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Monitoring® Times

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Satellite TV at 50:
The World Delivered to Your Home

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- Tune in International Broadcasts via Satellite
- The Low-Down on Low-Band Antennas
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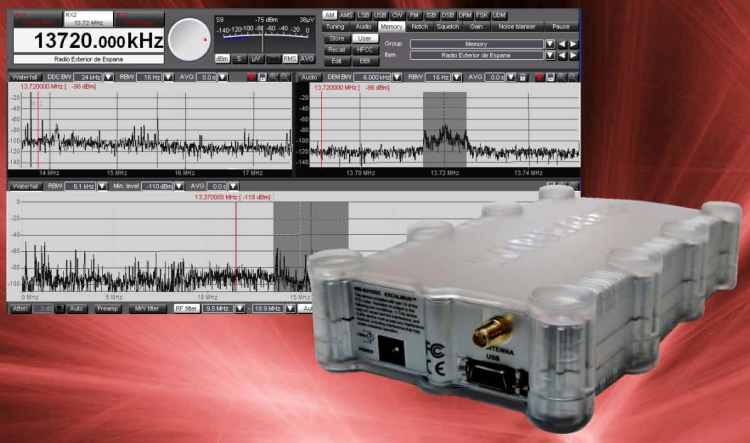


WinRadio Excalibur Pro

WRTH AWARDS 2012
WinRadio Excalibur Pro
BEST SDR

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

CONCLUSION

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

www.wrth.com

Overall rating ★★★★★

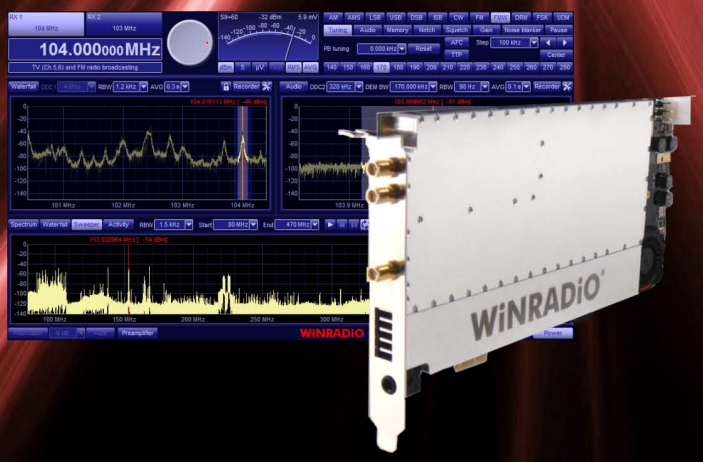
review

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

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

summary

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



FIRST LOOK

MT Takes a Look at the Latest Tech

By Bob Grove, W8JHD

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

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

*** Yes, this does mean get one for free. Go to this web page for details:**

www.winradio.com/mt

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

Monitoring Times

Vol. 32 No. 2 February 2013

FTA Satellite Reception Made Easy 8

By Mario Filippi N2HUN

Since Telstar 1 relayed the first grainy, black and white television images across the Atlantic Ocean in July 1962, satellite TV has come a long way. But it wasn't until the home satellite dish revolution of the late 1970s and early 80s that satellite TV became accessible to the average U.S. citizen. In those days hobbyists invested thousands of dollars in racks of equipment and 10 foot diameter dishes. For all that gear, the best they got was watching standard definition programming in analog.

Today, complete digital satellite TV receiving systems with dishes only three feet in diameter sell for less that $200; HD-capable receivers alone sell for as little as $200.

In this month's cover story, Mario Filippi N2HUN shows how it's done. With a modest investment and just the right spot in your backyard or on your apartment balcony you can be watching news and entertainment from around the world for free.

And, while most transmissions are done in the Ku-band, Mario proves that with enough patience and a new LNBF, you can be watching C-band channels on a dish as small as 39 inches.

On Our Cover

Deutsche Welle headquarters with studios and transmitting facilities in Bonn and Berlin Germany. (Courtesy: Deutsche Welle TV)

C O N T E N T S

R E V I E W S

AR2300 "Black Box" Professional Grade Communications Receiver

Introducing a new generation of software controlled "black box" receivers!

Available in professional and consumer versions, the AR2300 covers 40 KHz to 3.15 GHz*

With the new AR2300 "black box" receiver from AOR, up to three channels can be monitored simultaneously. Fast Fourier Transform algorithms provide a very fast and high level of signal processing, allowing the receiver to scan through large frequency segments quickly and accurately. All functions can be controlled through a PC running Windows XP or higher. The AR2300 features advanced signal detection capabilities which can detect hidden transmitters. An optional external IP control unit enables the AR2300 to be fully controlled from a remote location and send received signals to the control point via the internet. It can also be used for unattended long-term monitoring by an internal SD audio recorder or spectrum recording with optional AR-IQ software for laboratory signal analysis. The AR2300 appeals to federal, state and local law enforcement agencies, the military, emergency managers, diplomatic service, news-gathering operations, and home monitoring enthusiasts.

Discover exceptional performance, state of the art specifications and a receiver with a menu of optional extras that can be configured to your own needs and specifications.

- Receives AM, wide and narrow FM, upper and lower sideband, CW modes, and optional APCO-25
- Up to 2000 memory channels (50 channels X 40 banks) can be stored in the receiver
- Alphanumeric channel labels
- Fast Fourier Transform algorithms
- Operated by a Windows XP or higher computer through a USB interface using a provided software package that controls all receiver functions
- An I/Q output port that allows the user to capture up to 1 MHz of bandwidth onto a computer hard drive or external storage device
- An SD memory card port that can be used to store recorded audio
- Analog composite video output connector
- CTCSS and DCS squelch operation
- Two selectable Type N antenna input ports
- Adjustable analog 45 MHz IF output with 15 MHz bandwidth
- Optional AR-I/Q Windows software facilitates the easy storage and playback of transmissions captured within up to 1 MHz bandwidth or, signals can be subjected to further analysis.
- An optional GPS board can be used for an accurate time base and for time stamping digital I/Q data.
- The triple-conversion receiver exhibits excellent sensitivity across its tuning range.
- Powered by 12 volts DC (AC Adapter included), it may be operated as a base or mobile unit.
- Software-driven operating selections include IF bandwidth, frequency, mode, filters, a screen-displayed graphical "S-meter," memory inputs, volume and squelch settings and more
- Professional (government) version is equipped with a standard voice-inversion monitoring feature

**Cellular blocked for US consumer version. Unblocked version available to qualified purchasers with documentation. Specifications subject to change without notice or obligation.*

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WORLD RADIO TV HANDBOOK

Available from Grove Enterprises!

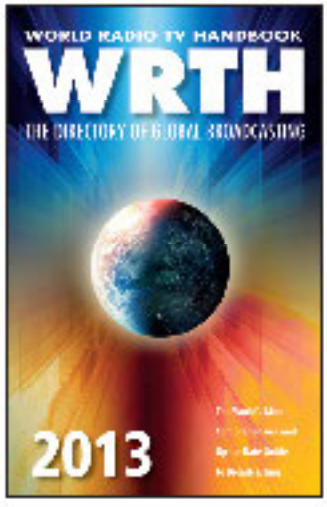
WRTH 2013

We are very pleased to announce the publication of the 2013 edition of *World Radio TV Handbook*, the best-selling directory of global broadcasting on LW, MW, SW & FM

The Features section has a look at some classic 1990s DSP receivers, reviews of the latest equipment, an article on DXing on Curaçao, a visit to Khmer Post Radio, along with other articles and items, including our regular *Digital Update*.

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

- National and International broadcasts and broadcasters by country with frequencies, powers, languages, contacts, and more, including 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.
- Reference section with Transmitter locations, DX clubs, Internet Resources, and much more



Available December 2012

SOME COMMENTS ON WRTH 2012

The 2012 World Radio TV Handbook is the ultimate and most comprehensive reference book for broadcast radio hobbyists. The World Radio TV Handbook continues to set the gold standard in broadcast reference information. It remains the very best, most authoritative, and comprehensive reference book in the broadcast world. It is an exceptional annual guide that should be in every radio hobbyist's listening post – *Gayle Van Horn*, Monitoring Times

I recently purchased the 2012 edition of your handbook. I'm enjoying all of the exquisite detail and information that I've missed since the last issue I bought years ago – *Bill Calderwood, USA*

There's a reason I purchase the WRTH every year: It's a superbly executed publication that makes the Dxing hobby a true pleasure for all involved. I still get a thrill when each new edition appears – *William Patalon III, USA*

The WRTH is a must-have publication for all who work in international broadcasting, and those who like to hear or see broadcasts from outside their own country – *Radio Netherlands Worldwide*

WRTH 2012 gets 5 stars, because both in the past and for 2012, it earns that pinnacle. It is *indeed* the World Radio and Television Handbook – *Joe Rotello*

Let me express my thanks for publishing another great issue of the handbook. WRTH has been an indispensable reference for my radio listening hobby since 1989 – *Matthias Gatzke, Germany*

The resources provided by WRTH are not only essential to radio listening but also an excellent knowledge tool – *David J Morris, UK*

I am new to WRTH, very impressed so far. Don't know how I survived without it – *Adrian Morgan, Ireland*

to the editors

editor@monitoringtimes.com

This column is open to your considered comments. Opinions expressed here are not necessarily those of Monitoring Times. Your letters may be edited or shortened for clarity and length. Please mail to Letters to the Editor, 7540 Hwy 64 West, Brasstown, NC 28902 or email editor@monitoringtimes.com

Happy monitoring!

Ken Reitz, Editor

60 Years of Lafayette Radio (*MT* cover story, December 2012)

Mario Filippi N3HUN writes:

Re: December issue of *MT* and the article on Lafayette Radio. What a great retrospective look at a company that many of us grew up with. In my hometown of New Rochelle, New York we had a Lafayette Radio in the 1960s through to the 1970s. One of my most memorable purchases was a green-burst-colored electric guitar and case for about 30 bucks, and it was a decent buy; it had three pickups, tremolo bar, similar to a Fender.

We had an even bigger one in Yonkers, New York, where I got my first AM/high band VHF radio. That started my interest in police/fire/utility monitoring. Back then the National Weather Service was just starting up the VHF weather channels on 162.55 MHz. I remember hearing KWO-35 from Rockefeller Center in New York City for local weather. And, being near Long Island sound, I would occasionally hear boats on the VHF band. Ah yes, all the great memories of Lafayette Electronics.

Kudos to Dan Veenaman's Scanning Report "Scanner Terminology" (MT December 2012)

John Razmus N5WMT writes:

Many thanks for your article in the December issue (Scanner Terminology"), it sure cleared up a lot of questions for me. Another GOOD reason to read MT!

More Running Linux on SDRs (MT cover story, November 2012)

Jerald Brodkey KB8KIW writes:

In answer to Dan Ramos [*see MT Letters December 2012 – Editor]*, I run Linux and with it use the WiNRADiO WR-G313e happily. The method is to run the standard WiNRADiO software in a virtual Windows XP machine. For the virtual machine I have Vmware but if I was just starting out I would give Xen a try first since it is free. Wine or Crossover seem to install such programs but I think the problem is that there are no suitable drivers for the radios under Linux. The advantage of running XP this way is that there are many ham programs for Windows that work very nicely with this system as well as other programs that one would like to use but don't, as it would require dual booting.

MT's *Digital Digest* columnist, Mike Chase-Ortiz also writes:

Just read the comments in the recent issue about SDRs on Ubuntu and Windows. You forgot to mention stuff that runs on Mac OS X too. There's both CuteSDR and SDRDX (an enhanced offshoot of Cute) that run natively on that operating system. I bought an RFSpace NetSDR since, being an Ethernet-connected device, it will shoot data to anything without all the proprietary USB driver hassles you find with Windows software in particular.

TV Accessories for Scanner or SWL

Mike Hoblinski N6IMF writes:

I enjoyed Kent Britain's column in the November 2012 issue (page 52) on "TV Accessories you can use with your Scanner or SWL Receiver." I have three scanners and was going to try one antenna and feed a four way splitter. Should I terminate the unused terminal on the splitter with a 75 ohm termination cap? I was also wondering about feeding two antennas into a splitter. I was considering a wide range discone and a second antenna that was more suited for low band monitoring for California Highway Partrol (CHP) frequencies.

Kent Britain WA5VJB responds:

In an analog TV system where multiple TV's are fed with long lines after the split, the reflection from the unterminated port could cause a ghost on the picture. For this application, I don't think it would be worth the effort to terminate that last port. You are welcome to try of course. Plan B, our local Dollar Tree sells 3-way splitters for $1. And yes, you can go the other way and have two antennas on one radio. I would usually use an A-B switch myself, but it does depend on which services you are monitoring.

Pizza Pan 150 MHz Antenna

Joe Wdowiak writes:

Regarding Kent Britain's antenna column from June 2011 titled, "Construct Super-Wideband Antennas." Just wanted to let you know that I've made up a pizza pan antenna, mounted it in the attic and it has been performing beyond my expectations. As you say, it is a serious item. When the weather is stable, I pick up signals from Niagara Falls, New York which, as the crow flies, would be well over 100 miles. I used a switch box to compare my other antenna, a homemade 'ground plane/discone' and the winner was....pizza pan.

Kent Britain WA5VJB responds:

It's always good to get positive feedback. Yes, it really is a serious antenna. For others wanting to try this, make sure your disks are at least 18 inches across and it will work fine at 150 MHz. Above 1500 MHz it does tend to have two beams going out from the edges of the pizza pans, but still pretty omni-directional. Good luck with your scanning. Right now, I'm working on a family of antennas to listen to aircraft transponders for MT's March Air Show issue.

Disappearance of the Boston Acoustics Solo II

Walter Breville writes:

I vey much enjoyed your article in the November 2012 *Monitoring Times* "The $467.56 Radio Buying Challenge" – except for one radio featured in the article that I would love to have, but can't find it anyplace: The Boston Acoustics Solo II. I have tried the websites of Amazon, eBay, Overstock, Best Buy, nobody even lists it as discontinued! You must have gotten information from Boston Acoustics just as they decided not to manufacture this model.

Cambridge Soundworks Ambiance Touch: AM/FM WiFi radio with iPhone/iPod docking offers superb audio and will be reviewed in the March issue of MT. (Courtesy: Cambridge Soundworks)

I discovered shortly after the November issue came out that the Solo II had been discontinued. As noted in my January Beginner's Corner column, the replacement was the Boston Acoustics Duo-iPlus is $250 ($100 more than the unavailable Solo II). But now that model is also discontinued.

If you're looking for great audio and WiFi radio, I'm recommending the Logitech UE Smart Radio ($180 with free shipping from: ***http://ue.logitech.com/en-us/smart-radios****) and at the high end, Cambridge Soundworks Ambiance Touch ($400* ***http://store.cambridgesoundworks.com/info/Ambiance_Touch_World_Radio****). The Smart Radio (wouldn't you know it) replaces the Logitech Squeezebox, also discontinued. But, it has a built-in rechargeable battery pack (Logitech had been charging an additional $50 for the Squeezebox battery pack). It's the best buy of all the WiFi sets. No AM/FM, but with WiFi, who needs it?*

The Ambiance Touch is the best WiFi radio overall on features, including a great remote control (the Smart Radio doesn't have one) and it finds things I can't find on any other WiFi radio. It also has the best audio of any radio, including Bose!. The BA Solo II is a lesson to us all: Find a radio you like? Buy it without regrets! – Editor

COMMUNICATIONS

by Ken Reitz KS4ZR

Communications is compiled and edited by Ken Reitz KS4ZR (kenreitz@monitoring-times.com) based on clippings and links provided by our readers. Many thanks to this month's fine reporters: Anonymous, Bob Grove, Norm Hill, Lynn Kelly, Steve Karnes, and Larry Van Horn.

FCC Grants Extended Narrowbanding Deadline

The FCC's mandated change to narrowband frequency transmissions by the country's public service radio systems hasn't gone 100 percent according to plan. A combination of a poorly performing economy and slow-moving local bureaucracies has made many counties and municipalities unable to meet the commission's January 1, 2013 deadline for the change.

The FCC was prepared for that eventuality but had also hedged against bumbling and general slothfulness on the part of local governments by requiring all claimants to meet a rigorous excuse standard. There were plenty of takers on the waiver and, in most cases, the FCC has granted a full two year waiver of the narrowbanding rules to those entities that applied for them with the new deadline for compliance being December 31, 2014.

MT publisher, Bob Grove W8JHD, expected the extended deadline, "It was inevitable. Mandating a nationwide replacement of all currently-used government radio equipment that can't be reprogrammed for narrowband operation sounds good on paper, but expecting it to happen at all levels during a down economy is quite another, especially when the entity's current radio system is working."

How does this affect scanner listeners? Bob Grove says, "It should mean the successful extended use of older scanners that must be programmed with wider frequency intervals. However, as narrowband technology appears on the local spectrum, some scanners will detect marginal weakening of signal strengths because of narrower deviation (FM modulation), some additional weakening and even distortion due to new frequency offsets from the old channelization plan, and possibly some adjacent-channel interference due to the closer channel spacing."

Looking to the future, how does this extension of two years affect the eventual change to a 6.25 kHz narrowbanding plan? "It probably won't be so traumatic," Bob Grove says, "Most of the newer, narrowbanded, two-way radios have both 12.5 and 6.25 kHz bandwidths, so they are ready when the FCC issues a Report and Order transition deadline which will be a few years away."

Des Moines Police Radio dogged by Impersonator

An article in the *Des Moines Register* from late November detailed the havoc caused by a 22 year-old man who programmed a hand-held radio to break in to that city's police frequencies. The 16 year-old radio system is not encrypted and, according to the article, "an upgrade hasn't been feasible with recent budgets." The accused faces 28 counts of obstructing emergency communications and eight counts of impersonating public officials.

City detectives used direction-finding techniques to pinpoint the location of the transmissions, a task made difficult by the brief, irregular calls during which the accused was said to have caused fire department and police vehicles to be sent to non-existent structure fires and auto accidents. Officials confiscated equipment used but declined to give details on just how he broke into the city's police and fire frequencies.

Confessions of a Cable CEO

An article in *Advanced-Television.com* reported on a comment made by Time Warner Cable (TWC) CEO Glenn Britt, speaking to the UBS Global Media & Communications Conference in early December 2012. Britt reportedly gave notice to what the article called "underperforming" networks. According to the article Britt said that TWC had "over the years accumulated networks that 'hardly anybody watches.'"

Extra Class Hams Gone Wild

Most radio stations would love to see the kind of publicity afforded a Manhattan, Kansas FM station in early December 2012. Articles from around the state and around the nation talked about the station on 88.3 MHz run by an Extra Class amateur radio operator no less! The problem was that the garage-based radio station was not legal. According to FCC documents, FCC agents used direction finding techniques to locate the station which they inspected, accompanied by the property owner who explained that he agreed to allow the station to operate in his garage because the station owner said he was "a licensed radio operator."

According to a Notice of Apparent Liability for Forfeiture (NAL), the operator, Glen Rubash KC0GPV, told FCC agents in a telephone interview that "he purchased the radio transmitter and that the station had been on the air for two months." He also told agents he would not voluntarily relinquish the transmitter if asked to do so. The FCC found that because the operator was a licensed Extra Class amateur radio operator, he should have known better and assessed the ham a $10,000 fine.

In a far more interesting case, another Extra Class licensee, this time from New Jersey, was found to be operating on 296.550 MHz, a U.S. military frequency. In February 2008, according to FCC documents, agents "conducted an inspection of the unauthorized station at the residence. During the inspection, the agents directly observed a transceiver whose display showed that it was set to transmit frequency on 296.550 MHz. The agents also observed that the transmitter was connected to an antenna mounted on the back of the house."

During the interview the operator admitted to owning and operating the station for at least four months. He also acknowledged that the frequency was not a U.S. frequency authorized for amateur radio activity. The FCC issued a fine of $10,000 with an additional $10,000, "because of the egregiousness of the violation," his transmissions were later confirmed to have been the source of harmful interference with a government communications system, according to FCC documents.

FLTSAT Charlie Navy Fleet Relay (Courtesy: Milcom Monitoring Post)

The Extra Class ham, Joaquim Barbosa N2KBJ, a U.S. citizen and a native of Brazil, explained to FCC agents that he operated the station, "based on the authority vested in him by a Brazilian man, who is authorized to operate the radio equipment using the frequency 296.550 MHz in Brazil." The frequency, he stated, was one, "[I] knew to be an authorized Brazilian frequency for satellite communications and that [I] was operating on that frequency in compliance with a Brazilian permit..." He also stated that the Brazilian man gave him the radio as a gift.

In the Forfeiture Order (FO) the FCC notes, "We also remain unconvinced that Barbosa did not knowingly violate the Commission's rules, especially given his status as an Amateur Extra Class licensee, the highest amateur license class. Based on the examination process involved in pursuing an amateur license, amateur licensees are expected to have an understanding of radio operations and pertinent FCC regulations."

According to Larry Van Horn N5FPW, *MT*'s Military Satellite Communications specialist, 296.550 is the input frequency for a well-known military satellite, FLTSAT Charlie Navy Fleet Relay (25 kHz) Channel 04, with a downlink at 255.550 MHz. Van Horn notes that the transponder is often used by unauthorized stations from South America, particularly from Brazil, for personal communications.

In the December 12, 2012 FO, the FCC agreed to reduce the fine to $16,000 based the Barbosa's "overall compliance with Commission rules." According to the FCC Universal Licensing System data, his license expired in 2008 and the renewal is still pending.

How Not to Move a Tower

According to an article in the Austin (Minnesota) *Daily Herald*, a 24 year-old man from Iowa was living a nightmare when he was charged with 22 counts, including exceeding load size, unsafe equipment, inoperable lights, no driver's license and proof of insurance on hand, reckless driving and public nuisance, while trying to haul "a very large radio tower" that blocked the entire road and interfered with power lines. After things got sorted out, the man was charged only with public nuisance and reckless driving, the rest of the charges having been dropped.

Free-to-Air Satellite Reception made Easy

By Mario Filippi N2HUN
(All photos courtesy of the author)

A few years back, while attending the Winter SWL-Fest in Kulpsville, Pennsylvania, I happened upon a gentleman who was demonstrating a basic, stationary Free-to-Air (FTA) satellite system. Being an avid shortwave listener, my ears and eyes became transfixed on the fact that he was receiving a transmission from Africa. It was some type of evening talk show with the host and guests speaking Portuguese and it was a defining moment for me as a xenophile: here was another avenue of not only hearing, but seeing what was going on in the world. From that point on, my goal was to install one of these FTA systems at my home. That took priority over everything including house chores, eating, shaving, work, and sleep!

Fast forward three years later, a little older and wiser, hair is a little greyer and thinner, but with an immense amount of knowledge and experience now under my belt. I speak with total honesty when I state that it took me three months before I lassoed my first satellite. Many days and nights were spent out in the back yard turning and elevating a satellite dish before my receiver miraculously displayed my first transponder!

Looking back, and having gone it alone, there are many ideas, experiences, and gadgets that I have used in setting up and troubleshooting FTA systems. My purpose in writing this article is so that you won't have to wait three months to see your first transponder.

Know the Layout of your Land

First off, a satellite dish needs to be installed somewhere, whether it be on a deck, roof, back/front yard, balcony, vehicle, or mounted on the wall of a building. Satellites are out there at different elevations in the southern sky, from east to west. It sure would be nice if we could see them, but being nearly 23,000 miles away makes it a little difficult. Suffice it to say that you want to place your dish where it has a reasonably clear shot of the satellite(s) you want to see. Now, don't start cutting down every tree and demolishing every building on your property in the name of FTA. No need to sell the house and move away, no need to move to an apartment a few floors above; you just have to move the dish to different areas of the property until you find that spot where it works for you. Patience and experimentation are necessary.

At my location over the past three years I've set up dishes at dozens of different locations in pursuit of FTA nirvana. Some spots worked well, some not. Some spots I could receive satellites from 15º W all the way to 129º W, while just a few feet away or back, it was a different ball game. Since my goal was to set up a motorized system and get as many satellites as possible with one dish, this underscored the need to find the "sweet spot" on the property. Satellite dishes, unlike other antennas, don't need to be installed high above ground in most cases. If you have a reasonably clear view of the sky then ground-level mounting is the best. It's convenient to get to, it's safer than climbing to the roof and it's less affected by stormy weather that could knock the dish out of alignment.

Time to do the Dishes

My first FTA system was purchased as a package deal from an Internet distributor. Buying my first system was pretty much a shot in the dark as I had no experience whatsoever. What I got was an LNBF (device that mounts on the dish and amplifies the weak satellite signal, and switches channel polarity), a receiver (turns the amplified satellite signal into video and/or audio), a motor (drives the dish to an assigned location in the sky where you've found a satellite), a 30 inch dish, mounting bracket, DiSEqC switch (lets you electronically switch between up to four separate dishes or LNBFs) and a complimentary free compass. Oh, the compass lasted about 30 minutes in the blazing sun. It heated up and warped, rendering it useless.

The 30 inch dish worked well at first but of course, thinking like a ham, the idea that bigger is better, a 36 inch dish was purchased as a replacement. After using that one for a year or so, a 39 inch dish was purchased in the hopes of finding even more weak stations. Well, after having tried three different sized dishes I came to the conclusion that the original 30-incher was sufficient for my needs. It receives the same number of stations and satellites as the bigger ones, with the added advantage that it's much lighter and easier to adjust.

The 36 inch dish in the center of the picture is an experimental stationary dish mounted with three universal LNBs. The multi-LNB bracket was purchased from an EBay vendor at a very reasonable price and was used for satellites spaced four or more degrees apart, e.g. 83º W, 87º W, and 93º W. For satellites at two degrees apart I ran into problems as the LNB housings were too wide to aim properly. After several months of experimentation and use, the multi-LNB bracket worked very satisfactorily and was a great learning experience. A multiple port DiSEqC switch was mounted on the back of the dish to allow one coax feed to the house to switch among the satellites. One must also take in consideration the added weight of multiple LNBs and possibly rig up some type stabilizing bars for the main LNB arm of the dish to prevent sag.

Anchoring the Dish

There are several ways to mount a small dish. First make sure the mount is plumb, especially if you are going with a motorized system. My favorite leveling device is the old-school type readily available in big-box stores. It's cheap and has level indicators at ninety degree angles.

My favorite semi-permanent dish mount is made with a wood pallet, found as a roadside freebie. Anchored down with bricks, it's an easy-up installation and makes use of the standard mount that usually is supplied with a dish. Be sure to make use of the angled side arms to keep the main mount secure and use shims to level the pallet. For stationary dishes this is a great mount, and I've used it also with motorized systems. Just remember that wood can warp and could cause slight shifts that affect motorized systems.

A permanent mount at my QTH is a length of pipe sunk into the ground and anchored with ready-mixed concrete. This mount, when properly installed, keeps the dish level and secure. To keep the pipe from twisting, drill a hole at the bottom end of the pipe and insert a large nail before anchoring it in the cement. Another little trick is to place a water hose clamp on the mast just below the satellite dish clamp; this keeps the dish bracket from sliding down the pipe when you are adjusting it.

Once the dish is installed on the mounting pipe the next step is to find where south is. Compasses come in a variety of shapes, sizes, and price ranges. It would be nice if someone manufactured a huge compass, I'd say one a least a foot in diameter, with a nice, big needle. That way you could easily see the needle from a few feet away. Well, I made one using a cheap compass and a scrap fence picket that accomplishes the same thing. Just turn the picket until the compass reads south, then place it on the ground and you have a nice, very noticeable point of reference. Remember to keep the compass away from metal (including the dish) otherwise you'll get an inaccurate reading. If you want a compass capable of determining both true and magnetic south then invest in an electronic compass. Just like the liquid compass, this one needs to be away from metal objects when taking measurements.

So now you have the dish pointing south and you're ready to aim at a satellite. Well, just

hold on a moment. Always have on hand small magnets, tape and a marking pen. These come in handy to mark your southern reference on the mounting pole. Make a mark on the mounting pole and on the dish bracket to keep track of your starting point. This way, if you veer too far off with your adjustments you can always come back to where you started.

Satellite meters cheap and expensive.

A compass alone will not tell you where a satellite is so invest in a decent satellite finder. Satellite finders (a.k.a. satellite meters) come in all shapes and sizes and in prices from a few dollars to upwards of a thousand. Get one that uses both visual and audio indicators, such as the Radio Shack Model 16-594. It has an analog meter to guide you towards a satellite, and a tone generator that increases in pitch as you home in. Take it from me, when you are adjusting a dish your eyes will be on the dish, not the meter so hearing an audio signal is important.

The best way to positively identify a satellite and adjust for the best signal quality is to actually view the FTA transmission on a TV screen. In my case I use a Satlink WS-6906 which is basically a hand held FTA satellite receiver having audio/visual indicators of signal quality and the ability to display FTA radio and TV transmissions.

Pig tails are short lengths of cable with connectors on both ends that come in handy for attaching meters, LNBs, receivers, and other interconnected components. Have several of these on hand, ranging from a foot to a few feet long. You'll need them when setting up a dish and performing troubleshooting. Over the years I have made dozens ranging from six inches to about three feet.

Invest in a good coax cutter, stripper, and attachment tool, you'll save time and money by trimming coax on your own. For outside use I recommend exterior grade, weatherproof compression F connectors. There are times when you have to interconnect lengths of coax so female-to-female (barrel) connectors are a must. And, get a hold of some quick-connect adaptors.

Last fall, after a long day's work, I tumbled into my easy chair for an evening's entertainment. Looking forward to maneuvering around the Clarke Belt with my motorized Ku-band FTA system, I switched on my FTA receiver to see what was on satellite TV. "No Signal," was displayed on the TV. Okay, let's turn the motor to another bird, SES 1 at 101W, that's a sure bet. Again, "No Signal." This situation had presented itself several times in the past few months. In each case, my Horizon to Horizon (H-H) motor decided to get stuck in one position and would not respond to any of the receiver's commands. I would don a heavy coat, flashlight in hand, tools

C-BAND RECEPTION ON A KU-BAND DISH

A lot of anecdotal evidence exists regarding C-band reception using small (1.2, 1.0 meter, 90 cm) dishes. Most would agree that a dish of six feet (1.8 meters) or eight feet (2.4 meters) is the minimum size necessary for reliable reception. I examined the usefulness of a small (90 cm) Ku-band offset dish for C-band reception in order to see what such a small dish was capable of doing. It was undertaken purely in the pursuit of knowledge and for curiosity's sake.

Currently I use a 90 cm dish for Ku-band FTA reception for satellites from 30º W to 121º W. For this experiment I will be retrofitting the dish for dual C and Ku-band reception. This WS International dish was purchased a few years ago and is an offset dish with an oval shape measuring 39 inches high by 36 inches wide. It is outfitted with a Chaparral universal LNB and turned by a Sadoun PowerTech DG-280 H-H motor. This system has been in use for a few years with excellent results.

C Ku-band LNBF on Ku-band dish

Two items had to be purchased to experiment with C-band reception while at the same time maintaining Ku-band reception capability. In this case, a DMS International BSC621-2D C/ Ku-band LNBF was purchased from Hypermegasat along with an optional kit consisting of a conical scalar ring and LNB mounting bracket. Hypermegasat is a great outfit to deal with and they stocked exactly what was needed. They even included a free 2 x 1 DiSEqC switch with the LNB!

The old Ku-only LNB was removed from the existing setup and the BSC621-2D was attached. Next, the conical scalar ring adaptor was attached with the three included thumbscrews. With the LNBF attached, the next step was to connect it to the DiSEqC switch so that band switching from the C and Ku-band could be done with my FTA receiver. The changeover to the new LNBF was a piece of cake, requiring about 15 minutes to complete. All connections were then checked for tightness and weatherproof boots were put on all exposed connections to prevent corrosion.

Being that a new LNBF was installed, the first item on the agenda was to optimize the system for Ku satellite reception. An FTA receiver, signal meter, and TV were connected and the dish rotated to my southernmost satellite at 72º W. Only a slight adjustment of the elevation angle was needed to optimize the signal quality. Next, scans of Ku satellites from 30º W to 121º W confirmed correct tracking of the Clark Belt.

Not quite enough signal causes pixilation of video.

Next, I programmed my FTA receiver for C-band satellites ranging from 31.5º W to 121º W and scanned the transponders for linear signals. Initially, transponders on Galaxy 17 (91º W), Galaxy 16 (99º W), and Intelsat 805 (55.5º W) were detected and consisted of both radio and TV broadcasts. Success! Happy Days! My first C-band signals on a small dish!

Remember, there were many strikes against us since the dish is grossly undersized for C-band, so it was no surprise that pixilation was a problem. This indicated that some fine adjustment of the LNBF was needed so I went back to the dish for more adjustments!

Proper adjustment of the LNBF for C-band takes a steady hand and patience. Rotating the LNBF ever so slightly, followed by slow turning of the conical scalar ring while monitoring the signal quality with an FTA receiver is the best approach. I used Galaxy 17 at 91º W to adjust for best signal quality, since this was the strongest signal of all from the very beginning.

A total of five C-band satellites were received, with 55.5º W, 91º W, 99º W and 107.3º W being the most reliably received. However, the transmissions received were probably from the strongest transponders, since many more FTA stations are available on these birds and thus the need for a bigger dish! In total about 40 TV channels were received, not counting the sporadic feeds on 72º W. There are many radio channels available in addition, but my emphasis was not on these.

Galaxy 16 at 99º W carries several Caribbean stations such as WVGN along with some stateside stations such as World Harvest Television and KWHS via LeSea Broadcasting. Vintage sitcoms can be found on some of the LeSea channels.

EWTN (Eternal World Television Network) has about 18 stations on Galaxy 17 at 99º W, in English, Spanish, and German. This religious network has lots of interesting programming from around the world.

Further to the east in the orbital slot is Intelsat 805 at 55.5º W, which carries a few channels that are familiar to Ku-band aficionados such as Vietnam TV 4, Thai Global Network, Myanmar TV and sometimes Meio Norte Sat from Brazil. If my dish was about four times as large there would surely be lots more to see on this bird!

in pocket, trudge out to dish, press "reset" on the motor, check all the coax connections, press the east and west buttons, reset the motor to "0," and as a last resort, open up the motor case to see if there was any obvious mechanical or electronic problem. Then back into the house, check all the parameters on my FTA receiver to make sure nothing had changed, check all connections to the receiver, and as a last ditch effort, restore the receiver to default settings.

Murphy's Law ensured that these motor malfunctions *only* occurred after dark and no earlier than 10 pm. Never on a nice spring or summer day, never during daylight when I could actually see what I was doing. My reservoir of patience was almost sucked dry with this particular motor after several late-night malfunctions. Finally, the jury was in: my Horizon-to-Horizon (H-H) motor had given up the ghost. It would not budge under any circumstances. After two years of service its days of dish-turning were done. Rest in peace, old friend.

H-H motors are produced by a variety of manufacturers and, for the most part, are purchased on-line, since bricks-and-mortar satellite shops are as scarce as hen's teeth today. Motors are generally purchased as part of a package deal: a dish, receiver, LNBF and motor. Or, they are purchased when one decides to upgrade from a stationary setup. The assumption is that all components will work together in harmony.

FTA satellite equipment vendors are a responsible group of business people so when you purchase a motorized package the individual components (dish, LNBF, motor, receiver) usually work together pretty well. However, when components break or become obsolete and you begin mixing different receivers with different motors, this is where the challenges begin. Some basic knowledge about motor-receiver interaction comes in handy.

An H-H motor is controlled by the satellite receiver, sometimes referred to as a Set Top Box (STB). The STB contains software that directs the motor, and thusly the dish to a specific satellite of interest. In the world of Ku-band FTA, there are well over thirty C and Ku-band satellites ranging from 15º W to 125º W that most locations in the U.S. can see. The motor and receiver must work together to accurately aim the dish at each of these different satellites. In it's lifespan that motor is turned thousands of times to the east and west in rain, snow, hail, sun, cold, and hot weather. That is a lot of responsibility for one relatively inexpensive component to handle. Just think: it has to consistently assist in hitting a target located nearly 23,000 miles away!

How does the motor know where to move (east or west) and where to stop? How does it know that Galaxy 19 (97º W) is at one specific spot in the sky? Well, the motor alone does not have the capability to accurately point a satellite dish consistently and reliably. It needs a partner, a helping hand, and that is where the receiver comes into play.

Earlier I mentioned receiver software. When one purchases an FTA receiver, it usually comes with the appropriate software needed to give the motor its marching orders. The two current industry standards are USALS® (Universal Satellite Automatic Location System, and DiSEqC® (Digital Satellite Equipment Control). While both have the capability to accurately control a motor, there are differences between the two. I have used both software types with great success so it is a matter of personal preference, but for this article I am using USALS since it is generally what most fledgling FTA hobbyists use initially.

When purchasing a receiver and/or a motor, make sure both have compatible software so they can communicate with each other. Do your homework ahead of time, go on the Internet to the satellite vendor's site and read the specifications for the motor and receiver to make sure they'll be compatible.

After shopping around the 'Net, I decided on the Stab HH90**.** Weighing in at around two pounds, it is one of the lightest, smallest motors I have used. The plan was to pair it with my current USALS compatible receiver for reception of satellites from 30º W to 125º W. The fact that both the motor and receiver were USALS and DiSEqC compatible was important for this project and would ensure success in hitting all the birds consistently and accurately. The ultimate goal was to use this motor to replace the old one that got stuck.

Bench-Testing the New H-H Motor

I wanted to put the new motor through a test run prior to installing it outside so in the warmth and brightness of my shack the motor and receiver were connected. A FortecStar Dynamic receiver was attached to the H-H motor and an Accurian 7 inch LCD TV was connected via an A/V cable.

Next, the receiver was programmed for satellites at 30º W, 72º W, 97º W and 125º W as these are my favorites. It is necessary to input your longitude and latitude when using USALS because these will affect your motor movement. For each satellite I programmed, the motor position was recorded.

When the motor was activated by the receiver for Hispasat 1C/1D (30º W) notice that the H-H motor moved to a position of 50 degrees anti-(counter) clockwise. That is the position the motor should consistently stop at for my geographic coordinates which are 74.8º W and 40.4º N. For AMC 6 at 72º W, my closest southern satellite, the motor moved to 2 degrees counterclockwise. For AMC 21 at 125º W, the motor moves all the way to 55 degrees clockwise. The motor position for Galaxy 19 at 97º W is 25 degrees clockwise.

Bench-testing dish mover.

So for every satellite you program into the STB, it will direct the motor to a specific position on the degree scale. If you have programmed in 20 different satellites then there will be 20 different degree positions the motor will move to. These motor degree positions are important to document as they should remain consistent for your site.

If for some reason your motor malfunctions and consequently moves slightly off position then you may experience problems with reception. Even one-half of a degree can result in significant signal degradation. That's why I document my motor degree scale readings for every satellite of interest as this information comes in handy when troubleshooting.

Say, for example, one day you are getting a "No Signal" for AMC 21 (125º W). One of the things you'd want to ascertain is whether your motor is stopping at the correct degree setting. In my case, for AMC 21 the motor pointer should be at 55 degrees clockwise. If that is the case, then the motor is probably not at fault and there are other issues to investigate such as dish angle, azimuth, and motor angle.

After spending a few days testing the motor in the shack I was confident it was ready to install outside. A mount was bolted to a wooden pallet that was weighted down with bricks and plumbed so it was level. The motor was installed on the mount and adjusted to the correct motor angle which in my case was 40.4 degrees. Next a 30 inch dish was attached along with a universal LNB.

Using the owner's manual as a guide, the system was aimed at my closest southern satellite; for my location it's AMC 6 (72º W). I adjusted for maximum signal quality, and then checked the signal quality for the other satellites of interest which included Hispasat 1C/1D (30º W), Galaxy 19 (97º W), and AMC 21 (125º W). As usual, it took several readjustments of the dish angle and azimuth to get all four satellite signals optimized.

It's important for FTA enthusiasts to get to know your motor better. Test it out in the comfort and convenience of your shack before installing it outside. Attached it to the receiver, program in several satellites, and see how it turns and where it turns. Try it at the extreme ends of the range, e.g. for satellites from 15º W to 139º W. One interesting observation seen over and over again is that I've yet to find a motor/receiver combo that will turn to 15º W (Telstar 12). For this I needed to use DiSEqC.

Make sure the motor turns consistently and accurately for each of the satellites. And write down, or take a digital photo of the motor pointer positions as this information will be helpful when problems occur.

You might even try inputting different latitudes and longitudes into the receiver and observe how the motor is affected.

And please take the time to read the motor operating manual. All motors are not the same; they all have different operating characteristics. Well, I've made much ado about motors, so now let me sink into my easy chair, aim the dish towards Hispasat with a touch of the remote button and travel over to Havana, Cuba to see what's up. Adios!

Tuning in to International Broadcasts via Satellite

By Ken Reitz KS4ZR

The era of satellite television began with the first international television relay between Europe and the U.S. in July 1962 over Telstar 1. International broadcasters have used satellites to relay programming to terrestrially-based transmitters for decades. Over the last twenty years international broadcasters have partnered with cable-TV and broadcast TV to provide direct broadcasts to the U.S. Even during the last five years, while abandoning the shortwave bands in favor of Internet streaming, these broadcasters have maintained their satellite links.

The only thing that's changed over the last two decades is the mode of transmission. Originally, all video and audio programming was transmitted in analog format. Today it's all digital, mostly the internationally established Digital Video Broadcast (DVB) standard and many such channels are not encrypted.

The advantage of the format switch was an increase in transponder capacity and improved audio and video quality. While most satellite programming transmits Standard Definition (SD) video, some channels are opting for High Definition (HD) transmissions. But doing so ups the cost considerably because, as we've all learned, HD requires many times the bandwidth of SD, making SD broadcasting considerably cheaper than HD broadcasting; an important distinction for international broadcasters.

Satellite receiver manufacturers have kept up with the technical changes. Low cost digital satellite receivers have been available to consumers for over 15 years and, like all electronic devices, have steadily declined in price while increasing in capability. Many receivers now are under $100 with complete receiving setups (dish, LNBF, receiver and, in some cases, even the cables) sometimes found under $200 (see resources list).

Until recently there were few capable HD FTA receivers on the market. That changed with the introduction of the Manhattan RS1933 FTA HD receiver (see review in *Beginner's Corner* pages 30-31 *MT* January 2012). It's ability to receive both SD and HD FTA formats in addition to its low price ($200) has made this a must-have for satellite TV hobbyists. Only HD-capable receivers can tune in and properly display HD FTA broadcasts. When tuned on an SD receiver, the screen will be blank. Some SD receivers will lock up when tuned to an HD channel and have to be re-booted.

The list of international broadcasters, while certainly enough to make FTA satellite viewing/listening an interesting hobby on its own, is just the beginning. Also found among the C and Ku-band satellites are NASA-HD, PBS-HD, CBC-HD, CTV, dozens of local video and radio channels from Mexico, Dominican Republic, Jamaica, Central America, U.S. network programming, vintage TV programming, religious as well as political programming from the right and left perspectives, and commercial-free continuous music format channels. It's hard to imagine why anyone is still hooked up to cable or pay satellite-TV.

Even though Ku-band satellite viewing is cheap and a number of C-band channels can be received on dishes under 10 feet in diameter, results as described in the list of C-band broadcasters above will realistically take a 10 foot dish to accomplish. One of the few retailers still selling 10 foot mesh dishes is Skyvision which carries 6, 8.5 and 10 foot C/Ku-band dishes. They're expensive, ranging from $300 to $1,300. However, there are still thousands of "orphan" big dishes still sitting in America's backyards, I see them all the time. Most owners haven't bothered to dismantle them and would be happy to have someone take them off their hands. Check your neighboring towns and countryside for such dishes and make an offer. You may get one for free and start a whole new monitoring career!

One of the most common questions from consumers is, "Can I convert my DISH Network (DN) or DirecTV (DTV) dish to receive FTA broadcasts?" The short answer is that it's not worth it. Many DN or DTV dishes are too small to adequately receive FTA satellite signals. That's due mostly to the fact that DTH satellites are very powerful, typically ten times the power of domestic broadcast satellites. Secondly, you'll have to replace the DTH LBNF because DTH satellites transmit in different portion of the Ku-band, so you can't just hook up a DTH dish pointed at a broadcast satellite to an FTA receiver. By the time you replace the dish and LNBF you would be better off buying an FTA complete system.

Your Right to See and Hear

In the past there has been an element of unscrupulous activity around FTA satellite (basically, crooks figured out how to hack FTA receivers so that they could receive pay-satellite programming such as DirecTV or DISH Network without paying) but the Department of Justice and the satellite TV industry has done a great job of jailing the culprits. FTA satellite remains an important connection for millions of ethnic Americans, immigrants and foreign visitors who appreciate being able to watch their home-country news and hear their favourite radio stations in their native tongue. And, it lets the rest of us enjoy TV and radio programming from around the world in real-time, something most cable and satellite TV companies won't waste their precious bandwidth on unless of course there's extra money to be made.

Participating in the FTA hobby is not only inexpensive and something you can actually set up yourself, but it's legal for you to do no matter where you live. The FCC has even created a pre-emption for doing so. You can find out all you need to know about your rights to install an FTA satellite system here: **www.fcc.gov/guides/over-air-reception-devices-rule.**

Here are the salient parts:

"The rule (47 C.F.R. Section 1.4000) has been in effect since October 1996, and it prohibits restrictions that impair the installation, maintenance or use of antennas used to receive video programming. *The rule applies to video antennas including direct-to-home satellite dishes that are less than one meter (39.37") in diameter (or of any size in Alaska), TV antennas, and wireless cable antennas.* The rule prohibits most restrictions that: (1) unreasonably delay or prevent installation, maintenance or use; (2) unreasonably increase the cost of installation, maintenance or use; or (3) preclude reception of an acceptable quality signal.

"Effective January 22, 1999, the Commission amended the rule so that it also applies to rental property where the renter has an exclusive use area, such as a balcony or patio.

"On October 25, 2000, the Commission further amended the rule so that it applies to customer-end antennas that receive and transmit fixed wireless signals. This amendment became effective on May 25, 2001." Emphasis added is the author's.

No matter where you live, the FCC wants to make sure you have access to the programming that you want. Condo, apartment, townhouse apartment or gated community, you can set up a dish and enjoy FTA satellite anywhere. What are you waiting for?

Intelsat 805 55.5° W
Caribbean Super Station Radio Barbados (English)
BBC World Service Radio (English, Spanish, Portuguese and Arabic)

Intelsat 21 58° W
Deutsche Welle HD TV (German)
Deutsche Welle Radio 2 (English)
NHK World HD TV (English/Japanese)
NHK Radio Japan (Japanese)
Al Jazeera HD TV (English)
France 24-HD TV (English)
Russia Today HD TV (Spanish)
CCTV4 SD (Chinese)
CCTV News SD (English)
CCTV9 Documentary SD (English)
China Radio International SD (English, Spanish, French)
YTN World SD (Korean)
Thai Global TV SD (Thai)
RAI Radio Service SD (Italian)

SES-3 103° W
Antenna 1 SD TV (Greek)
Deutsche Welle SD TV (English/German)
Deutsche Welle Radio (English/German)

Galaxy 23 121° W
France 24 HD (English)
Russia Today-SD (Spanish)
RNE Radio (Spanish)
RNE Radio 1 (Spanish)
RNE Radio 3 (Spanish)
RNE Radio 5 (Spanish)
RNE Radio Classica (Spanish)

International Broadcasters on Ku-band
Galaxy 19 97° W
Kazakh SD TV Kazakhstan (Kazakh/Russian)
Vatican Radio (Italian)
MRTV3 SD TV Myanmar (English)
VTV4 SD TV Vietnam (Vietnamese)
RTPI SD TV Portugal (Portuguese)
ORTM SD TV Mali (French)
Russia Today SD TV (English)
Voice of Russia Radio (English/Russian)
MKTV SD TV Thailand (Thai)
Al Jazeera SD TV (English)
TeleSur SD TV Venezuela (Spanish)
Radio France Internationale (French)
RFI Afrique (French)
Press TV SD TV Iran (English)
World Radio Network 1 (English)
Plus many African and Mideastern countries

FTA Satellite Resources

There are many FTA satellite retailers here a just a few:
Galaxy Marketing 888-333-5560
www.galaxy-marketing.com
Global Communications (carries Manhattan RS1933 HD receiver) 608-546-2523 **www.global-cm.net**
HyperMegaSat.com 810-744-1488
www.hypermegasat.com
Impakt Products 800-864-4046
www.impaktproducts.com
Sadoun Satellite Sales 888-527-9888
www.sadoun.com
Skyvision (carries Manhattan RS1933 HD receiver) 800-500-9275 **www.skyvision.com**
Most reliable transponder list:
www.global-cm.net/mpeg2central.html
FTA Forums:
www.legalfreetoair.com requires login
www.satforums.com allows guest login
www.satelliteguys.us requires login

The Low-down on Low-band Antennas

By Bob Grove W8JHD

First, let's look at what I call the "longwire conundrum." Many hobbyists simply assume that a longwire antenna is an arbitrary, oblique reference to a wire antenna that stretches a good length. In fact, even a wire a few inches in length can be a longwire antenna if the frequency is high enough.

The "long" reference is not random, but specific in terms of the wavelength at which it is operating. If the length is greater than a full electrical wavelength at its operating frequency, then it's a longwire. Thus, a 136 foot wire is a longwire on 10 meters, but a short wire on 80 meters!

The pattern of a longwire (or any antenna for that matter) is identical for transmitting and receiving. The lower the frequency for any given wire antenna, the more its pattern favors a right angle to the axis of the wire. The higher the frequency, the more the main lobes begin to migrate toward the ends of the wire.

The pattern doesn't effectively change depending on how it's fed; center fed, off-center fed, or end fed, it's the same.

The presence of earth below a horizontal antenna causes signal reflections which alter that pattern. The lower the frequency, the higher the antenna must be erected to avoid those pattern-distorting reflections. Too close to the ground and the main lobes extend above the wire (great for working overhead airplanes) not off to the sides where we want them to reach into the horizon. Ground reflections become worse the closer the antenna comes under one-half wavelength in elevation.

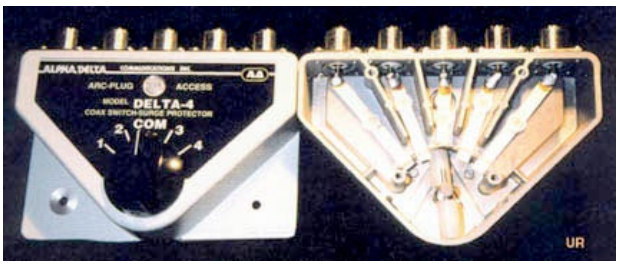
Any horizontal wire at a fixed elevation above ground behaves better the higher the frequency at which it is operating, since the electrical wavelength becomes shorter and shorter.

The half-wave dipole in free space is the standard of comparison for antenna gain figures. If a multi-element antenna is specified to provide 6 dBd gain, that means it will transmit and receive a signal that is one S-unit stronger than would be delivered or received from the sides of a half-wave dipole.

Big Antennas for Small Lots

The straight wire is the simplest of all antennas, but there are times when we need superior performance and don't have room for a long wire. What are the options? There are many.

Several antenna manufacturers offer vertical antennas, many with multiband performance for both transmitting and receiving. These are omnidirectional so you don't have to worry about rotating them.



Delta 4-way antenna switch ($57), inside and out. (Courtesy: Universal Radio)

Most verticals are made to operate along with a good ground plane, usually wires radiating as spokes from its base. There are some verticals, however, that have their own "counterpoises," or artificial electrical grounds, making the ground plane unnecessary.

Rotatable beam antennas are readily available for frequencies above 14 MHz (20 meters). Such antennas require a husky tower and rotator, and these aren't cheap. You can gang more than one on a tower, however, so the total frequency range can be considerable, often extended well into the VHF/UHF range.

On the high frequency (HF "shortwave") bands, beams are almost always horizontally polarized. This is because distant (DX) signals are distorted into mixed polarization so that a matching antenna is not necessary.

On the VHF/UHF bands, most communications are done with mobile and portable equipment which nearly always employs vertically mounted whips, and since the signals haven't bounced around over considerable distances, the polarity remains relatively constant. Thus, the elements of a base beam for VHF/UHF are suspended in a vertical orientation.

Wire Antenna Directivity

While at VHF and UHF frequencies we can easily add elements to improve directivity, at lower frequencies (longer wavelengths), it's a bit awkward. The same rules apply, but the required real estate generally forbids such an array of wires. A case in point is the Wullenweber array, affectionately called the "elephant cage" for its huge dimensions. This giant contraption is obsolescent, but has had quite a military history listening for enemy communications.

A single wire can be made quite directional as evidenced by the Beverage antenna. Working especially well in the lower shortwave bands, this horizontal receiving antenna is at least one wavelength long, mounted typically ten feet above the ground, and terminated with a 470 ohm carbon resistor to ground. Its favored direction is off the far (terminated) end.

Of course such an antenna is directional, and if you want to shift its direction, you're out of luck; moving a wire hundreds of feet long on a whim is not too practical. So how about an array of such antennas – if you have the room?

Directional "low band" antennas aren't razor sharp. You could put up one for each cardinal point of the compass. These four coaxial lines can be led into your radio room and connected to a four-way antenna switch ($75-$85). Now you're in business!

Some hobbyists do the same thing with two dipoles at right angles to one another. Since horizontal dipoles are bidirectional, you can select the best performance with a two-way switch ($30-$57). Two and four pole antenna switches are readily available from *MT* advertisers.

MFJ six position antenna switch ($65). (Courtesy: Universal Radio)

Buried wire antennas

It is probably intuitively obvious to most hobbyists that if the ground is a loss factor in signal propagation, then burying an antenna might not be a good idea. In fact, while definitely not a good idea for transmitting due to signal absorption by moisture and minerals, reception can be quite good below a few megahertz. Electrical noise interference is frequently less as well since most of it is at nearby, elevated locations.

From ELF up through 3-4 MHz, a 100-200 foot wire buried 3-4 inches deep and end-fed by coax cable makes a dandy receiving antenna, and it's certainly not conspicuous!

Loops

Folding a wire or a copper or aluminum pipe into a circle or square reduces the dimensional length that a wire antenna would take up. Does this smaller aperture mean poorer reception or transmission? Not by a long shot.

C. Crane twin-coil ferrite loop antenna ($100). (Courtesy: C. Crane)

Another benefit is its ability to be rotated to favor various directions.

By tuning the impedance with a suitable transmatch for transmitting, such a loop can be used over a wide frequency range. Even without the tuner, reception will be good over the same range.

Small loops are often used indoors for shortwave and longwave reception. For the high frequencies, the architecture is always an open loop, but at lower frequencies – AM broadcast and below – ferrite rods are frequently called into play with fine "Litz" wire coiled around them.

But you are still indoors with these, and they are subject to the same limitations as any other indoor antenna; electrical interference and low signal strengths because attenuation from walls and wiring can be a problem. Since the loop can be repositioned as well as rotated, these effects can be minimized.

Attaching random-wire antennas

Can simply throwing a length of wire over a tree branch and attaching it to a receiver improve reception? This is one of those questions that can't be answered without asking more questions. What antenna are you using now? What kind of receiver do you have? What frequency range is of primary interest?

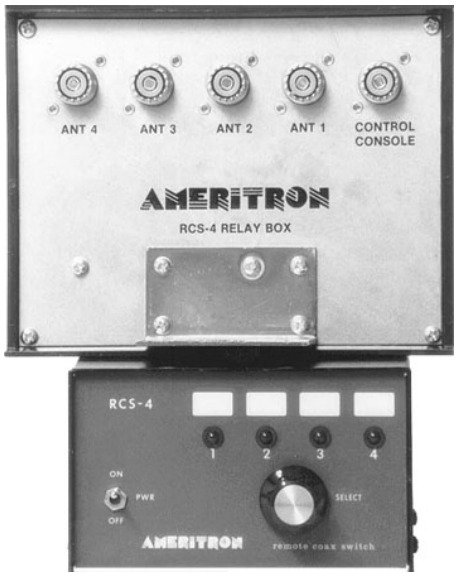
If you are listening in a basement apartment with an indoor antenna on a $49 portable, nearly anything will help. The rapid fluctuation of signal quality you experience when you move the portable around is a good indicator of the capriciousness of indoor antenna reception.

A 25 foot length of wire suspended from a tree branch, attached at the end to the center conductor of a length of coax will work as well as nearly any other shortwave antenna you can build or buy for general purpose listening. It makes no difference whether the wire is solid or stranded, insulated or bare, thick or thin, copper or gold, the signal capture will be the same.

But can you simply attach the center wire of that cable to the whip on a multiband portable, or even plug it into that radio's external antenna port? Shortwave portables are notorious for their poor dynamic range, the ability to treat weak and strong signals equally without overloading their signal level capacity. Overly-strong signals cause the radio's circuitry to develop "spurs," spurious signals throughout its tuning range, which aren't really there.

With a good receiver, however, any outdoor antenna will work better than a comparable indoor antenna. Outdoors, they are free and clear of signal obstructions like metal siding, metalized Mylar insulation, electrical wiring, and plumbing. They are also removed from electrical interference generated by modern household electronics.

Generally speaking, the higher the frequency being received, the less electrical interference you will experience. By the time you move up into the VHF/UHF region, electrical interference is rarely a problem. That's why



Ameritron 4 position remote antenna switch ($150) uses one coax cable to remotely switch four different antennas. (Courtesy: Universal Radio)

scanner listeners rarely suffer from that source of interference.

But there's another reason. Nearly all electrical interference you hear buzzing from your speaker is amplitude modulated, and except for aircraft monitoring, scanner signals are all frequency modulated (FM) which is relatively immune to the raucous sound.

If strong-signal overload is a problem, a variable attenuator available from electronics outlets and online sources (**http://www.grove-ent.com/varatt.html**) can be continuously adjusted from low to high levels to suit your application.

And, Speaking of Receivers

Receiver quality is almost in direct proportion to its cost. Over the years, name-brand desktop receivers from Drake, ICOM, AOR, Radio Shack, JRC, Yaesu, Kenwood, Hammarlund, Hallicrafters, National, Heathkit, Lafayette, Allied, and many more flooded the marketplace. Few of these remain.

At the present time, you have fewer choices. If you want the compact convenience

Want better reception from a better antenna? Get a better receiver, such as this AOR AR8600 ($990). (Courtesy: Grove Enterprises)

of a portable, are you willing to sacrifice quality of performance for it? If so, there are many models of multiband radios available from *MT* advertisers.

If you're ready to move up to a desktop receiver with vastly improved reception, these are also available from *MT* advertisers.

And how about software defined radios (SDRs)? Few aficionados will deny that SDR is the *de facto* standard for future receiver design. Currently, prominent companies in this field include WiNRADiO, Perseus, ICOM, AOR, Signal Hound, and RF Space.

Modes of reception

Growing up with radio, I knew that anytime I tuned the dial on my Philco cathedral radio I could hear voices; they were always in the amplitude modulation mode (AM). Of course Morse code was in there too, but I wasn't able to choose continuous wave (CW) to hear the dots and dashes.

A few years after the close of WWII, a new voice mode, single-sideband (SSB), appeared, requiring the acquisition of a receiver that could demodulate those signals. At the beginning, any receiver with a beat frequency oscillator (BFO), for adding a tone to those CW signals, could also tune in SSB and even frequency-shift keying (FSK), but it was much more stable to use a receiver equipped with a product detector. Now, all receivers use a product detector for SSB reception. Better yet, with a flick of the switch you can choose whether that signal is upper or lower sideband (USB or LSB).

WiNRADiO WR-G33DDC, one of a new breed of multi-band Software Defined Radios. (Courtesy: WiNRADiO)

Along with the evolution of electronic communications, digital modes have appeared, each requiring decoding techniques. Even modern receivers depend on additional software to decode those functions. Receivers also use their own digital signal processing (DSP) to refine reception formerly manipulated by simpler analog circuitry.

In a word

Next to the equipment you acquire for transmitting and receiving, nothing is more important than the choice of antenna. A well positioned outdoor antenna makes the difference between hearing only the strongest signals on a band and being able to hear and work those weak DX stations.

New Broadcast Horizons for Myanmar

By Md. Azizul Alam Al-Amin

The country known to most Western media as Burma, has been called Myanmar by its own government since 1989, when military rulers in charge officially changed the country's name. Due to the autocratic nature of that government and the awkward relationship it has had with the West, the country is still referred to as Burma in most Western press. It's just one of many things slowly changing in Myanmar. A most significant change came in a surprising move in which the Myanmar government lifted a 48 year-long media censorship in August 2012, allowing political and religious publications to go to press without passing through the censorship board.

The government also lifted blocks on some 30,000 Internet sites, giving users unrestricted access to political content for the first time. That represents a real breakthrough regarding media freedom and this dramatic change in Myanmar creates an interesting prospect for the global media industry. Now Myanmar is very much in the international spotlight as it continues to make progress toward democracy.

Myanmar is one of the poorest countries in Southeast Asia. With more than 60 million people, it is the twenty-fourth most populous country in the world. According the latest findings of the U.S. Broadcasting Board of Governors (BBG) and the Gallup organization, radio is the most used media for entertainment and news in Myanmar. In fact, domestic outlets have expanded rapidly in recent years. Weekly use of FM now stands at 47 percent of adults, thanks mostly to the success of the three year-old nationwide commercial broadcaster Shwe FM. AM/MW listening has dropped from 46 to 18 percent since the 2010-11 survey while shortwave listening held steady at 34 percent.

Radio broadcasting began in the country in 1936 with the establishment of the Burma Broadcasting Service. Regular broadcasting started ten years later in February 1946. According to Ms. Nang Calyar Win, Publisher of *Popular News Journal* of Myanmar, as of March 2012 there are only eight radio stations (one public, seven private stations), two public TV channels (MRTV and MRTV 3) and two private channels, MRTV-4, and Skynet.

Global Broadcasters Move

A conference on Media Development was held in March 2012 hosted by the Myanmar Ministry of Information and Culture along with UNESCO and in partnership with International Media Support (IMS) and Canal France International (CFI). Among the topics discussed at the conference were: Media as a Platform for Democratic Discourse; Media Legislation and Regulation; Media Pluralism and Business Sustainability; Professionalism and Capacity Building; Media Associations and Collective Responsibilities, and Media in Peace Building and National Reconciliation.

VOA's David Ensor, left, with Thein Aung, Director General of Myanmar State Radio and Television. (Courtesy: Broadcasting Board of Governors)

The aim of the conference was to examine current media developments in Myanmar and to find a path forward. The Minister for Information and Culture, Kyaw Hsan, in the opening speech of the conference, said, "This conference is a result of our media reforms taking place since 2008, the year which saw the reform of the Constitution through a referendum."

Germany's Deutsche Welle Akademie has been in close contact with media representatives in Myanmar since 2009. In 2012 the group organized several workshops in cooperation with the Asia-Pacific Institute for Broadcasting Development (AIBD) and the Friedrich Ebert Foundation (FES). Three workshops have already taken place: two on TV production and one on training media producers.

In September of last year, Forever Group of Myanmar joined Asiavision, a daily news exchange operated by the Asia-Pacific Broadcasting Union.

Broadcast giants such as BBC, VOA, NHK, among others, are expected to increase their presence in Myanmar's newly developed and emerging broadcast industry. In September of 2012 senior officials with BBC World Service met with Myanmar government officials and private broadcasters to discuss training and distribution of BBC programs. BBC is said to be interested in working with private broadcasters as well as Myanmar state broadcasters. BBC delegates also proposed providing editorial and production training to journalists and editors at state media outlets and some private organizations, including Forever Group and Sky Net. BBC World Service Director Peter Horrocks told *The Myanmar Times* "The first thing that we want to do is offer a substantial training package and to establish a project office."

With the financial support of the U.K.'s Department for International Development and other donors, BBC Media Action has initiated a package of training and development for the broadcast sector in Myanmar. "If all goes to plan, we will be offering long term support to state and commercial broadcasters to help their journalists and managers improve standards," Horrocks said.

In June 2012 VOA Director David Ensor visited Myanmar and met various Burmese officials to negotiate the establishment of a news bureau in Myanmar. Meanwhile, VOA has added more news to its Burmese language TV programming. "Our Burmese Service continues to look for new ways to offer its audience fair, balanced and cutting-edge news and information on the platforms they prefer. VOA has a significant radio and TV audience in Burma and Direct-to-Home (DTH) satellite is increasingly the way many people get their news. These upgrades to our TV program to Burma will build on our success in this important corner of the world," Ensor said.

NHK World's English language service is now available around the clock in Myanmar via the local satellite service provider Sky Net. NHK World Premium, the Japanese-language TV service geared toward Japanese people living overseas, is also available, on request from Sky Net.

In August of 2012 Singapore based MediaCorp's channel NewsAsia signed an agreement with Myanmar's Sky Net. It will air on Sky Net's channels 40 and 20 of its DTH and IPTV platforms respectively. Channel NewsAsia is also available on Forever Group's MRTV-4 international platform in Myanmar.

According to reports from Xinhua, China's official news agnecy, three Chinese state-run channels, CCTV-4 (Chinese), CCTV-News (English) and CCTV-9 (Documentary), were launched in Myanmar in October last year.

Digital Development

In November 2012 the Forever Group of Myanmar, jointly with Asia-Pacific Broadcast-

ing Union, organized a digital broadcasting conference for Asian broadcasters in Yangon, Myanmar. It addressed digital implementation, new transmitter technologies and their features related to both TV and radio broadcast technologies.

Japan's IT conglomerate NEC announced that it will be providing Myanmar Album Media Services (MAMS) with eco-friendly digital terrestrial TV broadcasting transmitters. With their installation, the MAMS transmitter will be able to provide digital broadcasting capabilities and high quality multi-channel service. At present MAMS broadcasts to 13 major cities in Myanmar.

In a press release from early December 2012, BBG announced that, "Audiences in Burma will soon have a new way to watch Voice of America television programs following a breakthrough agreement between the Broadcasting Board of Governors (BBG) and Sky Net, a regional direct-to-home satellite provider."

Under the terms of the agreement, Sky Net will carry BBG content, starting with a new VOA Asia TV channel that will provide Burmese-language news, as well as English-language education, information and entertainment programs. The line-up includes popular VOA music programs, as well as science shows and the English language news magazine program, "On Assignment," which showcases VOA reporting from around the world and lets front-line journalists share their experiences from the field. The deal was signed in Rangoon by Voice of America Director David Ensor and Daw Myint Myint Win, managing director of Shwe Than Lwin Media Co. Ltd., which operates Sky Net.

According to the BBG press release, "The leadership of BBG, RFA and VOA are committed to helping the people of Burma open up a free media during this historic time of democratic transition. On the heels of the historic visit by President Obama and Secretary of State Clinton, BBG board members and staff have been on the ground in discussions with the government officials, democracy leaders such as Aung San Suu Kyi, media companies and citizens looking to expand the free flow of information within Burma. Today's signing is another step to reach even more of the Burmese people through satellite television."

Since the BBG and Gallup's latest study showed that FM broadcasting is gaining popularity and radio continues to be the dominant source for news and information in Myanmar,

VOA signs agreement with Sky Net to distribute VOA programming to Myanmar via Direct-to-Home satellite. (Courtesy: Broadcasting Board of Governors)

Mrs. Rabida Begum listening to a Grundig YB 80 shortwave radio. (Courtesy: Author)

there is a huge prospect for international broadcasters. It seems that radio broadcasting will create a significant impact on the face of media in Myanmar. Myanmar's broadcasting industry has really opened a new horizon to the international broadcasters as well as other media.

About the Author

Md. Azizul Alam Al-Amin is a Bangladesh-based radio researcher and has been an avid shortwave hobbyist for more than two decades. He also served as a Technical/Official Monitor of some international radio stations. His international DX contributions have regularly aired on DW and Radio Veritas-Asia. His feature articles about international shortwave broadcasting have appeared in Monitoring Times and the international edition of Radio World. You may contact him at alamin@librabd.net

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NEXEDGE: Kenwood's Next Step in Digital Narrowband Technology

Although we hear a lot about the capabilities of new digital scanners there are a number of radio technologies that cannot be monitored by consumer devices. This month we take a look at one emerging standard that is currently out of reach and report on a new system that has an integrated set of diverse products.

❖ NEXEDGE

Hi Dan,

Could you add Kenwood (ICOM) NEXEDGE trunking to the "Out of Reach" list your web site? It looks like it is one of the systems that WILL NOT be supported by ANY modern hobby radio scanner. The Kenwood website at nexedge.kenwood.com/advantages.html promotes their digital narrowband radio's immunity to "casual electronic eavesdropping." It seems to be able to do analog voice as well as digital. For instance, the new F-1 racetrack in Austin, Texas is reported to be a NEXEDGE trunk system.

Jim

NEXEDGE is Kenwood's marketing term for their product line that follows a radio system specification called Next Generation Digital Narrowband (NXDN). The development of NXDN began in 2003 through a partnership between ICOM and Kenwood. The first products, conventional radios and repeaters, came on the market in 2006 and were capable of supporting both analog and digital voice. Later additions to the NXDN specification added trunking and encryption. ICOM sells their radios under the name IDAS, which stands for ICOM Digital Advanced System.

NXDN-based equipment was originally intended as a relatively low cost solution for business and industrial users, but has recently been making inroads into public safety.

❖ Voice Encoding and Decoding

NXDN uses the AMBE+2 voice encoder/decoder (vocoder) from Digital Voice Systems, Inc. DVSI is the same company that licenses the IMBE (Improved Multi-Band Excitation) vocoder used in APCO Project 25 systems.

The purpose of a vocoder is to convert analog voice into a digital form (called *encoding*) as well as convert that digital form back into understandable analog sounds (called *decoding*). The details of the digital form are specific to a particular vocoder, so the encoded output from one vocoder will not work with a different vocoder. For instance, IMBE is not directly compatible with AMBE (although DVSI has products that support both).

From a technical perspective, vocoders have two conflicting goals. First, they must accurately reproduce the sounds that they encode. Poor voice quality that is difficult to understand does not go over well with users, so it is important that the decoded output of a vocoder sound good, or at least be intelligible under most conditions. The second goal is to be efficient in the way the sound is represented. Because there are limits to the amount of digital information a radio channel can carry, the fewer binary digits ("bits") a vocoder produces to represent a given segment of audio, the better.

Unfortunately for vocoder designers, better voice fidelity generally requires more bits, so there is a tradeoff between sound quality and the number of bits needed to represent that sound.

Vocoders typically divide up analog sounds into brief snippets and encode each snippet into individual sequences of bits. Each of these sequences usually contains the same number of bits, so an analog conversation will result in a steady stream of bits coming out of the vocoder at a constant rate. This *data rate* is the limiting factor for digital radios.

Relative to most digital audio systems, vocoders like IMBE and AMBE produce bits at a very low rate. This is good for transmitting over narrow radio channels but not so good for audio quality relative to other technologies.

Audio Technology	Thousands of Bits per Second
Compact Disc (CD)	1,411
Common audio MP3 file	192
Landline telephone	64
GSM cellular telephone	13
IMBE	4.4
AMBE	3.6

❖ Multiple Access

As you might recall from previous *Scanning Report* columns, the Federal Communications Commission (FCC) now requires most public safety, business, industrial and similar users to operate within what are called "narrowband" channels that are 12.5 kHz wide rather than the "standard" 25 kHz channel. Technical innovations now allow effective communications in these narrowband channels, making it possible to fit more users into the same amount of space. The requirement is intended to make more channels available for potential users, easing the spectrum shortage that has limited or shut out some of these users in the past. Although the requirement just went into effect in January, the FCC has already indicated they will eventually force users to move to yet more narrow channels, specifically 6.25 kHz wide. A forward-looking radio technology will have the means of meeting this future requirement.

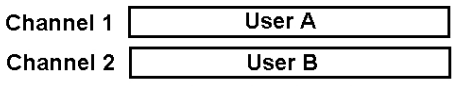
❖ Frequency Division

A common problem with radio channels is how to share them efficiently among more than one user. The oldest and most common method is to simply assign different channels to different users. This is called Frequency Division Multiple Access (FDMA) and is how normal analog and many digital systems separate users. For example, User A transmits on Channel 1 and User B transmits on Channel 2. Each user can transmit whenever they want to and can transmit for as long as they like. They don't interfere with each other because they are transmitting on different frequencies. However, FDMA requires one channel for every user.

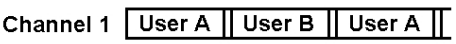
❖ Time Division

A more complex method of sharing is to rapidly take turns using the same channel. For example, User A transmits on Channel 1 for a short period of time, then stops. Right after User A stops transmitting, User B starts transmitting for a similar amount of time, then stops. User A then resumes transmitting for another period. This process continues for as long as each user has information to send. The big advantage of this method, called Time Division Multiple Access (TDMA), is it requires only one radio channel.

One downside to TDMA is the added



Frequency Division Multiple Access



Time Division Multiple Access

complexity of making sure that the transmitting users and the receiving users are synchronized. The time period during which a user is allowed to transmit is called a *slot*, and as you might imagine the transmitting users need a reliable method of determining exactly when each slot starts and stops.

For identical reasons, receivers have to be synchronized to the correct slots so that they are listening at the proper time. For example, if User A wants to transmit information to User C, User C has to listen during the slot for User A and ignore the slot for User B. Synchronization timing in TDMA systems is often provided by a separate piece of equipment that transmits a time mark from which all users take their cue.

Another downside to TDMA is that because each transmitting user only has part-time access to the radio channel, it is limited in the amount of information it can transmit relative to an FDMA user. If two users are sharing a TDMA channel,

each user can only transmit half the information they might otherwise send if they were using an equivalent FDMA channel. In fact, in real-world instances the reduction is actually a little worse than that. Synchronization between users isn't always perfect, so TDMA systems build in very short gaps between slots called *guard times* that help to separate users when they don't exactly agree when to start and stop. Because no one is supposed to be transmitting during these guard times, the amount of data that can be sent is slightly reduced in proportion to their duration.

To make up for the overall reduction due to sharing, many TDMA systems use twice as much bandwidth as a corresponding FDMA channel. For instance, where a 12.5 kHz channel could support a single FDMA user, a TDMA system might use a 25 kHz channel and allow each user to transmit twice as fast as the FDMA user.

As a side note, the FCC is okay with the use of channels that are larger than 12.5 kHz as long as the system supports "equivalent talk paths" - that is, as long as the equivalent of a single conversation fits in a 12.5 kHz channel, it meets the narrowband requirement. Because the aforementioned TDMA system fits two conversations into a 25 kHz channel, it averages out to one conversation per 12.5 kHz and satisfies the FCC.

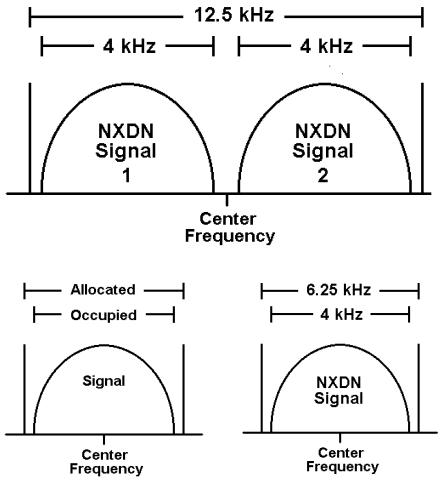
❖ NXDN Signals

The NXDN designers selected FDMA, arguing the simplicity and therefore lower cost of equipment and maintenance would be more attractive to system operators than the potential benefits available from TDMA. It is also easier for two FDMA radios to communicate directly with each other (that is, not through a repeater) because they do not need the timing synchronization normally provided by the repeater for TDMA radios.

Two channel sizes are available under the NXDN standard, depending on whether the AMBE+2 vocoder is run at "half rate" (3600 bits per second, giving normal voice quality) or "full rate" (7200 bits per second, giving better voice quality).

Bandwidth	Vocoder Rate	Transmit Rate
6.25 kHz	3,600	4,800
12.5 kHz	7,200	9,600

The half-rate NXDN signal occupies 4 kHz of bandwidth and therefore fits within a narrow



6.25 kHz channel without difficulty. Two half-rate NXDN signals can fit within a standard 12.5 kHz channel without interfering with each other or with adjacent channels.

A full rate NXDN signal is 8.3 kHz wide and fits in a 12.5 kHz channel, meeting the current FCC requirement.

IDAS uses "ESN registration" "to prevent anyone from illegally loading radios onto the MultiTrunk system"

❖ NXDN Operations

There are four types of NXDN operations.

The first type is called "peer-to-peer" and describes two radios communicating directly with each other. This is often referred to as "talk-around" since users are talking around the repeater, that is, without needing the repeater.

The second type is conventional operation through a repeater, where the NXDN signal is received at one pre-determined frequency (the input) and re-transmitted at a different, pre-determined frequency (the output). This is exactly how communications through a repeater works for almost all radio systems and technologies, not just NXDN.

The third type of operation is identified by NXDN as "Type C" and is the familiar centralized trunking used by other systems like Motorola and EDACS. One channel is set aside and carries only commands and responses between radios and a repeater. NXDN supports both single and multi-site trunking with this dedicated control channel operation.

The fourth type is distributed logic trunking, called "Type D" by NXDN. In this operation, there is no dedicated control channel - commands and responses are sent within the voice channel data stream similar to the more common Logic Trunked Radio (LTR) systems. This type of operation is only supported on the 6.25 kHz NXDN signal.

Like other digital systems, NXDN supports individual and group calls as well as short data messages (including GPS location and status indicators). Each radio has a unique identifier and an NXDN can support a maximum of 65,545 IDs per system

❖ Encryption

NXDN includes a "digital scrambling" feature as a standard component. A voice scrambler fed with a 15-bit key provides a limited amount of protection from the "casual eavesdroppers" mentioned on Kenwood's website. From a security perspective this isn't much protection, but it will thwart basic hobbyist listening.

If a system operator is really concerned about eavesdropping, the NXDN standard also defines a way to use the old Data Encryption Standard (DES) or the newer Advanced Encryption Standard (AES) as a means of encrypting digital voice traffic, although these cost extra.

An interest group called the NXDN Forum has about 30 member companies and is encouraging the use of the technology in a variety of applications. NXDN equipment is currently authorized for operation in the VHF (136 to 174) and UHF (400 to 520 MHz) bands.

❖ Austin, Texas

Jim mentions the Circuit of the Americas racetrack near the capital of Texas, Austin. The 3.4-mile track supports Formula One racing, including the United States Grand Prix. Other types of cars and motorcycles also race on the track.

Circuit of the Americas uses Kenwood NEXEDGE radio hardware operating the NXDN standard. The FCC license database shows the following frequencies licensed to Circuit of the Americas: 451.9000, 452.4750, 452.6750, 461.4125, 461.5250, 461.7375, 461.8125, 463.4625, 463.9750, 464.0375, 464.0625, 464.6375 and 464.9625 MHz.

❖ Wichita Falls, Texas

In April of last year the City of Wichita Falls, Texas authorized the purchase of 369 radios and associated infrastructure to operate a new UHF radio system. The winning bid, using Kenwood hardware, came to $267,000. Competing bids based on Motorola technology were more expensive. An additional benefit for the city is that the Kenwood equipment can natively interoperate with the Public Transit System installed in 2009.

The new system allows the city to switch from their old five-channel analog system to a six-channel system with two repeater sites. Local reports show these six frequencies to be 453.1625, 453.9000, 460.2750, 460.3500, 460.6000 and 460.6250 MHz.

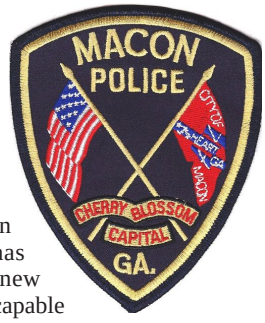
❖ Macon, Georgia

Last November the city of Macon, Georgia awarded a $7 million contract to Harris Corporation for a new public safety radio system that will support the city police and fire departments as well as the county sheriff's office. The contract includes almost 700 radios and data modems.

Macon is located about 80 miles south of Atlanta and is the county seat of Bibb County. Last year the city and the county consolidated their governments, creating the fourth largest city in Georgia with just over 156,000 residents.

The new system will use three existing repeater sites operating in the 800 MHz band.

Voice activity will follow the APCO Project 25 (P25) standard while an OpenSky overlay will carry data. The system will also support Wi-Fi hot spots in certain locations. Harris has indicated that the new system will also be capable of supporting new LTE (Long-Term Evolution) broadband technology. So, in a single system there are at least four potential technologies, each defined by a different standard. Some are open and some are proprietary, but the end user will expect all of them to work together. This is an integration challenge for everyone involved.



The current radio system is a Motorola Type II SmartZone operated by the city of Macon and Bibb County. It supports both analog and the P25 Common Air Interface (CAI) and operates from three repeater sites: one at the junction of Upper River Road and Dr. Lee Road (North), one near Highway 475 and Thomaston Road (West), and one on Guy Paine Road (South). Mobile radios are licensed to operate within 70 miles of the city.

The FCC database lists the following frequencies: 854.0625, 854.7125, 854.9125, 854.9875, 855.2375, 855.4875, 856.2375, 856.2625, 856.4875, 856.5875, 857.2375, 857.4875, 858.7375, 858.9875, 859.2125 and 859.9875 MHz.

Active talkgroups on the system include:

Decimal	Hex	Description
1968	07B	Macon Police STRIKE Unit
2000	07D	Macon Police STRIKE Unit
2064	081	County Sheriff (Car-to-Car)
2096	083	County Sheriff (Secondary)
2128	085	County Sheriff (Dispatch)
2288	08F	Sheriff Criminal Investigation Division
2416	097	Marshalls
2512	09D	Macon Parks and Recreation
2544	09F	Macon Parks and Recreation
2576	0A1	Macon Parks and Recreation
2640	0A5	Macon/Bibb County REACT
2672	0A7	Macon/Bibb County REACT
2960	0B9	County Court Security
3248	0CB	Macon/Bibb County Fire Department (Dispatch)
3280	0CD	Macon/Bibb County Fire Department (Rescue)
3312	0CF	Macon/Bibb County Fire Department
3344	0D1	Macon/Bibb County Fire Department
3376	0D3	Macon/Bibb County Fire Department
3408	0D5	Macon/Bibb County Fire Department
3440	0D7	Macon/Bibb County Fire Department (Training)
3472	0D9	Macon/Bibb County Fire Department (Training)
3504	0DB	Macon/Bibb County Fire Department (Talk-Around)
3952	0F7	County Engineering
4848	12F	Macon/Bibb County Emergency Management Agency
6480	195	Macon Traffic Engineering
6576	19B	Macon Traffic Engineering
6608	19D	County Animal Control
6672	1A1	County School Police
8048	1F7	Macon Public Works (Administration)
8080	1F9	Macon Streets
8112	1FB	Macon Sanitation Department
8240	203	Macon Parks and Recreation
8272	205	Macon Landfill
8336	209	Macon Police Patch to Ackerman Police
8400	20D	Macon Water Department
8432	20F	Macon Water Department
8464	211	Macon Water Department
8496	213	Macon Water Department
9648	25B	Macon Public Works (Engineering)
10416	28B	Macon Vehicle Maintenance
11216	2BD	Macon Inspections and Permits
12816	321	Countywide Events
12848	323	Countywide Events
12880	325	Countywide Events
16144	3F1	Medical Center of Central Georgia
57616	E11	Macon Police Special Weapons and Tactics (SWAT)
57648	E13	Macon Police (Dispatch for South and East Precincts)
57680	E15	Macon Police (Dispatch for North and West Precincts)
57712	E17	Macon Police (Talk-Around)
57744	E19	Macon Police (Records)
57776	E1B	Macon Police (Traffic)
57808	E1D	Macon Police Detectives
57840	E1F	Macon Police Detectives
57904	E23	Macon Police Narcotics
58032	E2B	County Sheriff (Dispatch)
58000	E29	County Sheriff
58064	E2D	County Sheriff
58192	E35	County Sheriff
58320	E3D	County Sheriff
58544	E4B	County Jail
58608	E4F	County Court Security
58704	E55	County Sheriff
59088	E6D	Medical Center of Central Georgia
59120	E6F	Georgia Search and Rescue
59152	E71	Macon/Bibb County Emergency Management Agency
59248	E77	Medical Center of Central Georgia Emergency Medical Services
59280	E79	Georgia Search and Rescue
60336	EBB	Macon Police Events
60368	EBD	Macon Police Events

There are also a number of conventional analog frequencies active in the county.

Frequency	Description
152.345	Radio Cab, Inc. Transportation (Base)
153.875	County School Buses
155.295	Medical Center of Central Georgia Emergency Medical Services
155.340	Medical Center of Central Georgia Hospital Emergency Ambulance Radio
157.605	Radio Cab, Inc. Transportation (Mobiles)
453.375	Macon Coliseum
453.700	Macon Coliseum
453.800	Macon Transit Authority
460.125	Mercer University Police
462.950	Medical Center of Central Georgia Police
464.525	Macon Mall Security

That's all for this month. More information on emerging technologies as well as other topics are all available on my web site at **www.signalharbor.com**. I welcome your questions, comments and frequency lists via electronic mail to *danveeneman@monitoringtimes.com.* Until next month, happy scanning!

ASK BOB
GENERAL QUESTIONS RELATED TO RADIO

Bob Grove, W8JHD
bobgrove@monitoringtimes.com

Q. *Electrical current is measured as the number of electrons passing a fixed point per second. Where do these electrons come from? (Mark Burns, Terre Haute, IN)*

A. The electrons are simply those that orbit the atoms of copper in the wiring; this is known as "electron mobility." They move from atom to atom when forced by a voltage induced either by chemical reaction (the battery electrolyte) or by moving magnetic lines of force (the generator). In order for electrons to flow, there must be a closed circuit. In other words, the electrons must have a path of return from which they started. No electrons are created or destroyed.

Q. *I have noticed a "CE" symbol on many electronic products. Is this a certification of some type?*

A. Yes, it is French: *Conformité Européenne* which translates to European Conformity, meaning that the product meets standards set for European consumer distribution. The implication is that the product does what it's supposed to do, and safely.

Q. *I am planning to put a shortwave antenna on top of a 12 story building, but I would need 100 meters (330 feet) of coaxial cable. Does that present a problem? And do I need 50 ohm coax? (Andy, Russia)*

A. Naturally, the longer the transmission line, the more loss it will exhibit due to resistive effects and absorption by the dielectric (insulation). At 30 MHz, the top of the HF (shortwave) spectrum, RG-58/U will lose at least 8 dB of the received signal, and about 5 dB in the 10 MHz zone. RG-6/U outdoor TV coax for those same frequencies would lose less than 5 dB at 30 MHz and less than 3 dB at 10 MHz.

That's not a lot of difference, but if you ever decide to use that coax for VHF/UHF applications, the difference is astronomical. At 150 MHz the RG-58/U will lose some 19 dB while the RG-6/U will only lose about 11 dB. And it gets worse as you go up in frequency from there.

But, equally important is the shielding. RG-58/U may have only 70% shielding while RG-6/U is 100% double-shielded. You can guess which one is more vulnerable to picking up electrical noise interference on that 100 meter run.

So far as impedance, that's of no concern for receiving over such a wide frequency range. The feedpoint impedance will vary all over the place with changes in frequency.

Q. *A car's battery is "grounded" to the chassis of the car. Is grounded really a good word as the chassis is in no way connected to the earth? Wouldn't "chassis ground" be a better term?*

A. Yes, chassis ground is a common term used in electronics for the common return path, often the negative charge. The term "grounding" originated in the 19th century when early experiments in electrical transmission actually used the ground as part of the return path. It is still used literally with antenna systems and commercial power distribution to prevent shock hazard and to bleed off static electricity discharge.

Q. *What might be the cause of the strong buzzing noise interference I hear every 64 kHz (64, 128, 192, 256, 320, 384, 448 and 512 kHz) in VLF range of my receiver? I have my computer system shut off. (John K2AZ)*

A. Most likely a switching power supply plugged into the wall for a cell phone or some other small accessory. The heavier transformer wall warts don't do that.

One way to find it is by carrying a small AM radio tuned to one of the spurs (spurious signals) around the house listening for the signal to become stronger. You can also switch off and on each of the circuit breakers on your AC power panel listening for it to stop to isolate which circuit has the offending device.

Q. *I occasionally hear AC hum on some shortwave stations. I tried using battery power but that didn't help. What causes it and can I do anything about it? (Mark Burns, Terre Haute, IN)*

A. Are you using any other accessory connected to your radio, especially a preamplifier? If AC operated, they are a common source of common-mode hum. Battery power of the accessory helps. Another dreadful source of such noise is the modern switching power supply (see previous question and answer).

There is a possibility that you are receiving actual AC line noise impacting your antenna right along with signals. Depending on where the line noise originates, it sometimes arrives in harmonics of the lower frequencies so it will effect some signals and not others. Listen for the noise on spots between signals. If you hear it there, that could be the problem.

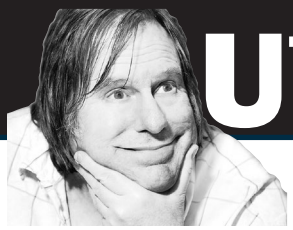
While hearing the interference, try briefly grounding the radio to see if the interference changes.

Finally, there's always the possibility that the transmitter is emitting the hum. This is true with some of the old equipment used in Cuba and elsewhere.

Q. *When opening up the case of a tower or desktop computer, it is obviously a good idea to clear out the accumulated dust. But every source I read says to blow it out with compressed air. What is wrong with carefully vacuuming the interior? I made some simple vacuum attachments to get into tight spots that terminate in rubber and plastic tubing. Is there some danger of static discharge when using a vacuum cleaner? (Judy May W1ORO, Union, Kentucky)*

A. While the thought of generating dangerous levels of static electricity from a vacuum cleaner is an interesting consideration, I really doubt it would cause any problems. Portable vacuum cleaners are made for this very purpose; we've used one on our office computers for decades with no ill effects. A vacuum cleaner avoids driving dust deeper into little crevices like switch contacts on the keyboard. I suspect that the recommendation of canned air is simply one of convenience.

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.)



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

HM01: New Cuban "Hybrid" Mode Baffles Listeners

Listeners in North America continue to track every strange on-air move of the Cuban DI spy organization. DI is a Spanish acronym for *Dirección de Inteligencia*, formerly DGI, *Dirección General de Inteligencia*. It is presumably responsible for the decades of weirdness coming out of Cuba's "numbers" operation.

The Problem

Some numbers agencies run like well-oiled machines. DI is not one of these. For decades now, its legendary sloppiness has been chronicled in this and other publications.

It's hard to believe, but recently it's gotten much worse. More than ever, one gets the idea that people just aren't concentrating. Buttons get pushed late, or not at all. Audio modulation is weaker, and power-supply hum is louder. Messages start in the wrong mode, then suddenly switch to the right one without restarting.

And then, there's that bizarre issue concerning the figure "9" ("nueve" in Spanish). A couple of years ago, it largely went away. In other words, most messages did not have any 9s in them at all. Once in a while, there would be one that did. It really stood out.

Most followers in the numbers sub-hobby came to agree that the 9-less messages were dummy traffic, and the ones with the 9s were the real thing. Clues came in repetition patterns and such.

Cryptography people were aghast. This is just loony. No one in their right mind deliberately decreases the randomness of their traffic. Neither is anyone dumb enough to devote endless time, money, and aging equipment to a continuous stream of obvious filler, then turn right around and tip off the other players when something big is up.

In any event, interest in Cuban numbers seemed to be dropping off. Perhaps listeners just decided that the transmissions didn't matter anymore. If the people responsible so obviously didn't care what they were sending out, why should anyone else?

Enter HM01

This column has talked many times about the European Numbers Information Gathering and Monitoring Association (ENIGMA 2000). It's an online group of advanced numbers enthusiasts, which publishes the "Control List" of designators pretty much universally used by everyone else.

Until late 2012, the Cuban operation had only three of these. Voice transmissions were labeled V02. The current format is called V02a. It's a three-message broadcast lasting around 42-45 minutes.

Morse code transmissions were labeled M08. Again, the three-message format is in use,

and it is called M08a. Fast sending and letter substitution, a procedure known as "cutting" numbers, makes M08a broadcasts far shorter than the same messages in voice. Also, the machine-perfect Morse characters lend themselves to software decoding.

More recently, the DI decided to use digital transmission. Other agencies might have paid big money to design some fancy custom mode, adding yet another funny noise to short wave radio. However, this low-budget organization tried various types of ham radio shareware. An early test was in PSK (phase-shift keying), so ENIGMA labeled it SK01.

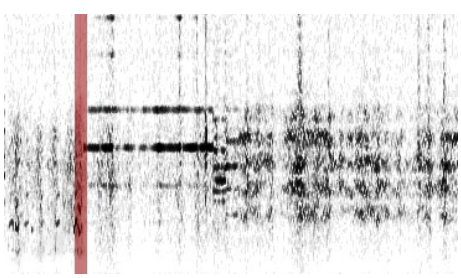
Finally, the DI settled on an otherwise little-known ham mode called RDFT, for Redundant Digital File Transfer. This is still heard daily, in a number of slots.

Fast forward to last November 17. This particular Saturday marks the first discovery of Cuba's strangest idea ever. It's a hybrid mode, quickly labeled HM01 ('Hybrid Mode' number 1) by ENIGMA.

Several listeners made the initial intercept. It is well described in the advance ENIGMA newsletter copy graciously supplied to this column by the ever-helpful Paul Beaumont. As always, this editor thanks him and ENIGMA 2000.

It apparently all started at 0600 Coordinated Universal Time (UTC). The strange noises on 5800 were originally taken as yet another screw-up, with SK01 and V02a transmitting at the same time.

Soon enough, it was clear that there was no screw-up. It was a whole new mode, in which the voice and the data alternated. The voice sent a few groups, and then the RDFT sent the same ones. Then the whole cycle repeated six times. Interestingly, all the groups in this message ended in "1." A test? A similar message was sent at 0900 UTC on 5898 kHz.



HM01: Voice (L.) followed by data (Courtesy Paul Beaumont)

On the next day, Sunday UTC, similar transmissions were made on 5898 at 0502, on 5800 at 0600, 5883 at 0704, and 5898 at 0800. On Monday (UTC), HM01 was found on 9124 at 0620, and 5898 at 0820. On Tuesday, it was logged on 9124 at 0620, on 5898 and 8180 at 0815, and on 6768 at 1600. Wednesday had 5898 and 11435 at 0600, 5800 at 0700, 8186 at 0800, 9063 at 0907, and 9240 at 1000. Busy, indeed.

Similar loggings continued for about a week. If this was a test, it was a very thorough one, obviously using well thought out software. One hopes that more will be heard from HM01. In any event, this editor must agree with Paul that all this offers yet more proof that the numbers scene continues to be dynamic and fluid. Surely, more surprises are guaranteed.

More Sandy Activity

Listeners continue to send in reception reports from superstorm Sandy. This one comes from Les Polt, Esq. in Baltimore, MD:

5236.0 - SHARES Night Primary
5696.0 - CAMSLANT Chesapeake (working USCG rescue at sea)
6577.0 - New York Oceanic (working TEAL 72 Hurricane Hunter)
6845.0 - SHARES N.E. Coordination
7268.0 - WX4NHC Hurricane Watch Net (LSB)
7268.0 - Waterway Net (LSB)
7272.0 - PA Emergency Net (LSB)
7348.0 - FEMA
7632.0 - FEMA/SHARES
8918.0 - NY Oceanic (working TEAL 71 Hurricane Hunter)
8983.0 - CAMSLANT Chesapeake (working USCG rescue at sea)
14325.0 - WX4NHC Hurricane Watch Net

The three frequencies marked "LSB" are amateur emergency nets using lower-sideband voice. All the rest are upper sideband (USB).

TEAL is the call sign used by the U.S. Air Force Reserve 53rd Weather Reconnaissance Squadron based at Keesler Air Force Base near Biloxi, MS. These are the famous "Hurricane Hunters," who fly long missions involving multiple penetrations of storms by WC-130J aircraft. North Atlantic oceanic air traffic control frequencies were much quieter than usual due to all the U.S. airport closures, but the TEAL missions were frequently using them for various authorizations.

WX4NHC ("Weather for NHC") is the amateur station at the U.S. National Hurricane Center in Miami, Florida. Usually, the 7 megahertz (MHz) frequency in the 40 meter band is a night primary, and the 14 MHz on 20 meters is used in day time. Traffic was so heavy in this storm, however, that both were used at once.

WX4NHC participates in the Hurricane Watch Net (HWN), but it is not a control

station. Net control is organized by around 40 dedicated amateurs who disseminate the National Hurricane Center advisories and collect weather and status reports from stations in affected areas. It activates whenever a hurricane is within 300 miles of its predicted landfall, or when it seriously threatens populated areas. Initial startup is nearly always on the 14325 kHz frequency.

SHARES is a U.S. inter-agency frequency pooling arrangement with its own nets and procedures. Among its many users is FEMA, the Federal Emergency Management Agency. It also has heavy participation by stations in the Military Auxiliary Radio System (MARS).

NHC Amateur Station (Courtesy ARRL)

CAMSLANT is the U.S. Coast Guard's Communications Area Master Station, Atlantic, in Chesapeake, VA. 5696 and 8983 kHz are both primary safety-of-flight frequencies used by CAMSLANT for radio guard with aircraft on missions. These were especially active in the search for survivors of the sunken *HMS Bounty*.

Thanks to Les for sending these. This column is interested in any reception reports from the entire Sandy disaster. These will provide valuable input on which frequencies should stay in the 2013 Hurricane Frequency List, and which ones should be dropped.

Massive damage to communications infrastructure in Sandy showed that the Internet remains vulnerable in the worst storm disasters. Considering the general agreement that such storms are on the increase, it is quite doubtful that the majority of these frequencies will go away any time soon.

ABBREVIATIONS USED IN THIS COLUMN

AFB..... Air Force Base
ALE..... Automatic Link Establishment
ARQ ..... Automatic Repeat reQuest
Camslant..... Communications Area Master Station, Atlantic
Camspac..... Communications Area Master Station, Pacific
CAP ..... U.S. Civil Air Patrol
COTHEN..... Customs Over-The-Horizon Enforcement Network
CW..... On-off keyed "Continuous Wave" Morse telegraphy
DHFCS ..... Defence High Frequency Communications Service
DSC ..... Digital Selective Calling
E11..... English "Strich" family, null-message format
E11a..... E11 with group count and message
EAM ..... Emergency Action Message
FAX..... Radiofacsimile
FEMA..... U.S. Federal Emergency Management Agency
FM..... Frequency Modulation
FSK..... Frequency Shift Keying
HFDL..... High-Frequency Data Link
HFGCS..... High-Frequency Global Communications System
ID ..... Station identification
LDOC..... Long-Distance Operational Control
LSB..... Lower Sideband
MARS ..... U.S. Military Auxiliary Radio System
Meteo..... Meteorological; weather office
MFA..... Ministry of Foreign Affairs
MX..... Generic for Russian single-letter beacons/markers
NDB..... Non-Directional Beacon (Aero).
Pactor ..... Packet Teleprinting Over Radio, modes I-IV
RTTY..... Radio Teletype
S38..... Russian voice messages on "UVB-76"
Selcal ..... Selective Calling
SESEF..... Shipboard Electronics Systems Evaluation Facility
SHARES ..... SHAred RESources, U.S. Federal frequency pool
Sitor..... Simplex Telex Over Radio, modes A & B
TACAMO ..... TAke Charge And Move Out
TISCOM ..... Telecommunication & Information Systems Command
UK ..... United Kingdom
Unid..... Unidentified
U.S. ..... United States
USAF ..... U.S. Air Force
USCG ..... U.S. Coast Guard
VC01 ..... Robotic Chinese air defense "voice chip" station
V02a ..... Cuban "Atencion," 3x150 format
V13 ..... Taiwan music and numbers in Standard Chinese
Volmet..... Scheduled, formatted, aviation weather broadcasts

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 ().

319.0 VAR-NDB, Stavanger Varhaug, Norway, CW ID at 2119 (Patrice Privat-France).
373.0 KEM-NDB, Kemi, Finland, CW ID at 2050 (Privat-France).
404.0 AGO-New NDB, Angoulème, France, CW ID at 2126 (Privat-France).
515.0 OS-NDB, Columbus, OH, CW ID at 0139 (Mario Filippi-NJ).
520.0 F9-NDB, Miramichi, NB, Canada, CW ID at 0138 (Filippi-NJ).
521.0 GM-NDB, Greenville, SC, CW ID at 0137 (Filippi-NJ).
526.0 ZLS-NDB, Stella Maris, Bahamas, CW ID at 0136 (Filippi-NJ).
1704.0 OXZ-Lyngby Radio, Denmark, news in English and Danish, parallel 1734 and 1758, at 0550 (Michel Lacroix-France).
1801.0 4OSD-Fishing gear locator beacon, CW ID at 0327 (Filippi-NJ).
2142.5 ZBOR-German Customs Cruiser *Borkum* (DBHD), working ZLST, Customs Control Post, Cuxhaven, ALE at 2247 (MPJ-UK).
2187.5 UAAO-Russian flag cargo vessel *Sormovskiy-3055*, DSC safety test with Bremen rescue center, Germany, at 2326 (MPJ-UK).
2656.0 IPA-Ancona Radio, Italy, weather in Italian, at 2206 (MPJ-UK).
3413.0 Shannon Volmet, Ireland, weather for many European airports, at 0333 (Filippi-NJ).
3850.0 BP25-German Federal Police, Patrol Boat *Bayreuth*, working BPLEZS, headquarters in Cuxhaven, similar on 5258, ALE at 2122 (PPA-Netherlands).
4149.0 WPE Jacksonville-Crowley Marine, FL, taking operational report from seagoing tug WRN 6111, at 0600. WPE, taking report from WCX 9104, at 0604 (Allan Stern-FL).
4186.0 OSN-Belgian Navy, Zeebrugge, RTTY channel availability marker at 2257 (MPJ-UK).
4190.0 I22-Italian Forces patrol aircraft, working Santamaria Control in English and Italian, at 2015 (Lacroix-France).
4207.5 UBOG3-Russian flag cargo vessel *Professor Katsman*, DSC safety test with Aarhus rescue center, Denmark, at 2238 (MPJ-UK).
4209.5 TAH-Istanbul Radio, Turkey, Sitor-B marine information bulletins in Turkish, at 2229 (MPJ-UK).
4488.5 A30-Dutch military, calling A62, similar traffic on 5388.5, ALE at 2050 (PPA-Netherlands).
4557.7 D-Russian CW cluster beacon (MX), Odessa/Sevastopol, Ukraine, also on 5153.7 and 10871.7, CW ID at 2117 (MPJ-UK).
4557.8 P-MX, Kaliningrad, also on 10871.8, CW ID at 2118 (MPJ-UK).
4557.9 S-MX, Severomorsk, also on 10871.9, CW ID at 2119 (MPJ-UK).
4558.0 C-MX, Moscow, also on 10872.0, CW ID at 2227 (MPJ-UK).
4625.0 Unid-Russian "UVB-76" station, voice message "MDZhB 92 410 KORPORATsIYA 29 04 38 18" in Russian (S38), also using 4525, at 0356 (Ary Boender-Netherlands).
4964.0 F9TM-French National Net, CW all-stations call and request for clear frequency in French and English, followed by a list of French amateur calls, at 1630 (MPJ-UK).
5035.0 MX40-Algerian military, calling MX48; similar on 6301, 6716.4, 6847.5, 6925, and 6986; ALE at 2103 (PPA-Netherlands).
5123.0 AAA-Israeli Air Force, Tel Aviv, calling DD2, also on 6631 and 7651, ALE at 2004 (PPA-Netherlands).
5145.0 Ambarchik-Aktyubinsk Airport, Kazakhstan, working Amba in Russian, at 2119 (Lacroix-France).
5268.5 XJR-UK DHFCS, raised XSS (Terrestrial Air Sea Communications, Forest Moor) in ALE, then data modem traffic, similar activity on 5295 and 5421, at 1919 (PPA-Netherlands).
5714.0 FUI-French Navy, Ajaccio, Corsica, coordinating RTTY in French with Echo Charlie, at 2005 (PPA-Netherlands).
5732.0 ROS-USCG Cutter *Spencer* (WMEC 905), COTHEN ALE sounding, also on 7527 and 8912, at 1210 (MDMonitor-MD).
6519.0 WLO-ShipCom, AL, voice synthesized "female" with weather, at 0607 (Lacroix-France).
6522.0 Unid-Unknown marine business on international duplex channel #608, working vessel on 6221 regarding barges, saying "come back" instead of "over," at 2200 (Mark Morgan-OH).
6676.0 9VA40-Singapore Volmet, aviation weather at 1950 (PPA-Netherlands).
6754.0 Trenton Military-Canadian Forces volmet, Ontario, weather for Canadian airports at 2345 (Filippi-NJ).
6761.0 Hunt 61-USAF C-17A #04-4129, calling unknown aircraft on air-air channel, no joy, at 1800 (Stern-FL).
6771.0 Unid-"Chinese Robot" (VC01), rapid voice-chip numbers in Chinese, LSB at 1321 (Boender-Hong Kong).
7317.0 Unid-English numbers voice, callup "431 oblique 37" (E11a), then "Attention" and message in 37 5-figure groups, repeated, then "Out," at 0820 (Boender-Netherlands).
7527.0 LNT-USCG Camslant Chesapeake, VA, calling F35 (USCG HU-25C #2135) in ALE on COTHEN, then establishing voice radio guard enroute Atlantic City, NJ, at 1230 (MDMonitor-MD). *[Likely Sandy related. -Hugh]*

7577.0 NMH1-USCG TISCOM, ALE sounding at 1345 (MDMonitor-MD).
7632.0 NNN0YTD-Navy/ Marine Corps MARS, control of SHARES Region 4 Net, at 1623 (Stern-FL).
7633.5 AFA5QW-USAF MARS, IN, came from 13927 for AFA4WL, GA, at 1547 (Stern-FL).
7654.0 New Star Radio Station-Chinese numbers (V13), Program number four, music and coded messages, at 0800 (Boender-Hong Kong).
7688.0 V13, started late without the music and switched off a few words later, obviously having problems, at 0701 (Boender-Hong Kong).
7795.0 JMH2-Japanese meteo, FAX weather chart, also on 9970, at 1120 (Eddy Waters-Australia).
8414.5 VRAF5-Chinese flag bulk carrier *Great Morning*, DSC safety test with Charleville/Wiluna, Australia, at 1557 (MPJ-UK).
8728.0 3AC8-Monaco Radio, weather in French at 0935 (Lacroix-France).
8912.0 939ICE-U.S. Immigration and Customs Enforcement, unknown new COTHEN player, ALE sounding at 1622. Z13-USCG Sector Key West, FL, calling 718 (HC-130H #1718), ALE at 2352 (MDMonitor-MD).
8918.0 JetBlue 214-Flight getting selcal check from New York (Caribbean oceanic air control), at 2255 (Filippi-NJ).
8964.0 ST1-U.S. government "Three-Letter Net" player, calling MHE, ALE at 1640 (Jack Metcalfe-KY).
8971.0 711-Partial call sign of a U.S. Navy P-3C, ALE link with Fiddle (Tactical Support Center, FL), then clear and secure radio checks, at 1358 (MDMonitor-MD).
8993.0 King 64-USAF HC-130P #64-14864, working unknown ground station at 1300 (Stern-FL).
9047.0 001NHQCAP-CAP headquarters, AL, ALE sounding at 1404 (MDMonitor-MD).
9057.0 Bite Wing-U.S. military command post aircraft, encrypted data with Medallion and Titanium, at 1730 (MDMonitor-MD).
9062.0 Unid-Spanish female (possible V02a), message in 5-figure groups with 5 minutes of "tone" type jamming attempting to interrupt the transmission, at 0800 (Dean-CA).
9082.0 0065DECAP-CAP, DE, ALE sounding at 1424. 0045WVCAP, WV, ALE sounding at 1454 (MDMonitor-MD).
9235.5 HW2-Unknown U.S. Army National Guard, calling I070AN, Camp Dodge, IA, ALE at 1406 (MDMonitor-MD).
9446.0 Unid-E11 null-message variant, callup "534 oblique 00, no message, at 0900 (Boender-Netherlands).
10075.0 9V-SKQ-Singapore Airlines A380, flight SIA346, HFDL position for Muharraq, Bahrain, at 2227 (MPJ-UK).
10242.0 TSC-COTHEN Technical Service Center, FL, ALE and voice with J15 (USCG HH-60J #6015), at 2159. LNT-USCG Camslant, VA, ALE and voice with J12 (MH-60J #6012), at 2217 (MDMonitor-MD).
11090.0 KVM70-U.S. Government, HI, FAX satellite image at 1247 (Filippi-NJ).
11175.0 Andrews-USAF HFGCS, MD, sending B-52H Fear 16 to 11220 for a patch, at 2018. Andrews, patch to VQ-4 squadron ops at Tinker AFB for New Deal, an E-6B TACAMO reporting that their "short wire" (antenna) is jammed, at 2247 (Stern-FL).
11220.0 Andrews-USAF HFGCS, came from 11175 for a patch to Minot AFB Ops for Fear 16, who is returning to base after a bird strike, at 2025 (Stern-FL).
11229.0 Geodetic-U.S. military command post aircraft, setting up secure data comms with Medallion and Bite Wing on Z-160 (9057), at 1735 (MDMonitor-MD).
11232.0 Canforce 4464-Canadian Forces transport, working unknown ground station at 1524 USB (Lacroix-France).
11402.0 4721WICAP-CAP, WI, calling 0314MICAP (CAP, MI), ALE at 2144 (MDMonitor-MD).
11427.6 "ZC"-Unknown radio beacon, loud CW ID at 1646 (Metcalfe-KY).
11494.0 LNT-USCG Camslant, VA, calling J02 (USCG MH-60T #6002) in ALE on COTHEN, then taking a voice ops-normal report, at 1519 (MDMonitor-MD).
12212.0 F040LN-FL National Guard, calling I050LN (Camp Lincoln, IL), at 2128 (MDMonitor-MD).
12362.0 VMW-Australian meteo, Wiluna, weather report at 1346 (Lacroix-France).
12365.0 VMC-Australian meteo, Charleville, weather report at 1334 (Lacroix-France).
12613.0 XSQ-Guangzhou Radio, China, CW ID in Sitor-A calling marker, at 1625 (Filippi-NJ).
12654.0 TAH-Istanbul Radio, Turkey, CW ID in Sitor-A marker, at 1632 (Filippi-NJ).
12745.5 Unid-Kyodo News, Singapore or Penang, FAX newspaper in Japanese at 60 lines per minute, parallel 17430, at 1114 (Waters-Australia).
12789.9 NMG-USCG, New Orleans, LA, FAX 24-hour Caribbean surface forecast, dial frequency 12788, at 1311 (Filippi-NJ).
13185.0 UGE-Arkhangelsk Radio, Russia, phone patch in Russian at 1226 (PPA-Netherlands).
13312.0 D41-U.S. Customs and Border Protection P-3B "Slick," reg N741SK, ALE sounding at 1937 (MDMonitor-MD).
13362.0 Unid-U.S. Navy, Barrigada, Guam, rebroadcasting a talk show from American Forces Network, at 0517 (Waters-Australia).
13415.0 Unid-Russian six-tone Mazielka selcal, lasted at least an hour then faded, at 0730 (Waters-Australia).
13920.0 VMC-Australian meteo, Charleville, FAX weather chart at 0234 (Waters-Australia).
13927.0 AFA5RS-USAF MARS, IN, and then AFA5QW, patch to Dyess AFB Ops for Dark 31, a B-1 declaring an emergency for hung ordnance, at 1945 (Stern-FL).
13988.6 JMJ2-Japanese meteo, FAX weather chart at 0503 (Waters-Australia).
13993.0 AFA6BZ-USAF MARS, Transcon Net with AFA7PW and others, at 2031 (Stern-FL).
14389.0 AFA5RS-USAF MARS, IN, control of national Sunday net, calling for stations in various MARS regions, at 1600 (Stern-FL).
14396.5 NCS 312-U.S. National Communications System, control of weekly SHARES net, checking in WGY 9498 (FEMA Auxiliary Station, ID), NCS 202 (SHARES, FL), and several MARS stations, at 1600 (MDMonitor-MD).
14410.0 E11a, callups 954/31, 956/34, 950/40, and 958/40, all with messages, different days at 0110 (MPJ-UK).
14411.0 RDL-Group call for Russian strategic broadcast, FSK Morse code message in 5-figure groups, at 1046 (MPJ-UK).
14484.0 Head Master-Probable U.S. military command post aircraft, monthly exercise with Desert Eagle (Army MARS, Ft Huachuca, AZ), Green Acres, Poker Face, Looking Glass (possible airborne command post), Step Mother, Horse Trader, Granite Sentry, Top Hand, Nightwatch, and many stations using Showdown call signs; at 1625 (MDMonitor-MD).
14582.0 PAC-USCG Camspac Point Reyes, CA, COTHEN ALE with K39 (USCG MH-65C #6539), later a voice position check with K39, at 2005 (MDMonitor-MD).
14661.0 HKI2-Finnish MFA, Helsinki, working ANK, Ankara embassy, also on 14925, ALE at 1257 (MPJ-UK).
14822.5 S1B-Lithuanian military, calling P1G in ALE, at 1143 (PPA-Netherlands).
14836.0 FC1FEM002-FEMA region 1 communications, MA, ALE sounding at 1119 (PPA-Netherlands).
14851.7 Unid-Pakistani Intelligence, repeated Pactor-II messages in 5-letter code groups, parallel 19889.7, at 1047 (Waters-Australia).
14900.0 LCR154-Polish military, Janki, working SPI324 in ALE, at 1144 (PPA-Netherlands).
15016.0 Croughton-USAF HFGCS, UK, 6-character EAM, simulcast on 8992 and 11175, at 1449 (Jeff Haverlah-TX).
15034.0 Trenton Military-Canadian Forces volmet, weather for Canadian airports at 1257 (PPA-Netherlands).
15615.0 VMW-Australian meteo, Wiluna, also on 18060, FAX weather chart at 0408 (Waters-Australia).
15632.0 E11, null-message callup 228/00, ended with "out," at 1540 (MPJ-UK).
15867.0 Z05-USCG Sector New York, calling LGV (USCG Cutter *Legare*, WMEC 912), COTHEN ALE at 2030 (MDMonitor-MD).
16006.5 Unid-North Korean MFA, Pyongyang, encrypted traffic in 600/600 ARQ, also on 19418.5 and 23133.5, at 0953 (Waters-Australia).
16035.0 Unid-Kyodo News, Singapore or Penang, FAX newspaper in Japanese at 60 lines per minute, also on 22542, at 0400 (Waters-Australia).
16087.0 Gargoyle-U.S. Navy, coordinating electronics testing in clear and secure LSB voice with Magic Carpet (Ediz Hook SESEF, WA), at 1930 (Metcalfe-KY).
16125.0 STAT14-Tunisian government, Station 14, working STAT151 in ALE, at 1149 (MPJ-UK).
16135.0 KVM 70-U.S. Government, HI, FAX weather chart at 0405 (Waters-Australia).
16200.0 DJK-Unknown Myanmar agency, calling DKB, also on 18000 and 20000, ALE at 1153 (Waters-Australia).
16252.5 OEY80-Austrian Army, Villach, working OEY61, United Nations operation in Syria, at 1239 (MPJ-UK).
16402.0 ABA-Maltese Maritime Squadron headquarters, Floriana, ALE text message for AB2, Patrol Boat P-2, at 1157 (MPJ-UK).
16804.5 *355778000*-Panama flag liquefied petroleum gas tanker *Gas Spirit 1* (3EMT8), DSC with Alexandria Radio, Egypt, at 1155 (PPA-Netherlands).
16901.0 ZSC-Globe Wireless, Cape Town, South Africa, digital ID in FSK idler, also on 22540, at 0833 (Waters-Australia).
16971.0 JSC-Kyodo News, Kagoshima, Japan, FAX newspaper in Japanese at 60 lines per minute, at 1125 (Waters-Australia).
17916.0 SDJ-Stockholm LDOC, working D2-TEG, TAAG Angola Airlines B777 "Sagrada Esperanca," at 1208 (PPA-Netherlands).
17928.0 G-VFIT-Virgin Atlantic A340 "Dancing Queen," flight VS0026, HFDL log-on with Canarias, Canary Islands, at 1621 (MPJ-UK).
18594.0 I86-U.S. Customs and Border Protection Cessna 550, reg N586RE, COTHEN ALE sounding at 2025 (MDMonitor-MD).
18725.0 8WD2-Indian MFA, Delhi, RTTY test message for 8WA3, at 1005 (Waters-Australia).
19726.0 A9M-Globe Wireless, Bahrain, digital ID in FSK idler, at 0603 (Waters-Australia).
20256.7 Unid-Egyptian MFA, Cairo, ARQ traffic for unknown embassy, at 0842 (Waters-Australia).
20519.7 Unid-Egyptian MFA, Cairo, messages to Malaysia embassy in Kuala Lumpur in Arabic 4th-shift variant of Sitor-A, at 0430 (Waters-Australia).
22437.0 NNC-Singapore Navy, calling 072, ALE at 0535 (Waters-Australia).
22559.6 Unid-Japanese Fisheries, FAX text in Japanese at 1140 (Waters-Australia).
22989.0 HQ703N-U.S. National Guard Readiness Center, VA, calling L060AN (Jackson Barracks, LA), ALE at 1703 (MDMonitor-MD).
28224.0 K5GJR/B-10 meter amateur propagation beacon, TX, CW ID at 1555 (Filippi-NJ).
33560.0 KUG 740-Lancaster County, PA, audio tone Morse code ID on fire department channel, FM at 2042 (Hugh Stegman-CA).
33700.0 Westmoreland 911-Westmoreland County Emergency Management, PA, tone calls and dispatches for Stations 92 and 48, FM at 2044 (Stegman-CA).
33720.0 KGC 755-Lancaster County, PA, audio Morse code ID on fire department channel, FM at 2041 (Stegman-CA).
33860.0 KGC 676-Washington County Fire/EMS, MD, rogering status of Paramedic 59-2, then identifying with time and call sign, FM at 2000 (Stegman-CA).
33900.0 KGC 755-Lancaster County, PA, dispatching Engine and Squad 29-1 (Pomeroy Volunteer Fire Company), then identifying in audio Morse code, FM at 1952 (Stegman-CA).

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End of NAR and Chinese 4+4

This month we look at the closure of some well-known transmitters in Florida and hear from a listener having some great success with Hoka's new Chinese 4+4 modem decoder.

❖ U.S. Navy HF Station NAR Decommissioned

A long-established presence on the HF bands, the U.S. naval transmission facility on Saddlebunch Key in far southern Florida, has now been decommissioned and its many HF outlets moved to U.S. Air Force facilities in Puerto Rico and possibly Maryland too. NAR began operations in 1905 as one link in a chain of CW stations that extended from Maine to Panama with the recently closed, 600 acre modern transmitter site being bought by the Navy in 1965.

At the time of writing (November 2012) there have been almost daily changes in frequencies used to carry both 75bd/850 and 50bd/850 STANAG4481 encrypted FSK signals. It is most likely that NAR's transmissions are now being sent from the facilities at Isabela on the northern coast of Puerto Rico, whose coordinates are at 18° 27' 45.84" north and 67° 04' 0.54" west. While no new transmissions have yet to be confirmed as being sent from the unnamed Maryland location, it is likely that this is the Davidsonville transmitter complex, located at 38° 57' 59" north and 76° 41' 1" west.

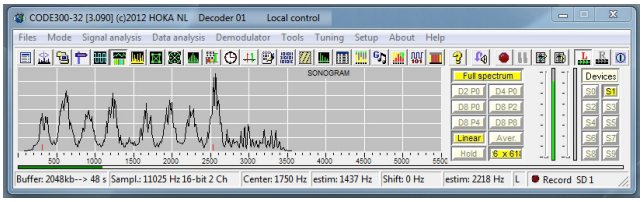
The closure of NAR also seems to have affected some channels used by naval station NAA in Cutler, Maine. Channels used by NPG (Dixon, CA), NPN (Guam), NPM (Hawaii) and NKW (Diego Garcia) appear to be unaffected by the change (see this column's January 2009 and July 2010 editions for details of where to find these stations). Here is the current list of channels and modes used by NAU (ex-NAR) and NAA (frequencies quoted are center of data):

3133.0	75bd/850	NAA
3359.0	75bd/850	NAU (was NAR)
4005.0	50bd/850	NAR
5340.0	75bd/850	NAU (was NAR)
5412.5	50bd/850	NAU (was NAR)
5842.0	50bd/850	NAU (was NAR)
6489.0	75bd/850	NAA
6691.4	50bd/850	NAU
6726.0	75bd/850	NAA
6834.0	50bd/850	NAU
6949.0	50bd/850	NAU
7713.0	50bd/850	NAU
7455.0	50bd/850	NAA
8578.0	75bd/850	UNID
9427.0	75bd/850	NAU (now off the air?)
10130.0	50bd/850	NAA (nighttime)
10153.0	50bd/850	NAU
10534.0	50bd/850	NAA
11687.5	50bd/850	NAA
12015.0	50bd/850	NAU (was NAR)
12120.0	75bd/850	NAU (was NAR)
13230.0	50bd/850	NAU
15022.4	50bd/850	NAU
15959.0	50bd/850	NAA
16122.3	50bd/850	NAA (daytime)
17972.0	75bd/850	NAU

❖ Decoding the Chinese 4+4 Modem with Hoka's Code300-32

Not a few days after the November 2012 issue of this column was complete and sent to the editor, I received news from long-time correspondent Eddy Waters in Australia that he had installed the latest version of the Hoka decoder software and was busy chasing down traffic from the Chinese. Fortunately for Eddy, these signals are much more common on his side of the world than they are over here in the US.

The modem is christened "4+4" (said as "four by four") because of the two groups of four tones present in the audio spectrum of the signal (see Figure 1 below).



The two tone groups are separated by 450 Hz and each tone within the groups by 300 Hz, making for a total bandwidth of 2250 Hz. Tone 1 is positioned at +615 Hz above carrier and tone 8 at +2865Hz. Each modem tone is modulated with 75bd QPSK and the same data is sent on 4 pairs of tones each delayed by around 300ms from the next: tones 2 and 5 first, followed by 3 and 6, then 4 and 7, and finally tones 1 and 8. The modem thus delivers both frequency and time diversity thereby improving robustness against interference and fading. You can see this behavior quite clearly in the Hoka Italy video of the modem in action (see Resources). Unusually, most 4+4 transmissions take place on the lower sideband (LSB) rather than upper.

Here are some typical examples of the text received by Eddy using the new Hoka decoder. Stations usually come on frequency and send what appears to be a call-up text or call sign of the receiving station, such as the following:

17/10/2012 8:26:01 PM +KCEH52470000
+KCEH52470000 +KCEH52470000
+KCEH52470000
17/10/2012 8:26:24 PM +KCEH52470000
+KCEH52470000 +KCEH52470000
+KCEH52470000

Note that the digits after the "call sign" portion, KCEH in this case, often change. After some time, the stations connect and the encrypted message is sent 10 groups to a line with a separator after every tenth line. Eddy notes that messages don't tend to exceed 500 characters:

17/10/2012 8:52:15 PM XYXYXYXYXYXY
17/10/2012 8:52:18 PM OK QSL IS 1822 AHR HR MSG GA HW ? TKS /$
17/10/2012 8:53:11 PM XYXYXYXYXYXY
17/10/2012 8:53:14 PM OK HR MSG CLS 06 GA PSE CY
17/10/2012 8:53:19 PM 779 499 06 1017 1822
17/10/2012 8:53:25 PM 3106–0935
17/10/2012 8:54:35 PM 3407 4560 7627 6784 3415 9196 8336 1684 4086 0928
17/10/2012 8:54:43 PM 7935 6763 5934 1659 7474 1960 0325 7241 2120 6460-1
17/10/2012 8:54:51 PM 6342 9292 4594 4910 5749 6519 1371 4676 0301 0002
17/10/2012 8:55:00 PM 5169 2627 1794 6058 6378 1216 6741 9478 0104 9769
17/10/2012 8:55:09 PM 3585 2637 3409 4909 0407 6018 1837 2317 9420 2178
17/10/2012 8:55:17 PM 4743 7507 5978 2034 9380 8062 8283 1093 0086 7853
17/10/2012 8:55:25 PM 6057 0396 2628 6363 3017 4558 7168 9979 3719 6710
17/10/2012 8:55:33 PM 2526 4953 0949 1084 2512 7302 9782 8721 2143 2002
17/10/2012 8:55:42 PM 6120 7254 8308 6593 4354 6682 7807 5323 3134 8152
17/10/2012 8:55:50 PM 7455 8926 5363 3129 9318 7074 8481 9854 4961 5021
17/10/2012 8:55:58 PM 8450 3549 5635 5406 5861 8528 9128 9145 2579 1824
17/10/2012 8:56:06 PM 3231 5930 6290 0173 7641 8416 0940 9728 5350 1670-2
17/10/2012 8:56:15 PM 6261 2498 1840 4548 2469 0419 6513 3565 0301 0003

Sometimes, there is just the traditional operator chatter as follows:

HR IS RUQW RUQW RUQW HR IS RUQW RUQW RUQW
PQLD PQLD PQLD DE RUQW RUQW RUQW K QSA?

Note that the operators use standard international abbreviated procedure signals like QSL, TKS etc. To date, Eddy has collected some 60+ frequencies carrying 4+4 traffic and around a dozen of the "call signs" used on each.

That's it for this month. Please keep your letters and emails coming!

RESOURCES

Chinese 4+4 Modem Video: **www.youtube.com/watch?v=6r74PzU89BY**

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Junk Works, Too 2.0

Like the many Russian hams that I worked as a teenager, I have always wanted to build a complete station, from tip to tail, from scratch. And not from a kit, either. Don't get me wrong, I love kits. But this isn't an itch that can be scratched by kit building! Most of my treasured QSL cards from Soviet-era Russian hams simply list their transceivers as "15-tube," or "UW3DI." On the surface, this meant that their equipment had a total of 15 tubes. What wasn't immediately obvious was that no familiar brand names were listed, and that the radio gear was homemade!

Thousands of Russian hams (and thousands more in Eastern Europe and beyond) built their own versions of the famous HF transceiver designed by Yuri Kudryavtsev UW3DI. The first version appeared in a Russian amateur radio magazine in 1969 or 1970, and several updated designs were released into the mid 1980s. These rigs, which remind me of National NCX-5s, were once used by *the majority of Russian hams* and are a testament to ham ingenuity and resourcefulness. (See the photo caption for more info.) The next time you're struggling to build a simple receiver or other station doodad and need moral support, take a look at a UW3DI photo or schematic and stand tall! (Interestingly, UW3DI is listed as a Hamsphere subscriber! See last month's column for more info.)

My "UW3DI" doesn't have 15 tubes. In fact, it doesn't have any tubes! But the ubiquitous Russian rig inspired me to make a multiband CW/DSB transceiver based on the "Progressive Communications Receiver" designed by Wes Hayward W7ZOI and John Lawson K5IRK, which started appearing in *QST* and *The ARRL Handbook* in the 1980s ("double-sideband" isn't a typo. I mostly work CW, so I'm hoping that, when I do use QRP phone, I can get away with transmitting *both* sidebands at once, one useful, the other "extra." Generating DSB is a *lot easier* than generating SSB, especially on more than one band).

I've been collecting parts for the project for nearly 20 years, and I've built a few circuits that will be used therein, but mass construction hasn't yet started. Years ago I repackaged an external Kenwood VFO-830, which tunes from 5.5-5.0 MHz (required to make an 80-meter receiver with a 9-MHz intermediate frequency), but recently decided that a fancy DDS VFO would provide more agility and increased "sexiness." A Norcal FCC-2 MK II DDS kit is on hand, waiting only for me to find the courage to "reflow" the surface-mount parts in my toaster oven. A few other details need to be worked out, of course. I have a pair of scavenged 9-MHz SSB crystal filters, but I'll need to build CW and AM filters from a bunch of 9-MHz crystals. And IF amplifiers have come a long way since the original design, so that may have to be tweaked. You get the idea!

The Latest and the Greatest

In addition to my self-imposed construction delays, writing the amateur radio portion of *MT*'s *2013 Buyer's Guide*, which is all about software-defined radios, inadvertently set my UW3DI project back even further, at least psychologically. Until I thought it through, I was initially depressed that, because SDR technology makes radios that perform on an RF level that's just not attainable by previous technologies, my resulting "homebrew dream rig" would be far from state of the art. Well, of course it won't be state of the art! Duh! And it doesn't have to be. The only "art" that really matters is the art of being personally involved in designing, building, testing and using the radio. It's the DIY process, and the education and experiences that come along with it, that matter, not the final destination.

From the 1970s through the 90s, countless thousands of 80-10 meter SSB/CW transceivers just like this one were homebuilt by Russian and Eastern European hams. (Photo and info courtesy of Andrew Fedorov, KL1A, RW3AH [and about 30 other call signs!], creator of www.cqdx.ru, affectionately known as "Sparky," and presently based in Bonn, Germany.)

A recent online conversation on an ICOM IC-718 user group really pointed that out (I've used one of these radios for several years). As happens periodically, someone "badmouthed" the venerable, affordable IC-718 by calling it "old technology with a crappy receiver." Interestingly, depending on your exact frame of reference, that statement is either completely true or completely false!

Compared to the "actual" state of the art, say, FlexRadio's 6000-series SDRs, the ICOM's receiver can't even come close in performance (not many radios can, regardless of price). And the little ICOM rig has AGC issues, especially on the low bands (a major frustration for me over the years). But, at one-eighth the price, the '718 does everything reasonably well, is reliable and built like a tank, and is super easy to operate. Plus, it doesn't require a computer or terminal to operate (which can be important if you don't happen to have one on hand!). From that perspective, the ICOM radio easily refutes whatever badmouthing it may encounter from time to time.

In passionate defense of their favorite rig, a bunch of online "IC-718 lovers" fought back with statements of praise and comments about using the radio to "work 200+ countries with only a dipole," or about how the '718 was "the best radio I've ever owned." The relativity of it all was clear. Countless ops with radios far less capable and convenient than the '718 have worked bunches of DXCC Entities (or states, grid squares, or whatever). Heck, there were hams on the top of the DXCC Honor Roll who got there with Swan 350s, HT-37s or even homemade UW3DI transceivers!

As a kid who landscaped yards for months to afford an entry-level Tempo One transceiver (built by Yaesu and similar to the FT-101), I was too green to know that my Dream Radio was "old technology with a crappy receiver." Compared to the WWII-vintage castoffs I'd been given by local Old-Timers, the Tempo One was a starship among sailboats.

The gear we use or make ourselves doesn't have to be the latest and the greatest. It just has to be built and used. There's a huge spectrum of radios and radio types available to be explored by DIY hams everywhere. Fellow ham radio journalist and author Dave Newkirk W9VES once wrote a column that articulated this much better than I've done here. As I remember, it was titled "Junk Works, Too." And because it does, we don't have to develop an inferiority complex for exploring circuits or using radios that aren't "state of the art."

Radio is radio, so in that light, let's look at some "old technologies" that are still perfect for DIY exploration. My list is certainly not exhaustive, and I start with crystal sets, a relatively recent "obsolete" technology when compared to metal filing coherers, spark-gap transmitters, and the like. And if you think crystal sets are over and done, and hold no new wonders, you're wrong. Very wrong! Don't take my word for it. Build a few and you'll see that the magic is still there!

❖ Crystal Sets

For many hams, a "crystal set" was the first, and perhaps only, radio we ever built. Other than receiving AM broadcasts by accident on some non-radio device (RFI), it's the simplest radio there is. A coil, a capacitor, a diode and a set of high-impedance magnetic headphones or a crystal earpiece combine to make a radio that can receive AM broadcasts, with no external power required. They work better now than they did in WWI. But the devil, as they say, is in the details.

A crystal set made from *any* germanium small-signal diode and *any* coil wound on a cardboard toilet paper tube will work well enough to demonstrate function. But the art and science behind optimizing every component, choosing the best diodes, the best diode configuration (if using more than one!), using exotic wire and winding techniques to make coils with the highest possible Q-factors, or using external impedance-matching antenna couplers, can turn a foxhole radio into a usable, unusual work of radio art.

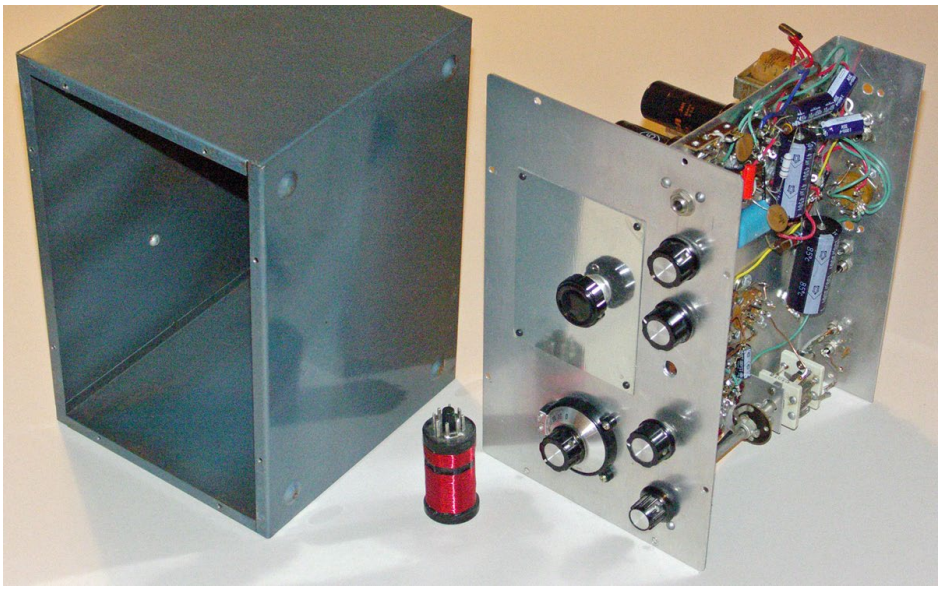
These super-specialized crystal sets are discussed and detailed online by crystal set gurus who have forgotten more about the simplest receivers than most of us will ever know. See **www.midnightscience.com** and **www.crystalradio.ee** for ideas, parts and more.

❖ Regenerative Receivers

Invented by American radio pioneer Edwin Armstrong in 1914, the regenerative receiver (regenerative circuit) uses controllable, positive feedback to allow an RF detector/receiver made from a single tube (or FET/transistor) to exhibit tremendous gain and selectivity. The regen (also called the "autodyne") was a tremendous leap forward in receiver technology and paved the way for commercial, military and amateur radio advancement. State of the art from the 1920s through WWII, with only a handful of parts, regens can receive AM, SSB and CW, even FM after a fashion, from VLF through 20 meters or so. Super-regenerative designs handle VHF reception (like the receiver in your garage door opener!).

Regen designs are shrouded in lore and mystery, and because hams have discovered *dozens* of ways to make circuits regenerative, and *dozens* of ways to control the degree of RF feedback (critical for performance and ease of use), every regen devotee has his or her favorite, secret approach! Surprisingly, these techniques are *hotly debated* 100 years after Major Armstrong developed the circuit!

Even in today's "modern RF environment," regens are still used by SWLs and hams, and perhaps no other design provides such an emotional connection to the golden age of radio. You can start with an easy-to-build transistor regen and move on to something more exotic, perhaps with vacuum tubes! There are dozens of schematics floating around in cyberspace, but perhaps the best way to start your regen research is with a design by Charles Kitchin N1TEV who has provided several high-performance, easy-to-build designs over the past 20 years. See **www.arrl.org/files/file/Technology/tis/info/pdf/0009061.pdf**, a *QST* reprint from ARRL, to get started.



The author's SWL regenerative receiver, a 20-year work in progress, started its life as an Eico signal generator (at least the enclosure did). The basic design is from a late-1930s ARRL Handbook, with significant improvements by regen guru Dave Newkirk, W9VES. With a pair of plug-in coils, the four-tube RX (RF, detector, AF and a VR tube) covers 3-18 MHz. It's stable enough for SSB, and regeneration is smooth and predictable. I'm sure Major Armstrong would approve!—NT0Z photo.

❖ Direct-Conversion Receivers

Direct-conversion receivers, popular with QRPers and home-brewers since the 1960s, have a single RF mixer that converts incoming RF directly to audio (unlike more familiar superhet designs that have an intermediate stage). In DC receivers, the signal from a local oscillator (LO or VFO) is mixed with RF signals from the antenna (also at the same frequency as the LO), and audio comes out. Amplify that audio and you have a receiver!

Because DC receivers have most or all of their gain at audio (100 dB or more!), things can get a bit squirrely, so for best performance you have to design and build them in ways that account for crazy audio gain. All "standard" DC receivers (like the popular Heathkit HW-8 QRP XCVR from the 1970s) output signals on *both sides* of zero beat, so every CW and SSB signal shows up twice (one on upper sideband, one on lower), which can make crowded bands seem twice as crowded!

Despite their quirks, directly converting RF signals to audio has two tremendous benefits: fidelity and simplicity. Without multiple conversions and crystal filters to add noise, distortion and unwanted mixing artifacts, the audio from a good DC receiver sounds like music from a CD (instead of music played through a telephone connection).

Beginners might want to start with "The Neophyte," a beginner's DC receiver from *QST* at **www.arrl.org/files/file/Technology/tis/info/pdf/28814.pdf**. Too see ultimate-performance DC receivers and designs that offer single-signal reception (upper or lower sideband, not both), look for anything on the topic written by Rick Campbell KK7B, an acknowledged "guru of DC design." This article started it all: **www.arrl.org/files/file/Technology/tis/info/pdf/9208019.pdf**.

❖ Superhets

Superheterodyne receivers, supreme in performance and ease of operation since the 1940s and used in almost every ham, broadcast and TV receiver of the era, have only recently lost their performance crown to software-defined radios (SDRs). Some superhet designs are wildly complex, but many are surprisingly accessible to home builders thanks to easy-to-use high-performance mixers and the magic of integrated circuits. Because this is "known" technology, I won't spend a lot of time addressing it. I will, however, point you to the story of one ham's journey in building the "IRK-ZOI" superhet I'm collecting parts for. See **http://home.comcast.net/~banda5/A%20Progressive%20Communications%20Receiver.html**.

❖ SDRs

Performance-wise, software-defined radios *are* the state of the art. They're based on a fusion of traditional radio architecture and advanced digital-signal processing. Ironically, most are essentially high-tech direct-conversion receivers with a digital twist! A more in-depth discussion of the various SDR flavors can be found in the SDR section of the 2013 Buyer's Guide in the November 2011 issue of *MT*. If you have a PC with a sound card (and who doesn't?), a Softrock kit SDR (yes, a kit) to get you started in your experiments can be found at **http://fivedash.com** for about $20.

Whether old, new or a hybrid fusion of your own design, don't worry about The Latest and Greatest. Just build something and go from there! I plan to cover home-brewing, including the new breed of affordable test equipment, in future columns.

GETTING STARTED
THE BEGINNER'S CORNER

Ken Reitz, KS4ZR
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Chasing Uncertified CB Radios and More on Cord-Cutting

In the December "Communications" column I noted that the FCC had launched a crackdown on retailers using the Internet sales site Craigslist to advertise the sale of "devices designed to intentionally block, jam or interfere with authorized radio communications," as the FCC put it in their press release. The news item was picked up by numerous media outlets. The crackdown stems from the fact that the devices are not FCC certified and because it's illegal to attempt to jam or interfere with licensed users, in this case wireless phone and GPS satellite systems. It's also illegal to offer such devices for sale, own or, in fact, even use such devices.

Long time *MT* reader Steve Karnes K9HY took note of the announcement and commented to the effect that, when it comes to wireless telephone interference, or when FM broadcast stations are interfered with, FCC field agents are Johnny-on-the-Spot. But, when it comes to online and brick-and-mortar retailers selling modified CB sets, uncertified amateur radio transceivers and power amplifiers that can interfere with licensed amateur radio stations, the FCC is slow, if ever, to react.

For years Steve has waged a one-man campaign to alert the FCC and the Federal Trade Commission (FTC) about the illicit trade in transceivers dressed up like ham gear but sold to CBers. The issue is the sale of CB sets to the general public which are called 10 meter "amateur radio" transceivers that can be easily modified, by use of a switch or clipping a jumper wire for example, to transmit on the 11 meter Citizens Band frequencies.

Why wouldn't hams want such a transceiver and why don't you see these products sold in ham shops and catalog companies? Mostly because the features found on most such rigs are useless to hams: echo boards, "roger" beeps, channels instead of frequency counters, AM and FM modulation with no provision for CW, SSB or digital mode output. There are only certain frequencies on 10 meters where AM and FM modulation is used and many of these sets don't show the actual operating frequency without a separate frequency counter or allow for split frequency for FM repeater use.

Galaxy DX44HP is a 10 meter "amateur radio" transceiver made in Taiwan. But, under FCC rules, it might be a CB set in disguise. Oddly, only the ARRL knows for sure. (Courtesy: Galaxy Radio)

In 1996 the FCC issued a public notice from the commission's Office of Engineering and Technology (OET) that labelled such devices as in fact CB transmitters, thereby making them uncertified equipment and illegal to sell. It's the OET from 1996 that has allowed the Enforcement Bureau to do anything against the sale of such transceivers.

The big payoff in this effort came between 1999 and 2003 when the commission went after Pilot Travel Centers of Knoxville, Tennessee, a nationwide chain of truck stops that, among other things, sold CB and "amateur radio" transceivers. The commission issued nine citations, one to the corporate headquarters and eight to individual stores visited by FCC agents. Here's how it went down, according to the Notice of Apparent Liability for Forfeiture (NAL) issued November 2004:

"From December 9, 2001 through May 6, 2003, the Commission received four complaints specifically naming Pilot Travel Centers as marketing non-certified CB transceivers. From August 2001 through September 2002, Enforcement Bureau field agents visited eleven Pilot retail outlets at the following locations: Sulphur Springs, Texas; Dallas, Texas; Weatherford, Texas; Brooks, Oregon; Casa Grande, Arizona; Quartzsite, Arizona; North Palm Springs, California; North Las Vegas, Nevada; Barstow, California; Boron, California; and Hesperia, California. At these locations, the stores displayed and offered for sale various models of non-certified CB transceivers marketed as ARS transmitters. Prior to the field visits, OET had tested all of these models and found each of them to be non-certified CB transceivers."

Through their counsel the chain had dismissed the original citations issued in 2001 claiming the devices were marketed as amateur radio transceivers which required no certification. Invoking the 1996 OET, the FCC rejected the company's claim. Creep forward from 2001, when the FCC began its investigation, to 2004 when it issued the NAL:

"Subsequently, in forty-seven separate instances from October 8, 2002 to July 3, 2004, Pilot offered for sale various models of non-certified Galaxy brand CB transmitters, which had all been tested and determined by OET to be non-certified CB transmitters. Although they were labeled as 'amateur radios,' the specified models of Galaxy transmitters are CB transmitters, because each was designed to be easily modified by the end user to allow operation on CB frequencies. Additionally, in at least eleven of the forty-seven instances of marketing by Pilot, Pilot employees referred to the devices as `CB's.'"

WHAT CAN YOU DO?

According to the FCC web site, "The Enforcement Bureau's Spectrum Enforcement Division handles complaints relating to the importation and marketing of radio frequency devices in violation of the equipment authorization and technical requirements set forth in Parts 2 and 15 of the Rules.

"Complaints alleging violations of the equipment marketing requirements should be sent to the attention of Kathryn Berthot, Division Chief, or Neal McNeil, Senior Engineer, at the following address: Federal Communications Commission, Enforcement Bureau, Spectrum Enforcement Division, 445 12th Street, SW, Washington, D.C. 20554.

"Complaints should include as much of the following information as possible: (1) a detailed description of the equipment, including the model number and FCC ID number, if any; (2) the name, address and website of the company manufacturing or marketing the equipment; (3) a detailed statement as to the alleged violation, including the provisions of the Communications Act, Commission rule or order believed to have been violated; and (4) any documentation supporting the alleged violation."

So, is there a truck stop/CB shop in your area offering modifiable CB sets, uncertified amps and transceivers? Let the Enforcement Bureau know. File a complaint and hope you live long enough to see the results.

The FCC calculated the base forfeiture amount for all of Pilot's violations at $90,000, but then added:

"We are particularly troubled that Pilot continues to violate these rules despite receiving nine Citations for marketing non-certified CB transmitters. These Citations put Pilot on actual notice that marketing of this equipment is unlawful, yet Pilot intentionally continued to market the unlawful equipment. Pilot's continuing violations of the equipment authorization requirements evince a pattern of intentional non-compliance with and apparent disregard for these rules. Accordingly, we believe an upward adjustment of the base forfeiture amount is warranted. Applying the Forfeiture Policy Statement and statutory factors (e.g., nature, extent and gravity of the violation and the history of prior offenses) to the instant case, we conclude that it is appropriate to propose a forfeiture of $125,000 for Pilot's apparent violations. Therefore, we find Pilot apparently liable for a forfeiture in the amount of $125,000."

Inch forward again to May 2006, seven years after the investigation began and during which time, according to FCC documents, Pilot

continued to market the devices. Lo and behold, a Consent Decree in which, "Pilot does not admit or deny any liability for violating the Act or the Rules in connection with the matters that are the subject of this Consent Decree."

The company now suddenly agreed that any CB sets it offers for sale will be FCC certified. That, "Prior to the sale or marketing of Amateur Radio Service transmitters, Pilot will ensure that the transmitters have been reviewed by the Technical Department Laboratory of the American Radio Relay League, Inc. ("ARRL") and found to transmit only in Amateur Radio Service bands.

"It will remove all Galaxy Model Number DX33HML, DX66V or DX99V transceivers and any other Amateur Radio Service transmitters that have not been reviewed by the Technical Department Laboratory of the ARRL and found to transmit only in Amateur Radio Service bands from all retail areas of Pilot Travel Centers."

The Decree required that the company will, "ensure that CB transmitters offered for sale or sold by entities leasing space on the premises of any Pilot owned or operated property are certified. It will ensure that all Amateur Radio Service transmitters offered for sale or sold by entities leasing space on the premises of any Pilot owned or operated property are reviewed by the Technical Department Laboratory of the ARRL and found to transmit only in the Amateur Radio Service bands."

The Consent Decree goes on to explain rules that the company must adhere to *if* it decides to offer "amateur radio" transceivers in the future and how salespeople and those ordering such products must behave. It was up to Pilot's Director of Marketing to make sure the Decree's requirement were lived up to for a period of two years after the date of the decree. The punch line is that Pilot also agreed "to make a voluntary contribution to the United States Treasury in the amount of ninety thousand dollars ($90,000)…" thus saving the company $35,000 in fines.

One purpose in levying any large fine is that it's supposed to serve as a warning to others not to sell uncertified transceivers. But, two years later in 2006 the FCC issued fines for similar activities to Love's Truck Stops ($25,000), G.I. Joe's CB shops ($21,000), Gambler's CB and Ham Radio Sales ($7,000), and CB and Electronics ($14,000) for similar CB sales. Even now, over the ensuing seven years since the above activity, such products sell daily online and on the shelves at truck stops across the U.S.

These retail operators rely on the thinly staffed and notoriously slow process of the Enforcement Bureau. For example, a Colorado store was first cited in November 2002 for selling such devices and by March 2008 a $7,000 Forfeiture Order was finally issued. According to FCC documents, the store continued selling the rigs after the first citation. It would be possible, based on the retail price of the cited radio, that the store only had to sell an average of a handful of uncertified rigs per year in each of the six years to pay for the FCC fine, or as might be argued, the "cost of doing business with the FCC."

And, unless you thought sales of such products were disappearing, in addition to truck stops, you can find uncertified CB sets on eBay and Amazon. In fact, the online stores are branching out. On one site, legitimate Icom mobile 2 meter and hand-held duo-band units are sold under the guise of "hunting" radios, no licensed required; non-certified "amateur radio" 40 and 100 watt transceivers are still widely available.

❖ Disappearance of OTA-TV

MT reader Ronny Bolsega KG7A wrote, "I read your Communications column in *MT* November 2012 (*"FCC Readies OTA Auction Date"*) and I'm a bit curious because you mentioned, 'In a relentless effort to turn what's left of the broadcast TV spectrum over to commercial broadband interests to solve the perceived shortage of spectrum being sucked up by bandwidth-hungry 4G devices, the FCC has a set timetable that will allow 'repacking' of the TV band by as early as 2014.' Also, you mentioned, 'The process involves a convoluted scheme by which local TV Stations will first be encouraged to cash in their licenses and join with their competitors on new consolidated TV channels. It includes broadband mega-corporations such as Verizon, which will presumably win such an auction, which would then make local TV programming, cable and Internet-TV fare available to consumers via mobile devices on a monthly basis. What hasn't been discussed is what to do with recalcitrant TV stations unwilling to surrender their licenses.' Is this the Real Deal, Ken?

"I totally boycott the cable companies because of their ridiculous prices. My Mother is 86 and her bill jumped from $19.99 monthly to $72.00 monthly, in one month! Sorry!!! I'm going to work for our family, but this isn't going to work for our family. So, I switched her to OTA by setting a Winegard antenna on the roof and getting a digital TV converter box. My wife and I also use OTA because of ridiculous cable costs."

I'm glad to hear about your "cord-cutting" experiences. I think the biggest hindrance to most American's ditching cable or satellite-TV is ESPN. I've said before that it's probably easier for most men to kick tobacco than to kick their ESPN habit.

The essential problem is that, by some estimates, only 11 percent of us watch OTA-TV exclusively. That means that 89 percent of Americans could care less about whether or not channel 6 teams up with channels 8 and 12 to transmit from one tower. They get local TV on cable and nothing will appear to change for them. That's why, even today, most cable-TV viewers are watching their local channels only in standard definition; when cable companies make their local channels available in HD it naturally goes to a more expensive tier.

Cable TV subscribers who see OTA-TV for the first time are astonished at how much better the picture is (now that most consumers have purchased HDTV sets, they can see the difference). There is a whole generation of TV viewers who don't know that they can get TV reception OTA and think they are somehow "hacking" the signal when they use an outside antenna.

It's difficult not to see a conspiracy in the business of selling out OTA-TV spectrum. The great majority of FCC commissioners, who will decide the fate of OTA-TV, are from the wireless industry and, as they revolved in and out of the FCC over the last 10-15 years, have charted a course for the country that moves us all to a pay-based wireless broadband TV system.

Winegard HD7084 OTA-TV antenna: a relic of the past? (Courtesy: Winegard)

PROGRAMMING SPOTLIGHT

WHAT'S ON WHEN AND WHERE?

Fred Waterer
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Warm Sounds for Winter Listening

February has arrived, and in North America that means most of us descend into the annual deep freeze of winter. But not to worry, because we are shining the Programming Spotlight on some programs and frequencies which originate in mostly warmer climes, and which will warm the spirit, entertain and inform through those long winter nights. It works for those in southern regions as well!

Recently, due to some schedule changes here at home, I have spent more than a few hours listening to **Radio Australia** in the local mornings. 9580 kHz has been one of the better **Radio Australia** frequencies for almost as long as I can remember. There are more than a few interesting programs to be heard in our local mornings.

Radio Australia gets it. Like their colleagues at **Radio New Zealand (National and International)** and a limited number of other stations, the folks at **Radio Australia** still provide a full service schedule. Yes, news is important, but they also provide a wide variety of highly entertaining programs to go along with their top-notch factual reporting. Other programs go behind the headlines and report on issues in depth, and do it with a sense of humor.

Damien Carrick, host of The Law Report (Courtesy: radioaustralia.net.au)

On the surface, a program called *The Law Report* sounds, well, kind of dry. But that is anything but the case. Recently, host Damien Carrick devoted the entire program to an interview with Beth Wilson, the retiring Health Commissioner (a sort of Health Ombudsman) for the State of Victoria. It was a fascinating half hour.

Carrick is a great interviewer, and he brought out the most, from the very engaging Ms. Wilson. One of her main efforts was to shut down charlatans who prey on the sick and vulnerable. They discussed a few rather egregious examples. She has been a tireless advocate for the legal rights of patients. We also got to see her human side. For instance, she plays the harmonica (and demonstrated her talent on air) and she has a fabulous wit. She related a story about revealing, during a symposium, that she suffers from incontinence, and getting over the feelings of shame associated with this common and treatable affliction. She felt if she "came out" it would help others. In her own self-deprecating words, she was so eloquent that at the end of her talk "there was not a dry seat in the house!" She demonstrated a talent for handling the most serious problems with common sense and humor. Carrick skilfully drew this out. Programs like *The Law Report* make for compelling listening, if you give them a chance. You can hear it UTC Wednesdays at 1230 UTC.

Later at 1330 UTC Wednesdays, another fantastic program is *Jazz Notes*, hosted by Ivan Lloyd. This program is a window into the vibrant Jazz music scene in Australia. In December Ivan and his studio guests were reviewing the best Jazz releases of 2012, and they featured some great tracks.

Like Country Music? Tune in UTC Saturday mornings for *Saturday Night Country*, hosted by Felicity Urquhart. Catch the first three hours of this show from 1100-1400 UTC on 9580 kHz. Each week Felicity presents the best of the extraordinary country music scene down under, including music, interviews and featured artists. These are just three of the programs one can hear from Australia. One can hear news, information and music that one won't find anywhere else, with a unique South Pacific humor and perspective.

Next door in New Zealand, **Radio New Zealand International** also provides a broad spectrum of programming. A long time favorite with listeners is *Sounds Historical* with Jim Sullivan, heard from 0800-0900 UTC Sundays on 9765 kHz. Each week, Jim delves into the history of New Zealand, discussing sometimes rather contemporary stories, other times looking at issues deep in antiquity, but it is always interesting. Also on weekends, **RNZI** tends to relay a lot of domestic programming from **Radio New Zealand National**, so if you want a taste of the local flavors, tune in and enjoy! Just a few of the programs on offer include *Music 101* UTC Saturdays at 0100 UTC on 15720 kHz and Saturday Night with Peter Fry, featuring music, reminiscences and listener requests. Catch Peter at 0600 UTC on 11725 kHz.

While 9580 kHz has been a long-standing **Radio Australia** frequency, another station which has been parked on the same frequency for many years is **Radio Nacional da Amazonia** from Brazil. I can remember listening to the programming from this station as far back as the early 1980s. I do not speak Portuguese at all, but that does not prevent me from finding this radio station rather entertaining. One can linger on the frequency and listen to some pretty eclectic music, and despite the language barrier, it is very pleasant to listen to.

Radio Australia logo (Courtesy: mt-shortwave.blogspot.com)

Brazil is one of those countries that seems to fly under the radar here in North America, yet it is a happening place. The economy is reportedly strong and it will play host to the 2016 Summer Olympics. Tune in to **Radio Nacional da Amazonia**, and hear some great Brazilian music and a mix of world music. The Portuguese language is fun to listen to, and the speakers always seem to be having a party, perhaps not unusual in the land of carnival. I may have even heard a "futbol" match on a **Radio Nacional** frequency, with the trademark "goooooooooal!" Check it out on 6180 kHz most mornings and evenings.

While we are on the topic of interesting languages, just down the dial at 6175 kHz, one can hear the **Voice of Vietnam**. With the demise of the Sackville relay station in New Brunswick, Canada, many shortwave broadcasters have scrambled to get transmitter time from other locations. the **Voice of Vietnam** had been on 6175 kHz via Sackville for many years and, sure enough, they are still there, reportedly now from Montsinery in French Guiana. The programming in the one-hour block from 0430-0530 UTC contains a lot of beautiful Vietnamese music and an opportunity to hear the unique sing-song language of that country.

The **Voice of Serbia** has been putting a good signal into North America during local evenings on 6190 kHz. The English Service can be heard at 0130 UTC. They also appear to have a new, very melodic interval signal, which I don't recall hearing before. Once you get past the news and information aspects of the broadcast, the music is well worth the price of admission. The countries in the former Yugoslavia are a complicated bunch, but they all share a fantastic musical heritage. And, they have developed a style of music that psychologists would have a field day with. It is a very frenetic mix of folk and rock with a sort of "party now because tomorrow we might die" attitude. And in the 1990s that was a distinct possibility. Listening at the end of a **Radio Serbia** transmission in December there were several minutes of this high octane music. Is it any wonder that it is called Turbo Folk! Often you can hear more great music if you stay tuned to the Serbian language broadcast at 0200 UTC.

I hope after reading this that you will find something to keep you entertained during our cold winter months and remind you that spring is just around the corner!

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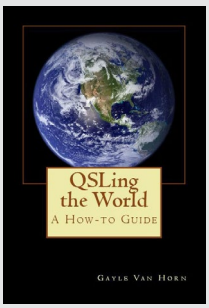
http://mt-shortwave.blogspot.com
Twitter @QSLRptMT

Period Reporting...an Alternative Approach

One of the most effective approaches to QSLing, with minimal extra expense involved, is the Period Report. This involves creating a series of reports encompassing intercepts taken over a number of days or even weeks. This method provides the station with useful information, and a better indication of how well their signal is received over a longer amount of time, as opposed to a single report of thirty minutes in duration.

The best or first logging can be written up in detail in the usual reporting format. Period reporting of programming information should be omitted from the remaining logs, but they should include time (UTC) date and any parallel frequencies monitored. The SINPO code, for international broadcasters is encouraged. Any additional technical observation should be included and cover a 20-30 minute listening session.



QSLing the World cover & India's Athmeeya Yatra Radio cd via GVH

By using this extended reporting method, you will show the station you have taken an interest in providing them with information and that you have taken the extra time and effort to do so.

More QSL tips and tricks are available in my new e-book available from Amazon.com at http://tinyurl.com/acfsjav.

BULGARIA

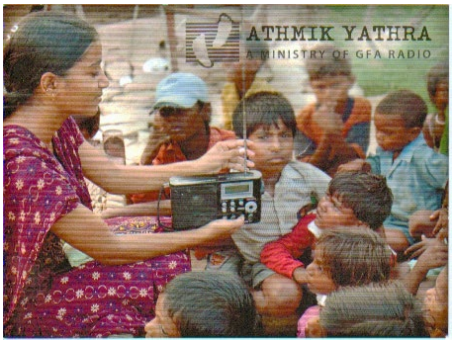
The Mighty KBC 9500 kHz via Kostinbrod, Bulgaria relay. Full data E-QSL and cover letter from Eric von Willegen. Received in three hours for email report to *themightykbc@gmail.com* Station address: Argonstraat 6, 6718 WT Ede, The Netherlands (Edward Kusalik, Alberta, Canada) Received in five hours via KBC email (Bruce Portzer, HCDX) Website: **www.kbcradio.eu**

CLANDESTINE

Sound of Hope Radio International, 9450 kHz. No data QSL card and stickers. Received in 50 days for report to *info@sohnetwork.com* and postal report with audio CD to: Sound of Hope Radio International, 6-4, Lane 84, Guo Tai Street, North District, Taichung 404 Taiwan. (Portzer) Falun Gong-related Sound of Hope Radio International is the shortwave programming of Sound of Hope Radio Network, Inc., and global provider of Chinese programming. Broadcast are subject to 'Firedrake,' Chinese music jammers. Streaming audio **www.soundofhope.org**

INDIA

Athmeeya Yatra Radio, 15390 kHz. Partial data, color logo *Reaching the Most Unreached* card, featuring children listening to shortwave radio, unsigned. Received in 55 days for an English report for the Karbi and Mising services, plus $2.00 and a souvenir postcard. Station address: P.O. Box 12, Manjadi Junction P.O., Tiruvalla-5, Kerala 689 105, India. Reply from Gospel for Asia, 1800 Golden Trail Court, Carrollton, X 75010. Athmeeya Yatra Radio is a ministry of Gospel for Asia. (Gayle Van Horn, NC) On demand audio **www.athmeeyayaathra.org/radio.php** (or) **www.ayasia.org** Email: *info@Athmeeyayayathra.org*



MEDIUM WAVE

Iran-IRIB Orumiyah 936 kHz AM. Station QSL card misdated as October 7, 2012, instead of October 7, 2010. Received in three months for follow up report. The large envelope was badly damaged en route, but included a calendar, two magazines, an English shortwave schedule, hardcover book The Life of Imam Khomeini and a Facebook invitation to **www.facebook.com/IRIB-English-Radio**. QSL address: Islamic Republic of Iran Broadcasting, IRIB World Service Public Relations Tehran-I.R., of Iran Valiasr Avenue. jam e jam St., P.O. Box 19395/6767, Tehran, Iran (Jim Renfrew, Holley, NY/NRC DX News 80) Email *prworld@irib.ir*

Mexico-XENZ 890 kHz AM. Culiacán, Sinaloa. Partial data email attachment on Televisa Radio letterhead from Lic Enrique Torres Segovia, Director General. Confirmation for 2001 reception. Email for reply to follow up report sent to: Av Alvaro Oberegón 24 Sur, Local 53, Plaza Paladio, Culiacán, Sinaloa 80000 Mexico. (John Wilkins, Wheat Ridge, CO/NRC DX News)

WMVP 1000 kHz AM. *ESPN Chicago 1000*. Full data station QSL and prepared QSL card returned as verified by John Hurni, Chief Engineer. Received in nine days for an AM report, prepared QSL card, and one mint stamp. Station address: 190 North St., Chicago, IL 60601 (Loyd Van Horn, SC) Streaming audio **www.espn.go.com/chicago/radio/**

WQAM 560 kHz AM. *Sports Radio*. Full data prepared QSL card returned as verified by George C., Chief Engineer. Received in nine days for an AM report, prepared QSL card, and one mint stamp. Station address: 194 NW 187 St., Miami Gardens, FL 33169 (Van Horn) Streaming audio **www.wqam.com**

SEYCHELLES

BBC Mahé, Seychelles relay, 9410 kHz. Full data QSL card signed by José Tambara. Received in 134 days. Station address: BBC Indian Ocean Relay Station, P.O. Box 448, Victoria, Seychelles (Alex Robert/playdx)

UTILITY

Bermuda-ZBR Bermuda, 518 NAVTEX. Full data Telex style E-QSL from Duty Officer. Received in 352 days for a utility report via postal mail and one IRC. Follow-up report to *rccbd@gov.bm* (Al Muick, PA/HCDX)

Canada-Trenton Military Volmet, 6754 kHz. Full data card, signed by Corp. Charles Raine. Received in 146 days for a utility report. QSL address: 8 Wing Trenton, WITSS (MACS Site), Hwy N 33, 21124 Loyalist Pkwy., Varrying Place, ONT Canada KOK1L0 (Rafael Rodriguez R, Bogotá, Colombia/playdx)

Croatia-BRZ-NDB Breza/Rijeka, 400 kHz. Full data verification letter, and prepared QSL returned with stamped station seal. Received in 23 days for a utility report and prepared QSL card. QSL address: Hrvatska kontrola zracne plovidbe d.o.o., Podruznica Rijeka, p.p. 28, 51313 Omisalj, Croatia. (Patrick Robic, Austria/UDXF).

Germany-DCF49, 129,1 kHz Mainflingen, Germany; DC39, 139 kHz Burg, Germany; HGA22, 135,6 kHz Lakithegy, Hungary. Europäische Funk-Rundsteuererung GmbH (European Radio Ripple Control). Three QSL cards for long wave transmissions, signed by Ulrike Kattner. Received in 14 months for utility reports. QSL address: Postfach 20 05 53, 80005 München, Germany (Juan Francesco, Italy/playdx)

Hong Kong-Marine Rescue VRC 12577 kHz. Full data verification form letter. Received in four months for a utility report to Hong Kong MRCC address, reply from: PCCW Limited, P.O. Box 9896, GPO Hong Kong (Martin Foltz, CA/UDXF)

USA-IWA KHRC, S.S. Matsonia (Cargo Vessel), MMSI 366365000, 12577 kHz. Full data prepared form letter returned as verified, unsigned. Received in 24 days for a utility report and prepared QSL letter. QSL address: Port of Long Beach, Port Administration Bldg., 925 Harbor Plaza, Long Beach, CA 90802 (Foltz)

USA-KAH63-FBI St. Louis, 7903.5 kHz. No data email response from Ricky J. Holt-Telecommunications Manager *stlouis@ic.fbi.gov*. Received in ten hours and noted QSL card response would be from headquarters in Virginia. Verification card and certificate received from headquarters in 11 days. QSL address: FBI Engineering Research Facility, Building 27958-A, Quantico, VA 22135 USA (Robic)

How to Use the Shortwave Guide

CONVERT YOUR TIME TO UTC

Broadcast time on ① and time off ② are expressed in Coordinated Universal Time (UTC) – the time at the 0 meridian near Greenwich, England. To translate your local time into UTC, first convert your local time to 24-hour format, then add (during 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.).

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

FIND THE STATION YOU WANT TO HEAR

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

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

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

CHOOSE PROMISING FREQUENCIES

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

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

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

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

Target Areas

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

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

MT MONITORING TEAM

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Additional Contributors to This Month's Shortwave Guide:

Thank You to …

AOKI; BCL News; Cumbre DX; DSWCI/DX Window; Hard-Core DX; DX Re Mix News 752-759; HFCC; British DX Club; WWDX Club/Top News.

A.J. Janitschek/RFA; Alokesh Gupta, New Delhi, India; Alan Pennington, UK; Tom Taylor, UK; Andreas Volk, Germany/ADDX; Ashik Eqbal Tokon, Rajshahi, Bangladesh; Cladius Dedio/AWR; Brenda Constantino/WYFR; Dan Elyea/WYFR; Tom Solomon/WYFR; Georgi Bancov/Balkan DX; Ivo Ivanov, Bulgaria; Harold Frodge, MI; Ron Howard, CA; Jose Jacobs, India/DXindia; Juan Franco Crespo, Spain; Walt Salmaniw, Canada; Michael Puetz/MB; Sei-ichi Hasegawa, Japan; Sean Gilbert UK/WRTH 2013; Wolfgang Bueschel, Stuttgart, Germany.

SHORTWAVE BROADCAST BANDS

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

Notes

Note 1	Tropical bands, 120/90/60 meters are for broadcast use only in designated tropical areas of the world.
Note 2	Broadcasters can use this frequency range on a (NIB) non-interference basis only.
Note 3	WARC-92 bands are allocated officially for use by HF broadcasting stations in 2007
Note 4	WRC-03 update. After March 29, 2009, the spectrum from 7100-7200 kHz will no longer be available for broadcast purposes and will be turned over to amateur radio operations worldwide

0000 UTC - 7PM EST / 6PM CST / 4PM PST

0000 0030	Egypt, R Cairo	9965am	11510al	
0000 0030	USA, BBG/VOA	7560as		
0000 0030 twhfa	USA, WHRI Cypress Creek SC			9895ca
0000 0030 sm	USA, WHRI Cypress Creek SC			7335ca
0000 0045	India, AIR/External Svc	6055as	9690as	
	9705as	11710as	13605as	
0000 0045 DRM	India, AIR/External Svc	11645as		
0000 0057	China, China R International			6005eu
	6020as	6180eu	7350as	7415as
	9425as	9570as	11650as	11790as
	11885as			
0000 0100	Anguilla, University Network			6090na
0000 0100	Australia, ABC NT Alice Springs			4835do
0000 0100	Australia, ABC NT Katherine			5025do
0000 0100	Australia, ABC NT Tennant Creek			4910do
0000 0100	Australia, ABC/R Australia	9660pa	12080pa	
	15240pa	15415pa	17795pa	19000pa
	21740pa			
0000 0100	Bahrain, R Bahrain	6010me		
0000 0100	Canada, CFRX Toronto ON	6070na		
0000 0100	Canada, CFVP Calgary AB	6030na		
0000 0100	Canada, CKZN St Johns NF	6160na		
0000 0100	Canada, CKZU Vancouver BC			6160na
0000 0100 Sun	Germany, Mighty KBC Radio			9450eu
0000 0100	Malaysia, RTM Kajang/Traxx FM			7295do
0000 0100	Micronesia, V6MP/Cross R/Pohnpei			4755 as
0000 0100	New Zealand, R New Zealand Intl			15720pa
0000 0100 DRM	New Zealand, R New Zealand Intl			17675pa
0000 0100	Palau, T8WH/World Harvest R			17650as
0000 0100	Russia, VO Russia	7250na		7290na
0000 0100	Thailand, R Thailand World Svc			13745na
0000 0100	UK, BBC World Service	5970as	6195as	
	7360as	9410as	9740as	11750as
	12095as	13725as	15335as	15755as
0000 0100	USA, AFN/AFRTS	4319usb	5765usb	
	12759usb	13362usb		
0000 0100	USA, Overcomer Ministry	3185na		
0000 0100 Sat/Sun	USA, WBCQ Monticello ME	5110na		
0000 0100	USA, WBCQ Monticello ME	7490na		9330na
0000 0100	USA, WEWN/EWTN Irondale AL			11520af
0000 0100	USA, WHRI Cypress Creek SC			5920eu
0000 0100	USA, WINB Red Lion PA	9265ca		
0000 0100	USA, WRNO New Orleans LA			7505na
0000 0100	USA, WTWW Lebanon TN	5830na		
0000 0100	USA, WWCR Nashville TN	3195eu	5070af	
	9980af	13845af		
0000 0100	USA, WWRB Manchester TN			3185na
	3215na			
0000 0100	USA, WYFR/Family R Worldwide			6115na
0000 0100	Zambia, Christian Voice	4965af		
0030 0100	Australia, ABC/R Australia	17750as		
0030 0100	USA, WHRI Cypress Creek SC			7335ca
0030 0100 mtwhf	USA, WRMI/R Slovakia Intl relay			9955am

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

0100 0115 Sat/Sun	Canada, Bible Voice Broadcasting			7395as
0100 0130	Vietnam, VO Vietnam/Overseas Svc			9470na
0100 0157	China, China R International			6020as
	6075eu	6175eu	7350as	9410as
	9420na	9570na	9580as	11650as
	11885as			
0100 0200	Anguilla, University Network			6090na
0100 0200	Australia, ABC NT Alice Springs			4835do
0100 0200	Australia, ABC NT Katherine			5025do
0100 0200	Australia, ABC NT Tennant Creek			4910do
0100 0200	Australia, ABC/R Australia	9660pa	12080pa	
	15160pa	15240pa	15415as	17750pa
	17795pa	19000pa		
0100 0200	Bahrain, R Bahrain	6010me		
0100 0200	Canada, CFRX Toronto ON	6070na		
0100 0200	Canada, CFVP Calgary AB	6030na		
0100 0200	Canada, CKZN St Johns NF	6160na		
0100 0200	Canada, CKZU Vancouver BC			6160na
0100 0200	Cuba, R Havana Cuba	5040ca	6000na	
	6165na			
0100 0200 Sun	Germany, Mighty KBC Radio			9450eu
0100 0200	Malaysia, RTM Kajang/Traxx FM			7295do
0100 0200	Micronesia, V6MP/Cross R/Pohnpei			4755 as
0100 0200	New Zealand, R New Zealand Intl			15720pa
0100 0200 DRM	New Zealand, R New Zealand Intl			17675pa
0100 0200	Palau, T8WH/World Harvest R			17650as
0100 0200	Romania, R Romania Intl	6145na	7340na	
0100 0200	Russia, VO Russia	7250na	7290na	
0100 0200	Taiwan, R Taiwan Intl	11875as		
0100 0200	UK, BBC World Service	5940eu	5970as	
	9740as	11750as	12095as	15310as
	15335as	15755as	17685as	
0100 0200	USA, AFN/AFRTS	4319usb	5765usb	
	12759usb	13362usb		
0100 0200	USA, BBG/VOA	9435va	11705va	15155va
0100 0200	USA, KJES Vado NM	7555na		
0100 0200	USA, Overcomer Ministry	3185na		
0100 0200 mtwhf	USA, Overcomer Ministry	7490na		
0100 0200 mtwhf	USA, WBCQ Monticello ME	5110na		
0100 0200	USA, WBCQ Monticello ME	7490na		9330na
0100 0200	USA, WEWN/EWTN Irondale AL			11520af
0100 0200	USA, WHRI Cypress Creek SC			5920eu
0100 0200 m	USA, WHRI Cypress Creek SC			9605ca
0100 0200 twhfas	USA, WHRI Cypress Creek SC			7315sa
0100 0200	USA, WINB Red Lion PA	9265ca		
0100 0200	USA, WRNO New Orleans LA			7505na
0100 0200	USA, WWCR Nashville TN	3195eu	4840na	
	5890af	5935af		
0100 0200	USA, WWRB Manchester TN			3185na
	3215na			
0100 0200	USA, WYFR/Family R Worldwide			6115na
0100 0200	Zambia, Christian Voice	4965af		
0120 0200 mtwhfa	Sri Lanka, SLBC	6005as	9770as	15745as
0130 0200 twhfa	Serbia, International R Serbia			6190va
0140 0159	Vatican City State, Vatican R	7410as		9560as

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

0200 0230	Thailand, R Thailand World Svc			13745na
0200 0230	USA, KJES Vado NM	7555na		
0200 0257	China, China R International			11785as
	13640as			
0200 0300	Anguilla, University Network			6090na
0200 0300 twhfa	Argentina, RAE	11710am		
0200 0300	Australia, ABC NT Alice Springs			4835do
0200 0300	Australia, ABC NT Katherine			5025do
0200 0300	Australia, ABC NT Tennant Creek			4910do
0200 0300	Australia, ABC/R Australia	9660pa	12080pa	
	15160pa	15240pa	15415as	17750pa
	17795pa	19000pa		
0200 0300	Bahrain, R Bahrain	6010me		
0200 0300	Canada, CFRX Toronto ON	6070na		
0200 0300	Canada, CFVP Calgary AB	6030na		
0200 0300	Canada, CKZN St Johns NF	6160na		
0200 0300	Canada, CKZU Vancouver BC			6160na
0200 0300	Cuba, R Havana Cuba	6000na	6165na	
0200 0300	Egypt, R Cairo	9720na	9315al	
0200 0300	Malaysia, RTM Kajang/Traxx FM			7295do
0200 0300	Micronesia, V6MP/Cross R/Pohnpei			4755 as
0200 0300	New Zealand, R New Zealand Intl			15720pa
0200 0300 DRM	New Zealand, R New Zealand Intl			17675pa
0200 0300	Palau, T8WH/World Harvest R			17650as
0200 0300	Philippines, R Pilipinas Overseas Svc			11880me
	15285me	17700me		
0200 0300	Russia, VO Russia	7150ca	7290am	
	15630na	17665na	17690na	
0200 0300	South Korea, KBS World R	9580sa	9640as	
0200 0300 mtwhfa	Sri Lanka, SLBC	6005as	9770as	15745as
0200 0300	UK, BBC World Service	5875eu	5940eu	
	7435af	12095as	15310as	
0200 0300	USA, AFN/AFRTS	4319usb	5765usb	
	12759usb	13362usb		
0200 0300	USA, Overcomer Ministry	3185na		
0200 0300 mtwhf	USA, Overcomer Ministry	7490na		
0200 0300 fa	USA, WBCQ Monticello ME	5110na		
0200 0300	USA, WBCQ Monticello ME	7490na		9330na
0200 0300	USA, WEWN/EWTN Irondale AL			11520af

0200 0300	USA, WHRI Cypress Creek SC	5920eu 7315sa
0200 0300	USA, WINB Red Lion PA	9265ca
0200 0300	USA, WRNO New Orleans LA	7505na
0200 0300	USA, WWCR Nashville TN	3215eu 4840na 5890af 5935af
0200 0300	USA, WWRB Manchester TN	3185na 3195na
0200 0300	USA, WYFR/Family R Worldwide	6115na
0200 0300	Zambia, Christian Voice	4965as
0215 0220	Sri Lanka, SLBC	7190as 11905as
0215 0227 Sun	Nepal, R Nepal	5005do
0230 0300 twhfas	Albania, R Tirana	6100na
0230 0300	Myanmar, Myanma R/Yangon	9731do
0230 0300	Vietnam, VO Vietnam/Overseas Svc	9470na
0255 0300 Sun	Swaziland, TWR Africa	3200af

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

0300 0320	Vatican City State, Vatican R	15460as
0300 0325 Sun	Swaziland, TWR Africa	3200af
0300 0327	Vatican City State, Vatican R	9660af 11625af
0300 0330	Egypt, R Cairo	9720na 9315al
0300 0330	Myanmar, Myanma R/Yangon	9731do
0300 0330	Philippines, R Pilipinas Overseas Svc	11880me 15285me 17700me
0300 0357	China, China R International	9460am 9690na 9790as 11785as 13620as 15110as 15120as
0300 0400	Anguilla, University Network	6090na
0300 0400	Australia, ABC NT Alice Springs	4835do
0300 0400	Australia, ABC NT Katherine	5025do
0300 0400	Australia, ABC NT Tennant Creek	4910do
0300 0400	Australia, ABC/R Australia	9660pa 12080pa 15160pa 15240as 15415pa 17750pa 19000pa 21725pa
0300 0400	Bahrain, R Bahrain	6010me
0300 0400	Canada, CFRX Toronto ON	6070na
0300 0400	Canada, CFVP Calgary AB	6030na
0300 0400	Canada, CKZN St Johns NF	6160na
0300 0400	Canada, CKZU Vancouver BC	6160na
0300 0400	Cuba, R Havana Cuba	6000na 6165na
0300 0400	Malaysia, RTM Kajang/Traxx FM	7295do
0300 0400	Micronesia, V6MP/Cross R/Pohnpei	4755 as
0300 0400	New Zealand, R New Zealand Intl	15720pa
0300 0400 DRM	New Zealand, R New Zealand Intl	17675pa
0300 0400	Palau, T8WH/World Harvest R	17650as
0300 0400	Russia, VO Russia	7250am 7290na 15630na 17665na 17690na
0300 0400 mtwhf	South Africa, Channel Africa	3345af 6155af
0300 0400 Sun	Sri Lanka, SLBC	6005as 9770as 15745as
0300 0400	Taiwan, R Taiwan Intl	15320as
0300 0400	UK, BBC World Service	3255af 5940eu 6140af 6190af 7255af 7435af 9410eu 9460af 12035af 12095eu 15310as 17790as
0300 0400	USA, AFN/AFRTS	4319usb 5765usb 12759usb 13362usb
0300 0400	USA, BBG/VOA	4930af 6080af 9855af 15580af
0300 0400	USA, Overcomer Ministry	3185na
0300 0400 mtwhf	USA, Overcomer Ministry	7490na
0300 0400 fas	USA, WBCQ Monticello ME	5110na
0300 0400	USA, WBCQ Monticello ME	7490na 9330na
0300 0400	USA, WEWN/EWTN Irondale AL	11520af
0300 0400	USA, WHRI Cypress Creek SC	7520eu
0300 0400	USA, WRNO New Orleans LA	7505na
0300 0400	USA, WWCR Nashville TN	3215eu 4840na 5890af 5935af
0300 0400	USA, WWRB Manchester TN	3185na 3195na
0300 0400	USA, WYFR/Family R Worldwide	6115na
0300 0400	Zambia, Christian Voice	4965as
0330 0400	Iran, VO Islamic Rep of Iran/VO Justice	9710eu 11700eu 11770eu
0330 0400	USA, WHRI Cypress Creek SC	6175ca
0330 0400	Vietnam, VO Vietnam/Overseas Svc	9470na

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

0400 0427	Iran, VO Islamic Rep of Iran/VO Justice	9710eu 11700eu 11770eu
0400 0457	China, China R International	9460na 13620va 15120as 17725va 17855va
0400 0457	Germany, Deutsche Welle	5905af 7285af 9470af 9800af
0400 0457	North Korea, VO Korea	7220as 9345as 9730as 11735ca 13760sa 15180sa
0400 0458	New Zealand, R New Zealand Intl	15720pa
0400 0458 DRM	New Zealand, R New Zealand Intl	17675pa
0400 0500	Anguilla, University Network	6090na
0400 0500	Australia, ABC NT Alice Springs	4835do
0400 0500	Australia, ABC NT Katherine	5025do
0400 0500	Australia, ABC NT Tennant Creek	4910do
0400 0500	Australia, ABC/R Australia	9660pa 12080pa 15160pa 15240pa 15415as 21725pa
0400 0500	Bahrain, R Bahrain	6010me
0400 0500	Canada, CFRX Toronto ON	6070na
0400 0500	Canada, CKZN St Johns NF	6160na
0400 0500	Canada, CKZU Vancouver BC	6160na
0400 0500	Cuba, R Havana Cuba	6000na 6165na
0400 0500	Malaysia, RTM Kajang/Traxx FM	7295do
0400 0500	Micronesia, V6MP/Cross R/Pohnpei	4755 as
0400 0500	Palau, T8WH/World Harvest R	17650as
0400 0500	Romania, R Romania Intl	6130na 7305na 15220as 17870as
0400 0500	Russia, VO Russia	9830na 15630na
0400 0500 mtwhf	South Africa, Channel Africa	7230af
0400 0500 Sun	Sri Lanka, SLBC	6005as 9770as 15745as
0400 0500	Turkey, VO Turkey	7240as 9655va
0400 0500	UK, BBC World Service	3255af 6005af 6190af 7255af 9410eu 11760eu 12015af 12035af 12095af 15310as
0400 0500	USA, AFN/AFRTS	4319usb 5765usb 12759usb 13362usb
0400 0500	USA, BBG/VOA	4930af 4960af 9885af 15580af
0400 0500	USA, Overcomer Ministry	3185na 5890na
0400 0500 mtwhfa	USA, WBCQ Monticello ME	7490na
0400 0500	USA, WBCQ Monticello ME	9330na
0400 0500	USA, WEWN/EWTN Irondale AL	11520af
0400 0500 Sat	USA, WHRI Cypress Creek SC	7520eu
0400 0500 smtwhf	USA, WHRI Cypress Creek SC	9640eu
0400 0500	USA, WINB Red Lion PA	9265ca
0400 0500	USA, WRNO New Orleans LA	7505na
0400 0500	USA, WTWW Lebanon TN	5830na
0400 0500	USA, WWCR Nashville TN	3215eu 4840na 5890af 5935af
0400 0500	USA, WWRB Manchester TN	3185na 3195na
0400 0500	Zambia, Christian Voice	4965as
0430 0500 mtwhf	Swaziland, TWR Africa	3200af
0430 0500	USA, WHRI Cypress Creek SC	6175ca
0455 0500	Nigeria, VO Nigeria	15120af
0459 0500	New Zealand, R New Zealand Intl	11725pa
0459 0500 DRM	New Zealand, R New Zealand Intl	13730pa

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

0500 0527	Germany, Deutsche Welle	5905af
0500 0527	Vatican City State, Vatican R	7360af 13765af
0500 0530	Germany, Deutsche Welle	9420af 9800af 11800af
0500 0530	Japan, R Japan/NHK World	9770sa 11740na 17660va
0500 0557	China, China R International	7220as 11880as 15350as 15465as 17505va 17540va 17725va 17855va
0500 0557	North Korea, VO Korea	13650as 15100as
0500 0600	Anguilla, University Network	6090na
0500 0600	Australia, ABC NT Alice Springs	4835do
0500 0600	Australia, ABC NT Katherine	5025do
0500 0600	Australia, ABC NT Tennant Creek	4910do
0500 0600	Australia, ABC/R Australia	9660pa 12080pa 13630pa 15240pa 15415as 21725pa
0500 0600	Bahrain, R Bahrain	6010me

0500 0600	Bhutan, Bhutan BC Svc	6035do		
0500 0600	Canada, CFRX Toronto ON	6070na		
0500 0600	Canada, CKZN St Johns NF	6160na		
0500 0600	Canada, CKZU Vancouver BC			6160na
0500 0600	Cuba, R Havana Cuba	6010na		6060na
	6125am	6165na		
0500 0600	Eqt Guinea, Pan Am BC/R Africa			15190af
0500 0600	Malaysia, RTM Kajang/Traxx FM			7295do
0500 0600	Micronesia, V6MP/Cross R/Pohnpei			4755 as
0500 0600	New Zealand, R New Zealand Intl			11725pa
0500 0600 DRM	New Zealand, R New Zealand Intl			13730pa
0500 0600	Nigeria, VO Nigeria	15120af		
0500 0600	Palau, T8WH/World Harvest R			17650as
0500 0600	Russia, VO Russia	9830na		15630na
0500 0600 mtwhf	South Africa, Channel Africa			7230af
0500 0600	Swaziland, TWR Africa	3200af		9500af
0500 0600	UK, BBC World Service	3955eu		6005af
	7255af	9410af	11760eu	15310as
	15360va	15400af	15420af	17640af
0500 0600	USA, AFN/AFRTS	4319usb		5765usb
	12759usb	13362usb		
0500 0600	USA, BBG/VOA	4930af	6080af	9885af
	15580af			
0500 0600	USA, Overcomer Ministry	3185na		5890na
0500 0600	USA, WBCQ Monticello ME	9330na		
0500 0600	USA, WEWN/EWTN Irondale AL			11520af
0500 0600	USA, WHRI Cypress Creek SC			9615af
0500 0600	USA, WTWW Lebanon TN	5830na		
0500 0600	USA, WWCR Nashville TN	3215eu		4840na
	5890af	5935af		
0500 0600	USA, WWRB Manchester TN			3185na
0500 0600	Zambia, Christian Voice	6065af		
0502 0600	Swaziland, TWR Africa	6120af		9500af
0530 0557	Germany, Deutsche Welle	9470af		11800af
0530 0600	Australia, ABC/R Australia	17750as		
0530 0600	Thailand, R Thailand World Svc			12015va
0530 0600	USA, WHRI Cypress Creek SC			6195ca

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

0600 0630	China, Xizang PBS	6025do		6130do
	9580do			
0600 0630 Sat/Sun	USA, WRMI/R Prague relay	9955ca		
0600 0650 DRM	New Zealand, R New Zealand Intl			13730pa
0600 0657	China, China R International			11750af
	11770me	11880as	13645as	15145as
	15350as	15465as	17505va	17540as
	17710va			
0600 0657	North Korea, VO Korea	7220as		9345as
	9730as			
0600 0700	Anguilla, University Network			6090na
0600 0700	Australia, ABC NT Alice Springs			4835do
0600 0700	Australia, ABC NT Katherine			5025do
0600 0700	Australia, ABC NT Tennant Creek			4910do
0600 0700	Australia, ABC/R Australia	9660pa		11945pa
	12080pa	13630pa	15240pa	15415as
	17750pa	21725pa		
0600 0700	Bahrain, R Bahrain	6010me		
0600 0700	Canada, CFRX Toronto ON	6070na		
0600 0700	Canada, CFVP Calgary AB	6030na		
0600 0700	Canada, CKZN St Johns NF	6160na		
0600 0700	Canada, CKZU Vancouver BC			6160na
0600 0700	Cuba, R Havana Cuba	6010na		6060na
	6125am	6165na		
0600 0700	Eqt Guinea, Pan Am BC/R Africa			15190af
0600 0700	Germany, Deutsche Welle	13780af		17800af
0600 0700	Malaysia, RTM Kajang/Traxx FM			7295do
0600 0700	Micronesia, V6MP/Cross R/Pohnpei			4755 as
0600 0700	New Zealand, R New Zealand Intl			11725pa
0600 0700	Nigeria, VO Nigeria	15120af		
0600 0700	Palau, T8WH/World Harvest R			17650as
0600 0700	Russia, VO Russia	21800pa		21820pa
0600 0700 DRM	Russia, VO Russia	11635eu		
0600 0700 mtwhf	South Africa, Channel Africa			7230af
	15255af			
0600 0700	Swaziland, TWR Africa	3200af		6120af
	9500af			
0600 0700	UK, BBC World Service	3955eu		6005af
	6190af	9410af	9460af	12095af
	15360eu	15400af	15420af	15310as
	17640af	17790as		
0600 0700	USA, AFN/AFRTS	4319usb		5765usb
	12759usb	13362usb		
0600 0700	USA, BBG/VOA	6080af	9885af	15580af
0600 0700	USA, Overcomer Ministry	3185na		5890na
0600 0700	USA, WEWN/EWTN Irondale AL			11520af
0600 0700	USA, WHRI Cypress Creek SC			7315sa
	9615af			
0600 0700	USA, WTWW Lebanon TN	5830na		
0600 0700	USA, WWCR Nashville TN	3215eu		4840na
	5890af	5935af		
0600 0700	USA, WWRB Manchester TN			3185na
0600 0700	Zambia, Christian Voice	6065af		
0600 0700	Zambia, CVC Intl/1 Africa	13590af		
0617 0630 Sun	Nepal, R Nepal	5005do		
0630 0657	Vatican City State, Vatican R	11625af		13765af
0630 0700 DRM	Romania, R Romania Intl	9600eu		
0630 0700	Romania, R Romania Intl	7310eu		17780pa
	21600pa			
0651 0700 DRM	New Zealand, R New Zealand Intl			11675pa

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

0700 0730	Myanmar, Myanma R/Yangon			9731do
0700 0757	China, China R International			11785as
	11880as	13645eu	15125as	15350as
	15465as	17490eu	17540as	17710as
0700 0758	New Zealand, R New Zealand Intl			11725pa
0700 0758 DRM	New Zealand, R New Zealand Intl			11675pa
0700 0800	Anguilla, University Network			6090na
0700 0800	Australia, ABC NT Alice Springs			4835do
0700 0800	Australia, ABC NT Katherine			5025do
0700 0800	Australia, ABC NT Tennant Creek			4910do
0700 0800	Australia, ABC/R Australia	7410pa		9475pa
	9660pa	9710pa	11945pa	12080pa
	13630pa	15240pa		
0700 0800	Bahrain, R Bahrain	6010me		
0700 0800	Canada, CFRX Toronto ON	6070na		
0700 0800	Canada, CFVP Calgary AB	6030na		
0700 0800	Canada, CKZN St Johns NF	6160na		
0700 0800	Canada, CKZU Vancouver BC			6160na
0700 0800 mtwhfa	Ecuador, HCJB/LV de los Andes			3995eu
0700 0800	Eqt Guinea, Pan Am BC/R Africa			15190af
0700 0800	Malaysia, RTM Kajang/Traxx FM			7295do
0700 0800	Micronesia, V6MP/Cross R/Pohnpei			4755 as
0700 0800	Palau, T8WH/World Harvest R			17650as
0700 0800	Papua New Guinea, R Fly	3915do		
0700 0800	Russia, VO Russia	15745as		21800va
	21820va			
0700 0800 DRM	Russia, VO Russia	11635eu		
0700 0800 mtwhf	South Africa, Channel Africa			9625af
0700 0800	Swaziland, TWR Africa	3200af		6120af
	9500af			
0700 0800	UK, BBC World Service	5875eu		6190af
	7355eu	13820af	11770af	12095af
	13820af	15310as	15400af	15575va
	17640af	17660eu	17790as	17830af
0700 0800	USA, AFN/AFRTS	4319usb		5765usb
	12759usb	13362usb		
0700 0800	USA, Overcomer Ministry	3185na		5890na
0700 0800	USA, WEWN/EWTN Irondale AL			11520af
0700 0800	USA, WHRI Cypress Creek SC			7315sa
	9615af	9930as		
0700 0800	USA, WTWW Lebanon TN	5830na		
0700 0800	USA, WWCR Nashville TN	3215eu		4840na
	5890af	5935af		
0700 0800	USA, WWRB Manchester TN			3185na
0700 0800	Zambia, Christian Voice	6065af		
0700 0800	Zambia, CVC Intl/1 Africa	13590af		
0730 0744	Vatican City State, Vatican R	15595va		
0730 0800	Australia, HCJB Global Australia			11750pa
0759 0800	New Zealand, R New Zealand Intl			9765pa
0759 0800 DRM	New Zealand, R New Zealand Intl			9870pa

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

0800 0830	Australia, ABC NT Alice Springs	4835do
0800 0830	Australia, ABC NT Katherine	5025do
0800 0830	Australia, ABC NT Tennant Creek	4910do
0800 0830	Australia, HCJB Global Australia	11750pa
0800 0830 Sun	Canada, Bible Voice Broadcasting	7220eu
0800 0830	France, R France International	9955na
0800 0830	USA, WHRI Cypress Creek SC	11565pa
0800 0845 Sat	Canada, Bible Voice Broadcasting	7220eu
0800 0850	Austria, TWR Europe 7400eu	
0800 0850	Germany, TWR Europe 6105eu	
0800 0857	China, China R International	9415as
	11785as 11880as 15350as	15465as
	15625va 17490eu 17540as	
0800 0900	Anguilla, University Network	6090na
0800 0900	Australia, ABC/R Australia 5995pa	7410pa
	9475pa 9580pa 9710pa	11945pa
	12080pa 15240pa	
0800 0900	Bahrain, R Bahrain 6010me	
0800 0900	Canada, CFRX Toronto ON 6070na	
0800 0900	Canada, CFVP Calgary AB 6030na	
0800 0900	Canada, CKZN St Johns NF 6160na	
0800 0900	Canada, CKZU Vancouver BC	6160na
0800 0900	Eqt Guinea, Pan Am BC/R Africa	15190af
0800 0900	Malaysia, RTM Kajang/Traxx FM	7295do
0800 0900	Micronesia, V6MP/Cross R/Pohnpei	4755 as
0800 0900	New Zealand, R New Zealand Intl	9765pa
0800 0900 DRM	New Zealand, R New Zealand Intl	9870pa
0800 0900	Nigeria, VO Nigeria 15120af	
0800 0900	Palau, T8WH/World Harvest R	17650as
0800 0900	Papua New Guinea, R Fly 3915do	
0800 0900	Russia, VO Russia 15745as	21800va
	21820va	
0800 0900 DRM	Russia, VO Russia 9625eu	11635eu
0800 0900 mtwhf	South Africa, Channel Africa	9625af
0800 0900 Sun	South Africa, R Mirror Intl 7205af	17760af
0800 0900	South Korea, KBS World R 9570as	
0800 0900	UK, BBC World Service 5875eu	6190af
	7355eu 12095af 15310as	15400af
	15575va 17640af 17660eu	17790as
	17830af 21470af	
0800 0900	USA, AFN/AFRTS 4319usb	5765usb
	12759usb 13362usb	
0800 0900	USA, Overcomer Ministry 3185na	5890na
0800 0900	USA, WEWN/EWTN Irondale AL	11520af
0800 0900	USA, WHRI Cypress Creek SC	7315sa
	9930as	
0800 0900	USA, WTWW Lebanon TN 5830na	
0800 0900	USA, WWCR Nashville TN 3215eu	4840na
	5890af 5935af	
0800 0900	USA, WWRB Manchester TN	3185na
0800 0900	Zambia, Christian Voice 6065af	
0800 0900	Zambia, CVC Intl/1 Africa 13590af	
0815 0827	Nepal, R Nepal 5005do	
0830 0900	Australia, ABC NT Alice Springs	2310do
0830 0900	Australia, ABC NT Katherine	2485do
0830 0900	Australia, ABC NT Tennant Creek	2325do
0850 0900 mtwhf	Guam, KTWR/TWR Asia 15200as	

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

0900 0930 mtwhf	Guam, KTWR/TWR Asia 15200as	
0900 0930	USA, WHRI Cypress Creek SC	6195sa
0900 0930 mtwhfa	USA, WRMI/R Prague relay 9955ca	
0900 0957	China, China R International	9415as
	15210as 15270eu 15350as	17490eu
	17570eu 17650eu 17690va	17750va
0900 1000	Anguilla, University Network	6090na
0900 1000	Australia, ABC NT Alice Springs	2310do
0900 1000	Australia, ABC NT Katherine	2485do
0900 1000	Australia, ABC NT Tennant Creek	2325do
0900 1000	Australia, ABC/R Australia 9580pa	11945pa
0900 1000	Bahrain, R Bahrain 6010me	
0900 1000	Canada, CFRX Toronto ON 6070na	
0900 1000	Canada, CFVP Calgary AB 6030na	
0900 1000	Canada, CKZN St Johns NF 6160na	
0900 1000	Canada, CKZU Vancouver BC	6160na
0900 1000	Germany, Mighty KBC Radio	6095eu
0900 1000 Sat	Italy, IRRS SW 9510va	
0900 1000	Malaysia, RTM Kajang/Traxx FM	7295do
0900 1000	Micronesia, V6MP/Cross R/Pohnpei	4755 as
0900 1000 DRM	New Zealand, R New Zealand Intl	9870pa
0900 1000	New Zealand, R New Zealand Intl	9765pa
0900 1000	Nigeria, VO Nigeria 9690af	
0900 1000	Palau, T8WH/World Harvest R	17650as
0900 1000	Papua New Guinea, R Fly 3915do	
0900 1000	Russia, VO Russia 7205as	15745as
	21800va 21820va	
0900 1000 DRM	Russia, VO Russia 9625eu	
0900 1000 mtwhf	South Africa, Channel Africa	9625af
0900 1000	UK, BBC World Service 6190af	6195as
	9740as 11895as 12095af	15285as
	15310as 15400af 15575va	17640af
	17660eu 17760as 17790as	17830af
	21470af	
0900 1000	USA, AFN/AFRTS 4319usb	5765usb
	12759usb 13362usb	
0900 1000	USA, Overcomer Ministry 3185na	5890na
0900 1000	USA, WEWN/EWTN Irondale AL	11520af
0900 1000	USA, WHRI Cypress Creek SC	9930as
	11565pa	
0900 1000	USA, WTWW Lebanon TN 5830na	
0900 1000	USA, WWCR Nashville TN 3215eu	4840af
	5890af 5935af	
0900 1000	USA, WWRB Manchester TN	3185na
0900 1000	Zambia, Christian Voice 6065af	
0900 1000	Zambia, CVC Intl/1 Africa 13590af	
0930 1000 fs	China, VO the Strait 6115do	

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

1000 1018 mtwhf	Guam, KTWR/TWR Asia 11840pa	
1000 1030 Sat	Guam, KTWR/TWR Asia 11840pa	
1000 1030	Japan, R Japan/NHK World	9625as
	11740as	
1000 1030	Vietnam, VO Vietnam/Overseas Svc	9840as
	12020as	
1000 1057	China, China R International	5955na
	7215as 11640as 13590as	13720as
	15190as 15210pa 15350as	17490eu
	17690va	
1000 1057	North Korea, VO Korea 6170va	9335sa
	9850as	
1000 1058	New Zealand, R New Zealand Intl	9765pa
1000 1100	Anguilla, University Network	11775na
1000 1100	Australia, ABC NT Alice Springs	2310do
1000 1100	Australia, ABC NT Katherine	2485do
1000 1100	Australia, ABC NT Tennant Creek	2325do
1000 1100	Australia, ABC/R Australia 6020pa	9580pa
	11945pa	
1000 1100 Sat/Sun	Australia, ABC/R Australia 9475pa	
1000 1100	Bahrain, R Bahrain 6010me	
1000 1100	Canada, CFRX Toronto ON 6070na	
1000 1100	Canada, CFVP Calgary AB 6030na	
1000 1100	Canada, CKZN St Johns NF 6160na	
1000 1100	Canada, CKZU Vancouver BC	6160na
1000 1100	Germany, Mighty KBC Radio	6095eu
1000 1100	India, AIR/External Svc 7270as	13605as
	13695pa 15030as 15410as	17510pa
	17895pa	
1000 1100	Indonesia, VO Indonesia 9526va	
1000 1100	Malaysia, RTM Kajang/Traxx FM	7295do
1000 1100	Micronesia, V6MP/Cross R/Pohnpei	4755as
1000 1100 DRM	New Zealand, R New Zealand Intl	9870pa
1000 1100	Nigeria, VO Nigeria 9690af	
1000 1100	Pakistan, R Pakistan External Svc	15725va
	17700va	
1000 1100	Russia, VO Russia 7205as	7260as
	11680as 15745as	
1000 1100 DRM	Russia, VO Russia 9625eu	
1000 1100	Saudi Arabia, BSKSA/External Svc	15250as
1000 1100 mtwhf	South Africa, Channel Africa	9625af

1000 1100		UK, BBC World Service	6190af	6195as	
		9740as	11760va	12095af	15285as
		15310as	15575eu	17640af	17790as
		21470af			
1000 1100	Sat/Sun	UK, BBC World Service	17830af		
1000 1100		USA, AFN/AFRTS	4319usb	5765usb	
		12759usb	13362usb		
1000 1100		USA, KNLS Anchor Point AK		9615as	
1000 1100		USA, Overcomer Ministry	3185na	5890na	
1000 1100		USA, WEWN/EWTN Irondale AL		11520af	
1000 1100		USA, WHRI Cypress Creek SC		7315sa	
		9930as	11565pa		
1000 1100		USA, WTWW Lebanon TN	5830na		
1000 1100		USA, WWCR Nashville TN	4840na	5890af	
		5935af	6875af		
1000 1100		USA, WWRB Manchester TN		3185na	
1000 1100		Zambia, Christian Voice	6065af		
1000 1100		Zambia, CVC Intl/1 Africa	13590af		
1030 1100		Iran, VO Islamic Rep of Iran	21575va	21610va	
1030 1100	Sun	Italy, IRRS SW	9510va		
1030 1100		Mongolia, Voice of Mongolia		12085as	
1059 1100		New Zealand, R New Zealand Intl		17675pa	

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

1100 1127		Iran, VO Islamic Rep of Iran	21575va	21610va	
1100 1130	Sat/Sun	Canada, Bible Voice Broadcasting		15390as	
1100 1130	f/DRM	Japan, R Japan/NHK World		9760eu	
1100 1130	Sat/DRM	South Korea, KBS World R	9760eu		
1100 1130	mtwhf	UK, BBC World Service	15400af		
1100 1130		Vietnam, VO Vietnam/Overseas Svc		7285as	
1100 1157		China, China R International		5955as	
		9570as	11650as	11795as	13590as
		13645as	13665as	13720as	17490va
1100 1158	DRM	New Zealand, R New Zealand Intl		9870pa	
1100 1200		Anguilla, University Network		11775na	
1100 1200		Australia, ABC NT Alice Springs		2310do	
1100 1200		Australia, ABC NT Katherine		2485do	
1100 1200		Australia, ABC NT Tennant Creek		2325do	
1100 1200		Australia, ABC/R Australia	5995pa	6020pa	
		6080as	6140as	9580as	11945pa
1100 1200	DRM	Australia, ABC/R Australia	12080pa		
1100 1200		Bahrain, R Bahrain	6010me		
1100 1200		Canada, CFRX Toronto ON	6070na		
1100 1200		Canada, CFVP Calgary AB	6030na		
1100 1200		Canada, CKZN St Johns NF	6160na		
1100 1200		Canada, CKZU Vancouver BC		6160na	
1100 1200	Sat/Sun	Germany, Mighty KBC Radio		6095eu	
1100 1200	Sun	Italy, IRRS SW	9510va		
1100 1200		Malaysia, RTM Kajang/Traxx FM		7295do	
1100 1200		New Zealand, R New Zealand Intl		17675pa	
1100 1200		Nigeria, VO Nigeria	9690af		
1100 1200		Russia, VO Russia	7205as	7260as	
		9560as	11680as	15740as	
1100 1200	DRM	Russia, VO Russia	9625eu	11640as	
1100 1200		Saudi Arabia, BSKSA/External Svc		15250as	
1100 1200	mtwhf	South Africa, Channel Africa		9625af	
1100 1200		Taiwan, R Taiwan Intl	7445as	9465as	
1100 1200		UK, BBC World Service	6190af	6195as	
		9740as	11760va	11895as	12095af
		15285as	15310as	17640af	17790as
		17830af	21470af		
1100 1200		USA, AFN/AFRTS	4319usb	5765usb	
		12759usb	13362usb		
1100 1200		USA, Overcomer Ministry	3185na	5890na	
1100 1200	Sat/Sun	USA, Overcomer Ministry	15565as		
1100 1200		USA, WEWN/EWTN Irondale AL		11520af	
1100 1200		USA, WHRI Cypress Creek SC		7315ca	
		9930as	11565pa		
1100 1200		USA, WTWW Lebanon TN	5830na		
1100 1200		USA, WWCR Nashville TN	4840na	5890af	
		5935af	6875af		
1100 1200		USA, WWRB Manchester TN		3185na	
1100 1200		Zambia, Christian Voice	6065af		
1100 1200		Zambia, CVC Intl/1 Africa	13590af		
1115 1130	f	Canada, Bible Voice Broadcasting		15390as	
1130 1200	f	Vatican City State, Vatican R	17590va	21650va	
1130 1200		Vietnam, VO Vietnam/Overseas Svc		9840as	
		12020as			

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

1200 1225		Saudi Arabia, BSKSA/External Svc		15250as	
1200 1230		Japan, R Japan/NHK World		11740as	
		15190na			
1200 1230	asmtwh	USA, WHRI Cypress Creek SC		9930as	
1200 1257		China, China R International		5955as	
		7250as	9460as	9600as	9645as
		9730pa	9760as	11760as	11980as
		12015va	13655eu	13790eu	17490eu
1200 1258		New Zealand, R New Zealand Intl		17675pa	
1200 1300		Anguilla, University Network		11775na	
1200 1300		Australia, ABC NT Alice Springs		2310do	
1200 1300		Australia, ABC NT Katherine		2485do	
1200 1300		Australia, ABC NT Tennant Creek		2325do	
1200 1300		Australia, ABC/R Australia	6080as	6140as	
		9580as	11945pa		
1200 1300	DRM	Australia, ABC/R Australia	5995as		
1200 1300		Bahrain, R Bahrain	6010me		
1200 1300		Canada, CFRX Toronto ON	6070na		
1200 1300		Canada, CFVP Calgary AB	6030na		
1200 1300		Canada, CKZN St Johns NF	6160na		
1200 1300		Canada, CKZU Vancouver BC		6160na	
1200 1300		Ethiopia, R Ethiopia/Natl Svc		9705do	
1200 1300	Sat/Sun	Germany, Mighty KBC Radio		6095eu	
1200 1300	Sun	Italy, IRRS SW	9510va		
1200 1300		Malaysia, RTM Kajang/Traxx FM		7295do	
1200 1300		Nigeria, VO Nigeria	9690af		
1200 1300		Romania, R Romania Intl	15460eu	17530eu	
		17765af	21570af		
1200 1300	DRM	Russia, VO Russia	9625eu		
1200 1300		Russia, VO Russia	4780as	5885as	
		9560as	12075as		
1200 1300		South Korea, KBS World R	15575na		
1200 1300		UK, BBC World Service	5875as	6190af	
		6195as	9740as	11760va	11895as
		12095af	15310as	17640af	17790as
		17830af	21470af		
1200 1300		USA, AFN/AFRTS	4319usb	5765usb	
		12759usb	13362usb		
1200 1300		USA, BBG/VOA	7520va	9640va	11750va
		12150va			
1200 1300		USA, KNLS Anchor Point AK		9615as	
1200 1300		USA, Overcomer Ministry	3185na		
1200 1300	mtwhf	USA, Overcomer Ministry	5890na	13570ca	
1200 1300	Sat/Sun	USA, Overcomer Ministry	15565as		
1200 1300		USA, WBCQ Monticello ME	9330na		
1200 1300		USA, WEWN/EWTN Irondale AL		11520af	
1200 1300		USA, WHRI Cypress Creek SC		9840na	
		11565pa			
1200 1300		USA, WTWW Lebanon TN	5830na		
1200 1300		USA, WWCR Nashville TN	5935na	9980af	
		15825eu			
1200 1300		USA, WWRB Manchester TN		3185na	
1200 1300		Zambia, Christian Voice	6065af		
1200 1300		Zambia, CVC Intl/1 Africa	13590af		
1215 1300		Egypt, R Cairo	17870as		
1230 1300		Bangladesh, Bangladesh Betar/Ext Svc			
		15105as			
1230 1300		South Korea, KBS World R	6095as		
1230 1300		Thailand, R Thailand World Svc		9720pa	
1230 1300		USA, WHRI Cypress Creek SC		9930as	
1230 1300		Vietnam, VO Vietnam/Overseas Svc		9840as	
		12020as			

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

1300 1315		Palau, T8WH/World Harvest R		11925as	
1300 1330		Egypt, R Cairo	17870as		
1300 1330		Japan, R Japan/NHK World		11730as	
1300 1357		China, China R International		5995as	
		7300na	9570as	9655pa	9730va
		9765as	9870as	11760as	11900as
		11980as	13670eu	13790eu	
1300 1357		North Korea, VO Korea	7570eu	9335na	
		11710na	12015eu		
1300 1400		Anguilla, University Network		11775na	
1300 1400		Australia, ABC NT Alice Springs		2310do	

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1300 1400		Australia, ABC NT Katherine	2485do
1300 1400		Australia, ABC/R Australia 5940as 6020pa 9580pa 11945pa	
1300 1400 DRM		Australia, ABC/R Australia 5995pa	
1300 1400		Bahrain, R Bahrain 6010me	
1300 1400		Canada, CFRX Toronto ON 6070na	
1300 1400		Canada, CFVP Calgary AB 6030na	
1300 1400		Canada, CKZN St Johns NF 6160na	
1300 1400		Canada, CKZU Vancouver BC	6160na
1300 1400 Sat/Sun		Germany, Mighty KBC Radio	6095eu
1300 1400		Indonesia, VO Indonesia 9526va	
1300 1400		Malaysia, RTM Kajang/Traxx FM	7295do
1300 1400		New Zealand, R New Zealand Intl	5950pa
1300 1400		Nigeria, VO Nigeria 9690af	
1300 1400 DRM		Russia, VO Russia 9625eu	
1300 1400		Russia, VO Russia 4780as 7205as 7260as 9560as 12075as	
1300 1400		South Korea, KBS World R 9570as	
1300 1400		Tajikistan, VO Tajik 7245va	
1300 1400		UK, BBC World Service 5875as 6190af 6195as 9410as 9740as 11760va 11890as 12095af 15310as 15400af 17640af 17790as 17830af 21470af	
1300 1400		USA, AFN/AFRTS 4319usb 5765usb 12759usb 13362usb	
1300 1400 Sat/Sun		USA, BBG/VOA 7520va 9640va 11750va 12150va	
1300 1400		USA, KJES Vado NM 11715na	
1300 1400 mtwhf		USA, Overcomer Ministry 9980na 13570ca	
1300 1400		USA, Overcomer Ministry 9370na	
1300 1400		USA, WBCQ Monticello ME 9330na	
1300 1400		USA, WEWN/EWTN Irondale AL	15610eu
1300 1400		USA, WHRI Cypress Creek SC	9930as
1300 1400 Sat/Sun		USA, WHRI Cypress Creek SC 11565pa	9840na
1300 1400		USA, WINB Red Lion PA 13570ca	
1300 1400		USA, WTWW Lebanon TN 5830na	
1300 1400		USA, WWCR Nashville TN 7490af 9980af 13845eu 15825eu	
1300 1400		USA, WWRB Manchester TN	9370na
1300 1400		Zambia, Christian Voice 6065af	
1300 1400		Zambia, CVC Intl/1 Africa 13590af	
1315 1345		Bangladesh, Bangladesh Betar/Ext Svc 7250as	
1330 1400		India, AIR/External Svc 9690as 11620as 13710as	
1330 1400		Turkey, VO Turkey 12035eu	
1330 1400		Vietnam, VO Vietnam/Overseas Svc 9840as 12020as	

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

1400 1415 Sun		USA, Pan Amer Broadcasting	15205as
1400 1425 mthf		Guam, KTWR/TWR Asia 15225as	
1400 1430		Japan, R Japan/NHK World 11695as 11705al 11925as	
1400 1430		Serbia, International R Serbia	9635eu
1400 1430		Thailand, R Thailand World Svc	9950va
1400 1430		Turkey, VO Turkey 12035eu	
1400 1430		USA, WHRI Cypress Creek SC	9950as
1400 1435 swa		Guam, KTWR/TWR Asia 15225as	
1400 1445 Sat		Guam, KTWR/TWR Asia 11580as	
1400 1457		China, China R International 5955as 7300na 9460as 9765pa 9795as 9870as 11665eu 13625as 13685as 13740va 17630va	
1400 1500		Anguilla, University Network	11775na
1400 1500		Australia, ABC NT Alice Springs	2310do
1400 1500		Australia, ABC NT Katherine	2485do
1400 1500		Australia, ABC NT Tennant Creek	2325do
1400 1500		Australia, ABC/R Australia 5940as 5995pa 9580pa 11945pa	
1400 1500		Bahrain, R Bahrain 6010me	
1400 1500 Sun		Canada, Bible Voice Broadcasting	15470as
1400 1500		Canada, CFRX Toronto ON 6070na	
1400 1500		Canada, CFVP Calgary AB 6030na	
1400 1500		Canada, CKZN St Johns NF 6160na	
1400 1500		Canada, CKZU Vancouver BC	6160na
1400 1500		Eqt Guinea, Pan Am BC/R Africa	15190af
1400 1500 Sat/Sun		Germany, Mighty KBC Radio	6095eu
1400 1500		India, AIR/External Svc 9690as 11620as 13710as	
1400 1500		Malaysia, RTM Kajang/Traxx FM	7295do
1400 1500		New Zealand, R New Zealand Intl	5950pa
1400 1500		Nigeria, VO Nigeria 9690af	
1400 1500		Oman, R Sultanate of Oman	15560af
1400 1500		Russia, VO Russia 4780as 7260as 12075as 13790me	
1400 1500		South Korea, KBS World R 9640as	
1400 1500		UK, BBC World Service 5845as 5875as 6190af 6195as 9740va 11760eu 11890as 12095af 17640af 17830af 21470af	
1400 1500		USA, AFN/AFRTS 4319usb 5765usb 12759usb 13362usb	
1400 1500 mtwhf		USA, BBG/VOA 7520va 9760va 12150va	
1400 1500		USA, BBG/VOA 4930af 6080af 15580af 17530af 17725af	
1400 1500		USA, KJES Vado NM 11715na	
1400 1500 mtwhf		USA, Overcomer Ministry 9980na 13570ca 13810me	
1400 1500		USA, Overcomer Ministry 9370va 9460eu	
1400 1500		USA, WBCQ Monticello ME 9330na	
1400 1500		USA, WEWN/EWTN Irondale AL	15610eu
1400 1500 Sat/Sun		USA, WHRI Cypress Creek SC 21600af	9840na
1400 1500		USA, WINB Red Lion PA 13570ca	
1400 1500		USA, WJHR Intl Milton FL 15550 lsb	
1400 1500		USA, WRNO New Orleans LA	7505na
1400 1500		USA, WTWW Lebanon TN 9479na	
1400 1500		USA, WWCR Nashville TN 7490af 9980af 13845eu 15825eu	
1400 1500		USA, WWRB Manchester TN	9370na
1400 1500		Zambia, Christian Voice 6065af	
1400 1500		Zambia, CVC Intl/1 Africa 13590af	
1415 1427		Nepal, R Nepal 5005do	
1415 1430		USA, Pan Amer Broadcasting	15205as
1425 1455		Swaziland, TWR Africa 6025af	
1430 1445 Sun		USA, Pan Amer Broadcasting	15205as
1430 1500		Australia, ABC/R Australia 9475as	11660as
1430 1500 Sat		Canada, Bible Voice Broadcasting	15470as
1430 1500		China, China Business R 6190do	7220do
1430 1500		China, China Natl R/CNR11 4905do 4920do 6130do	
1430 1500		Myanmar, Thazin BC Sta 7110do	
1430 1500		Palau, T8WH/World Harvest R	11925as
1430 1500		USA, WHRI Cypress Creek SC	9965as
1430 1500		USA, WRMI/R Prague relay 9955ca	
1445 1500		Australia, HCJB Global Australia	15340as

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

1500 1530		Australia, ABC/R Australia 11945pa	
1500 1530		Australia, HCJB Global Australia	15340as
1500 1530 Sun		Canada, Bible Voice Broadcasting	13740as
1500 1530 Sun		Italy, IRRS SW 15190va	
1500 1530 mtwhf		USA, Overcomer Ministry 13570ca	
1500 1530		Vietnam, VO Vietnam/Overseas Svc 7285as 9840as 12020as	
1500 1550		New Zealand, R New Zealand Intl	5950pa
1500 1557		China, China R International 5955as 6095eu 7325eu 7405as 9435me 9525as 9650as 9720eu 9785eu 9870na 13685af 13740eu 17630af	
1500 1557		North Korea, VO Korea 7570eu 9335na 11710na 12015eu	
1500 1600		Anguilla, University Network	11775na
1500 1600		Australia, ABC NT Alice Springs	2310do
1500 1600		Australia, ABC NT Katherine	2485do
1500 1600		Australia, ABC/R Australia 5940as 5995pa 7240pa 9475as 11660as	
1500 1600		Bahrain, R Bahrain 6010me	
1500 1600		Canada, CFRX Toronto ON 6070na	
1500 1600		Canada, CFVP Calgary AB 6030na	
1500 1600		Canada, CKZN St Johns NF 6160na	

1500 1600		Canada, CKZU Vancouver BC			6160na
1500 1600		Eqt Guinea, Pan Am BC/R Africa			15190af
1500 1600	Sat/Sun	Germany, Mighty KBC Radio			6095eu
1500 1600		Malaysia, RTM Kajang/Traxx FM			7295do
1500 1600		Nigeria, VO Nigeria	15120af		
1500 1600		Palau, T8WH/World Harvest R			15680as
1500 1600		Russia, VO Russia	4780as		9735me
		9880as	11985me		
1500 1600	mtwhf	South Africa, Channel Africa			9625af
1500 1600		Uganda, Dunamis SW	4750do		
1500 1600		UK, BBC World Service	5845as		5875as
		5975as	6190af	6195as	9410va
		9490af	9505as	9740as	11760eu
		12095af	15400af	17640af	17830af
		21470af			
1500 1600		USA, AFN/AFRTS	4319usb		5765usb
		12759usb	13362usb		
1500 1600		USA, BBG/VOA	4930af	6080af	7520va
		9930va	11840va	12150va	13570va
		17725af	17895af		
1500 1600		USA, KJES Vado NM	11715na		
1500 1600		USA, KNLS Anchor Point AK			9655as
1500 1600	mtwhf	USA, Overcomer Ministry	9980na		13810me
1500 1600	Sat	USA, Overcomer Ministry	11900me		15420na
1500 1600		USA, WBCQ Monticello ME	9330na		
1500 1600	Sat	USA, WBCQ Monticello ME	15420na		
1500 1600		USA, WEWN/EWTN Irondale AL			15610eu
1500 1600	Sat	USA, WHRI Cypress Creek SC			21630af
1500 1600	Sun	USA, WHRI Cypress Creek SC			17570eu
1500 1600	Sat/Sun	USA, WHRI Cypress Creek SC			9840na
1500 1600		USA, WINB Red Lion PA	13570ca		
1500 1600		USA, WJHR Intl Milton FL	15550		lsb
1500 1600		USA, WRNO New Orleans LA			7505na
1500 1600		USA, WTWW Lebanon TN	9479na		
1500 1600		USA, WWCR Nashville TN	7490af		9980af
		13845eu	15825eu		
1500 1600		USA, WWRB Manchester TN			9370na
1500 1600		Zambia, Christian Voice	6065af		
1500 1600		Zambia, CVC Intl/1 Africa	13590af		
1515 1530	Sat	Canada, Bible Voice Broadcasting			13740as
1525 1555	Sat/Sun	Swaziland, TWR Africa	6025af		
1530 1545		India, AIR/External Svc	9910as		
1530 1549	smtwhf	Vatican City State, Vatican R	7485as		
1530 1550	smtwhf	Vatican City State, Vatican R	15595as		
1530 1550	smtwhf/DRM	Vatican City State, Vatican R			15775as
1530 1600		Afghanistan, R Afghanistan	7200as		
1530 1600		Australia, ABC/R Australia	11880pa		
1530 1600	DRM	Belgium, The Disco Palace	12115as		
1530 1600	h	Canada, Bible Voice Broadcasting			13740as
1530 1600		Iran, VO Islamic Rep of Iran	13785va		13785va
		15525va			
1530 1600		Mongolia, Voice of Mongolia			12015as
1530 1600	smtwa	Sri Lanka, AWR Asia	15255as		
1530 1600	Sat	Vatican City State, Vatican R	7585as		15595as
1530 1600	Sat	Vatican City State, Vatican R	15775as		
1551 1600		New Zealand, R New Zealand Intl			9765pa
1551 1600	DRM	New Zealand, R New Zealand Intl			7440pa

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

1600 1627		Iran, VO Islamic Rep of Iran	13785va		13785va
		15525va			
1600 1630		Australia, ABC/R Australia	9580as		
1600 1630	DRM	Belgium, The Disco Palace	12115as		
1600 1630		Guam, AWR Asia/Pacific	15215as		15660as
1600 1630		Vietnam, VO Vietnam/Overseas Svc			7220me
		7280eu	9550me	9730eu	
1600 1650	DRM	New Zealand, R New Zealand Intl			7440pa
1600 1657		China, China R International			6060as
		6155as	7235af	7255af	7420af
		7435eu	9435eu	9460eu	9570eu
		9600eu	9875as		
1600 1657		North Korea, VO Korea	9990va		1154va
1600 1658		Taiwan, R Taiwan Intl	9440as		15485as
1600 1700		Anguilla, University Network			11775na
1600 1700		Australia, ABC NT Alice Springs			2310do
1600 1700		Australia, ABC NT Katherine			2485do
1600 1700		Australia, ABC/R Australia	5940as		5995pa
		7240pa	9475as	11660pa	11880pa
1600 1700		Bahrain, R Bahrain	6010me		
1600 1700		Canada, CFRX Toronto ON	6070na		
1600 1700		Canada, CFVP Calgary AB	6030na		
1600 1700		Canada, CKZN St Johns NF	6160na		
1600 1700		Canada, CKZU Vancouver BC			6160na
1600 1700		Egypt, R Cairo	15345af		
1600 1700		Eqt Guinea, Pan Am BC/R Africa			15190af
1600 1700		Ethiopia, R Ethiopia/External Svc			7235af
		9558af			
1600 1700	DRM	Germany, Mighty KBC Radio			9755eu
1600 1700		Malaysia, RTM Kajang/Traxx FM			7295do
1600 1700		New Zealand, R New Zealand Intl			9765pa
1600 1700		Palau, T8WH/World Harvest R			15680as
1600 1700		Russia, VO Russia	4780as		5885as
		5995as	9735as	9880as	
1600 1700		South Korea, KBS World R	9515eu		9640as
1600 1700		Uganda, Dunamis SW	4750do		
1600 1700		UK, BBC World Service	3255af		5845as
		5975as	6190af	9410va	9505as
		9915eu	12095af	15400af	17640af
		17830af	21470af	21660af	
1600 1700		USA, AFN/AFRTS	4319usb		5765usb
		12759usb	13362usb		
1600 1700		USA, BBG/VOA	4930af	6080af	15580af
		17895af			
1600 1700	mtwhf	USA, Overcomer Ministry	9980na		
1600 1700		USA, Overcomer Ministry	9370va		
1600 1700		USA, WBCQ Monticello ME	9330na		
1600 1700	Sat	USA, WBCQ Monticello ME	15420na		
1600 1700		USA, WEWN/EWTN Irondale AL			15610eu
1600 1700		USA, WHRI Cypress Creek SC			9840na
		21630af			
1600 1700		USA, WINB Red Lion PA	13570ca		
1600 1700		USA, WJHR Intl Milton FL	15550		lsb
1600 1700		USA, WRNO New Orleans LA			7505na
1600 1700		USA, WTWW Lebanon TN	9479na		
1600 1700		USA, WWCR Nashville TN	9980af		12160af
		13845eu	15825eu		
1600 1700		USA, WWRB Manchester TN			9370na
1600 1700		Zambia, Christian Voice	6065af		
1600 1700		Zambia, CVC Intl/1 Africa	13590af		
1630 1700		Guam, AWR Asia/Pacific	15660as		
1630 1700	m	South Africa, R Mirror Intl	4895af		
1630 1700		USA, BBG/VOA/Sudan in Focus			9490af
		11655af	13800af		
1645 1700	mw	Canada, Bible Voice Broadcasting			9715me
1645 1700	thfas	Canada, Bible Voice Broadcasting			9715me
1651 1700		New Zealand, R New Zealand Intl			9890pa

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

1700 1710		Pakistan, Azad Kashmir R	3975do		4790do
1700 1715	f	Canada, Bible Voice Broadcasting			9715me
1700 1730		Australia, ABC/R Australia	11660as		
1700 1730	DRM	Germany, AWR Europe	9755eu		
1700 1730	m	South Africa, R Mirror Intl	3230af		
1700 1730		Vietnam, VO Vietnam/Overseas Svc			9625eu
1700 1745	h	Canada, Bible Voice Broadcasting			9715me
1700 1750	DRM	New Zealand, R New Zealand Intl			9890pa
1700 1750		New Zealand, R New Zealand Intl			9765pa
1700 1757		China, China R International			6090as
		6100as	6140as	6155eu	6165as
		7205af	7255as	7410as	7420af
		7425eu	7435af	9460eu	9570eu
1700 1758		Taiwan, R Taiwan Intl	15690af		
1700 1800		Anguilla, University Network			11775na
1700 1800		Australia, ABC NT Alice Springs			2310do
1700 1800		Australia, ABC NT Katherine			2485do
1700 1800		Australia, ABC/R Australia	5995pa		9475as
		9500pa	9580pa	11880pa	
1700 1800		Bahrain, R Bahrain	6010me		
1700 1800	tas	Canada, Bible Voice Broadcasting			9715me
1700 1800		Canada, CFRX Toronto ON	6070na		
1700 1800		Canada, CFVP Calgary AB	6030na		
1700 1800		Canada, CKZN St Johns NF	6160na		
1700 1800		Canada, CKZU Vancouver BC			6160na

1700 1800		Egypt, R Cairo	15345af		
1700 1800		Eqt Guinea, Pan Am BC/R Africa			15190af
1700 1800		Malaysia, RTM Kajang/Traxx FM			7295do
1700 1800		Palau, T8WH/World Harvest R			15680as
1700 1800		Russia, VO Russia	4780as		7240as
		7330eu	9735va	9880as	
1700 1800	mtwhf	South Africa, Channel Africa			15235af
1700 1800		Swaziland, TWR Africa	3200af		
1700 1800	Sat/Sun	Swaziland, TWR Africa	3200af		
1700 1800		UK, BBC World Service	3255af	5845as	
		5975as	6190af	12095af	15400af
		15420af	17640af	17830af	21660af
1700 1800		USA, AFN/AFRTS	4319usb	5765usb	
		12759usb	13362usb		
1700 1800		USA, BBG/VOA 6080af	13755af	15580af	
		17895af			
1700 1800	mtwhf	USA, Overcomer Ministry	9980na		
1700 1800	Sat	USA, Overcomer Ministry	15420na		
1700 1800		USA, Overcomer Ministry	9370va	11900me	
1700 1800		USA, WBCQ Monticello ME	9330na		
1700 1800	Sat	USA, WBCQ Monticello ME	15420na		
1700 1800		USA, WEWN/EWTN Irondale AL			15610me
1700 1800		USA, WHRI Cypress Creek SC			9840na
		21630af			
1700 1800		USA, WINB Red Lion PA	13570ca		
1700 1800		USA, WJHR Intl Milton FL	15550	lsb	
1700 1800		USA, WRNO New Orleans LA			7505na
1700 1800		USA, WTWW Lebanon TN	9479na		
1700 1800		USA, WWCR Nashville TN	9980af	12160af	
		13845eu	15825eu		
1700 1800		USA, WWRB Manchester TN			9370na
1700 1800		Zambia, Christian Voice	4965as		
1700 1800		Zambia, CVC Intl/1 Africa	13590af		
1715 1729		Vatican City State, Vatican R	11935va		
1730 1757		Vatican City State, Vatican R	11625af	13765af	
		15570af			
1730 1800		Australia, ABC/R Australia	6080pa		
1730 1800		Turkey, VO Turkey	11730va		
1745 1800		Bangladesh, Bangladesh Betar/Ext Svc			
		7250eu			
1745 1800		India, AIR/External Svc	7550eu	9445va	
		9950eu	11580af	11670eu	11935af
		13695af	17670af		
1751 1800		New Zealand, R New Zealand Intl			11725pa
1751 1800	DRM	New Zealand, R New Zealand Intl			11675pa

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

1800 1815	Sat	Canada, Bible Voice Broadcasting			7365me
1800 1830		Japan, R Japan/NHK World			15720af
1800 1830		Moldova, R PMR/Pridnestrovye			7290eu
1800 1830	DRM	Romania, R Romania Intl	5895eu		
1800 1830		Tanzania, Zanzibar BC/VO Tanzania			11735do
1800 1830		Turkey, VO Turkey	11730va		
1800 1830		UK, BBC World Service	5975as	7600as	
1800 1830		USA, BBG/VOA 6080af	13755af	15580af	
1800 1830	Sat/Sun	USA, BBG/VOA 4930af			
1800 1850	DRM	New Zealand, R New Zealand Intl			11675pa
1800 1857		China, China R International			6100eu
		7405eu			
1800 1857		North Korea, VO Korea	7570eu	12015eu	
1800 1858		Taiwan, R Taiwan Intl	3965eu		
1800 1900		Anguilla, University Network			11775na
1800 1900	mtwhf	Argentina, RAE	15345eu		
1800 1900		Australia, ABC NT Alice Springs			2310do
1800 1900		Australia, ABC NT Katherine			2485do
1800 1900		Australia, ABC/R Australia	6080pa	9475as	
		9500pa	9580as	11880pa	
1800 1900	Sat/Sun	Australia, ABC/R Australia	9710as		
1800 1900		Bahrain, R Bahrain	6010me		
1800 1900		Bangladesh, Bangladesh Betar/Ext Svc			
		7250eu			
1800 1900	Sat/Sun	Canada, Bible Voice Broadcasting			9715me
1800 1900	Sat	Canada, Bible Voice Broadcasting			9470me
1800 1900	Sun	Canada, Bible Voice Broadcasting			6030eu
1800 1900		Canada, CFRX Toronto ON	6070na		
1800 1900		Canada, CFVP Calgary AB	6030na		
1800 1900		Canada, CKZN St Johns NF	6160na		
1800 1900		Canada, CKZU Vancouver BC			6160na
1800 1900	mtwhfa	Ecuador, HCJB/LV de los Andes			3995eu
1800 1900		Eqt Guinea, Pan Am BC/R Africa			15190af
1800 1900		India, AIR/External Svc	7550eu	9445va	
		9950eu	11580af	11670eu	11935af
		13695af	17670af		
1800 1900		Kuwait, R Kuwait	15540eu		
1800 1900		Malaysia, RTM Kajang/Traxx FM			7295do
1800 1900		New Zealand, R New Zealand Intl			11725pa
1800 1900		Palau, T8WH/World Harvest R			15680as
1800 1900	DRM	Romania, R Romania Intl	9780eu		
1800 1900		Romania, R Romania Intl	7300eu		
1800 1900		Russia, VO Russia	4780as	7330eu	
		9735va	11985va		
1800 1900		South Korea, KBS World R	7275eu		
1800 1900		Swaziland, TWR Africa	3200af	9500af	
1800 1900	Sat/Sun	Swaziland, TWR Africa	3200af		
1800 1900		UK, BBC World Service	3255af	5875eu	
		5945eu	6190af	9430af	11810af
		12095af	15400af	17640af	
1800 1900		USA, AFN/AFRTS	4319usb	5765usb	
		12759usb	13362usb		
1800 1900		USA, KJES Vado NM	15385pa		
1800 1900	mtwhf	USA, Overcomer Ministry	9980na		
1800 1900		USA, Overcomer Ministry	9370va		
1800 1900		USA, WBCQ Monticello ME	9330na		
1800 1900	smtwhf	USA, WBCQ Monticello ME	15420na		
1800 1900		USA, WEWN/EWTN Irondale AL			15610me
1800 1900		USA, WHRI Cypress Creek SC			9840na
		9930as	21630af		
1800 1900		USA, WINB Red Lion PA	13570ca		
1800 1900		USA, WTWW Lebanon TN	9479na		
1800 1900		USA, WWCR Nashville TN	9980af	12160af	
		13845eu	15825eu		
1800 1900		USA, WWRB Manchester TN			9370na
1800 1900		Zambia, Christian Voice	4965af		
1800 1900		Zambia, CVC Intl/1 Africa	13590af		
1815 1845	Sat	Canada, Bible Voice Broadcasting			6030eu
1815 1845	Sun	Canada, Bible Voice Broadcasting			9470me
1830 1900	DRM/mtwhf	Nigeria, VO Nigeria	15120af		
1830 1900		South Africa, AWR Africa	11830af		
1830 1900		UK, BBC World Service	6005af	9410af	
1830 1900		USA, BBG/VOA 4930af	6080af	13755af	
		15580af			
1851 1900	DRM	New Zealand, R New Zealand Intl			15720pa
1851 1900		New Zealand, R New Zealand Intl			11725pa

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

1900 1930		Germany, Deutsche Welle	11800af	12070af	
		15275af			
1900 1930		Vietnam, VO Vietnam/Overseas Svc			7280eu
		9730eu			
1900 1945		India, AIR/External Svc	7550eu	9445eu	
		9950eu	11580af	11670eu	11935af
		13695af	17670af		
1900 1950		New Zealand, R New Zealand Intl			11725pa
1900 1957		China, China R International			7295va
		9440af			
1900 1957		North Korea, VO Korea	7219eu	9975va	
		11535va	11910af		
1900 2000		Anguilla, University Network			11775na
1900 2000		Australia, ABC NT Alice Springs			2310do
1900 2000		Australia, ABC NT Katherine			2485do
1900 2000		Australia, ABC/R Australia	6080pa	9500as	
		9580pa	11660as	11880pa	
1900 2000	Sat/Sun	Australia, ABC/R Australia	9710as		
1900 2000		Bahrain, R Bahrain	6010me		
1900 2000		Canada, CFRX Toronto ON	6070na		
1900 2000		Canada, CFVP Calgary AB	6030na		
1900 2000		Canada, CKZN St Johns NF	6160na		
1900 2000		Canada, CKZU Vancouver BC			6160na
1900 2000		Egypt, R Cairo	15290af		
1900 2000		Eqt Guinea, Pan Am BC/R Africa			15190af
1900 2000		Indonesia, VO Indonesia	9526va		

1900 2000 fas	Italy, IRRS SW	7290va			
1900 2000	Kuwait, R Kuwait	15540eu			
1900 2000	Malaysia, RTM Kajang/Traxx FM				7295do
1900 2000	Micronesia, V6MP/Cross R/Pohnpei				4755as
1900 2000 DRM	New Zealand, R New Zealand Intl				15720pa
1900 2000 DRM/mtwhf	Nigeria, VO Nigeria	15120af			
1900 2000	Palau, T8WH/World Harvest R				15680as
1900 2000	Russia, VO Russia	7330eu			
1900 2000 mtwhf	Spain, R Exterior de Espana	9605af			9665eu
1900 2000	Swaziland, TWR Africa	3200af			
1900 2000 Sat/Sun	Swaziland, TWR Africa	3200af			
1900 2000	Thailand, R Thailand World Svc				9585eu
1900 2000	UK, BBC World Service	3255af			5875eu
	5945eu	6190af	9410af		9430af
	11810af	12095af	15400af		
1900 2000	USA, AFN/AFRTS	4319usb			5765usb
	12759usb	13362usb			
1900 2000	USA, BBG/VOA	4930af	6080af		15580af
1900 2000 mtwhf	USA, Overcomer Ministry	9980na			13570ca
1900 2000	USA, Overcomer Ministry	9370va			9700eu
	9835af	13570ca			
1900 2000 Sat/Sun	USA, Overcomer Ministry	9980na			
1900 2000	USA, WBCQ Monticello ME	9330na			
1900 2000 smtwhf	USA, WBCQ Monticello ME	15420na			
1900 2000	USA, WEWN/EWTN Irondale AL				15610me
1900 2000	USA, WHRI Cypress Creek SC				9840na
	21630af				
1900 2000	USA, WINB Red Lion PA	13570ca			
1900 2000	USA, WTWW Lebanon TN	9479na			
1900 2000	USA, WWCR Nashville TN	9980af			12160af
	13845eu	15825eu			
1900 2000	USA, WWRB Manchester TN				9370na
1900 2000	Zambia, Christian Voice	4965af			
1900 2000	Zambia, CVC Intl/1 Africa	13590af			
1905 1920 Sat	Mali, ORTM/R Mali	9635do			
1930 1957	Germany, Deutsche Welle	12070af			15275af
1930 2000	Eqt Guinea, Pan Am BC/R Africa				9515af
1930 2000	Iran, VO Islamic Rep of Iran	6040eu			7345eu
	12670af	15450af			
1930 2000	Serbia, International R Serbia				6100eu
1930 2000	Turkey, VO Turkey	6050eu			
1930 2000 Sun	USA, Pan Amer Broadcasting				6040af
1951 2000	New Zealand, R New Zealand Intl				17675pa

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

2000 2027	Iran, VO Islamic Rep of Iran	6040eu			7345eu
	12670af	15450af			
2000 2027	Vatican City State, Vatican R	11625af			13765af
2000 2030	Australia, ABC/R Australia	6080pa			500as
2000 2030	Egypt, R Cairo	15290af			
2000 2030	Eqt Guinea, Pan Am BC/R Africa				9515af
2000 2030	Moldova, R PMR/Pridnestrovye				7290eu
2000 2030 Sat/Sun	Swaziland, TWR Africa	3200af			
2000 2030	Turkey, VO Turkey	6050eu			
2000 2030	USA, BBG/VOA	4930af	6080af		15580af
2000 2030 mtwhf	USA, Overcomer Ministry	13570ca			
2000 2057	China, China R International				5960eu
	5985af	7285eu	7295va		7415eu
	9440af	9600eu	11640eu		13630eu
2000 2057	Germany, Deutsche Welle	9655af			
2000 2100	Anguilla, University Network				11775na
2000 2100	Australia, ABC NT Alice Springs				2310do
2000 2100	Australia, ABC NT Katherine				2485do
2000 2100	Australia, ABC NT Tennant Creek				2325do
2000 2100	Australia, ABC/R Australia	9580pa			11650pa
	11660pa	12080pa	15515pa		
2000 2100	Bahrain, R Bahrain	6010me			
2000 2100	Belarus, R Belarus	6155eu			11730eu
2000 2100 DRM	Belgium, The Disco Palace	17875na			
2000 2100	Canada, CFRX Toronto ON	6070na			
2000 2100	Canada, CFVP Calgary AB	6030na			
2000 2100	Canada, CKZN St Johns NF	6160na			
2000 2100	Canada, CKZU Vancouver BC				6160na
2000 2100	Cuba, R Havana Cuba	11760am			
2000 2100	Eqt Guinea, Pan Am BC/R Africa				15190af
2000 2100	Italy, IRRS SW	7290va			
2000 2100	Kuwait, R Kuwait	15540eu			
2000 2100	Malaysia, RTM Kajang/Traxx FM				7295do
2000 2100	Micronesia, V6MP/Cross R/Pohnpei				4755as
2000 2100 DRM	New Zealand, R New Zealand Intl				15720pa
2000 2100	New Zealand, R New Zealand Intl				17675pa
2000 2100	Palau, T8WH/World Harvest R				15680as
2000 2100	Russia, VO Russia	7330eu			
2000 2100	South Africa, CVC 1 Africa R				9505af
	13590af				
2000 2100	UK, BBC World Service	3255af			6190af
	9410af	9430af	11810af		12095af
	15400af				
2000 2100	USA, AFN/AFRTS	4319usb			5765usb
	12759usb	13362usb			
2000 2100 mtwhf	USA, BBG/VOA	9480va			
2000 2100	USA, Overcomer Ministry	7290eu			9370va
	9700eu	9990af			
2000 2100	USA, Overcomer Ministry	9980na			
2000 2100	USA, WBCQ Monticello ME	9330na			
2000 2100 smtwhf	USA, WBCQ Monticello ME	15420na			
2000 2100 Sat	USA, WBCQ Monticello ME	7490na			
2000 2100	USA, WEWN/EWTN Irondale AL				15610me
2000 2100	USA, WHRI Cypress Creek SC				9505eu
	21630af				
2000 2100	USA, WINB Red Lion PA	13570ca			
2000 2100	USA, WTWW Lebanon TN	9479na			
2000 2100	USA, WTWW Lebanon TN	9479na			
2000 2100	USA, WWCR Nashville TN	9980af			12160af
	13845eu	15825eu			
2000 2100	USA, WWRB Manchester TN				9370na
2000 2100	Zambia, Christian Voice	4965af			
2000 2100	Zambia, CVC Intl/1 Africa	13590af			
2030 2045	Thailand, R Thailand World Svc				9535eu
2030 2100	Australia, ABC/R Australia	9500pa			11695as
2030 2100	USA, BBG/VOA	4930af	6080af		7560as
	15580af				
2030 2100 Sat/Sun	USA, BBG/VOA	4930af			
2030 2100	Vietnam, VO Vietnam/Overseas Svc				7220me
	7280eu	9730me	9730eu		
2045 2100	India, AIR/External Svc	7550eu			9445eu
	9910pa	11620pa	11670eu		11740pa
2045 2100 DRM	India, AIR/External Svc	9950eu			

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

2100 2130 mtwhfa	Albania, R Tirana	7465eu			
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 2150	New Zealand, R New Zealand Intl				17675pa
2100 2150 DRM	New Zealand, R New Zealand Intl				15720pa
2100 2157	China, China R International				5960eu
	7205af	7285eu	7405af		7415eu
	9600eu				
2100 2157	North Korea, VO Korea	7570eu			12015eu
2100 2200	Angola, R Nac de Angola/Intl Svc				7217af
2100 2200	Anguilla, University Network				11775na
2100 2200	Australia, ABC/R Australia	9500pa			9660as
	11650pa	11695pa	12080pa		13630pa
	15515pa	21740pa			
2100 2200	Bahrain, R Bahrain	6010me			
2100 2200	Belarus, R Belarus	6155eu			11730eu
2100 2200	Canada, CFRX Toronto ON	6070na			
2100 2200	Canada, CFVP Calgary AB	6030na			
2100 2200	Canada, CKZN St Johns NF	6160na			
2100 2200	Canada, CKZU Vancouver BC				6160na
2100 2200	Egypt, R Cairo	11890eu	12050al		
2100 2200	Eqt Guinea, Pan Am BC/R Africa				15190af
2100 2200	Germany, Deutsche Welle	11800af			12070af
2100 2200	India, AIR/External Svc	7550eu			9445eu
	9910pa	11620pa	11670eu		11740pa
2100 2200 DRM	India, AIR/External Svc	9950eu			
2100 2200	Malaysia, RTM Kajang/Traxx FM				7295do
2100 2200	Micronesia, V6MP/Cross R/Pohnpei				4755 as
2100 2200	Palau, T8WH/World Harvest R				15680as

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2100 2200 Russia, VO Russia 5940eu
2100 2200 South Africa, CVC 1 Africa R 9505af
13590af
2100 2200 Syria, R Damascus 9330va
2100 2200 UK, BBC World Service 3255af 3915as
5875as 5905as 5995af 6190af
6195as 9410af 9915af 12095af
2100 2200 USA, AFN/AFRTS 4319usb 5765usb
12759usb 13362usb
2100 2200 USA, BBG/VOA 6080af 15580af
2100 2200 USA, Overcomer Ministry 9370va 9700eu
2100 2200 Sat/Sun USA, Overcomer Ministry 9980na
2100 2200 mtwhfa USA, WBCQ Monticello ME 7490na
2100 2200 smtwhf USA, WBCQ Monticello ME 15420na
2100 2200 USA, WEWN/EWTN Irondale AL 15610me
2100 2200 USA, WHRI Cypress Creek SC 9490eu
21630af
2100 2200 USA, WINB Red Lion PA 13570ca
2100 2200 USA, WTWW Lebanon TN 9479na
2100 2200 USA, WTWW Lebanon TN 9479na
2100 2200 USA, WWCR Nashville TN 6875eu 9350af
9980af 13845eu
2100 2200 USA, WWRB Manchester TN 3215na
9370na
2100 2200 Zambia, Christian Voice 4965af
2100 2200 Zambia, CVC Intl/1 Africa 13590af
2130 2200 Australia, ABC NT Alice Springs 4835do
2130 2200 Australia, ABC NT Katherine 5025do
2130 2200 DRM Romania, R Romania Intl 6030eu
2130 2200 Romania, R Romania Intl 7310na 7380eu
9435na
2130 2200 Turkey, VO Turkey 9610va
2151 2200 New Zealand, R New Zealand Intl 15720pa
2151 2200 DRM New Zealand, R New Zealand Intl 17675pa

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

2200 2230 India, AIR/External Svc 9910pa 11620pa
11670eu 11740pa
2200 2230 DRM India, AIR/External Svc 9950eu
2200 2230 Moldova, R PMR/Pridnestrovye 7290eu
2200 2230 Serbia, International R Serbia 6100eu
2200 2230 South Korea, KBS World R 3955eu
2200 2230 Turkey, VO Turkey 9610va
2200 2245 Egypt, R Cairo 11890eu 12050al
2200 2257 China, China R International 5915eu
2200 2300 Anguilla, University Network 6090na
2200 2300 Australia, ABC NT Alice Springs 4835do
2200 2300 Australia, ABC NT Katherine 5025do
2200 2300 Australia, ABC/R Australia 9660as 9855as
12080pa 13630pa 15230pa 15415pa
15515pa 21740pa
2200 2300 Bahrain, R Bahrain 6010me
2200 2300 Canada, CFRX Toronto ON 6070na
2200 2300 Canada, CFVP Calgary AB 6030na
2200 2300 Canada, CKZN St Johns NF 6160na
2200 2300 Canada, CKZU Vancouver BC 6160na
2200 2300 Cuba, R Havana Cuba 11880af
2200 2300 Eqt Guinea, Pan Am BC/R Africa 15190af
2200 2300 Malaysia, RTM Kajang/Traxx FM 7295do
2200 2300 Micronesia, V6MP/Cross R/Pohnpei 4755 as
2200 2300 New Zealand, R New Zealand Intl 15720pa
2200 2300 DRM New Zealand, R New Zealand Intl 17675pa
2200 2300 Palau, T8WH/World Harvest R 15180na
15680as
2200 2300 Russia, VO Russia 7250am 11830na
2200 2300 Sat/Sun Spain, R Exterior de Espana 6125eu
2200 2300 Taiwan, R Taiwan Intl 6115na 15440na
2200 2300 UK, BBC World Service 3915as 5905as
5875as 5885af 6135as 6195as
7490as
2200 2300 USA, AFN/AFRTS 4319usb 5765usb
12759usb 13362usb
2200 2300 smtwhf USA, BBG/VOA 5895va 7365va 7425va
7480va 11860va
2200 2300 USA, Overcomer Ministry 9370va 9980na
9990af
2200 2300 USA, WBCQ Monticello ME 7490na 9330na
2200 2300 USA, WEWN/EWTN Irondale AL 15610me
2200 2300 USA, WHRI Cypress Creek SC 9490eu
9505eu
2200 2300 USA, WINB Red Lion PA 9265ca
2200 2300 USA, WTWW Lebanon TN 9479na
2200 2300 USA, WTWW Lebanon TN 9479na
2200 2300 USA, WWCR Nashville TN 6875eu 9350af
9980af 13845eu
2200 2300 USA, WWRB Manchester TN 3215na
9370na
2200 2300 Zambia, Christian Voice 4965af
2230 2300 China, Xizang PBS 4905do
2230 2300 Guam, AWR Asia/Pacific 15320as
2245 2300 India, AIR/External Svc 6055as 9690as
9705as 11710as 13605as
2245 2300 DRM India, AIR/External Svc 11645as

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

2300 0000 Anguilla, University Network 6090na
2300 0000 Australia, ABC NT Alice Springs 4835do
2300 0000 Australia, ABC NT Katherine 5025do
2300 0000 Australia, ABC/R Australia 9660as 9855as
12080pa 15230pa 15415pa 15230pa
15415pa 17795pa 19000pa 21740pa
2300 0000 Bahrain, R Bahrain 6010me
2300 0000 Canada, CFRX Toronto ON 6070na
2300 0000 Canada, CFVP Calgary AB 6030na
2300 0000 Canada, CKZN St Johns NF 6160na
2300 0000 Canada, CKZU Vancouver BC 6160na
2300 0000 Egypt, R Cairo 9965am 11510al
2300 0000 India, AIR/External Svc 6055as 9690as
9705as 11710as 13605as
2300 0000 DRM India, AIR/External Svc 11645as
2300 0000 Malaysia, RTM Kajang/Traxx FM 7295do
2300 0000 Micronesia, V6MP/Cross R/Pohnpei 4755 as
2300 0000 New Zealand, R New Zealand Intl 15720pa
2300 0000 DRM New Zealand, R New Zealand Intl 17675pa
2300 0000 Palau, T8WH/World Harvest R 7385na
15680as
2300 0000 Romania, R Romania Intl 6015eu 7220eu
9530as 11810as
2300 0000 Russia, VO Russia 7250am 7290am
2300 0000 Turkey, VO Turkey 5960va
2300 0000 UK, BBC World Service 3915as 5875as
5980as 6135as 6195as 7490as
9740as 11955as
2300 0000 USA, AFN/AFRTS 4319usb 5765usb
12759usb 13362usb
2300 0000 USA, BBG/VOA 5830va 7365va 7480va
11860va
2300 0000 USA, Overcomer Ministry 9370va
2300 0000 mtwhf USA, Overcomer Ministry 9980na
2300 0000 USA, WBCQ Monticello ME 7490na 9330na
2300 0000 USA, WEWN/EWTN Irondale AL 15610me
2300 0000 smtwhf USA, WHRI Cypress Creek SC 7315ca
9490eu
2300 0000 Sat USA, WHRI Cypress Creek SC 7315ca
9505eu
2300 0000 smtwhf USA, WHRI Cypress Creek SC 9490eu
2300 0000 USA, WINB Red Lion PA 9265ca
2300 0000 USA, WTWW Lebanon TN 9479na
2300 0000 USA, WTWW Lebanon TN 9479na
2300 0000 USA, WWCR Nashville TN 3195eu 5070af
9980af 13845eu
2300 0000 USA, WWRB Manchester TN 3215na
9370na
2300 0000 Zambia, Christian Voice 4965af
2300 2357 China, China R International 5915as
5990ca 6145na 7350eu 7415as
9535as 11790as
2330 0000 Australia, ABC/R Australia 17750pa
2330 0000 tw Guam, AWR Asia/Pacific 17700as
2330 0000 USA, WYFR/Family R Worldwide 6115na
2330 0000 Vietnam, VO Vietnam/Overseas Svc 9840as
12020as

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Ecuador, R El Buen Pastor ..... www.saraguros.com/radio.php
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Gabon, Africa No. 1 ..... www.africa1.com
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Guam, AWR Asia/Pacific www.awr2.org/
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Twitter: MilcomMP

Monitoring the U.S. Air Force Civil Air Patrol Auxiliary

We continue to monitor major changes to radio communications systems and frequencies used by various United States government and military civilian auxiliary services. One of those major movers is an auxiliary service that we have discussed in the past in this column – the Civil Air Patrol (CAP).

In past *Milcom* columns, I have documented the changeover of the CAP to a new narrowband VHF frequency system. All the new narrowband repeaters (output frequencies are 148.125 and 148.150 MHz) are dual mode, meaning that they use CTCSS tones in the analog mode or if the mission dictates the P25 digital mode (NAC codes). Inputs frequencies to the repeater outputs have changed also and they no longer use 143.750 and 143.900 MHz. The new inputs in the majority of the country are 143.550 and 143.700 MHz respectively.

CAP repeaters near the United States/Canadian border have alternative repeater input frequencies, to reduce interference with Canadian users of this spectrum. Border areas are using 139.875 and 143.600 MHz respectively.

Based on extensive monitoring the frequency/designator list below is believed to be the current load out of the ground radios used by the Civil Air Patrol nationwide.

•NATIONAL CAP PLAN (ZONE 1 ANALOG AND ZONE 16 DIGITAL)

Frequency (MHz)	PL Tone (Hz)	Usage	Frequency Designator NAC
141.5750 Simplex	127.3 Hz/S4F9	Command Control	<CC 1>
141.0000 Simplex	131.8 Hz/S526	Command Control	<CC 2>
149.2750 Simplex	141.3 Hz/S585	Air-to-Air	<Air 1>
150.5625 Simplex	151.4 Hz/S5EA	Air-to-Air	<Air 2>
150.2250 Simplex	162.2 Hz/S656	CAP Guard Channel	<Guard 1>
139.8750 Simplex	173.8 Hz/S6CA	Tactical/Miscellaneous use	<TAC 1>
148.1250/143.5500	100.0 Hz/S3E8	Repeater Common Access Tone	<R65 CAT>
148.1500/143.7000	100.0 Hz/S3E8	Repeater Common Access Tone	<R66 CAT>
148.1375/143.6250	203.5 Hz/S7F3	Airborne/Tactical Repeater	<R-67>
148.1375/143.6250	192.8 Hz/S788	Airborne/Tactical Repeater	<R-68>
148.1375/143.6250	131.8 Hz/S526	Airborne/Tactical Repeater	<R-69>
148.1375/143.6250	162.2 Hz/S656	Airborne/Tactical Repeater	<R-70>
148.1250/143.5500	203.5 Hz/S7F3	Airborne/Tactical Repeater	<R-63>
148.1500/143.7000	203.5 Hz/S7F3	Airborne/Tactical Repeater	<R-64>

In areas near the Canadian border, the following Zone 1/16 repeater bandplan is in use:

148.1250/139.8750	71.9 Hz/S2CF	Canadian Border Zone Repeater <R-101>
148.1500/143.6000	71.9 Hz/S2CF	Canadian Border Zone Repeater <R-102>
148.1250/139.8750	77.0 Hz/S302	Canadian Border Zone Repeater <R-103>
148.1500/143.6000	77.0 Hz/S302	Canadian Border Zone Repeater <R-104>
148.1250/139.8750	82.5 Hz/S339	Canadian Border Zone Repeater <R-105>
148.1500/143.6000	82.5 Hz/S339	Canadian Border Zone Repeater <R-106>
148.1250/139.8750	88.5 Hz/S375	Canadian Border Zone Repeater <R-107>
148.1250/139.8750	100.0 Hz/S3E8	Canadian Border Zone CAT Repeater <R-108 CAT>
148.1500/143.6000	100.0 Hz/S3E8	Canadian Border Zone Tactical Repeater <R-109 CAT>
148.1250/139.8750	203.5 Hz/S7F3	Canadian Border Zone Tactical Repeater <R-110>
148.1500/143.6000	203.5 Hz/S7F3	Canadian Border Zone Tactical Repeater <R-111>

The remainder of the zones in these new CAP radios use the following setup.

- Zones 2 and 3 – Suppose to be set aside for local options. Both zones were used for the old pre-narrowband band plan. Some wings have programmed P25 repeaters into these two zones.
- Zones 4 and 5 – Interoperability frequencies in use in the area that the radio will be used (e.g., law enforcement, fire/rescue, etc.). Zone 4 appears to be used for wideband interop and Zone 5 is narrowband interop. Some wings use Zone 5 for weather channels (WX1-7).
- Zone 6 – Appears to be a reserve zone; was used for the old CAP pre-narrowband band plan.
- Zone 7 – Most wings selected US Coast Guard marine frequencies (CG-06, 16, 21A, 22A, 23A, 81A, 82A and 83A) and the National Weather Service frequencies (WX-1-7) programmed. Some wings also program VHF Interop into this zone.
- Zone 8 – Analog repeater designators 1-16 (For Zones 8-15 see Table 1)
- Zone 9 – Analog repeater designators 17-32
- Zone 10 – Analog repeater designators 33-48
- Zone 11 – Analog repeater designators 49-64
- Zone 12 – P25 repeater designators 1-16
- Zone 13 – P25 repeater designators 17-32
- Zone 14 – P25 repeater designators 33-48
- Zone 15 – P25 repeater designators 49-64
- Zone 16 – National Plan (see Zone 1 listings above; used for P25 mode communications.)

TABLE 1: ZONE 8 - 15 REPEATER FREQUENCY LIST

Repeater Output/Input	CTCSS PL tone (Hz)	Analog Designator	P25 NAC	P25 Designator
Zone 8 Analog/Zone 12 Digital				
148.1250/143.5500	110.9	R01	$455	R01P
148.1500/143.7000	162.2	R02	$656	R02P
148.1250/143.5500	136.5	R03	$555	R03P
148.1500/143.7000	74.4	R04	$2E8	R04P
148.1250/143.5500	79.7	R05	$31D	R05P
148.1500/143.7000	71.9	R06	$2CF	R06P
148.1250/143.5500	85.4	R07	$356	R07P
148.1500/143.7000	67.0	R08	$29E	R08P
148.1250/143.5500	156.7	R09	$61F	R09P
148.1500/143.7000	192.8	R10	$788	R10P
148.1250/143.5500	123.0	R11	$4CE	R11P
148.1500/143.7000	173.8	R12	$6CA	R12P
148.1250/143.5500	91.5	R13	$393	R13P
148.1500/143.7000	167.9	R14	$68F	R14P
148.1250/143.5500	69.3	R15	$2B5	R15P
148.1500/143.7000	136.5	R16	$555	R16P
Zone 9 Analog/Zone 13 Digital				
148.1250/143.5500	82.5	R17	$339	R17P
148.1500/143.7000	88.5	R18	$375	R18P
148.1250/143.5500	94.8	R19	$3B4	R19P
148.1500/143.7000	141.3	R20	$585	R20P
148.1250/143.5500	141.3	R21	$585	R21P
148.1500/143.7000	69.3	R22	$2B5	R22P
148.1250/143.5500	71.9	R23	$2CF	R23P
148.1500/143.7000	127.3	R24	$4F9	R24P
148.1250/143.5500	107.2	R25	$430	R25P
148.1500/143.7000	146.2	R26	$5B6	R26P
148.1250/143.5500	146.2	R27	$5B6	R27P
148.1500/143.7000	156.7	R28	$61F	R28P
148.1250/143.5500	173.8	R29	$6CA	R29P
148.1500/143.7000	97.4	R30	$3CE	R30P
148.1250/143.5500	114.8	R31	$47C	R31P
148.1500/143.7000	110.9	R32	$455	R32P
Zone 10 Analog/Zone 14 Digital				
148.1250/143.5500	88.5	R33	$375	R33P
148.1500/143.7000	91.5	R34	$393	R34P
148.1250/143.5500	97.4	R35	$3CE	R35P
148.1500/143.7000	85.4	R36	$356	R36P
148.1250/143.5500	151.4	R37	$5EA	R37P
148.1500/143.7000	123.0	R38	$4CE	R38P
148.1250/143.5500	162.2	R39	$656	R39P
148.1500/143.7000	82.5	R40	$339	R40P
148.1250/143.5500	103.5	R41	$40B	R41P
148.1500/143.7000	77.0	R42	$302	R42P
148.1250/143.5500	74.4	R43	$2E8	R43P
148.1500/143.7000	114.8	R44	$47C	R44P
148.1250/143.5500	77.0	R45	$302	R45P
148.1500/143.7000	151.4	R46	$5EA	R46P
148.1250/143.5500	167.9	R47	$68F	R47P
148.1500/143.7000	131.8	R48	$526	R48F
Zone 11 Analog/Zone 15 Digital				
148.1250/143.5500	131.8	R49	$526	R49P
148.1500/143.7000	103.5	R50	$40B	R50P
148.1250/143.5500	100.0	R51	$3E8	R51P
148.1500/143.7000	79.7	R52	$31D	R52P
148.1250/143.5500	192.8	R53	$788	R53P
148.1500/143.7000	100.0	R54	$3E8	R54P

148.1250/143.5500	67.0	R55	$29E	R55P
148.1500/143.7000	107.2	R56	$430	R56P
148.1250/143.5500	118.8	R57	$4A4	R57P
148.1500/143.7000	118.8	R58	$4A4	R58P
148.1250/143.5500	186.2	R59	$746	R59P
148.1500/143.7000	94.8	R60	$3B4	R60P
148.1250/143.5500	127.3	R61	$4F9	R61P
148.1500/143.7000	186.2	R62	$746	R62P
148.1250/143.5500	203.5	R63	$7F3	R63P
148.1500/143.7000	203.5	R64	$7F3	R64P

Under current NTIA rules, CAP is only permitted to utilize the frequency 123.100 MHz in "coordinated search and rescue operations" for liaison communications among air and ground stations from other agencies. CAP stations are not allowed to use 123.100 MHz for internal CAP-to-CAP communication, training, non-search and rescue missions or any other purpose. No other VHF-AM frequency is authorized for CAP ground station use unless requested and authorized by an FCC licensee.

❖ CAP and the HF Radio Spectrum

As I mentioned in my April and July 2011 *Milcom* columns, the Civil Air Patrol (CAP) announced that they were creating new regional HF ALE networks to supplement their national ALE net.

Since the publication of those columns, monitors nationwide have identified all of these new regional nets, most of their frequencies and many of the stations sounding on them. While our list of this information below is still not complete, it will give you a great starting point to launch your monitoring effort if you want to follow the HF activity of the CAP. The mode is ALE/USB and frequencies are in kHz.

Net 1 – Northeast Region: Connecticut, Massachusetts, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont
2374.0 4576.0 4636.0* 6773.0 7656.0 10557.0 12218.0 14914.0
Net 2 – Middle East Region: Delaware, Maryland, North Carolina, South Carolina, Virginia, West Virginia
2393.0 3385.0 4585.0* 4633.0 5447.0 7665.0 9082.0 12124.0 14445.0
Net 3 – Great Lakes Region: Illinois, Indiana, Kentucky, Ohio, Michigan, Wisconsin
2508.0 4590.0 4604.0* 7630.0 10504.0 12200.0 14438.0 18513.0 24553.0
Net 4 – Southeast Region: Alabama, Florida, Georgia, Mississippi, Puerto Rico, Tennessee
2511.0 4502.0 4630.0* 7704.0 10545.0 14424.0 16350.0 18205.0 20873.0 22862.0
Net 5 – North Central Region: Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota
2371.0* 4482.0 4505.0* 7302.0* 7341.0* 10510.0 12098.0 14450.0 16353.0 20511.0
Net 6 – Southwest Region: Arizona, Arkansas, Louisiana, New Mexico, Oklahoma, Texas
4512.0 4627.0* 7416.0 10550.0 12183.0 14457.0 16333.0 22872.0 26617.0*
Net 7 – Rocky Mountain Region: Colorado, Idaho, Montana, Utah, Wyoming
3160.0 4509.0 4601.0* 7618.0* 10542.0 14430.0 18516.0 22875.0 24566.0
Net 8 – Pacific Region: Alaska, California, Hawaii, Nevada, Oregon, Washington
2525.0 4515.0 4582.0* 7637.0* 10518.0 12177.0 16330.0 20508.0 24563.0 26620.0*
Net 9 – National ALE Network
2011.0 3204.0 4477.0 5006.0 6806.0 7602.0 8012.0 9047.0 10162.0 11402.0 12081.0 13415.0 14357.0 15602.0 17412.0 19814.0 21863.0 23006.0 25354.0 27546.0 29894.0

National Reserve (These are the first four frequencies programmed in all CAP radios)

Unknown (NRA) Unknown (NRB) 7615.0 (NRC)* 14902.0 (NRD)*

** indicates a frequency where extensive voice activity has been recently monitored*

❖ CAP Call Signs

Voice call signs within CAP including those assigned to the national headquarters, each region and each wing are assigned Air Force Voice Call Signs (AFVCS). These tactical call signs are suffixed with numbers. These suffix numbers does not exceed four digits.

CAP corporate aircraft will use "CAP" (pronounced "kap") call sign. Member-owned aircraft may also use a CAP call sign when on Air Force assigned missions (AFAM). Wings and regions use the first two digits for their region/wing vehicle identity numbers (see table 2).

Civil Air Patrol uses unique ALE addresses for identification during ALE operation.

Wing ALE addresses use the format "xxxxwgCAP" in which "wg" is the two-letter state postal code of the wing and "xxxx" is a four digit call sign number.

Region ALE addresses use the format "xxxregCAP" in which "reg" is the three-letter region designator and "xxx" is a three digit call sign number.

Headcap ALE addresses use the format "xxxNHQCAP" in which "xxx" is a three digit call sign number.

The HF/ALE stations at the two CAP national headquarters have unique coordinated call signs and ALE identifiers. The National Headquarters station, located in the National Operations Center (NOC), uses the call sign Avenging Spirit and the ALE identifier AVS. NHQ/NTC uses the call sign Richmond and the ALE identifier RIC.

TABLE 2: CAP TACTICAL CALL SIGNS, REGION WING IDENTITY

Tactical Call Sign	Unit	Aircraft #	ALE Address
Abenaki	New Hampshire Wing	CAP 28xx	xxxxNHCAP
Aspen Gold	Rocky Mountain Region	CAP 97xx	xxxRMRCAP
Avenging Spirit	National HQ Special Use	AVS	
Beaver Fox	Oregon Wing	CAP 36xx	xxxxORCAP
Black Granite	Montana Wing	CAP 24xx	xxxxMTCAP
Blue Lake	Great Lakes Region	CAP 93xx	xxxGLRCAP
Blue Mesa	Colorado Wing	CAP 05xx	xxxxCOCAP
Blue Mound	Wisconsin Wing	CAP 48xx	xxxxWICAP
CAP ####	Civil Air Patrol Aircraft		
CAP Kitty Hawk	North Carolina Wing	CAP 32xx	xxxxNCCAP
CAP Stone	Northeast Region	CAP 91xx	xxxNERCAP
CAP West	Southwest Region	CAP 96xx	xxxSWRCAP
Charter Oak	Connecticut Wing	CAP 06xx	xxxxCTCAP
Columbus	Ohio Wing	CAP 34xx	xxxxOHCAP
Congressional	Congressional Squadron		
Diamond Flight	Delaware Wing	CAP 07xx	xxxxDECAP
Down East	Maine Wing	CAP 17xx	xxxxMECAP
Firebrand	Hawaii Wing	CAP 51xx	xxxxHICAP
Florida CAP	Florida Wing	CAP 08xx	xxxxFLCAP
Free State	Maryland Wing	CAP 18xx	xxxxMDCAP
Georgia CAP	Georgia Wing	CAP 09xx	xxxxGACAP
Goldenrod	Alabama Wing	CAP 01xx	xxxxALCAP
Grasslands	South Dakota Wing	CAP 40xx	xxxxSDCAP
Head CAP	Natl Headquarters	CAP 99xx	xxxNHQCAP
High Plains	Wyoming Wing	CAP 49xx	xxxxWYCAP
Hill CAP	West Virginia Wing	CAP 47xx	xxxxWVCAP
Hill Thunder	Congressional Squadron		
Iowa CAP	Iowa Wing	CAP 13xx	xxxxIACAP
Jefferson	Virginia Wing	CAP 45xx	xxxxVACAP
Kentucky CAP	Kentucky Wing	CAP 15xx	xxxxKYCAP
Louisiana CAP	Louisiana Wing	CAP 16xx	xxxxLACAP
Middle East	Middle East Region	CAP 92xx	xxxMERCAP
Missouri CAP	Missouri Wing	CAP 23xx	xxxxMOCAP
Mockingbird	Mississippi Wing	CAP 22xx	xxxxMSCAP
Narragansett	Rhode Island Wing	CAP 38xx	xxxxRICAP
Nat CAP	Natl Capital Wing	CAP 25xx	
North Central	North Central Region	CAP 95xx	xxxNCRCAP
Oil Well	Oklahoma Wing	CAP 35xx	xxxxOKCAP
Patriot	Massachusetts Wing	CAP 19xx	xxxxMACAP
Peace Garden	North Dakota Wing	CAP 33xx	xxxxNDCAP
Penn CAP	Pennsylvania Wing	CAP 37xx	xxxxPACAP
Puerto Rico CAP	Puerto Rico Wing	CAP 52xx	xxxxPRCAP
Red Cloud	Nebraska Wing	CAP 26xx	xxxxNECAP
Red Dragon	New Jersey Wing	CAP 29xx	xxxxNJCAP
Red Fire	Indiana Wing	CAP 12xx	xxxxINCAP
Red Fox	Illinois Wing	CAP 11xx	xxxxILCAP
Red Robin	Michigan Wing	CAP 20xx	xxxxMICAP
Red Rock	Arizona Wing	CAP 02xx	xxxxAZCAP
Sand Lapper	South Carolina Wing	CAP 39xx	xxxxSCCAP
Ship Rock	New Mexico Wing	CAP 30xx	xxxxNMCAP
Silver State	Nevada Wing	CAP 27xx	xxxxNVCAP
Sourdough	Alaska Wing	CAP 50xx	xxxxAKCAP
Southeast CAP	Southeast Region	CAP 94xx	xxxSERCAP
Star Fish	Minnesota Wing	CAP 21xx	xxxxMNCAP
Star Garnet	Idaho Wing	CAP 10xx	xxxxIDCAP
Tennessee CAP	Tennessee Wing	CAP 41xx	xxxxTNCAP
Texas CAP	Texas Wing	CAP 42xx	xxxxTXCAP
Uncle Mike	Utah Wing	CAP 43xx	xxxxUTCAP
Vermont CAP	Vermont Wing	CAP 44xx	xxxxVTCAP
Washington CAP	Washington Wing	CAP 46xx	xxxxWACAP
Western	Pacific Region	CAP 98xx	xxxPCRCAP
White Peak	New York Wing	CAP 31xx	xxxxNYCAP
Wild Wood	Arkansas Wing	CAP 03xx	xxxxARCAP
Yellow Brick	Kansas Wing	CAP 14xx	xxxxKSCAP
Yosemite	California Wing	CAP 04xx	xxxxCACAP

Before the CAP community has a major hemorrhage and sends the Feds to knock down our door, the information presented in this column has come from open sources we found on various Internet websites and from *MT Milcom* monitors in various areas of the country. Absolutely no internal CAP classified sources were used to compile the frequency list and call signs listed in this column.

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HD Radio without interference?

(All graphics courtesy the author)

If you've been into AM DX over the last few years, you're aware that HD Radio doesn't have a very good reputation in the hobby. (A severe understatement!) AM HD Radio generates loud noise sidebands in the first and second channels either side of the HD station's frequency. WTMJ-620's HD makes 610 and 630 useless for DXing in Milwaukee. Would you believe there's a way for stations to use HD without causing adjacent-channel interference?

CBS is planning a test of just such a mode. The station involved hasn't been named, but it seems almost certain it's WBCN-1660, Charlotte. WBCN was granted Special Temporary Authorization last October for some kind of digital test, and a Charlotte TV station received a letter from an engineering firm asking if their employees could help.

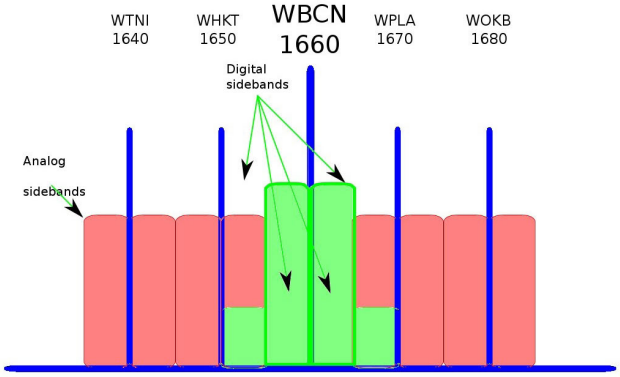
❖ Here's How All-Digital IBOC Works:

"Regular" hybrid HD radio broadcasts an analog signal in the middle of the channel, in an area 9.8 kHz wide. For WBCN, this analog signal would stretch from 1655 through 1665 kHz. The digital signal is transmitted in two groups of "sidebands." WBCN's "primary" digital sidebands would fall between 1645-1650 kHz, and between 1670-1675 kHz. The "secondary" sidebands would occupy 1650-1655 and 1665-1670. (see the drawing, it'll make more sense that way!) The diagram shows both sets of WBCN HD sidebands completely overlaying the signals of WHKT-1650 and WPLA-1670. The outer sideband pair is quite strong as well.

HD Radio offers a second mode. In this mode, there is only one secondary sideband; it occupies (in WBCN's case) 1665-1670. A "tertiary" sideband occupies 1650-1655. The "primary" sidebands are transmitted at much higher power than in the "regular" mode – but they occupy 1655-1665 kHz, so they can't interfere with adjacent stations. Looking at the other diagram, you see that only one set of sidebands overlays WHKT and WPLA – and that set of sidebands is much weaker.

So what's the catch? Note that in the second mode, I didn't say anything about where the analog signal goes. That's because there is no analog signal; we gave its spectrum to the interference-causing primary digital sidebands. Of course, this mode is not compatible with the vast majority of existing radios, which don't support HD.

What will the test prove? We'll know for sure next time. I strongly suspect all-digital mode will work very well. DXers who've tried HD receivers have noticed HD reception is far weaker than analog. I suspect all-digital HD reception will work just as well as analog, while delivering clean, clear digital quality audio. The other side of the coin is that any station adopting all-digital mode will immediately lose its entire audience! (Rumor has it CBS plans a change in programming for WBCN, so they really don't care if they lose the entire audience for the existing shows...)

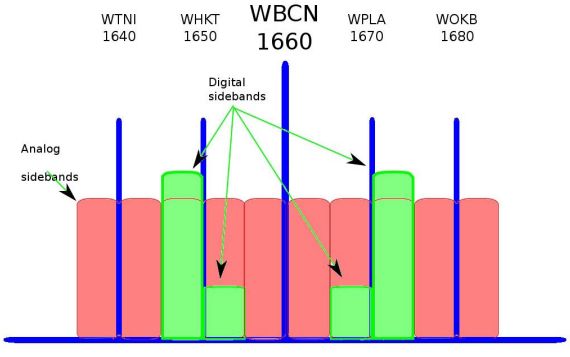


All-digital IBOC spectrum, showing WBCN's sidebands only partially overlaying WHKT & at a much lower level.

❖ What about FM?

FM HD sidebands also extend into the channels either side of the station's own frequency. There is no difference between the existing hybrid analog/digital FM mode and the all-digital FM mode, as far as the amount of spectrum occupied.

FM HD allows for transmission of more than one program at a time over a single transmiter. Hybrid mode allows for transmission of three programs. All-digital mode allows transmission of a fourth program, or transmission of fewer programs at higher audio quality. It also allows much higher digital power, greatly improving coverage.



Ordinary IBOC spectrum, showing WBCN's sidebands completely overlaying WHKT.

❖ The Wrath of Sandy

Hurricane Sandy hit the U.S. East Coast on October 29, causing enormous damage. Residents and businesses in the area are still recovering. The broadcasting industry saved numerous lives by warning of the approach and effects of the storm, but it wasn't immune from the damage Sandy caused.

AM radio transmission works best when a good connection can be made between the transmitter and earth ground. That's why so many stations transmit from wet, swampy locations. As you might guess, these are exactly the locations that flood first during severe weather conditions.

Most New York City AM stations transmit from the New Jersey Meadowlands, across the Hudson River from the city. Reports suggest most AM stations were off the air at least briefly due to storm-related power outages. The transmission site shared by WMCA-570 and WNYC-820 was flooded; both stations are reported on reduced power. WICC-600 Bridgeport, Connecticut was knocked off the air when the power failed. WICC has a backup generator – but the storm surge washed away its propane tanks. Other stations throughout the tri-state area, and as far away as Maryland, were reported at least briefly off.

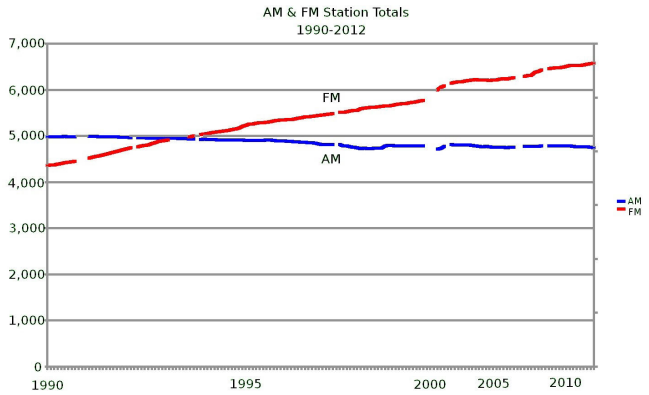
❖ The Thinning of the AM dial

We now have more information on the move of Mexican AM stations to the FM dial. Fred Cantu's "mexicoradiotv.com" website is listing the new FM destination frequencies. More than half of all Mexican AM stations have been assigned FM channels.

All of the AM stations in Acapulco and Veracruz are moving to FM. More than 90 percent of the AMs in Aguascalientes, Chihuahua, and San Luis Potosi are moving, as are two-thirds of the stations in Puerto Vallarta. Some of Mexico's largest stations are on the list, including the country's second most powerful station, XEWA-540 San Luis Potosi.

The FM dial is already full in some of Mexico's larger cities and in the north, near the U.S. border. None of the 14 stations in Juarez are moving; only one each of the stations in Mexicali and Tijuana; and only four of the 24 in Monterrey.

We also have more numbers from Canada. Not counting 40-watt low-power transmitters, 57 percent of Canadian AM stations have been



The number of AM stations in the U.S. continues to slowly decline.

deleted since 1985. Most have moved to FM, although a few have gone away altogether. The proportion is far higher in some provinces; 84 percent of Quebec's AM stations are gone, 72 percent of those in Nova Scotia, 68 percent in New Brunswick. Quebec City's last AM station, CHRC-800, signed off permanently last October. There are no AM stations left on Prince Edward Island, except for two 40-watt tourist-information outlets.

U.S. broadcasters are bucking the trend, more or less. The number of AM stations in the U.S. peaked at 4,990 in 1991; the total has since dropped by only 5 percent, to 4,745. In my humble opinion, this is still roughly five times as many stations as the band can reasonably hold... and yet, we continue to license new stations. See the sidebar, where we have new AM stations on the air in Minnesota and New Hampshire, and a permit issued for a new station in Oregon.

❖ Bits & Pieces

Earlier this year, a permit was issued for a new station on 640 at Terre Haute, Indiana. It now appears likely this station will never operate from Terre Haute. An application has been filed to amend the permit to specify operation at Peotone, Illinois. The transmitter would be located between Kankakee and Joliet, and would operate with 4,800 watts daytime, 1,150 watts at night, with a directional antenna.

The station owner, Birach Broadcasting, owns 25 AM stations, most of them programming ethnic formats. The Chicago area would seem a much better match for their portfolio than Terre Haute. It does seem Peotone is a bit close to existing station WMFN, broadcasting on 640 from Zeeland in southwestern Michigan. However, WMFN is also owned by Birach, so maybe something else is afoot?

URLs in this month's column:

http://americanbandscan.blogspot.com My AM DX blog.
www.mexicoradiotv.com Fred Cantu's Mexican radio & TV directory.
www.wnyc.org WNYC-820, New York.
www.radio-canada.ca/radio/frequencies/Ontario.shtml List of Radio-Canada frequencies in Ontario.
www.wsmonline.com/events/wsm-tower-open-house WSM Radio tower site open house.

Another change is now on the air in southwestern Ontario. CBEF-540 is the CBC's French-language station in Windsor. A recent inspection showed the 540 towers are in pretty bad shape and require replacement.

Last year, the CBC shut down their English-language AM station in Windsor, CBE-1550. The CBE programming moved to 97.5 FM. The 1550 transmission facility and towers are still in place, and are in good condition.

An application was filed to reactivate the 1550 facility, for use by the French service. That request has already been granted and, as of my deadline, CBEF is operating on both frequencies. It's likely 540 will be permanently off the air by the time you read this.

Last time, you read that 690 has been reactivated in Montreal. It's CKGM, with an English-language sports format moved from 990. At the time, CKGM had an application pending to switch languages to French.

That application was tied to a request to merge two of Canada's largest radio companies. The merger request has been denied, and with it the request to change CKGM's language. The last word I've heard is that CKGM is now for sale. While 690 will continue to operate in English for the time being, I think it's likely a request to flip to French will be filed again.

Visitors arriving in Nashville from the south are welcomed by WSM-650's huge tower, south of the city in Brentwood. That tower celebrated its 80th anniversary last November. The station celebrated with an open house, featuring a picnic, live music, and the opportunity to meet air personalities. Of course, I had a previous obligation to be out of town! Rumor has it the open house was a big success and may be repeated – keep your eyes on this column.

❖ Until Next Time...

Have you logged any of the rapidly-disappearing AM stations of Mexico? Please write, at 7540 Highway 64 West, Brasstown NC 28902-0098, or by email to *dougsmith@monitoringtimes.com*. Good DX!

STATION REPORT:
NEW STATIONS:
New stations on the air:

Wilton, Minnesota	820	WBKK 15,000/750 DA-N
Conway, N.H.	1340	WPQR 620/620 ND

Permits granted for new stations:

Lebanon, Oregon	1100	3,900/1,500 DA-2
Montreal, Quebec	600	10,000/5,000

TECHNICAL CHANGES

Frequency changes on the air:

Golden Valley, Ariz.	1170	KYET from 1180 at Williams, Ariz.
Windsor, Ontario	1550	CBEF from 540

Frequency changes requested:

Asheboro, N.C.	700	WZOO from 710

Location changes requested:

Peotone, Illinois	640	new, from Terre Haute, Indiana

DELETIONS:
Stations deleted:

Wainwright, Alberta	830	CKKY (going to 101.9 FM)
Mulberry, Florida	780	WXTO (new station, not built)
Fremont, Michigan	1550	WSHN
Plymouth, N.C.	1470	WJPI
Port au Choix, N.L.	790	CFNW (going to FM)
Yellowknife, N.W.T.	1340	CFYK (going to 98.9 FM)
Canton, Ohio		900 WCER
Niagara Falls, Ont.	710	CJRN
Quebec City, Que.	800	CHRC

ND: non-directional
ND-D: non-directional, only operates daytime
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

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A Look at SkyVector.com

The hobby of VHF aircraft communications listening would be hampered by not having an easily accessible source of frequency and airport information. For years, many listeners have and still do rely upon AirNav.com with its clean interface and relevant search results. There are, of course, other sites that offer similar information but with varying degrees of capability and user friendliness.

SkyVector provides a great array of on-line, high-resolution aeronautical charts and offers a capable airport look-up. It was founded in 2005 and now better than ever, evolving, and drawing more interest.

SkyVector includes a multi-topic forum where users can become involved by asking questions, suggesting new features and discussing anything else related to the site. How many similar sites do that?

Let's take a look at SkyVector – starting with the charts!

❖ The Initial Screen

At the home page **http://skyvector.com/,** you will see a SkyVector-selected chart if you have never been to the site before. If you have been there before, it may show a previously viewed chart. In any case, the chart can cover a considerable geographic area and with the fine details not being legible. Based on experiences with similar interfaces, you may already know that you can zoom in or out by using the slider or the plus and minus symbols, in this case at the bottom right. You can also click on and drag the chart to re-center as desired.

Crosshair: It may be hard to find at first but there is a small crosshair in the center of the chart as it appears on your screen. If you drag the chart, the crosshair stays centered / fixed on your screen. In the gray transparent band near the top and off-center to the right, you will see some latitude-longitude figures displayed in this format: 34°4'18"N 117°27'30"W. It is calling out the position of the crosshair on the chart. Drag the chart and the figures change. This can be fun to play with but it can also be useful.

Weather: Rest your cursor over any dot / map tack (most are green and white) and it will give the weather, see graphic. This example can serve as an introduction to weather forecast decoding. "KONT" is the four-letter airport identifier for Ontario International Airport in Southern California. "(38m ago)" is how old the weather forecast is since issued. "030153Z" is the issuance day of the month (03) and the time of day (0153Z). The time is Coordinated Universal Time (UTC) / Zulu Time using the 24-hour clock. "24008KT" is the surface wind forecast. The "240" part is the compass direction clockwise from true north from which the wind blows. "08KT" is the wind speed in knots. "10SM" is the expected visibility – ten statute miles. "FEW090" is few clouds (sky cover of more than zero and up to 2/8ths) and "090" is in hundreds of feet (090 x 100 = 9000 feet). "SCT180" is scattered clouds (sky cover from 3/8 to 4/8) at 18,000 feet. "31/06" is temperature / dew point in degrees Celsius. "A2986" is the current barometric pressure at the time of the forecast (29.86 inches of mercury). Pilots use this number to calibrate their cockpit altimeters since the pressure changes during the day and from location to location.

This is an example of an area weather forecast that appears when you place your cursor over a green, or partially green, map tack on one of the charts, see text. (Courtesy: SkyVector.com)

Note that some of the included terms in weather forecasts will vary from airport to airport and from time to time to reflect the weather conditions. The following will help you with decoding: Aviation Weather Formats: METAR/TAF (11 pages) at **www.uscg.mil/auxiliary/missions/auxair/metar_taf.pdf.** Here is another:
http://aviationweather.gov/static/help/taf-decode.php

Additional Charts: Just below the gray transparent band near the top are links to other aero charts. Clicking on those links will take you to the same, or nearly the same, geographical point on the newly selected chart, a really nice feature.

To select a chart of a particular type for an area other than the SkyVector default chart/location, rest your cursor on the world globe icon, labeled "Charts," near the top left. The choices are: Sectional, TAC (Terminal Area Charts), Helicopter, Enroute High, Enroute Low, and IFR Area. Click on your choice and the U.S. map will then display the area charts to select from. SkyVector provides an excellent opportunity to explore the various chart types close up. Learning at least the basics of aero charts can complement aircraft listening.

Chart Descriptions and Info: Descriptions of the chart types may be found here: **www.faa.gov/air_traffic/publications/ATpubs/AIM/index.htm**. Once there, click on *Chapter 9 - Aeronautical Charts and Related Publications* and then on *Section 1. Types of Charts Available.*

An essential part of trying to understand aeronautical charts is to have a reference at hand to look up all the various the symbols. Here it is: *Aeronautical Chart User's Guide* at: **http://aeronav.faa.gov/content/aeronav/online/pdf_files/Chart_Users_Guide_11thEd.pdf** (80 pages, 23 MB). A quality paper version may be ordered here for $5.10: **http://faacharts.faa.gov/ProductDetails.aspx?ProductID=USRGD.** See left column for other products of interest.

❖ Looking Up Airports

You can start from the SkyVector home page by clicking on the "Airports" icon near the top left for world airports or by going directly to **http://skyvector.com/airports/United%20States** for U.S. airports. They will be listed by state for browsing or if you know the airport code, enter it in the large search box. Alternately, you can enter a city or an airport name and then select from among the search results.

❖ Airport Page – Left Side

Once at a specific airport page, you will see a number of nicely presented components. Let's start by going down the left side.

The *Airport/Facility Directory (A/FD)* entry for your selected airport is at the top. Rest your cursor on it to view or click on it to download a high-resolution PDF view. The *A/FD* is an official FAA publication with new paper and electronic editions every eight weeks. Seven volumes, grouped into states, cover public-use airports in the U.S. Accessing *A/FD* airport listings using the government portal is slow and frustrating. SkyVector makes this task wonderfully easy.

For scanner listening purposes, the information offered in an individual *A/FD* airport listing may, or may not, have information available from other sources. They can be worth a look. The paper volumes have a rear supplemental section with lots of info, some interesting and useful to scanner listeners. The paper volumes also have a rather detailed directory legend which helps with understanding the *A/FD* listings. Both of these can be downloaded. Go to **http://aeronav.faa.gov/index.**

At the top of any SkyVector page, "SkyVector" takes you to the home page, "Airports" to world airports by country, "Charts" to a nice selection of charts, "Forum," to exchanges on a variety of topics, and "Help Video" speaks for itself. (Courtesy: SkyVector.com)

asp?xml=aeronav/applications/d_afd and click on the "digital - Airport/Facility Directory" link. Select a state of interest which takes you to the volume that includes that state. Select any airport ID. Click on search. At this point, these new links appear: "Legend | Supplemental | Airport Hot Spots." Download "Legend" (22 pages, about 250 KB) and "Supplemental" (about 15 MB).

Airport Diagram is the second down from the top. Click on it to download the PDF file. Airport diagrams are essential in order to understand and follow taxi instructions that include taxiways, ramps, and runways. Airport diagrams also include frequencies, some of which do not appear in the regular airport look-ups. Viewing a single document, the Hartsfield - Jackson Atlanta International Airport (ATL) airport diagram, as an example, you can see the eight ramp areas depicted graphically and their frequencies listed.

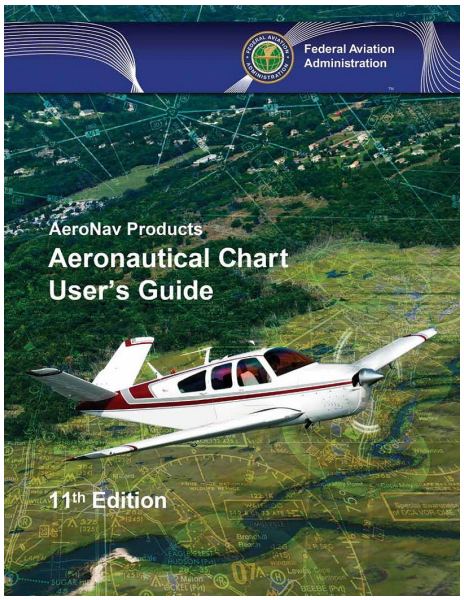
Runway numbering can be a little confusing. Picture a small airport with a single stretch of pavement. When a plane lands or takes off on one direction, the runway number is different from the runway number when using the same stretch of pavement in the opposite direction. The runway numbers are based on the magnetic compass direction of the runway rounded to the nearest ten degrees. If a runway runs east-west, the runway numbers will be 09 and 27. Add a zero to each and you have 090 and 270 degrees.

Complexity is added when there are parallel runways. Adding a second runway to the above example, and heading west, you then have runways 27 Right and 27 Left (RWYS 27R/27L). Going in the opposite direction, the two stretches of pavement are RWYS 09R/09L. If it isn't clear at first, it should become clearer as you mull over the concept a bit. Ground control, tower, and approach controllers call out runway numbers all the time. You will also encounter them in frequency listings, so gaining an understanding of the numbering is useful.

ATL has two sets of parallel runways. The two on the south side of the airport are as above – 09R/27L and 09L/27R. Look at the airport diagram for ATL, and though it may seem cluttered with information, look closely at the ends of the runways and you will see the runway numbers. You will also see the notation for the actual runway heading – 094.4º, rounded to 090. A legend for airport chart symbols can be found at **http://aeronav.faa.gov/index.asp?xml=aeronav/applications/d_tpp**. Once there, click on, "digital - Terminal Procedures" and then download "Legends & General Information.....PDF" (link at the bottom, 19 pages, 5 MB, airport symbols on PDF page 13). This file also includes chart symbols for Instrument Approach Procedures (IAP), Standard Terminal Arrivals (STAR), and Departure Procedures (DP).

Charts: Third and fourth down on the left are graphic links to "VFR Chart of KATL" and "IFR Chart of KATL." These take you directly to two charts that apply to ATL. This is very convenient! Once at either chart you have the zoom, the click-and-drag, and the ability to select other charts as mentioned above.

Satellite View: This allows a very easy way to bring up a Google Maps satellite view of the selected airport, and in this case, "Satellite View of KATL." Click on the "Map" icon at the upper right of the satellite view to change to a road map.



The Chart User's Guide is both interesting and useful to aircraft communications listeners who wish to better understand aeronautical charts, see text. (Courtesy: FAA)

❖ Airport Communications

In the wide center column, a box is devoted to frequencies and their uses. To some, the information after each frequency may seem as cryptic as a coded weather forecast. ATL is large, complex and busy, so the frequency information is more involved. Space limitations prevent describing them all here.

D-ATIS: This term conveys two things. One is that voice ATIS (Automatic Terminal Information Service) broadcasts are on the designated frequency. For ATL, there is a frequency for both arriving aircraft and departing aircraft – 119.65(ARR) 125.55(DEP). These are prerecorded, repeating, and periodically updated airport information broadcasts. The "D-" part indicates that ATIS information is also available textually via ARINC's GLOBALink service / ACARS (Aircraft Communications Addressing and Reporting System). Some hobbyists are set up to receive ACARS text messages.

Tower: Air Traffic Controllers in the tower control departing and landing aircraft and other aircraft in the airport area. Many towered airports have just a single tower frequency. ATL has five VHF frequencies! Notations like "RYS 9L & 27R" indicate what runways the frequency is dedicated to. "ILS PRM" (Instrument Landing System/Precision Runway Monitor) refers to an approach system that allows simultaneous approaches to parallel runways at some airports.

Ground: Also in the tower cab are ground controllers who control aircraft taxiing on the ground. The exception is that some large airports have ramp controllers. These controllers direct aircraft to and from ramp parking locations, but not on taxiways.

Approach and Departure: These are air traffic controller positions in a nearby TRACON (Terminal Radar Approach Control) facility. ("Atlanta TRACON" is in Peachtree City, Georgia.) Arriving planes are handed off from approach control to the tower. Departing planes are handed off from the tower to the departure controller.

CLEARANCE DELIVERY issues instrument flight (IFR) clearances based on what pilots have filed. The information relates to the initial phase of the flight.

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Winter Tactics

A common question I hear from prospective listeners goes something like this: "Is there anything to hear on longwave besides static and a few beacons?" The question tells me right away that the person has either been misinformed or has not listened to the band with an effective antenna system. The truth is that you'll be hard pressed to find a greater variety of signals in any other 500 kHz slice of spectrum than you will on longwave. Here is but a small sampling of what you might be able to hear:

Natural radio
Military transmissions
Time stations
Radiolocation services
License-free Experimenters
Broadcasters
Navigation Beacons
Maritime bulletins
Amateur Radio Stations

With this being early in the New Year, why not make 2013 the year that you learn more about longwave? I'll be the first to tell you that longwave shouldn't be your *only* radio pursuit, but I do hope to make the case for exploring what it has to offer, at least on an occasional basis.

❖ Raising the Bar

Suppose you've already gotten your feet wet on longwave or are even an intermediate DXer. If so, how about taking on some new challenges, such as exceeding 300 confirmed loggings, setting a distance record for daytime reception, or building a new receiving antenna. The possibilities are wide open.

If you're just starting out, you picked a good time to tune in. February often brings some of the best longwave monitoring of the year, at least in North America. This is a good time to set your sights northward in search of high power Canadian beacons which are often heard at surprisingly strong signal strengths at this time of the year, as well as other DX targets in the Pacific and trans-Atlantic regions.

Non-directional beacons (NDBs) are a mainstay of longwave DXing, yet we've grown accustomed to hearing about their imminent demise in recent years. So far, it hasn't happened, in large part because the stations offer a simple, proven method for navigation and positioning. Recent budget woes are forcing many services to be examined for continued effectiveness, cost and criticality. Let's be honest; NDBs are an area in which there is an opportunity for savings. This fact, along with recent innovations in high accuracy differential GPS (DGPS) might mean that we will see more NDB shut-downs in the not too distant future. This is *not* to say that they will go away overnight or that all beacons will be affected.

Private beacons, and those serving remote areas appear to be more secure and should be with us for some time to come. No matter what happens to traditional beacons, *Below 500 kHz* will be there to cover the many other activities happening on longwave. These include Experimental/Ham activity, Natural Radio signals, time stations, and other utilities. Ham operation in particular, has a very promising future on longwave, and we'll talk more about it later in this article.

❖ Lowfer Intrigue

Now is a great time to hunt for experimental Lowfer stations operating in the traditional 160-190 kHz band, as well as other experimenters near 136 kHz and 500 kHz.Traditional Lowfers operate license-free under Part 15 of the FCC rules. These rules allow a maximum power of 1 watt and an antenna length (including feedline) of no more than 15 meters (50 feet). Transmissions are limited to the frequencies between 160 and 190 kHz. Out-of-band emissions, such as harmonics or spurious signals, must be attenuated by at least 20 dB. Any transmission mode is allowed except for damped waves (spark signals).

Despite seemingly severe handicaps, Lowfers are routinely heard at distances up to about 300 miles, sometimes much farther. An update on active stations can be found at the website for the Longwave Club of America (www.lwca.org). The LWCA website is an excellent source of information about these stations, their operating modes and antenna systems.

For your best shot at hearing Lowfers, put on a good pair of headphones, switch in a narrow bandwidth filter and slowly sift through the band. You should try this at various times of the day. Surprisingly, some of my best Lowfer catches have been in full daylight during the mid-morning hours. A Lowfer QSL is a prized verification, and most Lowfers are excellent QSLers. If you hear one of these stations and need a mailing address, feel free to drop me a line. I can provide mailing information for many stations in North America.

Unmanned, low power beacons like this one await your DXing skills. (MDE, 379 kHz, Cincinnati, OH)

❖ Ice Breakers in Action

A few seasons ago, I noticed several loggings of ZG on 410 kHz. It turns out that this was the ID of a beacon aboard the CCGS Ice Breaker *Pierre Radisson* working on the St. Lawrence River. This ship, along with the Griffon (XF), Des Groseillers (WF), and perhaps others, were working to keep the river and the Great Lakes open to shipping interests during the winter months. NDBs are used to help guide helicopters traveling between land and these ships. Some ice breaker activity may also be heard at 413 kHz. If you catch an unfamiliar ID in the vicinity of 410-413kHz, there's a good chance it could be from temporary ice breaker operations. For your reference, the following websites have more information on this activity: 410/413 kHz frequency/callsign info: **www.dxinfocentre.com/ndb.htm**
Canadian Coast Guard Icebreaking Info: **www.ccg-gcc.gc.ca/eng/CCG/Ice_Home**

❖ What's in my Bookmarks?

A popular commercial asks: "What's in Your Wallet?" While I'm not ready to go that far (empty wallets are not exciting) I *will* share some of my bookmarks for longwave websites. *MT Express* readers can simply click on the addresses below to visit these sites. Others will need to key the URLs in on their PC.

Radio direction finders (RDF): **www.angelfire.com/space/proto57/rdf.html**
Natural VLF Radio - Sounds of Space Weather - Stephen P. McGreevy: **http://www.auroralchorus.com/**
The INSPIRE Project & Natural Radio Kit: **http://theinspireproject.org/**
LF Engineering Co. Inc.,Manufacturers of Low Frequency Equipment for Communications, Natural Radio, AM Broadcast, Marine &SW Radio: **www.lfengineering.com/**
U.S. Coast Guard Navigation Center: **www.navcen.uscg.gov/**
LWCA Longwave Home Page: **www.lwca.org**
VE3GOP Longwave Page: **www.ve3gop.com/**
The 500 KC Amateur Radio Experimental Group: **http://500kc.com/**
Alexanderson Alternator Site– Grimeton (click the British flag to view in English): **www.alexander.n.se/**
World Aeronautical Database: **http://worldaerodata.com/**
AirNav beacon listings: **www.airnav.com/**
W3EEE - Mt. Gretna, PA, U.S.A.: **www.w3eee.com/**
NDB and Fish Net Beacons (note that spaces in the URL are

intentional): **http://www.w8ji.com/ndb beacon fish buoy net beacons.htm**
WebSDR-VLF at Delft, Netherlands: **http://websdr.pa3weg.nl/**
Longwave DXing Info and Tips: **http://www.dxing.com/lw.htm**
Listening to Longwave book—The World Below 500 Kilohertz: **www.universal-radio.com/catalog/books/0024u.html**
NDBRNA > signals: **www.classaxe.com/dx/ndb/rna/index.php**
Aerobeacon &Radio Range history: **http://tinyurl.com/d6ha249**

❖ Winter SWL Fest

Ham operators have the famed destination of Dayton, Ohio in the spring. ForSWLs, one of the best places to be is the Winter SWL Fest!This event, just outside of Philadelphia, Pennsylvania, is being held on March 1-2 at the Doubletree Guest Suites, in Plymouth Meeting. If you are within driving distance of Philadelphia, I encourage you to check out this yearly gathering of the faithful.

There will be forums on many aspects of radio, exhibits, a swap meet, silent auction, and a chance to interact with your fellow hobbyists. There are many options for registration, depending on how long you want to stay and what activities you'd like to partake in. Full information on the event is available online at **www.swlfest.com**. While I am unable to attend this year, I hope that you will be able to sample some of what the 'Fest has to offer.

❖ Free Book: LF Propagation

An e-book called Understanding LF and HF Propagationis available for free download at **http://tinyurl.com/LW-Propag**. This book, by Steve Nichols, G0KYA and Alan Melia, G3NYK, is based on a series of articles written on LF and HF propagation for the RSGB's *RadCom* magazine in 2008-09. It includes three features specifically focused on LF. The site may take a while to download, but it will be well worth the wait for this free publication.

❖ 136 kHz Ham Band?

The *ARRL Letter* for November 21 reportsthe FCC is looking into a possible ham band allocation near 136 kHz (135.7-137.8 to be exact). The notice reads, in part: "Now that 135.7-137.8 kHz is allocated internationally to the Amateur Radio Service on a secondary basis in all ITU Regions, the FCC has concluded that it is an appropriate time to re-examine the potential for shared Amateur Service-PLC use of this band. It stated in the NPRM that [the FCC] is seeking comments on whether 135.7-137.8 kHz band should be allocated to the Amateur Service on a secondary basis in accordance with RR 5.67A."

❖ Mailbag & Loggings

Dick Holbert K2HZ writes: "I always read *Below 500 kHz* with great interest but found the December review of historical stations to be especially well done. Your descriptions of the various technologies were very accurate. You did omit one longwave navigation system: CONSOLAN. This was also known as CONSOL in Europe and was based on German WWII technology known as SONNE."

Good to hear from you, Dick. Indeed CONSOLAN was a significant player in LW navigation systems. A recording of such a station is included on my CD, *VLF Radio!* but it was overlooked in our December column. Many thanks for the additional information.

Mario Filippi N2HUN (NJ) sent the loggings shown in the table, which he made with his Ten Tec RX-320D receiver and 43-foot vertical antenna. He noted that several new beacons were heard this time, such as FIS from Tampa and JA from Jacksonville, along with YRR, CI, EMR, JB,ZYZ, YHD, YPH, FIQ and local TE. He also heard an NDB on 269 kHz that sounded like VIED or VIEDT, believed to be a mis-keying station.Finally, he says that CAT on 254 kHz from Chatham, NJ is keying properly after months of having a variable mis-key.

Selected beacons heard in NJ

FREQ	ID	ST/PR/ITU	CITY
214	TE	NJ	Teterboro
216	CLB	NC	Wilmington
248	IL	DE	Wilmington
248	UL	QC	Montreal
254	CAT	NJ	Chatham
254	EUD	PA	York
328	BZJ	PA	Indiantown Gap
329	CH	SC	Charleston
332	FIS	FL	Tampa
332	YFM	QC	La Grange
340	YY	QC	Mont-Joli
341	YYU	ON	Kapuskasing
344	JA	FL	Jacksonville
344	ZIY	CYM	Georgetown
351	MSQ	VA	Culpeper
351	YKQ	QC	Ft. Rupert
355	CGE	MD	Cambridges
356	HEU	NY	Schenectady
360	PN	QC	Port Menier
363	RNB	NJ	Millville
366	YMW	QC	Maniwaki
368	ZYZ	ON	Toronto
373	2Q	QC	Mont Laurier
373	AEA	VA	South Hill
376	ZIN	BAH	Matthewtown
377	YRR	ON	Ottawa
378	RJ	QC	Roberval
382	YPL	ON	Pickle Lake
384	JB	NC	Lumberton
385	EMR	GA	Augusta
388	AM	FL	Tampa
388	RNW	NC	Chocowinity
390	JT	NL	Stephenville
391	DDP	PR	San Juan
391	FIQ	NC	Morganton
392	ML	QC	Charlevoix
396	YPH	QC	Inukjuak
397	ZHA	ON	Hamilton
400	CI	MI	Sault St. Marie
400	PTD	NY	Potsdam
403	ZTO	ON	Toronto
404	YSL	NB	St. Leonard
407	FR	NY	Farmingdale
407	ZHU	QC	Montreal
408	SN	ON	St. Catharines
410	JU	NC	Jefferson
413	YHD	ON	Dryden
414	3U	QC	Ottawa
415	CBC	CYM	Cayman Brac
420	CFY	SC	Lake City
424	RVJ	GA	Reidsville Jail
473	WG2XJM	?	Exp. Stn.w/ CQ
476	WD2XSH/31	VA	Exp. beacon

That's it for this month. See you in March!

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Awakening a Hallicrafters S-38D

A Little History

This set came my way through a lunchtime conversation at work. When I happened to mention that I enjoyed working with antique radios, one of my lunch partners brightened up and mentioned that he had an old radio that needed a good home. A few days later, I was gratified to get my hands on the cosmetically excellent S-38D that is the subject of this article.

The S-38, introduced in 1954, was the first with a slide rule dial. Most people are more familiar with the previous S-38 models, which have two "half moon" dials (for bandspread and main tuning). Those modestly priced and very attractive receivers were manufactured from 1946 to 1954 as the S-38 and the S-38 A through C. All of the S-38s were very similar electrically and cosmetically, and all were favorite starter sets for young SWLs.

It's interesting to look at the evolution of the S-38. Essentially a modest consumer broadcast radio with added short-wave bands and some of the trappings of a communication receiver (BFO, phone jacks, bandspread, metal cabinet, etc.), this seems to have been the second A.C.- D.C. model sold under the Hallicrafters name. Its ancestry certainly stems from the very similar Echophone EC-1, which was manufactured in 1941-1943 by the Hallicrafters-owned Echophone company.

During the early postwar years (1945-1946), Hallicrafters produced, under its own brand name, a set almost identical electrically to the EC-1. It was called the S-41 Skyrider Junior. In spite of its later serial designation, this was a direct predecessor of the S-38 series. The layout of the Skyrider's controls and dials is very similar to those of the S-38 and S-38 A through C. Electrically the set is also similar to that S-38 series except that the latter lack a separate BFO tube.

But the general appearance of the S-38 and S-38 A through C is quite a bit more sleek than that of the S-41. The reason is that the look of the S-38s was created by noted industrial designer Raymond Loewy. Loewy also created the cosmetic design of the S-40, the S-38's larger cousin, as well as that of Hallicrafters' top of the line SX-42.

The S-41 Skyrider Junior—a very rough example from my "Someday" shelf.

The Loewy design was abandoned with the introduction of the slide-rule-dial S-38D (1954-1957) that is our latest project. Its successor, the S-38E (1957-1961), had much more modern styling, including a lengthening of its slide rule scales. Like the earlier S-38s, the S-38E had an "All American Five" tube complement, but the tubes were now miniature rather than octal. The S-38 line was discontinued when production of the "E" ceased. By that times Single Sideband (SSB) was becoming the preferred mode of amateur phone transmission, requiring receivers that were a little more sophisticated than the simple S-38s.

The original S-38— detail from a Hallicrafters ad.

Features of the S-38D

Electronically, the S-38D is a typical member of the S-38 series. First of all, as an A.C.- D.C. set, it has no power transformer. In most common A.C.- D.C. broadcast sets, this means that the B minus connections, including one side of the power line are grounded to the chassis. Thus there is a possibility of serious electric shock from coming in contact with metal parts of the chassis such as control shafts with missing knobs, chassis mounting screws or hardware accessible because of a missing cabinet back.

However, in the S-38D the B minus connections are not made to the chassis but are isolated from it. In fact the only connections to the chassis seem to be non B minus connections in the front end of the receiver where, presumably they are needed for shielding and/or stability. In addition, the S-38D's metal cabinet is electrically isolated from the cabinet, providing another layer of protection.

This receiver has the typical "All-American Five" tube complement used in A.C.- D.C. sets: 12SA7 oscillator-mixer; 12SG7 I.F. amplifier (a 12 SK7 is used here in earlier S-38s); 12SQ7 detector/first audio; 50L6 audio output; 35Z5 rectifier.

The radio covers the frequency range .55 – 30 MHz in four bands: .55-1.6; 1.7-5; 5-14 and 13-30 MHz. Each of these bands has a slide-rule scale on the front panel and there is an additional (0-100) scale for the radio's electrical bandspread. Besides the tuning, volume, band selector and bandspread knobs on the front panel, there is a switch to mute the radio on standby and another to start the BFO for CW reception.

A pair of tip jacks to accommodate headphones is located on the rear panel along with a switch for selecting either the phones or the radio's built-in speaker. Also on the rear panel are screw connections for a ground and either a doublet or single-wire antenna.

In looking for documentation for the S-38E I found that the radio is just a little too new to be included in the Rider Manuals series. The last Rider volume includes some of the previous S-38 models, but not the "D." However, I was fortunate enough to find a decent copy of the operation/troubleshooting/alignment manual for the set in the indispensable "Boat Anchor Manual Archive" (BAMA) at **http://bama.edebris.com/manuals**. And, my hat's off to the many, many, electronics enthusiasts who have taken the time and trouble to scan manuals from their collections and post them on BAMA, where they are accessible free of charge to all who need them.

A First Look at Our Set

The S-38D we will be working with is one of the cleanest radios I've had the privilege of discussing in this column. Except for a couple of scuffs, the cabinet looks as if it had just been removed from its shipping carton. In spite of that, you might be surprised to hear that I was almost more excited by the radio's perfect back as I was by its almost mint cabinet.

The composition backs of A.C.- D.C. radios seem to be subject to more abuse, indignity and loss than any other part of a radio cabinet. Often they've never been replaced by the last person who checked the tubes—a highly unsafe oversight because of possible shocks from exposed metal parts. In one radio I have, the omission of the back left the built in loop antenna with no

The S-38D as received from my lunch companion.

means of support, so that it was simply flopping around in the cabinet. Backs with missing screws are all too common as are backs with broken off pieces, the latter possibly because heat from the tubes has made them more brittle.

But this back was super pristine, even to the silk screened markings on its black finish. There was one missing screw, however, so I guess my record of never having found a perfect back is still unbroken! Actually, when I began to remove the back I found that all screws had been installed just finger tight, as if someone had checked out the set without finding the trouble and meant to come back and finish the job at some future time. Another sign of previous trouble was the fact that the line cord was gone, removed flush with the cabinet back.

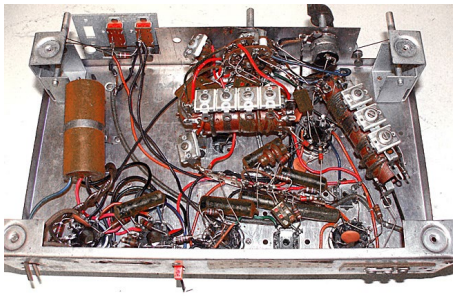
With the back removed, I could see that the chassis top was covered with a layer of fine dust, which had made its way through the ventilation holes. However, there was no rust or any of the dreaded signs of mouse habitation. Wiping that off could wait until I had the cabinet removed from the chassis, but I did remove and test each of the tubes, checking to see that each had been installed in the proper socket.

As most of you know, an open filament in an "All American Five" series string will render the set deader than a doornail because it interrupts the current flow through all the filaments in the string. But as it turned out all of the tubes tested good and had been correctly installed.

Now it was time to remove the chassis from the cabinet. The knobs, secured with Allen-head screws, were released with very little difficulty. The four screws securing the chassis to the cabinet bottom were a different story. Releasing them reminded me that a vintage radio technician can never have enough different screwdrivers! These screws had combination Phillips and slotted heads and all four had been installed very tightly.

Trying several Phillips drivers, I finally found one that fit two of the screws very well. It slipped badly in the other two, though, even though they were exactly the same type as the first two. I found a slotted screwdriver that worked well with them. Releasing the screws involved bracing the cabinet against my chest while pushing the screwdriver into the screw head as hard as possible and slowly increasing the twisting pressure until the screw gave up.

The "Receive-Standby" and "AM-CW" slide switches are mounted on a small plate attached to the front of the chassis with an "L" bracket. This plate is also secured behind the



Under the chassis the S-38D looks as if it had just come off the assembly line.

front panel with a machine screw. With that screw removed, the chassis was now free to move within the cabinet. However, it appeared that speaker, which is mounted in the top of the cabinet, would obstruct the radio's dial mechanism, which is mounted on the front of the chassis.

Dismounting the speaker was going to require contortionist-type hand positioning, so I decided to see if the chassis assembly could be removed with the speaker in place, carefully teasing it around the projecting speaker magnet housing. So I disconnected the speaker's connecting wires and gave it a try. Sure enough, by tilting and swiveling the chassis just so, I was able maneuver the chassis assembly around and past the speaker so I could remove it from the chassis and get a good look at it at last.

As previously mentioned, the top of the chassis was covered with a fine dust, which I was able to remove easily with a damp cloth. This revealed several areas of mild discoloration, but there was no rust or corrosion of any kind. The bottom of the chassis was bright and dust free, looking as if it had just come off the factory assembly line.

Clearly, this radio had spent most of its life stored under optimal environmental conditions. For that reason, I'm very much tempted to try starting up this radio without recapping it. I've done that only one other time in the history of this column, and it did work out then. If it works out now, I guess one might say that I have not so much restored this radio as reawakened it! See you next time when we'll give it a try.

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Understanding the Vertical: It's A Dipole *Stuck In The Ground!*

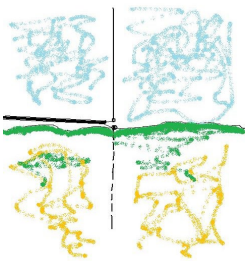
Welcome back, my friends. This month I'd like to delve a little deeper into the workings of an antenna that is very popular, but perhaps not as well understood as it might be; the vertical. Most of us can wrap our heads around the function of the various horizontally-arranged antennas, but find this spike stood on end, using the ground as half of the antenna, somewhat mystifying. The beauty of it is that we can use our understanding of horizontal antennas, like dipoles, to better grasp the vertical's function.

❖ Grounded in Fact

As we've discussed before, the dipole is the very essence of the *balanced* antenna. Two elements of equal length, at similar heights above ground; at any given instant one element is the "hot" and the other the "ground." Since the two elements are the same length, the one that is "ground" at a given instant balances the "hot" element perfectly, satisfying the requirement for an *RF ground return path*. After we use this setup for awhile, we tend to get mentally lazy about the concept of RF grounding since the dipole's design elegantly resolves this issue.

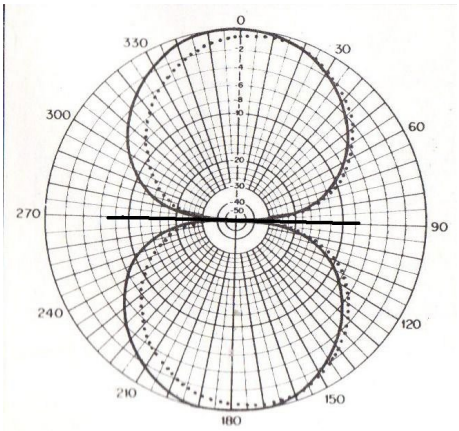
Many antennas are clearly extensions of this "dipole concept." The Yagi beam descends directly from the dipole; the *folded dipole*, opened up into a square or other shape, gives us the quad, the rhombic, the loop; in all these cases, it can be readily seen that the balanced state of the dipole is maintained, and RF ground is not an issue. Note that any of these antennas could be readily fed with balanced line such as 450 ohm ladder line (in fact they often are).

When we turn our attention to the vertical, we are confronted by a completely different configuration. A single, "hot" element is worked against an *RF ground image*. This ground image can and does take many forms, often a combination of these forms. The important thing to grasp is that, unlike the dipole mode of a hot element and a ground element cycling at RF frequency, the vertical's single element is always the "hot." The ground image doesn't "radiate" RF, at least, it had better not. This is the essence of an *unbalanced* configuration. It follows directly from this that the RF ground for a vertical is a crucial element in its success.



It helps a lot to think of a vertical as a dipole stuck end-on into the ground. (Drawing by author)

At first, direct connection to an earth ground, like rods driven into the soil, was seen to markedly improve the vertical's efficiency. Before long, someone noticed that cold water piping can be a very effective ground, since it is metal, lengthy, and buried in the ground. Eventually, with the evolution of the dipole, it was realized that a quarter-wave vertical is basically one side of a half-wave dipole stood on end, and the concept of *ground radials* was born. It was found that radials a quarter-wave long greatly improved the vertical's operation since—duh—the "other half" of a dipole is a quarter-wave long. Finally someone tumbled to the idea of the *ground counterpoise*, which in its simplest form is just a single length of wire that is, you guessed it, a quarter-wave long at the desired frequency. Also, it was discovered that stiff radials can be attached at the base of a vertical to form a *ground plane*, and the whole assembly can be mounted well above ground level.



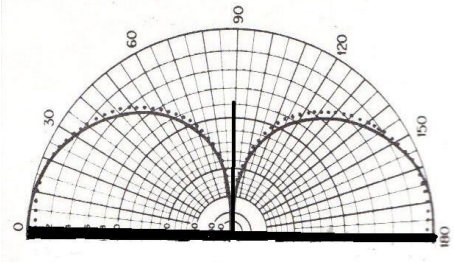
Expected radiation pattern of a dipole, looking down from above; the dipole is the line 90-270 degrees. (From 1997 ARRL Handbook)

The thing to take away from this is that every one of these "RF ground configurations" is basically *the other half of a dipole*. It may seem a bit mysterious at first, since we don't operate dipoles with one half lying on the ground (well, not deliberately, we don't). But if you keep the notion of balanced vs. unbalanced clear in your mind, it all makes perfect sense. Suddenly, a vertical's RF grounding requirements become clear and straightforward to attain once you grasp the concept that what is needed is a quarter-wave RF ground at the desired frequency.

❖ What's the Angle?

One of the best compensations gained from using a vertical is its inherently low angle of radiation. Horizontal, dipole-type antennas can be frustrating in this regard because they need to be high enough in the air, generally at least a half wavelength, to get a low angle of radiation. Otherwise ground reflection raises the angle, and if the antenna is really low you can end up with what old-timers called a "cloud burner," which is to say a nearly vertical angle of radiation. Of course, we now recognize this as a deliberate technique to produce short-distance communications, especially at lower frequencies, where a half wavelength above ground is hard to attain for most of us. (I doubt that many of us have, for example, an 80 meter dipole that is actually 135 feet above ground.) But because the vertical is turned 90 degrees and positioned above (hopefully) an effective ground image, the vertical radiates just like a dipole half at sufficient height, which is to say at a low angle. This makes the vertical an effective DX antenna.

Some gain can even be generated by the vertical, if we go beyond the customary quarter-wave length and make a vertical that is a half-wave, five-eighths-wave, or three-quarters-wave long. However, the tradeoff for the gain is a higher angle of radiation. Again, we can readily understand this by referring back to what we know about dipoles. Recall that as a dipole is lengthened beyond a half-wavelength, the bidirectional pattern begins to split into lobes that have more and more gain, but become ever more in line with the antenna wire, instead of broadside to it. If you turn this picture 90 degrees to visualize a vertical, you'll see that this translates to a higher and higher angle of radiation.



If we roll the dipole view 90 degrees, and ignore the part "underground," we get a nice view of the vertical's omni-directional, low-angle radiation. (From 1997 ARRL Handbook, altered in Windows Paint)

This point becomes clear when we look at, for example, the 43 foot verticals that are so popular today. The basic idea is that 43 feet is a best-case compromise that can be loaded up on "all" HF bands. (It's not as straightforward as they make it sound!) But in the fine print, you'll notice that, for frequencies above 20 meters, or 14 MHz, the antenna needs to be shortened for effective DX operation. Makes sense; at 15 meters, 43 feet is darn near a full wavelength, which means a very high angle of radiation. At six meters, it becomes a ray gun focused on the cone in the sky directly above it, which will produce very little DX, unless the aliens start getting on Six…

❖ Vertical Quirks

It may be almost too obvious to point out, but when we turn the dipole's bi-directional pattern 90 degrees to make a vertical, we now have, instead of a bi-directional antenna, an omni-directional one. Some say this can be a blessing or a curse; for example, it will receive interference omni-directionally. (Older operators used to grumble that the vertical was "equally bad in all directions.") Personally, having been frustrated many times over the years by gaps in my coverage of the globe caused by the fixed position of dipoles, I think this omni-directional notion has more good than bad about it.

Another potential annoyance with verticals is their *vertical polarization.* It turns out that a lot of what we hams call QRN—ignition noise, lightning noise, EMI noise—is vertically polarized. Thus a vertical on receive tends to pick up more "signal strength" of these noise sources than horizontal antennas like dipoles do. Here again is a classic example of the many tradeoffs that we consider when choosing between different antennas.

On the other hand, since it points straight up into the air, the vertical's *footprint* is far smaller. This compactness can be a real plus for those who don't have, say, two trees 100 feet apart to put up a big dipole. Vertical antennas enable mobile operation and handheld operation. (Try to imagine a 20 meter dipole strung up on your Taurus or Cobalt!) Verticals are potentially more concealable, since they have this smaller footprint and only one active element. Stealth, anyone? How about a flagpole vertical for patriotic DXing?

❖ Onward And Upward

I hope I've made the vertical a bit easier to understand; the notion of "a dipole stuck in the ground" was what helped me to finally visualize what's going on with this venerable and still very useful antenna. If you want omni-directional, low-angle radiation, and are willing to commit to providing an effective ground image for it to work against, the vertical may be just the ticket for your QTH. In a future column, we'll delve into details for actual construction of a bona fide vertical. Stay safe, and happy operating!

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A Flock of Other Amateur Radio Satellites - Part III

In previous columns, I've been sharing information about how you too can get in on the fun of listening for (or, if properly licensed) working through our fleet of amateur radio satellites now in orbit. In this installment, I'll continue the discussion I started in the August 2012 issue about a number of other amateur satellites, called "CubeSats," that have been launched in the last few years that were still in orbit and operational at press time (late November, 2012). Remember, however that because the lifetimes of these satellites are often relatively short, they may (or may not) still be operating by the time you read this. But, first:

❖ *FOX-1* Update

As you may recall, back in February 2012, FOX-1 was awarded a berth on an upcoming NASA ElANA (Educatoinal Launch of Nanosatellites) mission. Over the last few months, FOX-1 experimenters have been very busy "building stuff" to use the words of AMSAT-NA's Engineering Vice President Tony Monteiro AA2TX. Tony reports that members of the FOX-1 Team are also now making good progress prototyping and populating circuit boards as well as putting the finishing touches on the final spacecraft structural design.

During the past academic year, senior engineering students at Penn State University were also designing FOX-1's sole experimental payload, to see if the use of ordinary MEMs (Micro Electro Mechanical Systems) gyro sensors can be used to directly measure both the spin and "wobble" rate of the satellite in orbit. MEMS components consist of tiny mechanical devices built into micrometer-sized semiconductor chips that are most often used here on Earth as vibration sensors as well as for accelerometers in vehicle airbags, pacemakers and video games.

Tony reports that all the Penn State engineering students working on the project have successfully graduated and have turned over their handiwork to AMSAT's experimenters. The FOX Team is now in the process of integrating the Penn State designs into the flight model spacecraft.

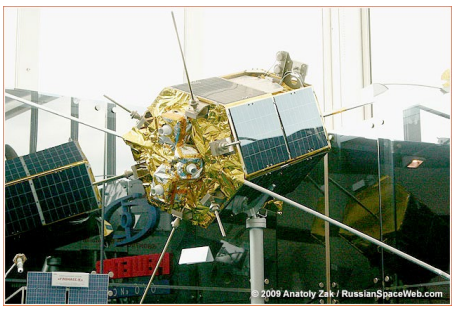
As part of my duties as AMSAT-NA's Treasurer, I had the good fortune to once again attend the AMSAT-NA Annual Meeting and Space Symposium held in Orlando, Florida in late October 2012. At the conference, AMSAT's able team of volunteer FOX experimenters brought us all up-to-date on the latest progress of AMSAT's very own CubeSat project called "FOX-1."

By far, the highlight of the gathering was the unveiling of a FOX-1 Structural Engineering Model. Structural models are a routine part of most amateur and commercial spacecraft projects and are built to insure that all the mechanical pieces of the planned satellite (such as the outside structure, internal circuit boards and specially crafted Delrin spacers) fit together as designed.

At the Symposium, AMSAT's Vice President of Engineering (Tony Monterio AA2TX) also reported that the FOX team was making good progress in preparing the satellite for a launch sometime in late 2013 or early 2014. FOX-1 is currently slated to carry a 70 cm to 2 meter FM transponder (similar to the now defunct AO-51) as well as one or two other experiments, one of which may include a camera experiment of some sort. I suggest you stay tuned to the AMSAT Web Site (**www.amsat.org**) for further updates.

Your satellite columnist (carefully!) holds the completed FOX-1 Structural Engineering Model at AMSAT-NA's 2012 Annual Meeting in Orlando, Florida. (Courtesy: Author)

YUBILENY-1 (RS-30) (Russian for "Jubilee") is a Russian technology development satellite which was built by Russia's NPO PM company which has built 27 different space systems and over a thousand individual satellites. In particular, the company was responsible for designing the Russian GLONASS satellite navigation system. YUBILENY-1 was built and launched to commemorate the 50th anniversary of the launch of Sputnik 1, the very first artificial satellite to be placed into Earth orbit. YUBILENY-1 launched on May 23, 2008 aboard a Rockot rocket from the Plesetsk Cosmodrome in northern Russia as a secondary payload to a cluster of three other satellites.



An engineering mockup of the YUBILENY-1 (RS-30) satellite shows off its many antennas. (Courtesy: Anatoly Zak/Russian SpaceWeb.com)

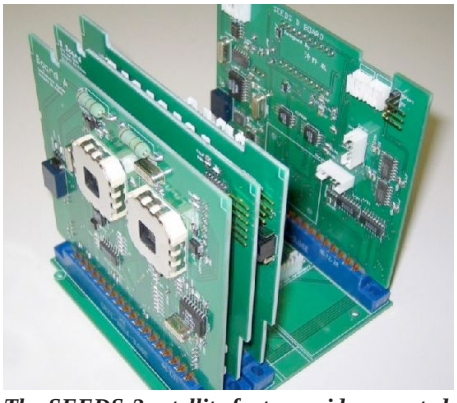
The satellite was intended to broadcast audio and video about the history of the Soviet and Russian space programs, as well as signals imitating those broadcast by Sputnik 1. Its builders deliberately placed the downlinks in the amateur radio bands to help ensure their direct reception by a worldwide audience.

At launch, the satellite weighed in at over 48 Kg (105 Lbs.) and was placed in a rather high (1516 x 1495 Km) Low Earth Orbit. And, as with previous Russian amateur radio satellites in the RS series, the amateur radio transponder is riding "piggyback" on a space frame with a host of other experiments.

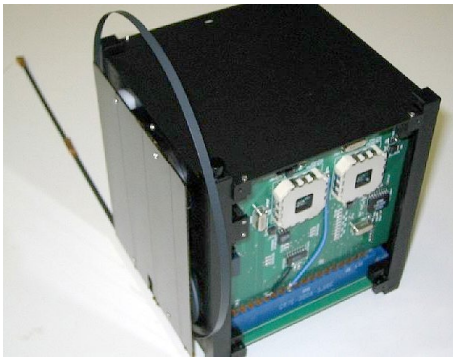
Unfortunately, at press time, only the 70 cm beacons were still working. To give you an idea of what RS-30's downlink signals sound like, an amateur radio operator in Brazil has captured RS-30's telemetry beacon in a You Tube video. **www.youtube.com/watch?v=AxClA0ubFXw.**

SEEDS-2 (CO-66) Later named "Cubesat-OSCAR 66" when it successfully achieved orbit, is a CubeSat mission sponsored by Nihon University in Japan. It was launched on April 28, 2008 as a secondary payload to the CartoSat-2A primary spacecraft of the Indian Space Research Organization (ISRO). The launch site was at the Satish Dhawan Space Centre (SDSC) of ISRO at Sriharikota, India. The overall objective of the project is to demonstrate reception of spacecraft telemetry data using CW (Morse code) and AX.25 FM packet as well as sound data by way of a "digitalker".

Digitalkers have been an integral part of several amateur radio satellites in the past and usually consist of an onboard microchip (or an SD card) that is pre-programmed with digital voice data. Most often, the programmed messages identify the satellite, or, as was the case with



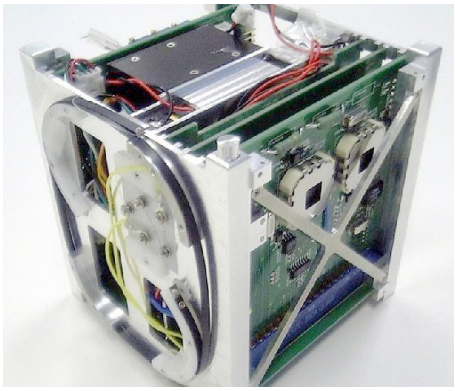
The SEEDS-2 satellite features side mounted, plug-in circuit boards (Courtesy: Nihon University)



The SEEDS-2 satellite with top and bottom covers attached. (Courtesy: Nihon University)

AMSAT's ARISSat-1, are used to send greetings to listeners in a number of different languages. The SEEDS-2 digitalker identifies the satellite (in phonetic English) and then announces its various downlink frequencies. **www.youtube.com/watch?v=typw61KPNco.**

The SEEDS-2 spacecraft conforms to the CubeSat standard in size (10 cm cube) and mass (1 Kg limit). Its unique structure employs two plates and trusses rather than a hexahedron box. SEEDS-2 does not provide any attitude stabilization; hence, it is a free tumbling spacecraft. Spacecraft power (about 1.6 W) is provided by solar panels consisting of two solar cells surface-mounted on every side of the spacecraft. The battery consists of four parallel Li-ion cells with a nominal voltage of 3.7 Volts.

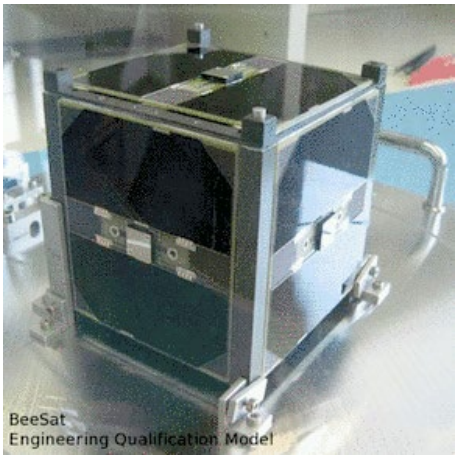


The SEEDS-2 satellite features a unique "truss" structure and a plastic form to secure its coiled 70cm downlink antenna for launch. (Courtesy: Nihon University)

For communication, SEEDS-2 features an FM/CW transmitter, an FM receiver, and two monopole-type deployable antennas. Packet data is transmitted based on the standard amateur packet communication (AX.25) protocol. When transmitting CW, (using the call sign JQ1YGU) the output power is about 90 mW, and the FM Digitalker/SSTV (Slow Scan Television) transmitter output is around 450 mW.

BEESAT (short for "Berlin Experimental and Educational Satellite") is another CubeSat project of the Berlin Institute of Technology in Germany. It was successfully launched on September 23, 2009 into a 752 x 726 Km (roughly circular) orbit from the Satish Dawan Space Center in India.

The main objective of the BEESAT Project is the on-orbit verification of newly developed



The flight model BEESAT is shown here just before launch. (Courtesy: Technische Universitat Berlin)

"reaction wheels" for CubeSat applications. Reaction wheels act like spinning gyroscopes that keep a spacecraft pointed in one direction as it orbits the Earth. Such capability becomes all but mandatory for satellites that require precise pointing, such as those designed for Earth observation, space science, or astronomy.

Because most CubeSats currently in orbit lack such precise attitude control systems, BEESAT's reaction wheel experiment has great promise to open up a whole new capability for these small satellites. The coin-sized micro reaction wheels for attitude control now being demonstrated on BEESAT are one of the key elements of CubeSat design that experimenters at the Berlin Institute will be perfecting on future satellites. **www.raumfahrt-technik.tu-berlin.de/beesat.**

RAX-2 (short for "Radio Aurora Explorer") Weighing in at just over 3 Kg, RAX-2 is a 3U Cubesat that was successfully launched on 28 October 2011 from Vandenburg AFB, California into a 810 x 330 Km, 101 degree inclined (polar) orbit.

The primary mission objective for the RAX-2 mission is to study the formation of so-called "Field Aligned Irregularities" (FAI) in the lower portion of the polar ionosphere. To seek out these anomalies, a ground-based radar transmitter is used in conjunction with the space-based receiver onboard RAX-2 to measure FAI intensity, altitude distribution, and degree of alignment to the Earth's magnetic field. This ground-based radar (called the Poker Flats Incoherent Scatter Radar, or PFISR) transmits RF pulses into the ionosphere to be scattered off the FAI structures. The received signal magnitude and phase is then recorded and processed by the satellite and then later downloaded for analysis by the mission science teams.

In addition to studying FAI, the secondary objective of RAX-2 is to use the wide-band science receiver to characterize ambient RF emission levels in the 430-434 MHz and 437-438 MHz portions of the UHF band as a function of position and time over the United States. This information will be of particular benefit to Amateur Satellite Service coordinators who are charged with coordinating frequencies for the numerous spacecraft operating in Low Earth Orbit. More information about the RAX mission can be found at: **rax.engin.umich.edu.**

SwissCube is the first satellite built entirely in Switzerland. It was developed at the Ecole Polytechnique Fédérale de Lausanne (EPFL) in collaboration with several Swiss engineering schools, universities, and private firms. The motivation to build and operate SwissCube is primarily to educate Swiss students in space technologies and space system engineering.

Built as a 1U CubeSat, SwissCube was successfully launched on 28 September 2009 from the Satish Dawan Space Center in India into a 752 X 726 Km, 98-degree (i.e. polar) orbit. Power is supplied by a 1.5 watt solar array with two 1.2Ah lithium-ion polymer batteries. Attitude determination and control is achieved with 6 sun sensors, a three-axis magnetometer, a gyro, and numerous temperature sensors.

SwissCube's onboard science mission is to observe the "airglow" phenomenon, defined as the photoluminescence of the atmosphere that occurs at approximately 100 km altitude. SwissCube carries a tiny (only 767-nm) telescope that captures images with a resolution of 188 x 120 pixels. Unfortunately, soon after launch, SwissCube was rotating at a high spin rate, which prevented use of the camera. However, this spin rate has since slowed enough for SwissCube's ground handlers to turn the camera on and start taking pictures of the Earth's upper atmosphere. The SwissCube project's live tracking website (**swisscube-live.ch/Home/OfficialData**) shows real-time telemetry gathered from ground control and amateur radio stations and also provides other links to the SwissCube project.

PRISM is a project of the University of Tokyo Intelligent Space Systems Laboratory (ISSL). PRISM is an acronym for "Pico-satellite for Remote-sensing and Innovative Space Missions." Its nickname, *hitomi*, means "eyes" in Japanese.

PRISM was successfully launched on 23 January 2009 from the Tanegashima Space Center in southern Japan. PRISM was initially planned to have a 6-month mission and an expected 1- to 2-year lifespan, both of which have now since been exceeded. The primary mission of PRISM is to capture images of Earth using an extendable optical system. A secondary mission provides amateur radio frequency communications for education purposes. Both objectives have since been met many times over.

PRISM obtains its 10-m resolution images using a color CMOS area imager (1280x1024 pixel image size). This relatively high resolution from a small satellite was achieved by deploying the lens on an extendable boom mechanism that was successfully deployed on 27 February 2009. A second CMOS area imager, with a nearly 1000-Km^2 field of view, captures images over a wider area and is used to determine where to point the narrow field imager. Power is supplied to the satellite by a Gallium Arsenide solar array charging lithium-ion polymer batteries. Attitude determination and control is achieved with magnetometers, gyros, a small magnetic torquer, and a sun sensor. At press time, only the 50 WPM CW telemetry beacon was operational. More information about the PRISM mission is at: **www.space.t.u-tokyo.ac.jp/prism/en/main.html.**

The 2013 Grundig Satellit 750

By Larry Van Horn N5FPW, MT Review Editor

When Etón Corporation released its long awaited Grundig Satellit 750 LW/AM/SW/FM portatop radio, *Monitoring Times* was one of the first organizations to put this radio through its paces. We published our review of this radio in the December 2008 issue of *MT* in our *First Look* column.

Etón's CEO Esmail Amid-Hozour commenting on the release of their new radio said, "The Grundig Satellit 750 is a model of what shortwave radios should be and Etón is proud to offer this high-quality Grundig product to our discriminating shortwave listeners." They billed this new radio as their company "flagship radio" and many equated it as the replacement for their Grundig Satellit 800.

In my final thoughts in my December 2008 review I wrote, "Overall, signal sensitivity appears to be very good for a receiver in this price category and there are some other neat featured I like on the 750. But some of the other issues may make these points mute to some. Time and the marketplace will be the final determination whether the Grundig Satellit 750 lives up to its billing as the new flagship of the Etón receiver line." We gave the radio only 2 ½ stars out of five back then.

Needless to say some folks were not happy with our review of the 750 including Etón. In retrospect, over four years later, I would not change one single word I wrote in that review. I believe we honestly gave a fair assessment of the unit that was shipped to us for review.

If you read my previous review closely, you would see that most of my concerns back then had to do with quality control issues and most in our industry fully acknowledge that we were seeing some nasty stuff coming out of China back in 2008.

So, in this edition of *MT's First Look*, let's fast forward to the present and see if Etón has done anything to improve a model that has had time and space in the marketplace.

❖ Opening up the Box

First, let me say when I first pulled this radio out of its display box back in 2008, it was the first time I had seen it, and my initial impression was of a radio with a bit of a retro look back to an earlier era. I have owned a number of portables through the years (my personal favorite is a Panasonic RF-2200) and this radio's general appearance reminded me of some of the beefier portables manufacturer from the late 70s and early 80s.

The unit has two large handles on each side of the radio, a hard plastic carrying handle on top of the radio, and a rotatable ferrite coil antenna for longwave/broadcast band reception. The signal strength indicator is an analog meter, not the normal LCD segmented meter you see on portables offered in today's marketplace.

The Satellit 750 offers complete coverage of long wave, medium wave and shortwave radio frequencies. Shortwave coverage includes the reception of the single sideband (SSB) mode, allowing the reception ham radio operators, maritime and shortwave aeronautical stations. You can select either wide or narrow selectivity to reduce co-channel interference and you can tune stations using the conventional tuning knob, quick keypad entry or via the 1000 memories that the user stores.

The 750 also receives the VHF aeronautical band (118-137 MHz), and the FM broadcast band (stereo reception available via the headphone jack).

❖ Inside the Box – The 2013 Version

The radio was well packaged in its display box and it comes with an AC/DC wall wart, owner's manual, and warranty registration card. The case is made of a hard, black plastic and construction appears to be solid.

MT First Look Rating (0-10 scale)

Audio Quality	8
Audio Levels	8
Sensitivity	6
Back light	7
Display	7
Battery Life	6
Ease of use (due to memory page setup)	6
Feature Set	6
Keyboard/Button/Control Layout	6
Manual	3
Overall Construction	7
Overall Reception	7

MT RATING: 3 3/4 STARS

Overall: 3.75 out of 5 stars

Overall ergonomics are still good, nothing has changed here. Number buttons and other major control buttons are large and have a good feel. The display is large and easy to read, especially with the amber backlighting turned on. There is a minor quirk with the volume knob I will cover later.

When I applied power and turned around in the AM/FM bands the radio provided good audio quality and volume. Reception on the FM broadcast band in our rural area, even on the internal whip was "very good." VHF civilian air band reception was excellent.

AM broadcast band reception was good, but I had to cut off all the laptop computers in the shack. Signals on the AM band except for local stations were completely covered up by extensive computer interference. I do not have this issue with most of my other radios or portables in my radio shack.

On the plus side I did note that the 750 has a lower noise floor than on some previous Etón radios of that era, specifically the E1XM. That probably had more to do with the type of display used on the 750 than anything else.

The signal strength of single side band (SSB) stations in the HF spectrum was good, especially compared to some other portables we have tested in recent times.

I'm still disappointed with the way you have to tune SSB signals with this radio. While it is nice to have your mode selection setup on one push button (similar to the later model Drake tabletop radios), the additional tuning required using a BFO was a step backward. I would have liked to see some fine tuning steps included with this radio and then you could have eliminated the BFO control.

The base and treble controls allowed for a wide range of adjustment to set that audio just right for the station being received. The wide/narrow selectable filters regardless of mode on all bands, except Air, is something you normally don't see on most portable radios and is a welcomed feature.

One of the other common complaints from radio hobbyists about the feature set on this radio was the lack of synchronous detection. Honestly, that doesn't bother me at all. Synch detection over the years got way more hype by some as a must-have feature than it truly deserved.

I would have liked to have seen an automatic loudness control (ALC) and/or automatic gain control (AGC) feature in this radio. You will be riding the volume control quite a bit as you tune around with this unit due to the lack of an ALC control. It appears that the AGC is set for a slow recovery and it is not adjustable.

❖ Some Final Thoughts on this 2013 Version

Overall, I still have mixed feelings about the Grundig Satellit 750. I still feel that, contrary to how some have characterized this radio, it is not a major improvement over the old Grundig Satellite 800. And, as is the case with most radios, there is room for improvement, especially at the suggested MSRP of $400.00 (street price is currently around $300).

First, the manual still gets an "F." It is not well written, has some obvious errors (i.e., Passport to World Band Radio has not been published in several years), uses very small type for its 3 ½ by 6-inch size, and it is printed using grey ink, which makes it a real pain to read.

The instruction in the manual on how to setup memory channels is well, let me be nice and say – challenging!

Like the earlier unit we tested, when tuned to stronger SW radio signals when connected to an external antenna, I did notice several instances of dynamic compression. The radio just could not handle the amount of signal being fed to it. When we would switch from the external antenna to the whip, the signal strength would improve dramatically, in some cases 20db or more.

Like its predecessor, the Satellit 800 and the initial 750 we tested, it looks like there may still be some minor quality control issues. The VFO knob still wobbles and is entirely too loose. When we did our initial test, a quick check with some other radio enthusiasts who owned the 750 indicated that their units also have wobbly tuning knobs.

In the past, owners of the Grundig 800 noted that this condition over time manifest itself with the tuning knob falling off. I have not heard of any recent reports that this is an issue with the 750, but a tuning knob that wobbles is not very comforting for me as I am heavy tuning knob kinda guy.

Also, I am not a fan of the battery contacts in the battery compartment. The D-cell "+" side uses a coil of wire rather than a metal plate like a lot of other radios. It is only a matter of time before the batteries will have a problem maintaining contact and providing power. We have seen this on more than one model of portable radios in the past that use these wire coils for the positive contacts.

Another issue is the battery compartment cover. It still looks a bit delicate to me. With heavy D-size batteries on the inside, you really have to be careful that everything is seated properly so you won't have an incident with breaking the battery cover or spilling out the batteries.

Another power issue is that this radio uses a wall wart that is center pin negative. Yes, the shield is hot of the incoming wall power. You really need to keep this in mind if you are going to use an alternative power source or need to replace the AC/DC wall wart at any point.

The AM/LW rotatable antenna works well for its size. Do not expect to null out you local AM radio stations with it, it just doesn't have that kind of capability. The issue with your hand effecting reception has apparently been addressed as we did not note any problems during this test as we did in the last one.

The radio still exhibits a chuffing sound when turning the tuning knob at a moderate tuning speed in the AM mode using the fast tuning steps.

Finally, from an ergonomic point of view, the volume control is not where you would expect to find it. Call me old fashion and, yes, certain habits are hard to break, but I tune with my left hand and ride the volume knob with my right. Granted I am right handed, but most radios put their volume controls on the right hand side of the radio. The bass, treble and volume controls are all on the left front side of the radio. Given the lack of an ALC, and my constant riding of the volume control as I tuned around, it was a constant nuisance reaching across the radio to turn that knob up or down.

Overall, signal sensitivity appear to be very good for a receiver in this price category and there are some other neat features I like on the 750. Many who buy this radio swear by it. A lot of my BCB DXing brethren really like this radio and overall, it is a good radio in that arena of monitoring.

❖ Bottom Line

Ultimately, Etón has chosen to stick with this radio even with all the bad press it got back in 2008 (I wasn't the only one who was critical of it). Other than maybe the tuning knob issue, it appears that quality control has gotten better which was my chief concern back in 2008.

The unit we tested this time around is a better radio than the one we tested four years ago, and that is probably why it has a loyal following within the radio hobby community. Most radio hobbyists are happy with their choice of the Grundig Satellit 750 and overall we are much happier with the 2013 version also.

FEATURES/SPECIFICATIONS:

- Manufactured in China
- Frequency Coverage: Longwave 100-519 kHz; AM 520-1710 kHz (US/Canada)/522-1620 kHz (selectable); SW 1711-30000 kHz; FM 87.5-108.0 MHz (US/Canada)/76-108 MHz (Rest of the world); and Air band 118.0-137.0 MHz
- Tuning rates

FM	*AM*	*SW*	*Air Band*	*SSB mode*	
Fast	1 MHz	10 kHz	5 kHz	.025 MHz	5 kHz
Slow	.01 MHz	1 kHz	1 kHz	.001 MHz	1 kHz plus manual tuning with BFO

- Selectable 9/10 kHz AM broadcast band tuning steps
- Selectable/tunable Single Side Band (SSB) reception
- Auto/Manual/Direct frequency key-in and station memory tuning
- Control knobs: Bass, treble, volume, SSB BFO, squelch, RF gain.
- Antenna Attenuator: 0/-10/-20 db
- Auto Tuning Storage function (ATS) for AM/FM/LW
- 1000 station memories (50 memories (MW/LW) 100 memories (FM/SW/SSB), and 500 customizable)
- Bandwidth button: Wide/narrow selections for all bands except Air
- Dual alarm clock function
- Audio: Four inch, eight ohm speaker at two watts audio output
- External audio jack: 1/8 inch (3.5 mm) stereo reception
- Power consumption: 80 mAh (without backlight)/90 mAh (with backlight)
- Power: Four alkaline D size (UM1) 1.5 volt batteries or four 1.2 volt rechargeable batteries; and AC/DC wall wart: 120VAC/6VDC 500 mA center pin = negative polarity
- 3.5 mm line in jack on front of the unit that will enable you to use the radio speaker for MP3 playback)
- Left/right RCA line out jacks (radio broadcasts can be transferred to recording device/audio amplifier)
- External antenna jacks:
  External 50 ohm BNC jack for FM
  External 50 ohm BNC jack for SW
  External 50 ohm 3.5 mm jack on the ferrite antenna for AM reception

External 500 ohm nominal (antenna clips for a random wire antenna (red clip) and ground connection (black clip)

- Internal whip antenna for FM/SW reception
- 360 degree rotatable ferrite antenna for AM/LW reception
- Internal/External antenna switch (LCD display indicates what position that switch is in)
- Dimensions: 14.65"W (372mm) x 7.21"H (183 mm) x 6.02"D (153 mm)
- Weight: 5.9 lbs (2.66 kg)
- Includes owner's manual, warranty card
- One year parts and labor limited warranty (North America) and two years parts and labor limited warranty (Europe)

** Specifications subject to change*

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An Exotic DXpedition for free?

Ever since I returned to the DX hobby in the last six months, I have found myself returning to an old pastime I used to enjoy in my earlier DX years: daydreaming of DXing at various locations around the world.

I have pictured myself on a remote campsite in the Pacific-Northwest, tuning in medium wave stations from the South Pacific and Asia, or nestled on a hidden beach in one of Canada's maritime provinces with my ears set for stations across Europe and the Middle East.

I recently found a place in Finland that allows DXers to rent out space in what can only be described as the ultimate medium wave DXpedition site. As much as I would absolutely love to be able to bring my logbook to Finland and catch stations that I have only dreamed of, the associated costs and my disdain for enormous amounts of snow are a bit prohibitive in this effort.

Wouldn't it be nice, though, if somehow I could remotely DX from all of those locations I have always dreamed of? Wouldn't it be great to be able to put my radio in all of these locations and somehow beam the audio back to my home?

That is the basic premise of an online SDR. Many DXers are very familiar with SDRs, as they are revolutionizing the way we DX. But how many of you are using online SDRs to aid in your DX, or to at the very least, finally hear what conditions are like at various parts of the globe?

In the medium wave realm, for instance, there are a number of people who specialize in DX of Trans-Atlantic or Trans-Pacific DX. At my location from the South Carolina interior, such DX is relatively rare. However, I am able to finally hear many of these stations that I read about in the DX bulletins through the use of an online SDR.

As with most of the DX tools that the Internet has brought into being, I look at online SDRs as more of a DX and educational tool than anything else. One of my goals for the upcoming DX season is to make a trip to the Carolina coast and try to do some Trans-Atlantic DX. Since I haven't had a lot of experience in this regard, I am not going to really know what I am listening for if I don't have a chance to educate myself first.

So, I first have made a list of stations to try to target, based on what people on the East Coast most commonly and easily seem to hear. From there, I travel to some of my favorite online SDRs and try to find those same stations.

One example of a commonly heard station on the East Coast, is 1521-BSKSA in Saudi Arabia. I recently went up to the University of Twente web-based SDR site and was able to tune in 1521 and tune in BSKSA with relative ease. This enables me to get acclimated to their programming content, when and how they identify themselves and the voices of the announcers. This will help me pick them out should I tune them in during any of my listening sessions while AM Dxing.

Medium wave is not the only thing to be found here, though. Amateur radio operators can get a good idea of how their signal is being received at various locations around the world, there are a lot of shortwave broadcasts, military communications and more that can be tuned in. There is even a web site devoted to listening to Russia's infamous UVB-76 "numbers station" on 4.625 kHz that streams audio from that frequency.

There are a number of SDRs available for tuning in FM radio and even the VHF/UHF bands from their location. This is truly a great way to hear signals around the world that otherwise would be completely hidden from most of us otherwise.

During one of my recent listening sessions, I was able to confirm that the weak and barely audible signal I was tuning in on my ICOM R-72 on 3.413 MHz was definitely Shannon Volmet. I then swung up to 5.505 MHz and was able to use the online SDR to confirm I was hearing Shannon Volemt here too.

One of my favorite aspects of listening to online SDRs, besides the medium wave stations, are the high-powered European longwave stations. These have been elusive to me in my DX sessions from the Carolinas, but thanks to several SDRs, I can finally tune in stations like Ireland's RTE 1 on 252 kHz and Iceland on 189 kHz.

There are a number of online SDR sites out there to get you started. My two favorite are WebSDR and Global Tuners. Global Tuners requires a registration to hear most of the streams, which means there can be some downtime before you are able to really get started. However, there is still plenty out there to hear in the meantime.

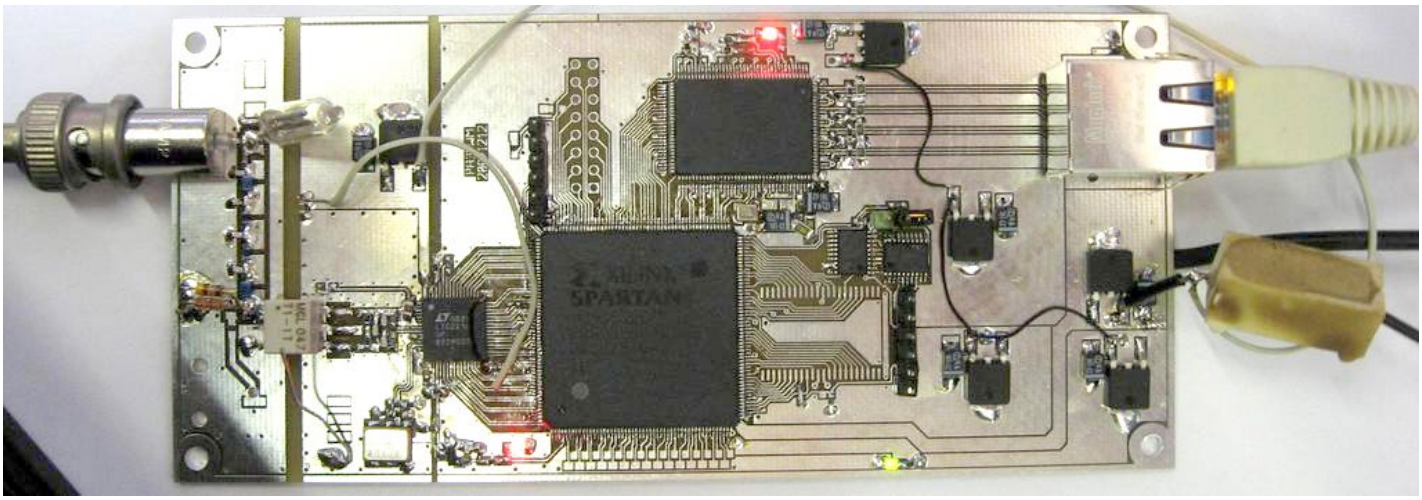
For those like me who enjoy tuning in the medium wave stations that can be found, but have no clue what they are hearing or where to look for certain countries, there is a Web site that can help with that too!

MWList.org has a pretty comprehensive listing and amount of details of MW stations from around the world. It was able to help me identify that the Middle Eastern/Indian station I was hearing on 1458 kHz was not Iran or Baharain, but the U.K.'s Sunrise Radio.

So, while you might not be able to pack up your gear and head to far away locales for a bit of DX, fear not. Thanks to the power of online SDRs, you don't have to. As long as innovative enthusiasts continue to make their SDRs available for people like me to spin their virtual dials, we can continue to DX the world, without ever leaving home.

GLOBALNET LINKS

The Ultimate Dxpedition site - **www.dxing.info/dxpeditions/aihkiniemi_dx_cabin_for_rent.dx**
University of Twente WebSDR - **http://websdr.ewi.utwente.nl:8901**
Websdr.org - **www.websdr.org**
UVB-76 Live Stream - **http://uvb-76.net**
Global Tuners - **www.globaltuners.com**
MWList.org - **www.mwlist.org/**



Part of SDR receiver setup at University of Twente in the Netherlands lets you hear exotic DX without leaving home. (Courtesy: websdr.ewi.utwente.nl:8901)

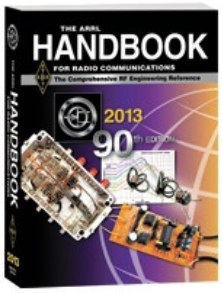
What's NEW

Tell them you saw it in Monitoring Times

Larry Van Horn, New Products Editor

ARRL Handbook 2013 – 90th Edition

The *ARRL Handbook for Radio Communications* is widely recognized as being the standard reference among radio amateurs and other technologists – experimenters, engineers and students. The fields of radio and electronics are constantly evolving, and no other publication provides as accurate a snapshot of the state of the art as *The Radio Amateur's Handbook*.



Dozens of contributing experts and technical editors have helped fill these pages with essential information from across the expanse of radio communication fundamentals and practical applications. Clear and thorough explanations cover nearly every aspect of radio and antenna design, equipment construction, and station assembly.

A lot has changed since this annual handbook was first published in 1926. What was said of the ninth edition can also be said of this 90th edition: Anyone who is at all interested in the technical side of radio can ill afford to be without *The Radio Amateur's Handbook*.

Here are just a few of the new projects and new content included in this latest edition:

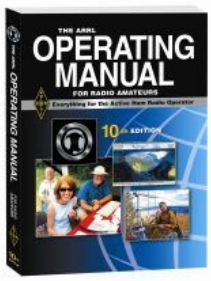
- New antenna projects, including a Low-band Quad, Delta Loops, Coaxial Dipoles for VHF or UHF, and a Skeleton Slot for 14-30 MHz.
- New material on power supply polarity protection circuits.
- 144 MHz band-pass filter for reducing harmonics.
- Updated Pebble Crusher QRP transmitter construction project.
- Design software on CD-ROM, including Elsie™ filter and Pi-El matching networks

This edition of the ARRL Handbook includes a CD-ROM with fully searchable text and illustrations in the printed book, as well as expanded supplemental content, software, PC board templates and other support files. (System Requirements: Windows® 7, Windows Vista®, or Windows® XP, as well as Macintosh® systems, using Adobe® Acrobat® Reader® software. The Acrobat Reader is a free download at www.adobe.com. PDF files are Linux readable.

The 90th edition of this handbook (ISBN: 978-0-87259-419-7) is 1320 pages (8 3/16 x 10 7/8 inches) in both hardcover and soft cover editions and sells for $60.

The ARRL Operating Manual for Radio Amateurs – 10th Edition

There's nothing quite like the excitement of getting on the air. But, navigating the dozens of ways ham radio operators communicate with each other (and all of the technology, procedures, and jargon) can make you dizzy.



The ARRL Operating Manual for Radio Amateurs is the most complete guide to Amateur Radio operating. For decades, this ARRL flagship title has been recognized by radio amateurs as the trustworthy source of everything you need to know about ham radio operating from exploring the broad range of activities and technology, to sharpening your on-air skills. It's filled with the information every ham needs, from newcomers looking for basic operating techniques to more experienced hams looking for new things to do with their gear.

Whether your interests are more technical or public service oriented, you'll turn to the Operating Manual for information on what to operate, where to operate and how to operate.

Every chapter of this 10th Edition has been updated to reflect the most current information, including a brand new chapter on remote station control over the Internet.

This 352 page, 8 3/16 x 10 7/8 inches, soft cover book (ISBN: 978-0-87259-596-5) sells for $35. The two books mentioned above are available from the ARRL, 225 Main Street Newington, Connecticut 06111-1494, toll free 860-594-0200/ Fax:860-594-0259 or via their website at www.arrl.org.

WiNRADiO WR G33EM Marine Receiver

The WiNRADiO WR-G33EM is a high-performance receiver specially developed for marine applications. It covers the HF frequency range to 30 MHz, and contains a number of decoding facilities including HF Fax, NAVTEX, DSC and TELEX, as well as classical AM, SSB and CW radio modes.

A GPS option is also available which integrates the receiver with a high-resolution global mapping facility.

This high-performance marine receiver is extremely sensitive and optimized to work with relatively short antennas, typically found in a marine environment, yet featuring a respectable dynamic range making the receiver resistant to strong signal overload.

The receiver comes in a small enclosure which connects to an IBM-compatible PC (desktop or laptop) via the supplied USB cable. An external antenna connects to the receiver. Some of the major features of this radio include:

- Frequency range 9kHz to 30MHz
- AM, LSB, USB, DSB, CW conventional modes
- DSC, HF Fax, NAVTEX, TELEX marine modes
- High sensitivity
- Excellent dynamic range
- Real-time spectrum analyzer
- Spot-on tuning in 1Hz steps
- Continuously variable bandwidth
- Automatic scheduling, recording and playback
- GPS option

The WR-G33EM is the first Software Defined Radio specifically designed for marine applications.

A Software Defined Radio (SDR) is one where most of the radio signal processing is performed in software, using digital signal processing methods, rather than using traditional hardware parts, resistors, capacitors, diodes, etc. The received signal is digitized early in the signal processing chain, and any further processing, demodulation and decoding of the digitized signal is then performed entirely in software.

There are many advantages to this approach, especially the flexibility of demodulation modes - new modes can be added easily by simply upgrading software. The G33EM also performs better than a comparable conventional receiver, thanks to advanced signal processing techniques which make it possible to implement sharper selectivity filters, and more accurate demodulators and decoders than conventional hardware.

The performance of Software Defined Radio receivers is also more consistent, stable and reliable because component tolerances and aging do not play such an important role as in a conventional receiver.

The G33EM receiver offers far more features and facilities than a conventional receiver. For example, the real-time spectrum analyzer with continuously variable bandwidth,

graphical notch filter and IF recording are some of the many features which were previously unavailable on a conventional marine radio, in particular at such an affordable price level.

The G33EM is available from Grove Enterprises for $1000 plus shipping and handling.

GRE-310/410 Scanners Still Available

With GRE Japan closing its doors, current supplies of scanners and related accessories like their popular preamplifier, are low and no replacements will be manufactured. Warranty service and repairs will continue on existing products here in the United States for the foreseeable future. The database updates for the PSR-800 will also continue. A new release containing new P25 firmware is now available.

Two of their more popular scanners that are still available (again availability is limited) are the PSR-310 handheld and the PSR-410 mobile.

The PSR-410 is a new generation of scanner designed for ease of use, yet powerful enough to satisfy the most sophisticated experts. Common data entry, browsing and control methods are used for non-trunked conventional channels, trunking talk groups, search configurations and Spectrum Sweeper setups. This radio grows with you. You can start out with a small, easy to manage configuration, then expand it whenever you need to.

This scanner uses the GRE Intuitive "Object Oriented" User Interface Design. It is easy to use, yet powerful enough to satisfy sophisticated experts. Common data entry, browsing and control methods are used for conventional channels, talk groups, searches and Spectrum Sweeper setups.

You can arrange, group and scan objects according to your preference, with no limit to the number or types of objects in a scan list, and no limit to the number of scan lists an object can be a member of.

Each menu item provides a few lines of help text that provide assistance with programming and using the scanner.

The PSR-410 handles multi-system trunking systems. The 410 scans most common trunked radio system signaling formats, including Motorola, EDACS Standard, EDACS Narrow, and LTR trunked radio systems. Talk group call and individual call monitoring are supported. It supports trunking operation in virtually any land mobile radio band, including 700 MHz and the new Federal 380 MHz band.

You can use programmable multi-color LED configurations to illuminate or flash when certain objects are active. This provides visual alerts when certain objects are active, e.g., blue can be used to signal activity on a primary police call, red for fire, etc.

Using control channel data streams, the 410 can decode trunking control data to a personal computer for use with popular third party trunking control channel monitoring software. No slicer needed! Also streams NOAA weather radio SAME alert data!

A high speed PC interface operates in full duplex mode at six times the speed of previous scanner models for PC transfer and eight times the speed of previous models for radio-to-radio cloning.

Memory is assigned as objects are created. You can store over 1,800 conventional channels, trunking talk groups, search configurations and Spectrum Sweeper objects in any combination.

PSR-410 supplied accessories include an AC adaptor, DC cable, mount bracket kit, and telescopic antenna. The PSR-310 handheld has basically the same feature set as its mobile/desktop cousin. Its supplied accessories include an alkaline battery holder, rechargeable battery holder, rubber antenna, and AC adaptor

The PSR-310 and PSR-410 each sell for $170 plus shipping and handling, and a limited stock of each of these scanners is still available from Grove Enterprises at press time.

Grace Wi-Fi Ethernet Tuner GDI-IRDT200

Plug it in, turn it on and enjoy a world of music. This new Grace Wi-Fi tuner provides digital audio direct from the Internet to your home stereo. Listen to your personal music collection, over 30,000 Internet radio stations, podcast and on demand Wi-Fi radio content or online music services like Pandora, Live365 and Sirius/XM.

If enjoying Wi-Fi Internet radio music on your home stereo is your pleasure, this Grace Tuner is for you.

The unit has a high contrast, adjustable 4-line, backlit LCD display that makes it easy to view your selections, adjust your audio settings or display song title and artist details.

With the unit's full-function remote control you'll be able to choose one of your 10 preset stations, search for new stations, skip songs, and give feedback on Pandora from any location in your room.

The Grace remote control application allows you to go where no IR remote has gone before. Control one or more of your Grace Internet radios from you iPhone or iPod Touch. You can change the volume, turn it on or off, find stations and set presets or even set any one of your five alarms

If you already own stereo or powered speakers and want to play Internet radio direct from the Internet or music stored on your PC or MAC, then this Grace receiver will be a welcome accessory to your existing system. The tuner provides the ultimate in connectivity with RCA, Toslink and coax digital outputs.

GDI-IRDT200 Feature Set

- Listen to over 50,000 Radio Stations, Podcast, and on demand content.
- Supports online music services: Pandora, Live365 and Premium Sirius Internet radio.
- Compatible with the Grace iPhone /iTouch remote control application. Also includes a full function remote with 10 presets and a 99 station folder.
- Two line backlit display with large font that displays station, song title and artist information. Has 30 backlight brightness settings.
- Built in FM radio receiver.
- Connectors: 1/4-inch stereo headphone jack, high quality RCA analog audio connectors, Toslink digital audio connector, coax digital audio connectors, an FM antenna connector and a built-in Ethernet jack.
- Supported audio formats: AIFF, AIFC, WAVE, CAF, NeXT, ADTS, MP3, AAC, Ogg Vorbis, FLAC, and WMA.
- Supported playlist formats: ASX, M3U and PLS.
- Supported streaming protocols: HTTP, HTTPS, RTSP, WSMP, and Shoutcast.
- Built in media player streams your audio files from your PC or MAC.
- Built in dual band equalizer.
- Up to 24bit /96K sampling rate via digital outputs.
- Play music on your SD card. Up to 4 gig support.
- True 802.11g wireless connectivity and works with all 802.11b/g/n routers. Supports WPA Personal, WPA2-AES, and 64/128-bit WEP encryption.
- 12 or 24 hour clock with date and the clock is auto synched via the internet.
- Five individual alarms, awake to buzzer or music.
- Set each alarm for daily, weekly, weekend, week days or one time and a sleep timer with 30 seconds to 23 hours setting.
- 12 Language Menu: English, French, German, Italian, Spanish, Portuguese, Dutch, Danish, Finnish, Swedish, Norwegian, and Japanese.

Accessories include the GDI-IRDT200 Wi-Fi tuner, a remote control and batteries, an FM antenna, AC power adapter and manual.

This Grace Wi-Fi radio is available from Grove Enterprises for $210 plus shipping and handling. You can learn more this product or order via the Internet at **www.grove-ent.com**, or calling during business hours 828-837-9200 or toll free for orders 800-438-8155.

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*.

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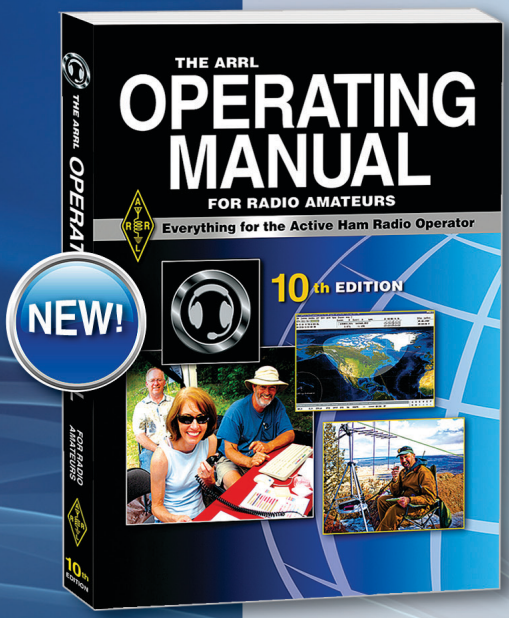

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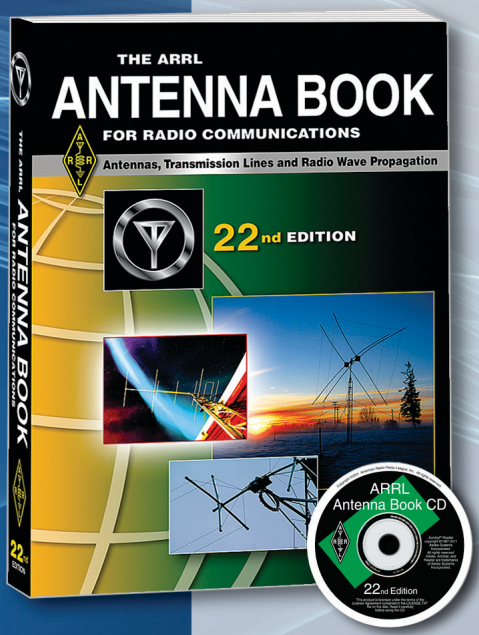

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