, NC 28902. – *Review by Gayle Van Horn*

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.

LETTERS

editor@monitoringtimes.com

Crazy about Radio? Or just Crazy?

This month I found myself in the rare situation of trying to write a "Letters to the Editor" column with almost no letters. A friend of mine said, "I'll give you a letter!" And she did:

"I have friends who are really involved, entertained, busy with their communications hobbies. I don't understand: Why do they do this?"

Amy Nicolson

For starters, I'll invite her to read the first three in MT's new series on "First Person Radio" to help explain the fascination that has taken some people to extraordinary lengths in their dedication to radio. But what about the rest of us?

I remember Bob Kay, a former *Scanning Report* columnist, periodically suggesting arguing points that scanner listeners could use to explain their hobby to friends and relatives. At that time, scanner listening had fallen into disrepute because of the vulnerability of analog cellular signals and cordless phones to "eavesdropping."

What do you tell your friends and family when they ask about your hobby? What drives *your* fascination with radio? Is it the content, the technology, connecting with the world around you?

Meanwhile, you may have noticed over the past few months that the cover of our magazine has featured the object of our affection – radios! So here are a few letters about that subject.

Grundig G-8

Ron Smith wrote regarding his experience of the Grundig G-8, following our January review.

"(1) After trying a few of these, there are two 'funnies' about this set: It eats batteries. The DSP IC is very hungry current-wise.

"The batteries were those that come with the Kaito 1102 and 1103. I charged up a set for Alan Weiner's Friday show on WBCQ; at 40 minutes into it, the G-8 had drained the 1300 mah batteries dry... whereas they run an FR-250 for several weeks.

"Ann B. Revelle on Amazon.com notes that Tecsun has the PL-310 and 380 on Ebay. These are later 'perfected' versions of the G-8 featuring selectable bandwidths from 3 kHz out to 6 and mucho memories. They use the same DSP and I'll bet they have about the same battery life.

"And Insignia's (Best Buy) HD portable has the same (well, 10 hours) type thing. Computer chipsets really soak up current.

"(2) There is a design flaw with the tension spring on the single battery; on some sets it may be stretched too long, resulting in a short at the negative base of the battery. You will literally see smoke. It is amazing how much juice there is in an AA.

"Tecsun seems to have this 'thing' about making their battery compartments a little smaller than they need to be. The G-6 and the KA-1102 both require a 'pry bar' to get the AA's out."

Ron Smith

Keep it Simple

A postcard from Charlie Bott apparently addressed our cover story about collecting transistor radios:

"I'm not sure where you're going with the December '09 *MT* unless you see the sense of what was in place in the '60s before it busted loose in the '70s (regs.) … There is something to be said for a simple system and the workability of the transistor era. …"

Charlie Bott

Retro Radio

Noting some of our recent articles on radio history and technology of the past, J.J. Owens sent these comments and suggestions:

"A good retro topic would be the large flying boats that ruled the sky from Pan Am; large flying boats ruled trans ocean skies from 1934 until WW2 then airports built during the war worldwide allowed large landplanes to take over. Like console radios, flying radios did not survive WW2. Flyboat Radio and Juan Trippe are good retro topics for *MT*…

"In the golden age of radio, rural USA was not wired with electricity or phone, so the choice of what radio to buy for rural people came down to how to run it. On farms and ranches in high wind areas 120 vdc Delco LP or gas systems were used. Thus farm and ranch radios were generally the cheap 5 or 6 tube AC-DC wood cased AM-SW sets console or table radios (sometime with LW included, too, but not often).

"Car radios were 6v, straight AM-only sets. Still, many junkyard car radios and speakers were put in wood cases for home use in rural USA. (The so-called "Hoover Console" radio. Cheap but good.)

"Non farm rural people generally had no 120 vdc wind or Delco system, so generally used 6v sets. Usually with a twenty dollar total cost Zenith Windcharger and 240 AH glass battery (one end cell had floating balls to see the state of charge) in high wind areas, or in low wind areas had one battery with the set and another in town on charge at the radio shop (or at a car repairer's shop) at 25 cents per full charge. The down side of 6v home sets is that the sets normally cost twice or more as much as the 120 volt ac-dc sets.

"Rural people selected radios on the basis of what type power they had. Nonfarm or ranch rural people with only a small 20-dollar Zenith Radio Charger and 6v battery had two choices – either a costly 120 vac-6vdc AM-SW 'farm' radio with 8 to 10 tubes or so (which required a fair amount of power to run as well as being more costly) *or* the cheap junkyard car radio and speaker, AM only, in a home built wood case. For the poor there was no choice at all.

"This is all good retro stuff for *MT*."

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

EDITOR'S SOAPBOX

Make a Radio

Editor Ken Reitz

There are two things that I hope *MT* readers will find interesting in this month's cover story. One is the fun of AM band DXing and the other is the art of building AM radios.

Veteran broadcast band DXers and newcomers to the hobby may want to take a shot at the "First Final Farewell DX Contest" held by the Birmingham, Alabama Crystal Radio Group. Details of their contest are found here: **http://crystalradio.us**.

The contest started on January 15, 2010, but doesn't end until March 15, so you may still have time to enter. Also, our cover story author, Dave Schmarder N2DS, hosts a contest of his own later this year as you'll read in his article.

Building an AM receiver – whether it's a crystal detector, tube-fired, or solid state – is a great way for beginners to learn about electronics. There's very little cost involved, schematics are simple, and the payoff is big: listening to a radio you built yourself.

There isn't enough room in this entire issue to reproduce the photos, schematics and construction details you'll find at Dave's web page: **www.makearadio.com**. There you'll find step-by-step photos of how he builds Litz wire spider coils for longwave, medium wave and shortwave radios, as well as authentic-looking front panels. There are even plans for making your own crystal set headphones.

Finally, building a simple radio is something that you can do with kids. If you have children or grandchildren old enough to cut wire and wind a coil, this is a great chance to have fun together while you introduce a new generation to electronics, just like Dave's dad did with him. You never know where it will lead.

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MT: AMERICAN BANDSCAN
http://americanbandscan.blogspot.com/ - by Doug Smith

MT: FED FILES
http://mt-fedfiles.blogspot.com/ - by Chris Parris

MT: MILCOM
http://mt-milcom.blogspot.com/ - by Larry Van Horn

Larry's Monitoring Post
http://monitor-post.blogspot.com/ - by Larry Van Horn

MT: SHORTWAVE
http://mt-shortwave.blogspot.com/- by Gayle Van Horn

MT: UTILITY WORLD
http://mt-utility.blogspot.com/- by Hugh Stegman

Looking for Writers

MT is soliciting feature articles, reviews, and how-to articles covering shortwave broadcasting, utilities, scanning, frequency profiles, construction projects or whatever excites you! Contact Feature Editor Ken Reitz at *kenreitz@monitoring-times.com* or write c/o Monitoring Times, 7540 Hwy 64 West, Brasstown, NC 28902.

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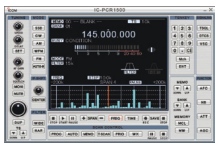

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