Scanning - Shortwave - Ham Radio - Equipment
Internet Streaming - Computers - Antique Radio

Monitoring Times

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Volume 28, No. 11
November 2009

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MT Special:

Radio Buyer's Guide Issue

11
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In this issue:

- Ham Radio Transceivers
- Shortwave Radios
- Scanners
- Antennas
- Also: Weather Radios, CBs, FRS/GMRS and Portable Shortwave

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Monitoring Times

Vol. 28 No. 11 November 2009

MT Special:

Radio Buyer's Guide Issue

With the Christmas season just around the corner, many readers are considering what they'd *really* like to see under the tree. To help with this, *MT* offers a special Radio Buyer's Guide written by hams who have tested and reviewed radio-related products for many years.

On Our Cover: *Some of the finest radios on the market. But which one is right for you? This issue will help you decide!*

C O N T E N T S

Buying a Ham Radio Transceiver 8
By Kirk Kleinschmidt NT0Z

Former QST assistant editor, current amateur radio columnist for Popular Communications, and a ham for 32 years, Kirk has handled, tested, and reviewed, more ham gear than most of us can imagine. Now, you get the benefit of his experience as he walks you through the purchase of your next amateur radio transceiver.

MT's Guide to Buying a Used Receiver..... 11
By Bob Grove W8JHD

Bob Grove knows shortwave radios, he's been reviewing them for decades, and he's seen and used them all. If you're looking for a portable, table-top set or software defined radio, Bob tells you how to look for the best deal among all the great used models now on the used radio market.

Expert's Guide to Buying a Scanner Radio..... 12
By Larry Van Horn N5FPW

Digital technology has put public service monitoring in a state of flux across the U.S. So, when it comes to choosing the kind of scanner that will be the most useful where you live, you could use a little expert advice. Nobody knows scanners like *MT*'s own Larry Van Horn. Listen up!

Trends in Radio..... 13
By Ken Reitz KS4ZR

There's a whole world of radios that we use every day: Weather Radios, CB sets, FRS/GMRS radios and pocket-sized portable shortwave sets. Ken details the pluses and minuses of some of the most well-known brands. He also looks at trends among the major manufacturers so you'll know what to look for before you buy.

Expert's Guide to Buying an Antenna 15
By Bob Grove W8JHD

Bob has been designing and building antennas for HF, VHF and UHF for decades. He's used nearly every type of antenna made and now you don't have to "Ask Bob:" He'll tell you!

A Life in Service to Amateur Radio..... 18
By Harry Dannals W2HD

The former 5-time ARRL president, and past president of QCWA, reflects on a life of service to amateur radio that took him around the U.S. and the world representing American hams during his 10 year term. Harry helped forge policies and regulations that gave us, among other things, the WARC bands (30, 17 and 12 meters). He may not look like the kind of guy who would jump off a garage roof to swing from a rope on a tree but then, maybe you don't know W2HD.

Photo by Ken Reitz KS4ZR

Reviews

Uniden BCD996XT
21st Century Scanner Technology

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Address:	7540 Highway 64 West, Brasstown, NC 28902-0098
Telephone:	(828) 837-9200
Fax:	(828) 837-2216 (24 hours)
Internet Address:	***www.grove-ent.com*** or ***www.monitoringtimes.com***
Editorial e-mail:	***editor@monitoringtimes.com***
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Subscription Questions?
belinda@grove-ent.com

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

Publisher
Bob Grove, W8JHD
bobgrove@monitoringtimes.com

Managing Editor
Rachel Baughn, KE4OPD
editor@monitoringtimes.com

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

Features Editor
Ken Reitz
kenreitz@monitoringtimes.com

Art Director
Bill Grove

Advertising Svcs.
Beth Leinbach
(828) 389-4007
bethleinbach@monitoringtimes.com

EDITORIAL STAFF Email firstlast@monitoringtimes.com

TJ "Skip" Arey .....On the Ham Bands
Rachel Baughn .....Letters to the Editor
Kevin Carey.....Below 500 kHz
Mike Chace.....Digital Digest
Marc Ellis .....Radio Restorations
Bob Grove.....Ask Bob
Jeffrey Lichtman.....Sky Surfing
Chris Parris.....Fed Files
Ken Reitz .....Features Editor
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..... QSL Corner
Larry Van Horn .....Milcom
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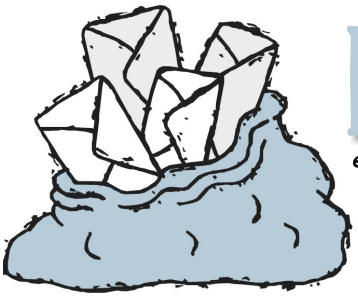

LETTERS

editor@monitoringtimes.com

September's Mystery Antenna

In December 2008, when my husband Harry Baughn and I were visiting San Diego, we took a trolley ride to Coronado Island for lunch. However, when our return trolley failed to show up on time, we discovered that the Coronado Bay Bridge had been closed because two people were on the bridge threatening to jump. The evening's rush hour traffic and our friendly trolley driver were detoured around the bay on the Silver Strand highway, which took us past the wonderful Wullenweber array just at sunset that I posted in September's *Letters*.

Fifteen people correctly identified the type and the location of this antenna: Dave Anderson, Bruce Ames, Dave Billeci, Deon, Gary, Rick Herndon, Donald Kalinowski, Jeff Lee, Bruce Oltman, Rich Ortloff, Denny Reeves, Gordon Schlesinger, Gary Shapiro, Tim W6TWR, and Dave Wilcox (winner of the 3 months' subscription to *MT Express*). Congratulations!

Gordon Schlesinger, W6LBV, is a local resident who remembers the bridge closing – fortunately, a rare event. He adds, "The Wullenweber is an HF direction finding system usually constructed and used by the U.S. Navy. The two concentric circles of vertical dipole antennas that can be seen in the picture give it utility on two different portions of the HF band… There's some good background information on the Wullenweber and similar DFing arrays in: **www.mapability.com/ei8ic/rhombic/wullen.php**"

Jeff Lee claims the antenna was even featured in a couple of episodes in the first season of "John From Cincinnati."

A couple of other locals wrote, as did readers who had been stationed in the area years ago. Deon said "Of course this antenna being in my backyard, I was very curious when I first moved here. This is the Imperial Beach Radio Receiving Facility, CA. The antenna is an AN/FRD-10 HFDF Wullenweber array (aka "Elephant Cage"). The array was for receiving signals in the 2-30MHz range operated by the NCTC and NSGD Dept. (Built in 1964 and used till 1999)."

Tim W6TWR, wrote: "I just went to this facility two weeks ago and asked the Main Gate security if there were tours available of the facility and got the standard answer of 'I don't know.'"

Everyone enjoyed reminiscing about these rhombic direction-finding antennas, even those who weren't sure of the location. Derek Helling attached a picture of "the one at RAF Chicksands in Bedfordshire, UK, taken in the 1960s, I believe. … I used to see this antenna regularly as my parents lived in nearby Biggleswade, and my grandmother lived in Shefford. The local nickname was 'Elephant Cage.'"

There was a lot of speculation about how many antennas with this configuration still stand and how many are still being used. Readers mentioned operating or seeing similar antennas at other locations, such as Homestead AFB, FL; Misawa, Japan; San Vito dei Normanni Air Station, Italy and Edzell, Scotland; Goodfellow AFB, San Angelo; Elmendorf AFB Alaska; Bramstedtlund, Germany; Scaggs Island, California; Oahu and Honolulu, Hawaii.

Dave Anderson, Bruce Ames, and others doubt this particular antenna is being used, even though cars were present at the center building. Dave says that this one "is located on the Silver Strand Training Complex, which is a principal area for training special forces, though the antenna is no longer used. There are apparently two of these still in use at Elmendorf, Alaska, and at Misawa, Japan. Most of the others have become landmarks. I once was stationed in Augsburg, Germany where we used one of these – it's still there, surrounded by what looks like an industrial park.

"A particularly unique use of one is in the Philippines, where they've made it into an amphitheatre." *(photo below)*

Frank McJunkins said he had the pleasure of using the antenna at Clark AFB in the Philippines. He also said, "I heard the FCC had been using the one at Bellingham, WA prior to its being torn down a few years back, so maybe that is who the current tenant is."

http://static.panoramio.com/photos/original/5414611.jpg

Francois Michaud said, "I had the chance to visit the one in Corea, Maine. It is very impressive in size." However, that antenna was demolished in August of 2001.

Canadian Jon Huneault, VE1FTL, of Nova Scotia says, "Well I'll be darned! That's an AN/FRD-10 Circularly Disposed Antenna Array (CDAA) affectionately known to the military as a 'Fred-ten,' and to techies as a Wullenwebber Array.

"I worked at both of Canada's sites in Gander (Newfoundland) and Masset (BC) while I was in the Canadian Forces … Both our sites had nicknames: Masset was known as the 'Elephant Trap' and Gander was the 'Turkey Farm.'"

Bruce Ames confesses to being a former "NSA spook," living California. Of course he nailed it, and included some other interesting information:

"The antenna in question is used for 'huff-duff' (HFDF) High Frequency Direction Finding and they were used by virtually all branches of the Department of Defense intelligence agencies during the cold war reporting to NSA (National Security Agency). The FRD-10 was code named 'Classic Bullseye' …

"I was a Crytpologic Technician (maintenance) at many places around the world during the cold war. I worked on the equipment on the Wullenweber system at Naval Security Group Sabana Seca Puerto Rico, which was roughly thirty miles west of San Juan, in the mid-'70s."

As to whether any sites are still active, Bruce says, "Nope, per my Crypto contacts all of the Wullenwebers have been de-established and just about every one of them has been taken down. There is a story that one may still be operating in Japan; however, that has never been verified. They were used only for receiving and would always be located far away from any transmitters.

"Because the Wullenwebers were so sensitive, periodic tests were done by other Crypto techs using test gear at the side of the access road to the [PR] site measuring any radiated electrical noise from a vehicle. If your vehicle was above a certain very low threshold, your vehicle was not allowed on the site and one had to hoof it. "

That's all we have room for in this discussion of our mystery antenna. We have lots more information links and memories of other Wullenweber sites worldwide, which we will post for your further reading. Just go to the *MT* homepage at **www.monitoringtimes.com** for the link.

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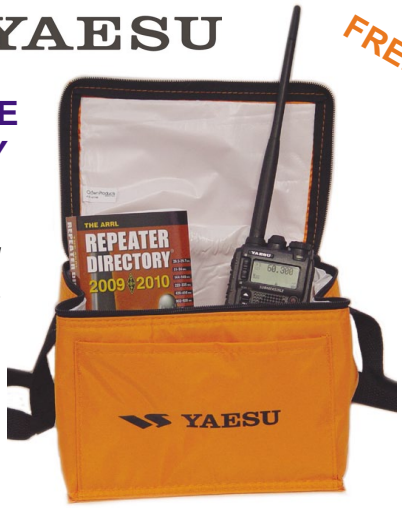

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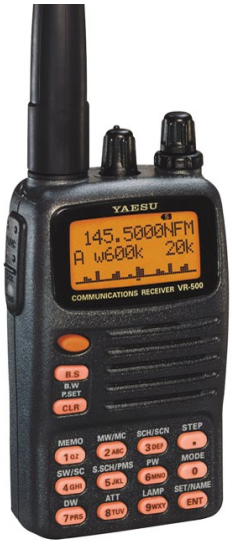

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- Prices shown do not include shipping.

COMMUNICATIONS

by Ken Reitz

"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, Ralph Johnson, and Larry Van Horn

SHORTWAVE/AMATEUR RADIO

Tale of Two Ham Antenna Companies

Last month signaled the end of the road for GLA Systems, maker of the Texas BugCatcher mobile ham antenna. In a statement posted on his website, owner Henry Allen K5BUG said, "It's been a fun 30 years, but it is time to hang it up. I would like to thank everyone who has made this experience possible…it has been a great trip down a long road."

The posting gave a timetable for the company's final months: "All orders received before October 31, 2009 will be filled. Effective November 1, 2009, only orders for items that are in stock at the time will be accepted. Effective December 31, 2009, the toll free line 800-588-2841, will be discontinued."

Meanwhile, long-time amateur radio antenna manufacturer Cushcraft was purchased July 31, 2009 by MFJ Enterprises, Inc. of Starkville, Mississippi. A statement released by the new owner, Martin F. Jue, president and founder of MFJ, stated that, "We are excited to have the Cushcraft amateur radio antennas product line alongside our other five companies."

MFJ had previously bought Hy-gain antennas in 2000 and produces a line of MJF-branded antennas as well. Cushcraft's line of 50 antenna products, ranging from HF through UHF and including verticals as well as horizontal beams, will be added to the MFJ catalog. Mr. Jue stated that Cushcraft models would continue to be made in Manchester, New Hampshire.

FCC Grants Experimental Licenses

The FCC was busy back in September issuing experimental licenses for various operations, including the Boeing Company, "for testing the radiated field effects of PEDs [Personal Electronic Devices] on aircraft electronic components and systems…and a ground cellular system on board commercial aircraft." Lockheed Martin received an experimental license "for identifying and geo-locating low power and high ground based signals."

While you may not have heard of L-3 Communications, the company is on the Fortune 500 list and receives a lot of money from the Pentagon for various high-tech, missile-related programs. The company received the call sign WE3XYO to operate in 902-928 MHz to test and evaluate command and control of an unmanned aerial vehicle.

Powerwave Technologies, Inc. received a license to operate in 2541.5-2561.5 MHz and 2630.5-2650.5 MHz for "testing WiMax mobile user handover and coverage operability in a network configuration."

And, the University of Puerto Rico at Mayaguez received a number of licenses at 9.410 GHz for testing lower-tropospheric weather radar to study rainfall.

AM/FM/TV BROADCASTING

KHCM-AM Goes CRI

An article in the Honolulu *Star-Bulletin* from September 4, explained the story of two seemingly strange bed-fellows: local AM station, KHCM 880 kHz (owned by Christian broadcasting conglomerate Salem Communications) and China Radio International (CRI), a radio service controlled by the Communist Party of the People's Republic of China. The agreement brings CRI's full schedule of programs in Chinese, English, Korean and Japanese to the 24/7 station, operating under an agreement between Salem and California-based R & C Productions.

Paradise and CRI Too: KHCM-AM 880 Switches to China Radio International for programming. (Courtesy: KHCM-AM)

The article quoted CRI officials, at a gathering to promote the programming change, as saying that China does not prevent listeners in China from hearing VOA and BBC shortwave broadcasts; and a senior company official from Salem described CRI broadcasts as "not intensely political." It turns out that the whole deal is simply a commercial venture; CRI is merely buying all of KHCM-AM's broadcast time. Meanwhile, sister station KHCM-FM continues its flag-waving, all-American, all-country format under the red, white and blue "Country 97.5" logo.

Pirate Cat Radio Gets City Approval

It's hard to imagine a city where the local pirate radio station is not only taken for granted by local citizens, but publicly praised by city officials. But then, San Francisco is not an ordinary city. The San Francisco *Chronicle*, in its on-line site **www.sfgate.com**, reports that a member of the local board of supervisors dropped by the radio station/coffee house a couple of months ago to present the station with a certificate of

Pirate Cat Radio gets approval from San Francisco officials, but will the FCC pet the nice kitty? (Courtesy: Pirate Cat Radio)

commendation, on behalf of the whole board, for, among other things, "[Pirate Cat Radio's] trailblazing efforts toward freeing the airwaves from corporate control, providing the community with training in radio broadcasting skills, [and] empowering voices ignored by traditional media outlets…"

Cal. TV Station Can Air 20 Channels

A report on **TV Technology.com** from early September details how a low-powered community TV station in San Jose, California, KAXT-CA, is using available technology to allow it to broadcast up to twenty MPEG2 video and audio channels within its allotted 19.39 Mbps signal. The commercial-supported station's main intent is to provide more alternative programming, including multicultural content, expected by the area's diversified population, within the station's limited budget. The station believes the concept can be a business model for similar low-power TV stations nationwide.

The station currently programs 12 video channels and 4 audio channels including Cool Music Network (world music videos), Que Dong (Vietnamese), Tempos Finales (Spanish Christian), Bahia TV (Brazilian Portuguese), Colours TV (multi-cultural), i2TV (Internet to TV), Jewelry TV (jewelry shopping), Peanut TV (pet care), Coastal TV (California coastal tourism channel), and Corner Store TV (shopping).

Eco-Terrorists Blamed in Downed Towers

Many media outlets reported the toppling of two of four radio towers belonging to KRKO-AM in Snohomish, Washington in early September. Most articles, including those written by the Associated Press, blamed "eco-terrorists," specifically, a group calling itself Earth Liberation Front (ELF) for the act. And, why not? A large banner left at the site indicated ELF was behind the attack.

But, the Seattle *Times'* staff reporter Sara Jean Green, dug a little deeper. Even though a web site, purporting to speak for the ELF claimed responsibility for the attack, the *Times* quoted the general manager of the family-owned, sports-format radio station as being in doubt. He said he suspected "disgruntled locals" who had just recently lost a court case against the station's tower site which is located on farm land.

The manager told the *Times* that the family will replace the towers and "accelerate plans to add several more." The towers had been brought down with the aid of a large piece of earth-moving machinery that had been left at the site, apparently part of the new construction plans.

According to the *Times* article, there were plenty of local people annoyed with the installation and the fact that the family had just received permission from the FCC to construct a second 50kW AM station at the site. Residents, according to the article, had been complaining of all manner of RF interference they blamed on the station including sportscasts coming in on a local church's PA system and electric garage and car doors randomly opening.

BusRadio? What Next!

Because school buses are already a terrible place to be stuck for 30 or 50 minutes twice a day for everyone involved, why not make it even worse by piping kid-oriented programming over the buses' loudspeaker systems? That's been the trial run for a company calling itself BusRadio which features not just pop music, commercials, public service announcements and games, but offers prizes and cash to students for texting answers to quizzes. Another fun feature is texting a "shout-out" to your bus driver, girlfriend or secret heartthrob. It makes riding the bus just like a fun-filled TV sitcom.

BusRadio: Games, Prizes, Music…It's like being at home with 80 of your closest friends and enemies. (Courtesy: BusRadio)

Now, with all the data in (including a little-publicized public comment period from the FCC, a raft of scornful comments from a Harvard-based organization called Campaign for a Commercial-Free Childhood, and high praise from various bus drivers who might rather lash the little darlings to their seats) the FCC is weighing the chance for the "service" to go nationwide. Since BusRadio is the only company with such a plan, it hopes to enjoy a monopoly on taxpayer-funded school transportation. So, what's next? BusTV, of course!

SATELLITES

Chinese Space Debris Haunts ISS

Remember that non-functioning Chinese weather satellite that they used for target practice in space back in 2007? The International Space Station is routinely haunted by debris from that event and other accidents and ineptitudes while NASA tries to maintain a no-junk zone around the ISS that extends out to 15 miles around it, in addition to a one-half mile zone above and below it. Still, Space.com reports that "…part of a three year-old slab of a European rocket body," was said to have come within one mile of ISS recently.

Cash-strapped City Taxes Dish Viewers

Omaha, Nebraska, like most American municipalities these days is strapped for cash. Falling property values have depleted the tax base, operating costs continue to rise, and budget decisions need to be made. What to do? The

Omaha wants to take a bite out of DISH and DirecTV viewers. (Courtesy: DISH Network and DirecTV)

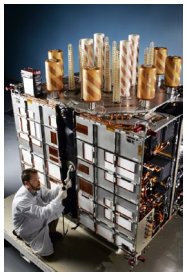
friendly folks at the National Cable Telecommunications Association (NCTA), cable-TV's national lobbying group, had a brilliant idea: tax satellite-TV viewers! One city councilman is fronting the scheme that proposes a $50/year fee that, he estimates, would raise $2 million in much needed revenue.

The Satellite Broadcasting and Communications Association (SBCA), the nation's satellite-TV lobbying group, was not amused. Citing FCC exemption from special taxes, the SBCA warned the city council that they would fight the tax. Omaha, seeking to slither around the FCC's exemption, is calling the tax a "safety inspection fee." Stay tuned for the showdown in Omaha.

The NCTA apparently went door-to-door to states and municipalities trying to drum up taxes for satellite-TV viewers. They were in Sacramento, California, in early September, asking state legislators to tax the state's estimated 3.6 million satellite-TV customers, citing the mouth-watering figure of $170 million that could flow into the state's empty treasury. But, the scheme ran out of time when it failed to get on the legislative calendar within the legal time limit.

New GPS Sat Goes Live

Lockheed Martin announced September 3, the operational status of the last in a series of eight modernized GPS satellites for global military and civilian use. Dubbed GPS IIR-21 (M), the satellite was launched by the Air Force August, 17. According to a press release by the company, the program is on track to launch the first GPS IIIA satellite in 2014. It must be time to finally bury the hysteria generated a few months back about the nation's GPS constellation going down.



Lockheed Martin GPS IIRM (Courtesy: Lockheed Martin Corp.)

PUBLIC SERVICE

San Antonio Scanner Channels Restored

The city of San Antonio, Texas, hatched a plan to bar the media from listening in to dispatches from the fire department and Emergency Medical Services (EMS). Reason given was so that the city could comply with provisions in the Federal Health Insurance Portability and Accountability Act of 1996. The theory was that the identity of individual patients would be compromised through in-the-clear transmissions.

But, according to an editorial in the San Antonio *Express-News*, the city found a way to keep the dispatch channels open to the press while keeping patient information private through the use of channels that are blocked to public reception. The paper had expressed a fear that closing all dispatch channels to the press would have "made it seem as though the city was trying to avoid scrutiny of its emergency services, scrutiny that in recent years has resulted in controversy and a review of EMS protocol."

Scientific American Examines Interoperability

The September issue of *Scientific American*, available on line at **www.scientificamerican.com**, examined the difficulties of developing a nationwide system of radios for first responders. The article noted that even though it's been eight years since 9/11, there are few local systems capable of allowing police and fire/rescue services to talk with one another, let alone any such nationwide system in place. The excellent article spells out the problem of having only one company so far, with a design that meets the criteria for such a system as set by the Department of Homeland Security.

It further examined the slow pace of the transfer of the former analog TV band to be developed as the place for such communications and the fact that commercial ventures bidding for the space wanted to be granted priority over public service agencies, even during an emergency, for its use.

7,432 Cell-phone Drivers Ticketed in NYC

The Washington *Post* noted that one day this past summer New York City police staged a 24 hour crackdown on violators of the city's law against driving and using a cell phone that is not a hands-free device. While on an average day the NYPD issues 580 such tickets, during this particular day they wrote 7,432 tickets which, at $130 a pop, brought the city nearly $1 million in revenue. Omaha and California, take note!

Bug-Killer Radio

Finally, *Radio World* on-line reported August 12 that KroneHit Radio, in Vienna, Austria was transmitting more than the usual radio fare this past summer. The station is said to have imbedded a 14.850 Hz tone (the 27th harmonic of a mosquitoes buzz), intending to imitate the buzz of a female mosquito, in its audio signal aimed at driving away all mosquitoes within a 5 meter radius of the radio. The station apparently warned that the effect does not work if the listener is wearing headphones.

Expert's Guide to Buying an HF Transceiver

By Kirk A. Kleinschmidt, NT0Z

Big or small? DC-to-daylight or HF only? New or used? Kit-built or manufactured? Base or mobile? Ham-bands only or SWL, too? Standalone or PC required? These days, buying the right rig can be amazingly complicated. Here's some advice on making the best choice.

Finding My Way

As a teenager in the late 1970s, choosing my first rig was a lot simpler than it is today. The internet, in its infancy, was "military only" and the worldwide web was more than a decade away. Like computers, radios were much more expensive (see sidebar) and my $3 an hour after-school job had to pay for gas and non-radio goodies.

Information about radios – used and new – came from magazines (*QST, CQ, 73* and *Ham Radio*); your Elmer, if you had one, and your ham radio buddies and fellow club members. These are still good resources today, despite the fact that the number of available radios and potential information sources has skyrocketed.

In an era with a Morse code requirement for HF access and unpublished exam questions, learning to be a ham seemed to require more one-on-one instruction. So, most followed the lead of their Elmers. Consequently, if your Elmer was a VHF guy, you were a VHF guy. If he was a DXer, you were a DXer. And so on.

Buying radio gear followed suit. I'm sure more than a few hams lusted after their Elmer's gear. I know I did! My first Elmer had a Swan 350 HF transceiver and a tri-band beam. Although its performance is eclipsed by the least expensive transceivers available today, I will never forget the sounds of faraway DX stations coming from the speaker and the eerie, warm glow of the dial lamps.

My second Elmer was an Old-Timer and a real techie. He had a pair of Drake Twins and, later, a Drake TR-7/R-7 setup with every option. After he switched to the TR-7, he lent me his Twins so I could operate split-frequency mode on 40-meter SSB during DX contests, something my trusty Tempo One couldn't do without an accessory VFO.

Made by Yaesu, and a veritable clone of the FT-101, the Tempo One was my first real radio. I worked all summer landscaping the huge lawn at our new house, and my Dad surprised me with the Tempo in the fall of that year. Although its sale did pay my tuition for one semester at college, I wish I still had it for the sake of nostalgia!

Reminiscing aside, how can you choose a suitable radio today? Even when accounting for the vastly expanded selection and rapidly evolving technology, the basics of buying a radio are surprisingly similar. Whether it's generated by a vacuum tube and a 1930s crystal oscillator or a newfangled software-defined radio (SDR), the essence of radio is still radio. So let's get started!

Define Your Interests

Before you reach for your VISA card, be sure to actually think about your interests – what they are now and what they're likely to be in the near future. At the most basic level, if you're simply interested in chatting with your friends on the local repeater, looking at contest-grade HF transceivers isn't necessary, and vice-versa. On a subtler level, however, you should be as detailed as possible when surveying your interests. Make a list so you don't forget when you're mesmerized by the shiny chrome and the blinking lights when you get to the showroom!

Do you have a home shack, or will hassles with the neighborhood association force you to operate portable or mobile? And, if you can reasonably operate from home, does your desire to operate from your camper suggest a compact portable transceiver that can also be easily hooked up at home? If you're not expecting to do a lot of Morse code work, whether a rig has silky smooth, full-break-in CW isn't really relevant. You get the idea.

Think about bands and modes, too. If HF and SWLing are your main interests, an HF transceiver that has a general-coverage receiver will do nicely and save you the expense and complexity of buying an HF rig that also covers VHF and up. Conversely, if you need a single rig that does everything, a compact dc-to-daylight transceiver is probably in your future.

If you require certain features such as a rig that can transmit RTTY with a dedicated FSK keying input (as opposed to the audio from your PC) or provisions for separate receive antennas (good for low-frequency reception or contest operation), be sure to note them in your shopping checklist because some features are difficult or impossible to add later.

Price and Relative Performance

When discussing buying a "starter radio," most of us tend to think about price, specifically, buying a starter radio that will work well enough to get started without breaking the bank. However, some hams are fortunate enough to "start" with a $10,000 transceiver…or a $3,000 transceiver…whatever. If that's your reality, lucky you! The really interesting thing is that radio gear has never been more affordable and performance has never been better! Regardless of price, today's radios offer enough features and performance to get the job done. They're all stable and they all produce clean, usable signals.

Icom 718: Great "starter" rig for new hams with plenty of room to grow. List price: $812, discounts bring it down to $579. (Courtesy: Icom America)

There's quite a range between the price of the most affordable HF transceiver and the most expensive. Using ICOM's lineup as a guide (just because I'm familiar with it), the entry-level IC-718 – full-featured, with general-coverage receive and plenty of bells and whistles – can be purchased for $579 new. The IC-7800, ICOM's flagship radio, costs about $10,500! One's a Toyota Corolla, the other's an Aston Martin – but both are cars that do essentially the same things. The 7800 offers better performance and some extra bells and whistles but, thanks to today's technology and manufacturing practices, there are few contacts that couldn't be completed by hams using either rig.

Icom 7800: For the ham who has/wants everything. List price: $14,000, discounts bring it down to $10,500. (Courtesy: Icom America) (Courtesy: www.w4rt.com)

When it comes to making your decision you'll have to evaluate your budget and any additional specific requirements and interests. If you're truly just getting started and need to explore the wide world of Amateur Radio – a little of this, a little of that, a friendly ragchew here, a little DXing there – any modern entry-level radio will work like a champ. If you're starting out with a competitive bent and want to dive deeply into every weekend contest

you can find, a competition-grade rig – with a competition-grade price – may be necessary.

You can't beat the Aston Martin in a cross-continent race with a Corolla, but you can certainly drive from coast to coast while thoroughly enjoying the ride! And, if you only have $600 to spend, the choice is easy!

Gathering Information

Before we get into some specifics, let's take a look at the process of finding information on, and getting input about, which radio to buy. In my experience, most hams are pretty good at this part – maybe a little too good!

It's a rare ham who won't chime in when someone asks for advice about radios! These folks will also probably offer opportunities to actually see or use a radio or two, which can be invaluable when you're just starting out.

Just remember that every ham carries the mark of his personal bias when it comes to which aspects of the hobby he finds interesting and which types and brands of gear to recommend. A Kenwood guy isn't likely to recommend a Yaesu radio, a low-band DXer may not know beans about weak-signal VHF work, and an Old-Timer who keeps paper logs won't necessarily know about the importance of computer control and computerized contest logging, etc. It's not a big deal – just remember to keep it in mind so you can read between the lines!

Even in the internet age, ham radio magazines are still excellent sources of information when it comes to choosing a radio, new or used. In addition to dozens of ads showcasing the latest and greatest offerings, most ham magazines have regular product reviews, some more thorough than others. When it comes to detailed technical and operational reviews with lots of numbers, charts, tests and actual measurements, the Product Review section of *QST* is the hands-down winner. It's the Consumer Reports of Amateur Radio evaluation.

QST's detailed product evaluations got into high gear in the 1970s, so there's an excellent chance that every mainstream radio you might be interested in – unless it's too new – has been reviewed in one issue or another. A complete list of *QST* product reviews can be found at **www.arrl.org/tis/info/prodrev.html**. ARRL members can download write-ups from 1980 onward right from the web site. If you're serious about finding the right radio, the $39 annual membership fee via **www.arrl.org** is a bargain. If your ham club doesn't have back issues, your local library might. Many *QST* Product Reviews end up on the internet by hook or by crook, so it also pays to Google around.

Speaking of the internet, it's a staggering resource when it comes to searching for tidbits about your soon-to-be favorite radio. In addition to manufacturer's web sites, complete with juicy pictures and detailed specs on everything they make, the 'net has a lot of nooks and crannies full of rig specs, modifications, workarounds, service info and photos. Google away, but be sure to point your browser to **www.eham.net**, which has a great classifieds section and a treasure trove of equipment reviews submitted by users.

Specific Features

Now that we've looked at how to start the overall process, let's look at some specific considerations.

Bands:

Almost every modern transceiver covers 160 through 10 meters, including the "WARC" bands. Not every modern rig covers 60 meters, however, so if you need to work ham radio's only "channelized" band, make sure the radio in question covers 5 MHz.

Many modern rigs also add multimode coverage of 50, 144 and 420 MHz – a true "station in a box!" Whether base or mobile, these dc-to-daylight super radios do just about everything reasonably well and were essentially unheard of before the mid '90s.

Although some older HF rigs cover 6 meters, most do not have any VHF/UHF coverage unless you're willing to add transverters to the mix, which is fine for performance but not necessarily recommended for beginners.

Most older radios don't cover 60 meters, and some don't even cover 160 meters! But most ops never use those bands, so it may not be a factor in your decision tree.

Size:

I used to think of this category as "mobile vs. base," but, because most modern mobile, compact radios are quite capable of being used at home, the distinction is more about size and convenience than ever before.

During the past decade we've seen a real trend toward compact, do-everything, dc-to-daylight radios that offer an amazing range of features and frequency coverage in the tiniest of packages. However, the added convenience sometimes has a price when it comes to absolute performance and functionality. For example, although a radio in this class can work SSB and CW on 6 and 2 meters, its weak-signal performance is certainly not best-in-class. Similarly, the radio can also work through VHF/UHF FM repeaters, but its ease of use when considering frequency splits, memories, etc, keeps it from truly competing with dedicated mobile FM rigs that are expressly designed for that service. But when it comes to "bang for the buck" and maximizing your ability to explore just about every aspect of ham radio in a compact, capable package, there's nothing better.

Base station radios are "big," and are generally designed for use in the shack instead of a 4X4 pickup. They generally perform better than their more-compact cousins and offer extra options and added operating convenience. The larger size means more circuitry, more features, more filters, more connectors and more switches and controls. They may seem more complicated to use at first, but after you get the hang of it, using a base station rig is generally easier than a compact one.

Usability:

In a related sense, big radios have larger displays and plenty of front-panel controls. That means no squinting and no digging through potentially complicated and layered menus and multifunction controls. If you need to switch on the speech compressor, for example, on a big radio you just push a button. On a compact radio you might have to push a sequence of several buttons – and remember that sequence the next time you need it. Both radios may have similar functions, but big radios generally offer more operating convenience, especially for older or visually impaired users.

Extended Receiver Coverage:

Once a premium on HF transceivers, most radios now receive from 100 kHz to at least 30 MHz. Radios that also cover VHF/UHF bands typically have extended receiver coverage at least to the top of the highest ham band on which the rig can transmit. Be sure to check the specs of the rig in question, though, because gaps in VHF/UHF coverage are the norm, and the radios are definitely not as functional as scanners or "VHF communications receivers."

THE GOOD OLD (EXPENSIVE) DAYS

Despite our embattled economy, when adjusted for inflation, amateur radio gear has never been more affordable. To see for yourself, check out the equipment ads in ham magazines from the '40s through the '60s. Separate receivers and transmitters made by Collins, National, Drake, etc, had stellar price tags to match their stunning appearances. A premium receiver might have set you back $1,000 or more and you could add a transmitter for about the same! Even in the late '60s you could buy a new car with all the extras for less than it cost to buy a Collins transmitter/receiver combo!

Don't believe me? A 1968 Camaro SS cost a measly $2,588. A '66 Ford pickup was a paltry $1,795. In 1968, A Collins 51S-1 ham/shortwave receiver cost more than $2,000. Drake's more affordable R4 still cost $600, but worked on ham bands only. Even Swan's 350 – considered a real budget transceiver, complete with scary TV sweep tubes as finals – cost about $500.

So, adjusting for inflation, a radio that cost $500 in 1968 would cost a whopping $2,917 in 2006 (the latest year I could find data for)! That Collins 51S-1 would cost $11,600 today – the same cost of ICOM's top of the line IC-7800 transceiver today!

It's interesting that top-of-the-line equals top-of-the-line, then and now, but what about performance and overall value? Does the venerable 51S-1 offer the ultimate performance and value of ICOM's 7800? Not hardly, though more than a few Collins collectors might sharply disagree with me!

Inflation works the other way, too. After a small rebate, ICOM's IC-718, arguably the most affordable full-featured HF transceiver available today, costs about $525 new and as little as $475 for a factory refurbished unit (online). In 1968 dollars, that's an amazing $90! Not bad for a radio that does stuff that a 1968 radio couldn't even dream of. With due respect to collectors everywhere, today's gear performs twice as well at a tenth the cost. – NT0Z

Modern HF rigs typically offer good to excellent performance as SWL receivers, but may lack versatility in AM filter bandwidths, sensitivity below 1.8 MHz, and advanced options such as synchronous detectors. Still, unless you're used to high-end SWL receivers, a typical HF rig more than gets the job done and runs rings around inexpensive shortwave radios.

It's interesting to note that the highest-performing "enthusiast-grade" ham transceivers do not feature SWL receive coverage. When it's necessary to boost receive performance by the final smidgen, a general coverage front end goes out the window!

Computer control:

Most – but not all – modern HF radios have computer-control interfaces. Although not needed to get on the air, they are necessary to take advantage of computerized logging, PC control and lots of automated goodness. The older a radio is, the less likely it has a PC interface.

Filters:

To simplify a complex topic, there are two main types of bandwidth (IF) filters in modern radios: crystal filters and digital filters created by a rig's digital signal processor (DSP). Most rigs use one or the other while some have both. Although exceptions exist, generally, big radios have bigger, better filters than those found in compact radios. Better crystal filters and better DSP units. After all, that extra space has to count for something!

W4RT add-on, inboard Collins Mechanical Filter for Icom 718 $114 if you install it yourself. (Courtesy: www.w4rt.com)

Again, generally, DSP filters offer more bandwidths and more flexibility, while crystal filters tend to offer better ultimate performance. Actually, the combination tends to offer the best of both worlds. For a starter radio, it's important to simply have (or have the option to add) filter bandwidths necessary to work the bands and modes you're interested in.

Another important tidbit to remember is that the filters in most entry level radios can be updated by purchasing new (or better) filters from the manufacturer or from a third party. My handy little ICOM IC-718, for example, has just about every feature a ham could want – except good-performing IF filters! A $500 radio has to cut a few corners and, because filters are expensive, guess what got cut? Don't get me wrong: the radio works just fine with its inexpensive Murata filters, but by upgrading the SSB filter and adding a CW filter, the performance goes way up, as does the radio's value. I prefer adding Collins mechanical filters from **www.w4rt.com** instead of those offered by ICOM. If you're considering a compact ICOM or Yaesu radio, the W4RT filters are less expensive and perform better.

VFOs:

Most modern rigs have dual VFOs, allowing you to listen on one frequency and transmit on another. This is especially useful for contesting and working DX pileups that require split-frequency operation to handle the sheer volume of calls. Some older rigs don't have this feature (remember my Tempo One?) though on some you can add an external VFO. Dual VFOs also offer a handy "memory scratchpad" function. When you tune across an interesting signal, push the button that sets VFO A equal to VFO B, then continue tuning up or down the band. To check in on your memorized frequency, simply switch to VFO B. Nifty!

Other goodies:

The list of goodies that can be found on modern radios is exhaustive. We're talking keyers, digital voice recorders, speech processors, RTTY decoders – you name it. While you're compiling your list of potential radios, make sure your candidates have the goodies you're interested in. Or make sure they can be added internally or "outboard" after the fact.

New or Used? Dealer or Individual?

Buying from a dealer – whether the rig's new or used – can be safer than buying from an individual. In addition to hardware, dealers offer information, service and a bit of security. Make sure the dealer you choose has a reasonable return period (a modest restocking fee is acceptable), and try to purchase your rig with a credit card, if possible. You'll be protected if the rig turns out to be a lemon.

Buying from individuals (hamfests, the internet, classified ads) is where the bargains can be found – but only if you're an experienced buyer, skillful in ham radio service or repair, or know someone who is who's also willing to assist you! As any horse trader will tell you, it's possible to find fabulous deals at such outlets, but it's also possible to come home with wretched doorstops that look great on the outside.

When a seller says a particular radio "works great!" he might be telling the truth, or he might be pulling your leg. If you're inexperienced or you can't fix the rig's "little problem," you could be stuck with the thing. Caveat Emptor even applies to ham radio!

There are dozens and dozens of used HF rigs that will still work well today (assuming that they're in good working condition). There's not nearly enough space here to list them, but a lengthy list and follow-on discussion can be found at **www.eham.net/articles/4140**.

The Future is Now

By now we're all familiar with computer-controlled radios. They make scanning and SWLing lots of fun and enable computerized logging and other nifty, high-tech features. The real future of ham radio isn't "computer control," however, it's "computer defined." More precisely, the newest ham radios are "software defined radios," SDR for short.

Wave of the future: Flex-3000 Software Defined Radio ($1,600). (Courtesy: Flex-Radio)

In an SDR, the front end is conventional and uses coils, capacitors and filters to prepare RF signals for transition into the digital domain. From that point on, all processing, demodulating, filtering, signal generation, etc, is done by the rig's digital signal processor. Essentially, the radio is a computer, and vice-versa! To add modes or other capabilities simply update the "radio's" firmware or software.

SDRs offer very advanced features such as graphical display of received signals (panoramic-type displays), the ability to demodulate extremely weak signals, very high dynamic range and receiver performance, etc. The potential downside is that SDRs require PCs and PC monitors to function (even if the PC is built into the SDR's cabinet). SDRs don't yet offer conventional front panel controls, etc, so some users are put off by the PC requirement. Operating SDR software and logging or PSK31 software, for example, can be quite a trick. Still, dollar for dollar, nothing beats an SDR when it comes to ultimate performance. To check out the future, see **www.flex-radio.com**.

Conclusion

As I wrap this up I can't help but wonder how many of you are peeved that I didn't tell you exactly which radio to buy! Well, it doesn't work that way. One size doesn't fit all! What I hope you understand is that choosing a rig is a process of identifying your interests, examining your budget, talking with hams in your circle of friends, researching information and specifications in person and online, putting your hands on a rig at a friend's shack or at a dealer (if possible), and so on.

As you gain experience, choosing a rig will become less mysterious – but probably no less frustrating! New gear is introduced every year, and most hams trade their stuff in for newer versions every few years. You probably will, too. It's all part of the fun! Your first rig – or your next rig – probably won't be your last, so work your process, get a radio, get on the air, and good luck!

About the Author:

Kirk Kleinschmidt, NT0Z, a ham since 1977, was licensed at age 15 and is still slinging dits to this day. Kirk was *QST*'s assistant managing editor from 1988 to 1994, is the Amateur Radio columnist for Popular Communications, wrote Stealth Amateur Radio and wrote features for Satellite Times, an MT sister publication, in the late '90s. He lives in Rochester, Minnesota, and can't wait to move back to a more rural setting so he can put up some real antennas. He can be reached at **kirk@cloudnet.com**.

MT'S GUIDE TO BUYING A USED RECEIVER

By Bob Grove W8JHD

Radio receivers have had a long, progressive evolution. In the earliest days, simple coherers and galena crystals were attached to an antenna and an earth ground to detect radio signals generated by spark-gap transmitters.

Eventually, tuned circuits, vacuum-tube amplifiers, regeneration and super-regeneration, heterodyne and superheterodyne refinements led to vastly-superior radio receiving equipment by the 1930s.

The second World War added impetus to the development of the final phases of vacuum-tube radio, with famous brand names like Hammarlund, National and Hallicrafters offering advanced designs and handsome packaging to the serious listener.

When transistors were first incorporated into radio circuits in the 1950s, their performance left much to be desired; vacuum-tube models still led the field. But, along came field-effect transistors, integrated circuits and other solid-state devices which finally competed with the old tube sets. Now vacuum tubes are virtually extinct, manufactured for replacement purposes, audiophiles, and specialized industrial/scientific/medical applications.

So what about buying one of those classics?

If it were possible to obtain a new model of the old radios, we would be initially impressed by their performance, but would soon observe their limitations like frequency drift, crystal-filter distortion, heat generation, and other subtleties that have been overcome by modern design techniques.

Worse, age has taken its toll on these fine, old receivers, and finding original replacement parts is not always possible. Capacitors have become "leaky," allowing voltage to pass through them like resistors; resistors have changed tolerance, changing as well the performance of the circuits of which they are part; potentiometers have decomposed, becoming noisy and erratic; RF and IF transformer potting compounds have taken on moisture, losing their crisp tuning ability, referred to as "Q".

These old sets deserve respect, even reverence for the period they represent, but they best serve as gentle reminders of our past; collectibles for nostalgic hobbyists and restorers.

But weren't early transistor sets also prone to poor performance?

Indeed they were, just like early vacuum-tube sets were. Both eras went through giant evolutional periods. But more modern, solid-state receivers and transceivers from revered companies like ICOM, JRC, Drake, Ten-Tec, Kenwood, and Yaesu, as well as the more recent introductions by innovators like WiNRADiO, Perseus, AOR, and RF Space, offer extraordinary improvements in sensitivity, selectivity, memory, autoscan, frequency stability, readout accuracy, and noise reduction.

What about portables?

There isn't a portable on the market that can match the performance of today's desktop receivers. Portables offer only one advantage: portability. Their small size and battery operation make them valuable as secondary and emergency radios, but they aren't primary receiving sets for serious applications.

Are there restorers around who can fix an old receiver?

Indeed there are. Probably the best source on these is Antique Radio Classified, published by John Terrey, and available on line at **www.antiqueradio.com**.

A local hobbyist has offered to sell me a used receiver; what should I look for?

Does it work? If not, unless you possess diagnostic and repair skills, don't buy it! It could have missing, weak, shorted, or burned-out tubes; shorted or open windings on power, audio, or IF transformers; leaky capacitors ("condensers"); out-of-tolerance resistors; frozen, dirty or decomposed adjustable components like the variable tuning capacitor and front-panel controls (RF gain, volume, tone, selectivity, switches, etc.).

There is also the daunting possibility that it has been improperly modified. Look for stray wires, extra holes, knobs, components, or switches and solder globs that are different from the rest of the chassis connections.

Except for the tubes part, these precautions apply to modern, solid-state radios as well.

It seems to be working just fine; how can I test its performance?

Attach an antenna, 20 feet of wire is just fine, preferably running out a window. Turn it on and tune in a signal with the SSB or CW mode switched on. Turn the frequency control, stopping on a signal. Does the tone drift in pitch? This is typical for older, vacuum-tube sets, but shouldn't happen on solid-state radios. In any case, drift will mean constantly readjusting the tuning on sideband, CW and digital signals.

Tap (don't slam!) the sides of the radio; does the pitch change erratically? If so, this indicates either flimsy design or possibly loose or worn components.

Fine-tune the received station; does the tone smoothly change, or does it jump erratically? Erratic tuning is a sign of a dirty, corroded or worn variable capacitor in an older set, or a defective encoder in a modern receiver.

Change bands or frequency ranges and listen for signals, especially above 10 megahertz (MHz) at the higher frequencies during the daytime. Even with the low sunspot cycle, broadcasters should be heard up through at least 15-18 MHz.

It's working great; how do I know a radio is a good value?

The quick answer is that if you can get it for less than you'd have to pay somewhere else, it's a good deal! As a practical matter, however, you can see how much that model and similar models are selling for at chain radio stores like Ham Radio Outlet and Amateur Radio Supply; individual outlets like Universal Radio and Grove Enterprises; and on line from specialty sites and eBay. Consider shipping costs, too, and availability of a warranty.

HOW TO TEST THAT USED SCANNER BEFORE YOU BUY IT

Folks sell their personal scanners for a variety of reasons:

1. They are no longer interested in listening.
2. They wish to step up to a more recent, more functional model.
3. They have too many scanners.
4. They are forced to sell because of the economy.
5. They aren't allowed to put up an effective antenna.
5. Their wives have said, "Either that scanner goes, or I go!"
6. It doesn't work well anymore.

It's that last reason that should give you pause, so test it before you buy it! Here's how: First, examine it carefully. Scratches may indicate rough handling, even dropping on hard surfaces. If it's a portable, be sure that the battery connectors aren't corroded. If you don't know the seller, get his guarantee that he has made no modifications and has not tampered with the circuitry or alignment.

Press all the keys multiple times to reassure you that all the keys work dependably, and watch the display to be sure that all LCD segments are functional, and that there aren't any black spots forming. If it has a back light, does it still work?

Attach a whip antenna and tune in a local weather channel; wiggle the base of the antenna slightly to determine that the connector is not loose, and that the center pin is connecting firmly – a loose connection would be revealed by an erratic change in signal strength.

Search for signals on several frequency ranges – 118-137, 144-163, 450-470, and 854-868 MHz. Be sure that the antenna is correct for that model, and hope for an operating manual. Some manufacturers post their owner's manuals on-line. Radio Shack has the owner's manuals for over 100 different RS scanners listed here: **http://support.radioshack.com/productinfo/ProductResults.asp?Name=Radio_Scanners&ID=004001001** Uniden has more than 50 scanner manuals here: **www.uniden.com/index/manuals_results.cfm?cat=3**

If the price is right, these simple steps should ease your mind.

Expert's Guide to Buying a Scanner Radio

What Kind of VHF/UHF Scanner Should I Buy?

By Larry Van Horn, MT Assistant/Review Editor

I wish I had a nickel for every time someone has asked me that question. To be honest, there is no easy answer so I usually answer this question with another question, "What services do you want to monitor?" That will certainly dictate the type of scanner you will want to buy.

Digital *V.* Analog/Trunk *V.* Conventional

If you are interested in monitoring public safety services, (e.g., police, fire, and EMS), you can narrow your purchase options to a couple of considerations – analog vs. digital, and conventional vs. trunk systems. I recommend that the first thing you do is to conduct a survey of the agencies you are interested in monitoring in your local area. You can do that at an Internet website such as RadioReference.com (**www.radioreference.com**).

Uniden BCD 396XT ($500) APCO 25-capable portable TrunkTracker scanner is rebanding supported. (Courtesy: Grove Enterprise)

For example, let's use the monitoring area around here in Brasstown, North Carolina. We are a rural area so the majority of the public safety radio systems we monitor will be conventional and analog. If that was the extent of it, I would recommend one of the inexpensive, conventional scanners such as a Uniden BC-346T or the GRE PSR-100/200 radios.

A closer examination of the RadioReference database reveals I have one important public safety trunk radio system in the area. This system is a statewide mixed mode (P16) 800 MHz trunk radio system known as "VIPER." It carries both analog and digital voice traffic. If I want to monitor this public safety trunk system, I will have to step up to a higher dollar scanner that, at a minimum, can follow a trunk radio system.

Even though the VIPER system mentioned above does have digital talk groups, if I want to monitor only analog talk groups, I have a wide variety of choices available to me.

Uniden - BC245XLT BC246T BC346XT BC780XLT BC895XLT BC898T BCT8 BCT15 BCT15X BR330T
GRE - PSR-300 PSR-400
Radio Shack - PRO-51 PRO-90 PRO-91 PRO-92 PRO-93 PRO-94 PRO-95 PRO-97 PRO-160 PRO-162 PRO-163 PRO-164 PRO-433 PRO-528 PRO-2050 PRO-2051 PRO-2052 PRO-2053 PRO-2055 PRO-2066 PRO-2067

There is one caveat that you should be aware of when purchasing some of the older trunk scanners. The following scanners will no longer correctly track most Motorola systems after 800 MHz rebanding takes place and cannot be updated. They are the Uniden BC245XLT, BC895XLT, and BC780XLT. If you need to follow an EDACS or LTR trunk system, the scanners below will work fine when the new rebanded 800 MHz frequencies are programmed.

If you are looking for additional information on rebanding, I have covered the topic extensively on my personal BTown Monitoring Post blog at **monitor-post.blogspot.com/2006/06/800-mhz-rebanding-and-uniden-scanners.html**

If I want to monitor the digital talk groups on the VIPER system or the new 380-390 MHz P25 trunk radio system in my area I will need to step up in price again and purchase one of the newer digital scanners.

Here is a list of scanners that I would consider.
Uniden - BC250D BC296D BCD396T BCD396XT BC785D BC796D BCD996T BCD996XT
GRE - PSR-500 PSR-600
Radio Shack - PRO-96 PRO-106 PRO-197 PRO-2096

The BC250 and 785 require the use of an optional BC25i digital card to enable digital trunking/decoding and they are becoming very hard to find. Even with the BC25i card, the only digital systems these two scanners will track are marked analog and APCO-25 Common Air Interface in the RadioReference website database. This means that these two scanners cannot track Project 25 trunking systems (9600 baud control channel); they can only track Motorola Type II systems (3600 baud control channel) that may use Project 25 common air interface (digital voice) for some (or all) of their voice channels.

At the Track and in the Air

If you are a NASCAR fan, any of the low end scanners in the marketplace will be just the ticket to let you monitor your favorite driver at the track. You can get complete details on monitoring races by downloading the Race Scanning Tips and Hints pdf from **www.midwestracingfrequencies.com/tips.pdf**

If you want to monitor other types of communications such as marine, aeronautical, railroad, and business, just about any analog style scanner will serve you well. While most of these specialities use analog communications, there is a slow migration to digital for all the above except the aeronautical bands. So, at some time in the future, a digital scanner might be needed to monitor some of the services I have mentioned above.

If you are an air show buff, the analog scanner playing field changes just a bit. While an analog scanner will let you hear most of the action, some scanners currently being marketed and most older scanners on the used market are not suited for air show monitoring. There are certain requirements your air show radio has to meet in order to successfully monitor the two major military aerial demonstration teams – the U.S. Navy's Blue Angels and the U.S. Air Force's Thunderbirds.

If you are going to a T-birds show, you will need a scanner that can monitor the 138-150 MHz military land mobile band in the AM mode. Most of the older Uniden scanners cannot be used for air show monitoring due to their lack of independent transmission mode selection.

You also need a scanner that has the 225-400 MHz military aeronautical band in it. Most of the action (especially the Blues) will be heard in this military UHF portion of the spectrum. Adding this criterion to the mix of possible radios again narrows our choice for air show scanners even further. You can get a comprehensive list of scanners we recommend for air show monitoring in the March issue of *Monitoring Times* in our exclusive, Annual Air Show Guide.

There are more radio manufacturers than the ones we listed above that have radios with VHF/UHF coverage. Names such as Alinco, AOR, Icom, Yaesu, and WinRadio also make radios that will let you catch activity in the VHF/UHF frequencies.

If you want further advice on purchasing a scanner, I recommend that you stop by the Monitoring Times or Grove Enterprises website. We have reviews and other background information to help you select a scanner that fits your monitoring needs. Also be sure to also visit our Trunk Scanner page at **www.monitoringtimes.com/html/trunkedscanners.html** for specific scanner information.

AOR AR-8200 MKII ($630) 500 kHz to 3 GHz tuning range (less cellular), all-mode hand-held scanner. (Courtesy: Grove Enterprises)

RADIO TRENDS: A Look at What Top Radio Manufacturers are Currently Offering

By Ken Reitz KS4ZR

Across the vast landscape of consumer electronics are many radios that we use every day: Weather radios, CB radios, FRS/GMRS two-way sets, and portable shortwave radios. These radios exist in a fiercely competitive world where one manufacturer often makes most of the components if not the finished products of competing lines. Still, this system has brought some interesting innovations to the market place. *MT* takes a look at current radio trends among these specialty radios.

Weather Radios

Weather radios have been added to CB sets, scanners, Family Radio Service (FRS) handitalkies, and there are dozens of stand-alone models. But, not all weather radios are all that useful. Look for sets that are Specific Area Message Encoding (S.A.M.E.)-capable, showing the "Public Alert" logo. Public Alert certification was developed between the Consumer Electronics Association (CEA) and the National Weather Service (NWS) to provide a standard for features that consumers could rely on.

Sima Products' WX-200 ($80) is a small, full-function S.A.M.E. weather radio featuring a rechargeable battery that trickle-charges while the radio is plugged into the wall. (Courtesy: Sima Products)

To be Public Alert certified a radio must include S.A.M.E. capability (to sound an alarm not only for severe weather but as many as 80 other selectable events such as a hazardous waste spill, Amber Alert or nuclear power plant "incident" near you); selectable alerting of events (the consumer can instruct the receiver not to turn on if there's an event that may not be a concern); battery backup that automatically engages when the main power is interrupted; external antenna jack, and external warning device jack (to enable a strobe light for the hearing impaired, for example).

S.A.M.E.-capable radios come in three types: desk-top, portable and emergency crank-powered portables. Midland Radio offers five such desk-top models that range in price from $40—100, but you should avoid desk-top sets with built-in clocks, AM/FM radios and bright displays. In an emergency such features help deplete the backup batteries. Sima Products is a company that makes many private-labeled weather radios. Their First Alert sets such as the WX-200 ($80) take rechargeable AA batteries (not included) that are trickle-charged while the unit is plugged into the wall. These batteries are widely available from $10–15 for four. I found the WX-200 at Ambient Weather.com for $44.

Portable S.A.M.E.-capable sets range in price from $20–60. Many are not Public Alert certified and most have inadequate antennas good only for reception within in a relatively small radius of your local NOAA weather radio station. You would probably be better off using the weather radio feature on your portable scanner.

This Oregon Scientific WR-602 hand-held weather radio is portable and handy, but it's also pricey ($80 at The Shack), the dinky antenna will not let you go far from a NOAA station, but at least it has a rechargeable battery and recharging cradle, some don't. (Courtesy: Oregon Scientific)

Crank-up S.A.M.E.-capable sets suffer from the same problems that portables do. There are no Public Alert crank-up models and, if you've ever actually used a crank-up radio, you know that the cranking stops being fun about two minutes into the job. That means that during an emergency, if a weather alert is sent and you fell asleep at the crank, you'll never know what hit you.

CB Radios

The biggest change in CB sets in decades has been the introduction of hand-held CBs, such as Midland Radio's 75-822 and Cobra's 75WX-ST. Some sets actually look like 2 meter HTs. But, as expected, these units have a few drawbacks, not the least of which is that, inside a car, they need help from an external antenna. You'll get poor reception inside the car without one and your transmission will never be heard without an external antenna.

CB manufacturers have had no real reason to upgrade their products: they're still limited to 40 channels; 4 watts output, and have little hope of being heard outside of a 3 to 5 mile radius. Even so, if you're on the road that may be all you need if you want to avoid speed traps, accident-generated "parking lots," or help when your cell phone runs out of juice.

Midland Radio 75-822 ($125) is a microphone-sized, full-featured CB with NOAA weather radio, but it's useless without an external antenna. (Courtesy: Midland Radio)

A welcome addition to many CBs models today is the inclusion of all 10 weather radio frequencies used in the U.S. and Canada. Other features you wouldn't have found on Smokey-and-the-Bandit-era CBs: Last channel memory, scanning function, 5 memory channels, Bluetooth connection to your cell phone, and hand-held portability. Even "full sized" sets look more like ham gear. They are smaller, with less chrome, and designed to fit in the smaller interiors of today's cars.

Two other things consumers will notice: the number of models has been greatly reduced while the prices have not. Midland's HH Road Trip hand-held CB set retails for $110, while Midland's more versatile 75-822, retails for $125. Substantial discounts can be found at many on-line retailers.

Full-sized "trucker" style CB sets, such as Cobra's 29 WX NWBT with NOAA channels and Bluetooth® wireless technology ($210) are even more expensive. The cheapest full-sized CB set I found was Midland Radio's 1001z ($45). More traditional chromed plastic sets such as Midland's 5001z ($110) and Cobra's 29 LTD Classic ($120) look like they are right out of 1975.

Regardless of what CB set you buy, you'll need a mobile mag-mount antenna. Mag-mount CB antennas are not what they used to be, especially from The Shack. Their mag-mount CB antenna (cat.#21-989) has an inadequate magnet base, poor construction and cheap coax that add up to emergency-side-of-the-road-use only. I found an old-fashioned Wilson "Little Will" mag-mount CB antenna at Overstock.com for $39 that will probably outperform anything from The Shack and can be trimmed to use on the 10 meter ham band. At least it will stay on the car at highway speeds!

FRS/GMRS Radios

When the FCC first authorized the Family Radio Service (FRS) it was hoped that it would be the new Citizens Band, offering essentially the same range with dozens more channels and privacy unknown on old-fashioned CB sets. And, the service has been wildly successful. Tens of millions of these two-way radio sets have been sold over the last decade. Families use them on trips and vacations; children use them at play; hunters and fisherman use them in the woods and on the water. They're packed with features CB sets never imagined in a size that truly fits in a shirt pocket. Some models include NOAA weather radio reception, many offer hands-free VOX operation, Direct Call, and privacy codes to allow you thousands of channels to choose from.

Midland Radio's GXT1000VP4 ($80/pair) is a top-quality FRS/GMRS HT set. Ignore the mileage claims and check out the features: rechargeable batteries/charging cradle, boom/mics for hands-free VOX operation and plenty of privacy channels. (Courtesy: Midland Radio)

There is one feature on all of these radios that's totally bogus: mileage. The smallest sets claim communications are capable up to 16 miles while the best claim up to 36 miles. Most hams know that, in theory, your five watt 2 meter HT is perfectly capable of contacting the International Space Station some 200 miles in the sky. Conditions have to be just right but, it can be done. Still, you don't see ham radio HT manufacturers plastering that claim on their sets. But, the FRS industry somehow found itself in a mileage war and, once it started, no one wanted to quit.

The fact is, that under perfect circumstances, as performed by the manufacturer's engineers, such mileage claims can be verified, but, as with EPA car mileage claims: your mileage will vary. Most units will not be able to achieve intelligent communications beyond a 3 mile limit regardless of their packaging claim unless you're out on the water or on a very high mountain looking over a vast desert.

Since mileage claims can be dismissed, shop for the features you want. All sets are sold in pairs. Better sets come with rechargeable batteries and recharging cradles. Look for sets that include headset boom-mics for hands-free VOX operating and NOAA weather radio reception with S.A.M.E. capability.

In addition to the FRS frequencies, most sets include General Mobile Radio Service (GMRS) frequencies as well. There is no license requirement to use FRS channels, but the FCC does require a license to operate GMRS frequencies ($80). The trouble is that, even though it's so stated in all the manuals, hardly any of the tens of millions who have bought these sets have applied for the GMRS license. Though it's unlikely that you would be caught by the FCC for using those channels, if you were, it could result in a fine of $10,000. The real problem occurs when businesses use these radios regularly without a license and interfere with companies that are also using the same frequencies, but have a license. Once the FCC is brought in, fines will ensue.

One company of note, Tri-Square, offers two-way hand-held sets that are not technically FRS because they operate at 900 MHz. Their TSX300R 2VP ($80) has slightly less range, due to less power output than FRS units, but includes built-in NOAA weather radio and uses digital transmissions to achieve "10 billion channels." Their units also include boom/mics and rechargeable batteries/cradle.

Portable Shortwave Radios

This is without doubt the "golden age" of portable shortwave radios. Surface mount and LCD technologies have made portable shortwave sets more sensitive, more versatile and certainly more capable. The trend here is smaller, better quality, more features, and at lower prices than ever before. Gone are the clunky, oversized, under-performing, power-sucking sets of the past. New models feature built-in NiMH rechargeable batteries with the charger built-in; on most you can use an "old-school" tuning knob or direct-entry frequency tuning, and nearly all offer more memory than you will probably use.

Long-time radio manufacturers Grundig/Eton, Sony and Sangean still dominate the portable shortwave market. But, Kaito has brought innovative sets to the market. Their KA1121 and ever-popular KA1103, are driving trends toward features serious shortwave listeners want, including lower prices. Other models such as the Kaito 1123 appear to push the limits in size while still maintaining performance and features reserved previously for more expensive and much larger portables. While sets like the 1123 have notable drawbacks: inconvenient tuning and front-end overloading, their size and price make them attractive.

Kaito's KA1123 ($70), miniscule AM/FM/SW with built-in MP3 recorder pushes the limits on size and features. (Courtesy: Kaito U.S.A.)

What shortwave listeners are waiting for, though, is a portable DRM receiver. Such a receiver is said to be on the way from Uni-Wave dubbed the Di-Wave 100. Promotional material touts features that would bring shortwave listening from the Cold War era into the 21st century. It's difficult to know what the performance of such a radio will be, let alone the price, but once it is available look for prices to fall as competing models appear out of China.

The biggest question for consumers regarding today's miracle minis is longevity. My Uniden 2021 all-band shortwave portable with LCD display was purchased new in 1983 and it's been in daily use since. How long will today's LCD displays hold out? How well will today's wafer-thin circuitry wear?

Kaito's KA1103 gets great reviews every time out in MT. Size, price and performance makes this radio attractive to serious listeners on a budget. But, how will it hold up over time? (Courtesy: Kaito U.S.A.)

One last note about trends from these specialty radio manufacturers: Today's fashion is the heavy promotion of Internet radios. The market is awash with Sony, Sangean, C. Crane, and Kaito Internet radio sets. Many previously unheard of brands such as Grace, iLuv, and Tangent have joined the fray. And now, even Cobra Electronics, long-time CB radio maker, is in on the rush to Internet riches. The trouble is that these radios are not cheap, typically $100–300, they're certainly not portable, and, to be useful, require consumers to have high-speed Internet service with a wireless network router in the home.

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The Expert's Guide to Buying an Antenna

By Bob Grove W8JHD

While all antennas serve the same basic purpose, to emit or accept signal voltages at radio frequencies, the "devil is in the details." Are we interested in directivity – favoring a particular compass direction? Is the required frequency range narrow or wide? Can the antenna be elevated or mounted at ground level? What frequencies are particularly important? Will the antenna be transmitting a signal or only receiving? Is an outdoor antenna out of the picture? Is the application portable? Mobile? Fixed? And, how about coaxial cable; are they all the same?

The radio marketplace bristles with antenna designs for virtually every application, but how do you make the best choice? Let's take a look at some typical questions – and the answers.

Q. *I live in a condominium with restrictions against outdoor antennas. I can remember reading that years ago shortwave listeners hooked their radios to bedsprings, rotary-telephone finger stops, and even through a capacitor to the house wiring. Are these contrivances still valid alternatives to an outdoor antenna?*

A. No. While all of these make-shift antennas work to some degree, the prevalence of modern household electric and electronic appliances produce enormous quantities of radio interference, especially at shortwave frequencies. Additionally, metallic obstructions like heating/air ducting, reinforcement rods/screen in walls, metalized Mylar insulation, and aluminum siding reflect and block radio signals. You will hear most major international broadcasters and some ham and utility shortwave stations, but they'll be heard amidst a mire of noise.

Q. *I enjoy scanner monitoring of local police, fire and ambulance calls. Is the attachable whip that came with my scanner going to be all I need?*

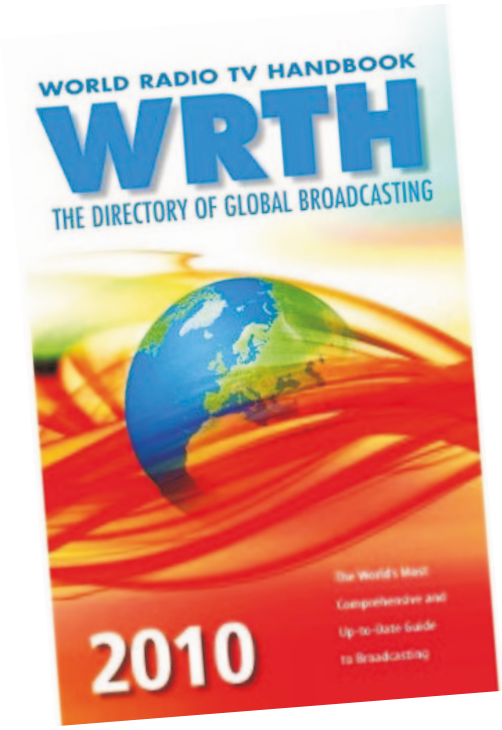
A. For the local repeaters up to several miles away, yes. In that case, it's best to put the scanner near a window on the side facing the activity. However, if you're at all serious and want to hear some distance away, especially listening to mobiles and hand-held radios, you'll need a good outdoor antenna.

While it's tempting to mount the antenna in an attic space, that's still not quite as good as being outdoors away from electrical wiring, ducting and other metallic surfaces and shields. Additionally, a higher location guarantees greater distances because of the curvature of the earth as well as the reduced likelihood of natural and man-made blockages between you and the target.

Q. *What about the line that connects the outdoor antenna to my receiver or scanner; can I use just about any type of coaxial cable?*

A. For receiving purposes, the impedance (50 or 75 ohm) is not important; what is important is the characteristic loss, the signal drop from absorption by the cable itself over a long length.

For shortwave applications (under 30 MHz), you can use any type of coaxial cable that's convenient – RG-58/U, RG-8/U, even TV-style



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RG-59/U and RG-6/U (my particular favorite). The worst cable is teensy RG-174/U, which is intended for short runs, and very lossy.

Remember, the higher the frequency, the greater the signal loss in the cable. For scanner listening at VHF (under 300 MHz), don't use RG-58/U for more than 50 feet. A much better choice is RG-59/U and the best of the four is RG-6/U. If you're really critical, operating at high UHF (450-1000 MHz), and your installation requires at least 100 feet, try a premium cable like LMR-400 (roughly $127 for 100 feet).

Q. *I've heard long-time hams talk about "ladder line"; what is it?*

A. It's like the old-style, flat, TV ribbon wire, only bigger and thicker! It has most of its insulation between the two parallel wire conductors punched out to reduce resistive losses when transmitters are hooked to it. This leaves a small rung of insulation connected between those wires every few inches, giving it the "ladder" look. The beauty of ladder line is that it's extremely low loss and allows a transmitter to be poorly matched to the antenna without losing its power heating up the insulation of the cable as it does with coax.

300 ohm and 450 ohm ladder line ($17-19 per 100' roll) used in construction of amateur radio HF antennas. (Courtesy: Universal Radio)

Q. *Are antennas designed for transmitting also good receiving antennas?*

A. Absolutely. But the converse isn't true; just because an antenna receives well doesn't mean it is the best choice for transmitting. The reason is that transmitting antennas are meticulously adjusted for the best impedance match with the transmitter/transceiver, but just because you hear signals well on a randomly-designed antenna doesn't mean it will properly match a transmitter.

Q. *I'm only interested in listening to distant shortwave signals. What's the least expensive way to design an antenna for this application?*

A. Any kind of wire (stranded or solid, thick or thin, insulated or uninsulated, aluminum clothesline, steel or copper). Yes, I can hear it now: "Aluminum corrodes, steel rusts, and thin wire breaks!" That's true, but all of them receive the same! For best results, use 40-50 feet of convenient, reasonably strong copper wire; locate it away from your house and away from power lines; elevate it as high as practical; position it so that its sides face the target direction; and feed it with RG-58/U coax to your receiver.

FlexWeave 14 gauge stranded copper antenna wire ($20 for 100') is strong, easy to work with, and makes a great shortwave or amateur radio wire antenna. (Courtesy: Universal Radio)

Q. *I have a chance to buy a used antenna that's presently on a tower for only a fraction of its original cost; is that a good investment?*

A. Only if it isn't corroded or weather-beaten. Check it thoroughly for signs of abuse, repair, rust and other corrosion. Generally speaking, antennas near saltwater beaches corrode faster than those farther inland. If it passes the test, have at it! But, safety first: To remove an antenna from a tower may require you to rent a "cherry picker" or hire experienced tower climbers with appropriate safety gear to do a safe removal. Consider those potential costs as additional to the "asking" price.

Q. *I've noticed that several scanner antennas, and even some HF (shortwave) antennas, are advertised as having very wide frequency ranges. Does this mean that they transmit as well as receive over these wide spans?*

A. No. If an antenna is designed for reception purposes, little attention is paid to impedance matching, so if you try transmitting with it, it is likely to have high reflected power which translates to losses in the coax transmission line. Reputable manufacturers will specify the recommended, and usually reduced, transmit-frequency range as well as the receive range on their antennas.

Q. *There are many brands of antennas out there that have been around for quite a while. Which ones are best?*

A. Actually, if the antennas have been marketed for several years, they probably have a good track record. Decide which antenna will do what you need for the lowest price, then, buy it from an established dealer.

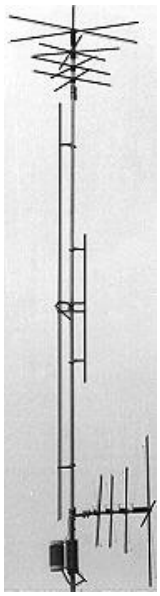
Q. *I want to hear stations from the greatest distance over the widest frequency range on my scanner; what kind of antenna do I want?*

A. For that demand, you'll need a log-periodic dipole array (LPDA) and a rotator on a tower, connected to your scanner with low-loss cable. Two of the most popular beams are the Create 5130-2N and the Grove Scanner Beam, both of which cover roughly the same frequency range. The Create is sturdier, but at a considerably higher price. For antennas of this size, a small TV-style antenna rotator will suffice.

VHF-UHF Log periodic dipole array (LPDA) receives 105-1,300 MHz (17 elements on a 4' boom): $300. (Courtesy: Create Antennas)

Q. *For VHF/UHF scanner listening, do I want a vertical antenna or a horizontal antenna?*

A. Vertical. If you note the transmitting antennas on base locations, they are vertical, as are the receiving antennas on mobile units. Even a handy-talkie works more reliably when held in a vertical position, matching the units with which it is communicating.

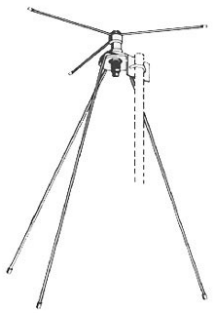


Wide-band HF antennas, such as this MFJ-1796 40-2 meter vertical ($230) could be the solution for hams with little or no real estate. It's 12' high and takes up only 24 square inches of patio, lawn or balcony space. But, safety first: make sure people and pets can't come into contact with the radiator. (Courtesy: MFJ Enterprises)

Q. *How about shortwave listening and HF transmitting? Vertical or horizontal?*

A. Now you've opened a can of worms! There are devotees to both polarizations. Over the considerable distances of shortwave signal propagation, signals have a tendency to mix and blend in both polarizations regardless of the original polarization of the transmitting antenna that you are trying to receive; thus, the polarization is unimportant.

More important are your real estate limitations. A horizontal wire must be suspended high; even a sloper must have one end high. This requires a high mounting point or points – a tower, mast, tree, or dwelling peak.



A VHF-UHF scanner antenna such as this Hustler DCX vertical ($25) might be a good omni-directional transmitting antenna for 2 meters and 70 cm as well, but keep the power output low. (Courtesy: Universal Radio)

When properly installed in the open, and high above the ground, a horizontal wire has two directions for transmitting and receiving – at right angles to the axis of the wire. It is virtually deaf directly off the ends. A vertical antenna in the clear has an omnidirectional (circular) pattern for transmitting and receiving and can be secured on the ground.

MT

Big Savings on Radio Scanners

Uniden® SCANNERS

Bearcat® 796DGV Trunk Tracker IV with free scanner headset

Manufacturers suggested list price $799.95

CEI Special Price $519.95

1,000 Channels • 10 banks • CTCSS/DCS • S Meter

Size: 6 15/16" Wide x 6 9/16" Deep x 2 3/8" High

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When you buy your Bearcat 796DGV Trunktracker package deal from Communications Electronics, you get more. The GV means "Great Value." With your BC796DGV scanner purchase, you also get a **free deluxe scanner headphone** designed for home or race track use. Headset features independent volume controls and 3.5 mm gold right angle plug. The 1,000 channel Bearcat 796DGV is packed with features to track Motorola Type I/II/IIi Hybrid, EDACS, LTR Analog Trunk Systems and Motorola APCO 25 Phase I digital scanner including 9,600 Baud C4FM and CQPSK. Also features control channel only mode to allow you to automatically trunk many systems by simply programming the control channel, S.A.M.E. weather alert, full-frequency display and backlit controls, built-in CTCSS/DCS to assign analog and digital subaudible tone codes to a specific frequency in memory, PC Control and programming with RS232C 9 pin port (cable not supplied), Beep Alert, Record function, VFO control, menu-driven design, total channel control and much more. Our CEI package deal includes telescopic antenna, AC adapter, cigarette lighter cord, DC cord, mobile mounting bracket with screws, owner's manual, trunking frequency guide and one-year limited Uniden factory warranty. For maximum scanning enjoyment, order magnetic mount antenna part number ANTMMBNC for $29.95. For complete details, download the owners manual from the **www.usascan.com** web site. For fastest delivery, order on-line at www.usascan.com.

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Manufacturer suggested list price $299.95

CEI Special Price $169.95

250 Channels • 5 banks • PC Programmable

Size: 7.06" Wide x 6.10" Deep x 2.44" High

Frequency Coverage: 25.0000-54.0000 MHz., 108.0000-174,.0000 MHz., 400.0000-512.000. MHz., 806.0000-823.9950 MHz., 849.0125-868.9950 MHz., 894.0125-956.0000 MHz.

The Bearcat BCT8 scanner, licensed by NASCAR, is a superb preprogrammed 800 MHz trunked highway patrol system scanner. Featuring TrunkTracker III, PC Programming, 250 Channels with unique BearTracker warning system to alert you to activity on highway patrol link frequencies. Preprogrammed service searches makes finding interesting active frequencies even easier and include preprogrammed police, fire and emergency medical, news agency, weather, CB band, air band, railroad, marine band and department of transportation service searches. The BCT8 also has preprogrammed highway patrol alert frequencies by state to help you quickly find frequencies likely to be active when you are driving. The BCT8 includes AC adapter, DC power cable, cigarette lighter adapter plug, telescopic antenna, window mount antenna, owner's manual, one year limited Uniden warranty, frequency guide and free mobile mounting bracket. For maximum scanning enjoyment, also order the following optional accessories: External speaker **ESP20** with mounting bracket & 10 feet of cable with plug attached $19.95. Magnetic Mount mobile antenna **ANTMMBNC** for $29.95.

Bearcat® BCD396T Trunk Tracker IV

Suggested list price $799.95/**CEI price $519.95**

APCO 25 9,600 baud compact digital ready handheld TrunkTracker IV scanner featuring Fire Tone Out Paging, Close Call and Dynamically Allocated Channel Memory (up to 6,000 channels), SAME Weather Alert, CTCSS/DCS, Alpha Tagging. Size: 2.40" Wide x 1.22" Deep x 5.35" High

Frequency Coverage:

25.0000-512.0000 MHz., 764.0000-775.9875 MHz., 794.0000-823.9875 MHz., 849.0125-868.8765 MHz., 894.0125-956.000 MHz., 1240.0000 MHz.-1300.0000 MHz.

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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Bearcat 796DGV 1,000 channel Trunktracker III base/mobile	$519.95
Bearcat BCD396T APCO 25 Digital scanner with Fire Tone Out	$519.95
Bearcat 246T up to 2,500 ch. Trunktracker III handheld scanner	$214.95
Bearcat Sportcat 230 alpha display handheld sports scanner	$184.95
Bearcat 278CLT 100 channel AM/FM/SAME WX alert scanner	$129.95
Bearcat 248CLT 50 channel base AM/FM/weather alert scanner	$104.95
Bearcat 92XLT 200 channel handheld scanner	$109.95
Bearcat 72XLT 100 channel handheld scanner	$99.95
Bearcat BR330T up to 2,500 ch. Trunktracker III with Tone out	$274.95
Bearcat BCT8 250 channel information mobile scanner	$169.95
Bearcat 350C 50 channel desktop/mobile scanner	$104.95
AOR AR16BQ Wide Band scanner with quick charger	$199.95
AOR AR3000AB Wide Band base/mobile receiver	$1,079.95
AOR AR5000A+3B Wide Band 10 KHz to 3 GHz receiver	$2,599.95
AOR AR8200 Mark IIIB Wide Band handheld scanner	$594.95
AOR AR8600 Mark II Wide Band receiver	$899.95
AOR AR-ONE Goverment/Export sales only 10 KHz-3 GHz	$4,489.95
Scancat Gold For Windows Software	$99.95
Scancat Gold for Windows Surveillance Edition	$159.95

Bearcat® BC246T Trunk Tracker III

Suggested list price $399.95/**CEI price $214.95**

Compact professional handheld TrunkTracker III scanner featuring Close Call and Dynamically Allocated Channel Memory (up to 2,500 channels), SAME Weather Alert, CTCSS/DCS, Alpha Tagging. Size: 2.72" Wide x 1.26" Deep x 4.6" High

Frequency Coverage:

25.0000-54.0000 MHz., 108.0000-174.0000 MHz., 216.0000-224.9800 MHz., 400.0000-512.0000 MHz., 806.0000-823.9875 MHz., 849.0125-868.9875 MHz., 894.0125-956.000 MHz., 1240.0000 MHz.-1300.0000 MHz.

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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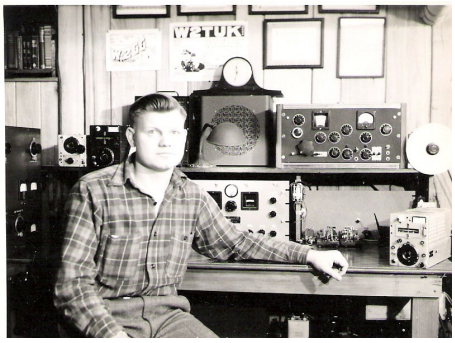
A Life of Service in Amateur Radio

Photo by Ken Reitz KS4ZR

This story begins many decades ago when a young lad of ten fell from a garage roof while trying to catch a swinging rope and hit the ground on his stomach. As it turned out, no injuries were sustained, but the parents of this fellow put him on house restriction and no more catching of ropes hanging from a tree!

What to do about this parental decision? Obviously, it was the end of all the fun, but was it? As a diversion from this outside activity, our young lad turned to his best friend and they decided to learn the Morse code (CW) together using little buzzer units connected by wire from room to room. It wasn't long before both boys became code proficient with increasing speeds.



Harry Dannals as W2TUK in 1947 at age 19 in the station he shared with his dad, W2GG, using an ARC-5 converted military transmitter for 80 meters and a BC-779 (WWII version of the Hammerlund Super Pro). (Courtesy: Harry Dannals W2HD)

Before long the young lad was listening to CW on the amateur radio receiver that his dad, W2GG had, and a life-long interest in ham radio quickly developed. As you now certainly know, that person was your writer and a wonderful and fascinating life began that has covered seven decades. The story continues today and what follows are highlights of that time.

Budding Ham Career Interrupted

As a twelve year-old I would often help my dad, the commanding officer at his Naval Communications Reserve group on Long Island, by sending CW to Navy trainees. Sometimes, when dad was on a distant assignment, "bootleg" radio contacts were made on CW between my dad and mom. Mom would read my code copy over my shoulder and tell me what to send.

A year later I found myself riding in a National Guard half-track in Clearfield, Pennsylvania, as the radioman, relaying our position in CW to the other half-track on maneuvers whose radioman was my dad. I got the job because the actual operator had called in sick. My dad told the National Guard Commander that I could do the job and he said, "But, isn't he just a kid?" My dad said, "Yes, but he's a better operator than anyone else here."

Dad was called to active duty in early 1941, assigned to Norfolk, Virginia and, unfortunately, study for my ham radio license took a step backward because moving required school changes and keeping up with school work was very important. Dad was then sent to the Panama Canal Zone as Officer-In-Charge of a radio receiving site. World War II started just weeks later. By then the federal government had banned all amateur radio activities and the ham bands went silent. My plans for a license had to be put on hold.

After graduation from Balboa High School, in the Canal Zone, my Navy life began for real. My dad was my first commanding officer, something never to be recommended! There was no "boot camp," so my first assignment was washing dishes while attending radio classes on the local base. The classes were easy because my code speed was now more than 25 words per minute.

Since Navy operating procedure had been part of my early life with my dad, all that was necessary was learning to type. I began standing radio watch at the receiving site at the age of 17 and another phase of my life began with my entry into a career in electronics, radio, and communications.

Learning quickly about the operation of our radio equipment and, having a deep interest in naval communications, led to early promotions. Eventually I became the supervisor of more than 20 radiomen and support personnel. Radio Balboa, with the call sign NBA, was one of the Navy's key radio stations and it was an honor to be the youngest Watch Supervisor at that time at the age of 18.

Another Try at a Ham Ticket

Discharge from the Navy came in mid-1946 and I found myself back in the U.S. after almost

W2TUK in the attic shack at his first home with his wife Kay in Bethpage, on New York's Long Island. On the bench: a Johnson Viking II transmitter with VFO, a Collins 75A4 receiver, and Johnson MatchBox that fed a 40 meter dipole. (Courtesy: Harry Dannals W2HD)

five years away. I was ready for another phase in life; one that I hoped would include a return to studying for an amateur radio license. I had enrolled at Polytechnic Institute of Brooklyn (now Polytechnic Institute of New York University), majoring in electrical engineering with an emphasis on electronics. I was eager to learn as much as I could about the fast changing world of electronics.

College work required a lot of time, but I found a way to prepare for my amateur license by doing a research paper for an English class using amateur radio as a resource. Among my references was the American Radio Relay League's (ARRL) *Radio Amateur's Handbook* with the latest ARRL license manual on the side! It worked, and my call sign, W2TUK, was received that year with a great deal of joy by me and my dad.

My early days as a licensed ham started with the handling of messages on the air, something that had been a major part of my Navy career. This also began my association with the ARRL, an organization which has been a very important part of my ham radio involvement.

Graduation from college in 1950 was a milestone that led to my employment at the Sperry Corporation where I worked in radar and other engineering programs. But, Sperry, too, had a connection with ham radio. During almost

In 1964 at the New York World's Fair, Dannals was trustee for K2US, the official U.S. amateur radio station. Here he's at the key of an all-Hallicrafters station. (Courtesy: Harry Dannals W2HD)

40 years of my employment there, the company provided a club station, W2YKQ, which was on the air during lunch periods, a fact that made the more than 200 ham radio operators that worked at Sperry very happy.

But, let's get back to the days after graduation. Another avenue had been opened when I applied for a direct commission as a naval officer which resulted in a new Ensign being added to the ranks. The Naval Security Group program was anxious to have qualified applicants and a new naval career for me soon followed. The final result of several decades of service as commanding officer of two highly rated Security Group divisions and an association with the communications world, ended with my retirement from the Navy as a full Commander in 1987.

Kay Enters the Scene

Before returning to my association with the ARRL, there is a very important part of my life that must be told. It involves meeting a very pretty, pleasant employee at Sperry whose carpool had busted up with a change in overtime work hours. She was in this carpool with another rider who needed a ride and he was, of all things, one of the Sperry hams. He approached me for a ride and that was OK. Then he said there was another person who needed a ride from the same pick-up point. My answer was simply that, while he was an old friend, someone else was going to be a newcomer to me and was questionable as a passenger. However, he was convincing and the gal who has been my wife for almost six decades was that passenger!

Mid 1990s W2HD is at the key for Field Day at WA4TFZ, club station for the Albemarle Amateur Radio Club (Charlottesville, VA). (Courtesy: Harry Dannals W2HD)

Kay and I have had a wonderful, busy life with four kids (two boys and two girls); twelve grand-children, and three great-grandchildren. Without her support for my involvement in amateur radio, there would simply be no story to tell. I thank Kay many times over for enabling my amateur radio activity.

As part of this story of ham radio and family, it should be mentioned that I am the son of a ham (K4GG when he became a Silent Key); the brother of three hams: Frank (W2DRL) and two who have become Silent Keys. And, I'm the father of two hams, Bob (W2GG, my dad's old call) and Tom (W2TUK, my old call). It's fun to have ham radio as a bonding tool.

The League Beckons

And now, back to the ARRL. During my direct involvement with the League, I have held many offices at various levels. As part of the League's field organization, I received appointments as Official Relay Station (ORS); Official Phone Station (OPS); Official Observer (OO), and Emergency Coordinator (EC). In the area of elected office I have been Section Communications Manager (SCM), the vice-director and director of the ARRL Hudson Division.

I was elected League president by the ARRL Board in 1972 and returned for a total of five two-year terms ending in 1982. It was my pleasure to serve the Amateur Radio Service which had given me so much over the years.

While, presiding over meetings of the Board and the Executive Committee was the responsibility of the office, to me, there was a message to be delivered to the League's membership and also to those hams who were not members.

This message is simple: Amateur radio is a service organization established with a basis and purpose as set forth by the Federal Communications Commission (FCC) in simple terms with the following key points: It is a voluntary, noncommercial, communication service, particularly with respect to providing emergency communications; to demonstrate a proven ability to contribute to the advancement of the radio art; to provide for advancing skills in both the communication and technical phases of the art; to provide trained operators, technicians and electronics experts; and finally, the extension of the amateur's unique ability to enhance international goodwill.

That was the key message I brought with me as I visited all fifty of the United States during my ten years in office. Many of my addresses to the assembled groups started out with the words, "I am proud to be a radio amateur because we continue to be responsive to our basis and purpose."

In addition to the visits to all 50 States, trips were made to the Canal Zone, Puerto Rico, Canada, Mexico, Chile, Peru, the Bahamas, Bermuda and the United Kingdom. Many of the visits to the countries beyond our borders were made as the U.S. representative to Region II of the International Amateur Radio Union (IARU). It was interesting to note as I traveled abroad that the ARRL and U.S. amateur radio was well respected and looked to for leadership in our mutual interest.

The Politics of Ham Radio.

One of the key events during my presidency was the preparation for the World Administrative Radio Conference (WARC) of 1979. The future of our radio frequency bands was of prime importance with retention and possible expansion as goals. ARRL staffers as well as volunteers were deeply involved with this effort. The concept of an additional band or more to bridge the gap between the existing Amateur Radio assignments had been set forth by A. Prose Walker of the FCC.

He envisioned having new bands between 40 and 20 meters; between 20 and 15 meters, and between 15 and 10 meters. The League took the concept into its workload by preparing details and promoting the idea with other countries seeking their support at the WARC level.

Vic Clark, W4KFC, then ARRL First Vice President (now a Silent Key), was asked to visit and work closely with IARU Region II countries in South and Central America plus the Caribbean islands. He performed this task with tremendous success and all of the countries in Region II voted in support at the WARC. All their efforts paid off with very successful results. The 30, 17 and 12 meter bands were approved with small, but foothold, assignments.

During my tenure, I made frequent visits to FCC offices in Washington to discuss ham radio repeater issues, possible expansion of Citizen Band (CB) frequencies, and other points. The CB subject ended with a congressional hearing on a Class "E" service taking the 220 MHz band from ham use to CB. My appearance before the hearing committee was to defend the continuation of the ham radio assignment and we were successful at that time. Subsequently, however, 40 percent of the band was lost to others (not CB) due to our lack of use. The remainder of the band is presently in use by hams for repeaters, links and other activities.

Another appearance before a Congressional Committee was concerned with radio frequency interference (RFI) to devices in the TV and audio field. Ham radio was successful here also; making the point that interference was not due to our equipment, but the lack of adequate filtering in the external device.

Without question, the time devoted to ARRL matters, working with the very capable and dedicated staff, and my association with the board of directors was a wonderful experience. Each year was punctuated by new developments for ham radio. A volume of great memories will never be forgotten.

Another chapter in my life began with the Quarter Century Wireless Association (QCWA) as a director and then president from 1989 to 1994. It is interesting to note that this was the first time that one person had held both offices.

As a licensee for 63 years, I am still active every day on the ham bands from my home in Charlottesville, Virginia and, if you tune to 14.291 MHz, you can hear me daily on the Sperry Net.

It has been a very interesting life. The challenges of new avenues in communication are wonderful to observe and, I believe, will keep amateur radio alive and well for decades ahead. I hope to meet you there!

MT

Ken Reitz, KS4ZR
kenreitz@monitoringtimes.com

How to Beat the Dismal Sunspot Cycle: Go Digital

Several years ago, like most hams, I was bemoaning the state of the sunspot cycle, – or more properly, the non-sunspot cycle – occurring just when I had been bitten by the DX bug. It just didn't seem fair. Then one day a casual mention from *MT* assistant editor, Larry Van Horn N5FPW sent me scurrying to the friendly confines of the more popular digital modes: PSK31 and RTTY. It was so much fun that I've operated almost exclusively in those modes since.

The Many Modes of Digital Operating

I had heard of RTTY (short for radioteletype) many years before. The term mostly conjured images of old-time Associated Press Teletype machines clacking away in the back rooms of radio stations and newspaper offices. Large boxes of continuous-fold AP copy paper spooled up into the machine's constant chatter and dropped neatly printed with the latest news into a box to be culled by various editors. But, that's an image from a half century ago.

The RTTY now used by hams is merely one of several software programs that can be downloaded into your computer (usually for free) and interfaced to your HF transceiver. The interface can be one of many manufactured units such as the Tigertronics SignaLink USB (see photo), but shortwave listeners can tune in these digital conversations by simply taking the audio output of your receiver and plugging it into the microphone input of your computer's soundcard: no need for an external interface. Adjusting the volume on the receiver will help get good copy: too much volume will distort the signal, too little will make the signal unreadable.

West Mountain Radio offers a wide range of products such as the RIGblasterPlus and RIGblasterPro that interface between your computer and your radio with prices ranging from $120-350. (Courtesy: West Mountain Radio)

Tigertronics' SignaLink USB ($100) is a compact digital interface that comes with a CD of software for the most popular digital modes including PSK31, SSTV, CW, RTTY, AMTOR, and Packet. (Courtesy: Tigertronics)

Current digital mode software programs are not just for RTTY, but typically handle most other digital modes, including the oldest digital mode of them all: CW (Morse code). They can also do PSK31 (Phase Shift Keying at 31 baud); Slow Scan TV (SSTV, a painfully slow way to transmit a still TV image); Packet transmissions (also common at VHF or UHF frequencies, using repeaters or amateur satellites), and a few other lesser used modes. The bulk of most HF digital mode operating is done with PSK31 and RTTY.

Slow but Sure

PSK31 and RTTY are relatively slow modes that don't offer Forward Error Correction (FEC) or allow big chunks of data to be exchanged quickly. Letters are sent as they are typed on the computer keyboard. To speed things up, as in CW, a "code" of abbreviations is often used: "BTU = Back To You," "TNX FB QSO = Thanks for the Fine Business (great) QSO (conversation)," etc. A QSO can go as fast as you can type.

Digital mode operators typically transmit at under 25 watts, many at far less than that, for two reasons. First, the nature of the narrowband transmission, especially PSK31, makes this mode a DX mode. It is seemingly immune to the vagaries of poor band conditions, static, fading and other forms of interference, so there's no need to run high power. Second, increasing the power simply makes the signal more broadband, not necessarily easier to copy. There's no better way to earn the wrath of your fellow PSK31 operators than to crash onto the frequency with a "dirty" .5 kHz-wide signal. The best compliment you can receive is that your digital signal is "clean."

Still, it's possible to run high power and put out a clean digital signal. Many operators from Asia run as much as 500 watts and put out terrific (and clean) digital signals. But, they have to have the sensitive antennas to match their big signal output to avoid being "alligators"– all mouth, no ears.

Just how great is PSK31 as a QRP, poor-

ARRL BAND PLAN FOR DIGITAL MODES

Band (Meters)	Frequency MHz	Mode, Notes
160	1.800-1.810z	PSK31, RTTY, other digital modes
160	1.843-2.000	SSTV, SSB and other wideband modes
80	3.570-3.600	Domestic RTTY, PSK31 and other digital modes
80	3.590	RTTY and other digital modes DX Operating Frequency
40	7.040	RTTY and other digital modes DX Operating Frequency
40	7.080-7.125	Domestic RTTY, PSK31 and other digital modes
30	10.130-10.140	All RTTY
30	10.140-10.150	Packet
20	14.070-14.095	RTTY (Most PSK31 in centered at 14.070)
20	14.095-14.995	Packet
20	14.230	SSTV Calling Frequency
17	18.100-18.105	PSK31 and RTTY
17	18.105-18.110	Packet
15	21.070-21.110	RTTY, PSK31
15	21.240	SSTV Calling Frequency
12	24.920-24.925	RTTY, PSK31
12	24.925-24.930	Packet
10	28.070-28.150	RTTY, PSK31 (Most PSK31 in centered at 28.120)
10	28.680	SSTV Calling Frequency
6	50.620	Packet Calling Frequency
6	51.120-51.180	Digital Repeater Inputs
6	51.620-51.680	Digital Repeater Outputs
2	145.01,03,05,07,09	are widely used for Packet
2	145.800	International Space Station Packet Repeater Downlink

The MFJ-1275 ($110) is a versatile digital interface that comes with a power supply and RS-232 cable. (Courtesy: MFJ Enterprise)

band-conditions mode? My first contact was on a seemingly dead 15 meter band. I had been "reading the mail" on 20 meters to get my feet wet in copying this mode, but was reluctant, due to the crowded conditions on 14.070, to try my hand at a QSO. So, I moved up to 15 meters. On arriving at 21.070 MHz I was disappointed to see that, unlike 20 meters which had 10 or 15 separate QSOs transmitting simultaneously, there were no signals. I tuned up to the SSB portion of the band and heard nothing. There weren't even any signals in the CW basement of 15 meters.

I kept the transceiver tuned to 21.070 and kept working at the desk, glancing now and then at the screen that would indicate the presence of a signal. One time I saw a very small spike on the screen indicating a transmission. It might have been just a random tone. I placed the cursor over the peak of the signal and watched the screen. In a few seconds a CQ from SV8UM, Aegina Island, Greece, magically appeared on the screen. I clicked the transmit button on the HamScope screen and started typing. Minutes later I had completed my first digital QSO on what had been an otherwise "dead" band.

In the last four years, and at the worst possible part of the solar cycle, I've worked a total of 188 countries using digital modes (ARRL DXCC awards don't make any distinction between PSK31 and RTTY modes, both are considered "digital" modes for their awards purposes) and confirmed 155 of those contacts. In fact, if it weren't for digital operating, I would not have worked many countries that I hadn't previously gotten on SSB, including Mongolia, Tajikistan and Antarctica.

❖ Becoming a Savvy Operator

It takes a while to become a proficient operator in the digital modes. Two things seem to be the most difficult for beginners. One is just learning the use of all of the options available on any of the digital programs. Getting used to the various modes, setting the polarity (reverse polarity for bands below 30 meters) and setting the balance from your computer's audio card to avoid overdriving the audio input, and using "macros." A macro is a ready-made stream of information that you prepare yourself and is used to speed up the typical exchange of information in a QSO.

That brings me to the second biggest problem with these modes. Many hams are terrible typists. Some of us are a little older and have trouble seeing what we're doing and so make a lot of typographical errors (referred

SV8UM
- AEGINA ISLAND -
Η ΠΡΩΤΗ ΠΡΩΤΕΥΟΥΣΑ ΤΗΣ ΝΕΟΤΕΡΑΣ ΕΛΛΑΔΟΣ
THE FIRST CAPITAL OF MODERN GREECE
JOTA EU-075 LOCATOR KM17RS
PELOPONISOS EAST
CONFIRMING QSO WITH RADIO
K,S4ZR.
DATE
05.01.05
G.M.T. 1438 | MHZ 21071 | MODE PSK31 | RST 5-9-9
TKS QSL PSE
NEKTARIOS LAVOUTAS
QTH 1, AG. ASOMATON STR., KIPSELI GR 130 10
AEGINA ISL. HELLAS (GREECE)

QSL from SV8UM on a "dead" 15 meter band. (Courtesy: Author)

to as having "fat fingers"). Others are simply "hunt-and-peck" typists, which really slows down the QSO speed.

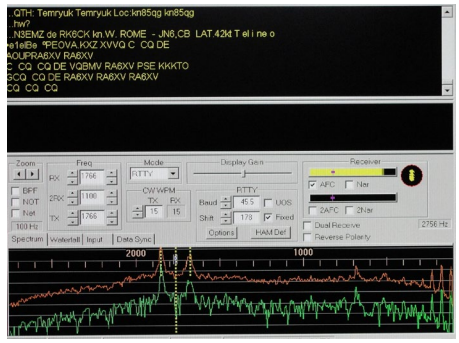
By pre-setting your macro buttons you can place your cursor on the proper macro and simply click it. Miraculously, a stream of typing begins to appear on the screen (without errors) that makes it seem like you're a really great typist. Instructions on setting up macros vary from program to program, but once you figure it out, you can tailor your macros to respond to many common on-air questions.

Many hams have complete lists of everything in their shack on these macros and this works well in many QSOs; it's often part of the "first QSO protocol" between stations. But, not with a rare DX station. It's the second way to earn the wrath of your fellow digital mode operators: hitting the macro containing your "brag" file. The minutes drag by while your computer details every little power supply and connector in your shack; every detail about your computer and the interface you're using. For this reason some DX operators, when sending a CQ, finish their call with the words "no brag files, please."

Most digital QSOs are done simplex: the transmitting frequency is the same as the receiving frequency. In the case of a rare DX station, especially a DXpediton station, operating simplex is inviting total chaos on the frequency. Better DX operators choose to operate "split" on digital modes. They will explain their operation in their CQ. For example: "CQ CQ CQ de FR1HA up 2 QRZ?" That means "I'm calling all stations and listening up the band 2 kHz, any station come now." So, if the DX station is transmitting on 14.084 MHz that means that he or she is listening for your call on 14.086 MHz, not 14.084.

Sometimes, particularly during a DXpedition, the station will be even more specific: "CQ CQ CQ de 3Y0X listening up 2-4 NA only." That means, "I'm transmitting here but listening between 2 and 4 kHz up the band for North American stations only." To work a station operating split, you have to set your transceiver to do so, too. Your owner's manual will explain how this is done. A third way to irritate all other digital mode operators is to ignore the DX station's instructions and send your call on the proper frequency when you're not from the area the station is asking for.

Sometimes stations responding to the



Typical RTTY screen shows the distinctive twin peaks of a RTTY signal, in this case, RK6CK, Temyruk, Russia. (Courtesy: Author)

DX station forget to set the split button on their transceiver and mistakenly transmit on the DX station's transmitting frequency. The DX station can't hear that you're transmitting on his frequency, but everyone else can. That usually brings out the "frequency cops" who add to the chaos by sending "up up up up up, lid…he's listening up, you idiot… what don't you understand about up?, etc." So, check your transceiver to make sure your settings are correct before you hit the transmit button and save us all a lot of grief.

There are times, particularly during a rare DXpedition, that the DX station takes up a big chunk of a particular band by announcing that they are listening up (and sometimes down!) 10 or 20 kHz. This makes it hard for any other digital operators to function on the band, as every kHz is taken in a 20 kHz segment by hard core digital DXers eager to put this one in the log. Many will trample on anybody's QSO just to log the DX. So, before you transmit, see if there are any other non-participating QSOs happening on the frequency on which you're about to transmit. If there are, move.

And, finally, there are many chances to rack up your DXCC count during the seemingly innumerable digital mode contests. These contests can also create a lot of animosity among non-digital operators by causing the contesters to occupy great amounts of a band that may be typically used by other modes. Try to avoid interfering with the enjoyment of our crowded ham bands, particularly on the weekends when these contests are often held. It's called being a "considerate operator" and, it's the true ham spirit.

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Looking for South Africa? Try the Internet!

If you ask shortwave radio enthusiasts for their favorite part of the world to tune in, many would say Africa. But in recent years, the opportunities to tune in stations from this part of the world have been greatly reduced. Thankfully, the Internet continues to provide an option for the world to listen to many of these stations, especially those originating from South Africa.

I started my search of South African radio stations by listening to 702 Talk Radio in Johannesburg, where the topic of the moment was American celebrities who were coming to African countries and adopting children "as a fashion accessory." There was also discussion about global diamond prices and their effect on the local economy.

Next, it was a trip to Cape Town's Bush Radio 89.5 FM. After a few station promos for "the best hip-hop from South Africa," the music began. The station really does offer a good mix of both local hip-hop artists as well as artists from the United States, the United Kingdom, and elsewhere.

Staying in Cape Town, I found some more traditional African sounding music on Tygerberg FM 104. While not in English, the station did have a pretty good mix of music from the region, in the style of Paul Simon's "Graceland" album.

More of a Western music feel could be found on Port Elisabeth's Algoa FM. During my listening session, the mix of a British sounding personality and a mix of current hits and those from the 1980s made it almost feel as if I was listening to a station in Britain or Australia.

Cape Town seems to have more stations with an American sound than do some of the surrounding towns. Examples of these are KFM 94.5, which also features British-sounding imaging and pop music from America; SA FM was playing Peaches and Herb's "Reunited" during my listening session, but the station features South African personalities. While I was listening, local callers were calling in debating ways to fight the AIDS epidemic in South Africa.

Overall, there seems to be a good mix of South African culture to be found from the country's local radio stations, but as one of the more advanced countries in Africa, there is a large dose of Western culture influencing the programming as well.

In the GlobalNet links below, you will find a site listing all of the stations mentioned here as well as a few others.

Shortwave listeners might be familiar with Channel Africa, but it can be difficult to tune in from the United States. Have no fear, the Internet provides another option for listeners. The station that claims to be "the gateway to Africa" provides a wide variety of programs, each highlighting a different aspect of African culture. A full broadcast schedule can be found on the Channel Africa Web site.

❖ Internet Radio Bucks the Trend

While the terrestrial radio industry is on the verge of collapse or at the very least in a major decline, Internet radio is seeing further growth not only in the amount of advertising revenue it is bringing in, but also in the number of listeners that are jumping on board.

Recent surveys by both Arbitron and Edison Research show the number of Internet radio listeners over the age of 12 in the United States has grown to more than 42 million. That is an increase in share from 13 percent in 2008 to 17 percent in 2009. Also, when you combine projected revenues for Internet radio and podcasting advertising, some surveys see as much as a 28 percent increase in revenue for the industry.

But true trends are hardly ever noticed in the span of a year. So what does the growth curve look like in the past couple of years? In short, explosive.

According to a report published by *Media Daily News*, from 2006 to this year, traditional media saw a 30 percent drop in advertising revenue, while Internet advertising grew in that same period by some 37.5 percent.

What does this mean for the streaming enthusiast? Think of it as something like job security. If the industry continues to grow as it currently is, the impetus for broadcasters to embrace the Internet market should only increase.

There had been some concern that with the struggling global economy, Internet products would be the first to take a hit in many broadcasters' bottom lines. However, with advertising revenue growing for their online components, many broadcasters might just turn to their Internet product to be the thing that saves them from bankruptcy.

A big part of that increase is also thanks to an increase in users accessing streams from their mobile phones. Leading the charge is Pandora, which claims 45,000 new users a day on their mobile phone service alone. Blackberry and iPhone users are pushing Internet radio into unchartered waters for the industry and should make a push for even further developments in the mobile streaming product world.

❖ One Stream to Rule Them All

The Internet Media Device Alliance (IMDA) has recently announced a certification standard for stand-alone Internet radio players. The standard, called IMDA Profile 1, should streamline competing technologies and make things easier and more efficient for consumers.

Right now, there are many different technologies and codecs for the various streaming profiles, which are expensive to develop. The streamlined profile should cut those costs, and might even lead to a flood of new devices in the market.

The standard dictates that Internet radio players must be able to decode both WMA and mp3 codecs. In addition, they must be able to handle playlist files such as M3U, ASX and PLS. Developers claim that new devices bearing the IMDA certified logo will be hitting stores by Christmas 2009.

Further standardization of streaming video and other products is also said to be on the agenda for the IMDA.

❖ LAUNCHcast wins Appeal

Yahoo's LAUNCHcast service, which has been fighting in court over paying extra licensing fees normally paid by streaming music providers, won a Federal appeal's court ruling recently, saving them from having to pay hundreds of millions in licensing fees.

The court determined that LAUNCHcast

was not "interactive enough" and that the listeners of the service would not use it to replace buying music outright. They said the service provided no more user control over what songs will be played than if a listener picked a radio station in their car that played a certain format.

The move by the court could open the doors for other services to offer music to listeners as long as they don't allow listeners to select specific songs that they want to hear.

❖ New WiFi Radios Hit the Market

It seems like every month there are more and more WiFi radios hitting the streets. Each seems to be an advancement over those that came before. This gives listeners more options with which to pull in their favorite streaming content.

Enter Logitech's new addition: the Squeezebox Radio. The newest in a line that already includes the highly popular Squeezebox Boom, the Squeezebox Radio adds a few new touches to the basic WiFi radio. For one thing, the Squeezebox Radio adds a color video screen, allowing users to display album artwork and photo slideshows. Secondly, a new feature is the ability to share favorite tracks with Facebook friends, thanks to an included application.

The Squeezebox Radio retails for $200, boasts a single mono speaker, alarm clock, auto-adjusting contrast on the display and a headphone jack. Coming in November, an optional accessory pack will be released giving users an infrared remote control and a battery pack that will provide up to six hours of portable operation.

In addition to the new Squeezebox Radio, Logitech is also updating their existing Squeezebox model in a version they are calling the Squeezebox Touch. The Touch is a gateway device that requires an existing audio system through which to route audio. It will retail for

$300 once it is released in the U.S. in December and it will also have wall-mount capability with an optional $100 mount.

GLOBALNET LINKS

South African radio stations:
www.surfmusic.de/country/south+africa.html
Channel Africa:
www.channelafrica.org/portal/site/ChannelAfrica/
Internet Radio Revs Up:
www.emarketer.com/Article.aspx?R=1007264
Media Daily News:
www.mediapost.com/publications/?fa=Articles.showArticle&art_aid=113045
More users listening to Internet radio on their phones:
www.switched.com/2009/09/13/internet-radio-taking-leap-from-the-desktop-to-the-pocket/
IMDA Announces New Certification:
www.reuters.com/article/pressRelease/idUS112531+07-Sep-2009+BW20090907
LAUNCHcast wins court ruling:
www.newsday.com/online-radio-service-wins-ruling-over-license-fees-1.1385302
Squeezebox Touch, Radio:
www.macworld.com/article/142588/2009/09/squeezeboxtouchradio.html
Revo Ikon on CNET:
http://news.cnet.com/8301-17938_105-10316713-1.html
Pure Siesta Flow:
www.pocket-lint.com/news/26875/pure-siesta-flow-elan-chronos
Pure Company Web site:
www.pure.com/
VTech IS9181:
http://content.zdnet.com/2346-9595_22-337120.html

Another WiFi radio available for streaming enthusiasts is the Revo Ikon. Those with iPods or iPhones will especially enjoy the Ikon's docking station. The Ikon also includes a color video screen with an icon-based navigation, full support of Internet radio and Digital Audio Broadcasting, DAB+ and terrestrial radio broadcasts with RDS-support.

The Ikon will be available sometime this month, but at a hefty $450.

Readers in the United Kingdom have a new choice for bedside Internet radio. The Siesta Flow, which will retail for £99.99, offers a different waking tone for each day of the year, USB connectivity to power external devices (mp3 players, etc.), DAB and FM radio reception, and iPod/mp3 inputs.

The Siesta Flow and other new Pure WiFi radio products can be ordered through the company's Web site, listed in the links table at the end of this article.

Finally, VTech, the popular cordless phone company, has also now jumped on the

WiFi radio bandwagon, with the release of the IS9181 ($160 retail).

What makes the VTech model an attractive choice? Portability. The IS9181 can be powered with 6 AA batteries, making it one of the few portable table-top WiFi radios on the market. Also, it has a down-firing subwoofer, which should give the audio coming from the speakers plenty of low-end. Curiously, a few features were not included with the IS9181, most notably, a headphone jack, the model also lacks Pandora or podcast support.

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Taming Talkgroups

Trunked radio systems are capable of carrying many conversations simultaneously. Have you ever stopped to consider how those systems keep track of each conversation and make sure that the correct radios participate in the correct conversation? More importantly, do you know how your scanner manages to track those same conversations?

Hi Dan.

I have read both introductory articles you've written on how trunked radios work and found it to be very helpful. However, I have searched the web and still cannot find anybody who can explain to me how do I find out what the talk group IDs are?

I currently own a Bearcat BCD996T Trunk tracking scanner that I sort of know how to use but don't understand how to program it correctly. The system I am trying to track is the local police and I am simply listening to them in the conventional manner between the frequency range 417.320 MHz and 420.440 MHz. I am speaking under correction but there are four control channels (417.780/ 417.920/ 419.720/419.960) or what sounds like control channels (sounds like a motor boat) but I am not sure how to program my scanner to listen to the conversation correctly.

Could you please assist me in setting up the scanner or could you please explain?

Bevil in Cape Town, South Africa

In order to explain how trunked radio systems use talkgroups, we need a bit of background, so let's start with some basics. Trunked radio systems use a set of radio frequencies assigned by a national authority responsible for spectrum allocation. In the United States, this duty falls to the Federal Communications Commission (FCC) for public safety and commercial organizations. For what is generically called "Land Mobile" communications, these frequencies are typically assigned in pairs, where one frequency is designated for mobile-radio-to-base (sometimes referred to as the *Inbound* direction) transmissions and the other for base-to-mobile-radio (*Outbound*) transmissions.

The actual signals carried on these inbound and outbound frequencies are usually classified as either *voice* traffic or *control* traffic. Voice traffic is the actual message content from the radio user, typically the user's voice in analog or digital format. Control traffic consists of digitized commands, requests, and other data used to carry out the moment-by-moment operation of the system. The control traffic is not supposed to be heard or noticed by the user; it is intended for the digital microprocessors inside trunked radio and base station equipment.

Outbound control traffic is almost always continuous, meaning a base station is transmitting on the assigned control frequency all the time, even if it doesn't have any instructions for any particular radio at the time. Inbound control traffic comes from individual radios out in the field, and occurs only when a radio is requesting service or responding to a previous outbound control command. The inbound control frequency is shared by all active radios within range of the base station.

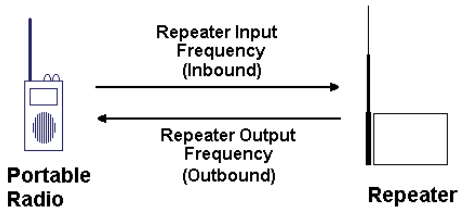
As you might expect, both outbound and inbound voice frequencies are active only when they are carrying part of a conversation. If no one is using the system at a particular moment, all of the voice frequencies will be idle.

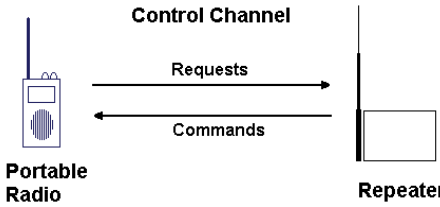
When a user wishes to communicate on the system, pressing the push-to-talk button causes the radio to transmit a request message on the inbound control channel. The system will quickly locate an idle voice frequency pair, if there is one, and assign it to the requesting radio. It informs the radio of the assignment over the outbound control channel.

The requesting radio immediately retunes to the assigned inbound voice frequency and emits the ubiquitous "beep-beep," informing the user that he or she may begin speaking. When user is done and releases the push-to-talk button, the system releases the assigned voice frequency pair back to the "idle pool" and waits for another request to come in. Meanwhile, the requesting radio has retuned to the outbound control channel and listens for subsequent instructions.

❖ Talkgroups

Before a radio can work properly on a trunked radio system, it must be programmed with a few pieces of information. At a minimum it needs to know the radio frequencies of the control channels, so that it can send and receive requests and instructions. It also needs to know which other radios it can communicate with. Technically, any radio can communicate with any other radio on the system, but not every conversation is relevant to every user. Because





all users share the same trunked radio system frequencies, a method is needed to automatically indicate when a conversation is of interest to a user.

In trunked radio systems, a *talkgroup identifier* serves to organize conversations, or, more specifically, identifies the radios that can participate in a shared conversation.

Type II

Talkgroup ID	Status Bits
12	4

❖ Examples

Public safety agencies typically organize their users by function and geography. For example, police patrol officers may have two talkgroups, one for the north side of town and the other for the south side. Detectives may have their own talkgroup, separate from the patrol officers. Our example system may also be shared by the fire department, which will have a completely different set of talkgroups for their operations – dispatch, fireground, arson investigation, training, and so on.

So, we can create a simple talkgroup list for this system:

Talkgroup Number	Description
10	Police Patrol (North)
20	Police Patrol (South)
30	Detectives
40	Fire (Dispatch)
50	Fireground
60	Investigators
70	Training

During a normal day for our fictional system, all the radios are tuned to the outbound control channel, waiting for an instruction. At some point, one of the patrol officers in the south end of town wants to speak with the dispatcher. When the officer presses the push-to-talk button, the radio transmits a request message containing the officer's talkgroup number, 20, on the inbound control channel. The system receives the request, assigns a

voice channel to talkgroup 20, and transmits a "channel assignment" message that includes the talkgroup number on the outbound control channel.

Since all of the town's radios are tuned to the outbound control channel, every radio receives the channel assignment message. Each radio immediately checks to see if the talkgroup number it was programmed with matches the talkgroup number in the message. If so, the radio tunes to the assigned voice channel and unmutes the squelch, allowing the user to hear the voice traffic. If the radio is not programmed for the talkgroup, it simply discards the message and waits to receive the next outbound control channel message. In this way, each radio decides whether to participate in a conversation based on talkgroup numbers that were programmed into it.

❖ Open and Closed Scanners

A scanner monitoring that same outbound channel will receive the same channel assignment messages coming from the system. Depending on the scanner and how it is programmed, one of following actions may take place:

If the scanner is programmed to operate in what is called "open" trunking mode, it will show the talkgroup number on the display and tune to the voice channel so that you can hear the conversation. It will do this for every assignment message it receives. By making note of the talkgroup number on the scanner's display and listening to the content of the voice traffic, you can begin to associate talkgroup numbers with specific departments and activities.

If the scanner is programmed to operate in "closed" mode, the scanner will check if the talkgroup number received in the assignment message is also in a list of previously-programmed talkgroups held in its memory. If it is in the list, the scanner will tune to the voice channel and allow the user to listen. If the received talkgroup number has not been programmed into memory, the scanner will ignore the channel assignment message and continue listening to the control channel.

This suggests a two-step process for monitoring a trunked system. The first step is a data collection stage, where you collect and identify the various talkgroups that appear on the system by running in "open" mode. Once you have the groups you're interested in, you move to the second stage, which is the "closed" mode where you listen only to the talkgroups you're interested in.

❖ Uniden BCD996T

The Bearcat BCD996T is a high-end base/mobile scanner introduced in 2006. Among its many features is a "Talk Group ID Auto Store" that automatically stores every new talkgroup number it monitors. This feature is described in the Owner's Manual beginning on page 99 and might be an easy way for you to quickly accumulate a list of talkgroup numbers. You will still need to listen to the traffic related to each talkgroup to figure out what departments and/or activities the talkgroup refers to.

The BCD996T uses different terminology for "open" and "closed" trunked system monitoring. On page 48 the manual describes "ID Scan" as the equivalent to our closed mode and "ID Search" as the open mode. You will want to operate in "ID Search" mode, at least in the beginning, in order to capture all of the available talkgroups on the system.

Before doing any of this, though, you will need to determine exactly what type of system you're actually monitoring. The BCD996T is capable of tracking activity on most types of Motorola and EDACS (Enhanced Digital Access Communications) systems, as well as LTR (Logic Trunked Radio) and Project 25-based networks. Until you correctly identify the system, the scanner will not know how to interpret the messages it receives on the outbound control channel.

❖ Status Codes

Sometimes talkgroup numbers carry more information than just an identifier for a conversation. Talkgroups in a Motorola Type II system, for instance, can also carry status information between the radio and the base station. You may have noticed that sequential Motorola talkgroup numbers go up by 16 rather than by 1. This is because of status bits that are part of every talkgroup identifier.

Motorola Type II talkgroup numbers use 16 bits (a bit is a "binary digit" that can be either a 0 or 1), broken up into a 12-bit Identifier field and a 4-bit Status field. The 12 bits represent the actual talkgroup number, which can range from 0 up to 4095. The four status bits give 16 possibilities and represent a code with the following meaning:

Code	Meaning
0	Normal message
1	Fleet-wide message (to reach all radios)
2	Emergency
3	Patch between talkgroups
4	Emergency and patch
5	Emergency and multi-group selection
6	Not assigned
7	Multi-Group selection
8	Talkgroup is encrypted
9	Encrypted, Fleet-wide message
10	Encrypted, Emergency
11	Encrypted, Patch
12	Encrypted, Emergency, Patch
13	Encrypted, Emergency, Multi-Group
14	Not assigned
15	Encrypted, Multi-Group selection

Most scanners typically display whatever talkgroup number they receive, whether it has a status code set or not. This can lead to some confusion if you're looking at received talkgroup numbers and find ones that aren't even multiples of 16. When you find such a talkgroup, consult the status code table to see what extra information is being transmitted. If you're programming your scanner to operate in the "closed" trunking mode, you may miss some interesting activity if you have only the normal talkgroup number programmed in.

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❖ Oswego, New York

Oswego, New York fire and police have gone to EF Johnson trunking system and none of my scanners will receive them. I am looking to buy one that will.

Is there any scanner available now that will trunk these frequencies correctly? I purchased a Bearcat 898T but it receives a clocking interference on the control channels. I also have various other scanners but they all do the same thing.

Thanks,
Bob

Oswego is a city of about 18,000 residents located on the shore of Lake Ontario in north central New York. Oswego is also the name of the county, which covers about 1,300 square miles and is home to nearly 120,000 people.

Since 2001 Oswego County has been operating an upgraded Logic Trunked Radio (LTR) system, transmitting from five base stations located in Boylston, Constantia Center, Dexterville, Hastings and Oswego on the following frequencies: 851.1375, 851.4625, 851.6125, 851.6375, 851.6875, 852.0375, 852.0875, 852.4375, 852.5125 and 852.5375 MHz. A sixth site in Redfield transmits on 852.3875 and 852.8875 MHz.

Logic Trunked Radio was developed by the E. F. Johnson company back in the late 1970s. A number of variations have been introduced since then, including the Multi-Net version of LTR used in Oswego County. Multi-Net supports several advanced trunking features, including the ability to queue channel requests when no frequencies are available and the use of unique radio identifiers.

Unlike other trunking systems with a channel dedicated to control messages, LTR systems combine voice and control traffic on the same radio frequency. Voice is transmitted in analog format with the control information carried in a "sub-audible" data stream. Radios listen to this data stream and act on the messages found there.

Radio frequency pairs are assigned a Logical Channel Number (LCN) that can range from 1 to 20. Messages in the data stream use these LCNs rather than sending the actual radio frequency, since LCNs are much shorter and therefore consume less bandwidth.

Radios on an LTR system are assigned a "home channel" and monitor the sub-audible data stream there when idle. If the system is not busy, conversations will take place on that channel. When the home channel for a radio is busy, the system may assign an alternate channel for a conversation. Messages in the data stream of the home channel will inform all listening radios that a conversation is taking place on a different channel, causing them to retune to that channel. The radios then return to monitoring their home channel when the transmission is finished.

❖ LTR Talkgroups

Talkgroups are called "Group Identifiers" in an LTR system and are made up of three parts. The first part is an "Area Code" which can be either a 0 or a 1 and is used to distinguish between two nearby LTR systems. All of the talkgroups from a system will have the same Area Code. If there is another LTR system nearby, all of its talkgroups will use the other Area Code and thus keep the two systems from carrying each other's traffic.

LTR Talkgroup Format

Area Code	Home Repeater	User ID

Area Code: 0 or 1
Home Repeater: 01 to 20
User ID: 000 to 254

The second part of a Group Identifier is a two-digit number from 1 to 20 that identifies the "home repeater" channel that a radio will monitor when it is idle. This corresponds to the LCN assigned to that radio frequency channel.

The third number is called a "User ID" or "Group Value" and ranges from 0 to 254. Each radio programmed with this code will be part of the talkgroup.

❖ Monitoring Multi-Net

Although there are several scanner models on the market that are able to track standard LTR systems by monitoring the sub-audible data stream, no scanner currently on the market is able to understand the Multi-Net messages and therefore cannot track conversations if subsequent transmissions use an alternate channel. However, since the voice traffic is in analog format, a scanner will be able to hear individual transmissions and you can monitor the system in conventional (non-trunked) mode.

Since you have more than one scanner, here's a technique that might help you to follow the action in Oswego.

1. Program the first scanner with the two most active frequencies on the system, which are 851.4625 and 852.5125 MHz. You will probably hear most activity on 852.5125, but keep 851.4625 as a Priority scan to be sure not to miss any "overflow" traffic.
2. Program a second scanner with all of the remaining frequencies, being sure not to include the two frequencies in the first scanner.

❖ Computer-based LTR Monitoring

If you have a computer and are adventurous, there are a couple of software programs that might help you follow the action on LTR and LTR Multi-Net systems.

At **http://home.ica.net/~phoenix/wap/LTR** you will find a ZIP archive containing a program called **LTR-Analyzer**. This program runs under the Microsoft Windows operating system (from Windows 98 up through Vista) and requires a sound card and a scanner with a discriminator output. Once everything is configured and running, the program will display the control messages on the outbound channel the scanner is tuned to. The program can also produce detailed reports containing lists of channel numbers and talkgroups observed. For Multi-Net systems, the program can identify channel numbers that are in use.

A pair of programs, called **LTRTrunk** and **LTRDump**, were under active development a few years ago that analyze and track activity on LTR systems, including Multi-Net. Unfortunately, they don't appear to be readily available today despite an apparent need for such tools.

I would be interested in hearing from readers who are using computer programs to help them monitor LTR systems. Send me an email with the details of your set up, including web site links, and I will put the results on my web site at **www.signalharbor.com**.

You may also find activity in Oswego County on the following frequencies, if they are still in use:

Frequency	Description
45.72	Highway Department
153.995	County Fire and Emergency Medical Services (Dispatch)
154.115	State University of New York at Oswego Police
155.130	Oswego City Police
155.160	School Buses
155.250	Sheriff (Dispatch)
155.730	Oswego City Police
155.955	State University of New York at Oswego Police

That's all for this month. You can read more about trunking, talkgroups, and LTR on my website at **www.signalharbor.com.** In the meantime, have a Happy Thanksgiving, take a moment to consider everything you have to be thankful for, and if you're looking for a chance to get away from the in-laws for a while, listening to a scanner can be a great escape!

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ASK BOB

GENERAL QUESTIONS RELATED TO RADIO

Bob Grove, W8JHD
bobgrove@monitoringtimes.com

Q. *I have been given an atomic clock which monitors the 60 kHz frequency standard station in Colorado. At those low frequencies, how can it send enough data to set my clock? Isn't there a time delay for the signal to be accurate over distances? (MB, Indiana)*

A. WWVB continuously broadcasts time and frequency signals at 60 kHz at a data rate of 1 bit per second using pulse width modulation. The code contains the year, day of year, hour, minute, second, Daylight Saving Time, leap years, and leap seconds.

VLF signals travel by ground wave; the delay of arrival at your location would only be 0.006 seconds. I doubt that your clock can display time that accurately!

Q. *I am thinking of replacing my outdoor loop antenna with an active whip like the LF Engineering H-800 or H-900, then reduce the electrical noise interference with an MFJ 1025 noise canceller. What should I use for the noise antenna? (Fred Edwards, email)*

A. The key here is the separation of the desired-signal antenna from the noise antenna so that you don't cancel both the signal and the noise. That's the reason to put the noise antenna near the noise; with that canceled, the only thing left is the desired signal from the receive antenna.

If I were doing the installation, I'd first mount the serious antenna as high and away from power lines and household noise as possible. It would be great if you could carry a portable shortwave radio with you as listen for the minimal noise spot to install the antenna.

For the noise antenna, simply run a random wire around the edge of your room (ceiling or floor) for some 10-20 feet; that should be enough to pick up enough ambient noise to cancel the lesser noise heard on the rooftop active whip.

The H-800 and H-900 are omnidirectional, while the loop is bidirectional. You may still wish to leave the loop in place in case you want to favor one direction over another. The H-800 is excellent; we sell a lot of them to very happy listeners. The primary advantage of the 900 is its slightly-greater dynamic range. If you are plagued with local overload, get the 900; if you aren't, get the 800.

Every situation is somewhat different. After mounting the antenna in that quiet spot, try placing that random noise antenna wire around in different locations while playing with the noise canceller to find the best configuration for noise reduction.

Q. *How often should I replace my 100 foot RG-6/U outdoor coax cable? When I do, should I replace it with LMR-400? (Shon Clark, Concord, CA)*

A. RG-6/U is good, all-around coax for outdoor installations. The general rule of thumb for all coax, however, is to replace it every five years. On the other hand, my cable has been up for some 15 years and I don't detect any worsening loss.

LMR-400 is lower-loss cable, but only by 2-3 dB at 900 MHz, and it's considerably more expensive. You would only see very minor improvement on the weakest signals at that frequency, and even less at lower frequencies.

Q. *Years ago I remember a gadget that you plugged into an electrical outlet to use the household wiring as a substitute for an outdoor TV antenna. Did these things actually work? (MB, email)*

A. I actually have one of those in my quackery/fraud collection. They didn't work worth a hoot or they'd still be on the market and there wouldn't be rooftop antennas. Some of the deficiencies include:

1. Household wiring isn't resonant on any particular TV frequency for proper impedance matching;
2. Wiring is electrically long in terms of TV wavelengths, rejecting signals broadside to the wires;
3. Incoming signals were blocked by household aluminum siding and metalized Mylar insulation;
4. Since they were connected to appliances all over the house, they were rife with electrical interference;
5. Because wiring is routed near conductive wiring, ducting, and metalized insulation, it was lossy.

Q. *The Slinky® toy is periodically resurrected as a portable dipole for ham and SWL use. Can it be assumed that its performance is really the same as a conventional wire dipole of the same length? (email)*

A. Because the Slinky is, in fact, a coil, it has a Q (selectivity) which varies with frequency depending on how compressed or stretched it is. Thus, its bandwidth/impedance characteristics vary differently than a straight wire of the same length.

If we aren't concerned about the Q (as in the case where it's being used as a random-length receiving antenna), then yes, its performance (aperture to intercept signal voltage) would be roughly equal to a straight wire antenna of the same length.

Q. *When we saw fire trucks going by our house today, we got out a very old scanner that we picked up at an auction years ago, but didn't hear anything. Have emergency communications all gone digital? (Wendy Kedzierski, Berryville, VA)*

A. While digital has definitely taken hold of the public safety agencies, it's been in steps that were bad for scanner listeners for a while until the consumer electronics industry caught up. Here's a simplified chronology:

1. Years ago, everything was analog (like AM/FM radio);
2. For security purposes, agencies started using analog scramblers until the consumer market started making analog descramblers;
3. The FCC and Congress banned descramblers that were intended to decode privacy communications, but these devices were still easy to come by or even make yourself;
4. Scanner manufacturers introduced digital scramblers that couldn't be duplicated in the workshop, and manufacturers kept the algorithms (codes) confidential;
5. Along came trunking so that a given series of transmissions could keep changing channels and analog scanners couldn't follow them;
6. The scanner industry then made trunk-tracking scanners, so we got back to at least step 4;
7. Following communications failures after 9/11, a reliable digital standard was called for by the government for interagency communications; APCO P-25, an open (public) algorithm, not developed for security, was adopted and has been widely implemented;
8. Scanner manufacturers now make P-25 compatible scanners.

Of course, there's still the possibility that your fire department has simply changed frequencies! One easy way to check local frequencies for your area is to go to **www.radioreference.com** and look up Clarke County.

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

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

Around the Bands: Odds and Ends

Let's start with some old business from last month, namely the Green Angels radio network in Mexico. You might remember how this civilian service helps motorists in trouble on the nation's major toll highways.

I was all set to go wall to wall with everything I've learned about its use of high-frequency radio (HF). Once again, though, Mike Chace-Ortiz beat me to it, with some great information from a knowledgeable Los Angles listener. Readers are advised to grab the September *MT*, and read his excellent *Digital Digest* column that runs right after *Utility World*. About the only thing left for me to do is to note that extensive monitoring of 7790 kilohertz (kHz) upper sideband (USB) can back up everything that was said there.

The big news is that the Green Angels' radio network is not limited to the states around Mexico City. Along with Mike's source, I have monitored daily traffic from Baja California. One base station, identifying "Ensenada," is extremely loud in the morning. The woman has a distinctive voice, and she pronounces it as "En-sen-a-DAAAH." A few mobiles are also audible. They frequently mention such border areas as Tijuana.

Mike's source backs up my observation that signals from the mobile units show distinct characteristics of NVIS propagation. NVIS (Near Vertical Incidence Skywave) is a technique commonly used for military tactical nets.

Most of the time, NVIS is accomplished by tilting the typical vehicle whip antenna at an extreme angle from the vertical, sometimes almost horizontal, for a very high angle of radiation. The resulting skip is very strong in a local area, and there are no dead spots. Of course, this compromises the long paths, making it harder for us to hear.

I figured that all frequencies except 7790 were for Automatic Link Establishment (ALE). However, I heard a station follow a typical ALE burst on 7815 kHz with two-way voice communication. Is voice allowed elsewhere as well, or was this just a mistake?

Other ALE frequencies confirmed by monitoring here are 7563, 7640, 7802, 7815, 7828, 7920, 8115, 8175, 10364, and 10369 kHz. These are all USB. ALE nets typically use a much wider frequency range, but then, the ones we hear don't usually use NVIS. Maybe this has something to do with it.

Mention the Green Angels, and the essential service they render, next time someone tells you that "Nobody uses short wave any more."

❖ Two-Year-Old Scholars?

Many thanks go to the alert readers who did the arithmetic on the Walter Kendall Myers "Cuban spy" case mentioned in the September *Utility World*. It would have been very nice if I had done the same. Then, I would not have written that Myers, age 72, was a noted political writer at the start of World War II - when he was two years old!

The confusion is due to late hours doing "research" on the Internet. I read the many Google hits properly when they said he wrote A Rationale for Appeasement. The part that I rather woozily missed was that it was the title of his Ph.D. dissertation in 1972.

And so, yes, Myers is accused of spying for Cuba. But no, he was not giving foreign policy advice when he was two.

I hope that everyone can see my bright red face right through the paper or screen. I apologize for a BIG oops on THAT one.

❖ Kyodo News Lives!

I don't know if the problem was lousy band conditions, or something else, but no one had reported the Kyodo News FAX for months. Now, however, the radiofacsimile transmission from this respected Japanese news agency is alive and well. I have it printing just fine on 16971.0 kHz. As winter comes, these long paths should improve in the United States.

Technically, shortwave fax is analog frequency modulation (international designator F3C), with a center frequency of 1.9 kHz. Deviation is plus or minus 400 hertz, with tone frequency corresponding to brightness. Black is therefore 1500 hertz, and white is 2300.

Fax is tuned in USB mode, and is centered properly when your dial reads around 1.9 kHz lower than the published frequencies. Most multi-mode digital programs do fax, though it's usually fussy to get it absolutely straight.

Other published Kyodo frequencies are 4316.0, 8467.5, 12745.5, 17069.5, and 22542.5. These come from JJC, Tokyo Radio, in Japan. There is also a transmitter in Singapore, callsign 9VF, using 16035 and 17430.

Kyodo spends most of its daily schedule sending a Japanese newspaper. This runs at 60 lines per minute (LPM), half normal speed. Their web site claims about 1600 subscribers on ships, remote islands, or in communities abroad.

A small English newspaper is sent daily at 120 LPM. This is intended for foreign crew members on Japanese ships. Fishery charts are also broadcast.

Since these broadcasts are for subscribers, we should treat anything we receive as someone else's property. Kyodo used to scramble a lot of their products, and we'd hate to see that happen again.

❖ HBG Going Off-Air

As we discussed in August, long-wave time stations are very popular for the automatic setting of consumer and commercial "atomic clocks." Well, in two years there will be one less such signal.

This news comes in a press release from the Swiss Federal Office of Metrology (METAS), which operates the HBG standard time station on 75 kilohertz (kHz). This station will leave the air at the end of 2011.

As always, the reason is money. Inspection has revealed significant age-related weakening of the 300-foot antenna towers in Prangins. Some good photos of this majestic site are at **www.emetteurs.ch/gallery/Prangin/Antennes_HBG_1**

METAS cannot afford the necessary repairs, and an independent study found few or no other options. One suggestion was to find a commercial user for a multiplex signal on HBG's carrier. Another was to pass the operation to a different agency. Neither proved feasible.

The long notice is so Swiss institutional users can reconfigure master clock systems. There are, according to the release, 3600 of these in schools and churches.

METAS claims that nearly all industrial, laboratory, and consumer devices used in Switzerland will also work with Germany's mighty DCF77 on 77.5 kHz. Many are probably using it already. The DCF77 signal uses compatible, though not identical, encoding. Reception is said to be about the same.

METAS will continue to distribute the Swiss time standard by Internet. Network Time Protocol users can go to ntp.metas.ch . The METAS web site, in four languages, is at **www.metas.ch**.

UTILITY WORLD

UTILITY LOGS

Hugh Stegman

ABBREVIATIONS USED IN THIS COLUMN

AFB.....Air Force Base
ALE.....Automatic Link Establishment
AM.....Amplitude Modulation
CAMSLANT.....Communications Area Master Station, Atlantic
CAMSPAC.....Communications Area Master Station, Pacific
COTHEN.....Customs Over-The-Horizon Enforcement Network
CW.....On-off keyed "Continuous Wave" Morse telegraphy
DHFCS.....UK Defence High-Frequency Communications Service
DSC.....Digital Selective Calling
EAM.....Emergency Action Message
E10.....Israeli phonetic station, with or without message
FAX.....Radiofacsimile
FEMA.....US Federal Emergency Management Agency
FSK.....Frequency-Shift Keying
HFDL.....High-Frequency Data Link
HF-GCS.....High-Frequency Global Communication System
LDOC.....Long Distance Operational Control
LSB.....Lower Sideband
MARS.....US Military Affiliate Radio System
MFA.....Ministry of Foreign Affairs
MX.....All Russian single-letter beacons/markers
NASA.....US National Aeronautics and Space Administration
NAT.....North Atlantic air control, nets A-F
NS/EP.....US National Security/ Emergency Preparedness
PACTOR-I.....Packet Teleprinting Over Radio, mode 1
PR.....Puerto Rico
RTTY.....Radio Teletype
Selcal.....Selective Calling
SITOR-A/B.....Simplex Telex Over Radio, mode A or B
STANAG.....Standardization Agreement
STS.....Space Transportation System ("Space Shuttle")
UK.....United Kingdom
Unid.....Unidentified
US.....United States
USAF.....US Air Force
USCG.....US Coast Guard
VOLMET.....Formatted voice aviation weather

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 ().

501.5 EI0CF-Amateur with 500 kHz experimental license, Ireland, working GW3UEP, UK, CW at 2050 (MPJ-UK).
502.8 EI0CF, working GM3BST, Scotland, CW at 2210 (MPJ-UK).
1797.0 SDJ-Stockholm Radio, Sweden, maritime information in English and Swedish, at 2203 (MPJ-UK).
2097.3 "A"-CW pirate beacon, AZ, at 0925 and 1034 (Jim-GA).
2187.5 *Keriolet*-Irish fishing boat, arranging voice comm on 3425 with Fishing Vessel *Boy Jason* (EI7397), DSC at 1908 (MPJ-UK).
2216.0 XSS-UK DHFCS, Forest Moor, ALE sounding, also on 3226, 3236.5, 4166.3, 4239.5, 8167, 8182, 9019, 9020, 10344.5, 11208, and 12230, at 1010 (MPJ-UK).
2311.0 Arklow Radio-Arklow Shipping Company, Ireland, duplex with unheard vessel, at 1925 (Michel Lacroix-France).
2971.0 Shanwick-NAT-D oceanic air route control, position from Scandinavian Airlines 926, at 0235 (Prez-MD).
3016.0 Shanwick-NAT-A air control, selcal and position check with Lufthansa Cargo 827, at 0220 (Prez-MD).
3053.0 CBE-USCG Cutter *Tahoma*, ALE sounding, also on 4730 and 6709, at 1316 (Mark Cleary-SC).
3181.0 RMP-Russian Baltic Fleet, Kaliningrad, CW storm warning to group callsign REO, parallel 3264, at 1959 (MPJ-UK).
3246.5 Unid-Russian Air Defense, time-stamped CW idle strings, parallel 5221.5, at 2013 (MPJ-UK).
3341.0 FR4FEM001 (FEMA Region 4, GA), ALE sounding, also on 9462, at 1030 (MDMonitor-MD).
3425.0 EI7397-Fishing Vessel *Boy Jason*, working *Keriolet* in clear voice and secure Fishfone, came from 2187.5, at 1912 (MPJ-UK).
3449.8 "OK"-CW pirate beacon, possibly OK, at 0931 (Jim-GA).
3476.0 Gander-NAT-F air control, Canada, working aircraft with Shanwick, Ireland/Scotland, at 0200. (MDMonitor-MD).
3802.7 Unid-German Red Cross, calling DEKA2710 (Hanover mobile), PACTOR-I at 1025 (ALF-Germany).
4026.9 AAA4CH-US Army MARS, net with AAA4SC and AAA4WR, at1137 (Cleary-SC).
4031.0 "P"-Russian Navy, Kaliningrad, FSK Morse broadcast in 5-figure groups, then back to single-letter marker, at 2233 (MPJ-UK).
4077.4 "MO"-CW pirate beacon, OK, at 0933 (Jim-GA).
4088.8 Unid-CW pirate dasher beacon, CA, at 1030 (Jim-GA).
4096.2 "Hexie"-CW pirate dasher beacon, CA, in and out at 0937 (Jim-GA).
4096.6 "Kelsie"-CW pirate dasher beacon, CA, in and out at 0939 (Jim-GA).
4102.3 "W"-Pirate CW wind beacon, CA, ID and wind speed pips, at 1016 (Jim-GA).
4483.0 DHJ67-German Air Force, Köln, working DHO78 in German, at 2104 (Lacroix-France).
4703.0 OWE-Danish Air Force, Karup, working unknown station in Danish, at 2105 (Lacroix-France).
4744.5 JWT-Norway Navy, Stavanger, voice and STANAG 4285 at 1957 (Lacroix-France).
5097.0 CFH-Canadian Forces, Halifax, NS, RTTY markers at 2125 (PPA-Netherlands).
5118.0 VMKI-Russian military, 5-letter CW message to Z09K, at 1756 (PPA-Netherlands).
5138.5 Russian Navy, weather for group call RKN (Caspian Sea Flotilla), CW at 0335 (ALF-Germany).
5153.7 "D"-Russian Navy CW single-letter beacon (MX), Sevastopol, Ukraine, also on 10871.7 and 13527.7, at 2034 (MPJ-UK).
5153.9 "S"-Russian MX, Severomorsk, CW beacon at 2111 (Lacroix-France).
5157.6 "Blinky"-CW pirate dasher beacon, possibly FL, at 1450 (Jim-GA).
5166.0 RIW-Russian Navy, Moscow, calling RIF80 and RIC83, CW at 0501 (PPA-Netherlands).
5215.0 RCV-Russian Navy, Sevastopol, working RJD83, CW at 0342 (ALF-Germany).
5270.5 DELTA03RS1006-Uzbek Military. working ASKAR17RS1006, ALE at 0115 (ALF-Germany).
5334.0 035-Hungarian military, working 082, ALE at 2045 (PPA-Netherlands).
5343.0 RIT-Russian Navy, Severomorsk, calling RIR96, CW at 2108 (PPA-Netherlands).
5598.0 N552UA-United Airlines Boeing 757, checking selcal BS-LQ with Shanwick, at 1912 (Lacroix-France).
5616.0 Reach 188-USAF Air Mobility Command, working Shanwick at 0718 (Lacroix-France).
5713.5 FAV22-French military Morse code practice, Favières, CW drill messages at 2015 (MPJ-UK).
6312.0 J8B2638-St. Vincent and Grenadines vessel *Lona*, DSC safety test with Aarhaus/Bremen, at 1927 (MPJ-UK).
6330.5 HBY4256-Swiss registry yacht *Citadel*, calling OSY (SailMail, Belgium), PACTOR-I at 1511 (ALF-Germany).
6464.0 567-Unknown, raised 673 in ALE, then voice in French, at 0246 (ALF-Germany).
6507.0 VMC-Australia Weather East, Charleville, marine weather at 1800 (Jim-GA).
6532.0 FedEx 008-Federal Express freighter, HFDL position for Shannon, Ireland, at 2018 (Lacroix-France).
6604.0 Gander Radio-Canadian Volmet, aviation weather at 2127 (MPJ-UK).
6617.0 St. Petersburg Volmet, weather in Russian at 2106 (PPA-Netherlands).
6676.0 HSD-Bangkok Volmet, Thailand, weather at 1940 (PPA-Netherlands).
6693.0 Tyumen Volmet, weather in Russian at 1753 (PPA-Netherlands).
6712.0 CO0056-Continental Airlines, HFDL position for Reykjavik at 0524 (Lacroix-France).
6729.0 JWT-Danish Navy, duplex with unheard vessel, at 0724 (Lacroix-France).
6733.0 Ascot 5104-UK Royal Air Force C-130M, getting cricket scores from TASCOMM (Tactical Air-Sea Comm), at 1155 (ALF-Germany).
6751.0 BRD-NASA Booster Recovery Director, Kennedy Space Center, FL, radio checks with STS-128 Booster Recovery Vessels *Freedom Star* and *Liberty Star*, at 0330 and 0403, then announcing weather scrub at 0526 (Hugh Stegman-CA).
6800.0 America 9-Unknown vessel, Spanish chatter with Medico 5, Barcelona 5, Danmark 1, and several others, at 1940 (ALF-Germany).
6803.1 ATTPRLCHI01B249-AT&T NS/EP station, Pearl City, HI, working WNDRF252, probably in FL, ALE at 2139 (Jack Metcalfe-KY).
6834.0 GYA-UK Royal Navy, Northwood, FAX Middle East weather chart at 1837 (PPA-Netherlands).

6840.0 EZI2-Israeli intelligence phonetic station (E10), callup only at 2001 (PPA-Netherlands).
6877.0 RIT-Russian Navy, Severomorsk, CW weather for group call RLO, at 0305 (ALF-Germany).
6897.8 S3D005E2-Moroccan weather net, calling 1S3D005E2, PACTOR-I at 0134 (ALF-Germany).
6945.0 Turkmenbashi Aero, Turkmenistan, working AMBA (Samara Aero, Russia), in Russian at 0306 (ALF-Germany).
7122.0 Unid-Russian military, messages for RDL in FSK Morse, at 0946 (ALF-Germany).
7480.1 ATTPHNXAZ01P255- AT&T NS/EP, Phoenix, AZ, working ATTCHPNSC01P148, AT&T Chapin, SC, ALE at 2236 (Metcalfe-KY).
7527.0 Foxtrot 35-USCG HU-25, securing guard with CAMSLANT at 1155 (Cleary-SC).
7530.0 CAMSLANT-USCG, VA, radio checks with District 7 and Sector Upper Mississippi, at 1308 (Cleary-SC).
7646.0 DDH7-German Weather Office, Pinneberg, RTTY observations for Europe, at 1740 (PPA-Netherlands).
7664.0 RIW-Russian Navy, Moscow, calling RFH77, CW at 1722 (PPA-Netherlands).
7675.0 RIT-Russian Northern Fleet, Severomorsk, working RMPV, CW at 1955 (MPJ-UK).
7697.1 CHLTNC116-Unknown NS/EP, Charlotte, NC, working BDMN-NJ112P, Bedminster, NJ, and WNDRF252, ALE at 1926. ATLA-GA104-Unknown NS/EP, Atlanta, GA, working KEYWFL168, Key West, FL, ALE at 1709 (Metcalfe-KY).
7791.5 VES-USCG Cutter *Venturous*, ALE message "USCG NVIS Antenna Testing ALE Net," at 0225 (ALF-Germany). *[NVIS = Near-Vertical Incidence Skip. -Hugh]*
7841.5 DTNTAM-Algerian Direction des Transmissions Nationales (DTN), Tamanrasset, calling INGUES (In Guezam), PACTOR-I at 1905 (ALF-Germany).
7880.0 DDK3-Pinneberg weather, FAX surface chart at 1817 (PPA-Netherlands).
7903.0 XVS-Ho Chi Minh Radio, Viet Nam, fishery information in Vietnamese, at 1803 (PPA-Netherlands).
7918.0 YHF-Israeli E10, callup and message at 1938 (PPA-Netherlands).
8000.8 "S"-Pirate CW beacon, sometimes sending "H," at 1008 (Jim-GA).
8023.7 Unid-Egyptian Embassy, Rabat, Morocco, SITOR-A at 2025 (Lacroix-France).
8035.1 WQDT278-XNet Yacht Association, PACTOR idler and CW "XNET," also 8045.1, at 0005 (ALF-Germany).
8040.0 GYA-UK Royal Navy, Northwood, FAX chart at 0739 (PPA-Netherlands).
8047.0 MDANG-Texas Army National Guard, ALE sounding at 1200 (MDMonitor-MD).
8050.0 FC8FEM-FEMA Region 8, CO, calling unknown PASFEM, ALE, also on 14776, at 0100. PMHUNG-Unknown FEMA, calling PISTON, at 0400 (MDMonitor-MD).
8066.7 SSE-Egyptian MFA, Cairo, SITOR-B Arabic call to Rome, then SITOR-A, at 1829 (ALF-Germany).
8113.0 VMW-Australia Weather West, Wiluna, marine weather at 0903 (Jim-GA).
8114.0 Unid-Two probable fishermen, in Spanish, also on 8160, at 1039 (Jim-GA).
8211.9 "OR"-Pirate CW beacon, unknown location, at 1012 (Jim-GA).
8283.7 ARL4-Pakistani Navy, Karachi, calling vessel KCGO, PACTOR-I at 0120 (ALF-Germany).
8285.0 F213-Venezuelan Navy Frigate *Mariscal Sucre*, calling CGA3 (Headquarters), LSB ALE at 0028 (ALF-Germany).
8292.5 Unid-Algerian Provincial Net, calling several stations beginning in BOSTAN, PACTOR-I at 1555 (ALF-Germany).
8301.6 Sector San Juan-USCG, PR, setting aircraft guard at 2348 (Cleary-SC).
8340.0 F21-Venezuelan Navy, Frigate *Mariscal Sucre*, calling CGA3 (Headquarters), LSB ALE at 0300 (MDMonitor-MD).
8345.0 RIR96-Russian Navy vessel, calling RIT with message for RJH45, CW at 0559 (PPA-Netherlands).
8376.6 VFF-Canadian Coast Guard, Iqaluit, SITOR-B Arctic weather, at 2030 (MPJ-UK).
8393.0 RFH77-Russian Navy vessel, working RIR96, CW at 0030 (ALF-Germany).
8414.5 MGLJ9-UK registry container ship *Dirhami*, DSC safety test with Lyngby Radio, Denmark, at 1131 (Lacroix-France).
8550.5 CTP-Portuguese Navy, Oeiras, RTTY marker at 1100 (MPJ-UK).
8879.0 G-YMMC-British Airways Boeing 777, selcal BJ-KL with Gander, Canada, at (Lacroix-France).
8885.0 B-6080-Air China A330, flight CA0965, HFDL log-on with Muharraq, at 2003 (MPJ-UK).
8912.0 Foxtrot 33-USCG HU-25, working CAMSLANT at 1301 (Cleary-SC). TSC-US Customs, FL, calling F12, USCG Falcon Jet #2112, ALE at 1920 (MDMonitor-MD).
8918.0 N921AN-American Airlines B737, selcal BJ-CM with New York, at 2057 (Lacroix-France).
8930.0 N851EL-Gulfstream IV bizjet, selcal MR-AJ, working Stockholm LDOC at 2004 (Lacroix-France).
8971.0 Fiddle-US Navy, working P-3C Goldfinch 711, at 1623 (Cleary-SC).
8992.0 Jeep 23-US Air Force Reserve tanker, working Lajes HF-GCS at 2327 (Cleary-SC).
9000.0 Unid-Chinese Firedrake jammer, deliberately over-modulated AM oriental music, also on 11300, at 2024 (Mike T-West Sussex, UK).
9025.0 OFF-USAF, Offutt AFB, NE, calling 538029, USAF Reserve tanker #63-8029, at 1450 (MDMonitor-MD). Foxtrot 33-USCG HU-25, ALE-initiated patch to Cape Air, MA, at 2333 (Cleary-SC).
9034.0 NOJ-USCG, AK, calling J07 (an MH-60J), ALE at 0346 (Cleary-SC).
9110.7 RIW-Russian Navy, Moscow, working RFH77, went to 13469, CW at 1316 (MPJ-UK).
9145.0 RIW, working RFH77 in CW, at 1858 (MPJ-UK).
9180.0 RIW, working RGK39, CW at 1537 (MPJ-UK).
9201.0 FAV22-French military CW code practice, drill message at 1407 (MPJ-UK).
9228.0 LCR154-Polish Army, Janki, working SOG933, at 1356 (MPJ-UK).
9380.0 1Z8C-Venezuelan Navy, calling 1EW1 (Vessel *Goijaira*), LSB ALE at 0430 (MDMonitor-MD).
9462.0 PASFEM-Unknown FEMA, calling PASTOR2, ALE at 0130 (MDMonitor-MD).
9996.0 RWM-Russian standard time station, Moscow, CW pips at 1246 (Lacroix-France).
10024.0 Cenamer-Central American air control, position from Lancia 05 in Spanish, at 0120 (MDMonitor-MD).
10051.0 Gander Volmet, Canada, formatted aviation weather at 0125 (MDMonitor-MD).
10540.0 RCV-Russian Navy, Sevastopol, Ukraine, working RMK39 in CW, at 1759 (MPJ-UK).
10872.0 "C"-Russian MX, Moscow, also 13528, CW at 2017 (Mike-UK).
10872.1 "A"-Russian MX, possibly Astrakhan, also 13528.1, CW at 2018 (Mike-UK).
11003.1 "CO"-Pirate CW beacon, CO, at 1448 (Jim-GA).
11175.0 Red Alder-US military, patch via Puerto Rico HF-GCS to Geometric (Offutt AFB, NE), at 1635 (Allan Stern-FL).
11184.0 XA-MXP-Mexicana Airlines A330, flight MX1587, HFDL log-on with Reykjavik at 1517 (MPJ-UK).
11226.0 210193-USAF C-17, working HAW, Ascension Island, ALE at 2004 (Lacroix-France).
11232.0 Akela 96-USAF MC-130, patch via Trenton Military to Kirtland AFB, NM, at 1557 (Cleary-SC). Halifax Military-Canadian Forces, NS, patching aircraft Rescue 338 to Rescue Coordination Centre, went to 15010, at 1839 (Stern-FL).
11282.0 San Francisco-Pacific oceanic air control, selcal and position check with Hawaiian Airlines 407, at 0155 (Prez-MD).
11436.0 CAMSLANT-USCG, radio checks with District 7 stations at 1316 (Cleary-SC).
11494.0 PAC-USCG, CA, raised 716 in ALE, then voice as CAMSPAC working C-130 Coast Guard 1716, on COTHEN at 2050 (Stegman-CA).
12577.0 SWAK-Greek registry tanker *Minerva Eleonora*, DSC safety test with ECA6, Madrid, at 1357 (MPJ-UK).
12613.0 XSQ-Guangzhou Radio, China, service bulletin and back to SITOR-A idler, at 1450 (MPJ-UK).
12916.5 HLF-Seoul Radio, Korea, weak CW marker at 1442 (MPJ-UK).
13200.0 Red Alder, came from 11175 for Andrews (Andrews AFB, MD), both stations calling but not hearing other, at 1719 (Stern-FL).
13215.0 HAW-USAF, Ascension Island, ALE sound at 2103 (Lacroix-France).
13303.0 OD-MEB-Middle East Airlines A330, HFDL log-on with Canarias, Canary Islands, at 1524 (MPJ-UK).
13342.0 CS-TEJ-White Airways A310, selcal BM-CR with Stockholm LDOC at 1332 (Lacroix-France).
13469.0 RIW-Russian Navy, Moscow, working RJF77, came from 9179.5, CW at 1329 (MPJ-UK).
13527.9 "S"-Russian MX, Severomorsk, CW at 1449 (MPJ-UK).
13927.0 Batt 71-USAF B-2A, morale patch via USAF MARS station AFA5RS, IN, at 1905 (Stern-FL).
14389.0 AFA5AD-USAF MARS, patching MN Air National Guard Gofer ?? to Scott AFB for weather; came from 13927, at 1840 (Stern-FL).
14522.0 RMIB-Russian Navy warship, CW 5-figure group message, at 1452 (MPJ-UK).
15010.0 Halifax Military, radio check with Rescue 338, came from 11232, at 1842 (Stern-FL).
15867.0 I21-US Customs Cessna 550, registration N26621, COTHEN ALE sounding at 1945 (MDMonitor-MD).
16050.0 FUE-French Navy, Brest, working FAKB in STANAG 4285, at 0430 (Eddy Waters-Australia).
16557.0 FUE-French Navy, Brest, working unknown station in STANAG 4285, at 0530 (Waters-Australia).
21955.0 AAF279-Aigle Azur flight, HFDL position for Las Palmas, Canary Islands, at 1637 (Lacroix-France).

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

Maritime Listening with SITOR-B

This month we focus on activity from the some of the world's maritime stations. Though these sections of the HF shortwave bands have also seen a number of changes over the past decade and reflect the general shift away from simple modes like CW and SITOR, there are still many stations that can be picked up as long as you are patient.

First, let's look in a little more detail at SITOR, the system most favored by these stations.

❖ SITOR in Focus

SImplex Telegraph Over Radio, SITOR for short, comprises two related digital systems. Both use two tones (FSK) at 100bd with a 170Hz shift as standard, though some organizations are peculiar or distinctive in their use of slightly different speeds and/or tone shift. Check UMC's Decoder Pages by Mike Agner (**www.chace-ortiz.org/umc/software.html**) for software that can read SITOR-A and B signals.

SITOR-A uses an ARQ format, or Automatic Repeat ReQuest to ensure that data arrives relatively error-free at the receiving station, whereas SITOR-B uses FEC or Forward Error Correction to accomplish the same function.

In SITOR-A, the information sending station (or ISS) sends a burst of characters, then waits for the acknowledgment from the receiving station (or IRS). If this is not received in the prescribed time interval, or the IRS was not able to copy the characters, it requests a repeat. All of this happens very quickly, in less than half a second, and is the reason for the familiar, rhythmic chirp-chirp-chirp of ARQ-type signals. ARQ thus works well for two stations and a one-to-one link.

FEC is better suited to a broadcast environment where there are multiple listeners. Without a "reply" signal from the receiving stations, the SITOR-B sending station ensures that its data gets copied well (again, not 100% guaranteed error-free) by sending the same characters one or more times interleaved or spread out in time. In the case of SITOR-B, it is spread by slightly less than half a second, or 350ms, with the characters being coded in a way that allows errors to be spotted. NAVTEX also uses SITOR-B.

Organizations using the standard SITOR-B signal include many coastal radio stations, many coast guard stations, US Forces MARS, Argentine Navy, Algerian Navy, Brazilian Navy, Portuguese Police, and the Diplomatic Services of both Egypt and Morocco.

The Ecuadorian Navy (see February 2006's *Digital Digest*) use the combination of 109bd and 400Hz tone shift.

❖ Coastal Station SITOR-B

Despite the downturn in coastal radio station activity over the past years and their switch to more complex transmission systems, there are plenty of examples still on-air today.

Here is a list of recently monitored stations that provide easy listening opportunities in both the US and Europe:

VFF Canadian Coast Guard, Iqaluit
This station can be heard most evenings on 8376.6 kHz

NMC US Coast Guard, Point Reyes CA
Can be heard nightly on 6323.5 and 8416.5 kHz

SVO Olympia Radio, Greece
Transmits every day using SITOR-B on 4123, 8424, 12603, 16830.5 and 22388 kHz. You can see a Google Earth picture of the antenna farm at 37.604211N, 21.488196E.

SVO Olympia Greece (credit: Google Earth)

These stations send a variety of ship navigation warnings and other information in addition to weather and sea condition reports and forecasts.

Here are some examples of what can be received.

Example 1: The sign-off information for station VFF

mcts iqaluit / vff and nordreg canada
63 43 42 n 068 33 00 w
mmsi : 00 316 0023
mailing address : fisheries and oceans canada canadian coast guard
officer - in - charge iqaluit mcts centre / nordreg canada
p . o . box 1 89 iqaluit , nu x 0 ~ 0 0
telephone numbers : 867-979-5 260 officer -~8, - charge 867-979-5269 mcts operations 867-979-5724 nordreg operations facsimile : 867-979-4264 mcts / nor dreg operations
telex number (telefax): 063-15529 nordreg cda
electr~nic mail : iqanordreg & innav . gc . ca
mcts iqaluit / vff , out

Note the "~" character in a few places that is used by the Hoka decoder to denote that a character was received in error.

Example 2: Message from SVO in Greek with latest currency exchange rates

deltio timwn synallagmatos
dolario hpa : 1,4031
lira agglias : 0,86517
korwna danias : 7,5036
korwna soyhdias : 11,0537
gien iapwnias : 134,64
fragko elbetias : 1,5133
korwna norbhgias : 8,9536
dolario kanada : 1,5884
dolario aystralias : 1,7668
sdr dolario : 1,54179
sdr euro : 1,10761
stop
de svo svo svo telos kala taxidia
nnnn

❖ STANAG4285 Independent Sideband Transmission

It is quite common practice to use the lower and upper sidebands of a transmitter to send independent signals on each. This is often heard with NATO Naval Link-11 signals (see October 2008's *Digital Digest*) and is sometimes heard in conjunction with the Russian Navy MS5 12 tone modems.

Not so often is an ISB STANAG4285 transmission heard. However, one has been heard using the frequencies of 8701 and 12704.5 kHz for the past few weeks.

The arrangement sends a regular KG84 encrypted stream of data on the upper sideband but the lower sends what appears to be a type of CARB (Channel Availability Radio Broadcast) as follows:

2315z//cta02i/cta04i/cta06i/cta08i/cta14i/cta16i// 2316z//cta02i/cta04i/cta06i/cta08i/cta14i/cta16i//

The (presumed) callsign of this station, CTA, has not been logged before and would indicate Portugal as the origin if it conforms to international standards. Consulting the ITU files suggests that this station is indeed located close to Lisbon judging by past STANAG4285 signals using the frequency.

DIGITAL BANDSCAN (8200 TO 8300 KHZ)

8200.0U	Mexican PEMEX Oil & Gas Operations with DSC selcals on 8201.9 kHz
8201.8	UNID Codan 8580 controlled net with "2011", "2012", etc.
8204.0	Russian Forces 75bd/200 FSK secure
8221.5U	Australian Forces MIL-188-110A HF modem continuous tfc
8230.0U	Mexican Navy MIL-188-110A HF modem ASCII tfc
8234.0U	Israeli Air Force USB Voice and MIL-188-141A ALE "AAA", "M64", etc.
8243.0U	Mexican PEMEX MIL-188-141A ALE "REBOM1", etc.
8258.0L	Moroccan Forces MIL-188-110A 39 tone modem, off-line crypto
8270.0U	Venezuelan Navy MIL-188-141A ALE "CGA, "PR3", etc.
8276.0U	French Navy MIL-188-141A ALE "1TL0FF", "1TA6FF", etc.
8283.7	Pakistani Navy PacTOR-II "ARL4", etc.
8292.1U	Mexican PEMEX MIL-188-141A ALE "REBOM1", etc.

PROGRAMMING SPOTLIGHT

WHAT'S ON WHEN AND WHERE?

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

Everything Old is New Again

The other day I was reading about a program that had been on the air since the 1950s. It got me to thinking about international broadcasters and the programs that have endured, in some cases for decades. I put on my thinking cap and came up with a list of such programs. Perhaps there is one I missed. If there is, please let me know! We'll also shine the *Programming Spotlight* on a long time favorite that has been revived.

❖ British Longevity

As one might expect, you will find a number of these programs at the BBC. Two of my favorites, are **Just a Minute** and **Brain of Britain**. Both are examples of light entertainment programming, which has been dropped, for the most part, from the World Service in favor of a concentration on news and current events – which is a pity. But that's a rant for another day.

Just a Minute is one of my all time favorite BBC programs. I'm not alone in this opinion, as the program is going as strong today as it did when it debuted in December 1967. Nicholas Parsons has hosted the program continuously for 42 years.

The rules of the game are simple. A panelist must speak on a topic for sixty seconds without repetition, deviation or hesitation. It sounds fairly easy, but it's trickier than one might think. Especially with three other panelists primed to jump in and steal the topic at the first sign of an infraction.

The key to the success of this program is the fabulous cast of panelists over the years. When I first heard the program on the World Service in 1978, it was worth it just to hear the verbal sparring between the outrageous Kenneth Williams, the erudite Clement Freud, Peter Jones, and Derek Nimmo. Sadly all the original panelists have left us, but the game continues, thanks to a stellar cast of players, anchored by Paul Merton.

Today, **Just a Minute** can be heard via the BBC Radio 4 website. It usually runs for twelve or so weeks, twice a year. You can access the **Just a Minute** home page at: **www.bbc.co.uk/programmes/b006s5dp** In addition, BBC 7 frequently runs old episodes of **Just a Minute**, offering the listener a chance to once again hear Kenneth Williams steal the show, or Clemet Freud steal the topic. **www.bbc.co.uk/radio7/**

Brain of Britain is another program I was introduced to by the World Service. It's a general knowledge quiz, hosted for many years by Robert Robinson. "**Brain of Britain**, the longest-running of all the broadcast quiz shows open to the public in Britain, started life as part of the series **What Do You Know?** hosted by Franklin Engelmann on the BBC Light Programme in 1953." (BBC website)

The program has similarities to TV's *Jeopardy*. Contestants have 10 seconds to answer a question, and if they cannot, their turn passes to another contestant. Those who get five straight answers correct get a bonus point. I've always enjoyed "playing along at home," and Mr. Robinson has a very dignified, charming style. Winners of **Brain of Britain** often go on to compete in a series of **Brain of Brains** programs.

Like **Just A Minute**, **Brain of Britain** can be heard on BBC Radio 4. You can hear it at: **www.bbc.co.uk/programmes/b00813s0**

From Our Own Correspondent has been one of BBC's flagship programs for over 50 years. Each week the BBC uses its vast network of correspondents around the world to bring the listeners the stories behind the headlines, often with a personal perspective. It can be heard a number of ways. Radio 4: Saturdays, 1130. Second weekly edition on Thursdays, 1100 (some weeks only) Listeners can also download the podcast or read story by story at the programme website **http://news.bbc.co.uk/2/hi/programmes/from_our_own_correspondent/default.stm**

❖ Canadian Mix

Next we turn to some Canadian programs that have been with us for decades.

Quirks and Quarks – In September, **Quirks and Quarks** began its 35th season as the flagship science program in the CBC Radio One line-up. The program's first host was renowned environmentalist Dr. David Suzuki. He was succeeded by Jay Ingram (who has gone on to host a similar show on Discovery Canada), and then by current host Bob McDonald. Both Ingram and Bob McDonald share the ability to explain scientific concepts in understandable language.

As the program website suggests, you don't need a PhD to enjoy it! This is evidenced by a reported weekly audience in Canada of half a million listeners, making it one of the most popular programs on CBC Radio One.

The program has won over 70 awards over its 35-year run. It can be heard at noon local time on Saturdays, 3pm Wednesdays and 11pm Mondays across the CBC Radio One network, via a podcast (available from **www.cbc.ca/podcasting**), and on shortwave via the CBC Northern Quebec Shortwave Service at 1700 UTC Saturdays and 0400 UTC Mondays on 9625 kHz.

Cross Country Checkup has been Canada's national kitchen table discussion since 1965, without a lot of the bombast usually associated with talk radio. The program has been hosted by a number of people over the years, most recently by Rex Murphy. Previous hosts included Dennis Trudeau, Harry Elton, Dale Goldhawk, Elizabeth Gray and Moses Znaimer. On occasion it has hooked up with NPR in the United States, or Radio Canada International to become an international talk show.

The program provides a lively and balanced discussion of the issues of the day and reportedly attracts as many as 5-10,000 callers. The program can be heard on the CBC Radio Network live across the country at 4pm Eastern Time. It can also be heard via shortwave at 2100 UTC on 9625 kHz. Finally, you can subscribe to the podcast (see Quirks and Quarks above).

As It Happens is perhaps the best current affairs program from CBC Radio. It's very simple. Using a telephone they talk to people all over the world. "As It Happens gets its stories from 'the horse's mouth' – securing interviews with world leaders, rabble-rousers, bingo callers and deposed dictators. The show has a soft-spot for 'characters' and never turns its nose up at something wild, weird or wacky. And, on the complex and troubling stories of the day, **As It Happens** searches for greater understanding in the story behind the story." (AIH website)

A program like this doesn't last for forty years without being good. **As It Happens** has been hosted by some of the giants in Canadian radio, including Barbara Frum, Alan Maitland, and Barbara Budd. Michael Enright, during his time at the program, in effect alerted the world to the genocide in Rwanda through his calls to General Romeo Dallaire, who pleaded for reinforcements for his tiny UN Peacekeeping contingent, which was, instead, reduced. Carol Off's interviews with Benazir Bhutto were compelling radio, in light of Ms. Bhutto's subsequent assassination.

There is also a lighter side to the program. Barbara Budd has a keen wit, which shows through in some of the "wackier" interviews that are aired from time to time.

As it Happens can be heard weeknights at 630pm local (7pm in Newfoundland) across the full CBC network. Also listen on shortwave via the Northern Quebec service at 2330UTC on 9625 kHz. **As It Happens** also has a podcast available via the CBC podcasting page listed above. I'm told **As It Happens** can also be heard in the United States via some NPR outlets.

❖ Old Friends from Russia

Folk Box is another program that dates back many, many years. It hasn't changed a lot since Soviet times. Each week, Svetlana Ye-

kimenko presents a 30-minute showcase of folk music from Russia's many diverse cultural groups. You might hear the bells of one of Russia's many cathedrals, intriguing throat singers from the far north, stunning vocal ensembles and distinctive Russian musical instruments. It is one of the few programs which haven't changed all that much since the end of the Soviet Union. The only real difference is that they no longer discuss the former Soviet Republics which are no longer part of Russia.

Moscow Mailbag is one of the longest running programs on first, Radio Moscow, then the Voice of Russia. For over 50 years, it has answered listener's letters and questions about Russia and the Soviet Union.

Svetlana Yekimenko

For many of those years, Joe Adamov, a very effective apologist for the Soviet Union, hosted the program. He was known for his engaging nature, his wit and, of course, his corny jokes, which featured in most editions of the program. **Moscow Mailbag** always ended with the catch phrase *"You couldn't do better than write us that letter!"*

I recall my excitement the first time Joe answered one of my questions on the program. My Radio Moscow files indicate it was read on August 12, 1979. I was an 18 year old and terribly excited about shortwave radio.

It was with some sadness I read a posting on the Voice of Russia website which noted the passing of Yuri Reshetnikov. "We report with sorrow the loss of our dear and cherished friend and colleague Yuri Reshetnikov. He succumbed after struggling with a grave disease on August 19th. From the bottom of our hearts we thank Voice of Russia listeners for sending in their condolences on Yuri Reshetnikov's death." (Moscow Mailbag web page) Reshetnikov was heard in a number of Voice of Russia programs and was a worthy successor to Joe Adamov. As one listener in Phoenix stated "We will miss Yuri as the friendly, consistent, far-away friend brought into our living rooms via RUVR."

The program, now approaching its 60th year, continues to be heard via the Voice of Russia website and on shortwave on Monday at 01.00, 05.00, 11.00 and 17.00, on Tuesday at 04.00, 13.00, 16.00 and 23.00, Thursday at 06.00, 10.00 and 17.00, Friday at 04.00, 13.00, 21.00 and 23.00 and Sunday at 01.00, 06.00 and 10.00 and 15.00 UTC.

When I listened most recently (in early September), Voice of Russia veteran Carl Watts was in the host's chair. I also noted they have changed the catchy theme tune which went back decades.

❖ And the Winner is...

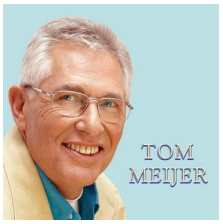
Unshackled is a program which has been discussed before in these pages. It is a throwback to the "golden age" of radio drama. **Unshackled** has been on the air since 1950, which may very well make it the longest running radio drama in history. It has been heard on many shortwave stations such as HCJB and Trans World Radio over the years, as well as a vast network of domestic outlets. Today one can hear it via WWCR at 1230 UTC Tuesdays 15820, and at 2330 UTC Saturdays on 7465 kHz.

"Today '**UNSHACKLED!**' is broadcast around the world over 7,000 times each week on over 1,800 radio outlets. In addition to the English broadcast, it is translated and re-dramatized in Spanish, Arabic, Russian, Romanian Polish, Korean and Japanese." (**www.unshackled.org**)

❖ Modern Echo of a Happy Past

In 2008, the **Happy Station** program "returned" to the airwaves. Sort of. In its original form, the **Happy Station** program was the world's longest running shortwave radio program, airing from 1927 until its cancellation in 1995. It was a production of Radio Netherlands and its predecessor PCJJ. For over 40 years it was hosted by Eddie Startz. Upon his retirement, Tom Meijer hosted well into the 1990s, followed briefly by Pete Myers and Jonathan Groubert.

I'm too young to remember Eddie Startz, but you could say I "grew up" with Tom Meijer. Tom was a regular Sunday night guest in my home for many years, bringing with him his delightful program full of "smiles across the miles." The late seventies and early eighties were an era in which I thought of Radio Netherlands itself as "the Happy Station." At one time, I don't think Radio Netherlands minded that name, either. Still, times change.



After Tom retired, the program seemed to lose some of its appeal. Pete Myers was a nice guy, I liked him, but I guess he just wasn't Tom. Interest in the program dwindled on my part and evidently also at Radio Netherlands, as it was gone not long after.

A few years ago, someone started a **Happy Station** group on yahoo. It gave a lot of "us" listeners of a certain vintage a chance to reminisce about the program.

Then, earlier this year came the announcement that a new version of the **Happy Station** program was returning to the airwaves. However, this one is not affiliated with Radio Netherlands. Keith Perron, who has worked at a number of international broadcasters, including Radio Canada International, Radio Habana Cuba, and China Radio International, hosts this newer version. Tom Meijer is involved in a consulting role.

This new program can be heard via WRMI on UTC Thursdays on 9955 kHz at 0100-0155, and repeated at 1500-1555 UTC.

Special New Years broadcasts

"Starting September 10th, 2009 we are launching a New Years contest with the winners to be announced at 1230am (local HK TIME) that's 1730UTC on January 1st, 2010.

"Times reflect the November time shift. Meaning 0100UTC now will be 0200UTC after that.

"Let me fill you in the loop, as they say. On December 31, 2009 both editions of Happy Station will be 2 hours each.

"The transmission at 0200UTC will be a special program for South America and the Caribbean and will run for 2 hours. Details are still being worked on at this moment. I will fill you in when they become available. This program will be recorded.

"The transmission at 1600UTC will be LIVE from Hong Kong. My friends at RTHK (Radio Television Hong Kong) are giving us a studio over looking Victoria Harbor where at 1659UTC we will do the countdown to 2010. They are also letting us patch into the audio feeds for RTHK, so you will be able to hear the countdown live as it happens in Hong Kong. After the countdown, plus a small concert of the Hong Kong Symphony Orchestra, I will announce the winner of the contest." (*The Happy Station Show Facebook page*)

NASB

National Association of Shortwave Broadcasters

Representing the privately-owned shortwave stations in the USA

- **Find links to all of our members at www.shortwave.org**
- **Subscribe to our free Newsletter: nasbmem@rocketmail.com**
- **Listen to "The Voice of the NASB" on the third Saturday of each month on HCJB's DX Party Line: 12 midnight Eastern Time on 9955 kHz**
- **Next annual meeting May 21, 2010 in Hamilton, ON, Canada**
- **More info at www.shortwave.org/meeting.htm**

NASB is a member of the HFCC (High Frequency Coordination Conference) and the DRM (Digital Radio Mondiale) Consortium

THE QSL REPORT

VERIFICATIONS RECEIVED BY OUR READERS

Gayle Van Horn, W4GVH
gaylevanhorn@monitoringtimes.com

Radio Saint Helena ready for annual *Party-on-the-Air*

The broadcast team from Radio Saint Helena have announced their annual broadcast will be on Saturday, November 14, 2009 on 11092.5 USB. Broadcast times in UTC include:

2000-2100 targeted to India and Southeast Asia
2100-2200 targeted to Japan and Asia
2200-2330 targeted to Europe
2330-0100 targeted to North America, Central America and the Caribbean.

This year's newly designed QSL card is being sponsored by the *Japan Shortwave Club*. Reception reports via airmail must contain verifiable details and recordings will not be returned. In European countries, please enclose a 5-Euro banknote. Otherwise, please enclose three or more U.S. dollars to cover the required postage. Email reports will not be verified. Thanks to Irving Ambler for sharing his 2008 QSL card photo with our *MT* readers.

Send your report to: Radio St. Helena, P.O. Box 93, Jamestown, St. Helena, STHL 1ZZ, South Atlantic Ocean, via Airmail, via United Kingdom & Ascension

Amateur Radio Expedition to Easter Island

CE0Y-XR0YA calls have been issued to the expedition to Easter Island (SA-001) which will be active October 31-November 15, 2009. The six team members (Marco-CE6TBN, Leszek-NI1L, Art-PA3C, Zbig-SP7HOV, Stan-SQ8X and Victoria-SV2KBS) are operating on all bands, with a focus on 160, 80, 40 and 30 meters (CW only, as digital modes on 30 meters are not allowed).

Working Europe on 30 meters will be their priority during the first week on the island. XR0YA will have three stations with two amplifiers and several antennas. Morse code will be the main operating mode, with some RTTY being planned. For QSLing and additional information, go to: **http://rapanui2009.org/**

AMATEUR RADIO

Guinea Bissau, J5UAP (ITU: 46/CQ: 35) 14335 SSB/RTTY 14089.0. Full data color scenery card signed by Peter Brucker. Received in two months for $2.00US to: QSL Manager, Peter Brucker HA3AUI, P.O. Box 15 Zamardi, H-8621 Hungary. Operator's email: *j5uap@cqafrica.net* (Larry Van Horn, NC)

UN Headquarters Amateur Radio Station, 4U1UN (ITU: 8/WAZ 5) 40 meters/RTTY. Full data color UN/satellite dish card signed by Herb. Received in 82 days for $2.00US to: QSL Manager, Herbert Aeby, Rte. Du Moulin 1, CH-1782 Belfaux, Switzerland (Van Horn)

BOSNIA

International Radio of Serbia and Montenegro, 6190 kHz. Full data *Listener's Club* card, unsigned. Received in 135 days for an English report and mint stamps (not used). Station address: P.O. Box 200, Hilandarska 2, 11000 Beograd, Serbia (Bill Wilkins, Springfield, MO)

CLANDESTINE

Cheetah Radio, 11885 kHz. Email response in three days to: *radio@cheetahlearning.com* (Sam Wright, Biloxi, MS) Brokered by Media Broadcast, Cheetah Radio broadcast in English on 11730 kHz, 1600-1700 on Saturday, via Wertachtal, Germany. Reception reports may be sent to *QSL-Shortwave@media-broadcast.com* or *michelle@cheetahpower.net* Postal address: Michael Puetz, Media Broadcast GmbH, Order Management & Backoffice, Josef-Lammerting-Allee 8-10, D-50933 Cologne, Germany.

Radio Dabanga, 11500 kHz. Full data handwritten verification letter, unsigned. Received for report sent to: Press Now, Witte Kruislaan 55, 1217 AM Hilversum, The Netherlands. (Artur Fernández Llorella, Catalonia, Spain/HCDX). Brokered by Media Broadcast, broadcasting to Darfur with the support of the Dutch NGO Press Now. Complete Arabic and vernacular schedules may be found in *MTExtra SW Guide*. Email: *radiodabanga@yahoo.com* Website: **www.radiodabanga.org**

Radio República, 9545 kHz. Handwritten statement on verification letter, unsigned. Received in 26 days for an English report and $1.00 US. Station address: P.O. Box 110235, Hialeah, FL 33011 USA (Harold Woering N1FTP, East Hampton, MA).
^ **www.radiorepublica.org**

COLOMBIA

Radio Marfil Estereo, 5910 kHz. Full data local scenes QSL card, unsigned. Also received religious tracts and a CD-R. Received in 115 days for an English report and mint stamps (used for reply). Station address: La Voz de Conciencia, Colombia para Cristo, c/o Raphael Rodriguez R., Ap # 67751, SF de Bogotá, Colombia (or) Calle 44° No. 13-67, Local 1, Barrio Palamemo, SF de Bogotá, Colombia (Wilkins). Email: *rafaelcoldx@yahoo.com*

EQUATORIAL GUINEA

Radio Africa 15190 kHz. Verification letter on Pan American Broadcasting letterhead, plus current broadcasting schedule and a full data color studio card unsigned. Received in 21 days for an English report, SAE, address label (used for reply), $1.00US, souvenir postcard and MT business card. QSL address: Pan American Broadcasting, 7011 Koll Center Pkwy, Pleasanton, CA 94566-3253 USA (Gayle Van Horn, NC). Received in 148 days. (Woering)

PIRATE RADIO

Euro: Sonnet Radio, 6309 kHz. Full data QSL from Mike West. Received in 24 hours for an email to: *studio@sonnetradio.com* (Roberto Pavanello/playdx via Dario Monferini, Italy)

U.S.: Radio Casablanca, 6940 USB kHz. Full data QSL featuring *Casablanca* movie poster. Received in two days for an email report to: *radiocasablanca@gmail.com* (Joe Wood, Greenback, TN).

THAILAND

Radio Thailand World Service, 15275 kHz. Full data color scenery QSL card of Bangkok's Grand Palace, signed by Mitver Patanajag-Broadcasting Operation Supervisor. Received in 25 days for an English report and one IRC (returned). Station address: IBB Thailand Transmitting Station, P.O. Box 99, Ampur Muang, Udon Thani 41000, Thailand. Received via: Thailand Transmitting Station, U.S. Embassy, Box UD, APO AP 96546-0001 Thailand (Richard W. Parker, Pennsburg, PA).

UTILITY

Australia: Townsville Radio VZG420, 6324 kHz (120 watts). Full data prepared card, signed by Paul Weldon-Service Manager/Director. Received in 44 days for report, prepared QSL card and mp3 file. Station address: Seabourne Electronics Pty Ltd., P.O. Box 1726, Townsville, Australia (Martin Foltz, CA/UDXF via LVH). Station is part of the Global Link Network. **www.globalinknetwork.com/**

New Zealand: ZLM-Taupo Maritime Radio, 6224 kHz. Email verification and attached station information from Peter Baird-Radio Operator. Received in 30 minutes for an email follow-up with an mp3 file to: *maritime@korida.co.nz* (Foltz) Schedule of news bulletins and coastal warnings on 2207, 4146, 6224 kHz at 0133, 0555, 1333, 1733 UTC.

US: Pirate Beacons CW (Colorado) CO 11.002.7 MHz, UFO 8.432.91 MHz, Pike 8.003.6 MHz. Full data UFO and sunset card. Verified from email report to: *hiferbeacon@yahoo.com* Reports may be posted at: **www.hfunderground/board/index.php/board.9.0.html** Site is dedicated to documenting longwave, mediumwave, utility/military stations, spy numbers and pirate radio (James McCalahan, Bowdon Junction, GA).

Additional QSLs, tips, photos and information excluded for space constraints are posted at the *Shortwave Central Blog* at **http://mt-shortwave.blogspot.com,/**

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 Daylight Time) 4, 5, 6 or 7 hours for Eastern, Central, Mountain or Pacific Times, respectively. Eastern, Central, and Pacific Times are already converted to UTC for you at the top of each hour.

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

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.

MT MONITORING TEAM

Gayle Van Horn
Frequency Manager
gaylevanhorn@monitoringtimes.com

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

Additional Contributors to This Month's Shortwave Guide:

Thank You to …

AOKI; *BCL News; Ardic DX Club*; *DX Asia*; *British DX Club*; *Cumbre DX*; EIBI; *HFCC; Hard-Core DX; Radio Bulgaria DX Mix News*; *Play DX 2003; WRTH; WWDXC*- BC DX, *Top News; World DX Club/Contact.*

Alokesh Gupta, New Delhi, India; Evelyn Marcy/WYFR; Ivo Ivanov; Bulgaria; Jeff White/WRMI; Jaisakthivel, Chennai, India; José Miguel Romero, Spain; Mike Barraclough, UK; Noel Green, UK; Rachel Baughn/MT; Rich D'Angelo/*NASWA Flash Sheet*, *NASWA Journal*; Tom Taylor, UK; 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

"MISSING" LANGUAGES?

A **FREE** download to MTXpress subscribers, the online MTXtra Shortwave Guide is 115+ pages of combined language schedules, sorted by time. Print subscribers: add a full year to your subscription for only $11.95. Call **1-800-438-8155** or visit ***www.monitoringtimes.com*** to learn how.

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

0000	0000		UK, BBC World Service	5970as	6195as	
			7395as	9410as	9740as	11955as
			13725as	15335as	15360as	
0000	0005	mtwhf	Canada, Radio Canada International		6100am	
0000	0005	Sat	Greece, Voice of Greece	7475va	9420va	
0000	0020		Japan, NHK World/ Radio Japan		5960eu	
			6145 na	13650as	17810as	
0000	0027		Czech Republic, Radio Prague	7345na	9440na	
0000	0030		Egypt, Radio Cairo	11590na		
0000	0030		Thailand, Radio Thailand World Service		15275na	
0000	0030		USA, Voice of America	7555va		
0000	0045		India, All India Radio	9705as	9950as	
			11620as	11645as		
0000	0045		USA, WYFR/Family Radio Worldwide		6085na	
			11720sa			
0000	0056		Romania, Radio Romania International		6135na	
			7535na	9580na		
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	12080as	
			13690as	15240pa	17665as	17715as
			17750va	17775va	17795va	
0000	0100		Bahrain, Radio Bahrain	6010me	9745al	
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		Canada, Radio Canada International		11700as	
0000	0100		China, China Radio International		6020na	
			6075as	6180as	7415as	9570na
			11790as	11885as	13750as	15125as
0000	0100		Germany, Deutsche Welle	9885as	15595as	
			17525as			
0000	0100		Malaysia, RTM/Traxx FM	7295do		
0000	0100	DRM	New Zealand, Radio NZ International		13730pa	
0000	0100		New Zealand, Radio NZ International		15720pa	
0000	0100		Russia, Voice of Russia	9480sa	9665sa	
0000	0100		Spain, Radio Exterior de Espana		6055na	
0000	0100		Ukraine, Radio Ukraine International		7440na	
0000	0100		USA, American Forces Network		4319usb	
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
0000	0100		USA, EWTN Vandiver AL	11520af		
0000	0100		USA, WBCQ Monticello ME	5110am	7415am	
0000	0100		USA, WBOH Newport NC	5920am		
0000	0100		USA, WHRA Greenbush ME	7385eu		
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	5070na	5935na	
			7465na	9980na		
0000	0100		USA, WWRB Manchester TN	3185va	5050va	
			5745va	6890va		
0000	0100		USA, WYFR/Family Radio Worldwide		5950na	
			9595na	15440na		
0000	0100		Zambia CVC Intl/ The Voice Africa		4965af	
0005	0100		Canada, Radio Canada International		6100am	
0005	0100	m	Greece, Voice of Greece	7475va	9420va	
0013	0017	twhfa	Austria, ORF/Radio Austria Intl	9820am		
0025	0100		Sri Lanka, SLBC	6005as	9770as	15745as
0030	0045	twhfas	Albania, Radio Tirana	9345na		
0030	0045	Sun	Germany, Pan American Broadcasting		9640as	
0030	0058	mtwhfa	Serbia, International Radio of Serbia		9675na	
0030	0100		Australia, Radio Australia	15415as	17665as	
0030	0100		China, China Radio International		11730as	
0030	0100		Thailand, Radio Thailand World Service		15275na	
0030	0100	fas	UK, Bible Voice Broadcasting	9490as		
0030	0100		USA, Voice of America/Special English		7430as	
			9715as	9780as	11725as	15205as
			15560as	17820as		
0030	0100		Uzbekistan, CVC Intl/ The Voice Asia		11800as	
0043	0047	twhfa	Austria, ORF/Radio Austria Intl	9820am		

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

0100	0105		Canada, Radio Canada International		6100am	
0100	0105	m	Greece, Voice of Greece	7475va	9420va	
			15630va			
0100	0125		Vietnam, Voice of Vietnam	6175na		
0100	0127		Czech Republic, Radio Prague	6200na	7345na	
0100	0127		Slovakia, Radio Slovakia International		5930am	
			9440am			
0100	0128		Serbia, International Radio of Serbia		9675na	
0100	0130		Australia, Radio Australia	9660as	12080as	
			13690as	15240pa	17665as	17715as
			17750va	17775va	17795va	
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		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		Canada, Radio Canada International		9620as	
0100	0200		China, China Radio International		6175as	
			9410eu	9470eu	9535as	9580na
			9790na	11870as	15125as	15785as
0100	0200	DRM	China, China Radio International		6080na	
0100	0200		Cuba, Radio Havana Cuba	6000na	6140na	
0100	0200		Malaysia, RTM/Traxx FM	7295do		
0100	0200	DRM	New Zealand, Radio NZ International		13730pa	
0100	0200		New Zealand, Radio NZ International		15720pa	
0100	0200		Palau, T8WH/World Harvest	15710as		
0100	0200		Russia, Voice of Russia	9480sa	9665sa	
0100	0200		Sri Lanka, SLBC	6005as	9770as	15745as
0100	0200		Taiwan, Radio Taiwan International		11875as	
0100	0200		UK, BBC World Service	7395as	9410as	
			9740as	11750as	11955as	15310as
			15335as	15360as	17615as	
0100	0200		USA, American Forces Network		4319usb	
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
0100	0200		USA, EWTN Vandiver AL	11520af		
0100	0200		USA, KJES Vado NM	7555na		
0100	0200		USA, Voice of America	7430va	9780va	
			11705va			
0100	0200	mtwhfa	USA, WBCQ Monticello ME	5110am	7415am	
0100	0200		USA, WBOH Newport NC	5920am		
0100	0200		USA, WHRA Greenbush ME	7385eu		
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	5070na	5935na	
			7465na	9980na		
0100	0200		USA, WWRB Manchester TN	3185va	5050va	
			5745va	6890va		
0100	0200		USA, WYFR/Family Radio Worldwide		7455na	
			9505na	15440na		
0100	0200		Uzbekistan, CVC Intl/ The Voice Asia		11790as	
			11880as			
0100	0200		Zambia CVC Intl/ The Voice Africa		4965af	
0113	0117	twhfa	Austria, ORF/Radio Austria Intl	9820am		
0130	0200		Australia, Radio Australia	9660as	12080as	
			13690as	15240pa	15415as	17665as
			17715va	17750va	17795va	
0130	0200		Iran, Voice of Islamic Rep. of Iran		7235na	
			9495na			
0130	0200		Sweden, Radio Sweden	6010na		
0130	0200	twhfa	USA, Voice of America/Special English		6040ca	
			9820ca			
0140	0200		Vatican City State, Vatican Radio		5915as	
			7335as			
0145	0200	twhfas	Albania, Radio Tirana	7425na		

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

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	0257		North Korea, Voice of Korea	13650as	15100as	
0200	0258	Sun	Lithuania, Mighty KBC Radio	6110na		
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, Radio Australia	9660as	12080as	
			13690as	15240pa	15415as	15515as
			17750va	21725va		

0200	0300		Bahrain, Radio Bahrain	6010me	9745al	
0200	0300	DRM	Bulgaria, Radio Bulgaria	9500na		
0200	0300		Bulgaria, Radio Bulgaria	9700na	11700na	
0200	0300		Canada, CFRX Toronto ON	6070na		
0200	0300		Canada, CFVP Calgary AB	6030na		
0200	0300		Canada, CKZN St John's NF	6160na		
0200	0300		Canada, CKZU Vancouver BC	6160na		
0200	0300		China, China Radio International		11770as	
			13640as			
0200	0300		Cuba, Radio Havana Cuba	6000na	6140na	
0200	0300		Egypt, Radio Cairo7540na			
0200	0300		Indonesia, Voice of Indonesia	9525va	11785al	
			15150al			
0200	0300		Malaysia, RTM/Traxx FM	7295do		
0200	0300	DRM	New Zealand, Radio NZ International		13730pa	
0200	0300		New Zealand, Radio NZ International		15720pa	
0200	0300		Palau, T8WH/World Harvest	15710as		
0200	0300		Philippines, PBS/ Radyo Pilipinas		11880me	
			15285me	15510me		
0200	0300		Russia, Voice of Russia	9480sa	9665sa	
			15425na			
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	6005af	6195me	
			9410eu	11955as	15310as	
0200	0300		USA, American Forces Network		4319usb	
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
0200	0300		USA, EWTN Vandiver AL	11520af		
0200	0300	mtwhfa	USA, WBCQ Monticello ME	5110am	7415am	
0200	0300		USA, WBOH Newport NC	5920am		
0200	0300		USA, WHRA Greenbush ME	7385eu		
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	6890va		
0200	0300		USA, WYFR/Family Radio Worldwide		4985na	
			6890na	7455na	9505na	9525na
0200	0300		Uzbekistan, CVC Intl/ The Voice Asia		11790as	
			11880as			
0200	0300		Zambia CVC Intl/ The Voice Africa		4965af	
0215	0230		Nepal, Radio Nepal	5005as		
0230	0300	twhfas	Albania, Radio Tirana	7425na		
0230	0300		China, China Radio International		15435as	
0230	0300		Sweden, Radio Sweden	6010na	11550as	
0245	0300		Australia, HCJB Global	15400as		
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	0320		Vatican City State, Vatican Radio		6040am	
			7305am			
0300	0327		Czech Republic, Radio Prague	7345na	9870na	
0300	0330		Egypt, Radio Cairo7540na			
0300	0330		Philippines, PBS/ Radyo Pilipinas		11880me	
			15285me	15510me		
0300	0330		Uzbekistan, CVC Intl/ The Voice Asia		11800as	
			11880as			
0300	0330		Vatican City State, Vatican Radio		7360af	
			9310as	9660af	12070as	
0300	0355		Turkey, Voice of Turkey	5975va	6165me	
			7325na			
0300	0356		Romania, Radio Romania International		6150na	
			9645na	9735as	11895as	
0300	0357		North Korea, Voice of Korea	7140as	9345as	
			9730as			
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	12080as	
			13690as	15240pa	15415as	15515as
			17750va	21725va		
0300	0400		Bahrain, Radio Bahrain	6010me	9745al	
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		China, China Radio International		9690na	
			9790na	11770as	13750as	15110as
			15120as	15785as		
0300	0400		Cuba, Radio Havana Cuba	6000na	6140na	
0300	0400		Germany, Deutsche Welle	11975as	13770as	
			15595as			
0300	0400		Malaysia, RTM/Traxx FM	7295do		
0300	0400		Malaysia, RTM/Voice of Malaysia		6175as	
			9750as	15295as		
0300	0400	DRM	New Zealand, Radio NZ International		13730pa	
0300	0400		New Zealand, Radio NZ International		15720pa	
0300	0400		Oman, Radio Oman	15355af		
0300	0400		Palau, T8WH/World Harvest	15700as		
0300	0400	DRM	Russia, Voice of Russia	15735as		
0300	0400		Russia, Voice of Russia	9665sa	15425na	
			15585as	15755as		
0300	0400		South Africa, Channel Africa	3345af	6135af	
0300	0400		Sri Lanka, SLBC 6005as	9770as	15745as	
0300	0400		Sweden, Radio Sweden	6010na		
0300	0400		Taiwan, Radio Taiwan International		5950na	
			15320as			
0300	0400		Uganda, UBC Radio	4976do		
0300	0400		UK, BBC World Service	3255af	6005af	
			6145af	6190af	6195as	7255af
			9410eu	9750af	12035af	12095as
			15310as	17790as		
0300	0400		Ukraine, Radio Ukraine International		7440na	
0300	0400		USA, American Forces Network		4319usb	
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
0300	0400		USA, EWTN Vandiver AL	11520af		
0300	0400		USA, Voice of America	4930af	6080af	
			9885af	15580af		
0300	0400	twhfa	USA, WBCQ Monticello ME	7415am		
0300	0400		USA, WBOH Newport NC	5920am		
0300	0400		USA, WHRA Greenbush ME	7385eu		
0300	0400		USA, WHRI Cypress Creek SC	5875na	7315na	
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	6890va		
0300	0400		USA, WYFR/Family Radio Worldwide		9505na	
			9930af	9985eu		
0300	0400		Uzbekistan, CVC Intl/ The Voice Asia		13680as	
0300	0400		Zambia CVC Intl/ The Voice Africa		4965af	
0300	0400		Zambia, Zambia Natl Broadcasting Corp	6165do		
0330	0357		Czech Republic, Radio Prague	9445na	11600na	
0330	0400	twhfas	Albania, Radio Tirana	7425na		
0330	0400		UK, BBC World Service	11945af		
0330	0400		Uzbekistan, CVC Intl/ The Voice Asia		15555as	
0345	0400	vl/Sat/Sun	Uganda, UBC Radio	4976do		

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

0400	0430		Australia, Radio Australia	9660as	12080as	
			13690as	15160as	15240pa	15515as
			17750va	21725va		
0400	0430	mtwhf	France, Radio France International		9805af	
			11995af			
0400	0445		USA, WYFR/Family Radio Worldwide		7445na	
			9505na			
0400	0458	DRM	New Zealand, Radio NZ International		13730pa	
0400	0458		New Zealand, Radio NZ International		15720pa	
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		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		China, China Radio International		6020na	
			6080na	6190na	13750as	15120as
			15785as	17730as	17855as	
0400	0500		Cuba, Radio Havana Cuba	6000na	6140na	
0400	0500		Germany, Deutsche Welle	6180af	7245af	
			12045af	15445af		
0400	0500		Malaysia, RTM/Traxx FM	7295do		
0400	0500		Malaysia, RTM/Voice of Malaysia		6175as	
			9750as	15295as		
0400	0500		Palau, T8WH/World Harvest	15700as		

0400	0500	DRM	Russia, Voice of Russia	15735as		
0400	0500		Russia, Voice of Russia	13755na	15585as	
			15755as			
0400	0500		South Africa, Channel Africa	3345af		
0400	0500		Sri Lanka, SLBC 6005as	9770as	15745as	
0400	0500		Uganda, UBC Radio	4976do		
0400	0500	DRM	UK, BBC World Service	3995eu		
0400	0500		UK, BBC World Service	3255af	6005af	
			6190af 7255af	7310af	9410eu	
			11945af 12035af	12095as	13675eu	
			15310as 15360as	17790as		
0400	0500		USA, American Forces Network		4319usb	
			5446usb 5765usb	6350usb	7812usb	
			10320usb 12133usb	12759usb	13362usb	
0400	0500		USA, EWTN Vandiver AL	11520af		
0400	0500		USA, Voice of America	4930af	4960af	
			6080af 9885af	15580af		
0400	0500		USA, WBOH Newport NC	5920am		
0400	0500		USA, WHRA Greenbush ME	7385eu		
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, WTJC Newport NC	9370na		
0400	0500		USA, WWCR Nashville TN	3215na	5070na	
			5890na 5935na			
0400	0500		USA, WWRB Manchester TN	3185va	5745va	
0400	0500		USA, WYFR/Family Radio Worldwide		6915na	
			9680na			
0400	0500		Uzbekistan, CVC Intl/ The Voice Asia		13680as	
			15555as			
0400	0500		Zambia CVC Intl/ The Voice Africa		4965af	
			9430af			
0400	0500		Zambia, Zambia Natl Broadcasting Corp		6165do	
0430	0500		Australia, Radio Australia	9660as	12080as	
			13690as 15240pa	15415as	15515as	
			17750va 21725va			
0430	0500	mtwh	Italy, IRRS-Shortwave	5990va		
0430	0500	mtwhf	Swaziland, TWR Swaziland	3200af		
0459	0500	DRM	New Zealand, Radio NZ International		11675pa	
0459	0500		New Zealand, Radio NZ International		11725pa	

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

0500	0507	twhfas	Canada, CBC NQ SW Service	9625na		
0500	0530		Australia, Radio Australia	9660as	12080as	
			13690as 15160as	15240pa	15515as	
			17750va			
0500	0530	mtwhf	France, Radio France International		11995af	
			13680af 15160as			
0500	0530		Germany, Deutsche Welle	6180af	7430af	
			9700af 9825af			
0500	0530	mtwh	Italy, IRRS-Shortwave	5990va		
0500	0530		Japan, NHK World/ Radio Japan		5975eu	
			6110na 11970af	15325as	17810as	
0500	0530		Vatican City State, Vatican Radio		4005eu	
			5965eu 7250eu	9660af	11625af	
			13765af			
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		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		6020na	
			11710af 11880as	11895as	15350as	
			15465as 17505va	17540as	17730as	
			17855as			
0500	0600		Cuba, Radio Havana Cuba	6000na	6010na	
			6140na 11760na			
0500	0600		Germany, Deutsche Welle	17525as		
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	DRM	New Zealand, Radio NZ International		11675pa	
0500	0600		New Zealand, Radio NZ International		11725pa	
0500	0600		Nigeria, Voice of Nigeria/External Service		15120af	
0500	0600		Palau, T8WH/World Harvest	15700as		
0500	0600		Russia, Voice of Russia	13755na		
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	DRM	UK, BBC World Service	3995af		
0500	0600		UK, BBC World Service	3255af	3995eu	
			6005af 6190af	7255af	7310af	
			9410eu 11945af	12095as	15310as	
			15360as 15420af	15565eu	17640af	
			17790as			
0500	0600		Ukraine, Radio Ukraine International		7440na	
0500	0600		USA, American Forces Network		4319usb	
			5446usb 5765usb	6350usb	7812usb	
			10320usb 12133usb	12759usb	13362usb	
0500	0600		USA, EWTN Vandiver AL	11520af		
0500	0600		USA, Voice of America	4930af	6080af	
			12080af 15580af			
0500	0600		USA, WBOH Newport NC	5920am		
0500	0600		USA, WHRA Greenbush ME	7390af		
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	3215na	5070na	
			5890na 5935na			
0500	0600		USA, WWRB Manchester TN	3185va		
0500	0600		USA, WYFR/Family Radio Worldwide		6915na	
			9680na			
0500	0600		Uzbekistan, CVC Intl/ The Voice Asia		13680as	
			15555as			
0500	0600		Zambia CVC Intl/ The Voice Africa		4965af	
			9430af			
0500	0600		Zambia, Zambia Natl Broadcasting Corp		6165do	
0515	0530		Rwanda, Radio Rwanda	6055do		
0530	0556		Romania, Radio Romania International		7305eu	
			9655eu 15345pa	17760pa		
0530	0600		Australia, Radio Australia	9660as	12080as	
			13690as 15160as	15240pa	15415as	
			15515as 17750va			
0530	0600		Clandestine, Sudan Radio Service		13720af	
0530	0600		Thailand, Radio Thailand World Service		17655va	

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

0600	0603		Croatia, Voice of Croatia	7355eu		
0600	0615	Sat/Sun	South Africa, Trans World Radio		11640af	
0600	0630	Sat/Sun	Australia, Radio Australia	15180as	15290as	
0600	0630		Australia, Radio Australia	9660as	11650as	
			12080as 13690as	15160as	15240pa	
			15515as 17750va			
0600	0630	mtwhf	France, Radio France International		9765af	
			11610af 15160af	17800af		
0600	0630		Germany, Deutsche Welle	7310af	15275af	
0600	0630		Laos, Lao National Radio	7145as		
0600	0645	mtwhf	South Africa, Trans World Radio		11640af	
0600	0658	DRM	New Zealand, Radio NZ International		11675pa	
0600	0658		New Zealand, Radio NZ International		11725pa	
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		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		China, China Radio International		11710af	
			11870as 11880as	11895as	13660as	
			15140as 15350as	15465as	17505va	
			17540as 17710as			
0600	0700		Cuba, Radio Havana Cuba	6000na	6010na	
			6140na 11760na			
0600	0700		Greece, Voice of Greece	11645eu		
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	15700as		
0600	0700		Russia, Voice of Russia	17635pa		
0600	0700		South Africa, Channel Africa	7230af	15255af	
0600	0700		UK, BBC World Service	3995eu	6005af	
			6190af 9410af	9860af	11765af	
			12015af 12095as	15310as	17640af	
			17790as			
0600	0700	Sat/Sun	UK, BBC World Service	15420af		
0600	0700		USA, American Forces Network		4319usb	
			5446usb 5765usb	6350usb	7812usb	
			10320usb 12133usb	12759usb	13362usb	
0600	0700		USA, EWTN Vandiver AL	11520af		
0600	0700		USA, Voice of America	6080af	12080af	

15580af
0600 0700 USA, WBOH Newport NC 5920am
0600 0700 USA, WHRA Greenbush ME 7390af
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 Uzbekistan, CVC Intl/ The Voice Asia 15555as
0600 0700 Zambia CVC Intl/ The Voice Africa 6065af 13590af
0600 0700 Zambia, Zambia Natl Broadcasting Corp 6165do
0609 0613 mtwhf Austria, ORF/Radio Austria Intl 6155eu 13730eu
0630 0645 mtwhfa Vatican City State, Vatican Radio 4005eu 5965eu 7250eu 9645eu 11740eu 15595va
0630 0700 Australia, Radio Australia 9660as 11650as 12080as 13690as 15160as 15240pa 15415as 15515as 17750va
0630 0700 Bulgaria, Radio Bulgaria 9600eu 11600eu
0630 0700 Swaziland, TWR Swaziland 6120af
0630 0700 Vatican City State, Vatican Radio 11625va 13765af 15570af
0645 0700 Sun Germany, TWR Europe 6105eu 9800eu
0645 0700 Sun Monaco, TWR Europe 9800eu
0659 0700 DRM New Zealand, Radio NZ International 7285pa
0659 0700 New Zealand, Radio NZ International 6170pa

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

0700 0727 Czech Republic, Radio Prague 9880eu 11600na
0700 0727 Slovakia, Radio Slovakia International 9440va 11650va
0700 0730 mtwhf France, Radio France International 13675af
0700 0730 Sun UK, Bible Voice Broadcasting 5945eu
0700 0745 USA, WYFR/Family Radio Worldwide 5745sa 5950na
0700 0750 smtwhf Germany, TWR Europe 6105eu 9800eu
0700 0750 smtwhf Monaco, TWR Europe 9800eu
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 9660as 9710as 11650as 11945as 12080as 13630pa 15160va 15240pa 17750va
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 China, China Radio International 11880as 11895as 13660as 13710eu 15125as 15350as 15465as 17490eu 17540as 17710as
0700 0800 mtwhf Equatorial Guinea, Radio Africa # 2 15190af
0700 0800 Sat/Sun Equatorial Guinea, Radio East Africa 15190af
0700 0800 Kuwait, Radio Kuwait 15110as
0700 0800 Sat Latvia, Radio SWH 9290eu
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 DRM New Zealand, Radio NZ International 7285pa
0700 0800 New Zealand, Radio NZ International 6170pa
0700 0800 Palau, T8WH/World Harvest 9930as 15700as
0700 0800 Russia, Voice of Russia 17635as 21790as
0700 0800 South Africa, Channel Africa 7230af
0700 0800 Swaziland, TWR Swaziland 6120af
0700 0800 Sat/Sun UK, BBC World Service 15420af
0700 0800 UK, BBC World Service 5790eu 6190af 9860af 11760me 11765af 13820af 15310af 15400af 15575as 17790as 17830af
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 Vandiver AL 11520af
0700 0800 USA, WBOH Newport NC 5920am
0700 0800 USA, WHRA Greenbush ME 11565pa
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 6915na 7455na 9495ca 11580va
0700 0800 Uzbekistan, CVC Intl/ The Voice Asia 15555as
0700 0800 Zambia CVC Intl/ The Voice Africa 6065af 13590af
0700 0800 Zambia, Zambia Natl Broadcasting Corp 6165do
0715 0750 Sat Germany, TWR Europe 6105eu 9800eu
0715 0750 Sat Monaco, TWR Europe 9800eu
0730 0800 Australia, HCJB Global 11750pa
0730 0800 Clandestine, Cotton Tree News 15220af
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 0825 Malaysia, RTM/Voice of Malaysia 6175as 9750as 15295as
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 0900 Anguilla, Worldwide Univ Network 6090am
0800 0900 Australia, HCJB Global 11750pa
0800 0900 Australia, Radio Australia 5995as 9475as 9580va 9590as 9710as 11945pa 12080as 13630pa
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, China Radio International 11620as 11880as 11895as 13710eu 15125af 15350as 15465as 15625as 17490eu 17540as
0800 0900 China, Guangxi FBS/Beibu Bay Radio 5050as 9820as
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 9545eu 12095as 13810eu
0800 0900 Sat Italy, IRRS-Shortwave 9510va
0800 0900 Malaysia, RTM/Traxx FM 7295do
0800 0900 DRM New Zealand, Radio NZ International 7285pa
0800 0900 New Zealand, Radio NZ International 6170pa
0800 0900 Nigeria, Voice of Nigeria/External Service 9690af
0800 0900 Palau, T8WH/World Harvest 9930as 15700as
0800 0900 DRM Russia, Voice of Russia 12060eu
0800 0900 Russia, Voice of Russia 17635as 21790as
0800 0900 South Africa, Channel Africa 9625af
0800 0900 Sun South Africa, SA Radio League 7205af 17570af
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 Vandiver AL 11520af
0800 0900 USA, KNLS Anchor Point AK 7355as
0800 0900 USA, WBOH Newport NC 5920am
0800 0900 USA, WHRA Greenbush ME 11565pa
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 15555as
0800 0900 Zambia CVC Intl/ The Voice Africa 6065af 13590af
0800 0900 Zambia, Zambia Natl Broadcasting Corp 6165do
0805 0900 thf Guam, KTWR/TWR 15190as
0820 0900 w Guam, KTWR/TWR 15170as
0830 0900 Australia, ABC NT Alice Springs 2310do
0830 0900 Australia, ABC NT Katherine 2485do

SHORTWAVE GUIDE

0830	0900		Australia, ABC NT Tennant Creek			2325do
0830	0900		Australia, CVC International	15555as		
0835	0900	m	Guam, KTWR/TWR	15170as		
0855	0900	mtwhf	Guam, KTWR/TWR	11840pa		

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

0900	0927		Czech Republic, Radio Prague	9880am		9955na
			21745af			
0900	0930		Australia, HCJB Global	11750pa		
0900	0930	mtwhf	Guam, KTWR/TWR	11840pa		
0900	0930		Japan, NHK World/ Radio Japan			9625pa
			9825pa	11815as	15590as	
0900	0930		Uzbekistan, CVC Intl/ The Voice Asia			15555as
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	9475va		9580va
			9590va	11945as	12080as	
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, China Radio International			11620as
			15210va	15270eu	15350as	15625af
			17490eu	17570eu	17690va	17750as
0900	1000		China, Guangxi FBS/Beibu Bay Radio			5050as
			9820as			
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	DRM	Germany, Deutsche Welle	9545eu		13810eu
0900	1000		Germany, Deutsche Welle	15340as		17705as
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	DRM	New Zealand, Radio NZ International			7285pa
0900	1000		New Zealand, Radio NZ International			6170pa
0900	1000		Nigeria, Voice of Nigeria/External Service			9690af
0900	1000		Palau, T8WH/World Harvest	9930as		15700as
0900	1000	DRM	Russia, Voice of Russia	12060eu		
0900	1000		Russia, Voice of Russia	15470as		15610as
			21790as			
0900	1000		South Africa, Channel Africa	9625af		
0900	1000		Tajikistan, Voice of Tajik	7245as		
0900	1000		UK, BBC World Service	6190af		6195as
			9740as	9860af	11760me	15310as
			15400af	15575as	17640af	17760as
			17790as	17830af	21470af	21660as
0900	1000		Ukraine, Radio Ukraine International			9950eu
0900	1000		USA, American Forces Network			4319usb
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
0900	1000		USA, EWTN Vandiver AL	11640as		
0900	1000		USA, WBOH Newport NC	5920am		
0900	1000		USA, WHRA Greenbush ME	11565pa		
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	5070na		5890na
			5935na	9985na		
0900	1000		USA, WWRB Manchester TN	3185va		
0900	1000		USA, WYFR/Family Radio Worldwide			5950na
			6915na	7455na		
0900	1000		Zambia CVC Intl/ The Voice Africa			6065af
			13590af			
0900	1000		Zambia, Zambia Natl Broadcasting Corp			6165do
0915	0930	Sat	Guam, KTWR/TWR	11840pa		
0930	1000		Australia, CVC International	15555as		
0930	1000	Sat/Sun	Italy, IRRS-Shortwave	9510va		

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

1000	1004		Pakistan, Radio Pakistan	15100as		17835as
1000	1030		Vietnam, Voice of Vietnam	9840as		12020as
1000	1057		Netherlands, R Netherlands Worldwide			11895as
			12065as	15110as		
1000	1057		North Korea, Voice of Korea	11710sa		11735as
			13650as	15180sa		
1000	1058		New Zealand, Radio NZ International			6170pa
1000	1058	DRM	New Zealand, Radio NZ International			7285pa
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	15555as		
1000	1100		Australia, Radio Australia	9475va		9580va
			9590va	11945as	12080as	
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		China, China Radio International			6040na
			6090as	11610as	11635as	11750na
			13590as	13620as	13720as	15190as
			15350as	17490eu		
1000	1100	mtwhf	Equatorial Guinea, Radio Africa # 2			15190af
1000	1100	Sat/Sun	Equatorial Guinea, Radio East Africa			15190af
1000	1100	DRM	Germany, Deutsche Welle	9545eu		13810eu
1000	1100		India, All India Radio	7270as		13695va
			15070as	15260as	15410pa	17510pa
			17800pa	17895pa		
1000	1100		Indonesia, Voice of Indonesia	9525va		11785al
1000	1100	Sat/Sun	Italy, IRRS-Shortwave	9510va		
1000	1100		Malaysia, RTM/Traxx FM	7295do		
1000	1100		Nigeria, Voice of Nigeria/External Service			9690af
1000	1100		Palau, T8WH/World Harvest	9930as		15700as
1000	1100		Russia, Voice of Russia	15470as		15610as
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		UK, BBC World Service	6190af		6195as
			9545eu	9740as	9860af	11760me
			15310af	15575as	17640af	17760as
			17790as	21470af	21660as	
1000	1100		USA, American Forces Network			4319usb
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
1000	1100		USA, EWTN Vandiver AL	11640as		
1000	1100		USA, KNLS Anchor Point AK	6890as		
1000	1100		USA, WBOH Newport NC	5920am		
1000	1100		USA, WHRA Greenbush ME	11565pa		
1000	1100		USA, WHRI Cypress Creek SC	7385va		
1000	1100		USA, WINB Red Lion PA	9265am		
1000	1100	vl	USA, WRMI Miami FL	9955va		
1000	1100		USA, WTJC Newport NC	9370na		
1000	1100		USA, WWCR Nashville TN	5070na		5890na
			5935na	9985na		
1000	1100		USA, WWRB Manchester TN	3185va		
1000	1100		USA, WYFR/Family Radio Worldwide			5950na
			6890na	6915na		
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	1057		Czech Republic, Radio Prague	9880eu		11665eu
1030	1100		Iran, Voice of Islamic Rep. of Iran			15600as
			17660as			
1030	1100		Mongolia, Voice of Mongolia	12085as		
1059	1100		New Zealand, Radio NZ International			9655pa

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

1100	1103	mtwhf	Croatia, Voice of Croatia	6165eu		
1100	1112		Venezuela, Radio Nacional de Venezuela			6060ca
1100	1127		Iran, Voice of Islamic Rep. of Iran			15600as
			17660as			
1100	1130		Australia, CVC International	15555as		
1100	1130		China, China Radio International			6060as
1100	1130	f/ DRM	Japan, NHK World/ Radio Japan			9760eu
1100	1130		Vietnam, Voice of Vietnam	7285as		
1100	1145		USA, WYFR/Family Radio Worldwide			5950na
			6000ca			
1100	1156		Romania, Radio Romania International			11775af
			15210af	15430af	17730af	
1100	1158	DRM	New Zealand, Radio NZ International			7285pa
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	DRM	Australia, Radio Australia	12080pa		
1100	1200		Australia, Radio Australia	6020va		9475as
			9560as	9580va	9590va	11945as
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		China, China Radio International				5955as
			6040na	11650as	11660as		11795as
			13645as	13650eu	13790eu		17490eu
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	Sat/Sun	Italy, IRRS-Shortwave	9510va			
1100	1200		Malaysia, RTM/Traxx FM	7295do			
1100	1200		New Zealand, Radio NZ International				9655pa
1100	1200		Nigeria, Voice of Nigeria/External Service				9690af
1100	1200		Palau, T8WH/World Harvest	9930as			15700as
1100	1200		Russia, Voice of Russia			12065as	15470as
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		UK, BBC World Service		6190af		6195as
			9740as	9860af	9545eu		11760me
			15310as	15340as	15400af		15575as
			17640af	17760as	17790as		17830af
			21470af				
1100	1200		Ukraine, Radio Ukraine International				9950eu
1100	1200		USA, American Forces Network				4319usb
			5446usb	5765usb	6350usb		7812usb
			10320usb	12133usb	12759usb		13362usb
1100	1200		USA, EWTN Vandiver AL	11640as			
1100	1200		USA, WBOH Newport NC	5920am			
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	5890na			5935na
			7490na	15830na			
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
1115	1130	mtwhfa	UK, Bible Voice Broadcasting	5945as			
1115	1145	Sun	UK, Bible Voice Broadcasting	5945as			
1130	1145	f	USA, Eternal Good News	15525as			
1130	1200		Australia, CVC International	13635as			
1130	1200		Bulgaria, Radio Bulgaria	11700eu			15700eu
1130	1200	f	Vatican City State, Vatican Radio				15595me
			17765me				
1130	1200		Vietnam, Voice of Vietnam	9840as			12020as

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

1200	1225		Saudi Arabia, BSKSA/External Service				15250af
1200	1230		China, China Radio International				11780as
1200	1230	mtwhf	France, Radio France International				13640af
			17800af	21620af			
1200	1230		Japan, NHK World/ Radio Japan				6120na
			9625pa	9695as	9790eu		
1200	1245		Australia, HCJB Global	15400as			
1200	1245		USA, WYFR/Family Radio Worldwide				6890na
1200	1258		New Zealand, Radio NZ International				9655pa
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, CVC International	13635as			
1200	1300	DRM	Australia, Radio Australia	5995pa			12080pa
1200	1300		Australia, Radio Australia	6020va			9475as
			9560pa	9580va	9590va		11945as
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		China, China Radio International				5955as
			9460as	9600as	9645as		9730as
			9760va	11650as	11660as		11690as
			11760va	11980as	13645as		13650eu
			17490eu				
1200	1300	Sat/Sun	Equatorial Guinea, Radio East Africa				15190af
1200	1300	DRM	Germany, Deutsche Welle	9545eu			13810eu
1200	1300	Sun	Latvia, Radio SWH	9290eu			
1200	1300	vl	Libya, LJB/Voice of Africa		17725af		21695af
1200	1300		Malaysia, RTM/Traxx FM	7295do			
1200	1300		Nigeria, Voice of Nigeria/External Service				9690af
1200	1300		Palau, T8WH/World Harvest	9930as			12130as
1200	1300		Poland, Polish Radio	7330eu			9525eu
1200	1300		Russia, Voice of Russia		7330as		12065as
			15470as				
1200	1300		South Korea, KBS World Radio				9650na
1200	1300	DRM	Taiwan, Radio Taiwan International				9850va
1200	1300		UK, BBC World Service		5875as		6190af
			6195as	9545eu	9740as		9860af
			11750as	11760me	15310as		15575as
			17640af	17790as	17830af		21470af
1200	1300		USA, American Forces Network				4319usb
			5446usb	5765usb	6350usb		7812usb
			10320usb	12133usb	12759usb		13362usb
1200	1300		USA, EWTN Vandiver AL	12160as			
1200	1300		USA, KNLS Anchor Point AK	7355as			9780as
1200	1300		USA, Voice of America		6140va		7575va
			9510va	9760va	12075va		
1200	1300		USA, WBOH Newport NC	5920am			
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	7490na			9980na
			13845na	15830na			
1200	1300		USA, WWRB Manchester TN	9385va			
1200	1300		USA, WYFR/Family Radio Worldwide				7455na
			11530sa	11970am			
1200	1300		Zambia CVC Intl/ The Voice Africa				6065af
			13590af				
1200	1300		Zambia, Zambia Natl Broadcasting Corp				6165do
1209	1213	mtwhf	Austria, ORF/Radio Austria Intl	17715va			
1230	1300		Bangladesh, Bangladesh Betar				7250as
1230	1300	mtwhf	Ethiopia, Radio Ethiopia/National Service				5990do
			7110do	9704do			
1230	1300		India, All India Radio		4920as		4970as
			5040as	5050as			
1230	1300		Thailand, Radio Thailand World Service				9890va
1230	1300		Turkey, Voice of Turkey		15420eu		15520as
1230	1300		Vietnam, Voice of Vietnam	9840as			12020as
1245	1300	smtwhf	Australia, HCJB Global	15400as			

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

1300	1325		Turkey, Voice of Turkey		15450eu		15520as
1300	1327		Czech Republic, Radio Prague		13580af		17540af
1300	1330		Egypt, Radio Cairo	17835as			
1300	1345		USA, WYFR/Family Radio Worldwide				7455na
			11970na				
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	DRM	Australia, Radio Australia	5995pa			12080pa
1300	1400		Australia, Radio Australia	6020va			9560as
			9580va	9590va			
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		China, China Radio International				5995as
			9570na	9650na	9730as		9760va
			9870as	11660as	11980as		13610eu
			13755as	13790eu	15260na		
1300	1400	Sat/Sun	Equatorial Guinea, Radio East Africa				15190af
1300	1400	DRM	Germany, Deutsche Welle	9545eu			
1300	1400		Indonesia, Voice of Indonesia	9525va			11785al
1300	1400	vl	Libya, LJB/Voice of Africa		17725af		21695af
1300	1400		Malaysia, RTM/Traxx FM	7295do			
1300	1400		New Zealand, Radio NZ International				6170pa
1300	1400		Nigeria, Voice of Nigeria/External Service				9690af
1300	1400		Palau, T8WH/World Harvest	9930as			
1300	1400		Russia, Voice of Russia		7330as		12065as
1300	1400		South Korea, KBS World Radio				9570na
			9770as				
1300	1400		Uganda, UBC Radio	4976do			
1300	1400	DRM	UK, BBC World Service		9545eu		13810eu
1300	1400		UK, BBC World Service		5875as		6190af
			6195as	9545eu	9740as		9860af
			11760me	15310as	15420af		15575as

SHORTWAVE GUIDE

			17640af	17790as	17830af	21470af	
1300	1400		USA, American Forces Network			4319usb	
			5446usb	5765usb	6350usb	7812usb	
			10320usb	12133usb	12759usb	13362usb	
1300	1400		USA, EWTN Vandiver AL		12160as		
1300	1400		USA, KJES Vado NM		11715na		
1300	1400		USA, Voice of America		7575va	9340va	
			9510va	9760va			
1300	1400		USA, WBOH Newport NC		5920am		
1300	1400	Sat/Sun	USA, WHRA Greenbush ME		15195va		
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	15830na			
1300	1400		USA, WWRB Manchester TN		9385va		
1300	1400		USA, WYFR/Family Radio Worldwide			11830na	
			11855as				
1300	1400		Zambia CVC Intl/ The Voice Africa			6065af	
			13590af				
1300	1400		Zambia, Zambia Natl Broadcasting Corp			6165do	
1305	1400	Sun	Greece, Voice of Greece		9420va	15630va	
1310	1340		Japan, NHK World/ Radio Japan			11985as	
1330	1357	fa/ DRM	Czech Republic, Radio Prague		9850eu		
1330	1400	mtwhf	Guam, KSDA/ AWR		15275as		
1330	1400	ha	Guam, KSDA/ AWR		11880as		
1330	1400		India, All India Radio		9690as	11620as	
			13710as				
1330	1400		Laos, Lao National Radio		7145as		
1330	1400		Sweden, Radio Sweden		15735va		
1330	1400		Vietnam, Voice of Vietnam		9840as	12020as	

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

1400	1427		Czech Republic, Radio Prague		9955na		
1400	1430		Australia, Radio Australia		5995va	6080va	
			7240va	9590va			
1400	1430		China, China Radio International			7325as	
1400	1430	f	Clandestine, Shiokaze/Sea Breeze			6120as	
1400	1430	Sun	Germany, Pan American Broadcasting			15205as	
1400	1430	`	Japan, NHK World/ Radio Japan			11705as	
			11985as	13630eu	21560af		
1400	1430		Laos, Lao National Radio		6130as		
1400	1430		Thailand, Radio Thailand World Service			9455va	
1400	1430	Sun	United Arab Emirates, FEBA Radio			12025as	
1400	1457		Netherlands, R Netherlands Worldwide			5825as	
			7530as	9345as	11835as	15815as	
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, HCJB Global		15425as		
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		China, China Radio International			5955as	
			9870as	11675as	11765as	13740na	
			13710eu	13790eu			
1400	1500	Sat/Sun	Equatorial Guinea, Radio East Africa			15190af	
1400	1500		Germany, CVC Intl-Christian Vision			17770af	
1400	1500		Germany, Overcomer Ministries			6110eu	
			13810as				
1400	1500		India, All India Radio		9690as	11620as	
			13710as				
1400	1500	vl	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	9965as	
1400	1500	DRM	Russia, Voice of Russia		9445as	9750eu	
1400	1500		Russia, Voice of Russia		6045as	7330as	
			9850as	15605as			
1400	1500		South Africa, Channel Africa		9625af		
1400	1500		Uganda, UBC Radio		4976do		
1400	1500	DRM	UK, BBC World Service		9545eu	15780eu	
1400	1500		UK, BBC World Service		5875as	6190af	
			6195as	7230af	9545eu	9740as	
			11920as	12095as	15310as	17640af	
			17830af	21470af			
1400	1500	Sat/Sun	UK, Bible Voice Broadcasting		17805as		
1400	1500		USA, American Forces Network			4319usb	
			5446usb	5765usb	6350usb	7812usb	
			10320usb	12133usb	12759usb	13362usb	
1400	1500		USA, EWTN Vandiver AL		12160as		
1400	1500		USA, KJES Vado NM		11715na		
1400	1500		USA, KNLS Anchor Point AK		7355as		
1400	1500		USA, Voice of America		4930af	6080af	
			7575va	9760va	11715va	13750af	
			15580af	17585af			
1400	1500		USA, WBOH Newport NC		5920am		
1400	1500	Sat/Sun	USA, WHRA Greenbush ME		15195va		
1400	1500	Sat/Sun	USA, WHRI Cypress Creek SC		9840va		
1400	1500		USA, WINB Red Lion PA		13570am		
1400	1500	vl	USA, WRMI Miami FL		9955va		
1400	1500		USA, WTJC Newport NC		9370na		
1400	1500		USA, WWCR Nashville TN		7490na	9980na	
			13845na	15830na			
1400	1500		USA, WWRB Manchester TN		9385va		
1400	1500		USA, WYFR/Family Radio Worldwide			11565na	
			11855as	13695na	17760na		
1400	1500		Zambia CVC Intl/ The Voice Africa			6065af	
			13590af				
1400	1500		Zambia, Zambia Natl Broadcasting Corp			6165do	
1415	1430		Nepal, Radio Nepal		5005as		
1415	1439	mtwhfa	Germany, Pan American Broadcasting			15205as	
1415	1450		Guam, KTWR/TWR		9975as		
1430	1445	Sun	Germany, Pan American Broadcasting			15205as	
1430	1500	mtwhfa	Albania, Radio Tirana		13625na		
1430	1500		Australia, Radio Australia		5995va	6080va	
			7240va	9475as	9590va	11660pa	
1430	1500		China, CPBS/CNR Business Radio			6010do	
			7245do				
1430	1500	f/ DRM	New Zealand, Radio NZ International			9660eu	
1430	1500	f/ DRM	South Korea, KBS World Radio			9660eu	
1430	1500		Sweden, Radio Sweden		13820va		

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

1500	1510	mtwhfa	Turkmenistan, Turkmen Radiosi			5015eu	
1500	1515	Sun	UK, Bible Voice Broadcasting		15680as		
1500	1525	Sun	China, Voice of the Strait		9505as		
1500	1530		Australia, HCJB Global		15425as		
1500	1530		China, China Radio International			9600as	
1500	1530	Sat/Sun	Clandestine, Sudan Radio Service			17745af	
1500	1530		Guam, KSDA/ AWR		11720as		
1500	1530		UK, BBC World Service		7385af	11860af	
			15420af				
1500	1530	Sat	UK, Bible Voice Broadcasting		15295as		
1500	1530		UK, Sudan Radio Service		17745af		
1500	1530		Vietnam, Voice of Vietnam		7285va	9840va	
			12020va				
1500	1545		USA, WYFR/Family Radio Worldwide			15210sa	
1500	1550		New Zealand, Radio NZ International			6170pa	
1500	1557		North Korea, Voice of Korea		9335na	11710na	
			13760eu	15245eu			
1500	1600		Anguilla, Worldwide Univ Network			11775am	
1500	1600		Australia, ABC NT Alice Springs			2310do	
1500	1600		Australia, ABC NT Katherine		2485do		
1500	1600		Australia, CVC International		11730as		
1500	1600		Australia, Radio Australia		5995va	6080va	
			7240va	9475as	9590va	11660pa	
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		Canada, Radio Canada International			11675va	
			17720va				
1500	1600		China, China Radio International			5955as	
			6095as	7160as	7325as	7405as	
			9720as	9800as	9870as	11965eu	
			13640as	13740na			
1500	1600	Sat/Sun	Equatorial Guinea, Radio East Africa			15190af	
1500	1600		Germany, CVC Intl-Christian Vision			17770af	
1500	1600		Germany, Overcomer Ministries			6110eu	
			13810as	17485af			
1500	1600	vl	Libya, LJB/Voice of Africa		17725af	21695af	
1500	1600		Malaysia, RTM/Traxx FM		7295do		
1500	1600		Myanmar, Myanma Radio		5985as		
1500	1600		Palau, T8WH/World Harvest		9965as		
1500	1600		Russia, Voice of Russia		4975me	9625as	
			9660as	9735me	9850as	11985me	
			12040eu	15605as			

1500	1600		South Africa, Channel Africa	9625af		
1500	1600		Uganda, Dunamis Shortwave	4750af		
1500	1600		Uganda, UBC Radio	4976do		
1500	1600	DRM	UK, BBC World Service	5790eu	15780eu	
1500	1600		UK, BBC World Service	5875as	5975as	
			6190af	6195as	7230af	7385af
			9740as	11920as	12095eu	15310af
			15400af	17640af	17830af	21470af
1500	1600		USA, American Forces Network			4319usb
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
1500	1600		USA, EWTN Vandiver AL	15610eu		
1500	1600		USA, Voice of America	4930af	6080af	
			7545va	7575va	9700va	12005va
			12150va	13750va	15530va	15580af
			17740va	17895af		
1500	1600		USA, Voice of America/Special English			6160va
			7520va	9485va	9760va	15550va
1500	1600		USA, WBOH Newport NC	5920am		
1500	1600	Sat/Sun	USA, WHRA Greenbush ME	15195va		
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	15830na		
1500	1600		USA, WWRB Manchester TN	9385va		
1500	1600		USA, WYFR/Family Radio Worldwide			11565na
			11855as	17760na		
1500	1600		Zambia CVC Intl/ The Voice Africa			6065af
			13590af			
1500	1600		Zambia, Zambia Natl Broadcasting Corp			6165do
1505	1600	DRM	Canada, Radio Canada International			9800na
1505	1600		Canada, Radio Canada International			9515na
1530	1545		India, All India Radio	7255as	9820as	
			9910as			
1530	1550	smtwhf	Vatican City State, Vatican Radio			13765as
			15235as			
1530	1600		Germany, AWR-Europe	15335as		
1530	1600		Iran, Voice of Islamic Rep. of Iran			7305as
			9600as	9635as		
1530	1600		Mongolia, Voice of Mongolia	9665as		
1530	1600		Sweden, Radio Sweden	13600va		
1530	1600	Sat	UK, BBC World Service	7385af	15420af	
1530	1600	Sun	UK, Bible Voice Broadcasting	13590me		
1530	1600	ha	UK, Bible Voice Broadcasting	15680as		
1530	1600		Vatican City State, Vatican Radio			11850as
1530	1600	Sat	Vatican City State, Vatican Radio			13765as
			15235as			
1545	1600	mw	UK, Bible Voice Broadcasting	13590me		
1545	1600	thf	UK, Bible Voice Broadcasting	13590me		
1551	1600	DRM	New Zealand, Radio NZ International			6170pa
1551	1600		New Zealand, Radio NZ International			7285pa

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

1600	1605	Sun	Croatia, Voice of Croatia	6165eu		
1600	1615	mtwhfa	Croatia, Voice of Croatia	6165eu		
1600	1615		Pakistan, Radio Pakistan	9385va	11565va	
			15100as			
1600	1615		UK, Bible Voice Broadcasting	13590me		
1600	1627		Czech Republic, Radio Prague	5930eu	17845na	
1600	1627		Iran, Voice of Islamic Rep. of Iran			7305as
			9600as			
1600	1630	Sun	Germany, Pan American Broadcasting			13830as
1600	1630		Guam, KSDA/ AWR	11720as	11805as	
1600	1630		Myanmar, Myanma Radio	9730do		
1600	1630		Vietnam, Voice of Vietnam	7220va	7280va	
			9550va	9730va		
1600	1630		Yemen, Rep of Yemen Radio/ Radio Sana'a			
			9780me			
1600	1645	h	UK, Bible Voice Broadcasting	13590me		
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	9680as		
1600	1700		Australia, Radio Australia	5995va	6080va	
			7240as	9475va	9580va	9710as
			11660pa			
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	DRM	Canada, Radio Canada International			9800na
1600	1700		Canada, Radio Canada International			9515na
1600	1700		China, China Radio International			6095af
			6180as	7235as	7420af	9570af
			9720af	9760as	11650eu	11900af
			11940eu	11965eu	13760eu	
1600	1700	Sat	Clandestine, Cheetah Radio	11730as		
1600	1700		Egypt, Radio Cairo	12170af		
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	6170as	9485as	
			9540as	15640as		
1600	1700		Malaysia, RTM/Traxx FM	7295do		
1600	1700	DRM	New Zealand, Radio NZ International			6170pa
1600	1700		New Zealand, Radio NZ International			7285pa
1600	1700		Palau, T8WH/World Harvest	9965as		
1600	1700		Russia, Voice of Russia	4975me	11985va	
			12040af	13855af		
1600	1700		South Korea, KBS World Radio			9515eu
1600	1700		Taiwan, Radio Taiwan International			11550as
			13840as			
1600	1700		Uganda, Dunamis Shortwave	4750af		
1600	1700		Uganda, UBC Radio	4976do		
1600	1700	DRM	UK, BBC World Service	5790eu	11810eu	
1600	1700		UK, BBC World Service	3255af	5790eu	
			5975as	6190af	7385af	9625as
			11920as	12095eu	15400af	17640af
			17795af	17830af	21470af	
1600	1700	Sat	UK, BBC World Service	7385af	15420af	
1600	1700	t	UK, Bible Voice Broadcasting	13590me		
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 Vandiver AL	15610eu		
1600	1700		USA, Voice of America	4930af	6080af	
			9885af	15580af	17715af	
1600	1700		USA, Voice of America/Special English			12080va
			13570va	17895va		
1600	1700		USA, WBOH Newport NC	5920am		
1600	1700		USA, WHRA Greenbush ME	17520af		
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	9980na	12160na	
			13845na	15830na		
1600	1700		USA, WWRB Manchester TN	9385va		
1600	1700		USA, WYFR/Family Radio Worldwide			6085na
			13695na	17690af	18980eu	21455eu
1600	1700		Zambia CVC Intl/ The Voice Africa			6065af
			13590af			
1600	1700		Zambia, Zambia Natl Broadcasting Corp			6165do
1615	1630		Vatican City State, Vatican Radio			4005eu
			5885eu	7250eu	9645eu	15595va
1615	1700	Sun	UK, BBC World Service	7385af	11860af	
			15420af			
1630	1657		Slovakia, Radio Slovakia International			5920eu
			6055eu			
1630	1700		Guam, KSDA/ AWR	6190as		
1630	1700	mtwhf	UK, BBC World Service	15420af		
1630	1700	Sat	UK, BBC World Service	11860af		
1640	1650	mtwhfa	Turkmenistan, Turkmen Radiosi			4930eu
1645	1700		Tajikistan, Voice of Tajik	7245as		

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

1700	1705	DRM	Canada, Radio Canada International			9800na
1700	1725		Vietnam, Voice of Vietnam	9725eu		
1700	1727		Czech Republic, Radio Prague	5930eu	17485eu	
1700	1730		Australia, CVC International	9680as		
1700	1730	DRM	Romania, Radio Romania International			7460eu
1700	1730		USA, Voice of America	6080af	9885af	
			11835af	15580af		
1700	1745		USA, WYFR/Family Radio Worldwide			18980eu
1700	1746		UK, BBC World Service	6005af	9410af	
1700	1750	DRM	New Zealand, Radio NZ International			6170pa
1700	1750		New Zealand, Radio NZ International			7285pa
1700	1756		Romania, Radio Romania International			9535eu
			11735eu			
1700	1759		Poland, Polish Radio	9790eu		
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, Radio Australia	5995va	6080va	
			9475as	9580va	9710as	11880as
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		Canada, Radio Canada International		9515va	
1700	1800	Sat/Sun	Canada, Radio Canada International		5850va	
1700	1800		China, China Radio International		6060as	
			6090as	6140as	6145eu	6165as
			7235as	7265as	7315va	7335eu
			7410as	7420as	9570af	9695eu
			11900af	11940eu	13760eu	
1700	1800		Egypt, Radio Cairo	12170af		
1700	1800		Equatorial Guinea, Radio Africa		7190af	
			15190af			
1700	1800		Germany, CVC Intl-Christian Vision		17770af	
1700	1800		Malaysia, RTM/Traxx FM	7295do		
1700	1800		Nigeria, Voice of Nigeria/External Service		15120af	
1700	1800		Palau, T8WH/World Harvest	9965as		
1700	1800	DRM	Poland, Polish Radio	7265eu		
1700	1800	DRM	Romania, Radio Romania International		9535eu	
1700	1800		Russia, Voice of Russia	4975me	11610me	
			11985af	12040af	12070af	13855af
1700	1800		South Africa, Channel Africa	15235af		
1700	1800		Swaziland, TWR Swaziland	3200af		
1700	1800		Taiwan, Radio Taiwan International		15690af	
1700	1800		Tajikistan, Voice of Tajik	7245as		
1700	1800		Uganda, Dunamis Shortwave	4750af		
1700	1800		Uganda, UBC Radio	4976do		
1700	1800		UK, BBC World Service	3255af	5790eu	
			5875eu	5975as	6190af	7400as
			7405af	9625as	9960eu	12095af
			13675eu	15400af	17795af	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 Vandiver AL	15610na		
1700	1800	Sat/Sun	USA, Voice of America	15675af		
1700	1800		USA, WBCQ Monticello ME	15420am		
1700	1800		USA, WBOH Newport NC	5920am		
1700	1800		USA, WHRA Greenbush ME	17520af		
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	15830na		
1700	1800		USA, WWRB Manchester TN	9385va		
1700	1800		USA, WYFR/Family Radio Worldwide		13695na	
			17555na	21455eu		
1700	1800		Zambia CVC Intl/ The Voice Africa		4965af	
			13590af			
1700	1800		Zambia, Zambia Natl Broadcasting Corp		6165do	
1720	1740	fas	USA, Voice of America	4930va	11605va	
			15775va			
1730	1800	DRM	Bulgaria, Radio Bulgaria	9400eu		
1730	1800		Bulgaria, Radio Bulgaria	5900eu	7400eu	
1730	1800		Clandestine, Sudan Radio Service		9590af	
1730	1800	fa	UK, Bible Voice Broadcasting	13590me		
1730	1800	mtwhf	UK, Sudan Radio Service	9840af		
1730	1800		USA, Voice of America	6080af	9885af	
			15580af	17895af		
1730	1800	mtwh	USA, Voice of America	4930va	11605va	
			15775va			
1730	1800		Vatican City State, Vatican Radio		11625af	
			13765af	15570af		
1745	1800		Bangladesh, Bangladesh Betar		7250as	
1745	1800	DRM	India, All India Radio	9950eu		
1745	1800		India, All India Radio	7410eu	9445af	
			11620eu	11935af	13605as	15155af
			17670af			
1750	1800		New Zealand, Radio NZ International		6170pa	
1751	1800	DRM	New Zealand, Radio NZ International		7285pa	

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

1800	1815	Sun	UK, Bible Voice Broadcasting	13590me		
1800	1830		China, China Radio International		6020eu	
			7265eu			
1800	1830		South Africa, AWR Africa	3215af	3345af	
			9610af			
1800	1830		UK, BBC World Service	5975as	6015as	
			9625as			
1800	1830	Sat	UK, Bible Voice Broadcasting	13590as		
1800	1830		USA, Voice of America	6080af	9885af	
			15580af			
1800	1830	Sat/Sun	USA, Voice of America	4930af		
1800	1845	smtwhf	Swaziland, TWR Swaziland	9500af		
1800	1845	Sat	UK, Bible Voice Broadcasting	6130eu		
1800	1850	DRM	New Zealand, Radio NZ International		7285pa	
1800	1850		New Zealand, Radio NZ International		6170pa	
1800	1857		Netherlands, R Netherlands Worldwide		6020af	
			15535af			
1800	1857		North Korea, Voice of Korea	13760eu	15245eu	
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	6080va	7240as	
			9475va	9580as	9710as	11880as
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		Canada, Radio Canada International		9530af	
			11765af	17735af	17810af	
1800	1900		China, China Radio International		6030eu	
			9600eu	13760eu		
1800	1900		Equatorial Guinea, Radio Africa		7190af	
			15190af			
1800	1900		Germany, CVC Intl-Christian Vision		17770af	
1800	1900	DRM	India, All India Radio	9950eu		
1800	1900		India, All India Radio	7410eu	9445af	
			11620eu	11935af	13605as	15155af
			17670af			
1800	1900	fas	Italy, IRRS-Shortwave	7290va		
1800	1900		Kuwait, Radio Kuwait	11990va		
1800	1900		Malaysia, RTM/Traxx FM	7295do		
1800	1900		Nigeria, Voice of Nigeria/External Service		15120af	
1800	1900		Palau, T8WH/World Harvest	9965as		
1800	1900		Russia, Voice of Russia	4975me	12040af	
			12070af			
1800	1900		South Korea, KBS World Radio		7275eu	
1800	1900		Swaziland, TWR Swaziland	3200af		
1800	1900	Sat	Swaziland, TWR Swaziland	9500af		
1800	1900		Taiwan, Radio Taiwan International		6155eu	
1800	1900		Uganda, Dunamis Shortwave	4750af		
1800	1900		Uganda, UBC Radio	4976do		
1800	1900		UK, BBC World Service	3255af	5790eu	
			5875eu	5995as	6190af	7405af
			9485as	9660eu	11810af	12095af
			13675eu	15400af	17795af	
1800	1900		USA, American Forces Network		4319usb	
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
1800	1900		USA, EWTN Vandiver AL	15610na		
1800	1900		USA, Voice of America	17895af		
1800	1900		USA, WBCQ Monticello ME	15420am		
1800	1900		USA, WBOH Newport NC	5920am		
1800	1900		USA, WHRA Greenbush ME	17520af		
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	15830na		
1800	1900		USA, WWRB Manchester TN	9385va		
1800	1900		USA, WYFR/Family Radio Worldwide		6915na	
			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	
1805	1810	Sat	Croatia, Voice of Croatia	6165eu		
1805	1815	mtwhf	Croatia, Voice of Croatia	6165eu		
1810	1820	f	USA, Voice of America	4930va	11605va	
			15775va			
1815	1845	Sun	UK, Bible Voice Broadcasting	9430me		
1830	1845		Rwanda, Radio Rwanda	6055do		
1830	1857		Slovakia, Radio Slovakia International		5920eu	
			6055eu			
1830	1858		Serbia, International Radio of Serbia		6100eu	
1830	1900		Turkey, Voice of Turkey	9785eu		

1830	1900		UK, BBC World Service	6005af	9410af	
1830	1900	f	UK, Bible Voice Broadcasting	9430me		
1830	1900		USA, Voice of America	4930af	6080af	
			9885af	15580af	17895af	
1845	1900	mtwhfa	Albania, Radio Tirana	7435eu	13640na	
1845	1900	Sun	UK, Bible Voice Broadcasting	11830af		
1851	1900	DRM	New Zealand, Radio NZ International	9890pa		

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

1900	1905		Canada, Radio Canada International	9515va		
1900	1925		Turkey, Voice of Turkey	9785eu		
1900	1930		Germany, Deutsche Welle	6150af	11795af	
			13650af	17860af		
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	7410eu	9445af	
			11620eu	11935af	13605as	15155af
			17670af			
1900	1945		USA, WYFR/Family Radio Worldwide	6085na		
			15565as			
1900	1950		New Zealand, Radio NZ International	9615pa		
1900	1955		Netherlands, R Netherlands Worldwide	9480af		
			11660af	15335af		
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	6080va	7240as	
			9500va	9580va	9710as	11880as
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		China, China Radio International	7285eu		
			7295va	9435va	9440va	
1900	2000		Egypt, Radio Cairo	11510af		
1900	2000		Equatorial Guinea, Radio Africa	7190af		
			15190af			
1900	2000		Germany, CVC Intl-Christian Vision	17770af		
1900	2000		Germany, Overcomer Ministries	6175eu		
1900	2000	fas	Italy, IRRS-Shortwave	7290va		
1900	2000		Kuwait, Radio Kuwait	11990va		
1900	2000		Malaysia, RTM/Traxx FM	7295do		
1900	2000		Nigeria, Voice of Nigeria/External Service	15120af		
1900	2000		Palau, T8WH/World Harvest	9965as		
1900	2000		Russia, Voice of Russia	12040af	12070af	
1900	2000	mtwhf	Spain, Radio Exterior de Espana	9665eu		
			11620af			
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	3995eu	
			5875eu	5995as	6005af	6155as
			6190af	9410af	11810af	12095af
			15400af	17795af		
1900	2000	Sun	UK, Bible Voice Broadcasting	11830af		
1900	2000		Ukraine, Radio Ukraine International	7490eu		
1900	2000		USA, American Forces Network	4319usb		
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
1900	2000		USA, EWTN Vandiver AL	15610na		
1900	2000		USA, Voice of America	4930af	4940af	
			6120af	9885af	15580af	17895af
1900	2000		USA, Voice of America/Special English	7480va		
			9780va			
1900	2000	smtwhf	USA, WBCQ Monticello ME	7415am		
1900	2000		USA, WBOH Newport NC	5920am		
1900	2000	twhfas	USA, WHRA Greenbush ME	9840af		
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	15830na		
1900	2000		USA, WWRB Manchester TN	9385va		
1900	2000		USA, WYFR/Family Radio Worldwide	6915na		
			13695na	15115af	17535na	17555na
1900	2000		Zambia CVC Intl/ The Voice Africa	4965af		
			5940af			
1900	2000		Zambia, Zambia Natl Broadcasting Corp	6165do		
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		
			6205eu	7205eu	9800af	9925af
1930	2000		South Africa, RTE Radio One	6225af		
1936	1950	DRM	New Zealand, Radio NZ International	9890pa		
1945	2000	mtwhf	UK, Bible Voice Broadcasting	11830af		
1945	2000	DRM	Vatican City State, Vatican Radio	9800na		
1950	2000		New Zealand, Radio NZ International	11725pa		
1950	2000		Vatican City State, Vatican Radio	4005eu		
			5885eu	7250eu	9645eu	
1951	2000	DRM	New Zealand, Radio NZ International	9890pa		

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	2015	mtwhf	UK, Bible Voice Broadcasting	11830af		
2000	2020		Vatican City State, Vatican Radio	4005eu		
			5885eu	7250eu	9645eu	
2000	2027		Czech Republic, Radio Prague	5930eu	11600na	
2000	2028		Iran, Voice of Islamic Rep. of Iran	5940eu		
			6205eu	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	9885af	15580af	17895af
2000	2030	DRM	Vatican City State, Vatican Radio	9800na		
2000	2030		Vatican City State, Vatican Radio	7365af		
			9755af	11625af		
2000	2045		USA, WYFR/Family Radio Worldwide	5745eu		
2000	2050	DRM	New Zealand, Radio NZ International	9890pa		
2000	2050		New Zealand, Radio NZ International	11725pa		
2000	2057		Netherlands, R Netherlands Worldwide	5905af		
			7425af	11610af		
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	Sat/Sun	Australia, Radio Australia	6080va	7240va	
			12080as			
2000	2100		Australia, Radio Australia	9500va	11650as	
			11660pa	11880as		
2000	2100		Bahrain, Radio Bahrain	6010me	9745al	
2000	2100		Belarus, Radio Belarus	7210eu	7255as	
			7390eu			
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		Canada, Radio Canada International	15235va		
			17735va			
2000	2100		China, China Radio International	5960eu		
			5985af	7275va	7285eu	7415eu
			9600eu	11640af	13630af	
2000	2100		Equatorial Guinea, Radio Africa	7190af		
			15190af			
2000	2100		Germany, CVC Intl-Christian Vision	17770af		
2000	2100		Germany, Deutsche Welle	6150af	11795af	
			11865af	13650af		
2000	2100		Indonesia, Voice of Indonesia	9525va	11785al	
2000	2100		Kuwait, Radio Kuwait	11990va		
2000	2100		Malaysia, RTM/Traxx FM	7295do		
2000	2100		Nigeria, Voice of Nigeria/External Service	15120af		
2000	2100		Palau, T8WH/World Harvest	9965as		
2000	2100		Russia, Voice of Russia	12040af	12070af	
2000	2100		Uganda, UBC Radio	4976do		
2000	2100	DRM	UK, BBC World Service	3995eu	5875eu	
2000	2100		UK, BBC World Service	3255af	3995eu	
			5875eu	6005af	6190af	9410af
			11810af	12095af	13820af	15400af
2000	2100		USA, American Forces Network	4319usb		
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
2000	2100		USA, EWTN Vandiver AL	15610me		
2000	2100		USA, WBCQ Monticello ME	7415am		
2000	2100		USA, WBOH Newport NC	5920am		
2000	2100		USA, WHRA Greenbush ME	15665af		
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	15830na		

2000	2100		USA, WWRB Manchester TN	9385va		
2000	2100		USA, WYFR/Family Radio Worldwide	6915na		
			15115af	17535na	17555na	17575as
2000	2100		Zambia CVC Intl/ The Voice Africa	4965af		
			5940af			
2000	2100		Zambia, Zambia Natl Broadcasting Corp	6165do		
2000	2105		Uganda, UBC Radio	4976do		
2030	2045		Thailand, Radio Thailand World Service	9680eu		
2030	2056		Romania, Radio Romania International	9690na		
			9765eu	11810eu	11940af	
2030	2100		Cuba, Radio Havana Cuba	11760va	17660va	
2030	2100		Sweden, Radio Sweden	7395va		
2030	2100		Turkey, Voice of Turkey	7205va		
2030	2100		USA, Voice of America	4930af	6080af	
			7555va	9885af	15580af	17895af
2030	2100		Vietnam, Voice of Vietnam	7220va	7280va	
			9550va	9730va		
2045	2100		India, All India Radio	7410eu	9445eu	
			9910pa	9950eu	11620va	11715pa
2051	2100		New Zealand, Radio NZ International	13730pa		
2051	2200	DRM	New Zealand, Radio NZ International	15720pa		

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

2100	2125		Turkey, Voice of Turkey	7205va		
2100	2128		Serbia, International Radio of Serbia	6100eu		
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	Sat	Canada, CBC NQ SW Service	9625na		
2100	2130		China, China Radio International	6135eu		
			7225eu	7415eu	9490eu	9600eu
			11640af	13630af		
2100	2130		Cuba, Radio Havana Cuba	17600va	17660va	
2100	2130		Germany, TWR Europe	11955af		
2100	2130		South Korea, KBS World Radio	3955eu		
2100	2145		USA, WYFR/Family Radio Worldwide	6915na		
			15115af	17535na	17555na	
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	9660as	
			11650pa	11660pa	11695as	12080as
			13630as	15515as		
2100	2200		Bahrain, Radio Bahrain	6010me	9745al	
2100	2200		Belarus, Radio Belarus	7210eu	7255as	
			7390eu			
2100	2200		Bulgaria, Radio Bulgaria	5900eu	7400eu	
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	DRM	Canada, Radio Canada International	9800na		
2100	2200		China, China Radio International	5990eu		
			7205af	7285eu	7325af	
2100	2200		Equatorial Guinea, Radio Africa	7190af		
			15190af			
2100	2200		Germany, Deutsche Welle	9735af	11865af	
			15205af			
2100	2200		Germany, Overcomer Ministries	6175eu		
2100	2200		India, All India Radio	7410eu	9445eu	
			9910pa	9950eu	11620va	11715pa
2100	2200		Malaysia, RTM/Traxx FM	7295do		
2100	2200		New Zealand, Radio NZ International	13730pa		
2100	2200		Palau, T8WH/World Harvest	9965as		
2100	2200		Russia, Voice of Russia	12040af	12070af	
2100	2200	Sat/Sun	Spain, Radio Exterior de Espana	9650eu		
2100	2200		Syria, Radio Damascus	9330eu	12085as	
2100	2200	DRM	UK, BBC World Service	3995eu	5790eu	
2100	2200		UK, BBC World Service	3255af	3915as	
			5790eu	5905as	5965as	6005af
			6190af	6195as	7410af	9915af
			12095af			
2100	2200		Ukraine, Radio Ukraine International	5840eu		
2100	2200		USA, American Forces Network	4319usb		
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
2100	2200		USA, EWTN Vandiver AL	15610me		
2100	2200		USA, Voice of America	6080af	7555va	
			15580af			
2100	2200		USA, WBCQ Monticello ME	7415am		
2100	2200		USA, WBOH Newport NC	5920am		
2100	2200		USA, WHRA Greenbush ME	15665af		
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	9265am		
2100	2200	vl	USA, WRMI Miami FL	9955ca		
2100	2200		USA, WTJC Newport NC	9370na		
2100	2200		USA, WWCR Nashville TN	7465na	9980na	
			12160na	15830na		
2100	2200		USA, WWRB Manchester TN	9385va		
2100	2200		USA, WYFR/Family Radio Worldwide	5950na		
2100	2200		Zambia CVC Intl/ The Voice Africa	4965af		
			5940af			
2100	2200		Zambia, Zambia Natl Broadcasting Corp	6165do		
2115	2200		Egypt, Radio Cairo	6255eu		
2130	2157		Czech Republic, Radio Prague	9410na	11600na	
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	6135eu		
			7225eu	7325eu	7365eu	7415eu
			9600eu			
2130	2200		Guam, KSDA/ AWR	11850as		
2130	2200		Sweden, Radio Sweden	7395va		
2130	2228		Lithuania, Mighty KBC Radio	6055eu		

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

2200	2205		Zambia, Zambia Natl Broadcasting Corp	6165do		
2200	2220		Japan, NHK World/ Radio Japan	13640pa		
2200	2230		Australia, HCJB Global	15525as		
2200	2230		India, All India Radio	7410eu	9445eu	
			9910pa	9950eu	11620va	11715pa
2200	2235	DRM	New Zealand, Radio NZ International	15720pa		
2200	2235		New Zealand, Radio NZ International	13730pa		
2200	2245		Egypt, Radio Cairo	6255eu		
2200	2245		USA, WYFR/Family Radio Worldwide	17690af		
2200	2255		Turkey, Voice of Turkey	9830va		
2200	2256		Romania, Radio Romania International	7440eu		
			9675eu	9790af	11940af	
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, Radio Australia	12010va	13630pa	
			15230va	15240pa	15515as	15560pa
			17795va			
2200	2300		Bahrain, Radio Bahrain	6010me	9745al	
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		China, China Radio International	7240as		
			7350eu	7360eu	9590as	
2200	2300		Equatorial Guinea, Radio Africa	7190af		
			15190af			
2200	2300		Malaysia, RTM/Traxx FM	7295do		
2200	2300		Palau, T8WH/World Harvest	9965as		
2200	2300		Russia, Voice of Russia	9890na	12040af	
			12070af			
2200	2300		UK, BBC World Service	3915as	5905as	
			5965as	6005af	6195as	9440as
			9740as	9915af	12095af	
2200	2300		USA, American Forces Network	4319usb		
			5446usb	5765usb	6350usb	7812usb
			10320usb	12133usb	12759usb	13362usb
2200	2300		USA, EWTN Vandiver AL	15610me		
2200	2300		USA, Voice of America	5895va	5915va	
			7480va	7555va	9415va	11955va
2200	2300		USA, WBCQ Monticello ME	5110am	7415am	
2200	2300		USA, WBOH Newport NC	5920am		
2200	2300		USA, WHRA Greenbush ME	11885af		
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	5050va	6890va	
			9385va			
2200	2300		USA, WYFR/Family Radio Worldwide	5950na		
			11740na	15440na		
2200	2300		Zambia CVC Intl/ The Voice Africa	4965af		
2215	2230	mtwhs	Moldova, (Transnistria) Radio PMR	9665na		
2230	2257		Czech Republic, Radio Prague	7345na	9415na	
2230	2300		Guam, KSDA/ AWR	15320as		
2230	2300		USA, Voice of America/Special English	9570va		
			11705va	15145va		
2236	2300	DRM	New Zealand, Radio NZ International	13730pa		
2245	2300		India, All India Radio	9705eu	9950as	
			11620as	11645as	13605as	

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		Bahrain, Radio Bahrain	6010me		9745al
2300	0000	DRM	Belgium, TDP Radio	9790na		
2300	0000		Bulgaria, Radio Bulgaria	9700na		11700na
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		China, China Radio International			5915as
			5990na	6145na	7410na	9610as
			11690as	11790as	11840na	
2300	0000		Cuba, Radio Havana Cuba	13790sa		
2300	0000		Egypt, Radio Cairo	11590na		
2300	0000		India, All India Radio	9705eu		9950as
			11620as	11645as	13605as	
2300	0000		Malaysia, RTM/Traxx FM	7295do		
2300	0000	DRM	New Zealand, Radio NZ International			13730pa
2300	0000		New Zealand, Radio NZ International			15720pa
2300	0000		Russia, Voice of Russia	9665sa		9890na
2300	0000		UK, BBC World Service	3915as		5965as
			6195as	9580as	9740as	9885as
			11850as	12010as		
2300	0000		USA, American Forces Network			4319usb
			5446va	5765va	6350va	7812va
			10320va	12133va	12759va	13362va
2300	0000		USA, EWTN Vandiver AL	15610me		
2300	0000		USA, Voice of America	5895va		5915va
			7480va	9415va	11955va	
2300	0000		USA, WBCQ Monticello ME	5110am		7415am
2300	0000		USA, WBOH Newport NC	5920am		
2300	0000		USA, WHRA Greenbush ME	9615eu		
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	5070na		7465na
			9980na	13845na		
2300	0000		USA, WWRB Manchester TN	5050va		6890va
			9385va			
2300	0000		USA, WYFR/Family Radio Worldwide			9430sa
			15400sa	15440na		
2300	0000		Zambia CVC Intl/ The Voice Africa			4965af
2300	2330		Australia, Radio Australia	9660as		12010pa
			12080pa	13690pa	15230va	15240pa
			15560va	17795va		
2300	2330		Palau, T8WH/World Harvest	15550as		
2300	2330		USA, Voice of America/Special English			9570va
			13755va	15145va		
2300	2330		Venezuela, Radio Nacional de Venezuela			13680ca
			15250ca			
2300	2345		USA, WYFR/Family Radio Worldwide			11740na
2300	2345	DRM	Vatican City State, Vatican Radio			9755na
2305	0000	mtwhf	Canada, Radio Canada International			6100am
2305	0000	Sat	Greece, Voice of Greece	7475va		9420va
2315	2330		Croatia, Voice of Croatia	3985eu		7375sa
2330	0000		Australia, Radio Australia	9660as		12010as
			12080as	13690as	15230va	15415as
			15560va	17750va	17795va	
2330	0000		USA, Voice of America/Special English			7460va
			9570va	13755va	15145va	15340va
2330	2358		Vietnam, Voice of Vietnam	9840as		12020as

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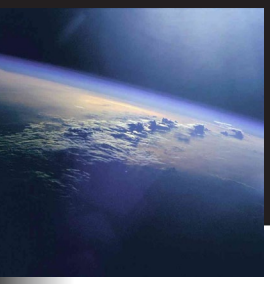
Albania, Radio Tirana ..... **http://rtsh.sil.at/**
Angola, Radio Nacional de Angola..... **www.rna.ao/**
Anguilla, Worldwide Univ Network ..... **www.worldwideuniversitynetwork.com/**
Argentina, Radio Nacional RAE..... **www.radionacional.com.ar/**
Australia, ABC NT Alice Springs..... **www.abc.net.au/radio/**
Australia, ABC NT Katherine..... **www.abc.net.au/radio/**
Australia, ABC NT Tennant Creek ..... **www.abc.net.au/radio/**
Australia, CVC International ..... **www.christianvision.com/**
Australia, HCJB Global ..... **www.hcjb.org/**
Australia, Radio Australia ..... **www.abc.net.au/ra/**
Austria, ORF/Radio Austria Intl **http://oe1.orf.at/service/international**
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, Voice of Croatia..... **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/radioethiopia/**
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-Shortwave..... **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**
Latvia, Radio SWH ..... **www.radioswh.lv/index.php**
Libya, LJB/Voice of Africa ..... **www.voiceofafrica.com.ly**
Lithuania, Mighty KBC Radio ..... **www.kbcradio.eu**
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, 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, Eternal Good News ..... **www.oldpaths.net/**
USA, EWTN 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, WBOH Newport NC..... **www.fbnradio.com/**
USA, WHRA Greenbush ME..... **www.whr.org/**
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**



MTXtra
Shortwave Broadcast Guide

SPANISH

The following language schedule is extracted from our new MTXtra Shortwave Broadcast Guide pdf which is a free download to all MTXpress subscribers. The online SW Guide combines more than 9,100 entries including all languages, sorted by time and updated monthly.

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

0000	0005		Austria, ORF/Radio Austria Intl	9820ca		
0000	0010	mtwhf	Spain, Radio Exterior de Espana			17595sa
0000	0027		Czech Republic, Radio Prague	7275sa		
0000	0100		Bolivia, Radio Eco	4409do		
0000	0100		Bolivia, Radio Estambul	4498do		
0000	0100		Bolivia, Radio Nacional de Huanuni			5967do
0000	0100		Bolivia, Radio San Jose	5580do		
0000	0100		Bolivia, Radio San Miguel	4699do		
0000	0100		Bolivia, Radio Tacana	4781do		
0000	0100		Bolivia, Radio Virgen de Remedios			4834do
0000	0100		Bolivia, Radio Yura	4716do		
0000	0100		Canada, Radio Canada International			11990sa
			13725ca			
0000	0100		Chile, La Voz Crista	9745sa		11665sa
0000	0100		China, China Radio International			5990ca
			15120sa			
0000	0100		Clandestine, Radio Republica	9545ca		
0000	0100		Colombia, La Voz de tu Conciencia			6010do
			5910al			
0000	0100		Colombia, La Voz del Guaviare			6035do
0000	0100		Colombia, Radio Marfil Estereo			5910do
			6010al			
0000	0100		Cuba, Radio Havana Cuba	5965ca		6000na
			6060na	6120na	6140na	9600sa
			11690sa	13760eu		
0000	0100		Cuba, Radio Rebelde	5025na		
0000	0100		Ecuador, HCJB Global	11625am		
0000	0100		Ecuador, Radio Quito	4919do		
0000	0100		Guatemala, Radio Verdad	4052do		
0000	0100		Honduras, HRMI/ Radio Misiones Intl			3340do
0000	0100		Honduras, Radio Luz y Vida	3250do		
0000	0100		Mexico, XEOI/Radio Mil	6010do		
0000	0100		Mexico, XERTA/Radio Transcontinental			4800do
0000	0100		Mexico, XEXQ/Radio Universidad			6045do
0000	0100		North Korea, Voice of Korea	11735am		13760am
			15180am			
0000	0100		Peru, Radio Bethel	5949do		
0000	0100		Peru, Radio Bolivar	5460do		
0000	0100	Sun	Peru, Radio Cusco	6195do		
0000	0100		Peru, Radio La Voz De Bolivar	5460do		4755al
0000	0100		Peru, Radio La Voz de la Selva	4824do		
0000	0100		Peru, Radio La Voz de las Huarinjas			5059do
0000	0100		Peru, Radio Libertad de Junin	5039do		
0000	0100		Peru, Radio Maranon	4835do		
0000	0100		Peru, Radio Melodia	5940do		
0000	0100		Peru, Radio Rasuwilca	4805do		
0000	0100		Peru, Radio San Antonio	4940do		
0000	0100		Peru, Radio San Nicolas	5470do		
0000	0100		Peru, Radio Santa Monica	4965do		
0000	0100		Peru, Radio Santa Rosa	6047do		
0000	0100		Peru, Radio Super Sensacion	6536do		
0000	0100	twhfas	Peru, Radio Tarma	4775do		
0000	0100		Peru, Radio Union	6114do		
0000	0100		Peru, Radio Vision	4790do		
0000	0100		Russia, Voice of Russia	7300sa		9810sa
			11510sa			
0000	0100		Spain, Radio Exterior de Espana			6020sa
			9535am	9620sa	11680sa	15160sa
0000	0100	mtwhf	Spain, Radio Exterior de Espana			5970sa
0000	0100	Sat	Spain, Radio Exterior de Espana			11815sa
0000	0100		USA, EWTN Vandiver AL	5810ca		17510sa
0000	0100		USA, KVOH Rancho Simi CA	17775ca		
0000	0100		USA, Radio Marti 6030ca	7365ca		11775ca
0000	0100		USA, WYFR/Family Radio Worldwide			5985ca
			9760sa	11835ca	11855ca	15215sa
			17895sa			
0000	0100		Venezuela, Radio Amazonas	4940do		mt0909
0030	0035		Austria, ORF/Radio Austria Intl	9820eu		
0030	0057		Czech Republic, Radio Prague	7345am		9440am
0030	0100		Iran, Voice of Islamic Rep. of Iran			9655sa
			9905sa			
0045	0100		Egypt, Radio Cairo	7540na	9360ca	9915sa

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

0100	0105		Austria, ORF/Radio Austria Intl	9820sa		
0100	0130		France, Radio France International			5995sa
			9750sa			
0100	0130		Peru, Radio San Nicolas	5470do		
0100	0145		USA, WYFR/Family Radio Worldwide			17725sa
0100	0157		Netherlands, R Netherlands Worldwide			6165am
			7325ca	9450ca		
0100	0200		Bolivia, Radio Eco	4409do		
0100	0200		Bolivia, Radio Estambul	4498do		
0100	0200		Bolivia, Radio Nacional de Huanuni			5967do
0100	0200		Bolivia, Radio San Jose	5580do		
0100	0200		Bolivia, Radio San Miguel	4699do		
0100	0200		Bolivia, Radio Tacana	4781do		
0100	0200		Bolivia, Radio Yura	4716do		
0100	0200		Bulgaria, Radio Bulgaria	7400sa		9400va
0100	0200		Chile, La Voz Crista	9745sa		11665sa
0100	0200		China, China Radio International			9595sa
			9665sa	9710sa		
0100	0200		Clandestine, Radio Republica	9545ca		
0100	0200		Colombia, La Voz de tu Conciencia			6010do
			5910al			
0100	0200		Colombia, La Voz del Guaviare			6035do
0100	0200		Colombia, Radio Marfil Estereo			5910do
			6010al			
0100	0200		Cuba, Radio Havana Cuba	5965ca		6060na
			6120na	9600sa	11690sa	13760eu
			13790eu			
0100	0200		Cuba, Radio Rebelde	5025na		
0100	0200		Ecuador, HCJB Global	11625am		
0100	0200		Ecuador, Radio Quito	4919do		
0100	0200		Egypt, Radio Cairo	7540na	9360ca	9915sa
0100	0200		Guatemala, Radio Verdad	4052do		
0100	0200		Honduras, HRMI/ Radio Misiones Intl			3340do
0100	0200		Honduras, Radio Luz y Vida	3250do		
0100	0200		Mexico, XEOI/Radio Mil	6010do		
0100	0200		Mexico, XERTA/Radio Transcontinental			4800do
0100	0200		Mexico, XEXQ/Radio Universidad			6045do
0100	0200		Peru, Radio Bethel	5949do		
0100	0200		Peru, Radio Bolivar	5460do		
0100	0200	Sun	Peru, Radio Cusco	6195do		
0100	0200		Peru, Radio La Voz De Bolivar	5460do		4755al
0100	0200		Peru, Radio La Voz de la Selva	4824do		
0100	0200		Peru, Radio La Voz de las Huarinjas			5059do
0100	0200		Peru, Radio Libertad de Junin	5039do		
0100	0200		Peru, Radio Maranon	4835do		
0100	0200		Peru, Radio Melodia	5940do		
0100	0200		Peru, Radio San Antonio	4940do		
0100	0200		Peru, Radio Santa Monica	4965do		
0100	0200		Peru, Radio Santa Rosa	6047do		
0100	0200	twhfas	Peru, Radio Tarma	4775do		
0100	0200		Peru, Radio Union	6114do		
0100	0200		Peru, Radio Vision	4790do		
0100	0200		Peru, Radio Vision	4790do		
0100	0200		Russia, Voice of Russia	7300sa		9735ca
			9810sa	9880ca	9945sa	11510sa
0100	0200		South Korea, KBS World Radio			9580sa

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0100	0200		Spain, Radio Exterior de Espana			6020sa
			6055na	9535am	9620sa	11680sa
			15160sa			
0100	0200	mtwhf	Spain, Radio Exterior de Espana			5970sa
			17595sa			
0100	0200	Sat	Spain, Radio Exterior de Espana			11815sa
0100	0200		Turkey, Voice of Turkey		9770va	9870va
0100	0200		USA, EWTN Vandiver AL		5810ca	11870sa
0100	0200		USA, KVOH Rancho Simi CA		9975ca	
0100	0200		USA, KVOH Rancho Simi CA		9975ca	
0100	0200		USA, Radio Marti	6030ca	7365ca	11775ca
0100	0200		USA, WYFR/Family Radio Worldwide			5985ca
			11835ca	11855ca	15215sa	15255sa
			17750sa			
0100	0200		Vatican City State, Vatican Radio			7305sa
			9610ca	11910sa		
0100	0200		Venezuela, Radio Amazonas		4940do	mt0909

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

0200	0227		Czech Republic, Radio Prague		6200am	7345am
0200	0227		Iran, Voice of Islamic Rep. of Iran			9655sa
			9905sa			
0200	0230		Bolivia, Radio San Jose		5580do	
0200	0230		South Korea, KBS World Radio			9560na
0200	0230		Vatican City State, Vatican Radio			7305sa
			9610ca	11910sa		
0200	0245		USA, WYFR/Family Radio Worldwide			17750sa
			17845sa			
0200	0257		Netherlands, R Netherlands Worldwide			6165ca
0200	0300		Bolivia, Radio Estambul		4498do	
0200	0300		Bolivia, Radio San Miguel		4699do	
0200	0300		Bolivia, Radio Tacana		4781do	
0200	0300		Canada, Radio Canada International			9755na
			13710ca			
0200	0300		China, China Radio International			9595sa
			9710sa			
0200	0300		Clandestine, Radio Republica		9545ca	
0200	0300		Colombia, La Voz de tu Conciencia			6010do
			5910al			
0200	0300		Colombia, La Voz del Guaviare			6035do
0200	0300		Colombia, Radio Marfil Estereo			5910do
			6010al			
0200	0300		Cuba, Radio Havana Cuba		5965ca	6060na
			6120na	9600sa	11690sa	13760eu
			13790eu			
0200	0300		Cuba, Radio Rebelde		5025na	
0200	0300		Ecuador, HCJB Global		6050sa	9745ca
0200	0300		Ecuador, Radio Quito		4919do	
0200	0300		Guatemala, Radio Verdad		4052do	
0200	0300		Honduras, HRMI/ Radio Misiones Intl			3340do
0200	0300		Honduras, Radio Luz y Vida		3250do	
0200	0300		Mexico, XEOI/Radio Mil		6010do	
0200	0300		Mexico, XERTA/Radio Transcontinental			4800do
0200	0300		Mexico, XEXQ/Radio Universidad			6045do
0200	0300		North Korea, Voice of Korea		11735am	13760am
			15180am			
0200	0300		Peru, Radio Bethel 5949do			
0200	0300		Peru, Radio Bolivar		5460do	
0200	0300		Peru, Radio Cusco 6195do			
0200	0300		Peru, Radio La Voz De Bolivar		5460do	4755al
0200	0300		Peru, Radio La Voz de la Selva		4824do	
0200	0300		Peru, Radio Maranon		4835do	
0200	0300		Peru, Radio Melodia		5940do	
0200	0300		Peru, Radio Santa Monica		4965do	
0200	0300		Peru, Radio Santa Rosa		6047do	
0200	0300	twhfas	Peru, Radio Tarma 4775do			
0200	0300		Peru, Radio Union 6114do			
0200	0300		Peru, Radio Vision 4790do			
0200	0300		Russia, Voice of Russia		7300sa	9735ca
			9880ca	9945sa		
0200	0300		Spain, Radio Exterior de Espana			3350sa
			6020sa	6055na	6125sa	9535am
			9620sa	9630na		
0200	0300	mtwhf	Spain, Radio Exterior de Espana			5970sa
			17595sa			
0200	0300	Sat	Spain, Radio Exterior de Espana			11815sa
0200	0300		Taiwan, Radio Taiwan International			7570sa
			9840sa			
0200	0300		USA, EWTN Vandiver AL		5810ca	11870sa
0200	0300		USA, KVOH Rancho Simi CA		9975ca	
0200	0300		USA, Radio Marti	6030ca	7365ca	11775ca
0200	0300		USA, WYFR/Family Radio Worldwide			9760sa
			11740ca	15255sa		
0200	0300		Venezuela, Radio Amazonas		4940do	mt0909
0205	0300		Canada, Radio Canada International			6100am
0230	0300		Iran, Voice of Islamic Rep. of Iran			9905sa
0230	0300		Slovakia, Radio Slovakia International			5930sa
			9440sa			

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

0300	0305		Canada, Radio Canada International			6100am
0300	0327		Iran, Voice of Islamic Rep. of Iran			9905sa
0300	0330		Peru, Radio La Voz De Bolivar		5460do	4755al
0300	0345		USA, WYFR/Family Radio Worldwide			11580sa
			15215sa			
0300	0357		Netherlands, R Netherlands Worldwide			6165ca
0300	0400		Bolivia, Radio Estambul		4498do	
0300	0400		China, China Radio International			9560sa
			9665ca			
0300	0400		Clandestine, Radio Republica		9545ca	
0300	0400		Colombia, La Voz de tu Conciencia			6010do
			5910al			
0300	0400		Colombia, Radio Marfil Estereo			5910do
			6010al			
0300	0400		Cuba, Radio Havana Cuba		5965ca	6060na
			6120na	9600sa	11690sa	13760eu
			13790eu			
0300	0400		Cuba, Radio Rebelde		5025na	
0300	0400		Ecuador, HCJB Global		6050sa	9745ca
0300	0400		Ecuador, Radio Quito		4919do	
0300	0400		Guatemala, Radio Verdad		4052do	
0300	0400		Honduras, HRMI/ Radio Misiones Intl			3340do
0300	0400		Honduras, Radio Luz y Vida		3250do	
0300	0400		Mexico, XEOI/Radio Mil		6010do	
0300	0400		Mexico, XERTA/Radio Transcontinental			4800do
0300	0400		Mexico, XEXQ/Radio Universidad			6045do
0300	0400		Peru, Radio Cusco 6195do			
0300	0400		Peru, Radio Melodia		5940do	
0300	0400		Peru, Radio Santa Monica		4965do	
0300	0400		Peru, Radio Santa Rosa		6047do	
0300	0400	twhfas	Peru, Radio Tarma 4775do			
0300	0400		Peru, Radio Union 6114do			
0300	0400		Peru, Radio Vision 4790do			
0300	0400		Russia, Voice of Russia		7300sa	9665ca
			9735ca	9880ca	9945sa	
0300	0400		Spain, Radio Exterior de Espana			3350sa
			5935ca	6020sa	6055na	6125sa
			9535na	9620sa	9630na	
0300	0400	mtwhf	Spain, Radio Exterior de Espana			5970sa
			17595sa			
0300	0400	Sat	Spain, Radio Exterior de Espana			11815sa
0300	0400		USA, EWTN Vandiver AL		5810ca	11870sa
0300	0400		USA, KVOH Rancho Simi CA		9975ca	
0300	0400		USA, Radio Marti	6030ca	7365ca	
0300	0400		USA, WYFR/Family Radio Worldwide			5985ca
			9680na	9715ca	11855ca	
0304	0400		USA, WYFR/Family Radio Worldwide			6915sa
0320	0400		Vatican City State, Vatican Radio			6040am
			7305ca			

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

0400	0430		Japan, NHK World Radio Japan			6195sa
0400	0445		USA, WYFR/Family Radio Worldwide			5985ca
			7730sa	9985sa	11740ca	15255sa
0400	0500		Colombia, La Voz de tu Conciencia			6010do
			5910al			
0400	0500	Sat/Sun	Colombia, La Voz del Guaviare			6035do
0400	0500		Colombia, Radio Marfil Estereo			5910do
			6010al			
0400	0500		Cuba, Radio Havana Cuba		5965ca	6060na
			6120na	9600sa	11690sa	13760eu
			13790eu			
0400	0500		Cuba, Radio Rebelde		5025na	
0400	0500		Ecuador, HCJB Global		6050sa	9745ca
0400	0500		Ecuador, Radio Quito		4919do	
0400	0500		Guatemala, Radio Verdad		4052do	
0400	0500		Honduras, HRMI/ Radio Misiones Intl			3340do
0400	0500		Mexico, XEOI/Radio Mil		6010do	
0400	0500		Mexico, XERTA/Radio Transcontinental			4800do
0400	0500		Mexico, XEXQ/Radio Universidad			6045do
0400	0500		Peru, Radio Melodia		5940do	
0400	0500		Peru, Radio Santa Monica		4965do	
0400	0500		Peru, Radio Santa Rosa		6047do	
0400	0500		Peru, Radio Union 6114do			
0400	0500		Peru, Radio Vision 4790do			
0400	0500		Russia, Voice of Russia		9735ca	9880ca
			9945sa			
0400	0500		Spain, Radio Exterior de Espana			3350sa
			5965sa	6055na	6125sa	9535am
			9620sa	9630na		

0400	0500	mtwhf	Spain, Radio Exterior de Espana 12035eu 17595sa	5970sa
0400	0500	Sat	Spain, Radio Exterior de Espana	11815sa
0400	0500		Taiwan, Radio Taiwan International	17725ca
0400	0500		USA, EWTN Vandiver AL 5810ca	11870sa
0400	0500		USA, KVOH Rancho Simi CA 9975ca	
0400	0500		USA, Radio Marti 6030ca 7405ca	
0400	0500		USA, WYFR/Family Radio Worldwide	9715ca
0430	0457		Czech Republic, Radio Prague 9955am	

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

0500	0530		Japan, NHK World Radio Japan	6195ca
0500	0545		USA, WYFR/Family Radio Worldwide	7520ca
0500	0600		Colombia, La Voz de tu Conciencia 5910al	6010do
0500	0600	Sat/Sun	Colombia, La Voz del Guaviare	6035do
0500	0600		Colombia, Radio Marfil Estereo 6010al	5910do
0500	0600		Cuba, Radio Rebelde 5025na	
0500	0600		Ecuador, Radio Quito 4919do	
0500	0600		Honduras, HRMI/ Radio Misiones Intl	3340do
0500	0600		Mexico, XEOI/Radio Mil 6010do	
0500	0600		Mexico, XERTA/Radio Transcontinental	4800do
0500	0600		Peru, Radio Melodia 5940do	
0500	0600		Peru, Radio Santa Monica 4965do	
0500	0600		Peru, Radio Santa Rosa 6047do	
0500	0600		Peru, Radio Union 6114do	
0500	0600		Peru, Radio Vision 4790do	
0500	0600		Spain, Radio Exterior de Espana 5965sa 6055na 9630na 12035eu	3350sa 11895me
0500	0600	mtwhf	Spain, Radio Exterior de Espana 17595sa	5970sa
0500	0600	Sat	Spain, Radio Exterior de Espana	11815sa
0500	0600	DRM	Spain, Radio Exterior de Espana	9780eu
0500	0600		USA, EWTN Vandiver AL 7555ca	11870sa
0500	0600		USA, KVOH Rancho Simi CA 9975ca	
0500	0600		USA, Radio Marti 6030ca 7405ca	
0500	0600		USA, WYFR/Family Radio Worldwide 9715ca 9985sa	5850ca
0504	0600		USA, WYFR/Family Radio Worldwide	9505ca
0530	0600		Iran, Voice of Islamic Rep. of Iran 17785va	15530va

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

0600	0627		Iran, Voice of Islamic Rep. of Iran 17785va	15530va
0600	0630		Bulgaria, Radio Bulgaria 11800eu	15800eu
0600	0700		China, China Radio International	17680eu
0600	0700		Colombia, La Voz de tu Conciencia 5910al	6010do
0600	0700	Sat/Sun	Colombia, La Voz del Guaviare	6035do
0600	0700		Colombia, Radio Marfil Estereo 6010al	5910do
0600	0700		Cuba, Radio Rebelde 5025na	
0600	0700		Ecuador, Radio Quito 4919do	
0600	0700		Honduras, HRMI/ Radio Misiones Intl	3340do
0600	0700		Mexico, XEOI/Radio Mil 6010do	
0600	0700		Mexico, XERTA/Radio Transcontinental	4800do
0600	0700		Peru, Radio Melodia 5940do	
0600	0700		Peru, Radio Santa Monica 4965do	
0600	0700		Peru, Radio Santa Rosa 6047do	
0600	0700		Peru, Radio Union 6114do	
0600	0700		Peru, Radio Vision 4790do	
0600	0700		South Korea, KBS World Radio	6045eu
0600	0700		Spain, Radio Exterior de Espana 11895me 12035eu	5965sa
0600	0700	DRM	Spain, Radio Exterior de Espana	9780eu
0600	0700	mtwhf	Spain, Radio Exterior de Espana 17595sa	5970sa
0600	0700	Sat	Spain, Radio Exterior de Espana	11815sa
0600	0700		Taiwan, Radio Taiwan International	5950ca
0600	0700		USA, EWTN Vandiver AL 7555ca	11870sa
0600	0700		USA, KVOH Rancho Simi CA 9975ca	
0600	0700		USA, Radio Marti 6030ca 7405ca	
0600	0700		USA, WYFR/Family Radio Worldwide 9505ca 9715ca	6915sa

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

0700	0745		USA, WYFR/Family Radio Worldwide 9680na	9355eu
0700	0800		China, China Radio International	17680eu
0700	0800		Colombia, La Voz de tu Conciencia 5910al	6010do
0700	0800		Colombia, Radio Marfil Estereo 6010al	5910do
0700	0800		Cuba, Radio Rebelde 5025na	
0700	0800		Ecuador, Radio Quito 4919do	
0700	0800		Honduras, HRMI/ Radio Misiones Intl	3340do
0700	0800		Mexico, XEOI/Radio Mil 6010do	
0700	0800		Mexico, XERTA/Radio Transcontinental	4800do
0700	0800		Peru, Radio Melodia 5940do	
0700	0800		Peru, Radio Santa Monica 4965do	
0700	0800		Peru, Radio Santa Rosa 6047do	
0700	0800		Peru, Radio Union 6114do	
0700	0800		Peru, Radio Vision 4790do	
0700	0800		Spain, Radio Exterior de Espana 12035eu 13720eu 17770pa	5965sa
0700	0800	DRM	Spain, Radio Exterior de Espana	9780eu
0700	0800	mtwhf	Spain, Radio Exterior de Espana 17595sa	5970sa
0700	0800	Sat	Spain, Radio Exterior de Espana	11815sa
0700	0800		USA, EWTN Vandiver AL 7555ca	11870sa
0700	0800		USA, KVOH Rancho Simi CA 9975ca	
0700	0800		USA, Radio Marti 5980ca 6030ca	
0700	0800		USA, WYFR/Family Radio Worldwide 9715ca	5850ca

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

0800	0827		Czech Republic, Radio Prague 11600am	15710va
0800	0900		Colombia, La Voz de tu Conciencia 5910al	6010do
0800	0900		Colombia, La Voz del Guaviare	6035do
0800	0900		Colombia, Radio Marfil Estereo 6010al	5910do
0800	0900		Cuba, Radio Rebelde 5025na	
0800	0900		Ecuador, Radio Quito 4919do	
0800	0900		Greece, Voice of Greece 11645eu	
0800	0900		Honduras, HRMI/ Radio Misiones Intl	3340do
0800	0900		Mexico, XEOI/Radio Mil 6010do	
0800	0900		Mexico, XERTA/Radio Transcontinental	4800do
0800	0900		Peru, Radio Melodia 5940do	
0800	0900		Peru, Radio Santa Monica 4965do	
0800	0900		Peru, Radio Santa Rosa 6047do	
0800	0900		Peru, Radio Union 6114do	
0800	0900		Peru, Radio Vision 4790do	
0800	0900		Spain, Radio Exterior de Espana 13720eu 17770pa	12035eu
0800	0900	DRM	Spain, Radio Exterior de Espana	9780eu
0800	0900	mtwhf	Spain, Radio Exterior de Espana 17595sa	5970sa
0800	0900	Sat	Spain, Radio Exterior de Espana	11815sa
0800	0900		USA, EWTN Vandiver AL 7555ca	11870sa
0800	0900		USA, Radio Marti 5980ca 6030ca	
0800	0900		USA, WYFR/Family Radio Worldwide 9505ca 9550sa 9715ca 11970sa	5850ca 11855ca
0830	0900	DRM	Ecuador, HCJB Global 11625eu	

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

0900	0930	DRM	Ecuador, HCJB Global 11625eu	
0900	0945		USA, WYFR/Family Radio Worldwide 9505ca	5850ca
0900	1000		Argentina, Radio Nacional RAE	6060am
0900	1000		Colombia, La Voz de tu Conciencia 5910al	6010do
0900	1000		Colombia, La Voz del Guaviare	6035do
0900	1000		Colombia, Radio Marfil Estereo 6010al	5910do
0900	1000		Cuba, Radio Rebelde 5025na	
0900	1000		Ecuador, Radio Quito 4919do	
0900	1000		Honduras, HRMI/ Radio Misiones Intl	3340do
0900	1000		Mexico, XEOI/Radio Mil 6010do	
0900	1000		Mexico, XERTA/Radio Transcontinental	4800do
0900	1000		Peru, Radio La Voz de la Selva 4824do	
0900	1000		Peru, Radio Libertad de Junin 5039do	
0900	1000		Peru, Radio Maranon 4835do	
0900	1000		Peru, Radio Melodia 5940do	
0900	1000		Peru, Radio Union 6114do	
0900	1000		Peru, Radio Vision 4790do	
0900	1000		Spain, Radio Exterior de Espana	21610me
0900	1000	mtwhf	Spain, Radio Exterior de Espana 13720eu 15585eu 17595sa	5970sa 21540af
0900	1000	Sat	Spain, Radio Exterior de Espana	11815sa
0900	1000	Sat/Sun	Spain, Radio Exterior de Espana	21540af
0900	1000		USA, EWTN Vandiver AL 7555ca	11870sa

0900	1000		USA, Radio Marti	5980ca	6030ca	
0900	1000		USA, WYFR/Family Radio Worldwide	9550sa	9715ca	5950na 11855ca 11970ca
0930	0957		Czech Republic, Radio Prague	9955am		
0930	1000		Bolivia, Radio Illimani/Radio Patria Nueva	6025do		
0930	1000		Peru, Radio Cusco	6195do		
0930	1000		Peru, Radio Tarma	4775do		

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

1000	1030		Japan, NHK World Radio Japan	6195sa		6120sa
1000	1030		France, Radio France International	9875sa		5970sa
1000	1030	Sun	Peru, Radio Madre de Dios	4950do		
1000	1100		Bolivia, Radio Estambul	4498do		
1000	1100		Bolivia, Radio Illimani/Radio Patria Nueva	6025do		
1000	1100		Bolivia, Radio Nacional de Huanuni			5967do
1000	1100		Bolivia, Radio San Jose	5580do		
1000	1100		Bolivia, Radio San Miguel	4699do		
1000	1100		Bolivia, Radio Santa Ana	4451do		
1000	1100		Bolivia, Radio Tacana	4781do		
1000	1100		Bolivia, Radio Virgen de Remedios			4834do
1000	1100		Colombia, La Voz de tu Conciencia	5910al		6010do
1000	1100		Colombia, La Voz del Guaviare			6035do
1000	1100		Colombia, Radio Marfil Estereo	6010al		5910do
1000	1100		Cuba, Radio Rebelde	5025na		
1000	1100		Ecuador, Radio Quito	4919do		
1000	1100		Honduras, HRMI/ Radio Misiones Intl			3340do
1000	1100		Iran, Voice of Islamic Rep. of Iran	9905sa		9655sa
1000	1100		Mexico, XEOI/Radio Mil	6010do		
1000	1100		Mexico, XERTA/Radio Transcontinental			4800do
1000	1100		Peru, Radio Bethel	5949do		
1000	1100		Peru, Radio Bolivar	5460do		
1000	1100		Peru, Radio Cusco	6195do		
1000	1100		Peru, Radio La Reyna de la Selva			5486do
1000	1100		Peru, Radio La Voz De Bolivar	5460do		4755al
1000	1100		Peru, Radio Libertad de Junin	5039do		
1000	1100		Peru, Radio Madre de Dios	4950do		
1000	1100		Peru, Radio Maranon	4835do		
1000	1100		Peru, Radio Melodia	5940do		
1000	1100		Peru, Radio Rasuwilca	4805do		
1000	1100		Peru, Radio San Antonio	4940do		
1000	1100		Peru, Radio Santa Rosa	6047do		
1000	1100		Peru, Radio Tarma	4775do		
1000	1100		Peru, Radio Union	6114do		
1000	1100		Peru, Radio Vision	4790do		
1000	1100		Spain, Radio Exterior de Espana			21610me
1000	1100	mtwhf	Spain, Radio Exterior de Espana	13720eu	15585eu 17595sa	5970sa 21540af
1000	1100	Sat	Spain, Radio Exterior de Espana			11815sa
1000	1100	Sat/Sun	Spain, Radio Exterior de Espana			21540af
1000	1100		USA, EWTN Vandiver AL	7555ca		11870sa
1000	1100		USA, Radio Marti	5980ca	9805ca	
1000	1100		USA, WYFR/Family Radio Worldwide	9550sa	9715ca 11855ca	6085ca
1000	1100		Venezuela, Radio Amazonas	4940do		mt0909
1045	1100		Peru, Radio La Voz de las Huarinjas			5059do

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

1100	1127		Netherlands, R Netherlands Worldwide			6165ca
1100	1130		Bulgaria, Radio Bulgaria	11800eu		15800eu
1100	1130		Peru, Radio Rasuwilca	4805do		
1100	1145		USA, WYFR/Family Radio Worldwide	9355eu	9715ca 11855ca	5915sa
1100	1200		Bolivia, Radio Estambul	4498do		
1100	1200		Bolivia, Radio Illimani/Radio Patria Nueva	6025do		
1100	1200		Bolivia, Radio Nacional de Huanuni			5967do
1100	1200		Bolivia, Radio San Jose	5580do		
1100	1200		Bolivia, Radio San Miguel	4699do		
1100	1200		Bolivia, Radio Santa Ana	4451do		
1100	1200		Bolivia, Radio Tacana	4781do		
1100	1200		Colombia, La Voz de tu Conciencia	5910al		6010do
1100	1200		Colombia, La Voz del Guaviare			6035do
1100	1200		Colombia, Radio Marfil Estereo	6010al		5910do
1100	1200		Cuba, Radio Havana Cuba	9600na	11760am 12000va	6000na 6180na 13760eu 15120va 15360sa
1100	1200		Cuba, Radio Rebelde	5025na		
1100	1200		Ecuador, HCJB Global	6050sa		11690sa
1100	1200		Ecuador, Radio Quito	4919do		
1100	1200		Honduras, HRMI/ Radio Misiones Intl			3340do
1100	1200		Honduras, Radio Luz y Vida	3250do		
1100	1200		Mexico, XEOI/Radio Mil	6010do		
1100	1200		Mexico, XERTA/Radio Transcontinental			4800do
1100	1200		Peru, Radio Bethel	5949do		
1100	1200		Peru, Radio Bolivar	5460do		
1100	1200		Peru, Radio Cusco	6195do		
1100	1200		Peru, Radio La Reyna de la Selva			5486do
1100	1200		Peru, Radio La Voz De Bolivar	5460do		
1100	1200	Sun	Peru, Radio La Voz de la Selva	4824do		
1100	1200		Peru, Radio La Voz de las Huarinjas			5059do
1100	1200		Peru, Radio Libertad de Junin	5039do		
1100	1200		Peru, Radio Madre de Dios	4950do		
1100	1200		Peru, Radio Melodia	5940do		
1100	1200		Peru, Radio San Antonio	4940do		
1100	1200		Peru, Radio San Nicolas	5470do		
1100	1200		Peru, Radio Santa Rosa	6047do		
1100	1200		Peru, Radio Tarma	4775do		
1100	1200		Peru, Radio Union	6114do		
1100	1200		Peru, Radio Vision	4790do		
1100	1200		South Korea, KBS World Radio			11795sa
1100	1200		Spain, Radio Exterior de Espana			21610me
1100	1200	mtwhf	Spain, Radio Exterior de Espana	13720eu	15585eu 17595sa	5970sa 21540af
1100	1200	Sat	Spain, Radio Exterior de Espana			11815sa
1100	1200	Sat/Sun	Spain, Radio Exterior de Espana			21540af
1100	1200		USA, EWTN Vandiver AL	7555ca		12050sa
1100	1200		USA, Radio Marti	5980ca	9805ca	
1100	1200		USA, WYFR/Family Radio Worldwide	9605ca	11970ca	6085ca
1100	1200		Venezuela, Radio Amazonas	4940do		mt0909
1100	1200		Venezuela, Radio Nacional de Venezuela			6060ca
1129	1157		Netherlands, R Netherlands Worldwide			6165am
1130	1200		Guatemala, Radio Verdad	4052do		
1130	1200	mtwhf	USA, Voice of America	15590ca	9885ca	13715sa
1130	1200	mtwhfa	Vatican City State, Vatican Radio			21680sa

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

1200	1227		Netherlands, R Netherlands Worldwide	9895ca		9715ca
1200	1230		France, Radio France International			13640sa
1200	1230		Peru, Radio San Nicolas	5470do		
1200	1230		USA, Voice of America	15590ca	9885ca	13715sa
1200	1300	mtwhf	Argentina, Radio Nacional RAE			11710am
1200	1300		Bolivia, Radio Estambul	4498do		
1200	1300		Bolivia, Radio Illimani/Radio Patria Nueva	6025do		
1200	1300		Bolivia, Radio Nacional de Huanuni			5967do
1200	1300		Bolivia, Radio San Jose	5580do		
1200	1300		Bolivia, Radio San Miguel	4699do		
1200	1300		Bolivia, Radio Santa Ana	4451do		
1200	1300		Bolivia, Radio Tacana	4781do		
1200	1300		Chile, La Voz Crista	9635sa		17680sa
1200	1300		Colombia, La Voz de tu Conciencia	5910al		6010do
1200	1300		Colombia, La Voz del Guaviare			6035do
1200	1300		Colombia, Radio Marfil Estereo	6010al		5910do
1200	1300		Cuba, Radio Havana Cuba	9600na	11760am 12000va	6000na 6180na 13760eu 15120va 15360sa
1200	1300		Cuba, Radio Rebelde	5025na		
1200	1300		Ecuador, HCJB Global	6050sa		11960sa
1200	1300		Ecuador, Radio Quito	4919do		
1200	1300		Guatemala, Radio Verdad	4052do		
1200	1300		Honduras, HRMI/ Radio Misiones Intl			3340do
1200	1300		Honduras, Radio Luz y Vida	3250do		
1200	1300		Mexico, XEOI/Radio Mil	6010do		

continued next month

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Larry Van Horn, N5FPW
larryvanhorn@monitoringtimes.com
http://mt-milcom.blogspot.com

North American Aerial Refueling Frequencies

Over the past few years I have documented in this column and on my internet blog **(http://mt-milcom.blogspot.com)** the major changes being made to the 225-400 MHz milair bandplan here in the Continental United States (CONUS). Part of the massive change in frequencies is due to the conversion of most of the 380-400 MHz frequencies from 25 kHz spaced aero frequencies to 12.5 kHz spaced Aero/LMR assignments. Other changes appear to involve new subbands devoted to wideband communications, air traffic control frequency blocks, new nationwide command and control frequencies, and other changes scattered throughout this portion of the UHF spectrum.

In the October 2007 column, I wrote about changes to primary/secondary boom frequencies used on various aerial refueling (AR) routes in CONUS. The biggest change I noted in that column was that some of the 319.500 and 319.700 assignments were being replaced by 256.650 and 343.250 MHz respectively.

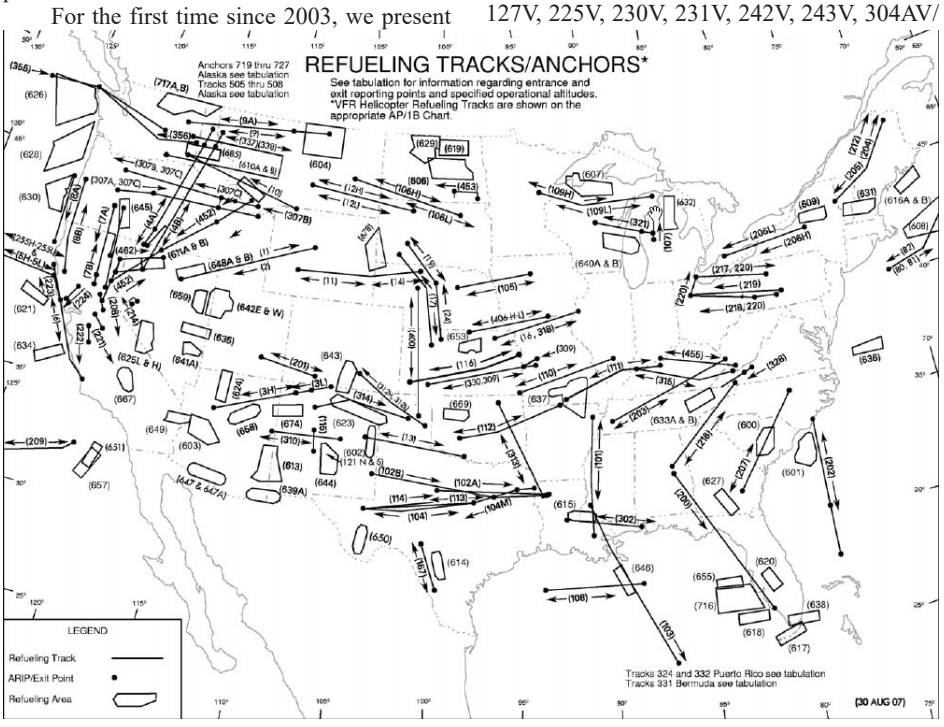
Not all of the 319.5/319.7 aerial refueling frequency assignments have changed, but a significant number have. If your local AR route uses 319.500 or 319.700 MHz, you need to program those new frequencies into your scanner, since the old frequencies may go silent at some point.

For the first time since 2003, we present our latest complete AR frequency list for North America in Table 1.

One of the tips I recommend to Milcom monitors (if they have free memories in their scanners) is to program all of the CONUS aerial refueling boom frequencies into a bank/group, even if a particular route is not within radio range. Monitors have observed that these frequencies are sometimes used off the aerial route as an air-to-air channel by receivers and tankers alike. You might hear some interesting communications that would otherwise be missed if you didn't have all the AR frequencies programmed in.

To aid you in that effort, I have broken out a complete list of all the frequencies noted in MT's AR list into a single list in Table 1. Please note that all the frequencies in both Tables 1 and 2 are in Megahertz (MHz) and the mode is AM.

A few AR boomer frequencies still have not been uncovered. If you have monitored the boomer frequencies for the following routes, please pass them along. Boomer frequencies are unknown for the following aerial refueling routes: AR-115, 208, 214, 221, 222, 223, 224. 657, 658, 44V (Dark Horse East), 45V (Dark Horse West), 46V (Nightstalker East), 47V (Nightstalker West), 48V (Green East), 49V (Green West), 53V (Wardog South), 54V (Wardog North), 55V (Wardog West), 68V, 126V, 127V, 225V, 230V, 231V, 242V, 243V, 304AV/BV, 305AV/BV, 306AV/BV, and 662V.



❖ Milcom Frequency Changes

We close out this month with a list of the latest frequency changes in the civilian and military aeronautical bands.

118.450	Southwest Oregon Regional OR (KOTH) CTAF (ex-122.700)
119.100	Tyndall AFB FL (KPAM) North sector below 5000 feet
119.775	Tyndall AFB FL (KPAM) South sector below 5000 feet
123.600	Fairchild AFB WA (KSKA) Ground control (ex-121.850)
127.875	Wallops Flight Facility VA (KWAL) COM GC
139.600	Beale AFB CA (KBAB) Supervisory of Flying (ex-138.500)
227.400	Lawson AAF/Fort Benning GA Doughboy advisory (ex-244.600)
263.150	Tyndall AFB FL (KPAM) Tower
269.325	Wallops Flight Facility VA (KWAL) CMSND
307.800	Tyndall AFB FL (KPAM) South sector above 5000 feet
371.250	Niagara Falls International NY (KIAG) Command Post/Base Operations

So until next time, 73 and good hunting.

TABLE 1. AERIAL REFUELING FREQUENCIES USED IN CONUS

138.250 138.500 141.300 143.250
228.250 229.500 230.050 233.725
235.100 235.025 235.150 236.650
238.500 238.900 239.725 240.350
242.050 243.450 249.500 249.525
252.800 252.975 255.750 255.775
256.650 258.200 260.200 263.900
264.325 264.900 265.050 270.200
271.650 274.450 275.950 276.500
276.700 278.400 278.750 279.800
280.400 282.000 282.550 282.700
283.800 283.900 284.075 284.900
286.300 288.800 291.650 291.900
292.600 295.400 295.800 296.000
297.300 303.125 305.350 305.500
309.950 310.425 311.500 311.575
312.225 315.900 318.000 319.500
319.700 320.900 324.400 324.600
327.600 328.450 336.100 341.400
341.750 342.550 343.250 343.500
344.700 348.900 349.700 352.600
359.100 360.900 361.700 365.775
366.300 373.600 377.700 384.600
394.900 396.200

TABLE 2: NORTH AMERICAN AERIAL REFUELING ROUTE BOOMER FREQUENCIES

Refueling Tracks

AR-1	343.500	256.650
AR-2	283.900	256.650
AR-3H	265.050	271.650
AR-3L	235.100	256.650
AR-4A	344.700	292.600
AR-4B	235.100	292.600
AR-5H	283.900	342.550
AR-5L	256.650	278.750
AR-6	256.650	274.450
AR-7A	276.500	256.650
AR-7B	236.650	256.650
AR-8A	240.350	256.650
AR-8B	305.500	256.650
AR-9	238.900	292.600
AR-9A	238.900	292.600
AR-10	278.750	292.600
AR-11	235.100	320.900
AR-12H	352.600	320.900
AR-12L	344.700	292.600
AR-13	238.900	260.200
AR-14	336.100	359.100
AR-16	343.500	319.700
AR-17	276.500	320.900
AR-19	295.400	320.900
AR-20	341.750	349.700
AR-24	295.400	320.900
AR-62 Canada	242.050	243.450
AR-80	373.600	343.500
AR-81	373.600	343.500
AR-101	324.600	260.200
AR-102A	276.500	260.200
AR-102B	276.500	260.200
AR-103	327.600	260.200
AR-104	344.700	260.200
AR-104M	344.700	260.200
AR-105	238.900	320.900
AR-106H	295.800	320.900
AR-106L	305.500	320.900
AR-107	324.600	282.700
AR-108	348.900	260.200
AR-109H	343.500	320.900
AR-109L	327.600	320.900
AR-110	327.600	319.700
AR-111	348.900	319.700
AR-112H	235.100	260.200
AR-112L	295.800	260.200
AR-113	283.900	260.300
AR-114	366.300	260.200
AR-116	366.300	260.200
AR-121	229.500	258.200
AR-167	235.100	260.200
AR-200	235.100	319.700
AR-201	336.100	319.500
AR-202	327.600	343.250
AR-203	238.900	319.700
AR-204	324.600	282.700
AR-205	327.600	282.700
AR-206H	348.900	282.700
AR-206L	235.100	282.700
AR-207	324.600	343.250
AR-209	238.900	256.650
AR-212	238.900	282.700
AR-216	276.500	343.250
AR-217	283.900	282.700
AR-218	274.450	282.700
AR-219	305.500	282.700
AR-220	274.450	282.700
AR-233	265.050	271.650
AR-255H	283.900	365.775
AR-255L	327.600	365.775
AR-302	278.750	260.200
AR-307A/B/C	264.900	238.900
AR-309	283.900	260.200
AR-310	352.600	319.500
AR-312H	284.075	312.225
AR-212L	291.900	260.200
AR-313/313A	352.600	260.200
AR-314	295.800	319.500
AR-315	343.250	236.650
AR-318	240.350	260.200
AR-321	276.500	282.700
AR-324 PR	327.600	343.250
AR-328	235.150	343.250
AR-330	305.500	260.200
AR-332 PR	235.100	343.250
AR-337/338	282.000	305.350
AR-355/356	320.900	238.900
AR-400	228.250	264.325
AR-406H	396.200	297.300
AR-406L	297.300	396.200
AR-452	361.700	384.600
AR-453	291.900	320.900
AR-455	336.100	291.900
AR-462	318.000	384.600
AR-505 AK	315.900	263.900
AR-506 AK	288.800	263.900
AR-507 AK	270.200	263.900
AR-508 AL	288.800	263.900

Refueling Anchors

AR-600	348.900	319.700
AR-601	284.900	319.700
AR-602	295.400	319.500
AR-603	238.900	319.500
AR-604	276.500	292.600
AR-606	366.300	320.900
AR-607	235.100	320.900
AR-608	343.500	282.700
AR-609	276.500	282.700
AR-610A/B	295.400	292.600
AR-611A/B	255.750	275.950
AR-613	282.550	319.500
AR-614	352.600	260.200
AR-615	295.400	260.200
AR-616A/B	283.900	282.700
AR-617	324.600	343.250
AR-618	348.900	343.250
AR-619	238.900	320.900
AR-620	238.900	343.250
AR-621	344.700	319.500
AR-623	359.100	319.500
AR-624	366.300	319.500
AR-625H	295.800	319.500
AR-625L	291.900	319.500
AR-626	235.100	292.600
AR-627	352.600	319.700
AR-628	343.500	292.600
AR-629	296.000	360.900
AR-630	238.900	292.600
AR-631	295.800	282.700
AR-632	238.900	282.700
AR-633A/B	240.350	343.250
AR-634	235.100	319.500
AR-635	352.600	319.500
AR-636	238.900	319.700
AR-637	291.900	319.700
AR-638	324.600	343.250
AR-639 & A	291.900	319.500
AR-640A	305.500	320.900
AR-640B	291.900	320.900
AR-641A	295.400	319.500
AR-642	291.650	319.500
AR-643	279.800	260.200
AR-644	324.400	319.500
AR-645	324.400	292.600
AR-646	238.900	260.200
AR-647 &A	283.900	319.500
AR-648A/B	238.900	256.650

AR-649	286.300	319.500
AR-650	295.800	260.200
AR-651	276.500	319.500
AR-652A/B	249.525	255.775
AR-653	324.600	260.200
AR-654	341.400	260.200
AR-655	276.500	343.250
AR-659	305.500	319.500
AR-667	318.000	264.900
AR-669	394.900	384.600
AR-672	249.500	310.425
AR-674	341.400	260.200
AR-687	280.400	377.700
AR-685	282.000	305.350
AR-716	283.900	342.550
AR-717AB	283.900	292.600
AR-719 AK	270.200	263.900
AR-720 AK	276.700	263.900
AR-721 AK	270.200	263.900
AR-722 AK	276.700	263.900
AR-723 AK	278.400	263.900
AR-724 AK	278.400	263.900
AR-725 AK	283.800	263.900
AR-727 AK	270.200	263.900

VFR Helicopter Refueling Tracks

AR-15V	363.900	252.800
AR-18V	311.575	303.125
AR-41V	230.050	260.200
AR-42V	239.725	309.950
AR-117V	138.500	235.025
AR-125V	138.250	252.975
AR-131V	143.250	318.000
AR-132V	143.250	318.000
AR-133V	141.300	311.500
AR-134V	141.300	328.450
AR-135V	238.500	233.725
AR-136V	233.725	238.500
AR-137V	233.725	238.500

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2009 Fed Files Wrap-Up

It's hard to believe that this year has gone by so quickly! And we still have some *Fed Files* topics to put some finishing touches on, so let's go!

More on the Great White Whale

I have to say that no other topic I've covered in this column has generated as much interest as the subject of the September *Fed Files*, the mobile trunked radio system in a motor home that I dubbed The Great White Whale. I have received all sorts of emails about this vehicle and what its true purpose might be. And much like the fictional Moby Dick, this whale is being spotted in various places over and over again.

Shortly after the September issue came out, I heard from a source in Texas that the White Whale was spotted in the Dallas area back in November of 2007. Rumors were that it has something to do with the FAA, and local sources had no knowledge of any visits from the President or any White House officials at the time. It remained in a fenced in lot for several weeks, then disappeared. No one seems to have found the trunked system frequencies while it was there, so it may not have been in continuous operation at the time, or maybe no one was searching.

Some readers have questioned what the purpose of this vehicle is besides the transportable trunked system. Technology now permits the trunked radio system to travel in a much smaller package than this motor home, so why continue to use such a rig? It does appear that the motor home possibly contains not only the radio equipment and power generator, but also a mobile command post or operations control room within the vehicle. This would provide the agency using this system a base to work out of without much trouble.

So keep an eye out for the White Whale motor home in your area. And in a future *Fed Files* column we'll look into the smaller cousin of the whale that accompanies the President in his motorcades.

Department of Agriculture Frequencies On-Line

Many scanner listeners seek some "official" source for frequencies on the Internet these days. Some local government web sites actually do feature communications frequencies as part of their efforts to keep an open relationship with citizens. But since federal frequencies are not part of the FCC license database, federal monitors have to search elsewhere.

The NTIA Government Master File, the database for all federal agency allocations, is not available to anyone without an official need for the information, and federal agencies rarely, if ever, publish radio communications on their public web sites. There are some exceptions, most notably some of the US Forest Service and their regional fire plans that, with a little digging, can be found on the web.

Over the last few years, many of these plans have had all the radio channels and frequencies deleted. Officially, frequencies such as these are considered "For Official Use Only" and are not supposed to be made available to the general public. However, some do occasionally show up with the frequencies intact. Recently one such plan for the Coleville National Forest in Washington State was found on line. You can check here and see if it's still available:
www.fs.fed.us/r6/colville/newicc/documents/Colville2009_Radio_UserGuide.pdf

Besides these regional plans, some documents from federal agencies (as they submit their communications budgets or requests for proposals for new radio equipment purchases) will sometimes contain specific frequencies or channel lists. In this case, the US Department of Agriculture has submitted their Strategic Spectrum Plan to the NTIA and it was found available for download here: **www.ntia.doc.gov/osmhome/spectrumreform/Spectrum_Plans_2007/Agriculture_strategic_spectrum_plan_Nov2007.pdf**

This document has some interesting background on the Department of Agriculture and its use of the radio spectrum. Because of the vast areas over which the Department of Agriculture has responsibility, it has a long history with radio. It started experimenting with wireless communications as far back as the early 1900s, with an early network covering eastern Arizona and western New Mexico. It wasn't until 1931 that the Forest Service officially adopted an HF radio system for communications. That system used the frequencies of 3114 kHz, 3172 kHz, 3250 and 3286 kHz.

Since the early days, the USDA has expanded its use of the federal spectrum to many frequencies in the 30 to 50 MHz, 162 to 174 MHz, and 406.1 to 420 MHz bands.

Probably one the most monitored agencies of the Department of Agriculture is the US Forest Service. They maintain responsibility for national forests and for fighting forest fires in many areas, not only on federal property, but also assisting state and local agencies to fight fires that threaten large areas. We covered some of the Forest Service allocations that can be used during forest fire fighting events back in the May 2006 edition of *Fed Files*.

One specific department of the USDA that has some frequency allocations listed in this document is the Office of the Inspector General. The OIG is responsible for many law enforcement and internal investigation of the USDA and has some specific allocations for these operations. Here are some of the frequencies used by the OIG:

164.1375	166.1250	167.3500
167.3375	167.3625	167.3750
167.9750	168.0250	168.1000
168.1250	168.1500	168.1750
168.4125	168.6000	168.6750
168.7000	168.7250	168.7750
168.9750	169.1750	169.9500
170.4750	170.6000	170.7000
170.9750	172.2500	172.3250
173.2500		

All of these frequencies can be used in analog or APCO P-25 digital modes. Encryption is

certainly available for use by the OIG operations.

An interesting item of note in the above list: the original list in the USDA document had three unusual frequencies listed. They listed 167.3450, 167.3575 and 167.3600 MHz in the table containing the OIG allocated frequencies. These listed frequencies are most likely a typographical error and not the actual frequencies.

Also noted in this document was the official confirmation that the USDA OIG is a subscriber to the DHS Customs nationwide VHF radio network. The USDA agents probably use a unique call sign when communicating with the CBP dispatch center in Orlando, so keep an ear on 165.2375 MHz as well. Also mentioned is the possibility of the USDA OIG being a user of the federal Integrated Wireless Network (IWN) at some future date.

In addition to the frequencies for the OIG, there were references to some other USDA frequencies as well. The National Resources Conservation Service (NRCS) uses some UHF frequencies for engineering support for remote operations:

411.2500 411.3000 411.3250
411.4250 415.0000 415.5000

NRCS land-mobile operations can utilize 163.7125 and 168.6125 MHz. The Soil Climate Analysis Network (SCAN) and the Snow pack Telemetry Network (SNOTEL) both utilize these VHF low-band VHF frequencies for non-voice data:

40.5300 40.6700 41.5300
41.6100 44.2000 45.9000

The SNOTEL network has master control stations located in Boise, ID and at Hill AFB in Ogden, UT. The USDA report noted that the Ogden control station would be relocated to the US Army's Dugway Proving Ground, due to local noise issues. A third SNOTEL master station is located in Anchorage AK and is operated under BLM management.

❖ VHF Mystery Networks

As federal operations continue to move from analog to digital modes of operations, some new frequencies are being heard as well. In some cases, these new frequencies are all running with encrypted traffic, so figuring out who is using them and for what remains a mystery of sorts. Here are some recent examples.

From the Florida panhandle, I have received reports of a "linked" VHF federal radio network. The repeaters all seem to key up with a common input frequency. The voice traffic has all been P-25 digital, but multiple Network Access Codes (NAC) have been noted. Much traffic has been using a NAC of N167, but some traffic is now using a NAC of N330. The frequencies used are:

167.2375 167.3125 167.4125
167.4375 167.4875 167.7125 167.7875
168.8875

From the New York City area, listeners have heard simultaneous repeater outputs on these frequencies:

168.9250 169.7250 169.7625

These linked repeaters have a possible input of 162.9250 MHz and are using a NAC of N864.

Also from the Northeastern US, a different linked network:

167.4625 167.5875 171.6125
172.1125 172.2125 172.7625

This linked repeater network has a possible input of 162.1500 MHz and uses a P-25 NAC of N207. Reports are that these repeaters have been heard around the New York City and Atlantic City/ Philadelphia regions. One source has stated that this is a Justice Department network.

Also from the New York City and other areas, these linked P-25 repeaters also carry mostly encrypted traffic:

167.7250 167.7750 171.6875
170.3375 171.7500 171.9875
172.2125

This repeater network has been heard using a P-25 NAC of N95C. One source seems to indicate the Department of Homeland Security possibly operates this network, but that could indicate any number of DHS agencies.

So what is the big mystery about these VHF networks? The biggest mystery is who is using them and for what purpose. In many cases the frequencies used are Justice Department allocations, but some frequencies are new allocations with no previous activity noted. The P-25 NAC codes are new to most monitors and have not been associated with any particular agency.

Another mystery is, why are all these frequencies linked together? Older FBI radio networks often had the ability to key up multiple repeaters from a single input frequency, depending on how the system was set up. The older analog Border Patrol system also had many VHF repeaters that were tied together for wide-area coverage if needed. These new P-25 networks appear to be trying to cover wide areas without the users having to switch channels multiple times as operations move around.

As previously reported in the March 2009 *Fed Files*, the Justice Department is making big changes in its communications networks, and part of that change is a trend towards multiple repeaters serving a wide area. This appears to be a prelude to local VHF trunked systems, and potential new sites as part of the federal Integrated Wireless Network (IWN).

❖ UHF Mystery Networks

Some recent postings on-line from listeners in Colorado and Washington DC have prompted some speculations about some new federal UHF radio systems.

In Gilcrest, Colorado, (north of the Denver area) a listener reported continuous "static" on these frequencies:

407.4250 407.4750 407.5000
416.4250 416.4500 416.5000

The report was that these frequencies carried digital traffic that was not decodable with APCO P-25 scanners. A quick look at the frequencies shows that 407 and 416 frequencies are 9 MHz apart, which should be the standard repeater offset for the federal UHF band. Since signals are being heard on both sets of frequencies, one can't yet assume which are the repeater inputs and which are outputs (I have seen them used both directions). Also, there were no reports of any known format of trunked radio system control channels, so whether or not this is a trunked radio system remains to be seen.

This could be a new system that is being tested and might be carrying a digital "test pattern" on the repeaters to check coverage and signal problems. That would explain the continuous noise being heard. The frequencies that have been heard have also been used in other UHF trunked systems, mostly at military installations.

Another listener in the Washington, DC area has asked about these frequencies, also carrying un-decodable digital-sounding traffic:

408.2250 408.2750 408.4625
408.5250 408.5375 408.6250
409.0500 417.2750 417.4625
417.5250

Some reports in response to the frequencies posted seemed to indicate this system has been on the air for a while, although I have not heard it when I was in the DC area last. Some speculated that this system has something to do with DARPA (Defense Advanced Research Agency, **www.darpa.mil**/), but I have no confirmed information on the use of these frequencies.

Anyone who might have any information on these or any other federal mystery networks, please feel free to pass them along to me at the *Fed Files*. All submission sources will be kept confidential, if desired.

That's all for this year in the *Fed Files*. I'll be back next January with more federal monitoring. See you then!

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"Black Boxes"
Cockpit Voice and Flight Data Recorders

When an airliner crashes, we hear on the news about searches for the Cockpit Voice Recorder (CVR) and the Flight Data Recorder (FDR). These are the so-called "black boxes." The recorders can contain valuable, last-minute information that assists in reconstructing the events leading up to and during a crash.

Airliners, corporate jets, and some others are required to have the two recorders. The CVR records crew conversations, public address announcements, radio transmissions, and sounds heard in the cockpit area. The FDR records up to 88 parameters, some of which are listed below.

Both recorders are usually installed in the aircraft tail section to improve survivability during a crash. As can be expected, traditional CVRs use magnetic tape and newer ones use digital technology with solid state memory.

Guess what? The "black boxes" aren't black! They are either bright orange or bright yellow. They also have reflective tape on them to facilitate locating them under water. This would also help at ground crash sites at night using spotlights.

Let's take a closer look at this interesting subject!

❖ The NTSB Component

"The National Transportation Safety Board is an independent Federal agency charged by Congress with investigating every civil aviation accident in the United States and significant accidents in the other modes of transportation – railroad, highway, marine and pipeline – and issuing safety recommendations aimed at preventing future accidents."

The NTSB seeks to determine "the probable cause of all U.S. civil aviation accidents and certain public-use aircraft accidents." This is why you always hear them mentioned on news broadcasts whenever there is a U.S. airliner crash. For more, see **www.ntsb.gov/Abt_NTSB/history.htm**. (All quotes in this and the next two sections are from NTSB documents.)

Among other things, "The NTSB is responsible for maintaining the government's database of civil aviation accidents and also conducts special studies of transportation safety issues of national significance."

The recovered CVRs and FDRs from crash sites are taken to the NTSB Vehicle Recorder Laboratory in Washington, D.C. for data extraction and analysis. The voice transcripts and flight data reports are combined with FAA communications and radar data archives, eye-witness accounts, the weather at the time, maintenance records, crash scene/debris field analysis, time-consuming and labor-intensive aircraft reconstructions, even microscopic examinations and more, all in an attempt to determine the probable cause of a crash.

The NTSB would like an additional regulation requiring airliners to "Install crash-protected image recorders in cockpits to give investigators more information to solve complex accidents." "This information is critical in determining whether there had been subtle indications of an approaching emergency, whether the crew followed published procedures, and whether or not any of the crew's responses to the emergency were effective."

❖ Brief FDR History

After World War II, the value and importance of crash-survivable flight recorders for airliners became apparent, and efforts began to create workable designs. There were various delays, one being lags in technology to meet the stringent requirements. Things didn't really get rolling until the late 1950s. The first FDRs were designed to record altitude, airspeed, heading, vertical accelerations, and time.

The next big jump was in late 1972 when additional functions to be recorded were added to FDRs for certain planes with newer recorders.

The FDRs manufactured up to this point employed a single-use metal foil tape onto which the data were imprinted. "Time was determined by foil movement, which typically advanced at a rate of 6 inches per hour. This often resulted in an entire accident sequence being recorded within a 0.1 inch of foil movement. Investigators recovered the recorded information by optically reading the scribed markings through a microscope, and then converting the displacement of the scribed marks from the reference line to engineering units. This process was very time consuming and required a significant amount of reader interpretation."

The introduction of solid state digital recorders (DFDRs, sometimes called SSFDRs) brought the advantages of little maintenance and much easier access to data.

Requirements remained pretty much the same until rule changes in 1987 and 1988, in which the remaining foil-type FDRs were replaced and yet more parameters were added. These included "pitch and roll attitude; thrust for each engine; flap position; flight control input or control surface position; lateral acceleration; pitch trim; and thrust reverser position for each engine." Various planes were required to move up to 17 or 28 parameters: Some older planes like the Boeing 707, 727, and 737 continued to operate under the 1957 rules.

In 1997 through 2002, things evolved even more. DFDR parameters were increased to 22, 34, 57, and 88 – depending on the date of manufacture of the plane.

An example of a combination CVR/FDR unit. The cylindrical structure on the end is the Underwater Locator Beacon (ULB) which can send pings once per second for a month down to depths of 14,000 feet when activated by submersion in water. Photo courtesy L3 Communications

A fairly detailed but interesting history may be found at **www.ntsb.gov/events/journalist/Article_from_JRN0601.pdf**

Brief CVR History

The FAA called for installation of Cockpit Voice Recorders in certain airliners by the mid to late 1960s, since Flight Data Recorders alone did not provide enough information.

"The CVR requirements were extended to multiengine turbine-powered aircraft capable of carrying six or more passengers and requiring two pilots" and "Flight crews would be required to use existing CVR hot-microphone systems below 18,000 feet."

On tape units, 1/4-inch tape holding six or eight tracks were common. One track was recorded at a time, sequentially progressed through the tracks, and then started over – overwriting old data by erasure followed by record.

Eventually, solid state CVRs with even greater memory capacity were developed with advances in solid state memory devices.

❖ CVR Audio Channels

CVRs have four record channels, each recording from different sources simultaneously, and some of which are combined in the Captain's and First Officer's audio panels and outputted to the CVR.

The Cockpit Area Microphone in the overhead panel captures voices and other sounds in the cockpit area. Crewmember "hot" headset microphones are used to capture voices and sounds

even when they are not being used for talking on the radio or intercom.

Both sides of radio communications are captured. This includes "company," ramp control (128.825 - 132.00 MHz), and Air Traffic Control frequencies – Ground, Tower, Departure, Air Route Traffic Control, etc. (118 - 136 MHz).

The CVR also captures data link communications (if installed), public address and aircraft interphone voice, and audio from navigation or approach aids, ATIS, AWOS, etc. when introduced into the headset or speaker. (Data link info: **www.answers.com/topic/controller-pilot-data-link-communications)**

Recovered CVR Audio

The recovered audio is used to prepare written transcripts, many of which are made available to the public. Reading some of them can draw you in like reading a good novel. In a way, it's like "hearing" the verbal exchanges between people who may soon die. Reading them can also be disturbing, so read them with caution.

Here is a transcript snippet from Alaska Airlines, Flight 261, January 31, 2000:

16:09:13 CAPT: Let's do that.
16:09:14 [Sound of click]
16:09:14 CAPT: This'll click it off.
16:09:16 [Sound of autopilot disengaging] [Sound similar to horizontal stabilizer in motion tone]
16:09:16 CAPT: You got it?
16:09:26 CAPT: It got worse.
16:09:31 CAPT: You're stalled.
16:09:32 [Sound of air frame vibration]
16:09:33 CAPT: No no you gotta release it ya gotta release it.
16:09:34 [Sound of click]
16:09:52 CAPT: Help me back help me back.
16:09:54 F/O: Ok.
16:09:55 RT CAPT: Center Alaska two sixty one we are uh in a dive here.
16:10:01 RT CAPT: ... and I've lost control, vertical pitch.
16:10:01 [Sound of overspeed warning] (continues for 33 seconds)
16:10:05 LA30: Alaska two sixty one uh say again sir.

Many CVR transcript Internet sites and individual transcripts may be found by going to **www.google.com** and then entering "CVR Recorder Transcripts" but with no quotes. For the NTSB "Accident Database & Synopses," see **www.ntsb.gov/ntsb/query.asp.**

❖ FDR Data

The regulations covering the number of data parameters to be captured on airliner FDRs are involved and vary with aircraft date of manufacture and other factors. Essentially, all airliners manufactured after August 19, 2002 must be equipped to record 88 parameters. Listed here are the first twenty from such a list to offer an idea of what is recorded: Time, Pressure altitude, Indicated airspeed, Heading, Normal acceleration (Vertical), Pitch attitude, Roll attitude, Manual radio transmitter keying or CVR/DFDR synchronization reference, Thrust/power of each engine, Autopilot engagement status, Longitudinal acceleration, Pitch control input, Lateral control input, Rudder pedal input, Primary pitch control surface position, Primary lateral control surface position, Primary yaw control surface position, Lateral acceleration, Pitch trim surface position, Trailing edge flap or

An example of a Cockpit Voice Recorder (CVR). They record four channels of audio that includes radio transmissions, cockpit voices, and other sounds. Photo courtesy National Transportation Safety Board (NTSB)

cockpit flap control selection …

A Flight Data Acquisition Unit (FDAU) precedes the FDR by collecting the analog, the discrete (such as engaged / not engaged), and the digital parameter data from numerous aircraft systems and sensors. The FDAU converts the data into digital binary format and passes it on to the FDR.

The binary data is a long series of ones and zeros. Parameter samplings are serially multiplexed, which means one parameter is sampled at a time in a predetermined sequence – one after the other. Some parameters that are typically slow to change are sampled less frequently than others. All this is a very precise, timed operation.

The digital data stream is divided into sequential segments called "frames" and "subframes." Each frame has four subframes. Subframes are recorded at one per second and each is made up of 32, 64, 128, or 256 "12-bit words" – depending on the FDR model. Each flight data parameter has an assigned "word slot" / location within a subframe.

Each subframe begins with a 12-bit synch word. With no synch words, the data would become meaningless, since no start or end points would be identified.

After an FDR recovery, the extracted data stream is turned back into terms that are more understandable, called "engineering units" and "discrete states." These are then charted on graphs vs. time in order to be useable by investigators. Here is a good example:
www.ntsb.gov/Dockets/Aviation/DCA-09MA026/418135.pdf

Combination Units

Combination units are manufactured with CVR and FDR functions in one unit. They may eventually replace the separate CVR and FDR units. In such instances, there must be two combination recorders installed, one in the tail section and one near the cockpit, and they must be powered by separate electrical systems. Two combination recorders will provide redundancy and thus maximize recovery of cockpit voice and flight data after a crash.

The two-page description and specifications of this combination unit by L3 Communications can be a lesson in itself:
www.l-3ar.com/PDF_Files/MKT047_FA2100CVDR.pdf

Overwriting Data

As CVRs and FDRs operate, they continuously overwrite the oldest data with new data.

If an aircraft has an "incident," as opposed to an outright crash and is able to land, important data can be overwritten with useless data while on the ground sitting on the runway, while taxiing, and even while parked if the recorders are not promptly deactivated by a possibly shaken crew with other things on their minds.

Also, if the flight crew recovers after an airborne incident but continues to fly for a time, relevant data can be overwritten.

CVRs using a tape loop with a thirty-minute capacity have greater limitations compared to newer units with a two-hour or greater solid state record time before relevant data is overwritten.

❖ QAR, A Third Black Box?

Well, not really – but almost. Quick Access Recorders are a third recorder, but they are not made to be crash-survivable like the other recorders. However, some do survive and are analyzed by crash investigators. The QAR usually can record many more parameters and at faster sampling rates than can the FDR.

The "Quick Access" means that the stored data can be quickly accessed and downloaded by airliner ground crews. The data is recorded on easily removable optical disks or memory cards which can be read by desktop computers for analysis. This is a regular occurrence rather than one intended for crash investigations. Some systems can send the data, encrypted and compressed, via wireless Internet in fifteen to thirty minutes.

The analysis of QAR recorded data is intended to identify in-flight parameter excursions outside of pre-defined / "normal" ranges. In simple terms, this is used to help identify components or systems needing attention, to help spot potentially problematic trends, and to improve efficiency, flight operations, and safety.

❖ Concluding Thoughts

Some have considered a system to allow in-flight emergency CVR/FDR/QAR data dumps to a satellite system when initiated by the pilot, or following rapid depressurization, explosion, emergency transponder settings, or whatever conditions were set as a triggering event. At this time, it appears to be too expensive in terms of infrastructure development, satellite use costs, and the rare need. That is to say, a poor cost / benefit ratio.

I hope that the next time you hear about "black boxes" in the news, you can draw from the information here to have a better understanding and fuller appreciation of the topic.

Books by Ernest H. Robl:
THE BASIC RAILFAN BOOK
UNDERSTANDING INTERMODAL
THE POWDER RIVER BASIN
Detailed descriptions at
http://www.robl.w1.com

Kevin Carey, WB2QMY
kevincarey@monitoringtimes.com

LF Receiving Antennas, Part II

We resume our discussion this month on LF receiving antennas. This subject began back in September, and I had originally planned to run this 2nd installment last month. However, there was not enough room to run it as a single piece along with the news, loggings, and mailbag items we had last month so it was saved until now. Thanks for sticking with us, and I apologize for the inconvenience.

Multi-turn Tuned Loops are a time-honored design worth discussing in this two-part series on receiving antennas. These loops usually consist of a box-shaped frame wound with several turns of small diameter wire. The windings are tuned to resonance at LF with a variable capacitor connected across the windings. A separate, one-turn winding is placed in the approximate middle of the tuned winding to provide a low impedance (50-100 ohm) "pickup link." It is this link, and not the multi-turn winding, that connects to the receiver via a coaxial cable.

Multi-turn loops are easy to build, and you can get plans for one by ordering a reprint of the September 1992 *Below 500 kHz* column from *Monitoring Times* – cost $3, plus an SASE. (An optional preamp for this same antenna was published in the November 1993 column.) Such a loop can be set on a tabletop and rotated to favor (or null) a particular signal. One *MT* reader I spoke with mounted his loop on an old music stand and is achieving excellent results.

One disadvantage of tuned loops is that they must typically be used indoors. Most wire-wound designs are too fragile to mount outside in the elements, and even if you did, there is the problem of tuning it to resonance. Whenever you move your receiver more than 10 kHz or so, the loop should be re-tuned for best performance. It is possible to employ remote tuning schemes, but such arrangements can become complicated and are subject to change with the weather. Some promise has been shown with varactor diode tuning, but getting a wide enough capacity range is usually difficult. The good news is that wire loops seem to perform very well indoors!

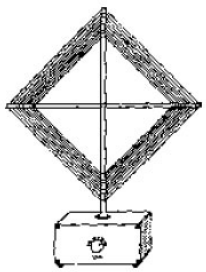


Figure 1. Multi-turn tuned loops often surpass the performance of wire antennas, particularly in noisy RF environments.

Finally, let's discuss **Broadband Shielded Loops**. These antennas have a number of advantages that make them popular with DX-ers. Among the advantages are: Low noise pickup, good sensitivity, tune-free operation, and mechanical stability.

Shielded loops contain only one turn of wire, and, as the name indicates, they are electrically shielded, except for a very small portion (an inch or so) at the top of the loop. Shielding reduces the antenna's susceptibility to electrical field noise, such as static crashes.

Shielded loops are typically made of a rigid or semi-rigid material such as "hardline" coaxial cable or copper pipe, so they can be easily mounted outdoors on a simple mast and turned with a TV rotor.

These loops typically contain a wideband (10-500 kHz) preamplifier, so there's no need for tuning the antenna as you move across the band. In a well-designed system, the preamp begins "rolling off" above 400 kHz and becomes nearly "deaf" above 500 kHz to minimize AM broadcast overload.

Would you like to build a shielded loop? If so, I highly recommend visiting VE7SL's web page at **http://members.shaw.ca/ve7sl/burhans.html**. Here, you'll find specific details for building a high performance loop and its associated preamp/coupler. This project is well within the skill set of most experimenters.

Another excellent reference on loop antennas is the late Joe Carr's *Loop Antenna Handbook*, available from Universal Radio Research, 6830 Americana Parkway, Reynoldsburg, OH 43068 (**www.universal-radio.com**). It contains over 130 pages of descriptions, plans and theory for many types of loop antennas.

❖ Loggings

As many of you already know, I also serve as editor of the *DX Downstairs* column for the Longwave Club of America's *Lowdown* journal (see **www.lwca.org**). This has allowed me to give something back to this respected publication, which has done so much to promote the longwave hobby since 1974. The *DX Downstairs* column is mainly devoted to reader loggings. To streamline the process and present the most interesting information, I cross-post many of the logs I receive via *MT* in the *DX Downstairs* column, and vice versa.

This month's loggings are provided courtesy of Richard Palmer (AZ). If you would like to submit loggings, simply send them via e-mail to the address at the top of this column. We have a free Loggings Template that can be obtained by simply requesting it at the same address (or download it at **www.monitoringtimes.com/Below_500_kHz-Loggings_Template.pdf**). I look forward to hearing from you as we get into the "DX season" on the longwave band!

TABLE 1. SELECTED LF LOGS (from Arizona)

FREQ	ID	ST/PR/ITU*	CITY
203	YBL	BC	Campbell River
207	YNE	MB	Norway House
209	HGT	CA	Hunter-Liggett MR
212	OVE	CA	Oroville
214	CHX	MEX	Choix
218	PR	BC	Prince Rupert
220	VI	CA	Visalia
222	CUW	MEX	Chihuahua
233	ALJ	AK	Johnstone Point
238	KT	NZL	Kaitaia
242	ZT	BC	Port Hardy
260	NF	NFK	Norfolk Island
270	FA	SMO	Faleolo
271	SC	CA	Stockton
280	IPA	PAQ	Easter Island
282.5	RT	OCE	Rurutu
283	DUT	AK	Dutch Harbor
284.5	MH	OCE	Manihi Atoll
307	NA	FJI	Nausori
311	CFS	AUS	Coffs Harbour
332	POA	HI	Pahoa
332.5	AA	OCE	Anaa
335	CC	CA	Concord
338	LSA	TX	Lamesa
341	ELF	AK	Cold Bay
347	LFA	CA	Merrill
349	TP	OCE	Takapoto
351	NO	NV	Reno
352	RG	CKH	Raratonga
353	LLD	HI	Lanai
368	GYM	MEX	Guaymas
370	PAI	CA	Los Angeles
372	RU	OCE	Raiatea
374	LV	CA	Livermore
376	NP	OCE	Napuka
382	GRN	MEX	Guerrero Negro
388	JUG	TX	Mesquite
391	DDP	PR	San Juan
414.5	RPB	KS	Belleville
415	CBC	CYM	Cayman Brac

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

We have something a little different planned for next month. Ever wonder if you can communicate appreciable distances using the Earth as a transmission medium? Well, according to one experimenter who's been working on this for years, it is indeed possible, and it requires little more than an audio amplifier and some metal rods driven into the Earth.

He has achieved distances up to about a half-mile with this technique, and cites one experimenter who achieved a distance of 10 km (6.2 miles) with a high-powered system. If you want a preview of this subject, try searching online for the terms "Ground Radio" and "Earth Wireless Telegraphy."

See you next month!

George Zeller
georgez@nacs.net

The Filipino Monkey - Malicious Unlicensed Jamming

The most notorious pirate jammer of all time has for some reason received very little attention in shortwave radio circles. This one is not a hobby pirate, but is instead an intentional jammer who broadcasts malicious interference on naval communications frequencies. It first appeared over a decade ago during the Persian Gulf War. In fact, a recording of the malicious jamming during the Persian Gulf War is posted on U-Tube, so anybody can listen to the dangerous antics of this station. **www.youtube.com/watch?v=BYHZjnDyWVI**

This sort of interference, with profanity and taunting reminiscent of Monty Python, has by no means been restricted to the Persian Gulf. From time to time it has been noted on various frequencies related to naval communications. The worldwide scope of these broadcasts suggests that this is not one single jammer. Instead, the "Filipino Monkey" has become a generic description for malicious interference to utility station transmitters.

The notorious Filipino Monkey finally got some national attention in the *Wonkette* gossip blog from Washington, DC in early September. It was widely reported in the worldwide press that the Coast Guard had attacked a boat on the Potomac River in Washington. Radio broadcasts of bullets flying were allegedly heard by CNN and other national news organizations. Reports of a Coast Guard boat speeding to catch some sort of intruder vessel on the Potomac got prominent worldwide coverage for one day.

White House Press Secretary Robert Gibbs was forced to comment somewhat sarcastically on these events at a press briefing for White House reporters. Gibbs attributed the action on the river to a "naval exercise," but many news organizations were unable to confirm a scheduled "naval exercise" on the Potomac in Washington, DC. *Wonkette*, hardly a mainstream press source, quickly blamed the malicious broadcasts on "The Filipino Monkey."

Their reporting discovered a similar incident in the Straits of Hormuz on January 14, 2008. Malicious naval broadcasts caused a small military crisis when five small Iranian patrol boats unexpectedly began to maneuver around United States warships in transit through the Straits of Hormuz. Malicious broadcasts on ship communications frequencies said that the small boats were attacking and that they were about to explode.

In the UK, *The Guardian* newspaper blamed the confusion on the Filipino Monkey's aggressive broadcasts on naval communications frequencies. The *Guardian* quoted retired naval captain Rick Hoffman with his analysis. Hoffman said in *The Guardian* that, "For 25 years, there's been this mythical guy out there who, hour after hour, shouts obscenities and threats. He used to go all night long. The guy is crazy. Could it have been a spurious transmission? Absolutely."

The United States and Iran released two different videos of this incident. The USA version edited in threats from The Filipino Monkey, but the Iranian version lacked such information. The US Navy told *The Guardian* that its ships came "within seconds" of firing at the Iranian vessels. United States President George W. Bush filed a formal complaint to the Iranian government, warning Iran of potentially "serious consequences" of such behavior.

Fortunately, neither incident in the Straits of Hormuz or the Potomac caused an actual naval battle, damage, or loss of life. But, it does remind us that it is extremely foolish for any unlicensed broadcaster to operate on military frequencies or to transmit malicious interference on any licensed radio frequency.

There have been occasional pirate radio examples of malicious interference over the years. The most notorious was Lad, the young operator of **The Voice of the Night**. It turned out that despite his intentional jamming of other North American pirates with a series of broadcasts titled the "Kill George Zeller" show, Lad was not actually dangerous on the HF bands. He did, however, receive a sentence of many years in the Kentucky State Prison for probably unrelated physical abuse of his girlfriend in Lexington, KY.

This confluence of events reminds us that even unlicensed pirate broadcasters universally condemn unsound operating practices that include malicious jamming of other radio broadcasters.

❖ MAC Shortwave QSLs

Aside from WBNY, the second biggest phenomenon on North American Pirate bands during the past year has been Paul Starr's widely heard **MAC Shortwave**. Sometimes assisted by a young boy called Ultra Man, Starr's well produced replica of top forty radio broadcasters of the 1960s is among the best produced pirate radio stations of all time. But, until recently, QSLs from **MAC Shortwave** have been extremely sparse. As we see here this month, that policy has dramatically changed. Many DXers have been delighted to receive the new **MAC Shortwave** QSLs.

❖ What We Are Hearing

Monitoring Times readers heard more than two dozen different pirate radio stations this month. You can hear them too, if you use some simple techniques. Pirate radio stations never use regularly announced schedules, but shortwave pirate broadcasting increases noticeably on weekends and major holidays. You sometimes have to tune your dial up and down through typically used pirate radio frequencies to find the stations, but more than 95% of all North American shortwave pirate broadcasts are heard on **6925 kHz**, plus or minus 30 or 40 kHz.

Big Dog Radio- This new station features a classic rock music format and barking dogs as sort of an interval signal. (Report to FRW and FRN)

Captain Morgan- The Captain mixes audio from the old Twilight Zone TV show with his rock music broadcasts. (*captainmorganshortwave@gmail.com*)

Channel Z Radio- Their professionally produced rock music shows are distinctive. (Belfast and *channelzradio@gmail.com*)

KUSA- Less Whitehouse's rock music podcast is audible on the internet at **http://kusaradio.com/Welcome.html** and also sometimes on the pirate bands. (*contact@kusaradio.com*)

Liquid Radio- Techno rock dance music is featured on most broadcasts, so **WMPR** is not the only pirate with this format. (*wwrbfm@gmail.com*)

MAC Shortwave- Paul Star and Ultra Man still use the old Radio Prague interval signal as a lead-in to their rock and novelty music shows. (*macshortwave@yahoo.com*)

Mystery Radio- Among the best heard European pirate stations is this one on 6220 kHz. With improving winter propagation, you might hear it around your local sunset on weekends. (*radio6220@hotmail.com*)

North Sea Radio Ohio- Little is known about this new station that has featured pirate music and an unusual station name. (unknown)

Northwoods Radio- If you hear a loon call interval signal, you probably have Jack Pine Savage's rock music station "from the Great Lakes." He sometimes gives IDs in Morse code. (*northwoodsradio@yahoo.com*)

Outhouse Radio- Normally they feature a mix of rock and novelty music, but they have been known to relay other pirates. (None, asks for reports to the FRN web site and has QSLed)

Pirates Week Relay- Relays of Ragnar Daneskjold's wonderful weekly pirate news podcast are still appearing on the pirate bands from time to time. If you miss the relays, you can hear the show at **www.piratesweek.info/** on the internet. (None)

Radio Casablanca- QSL's have arrived from this 1940s big band music station. (*radiocasablanca@gmail.com*)

Radio Ga Ga- Uncle Bob's pirate with rock music and SSTV digital pictures has become one of the most active current stations. (*popeonthepoint@gmail.com*)

Radio Mushroom- Their classic rock format has now been broadcasting for three months. Some DXers have received QSLs. (*radiomushroom@gmail.com*)

Radio Station XXP- Classic rock music is their normal format. (*radiostationxxp@gmail.com*)

Scott Joplin Radio- Given the station name, it is no surprise that piano music is their main focus. (unknown)

The Crystal Ship- For decades, the Poet's rock music and leftist political commentary have gone out on the pirate bands. He still normally uses odd frequencies such as 6876 kHz. (Belfast)

Thinking Man Radio- This new rock music station uses a slogan of "never be afraid to sit a while and think." (*Thinkingmanradio@gmail.com*)

Uncle Deercamp Relay- Some pirate has been relaying this "morning zoo" podcast from Detroit. (unknown)

Undercover Radio- Dr. Benway is back with rock music and tales about his travel adventures. ((Merlin and uses

Continued on page 61

T.J. "Skip" Arey, N2EI
tjarey@monitoringtimes.com

Transversion Conversions and Other Diversions

I am lucky enough to be based in the Northeastern region of the good old US of A. This part of the country is quite a hotbed of amateur radio fun on VHF and above. I live in the signal footprint of the Mount Airy VHF Radio Club, more commonly known as the Pack Rats. I live within a short drive of several hams who have very serious (and very large) Moon Bounce antenna systems in their yards. It's a great part of the world to live in if you have a hankering to work the world using the frequencies from 50 MHz up through Visible Light.

When the Technician Class license superseded the Novice ticket as the entry level path to ham radio fun, I was surprised to find that most folks never strayed beyond the limits of 2 meters or perhaps 432 MHz if they started out with a dual band handi-talkie. Hams have the opportunity to play in the frequency ranges running all the way up through 275 GHz and beyond. Much of this is largely uncharted territory for all but a handful of dedicated experimenters.

If you decide to get into VHF/UHF radio in the upper regions of what is possible, you have probably noticed that it isn't all that easy to find rigs above 1.2 GHz in your handy ham radio catalogs. You can get to just about anywhere in the upper spectrum if you have a good HF or 2 meter transceiver and one or more *transverters.*

Think of a transverter as a black box (actually, in some cases, it *is* a black box) that takes the signal from the transmitter portion of your rig and converts it up to a higher frequency. Likewise, the transverter also takes the higher received frequency and converts it down to something your existing rig can run with. These two functions are managed through a common local oscillator to keep everything coordinated. It is really no more complicated than that.

Transverters are sold (or can be built from a kit or parts) to take a radio with a 28 MHz IF and run it up to 50 MHz, 144 MHz, 222 MHz, or 432 MHz. VHF transceivers operating at 144 MHz can be used with transverters to take your signal up to 902 MHz, 1.2 GHz, 2.3 GHz, 3.4 GHz, 5.7 GHz, and even the 10.3 GHz bands.

The advantage of using transverters is obvious. Usually costing between $300 and $500 new, they are still cheaper than buying or building a dedicated transceiver for each of the above mentioned bands. Also, many transceiver designs incorporate filtering and preamplification that maximizes the signal quality of the desired frequency range.

So what are the downsides? As a general rule, transceivers take a minimal signal out of your existing rig and only amplify it marginally while taking it up the band. That means most practical applications will require you adding a stage of amplification at the higher frequency range. Also, remember, as you go up in frequency, managing feedline and even connector losses becomes an important consideration. So you may find yourself tossing another wad of cash into the mix to get that signal out to the world. Still, in most cases, transverters are still the least costly way to add microwave bands to your shack.

Start out by reading your primary transceiver manual. Does your existing rig have a transverter port? Many newer transceivers do. There are other ways to set up a transverter, but this is usually the easiest. If you don't have a dedicated port, don't worry; many transverters can be made to work against a low power RF signal (usually 5 to 10 watts).

Likewise, get a look at the specifications

The Elecraft XV144 transverter kit is a great way to move your HF transceiver up to VHF.

and manuals for any transverter you are considering. You will find most designs can be made to work in most cases, but there are some lash ups that just won't fly no matter how hard you try. A little prior planning will save you the trouble of testing the transverter company's friendly return policy.

There are a number of transverter manufacturers out there to choose from. Here are a couple of them: Down East Microwave **www.downeastmicrowave.com/** and Elecraft **www.elecraft.com/** are good places to start your search for transverters and sound advice on setting them up given the nature of your home station.

There is lots of fun to be had up there in the upper limits of the radio spectrum. There is still a lot of experimentation and new challenges to be found.

❖ So What is Up with the Sun...Really?

If you have been a ham for any length of time, you know that a good crop of sunspots is the key to putting a lot of DX into your logbook. If you are any sort of ham today, you are probably well aware that we are going through an unprecedented period of very few (if any) sunspots. Traditionally, hams and other folks have been able to depend on a fairly regular 11 year cycle of sunspot ups and downs. For reasons that even the best solar scientists can't seem to agree on, things just aren't coming around in the sun spot department. Oh, there are still lots of folks to talk with (and even quite a bit of DX) if you are willing to dig in a bit (CW anyone?), just don't expect to nail the Marshall Islands 59 with 1 watt to a dipole on phone like I did back in 2001, at least not for quite some time to come.

Are we downhearted? Not me, mate! I get on the air most evenings and I find lots of radio fun. The sunspots will come back some day.

But if you want to try to keep track of what the sun is up to and maybe even throw your theories into the mix, let me make a few recommendations to help you along the way.

You can start with the hard data: The daily sunspot report can be found on the NOAA Space Environment Sunspot page at **www.swpc.noaa.gov/ftpmenu/forecasts/SRS.html**.

Then you might want to get a more detailed perspective by backing out to the more comprehensive information that can be found on the NOAA Space Weather Prediction Center webpage at: **www.swpc.noaa.gov/.** Here you will find details including near real time satellite imagery.

Another great page that augments the basic NOAA data with more user friendly information and even some interesting history is the Space Weather page: **http://spaceweather.com/**. If you are afraid that the sky might be falling, don't scroll down too far on this page. They also give predictions about the over 1 thousand "Near Earth Objects" listed as "potentially hazardous."

If you use the Firefox Web Browser, there is a great little "plug in" for this browser called Propfire. Developed by Patrick Rundall N0HR, this add-on browser feature puts current HF propagation information right on the browser status bar. Give the info box a click and you get a chart of the last 3 hours of solar activity, as well as a number of links to more comprehensive solar information including the full WWV propagation report. Best of all, this handy little tool is free to Firefox users at: **www.n0hr.com/Propfire.htm**.

❖ Hey Buddy ... Got The Time

While were talking about Firefox Web Browser plug ins. I may as well also mention another ham radio favorite. FoxClocks **www.stemhaus.com/firefox/foxclocks/**. Developed

UNCLE SKIP'S CONTEST CALENDAR

California QSO Party
Oct 3 1600 UTC - Oct 4 2200 UTC

RSGB 21/28 MHz Contest
Oct 4 0700 - 1900 UTC

10-10 International Day Sprint
Oct 10 0100 - 2359 UTC

FISTS Fall Sprint
Oct 10 1700 - 2100 UTC

Pennsylvania QSO Party
Oct 10 1600 UTC - Oct 11 2200 UTC

Illinois QSO Party
Oct 18 1700 UTC - Oct 19 0100 UTC

CQ Worldwide DX Contest SSB
Oct 24 0000 UTC - Oct 25 2400 UTC

10-10 Int. Fall Contest CW and Digital
Oct 24 0001 UTC - Oct 25 2359 UTC

by Andy McDonald, you can set up multiple clocks on your status bar including UTC. Beyond that, you can have it show local times in other parts of the world. FoxClocks is a very comprehensive (and free) tool to make the Web a better place for people who play radio.

❖ November is Sweepstakes Month

It's that time of year again. The harvest is in and hams are gearing up for the ARRL Sweepstakes. This year, the CW weekend will be held on November 7th and 8th and the Phone weekend will be the 21st and 22nd of the month. I think it has something to do with the time of year, but this contest always seems to yield a lot of activity, especially many opportunities for single op stations with low power. You don't have to be a big gun to put together a reasonable score in Sweepstakes. Scan the bands for multipliers, working anything else you hear along the way and you will be surprised how fast the points can add up.

❖ The Alpha Delta DXCC

Every now and then I get asked, "Skip, what kind of antenna would you buy for HF?" Well, without getting into the "build versus buy" debate, the commercial product I have always felt good about is the:

Alpha Delta DXCC Parallel Dipole - $160
Alpha Delta Communications, Inc.
Order Line 888-302-8777
Info line 606-598-2029
FAX 606-598-4413
Product or order questions e-mail: jfburns@windstream.net
Antenna questions e-mail: tyrrell@cybertrails.com

The Alpha Delta DXCC is a multi-wire, multiband dipole designed to operate on 80, 40, 20, 15 and 10 meters feeding 50 ohm coax, but the antenna can also load the WARC bands with a good tuner. It is rugged and easy to assemble. The DXCC is constructed with 12 gauge insulated solid copper wire that will easily handle the full legal limit in the power department. All hardware is stainless steel and the overall design is severe weather rated.

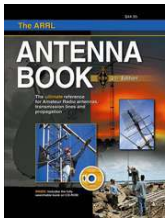
It can be mounted flat or configured as an Inverted V. It requires only 82 feet spacing and has been tested to work well as low as 35 feet. This makes it the "everyman's" (or everywoman's) basic HF skywire, likely to fit into most back yards.

I have used this antenna in two locations over many years and never found fault with the design or performance. Sure, you can put your own set-up together for less than half the price, but there is a lot to be said for the quality of the Alpha Delta gear and expertise of the Alpha Delta staff.

❖ Ham Radio Book of the Month

But if you want to roll your own antennas, there is only one place to start.

The ARRL Antenna Book 21st Edition
Editor: R. Dean Straw N6BV
ISBN: 9780-87259-987-6
Order Number - 9876
976 pages $44.95 from
The American Radio Relay League
225 Main Street
Newington, CT 06111-1494
www.arrl.org/shop
1-888-277-5289



The League's *Antenna Book* has been around in one form or another since 1939. You would think that everything to be said about putting pieces of wire together to pump RF into the sky might have been said by now. Well, this edition of the *Antenna Book* (the 21st) is about twice as thick as the one I first bought back in the 1970s when ham radio entered my life.

Like its sister publication The ARRL *Handbook for Radio Communications*, the *Antenna Book* never disappoints. The new information added (and the old information improved) always gets me out on the roof trying new things. This edition includes something that will allow me to keep my feet on the ground. The 21st handbook includes complete construction information for a mobile "Screwdriver" HF antenna. I have always wanted to give that design a try. This idea is found in among the many wonderful loops, Yagis, verticals and other designs.

And for those cold and rainy months where climbing for antenna work are not particularly safe, you can sit by the fire reading the excellent theory sections of the handbook, also completely revised and expanded. New to this edition is a comprehensive study of Near Vertical Incidence Skywave (NVIS) techniques. Reading this section will make you a believer in "cloud warmers."

The handbook includes a CDROM full of antenna utilities. You will find programs for antenna design and modeling as well as transmission line assessment. There are also programs for terrain assessment and even propagation forecasting. (They have included everything but the sunspots!)

This latest edition of the ARRL *Antenna Book* is a winner, just like all its previous iterations. Highly recommended for all hams.

Well, time to hit the key. I'll see you on the bottom end of 40 meters.

Outer Limits continued from page 59

undercoverradio@gmail.com)

Voice of Honor- There is a clear patriotic theme on this pirate that has been active on various holidays. (*voiceofhonor@gmail.com*)

Voice of KAOS- Their rock music protests high levels of chaos in the world. (*voiceofkoas@gmail.com*)

Voice of the Robots- Robots such as Dr. Smith's robot on "Lost in Space" play rock music on this pirate. (*voiceoftherobots@gmail.com*)

WANK- This new pirate has been programming classic rock music. It is unclear if the North American version is a relay of the Dutch Europirate. (unknown)

WBNY- Commander Bunny has announced that he now has a facebook page to supplement his Rodent Revolution broadcasts. (Belfast and *rodentrevolutionhq@yahoo.com*)

WEAK Radio- Rock music and comedy are their normal format, but they sometimes switch programming styles. (*weakradio@gmail.com*)

WMPR- When you hear "dance party" techno rock music on shortwave, it normally is this veteran station. (None; known to QSL occasionally only at the Kulpsville Winter SWL Festival)

WTCR- "20th Century Radio" plays music from various decades of the last century, from ancient pop to rock. (Belfast)

Wolverine Radio- Some still think that the diction of the announcer's voice on this rock music station sounds like Long Range Radio. (None)

QSLing Pirates

Reception reports to pirate stations require three first class stamps for USA maildrops or $2 US to foreign locations. The cash defrays postage for mail forwarding and a souvenir QSL to your mailbox. Letters go to these addresses, identified above in parentheses: PO Box 1, Belfast, NY 14711; PO Box 109, Blue Ridge Summit, PA 17214; PO Box 146, Stoneham, MA 02180; PO Box 293, Merlin, Ontario N0P 1W0, Canada, and PO Box 9, 8096 ZG, Oldebroek. Netherlands. PO Box 69, Elkhorn, NE 68022 is no longer a valid address, even though a few pirates announce it.

Some pirates prefer e-mail, bulletin logs or internet web site reports instead of snail mail correspondence. The best bulletin for submitting pirate loggings is the e-mailed *Free Radio Weekly* newsletter via *freeradioweekly@gmail.com*. A few pirates will sometimes QSL reports left on the outstanding **www.frn.net** web site. *The ACE,* a formerly widely read print bulletin, now has a valuable archive of *Free Radio Weekly* issues at www.theaceonline.com/

Thanks

Your loggings and news about unlicensed broadcasting stations are always welcome via 7540 Highway 64 W, Brasstown, NC 28902, or via the e-mail address atop the column. We thank this month's valuable contributors**:** Brian Alexander, Mechanicsburg, PA; Kirk Allen, Ponca City, OK; Skip Arey, Beverly, NJ; Kirk Baxter, North Canton, OH; Jerry Berg, Lexington, MA; Artie Bigley, Columbus, OH; Richard Cuff, Allentown, PA; Rich D'Angelo, Wyomissing, PA; Ragnar Daneskjold, North America; Gerry Dexter, Lake Geneva, WI; Bill Finn, Philadelphia, PA; Harold Frodge, Midland, MI; William T. Hassig, Mt. Prospect, IL; Don Jensen, Kenosha, WI; Ed Kusalik, Camrose, Alberta; Larry Magne, Penn's Park, PA; Greg Majewski, Oakdale, CT; Gene Patterson, Gibsonia, PA; Paul Starr, QTH unknown; A. J. Michaels, Blue Ridge Summit, PA; Adrian Peterson, Indianapolis, IN; John Poet, Belfast, NY; Mike Rhode, Columbus, OH; Lee Silvi, Mentor, OH, John Wilkins, Wheat Ridge, CO; and Dave Zantow, Janesville, WI.

Clem Small, KR6A
clemsmall@monitoringtimes.com

Build Your Antenna Library And a VHF-UHF Antenna

The most extensive treatment of antenna theory and practical, how-to-do-it information is the *ARRL Antenna Book*. This book deals with antennas for both receiving and transmitting from medium-frequency (HF) through microwave. Design formulas and useful information are given for many of the antennas covered, such that they can be designed for any frequency you wish, not just for ham frequencies.

The broad coverage volume of The Radio Society of Great Britain is *Antennas for All Locations* by Moxon. Although smaller than the *ARRL Antenna Book,* this book is filled with a lot of practical information on a great variety of antennas.

In *Joe Carr's Antenna Handbook,* the late Joe Carr presents an extensive treatment of antenna projects and information. Joe wrote in an informal style and offered a lot of practical information on antenna design and construction.

W. Clem Small's *The Antenna Handbook* presents a wide range of topics from antenna history to projects for building many different practical antennas and antenna accessories.

The late L. B. Cebik, W4RNL, has authored a series of antenna books called *Antennas from the Ground Up*. These books have a great deal of practical information on antenna construction and use. More than any other source I know, Cebik's books not only impart information on how to build various antennas, but also contain extensive discussions of their performance and radiation-reception patterns.

A large, interesting, and useful collection of antenna projects is found in *The Giant Book of Amateur Radio Antennas* published by Blue Ridge Publications. This book is a collection of antenna articles from the old *73* ham-radio magazine.

Bill Orr, W6SAI, often in collaboration with Stuart Cowan, wrote a series of short books, including *Antenna Handbook*, *Beam Antenna Handbook, Wire Antennas,* and *Vertical Antennas*. These books contain a lot of practical, how-to-do-it information.

The late Doug Demaw, W1FB, has written a great little antenna book for beginners called *W1FB's Antenna Notebook*. with lots of useful information.

And the late Lew McCoy, W1ICP, has a good discussion of many types of antennas and antenna accessories in his *Lew McCoy On Antennas*.

How to Access Antenna Information:

Radio magazines such as *QST*, *CQ*, and *Monitoring Times* routinely contain advertisements for books on antennas. They also publish articles on building and using antennas. Some even have a special, annual issue devoted to antennas.

Libraries near you may have some antenna books, or can get them for you on inter-library loan. Using Google or other search engines, enter the name of the book you want, or enter terms such as "antenna book," "antenna handbook,´"antenna information," etc, to bring up the desired results. The same goes for searching Ebay, Half.com, and Amazon.com for antenna books. The National Radio Club also offers papers and booklets on various antenna topics.

Out-of-print publications can often be found by a Google search, or on Ebay, or Half.com. Used book stores are sometimes a useful source. If there's a local ham club near you, check it out: Some clubs have talks on antennas at their meetings, and many have members who are glad to help with antenna questions and can even help in putting antennas up. You can often find a club near you by searching the web with terms like "radio club," "ham club," "amateur radio club," etc, plus the name of your city and state.

Following are some specific sources that are particularly useful.

The American Radio Relay League offers a number of books on antennas: **www.arrl.org/catalog/index.php3?category=Antennas,+Transmission+Lines+and+Propagation**

Check out *CQ Magazine*: **http://store.cq-amateur-radio.com/Categories.bok?category=Books:Antennas**

The National Radio Club site has many pamphlets on antennas: **www.nrcdxas.org/catalog/reprints/**

Grove Enterprises: **www.grove-ent.com/order.html**

Radioware and Radio Books: **www.radiobooks.com/**

RADIO RIDDLES

Last month:

I asked: "An antenna is sometimes said to 'capture' the signals it receives from passing radio waves. After the waves are captured, can they ever escape back into space?"

Well, when RF current flows in or on a conductor, radiation of some of that energy occurs. So, yes, some of the energy of the captured (received) waves is radiated back into the space around the antenna, and thus "escapes" from the antenna. In the Yagi-Uda beam antenna, the parasitic elements (reflector and directors) are not connected to any feed line at all, and so they radiate almost all of the wave energy that they capture. The Yagi-Uda beam's active element (the one connected to the feed line) captures some of this radiation from the reflector and director. The combination of this radiation and the energy captured by the active element itself from the passing waves combine to produce the Yagi-Uda's gain and directivity.

This Month:

Many beam antennas, such as the Yagi-Uda Beam mentioned above, also obtain their gain and directivity from the use of reflectors and directors. Can you name some beam antennas that do not have reflectors or directors in their design?

This Month's Interesting Antenna-Related Web sites:

All materials listed here are free.

The technical section of the *Monitoring Times* website reference library has a number of antenna-related articles, primers, and projects by Bob Grove and myself: **www.monitoringtimes.com/html/reference_library.html**

Here's an antenna and propagation book that is used in the U. S. Navy training course for training electronics technicians: **http://libro-ee.blogspot.com/2009/08/210-electronics-technician-volume-7.html**

W1GHZ freely shares his excellent microwave antenna handbook: **www.w1ghz.org/**

The Marine's *Field Antenna Handbook* has a lot of practical antenna information, especially on putting up and using antennas outdoors: **www.armymars.net/ArmyMARS/Antennas/Resources/usmc-antenna-hb.pdf**

Here's Laport's classic "Radio Antenna Engineering: **www.athm.net/andreas/RadioAntennaEngineering-printer/RadioAntennaEngineering-printer.pdf**

Laport has good discussions of antennas for various bands. And a short, antenna book for hams: **www.buxcomm.com/pdfzips/hro-antenna-handbook.pdf**

The site "Free Books!" lists quite a number of free antenna and propagation books including Kraus's *Antennas*, 2nd edition, a highly-respected antenna-engineering text: **http://timeandspacetoday.blogspot.com/2009/01/following-are-links-to-free-antenna.html**.

A number of other free antenna books can be downloaded at that same site, *Antenna Systems Guide* is particularly recommended.

Universal Radio **www.universal-radio.com/CATALOG/index2.html**

LET'S MAKE A QUICK AND EASY VHF OR UHF ANTENNA

Dipole antennas are covered in just about every antenna book. This vertical dipole is portable, but can be used in more permanent installations if protected from the weather.

1. Use the following formula to find the length needed for the elements. Length (in ft) = 234/frequency (in MHz), or Length (in m) = 71.3/frequency (MHz).
   For example, a quarter wavelength of wire at 150 MHz is 234/150, or 1.56 ft , which is about 18-3/4 in.
2. Trim the outer insulation from the coax a distance equal to 3 or 4 inches longer than the quarter wavelength found by the formula just given above. Don't use coax that has foil attached to the inner insulation.
3. At the end of the coax just trimmed of insulation, push the wire braid of the outer conductor downward on the coax line. This shield braid should enlarge and slip fairly easily back over itself down the line. Keep working the braid back down the line, eventually folding it back completely over the point where the outer insulation is still on the line (fig. 1B). A few kinds of coax won't push back down like this, so give the coax you intend to use a try to determine if you can use it this way. If not, go to step 5.
4. When you have folded the braid completely back down the coax, it should be a little over a quarter wavelength long. Trim it to the quarter wavelength you got from the formula above, and tape its end in place.
5. If you were unable to fold the coax back down the line, then you will have to make some quarter wavelength wires to take the place of the folded-back coax shield. Cut four bare wires to a quarter wavelength as given by the formula. Then trim the braid leaving about 3/4 inch extending above where the outer insulator was removed from the coax. Attach (solder) the wires to the remaining braid left above the outer insulation. Space the wires somewhat equally around the coax, and tape them down the length of the coax. Trim them if necessary to be equal to the desired quarter wavelength.
6. Remove the inner insulation from the quarter wavelength of inner conductor within about a quarter inch of the rolled back braid (fig. 1C). Make a loop at the end of the bare center conductor such that the length of the center conductor, including the loop, is a quarter wavelength. Solder the loop as it wraps around the wire, and trim any excess wire.
7. If you use this antenna outside where precipitation can reach it, then it must be weatherproofed. One solution is to hang it inside a PVC tube. Cap the top of the tube, but leave the bottom open, or vented.
8. Using the minimum length of coax necessary for comfortable operation with this antenna, put an appropriate coax connector on the far end of the line.
9. Tie the antenna up high and in the clear with a length of nylon fishing line or other line that doesn't absorb water.
10. Connect the antenna to your rig and you're on the air!
11. Don't forget lightning protection if you use this antenna outdoors. The minimum is to never use it or any outdoor antenna during weather likely to produce lightning. And disconnect and ground it when not in use.

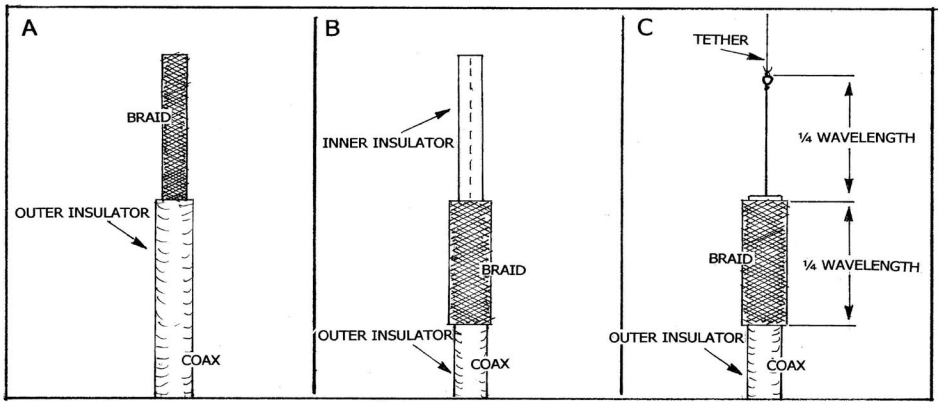


Fig. 1. COAX WITH A PORTION OF OUTER INSULATOR REMOVED (A), WITH BRAID FOLDED BACK OVER THE OUTER INSULATOR (B), THE COMPLETED ANTENNA (C).

❖ Next Month is Goodbye

It has been a genuine pleasure for me to write the *Antenna Topics* monthly column over the many years I've been with *Monitoring Times*. I've enjoyed writing about antennas and related topics with you readers in mind. Now it is time for me to retire from writing this column. I sincerely wish you all, as I have for some 25 years now, Peace, DX, and 73.

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marcellis@monitoringtimes.com

An S20-R "S" Meter and Introducing the BC314/BC-344

Here's a P.S. for the Hallicrafters S20-R restoration just completed in the last issue. Located on the rear apron of this receiver are an octal socket and a 5-pin socket. The octal socket is for use in powering the set from an external supply during portable operation. The rarely-used 5-pin socket is for an accessory S-meter. I've done a lot of electronic flea-market shopping in my time, but I've never seen one of these units.

However, if you have an S-20R receiver and wish to add an "S"-meter, here's a way to build your own. The information is from an article by Guy Dexter in a March, 1947 issue of *Radio News*. Reader James Williams, W7MBJ, called the article to my attention and kindly provided a scan of it for me to study. And by the way, Author Dexter says that this scheme will also work with an S-40, which has a similar plug.

As you can see from the schematic (Figure 1), all that is needed for the project is a 0-1 mA meter and a few small parts. Of course you'll also need some sort of box to house your project – perhaps one of those small sloping-front meter boxes if you can find one.

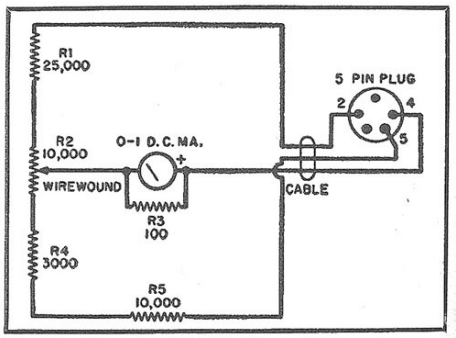

Fig. 1. Schematic of the S20-R "S"-Meter

Before beginning construction, the value of resistor R3 needs to be verified by experimentation. It is a shunt intended to multiply the meter range to 0-2 mA and must equal the internal resistance of the meter. The value is shown as 100 ohms, which is common, but your meter may be different.

Set up a test circuit with a 15k pot in series with a 9-volt battery, an accurate multimeter, and the project meter with its 100-ohm shunt. Set the pot for maximum resistance before connecting the battery, then adjust the pot, keeping an eye on the project meter to make sure it doesn't go off scale, until the multimeter shows 1 mA.

If the project meter now reads half scale, you're good to go. If not, experiment with the value of R3 (perhaps by adding series or parallel resistors) until you find a value that gives a half-scale reading with a current of 1 mA. Once this is done, the remainder of the construction is straightforward. Add a cable connecting to pins 2, 4 and 5 of a 5-pin plug as shown, insert it into the S20-R's socket, and your meter is ready for use.

Turn on the "S" meter by advancing the r.f. gain all the way until it clicks. Make sure your AVC is turned on (the meter works by measuring AVC voltage) and turn your BFO off. The next step is to zero the meter, which you should do before first using it and at intervals thereafter. To do that, detune the radio so no signal is present or – better – ground the antenna terminals. Then use potentiometer R2 to obtain a zero reading.

With a signal present, the meter will deflect proportionally to its strength. To convert the deflection on the 0-1 scale to "S" units, use the table of Figure 2.

SIGNAL STRENGTH	MILLIAMMETER DEFLECTION
50 db. above S-9	0.87
45 " " "	0.85
40 " " "	0.83
35 " " "	0.80
30 " " "	0.78
25 " " "	0.76
20 " " "	0.73
15 " " "	0.70
10 " " "	0.66
5 " " "	0.64
S-9	0.54
S-8	0.48
S-7	0.41
S-6	0.34
S-5	0.28
S-4	0.20
S-3	0.14
S-2	0.06
S-1	0.02

Fig. 2. Meter Reading VS "S" Unit Conversion Chart

According to the author:
"This S-meter does not give flattering indications of signal strength, neither is it especially 'Scotch' in performance. Several hundred tests made by the author in the laboratory and on received signals both on the broadcast and amateur bands (as well as the comparison with S-meter response in a number of competitive receivers) indicate that the calibration data given in the table is fair in every respect."

❖ Our Next Project

Any radio amateur or SWL old enough to be around when World War II surplus first hit the market – and even those who are younger but fascinated with military gear – will remember the BC-312 HF receiver and its a.c.-operated counterpart, the BC-342. Beautiful in its ugliness and carrying with it an aura of potency and military might, it was the treasured first receiver of many a 1940s era ham, including myself.

The BC-312 will be a "Radio Restorations" project in the not-too-distant future. But for the upcoming project I've chosen the BC-312's much more rare and very interesting cousin – the BC-314 and its a.c.-operated counterpart the BC-344. It's virtually identical, physically, to the BC-312/342, but covers the range 150-1500 kHz as compared with the BC-312's 1500-18000 kHz.

The BC-314/BC-344's two r.f. and two if. stages, plus its superb quality coils and other r.f. components, make it a truly hot receiver. Despite its over-70-year-old design, broadcast-band and aeronautical beacon DXers would probably enjoy a logging field day using this vintage set.

The particular radio we're going to work on is an a.c. model, a BC-344. The only difference between it and the dynamotor-powered BC-314 is the power supply installed. As is the case with the BC-312/BC-342, the a.c. model contains a type RA-20 supply; the d.c. model contains dynamotor DM-21.

These supplies were interchangeable and the RA-20 version was commonly available separately during the heyday of surplus availability. So it is not unusual to find a BC-312 or BC-314 with an RA-20 supply installed. I installed one in my own BC-312.

❖ The BC-344 Circuit

As is usual with my communication receiver restoration articles, I'm not going to include the full schematic here. To show it in enough detail to be meaningful would probably take a quarter of a page or more and I would rather use the space for discussion. For our present purposes a verbal description will do just fine, but as we focus on various details of the radio, appropriate sections of the schematic will be shown.

Starting at the antenna, there are two stages of r.f. (each a 6K7). These, along with the separate r.f. oscillator stage (a 6C5), feed a 6L7 mixer (first detector). The 92.5 kHz output of the mixer is amplified by two i.f. amplifier stages (two more 6K7s). The signal from the i.f. amplifiers, along with the output of the 6C5 CW oscillator passes to the 6R7 second detector/first audio amplifier/AVC tube. Finally, the signal is amplified to speaker volume by a 6F6

audio output amplifier. The rectifier tube in the a.c. power supply is a 5W4.

❖ On The Front Panel

One of the first things you might notice about the front panel (Figure 3) is the large right-angle connector at the lower right. It was intended for interconnection of the receiver with other elements of a complete radio system, notably a transmitter.

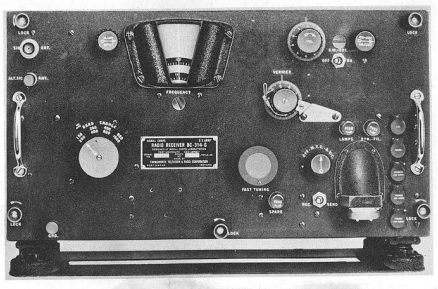

Fig. 3. Front Panel of the BC-314/BC344

Many hams and other radio hobbyists referred to it as the "ugly plug" and, seeing no use for the connector, removed it, clipping all the leads to it at their points of origin. This left a hole that could be used for a control or other accessory.

Just to the left of the connector is the receiver's power/mode switch which turns the radio on, selecting either manual or automatic volume control modes depending on how far it is rotated. Under that switch is a "send-receive" switch which, as wired, functions only when the set is used with a companion transmitter.

The top two jacks in the row at the right of the connector, labeled "KEY" and "MCRO" were also, obviously, put there for operation in concert with a companion transmitter. The three jacks below it are supplied for connection of speaker or phones.

Moving to the upper left of the panel, just under the panel lock at the corner, are an antenna connection for coax-type cable and one for a single wire. A binding post for the ground connection is a little to the right of the lower left-hand corner.

The four-position bandswitch is positioned just to the left of the identification plate. The four bands are: 150-260 kHz, 260-450 kHz, 450-820 kHz and 820-1500 kHz. Above the ID plate is the tuning dial which, as you can see, has a shutter that masks off all bands except the one in use. Just to the left of the dial is the "Align Input" knob – which is used to peak the response of the receiver to antennas of different characteristics.

The group of three controls at the upper right includes the volume control (left), CW Oscillator (BFO) "on-off" switch, and CW Oscillator pitch control. In a diagonal line below the volume control are the vernier tuning dial (which on this model is equipped with a lock) and the fast tuning dial. This concludes our quick tour of the front panel.

❖ A Peek Inside

Figure 4 which, like Figure 3, was copied from a military manual, gives us a look down at the top of the radio as removed from the cabinet. This view will give you a general idea of the layout of the set, though you may not be able to read all of the callouts.

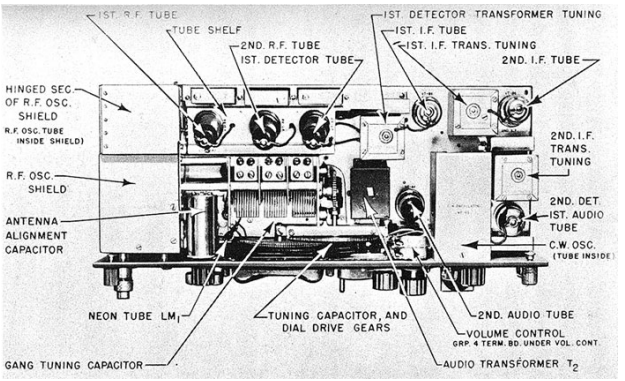

Fig. 4. Looking Down at the Top of the Radio

The three tubes on the shelf at the left rear are the first and second r.f. tubes and the first detector. At the right rear, the tubes to the left and right of the i.f. transformer are the first and second i.f. tubes. The tubes on either side of the oblong housing at lower right are the second audio tube (left) and the second detector/first audio tube.

You may be wondering where the r.f. and c.w. oscillator tubes are – as well you might. They're not visible because each is enclosed in a shielded housing. The r.f. oscillator tube and circuitry is in the oblong box at left; the c.w. oscillator tube is in the oblong box at right.

The reason that the tubes and circuitry are shielded is interesting. The radio direction finding equipment of the era was sensitive enough that, from a reasonable distance, it could pick up even the tiny bit of radiation from these oscillators. That could enable the enemy to pinpoint the location of the radio, which wouldn't be healthy for the operators!

❖ Possible Enhancements

When it comes to restoring military gear to working order, I'm not a purist. Oh, I wouldn't drill holes in the panel for extra switches. And I'd probably resist taking out the "ugly plug" (though I did just that with the BC-312 I had as a teen-ager). But if a small and invisible change would enhance performance or convenience I'd be up for it. And there are a few I'm going to consider as I go through this BC-344 restoration.

There are not many enhancements or modifications for the BC-344/BC-314 in the literature. Not covering the amateur bands, these radios didn't have that much of a following. However, quite a few improvements have been suggested for the almost-electrically-identical BC-312/BC-342 which – as mentioned – is an HF general coverage receiver that was widely used by hams. And I will consider any of these that seem useful and applicable to my set.

The most obvious one, which I'll defiantly do if someone hasn't already beat me to it, is disconnecting the send-receive switch from its wiring to the "ugly plug" and connecting it, instead, in series with the center tap of the power transformer – so that it can be used to silence the receiver. There are also modifications to the power supply (additional filtering) and audio section aimed at reducing hum. I'll consider those if the need is apparent.

I definitely like the idea of converting one of the three (!!!) second-audio output jacks to a first audio jack more appropriate for headphone use. And I'm going to look into the changes suggested for enhancing the sensitivity of the r.f. stages. But I probably won't go for adding a separate r.f. gain control or an "S" meter, since those mods would alter the front panel. We'll take a first look at our restoration subject next month.

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"Sky-Wires & Inhalers"
Part 2: From Antenna to Receiver

By Walter Lindenbach

Last time, Bill had just mentioned "radiation resistance" when Chuck had to go home, and he said that that's the stuff that antennas are built for. In transmitting antennas, it turns electric currents into radio waves or, more generally, electrons into photons.

But Chuck said that he wanted a receiving antenna, so Bill reminded him that antennas work both ways – always. A good antenna – meaning one that has radiation resistance – will turn radio waves into electric currents.

"And those electric currents are radio signals, right?"

"True," Bill confirmed.

"Good! Now we're on the right track! But we have to get those electric currents – radio signals – from the antenna to the radio receiver, don't we?" Then Chuck had another idea. "Hey, maybe we could put the antenna right at the radio receiver. What do you think?"

"Nope," Bill frowned, "not a good idea. For one thing, the radio will be near things that make electrical noise – QRM, y'know, ham-speak for man-made interference – and there's enough of that stuff around already.

"Next, buildings are made of stuff that gets in the way of radio signals, that is, the radio signals are *attenuated* by building materials. Walt – y'know, the guy who writes this thing – told me that he lives in a condo building where the windows are *treated* to reduce radio signals of all kinds."

"Whyever would they do that?"

"Well, do you remember last time we were talking about antennas converting electrons into photons and vice versa? The sun's radiation is in the form of photons. Radio signals are also in the form of photons. So, to keep the place cooler, the windows are coated to attenuate all photons."

"Aw bother," Chuck groaned, "that doesn't help! So the antenna works better outside, huh? Now what do we do?"

"Well, you remember last time we talked about transmission lines?"

"Aha!" Chuck brightened. "They have a characteristic impedance, the antenna has a characteristic impedance, and so does the receiver antenna connection. So if we get them all matched up with the same characteristic impedance, we get the radio signal from the antenna to the receiver, right?"

"Betcha! Good stuff! One more thing. The transmission line from the antenna to receiver is called a lead-in. Usually, it's just a wire, but that's not so good because that's where a lot of QRM is collected. A shielded transmission line is much better."

"You mentioned something called RG 58 last time, and you said it is a shielded transmission cable with a characteristic impedance of 50 ohms. Would that do?"

"Yes it sure would," replied Bill, "and it can do a lot more than that! Let's turn a transmission line into an antenna."

❖ Transmission Lines into Antennas

"Y'know Bill, I just got a funny feeling in my leg as if it was being pulled!"

"Well, tell your leg to settle down and pay attention. I'm not kidding! Now look at this. We're going to see how a transmission line can develop into an antenna where electrons get out of the transmission line and turn into photons – or the other way around."

Bill took a pad of paper, and began a sketch. He called it Figure 1[1].

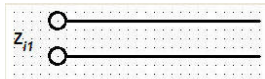

Figure 1: Transmission Line

"This isn't a coaxial cable, it's called a balanced transmission line – like the brown ribbon lead-in for a TV antenna. It's called 300-ohm twin-lead. 300 ohms is its characteristic impedance – the stuff we were talking about a minute ago.

"A transmission line is defined as a device with at least two conductors for transmission of electrical energy. The energy is transmitted by current in the conductors *and /or* the electric and magnetic fields between and around the conductors."

"Really? I can understand the energy being in the conductors and in the fields, but do you really mean 'or' in the fields?"

"Chuck, this may be the original chicken-and-egg situation! The electric voltage produces an electrical field between the conductors; the electric current in the conductors produces magnetic fields in and around the conductors. All of these entities are so closely associated that it is impossible to say which causes which. There are theories that include the idea that once – a few pico-pico seconds after the Big Bang, they were separate.

"Once upon a time, I read an article that said all electrical circuits could be described not with wires, but with the electric and magnetic fields, but that this is not done because it would be much more awkward. Still, if that statement is correct, you can see how closely electric voltage and electric fields, and electric current and magnetic fields, are associated.

"Transmission lines are arranged so that very little energy gets away. That is, almost all of the energy that goes in at one end comes out at the other. But the wires do have resistance, which converts electrical power to heat. This kind of resistance is called ohmic resistance as opposed to radiation resistance which is the stuff that we are going to meet next, and which is the *whole reason* to build antennas."

Bill went on sketching. "In Figure 2[1], we see a transmission line with the conductors diverging. This produces a number of effects, but the one we're interested in is that *energy gets away!* Another effect that we'll have to consider with our antenna design is that the energy that does not get away is reflected back to the source. That's over here." Bill pointed to the left end of the diagram where he had written "Z_{i2}".

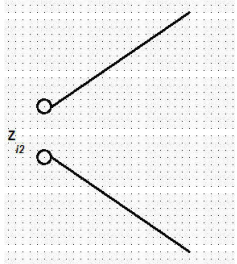

Figure 2: Transmission Line Conductors Spread

"You know what, Bill? I think we're talking about a transmitting antenna again."

"You know what, Chuck? You're both right and you're not right!"

"Oh, for Pete's sake! Are we going to get another dose of wild and woolly physics?"

"Na, Na, settle down! The reason is very simple: it is not possible to talk about a transmitting antenna without talking about a receiving antenna at the same time – or vice versa."

"Oh yeah? Here we go viceing and versing again. Do you mean that a receiving antenna has radiation resistance just like a transmitting antenna, but that the radiation resistance does not radiate, it receives? It turns radio waves into electrical signals in the antenna itself?"

"You got it, man! Right on the money." Bill picked up the paper pad again. "Now let's see what happens to our transmission line when it gets turned all the way into an antenna." And he drew what he called Figure 3[1].

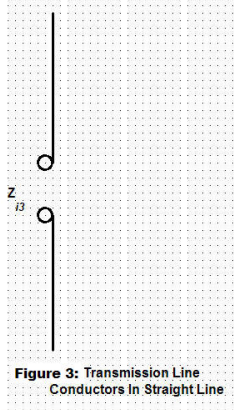

Figure 3: Transmission Line Conductors In Straight Line

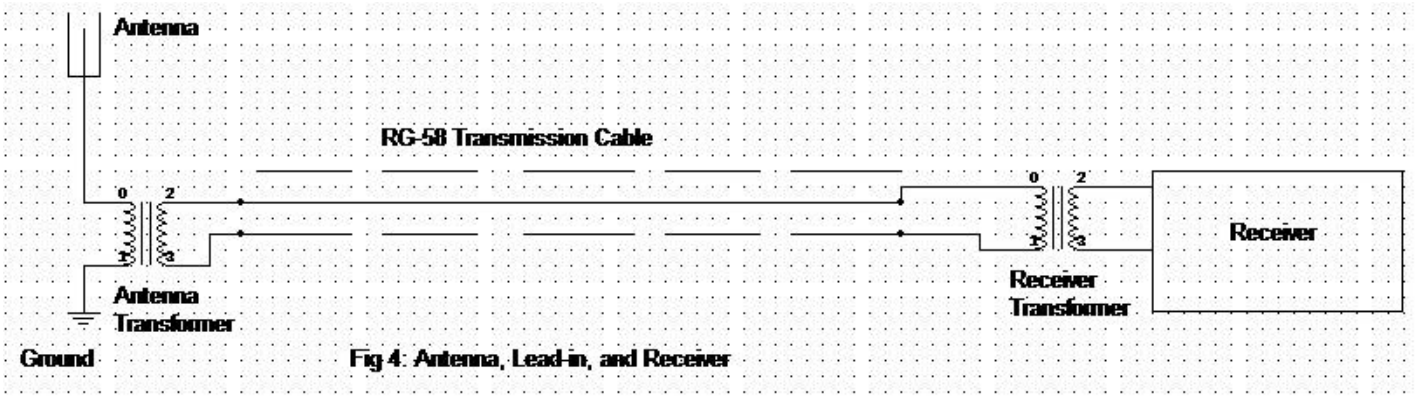

Fig 4: Antenna, Lead-in, and Receiver

"Now, if this thing was being used as a transmitting antenna, the RF power from the transmitter would be applied at the terminals marked Z_{i3}. Some of it would be turned into radio waves – yes, photons – and go squirting off into space.

"But no, we want a receiving antenna – which is the same thing – but now we can think of the radiation resistance converting radio waves from a radio transmitter and transmitting antenna somewhere else into electric currents which appear at the same terminals, Z_{i3}. So we can connect our lead-in from there to the antenna connection of our radio."

❖ Impedance – Characteristic and Otherwise

"The very cat's meow!" Chuck spouted gleefully, "Now, are you going to tell me about the Z_{i3} –er –1, 2, 3 things that you put on the sketches?"

"Will do. First, Z stands for impedance. Yup, we'd better talk about that stuff, because it's going to get really important before we're done. What do you know about impedance?"

"Well, let's see. It's something like resistance, only different. Yes?"

"Um – well yeah – that's a start. Impedance is a combination of resistance and reactance – all measured in ohms, which is convenient.

"Now, there are two kinds of reactance: inductive reactance and capacitive reactance. Inductive reactance is produced by things that have – logically – inductance: things like coils, transformers, wires – in fact, anything that conducts current.

"Capacitive reactance is produced by things with – again logically – capacitance, and they are usually capacitors. But there's more to it than that: any two conductors with an insulator between them, produce capacitance."

"Uh-huh, now let's go at this from the other end. Inductors and capacitors have inductance and capacitance which turns into inductive reactance and capacitive reactance, which are both parts of impedance, along with resistance. How's that?" Chuck looked quite self-satisfied.

"That's it."

"Yes, but how does inductance and capacitance turn into reactance?"

"Good," replied Bill, "I hoped you would ask that. In one word, the answer is: frequency. Now I was going to show you the equations that relate inductance, capacitance, reactance, and frequency, but I suppose –"

"Yes, yes, yes," Chuck yelped, "can we get on with the antenna without the math?"

"Well, not entirely, but we'll skip the reactance equations for now."

"Whew, that's a relief! What's next?"

"Hang on. This is what you have to know. When an AC voltage is applied to an inductor, the inductive reactance increases as the frequency increases. And capacitive reactance is just the reverse: as frequency increases, capacitive reactance decreases.

"Inductive reactance is exactly opposite to capacitive reactance. That means that they subtract one from the other. And, since one increases with frequency and the other decreases with frequency, it is possible to have a circuit where they exactly cancel each other, and there's nothing left in the circuit but resistance. That's called *resonance.* Isn't that neat?"

"Well, I guess so, but what has that got to do with the $Z_{i1, 2, 3}$ things on your sketches?"

"Aha, well first, the little *i* stands for input, and the *1, 2, 3* means that there are three different input impedances because of the different spacing between the wires. In the first case – Figure 1 – the wires are parallel and almost no energy gets away. The wires have inductive reactance, capacitive reactance and, because the wires are not perfect conductors, ohmic resistance.

"The dimensions of the wires, the spacing between them, and the insulating material is such that Z_{i1} is 300 ohms. That means that, if you put a 300 ohm resistor at one end, you will see 300 ohms at the other end, no matter the length of cable or the frequency. But, as you found out with an ohmmeter, things are different with DC. First, if there is a 300 ohm resistor at the end of a short length of transmission line, the ohmmeter will read 300 ohms. But if the 300 ohm resistor is at the end of a long piece of transmission line, the resistance will be higher, because the wire in the cable has resistance, too. And, if there is no resistor at the end of the transmission line and it is open, the ohmmeter will indicate an open circuit.

"It is only with high-frequency current that a transmission line of any length with a characteristic impedance of 300 ohms and a 300 ohm resistor connected at one end will appear to have a resistance of 300 ohms at the other end."

"Now, in the second case – Figure 2 – the wires are diverging at some angle, and some of the RF energy that we put in the at Z_{i2} end – if it's a transmitting antenna – will turn into radio waves and go off into space. So, we have the same impedance components as in the Figure 1 case plus one more – radiation resistance.

"The Figure 3 case is similar to the Figure 2 case, but the radiation resistance component is larger. In other words, it's a lot more like an antenna and a lot less like a transmission line.

"But before you get all excited about my talking about transmitting antennas when you're bent on a receiving antenna, remember they work both ways. In the receiving case, what we call *radiation resistance* is converting radio waves to electrical currents, and the terms $Z_{i1, 2, 3}$ could now be called $Z_{o1, 2, 3}$ or output impedance, not input impedance."

"Okay," said Chuck, reaching for the paper pad, "now let's see if I have the general picture straight." And he began to draw what he called Figure 4.

"So, the antenna transformer has to match the characteristic impedance of the antenna to the transmission cable whose characteristic impedance is 50 ohms. Then, at the other end, the receiver transformer has to match the transmission cable – again 50 ohms – to the receiver input impedance. How's that?"

"Perfect!" Bill was impressed. "You've got the thing cased to the letter! Now, all we need to know is the antenna characteristic impedance and the receiver input impedance. Then, we'll *make* the transformers to do that."

"Did you say 'make' transformers?" Chuck was wide-eyed. "Can we really do that?"

"Oh yes, ol' Buddy, we sure can!" Bill replied, "It's not hard, and certainly not expensive. The great trick is to find out what the transformers are to do. That means what impedance are they to convert to what other impedance, and over what frequency range … but not tonight."

"Huh! Now what? Is that nice? You tell me we can make transformers, and then you say 'not tonight.' Man, that sounds *terrific*! Come on!"

Bill just pointed to the clock.

"Oh, yeah sure, of course. Okay, next time. Thanks Bill. G'nite."

"G'nite."

References and Credits

1: "Radio-Electronic Transmission Fundamentals," B. Whitfield Griffith, Jr., page 336, McGraw-Hill Book Company Inc., 1962.

Diagrams and graphs were prepared using National Instrument's program "Multisim," kindly provided by Analog Devices Inc. Walter Lindenbach can be reached at lindenbachw@shaw.ca

Amateur Radio Satellite Report

Compiled by Larry Van Horn, N5FPW

Some of the information presented here is courtesy of the weekly AMSAT ANS bulletin. The ANS is released worldwide via the AMSAT ANS e-mail reflector and a live radiocast on the AMSAT-NA 20-meter net held each Sunday on 14.282 MHz. Pre-net operations start at 18:00 UTC, with current ANS bulletins transmitted to the eastern U.S. at 19:00 UTC and to the western U.S. at 19:30 UTC. Information is valid as of presstime. For operational purposes be sure to consult the latest information from AMSAT. All communications frequencies are in MHz unless otherwise indicated.

Information on AMSAT-NA is available at **www.amsat.org**
Mailing address: AMSAT-NA, 850 Sligo Avenue, Suite 600, Silver Spring, MD 20910-4703
Voice: 301-589-6062 and 888-322-6728 FAX: 301-608-3410

OPERATIONAL ANALOG AMATEUR SATELLITES

DO-64 Delfi-C3
Catalog number: 32789 Launch Date: April 28, 2008
Current communications mode: Science mode - beacon only
Telemetry/Beacon 145.870
Downlink: 145.880 - 145.920
Uplink: 435.530 - 435.570
Official webpage: **www.delfic3.nl/**

VO-52 HAMSAT
Catalog number: 28650 Launch Date: May 05, 2005
Current communications mode: U/v - Indian Transponder
Indian Beacon: 145.859330 CW
Dutch Beacon: 145.860 12-wpm with CW message
Mode and Antenna Polarization: V - LHCP and U - RHCP
Indian Transponder
Downlink: 145.930 - 145.870 USB/CW
Uplink: 435.220 - 435.280 LSB/CW
Dutch Transponder
Downlink: 145.925 - 145.875 USB/CW
Uplink: 435.225 - 435.275 LSB/CW
Note: To know what transponder is switched on listen for the beacon that is active. Each transponder has a different beacon.
Official webpage: **www.amsatindia.org/hamsat.htm**

AO-51 ECHO
Catalog number: 28375 Launch date: June 29, 2004
Current Status: System reload in progress at presstime
Broadcast identifier: PECHO-11 and BBS identifier: PECHO-12
Beacon: 435.150
Mode and Antenna Polarization: T - Linear, V- Linear, U - TX A (usually digital) LHCP/TX B (usually analog) RHCP, L- Linear, S - Linear
FM Repeater 1
Downlink: 435.300 FM
Uplink: 145.920 FM
FM Repeater 2 (QRP low power only)
Downlink: 435.150 FM
Uplink: 145.880 FM
Analog voice
Downlinks: 435.300 FM, 435.150 FM, 2401.200 FM
Uplinks: 145.860 FM, 145.880 USB, 145.920 FM, 1268.700 FM
Digital
Downlinks: 435.150 FM 38k4 PBP with 1 watt output, 435.150 FM 9k6 Pacsat broadcast protocol, 2401.200 FM 38k4 AX.25
Uplinks: 145.860 FM 9k6 PACSAT broadcast protocol, 1268.700 FM 9k6 Pacsat broadcast protocol
Official webpage: **www.amsat.org/amsat-new/echo/**

SO-50 SAUDISAT-1C
Catalog number: 27607 Launch date: December 20, 2002
Current communications mode: V/u
Mode and Antenna Polarization: V - Linear and U - Linear
Downlink: 436.795 FM
Uplink: 145.850 FM - 67.0 Hz PL tone
Operational note: To switch the transmitter on you need to send a CTCSS tone of 74.4 Hz. The order of operation is (allow for Doppler as necessary): First, transmit on 145.850 with a tone of 74.4 Hz to arm the 10 minute timer on board the spacecraft. Next transmit on 145.850 (FM Voice) using 67.0 Hz to turn the repeater on and off within the 10 minute window. Sending the 74.4 Hz tone again within the 10 minute window will reset the 10 minute timer.
Official webpage: **http://saudisat.kacst.edu.sa/index.shtml** (not currently functional)

International Space Station (ISS) - ARISS
Catalog number: 25544 Launch date: November 20, 1998
Callsigns: Belgian - OR4ISS, German - DP0ISS, Russian - RS0ISS/RZ3DZR, United States - NA1SS, Packet Mailbox: RS0ISS-11 and Digipeater callsign - ARISS
Active Modes: FM Repeater V/u, Voice V/v, BBS V/v, APRS V/v, and SSTV V/v
Mode and Antenna Polarization: V - Linear and U - Linear
Digital/APRS (worldwide)
Downlink: 145.825 FM 1k2 packet
Packet Uplink: 145.825 FM 1k2 packet
Voice
Downlink (worldwide) 145.800 FM
Uplinks: (Region 1) 145.200 FM/Region 2 and 3 144.490 FM
Crossband Repeater:
Downlinks: 145.800 FM and 437.800 FM (Kenwood)
Uplinks: 1269.650 FM, 437.800 FM, and 145.990 FM - 67.0 Hz PL (Kenwood)
SSTV
Downlink: 145.800 FM Robot 36
Official ARISS webpage: **www.rac.ca/ariss**
ISS Fan Club: **www.issfanclub.com**
APRS Tracking: **www.ariss.net/**
ISS Daily Crew Schedule: **http://spaceflight.nasa.gov/station/timelines**
Remember that the crew operates on UTC time. Also, not all of the time line is translated from Russian and posted.

FO-29 JAS-2
Catalog number: 24278 Launch Date: August 17, 1996
Current Status: Recovery
Callsign: 8J1JCS
Current communications mode: V/u (Mode JA)
Beacon: 435.795
Mode and Antenna Polarization: V - RHCP and U - RHCP
Voice/CW (Mode JA)
Downlink: 435.800 - 435.900 CW/USB
Uplink: 145.900 - 146.000 CW/LSB
Digital Mode JD
Downlink: 435.910 1200-baud BPSK or 9600-baud FSK
Uplinks: 145.850 FM, 145.870 FM, 145.910 FM
Digitalker 435.910
Current operational schedule: **www.ne.jp/asahi/m-arai/gkz/satinfo/fo29e.htm**
JARL English webpage: **www.jarl.or.jp/English/5_Fuji/ejasmenu.htm**
AMSAT-NA webpage: **www.amsat.org/amsat-new/satellites/satInfo.php?satID=5&retURL=/satellites/status.php**
Mineo Wakita, JE9PEL, has created a simple decoder program for FO29's CW telemetry downlink available at **www.ne.jp/asahi/hamradio/je9pel/fo29cwts.htm**

AO-27 AMRAD
Catalog number: 22825 Launch date: September 26, 1993
Current communications mode: V/u
Mode and Antenna Polarization: V - Linear and U - Linear
Downlink: 436.797 FM
Uplink: 145.850 FM
Official webpage: **www.ao27.org**

AO-7 AMSAT OSCAR 7
Catalog number: 07530 Launch Date: November 15, 1974
Current communications mode: Alternating between mode A and B every 24 hours
Beacons: 29.502 CW, 145.972 CW, 435.100 CW, 2304.100 CW
Downlinks: 29.400 - 29.500 CW/USB Mode A (1w PEP), 145.975 - 145.925 CW/USB Mode B (8w PEP), 145.975 - 145.925 CW/USB Mode C (2w PEP)
Uplinks: 145.850 - 145.950 CW/USB Mode A and 432.125 - 432.175 CW/LSB Mode B
Official webpage: **www.amsat.org/amsat-new/satellites/sat_summary/ao7.php**
AO-7 Logbook and Resource website: **www.planetemily.com/ao7/**

OPERATIONAL DIGITAL AMATEUR SATELLITES

Pollux (ANDE-2)
Catalog Number: 35694 Launch Date: July 31, 2009
Downlink: 145.825 1k2 AX.25

Castor (ANDE-2)
Catalog Number: 35693 Launch Date: July 31, 2009
Downlink: 145.825 1k2 AX.25

BEVO-1/PARADIGM (DRAGONSAT-1)
Catalog Number: 35690 Launch Date: July 31, 2009
Downlink: 437.325 9k6 GMSK and 437.325 20-wpm CW

AggieSat2 (DRAGONSAT-2)
Catalog Number: 35690 Launch Date: July 31, 2009
Downlink: 436.250 9k6

CP-6 Polysat
Catalog Number: 35004 Launch Date: May 19, 2009
Current Status: Not operational. The satellite is not beaconing.
Downlink: 437.365 1k2 AFSK

HAWKSAT 1
Catalog number: 35003 Launch Date: May 19, 2009
Current Status: Unknown
Downlink: 437.345?

Pharmasat
Catalog Number: 35002 Launch Date: May 19, 2009
Current Status: Commissioning
Downlink: 437.465 1k2 AFSK

ANUSAT
Catalog Number: 34808 Launch Date: April 20, 2009

Current Status: Unknown
Telemetry: 137.400
Downlink: 435.000
Uplink: 145.800

KKS-1 (Tokyo MCIT)
Catalog Number: 33499 Launch Date: January 23, 2009
Callsign JQ1YYY
Beacon 437.385 AFSK/CW
Downlink: 437.455 AFSK/CW
IARU coordination status: **www.amsat.org.uk/iaru/finished_detail.asp?serial=107**
AMSAT-NA webpage: **www.amsat.org/amsat-new/satellites/satInfo.php?satID=120&retURL=/satellites/status.php**

STARS (Kagawa Univ) (Twin Satellites)
Catalog Number: 33498 Launch Date: January 23, 2009
Callsigns: JR5YBN/ JR5YBO
Beacons 437.305 FM/CW and 437.275 FM/CW
Downlinks: 437.485 FM/CW and 437.465 FM/CW
IARU coordination status: **www.amsat.org.uk/iaru/finished_detail.asp?serial=99**
AMSAT-NA webpage: **www.amsat.org/amsat-new/satellites/satInfo.php?satID=121&retURL=/satellites/status.php**

SOHLA-1 (Astro Tech)
Catalog Number: 33496 Launch Date: January 23, 2009
Current Status: Commissioning
Proposed Frequencies and Modes
Beacon 437.505 AFSK/CW
Downlink: 437.505 AFSK/CW
IARU coordination status: **www.amsat.org.uk/iaru/formal_detail.asp?serial=101**

KAGAYAKI (Solan Co.)
Catalog Number: 33495 Launch Date: January 23, 2009
Beacon 437.375 FSK9k6/CW
Downlink: 437.375 FSK9k6/CW

PRISM (Tokyo University)
Catalog Number: 33493 Launch Date: January 23, 2009
Current Status: Operational?
Callsign JQ1YCX
Beacon 437.250 AFSK/GMSK/CW
Downlink: 437.425 AFSK/GMSK/CW
IARU coordination status: **www.amsat.org.uk/iaru/finished_detail.asp?serial=97**
AMSAT-NA webpage: **www.amsat.org/amsat-new/satellites/satInfo.php?satID=119&retURL=/satellites/status.php**

RS-30 Radio Sputnik 30 (Yubileiny)
Catalog Number: 32953 Launch Date: May 23, 2008
Current Modes: Telemetry, audio and images
Downlinks: 435.215 and 435.315
Official website: **www.npopm.com/?cid=leoca&caid=43**
AMSAT-NA website: **www.amsat.org/amsat-new/satellites/satInfo.php?satID=115&retURL=/satellites/status.php**

CO-66 Seeds II
Catalog number: 32791 Launch Date: April 28, 2008
Callsign: JQ1YGU
Downlink: 437.485
Project status updates: **http://cubesat.aero.cst.nihon-u.ac.jp/english/seeds_2_e.html**
IARU coordination status: **www.amsat.org.uk/iaru/finished_detail.asp?serial=36**
AMSAT-NA webpage: **www.amsat.org/amsat-new/satellites/satInfo.php?satID=113&retURL=/satellites/status.php**

CanX-2
Catalog number: 32790 Launch Date: April 28, 2008
Status: Operational in range of ground station only
Downlink: 437.478 GFSK
Project status updates: **www.utias-sfl.net/nanosatellites/CanX2/**
IARU coordination status: **www.amsat.org.uk/iaru/finished_detail.asp?serial=46**

AAUSAT-II
Catalog number: 32788 Launch Date: April 28, 2008
Downlink: 437.425 1k2 baud packet
Project status updates: **www.aausatii.aau.dk/homepage/index.php?language=en&page=home**
IARU coordination status: **www.amsat.org.uk/iaru/finished_detail.asp?serial=60**

Compass-1
Catalog number: 32787 Launch Date: April 28, 2008
Current communications mode: 4k8 MSK packet
Downlink: 437.275 CW and 437.405 Packet
Uplink: 145.980 FM
Project status updates: **www.raumfahrt.fh-aachen.de/**
IARU coordination status: **www.amsat.org.uk/iaru/finished_detail.asp?serial=52**
AMSAT-NA webpage: **www.amsat.org/amsat-new/satellites/satInfo.php?satID=114&retURL=/satellites/status.php**

CO-65 CUTE-1.7+APD II
Catalog number: 32785 Launch Date: April 28, 2008
Current Status: Digipeater
Telemetry beacon 437.2750 CW
Downlink: 437.475 9k6 Packet
Uplink: 1267.600
Project status updates: **http://lss.mes.titech.ac.jp/ssp/cute1.7/index_e.html**
Command station blog: **http://lss.mes.titech.ac.jp/ssp/cute1.7/blog/**
IARU coordination status: **www.amsat.org.uk/iaru/finished_detail.asp?serial=78**
AMSAT-NA webpage: **www.amsat.org/amsat-new/satellites/satInfo.php?satID=112&retURL=/satellites/status.php**

CAPE-1
Catalog Number: 31130 Launch Date: April 17,2007
Current Status: Intermittent
Callsign: K5USL
Current communications mode: /u
CW Beacon 435.245 CW
Telemetry Downlink: 435.245 9k6 FSK AX.25
Note: Telemetry and CW interchange on the UHF downlink every 30 seconds.
IARU coordination status: **www.amsat.org.uk/iaru/finished_detail.asp?serial=72**
AMSAT-NA webpage: **www.amsat.org/amsat-new/satellites/satInfo.php?satID=94&retURL=/satellites/status.php**

CP-3
Catalog Number: 31129 Launch Date: April 17,2007
Current communications mode: /u
Downlink: 436.845 1k2 AFSK AX.25

GENESAT-1
Catalog Number: 29655 Launch Date: December 16, 2006
Current communications mode: /u
Callsign: KE7EGC
Telemetry Beacon Downlink: 437.0695 1k2 AFSK
Official webpage: **www.crestnrp.org/genesat1/ahc.html**

CO-58 CubeSat XI-V
Catalog number: 28895 Launch Date: October 27, 2005
Current Status: Operational - CW beacon only
Callsign: JQ1YGW
Current communications mode: /u
Beacon 437.275 CW
Telemetry Downlink: 437.425 1k2 AFSK using AFK protocol
Official webpage: **www.space.t.u-tokyo.ac.jp/cubesat/mission/V/**
Pictures taken by this satellite, received by Mineo Wakita - JE9PEL: **www.ne.jp/asahi/hamradio/je9pel/xivpicte.htm**

CO-57 CubeSat XI-IV
Catalog number: 27848 Launch date: June 30, 2003
Current Status: Unknown
Callsign: JQ1YGW
Current communications mode: //u
Beacon 436.8475 CW
Telemetry 437.490 1k2 AFSK
Official webpage: **www.space.t.u-tokyo.ac.jp/cubesat/mission/V/**
AMSAT-NA webpage: **www.amsat.org/amsat-new/satellites/satInfo.php?satID=96&retURL=/satellites/status.php**

CO-56 CUTE-1.7+APD
Catalog number: 28941 Launch date: February 21, 2006
Current Status: Unknown
Callsign: JQ1YPC
Telemetry beacon 437.385 CW
Downlink: 437.470 1k2 FM AX25 or SRLL (active only near Japan?)
Uplink: 1268.500 9k6 GMSK
IARU coordination status: **www.amsat.org.uk/iaru/finished_detail.asp?serial=56**
Information webpage: **http://lss.mes.titech.ac.jp/ssp/spacerium/cute1blog/**

AO-51 ECHO
Catalog number: 28375 Launch date: June 29, 2004
(See listing in analog section of this report)

QuakeSat
Catalog Number: 27845 Launch Date: June 30, 2003
Current Status: Telemetry transmissions only
Current communications mode: /u telemetry
Downlink: 436.675 9k6 data packet
Quakesat webpage: **www.quakefinder.com/services/quakesat-ssite/**

CO-55 CUTE-1
Catalog Number: 27844 Launch date: June 30, 2003
Current communications mode: CW downlink (worldwide) and AX25 Packet with uplink command over Japan only
Mode U telemetry Downlink: 437.4000 1k2 AFSK
Mode U telemetry beacon Downlink: 436.8375 CW
AMSAT-NA webpage: **www.amsat.org/amsat-new/satellites/satInfo.php?satID=69&retURL=/satellites/status.php**

NO-44 PCSAT
Catalog number: 26931 Launch Date: September 30, 2001
Current Status: Telemetry transmissions only
Current communications mode: V/v
General usage
Uplink/Downlink: 145.827 1200 Baud
Special usage
Downlink: 144.390 1200 Baud
PCSAT APRS page: **http://pcsat.aprs.org**
APRS Telemetry Decoder program: **www.xciv.org/~iain/aprstlm/v1.2/**

GO-32 Gurwin TechSat-1B
Catalog number: 25397 Launch Date: July 10, 1998
Current Status: Telemetry transmissions only
Broadcast Callsign: 4XTECH-11 and BBS Callsign: 4XTECH-12
Current communications mode: /u telemetry
Downlink: 435.225 FM (9600-baud FSK) and 435.325 (not currently available due to temperature problems)
Uplinks: 145.850 FM, 145.890 FM, 145.930 FM, 1269.700 FM, 1269.800 FM, 1269.900 FM
More on GO-32 at **http://asri.technion.ac.il/techsat/**
AMSAT-NA webpage: **www.amsat.org/amsat-new/satellites/satInfo.php?satID=14&retURL=/satellites/status.php**

RS-22 RADIO SPORT 22
Catalog number: 27939 Launch Date: September 27, 2003
Current Status: Operational - 70cm CW only
Current communications mode: /u
Beacon 435.352 and 145.818 (CW)
AMSAT-NA webpage: **www.amsat.org/amsat-new/satellites/satInfo.php?satID=76&retURL=/satellites/status.php**

International Space Station (ISS) - ARISS
Catalog number: 25544 Launch date: November 20, 1998
(See listing in analog section of this report)

LO-19 LUSAT
Catalog number: 20442 Launch date: January 22, 1990
Current Status: CW beacon only
Broadcast Callsign: LUSAT-11 and BBS: LUSAT-12o
Downlink: 437.125 CW and digital 437.150 SSB (1200-baud RC-BPSK)
Uplinks: 145.840 145.860 145.880 145.900 (all 1200-baud Manchester FSK)
General information and telemetry samples can be found at: **www.telecable.es/personales/ea1bcu**

The Uniden BCD996XT
21st Century Scanning Technology

By Larry Van Horn, N5FPW, Assistant Editor *Monitoring Times*

Just when I think that our current crop of public safety scanners can't get any better, a new scanner is released that advances the technology even further.

The new Uniden Bearcat BCD996XT base/mobile is truly a 21st century marvel of modern scanning technology. While this new scanner is a lineal descendant of the BCD996T, there are some major differences between them.

Released hot on the heels of the popular Uniden BCD396XT handheld scanner, many of the innovative features included in that scanner and the BCD996D can be found in this new Uniden release. Some of the existing features found in both the BCD396XT and BCD996T have been expanded and updated.

The BCD996XT is a state-of-the-art scanner radio with Trunk Tracker IV and automatic scanning capabilities. You can store in the dynamic memory conventional frequencies such as police, fire/emergency, marine, air, amateur, and other communications. You can store and scan services that use trunked radio systems and more. You can use the scanner's scroll control to quickly select channels and frequencies, and you can automatically program channels in a system using the auto store feature.

❖ Case, Controls and the Antenna

The 996XT case is the same size as its 996T predecessor, measuring 7.2 (W) x 5.9 (D) x 2.2 (H) inches and weighing in at 3.44 lbs without mounting bracket.

There is a multicolor backlight system (user selectable) for the scanner's 1-1/8 by 2-1/8-inch (64 x 128 full dot matrix) liquid crystal display. Colors selectable by the user include white, red, green, yellow, blue, magenta and cyan. You can turn off backlighting or set three levels for each color without going into the scanner menu system by pressing the volume control on the front of the unit. The keyboard backlight also uses the same color and control features that the LCD screen uses.

Controls and switches on the 996XT includes a knurled rotary encoder knob with push switch used for function operations, volume control with power on/off switch and push switch for back light control (see paragraph above), and squelch control with push switch for Close Call mode.

❖ Under the Hood

Looking inside this new scanner I found a world of scanning capability. Here are some 996XT features that BC396T/BCD996T owners will be familiar with (note: specifications are subject to change without notice).

- TrunkTracker IV with control-channel only scanning and I-Call monitoring: Tracks voice traffic on APCO P25, Motorola (analog and P16 mixed mode systems), EDACS (with EDACS ESK support), and LTR trunked systems. The 996XT can decode APCO25 digital audio signals, CTCSS/DCS rapid decoding and NAC decoding. This unit has the ability to flag each channel as digital, analog, or both (all). This helps when setting up CTCSS/DCS/NAC decoding on a given frequency. The 996XT can also decode fire tone out alerts.
- Supports scanning of rebanded 800 MHz trunk analog radio systems
- Adaptive digital threshold automatically sets the digital decode threshold used to help monitor APCO 25 systems
- Close call RF capture and Close Call temporary store (last 10 hits)
- GPS support for location-based scanning, location alerts, and crows-flight navigation*
- Supported step sizes: 5, 6.25, 7.5, 8.33, 10, 12.5,15, 20, 25, 50 or 100 kHz
- Multi-site support. You can program all the sites within a trunk system and they can all share one set of talkgroup , saving time and memory space.
- Temporary frequency memory lockouts. You can even temporarily lockout frequencies with birdies and other constant carrier frequencies during searching.
- Ten startup configurations reduce the amount of reloading of pre-programmed frequency loadouts. This is especially useful when traveling or if you just want to monitor something different for a change.
- 12 Service Searches - Public safety, news, ham radio, marine, railroad, air, CB radio, FRS / GMRS, racing, military air, FM broadcast, and special (itinerant frequencies)
- You can perform a scan of the memory channels followed by selected "service" search ranges. You can perform custom searches that let you program up to 10 search ranges. You can also perform a scan of the memory channels followed by up to 10 of these custom service searches. Quick search keys by-pass the menu enitrely.
- Frequency/ID AutoStore - automatically store frequencies from a service or limit search into a conventional system or store talk group IDs into a trunked system
- 16 character text tagging for each system, group, channel, talkgroup, search range, and SAME group.
- Compatible with an optional BC-RH96 remote head
- SAME weather alert and weather priority
- Priority scan with priority plus
- Signal strength display
- Adjustable scan delay and adjustable hold (0-255 sec) per system, custom or service search
- Strong signal attenuation
- Independent Alert Tone Volume - lets you set the volume level of the following tones: key beep, emergency alert, channel alert, and close call alert. The unit also has analog and digital automatic gain controls (AGC).
- Repeater reverse and duplicate channel alert
- Broadcast signal ignore while searching (TV and radio station frequencies, pagers, etc)
- Record output
- Automatic backlight level detection (when used with the "Orange" wire connected to a headlight switched power lead)
- Upgradable firmware
- PC programming and control and wired cloning
- DIN / ISO in-dash mounting with included DIN-E sleeve.

MT FIRST LOOK RATING (0-10 SCALE)

Audio Quality	10
Audio Levels	10
Backlight/Display	10
Ease of Use	6
Feature Set	10
Keyboard/Control Layout	9
Overall Construction	10
Overall Reception	10
Owners Manual	6
Sensitivity	9
Selectivity	9
Spectrum Usability	9

❖ Trunk Tracking Capability

The BCD996XT is a Trunk Tracker IVmodel scanner. This lets you follow unencrypted conversations on analog Motorola, Motorola mixed mode (analog and digital/3600 baud) systems, Motorola Astro 25 (APCO 25 9600 baud) digital systems, EDACS (wide and narrow), EDACS SCAT, EDACS ESK and LTR trunked radio systems. Trunk systems in VHF, UHF, the new 700 MHz public safety band, 800 and 900 MHz bands can be tracked. This includes some of the trunk systems now being installed by the Department of Defense in the new 380-399.9 MHz LMR subband. The scanner can also scan both conventional and trunked systems at the same time.

The BCD996XT also does Motorola control channel trunking. If the scanner is set in this mode, the user can set it up so that it tracks a Motorola trunk system using only control channel data. You do not have to program all of the system's voice channel frequencies into memory in this mode, as long as all possible control channels have been programmed.

❖ What's New

There are several new features and innovations in the 996XT that are unique to this radio. They include:

- Support for P25 conventional channels that include NAC and TGID user differentiation (P25 one-frequency trunk)
- Control channel data output allows the analysis of control channel data without the need to perform invasive modifications to the scanner. This allows you to use certain selected software

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.

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** Government version, cellular blocked for US consumer version.*
***No audio is available when the frequency span is set to 20MHz or 40MHz.*
Specifications subject to change without notice or obligation.

SEE more and HEAR more with AOR, the serious choice in Advanced Technology Receivers™.

TABLE ONE: BCD996XT FREQUENCY COVERAGE

Frequency Range (MHz)	Modulation	Step (kHz)	Default
25.0000	27.9950	AM	5.0
28.0000	29.6800	NFM	20.0
29.7000	49.9900	NFM	10.0
50.0000	53.9800	NFM	20.0
54.0000	71.9500	WFM	50.0
72.0000	75.9950	FM	5.0
76.0000	87.9500	WF	50.0
88.0000	107.9000	FMB	100.0
108.0000	136.9750	AM	25.0
137.0000	143.9875	NFM	12.5
144.0000	147.9950	NFM	5.0
148.0000	150.7875	NFM	12.5
150.8000	161.9950	NFM	5.0
162.0000	173.9875	NFM	12.5
174.0000	215.9500	WFM	50.0
216.0000	224.9800	NFM	20.0
225.0000	379.9750	AM	25.0
380.0000	512.0000	NFM	12.5
764.0000	775.9875	NFM	12.5
794.0000	805.9875	NFM	12.5
806.0000	823.9875	NFM	12.5
849.0125	868.9875	NFM	12.5
894.0125	956.0000	NFM	12.5
1240.0000	1300.0000	NFM	25.0

Note: The scanner's frequency coverage is not continuous and does not include the cellular telephone, most of the UHF TV bands, or the 956-1240 MHz frequency range.

packages to analyze trunk radio systems for frequencies, talkgroups, radio IDs and more.
- Independent GPS control of sites and channel groups*
- Fire tone out search with a built-in frequency counter to display the received tones during a tone out.
- Band scope gives a graphic representation of signal activity with a frequency span of 0.2 to 500 MHz and steps from 5 to 100 kHz.
- Multi-color display backlight
- P25 digital NAC decoding
- System/channel number tagging to provide rapid access to a specific system or channel.
- Individual channel volume offset
- Intermediate frequency exchange that changes the IF used for a selected frequency to help avoid image and other mixer-product interference on a frequency.
- Key safe mode that lets you hand the scanner to a novice user and prevent them from modifying the programming.
- Private systems let you flag any system programmed into the scanner so that it cannot be read out or modified by the user.
- Priority ID scan on trunked systems
- Preemptive priority on Motorola analog systems
- Negative channel dropout delay (forced resume)
- Channel alert (using both tones and backlight color)

* *A GPS unit is required to use this feature and is not included with the 996XT.*

❖ What's in the box?

In addition to the BCD996XT scanner, accessories in the box include an AD1009 AC adapter, cigarette lighter adapter power cord, mobile mounting bracket, DIN-E sleeve, a push on type (BNC) telescopic antenna, PC DB9 serial cable and owner's manual on CD (no printed manual, CD manual not included in our review package).

❖ Rating and Final Thoughts

As with its predecessor, I was particularly impressed with the BCD996XT performance when I conducted a side by side test with my Uniden BCD396T, BCD996T and BC796D scanners. In most cases, sensitivity and selectivity appeared to be slightly better on the BCD996XT.

But those of you who have read this column in the past know that no scanner is perfect, at least in my opinion. My chief complaint with the 996XT and Uniden DMA scanners in general is the steep learning curve. Given this feature-rich scanner and the many systems it can monitor, I do not know how Uniden could simplify this learning curve, given the overall complexity and feature set. On the other hand, from the consumer's point of view this is a serious issue which needs to be addressed. Uniden is not alone: the three major manufacturers (Uniden, GRE and AOR) all face this dilemma, and they need to invest time and staff in making the operating manuals more intuitive. In order to use the full capability of these scanners, one must understand them better, but unfortunately, the manuals by and large hinder that process.

My second complaint is directly tied to the manual itself. I have struggled with trying to quantify my issues with it, and the best I can come up with is to say it is "kludgy." I didn't receive the CD manual that was supposed to be included with the unit, so I could not evaluate if it was any better, but my guess is it wasn't.

So how are you to learn to use this fine piece of radio equipment? Let me offer four pieces of advice to those who purchase this radio: read the manual several times, practice programming the scanner using the examples in the manual, use software to program the radio, and read the manual again and again. You do have the option of going up to various online radio hobby forums and asking specific questions, but this takes time and may not help you in the short run. Maybe what is needed here is a central source for questions and answers – an FAQ type of site.

I also noted that, like its 996T predecessor, the radio defaults to 5 kHz spacing in the 150.8-162.0 MHz public safety band. You can change that spacing, but it still will not match the current bandplan in use, due to the break in spacing around 154.500 MHz. The majority of this band now uses 7.5 kHz spacing with the exception of the break I mentioned above. Other than that, Uniden has come a long way in setting their search steps in line with current spectrum practices.

Finally, while the GPS capability is a neat feature, it is very labor and research intensive to get it up and operating. I am sure with time, like other aspects of the scanner hobby, information will be shared through the internet to aid hobbyists in programming location information for a variety of radio systems nationwide. But that will be at some point down the road and only a few will probably fully utilize the GPS features in this scanner in the near term.

Bottom line, this is one heck of a scanner. This unit is the most advanced and feature-rich radio scanner ever released by any radio company. No scanner in the marketplace even gets close to the BCD996XT in features, listening capability, and overall performance, especially in its price range. There is a lot of scanning capability loaded into this small package.

So, if you are looking for one unit that does a lot, with the features you could only dream about three years ago, this is it. This is truly a high tech base/mobile scanner for the 21st century.

*The Uniden BCD996XT (SCN 21 – **www.grove-ent.com/996xt.html**) is available from Grove Enterprises (1-800-438-8155 or **www.grove-ent.com**) for $499.95 plus shipping and handling.*

TABLE TWO: MISCELLANEOUS SPECIFICATIONS

Initialize Memory: Press and hold the "2+9+Hold" keys

Receiver type – Triple Conversion

1st Heterodyne

25.000-319.995 MHz	Upper Heterodyne 1st IF 380.705 ~ 380.800 MHz
320.000-519.995 MHz	Upper Heterodyne 1st IF 265.600 ~ 265.505 MHz
764.000-805.995 MHz	Lower Heterodyne 1st IF 265.500 ~ 265.595 MHz
806.000-1300.000 MHz	Lower Heterodyne 1st IF 380.700 ~ 380.800 MHz

2nd Heterodyne

25.000-319.995 MHz	Lower Heterodyne 2nd IF 10.800 MHz
320.000-805.995 MHz	Upper Heterodyne 2nd IF 10.800 MHz
806.000-1300.000 MHz	Lower Heterodyne 2nd IF 10.800 MHz

3rd Heterodyne

All Bands	Lower Heterodyne 3rd IF 450 kHz

Limits:

Channels: 25,000 maximum; Systems: 500 maximum; Groups per system: 20 maximum; Talkgroups per trunked system: 500 maximum; Channels per conventional system: 1000 maximum; Scan Rate: 100 channels per second (conventional mode); Search Rate: 300 steps per second (on 5 kHz steps); System Quick Key range: 0-99; Group Quick Key range: 0-9; Custom Search Ranges: 10; Startup Keys: 10; System Number Tagging: 999; Channel Number Tagging: 999; Preprogrammed Service Search Bands: 12; Band Scope Span Range: 0.2 MHz To 500 MHz; and Band Scope Step: 5 kHz To 100 kHz.

Operating temperature – Normal –20°C to +60°C; close call –10°C to +60°C; Storage -30°C-+70°C
Scan rate – 100 channels per second (conventional mode)
Search rate – Normal 100 steps per second/Turbo 300 steps per second
Audio output – 3W maximum into 8-ohn speaker; 30mW nominal into 32-ohm stereo headphone
Power Requirements – DC 11.0V to 16.6V via Cigarette Lighter Cord, AC Adapter (AD-1009) all included.

External Jacks:
Antenna Jack – BNC Type 50-ohm nominal impedance
Phone Jack – 3.5-mm (1/8-inch) Stereo Type
External Speaker Jack – 3.5-mm (1/8-inch) Monaural Type
Record Out Jack – 3.5-mm (1/8-inch) Stereo Type
DC Power Jack – 5.5-mm center pin positive
Remote Interface Jack – Four pin mini type
GPS Interface Jack – D-sub nine pin (male type)

Note: Features, specifications, and availability of optional accessories are all subject to change without notice by the manufacturer. Information presented above was based on the test unit provided by the manufacturer. Specifications certificated accordance with FCC Rules and Regulations Part 15 Subpart C as of date of manufacture.

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New Products from MP Antennas

Reviewed by Bob Grove W8JHD

❖ The Super-M Ultra Mobile Antenna

The new MP Antennas Super-M is a unique design. The original Super-M had three straight elements, equally spaced, and angled slightly outward from the base. This new model, however, has more elements for an expanded, continuous frequency coverage.

The manufacturer claims extremely wide-band receive coverage – 25-6000 MHz (6 GHz)! For transmitting, it can accept up to 200 watts of RF power up to 512 MHz, and 100 watts above that frequency. Impedance matching for normal 50 ohm coax is best above 120 MHz, providing an average 1.6:1 to 1.8:1 VSWR continuously through 6000 MHz.

Maximum height is 19 inches, with the top of the cluster of elements flaring out to a 12 inch diameter. Weight (minus the base) is a mere 5 ounces, yet the sturdy stainless-steel elements, firmly locked in place with set screws, provide reliable ruggedness with their low wind load at high road speeds.

The standard NMO mount makes it a ready replacement for professional mobile whip applications. A special magnetic-mount accessory is also available for no-hole attachment to a vehicle.

The new, mobile-mount antenna is sure to draw attention; on a recent vacation trip, it was very clear the folks passing me on the interstate were sizing up the rooftop antenna. It was even more clear – when I parked for shopping, motels, or even at tourist attractions – that this antenna would draw attention and a lot of questions!

Performance

So how did it perform? Very well, indeed. The accompanying chart shows the relative signal strengths when measured on an ATTEN

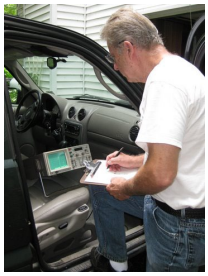
5011 spectrum analyzer. Signals do fluctuate, so these results are within +/-2 dB after three complete runs through the spectrum.

The competition was shared among five magnetically-attached mobile antennas – the new MP Antennas Super-M Ultra Mobile antenna, the well-designed Austin Spectra, Austin's revered Condor flex antenna, a generic multi-band VHF/UHF flex whip, and a simple 18" whip.

Interpreting the Results

So what do all these numbers tell us? The numbers are actual signal levels in decibels for various signals received at the frequencies shown. The highlighted readings show the strongest responses and the antenna(s) that provided them.

Keep in mind that it takes a 6 dB difference to register one S unit on an S-meter, so one or two dB difference is barely detectable to the discriminating ear, even on the weakest signals. However, when a signal is mostly buried in noise, ringing it up several dB can make a difference.



In our test, the new MP Antennas Super-M outperformed or equaled the competitors seven out of eleven times across the spectrum. On two more frequencies, it was within 2 dB of the closest competitor – hardly noticeable, if at all. So, in a practical sense, the "listenability factor" equaled or outperformed the other antennas ten out of eleven times.

❖ The Super-M Ultra Base

The Super-M is also available as the Ultra Base for fixed installations. This sturdy yet lightweight (2.1 lb) model includes a drooping ground plane array making the maximum tip-to-tip antenna height 44 inches. The ground plane elements flare out at its base to a 33-inch diameter. The stainless steel wire elements provide a good combination of low wind load and rugged weather durability. It utilizes an NMO mount with a female N connector for the attachment of coax cable.

The clever design is essentially a modified discone with a top cluster of various-length elements to enhance harmonic response, thus dramatically increasing the bandwidth of the antenna over a continuous 100-6000 MHz swath of spectrum. Our transmit test showed it to have excellent performance over the 140-160 and 420-466 MHz ranges. The manufacturer's lab tests show a VSWR averaging 1.2:1 to 1.6:1 over the entire advertised frequency range, with a minor 1.9:1 spike at 200 MHz, and only reaching 3:1 at 50 MHz.

The MP Antennas Super-M Ultra Mobile and Ultra Base are available for $119.99 and $199.99 respectively from Grove Enterprises and other MT advertisers.

RELATIVE SIGNAL STRENGTH RECEPTION COMPARISON

FREQ. MHz	MP Antennas	AUSTIN	CONDOR	MULTI WHIP	18" WHIP
38	10	8	20	15	12
50	25	13	12	9	20
95	44	38	27	10	35
103	64	50	60	54	60
152	32	32	25	27	30
162	26	15	16	17	20
463	45	50	42	42	42
572	20	18	8	12	12
860	24	23	26	14	26
882	12	8	14	8	12
996	16	0	12	6	8

New MP Antennas

The newest antennas are now at Grove!

The Super-M Ultra Mobile

MP Enterprises claims extremely wideband receive coverage–25-6000 MHz (6 GHz)! For transmitting, it can accept up to 200 watts of RF power at 50 ohms impedance from 120-512 MHz, and 100 watts from 512-6000 MHz. VSWR averages 1.6:1-1.8:1 continuously through 6000 MHz.

Maximum height is 19 inches, with the top of the cluster of elements flaring out to a 12 inch diameter. Weight (less base) is a mere 5 ounces, yet the sturdy, stainless-steel elements, firmly locked in place with set screws, provide reliable ruggedness with their low wind load at high road speeds.

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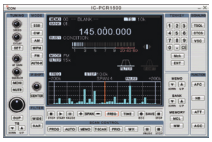

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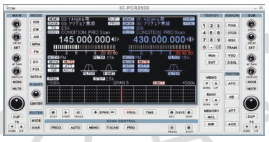

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