Scanning - Shortwave - Ham Radio - Equipment
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MT's Technology Issue

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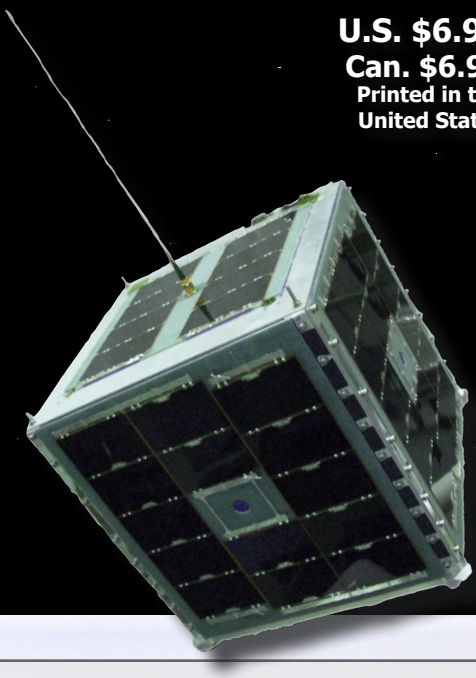
Getting Started with Amateur Radio Satellites: It's Easy!



In this issue:

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AR-ALPHA

Professional Grade Communications Receiver

With New I/Q Control Software!

AOR proudly presents the AR-ALPHA, the first in a new class of professional monitoring receivers! Designed to cover 10KHz to 3.3GHz continuous, with no interruptions*, this receiver features sophisticated I/Q control software that enables it to perform unattended datalogging for extended periods. It boasts a 6-inch color TFT display, five VFOs, 2000 alphanumeric memories that can be computer programmed as 40 banks of 50 channels, 40 search banks, a "select memory" bank of 100 frequencies, and a user designated priority channel. It also includes APCO-25 digital capability and a DVR with six channels that can record up to a total of 52 minutes of audio. Monitoring professionals will appreciate the world class engineering and attention to detail that makes the AR-ALPHA such an amazing instrument.

- Multi-mode unit capable of receiving AM (synchronous), ISB, RZ-SSB, USB, LSB, CW, WFM including FM stereo, NFM, APCO-25 digital, and TV in both NTSC and PAL formats
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- 6-inch TFT color panel can display received video signals or depict spectrum activity over a wide choice of bandwidths including a "waterfall" function to show signal activity over a specified time period
- Composite video output on the rear panel of the unit
- Selectable IF bandwidths:200 Hz, 500 Hz, 1 KHz, 3 KHz, 6 KHz, 15 KHz, 30 KHz, 100 KHz, 200 KHz and 300 KHz along with the ability to shift the IF
- CTCSS and DCS selectable squelch functions; DTMF tone decode
- Built-in voice-inversion descrambling**
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- Auto-notch feature
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- Use desktop or with 19" rack mount

The AR-ALPHA redefines excellence in professional monitoring receivers. No wonder so many monitoring professionals including government, newsrooms, laboratories, military users and more, rely on AOR.

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Authority On Radio Communications

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WSS-420 HRPT/CHRPT Weather Satellite System

WiNRADiO has added a new product to its large range of innovative receivers and radio monitoring and surveillance systems: The WSS-420 turn-key weather satellite monitoring system.

The WSS-420 system is a fully integrated package, including an antenna dish, rotator, down-converter, receiver and automatic tracking software.This is complemented by an optional image-processing software application which provides a number of meteorological products such as standard NOAA Contrast Enhancement Curves, Sea Surface Temperature (SST), Land Surface Temperature (LST), Normalized Differential Vegetation Index (NDVI), RGB Mixers and others.

Individual parts of this system are also available for third-party integration. Check out for example our rugged, reliable EL-AZ antenna rotator with ±0.5 degree positioning accuracy and its compact, USB-interfaced control unit.

- Fully-integrated hardware/software weather satellite solution
- Compact stand-alone system
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- Automatic satellite dish positioning
- Automatic real-time orbital satellite tracking
- Automatic reception scheduling and image storage
- Full support for multi-spectral AVHRR data
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- Advanced image-processing software application
- Automatic updating of satellite tracking data from the Internet
- Automatic clock synchronization from the Internet
- AVHRR data export in NOAA Level 1B (HRPT) file format

Monitoring Times

Vol. 29 No. 1 January 2010

Working Your First Amateur Radio Satellite: It's easier than you think!

By Keith Baker, KB1SF/VA3KSF

This month *MT* introduces a new columnist: former AMSAT president and long-time amateur radio satellite guru, Keith Baker, KB1SF/VA3KSF. In this month's cover story, Keith takes you step-by-step into space and lets you work the easiest amateur radio satellite in orbit: AO-51, a tiny little 2 meter FM repeater in the sky.

Even if your total radio shack consists only of a 2 meter handi-talkie and a handheld scanner, and you've never talked to anyone outside the range of your local repeater, Keith will give you inside information that could change the way you look at your radio hobby. From explaining what radios you'll need; how to "see" the satellite; what antennas work best; and what on-air satellite protocols to follow, your first satellite contact will literally send your voice into orbit.

And, we're happy to announce that you'll read more about amateur radio satellite operations from Keith who joins the rotating "SkySurfing" column.

On Our Cover

Keith Baker KB1SF/VA3KSF uses a Kenwood TH-78A dual-band HT and a lightweight 2 meter/70 cm Arrow Antenna to make a contact through AO-51 from the shores of Lake Huron in Michigan. (KB1OGF Photo)

C O N T E N T S

R E V I E W S

MT XPRESS

SPECIAL OFFER BELOW!

Going Green has never been more exciting!

Before the rising prices of gasoline, and before going "green" became a sales pitch, Monitoring Times created MT Express. The full version of the magazine you've come to depend on, in full electronic form. Now going into our 11th year of digital perfection, MT Express is better than ever. You get more with our digital magazine than you could ever have with print. The entire magazine is full color. All of the web links are clickable, so if you see a link to a website that you want to visit, just click on it! Want to email an author? Just click on their email address at the top of their column, and MT Express opens your email program, drops in their address, and is ready for your input! All of this, and it's even CHEAPER than the regular print version! Plus, you'll get it faster than you would your print copy, no matter where you are in the world. Now is the time to make the switch to digital. Sure, it's saving a tree and saving some gas, but it's also getting you what you need, when you want it. Make the switch today.

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Table Of Contents

WORLD RADIO TV HANDBOOK

WRTH 2010

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

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

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

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

Available December 2009

SOME COMMENTS ON WRTH 2009

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

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

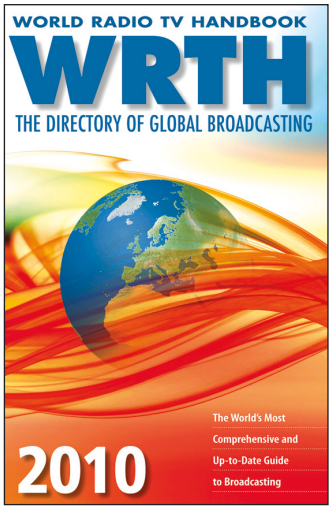
It's hard to see how much more the *WRTH could* be improved. As always, the *WRTH* is highly recommended *– Radio Netherlands Media Network*

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

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

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

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



COMMUNICATIONS

by Ken Reitz

SHORTWAVE/AMATEUR RADIO

CA Hams Aid in Rescue

According to a report on KCAL CBS2, Los Angeles, two hams, a husband and wife from the Los Angeles area, were checking on a ham club repeater on a hill on Catalina Island when they spotted an injured man who had fallen 40 feet to rocks below. The two had their handi-talkies and called in the emergency to hams on the mainland who called 911. An officer from the Malibu-Lost Hills sheriff's office credited the two with quick thinking and operator know-how that saved the man's life.

WWCR Programs Linked to Investigations

The Minneapolis-St. Paul *Star Tribune* reported October 28 about a complicated currency trading scheme involving millions of dollars and dozens of investors that, so far, has attracted investigations from the SEC, FBI, the Commodities and Futures Trading Commission as well as a federal grand jury and assorted officials from the state of Minnesota.

The investigations began when a group of nine investors from Ohio sued in Minnesota to recover the nearly $5 million they had invested in a currency program apparently promoted by two Minnesota-based radio talk-show hosts, Jerry Watkins and Pat Kiley. According to the report, Watkins, who had hosted a WWCR show called "Your Money Matters," was promoting the investment scheme even while awaiting sentencing in Minneapolis for involvement in an unrelated scheme that scammed investors out of $20 million.

According to the *Star Tribune* report, investigators were also looking into a company known as Universal Brokerage with which Kiley, who hosted the ironically titled WWCR show "Follow the Money," was associated. Several other individuals were tied in with similarly sounding "investment" firms, most located in Minnesota. Both programs no longer air on WWCR but, as of press time, WWCR's web site continued to provide a link to Kiley's web page.

AM/FM/TV BROADCASTING

FCC Extends LPFM Deadline

In October the FCC announced a filing window for applications for new Low Power FM (LPFM) licenses between December 11 and the 18th. After requests from numerous non-profit groups, the FCC announced in early November that the window has been moved. The filing window for non-commercial educational allotments on channels 221 through 300 (92.1 - 107.9 MHz) is now open from February 19 and closes February 26, 2010.

Death of Over-the-Air TV?

The VHF-TV spectrum, made available by vacating America's analog TV stations, hasn't even been tinkered with before parties wishing to take it all have started clamoring for the UHF-TV band as well. TV Technology.com noted in early November that an economic report, filed with the FCC by the Consumer Electronics Association, argues that there are so few people watching over-the-air "free" TV that the vast swath of valuable spectrum real estate could be more profitably used by other interests eager to exploit the frequencies that are perfect for subscription-based Internet access and other streaming enterprises.

The day after that report was filed, a group called the Association for Maximum Service Television (MSTV) and the National Association of Broadcasters (NAB) responded with their own comments. They argued, according to TV Technology.com, that TV broadcasters already have given up 25% of their originally assigned spectrum and, thanks to advanced digital compression technology, are doing considerably more with a whole lot less.

White Space Network Test in VA

One such potential player in the "white space" land rush is Spectrum Bridge, a privately held company based in Lake Mary, Florida, that plans to exploit the former VHF-TV band. It is currently operating a test station (WF2XCG) in rural Claudville, Virginia, on a frequency of former VHF-TV channel 8. According to TV Technology.com, the test is being done at 2 watts output and effectively covering the whole county and providing Internet access via the special transmitter and antenna. Because the frequency terrain is so well known, it was possible to design much of the technology for the experiment with existing VHF-TV-related equipment.

SATELLITES

Space Debris to Increase Mission Costs

ABC News reported in early November that the amount of space debris will figure large in the cost of launching and maintaining future space missions. The story quotes a British report that predicts near misses will increase 50 percent in the next 10 years and 250 percent by 2059 causing more than 50,000 close encounters per week. That prompted the U.S. Joint Space Command, which tracks 800 satellites daily, to announce it would increase tracking to 1,300 satellites.

PUBLIC SERVICE

Rescuers Wary of "Yuppie Rescues"

An Associated Press story from California, detailing the "rescue" of two men and their teenage sons, highlight a new hazard for rescue teams. The widespread use of inexpensive, and too easy to use, personal locator beacons and other devices have brought many unprepared adventurers into wilderness locations they don't belong. Incidents of misuse of the devices have led them to be dubbed "Yuppie 911" by some rescuers, according to the AP article.

In the above related story, the group had used their personal locator beacon three times in the course of a weekend causing mobilization of rescue teams and a helicopter, only to find the group really didn't have an emergency. The third time out the rescuers forced the group onto the helicopter, took them out of the area and cited the leader with "creating a hazard condition" for the rescue teams.

Guard with Scanner Captures Crooks

The Salt Lake City *Desert News* reported in late October about a couple who had allegedly robbed a restaurant and made good their escape, despite having the scene of the crime surrounded by police with K-9 units. But, when an alert private security guard at a nearby apartment complex, who had been monitoring the action on a police scanner, checked on a suspicious-looking couple in a car in the complex, he spotted what looked like a cash box in the back of the car. The guard called in to the official police, who by this time had given up looking for the pair, to make the arrest.

Scanner Listeners Aid Police

An article in the Bay City (MI) *Times* told the story of a suspect in an alleged assault trying to elude police in his tractor trailer rig. But, the police were aided by citizens listening to developments unfold on their scanners and reporting the whereabouts of the driver via cell phone. According to the article, a police spokesman said, "Deputies involved want to thank the

citizens who called in after observing the suspect vehicle for their assistance in putting an end to the incident."

Carjacker Stopped by OnStar

High-speed police chases are very popular in California, especially Los Angeles where at least one local TV station has a section of their home page devoted to them. Viewers can tune in as the station's helicopter provides thrilling live feeds of chases in progress. But last year, according to MSNBC, 334 people were killed nationwide in such incidents including five officers and 77 innocent bystanders.

Now, the vehicle onboard communications service OnStar is offering a "shut down" option to its service that can disable a vehicle at the owner's request. The service was used in late October when a high-jacked car in LA sped off for the traditional high-speed freeway chase. The owner authorized OnStar to shut down the vehicle which coasted to a stop in middle of a street. The shocked carjacker took off on foot, jumped a nearby privacy fence and landed directly in one of LA's ubiquitous backyard pools.

FCC ENFORCEMENT

Parade of Manufacturer Missteps

Midland Radio Corporation, which had earlier been hit with a $21,000 Notice of Apparent Liability for Forfeiture (NAL) for making General Mobile Radio Service (GMRS) transmitters with "a voice scrambling feature," a feature not allowed by FCC rules, has had the NAL cancelled, according to FCC documents.

Midland and the FCC signed a Consent Decree that spelled out future company actions including the appointment of a "compliance officer" to work with the FCC to insure compliance with FCC rules and regulations and the regular filing of compliance reports with the Commission over a two year period. But, they're not completely off the hook. The agreement also states that Midland will make a "voluntary" contribution of $14,000 to the U.S. Treasury.

Meanwhile, Uniden America was hit with a $23,000 NAL for the same design feature issue. There is reason to expect that their NAL will also be reduced and that they, too, will be making a voluntary contribution to the U.S. Treasury.

The FCC sent an NAL in the amount of $7,000 to R.F. Technologies for selling belt-pack transceivers, such as used by employees at fast food restaurants, without receiving FCC certification.

Richfield Electronics, a Chinese electronics manufacturer, was hit with an $18,000 fine for selling whole house FM transmitters that had originally been FCC certified, but whose design had been changed following certification so that there was a significant increase in the effective radiated power of the device.

FCC Scuttles Pirate Cat Radio

Bad news greeted San Francisco radio listeners tuning into 87.9 MHz expecting to hear Pirate Cat Radio (PCR) as they had for the previous 13 years. The FCC had just sent an NAL to PCR operator, Daniel Roberts, known on-air as "Monkey," for $10,000. According to FCC documents, the Commission had earlier sent Roberts several Notices of Unlicensed Operation (NOUOs) for PCR activities over the past few years.

This past April FCC agents took field strength measurements and determined that the station was operating at 10,000 times the maximum power allowed under FCC Part 15 rules. That same day, according to FCC documents, "…agents observed Roberts operating and controlling the unlicensed radio station on 87.9 MHz from the Pirate Cat Café and Studio…[and] identified Roberts as the voice on the unlicensed transmissions on 87.9 MHz." That couldn't have been too hard to do, since PCR operates openly at street level in the Pirate Cat Café publicly open to all. The real question is: Did the agents get a Pirate Cat Café maple/bacon latte? The fine was set at $10,000.

For its part, PCR immediately ceased on-air operations following receipt of the NAL, though it continues to stream its programming via the PCR website. PCR also issued a statement on its web site citing the station's battle against, "…corporate-run media monopolies and monocultural programming." Speaking for the station, Monkey stated, "…we made the collective decision that Pirate Cat Radio must come off the public airwaves until some method is found to change the law or get it authorized under existing law."

While PCR publicly retreated from its official on-air presence, FM broadcasts of the station's web-feed have apparently been heard from various locations. Monkey told one reporter, "The FCC can't come to you if someone else decides to start broadcasting your Internet radio station. Nothing shows that I broadcast all those transmitters." Sounds like there could be a movie contract in kitty's future.

Florida Pirate Fine Reduced

Last year a man from Lakeland, Florida who was operating a pirate radio station, also on 87.9 MHz, and who had originally been fined $10,000 for his activities, has now had that fine reduced to $2,500. Originally caught in the act of operating the illegal station, the owner, according to FCC documents, "…admitted he did not have a license to operate on 87.9 MHz, but stated that on an unspecified date and time he spoke to an unidentified person at the FCC who told him it was okay to broadcast as long as no one complained and there was no interference." Agents had measured the output of his station at more than 5,000 times the maximum allowed for a Part 15 transmitter.

Texas FM Pirate: Not Ruled by FCC

An Austin, Texas man, who broadcast news sources reported was a retired sheriff, had been operating a pirate FM stations from his home and was issued an NAL for $10,000 by the FCC for such operation. According to FCC documents, field agents had earlier measured the station's signal as being 13,000 times the maximum allowed for an unlicensed operation.

While the man didn't deny any of the facts in the case and stated that he had "…ceased all transmissions and has no plans to transmit in the future," he claimed that "…as a citizen of the Republic of Texas, he is not subject to the laws of the United States or the Commission's rules." Further, he asserted that the Commission's licensing policies violate the First Amendment of the U.S. Constitution.

Surely there's a judicial award for his curious defense: claiming simultaneous states' sovereignty *and* federal protection. Citing extensive legal precedent, the FCC dismissed the man's claim and stood by their fine.

"Communications" is compiled by Ken Reitz KS4ZR (kenreitz@monitoringtimes.com) from news clippings and links supplied by our readers. Many thanks to this month's fine reporters: Anonymous, Rachel Baughn, Pat Clawson, Richard Dillman, Norman Hill, Bob Margolis, John Mayson, and Larry Van Horn.

Working Your First Amateur Radio Satellite: It's easier than you think!

By Keith Baker, KB1SF/VA3KSF

Author's wife Kate Baker (KB1OGF/VA3OGF) makes a contact through the AO-51 satellite on the shores of Lake Huron in Michigan with her Kenwood TH-78A dual band HT. The extended "rubber duck" (MFJ Model 1717 from MFJ Enterprises) antenna and about 5 watts of uplink power provides just enough gain on the uplink and downlink to successfully work the satellite on near overhead passes. (KB1SF Photo)

One of the great features of amateur radio is that it is really several hobbies rolled into one. If you become bored with one aspect of the hobby, there is always something new and different to try. For the last 40 years or so, using the fleet of amateur radio satellites to communicate has always been one of the more interesting aspects of amateur radio.

However, if you are new to amateur satellites, or "birds" as AMSAT operators call them, it's important to establish a general understanding about how to find and track these modern day wonders before you make your first attempts at using them. My goal is to provide you with a general introduction to the basic concepts of tracking, operation and customs currently in use on the satellites and to give you some practical, "hands on" tips on how you, too, can get started in this wonderful aspect of ham radio.

I'm going to be using one of AMSAT's so-called "easy FM birds," AO-51, as an example for you to try out your newfound knowledge. For most of us, the thought of using our own radio equipment to hear or talk through a satellite conjures up a sense of mystery and awe. At the same time, it creates a certain amount of fear... fear of doing something wrong, or of not ever being successful no matter how hard we try.

In years past, when only one or two amateur satellites were in orbit, hams had to really work hard to even hear one of the OSCARs (Orbiting Satellites Carrying Amateur Radio) as they whizzed overhead, let alone work through one. As of this writing, there are now over 20 of them up there, and that's not counting the crew of the International Space Station (ISS) who use the amateur radio equipment installed aboard that permanent orbiting laboratory.

What's even more exciting is that there are several other HAMSATS currently on the drawing boards or awaiting launch. It's safe to say your chances of at least hearing one of them or, if you have a Technician Class ticket, communicating through one with your current equipment, is far better now than at any time in the recent past.

Tracking the Birds

In order to listen for or communicate through an amateur radio satellite, you first have to find out when it will be within range of your station. Fortunately, most of us now have computers in our shacks and access to the Internet so tracking satellites has become much easier than it used to be.

Today, several satellite-tracking programs are available in shareware or for purchase, as well as in a variety of different computer formats. What's more, a number of web sites related to amateur satellite operation now have online tracking programs that make rough tracking a snap.

But, if you're really serious about satellite tracking, you should also become familiar with how to use sets of orbital data called Keplerian Elements. Known to veteran satellite operators simply as Keps, these data are derived from observations of each satellite's orbital motion. (Kepler, you may recall, discovered some interesting things about planetary motion back in the 17th century!)

Today, NORAD, the North American Aerospace Defense Command, keeps track of almost everything in Earth orbit. Periodically, they issue orbital information on non-classified satellites to the National Aeronautics and Space Administration (NASA) for release to the general public. The information is listed by the individual catalog number of the satellite and contains numeric data that describes, in a mathematical way, how the satellite is moving around the Earth.

Without getting into the complex details of orbital mechanics (or Kepler's laws!), suffice it to say this data is what your computer software uses to plot the predicted paths of satellites. That is, once you've loaded your location (latitude and longitude), the current time along with the Keplerian element files into your satellite tracking software, the computer then solves the complex orbital math to make a prediction of where a selected satellite should be at the current (or a future) time.

Because they are such a vital ingredient to this part of our hobby, and because they age over time, finding a reliable source for the latest Keplerian Elements for amateur radio satellites should be high on your list of things to do as you get started in satellite work. Keps are often listed on many amateur radio Internet web sites. The AMSAT-North America web site lists the latest Keps in a variety of downloadable formats at: **www.amsat.org/amsat-new/tools**. For the so-called "easy FM birds," such as AO-51 and the ISS, the AMSAT web site even sports an embedded online tracking feature which allows you to simply plug in your latitude and longitude (or your Maidenhead Grid Square) to find out when those satellites of interest to you will next be in range of your location.

E-Z Sats-At-a-Glance

Satellite	Uplink	Downlink	Remarks
AO-51	145.920 MHz	435.300 MHz	Default FM Voice
(Echo)	145.880 MHz	435.150 MHz	
AO-27 (Eyesat)	145.850	436.795	Daytime Passes
SO-50 (SaudiSat 1-C)	145.850	436.795 MHz	67.0 Hz CTSS Tone Required for Access

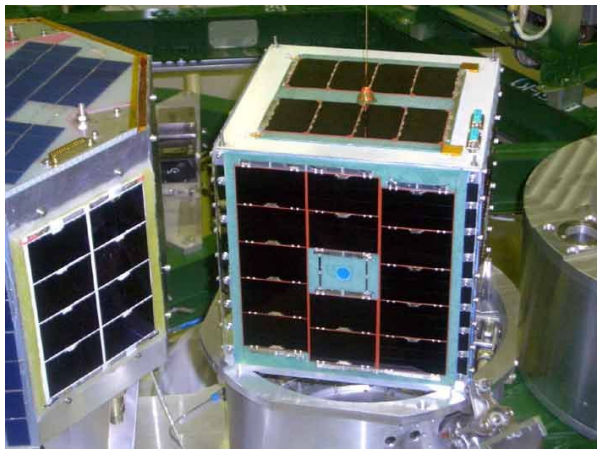
Beacons

Probably one of the first things you will learn to do after you find out when a particular satellite will be within range of your station is to listen for the satellite's beacon. Most satellite beacons consist of one or more transmissions coming from the satellite that will assist you in

your search as well as tell you other things about the satellite's health and the nature of its transponders.

Satellite beacons operate in many modes, from Morse Code to a variety of digital formats, and can usually be found on frequencies immediately above and/or below the satellite's other downlink frequencies. In addition, as most satellite beacons transmit with a fixed amount of output power, they can serve as a superb reference point for setting up and calibrating your station antennas and other equipment.

Satellite telemetry signals, which consist mostly of transmissions about the health of the satellite, are also sent to ground controllers by way of the beacon. What's more, some satellites even provide information regarding their transponder schedules, along with other items of interest to satellite operators, using their beacons.



Dubbed "Echo" before launch, the AO-51 satellite sits in the "Space Head Module," the upper stage of its launch vehicle at the Baikonour Launch Complex in Kazakhstan. (AMSAT Photo)

Transponders

Now that you have a reliable way to know when the satellite is within range of your station and you've heard its beacon, you next have to learn how to use its transponder. A transponder is the circuit that receives your uplink signal and then retransmits what it hears on the downlink transmitter, much like an FM repeater does. However, unlike a terrestrial FM repeater, which has a specific input and output frequency in the same band, most amateur satellite transponders receive and then retransmit what they hear on another frequency (or frequencies) on another amateur band entirely. Basically, most amateur satellites act much like cross-band repeaters in the sky.

What's more, as a satellite is a moving target, signals being passed through it will exhibit a pronounced Doppler shift, just like the changing pitch of a train whistle as it approaches and then passes. During a satellite contact, as the satellite approaches you, both uplink and downlink frequencies will appear higher than those published. As the satellite passes overhead, both the uplink and downlink frequencies will then appear to slowly drop in frequency compared to the published frequency. And, as if that weren't confusing enough, this apparent frequency shift will be more pronounced on the higher frequency (shorter wavelength) amateur bands than on the lower ones.

Our example satellite, AO-51, uses what's called a "bent pipe" transponder. That is, whatever form of radio communication is sent up to the satellite on the uplink is simply "sent through the pipe" on the downlink. AO-51 sports a variety of transponders, but the one we will attempt to use is the analog FM transponder.

Operating Modes

One of the terms you will soon come across in satellite work will be a reference to the mode of a satellite's transponder. A satellite's operating mode is nothing more than a shorthand way veteran satellite operators identify the various combinations of uplink and downlink frequencies available for use. One or more letters of the alphabet usually designates satellite transponder modes. For example, if a satellite's uplink frequency is on 2 meters and its downlink frequency is on 70 cm, the satellite is said to be operating in Mode J. An uplink on 70cm with a downlink on 2 Meters is called Mode B, and so on. For this article, the AO-51 transponder I'm interested in is the one for Mode J with uplinks in the 2 Meter band and downlinks in the 70cm band.

Schedules

Most amateur satellites operate on a published schedule that lists when its various transponders will be switched on and off and at what times. As AO-51 has multiple transponders, it's very important to always check the published schedule for the satellite before you attempt to use it. AO-51's current operating schedule is always available via the AO-51 Control Team page of the AMSAT Web site at: **www.amsat.org/amsat-new/echo/index.php**. Click on the "check the schedule" link and look for the "FM Repeater" frequencies.

During a typical month, traffic on the transponders might be FM voice, Slow Scan TV (SSTV), low power (QRP) FM operating and digital modes. By looking at the schedule you'll know when to expect the various modes and at what frequencies they'll be operating. Look for other activities on the schedule such as College Satellite Night and when operators reverse the spacecraft attitude to favor the southern hemisphere.

Equipment

Contrary to what you might believe, you don't need a super powerful FM transceiver and a huge antenna to work the birds. In fact, I (and many other amateur satellite operators) have sometimes met with success using just a simple dual-band hand-held radio and an antenna with just a bit more gain than the ordinary "rubber duck." However, because the UHF downlink output power on the "easy birds" is usually pretty weak (often less than 1 watt) you'll have far better success if you can create some signal gain on the downlink.

Several people have "rolled their own" Yagi satellite antennas for AO-51 using nothing more sophisticated than a series of trimmed coat hangers mounted on a block of wood. However, for many years and for my own AO-51 contacts, I've been using a commercially made, hand-held antenna from Arrow Antenna of Cheyenne Wyoming, **www.arrowantennas.com**. Their "Arrow II" Satellite antenna (with models starting at about $75) is specifically manufactured for hand-held radio satellite work, is very well constructed (from arrow shafts, hence the name) and is collapsible for easy portable use.

It is also important to remember that AO-51, like most amateur satellites, operates in what's called *true duplex* or *full duplex*

GETTING THE RIGHT ANTENNA

As with any radio installation, the more money you put into it, the more versatile it will be. Still, you don't have to break the bank to get started. Here are some antenna tips to help give you a better chance at working the EZ Sats with success.

The output power of these satellites is usually little more than a watt. Most often, the satellite's handlers will have the bird's downlink transmitters powered back into the 500 milliwatt range, so as to help extend the life of the satellite's batteries. This means that *any* antenna you can muster on the ground to listen to the UHF downlinks from these satellites will help. Even a simple, externally mounted, ¼ λ VHF/UHF scanner antenna, such as a Scantenna from Antennacraft ($50) should allow a casual listener to catch a few minutes of downlink from these satellites as they rise and set on near-overhead passes.

On the other hand, a more reliable arrangement consists of a higher gain, externally mounted VHF/UHF vertical antenna such as that used for amateur radio repeater operation. This antenna installation will usually provide a bit more success if you want to reliably hear satellite passes, for example, near the horizon and/or farther away from their location.

Another very reliable antenna arrangement that many FM satellite enthusiasts have used consists of an externally mounted dual band rotatable VHF/UHF, three or four element Yagi beam antenna. This approach allows users to aim their beam antenna at the horizon and work through the satellite as it rises. Then, as the satellite passes overhead, they swing their beam antenna around in the opposite direction and catch the satellite as it sets. Such an arrangement is useful for contacts on satellite passes up to about 45 degrees in elevation.

Now, of course, the ultimate satellite antenna for full pass coverage is a high gain, three or four element set of VHF/UHF Yagi beam antennas mounted on an altitude/azimuth rotator. But, you don't need that just to work the "easy-sats."

Chuck Green (N0ADI) prepares AO-51 for launch at the Baikonour Launch Complex in Kazakhstan. (N0ADI Photo)

mode, meaning that the uplink receivers and downlink transmitters are both operating at the same time. It is helpful (but not absolutely necessary!) for your ground-based equipment to do so as well. By operating your station (or your hand-held) in full duplex mode, you will get immediate feedback that the satellite hears you because you will actually hear your own uplink signal coming back down to you on the downlink.

Unfortunately, fewer and fewer commercially manufactured amateur radios these days have the capability to operate in full duplex mode. A short list of those (mostly older) radios that do so may be found at **www.thathamkid.com/website/ham-radio/full-duplex-radios.**

But, even if you don't have a full duplex radio, you can still get in on the fun of working these satellites by using two separate radios or a radio that can transmit on the satellite's uplink and another radio that can receive the downlink. If there is enough gain in your antenna, the latter radio can even be a hand-held or other programmable VHF/UHF scanner of some sort. Many novice satellite ops have also met with success on AO-51 by simply transmitting "in the blind" on the uplink and then waiting for someone to answer them on the downlink.

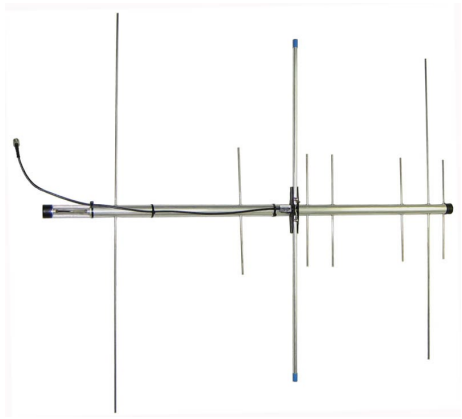
Setting Up Your Radio

Now that you have found out what time of day AO-51 will be in range of your location and you have assembled the equipment and antennas to do so, you are almost ready to work your first bird. But, first, you'll need to program your radios so as to take into account the Doppler shift that I discussed earlier. If your radio has programmable memories, it's a good idea to program one or two additional frequencies into the memory bank above and below the published uplink and downlink frequencies for use as the satellite first moves toward you and then away from you as it passes overhead.

For example, if the operating downlink frequency for AO-51 is listed in the satellite's operating schedule on the AMSAT Web site as 435.300 MHz, you should program memories into your radio for 435.320 and 435.310 on the high side and 435.290 and 435.280 MHz on the low side of the published downlink frequency. Likewise, if the uplink frequency is listed as 145.920 MHz, you should program memories for 145.925 and 145.930 MHz on the high side and 145.915 and 145.910 on the low side of the published uplink frequency.

Numerous other satellite passengers dwarf AO-51, shown here sitting in its upper stage carrying structure just prior to launch from the Baikonour Launch Complex in Kazakhstan. AO-51 is the small cube-shaped satellite shown in the lower left of the photo between the octagonal-shaped Italian UniSat-3 and the taller SaudiSat 2. (AMSAT Photo)

For a whole lot of reasons that are well beyond the scope of this article, the Doppler shift is more pronounced as the operating frequency increases. This means the Doppler shift will appear more pronounced on AO-51's downlink 70 cm frequency than on its 2 meter uplink. I've most often found that simply switching between my programmed 435 MHz downlink frequencies as the satellite passes overhead is usually enough to keep the satellite's downlink "on frequency" in my radio during the time that it is in range.



Hy-gain DB-2345 dual-band beam antenna delivers 8 dB gain on 2 meters, 6 dB on 440 MHz for $90. (Courtesy: Hy-gain Antennas)

Power: How Much is Enough?

The issue of power is a relative one. It depends on the number of other people using the transponder; how much uplink gain you have in your antenna system, and how close or far away (overhead *vs*. at the horizon) the satellite is compared to your location. Usually, a 5 watt HT and the antennas shown in the pictures above are sufficient to work AO-51 on "non-contentious" days. I say non-contentious because it is important to remember that the satellite is much like a terrestrial repeater mounted on a 500 mile high tower. With only one channel, it can get very busy, particularly on weekends. On some days, my dual band HT and an extended rubber duck antenna might be sufficient for a quick contact**.** On the other hand, some weekends, even my external Yagi and 50 watts isn't enough to overcome the high-powered uplinks of some less considerate operators.

Working in the Footprint

While it is technically possible to work these satellites "at the horizon," you'll need something more than 5 watts from an HT and a hand-held antenna to do so. It is important to remember that the "footprint" of the satellite, which is the area on the Earth where two people can "see" these Low Earth Orbiting (LEO) satellites and work each other through them, is about the size of North America. Some hams on the U.S. East coast have, for example, used AO-51 to make contacts into Western Europe (and from the U.S. West coast to Hawaii). That happens only when one person is on the extreme edge of the footprint and their counterpart is on the other edge.

Polar orbit satellites such as AO-51 will typically give you three chances to work them, twice a day. Pass duration, the time during which you'll be in the footprint, can range from 7-15 minutes depending on whether you

are in the full footprint or just part of it during the pass.

It's interesting to note that on many passes the footprint will cover the entire Atlantic Ocean. I know of several hams who have taken their Arrow antennas and HTs along on cruise ships and made contacts from the outside deck...after, of course...obtaining the appropriate permission from the Captain of the vessel!

Putting it All Together

Now is a good time to visit the AMSAT web site (if you haven't already) and download a set of current online pass predictions for AO-51 from **www.amsat.org/amsat-new/tools/predict.** Select the satellite for the prediction (AO-51) and then enter either your Maidenhead Grid Square or your latitude and longitude into the online prediction tool. Then, click on "predict" and, presto! A list of satellite pass dates and times (in UTC) and directions (in degrees) will pop up. You can also click the "view the current location of AO-51" link for a map-based view of AO-51's next few orbits.

In the table, the acronym AOS stands for "Acquisition of Signal" which is the time when the satellite will first come over your horizon. The acronym LOS stands for "Loss of Signal" which is when the satellite will fall back below the horizon at your location. Both azimuth and elevation headings are expressed in degrees of a 360-degree compass from your location.

You will also note that AO-51's satellite passes at your location follow a repeating pattern. As the satellite is in a near polar orbit (which means it orbits over the Earth's north and south poles) this means the satellite will be in view of every spot on the planet several times each day as the Earth (and you!) slowly rotate underneath. For AO-51, you'll usually observe a string of three passes, one moving from north to south (or south to north) off to the east, one nearly overhead, and then one off to the west, with each pass spaced about 90 minutes apart. A similar string of passes will repeat some 12 hours later in the opposite north/south direction.

When you are first starting out, it's probably best to pick a satellite pass that will put the satellite as nearly overhead to your location as possible. So, look for those pass elevations in the table above 45 or 50 degrees. These will be your "targets of best opportunity."

What to Listen for

Now, it's time to actually listen for the satellite. At the appointed AOS time, step outside, turn your radio(s) on and set it (or them) for one of the frequencies on the upper side of what's published for both the uplink and downlink. Then, wait for the satellite to pop above your horizon.

If you are using a Yagi antenna of some sort, aim it at the horizon in the direction of the AOS prediction and start "sweeping" the antenna back and forth horizontally. Be sure to turn the radio's squelch on the downlink frequency off and (carefully!) listen for the radio to "quiet." Once it does…congratulations…. you'll be listening to AO-51 in orbit some 500 miles above Earth!

Until its successful launch, AO-51 was called "Echo" as it was the 5th satellite built entirely by AMSAT-North America. The AO-51 moniker (which denotes it as the 51st AMSAT OSCAR satellite successfully launched) was awarded once the satellite achieved orbit and transmitted from space. (AMSAT Photo)

You may want to practice tracking the satellite with your antenna and simply listening for the rest of that satellite pass (or a few more) to get a better idea of how the conversations flow on the bird. It is important to remember that, not only is the satellite rapidly moving toward and away from you (which is causing the observed Doppler shift in frequency), the satellite is also slowly tumbling in orbit. So, at multiple times during each pass, its transmit and receive antennas will be cross-polarized with yours, which, in turn, will create a significant loss in signal strength. If the satellite signal fades (or the downlink gets garbled) try switching downlink frequencies on your radio up or down. Twisting or moving your antenna around to better match the satellite's changing antenna polarization with yours will also help.

During the pass, you'll probably hear one or more hams simply saying hello or exchanging Maidenhead Grid Square numbers. Indeed, most conversations on AO-51 are usually very brief hello-and-goodbye exchanges similar to an HF DX exchange so as to give the many others listening in, a chance to work the bird. As you might guess, long-winded rag chews are not welcome on the FM birds.

It's Showtime!

When you've gathered up enough courage to actually try your hand at making a contact (and if you are using the same radio in full duplex mode on the uplink and downlink) you also need to make sure you are using a speaker separated from your microphone. This can be an earpiece or an external speaker of some kind. In full duplex mode, using a microphone and a speaker located right next to each other (such as on a handheld) will cause howls of feedback through the satellite! Needless to say, such activity will not make you a welcome operator on the bird either!

However, once you are ready to try your luck at actually making a contact, simply wait for a pause in the action and then (quickly!) drop your call sign in between contacts. With any luck, you will immediately hear your own signal on the downlink, a discovery that will provide immediate confirmation that you are, indeed, getting in. But, please refrain from calling "CQ" because, just like causing long distance feedback and rag chewing, that's considered another amateur satellite protocol no-no.

Regardless of how, where and when you do it, the first time you hear your own voice coming back down from a satellite (or someone answers your call), the thrill will be much like your very first ham radio contact, shaking hands, sweaty palms and all! See you on the birds!

The AO-51 satellite launches on a converted Russian ICBM rocket on 29 June, 2004 from the Baikonour Launch Complex in Kazakhstan. (AMSAT Photo)

About the Author

First licensed in 1976, Keith Baker KB1SF/VA3KSF holds an Extra Class license and is a past president of AMSAT. He served as AMSAT executive vice president from 1994 to 1998 and was a member of the board of directors from 1994 to 2003. Besides *Monitoring Times*, his amateur satellite-related articles and photos have appeared in *QST*, *CQ Magazine, The AMSAT Journal*, *CQ Ham Radio (Japan), and OSCAR News (UK).* Keith is the author of *How to Use the Amateur Radio Satellites*, a work published in five languages. His most recent projects include writing portions of the AMSAT publication "*AMSAT: The First Forty Years,*" as well as serving as an editor for the ARRL's new *Satellite Handbook.* Keith makes his home in the small town of Corunna, Ontario, Canada with his wife, Kate (KB1OGF/VA3OGF) and daughter Emily.

MT

The Problem Isn't Demand, It's Bandwidth

A broadcast engineer takes a critical look at radio's digital future

By Frank McCoy

In the 1970s, as cable television took root in metropolitan areas, I was working for ABC-TV. It had just dropped a significant chunk of change to build a new transmitter facility on the Sears Tower in Chicago, replacing the old Marina Towers site.

Even then, there was talk of the time when cable would make over-the-air TV obsolete. We speculated as to how many remaining viewers it took to justify the rent, upkeep, electricity and salaries for the site we were working to complete. Meanwhile, my friends in radio engineering simply said, "I'll worry when they wire the beach for cable."

To many who report on media and analyze the stocks of media companies, wireless Internet in all its forms is looking a lot like they've finally "wired the beach," and this beach has video, audio, games, text, phone calls and more. There are dire predictions that radio's best days have come and gone. Who can blame the pundit who sees only a simple consumer choice between listening to what some radio program director predicts that I (and 20,000 other people) want to hear, and choosing for myself exactly what I want when I want it? As if to underscore this inescapable radio-is-obsolete reality, the radio sector's digital revenues are actually growing while overall sales results shrink.

Should we all be concerned that the days of the 1,000-foot tower are gone and that anyone with a computer and an Internet connection is a possible new competitor? Will radio as we know it become just another feature of cell phones? Will in-car Internet give commuters millions of station choices? The answer is no.

Highway Narrows Ahead

The problem for such platforms isn't consumer demand. It's bandwidth. Radio works efficiently by delivering the same content to all listeners at the same time. For each additional listener, there is no incremental additional overhead on the transmission side.

If I turn on my radio, the station I'm listening to doesn't have to add even one extra watt to accommodate me. Not so with our current scheme of Internet protocol (IP) delivery. On the Internet, every consumer of content requires a separate connection to the provider. It's a bit like a freeway where no two cars can occupy the same lane. Fifty morning commuters on their way to work require a 50-lane highway to get there.

Broadcast towers: End of an era? (Courtesy: Rohn Products)

It turns out that our information superhighway, the one that is going to eat radio's lunch, is really a very narrow road. To see what I mean, let's look at the technologies that now define streaming audio across the Internet.

Perceptual coding data reduction has advanced remarkably in the past two decades but the rate of progress has flattened considerably. There's not much more magic smoke in that pipe.

Right now a 48 kilobit per second stream (Fraunhofer AAC+, for example) can deliver acceptable fidelity stereo audio. Further dramatic improvements, even a reduction to 24 kbps, seem unlikely without sacrificing audio quality to a degree that would inhibit listener adoption. We'll use 48 kbps as our benchmark.

Now, let's say you run the IT department for a company that employs 2,000 people at 60 separate sites around the country. Presuming everyone is listening to Internet radio at 48 kbps, that's an aggregate bandwidth of 96 Mbps, equivalent to more than a T-1 at each site, just for employee entertainment.

This has already come up on the corporate radar, with Cisco, Juniper and others offering products to analyze data use by employees. A neighbor of mine is responsible for the agent services network for a major insurance company. His biggest bandwidth headache right now is YouTube. He's about to switch it off across all his networks. Distractions from work that cost the firm money? They're not long for this world. Businesses don't pay employees to watch funny video clips. Bring a radio to work if you want music.

In-car

But what about the holy grail of radio: the automobile? We've all seen Bluetooth handsets that pair with car audio systems. These provide reliable audio streaming to car audiences. Ford and Microsoft teamed up to create Sync, essentially a PC in your dashboard. It streams nicely, too. Chrysler and others are offering a Wi-Fi (802.11x) access point that covers your car interior. All these require data connectivity from a cellular provider, offered as a flat-rate data plan (though these are rapidly disappearing) and available wherever the cellular provider

Sangean WFR-1 Internet radio: Big promise and an uncertain future. (Courtesy: Sangean America)

Autonet Mobile WiFi router: Ready for prime time? (Courtesy: Crutchfield)

has data coverage. In metropolitan areas this usually means everywhere.

From our earlier office example, we know 2,000 listeners will consume 96 Mbps of data. What about 25,000, which is about the AQH [Arbitron's Average Quarter-Hour Persons: Average number of persons listening to a particular station for at least five minutes during a 15 minute period] for a successful Chicago FM station? Or for the top 10 Chicago stations? The arithmetic is pretty simple: 250,000 listeners will consume 12 Gbps.

Shannon's Law sets an upper bound on how many bits can be stuffed into a given RF bandwidth. Technologically we're up against the practical limit, with peak performance of 3.7 bits per second per Hertz. But this is a "gross" number. Doppler errors, noise and all manner of other perils drive the reliable throughput down sharply for real-world mobile data delivery. Various solutions to improve reliability are required.

As an example, HD Radio uses a set of OFDM [Orthogonal Frequency-Division Multiplexing] subcarriers in about 200 kHz of total sideband space.

According to the Shannon rule this should yield almost 750 kbps but in reality it doesn't. First, the OFDM carriers are duplicated in the upper and lower sidebands. This forfeits half the throughput but adds significantly to mobile reliability by largely overcoming multipath. After data duplication, framing and other overhead have taken their bites, we're down to a net capacity of less than 200 kbps. These same basic ratios apply to WiMax, 3G, 4G, NG, OhG, GWhiz (OK, I made up those last three) and all the rest where streaming is involved.

It's worth noting that the Internet also requires duplex communication, something that HD Radio doesn't have to waste spectrum on. Duplex allows for re-sends, though, so maybe the statistical advantage swings that way slightly. Some forward delivery robustness can be sacrificed if you can try again as needed. But those re-sends consume bandwidth, too. And the tall-tower world of FM requires no intercell handoffs.

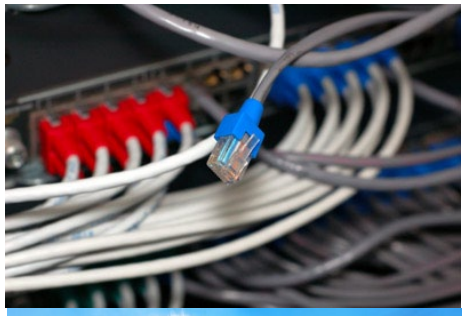
Case Study

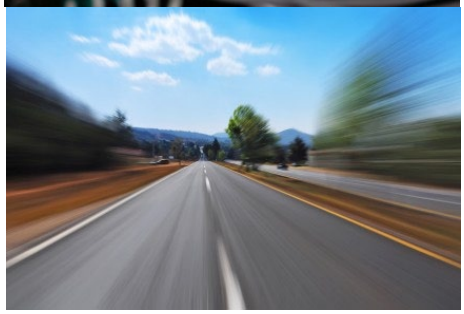
A geography example will help to illustrate the dilemma. In Chicago, the Kennedy Expressway is 17.8 miles long, running northwest and southeast from the city center to O'Hare Airport. From eight to 20 lanes wide, the Kennedy sees peak daily commuter traffic of 387,000 vehicles.

Let's also assume that half that traffic occurs during morning and evening rush and average transit times during rush hour are 40 minutes. Let's assume three-quarters of the cars are streaming during their commute. We need to serve 16,125 cars, spread over a 17.8 mile linear distance. The throughput must be 774 Mbps net of all transmission and connection management overhead. This means we'll need a Gigabit-per-second gross.

Sensing demand, Ford is angling to add mobile streaming Internet to their in-dash options packages starting with Sync, a partnership with Microsoft. (Courtesy: Ford Motor Co.)

Let's also assume that we have access to the entire spectrum in the former UHF TV Channels 51–73 that the feds have recently auctioned off, a total of 138 MHz. Using Shannon's Law and the approximate bandwidth-to-data-throughput ratio we see for HD-FM, we can deliver about 136 Mbps. Logically, we'd reuse frequencies along the cellular model, and our delivery capacity into any given cell is 1/4 that amount or about 34 Mbps. To cover the 17.8 miles and deliver 9.3 Gbps from cells with 34 Mbps capacity apiece requires 30 cell sites or one about every half mile. This doesn't seem so daunting an infrastructure challenge.





But this model assumes our cars are uniformly distributed on the expressway. Anyone who has ever been stuck in a gaper's block jam-up knows that isn't a realistic assumption. Inbound and outbound traffic concentrates at the ends of the expressway.

Most probably the capacity would need to be doubled, at minimum, for reliable throughput. For the cellular model that means twice as many cell sites. That's a cell site every 1,500 feet or so. Otherwise our commuters will experience buffering, dropouts, etc. and they'll just turn on the radio. Back-of-the-envelope, this probably represents about a fivefold or more increase in the number of cell sites in most metropolitan areas.

And the earlier assumption that we'd have access to the entire Channel 51–73 vacated spectrum is unrealistic, too. With multiple carriers all controlling discrete segments of spectrum, the uniformity of customer penetration across multiple cellular carriers will play into the reliability issue, too. If an outdoor ad on the Kennedy causes a thousand commuters to buy an iPhone, those subscribers may discover that AT&T's cell infrastructure is suddenly insufficient. Google Maps and YouTube already are taxing the capabilities of existing data plans and delivery infrastructure. Unlimited data plans are disappearing quickly from the market in response to the stresses.

In short, the greatest appeal of Internet radio remains its most fundamental problem: the requirement that every user have a separate, custom-per-user data stream. As long as this requirement remains, over-the-air radio need not be concerned about meaningful encroachment from the Internet. The only practical solution is for our data consumers to share content; essentially a multicast broadcast where many users capture the same transmitted packets at the same time. But, this means they'll listen to the same thing at the same time, which is what radio already does with much greater reliability and at far lower cost to the user.

Eventually the press-release-driven media may figure this out. So far they've been spoon-fed demos using one smartphone streaming one source. Hey, why not hold our own demonstration at the next NAB Show? Everybody should start streaming your own station during lunch, then invite the press to check out the results. I predict a wireless data train wreck.

[This article originally appeared in the Sept. 2, 2009 issue of Radio World (radioworld.com) and is used with permission.] The author is former president of engineering for American Media Services, a radio brokerage and developmental engineering firm. His email is fmc@ieee.org.

Nebraska Educational Television

How a Rural State in the Great Prairie Leads the Nation in Public Broadcasting

By Ken Reitz KS4ZR

Imagine an American state so techno-savvy that it not only covers the entire state with its own publicly funded TV signal, but broadcasts three separate channels, including a high-definition service; that you could travel border-to-border within that state and never lose its line-up of news and music through its 24/7 FM radio service. Or, that anyone in the U.S. could tune in to all three video channels and their radio service as well, via that state's own C-band, free-to-air satellite channels. Or, that all of these services were also available to anyone in the world online. You don't have to imagine it if you've discovered the wide world of Nebraska Educational Television.

The Deep Roots of NET

It all started 58 years ago when the University of Nebraska in Lincoln applied for an educational TV license for channel 18. But, this was early in TV's development and, in 1951, there were few TV sets in the state able to tune to UHF channels. Three years later there was still no license. Meanwhile, early broadcast pioneer and media mogul, John Fetzer, president of Fetzer Broadcasting Company, had acquired channels 10 and 12 in Lincoln, Nebraska, and offered channel 12 as a gift to the university, pending FCC approval. By November 1, 1954 KOUN-TV channel 12, from the University of Nebraska was on the air Monday through Saturday, mornings only.

NET Television Network: An even more extensive system of 35 TV transmitters, translators and boosters provide full coverage of all three NET channels. (Courtesy: Nebraska Educational Television)

A year later the Nebraska Board of Regents took control of the station and Fetzer gave the channel a new transmitter, studio and antenna. That was coupled with a $100,000 Ford Foundation grant to buy additional equipment and extend programming to aid adult education. NET was off and running.

By 1961 the state had budgeted enough money to launch five VHF channels and three UHF channels in order to provide TV coverage for the entire state. The FCC came through with the eight necessary licenses, the most ever granted to one state at one time.

NET satellite operations center satellite transponder ID card.

Two years later the state's legislature, known as the Unicameral (the only single-house legislature in the U.S.), established the Nebraska Educational Television Commission and appropriated $600,000 of state funds to begin the first phase of the new statewide TV network. And, by August, 1976 the NET Commission recommended the development of a statewide radio network.

Legislative support grew and in 1978, when a 1,500 foot tower collapsed during an ice storm, the Unicameral voted more than $900,000 to immediately replace it. Nearly ten years later they voted another $1.5 million to replace another 1,500 foot tower that also collapsed in an ice storm.

As the TV and radio networks grew, funding for innovative programming also came through the NET Commission. One program that enjoyed widespread success was "Reading Rainbow," which featured the former star of "Roots" and future star of "Star Trek: Next Generation," LeVar Burton as the host. The NET-based program went national on PBS in 1983 and was a children's favorite for the next 23 years, garnering a Peabody Award and 26 Emmy Awards on its way to becoming the third longest running children's show in PBS history. Re-runs still air on most local PBS stations.

NET MPEGII FTA Satellite Feeds (G28, 89ºW)
3.740 GHz (Horizontal Polarity) 25.320 (Symbol Rate) All Audio is AC3 Dolby Digital
NET1 (with audio from KUON-FM, KUON-HD2 Lincoln, NE)
NET2 (Nebraska state and PBS programming)
NET3 (Nebraska state and PBS programming)
NET-HD (Nebraska state and PBS programming in MPEGII-HD)
NET-Nebraska, various distance learning feeds
Note: Minimum reception requirements include a well-tuned 10′ C-band dish and an MPEGII receiver with AC3 and HDTV capability.

Diversified Programming Schedule

Throughout the early years of TV broadcasting, rural Nebraskans relied on NET to bring, perhaps for many, the only TV signal available. And, while NET maintains a full schedule of nationally broadcast PBS programming such as "Masterpiece Theater," "Austin City Limits" and "Barney," the extra two statewide channels make room for plenty of locally produced fare.

As a result, NET programming is quite diverse. Gavel-to-gavel proceedings from the Unicameral during its 60 and 90 day alternate year sessions are aired; a wide range of Nebras-

South Carolina Educational Television network control room. (Courtesy: SCETV)

In the heart of the Great Prairie, Nebraska state capitol building houses the state's unique Unicameral legislature and fierce supporter of NET. (Courtesy: Nebraska Unicameral Information Office)

ka-grown college and high school sports, including football, basketball, baseball, volleyball, high school swimming, bowling, wrestling and even rodeo are regularly aired. In a state where football could be considered a second religion, programs such as "Big Red Wrap-up," where sports activities at the University of Nebraska are the main topic, is must-see TV.

Programming generated from NET in the form of daily, weekly, and monthly series and single program documentaries have garnered so many state, regional, national and international awards that it takes 56 pages to list them all. NET has picked up everything from Emmys to National Teacher Awards, Hugo (Chicago International Film Festival) to Cronkite, Severeid, and Edward R. Murrow Awards; Peabody Awards, Writer's Guild Awards, Associated Press Awards, National Educational Telecommunications Awards, even a second place Asahi Newspaper Corporation (Tokyo, Japan) Award for Films and Videos on Japan.

NET has picked up awards from such diverse groups as the National Cowboy Hall of Fame and Western Heritage Center (for the documentary "Platte River Road"); the National Catholic Association for Communicators (for the radio documentary "Behind Closed Doors"); Society for Visual Anthropology (for "Return of the Sacred Pole"); American Indian Film Festival (for "The Trial of Standing Bear") and literally dozens more. NET is clearly the pride of Nebraska. No wonder the Unicameral makes sure it's fully funded!

None of this happened by accident. Rod Bates, NET General Manager, credits the early and lasting vision of Jack McBride who began his career with the Nebraska ETV Network, as it was known in 1954, and continued guiding NET throughout the decades. McBride, who died last year, is a national telecommunications legend. Bates summed it up when he wrote of McBride, "Jack built more than a public television network; he created one of the finest public telecommunications systems in the world."

HOW OTHER U.S. STATES STACK UP

All states in the U.S. have some form of public TV and FM broadcasting. Most have networks comprised of various stations that, combined, cover most of each state. All have active web sites and virtually all public radio stations stream live online. Few have extensive, linked, statewide networks and no other state matches what NET has done for its citizens. Here's a review some of the states that offer extensive terrestrial TV and radio as well as satellite coverage. TV, FM and satellite information is provided by the network's web sites and satellite TV sources.

No state has a tougher job of covering its citizens with a public broadcasting signal than Alaska. The combination of the vastness of the state, incredible terrain, severe weather and small, but wide-spread population makes coverage a daunting financial and technical task. Alaska Public Television and Alaska Public Radio Network coverage is done through a combination of C-band MPEGII satellite feeds (AMC8 139ºW) via spot beams that can be received only in Alaska, Washington, Oregon, British Columbia and the Yukon Territory. Local coverage is via terrestrial radio and television channels. Alaska Public Radio Network (APRN) programming is heard on a loose network of 25 AM and FM community-supported stations throughout the state. APRN is also streamed 24/7 online.

Florida Public Broadcasting Service (FPBS) has 20 TV and radio stations statewide and supports the satellite-fed Florida Knowledge Network (FKN) which is used by all Florida public schools from elementary through university levels. FKN has an MPEGII Ku-band satellite feed on AMC3 (87ºW), transponder 18 vertical polarity.

Georgia Public Broadcasting (GPB) has to cover the biggest state east of the Mississippi. It does an admirable job of it with nine primary TV stations and four TV translators covering nearly every square mile of the state. Its radio service, which provides 24/7 coverage combining National Public Radio as well as GPB state-wide and local content, consists of 17 primary FM radio stations and six FM translators. In addition to their terrestrial TV coverage, in the past, GPB used analog Ku-band transponders on AMC 3 (87ºW) for both GPB-TV and GPB-Radio feeds. They later switched to Free-To-Air (FTA) DigicipherII technology from Motorola, but have since switched to encrypted feeds in that same format.

South Carolina Educational Television (SCETV) has been a long-time resident on Ku-band satellites, contributing a steady list of regular programs to PBS's national program line-up. SCETV's statewide network includes 11 television stations, eight radio stations and a closed-circuit educational telecommunications system. SCETV uses Telstar 14 (63ºW) to beam its 10 Ku-band, MPEGII signals to affiliate stations.

Louisiana Public Broadcasting (LPB) has a network of six terrestrial stations transmitting from some substantial towers including 1,300, 1,500 and 1,700 foot structures, broadcasting their line-up of local, state and PBS network fare. They also have a Ku-band, MPEGII DVB-S2 feed on AMC21 (125ºW) which is only viewable with MPEGII DVB-S2 receivers, which require much more signal strength to lock in the signal.

Michigan Public Radio Network is heard on one of the most extensive statewide radio networks in the U.S., with more than 15 FM transmitters and translators throughout the state, most affiliated with local colleges and universities covering both the upper and lower peninsulas.

Montana, another vast, sparsely populated western state, tries to cover the whole state with terrestrial TV signals but it's very difficult. They are currently trying to raise enough money to put up a tower to allow PBS coverage for Great Falls for the first time ever. Many in the state watch Montana Public Television (MPTV) via DISH Network. MPTV has a Ku-band feed also found on AMC21 (11.959 GHz, horizontal polarity, 4.340 symbol rate MPEGII FTA).

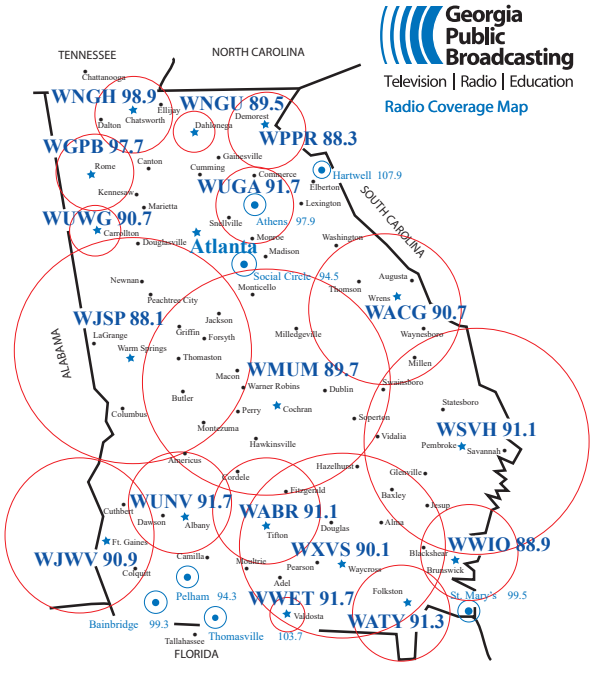
Texas, the biggest state in the continental U.S., covers its vast territory with localized public broadcasting stations. For example, there's South Texas Public Broadcasting (KEDT-TV-FM) from Corpus Christi; North Texas Public Broadcasting (KERA-TV-FM) from Austin; and Public Broadcasting for Central Texas (KWBU-TV-FM) from Waco. West Texas, bigger than most states with very few people between its widespread cities, is served by local, college-related public TV and FM radio stations.

West Virginia, while not a large state, has to contend with unrelentingly rugged terrain and sparse population centers. Still, it has one of the best state-wide networks of public TV and radio stations. West Virginia Public Broadcasting utilizes nine FM transmitters and five FM translators to cover nearly the entire state with primary signal coverage of its WVPB radio network. WVPB television coverage is done statewide via only three terrestrial TV stations and seven TV translators. Sports broadcast on WVPB include West Virginia University women's basketball and men's and women's soccer.

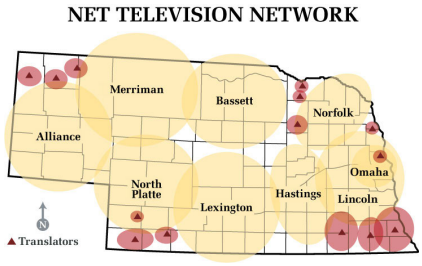
Distance Learning

The mandate for NET is not just about educating the general population through their three channels of public television and radio broadcasting. Less known to the general public is the vast distance learning network which was one of the most important contributions to NET from the mind of Jack McBride. It was he who designed and developed the NEB*SAT service that became the main link in early NET distance learning which today is done through two-way digital satellite and internet-based distance learning technology.

Since the advent of digital satellite broadcasting, NET has taken advantage of the



Georgia Public Broadcasting terrestrial radio network coverage map. (Courtesy: GPB)



NET Television Network Permanent Digital Channels

Transmitters	Translators*	
ALLIANCE KTNE-DTV13	**CULBERTSON (North Platte, KPNE)** K44PN DTV44	**CHADRON (Alliance, KTNE)** K06JC DTV6
LEXINGTON* KLNE-DTV26	**NELIGH (Norfolk, KXNE)** K50IO DTV50	**HARRISON (Alliance, KTNE)** K08LN DTV8
NORFOLK KXNE-DTV19	**BEATRICE (Lincoln, KUON)** K23AA DTV23	**VERDIGRE (Norfolk, KXNE)** K10JW DTV10
BASSETT KMNE-DTV7	**DECATUR (Norfolk, KXNE)** K34IB DTV34	**CRAWFORD (Alliance, KTNE)** K06KR DTV6
LINCOLN KUON-DTV12	**NIOBRARA (Norfolk, KXNE)** K14MI DTV14	**MAX (North Platte, KPNE)** K33FO DTV33
NORTH PLATTE KPNE-DTV9	**BLAIR (Lincoln, KUON)** K24GO DTV24	**WAUNETA (North Platte, KPNE)** K20IJ DTV20
HASTINGS KHNE-DTV28	**FALLS CITY (Lincoln, KUON)** K46FG DTV46	** Town in parentheses indicates the Transmitter from which the signal originates.*
MERRIMAN KRNE-DTV12	**PAWNEE CITY (Lincoln, KUON)** K33AC DTV33	
OMAHA KYNE-DTV17		

NET Radio Network: A system of 9 FM transmitters and 5 translators cover nearly every square mile of Nebraska with 24/7 programming from Nebraska Public Radio. (Courtesy: Nebraska Educational Television)

increased bandwidth available to launch many simultaneous distance learning feeds that take place on the satellite transponders NET leases on Galaxy 28 (89ºW). The various participating member institutions teach Nebraskans all over the state from the widest possible catalog of courses.

This tremendous technological effort requires the latest state-of-the-art satellite and internet video and audio equipment. The Unicameral voted to build NET a special telecommunications center in 1970, construction began immediately and two years later the installation was finished.

The Future

NET has always been at the leading edge of broadcast technology. It was among the first states to use analog C-band satellite technology to feed its programming to the state's outlying transmitters and translators. But, because they've kept their feeds open, they've also allowed the rest of the country to participate in their journey. When Motorola's DigicipherII (DCII) digital satellite technology became available, NET quickly switched from analog to digital and, in doing so, had much more satellite bandwidth available to use to broadcast more channels of distance learning. As the DCII technology slowly fell out of favor with broadcasters, NET switched to the Digital Video Broadcast (DVB) MPEG2 standard used by most domestic and European broadcasters for satellite transmissions. Today, their MPEG2 Free-to-Air transmissions are sent along with their DCII signal. Eventually, once all statewide downlinks are set up, the DCII signal will be turned off and only the MPEG2 FTA signal will remain.

When the terrestrial DTV switch was made last year, NET was already prepared. It was able to take immediate advantage of DTV's multicast capability with its main video channel and two additional channels already up and running. NET had already been doing HDTV broadcasts via satellite for many years. In fact, satellite TV viewers across the U.S. got their first glimpse of PBS HDTV programming thanks to the digital channels NET was transmitting.

The advent of HD-Radio sees, not surprisingly, NET Radio out front with a full line-up of alternative channel programming. NET's flagship station KUCV-FM in Lincoln, broadcasts jazz programming on its HD-2 channel from 7:00 pm to 5:00 am on the weekdays with jazz programming extended to 8:00 am on the weekends. This programming complements the classical music line-up found on its main NET Radio service. Nebraskans may have the most sophisticated musical taste of any state in the country.

While the HD-2 service is currently available only on KUCV-FM, NET has said it will replace analog FM transmitters with HD-Radio transmission equipment as the old gear wears out or as funding permits. Knowing the support the Unicameral gives NET, my bet is that the switch happens earlier rather than later. But, you don't need to wait for the future; you can listen to NET's HD-2 service online at **www.netNebraska.org/radio**.

From the beginning, NET set out an aggressive mission statement: "…to enrich lives and engage minds by connecting communities and celebrating Nebraska with services that educate, entertain and enlighten." While those are noble enough goals, it would have been impossible without the vision of the NET Commission, the commitment of the Unicameral, and ultimately the support of Nebraskans all over the state. They pay the taxes that fund the budgets that provide the transmitters, antennas, satellite links, and programming that, in turn, inform and entertain those same Nebraskans. It's a powerful formula from the center of the country that could stand to be imitated by all states.

West Virginia Public Broadcasting terrestrial radio network coverage map. (Courtesy: WVPB)

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The handheld BCD396T scanner was designed for National Security/Emergency Preparedness (NS/EP) and homeland security use with new features such as **Fire Tone Out Decoder**. This feature lets you set the BCD396T to alert if your selected two-tone sequential paging tones are received. Ideal for on-call firefighters, emergency response staff and for activating individual scanners used for incident management and population attack warning. **Close Call Radio Frequency Capture** – Bearcat exclusive technology locks onto nearby radio transmissions, even if you haven't programmed anything into your scanner. Useful for intelligence agencies for use at events where you don't have advance notice or knowledge of the radio communications systems and assets you need to intercept. The BCD396T scanner is designed to track Motorola Type I, Type II, Hybrid, SMARTNET, PRIVACY PLUS, LTR and EDACS® analog trunking systems on any band. Now, follow UHF High Band, UHF 800/900 MHz trunked public safety and public service systems just as if conventional two-way communications were used. **Dynamically Allocated Channel Memory** - The BCD396T scanner's memory is organized so that it more closely matches how radio systems actually work. Organize channels any way you want, using Uniden's exclusive dynamic memory management system. 3,000 channels are typical but **over 6,000 channels are possible** depending on the scanner features used. You can also easily determine how much memory you have used and how much memory you have left. **Preprogrammed Systems** - The BCD396T is preprogrammed with over 400 channels covering police, fire and ambulance operations in the 25 most populated counties in the United States, plus the most popular digital systems. **3 AA NiMH or Alkaline battery operation and Charger** – 3 AA battery operation - The BCD396T includes 3 premium 2,300 mAH Nickel Metal Hydride AA batteries to give you the most economical power option available. You may also operate the BCD396D using 3 AA alkaline batteries. Unique Data Skip - Allows your scanner to skip unwanted data transmissions and reduces unwanted birdies. Memory Backup - If the battery completely discharges or if power is disconnected, the frequencies programmed in the BCD396T scanner are retained in memory. Manual Channel Access - Go directly to any channel. LCD Back Light - A blue LCD light remains on when the back light key is pressed. Autolight - Automatically turns the blue LCD backlight on when your scanner stops on a transmission. Battery Save - In manual mode, the BCD396T automatically reduces its power requirements to extend the battery's charge. Attenuator - Reduces the signal strength to help prevent signal overload. The BCD396T also works as a conventional scanner to continuously monitor many radio conversations even though the message is switching frequencies. The BCD396T comes with AC adapter, 3 AA nickel metal hydride batteries, belt clip, flexible rubber antenna, wrist strap, SMA/BNC adapter, RS232C cable, Trunk Tracker frequency guide, owner's manual and one year limited Uniden warranty. Not compatible with AGEIS, ASTRO or ESAS systems. Order on-line at www.usascan.com or call 1-800-USA-SCAN.

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

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The Thrill of Shortwave Broadcasting

By Md. Azizul Alam Al-Amin
[All photos courtesy of the author]

The train I am riding in is on its way at 50 or 60 kph and its rattling and whistling sounds make a beautiful melody that is most pleasing to my ears. I find myself lost in the illusion of the sounds and sights. Along both sides of the rail line, trees create a wonderful, green atmosphere and the horizon looks like a painted portrait, heading towards an unknown destiny. What a splendid view!

I can't sufficiently express how I have enjoyed this voyage. After a six hour journey, the train has crossed almost 200 km from my hometown, Rajshahi. I made this trip recently to meet relatives in the small village of Joydevpur in the Dinajpur district. I like this place very much, because of its natural beauty. The traditionally styled houses really add to the sense of tranquility of life here. The people here are charming and friendly.

The Limitations of Digital Devices

Of course, on this trip I did not forget to pack all my digital gadgets; my cell phone with MP3 capability, my laptop computer, FM radio, etc. But, none of these would give much satisfaction where I was traveling. Due to the lack of network coverage, my cell phone and wireless Internet connection were totally useless and there is *no* FM radio coverage, not even any newspapers. It should go without saying, there is no cable television here.

The author's 2 ½ year-old cousin, Turjo, listening to shortwave radio.

Thankfully, I also brought my shortwave receiver, the German-made Grundig YB-400, which I won a decade ago from Deutsche Welle. Despite having all the latest, sophisticated technology that are used all over the world, I found the shortwave receiver is the only up-to-date technology that works here because shortwave broadcasting has no boundaries. Like the air itself, shortwave signals can travel everywhere in the world. Since there are no high-rise buildings, crowded population, or industries, shortwave reception here is excellent.

Shortwave Radio Remains Important

It is clear that, even now, there is not an appropriate alternative to shortwave broadcasting, at least in the rural places, where people have no access to Internet, no devices to receive satellite signals, no television or even newspaper or electricity. In so many places in the world, shortwave broadcasts are the main source of news, information and entertainment, and the reality is that most of the world's population lives in these areas.

"From a long view of the history of mankind - seen from, say, ten thousand years from now, there can be little doubt that the most significant event of the 19th century will be judged as Maxwell's discovery of the laws of electrodynamics," said Richard Feynman, the winner of Nobel Prize for physics in 1965. We know Maxwell's equations are the very foundation on which great scientists like Heinrich Hertz, Jagdish Chandra Bose, Alexander Stepanovich Popov, Karl Ferdinand Braun, Nikola Tesla and Guglielmo Marconi worked tirelessly and unfurled to the human civilization the fruition of science and technology of electromagnetic radiation or, in simpler terms, "radio waves."

In the last century, the discovery of shortwave technology made an important breakthrough to bring the world together as a "global village." And, shortwave radio has been enjoying a dominant position throughout most of the last century because it can reach across borders even when governments halt FM broadcasts, block Internet sites and jam television programming.

Graham Mytton, a former head of the BBC's audience research unit said, "Shortwave does not respect boundaries and reaches the rich and poor." Ian McFarland, former host and writer at Radio Canada International said, "Shortwave also can deliver news faster than you might find it online, and in places where your other devices don't work."

Vincent Nowicki, director of the engineering and technical operations at America's International Broadcasting Bureau (IBB) also recognized the importance of shortwave. In the response to Jack Quinn and Nick Olguin's guest commentary on the Broadcasting Board of Governors ("Don't Close Shortwaves, Improve Them") published in *Radio World*, he said, "The BBG is keenly aware of the value of shortwave in distinct markets such as some parts of Africa and parts of Asia. Shortwave sustained international broadcasting throughout the Cold War and still makes a significant mark today in the global war on terror." There are so many people around the world who still favor shortwave as the prime vehicle of international broadcasting.

Author's friend, Mr. Md. Abul Hossain, age 70, and his shortwave radio.

Author's niece, Soha who is 4 years old, listening to shortwave via headphones.

Digital Transformation

Charles Darwin wrote, "Those who survive are the ones most adaptable to change." We are in a period where nearly every human endeavor is digitalized. With vast technological advances in telecommunications, we now exist in a multimedia age, in which the integration of media and communications has eliminated pre-existing media boundaries.

A vast amount of information is now available through various transmission channels. Sweeping transformation in broadcast technology has started. In this juncture most of the media industries are confronted with the task of preparing and making the leap into the highest echelons of new-age media. Billions of dollars are being invested in new digital technology and investors expect a quick return on their investment.

But, rapid transformation to digital technology has brought an uncertain future to shortwave. International broadcasters are no longer looking at the importance of shortwave broadcasting. Instead, they are reducing or terminating this service, which I see, as helping increase the "digital divide."

For years now, we have heard the repeated, tired refrain: "shortwave is dead." As a long time shortwave listener I feel very depressed witnessing the elimination of short wave broadcasting, even though I realize the importance of digital broadcasting, which claims very high-quality audio without any interferences or disruption.

My concern is particularly for the so-called Third World countries, especially on the African continent, where there is a great scarcity of even electricity. Here shortwave is still playing a prime role as it has since the middle of the last century. Most of the people there are living below the poverty line; they have not enough food or clean water. The question is; how will these hungry and needy, but curious, people be able to afford to use this latest digital technology?

It should be kept in mind that, compared to all different media as far as penetration and cost, there is no other sound-broadcasting medium that can compete with short wave in these respects. To minimize the reality of the digital divide, broadcasters should not make shortwave broadcasting antiquated. I urge, in addition to adopting new digital technology, broadcasters continue analog shortwave broadcasting.

Author tunes the shortwave bands on his Grundig Yacht Boy 400.

About the author:

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MT

SCANNING REPORT

THE WORLD ABOVE 30MHZ

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Longing for the Simple Life

There was a time, not so many years ago, when scanning was simple. Buy a few crystals or key in a handful of frequencies and you were pretty much set to go. Transmissions were all analog and agencies stuck to the same frequencies.

All that has changed.

Scanning these days has become complicated. Many agencies use trunking to combine different department operations on a set of common radio frequencies. Conversations are identified by a talkgroup number and may take place on multiple channels. The voice traffic itself may be in one of several types of digital format, adding another level of complexity. Even the frequency bands are changing, as new systems come on-line and political decisions made in Washington, D.C. open up new 700 MHz spectrum and force shifts in the layout of the 800 MHz band.

This complication is reflected in the numerous features, settings and capabilities of modern scanners. Like the leap from traditional landline telephones to today's cellular telephones, scanners now cost more, do more, and have a much steeper learning curve than previous models.

❖ Radio Shack PRO-96

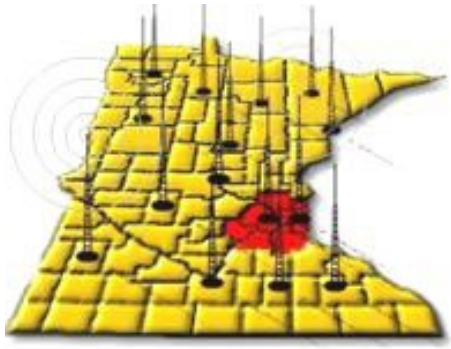
Dan,

Is there anywhere I can get a "cheat sheet" that can explain in simple terms how to use a PRO-96? I've had one for over a year and I still can't figure it out. Supposedly all the frequencies are loaded in but I can't seem to find the ones I want to listen to.

I'm located in the Twin Cities area of Minnesota. My local Radio Shack doesn't have anyone who understands the PRO-96. They suggested I try another store. That was my plan but I was hoping there was something I could use that would be less complicated than the manual.

Thanks,
George via the Internet

The Twin Cities, Minneapolis and Saint Paul, are part of the Allied Radio Matrix for Emergency Response (ARMER), the statewide public safety radio system. It is a "pure" APCO Project 25 system, meaning that it uses the Project 25 trunking standard as well as carrying voice traffic in the P25 digital format, called Common Air Interface (CAI). A digital-capable scanner is necessary to monitor the system.



ARMER is still being built out in various parts of the state, following a phased approach to planning, construction, and operation. Like many large states, Minnesota has a few large population centers and substantial rural and lightly populated areas. This creates planning challenges to achieve acceptable capacity and coverage. The core of the system grew out of an existing Metro radio system that served Minneapolis and Hennepin County. ARMER played a pivotal role after the Interstate 35 bridge collapse in August 2007.

The Radio Shack PRO-96 is a handheld scanner introduced in 2003. It covers most frequency bands of interest and can store 500 active channels in 10 banks. It is capable of monitoring both analog and APCO Project 25 (P25) digital voice transmissions, as well as correctly track conversations on Motorola, EDACS and P25 trunked systems.

The PRO-96 has been discontinued by Radio Shack, but is still available on the used market and remains a popular choice for digital system monitoring.

Automatic Tracking

The PRO-96 has a feature called "Control Channel Only" that allows the scanner to properly track Motorola trunked conversations while programmed only with the control channels. It does this by extracting messages from the control channel data stream and using them to calculate active voice frequencies. This means you don't have to enter the voice frequencies, saving quite a bit of keypad work, work, it allows you to scan a system even if you don't have a complete frequency list for it. This feature, referred to in the manual as "Automatic Channel Tracking," also provides the same capability for P25 systems.

Manual Programming

Because the active control channel on a trunked system may rotate among a set of frequencies, it is important to program all of the possible control channel frequencies. In the Minneapolis area, the control channels for ARMER include 852.0375, 852.1375, 853.6625, 853.8125, 858.2375, 858.2625, 859.7625 and 860.2375 MHz.

In order to track the ARMER system while in the vicinity of Minneapolis, perform the following steps:

1. Choose an empty channel storage bank to use for ARMER. The PRO-96 has ten bands, numbered from 0 to 9, to choose from.
2. Turn the scanner on and wait for the Welcome screen to clear.
3. Press the [PGM] button. The character in the upper left corner of the display should turn into a "P".
3. Press the [FUNC] button. The character in the upper left corner should turn into a blinking "F".
4. Use the arrow keys to move to the selected channel storage bank. The upper left corner of the display will show the letter "P" and then three digits. The first digit is the bank number (0 to 9) and the second number is the channel number (0 to 49). You can move from bank to bank (rather than from channel to channel) by pressing the [FUNC] key before pressing the [UP ARROW] or [DOWN ARROW] button.
5. Press the [TRUNK] key. The display will change and you will see the selected bank on the top line.
6. Press the [MODE] key until you see the word "Motorola" on the third line.
7. Press the [PGM] key. The display will switch back to the channel storage bank screen.

You have just set the bank for Motorola (and APCO Project 25) trunking. Now you need to enter each of the eight control channel frequencies listed above.

1. Use the arrow keys to select the first channel. For instance, if you are using Bank 7 for ARMER, press the arrow keys until the upper left corner of the display shows "P700".
2. Enter the frequency, digit by digit, and then press the [ENTER] key. The display will show the frequency you just entered.
3. Press the [UP ARROW] key. The display should show, for example, "P701".
4. Repeat steps 2 and 3 until all eight control channel frequencies have been entered.
5. Using the arrow keys, scroll through each of the channels and be sure the two right-most characters of the top line show "MO", indicating a Motorola (and P25) trunked entry.

The scanner is now set to track the ARMER system using just the control channel frequencies.

V-Scanner Settings

The PRO-96 has a timesaving feature called "V-Scanner." The scanner has eleven "Virtual Scanner" folders in memory, each of which can contain an entire configuration profile of frequencies, talkgroup identifiers, search settings, and other operating parameters. The PRO-96 uses one of ten configuration profiles at a time, with the eleventh profile acting as a "scratch pad" or temporary storage area. Each folder can be assigned a name that you choose. Loading, saving and editing operations can all be done from the keypad, or through the use of an external software program.

Rather than perform the entire manual programming process, entering each frequency and trunking mode, you can make use of the V-Scanner functionality to do the programming for you. The scanner comes from the factory pre-loaded with frequencies and talkgroups for most major metropolitan areas in the United States.

V-Scanner	Area
0	North Texas
1	South Texas, Louisiana
2	Southern California, Arizona and Nevada
3	Northern California, Northwest U.S.
4	Florida
5	Maryland, Delaware, Pennsylvania
6	Washington, D.C., Virginia, Maryland
7	New York, New Jersey, Connecticut, Massachusetts
8	Illinois, Michigan, Indiana
9	Ohio, Southeast U.S.

Unfortunately for George, Minnesota is not among the pre-programmed systems, but for other readers looking for shortcuts, this might be a good alternative.

Load the V-Scanner folder by performing the following steps:

1. Press the [PGM] key.
2. Press the [FUNC] key.
3. Press the [PGM] key a second time. The display will show the V-Scanner menu with several options.
4. Press the [2] key to load a V-Scanner folder. The scanner will ask you to confirm your selection.
5. Press the number key ([0] to [9]) corresponding to the V-Scanner you wish to load. When you press the key, the display will show the name of the folder.
6. Press the [ENTER] key.
7. Press the [ENTER] key again to confirm that you wish to overwrite the current settings with the contents of the selected V-Scanner folder. The scanner will load the folder and display a low-resolution progress bar (a series of '<' symbols) while it is working.
8. Press the [ENTER] key when the loading operation is complete.
9. Press the [CLR] key to exit the V-Scanner menu. The scanner will reboot and begin using the contents from the new V-Scanner folder.

As convenient as the pre-loaded V-Scanner contents can be, there is a problem. Frequencies and systems change over time, eventually rendering the factory information outdated and incorrect.

For instance, even if the Minnesota system had been included from the factory, it wouldn't really have helped George. The ARMER system completed their rebanding process in the summer of 2008, moving each frequency that was originally between 866 and 869 down by exactly 15 MHz, putting them between 851 and 854 MHz. This means that the original V-Scanner settings set at the factory would no longer be correct.

PRO-96 Software Application

Fortunately, the V-Scanner information can be updated. In fact, most information in the scanner can be changed via a computer connection.

The PRO-96 does not have the ability to be directly controlled from a computer, but frequencies and other settings can be loaded and saved using a data cable and the appropriate software application. Radio Shack sells the cable you will need, which is identified as part number 20-247. This cable provides a USB (Universal Serial Bus) connection between the scanner and your computer. For older computers that have a nine-pin serial port, you'll need to locate part number 20-289 instead. This older cable appears to have been discontinued by Radio Shack, but may be available from other sources including eBay and www.pfranc.com.

Once you have the correct cable you'll need a software application for your computer. A software package called WIN96 is a popular option for setting up and maintaining the PRO-96 configuration folders. It was developed in close coordination with the PRO-96 designers and offers a number of useful features. The program can be downloaded from the web site **www.starrsoft.com/software/win96**.

WIN96 has the ability to program the PRO-96 from a data file on your computer. If you can locate the proper data file for your area and download it to your computer, WIN96 can load that data into the scanner without you having to type everything in. These files are usually available in Internet discussion groups, where you can exchange messages with other PRO-96 users living in Minnesota. One such discussion group can be found at **http://groups.yahoo.com/group/PRO-96**, which is dedicated to the PRO-96 and has more than 2,300 members.

Besides frequency management, WIN96 allows you to set the PRO-96 to correctly track rebanded Motorola 800 MHz systems that use the older 3600-baud control channel. The program can set the Extended Trunking Tables to provide the proper offset, spacing and base frequency necessary for the scanner to compute the correct voice channel frequency.

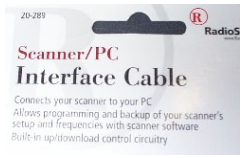
WIN96 is free to try for 30 days but requires a $30 registration fee after that.

A similar program that can help with loading and managing frequencies is ARC-96 from Butel Software at **www.butel.nl/products/arc96/arc96.html**. Some users prefer the user interface of ARC-96, which is more "user friendly" and easier to navigate. It can also import and export data files, as well as extend the frequency range of the scanner and provide

rebanding support. It has a 45-day trial period and is about $30 to purchase.

Upgrading the PRO-96

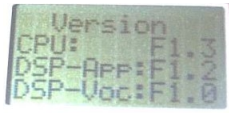
The data cable will also be useful if you ever want to upgrade the firmware inside the scanner. The PRO-96 contains a Digital Signal Processor (DSP) that is controlled by low-level computer instructions. These instructions are referred to as firmware, since they are tightly tied to the scanner and lie somewhere between software and hardware. The scanner can accept new firmware through an upgrade process, allowing the manufacturer to add features and correct problems without requiring you to return the scanner to Radio Shack.



To check the firmware versions on your PRO-96, perform the following steps:

1. Turn the scanner off.
2. Turn the scanner on.
3. While the Welcome screen is showing, press the [3] key.

You will see three version numbers on the screen, each associated with part of the scanner. The "CPU" and "DSP-Voc" versions are set in hardware and cannot be upgraded via the cable. The "DSP-App" version is what you are able upgrade with downloaded firmware.



Although newer versions of firmware do correct certain problems, some users report that earlier versions, as far back as 1.2, work better on some systems than later versions.

The latest upgrade available is DSP version 1.4, issued back in 2007. It is available on the Radio Shack support web site at **www.radioshack.com/search/softwareResults.jsp?kw=pro-96**

Rather than typing all that, it may be easier to do the following:

1. Navigate to **www.radioshack.com**
2. Enter "PRO-96" into the search box and press the "GO" button
3. Choose "Software Downloads" from the left-hand side menu.

You will see a list of updates, with the most recent one at the top. By clicking on the word "Download" you will end up with a file named *2000526_UPG_14.exe* on your computer. Running that program will provide a set of instructions for the installation process.

❖ Monitoring 800 MHz

I don't know about scanners but want to monitor digital 800 MHz APCO trunked systems. I bought a used Radio Shack PRO-96 digital unit, now I want to monitor 800 MHz police in the area but I don't understand the lingo.

The talk groups are printed as DEC (under that numbers like 40, 80, and 112) but on a web site it says they use a 800 MHz digital trunked system. I want to monitor from 866.850 to 868.500 and I'm having a hard time figuring out how to get it to scan in this area.

Any help would be great.
Michael

A trunked radio system in the 800 MHz band will operate on a set of specific frequencies licensed by the Federal Communications Commission (FCC). You shouldn't have to use the PRO-96 search function to find these frequencies, although you might stumble across something else of interest.

If you already have a frequency list from a web site or other source, try to identify the frequencies on which the control channels operate. There will only be two kinds of traffic on a trunked system – control traffic and voice traffic. Since the PRO-96 can track system activity just using information from the control channel, those are the frequencies that you will need to program into your scanner.

Once those are programmed and you're scanning, the PRO-96 will display activity when it hears it. The activity will have two basic components – the frequency that the activity is heard on and a number that identifies the group having a conversation.

The frequency will be a voice channel, not a control channel, and will really only be of interest to you if you're trying to compile a complete list. The voice frequencies you see should correspond to the licensed frequencies from the FCC, which can be double-checked against the FCC database available on their web site at **www.wireless.fcc.gov**.

In a trunked system, users of the system are put into groups. As a simple example, all the police would be in one group and all the firefighters in another group. When the radio system is first set up, each of these groups is assigned a number. Let's say the police are assigned the number '1' and the firefighters are assigned the number '2'. When a police officer wants to talk with other officers, he or she presses the push-to-talk button and the radio transmits a request message with the number 1 to the trunked system controller. That transmission takes place on the *inbound* control channel.

The system controller receives the request and sees that it came from someone who is a member of group number 1. It finds an empty voice channel and assigns it to group number 1, then transmits an announcement on the *outbound* control channel, informing everyone that group number 1 is having a conversation on the assigned voice channel.

Since all the system radios monitor the outbound control channel when they're not involved in a conversation, they all hear the announcement. Police radios recognize that they are members of group number 1 and immediately retune to the voice channel so they can participate. Fire radios hear the announcement, too, but recognize that they are not members of group number 1, so they ignore it and continue listening to the control channel.

These group numbers are referred to as "talkgroup identifiers" and can be represented either in decimal (base 10) form or in hexadecimal (base 16) form. Decimal is easiest to understand, since that's what we use in everyday life, but hexadecimal is closer to what the scanner is actually processing internally. The "DEC" you saw is just an abbreviation for "Decimal."

Your scanner is also listening to the outbound control channel, so it hears all the announcements as well. It also needs to decide whether to tune to the voice channel and provide the audio to you, or to stay on the control channel waiting for more announcements. The scanner makes that decision based on two criteria: whether the scanner is in "open" or "closed" mode and whether the talkgroup identifier is stored in an ID list.

When the scanner is in open mode, it tunes to the voice channel for every announcement on the control channel, unless you specifically exclude the talkgroup ID. This mode allows you to hear everything that happens on the system, but it can get overwhelming on a busy system or tedious when certain talkgroups get boring.

When the scanner is in closed mode, it will tune to the voice channel only when the talkgroup ID is already in the scanner's ID list. These topics are discussed on pages 83 and following in your PRO-96 *Owner's Manual*.

❖ Albuquerque, New Mexico

Our correspondent in Albuquerque provides an update on one of the EDACS systems operating in the city. Remember that EDACS frequencies must be programmed into your scanner in Logical Channel Number (LCN) order.

Hello Dan,

Three of the frequencies in our ABQ Public Works EDACS system were changed.

LCN	Old Frequency	New Frequency
5	860.2625	854.9125 new control channel
10	860.4625	855.4375
15	860.9875	855.9375

This EDACS system carries all of the traffic for the transit system, water department, animal control, garbage collectors, graffiti removers, transit security, and storm sewer system, Most interesting to monitor is the transit system bus drivers and dispatcher.

Here is the list of all of the frequencies:

LCN	Frequency
1	856.2625
2	857.2625
3	858.2625
4	859.2625
5	854.9125 control channel
6	856.4625
7	857.4625
8	858.4625
9	859.4625
10	855.4375
11	856.4875
12	856.7125
13	857.7125
14	858.7125
15	855.9375

William in Albuquerque

That's all for this first month of the year. As always, I welcome your e-mail at *danveeneman@monitoringtimes.com*. You can also find more radio-related information, including PRO-96 tips and tricks, on my web site at **www.signalharbor.com**. Until next month, happy scanning and Happy New Year!

ASK BOB

GENERAL QUESTIONS RELATED TO RADIO

Bob Grove, W8JHD
bobgrove@monitoringtimes.com

Q. *If I had the right antennas and the correct demodulators, could I receive Free to Air (FTA) programs on a computer-hosted receiver like a WiNRADiO? (Terry Murphy, Pensacola, FL)*

A. I'm afraid it's not that simple. The MPEG digitized signals are sent down on TV satellite frequencies in Ku band (12 GHz), and proprietary software is required to receive it on your computer. You can subscribe to these services over the Internet, or you could buy the dish, satellite receiver and do it yourself, but you can't kludge together your own system.

The bottom line is that it may be free to air, but it's not free to receive!

Q. *Are new digital TV sets going to be just as vulnerable to television interference (TVI) from CB linears and amateur radio transmitters as the older analog TVs, or will they have better filtering? (Richard Mollentine, WA0KKC, Overland Park, KS)*

A. Filtering for TV sets has evolved as interference sources have increased over the decades. While digital TV sets will probably not have substantially better filters than current analog sets, they will respond differently to radio frequency interference (RFI).

The old analog sets showed zigzag "hash" lines through the picture, but digital reception requires all the data bits without interference; if they don't, the picture becomes "pixilated" (blocky) or disappears altogether, much like what happens when a heavy downpour interferes with satellite TV reception.

Q. *On occasion, I receive an email after considerable delay from the time it was sent, perhaps a day or more. Since electronic messages are sent at nearly the speed of light, where's the delay? (M.B., IN)*

A. Typically, when you originate an email, it first is stored (a few milliseconds) on your computer, then it is sent through your common carrier's equipment and lines (telephone company), to your Internet service provider (ISP) – Google, Yahoo, whatever – then out again through a common carrier's equipment to the ISP handling the recipient's account. That ISP determines whether it's a legitimate email and then forwards it to your recipient's computer. If any of these intermediate services is down, experiencing technical difficulties, or being choked by high traffic loads, then that message will be stored at the ISP to be resent periodically until it can be successfully transferred to the recipient.

Q. *I am disappointed in the apparent sensitivity of both a Uniden and GRE hand-held scanner connected to a 5/8 wave vertical made for train frequencies when trying to monitor those signals. Do I need a better antenna? (John Cooney, email)*

A. Since both of these scanners have good sensitivity, and assuming they are in good condition, we need to look elsewhere for the poor performance. Here are some common problems:

- A bad connection on either end of the cable;
- A poor choice of cable or too long a run;
- Desensitization from a nearby strong signal;
- An unreasonable expectation of reception at your distance;
- Trains operating on other frequencies than those you are attempting to monitor.

Try listening for signals from non-train sources near the same frequencies to compare their reception, remembering that police and fire communications using repeaters may be much stronger than trains using simplex operation.

If you still think you need another antenna, you could switch to a directional (beam) antenna like the Grove Scanner Beam or Create LPDA. Either of these antennas would provide improved train reception over an omnidirectional antenna like you now have.

Q. *I would like to operate two scanners from one Grove Scanner Beam antenna; do I need to attach two balun transformers to the antenna and run separate coax lines down to the scanners? (James Jamerson, email)*

A. While you can hook two coax lines via individual balun transformers to the Scanner Beam, the biggest problem is that the oscillator radiation from each scanner is likely to be conducted to the other, locking up channels during scan and search.

The best way to do this is by using the one balun at the antenna and one coax cable down to a conventional, two-set, TV signal splitter. (Be sure it is marked for the correct frequency coverage (typically 5-950 MHz.) Then you attach two coax jumpers from that to your two scanners. The splitter helps isolate the two scanners from each other – and you also save a long length of coax!

Q. *I have frequent voltage fluctuations in my building and sometimes brief blackouts. To protect my computer equipment I am thinking of using a voltage regulator plugged into the wall socket, and a battery backup plugged into the regulator. Is that a good idea? (Ricardo Molinar, NY, NY)*

A. Yes, it should work just fine, but first I'd simply try the UPS (Uninterruptable Power Supply); it may provide all you need. Check the APC products like this one at NewEgg: **www.newegg.com/Product/Product.aspx?Item=N82E16842101311**.

Wal-Mart sells the APC brand as well. Depending on your power requirements and how many peripherals need battery backup or just voltage regulation, APC is a good power supply. I've been using them for years.

Q. *What SATCOM equipment is required on ocean-going passenger ships and freighters? (J.J. Owens, NC)*

A. The Global Maritime Distress and Safety System (GMDSS) requires all passenger ships and large freighters to use both terrestrial HF/VHF radio and satellite communications to respond to marine distress. INMARSAT C is used for data transmissions including the ship's position; INMARSAT B for radiotelephone and TELEX; INMARSAT FLEET 77 high quality voice and data for fleet service; and 406 MHz Emergency Position Indication Radio Beacons (EPIRBs) automatically transmit position data through the COSPAS/SARSAT satellites for Coast Guard rescue.

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

UTILITY WORLD

HF COMMUNICATIONS

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600 Meters: Signs of Life

As recently as a decade ago, most ships still communicated by Morse code on the international calling and distress frequency of 500 kilohertz (kHz). Since it started as one of three "waves" available to Marconi-era spark transmitters, this frequency and its surrounding working band is still often referred to the old way, by its wavelength. It was, and is, the 600-meter band.

This system worked beautifully and saved lives for nearly a century. Highly skilled operators, aided by automated distress alarms, stood round-the-clock watches at the key. Even the clock itself was special, marked for the twice-hourly silent periods when everyone listened for any faint distress calls.

What's the future for 600 Meters? Should it be preserved as a sacred shrine to the past, mined for potential profits by the highest bidder, put to work in a way that honors its roots – or all of the above?

But technology evolves. International treaties moved maritime communication to the largely automated and satellite-based Global Maritime Distress and Safety System (GMDSS). In most of the world, telegraphy working channels gradually went silent. Today, there are only the special events and continued teleprinting on a pair of Navigational Telex (NAVTEX) frequencies to remind us of what had been.

Today, 600 meters is regarded by many former operators, hams, and utility radio fans as an electromagnetic version of sacred ancestral ground. Everyone is pretty much in agreement that it deserves a far better fate than just getting snapped up by yet another high-spending political lobby for the latest digital entrepreneurial miracle. There's even a web site dedicated o this purpose: **www.save500khz.org/**

The controversy is culminating in an intensive period of engineering data gathering in preparation for a proposed agenda item at the 2012 World Radio Conference to include a small amateur radio band around 500 kHz. Experimental stations are coming on-air daily, giving a real challenge to utility fans who want to give this band a try.

❖ Present 600-Meter Allocations

As a frequency allocation, the old maritime band sits above a range used mostly for navigational beacons, and below standard AM (Amplitude Modulation) broadcasting. In the United States, 415 to 495 kHz is shared between maritime communication and aeronautical beacons. 495 to 505 is a guard band around the 500-kHz channel. 505 to 525 is once again maritime, with 510 and up again shared with the aero beacons.

Presumably, as aeronautical navigation also shifts to newer technologies, the beacons will largely vanish. Many countries, including the United States, have already started to phase them out.

NAVTEX, however, is an integral part of GMDSS, and it is here to stay. International agreements provide the frequency of 518 kHz as a primary channel where authorized agencies in the world's navigation areas broadcast maritime safety information and weather forecasts in a standard, Telex-like, automated format. 490 kHz is provided as a secondary frequency. It is very active in Europe. Some nations use 490 for NAVTEX in languages other than the English used on 518.

The experience with NAVTEX shows the potential of this band for truly global reception. These stations are assigned to cover immediate coastal areas, but DXers (distant transmitter chasers) have heard them over thousands of miles in ideal winter-night conditions.

Propagation this low down tends to favor ground wave rather than the sky wave we're more accustomed to on HF. It's more predictable, less prone to fading, and is less affected by solar storms (or the lack thereof). The main problems facing casual DXers come from noise and the use of equipment which was never designed for this band.

❖ 600-Meter Amateur Radio

Things are changing rapidly here. Just as we go to press, Norway has authorized amateurs from 493 to 510 kHz. Several other European countries have allowed experimental operations, typically beacons with low radiated power. Canada has a few stations authorized under experimental callsigns of the type granted for developmental activities. The United States has done the same, on a much larger scale.

The major US operation is organized by the American Radio Relay League. It uses the experimental/ developmental callsign WD2XSH. Last July, the Federal Communications Commission (FCC) allowed 45 stations to use this call, as WD2XSH/1 through WD2XSH/45. These stations are all over the US, and their activity is documented at **www.500kc.com/**

Details of the FCC authorization are in a .PDF file at this site. Most stations are licensed from 495-499 and 501-510 kHz. The gap is a guard band around 500 kHz, which is at present still protected as a distress channel.

In the band plan proposed by the WD2XSH license, 500 kHz is retained as a "Heritage" frequency for radio museums, special events, and such latter-day commercial licensees as KSM at Point Reyes, CA. In fact, the Maritime Radio Historical Society, operator of KSM and a museum at the old KPH, is specifically mentioned as the type of activity to be encouraged by any amateur operation here.

Not all 45 stations are on at any one time. Most have beacons, and some have worked 2-way on other frequencies. Emissions can be CW Morse telegraphy or several newer digital modes. These include the ultra-narrow, ultra-weak-signal modes QRSS and WSPR.

QRSS is a variation on "QRS," an international procedural signal meaning "reduce speed." It is essentially ultra-slow Morse, measured in minutes per word instead of the other way around. Amateurs typically receive it with a well-optimized free program called Argo.

WSPR ("whisper") stands for Weak Signal Propagation Reporter. We've talked about this before. It's a special automated mode that allows position checks to be received from well below the noise and reported over the Internet.

You won't be hearing DX pileups any time soon on 600 meters. Daunting technical challenges abound. Practical antennas tend to show loss rather than gain. Matching coils are sometimes the size of beer kegs. Verticals work best with ground radials, and lots of them. There can never be too many, and they can never be too long. If you like to spend your weekends burying wire, this is your band.

The associated transmitting and receiving equipment is ham radio the old way. No Japanese wonderboxes here. It's put together from cutting-edge solid-state circuits and ancient vacuum tube gear, usually in the same setup. There's a lot of good engineering work going on, and the result will mean better radio for everybody.

INTERNATIONAL BEACONS HEARD IN U.S.

Frequency	Call	Country	Mode	Power
500.00	SK6RUD	Sweden	QRSS	?
501.00	SM6BGP	Sweden	QRSS	?
501.05	GI4DPE	N. Ireland	CW	0.1
501.09	EI0CF	Ireland	CW	?
502.57	G3KEV	UK	QRSS	?
503.87	G4JNT	UK	WSPR	0.2
503.89	G0NBD	UK	WSPR	0.02
503.92	SM6BHZ	Sweden	WSPR	1
503.95	G3XIZ	UK	QRSS	0.25
503.95	M0BMU	UK	WSPR	?
503.95	M0LMH	UK	WSPR	0.2
504.6	VX9PSO	Canada	CW	?
505.00	DI2BJ	Germany	CW	?
505.06	OK0EMW	Czech Republic	QRSS/CW	1
505.09	DI2AG	Germany	WSPR	1
505.12	DI2BE	Germany	QRSS/CW	9
505.18	DI2AM	Germany	QRSS	18
507.7	VX9MRC	Canada	CW	?
508.00	SM6BHZ	Sweden	CW	?

❖ Frequencies

WD2XSH stations are allowed beacons around 505 to 506.4 kHz. 507.5, the band center, is a calling frequency for 2-way contact.

Another US experimental group uses the callsign WE2XGR/1 through WE2XGR/6. These are authorized from 505 to 515 kHz. These are all in the Northeastern US, and use input power of 200 watts. WE2XGR/6, 507 kHz in Pen Yan, NY, has recently been reported in Europe.

I've made a list of beacons outside of the US that have been heard on the air in the past year or so. It's hardly the longest list out there, but at least it's all from listeners. Power is effective radiated power, when known, in watts. Good hunting!

❖ Japanese Fishery Radio

Our December column briefly mentioned the Japanese radiofaxes that are broadcast to that country's fishing industry. With so much seafood in its diet, Japan definitely takes its fishery very seriously. It's huge, with many vessels operating over much of this planet's surface. Some fleets are gone for months at a time and are resupplied by support boats.

Japan's Fisheries Co-Operatives Law has provided various means of organizing this industry on a local and national level. Fishery radio stations are considered an important part of this organization. There are hundreds of these. Most use Very High Frequency (VHF, 30-300 megahertz) for close-in coverage, but HF (short wave, 3-30 megahertz) is hardly ignored. In fact, the HF radiofaxes are considered an important service to vessels operating far out in the Pacific Ocean.

Back when there were still fax stations all over the bands, Chuo Gyogyo Radio was frequently reported with fishery charts. It still appears in many utility listings, sometimes also called Chuo Fishery Radio. Since "Chuo Gyogyo" is simply Japanese for "Central Fishery," these names are really the same thing in different languages.

As part of my revision of Marius Rensen's list in last month's column, I tried to confirm whether the Chuo service was still on the air. One frequency, 16907.5 kilohertz (kHz) upper sideband (USB) was verified as active by Eddy Waters in Australia just as we went to press.

The other one, 8658.0 kHz USB, wasn't verified until early November of 2009. That's when Martin Foltz in California reported reception of fuzzy charts nightly around 0650 UTC. He's not that far from me, but so far it's all been no-joy here. He sent me one of his charts, though, so we know it's for real.

These charts are kind of cryptic unless you know how to read them, which I certainly don't. I'm pretty certain that some of the ones that look like weather maps have to do with water temperatures at various depths. Other charts are just numbers in columns, marked in Japanese. If anyone knows what these are, please write this editor.

There's more. Remember the news fax listed as coming from Kyodo News in Tokyo and Singapore? Well, there's another transmitter being used on at least one of the frequencies.

In November of 2009, seasonal propagation improvements allowed fairly clear copy here of several Kyodo frequencies in the 16-17 megahertz band. Daily at 2255 UTC, a 2300-hertz reference white signal came up. A news fax started at 2300 UTC, banging away methodically for several hours at a steady 60 lines per minute.

As we've noted before, this content is a small (and very copyrighted) Kyodo newspaper in Japanese. It's followed by the latest navigation warnings, newsletters from the All-Japan Seaman's Union (JSU), and other less identifiable products. While all frequencies run the same thing, one of them is much louder here and slightly out of sync with the others. This one is 16971.0 kHz USB.

This frequency's sign-on uses the call of JSC rather than the usual JJC in Tokyo or 9VF in Singapore. Some Googling around quickly identified JSC as a 10-kilowatt station in Kagoshima, Japan. There's also mention of a contract between the fishery association and the station for a separate beam aimed at Hawaii and intended for fishing fleets in the East Pacific.

Well, that certainly explains the killer signal in Southern California. I have it running now as I write this, and the copy looks a lot better than that from the Coast Guard in San Francisco lately.

Until demonstrated otherwise, I'll show this frequency as coming from both JSC and the usual JJC in Tokyo. Please correct my list accordingly, and see you next month.

ABBREVIATIONS USED IN THIS COLUMN

AFB .....Air Force Base
ALE.....Automatic Link Establishment
ARQ .....Automatic Repeat reQuest (teleprinting)
CAMSLANT .....Communications Area Master Station, Atlantic
CW.....On-off keyed "Continuous Wave" Morse telegraphy
DSC .....Digital Selective Calling
EAM .....Emergency Action Message
E03a .....UK Cherry Ripe, 5-figure groups in female voice
FAX.....Radiofacsimile
FEMA.....US Federal Emergency Management Agency
HFDL.....High-Frequency Data Link
HF-GCS.....High-Frequency Global Communication System
LSB.....Lower Sideband
MARS.....US Military Affiliate Radio System
MFA.....Ministry of Foreign Affairs
MSK.....Minimum-Shift Keying
NASA.....US National Aeronautics and Space Administration
NAT.....North Atlantic Air Route Control, nets A-F
NAVTEX .....Navigational Telex
NDB .....Non-Directional Beacon
PACTOR.....Packet Teleprinting Over Radio
PSK.....Phase-Shift Keying
RTTY .....Radio Teletype
SECURE .....State Emergency Capability Using Radio Effectively
Selcal.....Selective Calling
SITOR-A/B.....Simplex Telex Over Radio, mode A or B
UK.....United Kingdom
Unid .....Unidentified
US.....United States
USAF .....US Air Force
USCG.....US Coast Guard
V13 .....Taiwan, female 4-figure numbers and music
XSL.....Japanese encrypted data with jangly idler

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 ().

12.6 Unid-Russian "Alpha" navigation, Krasnodar, pulsed carrier every 3.62 seconds, at 1940 (PPA-Netherlands).
18.1 RDL-Russian Navy, RTTY identifier at 1215 (PPA-Netherlands).
19.6 GQD-UK Royal Navy, Anthorn, encrypted MSK at 1916 (PPA-Netherlands).
24.0 NAA-US Navy, ME, encrypted MSK at 0624 (PPA-Netherlands).
25.0 RJH69, pulsed time signals at 0714 (PPA-Netherlands).
25.5 RJH69-Russian standard time signals, Molodechno, Belarus, carrier at 0630, then went to 23.0 at 0635, and 20.5 at 0641 (PPA-Netherlands).
350.0 ROT-NDB, Rotterdam, Holland, CW identifier at 0525 (Ary Boender-Netherlands).
399.0 NGY-NDB, New Galloway, UK, CW at 2040 (Boender-Netherlands).
406.5 BOT-NDB, Bottrop, Germany, CW at 2019 (Boender-Netherlands).
408.0 BRK-NDB, Vienna, Austria, CW at 2021 (Boender-Netherlands).
414.0 SLB-NDB, Oslo, Norway, CW at 2023 (Boender-Netherlands).
500.0 SK6RUD-Radio Rud amateur club 600 meter experimental beacon, Sweden, markers in CW and QRSS (extremely slow CW), at 1927 (DL8AAM-Germany).
501.0 SM6BGP-Amateur experimental beacon, Sweden, CW and QRSS markers at 1910 (DL8AAM-Germany).
505.2 DI2AM-Amateur experimental beacon, Rostock-Schmarl, Germany, QRSS marker at 1647 (DL8AAM-Germany).
507.0 VX9MRC-Experimental beacon, Torbay, NF, Canada, CW marker at 0400 (DL8AAM-Germany).
508.8 WE2XGR/6-Experimental station, Penn Yan, NY, slow CW identifier at 0220 (DL8AAM-Germany).
518.0 "A"-French Search and Rescue Center, Corsen, NAVTEX warnings at 0001. "E"-Niton Radio, UK (GNI), NAVTEX weather and maritime warnings, at 0040 (MPJ-UK).
1852.0 IPP-Palermo Radio, Italy, weather in English and Italian, at 2111 (MPJ-UK).
2142.5 ZHEL-German Customs Cruiser Helgoland (DBQL) working ZLST, Cuxhaven, also on 2637, 4553.5, ALE at 2137 (MPJ-UK).

2187.5 256376000-Unknown Malta registry vessel, working 2BYA3, UK vessel Nomadic Bergen, DSC test at 1807 (MPJ-UK).
2600.0 IQQ-Mazard del Vallo Radio, Italy, weather in Italian at 2102 (MPJ-UK).
2624.0 IQX-Trieste Radio, Italy, weather in Italian at 2119 (MPJ-UK).
2656.0 IPA-Ancona Radio, Italy, weather in Italian at 2117 (MPJ-UK).
2680.0 IDC-Cagliari Radio, Italy, weather in English and Italian, at 2048 (MPJ-UK).
2886.0 Unid-Fishermen with salty language and Scottish accent, at 2058 (MPJ-UK).
3131.0 November Whiskey-US Navy tracking coordination net, working Lima and Golf, also on 4736, at 2354 (Jack Metcalfe-KY).
3159.5 Gunslinger-US Army exercise, working Newcastle Fire and Sea Sensor, looking for Widowmaker, clear and secure at 2344 (Metcalfe-KY).
3308.0 AFA5RT-USAF MARS, North Central Area Net at 1103 (Mark Cleary-SC).
3322.0 Unid-Russian Air Defense, time-stamped CW tracking datagrams, also on 6823.5 and 7834, at 1541 (MPJ-UK).
3390.0 NNN0HVK-US Navy/Marine Corps MARS, NC, Region 4 Net with NNN0SKZ and NNN0VLK at 0013 (Cleary-SC).
3455.0 New York-Caribbean air control net B, position and heading from Martin Air 618, went to 2887 due to poor copy, at 0240 (Prez-MD).
3595.0 ZPRI-German Customs Patrol Boat Priwall, calling BSEA (Fishery Protection Boat Seeadler), ALE at 0250 (ALF-Germany).
4002.9 AAV4DJ-US Army MARS, TN, LSB net traffic at 0040 (Cleary-SC).
4013.5 NNN0VWV-US Navy/Marine Corps MARS, KY, Region 4 net at 0010 (Cleary-SC).
4026.9 AAR4CY-US Army MARS, Region 4 Net at 1112 (Cleary-SC).
4032.9 AAA3VA-US Army MARS, Region 3 Net with AAM3IVA, LSB at 1119 (Cleary-SC).
4038.5 NNN0GBS-US Navy/Marine Corps MARS, SC, South Carolina Net with NNN0UTE and NNN0AAG, at 0027. NNN0EKB, Florida net at 2304 (Cleary-SC).
4145.0 CAV2FIXED-US Army exercise, calling CAV3FIXED, also on 4198, 4410, 4670, 4775, 4870, 4876, 4931, and 5610, all ALE at 2045 (Metcalfe-KY).
4146.0 UF2-Unknown multinational naval net, tracking coordination in German, at 2323 (ALF-Germany).
4231.5 Unid-Japanese military "slot machine" station (XSL), PSK idlers and data packets, simulcasting on 4153 (weak), 6250, 6417, 6445, 8313, 8558, and 8703.5 (weak), heard on board ship near Japan, at 0410 (Jon Van Allen-Maritime Mobile).
4274.0 Projector-US military, possible airborne command post, with a 28-character EAM simulcast on 8992, 11175, and 15016, at 1930 (Jeff Haverlah-TX).
4363.0 Iqaluit-Canadian Marine Communications and Traffic Services, Resolute, NWT, voice synthesized "male" with Arctic weather, at 0240 (Prez-MD).
4372.0 Delta-Probable US Navy single-letter tactical calls, Link-11 coordination net with Foxtrot and November, at 1150 (Cleary-SC).
4442.0 USDAHQ1-US Department of Agriculture, Washington, DC, working 010CDCNHQ, US Centers for Disease Control, ALE at 1754 (Metcalfe-KY).
4500.0 AFF4FL-USAF MARS, FL, Region 4 net control, working AFA4RA, AFA4BL (FL), AFA4LQ (FL), and AFA4HR, at 2303 (Cleary-SC).
4517.0 Unknown-USAF MARS North Central Area net, in progress at 0004 (Cleary-SC).
4540.0 "Uniform-1-Victor"-North Atlantic Treaty Organization, tracking messages with "3-Bravo-Foxtrot," at 1237 (MPJ-UK).
4560.0 TAH-Istanbul Radio, Turkey, Turkish and English language weather, SITOR-B at 2002 (PPA-Netherlands).
4585.0 Unid-US Civil Air Patrol, calling the North Carolina Net at 2305 (MDMonitor-MD).
4593.5 AFN3WV-USAF MARS, North East Area Net with AFA2RD, at 2332 (Cleary-SC).
4601.5 Unid-Irish Navy, selcalling XSFM in SITOR-A, at 1934 (PPA-Netherlands).
4623.5 NNN0BCI-US Navy/Marine Corps MARS, VA, 3B1B Virginia Net with NNN0FNO, NNN0XMMT, and NNN0XZQT, at 2314 (Cleary-SC).
4721.0 277171-USAF C-17A, ALE sounding at 0656 (Cleary-SC).
5035.0 WIDOWMAFIXED-US Army exercise, working ALPHA1FIXED, ALE at 2200 (Metcalfe-KY).
5037.5 Latam 58-Polish military, formatted "telegram" messages in Polish, at 1050 (ALF-Germany).
5097.0 CFH-Canadian Forces, Halifax, NS, RTTY marker, also on 10945, at 2138 (MPJ-UK).
5140.0 WNBE830-Missouri Emergency Management Agency, net control of weekly Operation SECURE, checking in three OK Department of Energy Management stations, at 1430. TLWY1-IL Operation SECURE at State Tollway Agency, working STATEEOC2 (State Emergency Operations Center), D09IDOT (IL Department of Transportation District 9), and D12ISP (State Police); also on 5135, 5192, 7477, 7932, and 7935; all ALE at 1450 (Metcalfe-KY).
5195.0 El Paso-Texas Department of Transportation regular Monday Net, with San Antonio and others, at 1334 (Metcalfe-KY).
5258.0 ZLST-German Customs, Cuxhaven, calling BP24, ALE at 0707 (PPA-Netherlands).
5456.0 RMEW-Russian Navy vessel, CW duplex with unknown station, messages for RJE73 and RJH45, at 0440 (ALF-Germany).
5580.0 Unid-Possible Czech Republic air defense, tracking data sent in the blind, daily at 0430 (ALF-Germany).
5655.0 9V-SLJ-SilkAir A320, HFDL log-on at 2304 (MPJ-UK).
5696.0 CAMSLANT Chesapeake-USCG, VA, working HU-25D Coast Guard 2102, at 0003 (Allan Stern-FL).
6340.0 NMF-USCG, Boston, MA, FAX Atlantic Surface Analysis chart, at 1750 (Prez-MD).
6513.0 VFF-Canadian Coast Guard, Iqaluit, Nunavut, voice synthesized "male" with Arctic weather in French, at 0100 (Prez-MD).
6768.5 Unid-Indonesian language station, giving earthquake reports in CW, at 0930 (Eddy Waters-Australia).
6778.0 "Kilo-8-Bravo"-Probable US military exercise station using a trigraph call for a 28-character EAM, similar activity on 6833, 7501, and 8035, at 2239 (Metcalfe-KY).
6824.5 Outlaw-US Army exercise, target coordination with Steel Dragon Main, at 2106 (Metcalfe-KY).
6933.0 RHI-Saudi Air Force, calling AAI, ALE at 1847 (PPA-Netherlands).
6967.5 IGTN-Italian Coast Guard, position for shore station ICI101, at 1006 (ALF-Germany).
7361.5 STPOPS-MN Army National Guard, St. Paul, ALE sounding at 0300 (MDMonitor-MD). MUIOPS-PA National Guard, Muir Army Air Field, calling KEYAVN (PA National Guard), ALE at 1855 (Metcalfe-KY).
7457.0 AFA4RD-USAF MARS, FL, Region 4 Net with AFA4SW, at 1307 (Cleary-SC).
7510.0 SELF-US Army Continuity of Operations, testing ALE, voice, text and data with TEST1 and TEST2, at 1858 (Metcalfe-KY).
7530.0 CAMSLANT Chesapeake-USCG, VA, weekly District Communications Net, also on 11436, at 1300 (Metcalfe-KY).
7630.5 AFA5NF-USAF MARS, alternate net control in NE1S1 net, at 1303 (Cleary-SC).
7635.0 Louisiana 30-US Civil Air Patrol, working Middle East 34 at 1403 (Metcalfe-KY).
7710.0 ARAR-Saudi border guards Ar'ar, ALE sounding at 1918 (PPA-Netherlands).
7756.7 Unid-Egyptian Embassy, Rome, Italy, urgent 5-letter group message for "71" in Arabic ARQ, at 1845 (ALF-Germany).
7862.0 OMMELEHMOB9-Saudi Arabian Border Guards mobile, link check with base OMMELEH, ALE at 1715 (ALF-Germany).
8023.0 WGY 9441-FEMA Auxiliary Station, Michigan, ALE sounding at 0018 (ALF-Germany).
8066.7 SSE-Egyptian MFA, Cairo, working Rome in Arabic ARQ, at 1845 (ALF-Germany).
8156.0 C6WC-Royal Bahamas Defence Forces, ops report to Coral Harbour Base, at 1131 (Cleary-SC).
8161.5 KBDLNG-CT Army National Guard, ALE sounding at 2217 (ALF-Germany).
8345.0 RBES-Russian Navy, calling RMP (Baltic Fleet, Kaliningrad), CW at 0013. RKW95, calling RIW (Headquarters, Moscow), CW at 0300. RKW95, calling RIT (Northern Fleet, Severomorsk), CW at 0320. RFH77. working RCV (Black Sea Fleet, Sevastopol), CW at 2150 (MDMonitor-MD).
8446.5 HEB28-GlobalLink/ Berne Radio, Switzerland, PACTOR idler and CW identifier at 1430 (MPJ-UK).
8806.0 WLO-Shipcom/ Mobile Radio, AL, voice synthesized tropical Caribbean and Pacific weather, then traffic list, at 0100 (Prez-MD).
8891.0 Reykjavik-NAT-B oceanic air control, position and altitude check with KLM 681, at 2124 (Prez-MD).
8903.0 Accra-Oceanic air traffic control, Ghana, getting position of Cubana 995, at 0230 (Prez-MD).
8912.0 Z13-USCG Sector Key West, FL, calling 720 (C-130H Coast Guard 1720) and TSC (COTHEN, FL), ALE at 1910. Z29-USCG San Diego, CA, calling J37 (MH-60J Coast Guard 6037), ALE at 2010 (MDMonitor-MD).
8971.0 Fighting Tiger 71C-US Navy P-3C, clear and secure with Fiddle (Jacksonville, FL), at 1638 (Stern-FL).
8977.0 CC-CXC-LAN Chile Boeing 737, HFDL position at 0955 (MPJ-UK).
8983.0 CAMSLANT-USCG, VA, message relay to Swordfish 14, a HU-25 on possible contraband interdiction, at 1345 (Cleary-SC).
8992.0 Convoy 3233-US Navy C-130T, patch to Duty Ops at Pt. Mugu, CA, at 2240 (Cleary-SC).
8992.0 Spit Ball-US military, 28-character EAM simulcast on 4724 and 11175, at 1433 (Haverlah-TX).
9007.0 Rescue 336-Canadian Forces CC-130E, patch via Trenton Military to Rescue Coordination Centre, at 2304 (Cleary-SC).
9025.0 JDG-US Naval Support Facility, Diego Garcia, calling JTY, Yokota, Japan, ALE at 1832 (PPA-Netherlands).
9110.0 NMF-USCG Boston, FAX surface analysis chart at 1743 (PPA-Netherlands).
10063.0 CO0590-Continental Airlines, HFDL position for Panama, at 2323 (MPJ-UK).
10100.0 DDK2-Pinneberg (Hamburg) Meteo, Germany, RTTY weather for North Sea and English Channel, at 1250 (Prez-MD).
10202.0 WGY9441-FEMA, ALE sound at 1754 (Cleary-SC).
10388.0 RJE56-Russian Navy, long CW message for RIT at 0915 (PPA-Netherlands).
10588.0 WGY916-FEMA, TX, voice and data with WGY 908, CO, at 1650 (Metcalfe-KY).
11104.0 BRD-NASA Booster Recovery Director, FL, working Booster Recovery Vessel Freedom Star downrange for Ares I-X launch, at 1514. Liberty Star-NASA BRV, working Freedom Star at 1522 (Stern-FL). [Ares uses a recoverable solid booster. -Hugh]
11175.0 Offutt-USAF Offutt HF-GCS, NE, all-frequency request for Rear Door, then announced that Offutt was maintaining "simulated no contact except for real world Rear Door," at 1912. Rear Door, working Offutt for a "real world" patch, was sent to 11220, at 1913. Legit 21-US military, passing exercise message to Skymaster, at 2331 (Haverlah-TX).
11205.0 Smasher-US military flight following, calling Skywatch, Honduras, at 2012 (Metcalfe-KY).
11220.0 Headliner-US military, came from 11175 for patch via Offutt HF-GCS to Reinstate for frequency assignment, at 1538. Rear Door, came from 11175 for patch via Offutt HF-GCS to Red Cedar for orderwire, at 1915 (Haverlah-TX).
11430.0 "Star Star Radio Station"-Taiwan numbers in Chinese (V13), AM at 1200 (Waters-Australia).
11513.0 RJE56-Unknown Russian warship, calling RJS, CW at 1323 (MPJ-UK).
12353.0 Tug Sentinel-Crowley Maritime, calling WPE Jacksonville, at 1413 (Cleary-SC).
12577.0 002241021-Bilbao Radio, Spain, calling 235053716 (MQVL4), UK registry Vehicle Carrier CSAV Rio Aysen, DSC at 1106 (PPA-Netherlands). [CSAV = Compañía Sud Americana de Vapores, Chile. -Hugh]
13303.0 N203UW-US Airways Boeing 757, HFDL position for Canarias, at 0946 (MPJ-UK).
13907.0 Coast Guard 1501-USCG HC-130, working Sector Key West on a search, at 2003 (Cleary-SC).
13927.0 Bison 67-USAF C-130H, patch via AFA1RE, USAF MARS, ME, at 1652 (Cleary-SC). AFA5QW-USAF MARS, IN, patching aircraft to Peachtree Ops (Robins AFB, GA), at 1804. AFA9AY-USAF MARS, CA, patching Evac 46703 to request ambulance meet plane on arrival, at 2300 (Stern-FL).
14221.0 RJE56-Possible Russian warship, calling RJE67, CW at 1356 (MPJ-UK).
14300.0 WGC5C-US Coast Guard Amateur Net, TX, weekly net control at 1601 (Cleary-SC).
15016.0 Rear Door-US military, EAM broadcast at 2200 (Cleary-SC).
15016.0 Club Dues-US military, 32-character EAM simulcast on 8992 and 11175, then standing by for traffic, at 1830 (Haverlah-TX).
15658.0 494FEMAUX-FEMA Auxiliary Station, CO, working 010CDCNHQ, US Centers for Disease Control, ALE at 2001 (Metcalfe-KY).
16525.0 Cherry Ripe-UK Intelligence (E03a), introduction tune and numbers, also using 18465, 20610, and 21865, at 0500 (Waters-Australia).
16804.5 A8CC4-Liberian registry container ship APL Arabia, DSC to Lyngby Radio, Denmark, setting up USB on another frequency, at 1531. V7LN9-Marshall Islands registry oil tanker Targale, DSC test to Rescue Coordination Center Las Palmas, Canary Islands, at 1610. ICLW-Italian registry freighter Medi Baltimore, urgent DSC call to IBCK, freighter Cielo Di Roma, who replied, setting up USB at 1708 (Ken Maltz-NY).
16971.0 JSC-Kyodo News, Kagoshima, Japan, FAX sign-on and into "Morning News" in Japanese, 60 lines per minute, at 2259 (Hugh Stegman-CA). [Japanese listings show JSC as a Pacific beam for fishing boats, on this freq only.-Hugh]
19250.0 A96-Unknown, calling A99 every 30 minutes, ALE at 0707 (Waters-Australia).
19586.0 192-Unknown, calling 191 in ALE, at 0732 (Waters-Australia).
19744.4 8PO-Globe Wireless, Bridgetown, Barbados, identifier bits in Globedata idler, at 1353 (MPJ-UK).

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South American ALE Nets

This month we have some updates to active South American ALE networks.

❖ Chilean Police ALE Network

This network, first revealed in this column in the April 2009 issue of *MT*, built up considerably during the summer and fall months. With the increase in stations, it soon became apparent that the Carabineros were not the source of the transmissions, as fewer of the new participants fit police locations.

We now know that this network belongs to the Army, with most locations in the order of battle now covered with an ALE-equipped station. There is still relatively little traffic on this system, ALE being used mostly to provide quick call-ups and the rest of the chatter being carried out in voice on USB.

Here again are the frequencies on which this network operates: 6920, 7527, 7755, 7922, 8125, 9075, 10530

The identifiers are as follows:

BASEATACAMA	1st Engineers Battalion, Calama
BASEBAVE	
BASECAZADORES	2nd Armored Brigade, Pozo Almonte
BASECHACABUCO	7th Reinforced Regiment, Concepcion
BASECHILLAN	9th Infantry, Chillan
BASECHILOE	8th Engineers Regiment, Chiloe
BASECOQUIMBO	21st Infantry, La Serena
BASECORACEROS	1st Armored Brigade, Arica
BASEESCINF	Infrantry School, Santiago
BASEESCART	
BASEHUAMACUCO	17th Reinforced Regiment, Putre
BASEHUSARES	3rd Armoured Cavalry, Angol
BASEJEFCO	HQ, Santiago
BASELANCEROS	5th Reinforced Regiment, Puerto Natales
BASELIMACHE	3rd Logistics Regiment, Santiago
BASELOSANGELES	17th Reinforced Regiment, Los Angeles
BASEMATURANA	2nd Artillery Regiment
BASEMEMBRILLAR	4th Signals Regiment, Valdivia
BASEPUNTAARENAS	5th Engineers Battalion, Punta Arenas
BASERANCAGUA	HQ, Army Aviation Brigade
BASEROSELA	
BASETALCA	16th Infantry, Talca
BASETARAPACA	6th Signals Regiment, Pozo Almonte
BASETUCAPEL	8th Mountain Infantry, Tucapel
BASEVICTORIA	4th Logistics Battalion, Victoria
BASEYUNGAY	3rd Reinforced Regiment, Los Andes

❖ Venezuelan Navy ALE Network

The Venezuelans were one of the first South American countries to be regularly heard on HF ALE. At one time there were many active networks used by the Army, Civil Defense, National Guard, Marines and Presidential Guard. The Navy also operated at least three networks for the ocean-going fleet, on the major inland rivers like the Orinoco and Acure and another for the Coast Guard. You can check this column in the June 2007 issue of *MT* for the early history of the Naval ALE networks.

Most of these networks have left, or perhaps moved from the old 2G (2nd Generation) MIL-188-141A ALE systems to the new generation of HF equipment. However, the inland river Naval network continues to flourish and remains very active.

I have been watching these frequencies for the frequent exchanges of long text messages that are completed with the use of DTM messaging, a standard part of the MIL-188-141A protocol. These messages are used to convey anything from commands from the HQ in Caracas, weather reports, regular news to navigational warnings and shipping movements.

At one point, the network used identifiers that matched easily with their sources. For example, ALE identifier "F24" for the Frigate *General Soublette* and "BE11" for the training ship *Simon Bolivar* (F24 and BO11 being the hull numbers of those particular ships). While the use of these ALE identifiers continues at low levels, the majority of traffic is sent using semi-tactical callsigns. I say semi-tactical in that they are not easily tied to the source, but they do not change on a frequent basis.

The main motivation for watching the DTM traffic has been to try to match the semi-tactical callsigns used by the participants with their users. This has been very slow going for a number of reasons, including the fact that there appears to much relaying of messages from one station to another and that some of the addresses may represent a flotilla of ships rather than a single vessel or Naval Base.

Perhaps you'd like to help with discovering more about which identifier is which ship or base?

Here are the known frequencies – mostly on LSB but sometimes USB on the same channel – on which the network operates:

5334, 5439, 5841, 6255, 6280, 6283, 6284, 6357, 6360, 6888, 6894, 6895, 6963, 6965, 7357, 8180, 8275, 8280, 8285, 8290, 8297, 8298, 8340, 8358, 8500, 8540, 8582, 8810, 9017, 9075, 9190, 9350, 9355, 9380, 9400, 10650, 12480, 13139, 13500, 17080, 19098 and 20400 kHz

Here are the ALE IDs with sources known so far:

1C3Z	F-24 Frigate "General Soublette"
1DV6	
1EW1	Naval Base Agustin Armario (BNAR)
1F5G	
1FS8	
1HG9	
1JT4	
1LY3	
1PZ2	
1W1S	
1XV7	T-61 Landing Ship "Capana"
1Z8C	BO-11 Oceanographic Survey Vessel "Punta Brava"
2PO2	
2TB9	T-63 Landing Ship "Goajira"
2XM7	
3K5I	
3KF4	ESGAS
3QB2	
3V2Y	
3WP1	
4FJ0	
4LA3	EPGZ07, PG407 Patrol Ship "Fardela"
4SK2	
5AL1	
5CT8	
5EA3	
5JL1	
5TL1	
6EW7	
6E78	
6GY2	
6QA8	T-62 Landing Ship "Esequibo"
6T4T	
71XV	
7P4S	
7Q8W	
7RC4	Flotilla CGT 23.4 (F21, F24, T62)
8AV4	
8DV9	T-64 Landing Ship "Los Llanos"
9FS3	
LSH3	
T5L1	BNAR CEDCOMEBA
T54W	
T8R1	CGA HQ Caracas
V5A4	

At the time of writing, I'm watching several days of Caracas sending network channel updates to various stations in the system, and yet another callsign change seems to be underway to denote a split into three sub-networks. Caracas is now using CGA1, CGA2 and CGA3 for net control on each sub-network. Outstations like Landing Ship T64 "Los Llanos" now use identifiers like T611, T612 or T613 according to the network in use.

❖ Ecuadorean Navy Update

First reported in the February 2006 issue of *MT*, the Ecuadorean Navy seems to bounce around a number of channels at night around the 8 MHz maritime band in order to maintain links using the MIL-188-110A high-speed modem.

The network has now been heard regularly on the following frequencies: 7900, 8165, 8750, 8758, 8873 and 8973kHz USB.

That's it for this month. Until next time, please keep the letters and emails coming and here's to better propagation during 2010 and the beginning of Cycle 24!

ON THE HAM BANDS

THE FUNDAMENTALS OF AMATEUR RADIO

T.J. "Skip" Arey, N2EI
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A Ham's Calendar

Another year come and gone. Time to repost Uncle Skip's annual New Year's resolutions. Write these out 10 times each.

1. If I do not have an Amateur Radio license I will get licensed this year.
2. If I do have a license I will upgrade it to the next highest license until I am an Extra class.
3. If I am an Extra class I will find somebody who isn't licensed and help them get licensed.
4. I will repeat number 3 until everyone I know has their own callsign.

Okay, with the annual New Year's obligations out of the way, allow your humble ham radio writer to wax pensive for a bit.

The first day of the year usually finds me updating my shack desk calendar for notable events that will follow through the year. (Between Straight Key Night QSOs, of course!) I take the time to make note of all the contests I like to operate. Of course I plug in Field Day. (June 26th this year, folks.) But, over the years, I have also made note of notable personages and passages in the amateur radio world. I find it fun to have this information at hand to remind me of what a great hobby ham radio has always been. I also find they are great rag chewing fodder for those times on the air when the conversation grows a bit thin.

Allow me to share a few of my favorites to get you started. You can add those that you enjoy to your own calendar and seek out a few additions that make sense to you as well.

❖ We Stand on the Shoulders of Giants

If they put me in charge for a few days, I'd certainly write a lot of new holidays in the books. There are quite a few folks to whom we owe an enormous debt of gratitude for making this thing we call radio possible. Their discoveries and the inventions that followed allow you and me to literally play with the basic forces of the universe. How cool is that?! Let's tick off a few folks to keep in mind on their birthdays, shall we? I will be tossing in a few other dates as we go along as well.

Michael Faraday - September 22, 1791

Faraday is known to us for his work with electricity and magnetism. It all starts right there, folks. If you can figure out a way to play radio without those two phenomena, you have more on the ball than I do (or anyone else, for that matter).

Samuel F.B. Morse - April 27, 1791

Was 1791 a great year or what? Morse developed a practical telegraph system, but the code system that bears his name outlived the usefulness of his basic invention and is still in use (by folks like me) to this day. I think every ham regardless of their normal operating habits, should bow the dust off their keys and send a few words in honor of old Sam on his birthday. I always do. *(And also to Alfred Vail; see September MT - ed.)*

James Maxwell - June 13, 1831

Anyone who has struggled through a physics course may get the cold shivers when they think of Maxwell's equations. But this Scot took all the work in electromagnetism up to this point and created a single coherent model that, quite literally, serves to hold our universe together. While you're at it, plug in March 14, 1879. **Albert Einstein** took Maxwell's equations and… well… you know the rest.

Heinrich Hertz - February 22, 1857

Another guy who advanced Maxwell's equations, going on to produce a device that demonstrated the existence of electromagnetic waves. In other words RADIO! We used to call them cycles, but those things we keep track of on our radio dials were renamed Hertz in his honor for good reason.

Guglielmo Marconi - April 25 1874

Arguably, the father of radio as we know it. His system of radiotelegraphy made radio a commercial enterprise. As such, research and development along commercial lines advances the radio art, laying the foundation for all the fun we have as hams to this day. Marconi's birthday is always celebrated in the shack here at N2EI. I also make a point of commemorating his first successful transatlantic communication on December 12, 1901.

Reginald Fessenden - October 6, 1866

If you mention Marconi to a non-ham, most folks will nod in recognition. But Fessenden deserves more recognition as a radio pioneer even amongst folks with no amateur radio affiliation. It was the pioneering experiments of Fessenden that brought about the first voice and music transmissions on Dec 24 1906.

As the father of radio broadcasting, we would have to admit that we would all be reading *Knitting Monthly* instead of *Monitoring Times* if not for his work in the radio art.

Nikola Tesla - July 10, 1856

The often misunderstood genius who gave us alternating current (among other things). In 1943, the Supreme Court of the United States credited him as being the inventor of the radio. That puts him on my calendar for certain.

Edwin Armstrong - December 18, 1890

You can keep your De Forest's and your Sarnoff's. Armstrong invented frequency modulation, regeneration, and the superheterodyne reception. In other words, most of what became the basis of modern radio design. Sadly, full credit did not come his way until after his untimely death. We can only imagine where we would be today if the protracted lawsuits with his competitors had not driven him to suicide. Every December 18th, I raise a glass to his memory and dream of what might have been.

Hugo Gernsback - August 16, 1884

Speaking of dreamers, Gernsback opened the minds and imaginations of several generations. In addition to being one of the founders of science fiction, his practical radio and electronics magazine got folks building and using radio equipment in the early days of the radio hobby. Countless folks discovered radio and made it a way of life, thanks to his writing and publishing efforts.

The invention of the vacuum tube is somewhat controversial, with at least half a dozen folks deserving some level of credit. We are much clearer on later developments that took radio into the 21st century.

John Bardeen - May 23, 1908, Walter Brattain -February 10, 1902 and William Bradford Shockley- February 13, 1910

These three gentlemen worked in concert to give the world the first practical transistor, the basis of nearly all modern electrical devices. Admittedly, they built upon the theoretical work of Canadian physicist **Julius Lilienfeld -** April 18, 1882, who should also be noted on any ham's calendar.

Jack Kilby - November 8, 1923

Demonstrated the first working integrated circuit on September 12, 1958. Building on the work of **Geoffrey Dummer -** February 25, 1909. From this, we now have chips with millions of transistors on them performing the most mundane tasks of modern life.

❖ Dates by Hams for Hams

While we have been standing on the shoulders of those aforementioned giants, amateur operators have quite a few of their own accomplishments they can trumpet – all of which have a place on my shack's desk calendar.

January 2, 1909

Is thought to be the date that the first amateur radio club was formed. The Junior Wireless Club, Limited, of New York City first met on that date. They later changed their name to the Radio Club of America. I wonder who brought the donuts?

November 27, 1923

This is a day we should commemorate by working a little DX. On that date US Ham Fred Schnell completed the first successful transatlantic QSO with French Ham Leon Deloy. I can't help thinking that Fred ran up out of the basement to tell his XYL who calmly looked up from her reading saying "That's nice dear."

Yuri Gagarin - March 9 1934

Was the first man in space an amateur radio operator? Gagarin was, for a long time credited with holding the callsign UA1LO. This has come under some scrutiny in recent years based upon QSL card reviews. It's nice to think that he may have been. Anyway, Yuri was *still* the first man in space. Folks celebrate his birthday with Yuri's Night celebrations all over the world.

I may not be entirely sure who the first amateur radio operator in space was but I do know who the first ham was. The United State sent a monkey named **Ham** on a sub-orbital mission with successful recovery on January 31, 1961. If you recall that Yuri Gagarin went up on April 12, 1961, Ham the monkey is still the first Ham in space. You might be able to use this information to win a few bar bets at Dayton this year. Give it a try.

Owen Garriott W5LFL -November 22, 1930

Owen was, in fact, first amateur radio operator to use ham radio from space in 1983. In 2008, his son **Richard (Lord British) Garriott W5KWQ** - July 4 , 1961, went into space as a civilian and also operated ham radio from space.

While we are up in space, I would be remiss if I did not point out the importance of December 12, 1961. On that date our first amateur radio satellite OSCAR 1 orbited the earth sending back "HI" in CW to folks on the ground. Dozens of birds have gone up since then, capable of so much more. But I will always have a warm fuzzy feeling for our first OSCAR.

January 10 1946

John DeWitt made the first successful reception of echoes off the Moon being transmitted from Fort Monmouth New Jersey. While this was a military project, over the years, hams have done much to perfect this mode of operation, including the developments of amateur radio's own Nobel Prize winning physicist, **Joe Taylor K1JT**. Come to think of it, Joe is one of those folks whose shoulders the rest of us stand on. Maybe we need a Joe Taylor Day, too. His birthday is March 29, 1942. Send him a card to say thanks.

There are a couple of dates I post with some small sadness.

March 30, 1992

The date that Heathkit announced that it was closing out its kits and leaving the business after 45 years. I can't remember how many Heathkits I have built over the years and the incredible joy that melting all that solder gave me. I still cloud up a bit when I think about the first time I drove past the Heath Store on Frankfort Avenue in Philadelphia and saw it closed down. A very sad day.

February 23, 2007

The FCC removed the CW testing element for all amateur radio licenses. As a dedicated CW freak I could not help but feel sad about this. However, I am happy to report that the CW portions of the bands are still busy with signals. Feel free to come on down and join in the fun. We'll all be happy to help you out.

You get the idea? I have no doubt that you can come up with quite a few more ham radio related commemorative dates to add to your personal calendars. How about the date you were first licensed? (June 29, 1976, here.) Or maybe the date you finally completed DXCC (January 7, 2000. Yeah I know; I was so busy building things I never got around to working that much DX. Go figure.)

2010 ARRL Handbook for Radio Communications
87th Edition
Editors H. Ward Silver N0AX and Mark J. Wilson K1RO
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As the header indicates, this is the 87th edition of the League's *Handbook*. It is the 35th *Handbook* I have personally owned and pored over for… well… until the next edition comes out. At more than 1250 pages, this edition is the biggest one ever. More than that, the 2010 *Handbook* is the most revised, reedited and rewritten in many years. Over 70% of the material in the 2010 *Handbook* has been brought up to date to make this edition a must have for any ham. The book also comes with a fully searchable CDROM of all material.

While the *Handbook* remains the standard by which all other practical radio communications books are judged, for me at least, it remains a source of project ideas that keeps my soldering iron warm all year long. Each edition brings a number of new projects worth considering. This year, two stand out for me: a Four-Output Switching Bench Power Supply and an Automatic Sealed Lead-Acid Battery Charger that can keep my QRP gear fat and happy. For folks who have an interest in running a bit more than 5 watts, you may find the 250-W solid-state amplifier project just the thing to push out a DX worthy signal.

All this, and all the information you have come to expect from the *Handbook* over the years. Buy one for yourself and buy one for a young person just getting started in radio. You can bet that 35 years from now they will still be thanking you too!

Well, the smoothed Sunspot number is slowly creeping up. Here's hoping for a great year on the bands. I'll be listening for you on the bottom end of 40 meters. Have Fun!

GETTING STARTED

THE BEGINNER'S CORNER

Ken Reitz, KS4ZR
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Shortwave Listening and Art

Even in 2010, surrounded as we are by the perfection of digital audio from our iPods, XM receivers, HD-Radios, CD players and Internet radio, there remains the undeniable allure of the sound of analog shortwave broadcasting. What is it about the uncertainty of the signal, the faulty audio twisting in the ether, torn and pushed along by unseen forces, bouncing along between the varied surfaces of the planet and the fluctuating layers of atmosphere, that brings foreign voices and music to our ears? It's an unanswerable question, but its description alone helps explain the allure of HF that has us slowly turning the dial and absorbing the sounds.

I have a Sony in-dash AM/FM/SW radio that I listen to whenever I'm in the car. Pressing the "seek" button on either of the shortwave bands, the receiver silently tunes through the frequencies until it finds a signal, any signal strong enough to get the radio to stop and listen. Sometimes it lands on a Spanish numbers station and I'll listen for 10-15 minutes to the droning, staccato of the computer-generated voice. It's a woman's voice and as innocuous as the one that gives me the weather report from my local NOAA weather radio station. But, since it's a computer-generated voice, why not make it sound like Darth Vader or some other unworldly voice. Spooks must not have much imagination.

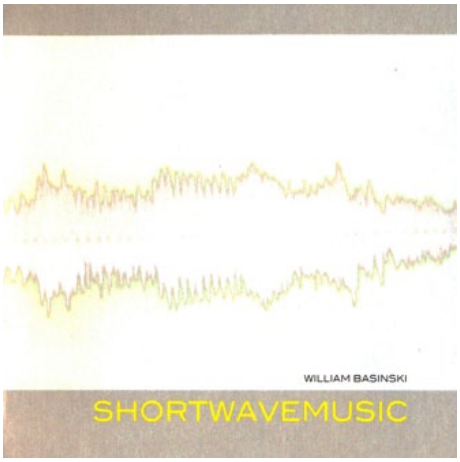
One recent weekend I was on the road during a RTTY contest and the seek feature landed squarely in the middle of the 20 meter amateur radio RTTY frequencies where several different stations, with their "deedledeedle" characteristic RTTY sounds, made an interesting tonal variation on a signal theme. It was, in its own narrow sense, music. Sometimes the radio falls on 15.000 MHz, WWV, the station that tells the correct time, the absolutely correct time, every second of the day, and I'll listen again for 10 or 15 minutes. The thumping tone and incessant "tick-tock" audio is also, in a sense, music.

Inspiration for audio art: Radio station WWV, Ft. Collins, Colorado and its very short playlist yet surprisingly large audience. (Courtesy: NIST)

During my commercial radio career from 1965-70, as anyone who had access to production studio facilities would, I made what is now known as transmission art. Of course, I thought I was just having fun. Using broadcast reel-to-reel tape decks, a mixing console, patch panel, a considerable sound effects library and deft use of a tape splicing block, I would turn ordinary Top 40 tunes into something considerably different. Today this would be called remixing or a "mashup." Every now and then I would broadcast one of the concoctions on the air. Once a listener called up to say that he had bought the record I played, but it didn't sound anything like the one he had heard on the radio.

Cover art for Anna Friz, Canadian sound and radio artist (Courtesy: Anna Friz)

We had primitive single track, analog gear to work with in those days, especially at the stations I worked. But, by looping tapes and vinyl through the console and into another tape deck you could get a really nice echo. Running the recorded echo tape backwards through to another deck would get even wilder sounds. Running sound effects through the echo tape and selected parts of various records you could really have fun. Then, of course, if you added voice to the mix it was even better!



Cover art for William Basinski's Shortwave Music (Courtesy: Boomkat.com)

❖ Audio Music History

Mixing radio and audio to make art is a long tradition in radio. Finding art in the sounds emanating from shortwave radios dates to the early 1950s with the experimental work of Karlheinz Stockhausen, a German composer who used what he called "found objects" in his compositions. In one case he referred to "shortwave events" that he added to his performances. The controversial composer inspired many later musicians including Frank Zappa, Pete Townsend and Jerry Garcia and appeared among the crowd on the cover of the Beatles 1967 LP *Sgt. Pepper's Lonely Hearts Club Band*.

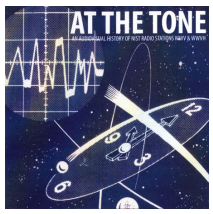
Cover art for 30: A Retrospective 1976-2006 (Courtesy: Myke Weiskopf)

Experimental composer John Cage released *Variations V* in 1965. In the premier performance, shortwave radios and tape recordings of various common sounds, recorded by Cage, were mixed with other electronic sounds including percussion by Robert Moog.

Today, there are actually quite a few people doing this type of audio art. Thanks to versatile personal computers, mixing programs and keyboard synthesizers, anyone with a computer and enough time to understand how the programs work can make their own transmission art.

Some transmission artists have become downright prolific. One such person is William Basinski, a classically trained musician/composer from New York City whose moody, melancholy experimental music is widely available. His 1997 album, "Shortwave Music,"

available in MP3 download from Boomkat.com (www.boomkat.com/item.cfm?id=87511) for £12.49, was re-released in 2007 and features waves of tones and subtle vibrations, evoking SSTV transmissions and WEFAX audio mixed with a barely perceptible interval signal. The few 30 second previews on this and other web pages are little to go on but, still interesting. Pieces such as "Particle Shower," "On a Frontier of Wires," and "Evening Scars," range from subtly intriguing to oppressively irritating.



Cover art for At The Tone (Courtesy: Myke Weiskopf)

The Wave Farm 103point9 is an audio art project that started in New York City and maintains a connection through the Ontological Theater at 131 E. 10th Street and has a tract of land in New York's Catskill Mountains as well. You can listen to all manner of radio-related transmission art emanating from their web site www.free103point9.org, which streams 24/7.

If you listen long enough you'll hear everything from the *Conet Project's* "Phonetic Alphabet" to music in support of the New York Society for Acoustic Ecology featuring performers from Tune (Out)))side. The music on free103point9 is challenging, intriguing, grating, chilling, grotesque, lovely and sometimes just plain inaccessible. But, it's never boring. The free103point9 web site can take you on an amazing audio safari. And, if you check out the list under www.free103point9.org/transmissionartists, you'll find some 23 different transmission artists to listen to.

Free 103point9 Transmission Art logo (Courtesy: free103point9)

One group of recordings that has had a big following is also one that should be familiar to MT readers: *The Conet Project*. These are recordings of shortwave numbers stations, which it claims is the first comprehensive collection of such stations released to the public. The package is comprised of four CDs covering 150 recordings from over the past 20 years. Their web page: www.irdial.com/conet.htm says that the package is currently out of print, but you can put yourself on a list of people who will be notified (by coded numbers?) when the package is back in print.

The Wave Farm has received an FCC license for a 3,300 watt FM station, WGXC-FM on 90.7 MHz in nearby Cairo, NY, which should be on the air by June of this year. Meanwhile, they are streaming the station here: www.free103point9.org/communityradio. According to the station's mission statement "WGXC is a community-run media project, re-envisioning radio as an innovative platform for local participation. Our inclusive programming connects diverse voices, and distributes information across the public spectrum in New York's Greene and Columbia counties."

❖ The Artistic Ear of Myke Weiskopf

Some audio artists started out as shortwave listeners. Myke Weiskopf was very young when he first became obsessed with the sound of WWV that he heard on his new shortwave radio. So obsessed was he that he actually launched a publication about time signal stations called, *The Tick Tock Times*. At the peak of the publication's popularity he had 200 subscribers in six or seven countries. He was 15 years old.

For years Myke kept a blog called Shortwavemusic.com where he stored recordings of randomly received iconic sounds from the shortwave bands and wrote about the art of listening to the sounds of shortwave radio for veteran listeners or those who had never heard a shortwave station before. His blog is now part of his main web site www.mykeweiskopf.com.

Throughout his college years, he worked his interest in radio-related audio into an *avant garde* rock performance group known as *Science Park* that, in 2001, *Boston Globe* called one of Boston's best up-and-coming acts.

It's no great surprise that Myke, who has made several appearances as guest speaker at the Kulpsville annual SWL Fest, found a career in audio art. In 2007 he brought together those first 30 years into a collection of the sounds of the shortwave bands mixed with his own compositions on *30: A Retrospective 1976-2006*. The compilation is comprised of 26 tracks, some as short as a few seconds and others four minutes long. You can sample several of the tracks at www.cdbaby.com/cd/mykeweiskopf.

Titles on the album, such as "Interval Signal," "Ascension Island," and "WWV," refer directly to shortwave listening. His masterpiece, "Wonderful," with its urgent percussion, heavenly choir and selection of edited vocals, skillfully captures the ominous undertones of the ubiquitous, yet decidedly dead, Dr. Scott, still preaching from one of his earthly paradise locations. The pieces on *30: A Retrospective* soar, ripple and wave just as the audio from your shortwave radio does.

In 2008 Myke launched his much anticipated compilation CD of his lifelong affair with WWV called *At The Tone* (ATT). This past November he was offering a fundraising edition of ATT with a different cover and lots of other extras. He may still have some copies of this limited edition print run. More information may be found here: www.myke.me. Myke's music is available at both CDBaby and iTunes.

Today Myke is an associate radio producer with the Los Angeles Theater Works. Their work is heard Saturday from 10 p.m. to midnight on KPCC-FM 88.9 MHz as well as 18 other affiliated radio stations around the U.S.

❖ DIY Transmission Art

As mentioned at the beginning, it's never been easier to create your own transmission art. Some radios, the Kaito 1121 with its built-in MP3 player for example, are made to order for the art, allowing you to record in MP3 .wav files that are easily transferable to your computer and filed. This radio, usually $180 has been discounted to as low as $135 at Universal Radio. Even if all you have is an old cassette tape with built-in microphone and a small shortwave radio you can still have some fun.

Kaito KA1121 is perfect for DIY transmission art. (Courtesy: Kaito U.S.A.)

If you have an electronic keyboard with record out and input jacks you can have even more fun playing with shortwave sounds and doing your own compositions. Like everything else worth doing, the more you do it, the better you'll get.

Eventually, of course, many years from now, all broadcasts on HF will be digital. And sometime, on some station, someone will play the old analog mixes from the transmission artists of today and listeners will have an idea of what it must have been like.

PROGRAMMING SPOTLIGHT

WHAT'S ON WHEN AND WHERE?

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Shortwave from Canada's Olympic City

This month, we shine the *Programming Spotlight* on Vancouver, British Columbia, where in just a few weeks' time, the Winter Olympics will open. We'll look at sports broadcasting among some of the major winter sports nations, shortwave broadcasting from Vancouver, and finally, we'll look at some interesting new programming from Deutsche Welle, aimed at Africa.

The inventors of the Olympics were the ancient Greeks (whose all-male participants competed in the nude). The modern games as we know them were inaugurated in 1896, appropriately in Athens. The Olympic Games were the brainchild of a Frenchman, Pierre Fredy, Baron de Coubertin, an unlikely sports hero and aristocrat who thought physical education could have saved his homeland from military humiliation in the late 1800s. The first few Olympiads were held in the summertime, but in 1924, a winter version was inaugurated.

In 2010, Vancouver becomes the third Canadian city to hold an Olympic games, following Calgary (winter) in 1988 and Montreal (summer) in 1976. Interestingly, all three cities have, or had, shortwave radio stations – but more on that later.

The winter Olympics feature a number of sports one rarely encounters, including such diverse disciplines as biathlon (skiing and shooting), bobsleigh, curling, luge, skeleton (perhaps the scariest sled sport i have ever seen), various forms of skiing and ski jumping, snowboarding, and perhaps the most anticipated events (from my admittedly biased Canadian viewpoint) figure skating, and ice hockey.

As one would imagine, the sports of the Vancouver Olympics are dominated by nations of the northern hemisphere, where one tends to find long, cold winters. One can expect that during the games reporting will be expanded and spill over into the news and feature programming of international broadcasters.

Let's look at sports programming from the dominant players. In 2006 in Torino, Germany walked away with the most medals.

Deutsche Welle – Sports Report

In most Saturday and Sunday DW broadcasts, one can hear ***Sports Report***.

"Be it soccer, tennis, athletics, rugby, boxing or formula one, to name just a few, DW-RADIO keeps you up-to-date with the latest developments in the world of sport every weekend.

"***Sports Report*** is broadcast every Saturday and Sunday with all the latest news and results. ***Sports Report*** brings you fascinating reports on Germany's top sporting personalities, on the success of African football players in Europe or on young people pursuing their dream of becoming Olympic athletes." **www.dw-world.de/dw/article/0,,1848755,00.html**

Sports Report is also available online for listening, or as a podcast for download. There is also a dedicated Sports page, linked on the DW homepage, which has heavy coverage of the German Bundesliga (soccer).

Germany is an Olympic powerhouse; count on lots of coverage via DW.

United States – Sonny Side of Sports

The United States was second in medals at Torino. The Voice of America has an excellent daily sports program called ***Sonny Side of Sports***, beamed to Africa. The program is hosted by Sonny Young, who is an energetic and enthusiastic presenter. Like the DW program there is lots of soccer coverage, especially with the World Cup coming to South Africa this year. The program can be heard daily at 1630 and 1830 UTC, online and via shortwave to Africa.

On Fridays there is a half hour edition at 1730 UTC. The frequencies listed on the VoA website were effective May 1, 2008 (!), so check the *Shortwave Guide* in the center pages of this magazine for the latest frequencies to Africa. You can also subscribe to the program as a podcast. Sonny has a very active Facebook page, with updates on what is or has been on the program and a multitude of links and photos. Just look up ***Sonny Side of Sports*** on Facebook and "become a fan." (Facebook is a great resource for radio fans)

Other Olympic Winners

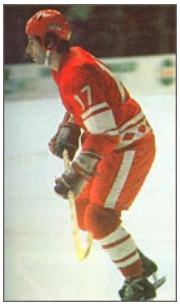
Canada, the host nation was third in medals at Torino. We'll save them for last, as is the Olympic Opening Ceremony tradition.

Austria, Russia and Norway were next. Austria's shortwave output for 2010 is in some doubt as this is written, and Radio Norway long since gave up the shortwave bands. However, ORF (Oesterreichischer Rundfunk) maintains a "Sport" page at **http://sport.orf.at/** Presumably you will be able to hear some sort of sports coverage online via ORF as well, assuming one understands a bit of German.

The Voice of Russia, as this is written, does not have a dedicated on-air sports program, but there is a program available on the VoR website called ***Legends of Russian Sports***.

"The ***Legends of Russian Sports*** series is dedicated to prominent Russian athletes, known for their outstanding achievements and contribution to the Russian and international Olympic Movement." (Voice of Russia website)

Here you can read about, and listen to, programs about the great Soviet and Russian athletes of the twentieth century and beyond. Just a few of the people featured include the great Soviet hockey player Valery Kharlamov, chess champion Anatoly Karpov, and others in such sports as soccer, speed skating and weightlifting. Over the years, the Soviet Union and to a lesser extent, Russia, have been Olympic machines, dominating the summer and winter games. I can easily see this program sliding into the Voice of Russia's regular program line-up as the Vancouver games approach, or as the 2014 games in Sochi, Russia loom on the horizon. You can access the ***Legends of Russian Sports*** at **http://ruvr.ru/main.php?lng=eng&rt=199&p=**



Like the Deutsche Welle site, there is a Sports page on the Voice of Russia website which features the latest sports news. There is lots of soccer and figure skating news as this is written. You can find it near the top of the left hand menu on the English home page.

On the right hand side of the web page, there are regular features about the upcoming Sochi Games in Russia as well, discussing the progress in building the venues. For instance, the alpine skiing venue is to be at Krasnaya Polyana, summer home of Leo Tolstoy, and a favorite hunting ground of Russian rulers from Nicholas

II to Vladimir Putin. Keep an eye on the website as the Sochi Games get closer.

Sweden was next in medals at Torino and is perhaps Canada's principal rival for Olympic Hockey supremacy. Sweden was the only country to walk away with two medals in hockey in Torino, Gold in the men's game, and Silver in the women's tournament. Sweden also won gold in women's curling, and a ton of skiing medals. **Radio Sweden** does not have a dedicated sports program, but there is a link to sports on their home page (in the center-right column). And no doubt, if Sweden is as successful in Vancouver as they were in Torino, it will merit extensive coverage in **SRI's** daily broadcasts. **www.sr.se/rs/english/**

Switzerland, Korea, Italy and China were all in double digits in medals won in 2006. Switzerland and Italy are gone from shortwave. Korea has no dedicated sports program, but **CRI** has a daily sports podcast, and a page of sporting news. You can subscribe at **http://english.cri.cn/08sports/index.htm**

The Czechs and Slovaks are hockey powers; look for coverage of the hockey tournament especially in their broadcasts.

Canada

And finally, we come to the host nation of Canada.

In Canada, a conglomerate led by CTV, TSN and other private sector stations holds the television rights to the Games. For the first time in some years, the CBC will not be involved in broadcasting the Olympics.

On the radio side of things, **Rogers Radio** division in English Canada, and **Corus Quebec** will have broadcast rights for hockey, and the opening and closing ceremonies as well as hourly updates on the various events. A number of stations may give listeners in Canada and the United States an opportunity to hear coverage, including **CKAC 730** (French) in Montreal, **The Fan 590** (English) in Toronto and **News1130** in Vancouver.

Oddly enough, CBC radio recently cancelled its only sports program, ***The Inside Track***. It seems to be very strange timing just before a major sporting event such as this. I know in Canada, the hockey tournament will be highly anticipated. The 2002 gold medal men's hockey game between Canada and the United States was the most watched sporting event in Canadian history. Every hockey game is guaranteed to be available via this radio co-operative.

The Vancouver Olympics promise to be one of the more spectacular events of the year in sports. The Games have come a long way from their Ancient Greek roots. For one thing the athletes will all be clothed in Vancouver, probably a good thing in a winter climate, although the ratings conscious television networks might disagree (especially now that female athletes are equal competitors in the Games).

❖ Sw from Canada's West Coast

Interestingly, all of Canada's Olympic cities have or had shortwave radio stations. Although Montreal's shortwave broadcaster has gone silent, for many years **CFCX** relayed **CFCF** to Quebec and the World (I heard it well here in Southern Ontario).

The ODXA's Harold Sellers, newly moved to the West Coast, has reported hearing Calgary's **CFVP** 6030 kHz, relaying **CKMX, "AM 10-60 Classic Country,"** with fair reception in British Columbia.

CKZU is Vancouver's shortwave station, rebroadcasting Vancouver's **CBU** 690 kHz AM to the British Columbia interior on 6160 kHz with 1 kW of power. **CBU** began broadcasting in 1925 as part of the Canadian National Railway Network, and later as part of the Canadian Radio Broadcasting Commission, forerunner of the CBC. The shortwave relay began in the 1940s, designed to reach remote areas of BC.

CKZU carries the programming of the CBC Radio One network. One can hear international broadcasters via CBC Overnight from 1-5 am local (0900-1300 UTC), and local programming such as ***Early Edition*** in the mornings and ***On The Coast*** in the afternoons. **CKZU** has been heard in Western North America by a number of DXers in late October and early November.

❖ Innovative Programming from Deutsche Welle

Recently, while surfing their website in search of my favorite DW music program, ***Hits in Germany***, I came across this interesting initiative by DW. It looks to be quite comprehensive.

Learning by Ear – The Skills to Succeed in Today's Africa

"Education is the key to Africa's development. But schools and universities are still rare. ***Learning by Ear***, Deutsche Welle's new multimedia distance-learning programme, brings knowledge to every corner of the continent.

"Life is quickly changing in Africa: Internet and mobile phone usage continues to grow, yet thousands of people are still cut off from the digital world. Young Africans search for their perspective in a globalized, knowledge-based society and wonder which path will lead them to a successful career or education. For instance, many ask what opportunities for learning and studying are available online and what opportunities globalization has to offer. Thousands more want to study in Europe, but don't know what awaits them there.

"Deutsche Welle wants to make a difference. The ***Learning by Ear*** program examines the challenges that young Africans face and engages listeners in an informative and entertaining way. The programming is a lively mix of in-depth reports, radio dramas and feature stories that will provide listeners with an opportunity to get the necessary skills to succeed in Africa today and to discover a whole new world of knowledge. The target audience is girls and boys from 12 to 20 years of age.

"Programs are produced by African authors from across the continent, supported by dedicated Deutsche Welle staff. ***Learning by Ear*** is available in six languages: English, Kiswahili, French, Hausa, Portuguese and Amharic. ***Learning by Ear*** is supported by Germany's Federal Foreign Office."

www.dw-world.de/dw/article/0,,3121125,00.html

"Learning by Ear" Times and Frequencies across Africa:
www.dw-world.de/dw/article/0,,3564140,00.html

Shortwave:
Sundays 4.45 am UTC
Eastern Africa: 6180, 15445 kHz
Central Africa: 6180, 12045, 15445 kHz
West Africa: 7245 kHz
Southern Africa:12045 kHz
Sundays 9.45 pm UTC
Eastern Africa: 9735 kHz
West Africa: 9735, 11865, 15205 kHz

Satellite and Online
Sundays at 5.45 am UTC
(re-run of the 4.45 am UTC program)
Sundays at 7.45 pm UTC
(program re-run at 9.45 pm via shortwave)

For DW's African audience, the programming is available by radio, for listeners in more remote areas, and for those with access to the internet, audio and associated text are available online. It will be interesting indeed to see how this effort unfolds in the coming months. DW has already shown a long-standing commitment to distance learning with its German-language courses.

How to Use the Shortwave Guide

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

① ② ⑤ ③ ④ ⑥ ⑦

Convert your time to UTC.

Broadcast time on ① and time off ② are expressed in Coordinated Universal Time (UTC) – the time at the 0 meridian near Greenwich, England. To translate your local time into UTC, first convert your local time to 24-hour format, then add (during Standard Time) 5, 6, 7 or 8 hours for Eastern, Central, Mountain or Pacific Times, respectively. Eastern, Central, and Pacific Times are already converted to UTC for you at the top of each hour.

Note that all *dates*, as well as times, are in UTC; for example, a show which might air at 0030 UTC *Sunday* will be heard on *Saturday* evening in America (in other words, 7:30 pm Eastern, 6:30 pm Central, etc.).

Find the station you want to hear.

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

If a broadcast is not *daily*, the days of broadcast ⑤ will appear in the column following the time of broadcast, using the following codes:

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

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

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

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

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

Target Areas

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

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

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Additional Contributors to This Month's Shortwave Guide:

Thank You to …

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

Adrian Sainsbury, R New Zealand Int'l; Alan Roe, UK; Alexander Mazgo, Russia; Alexey Zinevich, Russia; Alokesh Gupta, New Delhi, India; Alok Dasgupta, Kolkata, India; Arnulf Piote, Berlin, Germany; Bernhard Schrant/TWR Europe; Daniel Sampson, Ernest Riley/PTSW; Dragan Lekic; Elena Espinova/ VO Russia; Joan S/BVB; Evelyn Marcy/WYFR; Gérald Theôret/RCI; Giovanni Lorenzi; Glen Tapley/WWCR; Larry Vehorn/WHRI;Tibor Szilagyi; vo Ivanov; Bulgaria; Jaisakthivel, Chennai, India; John Wrighr/ARDXC; José Jacob, India; Mike Barraclough, UK; Nigel Holmes/R Austrralia; Leo van der Woude, Radio Netherlands Freq Manager; Noel Green, UK; Rachel Baughn/MT; Rich D'Angelo/NASWA Flash Sheet, NASWA Journal; S. Hasegawa, Japan; Sergio Salvatori/Vatican Radio; Tom Taylor, UK; Jeff White, WRMI; Wolfgang Büeschel, 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	0000		UK, BBC World Service	5970as	6195as	
			7360as	9410as	9740as	13735as
			15335as	15360as		
0000	0020		Japan, NHK World/ Radio Japan			5960eu
			6145na	13650as	17810as	
0000	0030		Australia, HCJB Global	15400as		
0000	0030		Egypt, Radio Cairo7580na			
0000	0030		Thailand, Radio Thailand World Service			9680na
0000	0030		USA, Voice of America	7405as		
0000	0030		USA, Voice of America/Special English			6180as
			9325as	9620as	9715as	11695as
			12005as	15185as	15205as	15290as
			17820as			
0000	0045		India, All India Radio	6055as	7305as	
			9705as	11645as		
0000	0045		USA, WYFR/Family Radio Worldwide			6085na
			11720sa			
0000	0057		Canada, Radio Canada International			9880as
0000	0057		China, China Radio International			6005na
			6020na	6180na	7350as	7425as
			9425as	9570as	11650as	11885as
			11730as	11790as		
0000	0100	twhfas	Albania, Radio Tirana	7425na		
0000	0100		Anguilla, Worldwide Univ Network			6090am
0000	0100		Australia, ABC NT Alice Springs			4835do
0000	0100		Australia, ABC NT Katherine	5025do		
0000	0100		Australia, ABC NT Tennant Creek			4910do
0000	0100		Australia, Radio Australia	9660as	12080pa	
			13690pa	15240pa	17715pa	17750as
			17665as	17795pa		
0000	0100		Bahrain, Radio Bahrain	6010me	9745al	
0000	0100		Bulgaria, Radio Bulgaria	5900na	7400na	
0000	0100		Canada, CFRX Toronto ON	6070na		
0000	0100		Canada, CFVP Calgary AB	6030na		
0000	0100		Canada, CKZN St John's NF	6160na		
0000	0100		Canada, CKZU Vancouver BC	6160na		
0000	0100		Germany, Deutsche Welle	7265as	9785as	
			15640as			
0000	0100		Malaysia, RTM/Traxx FM	7295do		
0000	0100		New Zealand, Radio NZ International			15720pa
0000	0100	DRM	New Zealand, Radio NZ International			17675pa
0000	0100		Russia, Voice of Russia	6240eu	7250eu	
0000	0100		Spain, Radio Exterior de Espana			6055na
0000	0100		USA, American Forces Network			4319usb
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
0000	0100		USA, EWTN/WEWN Vandiver AL			15610af
0000	0100		USA, WBCQ Monticello ME	5110am	7415am	
0000	0100		USA, WHRI Cypress Creek SC	5875na	7315va	
0000	0100		USA, WINB Red Lion PA	9265am		
0000	0100	vl	USA, WRMI Miami FL	9955va		
0000	0100		USA, WTJC Newport NC	9370na		
0000	0100		USA, WWCR Nashville TN	3230na	5070na	
			9980na			
0000	0100		USA, WWRB Manchester TN	3185va	3215na	
			5050va	5745va		
0000	0100		USA, WYFR/Family Radio Worldwide			5950na
			7360ca	9505na	9595na	15440na
0000	0100		Zambia CVC Intl/ The Voice Africa			4965af
0005	0100	twhfa	Canada, Radio Canada International			9755na
0010	0100	m	Greece, Voice of Greece	7475va	9420va	
0030	0045	Sun	Germany, Pan American Broadcasting			9640as
0030	0100		Australia, Radio Australia	15415as		
0030	0100		Thailand, Radio Thailand World Service			12095na
0030	0100	sfa	UK, Bible Voice Broadcasting	9490as		
0030	0100		USA, Voice of America/Special English			6180as
0030	0100		Uzbekistan, CVC Intl/ The Voice Asia			7395as

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

0100	0104		Canada, Radio Canada International			9755na
0100	0125		Vietnam, Voice of Vietnam	6175na		
0100	0127		Czech Republic, Radio Prague	6200na		7355na
0100	0130	mtwhfas	Albania, Radio Tirana	7425eu		
0100	0130		Australia, Radio Australia	9660as	12080pa	
			13690pa	15240pa	15415as	17715pa
			17750as	17795pa		
0100	0130		Slovakia, Radio Slovakia International			7230na
			9440sa			
0100	0156		Romania, Radio Romania International			6145na
			9800na			
0100	0157		Canada, Radio Canada International			6040as
			6165as			
0100	0157	DRM	China, China Radio International			6080na
0100	0157		North Korea, Voice of Korea	7140as	9345as	
			9730as	11735sa	13760sa	15180sa
0100	0200		Anguilla, Worldwide Univ Network			6090am
0100	0200		Australia, ABC NT Alice Springs			4835do
0100	0200		Australia, ABC NT Katherine	5025do		
0100	0200		Australia, ABC NT Tennant Creek			4910do
0100	0200		Australia, HCJB Global	15400as		
0100	0200		Bahrain, Radio Bahrain	6010me	9745al	
0100	0200		Canada, CFRX Toronto ON	6070na		
0100	0200		Canada, CFVP Calgary AB	6030na		
0100	0200		Canada, CKZN St John's NF	6160na		
0100	0200		Canada, CKZU Vancouver BC	6160na		
0100	0200		China, China Radio International			6005as
			6020eu	6080eu	6175as	7350as
			9570na	9580as	11650as	11730as
			11885as			
0100	0200		Cuba, Radio Havana Cuba	6000na	6140na	
0100	0200		Malaysia, RTM/Traxx FM	7295do		
0100	0200		New Zealand, Radio NZ International			15720pa
0100	0200	DRM	New Zealand, Radio NZ International			17675pa
0100	0200		Palau, T8WH/World Harvest	15680as		
0100	0200		Russia, Voice of Russia	6240eu	7250eu	
0100	0200		Sri Lanka, SLBC	6005as	9770as	15745as
0100	0200		Taiwan, Radio Taiwan International			11875as
0100	0200		UK, BBC World Service	5940as	5970as	
			9410as	9740as	11750as	11955as
			15335as	15360as	17615as	
0100	0200		Ukraine, Radio Ukraine International			7440na
0100	0200		USA, American Forces Network			4319usb
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
0100	0200		USA, EWTN/WEWN Vandiver AL			11520af
0100	0200		USA, KJES Vado NM	7555na		
0100	0200		USA, Voice of America	7325va	9435va	
			11705va			
0100	0200		USA, WBCQ Monticello ME	5110am	7415am	
0100	0200		USA, WHRI Cypress Creek SC	5875na	7315va	
0100	0200	mtwhf	USA, WHRI Cypress Creek SC	5850na		
0100	0200	Sat/Sun	USA, WHRI Cypress Creek SC	7315na		
0100	0200		USA, WINB Red Lion PA	9265am		
0100	0200	vl	USA, WRMI Miami FL	9955va		
0100	0200		USA, WRNO New Orleans LA	7505am		
0100	0200		USA, WTJC Newport NC	9370na		
0100	0200		USA, WWCR Nashville TN	3230na	5070na	
			5935na	9980na		
0100	0200		USA, WWRB Manchester TN	3185va	3215na	
			5050na	5745va		
0100	0200		USA, WYFR/Family Radio Worldwide			7455na
			9505na	15440na		
0100	0200		Uzbekistan, CVC Intl/ The Voice Asia			7395as
0100	0200		Zambia CVC Intl/ The Voice Africa			4965af
0105	0110	m	Greece, Voice of Greece	7475va	9420va	
			12105va			
0105	0200		Canada, Radio Canada International			9755na
0130	0200		Iran, Voice of Islamic Rep. of Iran			7235na
			9495na			
0130	0200	mtwhfa	Serbia, International Radio of Serbia			6190na
0130	0200	ta	USA, Voice of America/Special English			5960ca
			7405ca			
0140	0200		Vatican City State, Vatican Radio			5895as
			7335as			

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

0200	0204		Canada, Radio Canada International			9755na
0200	0227		Czech Republic, Radio Prague	6200na		7355na
0200	0227		Iran, Voice of Islamic Rep. of Iran			7235na
			9495na			
0200	0230		Thailand, Radio Thailand World Service			15275na
0200	0230		USA, KJES Vado NM	7555na		
0200	0230		Uzbekistan, CVC Intl/ The Voice Asia			7395as
0200	0257		China, China Radio International			9550as
			11785as	13640as	15435as	
0200	0257		North Korea, Voice of Korea	13650as	15100as	
0200	0258	DRM	Germany, Deutsche Welle	15205eu		
0200	0300		Anguilla, Worldwide Univ Network			6090am
0200	0300		Argentina, Radio Nacional RAE			11710am
0200	0300		Australia, ABC NT Alice Springs			4835do
0200	0300		Australia, ABC NT Katherine	5025do		
0200	0300		Australia, ABC NT Tennant Creek			4910do
0200	0300		Australia, HCJB Global	15400as		
0200	0300		Australia, Radio Australia	9660pa	12080pa	
			13690pa	15240pa	15415as	15515pa
			17750as	21725pa		
0200	0300		Bahrain, Radio Bahrain	6010me	9745al	
0200	0300		Canada, CFRX Toronto ON	6070na		
0200	0300		Canada, CFVP Calgary AB	6030na		

SHORTWAVE GUIDE

0200	0300		Canada, CKZN St John's NF	6160na		
0200	0300		Canada, CKZU Vancouver BC	6160na		
0200	0300		Cuba, Radio Havana Cuba	6000na	6140na	
0200	0300		Egypt, Radio Cairo	7540na		
0200	0300		Indonesia, Voice of Indonesia	9525va	11785al	15150al
0200	0300		Malaysia, RTM/Traxx FM	7295do		
0200	0300		New Zealand, Radio NZ International		15720pa	
0200	0300	DRM	New Zealand, Radio NZ International		17675pa	
0200	0300		Palau, T8WH/World Harvest	15680as		
0200	0300		Philippines, PBS/ Radyo Pilipinas		11880me	15285me 17770me
0200	0300		Russia, Voice of Russia	6240eu	7250eu	
0200	0300	DRM	Russia, Voice of Russia	15735as		
0200	0300		South Korea, KBS World Radio		9580sa	
0200	0300		Sri Lanka, SLBC	6005as	9770as	15745as
0200	0300		Taiwan, Radio Taiwan International		5950na	9680na
0200	0300		Uganda, UBC Radio	4976do		
0200	0300		UK, BBC World Service	5940as	6005af	6195me 9410as 15310as
0200	0300		USA, American Forces Network		4319usb	5446usb 5765usb 6350usb 7812usb 10320usb 12133usb 12759usb 13362usb
0200	0300		USA, EWTN/WEWN Vandiver AL		11520af	
0200	0300	mtwhfa	USA, WBCQ Monticello ME	7415am		
0200	0300		USA, WBCQ Monticello ME	5110am		
0200	0300		USA, WHRI Cypress Creek SC	5875na	7315va	
0200	0300		USA, WINB Red Lion PA	9265am		
0200	0300	vl	USA, WRMI Miami FL	9955va		
0200	0300		USA, WRNO New Orleans LA	7505am		
0200	0300		USA, WTJC Newport NC	9370na		
0200	0300		USA, WWCR Nashville TN	3215na	5070na	5890na 5935na
0200	0300		USA, WWRB Manchester TN	3185va	5050va	5745va
0200	0300		USA, WYFR/Family Radio Worldwide		4985na	5985na 6890na 7455na 9505na 9525na
0200	0300		Zambia CVC Intl/ The Voice Africa		4965af	
0215	0230		Nepal, Radio Nepal	5005as		
0230	0300		Sweden, Radio Sweden	6010na	11550va	
0230	0300		Uzbekistan, CVC Intl/ The Voice Asia		11970as	
0245	0300	twhfas	Albania, Radio Tirana	7425eu		
0245	0300		Zambia, Zambia Natl Broadcasting Corp		6165do	
0250	0300		Vatican City State, Vatican Radio		6040am	7305am

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

0300	0330		Croatia, Croatian Radio	3985va	7375va	
0300	0330		Egypt, Radio Cairo	7540na		
0300	0330		Philippines, PBS/ Radyo Pilipinas		11880me	15285me 17770me
0300	0330		Sri Lanka, SLBC	6005as	9770as	15745as
0300	0330		Vatican City State, Vatican Radio		7360af	9660af
0300	0355		South Africa, Channel Africa	6120af		
0300	0357		China, China Radio International		6190na	9460na 9690na 9790as
0300	0357		North Korea, Voice of Korea	7140as	9345as	9730va
0300	0400		Anguilla, Worldwide Univ Network		6090am	
0300	0400		Australia, ABC NT Alice Springs		4835do	
0300	0400		Australia, ABC NT Katherine	5025do		
0300	0400		Australia, ABC NT Tennant Creek		4910do	
0300	0400		Australia, Radio Australia	9660as	12080pa	13690pa 15240pa 15415as 15515pa 17750as 21725pa
0300	0400		Bahrain, Radio Bahrain	6010me	9745al	
0300	0400		Bulgaria, Radio Bulgaria	5900na	7400na	
0300	0400	twhfas	Canada, CBC NQ SW Service	9625na		
0300	0400		Canada, CFRX Toronto ON	6070na		
0300	0400		Canada, CFVP Calgary AB	6030na		
0300	0400		Canada, CKZN St John's NF	6160na		
0300	0400		Canada, CKZU Vancouver BC	6160na		
0300	0400		Cuba, Radio Havana Cuba	6000na	6140na	
0300	0400		Germany, Deutsche Welle	11695as	17800as	
0300	0400	Sun	Greece, Voice of Greece	7475va	9420va	
0300	0400		Italy, IRRS/NEXUS	9835va		
0300	0400		Malaysia, RTM/Traxx FM	7295do		
0300	0400		Malaysia, RTM/Voice of Malaysia		6175as	9750as 15295as
0300	0400		New Zealand, Radio NZ International		15720pa	
0300	0400	DRM	New Zealand, Radio NZ International		17675pa	
0300	0400		Oman, Radio Oman	15355af		
0300	0400		Palau, T8WH/World Harvest	15680as		
0300	0400		Russia, Voice of Russia	6240eu	7250sa	12030eu 12040eu 13735eu
0300	0400	DRM	Russia, Voice of Russia	15735as		
0300	0400		South Africa, Channel Africa	3345af		
0300	0400		Taiwan, Radio Taiwan International		5950na	15320as
0300	0400		Uganda, UBC Radio	4976do		
0300	0400		UK, BBC World Service	3255af	6005af	6105af 6145af 6190af 6195as 7255af 7445af 9410as 12095as 15310as 17790as
0300	0400		USA, American Forces Network		4319usb	5446usb 5765usb 6350usb 7812usb 10320usb 12133usb 12759usb 13362usb
0300	0400		USA, EWTN/WEWN Vandiver AL		11520af	
0300	0400		USA, Voice of America	4930af	6080af	9885af 15580af
0300	0400	mtwhfa	USA, WBCQ Monticello ME	7415am		
0300	0400		USA, WHRI Cypress Creek SC	5875na	7315na	
0300	0400		USA, WINB Red Lion PA	9265am		
0300	0400	vl	USA, WRMI Miami FL	9955va		
0300	0400		USA, WRNO New Orleans LA	7505am		
0300	0400		USA, WTJC Newport NC	9370na		
0300	0400		USA, WWCR Nashville TN	3215na	5070na	5890na 5935na
0300	0400		USA, WWRB Manchester TN	3185va	5050va	5745va
0300	0400		USA, WYFR/Family Radio Worldwide		7455na	9505na 9930ca 9985eu
0300	0400		Zambia CVC Intl/ The Voice Africa		4965af	
0300	0400		Zambia, Zambia Natl Broadcasting Corp		6165do	
0300	4000		Uzbekistan, CVC Intl/ The Voice Asia		11970as	
0330	0400	twhfas	Albania, Radio Tirana	6150na		
0330	0400	Sun	Sri Lanka, SLBC	6005as	9770as	15745as
0330	0400		Sweden, Radio Sweden	6010na		
0330	0400		UK, BBC World Service	11945af		
0340	0400		Vatican City State, Vatican Radio		9545as	
0345	0400	vl/Sat/Sun	Uganda, UBC Radio	4976do		

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

0400	0427		Czech Republic, Radio Prague	6200na	7345na	
0400	0430	mtwhf	France, Radio France International		9805af	11995af
0400	0445		USA, WYFR/Family Radio Worldwide		7445na	9505na
0400	0455		Turkey, Voice of Turkey	6020va	6040me	7240na
0400	0456		Romania, Radio Romania International		6130na	7310na 9690as 11895as
0400	0457		China, China Radio International		6190na	9460na 13620as 15120as 17725as 17855as
0400	0458		New Zealand, Radio NZ International		15720pa	
0400	0458	DRM	New Zealand, Radio NZ International		17675pa	
0400	0500		Anguilla, Worldwide Univ Network		6090am	
0400	0500		Australia, ABC NT Alice Springs		4835do	
0400	0500		Australia, ABC NT Katherine	5025do		
0400	0500		Australia, ABC NT Tennant Creek		4910do	
0400	0500		Australia, Radio Australia	9660pa	12080pa	13690pa 15240pa 15515pa 17750as 21725pa
0400	0500		Bahrain, Radio Bahrain	6010me	9745al	
0400	0500	twhfas	Canada, CBC NQ SW Service	9625na		
0400	0500		Canada, CFRX Toronto ON	6070na		
0400	0500		Canada, CKZN St John's NF	6160na		
0400	0500		Canada, CKZU Vancouver BC	6160na		
0400	0500		Cuba, Radio Havana Cuba	6000na	6140na	
0400	0500		Germany, Deutsche Welle	5905af	5945af	6180af 15600af
0400	0500		Italy, IRRS/NEXUS	9835va		
0400	0500		Malaysia, RTM/Traxx FM	7295do		
0400	0500		Malaysia, RTM/Voice of Malaysia		6175as	9750as 15295as
0400	0500		Palau, T8WH/World Harvest	15680as		
0400	0500		Russia, Voice of Russia	6240ca	12030na	12040na 13735eu
0400	0500	DRM	Russia, Voice of Russia	15735as		
0400	0500		South Africa, Channel Africa	7230af		
0400	0500	Sun	Sri Lanka, SLBC	6005as	9770as	15745as
0400	0500		Uganda, UBC Radio	4976do		
0400	0500		UK, BBC World Service	3255af	6005af	6190af 7255af 7445af 9410as 11945af 12035af 15310as 15360as 17790as
0400	0500		Ukraine, Radio Ukraine International		7440na	

0400	0500		USA, American Forces Network				4319usb
			5446usb	5765usb	6350usb	7812usb	
			10320usb	12133usb	12759usb	13362usb	
0400	0500		USA, EWTN/WEWN Vandiver AL				11520af
0400	0500		USA, Voice of America		4930af	4960af	
			6080af	9885af	15580af		
0400	0500	twhfa	USA, WBCQ Monticello ME		7415am		
0400	0500		USA, WHRI Cypress Creek SC		5875na	7315va	
0400	0500	smtwhf	USA, WHRI Cypress Creek SC		5850na		
0400	0500	Sat	USA, WHRI Cypress Creek SC		9825na		
0400	0500	vl	USA, WRMI Miami FL		9955va		
0400	0500		USA, WRNO New Orleans LA		7505am		
0400	0500		USA, WTJC Newport NC		9370na		
0400	0500		USA, WWCR Nashville TN		5070na	5890na	
			5935na	15825na			
0400	0500		USA, WWRB Manchester TN		3185va	5050va	
			5745va				
0400	0500		USA, WYFR/Family Radio Worldwide				6915na
			9680na	9715na			
0400	0500		Uzbekistan, CVC Intl/ The Voice Asia				11970as
0400	0500		Zambia CVC Intl/ The Voice Africa				4965af
			7160af				
0400	0500		Zambia, Zambia Natl Broadcasting Corp				6165do
0430	0457		Czech Republic, Radio Prague		9855va		
0430	0500	twhfas	Albania, Radio Tirana		6100na		
0430	0500		Australia, Radio Australia		15415as		
0430	0500	mtwhf	Swaziland, TWR Swaziland		3200af		
0459	0500		New Zealand, Radio NZ International				11725pa
0459	0500	DRM	New Zealand, Radio NZ International				13730pa

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

0500	0507	twhfas	Canada, CBC NQ SW Service		9625na		
0500	0530	mtwhf	France, Radio France International				11995af
			13680af	15160as			
0500	0530		Germany, Deutsche Welle		6130af	6180af	
			9755af	12045af	15600af		
0500	0530		Japan, NHK World/ Radio Japan				5975eu
			6110na	9770va	15325as	17810as	
0500	0530		Vatican City State, Vatican Radio				7360af
			9660af	11625af			
0500	0600		Anguilla, Worldwide Univ Network				6090am
0500	0600		Australia, ABC NT Alice Springs				4835do
0500	0600		Australia, ABC NT Katherine		5025do		
0500	0600		Australia, ABC NT Tennant Creek				4910do
0500	0600		Australia, Radio Australia		9660pa	12080pa	
			13630as	13690pa	17750as		
0500	0600		Bahrain, Radio Bahrain		6010me	9745al	
0500	0600		Bhutan, Bhutan Broadcasting Service				6035as
0500	0600		Canada, CFRX Toronto ON		6070na		
0500	0600		Canada, CKZN St John's NF		6160na		
0500	0600		Canada, CKZU Vancouver BC		6160na		
0500	0600		China, China Radio International				5960na
			6190af	7220as	11880as	15350as	
			15465as				
0500	0600		Cuba, Radio Havana Cuba		6060na	6140na	
			11760na	13790na			
0500	0600		Italy, IRRS/NEXUS		9835va		
0500	0600		Kuwait, Radio Kuwait		15110as		
0500	0600		Malaysia, RTM/Traxx FM		7295do		
0500	0600		Malaysia, RTM/Voice of Malaysia				6175as
			9750as	15295as			
0500	0600		New Zealand, Radio NZ International				11725pa
0500	0600	DRM	New Zealand, Radio NZ International				13730pa
0500	0600		Nigeria, Voice of Nigeria/External Service				15120af
0500	0600		Palau, T8WH/World Harvest		15680as		
0500	0600		Russia, Voice of Russia		9855na	9840na	
			12030na				
0500	0600	DRM	Russia, Voice of Russia		15735as		
0500	0600		South Africa, Channel Africa		7230af		
0500	0600		Swaziland, TWR Swaziland		3200af		
0500	0600		Taiwan, Radio Taiwan International				5950na
0500	0600		Uganda, UBC Radio		4976do		
0500	0600		UK, BBC World Service		3255af	3995eu	
			5875eu	6005af	6190af	7255af	
			9410as	11765af	11945af	12095eu	
			15310as	15360as	17640af	17790as	
0500	0600	smtwhf	UK, BBC World Service		15420af		
0500	0600		USA, American Forces Network				4319usb
			5446usb	5765usb	6350usb	7812usb	
			10320usb	12133usb	12759usb	13362usb	
0500	0600		USA, EWTN/WEWN Vandiver AL				11520af
0500	0600		USA, Voice of America		4930af	6080af	
			9885af	15580af			
0500	0600		USA, WHRI Cypress Creek SC		5875na	11565na	
0500	0600	Sun	USA, WHRI Cypress Creek SC		7365na		
0500	0600	vl	USA, WRMI Miami FL		9955va		
0500	0600		USA, WTJC Newport NC		9370na		
0500	0600		USA, WWCR Nashville TN		5070na	5890na	
			5935na	15825na			
0500	0600		USA, WWRB Manchester TN		3185va		
0500	0600		USA, WYFR/Family Radio Worldwide				6915na
			9680na				
0500	0600		Uzbekistan, CVC Intl/ The Voice Asia				11970as
0500	0600		Zambia CVC Intl/ The Voice Africa				4965af
			7160af				
0500	0600		Zambia, Zambia Natl Broadcasting Corp				6165do
0515	0530		Rwanda, Radio Rwanda		6055do		
0530	0600		Clandestine, Sudan Radio Service				13720af
			15325af				
0530	0600	mtwh	Italy, IRRS/NEXUS		5990va		
0530	0600		Thailand, Radio Thailand World Service				11730va

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

0600	0615	Sat/Sun	South Africa, Trans World Radio				11640af
0600	0620		Vatican City State, Vatican Radio				4005eu
			5965eu	7520eu			
0600	0630	Sat/Sun	Australia, Radio Australia		15180as	15290as	
			15415as				
0600	0630	mtwhf	France, Radio France International				9765af
			15160af	17800af			
0600	0630		Germany, Deutsche Welle		5945af	7240af	
			12045af				
0600	0630		Laos, Lao National Radio		7145as		
0600	0630		Uzbekistan, CVC Intl/ The Voice Asia				11970as
0600	0645	mtwhf	South Africa, Trans World Radio				11640af
0600	0655		South Africa, Channel Africa		15255af		
0600	0657		China, China Radio International				6115af
			11750af	11770as	11880as	13645as	
			15145as	15350as	15465as	17505va	
			17540as	17710as			
0600	0658		New Zealand, Radio NZ International				11725pa
0600	0658	DRM	New Zealand, Radio NZ International				13730pa
0600	0700		Anguilla, Worldwide Univ Network				6090am
0600	0700		Australia, ABC NT Alice Springs				4835do
0600	0700		Australia, ABC NT Katherine		5025do		
0600	0700		Australia, ABC NT Tennant Creek				4910do
0600	0700		Australia, Radio Australia		9660pa	12080pa	
			13630as	13690pa	15160pa	15240pa	
			17750as				
0600	0700		Bahrain, Radio Bahrain		6010me	9745al	
0600	0700		Canada, CFRX Toronto ON		6070na		
0600	0700		Canada, CFVP Calgary AB		6030na		
0600	0700		Canada, CKZN St John's NF		6160na		
0600	0700		Canada, CKZU Vancouver BC		6160na		
0600	0700		Cuba, Radio Havana Cuba		6000na	6140na	
			11760na	13790na			
0600	0700		Greece, Voice of Greece		7475eu	9420eu	
0600	0700		Italy, IRRS/NEXUS		9835va		
0600	0700	mtwh	Italy, IRRS/NEXUS		5990va		
0600	0700		Kuwait, Radio Kuwait		15110as		
0600	0700		Malaysia, RTM/Traxx FM		7295do		
0600	0700		Malaysia, RTM/Voice of Malaysia				6175as
			9750as	15295as			
0600	0700		Nigeria, Voice of Nigeria/External Service				15120af
0600	0700		Palau, T8WH/World Harvest		15680as		
0600	0700		Russia, Voice of Russia		9855na	9840na	
			12070na				
0600	0700		South Africa, Channel Africa		7230af		
0600	0700		UK, BBC World Service		3995eu	5875eu	
			6005af	6190af	9860af	11760as	
			11765af	12015af	12095eu	15310as	
			17640af	17790as			
0600	0700	Sat/Sun	UK, BBC World Service		15420af		
0600	0700		Ukraine, Radio Ukraine International				7440na
0600	0700		USA, American Forces Network				4319usb
			5446usb	5765usb	6350usb	7812usb	
			10320usb	12133usb	12759usb	13362usb	
0600	0700		USA, EWTN/WEWN Vandiver AL				11520af
0600	0700		USA, Voice of America		6080af	9885af	
			15580af				
0600	0700		USA, WHRI Cypress Creek SC		5875va	7365na	
			11565na				
0600	0700	vl	USA, WRMI Miami FL		9955va		
0600	0700		USA, WTJC Newport NC		9370na		
0600	0700		USA, WWCR Nashville TN		3215na	5070na	
			5890na	5935na			
0600	0700		USA, WWRB Manchester TN		3185va		
0600	0700		USA, WYFR/Family Radio Worldwide				5745sa
			6000ca	9680na	9985eu	11530va	
0600	0700		Zambia CVC Intl/ The Voice Africa				6065af
			13590af				
0600	0700		Zambia, Zambia Natl Broadcasting Corp				6165do

0630	0656		Romania, Radio Romania International				7370eu
			17780pa	21600pa			
0630	0656	DRM	Romania, Radio Romania International				6020eu
0630	0700		Australia, Radio Australia	15415as			
0630	0700		Swaziland, TWR Swaziland	6120af			
0630	0700		Uzbekistan, CVC Intl/ The Voice Asia				15700as
0630	0700		Vatican City State, Vatican Radio				7360af
			9660af	11625af			
0659	0700		New Zealand, Radio NZ International				9765pa
0659	0700	DRM	New Zealand, Radio NZ International				13730pa

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

0700	0705		Croatia, Croatian Radio	6165eu			
0700	0730	mtwhf	France, Radio France International				13675af
0700	0730	mtwh	Italy, IRRS/NEXUS	5990va			
0700	0730		Slovakia, Radio Slovakia International				13715va
			15460va				
0700	0730	Sun	UK, Bible Voice Broadcasting	5945eu			
0700	0745		USA, WYFR/Family Radio Worldwide				5745sa
			5950na				
0700	0757		China, China Radio International				11785as
			11880as	13645as	15125eu		15350as
			15465as	17505as	17540as		17710as
0700	0800		Anguilla, Worldwide Univ Network				6090am
0700	0800		Australia, ABC NT Alice Springs				4835do
0700	0800		Australia, ABC NT Katherine	5025do			
0700	0800		Australia, ABC NT Tennant Creek				4910do
0700	0800		Australia, Radio Australia	9475as			9660pa
			9710as	11945pa	12080pa		13630as
			15160pa	15240pa			
0700	0800		Bahrain, Radio Bahrain	6010me			9745al
0700	0800	DRM	Belgium, TDP Radio	17755as			
0700	0800		Canada, CFRX Toronto ON	6070na			
0700	0800		Canada, CFVP Calgary AB	6030na			
0700	0800		Canada, CKZN St John's NF	6160na			
0700	0800		Canada, CKZU Vancouver BC	6160na			
0700	0800		Cuba, Radio Havana Cuba	6060na			
0700	0800	mtwhf	Equatorial Guinea, Radio Africa # 2				15190af
0700	0800	Sat/Sun	Equatorial Guinea, Radio East Africa				15190af
0700	0800	DRM	Germany, Deutsche Welle	3995eu			6130eu
0700	0800		Greece, Voice of Greece	12105va			
0700	0800		Kuwait, Radio Kuwait	15110as			
0700	0800		Malaysia, RTM/Traxx FM	7295do			
0700	0800		Malaysia, RTM/Voice of Malaysia				6175as
			9750as	15295as			
0700	0800		Myanmar, Myanma Radio	9730do			
0700	0800		New Zealand, Radio NZ International				9765pa
0700	0800	DRM	New Zealand, Radio NZ International				9870pa
0700	0800		Palau, T8WH/World Harvest	9930as			15680as
0700	0800	DRM	Russia, Voice of Russia	11635eu			
0700	0800		Russia, Voice of Russia	17665pa			17805pa
0700	0800		South Africa, Channel Africa	9625af			
0700	0800		Swaziland, TWR Swaziland	6120af			
0700	0800		UK, BBC World Service	3995eu			6190af
			9860af	11760me	11765af		13820af
			15310as	15400af	15575as		17790as
			17830af				
0700	0800	Sat/Sun	UK, BBC World Service	15420af			
0700	0800	Sat	UK, Bible Voice Broadcasting	5945eu			
0700	0800		USA, American Forces Network				4319usb
			5446usb	5765usb	6350usb		7812usb
			10320usb	12133usb	12759usb		13362usb
0700	0800		USA, EWTN/WEWN Vandiver AL				11520af
0700	0800		USA, WHRI Cypress Creek SC	7385va			7390na
			11565na				
0700	0800	vl	USA, WRMI Miami FL	9955va			
0700	0800		USA, WTJC Newport NC	9370na			
0700	0800		USA, WWCR Nashville TN	3215na			5070na
			5890na	5935na			
0700	0800		USA, WWRB Manchester TN	3185va			
0700	0800		USA, WYFR/Family Radio Worldwide				5950na
			6915na	7455na	9495ca		11580va
0700	0800		Uzbekistan, CVC Intl/ The Voice Asia				15700as
0700	0800		Zambia CVC Intl/ The Voice Africa				6065af
			13590af				
0700	0800		Zambia, Zambia Natl Broadcasting Corp				6165do
0730	0745		Vatican City State, Vatican Radio				
			4005eu	5965eu	7250eu		9645 et
			11740eu	15595eu			
0730	0800		Australia, HCJB Global	11750as			
0730	0800		Bulgaria, Radio Bulgaria	5900eu			7400eu
0730	0800		Clandestine, Cotton Tree News				15220af
0745	0800	Sun	Germany, TWR Europe	6105eu			
0745	0800	Sun	Monaco, TWR Europe	9800eu			
0745	0800	f	UK, Bible Voice Broadcasting	5945eu			

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

0800	0815	Sat	UK, Bible Voice Broadcasting	5945eu			
0800	0827		Czech Republic, Radio Prague	7345eu			9860eu
0800	0830		Australia, ABC NT Alice Springs				4835do
0800	0830		Australia, ABC NT Katherine	5025do			
0800	0830		Australia, ABC NT Tennant Creek				4910do
0800	0830		Myanmar, Myanma Radio	9730do			
0800	0845		USA, WYFR/Family Radio Worldwide				11580va
0800	0850	mtwhf	Germany, TWR Europe	6105eu			
0800	0850	Sun	Germany, TWR Europe	6105eu			
0800	0850	mtwhf	Monaco, TWR Europe	9800eu			
0800	0850	Sun	Monaco, TWR Europe	9800eu			
0800	0857		China, China Radio International				9415as
			11785as	11880as	15350as		15465as
			15625as	15465as	15625as		17490eu
			17540as				
0800	0858	DRM	Germany, Deutsche Welle	12005as			
0800	0900		Anguilla, Worldwide Univ Network				6090am
0800	0900		Australia, HCJB Global	11750pa			
0800	0900		Australia, Radio Australia	5995pa			9475as
			9580pa	9590pa	9710pa		11945pa
			12080pa	13630as			
0800	0900		Bahrain, Radio Bahrain	6010me			9745al
0800	0900	m/DRM	Belgium, TDP Radio	6015eu			
0800	0900		Canada, CFRX Toronto ON	6070na			
0800	0900		Canada, CFVP Calgary AB	6030na			
0800	0900		Canada, CKZN St John's NF	6160na			
0800	0900		Canada, CKZU Vancouver BC	6160na			
0800	0900		China, Guangxi FBS/Beibu Bay Radio				5050as
			9820as				
0800	0900		Cuba, Radio Havana Cuba	6060na			
0800	0900	mtwhf	Equatorial Guinea, Radio Africa # 2				15190af
0800	0900	Sat/Sun	Equatorial Guinea, Radio East Africa				15190af
0800	0900	DRM	Germany, Deutsche Welle	9610eu			13810eu
0800	0900		Malaysia, RTM/Traxx FM	7295do			
0800	0900		Malaysia, RTM/Voice of Malaysia				6175as
			9750as	15295as			
0800	0900		New Zealand, Radio NZ International				9765pa
0800	0900	DRM	New Zealand, Radio NZ International				9870pa
0800	0900		Nigeria, Voice of Nigeria/External Service				9690af
0800	0900		Palau, T8WH/World Harvest	9930as			15680as
0800	0900	DRM	Russia, Voice of Russia	11635eu			
0800	0900		Russia, Voice of Russia	17650af			17665af
			17805af				
0800	0900		South Africa, Channel Africa	9625af			
0800	0900	Sun	South Africa, SA Radio League	7205af			17860af
0800	0900		South Korea, KBS World Radio				9570as
0800	0900		Swaziland, TWR Swaziland	6120af			
0800	0900		UK, BBC World Service	6190af			9860af
			11760me	15310as	15400af		15575as
			17640af	17790as	17830af		21470af
0800	0900		USA, American Forces Network				4319usb
			5446usb	5765usb	6350usb		7812usb
			10320usb	12133usb	12759usb		13362usb
0800	0900		USA, EWTN/WEWN Vandiver AL				11520af
0800	0900		USA, KNLS Anchor Point AK	9615as			6150al
0800	0900		USA, WHRI Cypress Creek SC	7385va			
0800	0900	vl	USA, WRMI Miami FL	9955va			
0800	0900		USA, WTJC Newport NC	9370na			
0800	0900		USA, WWCR Nashville TN	3215na			5070na
			5890na	5935na			
0800	0900		USA, WWRB Manchester TN	3185va			
0800	0900		USA, WYFR/Family Radio Worldwide				5950na
			6915na	7455na			
0800	0900		Uzbekistan, CVC Intl/ The Voice Asia				15700as
0800	0900		Zambia CVC Intl/ The Voice Africa				6065af
			13590af				
0800	0900		Zambia, Zambia Natl Broadcasting Corp				6165do
0815	0850	Sat	Germany, TWR Europe	6105eu			
0815	0850	Sat	Monaco, TWR Europe	9800eu			
0820	0900	smtwhf	Guam, KTWR/TWR	15170as			
0830	0900		Australia, ABC NT Alice Springs				2310do
0830	0900		Australia, ABC NT Katherine	2485do			
0830	0900		Australia, ABC NT Tennant Creek				2325do
0830	0900	mtwhfa	Guam, KTWR/TWR	11840pa			

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

0900	0910	mtwhfa	Guam, KTWR/TWR	11840pa			
0900	0930		Australia, HCJB Global	11750pa			
0900	0930		Japan, NHK World/ Radio Japan				9625pa
			9825pa	11815as	15590as		
0900	0930		Uzbekistan, CVC Intl/ The Voice Asia				15700as
0900	0957		China, China Radio International				9415as
			15210va	15270eu	15350as		17490eu
			17570eu	17690va	17750as		

0900	1000		Anguilla, Worldwide Univ Network			6090am
0900	1000		Australia, ABC NT Alice Springs			2310do
0900	1000		Australia, ABC NT Katherine	2485do		
0900	1000		Australia, ABC NT Tennant Creek			2325do
0900	1000		Australia, Radio Australia	9475as		9580pa
			9590pa	11945pa		
0900	1000		Bahrain, Radio Bahrain	6010me		9745al
0900	1000	t/DRM	Belgium, TDP Radio	6015eu		
0900	1000		Bhutan, Bhutan Broadcasting Service			6035as
0900	1000		Canada, CFRX Toronto ON	6070na		
0900	1000		Canada, CFVP Calgary AB	6030na		
0900	1000		Canada, CKZN St John's NF	6160na		
0900	1000		Canada, CKZU Vancouver BC	6160na		
0900	1000		China, Guangxi FBS/Beibu Bay Radio			5050as
			9820as			
0900	1000		Cuba, Radio Havana Cuba	6060na		
0900	1000	mtwhf	Equatorial Guinea, Radio Africa # 2			15190af
0900	1000	Sat/Sun	Equatorial Guinea, Radio East Africa			15190af
0900	1000	2nd Sun	Germany, Blue Star Radio	6140eu		
0900	1000		Germany, Deutsche Welle	17710as		21780as
0900	1000	3rd Sun	Germany, European Music Radio			6140eu
0900	1000	4th Sun	Germany, Radio Gloria International			6140eu
0900	1000		Malaysia, RTM/Traxx FM	7295do		
0900	1000		Malaysia, RTM/Voice of Malaysia			6175as
			9750as	15295as		
0900	1000		New Zealand, Radio NZ International			9765pa
0900	1000	DRM	New Zealand, Radio NZ International			9870pa
0900	1000		Nigeria, Voice of Nigeria/External Service			9690af
0900	1000		Palau, T8WH/World Harvest	9930as		15680as
0900	1000		Russia, Voice of Russia	17605af		17665af
			17805af			
0900	1000		South Africa, Channel Africa	9625af		
0900	1000		Tajikistan, Voice of Tajik/Radio 2			7245as
0900	1000	DRM	UK, BBC World Service	9610eu		13810eu
0900	1000		UK, BBC World Service	6190af		6195as
			9740as	9860af	11760me	15310as
			15400af	15575as	17640af	17760as
			17830af	21470af		
0900	1000		USA, American Forces Network			4319usb
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
0900	1000		USA, EWTN/WEWN Vandiver AL			9390as
0900	1000		USA, WHRI Cypress Creek SC	7385va		
0900	1000	smtwhf	USA, WHRI Cypress Creek SC	9425na		
0900	1000	Sat	USA, WHRI Cypress Creek SC	7465na		
0900	1000	vl	USA, WRMI Miami FL	9955va		
0900	1000		USA, WTJC Newport NC	9370na		
0900	1000		USA, WWCR Nashville TN	3215na		5070na
			5890na	5935na		
0900	1000		USA, WWRB Manchester TN	3185va		
0900	1000		USA, WYFR/Family Radio Worldwide			5950na
			6915na	7455na	9465as	
0900	1000		Zambia CVC Intl/ The Voice Africa			6065af
			13590af			
0900	1000		Zambia, Zambia Natl Broadcasting Corp			6165do
0930	1000		Australia, CVC International	15535as		

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

1000	1005		Croatia, Croatian Radio	11675va		
1000	1029		Czech Republic, Radio Prague	9955sa		15700as
			21745af			
1000	1030	Sat/Sun DRM	Bulgaria, Radio Bulgaria	11900eu		
1000	1030		Vietnam, Voice of Vietnam	9840as		12020as
1000	1057		China, China Radio International			5955na
			7215as	11640as	13590as	13720va
			15190as	15210as	15350as	17490eu
			17690va			
1000	1057		Netherlands, R Netherlands Worldwide			6040va
			9720as	12065as		
1000	1057		North Korea, Voice of Korea	11710sa		11735as
			13650as	15180sa		
1000	1058		New Zealand, Radio NZ International			9765pa
1000	1100		Anguilla, Worldwide Univ Network			11775am
1000	1100		Australia, ABC NT Alice Springs			2310do
1000	1100		Australia, ABC NT Katherine	2485do		
1000	1100		Australia, ABC NT Tennant Creek			2325do
1000	1100		Australia, CVC International	15535as		
1000	1100		Australia, Radio Australia	9475as		9580pa
			9590pa	11945pa		
1000	1100		Bahrain, Radio Bahrain	6010me		9745al
1000	1100	w/DRM	Belgium, TDP Radio	6015eu		
1000	1100		Canada, CFRX Toronto ON	6070na		
1000	1100		Canada, CFVP Calgary AB	6030na		
1000	1100		Canada, CKZN St John's NF	6160na		
1000	1100		Canada, CKZU Vancouver BC	6160na		
1000	1100		Cuba, Radio Havana Cuba	6060na		
1000	1100	mtwhf	Equatorial Guinea, Radio Africa # 2			15190af
1000	1100	Sat/Sun	Equatorial Guinea, Radio East Africa			15190af
1000	1100		India, All India Radio	7270as		13710pa
			15235as	15260as	17800as	17895pa
1000	1100		Indonesia, Voice of Indonesia	9525va		11785al
1000	1100		Malaysia, RTM/Traxx FM	7295do		
1000	1100		Mongolia, Voice of Mongolia	12085as		
1000	1100	DRM	New Zealand, Radio NZ International			9870pa
1000	1100		Nigeria, Voice of Nigeria/External Service			9690af
1000	1100		Palau, T8WH/World Harvest	9930as		12130as
1000	1100		Russia, Voice of Russia	7205af		17650af
			17665af	17805af		
1000	1100		Saudi Arabia, BSKSA/External Service			15250af
1000	1100		South Africa, Channel Africa	9625af		
1000	1100	Sat/Sun	UK, BBC World Service	15400af		17830af
1000	1100	DRM	UK, BBC World Service	9545eu		13810eu
1000	1100		UK, BBC World Service	6190af		6195as
			9545eu	9740as	9860af	11760me
			11895as	15310as	15575as	17640af
			17790as	21470af		
1000	1100		Ukraine, Radio Ukraine International			9950eu
1000	1100		USA, American Forces Network			4319usb
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
1000	1100		USA, EWTN/WEWN Vandiver AL			9390as
1000	1100		USA, KNLS Anchor Point AK	6150as		
1000	1100		USA, WHRI Cypress Creek SC	7385va		
1000	1100	vl	USA, WRMI Miami FL	9955va		
1000	1100		USA, WTJC Newport NC	9370na		
1000	1100		USA, WWCR Nashville TN	5070na		5935na
			9985na			
1000	1100		USA, WWRB Manchester TN	3185va		
1000	1100		USA, WYFR/Family Radio Worldwide			5950na
			6890na	6915na	7455na	9460as
			9465as			
1000	1100		Zambia CVC Intl/ The Voice Africa			6065af
			13590af			
1000	1100		Zambia, Zambia Natl Broadcasting Corp			6165do
1015	1045	Sun	UK, Bible Voice Broadcasting	5910as		
1030	1100		Australia, HCJB Global	15400as		
1030	1100		Iran, Voice of Islamic Rep. of Iran			15600as
			17660as			
1030	1100	Sun	Italy, IRRS/NEXUS	9510va		
1059	1100		New Zealand, Radio NZ International			13660pa

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

1100	1105	mtwhf	Croatia, Croatian Radio	7370va		
1100	1112		Cuba, Radio Nacional de Venezuela			6060ca
1100	1127		Iran, Voice of Islamic Rep. of Iran			15600as
			17660as			
1100	1130		Australia, CVC International	15535as		
1100	1130	DRM	South Korea, KBS World Radio			9760eu
1100	1130		Vietnam, Voice of Vietnam	7285as		
1100	1145		USA, WYFR/Family Radio Worldwide			5950na
			6000ca			
1100	1157		China, China Radio International			5955as
			5960na	6060as	9570as	11650as
			11795as	13590va	13645eu	13665eu
			13720as	17490va		
1100	1158	DRM	New Zealand, Radio NZ International			9870pa
1100	1200		Anguilla, Worldwide Univ Network			11775am
1100	1200		Australia, ABC NT Alice Springs			2310do
1100	1200		Australia, ABC NT Katherine	2485do		
1100	1200		Australia, ABC NT Tennant Creek			2325do
1100	1200		Australia, HCJB Global	15400as		
1100	1200		Australia, Radio Australia	5995pa		6020pa
			9475as	9560pa	9580pa	9590pa
			11945pa	12080pa		
1100	1200		Bahrain, Radio Bahrain	6010me		9745al
1100	1200	h/DRM	Belgium, TDP Radio	6015eu		
1100	1200	Sat/Sun	Canada, CBC NQ SW Service	9625na		
1100	1200		Canada, CFRX Toronto ON	6070na		
1100	1200		Canada, CFVP Calgary AB	6030na		
1100	1200		Canada, CKZN St John's NF	6160na		
1100	1200		Canada, CKZU Vancouver BC	6160na		
1100	1200	mtwhf	Equatorial Guinea, Radio Africa # 2			15190af
1100	1200	Sat/Sun	Equatorial Guinea, Radio East Africa			15190af
1100	1200	DRM	Germany, Deutsche Welle	9545eu		13810eu
1100	1200	Sun	Italy, IRRS/NEXUS	9510va		
1100	1200		Malaysia, RTM/Traxx FM	7295do		
1100	1200		New Zealand, Radio NZ International			13660pa
1100	1200		Nigeria, Voice of Nigeria/External Service			9690af
1100	1200		Palau, T8WH/World Harvest	9930as		12130as
1100	1200		Russia, Voice of Russia	7205af		
1100	1200		Saudi Arabia, BSKSA/External Service			15250af
1100	1200		South Africa, Channel Africa	9625af		

1100	1200		Taiwan, Radio Taiwan International			7445as
			11715as			
1100	1200	Sat/Sun	UK, BBC World Service	15400af		
1100	1200		UK, BBC World Service	6190af		6195as
			9545eu	9605as	9740as	9860af
			11760me	11895as	15310as	15575as
			17640af	17790as	17830as	21470af
1100	1200		USA, American Forces Network			4319usb
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
1100	1200		USA, EWTN/WEWN Vandiver AL			9390as
1100	1200		USA, WHRI Cypress Creek SC	7315va		7385va
1100	1200		USA, WINB Red Lion PA	9265am		
1100	1200	vl	USA, WRMI Miami FL	9955va		
1100	1200		USA, WTJC Newport NC	9370na		
1100	1200		USA, WWCR Nashville TN	5070na		5935na
			9985na			
1100	1200		USA, WWRB Manchester TN	3185va		
1100	1200		USA, WYFR/Family Radio Worldwide			6890na
			7455na	11725ca	11830sa	
1100	1200		Zambia CVC Intl/ The Voice Africa			6065af
			13590af			
1100	1200		Zambia, Zambia Natl Broadcasting Corp			6165do
1105	1200	Sun	Greece, Voice of Greece	9420va		15650va
1115	1130	mtwhf	UK, Bible Voice Broadcasting	5945as		
1115	1200		UK, Bible Voice Broadcasting	5945as		
1115	1200	Sat	UK, Bible Voice Broadcasting	5945as		
1130	1157		Czech Republic, Radio Prague	11640eu		17545va
1130	1200		Australia, CVC International	15535as		
1130	1200	sthf	Guam, KSDA/ AWR	15260as		
1130	1200	f	Vatican City State, Vatican Radio			15595as
			17765as			
1130	1200		Vietnam, Voice of Vietnam	9840as		12020as
1145	1200		Australia, HCJB Global	15340as		

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

1200	1225		Saudi Arabia, BSKSA/External Service			15250af
1200	1230		Australia, CVC International	15535as		
1200	1230	mtwhf	France, Radio France International			13640af
			21620af			
1200	1230		Germany, AWR-Europe	15495as		
1200	1230		Japan, NHK World/ Radio Japan			6120na
			9625as	9695as	9790eu	
1200	1245		USA, WYFR/Family Radio Worldwide			6890na
1200	1256		Romania, Radio Romania International			11970eu
			15105eu	15430af	17760af	
1200	1257		China, China Radio International			5955as
			7250as	9460as	9600as	9645as
			9730va	9760as	11650as	11690as
			11760va	11980as	12015as	13665eu
			13790eu	17490eu		
1200	1258		New Zealand, Radio NZ International			13660pa
1200	1300		Anguilla, Worldwide Univ Network			11775am
1200	1300		Australia, ABC NT Alice Springs			2310do
1200	1300		Australia, ABC NT Katherine	2485do		
1200	1300		Australia, ABC NT Tennant Creek			2325do
1200	1300		Australia, HCJB Global	15400as		
1200	1300		Australia, Radio Australia	5995pa		6020pa
			9475as	9560pa	9580pa	9590pa
			11945pa			
1200	1300		Bahrain, Radio Bahrain	6010me		9745al
1200	1300	f/DRM	Belgium, TDP Radio	6015eu		
1200	1300	Sat/Sun	Canada, CBC NQ SW Service	9625na		
1200	1300		Canada, CFRX Toronto ON	6070na		
1200	1300		Canada, CFVP Calgary AB	6030na		
1200	1300		Canada, CKZN St John's NF	6160na		
1200	1300		Canada, CKZU Vancouver BC	6160na		
1200	1300	Sat/Sun	Equatorial Guinea, Radio East Africa			15190af
1200	1300	DRM	Germany, Deutsche Welle	9545eu		13810eu
1200	1300	Sun	Italy, IRRS/NEXUS	9510va		
1200	1300		Malaysia, RTM/Traxx FM	7295do		
1200	1300		Malaysia, RTM/Voice of Malaysia			6175as
			9750as	15295as		
1200	1300		Nigeria, Voice of Nigeria/External Service			9690af
1200	1300		Palau, T8WH/World Harvest	9930as		12130as
1200	1300		Russia, Voice of Russia	7340af		7350af
			9695af	11660af		
1200	1300		South Korea, KBS World Radio			9650na
1200	1300		UK, BBC World Service	5875as		6190af
			6195as	9545eu	9605as	9740as
			9860af	11760me	15310as	15575as
			17640af	17790as	17830af	21470af
1200	1300		Ukraine, Radio Ukraine International			9950eu
1200	1300		USA, American Forces Network			4319usb
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
1200	1300		USA, EWTN/WEWN Vandiver AL			9390as
1200	1300		USA, KNLS Anchor Point AK	6150as		6915as
1200	1300		USA, Voice of America	7575va		9640va
			11705va	11730va	11750va	
1200	1300		USA, WHRI Cypress Creek SC	7315va		7385va
1200	1300		USA, WINB Red Lion PA	9265am		
1200	1300	vl	USA, WRMI Miami FL	9955va		
1200	1300		USA, WTJC Newport NC	9370na		
1200	1300		USA, WWCR Nashville TN	5935na		7490na
			9980na	15825na		
1200	1300		USA, WWRB Manchester TN	9385na		
1200	1300		USA, WYFR/Family Radio Worldwide			7455na
			11530ca	11970am	17505as	
1200	1300		Zambia CVC Intl/ The Voice Africa			6065af
			13590af			
1200	1300		Zambia, Zambia Natl Broadcasting Corp			6165do
1215	1300		Egypt, Radio Cairo	17870as		
1230	1300		Australia, CVC International	13635as		
1230	1300		Bangladesh, Bangladesh Betar			7250as
1230	1300	mtwhf	Ethiopia, Radio Ethiopia/National Service			5990do
			7110do	9704do		
1230	1300		Thailand, Radio Thailand World Service			9720va
1230	1300		Vietnam, Voice of Vietnam	9840as		12020as

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

1300	1330		Egypt, Radio Cairo	17870as		
1300	1345		USA, WYFR/Family Radio Worldwide			7455na
			11970na			
1300	1357		China, China Radio International			5995as
			7300na	9570na	9730as	9765va
			9870as	11760as	11885as	11900eu
			11980as	13790eu	15230na	17490va
1300	1357		North Korea, Voice of Korea	9335na		11710na
			13760eu	15245eu		
1300	1400		Anguilla, Worldwide Univ Network			11775am
1300	1400		Australia, ABC NT Alice Springs			2310do
1300	1400		Australia, ABC NT Katherine	2485do		
1300	1400		Australia, CVC International	13635as		
1300	1400		Australia, HCJB Global	15340as		15400as
1300	1400		Australia, Radio Australia	5995pa		6020pa
			9560pa	9580pa	9590pa	
1300	1400		Bahrain, Radio Bahrain	6010me		9745al
1300	1400	a/DRM	Belgium, TDP Radio	6015eu		
1300	1400	Sat/Sun	Canada, CBC NQ SW Service	9625na		
1300	1400		Canada, CFRX Toronto ON	6070na		
1300	1400		Canada, CFVP Calgary AB	6030na		
1300	1400		Canada, CKZN St John's NF	6160na		
1300	1400		Canada, CKZU Vancouver BC	6160na		
1300	1400	Sat/Sun	Equatorial Guinea, Radio East Africa			15190af
1300	1400	DRM	Germany, Deutsche Welle	9545eu		13810eu
1300	1400		Indonesia, Voice of Indonesia	9525va		11785al
1300	1400	Sun	Italy, IRRS/NEXUS	9510va		
1300	1400		Malaysia, RTM/Traxx FM	7295do		
1300	1400		Malaysia, RTM/Voice of Malaysia			6175as
			9750as	15295as		
1300	1400		New Zealand, Radio NZ International			6170pa
1300	1400		Nigeria, Voice of Nigeria/External Service			9690af
1300	1400		Palau, T8WH/World Harvest	9930as		11880as
1300	1400		Poland, Polish Radio	11675eu		11860eu
1300	1400		Russia, Voice of Russia	7205af		
1300	1400		South Korea, KBS World Radio			9570as
			9770as			
1300	1400		Uganda, UBC Radio	4976do		
1300	1400		UK, BBC World Service	5875as		6190af
			6195as	9410as	9545eu	9740as
			9860af	11760me	11835as	15310as
			15420af	15575eu	21470af	
1300	1400		USA, American Forces Network			4319usb
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
1300	1400		USA, EWTN/WEWN Vandiver AL			13835eu
1300	1400		USA, KJES Vado NM	11715na		
1300	1400		USA, Voice of America	7575va		9640va
			9760va	11705va		
1300	1400		USA, WHRI Cypress Creek SC	7315va		
1300	1400	Sat/Sun	USA, WHRI Cypress Creek SC	9840va		
1300	1400		USA, WINB Red Lion PA	9265am		
1300	1400	vl	USA, WRMI Miami FL	9955va		
1300	1400		USA, WTJC Newport NC	9370na		
1300	1400		USA, WWCR Nashville TN	7490na		9980na
			13845na	15825na		
1300	1400		USA, WWRB Manchester TN	9385na		
1300	1400		USA, WYFR/Family Radio Worldwide			7560as
			9310na	11830na	11620as	11560as
			11855na			

1300	1400		Zambia CVC Intl/ The Voice Africa 13590af			6065af
1300	1400		Zambia, Zambia Natl Broadcasting Corp			6165do
1310	1340		Japan, NHK World/ Radio Japan			9875as
1330	1357	fa/ DRM	Czech Republic, Radio Prague	9850eu		
1330	1400	mtwhfa	Guam, KSDA/ AWR	15660as		
1330	1400		India, All India Radio 13710as	9620as		11620as
1330	1400		Laos, Lao National Radio	7145as		
1330	1400		Sweden, Radio Sweden	7405va		
1330	1400		Turkey, Voice of Turkey	12035eu		15300as
1330	1400		Vietnam, Voice of Vietnam	9840as		12020as

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

1400	1425		Turkey, Voice of Turkey	12035eu		15300as
1400	1429		Czech Republic, Radio Prague	11600as		13580na
1400	1430		Australia, HCJB Global	15400as		
1400	1430	f	Clandestine, Shiokaze/Sea Breeze			6120as
1400	1430	Sun	Germany, Pan American Broadcasting			15205as
1400	1430	`	Japan, NHK World/ Radio Japan 9875as	11705na	11780eu	5995as 21560va
1400	1430		Laos, Lao National Radio	6130as		
1400	1430		Thailand, Radio Thailand World Service			9725va
1400	1430	Sun	United Arab Emirates, FEBA Radio			12045as
1400	1440		Guam, KTWR/TWR	9975as		
1400	1457		China, China Radio International 6075na 9560as 11665as 15230af	7300na 9700as 13675eu 17630af	7325na 9765va 13685eu	5955na 9460as 9870as 13740na
1400	1459		Netherlands, R Netherlands Worldwide 15595va			12080va
1400	1500		Anguilla, Worldwide Univ Network			11775am
1400	1500		Australia, ABC NT Alice Springs			2310do
1400	1500		Australia, ABC NT Katherine	2485do		
1400	1500		Australia, ABC NT Tennant Creek			2325do
1400	1500		Australia, CVC International	13635as		
1400	1500		Australia, Radio Australia 7240pa	9590pa		5995pa 6080pa
1400	1500		Bahrain, Radio Bahrain	6010me		9745al
1400	1500	s/DRM	Belgium, TDP Radio	6015eu		
1400	1500		Bhutan, Bhutan Broadcasting Service			6035as
1400	1500	Sat/Sun	Canada, CBC NQ SW Service	9625na		
1400	1500		Canada, CFRX Toronto ON	6070na		
1400	1500		Canada, CFVP Calgary AB	6030na		
1400	1500		Canada, CKZN St John's NF	6160na		
1400	1500		Canada, CKZU Vancouver BC	6160na		
1400	1500	Sat/Sun	Equatorial Guinea, Radio East Africa			15190af
1400	1500		Germany, CVC Intl-Christian Vision			17770af
1400	1500		Germany, Overcomer Ministries 13810as			6110eu
1400	1500		India, All India Radio 13710as	9620as		11620as
1400	1500		Libya, LJB/Voice of Africa	17725af		21695af
1400	1500		Malaysia, RTM/Traxx FM	7295do		
1400	1500		New Zealand, Radio NZ International			6170pa
1400	1500		Nigeria, Voice of Nigeria/External Service			9690af
1400	1500		Oman, Radio Oman	15140va		
1400	1500		Palau, T8WH/World Harvest	9930as		
1400	1500	DRM	Russia, Voice of Russia	5905eu		
1400	1500		Russia, Voice of Russia 11660af	12055af		7205af 7340af
1400	1500		South Africa, Channel Africa	9625af		
1400	1500		Uganda, UBC Radio	4976do		
1400	1500		UK, BBC World Service 6190af 9625as 15420af	6195as 9740as 17640af	9410as 9860af	5875as 9545as 11760as
1400	1500	DRM	UK, BBC World Service	9545eu		13590eu
1400	1500	Sat/Sun	UK, Bible Voice Broadcasting	15680af		
1400	1500		USA, American Forces Network 5446usb 10320usb	5765usb 12133usb	6350usb 12759usb	4319usb 7812usb 13362usb
1400	1500		USA, EWTN/WEWN Vandiver AL			13835eu
1400	1500		USA, KJES Vado NM	11715na		
1400	1500		USA, KNLS Anchor Point AK	6890as		
1400	1500		USA, Voice of America 7575va 12150va 17715af	9760va 15205va	9930va 15580af	4930af 11985va 17650af 6080af
1400	1500	Sat/Sun	USA, WHRI Cypress Creek SC	9840va		
1400	1500		USA, WINB Red Lion PA	9265am		
1400	1500	vl	USA, WRMI Miami FL	9955va		
1400	1500		USA, WTJC Newport NC	9370na		
1400	1500		USA, WWCR Nashville TN 13845na	7490na 15825na		9980na
1400	1500		USA, WWRB Manchester TN	9385na		
1400	1500		USA, WYFR/Family Radio Worldwide 9485as 11565na	11560as 17760na	11855na	6225as 13695na
1400	1500		Zambia CVC Intl/ The Voice Africa 13650af			6065af
1400	1500		Zambia, Zambia Natl Broadcasting Corp			6165do
1400	1557		China, China Radio International 6095as 9870as	7325as 13685as	7405as 13740na	5955as 9435na 17630va
1405	1500	Sat	Greece, Voice of Greece	9420eu		
1415	1430		Nepal, Radio Nepal	5005as		
1415	1439	mtwhfa	Germany, Pan American Broadcasting			15205as
1430	1445	Sun	Germany, Pan American Broadcasting			15205as
1430	1500		Australia, Radio Australia	9475as		11660as
1430	1500		China, CPBS/CNR Business Radio 7245do 9820as	7315as 9775as	7335as	6155do 7375as
1430	1500		Sweden, Radio Sweden	9400va		

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

1500	1510	mtwhfa	Turkmenistan, Turkmen Radiosi			5015eu
1500	1515	Sun	UK, Bible Voice Broadcasting	15680af		
1500	1525	Sun	China, Voice of the Strait	9505as		
1500	1527		Czech Republic, Radio Prague	9955na		
1500	1530		Australia, HCJB Global	15340as		
1500	1530	Sat/Sun	Clandestine, Sudan Radio Service			17745af
1500	1530		Guam, KSDA/ AWR	15255as		
1500	1530		UK, BBC World Service 15105af	9410af		11860af
1500	1530	Sat	UK, Bible Voice Broadcasting	15295as		
1500	1530		UK, Sudan Radio Service	17745af		
1500	1530		Vietnam, Voice of Vietnam 12020va	7285va		9840va
1500	1545		USA, WYFR/Family Radio Worldwide			15210sa
1500	1550		New Zealand, Radio NZ International			6170pa
1500	1557		Canada, Radio Canada International 11975as			9635as
1500	1557		China, China Radio International 6060as 7420as 9570as	6100as 7435as 9600na	7235as 9435as 11650as	5955as 7255as 9525eu
1500	1557		Libya, LJB/Voice of Africa	17725af		21695af
1500	1557		Netherlands, R Netherlands Worldwide 15595va			12080as
1500	1557		North Korea, Voice of Korea 13760eu	9335na 15245eu		11710na
1500	1600		Anguilla, Worldwide Univ Network			11775am
1500	1600		Australia, ABC NT Alice Springs			2310do
1500	1600		Australia, ABC NT Katherine	2485do		
1500	1600		Australia, CVC International	13635as		
1500	1600		Australia, Radio Australia 7240pa	9475as	9590pa	5995pa 6080pa 11660as
1500	1600		Bahrain, Radio Bahrain	6010me		9745al
1500	1600	DRM	Belgium, TDP Radio	6015eu		
1500	1600	Sat/Sun	Canada, CBC NQ SW Service	9625na		
1500	1600		Canada, CFRX Toronto ON	6070na		
1500	1600		Canada, CFVP Calgary AB	6030na		
1500	1600		Canada, CKZN St John's NF	6160na		
1500	1600		Canada, CKZU Vancouver BC	6160na		
1500	1600	Sat/Sun	Equatorial Guinea, Radio East Africa			15190af
1500	1600		Germany, CVC Intl-Christian Vision			17770af
1500	1600		Germany, Overcomer Ministries 13810as	17485af		6110eu
1500	1600		Italy, IRRS/NEXUS	15650va		
1500	1600		Malaysia, RTM/Traxx FM	7295do		
1500	1600		Myanmar, Myanma Radio	5985as		
1500	1600		Palau, T8WH/World Harvest	9905as		9930as
1500	1600		Russia, Voice of Russia 9660af	4975me		7260af
1500	1600	DRM	Russia, Voice of Russia	5905eu		
1500	1600		South Africa, Channel Africa	9625af		
1500	1600		Uganda, Dunamis Shortwave	4750af		
1500	1600		Uganda, UBC Radio	4976do		
1500	1600		UK, BBC World Service 5975as 9740as 15400af	6190af 9855as 15420af	6195as 9860af 17640af	5790eu 7395as 12095eu
1500	1600	DRM	UK, BBC World Service	5790eu		13590eu
1500	1600		USA, American Forces Network 5446usb 10320usb	5765usb 12133usb	6350usb 12759usb	4319usb 7812usb 13362usb
1500	1600		USA, EWTN/WEWN Vandiver AL			15610me
1500	1600		USA, Voice of America 7545va 11765va 17715af	9685va 12150va 17895af	9930va 13735af	4930af 11525va 15580af 6080af

SHORTWAVE GUIDE

1500	1600		USA, Voice of America/Special English			6140va
			7520va	9760va	15460va	
1500	1600	Sat/Sun	USA, WHRI Cypress Creek SC		9840va	11785va
1500	1600		USA, WINB Red Lion PA		13570am	
1500	1600	vl	USA, WRMI Miami FL		9955na	
1500	1600		USA, WTJC Newport NC		9370na	
1500	1600		USA, WWCR Nashville TN		7490na	9980na
			13845na	15825na		
1500	1600		USA, WWRB Manchester TN		9385na	
1500	1600		USA, WYFR/Family Radio Worldwide			6280as
			9495as	11565na	11855na	12015as
			17760na			
1500	1600		Zambia CVC Intl/ The Voice Africa			6065af
			13650af			
1500	1600		Zambia, Zambia Natl Broadcasting Corp			6165do
1515	1530		Vatican City State, Vatican Radio			7585as
			9310as	11850as	13765as	
1530	1545		India, All India Radio		7255as	9620as
			9820as	9910as		
1530	1600	mtwhfa	Albania, Radio Tirana		13640na	
1530	1600		Iran, Voice of Islamic Rep. of Iran			7305as
			9600as	9635as		
1530	1600		Mongolia, Voice of Mongolia		9665as	
1530	1600		Sweden, Radio Sweden		9360me	
1530	1600	Sat	UK, BBC World Service		9410af	11860af
			15105af			
1530	1600	Sun	UK, Bible Voice Broadcasting		13590me	
1530	1600		UK, Bible Voice Broadcasting		15680as	
1530	1600	Sat	Vatican City State, Vatican Radio			7585as
			11850as	13765as		
1545	1600	mtwhfa	UK, Bible Voice Broadcasting		13590me	
1551	1600		New Zealand, Radio NZ International			6170pa
1551	1600	DRM	New Zealand, Radio NZ International			7440pa

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

1600	1615		Pakistan, PBC/ Radio Pakistan		7510me	11565me
			15100af			
1600	1615	f	UK, Bible Voice Broadcasting		13590me	
1600	1620	t	UK, Bible Voice Broadcasting		13590me	
1600	1627		Iran, Voice of Islamic Rep. of Iran			7305as
			9600as			
1600	1630	Sun	Germany, Pan American Broadcasting			13830as
1600	1630		Guam, KSDA/ AWR		9585as	11690as
1600	1630		Myanmar, Myanma Radio		9730do	
1600	1630	Sat	USA, Voice of America		11750af	
1600	1630		Vietnam, Voice of Vietnam		7220va	7280va
			9550va	9730va		
1600	1630		Yemen, Rep of Yemen Radio/ Radio Sana'a			
			9780me			
1600	1645		USA, WYFR/Family Radio Worldwide			11565na
			11830na	17760na		
1600	1657		North Korea, Voice of Korea		9990va	11545va
1600	1700		Anguilla, Worldwide Univ Network			11775am
1600	1700		Australia, ABC NT Alice Springs			2310do
1600	1700		Australia, ABC NT Katherine		2485do	
1600	1700		Australia, CVC International		13635as	
1600	1700		Australia, Radio Australia		5995pa	6080pa
			7240pa	9475as	9710pa	11660as
1600	1700		Bahrain, Radio Bahrain		6010me	9745al
1600	1700	Sat	Canada, CBC NQ SW Service		9625na	
1600	1700		Canada, CFRX Toronto ON		6070na	
1600	1700		Canada, CFVP Calgary AB		6030na	
1600	1700		Canada, CKZN St John's NF		6160na	
1600	1700		Canada, CKZU Vancouver BC		6160na	
1600	1700	Sat	Clandestine, Cheetah Radio		11730as	
1600	1700		Egypt, Radio Cairo12170af			
1600	1700		Ethiopia, Radio Ethiopia/External Service			7165af
			9560af			
1600	1700	mtwhf	France, Radio France International			15605af
			17605af			
1600	1700		Germany, CVC Intl-Christian Vision			17770af
1600	1700		Germany, Deutsche Welle		5965as	
1600	1700		Italy, IRRS/NEXUS		15650va	
1600	1700		Malaysia, RTM/Traxx FM		7295do	
1600	1700		New Zealand, Radio NZ International			6170pa
1600	1700	DRM	New Zealand, Radio NZ International			7440pa
1600	1700		Palau, T8WH/World Harvest		9905as	9930as
1600	1700		Russia, Voice of Russia		4975me	6130eu
			7305af	9470va	11630af	
1600	1700		South Korea, KBS World Radio			9515eu
1600	1700		Taiwan, Radio Taiwan International			9785as
			11550as			
1600	1700		Uganda, Dunamis Shortwave		4750af	
1600	1700		Uganda, UBC Radio		4976do	
1600	1700		UK, BBC World Service		3255af	3995eu
			5790eu	5975as	6190af	7255as
			9740as	11860af	12095eu	13820af
			15400af	15420af	17640af	
1600	1700	DRM	UK, BBC World Service		3995eu	5790eu
1600	1700	Sat	UK, BBC World Service		9410af	15105af
1600	1700	Sun	UK, Bible Voice Broadcasting		13590me	
1600	1700		USA, American Forces Network			4319usb
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
1600	1700		USA, EWTN/WEWN Vandiver AL			15610me
1600	1700		USA, Voice of America		4930af	6080af
			15580af	17715af	17895af	
1600	1700		USA, Voice of America/Special English			9395va
			13600va	15445va		
1600	1700		USA, WHRI Cypress Creek SC		9840va	11785va
1600	1700		USA, WINB Red Lion PA		13570am	
1600	1700	vl	USA, WRMI Miami FL		9955na	
1600	1700		USA, WTJC Newport NC		9370na	
1600	1700		USA, WWCR Nashville TN		7490na	9980na
			13845na	15825na		
1600	1700		USA, WWRB Manchester TN		9385na	
1600	1700		USA, WYFR/Family Radio Worldwide			6085na
			9870af	11740as	11830af	13695na
			17690eu	18980eu	21455eu	
1600	1700		Zambia CVC Intl/ The Voice Africa			6065af
			13650af			
1600	1700		Zambia, Zambia Natl Broadcasting Corp			6165do
1600	1757		China, China Radio International			6060af
			6100as	7235as	7255as	7420as
			7435as	9435as	9525eu	9570as
			9600eu	11650va		
1605	1700		Canada, Radio Canada International			9610na
1605	1700	DRM	Canada, Radio Canada International			9800na
1615	1700	Sun	UK, BBC World Service		9410af	11860af
			15105af			
1615	1700		UK, Bible Voice Broadcasting		13590me	
1630	1700		Guam, KSDA/ AWR		9840as	
1640	1650	mtwhfa	Turkmenistan, Turkmen Radiosi			4930eu

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

1700	1704		Canada, Radio Canada International			9610na
1700	1704	DRM	Canada, Radio Canada International			9800na
1700	1725		Vietnam, Voice of Vietnam		9725eu	
1700	1727		Czech Republic, Radio Prague		5930eu	15710af
1700	1730		Croatia, Croatian Radio		6165va	
1700	1730		Sweden, Radio Sweden		7465me	
1700	1730		UK, Bible Voice Broadcasting		13590me	
1700	1745		USA, WYFR/Family Radio Worldwide			18980eu
1700	1746		UK, BBC World Service		6005af	9410af
1700	1750		New Zealand, Radio NZ International			6170pa
1700	1750	DRM	New Zealand, Radio NZ International			7440pa
1700	1755		South Africa, Channel Africa		15235af	
1700	1757		China, China Radio International			6090af
			6100as	6140as	6165af	7205af
			7255af	7335as	7410eu	7420af
			7425eu	7435va	9570eu	
1700	1800		Anguilla, Worldwide Univ Network			11775am
1700	1800		Australia, ABC NT Alice Springs			2310do
1700	1800		Australia, ABC NT Katherine		2485do	
1700	1800		Australia, CVC International		13635as	
1700	1800		Australia, Radio Australia		5995pa	6080pa
			9475as	9580pa	9710pa	11880pa
1700	1800		Bahrain, Radio Bahrain		6010me	9745al
1700	1800	Sat	Canada, CBC NQ SW Service		9625na	
1700	1800		Canada, CFRX Toronto ON		6070na	
1700	1800		Canada, CFVP Calgary AB		6030na	
1700	1800		Canada, CKZN St John's NF		6160na	
1700	1800		Canada, CKZU Vancouver BC		6160na	
1700	1800		Egypt, Radio Cairo12170af			
1700	1800		Equatorial Guinea, Radio Africa			7190af
			15190af			
1700	1800		Germany, CVC Intl-Christian Vision			17770af
1700	1800		Italy, IRRS/NEXUS		15650va	
1700	1800		Malaysia, RTM/Traxx FM		7295do	
1700	1800		Nigeria, Voice of Nigeria/External Service			15120af
1700	1800		Palau, T8WH/World Harvest		9905as	9930as
1700	1800		Russia, Voice of Russia		4975me	7240af
			7305af	9470va		
1700	1800		Swaziland, TWR Swaziland		3200af	
1700	1800		Taiwan, Radio Taiwan International			11850af
1700	1800		Tajikistan, Voice of Tajik/Radio 2			7245as
1700	1800		Uganda, Dunamis Shortwave		4750af	
1700	1800		Uganda, UBC Radio		4976do	

1700	1800		UK, BBC World Service	3255af	3995eu		
			5975as	6190af	7355as	12095af	
			13820af	15400af	15420af	17830af	
1700	1800	Sat	UK, Bible Voice Broadcasting	9430me			
1700	1800	Sun	UK, Bible Voice Broadcasting	13590me			
1700	1800		USA, American Forces Network			4319usb	
			5446usb	5765usb	6350usb	7812usb	
			10320usb	12133usb	12759usb	13362usb	
1700	1800		USA, EWTN/WEWN Vandiver AL			15610me	
1700	1800		USA, Voice of America	6080af	13710af		
			15580af	17895af			
1700	1800		USA, WHRI Cypress Creek SC	11785va			
1700	1800	smtwhf	USA, WHRI Cypress Creek SC	9840va			
1700	1800	Sat	USA, WHRI Cypress Creek SC	9495va			
1700	1800		USA, WINB Red Lion PA	13570am			
1700	1800	vl	USA, WRMI Miami FL	9955va			
1700	1800		USA, WTJC Newport NC	9370na			
1700	1800		USA, WWCR Nashville TN	9980na	12160na		
			13845na	15825na			
1700	1800		USA, WWRB Manchester TN	9385na			
1700	1800		USA, WYFR/Family Radio Worldwide			13695na	
			17505af	17555na	21455eu	21680af	
1700	1800		Zambia CVC Intl/ The Voice Africa			4965af	
			13590af				
1700	1800		Zambia, Zambia Natl Broadcasting Corp			6165do	
1705	1800		Canada, Radio Canada International			9610na	
1705	1800	DRM	Canada, Radio Canada International			9800na	
1717	1730		Vatican City State, Vatican Radio			4005eu	
			5885eu	7250eu	7290eu	9645eu	
1720	1740	fas	USA, Voice of America	4930af	12080af		
			15775af				
1730	1800		Clandestine, Sudan Radio Service			9590af	
1730	1800		Slovakia, Radio Slovakia International			5915eu	
			6055eu				
1730	1800		UK, Bible Voice Broadcasting	13590me			
1730	1800	Sun	UK, Bible Voice Broadcasting	9430me			
1730	1800	mtwhf	UK, Sudan Radio Service	9840af			
1730	1800		USA, Voice of America	4930af	12080af		
			15775af				
1730	1800		Vatican City State, Vatican Radio			9755af	
			11625af	13765af			
1745	1800		Bangladesh, Bangladesh Betar			7250as	
1745	1800	DRM	India, All India Radio	9950eu			
1745	1800		India, All India Radio	6180eu	7410eu		
			11935af	15075af			
1751	1800		New Zealand, Radio NZ International			9765pa	
1751	1800	DRM	New Zealand, Radio NZ International			9890pa	
1755	1800		Clandestine, Radio Dialogue	3955af			

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

1800	1804		Canada, Radio Canada International			9610na	
1800	1804	DRM	Canada, Radio Canada International			9800na	
1800	1815	Sun	UK, Bible Voice Broadcasting	13590me			
1800	1827		China, China Radio International			6020eu	
1800	1827		Czech Republic, Radio Prague	5930eu	9400va		
1800	1830		Australia, CVC International	13635as			
1800	1830	w	Austria, AWR Europe	9515af			
1800	1830	DRM	Romania, Radio Romania International			5895eu	
1800	1830		South Africa, AWR Africa	3215af	3345af		
			11830af				
1800	1830		UK, BBC World Service	5975as	7260as		
			7355as				
1800	1830		UK, Bible Voice Broadcasting	13590me			
1800	1830	fa	UK, Bible Voice Broadcasting	9430me			
1800	1830		USA, Voice of America	4930af	6080af		
			11975af	12080af	13710af	15580af	
			15775af	17895af			
1800	1830	Sat/Sun	USA, Voice of America	4930af			
1800	1845	smtwhf	Swaziland, TWR Swaziland	9500af			
1800	1850		New Zealand, Radio NZ International			9765pa	
1800	1855		Clandestine, Radio Dialogue	3955af			
1800	1856		Romania, Radio Romania International			7215eu	
1800	1856	DRM	Romania, Radio Romania International			6065eu	
1800	1857		China, China Radio International			6100eu	
			7265eu	7405eu			
1800	1857		Netherlands, R Netherlands Worldwide			6020af	
			11655af	12045af			
1800	1857		North Korea, Voice of Korea	13760eu	15245eu		
1800	1859		Canada, Radio Canada International			9740af	
			11845af	13650af	15365af	17790af	
1800	1900		Anguilla, Worldwide Univ Network			11775am	
1800	1900	mtwhf	Argentina, Radio Nacional RAE			9690eu	
			15345eu				
1800	1900		Australia, ABC NT Alice Springs			2310do	
1800	1900		Australia, ABC NT Katherine	2485do			
1800	1900		Australia, Radio Australia	6080pa	7240pa		
			9475as	9580pa	9710pa	11880pa	
1800	1900		Bahrain, Radio Bahrain	6010me	9745al		
1800	1900		Bangladesh, Bangladesh Betar			7250eu	
1800	1900		Canada, CFRX Toronto ON	6070na			
1800	1900		Canada, CFVP Calgary AB	6030na			
1800	1900		Canada, CKZN St John's NF	6160na			
1800	1900		Canada, CKZU Vancouver BC	6160na			
1800	1900		Equatorial Guinea, Radio Africa			7190af	
			15190af				
1800	1900		Germany, CVC Intl-Christian Vision			17770af	
1800	1900	DRM	Germany, Deutsche Welle	3995eu			
1800	1900	DRM	India, All India Radio	9950eu			
1800	1900		India, All India Radio	9445af	11935af		
			15075af				
1800	1900		Italy, IRRS/NEXUS	15650va			
1800	1900	fas	Italy, IRRS/NEXUS	6170va			
1800	1900		Kuwait, Radio Kuwait	11990va			
1800	1900		Malaysia, RTM/Traxx FM	7295do			
1800	1900	DRM	New Zealand, Radio NZ International			9890pa	
1800	1900		Nigeria, Voice of Nigeria/External Service			15120af	
1800	1900		Palau, T8WH/World Harvest	9905as	9930as		
1800	1900		Poland, Polish Radio	9650eu			
1800	1900	DRM	Poland, Polish Radio	6130eu			
1800	1900		Russia, Voice of Russia	4975me	7240af		
			7270me	7305af	7330eu	11985af	
1800	1900		South Korea, KBS World Radio			7275eu	
1800	1900		Swaziland, TWR Swaziland	3200af	9500af		
1800	1900	Sat	Swaziland, TWR Swaziland	9500af			
1800	1900		Taiwan, Radio Taiwan International			3965eu	
1800	1900		Uganda, Dunamis Shortwave	4750af			
1800	1900		Uganda, UBC Radio	4976do			
1800	1900		UK, BBC World Service	3255af	3995eu		
			5875eu	5945as	5955as	6190af	
			7390eu	11810af	12095af	13820af	
			15400af	15420af			
1800	1900	Sun	UK, Bible Voice Broadcasting	6130eu	9430me		
1800	1900		USA, American Forces Network			4319usb	
			5446usb	5765usb	6350usb	7812usb	
			10320usb	12133usb	12759usb	13362usb	
1800	1900		USA, EWTN/WEWN Vandiver AL			15610me	
1800	1900		USA, WBCQ Monticello ME	15420am			
1800	1900		USA, WHRI Cypress Creek SC	9840va	11785va		
1800	1900		USA, WINB Red Lion PA	13570am			
1800	1900	vl	USA, WRMI Miami FL	9955ca			
1800	1900		USA, WTJC Newport NC	9370na			
1800	1900		USA, WWCR Nashville TN	9980na	12160na		
			13845na	15825na			
1800	1900		USA, WWRB Manchester TN	9385na			
1800	1900		USA, WYFR/Family Radio Worldwide			6045na	
			6915na	7395af	9895af	13695na	
			15115af	17535na	17555na		
1800	1900		Yemen, Rep of Yemen Radio/ Radio Sana'a				
			9780me				
1800	1900		Zambia CVC Intl/ The Voice Africa			4965af	
			13590af				
1800	1900		Zambia, Zambia Natl Broadcasting Corp			6165do	
1830	1845		Rwanda, Radio Rwanda	6055do			
1830	1900		Bulgaria, Radio Bulgaria	6200eu	7400eu		
1830	1900	DRM	Bulgaria, Radio Bulgaria	9700eu			
1830	1900		UK, BBC World Service	6005af	9410af		
1830	1900	f	UK, Bible Voice Broadcasting	9430me			
1830	1900		USA, Voice of America	4930af	6080af		
			11975af	13710af	15580af	17895af	
1845	1900		UK, Bible Voice Broadcasting	11830af			
1851	1900		New Zealand, Radio NZ International			11725pa	

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

1900	1930		Germany, Deutsche Welle	9735af	11690af		
			13780af				
1900	1930		Vietnam, Voice of Vietnam	7280va	9730va		
1900	1935	DRM	New Zealand, Radio NZ International			9890pa	
1900	1945	DRM	India, All India Radio	9950eu			
1900	1945		India, All India Radio	9445af	11935af		
			15075af				
1900	1945		USA, WYFR/Family Radio Worldwide			6085na	
			15565as				
1900	1957		China, China Radio International			7285eu	
			7295va	9440va			
1900	1957		Netherlands, R Netherlands Worldwide			7425af	
			12080af				
1900	1957		North Korea, Voice of Korea	7100af	9975va		
			11910af	11535va			
1900	2000		Anguilla, Worldwide Univ Network			11775am	
1900	2000		Australia, ABC NT Alice Springs			2310do	
1900	2000		Australia, ABC NT Katherine	2485do			

1900	2000		Australia, Radio Australia	6080pa	7240pa		
			9500as	9580pa	9710pa	11880pa	
1900	2000		Bahrain, Radio Bahrain	6010me	9745al		
1900	2000		Canada, CFRX Toronto ON	6070na			
1900	2000		Canada, CFVP Calgary AB	6030na			
1900	2000		Canada, CKZN St John's NF	6160na			
1900	2000		Canada, CKZU Vancouver BC	6160na			
1900	2000		Egypt, Radio Cairo	11510af			
1900	2000		Equatorial Guinea, Radio Africa			7190af	
			15190af				
1900	2000		Germany, CVC Intl-Christian Vision			17770af	
1900	2000	DRM	Germany, Deutsche Welle	3995eu			
1900	2000		Germany, Overcomer Ministries			6175eu	
1900	2000	fas	Italy, IRRS/NEXUS	6170va			
1900	2000		Kuwait, Radio Kuwait	11990va			
1900	2000		Malaysia, RTM/Traxx FM	7295do			
1900	2000		New Zealand, Radio NZ International			11725pa	
1900	2000		Nigeria, Voice of Nigeria/External Service			15120af	
1900	2000		Palau, T8WH/World Harvest	9875as	9930as		
1900	2000		Russia, Voice of Russia	4975me	5985me		
			7290me	7330eu	11985af		
1900	2000	mtwhf	Spain, Radio Exterior de Espana			9605af	
			9665eu				
1900	2000		Swaziland, TWR Swaziland	3200af			
1900	2000		Thailand, Radio Thailand World Service			7570eu	
1900	2000		Uganda, UBC Radio	4976do			
1900	2000		UK, BBC World Service	3255af	5875eu		
			5955as	6005af	6190af	7390eu	
			9410af	11810af	12095af	13820af	
1900	2000		UK, Bible Voice Broadcasting	11830af			
1900	2000		USA, American Forces Network			4319usb	
			5446usb	5765usb	6350usb	7812usb	
			10320usb	12133usb	12759usb	13362usb	
1900	2000		USA, EWTN/WEWN Vandiver AL			15610af	
1900	2000		USA, Voice of America	4930af	4940af		
			6080af	11975af	13710af	15580af	
			17895af				
1900	2000		USA, Voice of America/Special English			9585va	
			12020va				
1900	2000		USA, WBCQ Monticello ME	15420am			
1900	2000	mtwhf	USA, WBCQ Monticello ME	7415am	9330am		
1900	2000		USA, WHRI Cypress Creek SC	11785va			
1900	2000		USA, WINB Red Lion PA	13570am			
1900	2000	vl	USA, WRMI Miami FL	9955ca			
1900	2000		USA, WTJC Newport NC	9370na			
1900	2000		USA, WWCR Nashville TN	9980na	12160na		
			13845na	15825na			
1900	2000		USA, WWRB Manchester TN	9385na			
1900	2000		USA, WYFR/Family Radio Worldwide			3230af	
			6020af	6915af	7395af	9480af	
			9480af	9885af	13695na	15115af	
			17535na	17555na			
1900	2000		Zambia CVC Intl/ The Voice Africa			4965af	
			13590af				
1900	2000		Zambia, Zambia Natl Broadcasting Corp			6165do	
1905	1915		Croatia, Croatian Radio	6165va			
1905	1920	Sat	Mali, RDTV Du Mali	5995do			
1905	2000	Mon	South Africa, SA Radio League	3215af			
1930	2000	Sat/Sun	Germany, Pan American Broadcasting			9515af	
1930	2000		Iran, Voice of Islamic Rep. of Iran			5940eu	
			6040eu	7205eu	9800af	9925af	
1930	2000		Serbia, International Radio of Serbia			6100eu	
1930	2000		Slovakia, Radio Slovakia International			5915eu	
			7345eu				
1930	2000		South Africa, RTE Radio One	6225af			
1930	2000		Turkey, Voice of Turkey	6050eu			
1936	1950	DRM	New Zealand, Radio NZ International			11675pa	
1945	2000	mtwhas	Albania, Radio Tirana	11635eu			
1945	2000	mtwhf	UK, Bible Voice Broadcasting	11830af			
1951	2000	DRM	New Zealand, Radio NZ International			11675pa	

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

2000	2005	Mon	South Africa, SA Radio League	3215af			
2000	2015	Sat/Sun	Germany, Pan American Broadcasting			9515af	
2000	2025		Turkey, Voice of Turkey	6050eu			
2000	2028		Iran, Voice of Islamic Rep. of Iran			5940eu	
			6040eu	7205eu	9800af	9925af	
2000	2030	mtwhfa	Albania, Radio Tirana	7465eu	13640na		
2000	2030		Egypt, Radio Cairo	11510af			
2000	2030	Sat	Germany, Pan American Broadcasting			9515af	
2000	2030		South Africa, RTE Radio One	6225af			
2000	2030		Swaziland, TWR Swaziland	3200af			
2000	2030		USA, Voice of America	4930af	4940af		
			6080af	11975af	13710af	15580af	
2000	2030		Vatican City State, Vatican Radio			7365af	
			9755af	11625af			
2000	2045		USA, WYFR/Family Radio Worldwide			5745eu	
2000	2050		New Zealand, Radio NZ International			11725pa	
2000	2050	DRM	New Zealand, Radio NZ International			11675pa	
2000	2057		China, China Radio International			5960eu	
			5985af	7415va	7285eu	7295eu	
			9440eu	9600af	11640af	13630af	
2000	2057		Netherlands, R Netherlands Worldwide			7425af	
			11655af	21525af			
2000	2100		Anguilla, Worldwide Univ Network			11775am	
2000	2100		Australia, ABC NT Alice Springs			2310do	
2000	2100		Australia, ABC NT Katherine	2485do			
2000	2100		Australia, ABC NT Tennant Creek			2325do	
2000	2100		Australia, Radio Australia	9500as	11650pa		
			11660pa	11880pa			
2000	2100	Sat/Sun	Australia, Radio Australia	6080pa	7240pa		
			12080pa				
2000	2100		Bahrain, Radio Bahrain	6010me	9745al		
2000	2100		Canada, CFRX Toronto ON	6070na			
2000	2100		Canada, CFVP Calgary AB	6030na			
2000	2100		Canada, CKZN St John's NF	6160na			
2000	2100		Canada, CKZU Vancouver BC	6160na			
2000	2100		Equatorial Guinea, Radio Africa			7190af	
			15190af				
2000	2100		Germany, CVC Intl-Christian Vision			17770af	
2000	2100		Germany, Deutsche Welle	9690af	9735af		
			13780af				
2000	2100		Indonesia, Voice of Indonesia	9525va	11785al		
2000	2100	fas	Italy, IRRS/NEXUS	6170va			
2000	2100		Kuwait, Radio Kuwait	11990va			
2000	2100		Malaysia, RTM/Traxx FM	7295do			
2000	2100		Nigeria, Voice of Nigeria/External Service			15120af	
2000	2100		Palau, T8WH/World Harvest	9875as	9930as		
2000	2100		Russia, Voice of Russia	7330af			
2000	2100		Uganda, UBC Radio	4976do			
2000	2100		UK, BBC World Service	3255af	6005af		
			6190af	9410af	11810af	12095af	
			15400af				
2000	2100		Ukraine, Radio Ukraine International			7510eu	
2000	2100		USA, American Forces Network			4319usb	
			5446usb	5765usb	6350usb	7812usb	
			10320usb	12133usb	12759usb	13362usb	
2000	2100		USA, EWTN/WEWN Vandiver AL			15610af	
2000	2100		USA, WBCQ Monticello ME	15420am			
2000	2100	smtwhf	USA, WBCQ Monticello ME	7415am			
2000	2100	mtwhf	USA, WHRI Cypress Creek SC	7520va			
2000	2100	Sun	USA, WHRI Cypress Creek SC	9495va			
2000	2100		USA, WHRI Cypress Creek SC	11785va	15665na		
2000	2100		USA, WINB Red Lion PA	13570am			
2000	2100	vl	USA, WRMI Miami FL	9955ca			
2000	2100		USA, WTJC Newport NC	9370na			
2000	2100		USA, WWCR Nashville TN	9980na	12160na		
			13845na	15825na			
2000	2100		USA, WWRB Manchester TN	9385na			
2000	2100		USA, WYFR/Family Radio Worldwide			6020na	
			6915eu	9480af	9610af	15115af	
			15195af	17535na	17555na	17574ca	
2000	2100		Zambia CVC Intl/ The Voice Africa			4965af	
			9505af				
2000	2100		Zambia, Zambia Natl Broadcasting Corp			6165do	
2000	2105		Uganda, UBC Radio	4976do			
2030	2045		Thailand, Radio Thailand World Service			9535eu	
2030	2100		Cuba, Radio Havana Cuba	11760va	17660va		
			17750va				
2030	2100		Sweden, Radio Sweden	9490va			
2030	2100		USA, Voice of America	7405as			
2030	2100	Sat/Sun	USA, Voice of America	4940af			
2030	2100		Vietnam, Voice of Vietnam	7220va	7280va		
			9550va	9730va			
2045	2100		India, All India Radio	6180eu	7410eu		
			9445eu	11620pa	11715pa		
2045	2100	DRM	India, All India Radio	9950eu			
2045	2100	DRM	Vatican City State, Vatican Radio			9800am	
2050	2100		Vatican City State, Vatican Radio			4005eu	
			5885eu	7250eu			
2051	2100		New Zealand, Radio NZ International			17675pa	
2051	2200	DRM	New Zealand, Radio NZ International			15720pa	

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

2100	2120		Vatican City State, Vatican Radio			4005eu	
			5885eu	7250eu			
2100	2127		China, China Radio International			7250af	
			11640af	13630af			
2100	2127		Czech Republic, Radio Prague	5930va	9430va		
2100	2130	mtwhfa	Albania, Radio Tirana	7520eu	9895eu		

2100	2130		Australia, ABC NT Alice Springs			2310do
2100	2130		Australia, ABC NT Alice Springs			2310do
2100	2130		Australia, ABC NT Katherine	2485do		
2100	2130		Australia, ABC NT Tennant Creek			2325do
2100	2130		Austria, AWR Europe	9830af		
2100	2130	Sat	Canada, CBC NQ SW Service	9625na		
2100	2130		Cuba, Radio Havana Cuba	11760va		17660va
			17750va			
2100	2145		USA, WYFR/Family Radio Worldwide			6915na
			15115af	17535na	17555na	
2100	2157		China, China Radio International			5960eu
			6135af	7205eu	7225af	7325af
			7405af	7415af	9600af	
2100	2157		North Korea, Voice of Korea	13760eu		15245eu
2100	2200		Angola, Radio Nacional de Angola			7217do
2100	2200		Anguilla, Worldwide Univ Network			11775am
2100	2200		Australia, Radio Australia	9500as		9660pa
			11695as	12080pa	13630pa	15515pa
2100	2200		Bahrain, Radio Bahrain	6010me		9745al
2100	2200		Belarus, Radio Belarus	6155eu		7360as
			7390eu			
2100	2200		Canada, CFRX Toronto ON	6070na		
2100	2200		Canada, CFVP Calgary AB	6030na		
2100	2200		Canada, CKZN St John's NF	6160na		
2100	2200		Canada, CKZU Vancouver BC	6160na		
2100	2200		Equatorial Guinea, Radio Africa			7190af
			15190af			
2100	2200		Germany, Deutsche Welle	7280af		9545af
			11690af	13780af		
2100	2200		Germany, Overcomer Ministries			6175eu
2100	2200		India, All India Radio	11620pa		11715pa
2100	2200	DRM	India, All India Radio	9950eu		
2100	2200		Malaysia, RTM/Traxx FM	7295do		
2100	2200		New Zealand, Radio NZ International			17675pa
2100	2200		Palau, T8WH/World Harvest	9875as		9930as
2100	2200		Syria, Radio Damascus	9330eu		12085as
2100	2200	DRM	UK, BBC World Service	3995eu		
2100	2200		UK, BBC World Service	3255af		3915as
			5875as	5965as	6005af	6190af
			6195as	7445af	9410af	9915af
			12095af			
2100	2200		USA, American Forces Network			4319usb
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
2100	2200		USA, EWTN/WEWN Vandiver AL			15610af
2100	2200		USA, Voice of America	6080af		7405as
			15580af			
2100	2200	smtwhf	USA, WBCQ Monticello ME	7415am		
2100	2200		USA, WHRI Cypress Creek SC	11785va		11885na
2100	2200	mtwhfa	USA, WHRI Cypress Creek SC	15665na		
2100	2200	Sun	USA, WHRI Cypress Creek SC	9690na		
2100	2200		USA, WINB Red Lion PA	13570am		
2100	2200	vl	USA, WRMI Miami FL	9955ca		
2100	2200		USA, WTJC Newport NC	9370na		
2100	2200		USA, WWCR Nashville TN	7465na		9980na
			12160na	13845na		
2100	2200		USA, WWRB Manchester TN	3185va		3215va
			5050va	5745va		
2100	2200		USA, WYFR/Family Radio Worldwide			5950na
			6240eu	9480af	15115af	15195af
2100	2200		Zambia CVC Intl/ The Voice Africa			4965af
			9505af			
2100	2200		Zambia, Zambia Natl Broadcasting Corp			6165do
21000	2200		Japan, NHK World/ Radio Japan			13640pa
2115	2200		Egypt, Radio Cairo6270eu			
2130	2156		Romania, Radio Romania International			6030eu
			6115na	7380eu	9755na	
2130	2200		Australia, ABC NT Alice Springs			4835do
2130	2200		Australia, ABC NT Katherine	5025do		
2130	2200	mtwhfa	Canada, CBC NQ SW Service	9625na		
2130	2200		China, China Radio International			7365eu
			7415as			
2130	2200		Guam, KSDA/ AWR	9625as		
2130	2200		Sweden, Radio Sweden	7425va		
2130	2200		Turkey, Voice of Turkey	9610va		

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

2200	2205		Zambia, Zambia Natl Broadcasting Corp			6165do
2200	2225		Turkey, Voice of Turkey	9610va		
2200	2230	mwf	Guam, KSDA/ AWR	11850as		
2200	2230		India, All India Radio	11620pa		11715pa
2200	2230	DRM	India, All India Radio	9950eu		
2200	2230		Serbia, International Radio of Serbia			6100eu
2200	2230		South Korea, KBS World Radio			3955eu
2200	2235		New Zealand, Radio NZ International			17625pa
2200	2235	DRM	New Zealand, Radio NZ International			15720pa
2200	2245		Egypt, Radio Cairo6270eu			
2200	2245		USA, WYFR/Family Radio Worldwide			17690af
2200	2257		China, China Radio International			5915na
2200	2300		Anguilla, Worldwide Univ Network			6090am
2200	2300		Australia, ABC NT Alice Springs			4835do
2200	2300		Australia, ABC NT Katherine	5025do		
2200	2300		Australia, HCJB Global	15525as		
2200	2300		Australia, Radio Australia	9660pa		12010as
			12080pa	13630pa	15230pa	15240as
			15515pa	15560pa		
2200	2300		Bahrain, Radio Bahrain	6010me		9745al
2200	2300		Belarus, Radio Belarus	6155eu		7360as
			7390eu			
2200	2300		Bulgaria, Radio Bulgaria	6200eu		7400eu
2200	2300	smtwhf	Canada, CBC NQ SW Service	9625na		
2200	2300		Canada, CFRX Toronto ON	6070na		
2200	2300		Canada, CFVP Calgary AB	6030na		
2200	2300		Canada, CKZN St John's NF	6160na		
2200	2300		Canada, CKZU Vancouver BC	6160na		
2200	2300	DRM	Canada, Radio Canada International			9800na
2200	2300		Equatorial Guinea, Radio Africa			7190af
			15190af			
2200	2300		Malaysia, RTM/Traxx FM	7295do		
2200	2300	Sat/Sun	Spain, Radio Exterior de Espana			6125eu
2200	2300		Uganda, UBC Radio	4976do		
2200	2300		UK, BBC World Service	3915as		5875as
			5910af	6135as	6195as	9740as
			9915af	12095af		
2200	2300	DRM	UK, BBC World Service	3995eu		
2200	2300		Ukraine, Radio Ukraine International			5830eu
2200	2300		USA, American Forces Network			4319usb
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
2200	2300		USA, EWTN/WEWN Vandiver AL			15610af
2200	2300		USA, Voice of America	5895va		6105va
			7220va	7405as	7425va	7480va
			9490va	11560va		
2200	2300		USA, WBCQ Monticello ME	7415am		
2200	2300		USA, WHRI Cypress Creek SC	11785va		11885na
2200	2300		USA, WINB Red Lion PA	9265am		
2200	2300	vl	USA, WRMI Miami FL	9955ca		
2200	2300		USA, WTJC Newport NC	9370na		
2200	2300		USA, WWCR Nashville TN	7465na		9980na
			12160na	13845na		
2200	2300		USA, WWRB Manchester TN	3185va		3215va
			5050va	5745va		
2200	2300		USA, WYFR/Family Radio Worldwide			5950na
			11740na	15440na		
2200	2300		Zambia CVC Intl/ The Voice Africa			4965af
2215	2230		Croatia, Croatian Radio	3985va		
2230	2257		Czech Republic, Radio Prague	5930na		7355af
2230	2300		Guam, KSDA/ AWR	15320as		
2230	2300	smtwh	Moldova, (Transnistria) Radio PMR			6240na
2230	2300		USA, Voice of America/Special English			5890va
			7230va	9780va		
2236	2300		New Zealand, Radio NZ International			15720pa
2236	2300	DRM	New Zealand, Radio NZ International			17675pa
2245	2300		India, All India Radio	6055as		7305as
			9705as	11645as		

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

2300	0000		Anguilla, Worldwide Univ Network			6090am
2300	0000		Australia, ABC NT Alice Springs			4835do
2300	0000		Australia, ABC NT Katherine	5025do		
2300	0000		Australia, HCJB Global	15525as		
2300	0000		Australia, Radio Australia	9660pa		12010as
			12080pa	13690pa	15230pa	15560pa
			17796pa			
2300	0000		Bahrain, Radio Bahrain	6010me		9745al
2300	0000	DRM	Belgium, TDP Radio	9790na		
2300	0000	smtwhf	Canada, CBC NQ SW Service	9625na		
2300	0000		Canada, CFRX Toronto ON	6070na		
2300	0000		Canada, CFVP Calgary AB	6030na		
2300	0000		Canada, CKZN St John's NF	6160na		
2300	0000		Canada, CKZU Vancouver BC	6160na		
2300	0000		Cuba, Radio Havana Cuba	13790sa		
2300	0000		Egypt, Radio Cairo7580na			
2300	0000		India, All India Radio	6055as		7305as
			9705as	11645as		
2300	0000		Malaysia, RTM/Traxx FM	7295do		
2300	0000	smtwhf	Moldova, (Transnistria) Radio PMR			6240na

2300	0000		New Zealand, Radio NZ International			15720pa
2300	0000	DRM	New Zealand, Radio NZ International			17675pa
2300	0000		Russia, Voice of Russia			7250na
2300	0000		UK, BBC World Service			3915as 5875as
			6135as	6195as	7385as	9740as
			11955as			
2300	0000		USA, American Forces Network			4319usb
			5446va	5765va	6350va	7812va
			10320va	12133va	12759va	13362va
2300	0000		USA, EWTN/WEWN Vandiver AL			15610af
2300	0000		USA, Voice of America		6105va	7220va
			7265va	7405va	7480va	9490va
			9580va	11560va		
2300	0000		USA, WBCQ Monticello ME		5110am	7415am
2300	0000		USA, WHRI Cypress Creek SC		5875na	7315va
			11785va			
2300	0000		USA, WINB Red Lion PA		9265am	
2300	0000	vl	USA, WRMI Miami FL		9955ca	
2300	0000		USA, WTJC Newport NC		9370na	
2300	0000		USA, WWCR Nashville TN		3230na	5070na
			9980na	13845na		
2300	0000		USA, WWRB Manchester TN		3185va	3215va
			5050va	5745va		
2300	0000		USA, WYFR/Family Radio Worldwide			5950na
			9430ca	15400ca	15440na	
2300	0000		Zambia CVC Intl/ The Voice Africa			4965af
2300	2330		Australia, Radio Australia		15240as	
2300	2330		Cuba, Radio Nacional de Venezuela			13680ca
			15250ca			
2300	2330		USA, Voice of America/Special English			6180as
			7460va	11840va		
2300	2345		USA, WYFR/Family Radio Worldwide			9430sa
			11740na	15400sa	15440na	
2300	2345	DRM	Vatican City State, Vatican Radio			7370am
2300	2355		Turkey, Voice of Turkey		5960va	
2300	2356		Romania, Radio Romania International			5915as
			6015va	7220eu	7300as	
2300	2357		China, China Radio International			5915as
			5990na	6040na	6145na	7350as
			7415as	9610as	11790va	11970va
2315	2330		Croatia, Croatian Radio		7375va	
2330	0000		Australia, Radio Australia		15415as	17750as
2330	0000		UK, BBC World Service		6170as	
2330	0000		USA, Voice of America/Special English			6180as
			7460va	11655va	11840va	13640va
2330	2357		Czech Republic, Radio Prague		5930na	7355af
2330	2358		Vietnam, Voice of Vietnam		9840as	12020as
2345	0000		Australia, HCJB Global		15400as	

MT SHORTWAVE STATION RESOURCE GUIDE

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

THE QSL REPORT

VERIFICATIONS RECEIVED BY OUR READERS

Gayle Van Horn, W4GVH
gaylevanhorn@monitoringtimes.com

QSLing in the Year of the Tiger

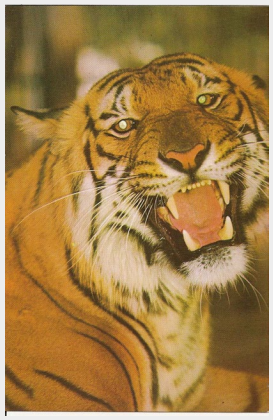
A new year brings new QSLing opportunities as stations release special card series to commemorate a variety of events and holidays. Radio Free Asia featured five colorful cards in 2009, including the popular *Year of the Ox* and their *13th Anniversary* card. Look for a new round of RFA cards to add to your collection this year.

This is the *Year of the Tiger* in the Chinese zodiac calendar, and fans predict China Radio International will once again wow their audience for the Chinese New Year. Radio Romania International's *Vintage Receivers* was a hit, and DXers anticipate more vintage cards in 2010. Vancouver will host the 2010 Winter Olympics, February 12-28, so focus on broadcasters that may honor their participating athletes with commemorative cards.

The Rhein Main Radio Club has released their annual QSL card wall calendar for 2010. This year the club's focus is "*the best QSL cards of the last 30 years*." The popularity of the annual calendars has grown in radio circles and this year's edition, too, will become a collector favorite. For ordering information consult **www.rmrc.de**

Brazil's Rádio Cultura 24 hour broadcaster is being heard again following a year's absence on 3365 kHz. Send your Portuguese program details to: Avenida Bento de Abreu789, Bairro Fonte Luminosa, 14802-396 Araraquara SP, Brazil. Website includes streaming audio at ^ **www.radiocultura.net.** Send listener feedback *to ouvintes@radiocultura.net*.

Rádio Cultura do Pará has reactivated on 5045 kHz from 0800-0300 UTC. Portuguese details to: Av. Almirante Barroso 735, 66093-020 Belém PA, Brazil. Website **www.portalcultura.com.br** Email *negrobanto@tuntelpa.com.br*



Take advantage of the early morning winter DX season by logging the low-powered Australian domestic stations. VL8-Katherine 5025; VL8A Alice Springs 4835 and VL8T Tennant Creek on 2325. Complete Aussie schedules are included in this month's English SW Guide from 0000 UTC. Reception reports to: Australian Broadcasting Corporation Northern Territory HF Service, Administrative Office, 1 Cavenagh Street, Darwin NT 0800 (or) GPO 9994, Darwin NT 0801 Australia.

Free radio station European Music Radio has been broadcasting the latest from the European pop scene since 1977. Tom Taylor, the originator, says, "We thrive on listener feedback." Look for Tom and his small team of volunteers, weekends on 6140 kHz, 0900-1000 UTC, repeats at 1200, 1500, 1800 and 2000 UTC. EMR internet radio at ^ **www.emr.or.uk/** Email reports to: *studio@emr.org.uk* Postal address: EMR, c/o A. Taylor, 32 Shearing Drive, Carshalton, Surrey SM5 1BL, United Kingdom.

The B09 winter schedule reveals Radio Bulgaria is broadcasting in ten languages. Send your email reports to the various services at: Albanian *albanian@bnr.bg* / Bulgarian *bulgarian@bnr.bg* / English *english@bnr.bg* / French *french@bnr.bg* / German *german@bnr.bg* / Greek *greek@bnr.bg* / Russian *russian@bnr.bg* / Serbian *serbian@bnr.bg* / Spanish *spanish@bnr.bg* / Turkish *turkish@bnr.bg* Postal address: 4, Dragan Tsankov Blvd., 1040 Sofia, Bulgaria (or) P.O. Box 900, 1000 Sofia, Bulgaria. Broadcast hours in *MT's English SW Guide* and *MTXtra SW Broadcast Guide*.

Pirate contributor, Delta Charlie, verified All Aboard Radio on 6925 kHz, from operator Casey Jones at *allaboardradio@gmail.com.* Delta still marvels over the *Catch the Train* eQSL.

Clandestine, Cotton Tree News remains active on 15220 kHz, 0730-0800 UTC. Verifications are via Fondation Hirondelle, a private, nonprofit Swiss-based foundation, broadcasting to world crises areas. Email reports to Grame Loten *Gloten@hirondelle.org* Fondation Hirondelle, Fourah Bay College, Mont Aureol, P.O. Box 766, Freetown, Sierra Leone (or) Fondation Hirondelle, 3 Rue Traversiére CJ 1018-Lausanne, Switzerland **www.hirondelle.org**

Two former African broadcasters, are being heard again on shortwave. Radio Burkina, broadcasting from Burkina Faso, is active on 5030 kHz, 0530-0800, 1700-0000. Report with French details and return postage or two IRCs to station address: 03 Boite Postal 7029, Ougadougou 03, Burkina Faso.

Radio Mauritanie has resurfaced on 4845 kHz. Broadcast hours can be found in *MTXtra SW Broadcast Guide*. Send currency or return mint postage to: Boite Postal 200, Nouakchott, Mauritania. ^ Streaming audio **http://wm-live.abacast.com/radio_mauritania-wm-32?.wma**

Good luck on your *Year of the Tiger* QSLing. Additional QSL information, photos, tips and selected archived columns are posted at the *Shortwave Central* blog at **http://mt-shortwave.blogspot.com/**

INDIA

Radio Kashmir, Srinagar, 4950 kHz. Verification letter signed by Ayaz A. Malik-Station Engineer. Received in one month for email report to ***rks_se@yahoo.co.in***. Postal address: Radio Kashmir, Srinagar 190001, Jammu and Kashmir. (José Jacob, India/HCDX)

KUWAIT

Radio Kuwait, 15110 kHz. Full data verification letter signed by Ammar Behzad, plus two Kuwati souvenir postcards, laminated schedules and three Kuwaiti mint postage stamps. Received in 35 days for an English report and $2.00 US. Station address: P.O. Box 397, 13004 Safat, Kuwait. Website **www.media.gov.kw** audio and video currently unavailable. (Gayle Van Horn, NC)

MEDIUM WAVE

KCFM 1250 kHz AM. Friendly verification letter signed by Jon Thompson-General Manager-Owner. Received in six days for a CD report. Station address: 4480 Highway 101, P.O. Box 20000, Florence, OR 97439 USA. Station informs it has moved to a new tower setup and dropped to 900 watts. (Patrick Martin, Seaside, OR)

WNQM 1300 kHz AM. Full data WWCR antenna card signed by Cathy S.-Program Director. Received in 336 days for an AM report, $ 1.00US and address lable (used). Station address: 1300 WWCR Avenue, Nashville, TN 37218-3800 USA (Bill Wilkins, Springfield, MO)

WWL, 870 AM kHz. Full data WWL logo card, unsigned. Received in twenty months for an AM report. Station address: 400 Poydras Street, New Orleans, LA 70130-3250 USA. ^ Streaming audio **www.wwl.com/** (Gerald William, Ayer, MA)

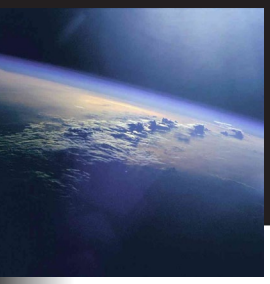
STANDARD TIME & FREQUENCY

HBG, 75 kHz. Full data QSL card and letter signed by Christian Schunegger. Received in ten days. Station address: Federal Office of Metrology METAS, Lindenweg 50, 3003 Bern-Wabern, Switzerland. (Francesco, Spain/UDXF) ***station plans to close service in 2011.***

UTILITY

Istanbul Turk Radio/TAH 4209.5 kHz. Full data verification letter. Received in eleven months for $1.00 US. QSL address: Kiyi Emniyeti Genel Mudurlugu, Teliz Isletme Mudurugu, Ataturk Havalimam E Kapisi, 34630 Sefakoy, Istanbul, Turkey. (Andrei Skorodumov, Russia/playdx)

New Zealand Meteo Service ZKLF 5807 kHz. No data prepared card signed by Peter Krefft-Manager Public Weather Services, plus 2010 calendar. Received in 4 months and returned my $2.00 US. QSL address: Met Service, P.O. Box 722, Wellington, New Zealand (Martin Foltz, CA/UDXF)



MTXtra
Shortwave Broadcast Guide

SPANISH / FRENCH

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

MT Spanish Shortwave Broadcast Guide (continued from last month)

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

2300	0000	mtwhf	Argentina, Radio Nacional RAE			6090eu
			11710af	15345am		
2300	0000		Bolivia, Radio Eco	4409do		
2300	0000		Bolivia, Radio Estambul		4498do	
2300	0000		Bolivia, Radio Illimani/Radio Patria Nueva			
			6025do			
2300	0000		Bolivia, Radio Nacional de Huanuni			5967do
2300	0000		Bolivia, Radio San Jose		5580do	
2300	0000		Bolivia, Radio San Miguel		4699do	
2300	0000		Bolivia, Radio Santa Ana		4451do	
2300	0000		Bolivia, Radio Virgen de Remedios			4834do
2300	2330		Bulgaria, Radio Bulgaria		5900eu	9400eu
2300	2359		Canada, Radio Canada International			9640sa
			11990sa			
2300	0000		Chile, La Voz Crista		9745sa	
2300	0000		China, China Radio International			6175eu
			7210eu	7250eu	9590sa	9800sa
2300	0000		Clandestine, Radio Nacional De La RASD			
			6300af	6297al		
2300	0000		Colombia, La Voz de tu Conciencia			6010do
			5910al			
2300	0000		Colombia, La Voz del Guaviare			6035do
2300	0000		Colombia, Radio Marfil Estereo			5910do
			6010al			
2300	0000		Cuba, Radio Havana Cuba		11690na	11770sa
			11800ca	13760eu	13790va	
2300	0000	mtwhf	Cuba, Radio Havana Cuba		6000ca	9640ca
2300	0000		Cuba, Radio Nacional de Venezuela			13680ca
			15250ca			
2300	0000		Cuba, Radio Rebelde		5025na	
2300	0000		Dominican Rep. Radio Amanecer Internacional			
			6025va			
2300	0000		Ecuador, HCJB Global		6050sa	
2300	0000		Ecuador, Radio Quito		4919do	
2300	0000		Guatemala, Radio Verdad		4052do	
2300	0000		Honduras, HRMI/ Radio Misiones Intl			3340do
2300	0000		Honduras, Radio Luz y Vida		3250do	
2300	0000		Mexico, XEOI/Radio Mil		6010do	
2300	0000		Mexico, XERTA/Radio Transcontinental			4800do
2300	0000		Mexico, XEXQ/Radio Universidad			6045do
2300	2357		Netherlands, R Netherlands Worldwide			11655sa
			15315sa			
2300	0000		Peru, Radio Bethel	5949do		
2300	0000		Peru, Radio Bolivar		5460do	
2300	0000		Peru, Radio Cusco	6195do		
2300	0000		Peru, Radio La Reyna de la Selva			5486do
2300	0000		Peru, Radio La Voz De Bolivar	5460do		
2300	0000	Sun	Peru, Radio La Voz de la Selva	4824do		
2300	0000		Peru, Radio La Voz de las Huarinjas			5059do
2300	0000		Peru, Radio Madre de Dios		4950do	
2300	0000		Peru, Radio Melodia		5940do	
2300	0000		Peru, Radio Rasuwilca		4805do	
2300	0000		Peru, Radio San Nicolas		5470do	
2300	0000		Peru, Radio Santa Rosa		6047do	
2300	0000		Peru, Radio Super Sensacion		6536do	
2300	0000		Peru, Radio Tarma	4775do		
2300	0000		Peru, Radio Union	6114do		
2300	0000		Peru, Radio Vision	4790do		
2300	0000		Spain, Radio Exterior de Espana			9535am
			9620sa	11680sa	15160sa	
2300	0000	Sat	Spain, Radio Exterior de Espana			11815sa
2300	0000		Taiwan, Radio Taiwan International			11885sa
2300	0000		USA, EWTN/WEWN Vandiver AL			12050ca
			13850sa			
2300	0000		USA, KVOH Rancho Simi CA		17775ca	
2300	0000		USA, Radio Marti	6030ca	9565ca	11930ca
2300	0000		USA, Voice of America		5890ca	5940sa
			9885ca			
2300	0000		USA, WYFR/Family Radio Worldwide			5985am
			9355ca	9935ca	13615sa	
2300	0000		Venezuela, Radio Amazonas		4940do	
2305	2359		Canada, Radio Canada International			6100na

MT French Shortwave Broadcast Guide

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

0000	0100		Cuba, Radio Havana Cuba	13790ca
0000	0100		USA, WYFR/Family Radio Worldwide	15400va

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

0100	0200		North Korea, Voice of Korea	13650as
0130	0200		Cuba, Radio Havana Cuba	13790va

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

0200	0300		Bulgaria, Radio Bulgaria	5900na	7400na
0200	0256		Romania, Radio Romania International		5975na
			7325eu		
0200	0230		Slovakia, Radio Slovakia International		7230na
			9440sa		
0230	0300		Vatican City State, Vatican Radio		6040am
			7360va		

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

0300	0400	mtwhf	Argentina, Radio Nacional RAE		11710am
0300	0400		Belgium, RTBF International	9970va	
0300	0400		North Korea, Voice of Korea	13760am	15180am

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

0400	0500		Belgium, RTBF International	9970va
0400	0500		France, Radio France Internationale	9790af
0430	0500		Austria, AWR Europe	6045af
0430	0500		UK, BBC World Service	6035af	7375af
			17885af		
0430	0500		Vatican City State, Vatican Radio		7360af
			9660af		

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

0500	0600		Belgium, RTBF International	9970va		
0500	0600		France, Radio France Internationale			5925af
			7265af	9790af	11700af	13695af
0500	0600		Gabon, Africa No. 1	9580af		
0500	0600		USA, WYFR/Family Radio Worldwide			9985af
			11530af			
0530	0600		Congo Dem. Republic, Radio Kazuhi			6209do
0530	0600		Japan, NHK World/ Radio Japan			9850af
			11750af			
0530	0600		Laos, Lao National Radio	7145as		
0530	0600	mtwhf	USA, Voice of America	4960af	6020af	
			7265af	9480af	9505af	
0540	0600		Vatican City State, Vatican Radio			4005eu
			5965eu	7250eu		

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

0600	0700		Belgium, RTBF International	9970va
0600	0700		China, China Radio International	17865eu
0600	0700		Congo Dem. Republic, Radio Kazuhi	6209do

0600	0700		France, Radio France Internationale			7265af
			9790af	11700af	13675af	13695af
			15300af			
0600	0700		Gabon, Africa No. 1		9580af	
0600	0626	DRM	Romania, Radio Romania International			6100eu
0600	0626		Romania, Radio Romania International			7370eu
			9690eu	11790eu		
0600	0630		UK, BBC World Service		6105af	7205af
			13740af	15430af		
0600	0630	mtwhf	USA, Voice of America		4960af	6020af
			7265af	9480af	9505af	
0600	0700		USA, WYFR/Family Radio Worldwide			7520af
			11580af			
0600	0630		Vatican City State, Vatican Radio			7360af
			9660af	11625af		

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

0700	0800		Belgium, RTBF International		9970va	
0700	0800	th/ DRM	Belgium, RTBF International		9925eu	
0700	0730		Bulgaria, Radio Bulgaria		5900eu	
0700	0800		China, China Radio International			17865eu
0700	0800		Congo Dem. Republic, Radio Kazuhi			6209do
0700	0727		Czech Republic, Radio Prague		5930eu	7345am
0700	0800		France, Radio France Internationale			11700af
			13695af	15170af	15300af	
0700	0800		Gabon, Africa No. 1		9580af	
0700	0727		Iran, Voice of Islamic Rep. of Iran			13750va
			15430va			
0700	0800		Nigeria, Voice of Nigeria/External Service			15120af
0700	0730		UK, BBC World Service		12095af	17640af

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

0800	0900		Belgium, RTBF International		9970va	
0800	0900	th/ DRM	Belgium, RTBF International		9925va	
0800	0900		Congo Dem. Republic, Radio Kazuhi			6209do
0800	0900		France, Radio France Internationale			11700af
			13675af	15170af	17620af	
0800	0900		Gabon, Africa No. 1		9580af	
0800	0830		Germany, AWR Europe		12010af	
0800	0900		Saudi Arabia, BSKSA/External Service			17785af
0800	0900		USA, WYFR/Family Radio Worldwide			9985va
0830	0857		Czech Republic, Radio Prague		9860va	11600va
0830	0857		Czech Republic, Radio Prague		9860va	11600am

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

0900	1000		Belgium, RTBF International		9970va	
0900	1000	th/ DRM	Belgium, RTBF International		9925va	
0900	1000		Congo Dem. Republic, Radio Kazuhi			6209do
0900	1000		France, Radio France Internationale			11700af
			13675af	15300af	17620af	
0900	1000		Gabon, Africa No. 1		9580af	
0900	0955		Saudi Arabia, BSKSA/External Service			17785af

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

1000	1100		Belgium, RTBF International		9970va	
1000	1100	th/ DRM	Belgium, RTBF International		9925va	
1000	1100		Congo Dem. Republic, Radio Kazuhi			6209do
1000	1100		France, Radio France Internationale			15300af
			17620af			
1000	1100		Gabon, Africa No. 1		9580af	
1000	1100		USA, WYFR/Family Radio Worldwide			11740ca
1000	1100		USA, WYFR/Family Radio Worldwide			11740va

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

1100	1200		Belgium, RTBF International		9970va	
1100	1200		Congo Dem. Republic, Radio Kazuhi			6209do
1100	1200		France, Radio France Internationale			15300af
			17525af	17620af		
1100	1200		Gabon, Africa No. 1		9580af	
1100	1103		Monaco, Radio Monaco		4368usb	8728usb
			13146usb	17260usb		
1100	1200		North Korea, Voice of Korea		11710am	11735as
			13650as	15180as		
1100	1156		Romania, Radio Romania International			15150af
			15255af	17780af	17800af	
1130	1200		France, Radio France Internationale			6175eu
			13640af	15365af	17800af	

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

1200	1300		Belgium, RTBF International		9970va	
1200	1300		China, China Radio International			15205eu
1200	1300		Congo Dem. Republic, Radio Kazuhi			6209do
1200	1300		France, Radio France Internationale			15300af
			17620af	17850af		
1200	1300		Gabon, Africa No. 1		9580af	
1200	1300		Germany, Deutsche Welle		15440af	17520af
			17800af	21780af		
1200	1230		UK, BBC World Service		15425af	17780af
			21630af			
1200	1300		USA, WYFR/Family Radio Worldwide			13695na
1200	1300		Vietnam, Voice of Vietnam/Overseas Service			
			7285as			
1230	1300		Japan, NHK World/ Radio Japan			15395af

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

1300	1400		Belgium, RTBF International		9970va	
1300	1400		China, China Radio International			13710eu
			15205eu			
1300	1400		Congo Dem. Republic, Radio Kazuhi			6209do
1300	1330		France, Radio France Internationale			17850af
1300	1400		France, Radio France Internationale			15300af
			17620af			
1300	1400		Gabon, Africa No. 1		9580af	
1300	1330		Laos, Lao National Radio		7145as	
1300	1400		USA, WYFR/Family Radio Worldwide			11740sa
1300	1330		Vietnam, Voice of Vietnam/Overseas Service			
			7285as			

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

1400	1500		Belgium, RTBF International		9970va	
1400	1500		China, China Radio International			11920va
			13670va			
1400	1500		Congo Dem. Republic, Radio Kazuhi			6209do
1400	1500		France, Radio France Internationale			15300af
			17620af			
1400	1500		Gabon, Africa No. 1		9580af	
1400	1500		North Korea, Voice of Korea		9335na	11710na
			13760eu	15245eu		
1400	1500		Saudi Arabia, BSKSA/External Service			17660af
1430	1457		Czech Republic, Radio Prague		11600eu	13580eu
1450	1500	Sat/Sun	Swaziland, TWR Africa		9635af	

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

1500	1600		Belgium, RTBF International		9970va	
1500	1600		China, China Radio International			11920va
			13670va			
1500	1600		Congo Dem. Republic, Radio Kazuhi			6209do
1500	1600		France, Radio France Internationale			15300af
			17620af			
1500	1600		Gabon, Africa No. 1		9580af	
1500	1600		Saudi Arabia, BSKSA/External Service			17660af
1500	1525	Sat/Sun	Swaziland, TWR Africa		9635af	
1530	1600	Sat/Sun	Clandestine, Radio Mada Internationale			15670af

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

1600	1700		Belgium, RTBF International		9970va	
1600	1700		China, China Radio International			11690eu
1600	1700		France, Radio France Internationale			13685af
			15300af	17620af	17850af	
1600	1700		Gabon, Africa No. 1		9580af	
1600	1700		Germany, Deutsche Welle		9535af	11795af
			12035af	15275af	17800af	
1600	1657		Libya, LJB/Voice of Africa		15215af	17725af
1600	1700		North Korea, Voice of Korea		9335na	11710na
			13760eu	15245eu		
1600	1700		Saudi Arabia, BSKSA/External Service			17660af
1600	1655		South Africa, Channel Africa		15235af	
1600	1700		USA, WYFR/Family Radio Worldwide			11855na
1630	1700		Vietnam, Voice of Vietnam/Overseas Service			
			7220va	9550va		

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

1700	1800		Belgium, RTBF International		9970va	
1700	1800		China, China Radio International			11690eu
1700	1800		Congo Republic, Radio Congo			6115do

1700	1800		Ethiopia, Radio Ethiopia/External Service	7165af		
			9560af			
1700	1800		France, Radio France Internationale	13695af		
			15300af	17620af	17850af	
1700	1800		Gabon, Africa No. 1	9580af		
1700	1800		Germany, Deutsche Welle	9535af	9735af	
			12035af	13790af	15275af	
1700	1757		Libya, LJB/Voice of Africa	11965af	15215af	
1700	1756		Romania, Radio Romania International	7370eu		
			9690eu			
1700	1800	DRM	Russia, Voice of Russia	6145eu		
1700	1800		Russia, Voice of Russia	6130eu	7295af	
			7330va	11985af		
1700	1755		Saudi Arabia, BSKSA/External Service	17660af		
1700	1800		USA, WYFR/Family Radio Worldwide	15115va		
1700	1730		Vatican City State, Vatican Radio	11625af		
			13765af			
1730	1757		Czech Republic, Radio Prague	5930eu	15710va	

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

1800	1900		Belgium, RTBF International	9970va		
1800	1830		Bulgaria, Radio Bulgaria	6200eu	7400eu	
1800	1830	DRM	Bulgaria, Radio Bulgaria	9700eu		
1800	1830	h	Canada, Eglise du Christ	15325af		
1800	1900		China, China Radio International	5970eu		
			6055af	9480eu	11695af	
1800	1900		Congo Republic, Radio Congo	6115do		
1800	1900		France, Radio France Internationale	11705af		
			13695af	15300af	17620af	
1800	1900		Gabon, Africa No. 1	9580af		
1800	1900		North Korea, Voice of Korea	7100af	9975va	
			11535va	11910af		
1800	1900		Russia, Voice of Russia	6130eu	7295af	
			12060va			
1800	1830		Slovakia, Radio Slovakia International	5915eu		
			6055eu			
1800	1900	mtwhf	Spain, Radio Exterior de Espana	9665eu		
1800	1830		UK, BBC World Service	5985af	15105af	
			15180af	17640af	17885af	
1800	1900		USA, WYFR/Family Radio Worldwide	15565af		
			17690af			
1805	1900		Canada, Radio Canada International	9610na		
1805	1900	DRM	Canada, Radio Canada International	9800na		
1830	1900	mtwhfa	Albania, Radio Tirana	7465eu		
1830	1845		Ascension Island, FEBA Radio	15250af		
1830	1900		China, China Radio International	7350af		
			9645af			
1830	1845		Germany, Radio Reveil Paroles de Vie	15675af		
1830	1900		Iran, Voice of Islamic Rep. of Iran	6025eu		
			9940va	13755as	15085as	
1830	1900		USA, Voice of America	6170af	9815af	
			15225af	17550af	17580af	
1830	1900		USA, WYFR/Family Radio Worldwide	17760va		
1830	1855		Vietnam, Voice of Vietnam/Overseas Service			
			7280eu	9725eu	9730eu	

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

1900	1930	mtwhfa	Albania, Radio Tirana	7465eu		
1900	2000		Belgium, RTBF International	9970va		
1900	1904		Canada, Radio Canada International	9610na		
1900	1904	DRM	Canada, Radio Canada International	9800na		
1900	1959		Canada, Radio Canada International	9670af		
			9770af	11845af	13650af	15365af
			17790af			
1900	2000		China, China Radio International	5970eu		
			6055af	7350af	9455eu	9645eu
			11695af			
1900	2000		Congo Republic, Radio Congo	6115do		
1900	2000		France, Radio France Internationale	9790af		
			11705af	13695af	15300af	17620af
1900	2000		Gabon, Africa No. 1	9580af		
1900	2000		Indonesia, Voice of Indonesia	9525va	11785al	
1900	1928		Iran, Voice of Islamic Rep. of Iran	6025eu		
			9940va	13755as	15085as	
1900	2000		Russia, Voice of Russia	6120eu	6130eu	
			12060va			
1900	2000	Sat	Spain, Radio Exterior de Espana	9570af		
			12015me			
1900	2000		Syria, Radio Damascus	9330va	12085va	
1900	1959		Taiwan, Radio Taiwan International	3985eu		
			9365af			
1900	2000		USA, Voice of America	15225af	16780af	
1900	1930		USA, WYFR/Family Radio Worldwide	17760af		
1900	2000		USA, WYFR/Family Radio Worldwide	9695af		
			17690va	21455va		
1905	2000		Canada, Radio Canada International	9610na		
1905	2000	DRM	Canada, Radio Canada International	9800na		
1930	2000		Austria, AWR Europe	9625af		
1930	1957		Czech Republic, Radio Prague	6200eu	9430eu	
1930	2000		Germany, Radio Santec	12040va	15465va	
1930	2000	f/ DRM	Germany, Radio Santec	9880eu		
1930	1945	Sat	UK, Bible Voice Broadcasting	11830af		
1930	2000		Vietnam, Voice of Vietnam/Overseas Service			
			7280eu	9730eu		
1935	1950	smtwhf	Swaziland, TWR Africa	9525af		
1935	2000	Sat	Swaziland, TWR Africa	9525af		
1945	2000		India, All India Radio	6280af	7410af	

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

2000	2030	mtwhfa	Albania, Radio Tirana	7465eu		
2000	2100		Angola, Radio Nacional de Angola	7217af		
2000	2100	mtwhf	Argentina, Radio Nacional RAE	9690eu		
			15345af			
2000	2100		Belgium, RTBF International	9970va		
2000	2004		Canada, Radio Canada International	9610na		
2000	2004	DRM	Canada, Radio Canada International	9800na		
2000	2030		China, China Radio International	7350af		
			9645af			
2000	2100		Congo Republic, Radio Congo	6115do		
2000	2030		Cuba, Radio Havana Cuba	11760am		
2000	2100		Egypt, Radio Cairo	6255eu		
2000	2100		France, Radio France Internationale	5895af		
			9790af	11700af	17620af	
2000	2100		Gabon, Africa No. 1	9580af		
2000	2030		Germany, AWR Europe	9805af		
2000	2030		India, All India Radio	6280af	7410af	
2000	2100		North Korea, Voice of Korea	13760eu	15245eu	
2000	2100		Russia, Voice of Russia	6120eu	6130eu	
			12060eu			
2000	2100	DRM	Russia, Voice of Russia	6105eu		
2000	2030		South Africa, AWR Africa	11845af		
2000	2100	mtwhf	Spain, Radio Exterior de Espana	9690me		
			11620af			
2000	2020	Sat	Swaziland, TWR Africa	9525af		
2000	2100		USA, WYFR/Family Radio Worldwide	6240va		
			7300va	9595va		
2030	2100		Austria, AWR Europe	9805af		
2030	2100		China, China Radio International	7320eu		
			9430eu	11660eu		
2030	2100		Egypt, Radio Cairo	9280af		
2030	2100		Slovakia, Radio Slovakia International	5915eu		
			7345eu			
2030	2100		Turkey, Voice of Turkey	5970eu	6050eu	
2030	2100	Sat/Sun	USA, Voice of America	6040af	9780af	
			9815af	12080af	15225af	
2030	2100		Vatican City State, Vatican Radio	4005eu		
			5885eu	7250eu	9755af	11625af

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

2100	2115		Belgium, RTBF International	9970va		
2100	2200		Bulgaria, Radio Bulgaria	6200eu	7400eu	
2100	2159		Canada, Radio Canada International	11845af		
			15365af			
2100	2130		China, China Radio International	7320eu		
2100	2200		Congo Republic, Radio Congo	6115do		
2100	2115		Egypt, Radio Cairo	6255eu		
2100	2200		Egypt, Radio Cairo	9280af		
2100	2200		France, Radio France Internationale	5895af		
			6175af	9790af	17620af	
2100	2200		Gabon, Africa No. 1	9580af		
2100	2200		Nigeria, Voice of Nigeria/External Service	7255af		
2100	2126	DRM	Romania, Radio Romania International	6030eu		
2100	2126		Romania, Radio Romania International	7370eu		
2100	2200		Russia, Voice of Russia	6130eu	12060va	
2100	2200	DRM	Russia, Voice of Russia	6105eu		
2100	2200		South Korea, KBS World Radio	3955eu		
2100	2125		Turkey, Voice of Turkey	5970eu	6050eu	
2100	2130	mtwhf	USA, Voice of America	9435af	9680af	
			9780af	9815af		
2100	2200		USA, WYFR/Family Radio Worldwide	7305va		
			17575ca			
2100	2125		Vietnam, Voice of Vietnam/Overseas Service			
			7220va	7280eu	9550va	9730eu
2105	2200		Canada, Radio Canada International	6100na		
2130	2200		China, China Radio International	13630af		
2130	2200		Cuba, Radio Havana Cuba	11760am		
2130	2200		Serbia, International Radio of Serbia	6100eu		

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

2200	2204		Canada, Radio Canada International	6110na	
2200	2230		China, China Radio International	9430eu	
			11660eu		
2200	2300		Congo Republic, Radio Congo	6115do	
2200	2230		Cuba, Radio Havana Cuba	5965ca	17660ca
2200	2230		Egypt, Radio Cairo	9280af	
2200	2300		Gabon, Africa No. 1	9580af	
2200	2300		USA, WYFR/Family Radio Worldwide	9355va	
2230	2300		Cuba, Radio Havana Cuba	17705va	
2245	2300	mtwhs	Moldova, (Transnistria) Radio PMR	6240va	
2245	2300	smtwh	Monaco, Radio Monaco	4368usb	8728usb
			13146usb	17260usb	

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

2300	2329		Canada, Radio Canada International	6160as
2300	2330		Cuba, Radio Havana Cuba	5965ca
2300	2327		Czech Republic, Radio Prague	5930eu 7355am
2300	0000		Spain, Radio Exterior de Espana	6055na
2300	0000	Sat/Sun	Spain, Radio Exterior de Espana	6155eu
2300	0000		USA, WYFR/Family Radio Worldwide	6085na

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Methods of Rig Control

First, I'd like to thank the editors of *Monitoring Times* for the opportunity to write a regular column about the use of computers with radios. I plan to put a different spin on the topic than you may have seen in the past.

For one thing, I became a ham long before personal computers were around, and it was the allure of all those buttons, dials, lights and switches that lit my fire, not clicking a mouse. I grumble every time I have to reboot, update software, get a faster PC to handle the ever-increasing size of new programs or move to the latest operating system, add more memory, update virus protection software, try to figure out why the network is down or whether the RS-232 connector needs a null modem adapter or not, and so on.

I don't plan to nitpick every little thing that's wrong with most software, either. You install it, you use it and you live with the quirks. Such is life. So, without further ado, let's get into this month's topic: Methods of Rig Control.

Why use a computer with a perfectly good radio?

Have you seen the front panel of, say, an Agilent spectrum analyzer lately? The computing power inside the box is a small, internal PC, also called an "embedded PC." The designers take advantage of the enormous computing power of a PC to run the instrument, and they don't attempt to "hide" the operating system (O/S). The spectrum analyzer is just another application running in the box. See Figure 1.

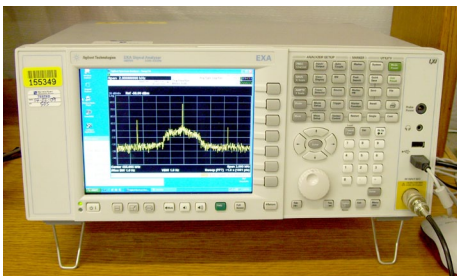

Figure 1 spectrum analyzer, showing how its screen is just Windows XP with a spectrum analyzer app.

The same thing is being done more and more with radios. When you attach a PC to a radio, either inside or outside, you can do some amazing things:

- Control the radio's functions, sometimes even half a world away by remote control.
- Pick an operating frequency and go there very fast.
- Add digital signal processing (DSP) to the audio, including noise reduction, variable width filters and automatic notching (reduction) of interfering signals.
- Record received signals and/or transmit prerecorded messages.
- Transmit and receive digital signals using the sound card and appropriate software to decode shortwave digital broadcasts; send and receive pictures such as Slow-Scan TV (SSTV); do the equivalent of text messaging by providing digital modes like PSK31 or Radio Teletype (RTTY); send and receive CW and much more.
- Transfer QSO or SWL info directly from the radio to a station log.
- Connect to the Internet and use Voice over Internet Protocol (VoIP) to connect to similar stations all over the world. Programs such as EchoLink and the Internet Radio Linking Project (IRLP) are used for this.
- Run software that implements almost the entire radio.

There are three basic approaches being used to connect a radio and a PC. We'll look at these one at a time:

Software-Controlled Radio
Software-Augmented Radio
Software-Defined Radio

Software-Controlled Radio

In this method, a PC is connected to the serial interface on a traditional radio. Remote control software, such as Ham Radio Deluxe (**www.ham-radio-deluxe.com**), running on the PC sends control commands to the radio, instead of, or in addition to the front panel. Often, an interface box must be used between the PC's sound card and the radio to allow digital modes to be used. The interface box matches the signal levels of the PC to what is required by the radio.

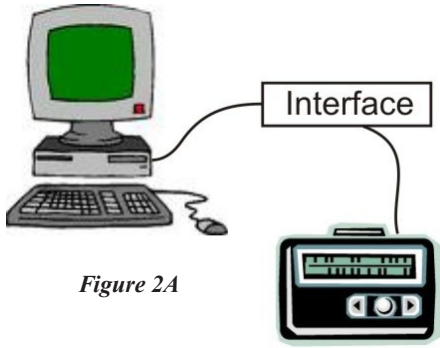

Figure 2A

Most modern radios can be controlled in this fashion. See Figure 2A.

Software-Augmented Radio

This is a new kind of radio, much like the test instrument mentioned earlier. An embedded PC is placed inside what is otherwise a fully functional radio and the PC controls the radio using the same remote control software as mentioned above. If the radio has a front panel, it can function even if the internal PC is not present or is turned off.

With this kind of radio, you have the choice of using the PC's features or not. Thus, the PC augments the radio by adding things the PC does best, but does not *become* the radio, which is still left to analog circuits.

Since the PC is inside the radio, sound card interfacing is done for you, which saves money and reduces the "rat's nest" of interconnect wires that would be required to an external PC. This makes the radio more portable, since only a keyboard, mouse and monitor must be carried with the radio, and then only if the features added by the PC are desired. And, since the embedded PC is not likely to be your main home computer (although technically there's no reason it can't be), there is less worry about virus protection and backups.

The kit radio "Sienna" uses this approach. See Figure 2B. The PC inside Sienna is made by Advantech Corporation (**www.advantech.com/ePlatform/**) and is called a "Biscuit PC." There are many other manufacturers of these tiny, relatively inexpensive, full-featured PCs. If you're interested in experimenting with such things, a good place to start looking is at the PC104 Consortium's web site **(www.pc104.org)**.

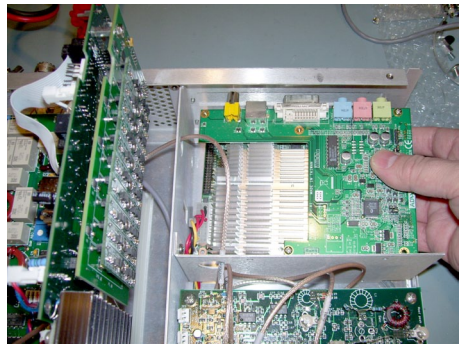

Figure 2B – I am holding the embedded PC in the compartment in which it is installed in the Sienna radio.

❖ Software-Defined Radio (SDR)

In this style of radio, the desired part of the radio spectrum is sampled very fast (at least twice as fast as the period of the operating frequency), and the resulting data is fed into a fast PC over a very fast interface (typically IEEE 1394, commonly called FireWire). Software running on the PC then operates on the data mathematically instead of electronically and converts the result back into audio to drive a speaker. The reverse process is used for transmitter circuits, starting at the microphone or key and ending up at the power amplifier stages.

Although the theory has been known since the early days of radio, this kind of approach has only become practical in recent years because the software and the hardware must execute extremely fast.

The technology to do SDR really started with Digital Signal Processing (DSP). In the early days, it wasn't possible to sample RF fast enough or execute software fast enough to implement a complete shortwave receiver. But it was possible for certain custom integrated circuits (ICs) to run fast enough to do some signal processing at intermediate frequencies (IFs).

That's why the first steps in the long path to SDR were made by rigs with DSP implemented at an IF of, say, 15kHz, long after the traditional receiver hardware has narrowed the signal down to just a few kilohertz in bandwidth. It wasn't a complete receiver, but it could perform noise reduction, filtering, and automatic notching of interfering CW signals.

In a true SDR, filters are made by applying mathematical formulas to a data stream instead of using inductors and capacitors; oscillators are created by using a simple cosine trigonometric function instead of using quartz crystals; and RF Mixers are implemented by simple multiplication instead of being made from diodes and transformers. FlexRadio (**www.flexradio.com**) makes radios (e.g. Flex-5000) using this approach. See Figure 2C.

The ARRL *Handbook for Radio Communications* (aka "The Radio Amateur's Handbook") has an excellent chapter on digital signal processing and software defined radio that is much more understandable than most college textbooks. If you want to understand the mathematics behind this emerging design technique, I highly recommend it.

❖ Hybrids

Since most modern radios use microprocessors that can have new code ("firmware") downloaded into them by the user, it can be confusing whether the radio is a true SDR.

If the radio has enough programmability built into it, many aspects of its internal control functions can be changed as the designer sees fit, or as users request new features. For example, suppose you wanted to allow some of the front panel controls to do different things than originally designed. If the controls are hardwired into analog circuits, that's not possible. But if they are merely generating analog voltages or digital data that's being processed by an internal microprocessor, and if that processor can be reprogrammed easily by the user, then the designer can offer new versions of downloadable code that can change the way the front panel works. This is technically not what's meant by SDR, even though some functionality is software-defined.

Conversely, there is no reason that an SDR cannot have a front panel. In the future, we will probably see SDRs with full front panels, but that are mostly empty boxes inside.

❖ Computers and Radios

As with any software product, there is a tendency for a radio that relies upon firmware or software to be "never quite done." Bugs must always be fixed, algorithms enhanced, new features added, and (if implemented on a PC instead of custom ICs) migration to the latest version of the PC operating system must be performed. But incorporating computing functions is the direction in which radio is headed, so it pays to learn something about it.

Does a computer add enough value to radio make it worth your while?

No matter which kind of radio you prefer, a computer can add enough features that it just might be worth the hassle that comes with it. If you use a PC only for rig control and not as your primary home PC, it does not have to be expensive, does not need virus protection, and does not have to be upgraded unless you want to use software that is new enough that it won't work on the older operating systems. If you use a radio that has a front panel, too, the computer does not need to be used at all if you don't feel like it!

Figure 2C – Rear-panel view of the new FLEX-5000A full duplex 160M through 6M 100W all mode transceiver (Courtesy www.flex-radio.com)

About the Author:

Brian Wood, W0DZ has been a ham since his freshman year of high school in 1965. He graduated with a B.S. in Electrical Engineering from the University of Arizona in 1973 and went to work immediately at Hewlett-Packard. He was an R&D Engineer at HP for 23 years and an Application Engineer for HP and its spin-off, Agilent Technologies, for 10 more years, specializing in in-circuit and functional test of electronic control modules.

He retired from Agilent in 2006 and formed The DZ Company, LLC, which manufactures electronic kits in Loveland, Colorado. His web site is **www.dzkit.com**.

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Military Brevity Codes

Alligators, Beanstalks, Cheapshots, Gingerbread, Lame Duck, Miller Time and Tumbleweed. What have any of these words to do with military communications?

Listen to military communications for any length of time and you will surely hear terms like these pop up in the conversation where they don't make logical sense. For instance, what the heck have alligators got to do with military communications?

Nothing: at least, not real alligators. The word, however, means a great deal when used as a military "brevity code." So what are these military brevity codes?

Within the Department of Defense (DoD), multiservice tactical brevity codes are codes used by various military air forces and air defense personnel. The code procedure words – a type of voice procedure – are designed to convey complex information in a few words. In short, a brevity code is a code which provides no security but which has as its sole purpose the shortening of messages, rather than the concealment of their content.

These codes are used for air-to-air, surface-to-air, and air-to-surface tactical communications. Using codes eases coordination and improves understanding during multiservice operations.

This month I want to pass along some of the more commonly used brevity codes that you are likely to hear on the air and that are used by American and NATO forces.

A

Alligator ..... Link-11/TADIL A
Angels..... Height of friendly aircraft in thousands of feet from mean sea level (MSL). (Note: NATO definition does not specify MSL or AGL)
Anyface..... Friendly GCI/AEW command and control agency when callsign is not known.
Arizona ..... No anti-radiation missile (ARM) ordnance remaining.
As Fragged..... Unit or element will be performing exactly as stated by the air tasking order (ATO).
Authenticate ..... To request or provide a response to a coded challenge.
Autocat ..... Any communications relay using automatic retransmissions.

B

Bandit ..... An aircraft identified as an enemy in accordance with theater ID criteria. The term does not necessarily imply direction or authority to engage.
Bead Window... Last transmission potentially disclosed unauthorized information.
Beanstalk ..... [NATO] Information call advising datalink users to check equipment for spurious tracks.
Bingo ..... Fuel state needed for recovery.
Bogey ..... A radar or visual air contact whose identity is unknown.
Break Away ..... Tanker or receiver call indicating immediate vertical and nose/tail separation between tanker and receiver is required.
Broke Lock..... Advisory call regarding loss of radar/IR lock-on.
Bugout (direction) Separation from that particular engagement/attack/operation with no intent to reengage/return.
Buster..... Directive call to fly at maximum continuous speed (military power).
Button ..... Radio channel setting.
Buzzer..... Electronic communications jamming. (NOTE: same as NATO term, chatter)

C

Cheapshot..... AIM-120 missile data link terminated between high and medium PRF active.
Cherubs ..... Height of a friendly aircraft in hundreds of feet AGL. (Note: NATO definition, when adopted, will not specify AGL or MSL)
Chicks..... Friendly aircraft.
Confetti ..... Chaff lane or corridor.

D

Details..... Request for modified J-FIRE 9-Line Brief from Joint Surveillance Target Attack Radar System (Joint STARS).
Dirty..... Link is not encrypted.
Divert..... Proceed to alternate base/*mission.
Dolly ..... Link-4A/TADIL C.

F

Faker ..... [NATO] A friendly track acting as a hostile for exercise purposes.
Father ..... (AIR-MAR) Shipboard TACAN station.
Feet Wet/Dry .... Flying over water/land.
Fox (number) .... Simulated/actual launch of A/A weapons.
..... ONE - Semiactive radar-guided missile.
..... TWO - IR-guided missile.
..... THREE - Active radar-guided missile.
Fox Mike ..... VHF/FM radio.

G

Gadget ..... Radar or emitter equipment.
Gingerbread .... Voice imitative deception is suspected on this net.
Go Clear..... Use unencrypted voice communications.
Go Secure ..... Activate encrypted voice communications.
Guns ..... Reference to A/A or A/S gun engagement.

H

Home Plate ..... Home airfield or ship.
Hot ..... Defined area is expected to receive fire (enemy or friendly).
Hotel Fox..... High Frequency (HF) 3-30 MHz radio.

I

Idle ..... Joint STARS call indicating surface vehicles are stationary.
India ..... Mode IV
Interrogate ..... Interrogate the designated contact of the IFF mode indicated.
Intruder..... An individual, unit or weapon system in or near an operational or exercise area, which represents the threat of intelligence gathering or disruptive activity.

J

Jackal ..... Surveillance network participating group (NPG) of Link 16/TADIL J.
Jink..... Directive call to perform an unpredictable maneuver to negate a tracking solution.
Joker..... Fuel state above BINGO at which separation/bugout/event termination should begin.
Judy ..... (A/A) Aircrew has radar or visual contact on the correct target, has taken control of the intercept and only requires situation awareness information; Controller will minimize radio transmissions.

K

Knock it off..... In training, a directive call to cease all air combat maneuvers/attacks/activities/exercises.

L

Lame Duck ..... An aircraft in a minor state of emergency.

M

Magnum (system/location) (A/S) Launch of friendly antiradiation missile.
Marshal(ing) ..... Establish(ed) at a specific point.
Mickey ..... Have Quick time-of-day (TOD) signal.
Midnight..... Informative call advising that C2 radar functions are unavailable due to degradation. Advisory information is still available. Opposite of Sunrise.
Miller Time ..... (A/S) Informative call indicating completion of air-to-ground ordnance delivery. Generally used by the last striker in conjunction with a pre-coordinated egress plan.
Mother ..... (AIR-MAR) Parent ship.
Music ..... Radar electronic deceptive jamming.

N

No Joy ..... Aircrew does not have visual contact with the target/bandit/landmark. Opposite of tally.

O

On Station..... Informative call that unit/aircraft has reached assigned station.

P

Pacman..... [NATO] Informative call that the fighters have found the end of the threat formation and are converting; given in range and bearing from the Bullseye (e.g. "Blue 4 is Pacman 290/5").
Parrot ..... IFF/SIF transponder.
Pedro ..... [NATO] Rescue helicopter.
Pigeons ..... Magnetic bearing and range to Homeplate.
Playmate ..... Cooperating aircraft.
Playtime ..... Amount of time aircraft can remain on station, given in hours plus minutes (e.g. One plus thirty equals one hour and thirty minutes).
(freq) Pogo (freq) Switch to communication channel number preceding Pogo. If unable to establish communications, switch to channel number following Pogo. If no channel number follows Pogo, return to this channel.
Push (channel).. Directive to switch to designated frequency; no acknowledgment required.

Q

Quail ..... Enemy air-/surface-launched cruise missile.

R

Racket (EW) ..... Intercepted electronic emission that has

been assigned to a number of the trackblock.
Restake ..... Request for Joint STARS to drive a new STAKE at the target centroid reported with direction of travel and elevation. Initiated by aircrew.
Rotator ..... Joint STARS MTI returns that signifies a high probability of a rotating antenna.

S

Scramble..... Takeoff as quickly as possible.
Scrub ..... Joint STARS Moving Target Indicator (MTI) return that signifies a low slow airborne target
Shooter ..... Aircraft/unit designated to employ ordnance.
Shopping ..... An aircraft request to Joint STARS for a target.
Skunk..... A maritime surface contact that has not yet been identified.
Smoke..... (A/S) Smoke marker used to mark a position.
Sour..... (Opposite of Sweet).
..... 1. (mode/type) Invalid/no response to an administrative IFF/SIF check.
..... 2. (link name)* (e.g. " Timbe Sour") Indicates there are potential problems with net entry and initiates premission link troubleshooting.
..... 3. [NATO] Equipment indicated is not operating efficiently
Spin ..... Directive or informative call to execute a timing/spacing maneuver.
Spoofer ..... (EW) An entity employing electronic or tactical deception measures.
Squawk (mode/code) Operate IFF/SIF as indicated or IFF/SIF is operating as indicated.
Stake ..... Joint STARS reference point for A/S targeting operations.
Sunrise..... Informative call that C2 radar functions are available. Opposite of Midnight.
Sunshine ..... (A/S) Directive or informative call indicating illumination of target is being conducted with artificial illumination.
Sweet..... (Opposite of Sour.)
..... 1. (mode/type)* Valid response to an administrative IFF/SIF check request.
..... 2. (link name)*. (e.g. Timber Sweet) Confirms receipt of datalink information.
..... 3. [NATO] Equipment indicated is operating efficiently

T

Tally ..... Sighting of a target, non-friendly aircraft, landmark, or enemy position. Opposite of No Joy.
Timber ..... The Link 16 network.
Timecheck..... Informative call to check/change IFF code.
Tumbleweed ..... Indicates limited situational awareness, (i.e., No Joy, Blind) and is a request for information.

U

Unable..... Cannot comply as requested or directed.
Uniform ..... UHF/AM radio.

V

Vampire ..... Hostile anti-ship missile.
Victor ..... VHF/AM radio.

W

Warning (color). Hostile attack is:
..... RED - Imminent or in progress.
..... YELLOW - Probable.
..... WHITE - Improbable (all clear).
Weapons ( )..... (Surface/Air) Fire only:
..... FREE - at targets not identified as friendly.
..... TIGHT - at targets positively identified as hostile
..... HOLD/SAFE - in self-defense or in response to a formal order.
Weeds ..... Indicates that aircraft are operating close to the surface.
Wilco ..... Will comply with received instructions.
Winchester ..... No ordnance remaining.

Z

Zap..... Request for data link information.
Ziplip ..... Directive call to minimize radio transmissions.

If you want additional codes or need to look up possible brevity codes you have heard on the air, you can download the latest DoD *Multi-Service Brevity Codes* publication: FM 3-54.10 (FM 3-97.18), MCRP 3-25B, NTTP 6-02.1, or AFTTP(I) 3-2.5 date June 2003 at **www.scribd.com/doc/12931024/US-Multi-Service-Brevity-Codes.**

❖ Monitoring the Tyndall AFB Trunk Radio System

Our good friend and fellow southeast US military monitor, Joe Cobb, recently spent some time along the Gulf Coast and did some monitoring of the Tyndall AFB, Florida, military trunk radio system. He passes along the following report.

System: P16 Mixed mode 3600 baud system
System ID: a810
Base Frequency:
406.100 MHz; Step: 12.5 kHz; Offset: 380; Low Channel: 380; High Channel: 758
Base Frequency:
410.800 MHz; Step: 12.5 kHz; Offset: 759; Low Channel: 759; High Channel: 759
Frequencies:
406.1625/415.1625c 406.3625/415.3625c 406.5625/415.5625c 406.9625/415.9625c 407.3625/416.3625 407.7625/416.7625 408.1625/417.1625 408.5625/417.5625 408.7625/417.7625 408.9625/417.9625 409.3625/418.3625 409.7625/418.7625 410.1625/419.1625 410.5625/410.5625 410.7625/419.7625 (Control channels change daily)

Analog Talk Groups:

16	Maintenance Control Announcement
436	43FS F-22 Maintenance "Checker Operations"
464	Flightline Maintenance
816	Security PD Dispatch <Channel 1>
944	Security PD Gate entrances <Channel 2>
1296	Emergency (for In Flight Emergencies) <Channel 10>
1392	Unknown user/usage
1424	Fire/Rescue Dispatch
1488	Unknown user/usage
2320	Transient Line Parking (Transient Alert)
2352	Tyndall Tower
2704	Flightline Maintenance
2736	2FS F-15 Maintenance crews "Beagle Operations"
2768	F-15 Maintenance crews
2800	Maintenance Operations Center (MOC)
3376	F-22 Maintenance crews
3440	Unknown user/usage
3344	Munitions: Chaff and Flares loading
3376	F-22 Flightline Maintenance
4560	Ordinance
4880	Drone Operations/Maintenance "Drone Control"
5104	Unknown user/Phone Patch
5552	POL - Aircraft Refueling (Transient Alert)
8368	Range Control
8848	Flight Safety
9648	Civil Engineers (Base Maintenance) <Channel 1>
9744	Unknown user/usage
9872	Civil Engineers (Base Maintenance) <Channel 2>
9936	Unknown user/usage
11280	Base Transportation (very active on airshow days, buses transporting patrons from/to parking lots)
11856	Dormitory Orderlies

Digital Talk groups:

43152	Janitorial services
44080	Telecom? (lots of references to phone service here)
44176	Unknown users/usage (Airshow related)
44304	Airshow related (setting up of the speakers/audio system)
44336	Unknown user/usage
50960	Vehicle Maintenance
54032	Supply
55664	Airshow Operations (some ramp boss here too)
55696	Logistics/Public Relation (heavily used on Friday before an airshow, getting rental cars, meeting pilots, etc)
55728	Unknown user/usage
55792	Airshow (Ramp Boss)
55856	Transportation Dispatcher, escorts

❖ Milcom Frequency Changes

To start the New Year, here are a few frequency changes that have been documented.

32.550	Fort Rucker, Alabama RT 114 (NFM)
49.925	Fort Rucker, Alabama (Tabernacle Stagefield) Air-to-Air (NFM)
64.350	Robert Gray AAF, Texas (KGRK), ATS
119.775	Tyndall AFB, Florida (KPAM), South Sector below 5,000 feet
139.600	Beale AFB, California (KBAB), Supervisor of Flying
140.100	Robert Gray AAF, Texas (KGRK) ATS (Primary) Command Post Belton
140.425	Robert Gray AAF, Texas (KGRK) ATS (Backup) Command Post Belton
229.125	Robert Gray AAF, Texas (KGRK) ATS (Backup) Command Post Belton
258.150	Robert Gray AAF, Texas (KGRK) ATS (Primary) Command Post Belton
271.100	Travis AFB, California (KSUU), PMSV Metro ex-269.200
307.800	Tyndall AFB, Florida (KPAM), South Sector above 5,000 feet
316.575	Robert Gray AAF, Texas (KGRK) 2-4 GSAB TAA PV
353.825	Hill AFB, Utah (KHIF), Com RTR ex-387.000

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

FED FILES

GOVERNMENT COMMUNICATIONS

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2010 Fed Files New Year!

A very Happy New Year to all the *Monitoring Times* readers out there. I'm glad to have you with us for another year of frequencies and discussions about federal monitoring. We've got a lot to cover this month, so let's jump right in.

Roadrunner and Other Strange Vehicles

As we have seen from our recent discussions of the mobile UHF trunked radio system, the federal government has some mighty unusual vehicles in their fleets. And government VIP motorcades have a history of some interesting support vehicles traveling along with the armored limousines.

Up until about 2003, one interesting vehicle in the presidential motorcades was a black, Ford van sporting a large number of antennas. This van was known as "Roadrunner," from its radio call sign. The Roadrunner van was operated by members of the White House Communications Agency and carried a number of communications systems to support executive communications while the President was traveling. Among them were the VHF radio channels used by the WHCA and the Secret Service, some satellite data capabilities, and even an HF (high-frequency – short wave) communications system on board. I actually got to look around inside of a Roadrunner van at a presidential event involving President Clinton.

In late 2003 or so, a new vehicle started showing up in the presidents motorcades that attracted the attention of a lot of people. The new vehicle was based on a Chevy Suburban chassis and it, too, was sporting a large number of unusual antennas. For a time, this new vehicle was traveling along with the Ford Roadrunner van, but eventually the van was replaced by the Suburban. Those listeners who were able to catch some clear radio traffic from the motorcade reported that this new vehicle has inherited the "Roadrunner" call sign.

These new Suburban communications vehicles carry a variety of strange antennas that are a departure from past mobile units and this has caused some to wonder about its true purpose. Some conspiratorial sources on the Internet have claimed that this vehicle is an NSA (National Security Agency) surveillance van, operating "under WHCA cover." Others have claimed it to be a bomb detector or radio frequency jamming system to prevent triggering of explosive devices near the presidential motorcade.

Exactly what is carried in these specially equipped vehicles is still open to some speculation, but publicly available sources have supported the claim that it is the next generation communications vehicle operated by the White House Communications Agency. After September 11, 2001 there was a mandate placed upon the WHCA to improve the communications capabilities for the President in the field, especially for emergency situations. This new vehicle was developed by the Navy Research Laboratory and is a mobile communications hub that provides real-time data, video and voice communications while the motorcade is out of reach of Air Force One. The system is a highly secure, IP (Internet Protocol) based link that allows the Presidential motorcade to maintain solid communications with voice, data, and live video everywhere they go.

Interestingly, there have been multiple reports from people around the Washington DC area that they have seen similar vehicles accompanying other motorcades, besides that of the President. One report was that it was someone high-ranking with the Pentagon that was traveling around with one of these vehicles. Other reports have come from members of the military or contractors saying they have seen similar-looking vehicles in the Persian Gulf areas where the US military is operating.

These new generation communications vehicles come in different versions or can be configured for different missions. Some carry more antennas than others, while some carry only a few VHF antennas. They have sometimes been seen carrying a single, large satellite antenna "hump" on the roof, while others carry two smaller satellite antenna radomes. One of the more prominent features that some of the presidential vehicles often carry are pairs of large, thick, black vertical antennas that seem to have either rubberized "boots" or perhaps heat sinks at the base.

What frequencies do these new "Roadrunner" vehicles utilize? Definitely check out the known VHF and UHF frequencies used by the Secret Service and WHCA. You can find the latest listings on the *Fed Files* blog page, **http://mt-fedfiles.blogspot.com/2008/02/secret-service-frequency-list.html**.

In addition to land mobile radios, there are UHF and SHF satellite systems on board, probably INTELSAT as well, and interconnection to land-based cellular and PCS digital phone networks, using government-secured phone equipment. Whatever frequencies may be used, we can be certain that they are using the latest in encryption technology.

Some have referred to these SUVs as the "War Wagon." In actuality, the "War Wagon" is a separate black SUV that carries the heavily armed Counter-Assault Team (CAT). You will usually see an armed agent riding in the rear of

the vehicle with the rear tailgate window open and ready to pounce in the event of an armed attack on the motorcade.

One other interesting vehicle that has been seen at political conventions, inaugurations, and other big security events is a camouflaged HMMWV or "Humvee" sporting Secret Service logos on the side doors. This Humvee appears to have two UHF military-air band discone antennas mounted on the rear of the vehicle, but its precise function is still unknown. There have been some descriptions published of these trucks and I have seen photos of this Humvee on the Internet, but have not been able to locate any that could be included with this column. If there are any readers with photos or who have seen this vehicle in action, please let us know at *Monitoring Times*!

Federal Railroad Administration

A recent inquiry from a *Fed Files* reader prompted me to look into a federal agency on which I had not seen much information until now: the Federal Railroad Administration. Part of the Department of Transportation, the Federal Railroad Administration was formed in 1966 and has many functions, including enforcement of rail safety operations; administration of railroad safety and improvement programs; and research into improving rail service technology and safety. The Federal Railroad Administration's web site can be found here: **www.fra.dot.gov/**.

Not much is known about how the Federal Railroad Administration utilizes the radio frequencies allocated to it. While FRA probably uses the standard AARR VHF railroad channels, they definitely have some federal frequencies allocated for their use. If you are interested in trying the standard railroad frequencies, have a look here: **www.on-track-on-line.com/scanner-radio.shtml#scnradio3**.

As for federal assignments, here are the frequencies I have for the FRA in my database:

164.6250171.6500
164.9875171.7250
165.2625172.3000
165.3125172.7000
165.3375172.8250
166.0250173.0500
166.2250173.1500
166.3750173.6375
170.7500173.9125
171.2375

All these frequencies are most likely in analog, as I have seen no reports of the FRA buying P-25 capable radios yet, but that may change in the future. Other Department of Transportation agencies, as well as the NTSB utilize some of these frequencies. Some are also allocated for use at the Railroad Transportation Technology Center in Pueblo, CO. You can find out more about the Pueblo facility here: **www.aar.com**.

Pittsburgh G20 Summit Wrap Up

The meeting of the G20 Nations in Pittsburgh this past September was another high-security event that provided plenty of monitoring possibilities for the folks in and around the area. Local monitors were kept busy with city, county, state, military and federal channels that provided non-stop action for the short time the G20 Summit was in session. Although the G20 event was over three months ago, I wanted to pass along what was found to be in use in Pittsburgh during the event. It can help provide a roadmap for monitoring future activities such as these in other cities.

The lead agency for the event was the US Secret Service, but many of the FBI radio network channels, and also DHS agencies were active as well. The Multi-Agency Command Center (MACC) housed the base of operations for all of the law-enforcement and public safety agencies participating in the G20 events. In the days prior to the event, the USSS set up temporary repeaters on top of the Hilton Hotel in downtown Pittsburgh. Other agencies also set up temporary gear for interoperability communications. Some of these federal interoperability frequencies have been heard in past events in the Pittsburgh area, so they might be permanently installed locally.

PL = CTCSS tone squelch
N = P-25 Network Access Code (NAC)

121.5000, AM – VHF Guard, used to warn aircraft of restricted airspace violations
123.0250, AM – Used extensively between helicopters in the area
123.4500, AM – Various agency helicopters

138.8875, DHS FEMA, used in both analog and P-25 digital with encryption

162.3250, N293
162.9500, N167
163.0375
163.1125, N001 – This frequency used for helicopter operations, CBP OMAHA units
163.4250, N68F – Federal Interoperability LE-5 repeater input
163.7250, N167
163.7375
163.7500, N167 – Input to FBI linked network
163.9500, N173
164.4000, N001 - USSS PAPA
164.6500, N001 - USSS TANGO
164.8875, N001 - USSS OSCAR
165.2125, N001 - USSS MIKE
165.2375, PL 100.0 – DHS Customs, used by multiple agencies
165.2875, N650 – BATFE Repeater
165.3625, N167
165.3750, N001 - USSS CHARLIE
165.7875, N001 - USSS BAKER
165.8250, N167 – FBI Linked repeater system
165.8500, N386
165.8750, N167 – FBI Linked repeater system
165.9750, N167
166.4375, PL 100.0 – DHS Customs, input to 165.2375
166.4625, N167 – FBI using DHS/TREASURY COMMON
166.5125, N001 – USSS WHCA ALPHA/SIERRA
166.7500, PL 167.9
167.0375, N001 - USSS
167.2125, N173 - Input to 163.950
167.2625, PL 167.9
167.5375, N167
167.5625, N167 – FBI D6
167.5625, PL 167.9
167.7250, N68F
167.7375, PL 167.9
167.7500, N68F - Federal Interoperability LE-3/LE-7
168.1250
168.2250, N167 - FBI
168.2500, N68F
168.3750, N167 - FBI
168.4625, N68F Federal Interoperability LE-5 repeater
168.5875, N001 – USSS Diplomatic Protection Division
168.8250, N167
168.9250, N167 – FBI Linked repeater system
169.5875, P-25 – This is a Pittsburgh VAMC channel
170.5875, P-25 – This is also a Pittsburgh VAMC channel
170.6250, N167
170.7000
170.8125, N167
170.8250, PL 167.9 – FBI A6, DES encryption
170.8875, N167
170.9125
171.0125, P-25 – This is also a Pittsburgh VAMC channel
171.3875, N167
171.4375, N173 – This is a Federal Interoperability channel in other cities
171.6125, PL 167.9
172.6875, P-25 – Pittsburgh VAMC Police
173.9875

254.7250, AM
255.8000, AM – KEYSTONE Operations
260.9000, AM – Combat Air Patrol flights, HARASS, HUNTER and TEFLON call signs

406.3375, N482 – US Postal Inspectors
407.6625, N421
407.7750, P-25 – US Postal Inspectors
409.3375, N293 – Was also used during the MLB All Star Game in Pittsburgh
411.1500, P-25
413.8750, PL 123.0 – Federal Protective Service
414.5000, PL167.9 - Common frequency for federal helicopter & air operations

Special thanks go to all the listeners in the Pittsburgh area for their help.

The G20 Summit also brought some interesting controversy in a scanner-related story that made the national news wires. It seems that a man from New York City set himself up a monitoring post and was listening to what was happening on his scanners. He was then passing along the information about what the Pittsburgh police were doing to protesters in the field, via Twitter messages over the Internet. Further details about the incident are available from the New York *Times* here: **www.nytimes.com/2009/10/05/nyregion/05txt.html?_r=1&bl**

This incident has provoked a lot of commentary about what this man did and if there are really any grounds to prosecute him. I will say that it certainly doesn't help the image that most people have of scanner listeners.

That's all for our opening kickoff of 2010. We will be back in March with more federal monitoring information, so see you then.

BOATS, PLANES, AND TRAINS

BOATS

Ron Walsh
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Retired, Relaxed, Reorganized and Reeducated

The cold weather has now descended upon southern Ontario and the DX season has begun. Since I am retired, I can give time to the radio waves and also not have to go out if I don't want to. I can now enjoy the fruits of my labor as I have serviced my antenna systems. The radios are crackling and the propagation has improved significantly in the last month or so. I have made some amateur QSOs with Asian stations of late.

Reorganized means that my radio shack has been set up for easier operation and I have got my books out to get some frequencies to monitor. A list is taking shape and my radios have been tuned to several frequencies to see what I can hear. I have also done some research and compiled a list of frequencies I want to try this winter.

Relaxed means I can really enjoy surfing the bands, while I enjoy a cup of coffee or hot chocolate. What could be better on a snowy day than a warm radio shack, a hot drink, and signals coming in?

Reeducated means that I have taken a look and see that there is a great deal I have to learn. I looked up at my old SWL certificate from *Popular Electronics* magazine, VE3PE1BQ, and a certificate from the National Radio Company for their Association of Arm Chair Adventurers, which causes me to realize that I have been monitoring radio for over 50 years now.

My first listening was with a National SW-54 in 1959. I look over at my old Hallicrafters S-38 and realize many things have changed in that time. The digital world is now upon us and there are many new and exciting signals on the air. I had better get with it and monitor the new signals that are on the bands.

Laker Cedarglen downbound from lock 3 of the Welland canal.

❖ Tools of the Trade

My shack consists of the following equipment: For the amateur bands and HF monitoring I have an Icom 756 Pro III that is attached to a R-8 vertical, the tip of which is 50 feet above ground, and an 80 meter dipole. Along with this is a Kenwood TS-570 with a sloper antenna for 80 and 160 meters. The TS-570 is connected to my lap top computer for digital monitoring.

For VHF amateur use and monitoring I have a Yaesu FT897 and a Yaesu FT-857 that was given to me recently. Each of these is attached to a vertical antenna. I have a Radio Shack digital scanner for the Ontario Police network as well as a regular scanner for other signals. My Kenwood R-500 with VHF converter is used to monitor the marine VHF band as well as some HF monitoring.

A Smart Radio SR-161 AIS receiver is on constantly here and feeds into a server in Quebec. I have access to the server and can see all the ships from the Gulf of St. Lawrence to Lake Ontario.

The old S-38 still works well and is used for time signals. Two handhelds, power supplies and emergency 12volt battery packs, and a personal computer complete the station.

❖ Digital Signals

For the digital signals I copy I have been using the program *Multipsk*. This is a free download and is very useful. There are many other programs out there and you should select the one that best fits your uses. I was using this for decoding Navtex (SITOR-B) signals on 518 kHz. At night I can get as far as New Orleans, LA and Bermuda. I have not seen longer DX yet, but intend to try later this winter. I decoded some DGPS signals on 306 from Cardinal, Ontario and 321 kHz from Youngstown, NY. The screen gives you information about which station it is and what its status is. Though not exciting fare, it is still interesting. I did, however, get a notice that I could no longer decode DGPS using the unlicensed version and later it did stop decoding the DGPS signals. I am looking into getting the licensed version of the program.

This is a great time to investigate the LF bands. Be sure to consult the excellent column, *Below 500 kHz*, in *Monitoring Times* for information.

Digital transmissions on the HF bands are something I need to work on. I always check other sources for information. Mike Chace's *Digital Digest* column, "Maritime Listening with Sitor-B" (Nov 2009 issue) was a great help. I have copied VFF Iqaluit on 8376.6 and NMC Point Reyes, CA on 6323.5. These stations were using SITOR-B mode. KPH transmits RTTY on 8433 and 12631 kHz most Saturdays. Hugh Stegman's *Utility World* column has a great loggings section and is a good source of information. I am trying to catch some of the stations logged there. I need to concentrate more on logging RTTY and ALE modes. I am learning about RTTY by monitoring CFH Halifax. They use fax plus RTTY 75bd/850Hz on 4271, 4997, 5097, 6389, 6496.4, 10536, 13510 and 15920 kHz.

FAX transmissions are also heard. Someday I would like to report reception of the Australian stations VMC and VMW. Their schedule can be had at **www.bom.gov.au/marine**. The stations run on a 24 hour cycle. VMC broadcasts fax on 20469 kHz during daytime and 2628 kHz nighttime. 5100, 11030 and 13920 are used all day. VMW uses 18060 during daytime and 5755 at night. 7535, 10555 and 15615 kHz are used all day.

CFH Halifax broadcasts fax at the standard rate of 120 LPM (IOC 576) on 122.5, 4271, 6496.4, 10536 and 13501 kHz. Tune your radio 1.9 kHz down from the stated frequency. They broadcast signals on a 24 hour basis. The 6496 kHz frequency is loud here in the evening. They alternate these transmissions with RTTY signals using 75 baud and 850 Hz shift.

DSC (Digital Selective Calling) calls are now being widely used on HF as well. This is another mode I need to get used to. Try monitoring 2187.5, 4207.8, 6312, 814.5, 12577 and 16804.5 kHz. Remember marine channel VHF 70 is now used for DSC.

❖ Listening on HF

The standard HF marine frequencies come in well here. I need not mention 2182 kHz is still active. The US Coast Guard uses 2670 for

broadcasts and the Canadian Coast Guard stations use 2598 and 2749 for broadcasts. The old standbys of 5696 and 8983 kHz for the USCG are active. Try CAMSLANT Chesapeake on 7527, 7530 and 11436 kHz USB.

Scheduled HF broadcasts by the USCG can be picked up on many frequencies. NOJ Kodiak Alaska was my best catch here. NMN Chesapeake, NMG New Orleans, NMC Pt. Reyes CA, and NMO Honolulu are on the air. I am still trying to hear NRV Guam and hope to this winter. Table 1 is a more complete schedule of their transmissions.

The Australian weather broadcasts have been monitored in North America, but so far they have eluded me here. VMC uses voice at 4426 and 16540 kHz during daytime, 2201 and 6507 kHz during nighttime, and 8176 and 12365 kHz continuously. VMW uses 4149 and 16528 during the daytime, 2056 and 6230 at night, and 8113 and 12362 continuously.

The USCG continuously monitors long range emergency frequencies. Try listening on 2182, 4125, 6215, 8291, 12290 and 16420 kHz.

My favorite station to monitor is ZBR Bermuda. They broadcast on 2582 kHz at 0035, after announcing on 2182 kHz, and every four hours after that. I also find this is a good station for checking propagation conditions. I still am trying to hear the west coast Canadian Stations on 2054 kHz.

Don't forget to monitor the marine HF frequencies to see what is in use in your area. For example, 4149 kHz is used by Crowley Marine to talk to their tugs and is easily heard here. 5717 kHz USB is often used by Canadian Forces during Search and Rescue activities. Let me know what you hear in your area.

❖ CW Activity

I am still a CW operator at heart. I do not claim to be fast, but try to be a good operator. KSM, the restored marine coast station in California, operates most Saturdays from 1900 to 2300 Z. They broadcast High Seas Weather at 2130 Z at 25 wpm on CW. They can be heard on 4350.5, 6474, 8436.3, 12993, 16914 and 22445.8 kHz.

Of course, we all remember the 500 kHz marine CW emergency frequency. You can still hear KSM on 500 kHz and 426 kHz CW most Saturdays.

The 500 kHz band has become of interest to amateur radio operators. [See this month's *Utility World* for more information – *ed*.] There have been several American stations allowed to operate on the band for test purposes. I have heard WE2XGR/2 on 507 kHz having a QSO.

Two Canadian stations have also been licensed for testing purposes. Jim Leahy, VE1ZZ, has the call VX9PSO on 504.6 kHz while Joe Craig, VO1NA has the call, VX9MRC on 507.77 kHz. A station in Ontario and one in British Columbia are also to be on the air soon. Reception reports are welcomed.

Let's hope we can get some activity and have this historic frequency spectrum allocated for regular use. It has been used in this area since 1914 when VBH Kingston went on the air.

Table 1: Schedule for USCG Voice Weather Broadcasts

(All frequencies in kHz and mode USB; time in UTC)

NMN Chesapeake
4426, 6501, 8764 kHz at 0330, 0515, 0930 UTC
6501, 8764, 13089 at 1115, 1530, 2130, 2315
8764, 13089, 17314 at 1715

NMC Pt. Reyes, CA
4426, 8764, 13089 at 0430, 1030
8764, 13089, 17314 at 1630, 2230

NOJ Kodiak, AK
6501 at 0203, 1645

NMO Honolulu
6501, 8764 at 0600, 1200
8764, 13089 at 0005, 1800

NRV Guam
6501 at 0930, 1530
13089 at 0330, 21320

NMG New Orleans, LA
4316, 8502, 12788 at 0330, 0515, 0930, 1115, 1530, 1715, 21230, 2315

The amateur bands have quite a few marine nets and I often monitor the maritime Mobile Service Net on 14300 kHz USB. You can often hear yachts and other vessels as they head south at this time of year. Many of them use the Intercoastal waterway as they travel the east coast of the US. The Intercoastal waterway net is on 7268 kHz LSB at 0745 Eastern Time. Stations begin gathering informally at 0700.

❖ VHF

VHF marine monitoring will continue to be active in the warmer climates, but here, with the St. Lawrence Seaway closed for the season, the VHF traffic dies down to virtually nothing. However, the continuous marine broadcasts for weather are continued in any area where there is traffic. 161.775 MHz is used here and this is alternated with 161.65 MHz as you move through the Great Lakes area.

I still hear traffic for the local ferries which operate through the winter because they have a bubble system under their track. Compressors at both ends of the track pump compressed air through a pipe that has holes in it, allowing bubbles to come to the surface. This, plus the ferry traffic, keeps the channels open all winter. I still monitor channel 16 for emergency broadcasts. We usually have some incidents with people on the ice, etc. over the winter. We will also have several Gale and Storm warnings for Lake Ontario.

❖ Catch you on the Net or 'Net

I hope I can talk with other hams who read this column. I can often be found on the Ontars Net 3755 kHz LSB in the afternoons, the CJ Net 3775 kHz USB from 2330 to 0030 Z, and I do check in to the Maritime Mobile Service Net in the afternoons, on 14300 kHz USB, whenever I can.

I really appreciate any email that can be sent to me about the frequencies and traffic you hear. I was having a great deal of spam trouble with my email, but this should be cleared up by the time this column is printed.

I certainly hope that everyone had an enjoyable Christmas season and has the best New Year ever! Perhaps you received some new radio equipment and the New Year will bring some new DX contacts. I am certainly enjoying my coffee, watching the FAX from CFH and scanning the marine bands for new signals.

Best 73's and Good DX!

Passenger Vessel Clelia II downbound in the Welland Canal. Vessel was leaving the lakes after a season sailing from Toronto to Duluth and back.

BELOW 500 kHz

DXING THE BASEMENT BAND

Kevin Carey, WB2QMY
kevincarey@monitoringtimes.com

Why Longwave?

Welcome to 2010! The start of a new year is a good opportunity to look at why we do what we do, and also explore new areas of listening adventure. I'd like to take some time this month to review what draws many of us to longwave – in part to share the mystique to newcomers, but also to "jumpstart" veteran listeners on this amazing part of the spectrum. Here are the best reasons I can think of to include longwave in your listening menu…

Variety of Signals – I've said it before and I'll say it again: ***Where else in the radio spectrum can you hear so many different types of signals in the space of just 500 kHz?*** On longwave, you can hear Natural Radio, Military, Time Stations, Broadcasters, Beacons, and Experimenters – all in this relatively narrow slice of spectrum. You simply can't become bored!

Beacons: The Ideal DX Target – If you were to design the perfect DX station to listen for, what features would it have? How about these: 24-hour year-round operation, omni-directional transmission pattern, constant and repetitive IDs (in CW mode, to help cut through noise), and published location/operator data. Guess what? Longwave beacons have ***all*** of these traits, making them a perfect DXing target.

Propagation Stability – Take a listen sometime below 100 kHz, and what do you hear? For the most part, this is the land of military RTTY, time stations, and other utilities that use longwave for reliable reception around the clock. How else would I hear Jim Creek, WA (NLK/24.8 kHz) in broad daylight near Rochester, NY, ***and*** hear the same station at night with virtually the same signal strength? When the signal ***must*** positively get through day or night, longwave rules. Even higher up the band, stable propagation is a hallmark of longwave operation, although skip does play a significant role above 100 kHz.

Not Everyone Can Tune It – Tuning in longwave used to be quite a challenge, because not many receivers available to U.S. listeners covered the band. Until the mid-1980s, you generally had two choices: Buy surplus military gear, or build up an outboard receive converter that would "move" the longwave band to a range your receiver could tune. Today, things are easier with the advent of wide-range receivers covering down to at least 100 kHz. Still, longwave capability is by no means common in every shack, and a suitable antenna is required if you expect to hear much.

Historical Significance – Some of the earliest work in radio communications took place on longwave. In fact, at one time it was believed that the longer the wavelength the longer the communication range. The shortwaves soon took over for most long haul work, but the unique behavior of longwave continues for radio navigation, military and other specialized users. In fact, it is being "rediscovered" today as a fertile ground for low power experimentation and homebrew construction. We could even see an LF ham band in the near future in the U.S.

Underdog Status – To borrow a theme from a country song, some of us were "longwave" before longwave was cool. As one example, I recall ***MT's*** Uncle Skip telling me of a chance encounter he had with an old timer who was chasing beacons on LF long before it was a popular pursuit. As I remember it, Skip had stopped to check out some discarded electronic "junque" at the curb in front of this fellow's house. As he looked through the goodies, he could hear the repetitive sounds of Morse Code coming from inside the home. He introduced himself to the operator and was invited in to see the shack. There, he noticed lists and lists of beacons this fellow had heard. Apparently, he pursued the activity with little or no knowledge that others chased beacons as a hobby. He was just doing it to satisfy his own curiosity about these stations. That's the kind of spirit I see even today in the longwave hobby, regardless of the particular area of interest. The "basement band" may not be for everyone, but it has a fiercely loyal following among those looking to explore the unusual and the intriguing!

Forgiving Circuitry – It is well known that things get trickier from a design standpoint the higher you go in frequency. In microwave, for example, even the length of a trace on a circuit board can drastically affect the operation of your circuit. No such formalities exist in longwave radio. Component leads can be ***feet*** long and still work just fine. Audio transistors are sometimes used for RF applications, and breadboard or perfboard construction is perfectly acceptable. Does surface mount construction have you down? Plug in your soldering iron and try longwave!

❖ Mailbag – 1,000th Beacon Logged

One of our readers, Dick Palmer, W7KAM (AZ), reached an impressive goal on November 12th, 2009. He announced that he has now logged *and confirmed* (via QSL cards) 1,000 beacons. Special thanks to Mark Moulding, KU7Z, for sharing this achievement and forwarding information from our friends at the Yahoo "ndblist" group. In announcing his accomplishment, Dick wrote:

"After many years of dedicated persistence I received my number 1000th QSL from **DXB, 385 kHz**, at Beauregard Regional Airport, De Ridder, LA., confirmed by John B. Jones, Airport Manager. (Mr. Jones included a note stating he hoped that he was number 1000 – He got his wish.)

"I started in 1983 sending reception reports to any new beacon that I heard which operated in the 194-530 and 1600-1750 kHz bands. To date I have heard 1,646 different airport beacons. Out of these, 108 of my reports were returned as "insufficient address." A few that I heard I could not find any address to send the report to, such as the military beacon PQ, 373 kHz from Japan for example. (Anyone have an address for this one?) Some were returned unopened marked "Refused." Most of these were from Cuba during the cold war era. The event now labeled "9/11" caused a lot of returns to go unanswered for the first few months after it happened, which was understandable.

"Some of the replies were exceptional. I received video tapes of the airport and its facilities, pins to put in my hat, coffee mugs and other sou-

TABLE 1. SELECTED BEACON LOGGINGS

(Heard in Arizona)

FRQ	ID	ST/PR/ITU*	CITY
206	QI	NS	Yarmouth
216	YFA	ON	Fort Albany
219	GAV	AK	Gustavus
222	WY	NT	Wrigley
227	LCE	HND	La Ceiba
233	ALJ	AK	Johnstone Point
245	CB	NU	Cambridge Bay
260	NF	NFK	Norfolk Island
270	FA	SMO	Faleolo
272	ULM	MN	New Ulm
274	FR	NT	Fort Resolution
280	IPA	PAQ	Easter Island
283	DUT	AK	Dutch Harbor
283	PT	ON	Pelee Island
284.5	MH	OCE	Manihi Atoll
302	XY	YT	Whitehorse
307	NA	FJI	Nausori
329	YEK	NU	Arviat
332.5	AA	OCE	Anaa
341	ELF	AK	Cold Bay
341	DB	YT	Burwash Landing
343	ML	JPN	Minami Tori Shima
344	ZIY	CYM	George Town
349	TP	OCE	Takapoto
352	RG	CKH	Raratonga
356	ZF	NT	Yellowknife
363	RNB	NJ	Millville
370	LMS	HND	San Pedro Sula
372	YCO	NU	Kugluktuk
375	FS	NT	Fort Simpson
375	GUA	GTM	Guatemala City
376	NP	OCE	Napuka
377.5	MO	OCE	Moorea
378	RJ	QC	Roberval
387	SPP	CLM	San Andres Is.
390	HBT	AK	Sand Point
394	RWO	AK	Kodiak
403	TUT	SMA	Pago Pago
415	IEE	PO	Platform Irene
450	PPA	DOM	Puerto Plata
530	ADK	AK	Adak Island

* For a complete list of ITU codes, see **www.wordiq.com/definition/ITU_letter_codes**

Beacon ZWG/287 kHz, near Winnipeg, MB *(Photo courtesy of Daniel Gillet, MB)*

Station sign for ZWG/287 kHz, near Winnipeg, MB *(Photo courtesy of Daniel Gillet, MB)*

venirs from some of the airports. Many thanked me for my report and a few said they posted them on their bulletin boards for all to see. One actually thanked me for sending the report so that he could show it to complaining pilots proving that his beacon was getting out. Some wrote nice letters, sent copies of their beacon license, copies of photos showing the transmitter in use, and photos of the antenna installation. Many included brochures of the highlights for visiting their city. Some even wanted me to move to their friendly city.

"Latin American stations continue to be the hardest to verify with poor percentage replies from most countries south of our border. But if you keep trying you will get a few to answer. Of the 1000 QSLs I verified, 19 are different DXCC countries. I think now I will go and get a beer to celebrate # 1000!"

Nice going, Dick, and your perseverance has certainly paid off. Table 1 below shows some of Dick's latest loggings made from his QTH in Arizona. He uses an Icom R75 receiver with an active antenna up 13 feet.

❖ End Notes

Did you notice something new about this month's column? It's longer! Thanks to your responses in the 2009 *MT* survey, the magazine has decided to expand longwave coverage. Your thoughts and comments are taken seriously, and this longer column is one result. I look forward to hearing from you on what you would like to see covered in 2010 and beyond. Have a great New Year!

You're Using *What* for an Antenna?!

By Dan Farber, AC0LW

I sat grinning in front of my old Kenwood transceiver, relishing the log entry I was making. I'd just worked a station in Slovenia, S51NR; I heard him clearly and he heard me fine, too. "Okay, Dan, copy you five by nine," Vinko had said, sounding like he was just down the street. And this was in the middle of the noisy mess the 20-meter band always is in the evening.

Maybe this doesn't sound too impressive. After all, I've been a ham for over 38 years. I should be able to easily work Slovenia on 20 meters, noisy band conditions or no.

Well, here's the amazing part: my antenna was the second-floor rain gutter of my house.

One of the most daunting tasks facing any new or experienced shortwave listener or ham operator is the installation of an effective antenna. Especially in the modern world, where neighborhood associations restrict or even ban any sort of visible antenna structure, it pays to explore alternate methods of dealing with this essential issue. And even where there are no restrictions, many don't have the real estate to put up full-sized conventional antennas. I'd like to share with you some of my personal adventures in discovering alternatives to traditional antennas.

❖ The Tuner's the Trick

My strongest ally in this quest was an *antenna tuner.* This is the real key to success with out-of-the-ordinary antennas. Don't let yourself be boggled by the technical aspects of the tuner. Just think of it as a "black box" that adapts the antenna connection on your radio to the unknown load presented by an unorthodox antenna.

There are many good ones on the market; MFJ Enterprises stands out as a maker of tuners that are both effective and user-friendly. I bought my first MFJ tuner on the used market from an eager salesman who apparently thought he was unloading some junk on me. Little did he know of the adventures I would proceed to have using this battered old tuner, which I still have.

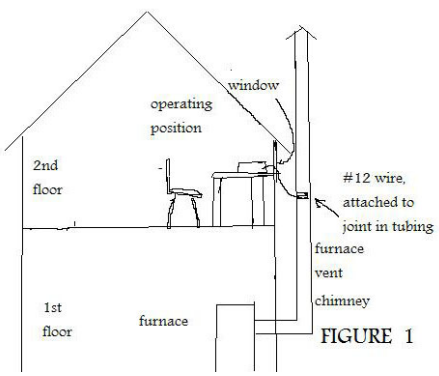


FIGURE 1

You can even build your own, if you feel adventurous; the *Radio Amateur's Handbook,* published yearly by the American Radio Relay League, routinely features a tuner project or two, as well as excellent technical discussion of the nature of tuners, antennas, and their interaction.

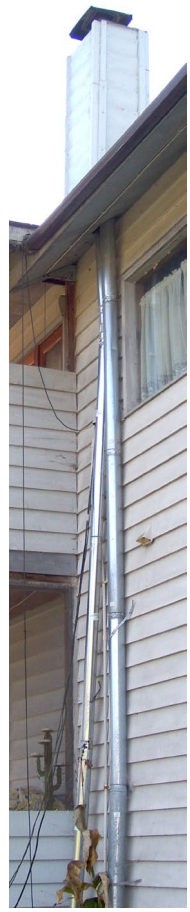
Many listeners and hams already use a tuner to maximize their results with conventional antennas, so the use of a tuner is certainly nothing new. Tuners have been part of our hobby for years. What makes the dramatic difference is exploring the possibilities of the jack on the back of the tuner marked RANDOM, or, sometimes, WIRE. Here, you'll encounter a rich new world of opportunity in which *anything* metal – be it wire, sheet metal, window screen, or rain gutter – has the potential to be a very effective antenna. This can greatly lessen the amount of space you'll need, since much of this metal is already part of the house or property it's on. And perhaps best of all, no one but you need know you're using it as an antenna.

Before we begin, let me clarify that I'm not speaking to hams alone, although most of my discoveries were made during ham operation. Everything I'm going to say is applicable to shortwave listening, too. Indeed, one tenet long held by hams is that good receiving is the more critical operation – "If you can't hear 'em, you can't work 'em."

All of my experimenting was done with a transceiver, so obviously the random antenna of the moment was my receive antenna as well as my transmit antenna. And like any experienced, patient ham, I *listened for, and heard,* the distant stations, and then I proceeded to work them. So, all you shortwave listeners, this is all applicable to you, too.

❖ Hiding the Evidence

Necessity, you know, is the mother of invention. I started trying unusual antennas because I lived where I simply had no way to erect any real outdoor antennas. At one point I was living in a large apartment that occupied the entire second story of a house, and the landlord forbade any external antennas. So I stretched a wire across about 25 feet of ceiling and brought one end down to the operating table, where I hooked it to the RANDOM jack on my tuner.


Necessity is the mother of invention, and anything metal is fair game for an antenna. How about this metal vent pipe? (Photo by Rachel Baughn)

This plain little length of #18 wire loaded right up on every ham band between 10 MHz and 28 MHz, which is to say the 30-, 20-, 17-, 15-, 12-, and 10- meter bands. In a couple of months I worked all 50 states and 155 countries on this humble indoor antenna.

But of course, the experimenter is never satisfied. My 25 foot wire refused to load up on the lower frequencies, 40, 80 and 160 meters. I wanted to work these bands, too. What to do? I tried a longer piece of wire – bent to pass along a hallway ceiling and into another room – that ended up being about 45 feet long. But, for whatever reasons, this wire, too, refused to load up on the lower bands. It didn't even work as well on the higher bands as the 25 foot wire, which I quickly reverted to. I suppose the fact that the shorter wire was perfectly straight had something to do with its effectiveness. Regardless, access to the lower bands was not available to me by this route. What to do now?

❖ Vent Pipes and Chimneys

As I gazed out the window behind my operating position, pondering this dilemma, my eye fell on the chimney of the downstairs apartment's furnace. (The downstairs unit was vacant at this time.) This chimney was a sheet metal tube about four inches in diameter and maybe 40 feet long, running from the closet-mounted furnace on the first floor, out the wall, and straight up, parallel to the house and a few feet from it, supported in a couple of spots by some thin guy wires. At the top, this chimney terminated in a sheet metal weather cap.

Being attached to the furnace at the bottom meant that this tube was effectively grounded, but hadn't I read somewhere about hams successfully feeding a grounded tower by simply finding the right spot on the structure to feed it?

Who knew you could work the world with a rain gutter?! (Photo by Rachel Baughn)

So, I ran a short length of #12 insulated wire right out my window and tied it to the first convenient spot I saw on the chimney, at a joint between two lengths of tubing. Did it load up on the lower bands? Well, that first night, I worked six states on 160 meters, sixteen states on 80 meters, and half the countries in Africa on 40 meters. The only real frustration was the difficulty in convincing other operators of the nature of my antenna. I finally started just calling it a "vertical," which was at least somewhat accurate and raised fewer questions.

❖ Antennas in the Gutter

My next place of residence was a three story brick house, and the third floor – really a large finished attic – became my radio room, and the scene of further fascinating experiments with unusual antennas. At first I put up a 90 foot wire dipole, between two trees, and this provided fairly good results on all bands, when fed with ladder line from the BALANCED output of my tuner. However, after the great "chimney adventure," I had caught the fever and wanted to try more unorthodox antennas.

I had been reading at the time about horizontal loop antennas and how effective they could be, especially for the operator unable to put up antennas very high above ground. The property the house stood on didn't have the requisite trees and/or poles to erect a conventional loop, so I looked at stringing a loop of wire directly on the roof. I ended up with a nearly square loop of #18 wire, about 100 feet long and stapled right onto the shingles. I fed it with a short length of ladder line and the BALANCED output of the tuner. But despite all that I had read about how wonderful these horizontal loops were, mine was sadly ineffective. It would only properly load up on a couple of bands, and its performance was very poor. What had gone wrong?

Analyzing the problem, I seized on the point that my loop, in circumnavigating the roof, ran very close to the rain gutter throughout its length. I reasoned that the gutter, being comprised of metal, was somehow interfering with the loop's field and preventing its expected operation.

Then, in a flash of insight, I remembered my chimney vertical. Why not give up on the wire loop and try feeding the gutter itself as a sort of loop? After all, it, too, ran all the way around the house, 100 feet or so, and also had those four long downspouts reaching nearly to the ground. Lots of metal there, indeed, if I could feed it and get it to load.

Before you could say "open path to Europe," I had a length of #12 insulated wire running out the attic window at my operating table, with the outer end clipped to the rain gutter which passed right below this window. Within minutes I had it loaded up on 20 meters and was talking away to Europe, culminating in my chat with Vinko in Slovenia. The rain gutter also loaded up well on most other bands, though for some reason it would not work at all on 17 or 12 meters. Among its many great accomplishments was its sterling performance in a 160 meter contest one frosty December night, when I astounded myself by working 33 states. Not bad for an old rain gutter.

❖ Go Ahead: Try It!

Wire window screens are fun to play with, too. I tried feeding an ordinary screen, in one of the attic windows, about 24 inches by 40 inches, with a single length of #12 insulated wire. Not surprisingly, it was a failure at all frequencies below 10 meters. But on 10 meters – 28 MHz – it loaded right up and I proceeded to work Japan, Australia, and a number of the Pacific islands.

I also noticed that although the screen would not work as a *transmit* antenna on any of the lower frequencies, it did very well as a *receive* antenna throughout the shortwave spectrum. In fact, all of the oddball antennas I have mentioned were good to excellent receive antennas all across the dial, even if they could not be made to accept transmitting power at some frequencies. Again, all you shortwave listeners, take note.

Since then, I've gone on to try a number of off-the-wall antenna ideas, such as going out in the yard and feeding a chain-link fence (works a lot better than you might expect), a metal clothesline pole, even the rusting body of my '78 Chevy pickup truck. Through these experiments I've learned to completely rethink the concept of what an antenna is. The substance of the idea, again, is this: *any* metal surface is potentially an antenna and might be made to serve your purposes as such. Don't let yourself be discouraged from trying such a prospect just because it isn't a design from an antenna book, or a product sold by one of the big companies. Remember, those antennas are all highly visible and obvious – the ones I've described are definitely not.

❖ Grounding Optional

I should address one more area of concern in the world of antennas, and that's the concept of *ground wires.* You'll notice that most of the adventures I have described took place on the second or third floor. When I tried to use conventional wires run to an earth ground from these heights, the lengthy ground wire itself tried to behave like an antenna, introducing very unpredictable behavior when I would try to feed power to the actual intended antenna. I quickly learned that, from upper floors at least, *no* ground wire is a much more effective choice.

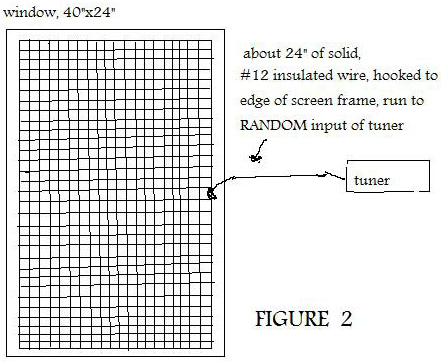


FIGURE 2

I know we've all had it drilled into us that a good earth ground is essential to both performance and safety when using radio equipment. I'm here to tell you that you can attain excellent *performance* with absolutely no ground wire; but please, for *safety's* sake, always disconnect all antennas from ungrounded equipment when it's not in use, especially if stormy weather threatens. And make sure that all equipment is plugged into properly grounded electrical outlets, no matter which floor you're on.

So there you have it, hams and listeners. Any metal surface is potentially an effective antenna. Holster up your tuner, some wire and alligator clips, and start experimenting. Please remember to think safety and use common sense – don't try to use power lines, or wires hung from balloons on a windy day, or your neighbor's metal rose trellis, as antennas. And if you, too, find yourself pulling in Slovenia one day on your rain gutter antenna, drop me a line at ac0lw@att.net. I'd love to hear about your unusual antenna exploits. Happy operating!

Even a metal screen can be put into use as a receiving antenna if you use a tuner. (Photo by Rachel Baughn)

RADIO RESTORATIONS

BRINGING OLD RADIOS BACK TO LIFE

Marc Ellis, N9EWJ
marcellis@monitoringtimes.com

We Begin Recapping the BC-344

AN IMPORTANT ANNIVERSARY!

Amazingly, this column concludes my 10th year with *Monitoring Times.* It seems just like yesterday when I was first recommended to Editor Rachel Baughn – who was interested in establishing a column representing an additional radio-related hobby interest. Antique radio was on her short list of possible ideas, and a friend of mine who was aware of that suggested I contact her.

As it happened, my 13-year association with Gernsback publications had just come to an end. It had begun with a monthly antique radio column in *Hands On Electronics* – which soon became *Popular Electronics* when the title of that discontinued magazine was purchased from Ziff-Davis publications.

Still later, Gernsback began publishing a new magazine, *Electronics now*, which catered to the more classical electronics interests, allowing *Popular Electronics* to concentrate on more computer-oriented content. At that time, my column was moved to *Electronics Now*, where it remained until the December 1999 issue.

At that point, both magazines were discontinued, and elements were taken from both to form *Poptronics*, a new publication. A little later, *Poptronics* was also discontinued and Gernsback Publications – a company founded by the legendary Hugo Gernsback and with a history approaching a hundred years – was no more.

As fate would have it, my column continued without missing a beat in the January 2000 issue of *Monitoring Times* – and I hope you enjoy reading the *MT* version of the column as much as I enjoy writing it!

❖ Last Month

In the December issue, we reviewed the technical documentation available for the BC-344/BC-314 and suggested some sources. We took a first look around the set, noting that is a "D" model and discussing the characteristics of that model versus the other known variation (which has no letter suffix).

We also removed the radio from its cabinet, noting that it still looked impregnable – with sheet metal assemblies everywhere blocking access to the wiring. All tubes were tested and found to be okay. Then we made a small beginning on disassembly for the replacement of all the paper capacitors.

This set has the original black rectangular units (made by Micamold) that look like mica capacitors, though you may find black tubular units (Sprague Black Beauties) that were installed in a military overhaul. The Micamolds are notorious for developing shorts and the Black Beauties are not much better.

Finally, to expose the single capacitor in the r.f, oscillator compartment, we removed a panel that formed, essentially, the entire right side of the radio (as viewed from the rear). This was a simple matter, though it did involve the removal of many screws.

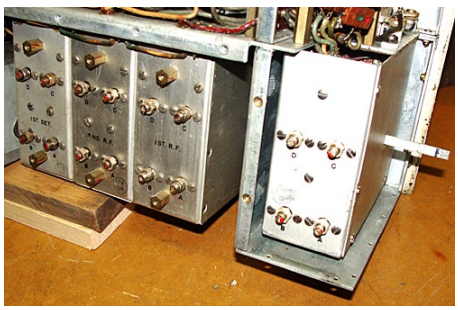
Just before beginning work for this month, I received an e-mail from Jim Falls. K6FWT. He advised that he had pulled his own BC-344 out of storage with the idea of doing a restoration roughly parallel with mine. He was fortunate enough to pick up his unit for $20 during the last few minutes of a swap meet for military radio collectors. It was one of those "I don't want to lug it back home" specials.

I believe Jim is beginning his restoration with an examination of the radio's a.c. power supply, though I'm starting at the front end of my set. It will be interesting to hear of his adventures from time to time.

❖ Removing the Bandswitch Shaft

The "front end" of this radio consists of the first r.f. amplifier, second r.f. amplifier and first detector, or mixer, stages. The tuned circuits for these stages are housed in three rectangular cans, and the associated tubes are mounted on a shelf above the cans. Each can contains one or two of those notorious Micamold caps.

Getting access to the capacitors is quite a process. In fact, it looks like the restoration of this radio is going to be more of a mechanical than an electrical problem. The first step is the removal of the bandswitch shaft. This is a flat



Bandswitch shaft (shown partly withdrawn at right) must be pulled out all the way before the three front end cans (at left) can be removed.

One side of chassis was raised to obtain clearance for dropping out 2nd r.f. can. Note that tube shelf above cans has been tipped up to get access to wiring connections and mounting screws.

shaft that runs through bandswitch wafers in the oscillator compartment and each of the three front end compartments. It's geared to the front-panel bandswitch and rotates as this control is turned.

Because the three cans must be removed from the radio to get access to the capacitors, the bandswitch shaft has to come out. It is released by removing a setscrew near the gears that couple the bandswitch control and shaft. The screw is accessible through the space between the oscillator compartment and the group of front end compartments. Rotating the bandswitch control to Band "A" (lowest frequency position) points the screw to the rear of the set, where it can be easily reached.

Because this screw is beyond the reach of one's fingers, I thought it would be very difficult to replace. So I began by backing it off a little bit, thinking that a simple release of pressure might release the shaft. At first the shaft would not move at all, but by working it back and forth with pliers, I was able to get a little movement. Then I noticed that the setscrew was being jarred at each end of the "back-and-forth."

Now I realized that the screw had to come all the way out in spite of my concerns about replacing it. After dropping the screw and withdrawing the now-free shaft, I saw that the screw had a clever little nub on the end that engaged a hole in the shaft.

Incidentally, the panel that I had removed last month to open the oscillator compartment had an access hole, with a removable cover, intended to make it possible to insert needle-nose pliers for the purpose of withdrawing the shaft. I think I would have had a tough time getting a solid enough grip on the shaft that way. But

with the panel completely removed, I was able to get a firm grip with a pair of ordinary piers.

❖ Dismounting the Cans

With the rod out, removing a front-end can now became a matter of disconnecting its connecting wires and removing its four mounting screws. But to get at all the wires and the mounting screws, it was necessary to unscrew and swing aside the tube mounting shelf that occupied the space over the cans. That was easily accomplished

I would have liked to remove all the cans at once and be done with it, but that would have been foolhardy because of the increased possibility of mixing up all those disconnected wires. So, for no particular reason, I picked the second r.f. can to start with.

This can has wires connected to three feedthrough terminals at the top and two at the front (well, it's technically at the back of the set – but it's the front from our perspective as we work on the radio). The 60-watt pencil iron I use for most of my restoration work didn't make much headway on the solder. Perhaps it has an unusually high melting point. I finally had to break out my Weller 140-watt instant-heat gun, and even then wasn't able to develop enough heat for "solder sucker" braid to be effective.

However, I was now able to remove all of the wiring, except for one wire attached to a front terminal, which was just out of reach. That one would have to wait until I could dismount the can and lower it slightly. Doing that required only that I remove the four mounting screws holding up the top.

The two front screws were easy to find; they were at the front corners of the can as expected. At first I couldn't find the back ones – expecting them to be at the back corners of the can. And most of that area is obscured by other assemblies. Then I finally found the screws – which are placed in odd positions to make them accessible on the crowded chassis.

❖ Recapping

Now the can dropped far enough for me to reach and unsolder the last wire and I was finally free to slip it out of the radio. Getting access to its innards required removing the 14 or 15 screws holding the side and bottom panels in place. With those out, I could finally get a look inside. And it was a daunting sight!

There were two of the infamous black Micamolds and each looked as if it had been shoehorned in behind several other components. Both were mounted vertically and wired tightly to terminals at the top and bottom with very little clearance between capacitor and terminal.

The top terminals were accessible, as was the bottom terminal of one of them. The bottom terminal of the other was blocked, but proved to be a ground, so the connection that would ordinarily be made there could be made elsewhere. There would be no way to remove these capacitors physically, but I was able to remove them electrically by clipping the leads to the top terminals. I had just enough clearance to get a pair of cutters in to do the job.

These capacitors were shown as 0.1 uf,

The new 0.1 uf capacitors (light-colored tubular units) installed in the 2nd r.f. can.

400-volt units in the parts list, and would be replaced with modern 0.1 uf 600-volt units. I began with the capacitor having two accessible terminals. Well, the lower one wasn't exactly accessible, being at the bottom of a canyon surrounded by other parts. But I could at least see it.

There wasn't enough clearance to crimp a lead from the new capacitor around that lower terminal, so I had to violate one of the classical soldering rules: namely that you must begin with a good mechanical connection. I cut and bent a lead from the new capacitor so that it would lie on top of the lower terminal with the capacitor in an upright position next to the disconnected unit. And I held the capacitor in that position by clamping its other lead to a convenient wire.

Now, *very* gingerly, I manipulated my pencil iron and a length of solder down into the canyon, attempting to solder the joint without disturbing it. After a few tries I finally succeeded, but not before making some char marks on a wire or two and some of the wax surrounding one of the coils (I really hate it when that happens).

Trimming and bending the upper lead of the new capacitor, I was able to crimp it to the upper terminal with no difficulty. And the fact that this upper terminal was a ground made replacing the other capacitor quite simple. I just needed to connect the replacement capacitor between its easily accessible upper terminal and the upper terminal of the other capacitor – thus avoiding the need to connect to the ground on the inaccessible lower terminal.

See you next month when we'll recap the other two cans and move on to other parts of the BC-344.

"Sky-Wires & Inhalers"
Part 4: Anatomy of an Antenna

By Walter Lindenbach

Last time, Chuck had just caught on to the reason for a transformer between the antenna and lead-in cable, when Bill began babbling about donkeys, tales and tails. Chuck concluded that he was getting punchy, and went home.

"How're ya feeling?" Chuck asked, as he came into Bill's living room.

"Huh? Fine! Why? What's it to ya'?" replied Bill, mystified.

"Well," Chuck continued, "when I came in last time, we agreed that you had said that we were going to make transformers. Just before I left, I got the idea that transformers would be a good thing between the antenna and lead-in cable, and between lead-in cable and receiver. Then you began philosophizing about donkeys, so I was a bit worried."

"Me? Philosophizing?"

"Yup! After you agreed about the transformer, you quoted a donkey who said, when he surveyed his derrière, 'Thereon hangs a tail!'"

"Um – yes – well … Say! How would you like me to tell you how to make an RF transformer?"

"You betcha'! When do we start?" Thank goodness, thought Bill, I've got him off the donkey business!

"Right now," Bill continued, aloud. "If we were talking about audio or power transformers, I would not have said that. But low-power RF transformers for the shortwave bands are not hard to make. Still, there are certain things to do, and certain things not to do, or the hoped-for transformer will act more like a sort-of connection with a resistor in it – not helpful for shortwave listening.

"The first thing to do is to decide what is to be transformed into what. Have you any preferences?"

"Smart aleck!" said Chuck with a snort. "You know what I want! You said we have to match the antenna to the lead-in cable, and then match the lead-in cable to the receiver antenna input.

"Are you sure you're feeling okay? Do you remember anything about that? Sometimes I wonder about you!"

"Really?! Well, that makes two of us," replied Bill with a smile, "and thanks for your concern, but I was just making the point – in an oblique sort of a way – that you have to ask the right question before you can hope for the right answer.

"Oh, and by the way, I didn't say that we *have* to match antenna, lead-in and receiver antenna input: you did."

"*I* did?" Chuck looked skeptical. "But didn't you imply it?"

"Yes, yes," Bill agreed, "and that's where we're going now. Just remember later on: there's no '*have to*' about it."

❖ How to "Solve" an Impossible Problem

"But now, getting back to matching, the first question to ask is 'What is the antenna impedance?' That question is not easy, especially for a little 12-foot-long random wire which, I presume, is what you are intending to use.

"Actually, it's worse than that: there is no answer – for two reasons."

"Oh fine!" groaned Chuck, "Not only no answer, but two whole reasons not to have one! Mister, you're out-doing yourself! Okay, I'll play along: So what are the reasons that there is no answer to the first question that we must ask even before we start talking about making an RF transformer? Man, this gets tiresome. We're going in circles."

"Aww, poor Chuckie," cooed Bill soothingly, pretending to pat him on the head, "we're not going in circles. I'll tell you the reasons and then I'll tell you what we can do about it – unless you begin to doubt my sanity again.

"The first reason that we cannot determine the impedance of the antenna is that it varies with frequency. Every antenna does that. The impedance of a short antenna – short with respect to the shortest wavelength for which it is to be used – is almost entirely capacitive, with just a wee tiny bit of resistance, some of which is radiation resistance.

"The second reason is that the impedance is very high, and it is almost impossible to measure.

"No, we can't do anything about the impedance variation with frequency, and, while we can't measure the impedance, we can *simulate the antenna*. It's done with a program called 'EZNEC'[2] .I figured you might want to see them, so I got us some impedance numbers. Wanna see 'em?"

f, MHz.	R|W	X|W	C|pF
3	0.26	-J41.7K	1.27
18	5.6	-J6.6K	1.34
21	11.1	-J5.52K	1.37
26	35.4	-J4.15K	1.47
28	57.8	-J3.68K	1.54
30	98.7	-J3.2K	1.64

Table 1 'Simulation Results' here

"You have them? Well, I guess!"

So Bill pulled out what he called Table 1.

"Huh?" Chuck looked mystified. "Bill, what in the world is all that stuff? Is that what happens to an antenna when you simulate it? 'J'? Capacitors? No, no, Bill – there's something wrong. I thought we were talking about a 12-foot random wire antenna, not a 'J', and not something with capacitors stuck on!"

"Now, settle down! We *are* talking about your antenna, and all this other stuff is what we need Actually, I should have drawn the antenna. Then you'd see what was being simulated. Here, look at this."

Bill took his paper pad and drew the antenna as Figure 1.

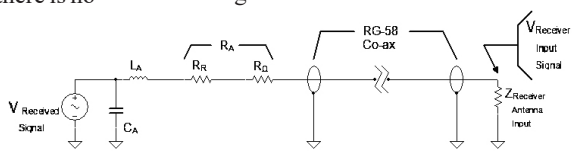


Figure 1 'Chuck's Proposed Random Wire Antenna

❖ Facts of Life

"Now it is my duty, young feller, to tell you one of the deep, dark facts of life! Ready? Here it is: *Antennas Are Complicated*."

"Oh, I'm so relieved! I would never have guessed it. Not even with 'Js' and 'Xs' and capacitors stuck on. Gratitude overwhelms me, Daddy, that you did your duty and told me the facts of life. When do we get to the birds and the bees?"

Bill was grinning. "That's the spirit. Let me tell you what all these extra doodads are for.

"Look at the sketch that I marked Figure 1. All the things that are shown to the left of the RG 58 lead-in coax are what's called 'distributed components,' and they are part of every antenna in existence. They are not discrete components, and they don't act like discrete components, either. It's not as if you took a capacitor, connected one end to the antenna and the other end to ground.

"Instead, it's rather as if the antenna has –um – well, let's call it qualities or characteristics or tendencies or attributes – something like that – that makes it look as if there are resistors, capacitors and inductors in it. I know that that is very nebulous, but distributed components are that way."

"How did they get there?" Chuck wanted to know.

"Aha! Good question! Now we come to

some real 'facts of life'. These three facts are central to all things electrical:

(1) Everything that conducts has inductance.

(2) Everything that is does not conduct has capacitance.

(3) Everything has resistance.

"Now that means that every wire has inductance. It means that even a lightning bolt has inductance.

"We say that insulators do not conduct. That's a good practical statement, but they do have resistance – gobs of it! We define a capacitor as an insulator with conductors on both sides. So, how far do you have to look on either side of an insulator before you find a conductor? Well, it doesn't matter, you *will* find a conductor, therefore, you have a capacitor.

"The air between a cloud and the earth is an insulator, the cloud is a conductor – well, sort of – and the earth is a conductor. Ergo: a capacitor. A lightning bolt has inductance, so we have a resonant circuit. That's why lightning bolts cause noise at some frequencies and not at others."

"Wonderful!" said Chuck, "That explains a lot of things. And so the antenna you simulated has a resonant frequency, yes?"

"Yup. It's high compared to the HF band – about 300 MHz – but look at Table 1 again. The capacitance ranges from 1.27 pF to 1.64 pF, so an inductor that can be adjusted from about 17 µH to 2.2 mH connected in series could resonate the antenna over the HF band. Then the antenna impedance would be just the resistance – 0.26 ohms to 98.7 ohms – plus the resistance of the inductor."

❖ The Way Out?

"Good stuff!" Chuck perked up. "That sounds like fun! It also smells like a high-Q tuned circuit which could produce a nice big signal voltage. What say?"

"Yes, but there are difficulties. Ever heard of a variable inductor that can be adjusted from 17 µH to 2.2 mH? I haven't. But that's not fatal; it could be arranged with a number of parts.

"Next, the new impedance – 0.26 ohms to 98.7 ohms – has to be coupled to the lead-in cable. Well, that can be done with a transformer – approximately.

"But here comes the bitter bit. Why?"

"I'm surprised you ask, Bill. Isn't a larger signal a good thing?"

"Good for what?"

"Tsk! Well, to hear –," Chuck began. "Aww c'mon, you're being obstinate!"

"Not I! There's a reason for asking. Consider this question. Which would you prefer: a nice S9 signal with a S/N ratio – that means 'signal-to-noise ratio' y'know – of about 3 dB, or an S3 signal with a S/N ratio of 10 dB?"

"The higher S/N ratio is better of course, but if the signal is weak, there will be more noi – oops! Now *I'm* going in circles!"

❖ S3 Better Than S9?

"Just right! You've just demonstrated how we are conditioned to identify stronger signals with better signals – unconditionally! The general notion is to hear the program, not to receive a lot of noise. As soon as I say it, it's obvious that it is necessary to select the *better* signal, not the stronger. And that selection process must include our decisions for a good antenna.

"If we don't make an effort to choose arrangements for a higher S/N ratio, we will – by habit – look for a stronger signal only.[1]"

"Thank you, Reverend!" was Chuck's response. "You can get off the soapbox now – especially because you've made the point, very well. It does seem so obvious, but I recognize the tendency. Almost everything we do is intended to *increase the signal strength*. In most cases, like doing an alignment in a receiver, that's the proper approach. But that's exactly why the point you brought up is so important – especially when trying to cook up an antenna. Thanks again."

"You're welcome – all to pieces! No extra charge! So, you figure we can leave antenna tuning alone for now?"

"Oh sure. Let's look at those – ah – oh yes, 'distributed components' in Figure 1."

"Okay," replied Bill, "what do you want to know?"

❖ Resistance: Good and Bad

"The antenna resistance, R_A, is shown as two parts. What are they?"

"Well, the first part is called R_R. That's the good stuff: radiation resistance. It is the whole reason for putting up antennas. That resistor symbol represents the stuff that turns radio signals into electric currents. And again, if you're thinking of a transmitting antenna, it's easy to get confused, because, of course, the radiation resistance turns electric currents from a transmitter into radio signals, also.

"Now the other part of the antenna resistance, R_A, is marked R_Ω, which is just ordinary, every-day, garden-variety ohmic resistance, the stuff that turns electric current into heat. It is the resistance of the wire, but you can't measure it with an ohmmeter because it is RF resistance. It's much higher than the DC resistance, and it gets higher as the frequency rises."

"It's clear," interjected Chuck, "that we want more of the radiation resistance and less of the ohmic resistance. How do we do that?"

"The first thing to do is use thicker wire. It's the surface area that matters, not the amount of copper. So, a quarter-inch-diameter copper pipe is just as good for an RF conductor as a quarter-inch-thick copper ground rod.

"This is because of something called the skin effect. That's a polite way of saying that RF currents are antisocial. They do not want to get nice and cozy inside the wire. They will flow on the surface to get as far from each other as possible.

"How close to the surface? Well, there is a mathematical equivalent called skin depth[3] which is a calculation of the thickness of a surface layer in which all of the current flows. At 3 MHz, that depth is 36 microns, or 36 millionths of a meter, and at 30 MHz, it is 12 microns.

"That's pretty antisocial, and you need never fear that a conductor – like a circuit board trace – is too thin.

"Oh, and another thing. You might get the urge to use stranded wire to increase the surface area. Don't! It's worse, not better, because of something called the proximity effect. That's another way in which RF current is antisocial."

"Now the good stuff: radiation resistance. How do we get more of that? Higher and longer. The simulation results in Table 1 are for a height of 5 feet. That seems too low, but on your condo balcony, if the antenna is 5 feet away from the nearest ground, you're lucky.

"So, let's see what happens to our simulated antenna if it gets higher and longer.

RADIATION RESISTANCE, OHMS

f, MHz	Height: 5 feet, Length: 12 feet	Height: 10 feet, Length: 12 feet	Height: 5 feet, Length: 24 feet
3	0.26	0.27	0.56
19			1180
30	98.7	196	36

Table 2 'Effects of Height and Length' here

"In Table 2, two of the RF resistance results from Table 1 are shown for a height of 5 feet and a length of 12 feet. Then, results are shown for the same length and a height of 10 feet, and then for the same height, but a length of 24 feet.

"Mostly, the RF resistance increases with increases in length and height, but not every time and not proportionally. There are other things happening here, so we can't make a general rule.

"Okay, now let's see how the signal becomes an output from the antenna and how it gets coupled into the lead-in cable. That will get us back to your transformer (if you still want one, and if so, why). Look at Figure 1 again and … Huh? What now?

"Your watch? Yeah, nice wristwatch, but – oh, you have to run away again! Just when we were about to get to your transformer. Oh, well. It will have to be next time."

"Promises, promises! I don't think you like transformers! So be it: next time. G'nite!"

"Me? Not like transformers? Now why would you – huh – oh yeah, okay – G'nite!"

References and Acknowledgments

1. The author is indebted to Bob Grove, "Monitoring Times" publisher, for his valuable assistance in clarifying these points via email correspondence.
2. EZNEC+ v. 5.0 is an antenna simulation program, developed and copyrighted by Roy W. Lewallen; the author is grateful for Mr. Lewallen's assistance in its use for this article.
3. "Radio Engineering Handbook," Frederick Eamons Terman, page 35, McGraw-Hill Book Company Inc., 1943.
4. Diagrams and graphs were prepared using National Instrument's program "Multisim," kindly provided by Analog Devices Inc.
5. Walter Lindenbach can be reached at *lindenbachw@shaw.ca*

MT REVIEW

Grundig G8 Traveler II Digital AM/FM/SW Pocket Receiver

Solid Performance and Features for Just $50

By Gary Sargent, KE8WO

Eton has a history of bringing various types of radios to market throughout the year. They offer radios under the Eton or the Grundig labels. A new model in the low cost AM / FM / SW pocket sized portable is the Grundig G8 Traveler II.

The G8 has an interesting set of features that have attracted much interest. I decided I "needed" a G8 and obtained one recently. My hands-on evaluation and comparison to other lower cost radios follows.

The following are the main G8 features and specifications provided by the manufacturer:

- Receives FM/MW/SW (3150 through 21950 kHz)/LW (AM and FM frequency range user selectable depending on continent)
- Utilizes SI4734 DSP Radio Microchip
- Four tuning modes:
  a) jog dial manual tuning
  b) auto scan tuning
  c) memory pre-set auto scan tuning
  d) memory pre-set manual scan tuning
- Multiple tuning step sizes and variable rate tuning
- Auto Tuning Storage (ATS) function: AM, FM and LW (not SW)
- 500 memories (100 each: AM, LW and FM, 200 on SW)
- Digital tuning with digital frequency readout (LCD) with backlight
- Multi-functions digital display for frequency, signal strength, S/N ratio, clock and alarm, temperature and battery status.
- Independent local and world times
- Sleep timer and alarm clock (either radio or buzzer) with snooze option
- 3.5 mm headphone output jack

Powered by 3-AA batteries

- DC jack - 6V center negative

❖ Inside the Box

The G8 is 5.3 by 3.4 by 1.1 inches, and weighs under one half pound. It is shirt pocket sized for larger pockets. It has the flat black rubbery finish common to several other models of Eton radios. The radio is solidly constructed and has an overall attractive appearance and feel.

The 21 inch telescoping antenna tilts and swivels. A thin pop-out prop from the back angles the G8 for table top use.

Packed in the box were the following items:

G8 Radio
Stereo 'ear-bud' style headphones
Nice carry pouch and carry strap
User's manual and warranty card

❖ G8 Operational Controls

The left side of the G8 has just a standard stereo headphone jack and a common DC power in jack.

The right side of the unit has a rotary tuning/multi-purpose control and a rotary volume control. Both of these controls are of the detent type, meaning you get a small bump as you rotate these controls. The tuning control is also used to select the desired memory channel and to set the current time or the alarm time. When tuning AM or SW, there is very short "chuffing." It's not overly objectionable, but nonetheless it is not continuous, stepless tuning. The detented volume control is such that at times you wish for finer control of the volume.

The front of the G8 is dominated by the large display and a door hiding additional controls. There are five buttons along the top left edge primarily for band selection. These small buttons take a little force to activate. On the G8's top right are three buttons for power and to control the display and tuning modes. Many of the buttons have dual functions via a short or long press of the button. Not seen on the front panel is an under-two-inch speaker which works well and has typical sound for a small radio.

The LCD display is large with an amazing amount of informational options that the user can control. The display is illuminated with any control operation for about 2 seconds. The backlight may be locked on. With the radio off, the current time is displayed along with a user selected world time, alarm time, or current temperature. When the radio is on, the user can also opt to choose to display an innovative signal strength/quality pair of numbers (see the photo).

When in the memory or preset mode, the memory number is also displayed. Other icons are used to indicate band currently receiving, tuning rate selected, sleep time status and battery strength. As you can see, this is one busy display.

Behind the fold-down door is a 24-position rotary switch used to set your time zone and control the world time when displayed. Also "behind the door" are four buttons to control the radio memories and to set current time and alarm times. Lastly is a pin-hole access to a reset button. The two memory buttons allow to store a frequency in memory or to delete one or all memories. Typically, you will only need to have the door open to save or delete a memory preset.

The top left buttons select the band to be received. Two buttons select either the next higher or lower SW meter band from 90 meters to 13 meters. The current meter band is displayed briefly while tuning. These buttons also are used to select the FM (e.g. 87.5 to 108 MHz) and AM (i.e., 9 or 10 kHz channels) band plans. The "AM/LW" alternates between the AM and LW bands. This button can also be used to omit the LW band.

Lastly, the "AM/LW" and "FM" buttons are used to select the Auto Tuning Storage (ATS) function. ATS is not available for SW reception.

The user can choose from a set of sleep times, including no sleep time, when powering up the G8. The "Display" button allows the user to select what information is displayed when the radio in off and when it is on.

The "VF/VM" button controls several of the G8's powerful features. This button normally selects from VFO or preset/memory operation. In VFO mode, the rotary control is used to dial the frequency. In memory mode, the rotary control sequentially selects from the band's memory channels. This button controls the tuning step size when given a long press.

The G8 features variable rate tuning where it selects a slow or fast step size, depending on how quickly you spin the tuning dial. The net result is that the user has good control of tuning rates to allow zipping through the bands at a maximum step size of 100 kHz for AM and SW, or 1 MHz for FM. This goes a long way towards compensating for the lack of a keypad to enter frequencies directly. On the other hand, most of this is not documented in the skimpy user manual.

❖ DSP under the Hood

Grundig does not advertise the fact that the G8 is based the Silicon Labs SI743x DSP (Digital Signal Processing) based radio integrated circuit. See the May 2009 issue of *MT* for the review of the DE1123 receiver for the benefits of this design approach.

For the G8, this means solid performance and support for the features described above. One interesting feature the DSP chip provides is a display of signal quality as two double-digit numbers. The first is received signal strength (RSSI) in dBuv which ranges from 0 to 80 or more. Bigger is better.

The second number is a signal to noise ratio (SNR) which also ranges from 0 to 25 or more. It is unusual for this level of signal quality to be available even on a radio several times the G8's $50 price point. Some G8 owners will not care about this and may even be confused with these numbers displayed.

❖ Radio Performance

I decided to compare the G8's performance to my Degen/Kaito 1103 receiver. The 1103 is in wide use and is a top-notch performer in the $75 to $100 price range of portable receivers. My expectation was for the G8 to fall short of the 1103's performance.

The G8 offers very good performance in the AM MW range with sensitivity only slightly reduced compared to the 1103. The G8 selectivity is excellent and has slightly less adjacent channel spill over when the 1103 is set to the wide filter setting. The G8 had low level heterodynes on a few weak stations, while the 1103 did not. The DSP chip supports multiple filter bandwidths, but there is no control to select bandwidth, and the G8's specifications do not detail this nor any other technical details (reported 3 kHz per other sources).

The G8's longwave performance is poor, at least to the extent I have stations to tune in. I did manage to tune in a few local aero beacons, but the 1103 was able to receive many more.

FM performance on the G8 was noticeably superior to the 1103 in both sensitivity and selectivity. Remote stations only 200 kHz from a powerful local station could be received. Powerful locals did not swamp large sections of the band as has been the case on some lesser performing receivers I have used. Stereo audio in headphones was free of noise and had high quality sound at all volume settings. The G8 does not have any form of base or treble controls to tailor audio. Overall, the G8's FM performance is the best of the several portable radios I own, including besting the Eton E1. I found FM stations I did not even know were receivable at my location.

SW coverage is continuous from 3150 through 21950 kHz, which includes the 90 to 13 meter bands. The G8's sensitivity is a minor step behind the 1103, using their whip antennas. As with the AM BCB, the G8 does have good immunity from splatter from another station just 5 kHz away. There is no connector for an external antenna nor a signal attenuator button.

Just as I found with the DSP-based DE1123 radio, there is a SW performance caveat: I live in a typical suburban area (Dayton, Ohio) with a 5 kW AM station about five miles away that has interfered to some extent on all of my radios (including a Sony 2010 and an Eton E1). This station shows up on most of the SW bands on the G8 as a clear or garbled subdued background on many channels. This is not too much of a problem for medium to strong SW stations. Shortening the whip or just touching the whip with your finger will usually reduce or eliminate this interference. Users without strong local AM stations will likely not experience this.

To illustrate the usefulness of the dBuv signal strength readout, this strong local AM station peaks at a value of 82. This value converts to about 12.5 millivolts of signal measured by the G8. Typical SW stations will measure in the 20 to 40 dBuv range, some lower, some much higher. This converts to around 32 microvolts. So the local AM interfering station is some 400 times stronger.

I consider the G8 only adequate for SW reception, due to the local interference issue. If this AM interference were not present, the G8's SW performance could be very good and just a step behind the DE1103. But beware if you live in a medium to large metro area with strong local AM stations and wish to use the G8 primarily for SW reception.

The G8 Pluses
- Pocket sized
- Exceptional feature set
- Exceptional FM reception
- Very good AM reception
- Acceptable SW reception

The G8 Negatives
- SW interference from strong local AM MW stations
- Lack of sensitivity on the LW band

❖ Bottom Line

For a $50 radio, the G8 offers an excellent value with very acceptable overall radio performance, along with loads of features. It is available from several suppliers with a street price of $50 or less.

(*The G8 is available from Grove Enterprises: see ad on page 73.)*

GLOBALNET

Exploring the World of Internet Radio and Television

Loyd Van Horn, W4LVH
loydvanhorn@monitoringtimes.com

A New Hobby for the New Year

Greetings! I welcome each of you to a new year and what will hopefully be an exciting one in the world of Internet radio.

For those new to this column, I welcome you and hope that you make this a regular part of your monthly Monitoring Times experience. For those already familiar with this column, I thank you for returning and hope you continue to find informative and helpful content each month.

For the uninitiated, this column delves into the growing and ever-changing world of Internet radio. From all indications, 2010 looks to be another exciting year in the industry. 2009 saw the explosion of the Internet as a source for streaming music and information content, thanks to growth in the availability of mobile streaming products and streaming music services such as Pandora and Slacker.

In this column, you can expect to find regular spotlights on streaming stations from a country or genre of interest, information on new Internet radio technology such as WiFi radios and applications, legislation that affects Internet radio, and new and exciting developments in the industry.

Internet radio holds the promise of being a new wrinkle in the future of our beloved radio hobby. An increasing number of broadcasters (both local and shortwave) are adding or completely turning programming to the Internet. In addition, there are an increasing number of online streaming options coming available in the amateur and scanner hobbies, as well as online receivers from around the world.

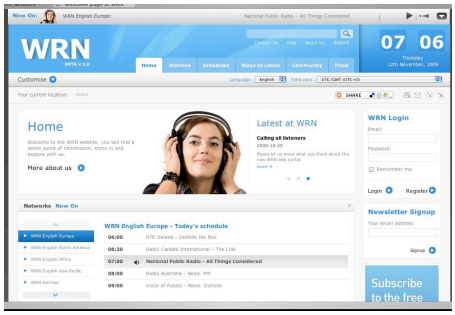
For those of you who, like me, were raised to pull in elusive signals and programming content over crackling radio waves in the middle of the night, Internet radio might seem a bit awkward to maneuver at first. However, the positives far outweigh the discomfort of any initial acclimation period.

No matter the atmospheric conditions, no matter the time of day, I know that I can sit in my living room, turn on my WiFi radio, and programming from virtually anywhere in the world will be there waiting for me, with a few turns of the dial.

This month, we are going to discuss one particular source of worldwide streaming content that is an excellent and familiar way for new Internet radio users to get their "feet wet" in the hobby. So, if your New Year's resolution was to finally see what all of the clamor was about with Internet radio, WRN is the perfect introduction for you!

❖ WRN: The world in one place

Seasoned shortwave radio listeners are no doubt familiar with World Radio Network, which relays a wide variety of international broadcasters. While WRN's broadcasts can no longer be found on shortwave, they are still available through the Internet, ensuring that a worldwide audience can still tune in programming from across the globe.



A number of international broadcasters provide content to WRN. These include: Radio Australia, Banns Radio International, Radio Freundes-Dienst, Radio Guangdong, HCJB, Israel Radio, KBS World Radio (Korea), Radio New Zealand International, Polish Radio External Service, Voice of Russia, Radio Romania International, RTE Ireland, Radio Slovakia International, Radio Sweden, World of Radio, United Nations Radio, Vatican Radio, and many more.

WRN recently redesigned their Web site, making it more user-friendly and updating it with more features. One handy addition from the main listener page is the current schedule. From here, you can see which stations/programs will be featured for the next few hours (listed in UTC). Many of the stations also have podcasts available so that, even if you have missed listening to your favorite station, you can go back and listen to programming content from (in some cases) the past few days.

Programming schedules are divided into regions and languages, so that listeners can listen to programming that is catered to their region and in their preferred language. If you're looking for more variety, you can still click on streams from other regions. For instance, while writing this column, I was listening to KBS in Korea broadcast in German through WRN German. In all, WRN carries broadcasts in five languages, including English, German, French, Russian and Arabic.

Users can register through WRN to gain access to varying levels of content. Users can register to listen only to current streams and programming, or to be able to access the past seven days worth of content, or to be able to access the past 30 days of content. Registration is simple and is free. As a registered user, you can even set favorite stations to make it easier to access recent content.

For those looking for information on specific stations offered by WRN, there is a menu on the bottom left hand side of every page (the 'stations' section), which makes it easy to navigate from station to station. Each station's page includes general station information, a contact e-mail address, website address, and links to previous days' content.

If you're looking for familiar surroundings in which to begin your journey into Internet radio, WRN is an excellent option. Many shortwave hobbyists will be happy to find international broadcasting content that may be difficult or impossible to hear on shortwave anymore.

❖ HD Radio on the iPhone?

As regular readers will know, I am a proud owner of a 3GS iPhone. I have found it to be the handiest gadget I own. Since getting my iPhone this past summer, I have found myself using my computer less and less, and searching for more ways to integrate the iPhone's 3G and WiFi connections into my daily life.

One application I have found to be most enjoyable is streaming Internet radio in my vehicle. Using the ooTunes application (downloadable at the iTunes App Store), I can stream thousands of radio stations through my car stereo's auxiliary input. I have enjoyed listening to talk radio in England, music from Australia, and local weather reports in Hawaii, all while on my daily commute to my day job.

I have often thought it would be nice to have HD radio capability in my vehicle without the expense of adding an HD receiver in my vehicle. Wouldn't it be nice if my iPhone could receive HD Radio signals?

Now, it can.

Gigaware and iBiquity Digital have recently released an HD Radio adapter that plugs directly into the iPhone or iTouch that, when combined with a downloadable application, makes HD Radio reception possible on the go. The adapter allows users to listen to traditional analog radio signals, as well as the digital-only

format, including sub-channel stations offered in your local area.

A really handy tie-in for HD Radio reception on an iPhone or iTouch, is the application's iTunes tagging capability. Hear a song you like on the radio? Tag it and next time you sync your iPhone or iTouch to your computer, iTunes will download the song for you and add it to your music library automatically.

The adapter is currently being sold at U.S. Radio Shack locations for $80. There are already talks underway by Gigaware developers to incorporate built-in HD Radio receiving capability in future iPhone and iTouch models.

All of this appears to be a move on Apple's part to compete with Microsoft's Zune media player, which already incorporates a built-in HD Radio receiver. The surprising part of this is that traditionally, Apple has preferred to be the forerunner of technology, especially when competing with Microsoft, rather than "playing catch-up."

❖ "Chumby" the WiFi hesitation blues

Some of you are no doubt reading about the explosion of Internet radio with some ambivalence about actually spending your hard-earned money on a WiFi radio receiver. You want to get in on the action, but you are a bit unsure about spending all of that money for a device that only tunes in radio stations.

There is a device on the market that may actually be just the answer for the WiFi waffler: Meet the Chumby One.

The Chumby One is a relatively inexpensive WiFi device that does more than just tune in Internet radio. Through its 3.5 inch LCD touch screen, you can access information from a number of Web widgets. Scroll through your Flickr photos, check to see what the weather forecast will be for the weekend, see if your friends uploaded photos from the class reunion to their Facebook page, or pass the time playing a game and more.

At $99, the Chumby One is a cost-effective way to get started with Internet radio with a device that offers other capabilities as well.

You will need a WiFi connection in your home to take advantage of the Chumby One's web features. It has a built-in speaker, but also includes a 3.5mm stereo output for those looking for a little more audio quality. The Chumby One has a rechargeable lithium ion battery which allows for about one hour of portable use (an AC adapter is included as well), a built-in FM receiver, a USB 2.0 port, volume controls, and a 2GB microSD memory card.

The Chumby One would make a perfect option for those looking for an Internet radio player in their office or at their bedside. Plus, with the added functionality of the other Web-based applications, the Chumby One is like having a little mini-computer without all of the added bells, whistles (and headaches) that can come with it.

❖ Droid hits the market

After months of hype for Motorola's Droid mobile phone – a competitor to Apple's iPhone, the new phone's release had good reviews but left some disappointed. But Internet radio fans can't complain they were forgotten.

It didn't take long for Internet radio applications to become available for the Droid. The streaming music services, Pandora and Slacker, were among the first to jump on the Droid bandwagon.

There is also StreamFurious and DroidLive. Both applications stream broadcast and Internet-only radio stations and use ShoutCast as their main stream provider. Both appear to have a cost ($5.99 for StreamFurious and $1.99 for DroidLive), but this is comparable to streaming applications for the iPhone and other smartphones.

I am interested to see what other streaming applications will come about for the Droid and whether the phone will put a dent in the iPhone and Blackberry share of the smartphone market. The marketing for the Droid promises open development and no control over what apps will be available to consumers (a complaint voiced by some iPhone users, although I welcome Apple screening applications to ensure quality).

In such an open environment for development, it will be interesting to see how much of a share Internet radio will play in the Droid's ever expanding application market.

❖ AppleTV adds Internet radio player

Users of AppleTV will notice an upgraded interface has been released. Along with new options for movies and other features, there is now an Internet radio player included with AppleTV.

Organized by genre, AppleTV's Internet radio player interfaces with a user's iTunes account, which means you can browse not only the thousands of stations streamed through iTunes, but also set your favorites for ease of access.

AppleTV can be ordered from Apple for $229. In addition to the Internet radio player, AppleTV allows users to stream movies and music from their iTunes library on their computer through their home theater system and HD television.

GLOBALNET LINKS

World Radio Network - **www.wrn.org/listeners/**
IPhone/iTouch HD Radio adapter - **www.radioshack.com/product/index.jsp?productId=3734241**
The Chumby One - **http://reviews.cnet.com/digital-media-receivers/chumby-one/4505-6739_7-3874298.html?tag=mncol;txt**
AppleTV - **http://www.apple.com/appletv/**
StreamFurious Review - **www.androidtapp.com/streamfurious/**
DroidLive Review - **www.androidtapp.com/droidlive/**

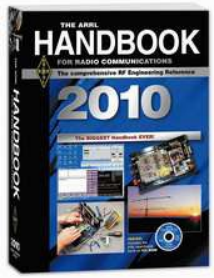
What's NEW

Tell them you saw it in Monitoring Times

The ARRL Handbook for Radio Communications – The Comprehensive RF Engineering Reference

The *2010 ARRL Handbook for Radio Communications* is the biggest handbook ever. Since it was first published in 1926, the handbook has been a mainstay for the radio electronic experimenter. A core resource for radio amateurs, hobbyists, engineers and scientists, the *ARRL Handbook* is the single most authoritative reference on practical communications topics. It is both reference book and tutorial, woven together with practical applications and solutions.

The 2010 *Handbook*, the 87th edition, is both a useful introduction to radio communication and features the most current material on electronics and amateur radio.



More than 60 authors and reviewers contributed over 70 percent new or completely revised content, making this the biggest *Handbook* ever (over 1,250 pages). New material includes all-new treatments of digital communications technology, solid-state RF power amplifiers and switch-mode power supplies.

According to the ARRL, when editors H. Ward Silver, N0AX, and Mark Wilson, K1RO, dove into preparing this 87th edition, they kept in mind what F. E. Handy, W1BDI (author of the first edition) wrote in that book: "Written first of all for the beginner, such an amount of useful and up-to-date information has been added that the handbook in its present form is equally valuable as a compendium of information for the experienced brass-pounder and the beginner alike."

For 2010, *The ARRL Handbook for Radio Communications* has been reorganized into five major sections, making it easier than ever to find exactly what you are searching for: Fundamental Theory, Practical Design and Principles, Antenna Systems and Radio Propagation, Equipment Construction and Maintenance, and Station Assembly and Management.

In this edition of the handbook there is a new table of contents: Electrical Fundamentals, Analog Basics, Digital Basics, RF Design Techniques, Computer-Aided Circuit Design, Power Supplies, Modulation, Oscillators and Synthesizers, Mixers, Modulators and Demodulators, RF and AF Filters, Receivers, Transmitters, Transceivers, DSP and Software Radio Design, Digital Modes, RF Power Amplifiers, Repeaters, Propagation of Radio Signals, Transmission Lines, Antennas, Component Data and References, Circuit Construction, Station Accessories, Test Equipment and Measurements, Troubleshooting and Repair, Electromagnetic Compatibility and Direction-Finding, Safety, Assembling a Station, Space Communications, Digital Communications, and Image Communications

"Each chapter has been designed to be either an 'encyclopedia' (providing descriptive overviews of current practices and technology) or 'practical handbook' (focusing on techniques, designs and projects)," Silver explained. "In either case, Mark and I tried to ensure that there was enough introductory material to get the newcomer started, as well as plenty of in-depth discussion the experienced amateur will expect."

Nearly every chapter has been rewritten or reworked, with many projects making their first appearance in the handbook. Here are some of the new topics you will find:

A full suite of new or revised chapters address the burgeoning digital modes: Modulation (by Alan Bloom, N1AL); DSP and Software Radio Design (also by N1AL), Digital Modes (by Scott Honaker, N7SS, and Kok Chen, W7AY), and Digital Communications (by Steve Ford, WB8IMY). There's also a new section on D-STAR digital repeaters by Pete Loveall, AE5PL and Jim McClellan, N5MIJ.

The popular chapter on RF Power Amplifiers has been thorough refreshed by experts John Stanley, K4ERO (vacuum tube technology) and Dick Frey, K4XU (solid-state amplifiers). You'll find new software, expanded design examples, and a new 250 W solid state amplifier project to get you started toward that bigger signal.

Power Supplies is a chapter that every ham turns to regularly. It received the attention of world-class authority Rudy Severns, N6LF. As a result, there is a detailed introduction to switch-mode power conversion, arguably the most common power supply technology in the world and whose coverage was long overdue in the handbook.

Some of the other new projects you will find in the handbook include: variable-voltage bench supply using switch-mode modules; an extended double-Zepp, multi-band horizontal loop; and inexpensive Yagis for VHF/UHF.

Station accessory projects include a high-power 160/80 meter matching network for 43 foot verticals, and a 100 W Z-match antenna tuner and transmitting chokes.

If you're learning electronics from the handbook, as many do, the Fundamental Theory section sports reworked and expanded chapters on basic electronics and analog design, including analog-digital conversion and microprocessor interfacing.

New resources for experimenters include a chapter on Computer-Aided Circuit Design by Dave Newkirk, W9VES. The Component Data and References chapter received needed updates to the information on component characteristics and surface mount devices by Paul Harden, NA5N.

In recognition of the growing range of operating modes and activities, you'll find updated and expanded chapters on Space Communications (satellites by Steve Ford, WB8IMY, and EME by Joe Taylor, K1JT) and Image Communications (ATV by Tom O'Hara, W6ORG, and SSTV by Dave Jones, KB4YZ).

The book's accompanying CD-ROM inside the back cover once again includes a searchable PDF version of the entire book, including graphics. Construction information and PC board templates for all projects are included, as are the original *QST* articles, if that was the project's source. Jim Tonne, W4ENE, has again generously provided his powerful filter design and analysis software, Elsie, as well as other useful applications. Recognizing that the printed *Handbook* and CD-ROM support a dynamic activity, a webpage has been created to provide links and supplemental information that may change with time.

The CD-ROM is fully-searchable book and operates on the following operating systems: Windows® XP, Windows Vista® or Windows® 7, 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.

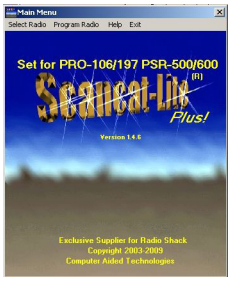
Available in softcover (hardcover has sold out), the softcover includes book and CD-ROM. ARRL Order No. 1448 (ISBN 0-87259-144-1) $49.95 plus shipping.

You can order all ARRL publications from the ARRL, 225 Main Street, Newington, CT 06111-1494. Order Hotline 1-888-277-5289 (toll-free US only), Monday through Friday, 8 AM to 8 PM Eastern time. You can also order online at **www.arrl.org**.

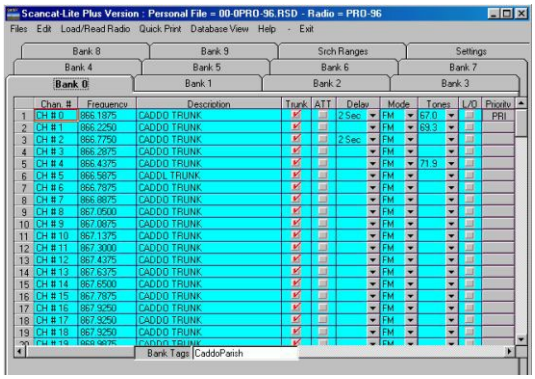
For more than eight decades, hams, hobbyists, engineers and scientists have used *The ARRL Handbook for Radio Communications* for both practical solutions and as a teacher to open doors of understanding. Whether you use it at the radio, on the workbench or in the library, this is one reference that belongs in your radio shack.

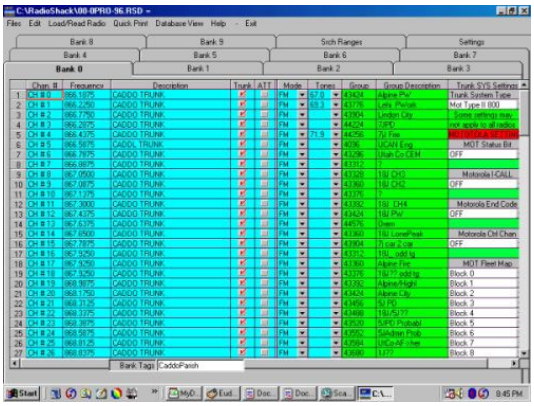
Scancat -Lite-Plus

Are you tired of having a different software program for each of your scanners? Are you tired of retyping all your data into one software program to another? Then maybe you're ready for Scancat-Lite-Plus.



Scancat-Lite-





Plus supports all the most popular scanners on the market with one single, easy to use interface, and the list of supported radios continues to grow. Scancat-Lite-Plus for Windows supports the memory programming for Radio Shack and Uniden Scanners at a price that is very affordable.

While their Scancat-GOLD supports both memory programming and scanning from the PC, Scancat-Lite-Plus is targeted to those radio owners who need to program the radio's memories, but do not need the additional scanning control.

In the tradition of other Scancat products, all radios supported are available in one software product. This means if you have any of the radios supported by Scancat-Lite-Plus, you only need to buy the one software program. If you have more than one radio that is supported, you can use the same databases from any of the radios (to the limits of their frequency coverage and features, of course).

It is easy to use Scancat-Lite-Plus. Just pick the radio from the radio selection list and "plug it in." The program supports both programming the radio's memories and (if supported by the radio) downloading from the radio the frequency information already programmed. So you can download from one radio and send the same frequency information to a second or third radio. You won't be able to do that with software that only supports a single radio.

The following radios are currently covered by Scancat-Lite-Plus software:

GRE America
PSR-300 PSR-400 PSR-500 PSR-600

Radio Shack Scanners
PRO-64/2041 PRO-76 PRO-79/2017 PRO-82/2018 PRO-83/84 PRO-89 PRO-93/2053 PRO-94 (B) PRO-95 PRO-96/2096 PRO-97/2055 PRO-99 PRO-106 /197 PRO-135/136 PRO-137 PRO-160/162 PRO-163/164 PRO-528/433 PRO-2019 PRO-2051 PRO-2052 PRO-2054 PRO-404 PRO-405

Uniden Scanners
BC-95XLT BC-895 BC-245 BC-246T BC-780 BC-250D BC-785D BC-296D BC-796D BCT-8 BCT-15 BCT-15X BC-898T BCD346XT BC-396T BCD396XT BC-996T BCD996XT BR-330 SC-230

It should be noted that the PRO-92 and the PRO-2067 are not supported, and the SC-200 is no longer supported.

Scancat-Lite-Plus works on Win 95/98/98SE, Windows 2000, Windows ME/XP, Vista and Windows 7. The program is available as a download from **www.scancat.com/** or on CD-ROM. The manual is included on the CD-ROM in an Adobe Acrobat PDF file. The cost is US$29.95.

If you just need some software to help you program the scanners in your shack, Scancat-Lite-Plus is an affordable and powerful alternative to most of the software packages in the radio hobby marketplace today.

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

LETTERS

editor@monitoringtimes.com

Harry Helms

We were saddened to hear that Harry Helms W5HLH lost his extended battle with cancer on November 15, 2009, in Fort Mill, SC, at the age of 57. Harry Helms is the author of over a dozen books on technical and radio-related topics, such as *Electronic Circuits Cookbook, All About Ham Radio, Shortwave Listening Guidebook*, and *Handbook of Radio Communications Servicing and Maintenance*. A former editor for such publishers as McGraw-Hill and Academic Press, he was co-founder of LLH Technology Publishing. He also wrote for magazines such as *Popular Communications* and *Monitoring Times.*

Thanks to a note from Thomas Giella NZ4O on QRZ forums, we were led to a touching farewell written by Harry Helms in August in his blog: **http://harryhelmsblog.blogspot.com/2009/08/greetings-from-fort-mill-south-carolina.html**

We extend our condolences to Harry's wife Di, his family and close friends. Harry was always generous in sharing his knowledge, his time, and his opinions, and he will be sorely missed by the entire radio community.

More on Alfred Vail

"As usual your magazine continues to have a very good mix of well written articles that cover many aspects of radio, communications and related matters and I enjoy reading it cover to cover every month. I really enjoyed the Morse Code article by Greg Smith in the Sept 09 edition, but wish that he had mentioned that Camp Alfred Vail in Oceanport NJ (later renamed Fort Monmouth) was named after him.

"There are also many other buildings named after other radio pioneers who were in the US Army Signal Corps Labs, such as Major Edwin Armstrong inventor of the superhet, FM and other items, and the builder of the incredible Alpine tower in Alpine NJ. See **www.monmouth.army.mil/historian/** for more information.

"It's a shame that all this history and legacy of innovation will be lost with the wasteful and harmful BRAC closure of Fort Monmouth in 2011 and its relocation to Aberdeen Proving Ground in MD.

Steven Pizzo, Toms River NJ

Steve later added, "Check out the documents on the link (above); there is lots of good stuff on Alfred Vail and others. One actually says the army meant to name it after another Vail who was the head of ITT who provided many engineers to the army in support of the war effort and helped them obtain the land."

Author Greg Smith WB2PPQ replied to Steven: "It was important to me that Alfred Vail receive credit for his technical efforts and for the code protocol known as Morse Code. I have received requests from two libraries to have this issue of 'Monitoring Times' in their Reference Departments, one being Morristown, NJ.

"For many years I had a second home close to you in Monmouth Beach and bicycled through Oceanport on many occasions. The closure of Fort Monmouth was a bad decision for many reasons.

"Here is a link that mentions Camp Alfred Vail, a wonderful honor for a great inventor. **http://iagenweb.org/greatwar/tcs/alfval.htm**

Remembering the Regency TR-1

"The latest issue just came in and is one of the best! Thanks so much.

"All of you will enjoy (hopefully) these links about the first ever transistor radio, the Regency TR-1:

* This is a 1955 "Industry on Parade" clip showing how they built them – note the solder bath "Ferris Wheel" – OSHA would have a fit today! : **http://www.youtube.com/watch?v=kKln6zTy4C8&NR=1&feature=fvwp** .

* Here is a blog link with more interesting info including mp3's of an actual restored TR-1 playing- veeery interesting: **http://blog.wfmu.org/freeform/2005/10/still_portable_.html** .

"My grandmother was a "contester" and gave me one of these things in 1956, with the case and earphone. It gave out sometime later, probably due to a bad capacitor. It was salvaged for parts when we became hams....oh the humanity!..."

These things go for $700 and up on Ebay now, no matter how they look and even if they don't play.... ."

Ron Smith

The Buzz

Allen Lutins wrote to Ken Reitz with the following correction to the final item of the November Communications column, which referenced a tone imbedded by an Austrian station to repel mosquitoes: "The frequency was off by a factor of 1,000. This is no doubt due to the way large numbers are written in Europe, where periods (*or a space-ed)*, rather than commas, are used to separate groups of three digits. The '14.850 Hz' frequency cited is actually (in U.S. representation) 14,850 Hz, or 14.85 kilohertz. This makes sense if you consider that 14,850 Hz is the 18th harmonic of 825 hertz; it would be hard to believe in a base frequency of 0.825 Hz (of which 14.85 Hz would be the 18th harmonic)!

"Thanks for all the great information conveyed in the remainder of this month's column!"

Allen Lutins KC2KLC

EDITOR'S SOAPBOX

Computers & Radio is Back!

As we all know, the world of radio is becoming ever more intertwined with the world of computers, and to become comfortable with either one has been a slow learning curve for many. That's why we are delighted to reinstate our longtime *Computers & Radio* column with an author who is experienced in both worlds.

The name **Brian Wood W0DZ** should be familiar to you, because he has already been thoroughly introduced in the October feature article *Living the Dream*. That article focused on Brian's fascination with radio, his career with Hewlett-Packard, the evolution of his company DZKits, and the Sienna computer-based radio he designed. Brian's first article in *QST*, "*A Microprocessor Controlled Contest Accessory,"* appeared in April 1982, long before personal computers were common gear in most ham shacks.

Meeting the diverse interests of *MT* readers isn't easy to do within a limited number of pages, so *Computers & Radio* will appear quarterly, starting with this January issue. It will be in rotation with two other quarterly columns: *SkySurfing* radio astronomy (by Jeffrey Lichtman) and *SkySurfing* amateur radio satellites.

We can now announce that the amateur satellite edition of *SkySurfing* will be authored by **Keith Baker KB1SF** (whose article is this month's lead feature). We are honored to welcome Keith, who has long held leadership positions with AMSAT (the Radio Amateur Satellite Corporation), to the *MT* staff of writers.

You'll also be glad to hear we are very close to filling the vacancy left by Clem Small's retirement from the *Antenna Topics* column. The author of this month's antenna article (which had been submitted as a freelance feature) is certainly one of the contenders for that monthly column. Stay tuned for that announcement next month if possible.

As Managing Editor, I am relieved to be able to start the New Year with the full complement of top-notch writers, in the feature section as well as in the regular monthly departments. It bodes extremely well for 2010 to be one of the best years yet in *Monitoring Times'* always comprehensive coverage of the spectrum – dc to daylight!

Rachel Baughn, Managing Editor

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

Happy monitoring!
Rachel Baughn, Editor

SEE More and HEAR More!

With the SR2000A and AR8200MkIII from AOR

SR2000A Color Frequency Monitor

The SR2000A is an ultra-fast spectrum display monitor that lets you SEE received signals in FULL color.

Using the power of FFT (Fast Fourier Transform) algorithms with a sensitive receiver covering 25MHz ~ 3GHz, the SR2000A features a color monitor that displays up to 40MHz spectrum bandwidth**, a switchable time-lapse "waterfall" display or live video in NTSC or PAL formats.*

Ultra sensitive, incredibly fast, yet easy to use with a high quality internal speaker for crisp, clean audio signals. Scans 10MHz in as little as 0.2 seconds! Instantly detects, captures and displays transmitted signals. PC control through RS232C serial port or USB interface. With 12 VDC input, it's perfect for base, mobile or field use.

AR8200MkIII Handheld Receiver

From inter-agency coordination to surveillance, you can't know too much. The world-class AR8200MkIII portable receiver features a TXCO that delivers solid frequency stability and performance not found in most desktop units. With 1,000 alphanumeric memory channels, it covers 500 KHz ~ 3GHz. Improved RF circuits combine greater sensitivity, resistance to intermod and enhanced Signal to Noise ratio. It offers increased audio frequency response and includes NiMH AA batteries that can be charged while the unit is in use.*

Optional internal slot cards expand the AR8200MkIII's capabilities. Choose from Memory Expansion (up to 4,000 memories), CTCSS Squelch and Search, and Tone Eliminator.

The AR8200MkIII offers "all mode" reception that includes "super narrow" FM plus wide and narrow FM in addition to USB, LSB, CW and standard AM and FM modes. It also features true carrier reinsertion in USB and LSB modes and includes a 3KHz SSB filter. The data port can be used for computer control, memory configuration and transfer, cloning or tape recording output.

A special government version, AR8200MkIII IR features infra-red illumination (IR) of the display and operating keys. The IR illumination function is selectable, allowing operation by users wearing night vision apparatus without removing goggles and waiting for the eyes to re-adjust. Ideal for military, law enforcement and surveillance operators.

AOR®
Authority on Radio Communications

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20655 S. Western Ave., Suite 112, Torrance, CA 90501, USA
Tel: 310-787-8615 Fax: 310-787-8619
info@aorusa.com http://www.aorusa.com

** Government version, cellular blocked for US consumer version.*
***No audio is available when the frequency span is set to 20MHz or 40MHz.*
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INDEX OF ADVERTISERS

Stock Exchange

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NON-COMMERCIAL SUBSCRIBER RATES: $.25 per word. All merchandise must be personal and radio-related.
COMMERCIAL, NON-SUBSCRIBER, AND MULTIPLE SALES RATES: $1.00 per word. Commercial line ads printed in bold type.

Ads for Stock Exchange must be received 45 days prior to publication date. All ads must be paid in advance to Monitoring Times. Ad copy must be typed for legibility.

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Blogs offer an opportunity for columnists to share information that does not make their columns. The news might be too timely for deadline, too short, confined to a small geographical area, too far away to be heard in North America, or even off the columnist's regular "beat." Bookmark these blogs for frequent visits!

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http://americanbandscan.blogspot.com/ - by Doug Smith

MT: FED FILES
http://mt-fedfiles.blogspot.com/ - by Chris Parris

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http://mt-milcom.blogspot.com/ - by Larry Van Horn

Larry's Monitoring Post
http://monitor-post.blogspot.com/ - by Larry Van Horn

MT: SHORTWAVE
http://mt-shortwave.blogspot.com/- by Gayle Van Horn

MT: UTILITY WORLD
http://mt-utility.blogspot.com/- by Hugh Stegman

Looking for Writers

MT is soliciting feature articles, reviews, and how-to articles covering shortwave broadcasting, utilities, scanning, frequency profiles, construction projects or whatever excites you! Contact Feature Editor Ken Reitz at *kenreitz@monitoring-times.com* or write c/o Monitoring Times, 7540 Hwy 64 West, Brasstown, NC 28902.

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IC-R2500

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- Optional P25 (UT-122)
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