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MT's Annual Radio Buyer's Guide

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In this issue:

- SDRs: Pluses and Minuses
- Invasion of the Chinese Radios
- Electronic Kits for Young Experimenters
- Ham and SWL Apps for Tablet and Phone
- *MT Reviews:* WiNRADiO G313 and G315

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Monitoring Times

Vol. 32 No. 11 November 2013

Software Defined Radio: The Pluses and Minuses..8

By Kirk A. Kleinschmidt NT0Z

Because we are in an SDR transition of sorts, some operators confuse software controlled radios with software defined radios. The evidence of such confusion is endemic on Internet forums and even in print.

Now, well into its adolescence, SDRs have already taken the performance and cost crowns; they can outperform traditional desk-top receivers and transceivers, often at lower prices.

And, once manufacturing economy of scale and ergonomics push HF SDR into young adulthood (it's already there in cellular, military, computer and satellite applications), it will likely be the only flavor of radio commercially available, save for home-brew designs and the odd holdout.

In this edition of the Radio Buyer's Guide, Kirk looks at amateur radio SDR technology and the current crop of SDRs, from über-expensive, direct-sampling powerhouses to $15 USB dongles. SWLs? This concerns you, too!

On Our Cover

Apache Labs SDR Transceiver (Courtesy: Apache Labs); Baofeng dual-band HT (Photo by Mark Haverstock K8MSH); Flex Radio Systems Flex-3000 (Courtesy: Flex Radio Systems); Pirate radio shortwave SSTV transmission decoded on a Verizon smartphone with app (Photo by Thomas Witherspoon K4SWL); Terratec dongle (Photo by Kirk Kleinschmidt NT0Z);

C O N T E N T S

Invasion of the Chinese Radios.....12

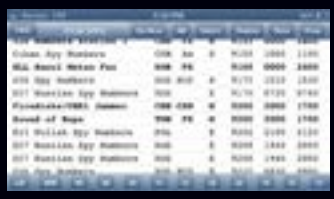
by Mark Haverstock K8MSH

Back in the 1950s, when Mark was a kid, the phrase, "Made in Japan," meant cheaply constructed products at a cheap price. By the 1970s, this reputation had changed radically; people actually sought out Japanese products because they were manufactured to high standards and under strict quality control.

Electronics, such as home audio products and ham radio equipment, had risen to a level of quality that rivaled, or even exceeded, those made in the U.S. Is the same thing happening with radio products from China? In this feature article, Mark lays it all out.

Ham and SWL Apps for Tablets and Smartphones.....14

By Thomas Witherspoon K4SWL



The proliferation of smartphone and tablet apps haven't left the amateur radio and shortwave listener out. Many great apps are available now that can capture SSTV images directly off the air, find the nearest 2-meter repeaters to your devices' current location, display a shortwave broadcast schedule, read on-air CW QSOs, and more.

Studying for an upcoming amateur license exam? Thomas found an app that could help. He also found an app for using your smartphone as an HT to use with Echolink. He notes, "I recently traveled to Belize City and used EchoLink to connect with hams in the U.S. and Canada and even check into a net. It worked flawlessly."

Radio-Electronic Kits for Young Experimenters.....26

By Ken Reitz KS4ZR

As parents, or even grandparents, we find ourselves wanting to share our enthusiasm for our hobby with our children or grandchildren, but lack a coherent course to pursue. The roles have switched and now we are the mentors, but where do we start?

One place to start is with the basics of all electronics, an understanding of the fundamentals through the use of simple, easy-to-use electronics kits. Today's electronics kits are worlds apart from a generation ago. Today, they're better made, easier to use and teach alternative energy concepts in addition to electronic circuits.

R E V I E W S

WiNRADiO G315 and Alinco DJ-11XT 56

By Bob Grove W8JHD

The WiNRADiO G315 is loaded with features unheard of just a few years ago. Right out of the box, it can demodulate AM, synchronous AM, USB, LSB, ISB, DSB, CW, and narrow FM in a range from 9 kHz to 1800 MHz. For shortwave devotees, a DRM decoder is available in downloadable software. And, its real-time spectrum display can spot weak signals within short frequency ranges.

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With its popular analog signal strength meter and large easy-to-read digital spectrum display, the AR6000 is destined to become the new choice of federal, state and local law enforcement agencies, the military, emergency managers, diplomatic service, lab technicians, news-gathering operations and security professionals.

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- Tuning steps of 1 Hz up to 3.15 GHz; 2 Hz from 3.15 ~ 6 GHz
- Receiver is programmable and manageable through a USB computer interface
- Up to 2,000 alphanumeric memory channels
- Analog S-meter, large tuning dial, front panel power, volume & squelch controls
- Direct frequency input
- Fast Fourier Transform algorithms
- An SD memory card port can be used to store recorded audio
- Two selectable antenna input ports plus optional remote antenna selector

Add to the capabilities of the AR6000 with:

- Optional APCO-25 decoder
- Optional interface unit enables remote control via the internet
- Optional I/Q output port allows capture of up to 1 MHz onto a computer hard drive or external storage device

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Table Of Contents

Letters 6
More comment on dead 2-meter repeaters: Jamming issues and Echolink/IRLP modes; More farewell messages; MT congratulates.

Communications 7
Life after MT? Yes!;73 Publisher, Wayne Green W2NSD, SK;

Scanning Report 16
By Dan Veeneman
L.A.'s New Public Safety System and Scanning Nebraska

Ask Bob 19
By Bob Grove W8JHD
Improving an attic-mounted HF dipole; Portable radio shuts down by itself; What causes "rain fade" on Dish Network TV?; Why did the government switch from DES to AES encryption?;Why the increase in interest in vinyl records?;SW antenna installation for beginners; Roof-top scanner antenna doesn't pick up as well as stubby antenna; What satellite does Google use for its imaging?; Can trunked radio systems overload system?; What is the difference between a frequency allocation and an assignment?

Utility World 20
By Hugh Stegman NV6H
CLP44: Cuba's Getting Strange Again

Digital Digest 23
By Mike Chace
U.S. Agencies still Found on HF

On the Ham Bands 24
By Kirk Kleinschmidt NT0Z
Best Advice? Better Antennas!

Beginner's Corner 26
By Ken Reitz KS4ZR
Radio-Electronics Kits for Young Experimenters

Programming Spotlight 28
By Fred Waterer
Shortwave Today: Cold War Ghosts, Blues and Laughs

QSL Report 29
By Gayle Van Horn W4GVH
QSL Contact Updates - Part 2

English Language SW Guide 30

Milcom 42
By Larry Van Horn N5FPW
Monitoring the Customs COTHEN HF Network

Fed Files 44
By Chris Parris
When Federal Frequencies aren't Federal Frequencies

Amateur Radio Satellites 46
By Keith Baker KB1SF/VA3KSF
Amateur Radio Satellite Update

Below 500 kHz 48
By Kevin O'Hern Carey WB2QMY
Logging On

Radio Restorations 50
By Marc Ellis N9EWJ
Finishing up the Echophone EC-1

Broadcast Bandscan 52
Doug Smith W9WI
Translator Madness

Antenna Topics 54
By Dan Farber ACØLW
Copper Water Piping: A Greatly Improved Ground

First Look 56
By Bob Grove W8JHD
WiNRADiO G315 Wide-Coverage SDR Receiver

Global Net 58
By Loyd Van Horn W4LVH
Internet Radio Essentials

What's New 59
By Larry Van Horn N5FPW
"North American Enroute Aviation Guide" available as a Kindle e-book; 2013-14 National Radio Club's "AM Radio Log" released; Coaxial Dynamics Model 81021 Average Reading Dual Socket Wattmeter; DX Engineering UC8 Network Enabled Controller; Hy-Gain Multi-Band Patriot Vertical Antennas.

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

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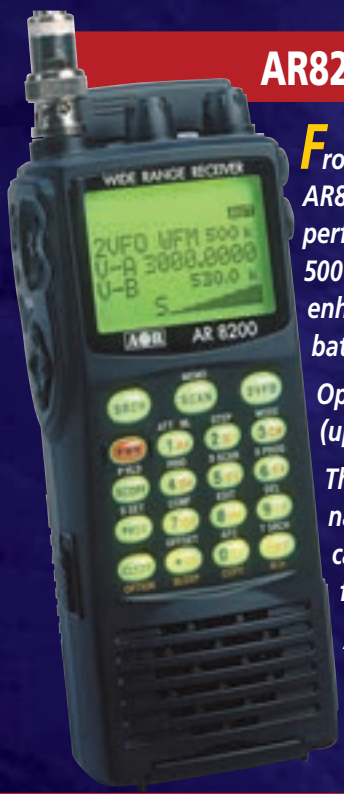

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Optional internal slot cards expand the AR8200MkIII's capabilities. Choose from Memory Expansion (up to 4,000 memories), CTCSS Squelch and Search, and Tone Eliminator.

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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to the editors

editor@monitoringtimes.com

More Response on Dead 2-Meter Repeaters

Paul KH6/G3SEA writes:

" I thought I would respond to your [Beginner's Corner column] in the August issue of *Monitoring Times.* I have heard reams of comments (and experienced) the dearth of activity (or closed clique repeaters) on 2-meter and 70-cm repeaters across the U.S.A.

"As a telecomm professional, I realize that hams will eventually lose everything above 2-meters, and possibly 2-meters itself, because of this lack of activity and the voracious demand for bandwidth from commercial entities. The ARRL tries to defend the spectrum around 1296 MHz and up...for what? Who uses those frequencies outside of a literal handful?

"It's the same story here in Hawaii. Due to [Home Owners' Association] restrictions, I have not been able to operate HF, so, I've had to resort to IRLP/Echolink. But, since there are so few Echolink nodes to hit from this QTH, I simply use Echolink on this laptop! I just go straight to the distant repeaters (especially in the U.K.) without any hassles from local node owners. In this lousy sunspot cycle, at least I can have reliable conversations as opposed to "599 – 73!" QSOs.

"These IRLP/Echolink systems have kept a lot of hams in the loop with fellow hams because so may cannot put up antennas due to HOA restrictions and/or find a nearby repeater with IRLP or Echolink capability. This is a fact of contemporary ham life in the U.S.A.! I do monitor HF (both CW and SSB) but wonder, outside of contests, just where all the U.S. hams are?"

Ken Reitz KS4ZR responds:

Thanks for your reply to my column question. I've heard from many hams across the U.S. about this with similar stories. And, I think your warning about losing 2-meters is right on target. We can't discount the demand that new wireless devices may place on what appears to be prime, unused, frequency real estate.

Ryan McCarthy writes:

"I read with interest your article, "Whatever Happened to 2 Meters." I think of all the arguments mentioned, the cell phone sounds the most reasonable to me. One thing did come to mind as I thought about this. Before I obtained my license, I used to listen to the 2-meters on my scanner. I do believe there has been a drop since then and now. The biggest issue I noticed at that time were people jamming repeaters. This was especially true for the largest amateur radio club here on Long Island. In fact, I wanted to check into one of their nets within the last year, but I gave up after five minutes of constant jamming."

Ken Reitz KS4ZR responds:

Thanks for your comments about 2-meters in your location. The jamming issue is a big one. There are repeaters in California infamous for being a wasteland of jammers, jokers and funny noise artists, more like CB channel 19 than ham radio. That's the kind of activity that leads clubs to set up exclusive access rules, but there's little else that can be done.

More Farewell Messages

Timothy Kuryla, Lexington, Kentucky, writes:

" *MT* going is like a death in the family. I have been retired from Kentucky State Government for 10 years, so, I understand Bob and Judy's decision."

Walt Thompson writes:

"I'm really shocked and sad that *MT* is coming to an end. Ken, I really appreciate your articles every month. I'm a cord cutter.... you have saved me so much money. I have the Vizio Co-Star, like you mentioned in your article awhile back. Why pay for TV that I don't watch? I'm a huge sports fan...and now, I even read *MT* and radio communications more than I ever have.

"I'm a shortwave listener from back in the 60s. I had the Radio Shack DX-100. The radio DX hobby gets in your blood. Good luck to you in the future. I feel like I'm losing family with *MT* coming to an end."

Brent Pepper KF5WTW writes to Bob Grove:

"I just received my September, 2013, issue of your magazine, and want to thank you for publishing one of the best communications magazines in the industry. Congratulations on your future plans for retirement, and best of luck. Your magazine motivated me to get back in amateur radio and your writers gave innumerable information and tips that, to this day, I still use. I will sorely miss your fine magazine. Hope to work you on the air one day."

Bob Grove responds:

Hi, Brent, and thanks for the kind thoughts. I hope we run across one another on the ham bands. 73, Bob W8JHD.

James Broyles, Florissant, Missouri, writes:

"I am a 56 year-old man with 30 years of the listening in the shortwave hobby, and, I believe, the same amount of time with *Monitoring Times,* along with some samples of *Satellite Times*.

"I have found the magazine very insightful on different subjects and looked forward to the next issue. I am glad that Bob Grove will retire and I wish him and his wife many more years of this good life. Life moves forward. I hope to find a magazine of the same quality in the future towards the hobbies that we all enjoy. My hat's off to all the writers and contributors for the past issues, and to the ones who answered a few questions that I had and lots of other people. It has been a blessing to receive *Monitoring Times* for all these years."

Bob Grove responds:

Yes, Judy and I have been blessed with many new friendships through the writing of Monitoring Times, and we are always pleased to hear comments about how useful it has been to fellow listening hobbyists. But, as you have observed, life moves forward, and Judy and I are fortunate to have excellent health to share our remaining years.

Robert Osborn, Centennial, Colorado writes:

"I want you all to know how sad this makes me to hear that this is the last year of my favorite magazine. I have been buying it on the newsstand longer than I can remember. As a matter of fact, I stopped buying and subscribing to amateur radio magazines because they were not giving me what I want, and I have a amateur license. This year I finally got a subscription to *MT*, and this is the last year! I am 43 and I actually cried a little. Ask my wife! Again, I am very upset by this. I mean, I am losing sleep over this!"

Bob Grove responds:

Thank you for the kind comments about the value Monitoring Times has been to you. Judy and I have also enjoyed helping you and thousands of other listening hobbyists over the years. But, it's time for us to take some time off while we still have good health.

Congratulations

MT Columnist Weds:

MT Assistant Editor, Larry Van Horn N5FPW, and *MT* QSL and Shortwave columnist, Gayle Van Horn W4GVH, attended the September wedding of their son, *MT* Global Net columnist, Loyd Van Horn W4LVH, on Sullivan's Island, South Carolina. Loyd married Megan Lee Wade, also of South Carolina. The couple honeymooned in the Bahamas.

MT Columnist Adds a New Call Sign:

"Just wanted to put a word in for **www.hamstudy.org**. I found this site via Icom who are now sponsoring it. I fell in love with its clean, straightforward, slideshow-like design. You can do flashcards, read the answers randomly or practice as many times as you like for all three levels. If you register (free) it will also track your progress. I studied about two hours for a couple of weeks and successfully sat all three exams in one go!" – Mike Chace G6DHU and now AB1TZ

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

Happy monitoring!

Ken Reitz, Editor

COMMUNICATIONS

by Ken Reitz KS4ZR

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

Life after *Monitoring Times*? Yes!

Without exception, the entire staff at *Monitoring Times* owes a great debt of gratitude to Bob and Judy Grove, publishers of this magazine for over three decades. Most of us have been with the magazine for many years, some for more than a quarter century, and a few almost as long as Bob and Judy. Some of us cut our journalism teeth on this magazine which, in turn, led to all manner of writing opportunities we might not have otherwise had. Some of us earned the bulk of our electronics education thanks to our work on this magazine. As one, we thank them both for all that they have done for us individually and for the work that they've done for consumer communications during the lifespan of this publication. And, as one, we wish them the best in their well-deserved retirement.

During my tenure as *MT* managing editor, features editor and during the rest of the 25 years that I've been a regular feature writer and columnist, the Groves exercised a hands-off editorial policy. They have always trusted *MT* editors to produce a monthly magazine that met their standards. As editors, we have always enjoyed free editorial rein to pursue, write and edit the stories we thought most important to our readers. This policy has allowed the magazine to explore every aspect of radio and electronics, which gave us unique status among all other radio-related magazines. We delivered on that editorial trust every month.

The staff at *Monitoring Times* are not retiring. In fact, most of us have many years to go before that notion becomes a reality. As the accolades poured in to *MT* over the past three months, all readers, regardless of how long they have been subscribers, have expressed sadness and dismay at the closure of the magazine, following the publication of the December, 2013, issue. Hearing those sentiments, I came to believe that there might be enough interest to warrant continuing the publication in some other form. With that in mind, I've taken it upon myself, as managing editor, to explore the possibility of publishing a follow-on magazine not connected with *Monitoring Times*, Grove Enterprises or Bob and Judy Grove.

The new monthly publication, called *The Spectrum Monitor*, will debut with the January, 2014 issue (timed to appear when ordinarily the January issue of *MT* would appear). It will be an electronic magazine, similar in style and content to *MTXpress* (the electronic version of *MT)*. It will be produced in PDF format which can be read anywhere in the world on any desktop, laptop, iPad, Kindle Fire or any other device on which PDF documents may be opened.

I realize that this might appear to leave those without computers at a disadvantage. But, that doesn't have to be the case. A Kindle Fire ($160), for example, is WiFi capable and requires no cell phone subscription. You can surf the web, do email, and download books and magazines in many coffee shops, libraries and other public spaces that provide free WiFi. You can download the latest issue of *The Spectrum Monitor*, take it home and read it at your leisure; no expensive cable service, Internet service, router or wireless modems needed. If you do have such services and devices, you're set!

In *The Spectrum Monitor* you'll see some very familiar bylines. These are the experts in all the facets of radio who have helped make *MT* the best full-spectrum magazine available. And, we are excited about continuing our work for the new publication. The success of *The Spectrum Monitor* will depend on those who currently subscribe to *MTXpress*, as well as many of the print-only *MT* subscribers, signing up, now that there is only one issue of *MT* left. To do so, and to find out more, go to **www.thespectrummonitor.com**. I hope you'll join us for continuing adventures in the HF spectrum and beyond.

73 Publisher, Wayne Green W2NSD, SK

Amateur radio publishing icon, Wayne Green W2NSD, died September 13 at the age of 91. After editing *CQ* magazine from 1955 to 1960, Green founded *73 Amateur Radio Today*, which he published until October, 2003. In an online obituary, the ARRL, publishers of *QST* magazine, described Green, often at odds with League policy, as, "A well-known and often outspoken figure during what some consider amateur radio's golden years in the 1950s and 1960s."

Throughout the 43 years of its publishing, his popular, wordy, and often vitriolic *73* editorial column, "Never Say Die" (the phonetics he used for his call sign), was packed with insights and incitement. Readers found they could whole-heartedly agree and vehemently disagree with Green, often in the space of the same editorial. In the magazine's masthead he was listed as "El Supremo and Founder."

MT's Larry Van Horn N5FPW notes, "Not only did I grow up with *73* magazine and 'Never Say Die,' but I have had the chance to talk to Wayne many times on the phone in my job as the assistant editor of *Monitoring Times*. He was quite the character in print, on-the-air and in person."

Back issues of *73* have been donated to the Internet Archives and may be accessed here: **http://archive.org/details/73-magazine.**

According to his blog, **ww.waynegreen.com/wayne/news.html**, he was a ham and chief cameraman working at WPIX, channel 11, in New York City in the early 1950s, when he was introduced to RTTY. That introduction started him on his lifelong obsession with publishing, which would go on to include some of the earliest computer-related magazine titles. From his blog dated January 10, 2013 he wrote:

"They [WPIX] let me set up a two and a half meter ham station on the top floor of their skyscraper on East 42nd Street in Manhattan… right near the WPIX transmitter. Wow, what a great location for line-of-sight communications.

"But, what was that strange new sound up at the top of the ham band? It turned out to be Johnny Williams W2BFD, out in Flushing, using an old Model 12 Teletype machine, with which he was swapping Teletype messages with a few nearby hams, who also had machines, and built the equipment to send the signals by radio. John had a contract with Teletype Corporation to buy their old Model 12 (1930s models) for us hams.

"That looked like great fun, so I got one, built the converter, and was doing a lot like today's email with a half-dozen local hams.

"This was so much fun I pushed John to start a newsletter, but he was too busy with his radio and TV repair shop.

"A few months later I graduated from cameraman to a TV director in Cleveland. They had a mimeograph machine that wasn't doing anything evenings, so I started my *Amateur Radio Frontiers* newsletter to help get more hams excited about ham radio Teletype (RTTY).

"My newsletter grew to a 32-page mini-magazine, with over 2,000 ham subscribers, plus it got me a monthly RTTY column in *CQ*, one of the two ham magazines. A couple years later I helped the editor get a better job, and found myself the editor of *CQ*, where I continued my editorials. And, what could possibly be more fun than editing a ham magazine?"

After a falling out with the publisher of *CQ*, he decided to publish his own ham magazine. "I got all the money together I could, and had just enough to publish the first issue of my own ham magazine, *73, Amateur Radio Today*. With it, I pushed one new ham technology after another, not giving up for 43 years…"

Software Defined Amateur Radio: Pluses and Minuses

By Kirk A. Kleinschmidt NT0Z

Superhet designs, once thought to be unbeatable and ever-enduring, have been handily eclipsed by software-defined radio (SDR) technology, which is now sweeping across the landscape.

Well into its adolescence, SDR has already taken the performance and cost crowns, and once manufacturing, economy of scale and ergonomics push HF SDR into young adulthood (it's already there in cellular, military, computer and satellite applications), it will likely be the *only* flavor of radio commercially available, save for home-brew designs and the odd holdout.

This edition of the Radio Buyer's Guide looks at amateur radio SDR technology and the current crop of SDRs, from über-expensive, direct-sampling powerhouses to $15 USB dongles. SWLs? This concerns you, too!

Using SDRs can be quite different from using conventional ham rigs, but unless you're willing to spend nearly $20,000 for Hilberling's exotic PT-8000A (probably the last high-performance, analog superhet that will ever be manufactured), SDR performance is undisputed. The chart at Sherwood Engineering (**www.sherweng.com/table.html**), a manufacturer-independent testing lab, tells the tale and ranks the performance of many ham and SWL rigs (past and present).

Note that the chart is sorted on "dynamic range at 2-kHz signal spacing" (the ability of the radio to receive weak desired signals that are only 2 kHz away from strong unwanted signals). Other than the limited-availability Hilberling, SDRs dominate. Notably missing are Flex-Radio's 6000-series direct-sampling models (shipping in limited quantities with beta software at press time) and Apache Labs' ANAN-series radios (not yet tested at press time).

SDR: Advancing the Art

In a superhet, incoming radio signals are mixed with a locally generated signal (VFO) and converted to an *intermediate frequency* (IF), at which filtering, amplification and other functions take place, *before* the IF signal is itself mixed with another local signal (BFO) and converted to audio, which we can hear. The performance of the mixers, crystal filters and RF amplifiers in the IF must be top-notch, which is difficult and expensive.

Direct-conversion receivers (DC), much simpler than superhets, mix incoming radio signals with a locally generated signal (VFO) and convert the resulting "0-Hz IF signal" directly to audio (baseband). Many simple home-brew receivers use direct conversion, as do most SDRs. Surprise!

First-generation SDRs use DC receiver circuits that output a pair of baseband signals (from dc to 200 kHz or so, including the audible range) that have a specific phase relationship. These audio signals, called I and Q, are fed into a PC sound card (high performance is desirable) where they're converted into digital signals by the card's analog-to-digital converters (ADCs). The card's digital signal processor (DSP) can then perform all of the functions normally performed by superhet analog circuits (amplification, detection, AGC, demodulation, filtering, limiting, etc), plus noise reduction and blanking, binaural audio, digital-mode demodulation, and more. Sophisticated PC software runs the show, so a fast PC is always required, even for basic radio operation.

The dynamic range of the sound card's ADCs and DSPs essentially determines the dynamic range of the receiver, so even if the receiver has only a few "real" parts, it can still offer very high performance! The pioneering FlexRadio SDR-1000 uses this approach, as do many home-brew and kit SDRs. Audiophile sound cards work best (they're expensive!), but almost any PC sound card will work. This architecture is called QSD/QSE, short for Quadrature Sampling Detector (receivers) and Quadrature Sampling Exciter (transmitters).

At the next evolutionary step, SDRs still use direct-conversion, QSD/QSE designs, but incorporate the "sound card ADC/DSP" into the radio and connect it to the PC (and the SDR control software) via Firewire or USB. This simplifies things and allows for tiny radios, but keeping critical software/hardware timing synchronized on each end of the connecting cable can sometimes be challenging. FlexRadio 1500- and 3000-series transceivers use this approach.

The latest generational designs put the DSP/SDR hardware *and the computer itself* inside the radio (not a general-purpose PC, but a dedicated platform designed *only* to run the SDR/DSP hardware and operating system at *stunningly high* performance levels). This approach allows SDRs to have physical knobs and switches and supports designs that don't need external PCs at all (this is potentially important). Many new SDRs use ADC/DSP hardware that can "directly sample" the RF signals being received without first converting them to baseband. This requires fast, digital processing at RF (not just from dc to 200 kHz).

This latest-gen SDR technology is called DDC/DUC, short for Direct Down Conversion (receivers) and Direct Up Conversion (transmitters) and is the likely future of all commercially made radios, amateur and otherwise. Today's DDC/DUC transceivers are still somewhat expensive ($900 to $10,000 and beyond). But, if they follow in the path of cell phone SDRs, they'll soon be "peanuts." Direct-sampling amateur radio transceivers have just become available, but at press time, shipping delays and "vaporware" issues are still slowing adoption.

DDC/DUC technology ushers in never-before-seen capabilities, including models that can continuously receive and record the *entire* HF spectrum (or smaller, more manageable swaths); models that feature eight full-performance; independent receivers that can simultaneously receive on single or multiple bands (serving multiple human operators logged on from separate networked PCs), and more.

Using SDRs: The PC Perspective

Most SDRs require PCs to function, and fast, modern computers are almost always preferred, but many radios have specific requirements, so it's *important* to check these out ahead of time. Some SDR software runs in Linux and OSX, but most requires Windows (sometimes XP or Windows 7).

Basic SDRs prefer (or require) high-performance sound cards (or SDR-oriented

Flex Radio Systems Flex-6500-6700 Limited Edition (Courtesy: Flex Radio Systems)

codec cards), internal or external. Some models require Firewire or USB ports that meet certain performance requirements, but don't need sound cards because the equivalent hardware is built in. Many latest-gen models require proprietary software, but may need less-powerful PCs because the heavy lifting is done by the radio's internal processors (FlexRadio 6000-series, for example). Newer models also connect to the outside world via Ethernet, which may allow operation from computers, tablets or smart phones.

Pros

SDRs offer many features that superhets can't offer, the most important of which is "point and click" tuning and graphical spectrum displays. "Seeing" signals up and down any particular band is a tremendous leap forward, and when you see an interesting signal, you can simply click on it with your mouse pointer to tune it in—no more Flat Earth!

SDRs typically have "crunch proof" receivers that are a joy to use on crowded bands stuffed with big signals. They also offer an infinite variety of "brick wall" filters, unlike superhets, which offer only a few (or one). Digital SDR filters don't ring or sound mushy, even at 100-Hz bandwidths. You can tune in a weak CQ right next to a powerhouse ragchew, select a narrow filter and you'll never even know the "unwanted" signal is nearby. That ability is a game-changer. Other digital features include noise-reduction, notch filters, binaural reception, RX and TX audio equalization, and much more.

Cons

New technologies have rough edges, and SDRs aren't exempt. PC-based SDRs need PCs, of course, which limits their flexibility and portability. SDR transceivers can be difficult to connect and configure (receivers less so). Although newer PC-based models don't require complicated sound card interconnects, SDR software still has *lots* of settings that can (or need to) be tweaked. PC-based SDRs aren't yet "plug and play," so compu-phobes should choose carefully!

Despite their unparalleled graphical displays, flexibility and performance, the ergonomics of actually using PC-based SDRs on the air can be frustrating, especially if you're used to physical knobs and switches. Getting SDR software to cooperate with logbooks, contesting software, digital-mode controllers, CW and voice keyers, etc, can be frustrating, difficult or impossible. Success can require extreme multitasking, the use of multiple monitors, and complex configuration schemes that map virtual COM ports and require internal audio redirects. The latest designs may offer some improvements, but it's too early to be sure.

When using PC-based setups it can be difficult or impossible to tune or control your SDR in any way when the mouse pointer is "focused" on your logbook or digital-mode software. Clicking back and forth between SDR and contest software windows, for example, even if each is displayed on a different monitor, can require lots of mouse hand gymnastics and back-and-forth clicking *for every QSO*. That's why most radio contesters still don't use SDRs.

Software

PC-based SDRs require software to function, and although some models support a wide variety of open-source or free SDR software, many models require specific or proprietary software to function at all. If your favorite PC/operating system can't support your SDR, it won't work, so be careful (or consider an SDR that doesn't require a PC).

SDR software comes in two main flavors: computer software that speaks radio, and radio software that speaks computer. The first is designed by programmers and, while offering fantastic performance, has little radio "feel." The second is designed by radio users and, while offering a similar set of computerized goodness, still "feels" like you're using a ham or SWL radio, and the layout and relationship of the controls makes sense to ops used to using physical radios. Each software type can be awesome, but your expectations and usage scenarios must match your "software design orientation" or the whole experience will seem extra awkward!

SDR Buyer's Guide

SDR technology is exploding globally, and that fact is reflected in the sheer number of SDR transceivers available as kits, semi-kits and fully assembled radios. Space here is limited, so we apologize for those models we couldn't include. Many kit radios require a wide range of skills to successfully assemble (some easy, some extreme), so make sure you're up to the task or have sufficient help lined up before getting started.

Sound Card-Based SDRs

These basic radios require high-performance sound cards (or other ADC/DSP hardware) and fast PCs running SDR software (many flavors are available, most are free). A high-performance stereo sound card is required for RX, and a *second* stereo card (not so high performance) is required for TX. Some high-end (expensive) sound devices are *full duplex*, supporting two or more simultaneous stereo signal paths. To save money, many ops use a "good" internal sound card for RX and an "inexpensive" external USB sound device (or dongle) for TX.

Most QSD/QSE rigs that share this "external sound card(s) required" architecture (such as the pioneering FlexRadio SDR-1000) are now kits, as mainstream manufacturers have generally moved their designs forward. Sound card rigs are still heard on the air every day, however, and are great platforms for exploring and experimenting. When paired with high-end sound cards, even simple SDRs can offer outstanding performance. Assembly, setup and interconnections can be challenging, however, so they're not recommended for non-technical types!

Softrock RXTX Ensemble: KIT or ASSEMBLED, $, GOOD, MT-PICK. This 1-W, multimode SDR transceiver can be built for full coverage of one of the following five band

Softrock RX/TX Ensemble (Courtesy: Softrock SDR)

SDRS THAT AREN'T?

Because we're in an "SDR transition" of sorts, some ops are confusing software-controlled radios with software-defined radios. This is evident on Internet forums and even in print. The simplest way to differentiate between SCRs and SDRs is to remember that, in SDRs, the "software" handles the tasks that would have previously been performed by hardware devices such as mixers, filters, demodulators, etc. Most superhet radios made in the past 20 years can be interfaced with computers for control of most (or all) internal functions, remote access, etc., but conventional circuits still "do the work."

Some SCRs *seem a lot like* SDRs. Ten-Tec's RX-320D, for example, a "black box radio" without any physical controls that uses a PC to control all functions, has a certain amount of DSP functionality built in, but the core circuits are conventional. The Kachina 505 and Ten-Tec's Pegasus pioneered this in the amateur market. Kenwood's TS-B2000, the black box version of the TS-2000, has no physical controls, but it's not an SDR. Ten-Tec's new 506 Rebel, an "open-source," experimenter-friendly, two-band QRP transceiver, has an Arduino-based architecture that's designed to easily be changed, adapted and modified by users, is also not an SDR. Its direct-digital-synthesis (DDS) "VFO" is Arduino-controlled, but the "radio" circuits are conventional.These are fine radios, but if you're searching for an SDR, be sure to verify a PC-friendly radio's underlying architecture!

Ten-Tec Rebel (Courtesy: Ten-Tec)

A $20 SDR ON A STICK?

If only to prove the power and potential of inexpensive future SDR systems, check out the "DVB Dongle Craze" and you'll be amazed by how much radio you can buy for less than $20!

Powered by the USB port on your PC and about the size of a USB thumb drive, "DVB-T dongles" are SDR "systems on a stick" that were designed to receive digital television signals overseas. To the delight of hams and SWLs everywhere, developer Antti Palosaari discovered that the DVB dongles could be used with free software to make decent, dirt-cheap, all-mode SDRs that cover 25-2200 MHz! Add a similarly priced HF converter and you have a $40 dc-to-daylight SDR that can receive all modes and display a 2-MHz-wide swath of RF on its PC-based band scope!

At press time, the preferred dongles, usually sourced on eBay, pair a Realtek 2832U quadrature sampling detector with Elonics E4000 or Rafael Micro R820T tuners (other combos may not work). The stick radios have an antenna connector on one end and a USB connector on the other. RF signals go in one side and raw I/Q data goes out the other, to the PC, where a variety of powerful, free software makes the magic happen.

Unlike conventional designs, SDR dongles can receive AM, AM-synchronous, FM (wide and narrow), USB, LSB, ISB, DSB, CW – all the modes we know and love. Plus, support is emerging for obscure modes such as APCO 25, INMARSAT, ADS-B, and more.

While these powerful little radios aren't yet polished (they will be soon), they're practically free and are perfect for experimenters and computer enthusiasts. It does take some fiddling to get the software set up, and with only a 50-dB dynamic range, if you connect yours to a giant external HF antenna, for example, you may receive all bands at once! External RF attenuation or band-pass filters may be required to avoid interference or distortion.

Similarly, if you only connect the tiny whip antenna that accompanies these units, you won't receive much more than the RF noises from your PC, fluorescent lights and household appliances. Using them with companion transmitters is awkward at best, but low-cost transceiver designs inspired by these dongles are already being tested. Start at **http://sdr.osmocom.org/trac/wiki/rtl-sdr** and Google as necessary. *MT*'s June, 2013, "On the Ham Bands" column has more info.

groups: 160; 80-40; 40-30-20; 30-20-17;15-12-10. Components are included for all five options; you choose prior to assembly. The circuit board, which measures 5 x 2.5 inches, has mostly surface-mount parts, so SMT soldering experience—or a willingness to dive in—is a must. The venerable rig, available in several versions over the years, was designed by Tony Parks KB9YIG, the "father of affordable SDR experimentation." Softrocks work with a wide variety of software and enjoys a strong online support community and an active user base. The RXTX Ensemble is probably the least expensive "full-performance" SDR transceiver. Prices: $89 (kit); $124 (assembled). Both are available factory-direct at **http://fivedash.com**.

GenesisRadio G11: KIT, $$, BETTER. The basic kit, a 10-W, multimode SDR transceiver, can be built for full coverage of two to five ham bands from 160-6 meters, and an add-on kit enables all-band coverage (160-6) and general-coverage receive. All 600+ surface-mount components are factory installed and the remaining 60 through-hole parts take about eight hours to assemble. The G11 requires GenesisRadio's proprietary software, *GSDR*, to operate, and the radio has a dedicated following and a healthy online support community. Prices: $299 (basic kit); $139 (all-band filter add-on); $60 (enclosure); $435 (kit + all-band filter add-on); $480 (kit, all-band filters, enclosure). See **www.genesisradio.com**.au and **www.greenmountainradio.com/G11/order.html** for more info.

Genesis G11 SDR transceiver (Courtesy: Genesis Radio)

USB/Firewire SDRs

With built-in "sound cards" (ADCs), second-generation SDRs require reasonably fast PCs outfitted with Firewire and/or USB ports that meet certain performance specs and run proprietary SDR software (FlexRadio's *PowerSDR* for these two models). Although still QSD/QSE designs, second-generation SDRs generally offer improved performance, fewer connections and are generally much easier to get up and running. Surprisingly, FlexRadio recently retired its former flagship, the FLEX-5000A, because of parts unavailability and the introduction of the company's new 6000-series models.

Terratec SDR Dongle (Courtesy: Terratec)

FlexRadio FLEX-1500: ASSEMBLED, $$$, GOOD, MT-PICK. This 5-W, HF+6 multimode transceiver (RX 0.01-54 MHz) can put out as little as 1 mW and is designed to also work as an IF deck for external VHF/UHF/microwave transverters. Features: 48-kHz-wide panoramic band scope display with point-and-click tuning, sophisticated

Flex Radio Systems Flex-1500 (Courtesy: Flex Radio Systems)

DSP filters, noise-reduction, advanced AGC, and very high RF performance for its price. It outperforms previous-generation superhets costing many times more and sits surprisingly near the top of the Sherwood Engineering receiver performance charts. A full feature matrix can be found at **www.flex-radio.com**. The tiny and versatile FLEX-1500 is the most affordable way to get your feet wet with a commercially made, second-generation SDR. The '1500 requires a Windows PC with high-performance, low-latency USB ports (often easier to find on older PCs than on new!). Some users experience T/R and keying issues related to USB implementation. Available factory-direct for $699 from www.flex-radio.com.

FlexRadio FLEX-3000: ASSEMBLED, $$$$, BEST. This 100-W, HF+6 multimode transceiver (RX 0.01-65 MHz) can't juggle transverters like its little brother, but the "Workhorse 3000" boasts better specs in every critical subsystem, including a 96-kHz-wide spectrum display and a Firewire PC interface that eliminates the USB connectivity problems that affect many FLEX-1500 users. A full feature matrix can be found at **www.flex-radio.com**. Available factory-direct for $1749.

Flex Radio Systems Flex-3000 (Courtesy: Flex Radio Systems)

DDC/DUC SDRs

Most latest-generation, direct-sampling SDRs are so new that they've just begun shipping (some in limited quantities and some with beta software). They offer (or promise) unbeatable RF performance and never-before-seen capabilities, but they're not mature and don't have a track record. For connectivity, the new radios rely on Ethernet, which dramatically outclasses USB or Firewire. DDC/DUC technology is *rapidly* evolving, so these initial models have the potential to be replaced or become obsolete fairly quickly, so do your homework.

FlexRadio FLEX-6500: ASSEMBLED, $$$$, BEST (expected rating, not shipping in quantity at press time, software still in beta). This 100-W, HF+6 multimode transceiver (RX 0.03-77 MHz), intended to be a dramatic step forward in transceiver design, is powered by FlexRadio's next-gen *SmartSDR* software.

The '6500's internal FPGAs and digital hardware (dedicated computing platform) promises digital-radio number crunching on par with an 8-core Intel CPU with 100% load on all cores!

The '6500 provides every existing SDR function, plus: four independent, full-performance receivers (anywhere in the 0.03-77 MHz range), each with 384-kHz-wide spectrum displays; promised receiver dynamic performance so high "it no longer matters," (FlexRadio brochure, public lab tests forthcoming) and may not even be measurable by most labs; multiple antenna and XVTR ports; digital QSK; GPS Disciplined Oscillators (GPSDO, add-on) for lab-grade frequency accuracy; Gigabit Ethernet interface with future WAN/internet connectivity (simultaneous remote operation by multiple users); and enough built-in smarts to intelligently control, monitor and interface with external amplifiers, tuners, rotators, antennas, etc. For a comprehensive feature list or to order factory-direct, see **www.flexradio.com**. Prices: $4,300 (radio), $699 (GPSDO add-on).

FlexRadio FLEX-6700: ASSEMBLED, $$$$$, BEST (expected rating, not shipping in quantity at press time, software still in beta). This 100-W, HF+6 multimode transceiver (RX 0.03-77 and 135-165 MHz) is similar to its little brother, but packs more number-crunching power, up to eight independent receivers, coverage of 135-165 MHz (RX on any antenna port, TX via XVTR ports). For a comprehensive feature list or to order factory-direct, see **www.flexradio.com**. Prices: $7,500 (radio), $699 (GPSDO add-on).

Apache Labs ANAN-100/D: ASSEMBLED, $$$$, BEST (expected rating). This 100-W, HF+6 multimode transceiver (RX 0.01-55 MHz) is a 4th-generation, cooperatively developed design based on the OpenHPSDR Hermes SDR. The 100/D can simultaneously support four to seven full-performance receivers, each with 384-kHz spectrum displays; claimed dynamic range of 125 dB; multiple antenna and XVTR ports; digital QSK; lab-grade frequency accuracy; Gigabit Ethernet interface to support simultaneous remote operation by multiple users; and more. Supported by various SDR software for Windows, Linux and OSX, Apache Labs recommends fast, modern PCs for best results. For a comprehensive feature list or to order factory-direct, see **https://apache-labs.com**. Prices: $3,489 (ANAN-100/D); $2,489 (ANAN-100); $1,679 (ANAN-10, 10-W version).

Apache Labs ANAN 10 (Courtesy: Apache Labs)

Standalone SDRs

Most SDRs require PCs, but it's a design choice, not a necessity. As mentioned, most of today's top-performing hybrid superhet radios incorporate SDRs internally, but don't necessarily say so. The following standalone SDRs, which *do not* require external PCs, are likely blazing a trail that will become well-worn in the future.

Midnight Design Solutions SDR Cube: KIT or ASSEMBLED, $$$, GOOD. This 1-W, single-band (80, 40, 30, 20 or 17 meters), multimode HF transceiver is a flexible, self-contained QSD/QSE radio that doesn't require a PC. At only four inches square, the SDR Cube pairs a Softrock SDR transceiver board (built-in or external) with a dedicated DSP controller and a full-featured "front panel" – complete with knobs, switches an LCD frequency readout, and an 8-kHz-wide spectrum display. Add plenty of I/O connectors, experimenter-friendly firmware and an active support community and you've got a platform for SDR fun and innovation – no PC required. See the complete list of goodies, including the new general-coverage RX module, and order factory-direct at **www.sdr-cube.com**. Prices: $575 (assembled and tested); $416 (assembled and tested, you supply your own Softrock SDR board); $339 (full kit); $241 (you supply your own Softrock SDR board); $31 (PCBs only).

SDR Cube (Courtsy: Midnight Design Solutions)

Elecraft KX3: ASSEMBLED or KIT, $$$, BEST, MT-PICK. This 10-W, multimode, HF+6 transceiver (RX 0.5-30 MHz) would be a remarkable achievement at several times the price. About the size of a house brick and weighing 1.5 pounds, the trail friendly KX3 is a competition-grade, "do everything" SDR for home or field use. At press time the KX3 is ranked second on the Sherwood Engineering Receiver Performance Chart (**www.sherweng.com/table.html**) when compared to *every radio the lab has ever tested*, regardless of price or size (104 dB dynamic range at 2-kHz signal spacing). The only radio to yet best it, the exotic Hilberling PT-8000A, is 20 times the size and costs nearly 20 times as much!

Elecraft KX3 (Courtesy: Elecraft)

This tiny powerhouse has a full complement of knobs, switches, displays and I/O connectors – it's a standalone radio, no PC required – but includes I/Q quadrature audio outputs for easy PC/tablet spectrum display connections (and is fully PC-controllable via the usual CAT commands). To many ops this provides the best of both worlds: a conventional radio with knobs and switches with the hi-res spectrum display of an SDR. The 10-W "base model" starts at $899, and a large assortment of add-ons allows you to create a custom radio over time. It's too tiny for some users, but it's a Ferrari for the price of a scooter! The KX3 is available factory-direct from **http://elecraft.com**. Prices: $899 (modular kit); $999 (assembled); $169 (internal wide-range ATU); $699 (matching 100-W amplifier); (internal 2-meter module coming Q1 2014).

Apache Labs SDR Transceiver (Courtesy: Apache Labs)

Invasion of the Chinese Radios

by Mark Haverstock K8MSH
(Photos courtesy of the author, except where noted)

Back in the 1950s, when I was a kid, the phrase, "Made in Japan," meant cheaply constructed products at a cheap price. By the 1970s, this reputation had changed radically; people actually sought out Japanese products because they were manufactured to high standards and under strict quality control. Electronics, such as home audio products and ham radio equipment, had risen to a level of quality that rivaled or even exceeded those made in the U.S.

Now China is coming close to where Japan was in the 1970s, producing inexpensive electronics that seem to be getting better every year. Among these are the new crop of bargain handie-talkies that have been appearing under the label of dual band commercial radios, ones that coincidentally cover the ham bands as well.

Prices are unbelievably low, compared to handhelds made by the "big three," Yaesu, Icom and Kenwood. They do vary considerably, and generally are cheaper from online storefronts; especially those websites based in China. For example, the miniature Baofeng UV-3R, a 2-watt, dual-band UHF/VHF, with drop-in charger and earphone/mic accessory, currently costs $35 (including shipping from Asia!) from several online dealers. For an extra $5, you can move up to a 5-watt UV-5R, which also includes a front panel keypad for manual programming and control.

Typically, these import radios are found at many amateur radio dealers, on eBay, Amazon.com, Rakuten.com, New Egg and other online dealers. They can also be ordered directly from Asia at such websites as 409shop.com, Radioshop888 and others. Alex Lentini, president of Lentini Communications, says, "We now handle the TDXone, TYT and Wouxun brands. Sales volume has dropped somewhat, but these still sell better for me than the major brands." Brisk sales at the 2013 Dayton Hamvention seem to confirm their continuing popularity.

Baofeng UV3R ($35 online),Baofeng's most inexpensive and popular miniature radio. This Mark II release of the original 3R has a dual-frequency display and continues to be a big seller.

Quality Control

You get what you pay for. When it comes to build quality, the earlier models seemed a bit rough around the edges and lacked some of the amenities of those made by the mainstream manufacturers. Materials do not appear to be as durable, and controls could be awkward and confusing. As for functionality, most perform acceptably well; providing good transmit and receive audio.

Kevin Karanmanos, director of sales and marketing for Powerwerx, previously worked for Yaesu and did a lot of their importing. "What I can tell you is Yaesu, Icom, Kenwood and Motorola, make a lot of their radios in China," he says, "People have no clue." However, the specs to which these mainstream radios have been manufactured are considerably higher than the Baofeng, TYT, Wouxon and other Chinese brands.

The consensus among dealers and users is that the Chinese are improving their products. A lot of this is a result of feedback periodically given to the manufacturers. "We have meetings with them every month, we give input from band specs to intermod levels," says Karanmanos. "They've greatly improved the last few years. We thought the radios were good two years ago, but they're even better now."

It's the importers and dealers who have become the gatekeepers when it comes to quality control for these radios, not so much the manufacturers. They are the ones testing the radios on spectrum analyzers and getting manufacturers to adjust the specs. Some are even creating their own "house brand" versions by ordering custom radios with their specifications.

Baofeng UV-5RA ($35 online)features keypad and belt clip on radio, instead of battery pack. It meets new Part 90 requirements including narrow band capability and 2.5 kHz channel step–though these features are not required for amateur use.

Part 90 and Part 97 Issues

Many of the Chinese imports claim FCC Part 90 certification for the Land Mobile Radio Service. As a buyer, you should look for this Part 90 certification as being some level of quality assurance for the radio. "It tells me that, if the manufacturer can comply with Part 90, you have a reasonable chance that they are paying attention to the radio and its capability," says Dan Fish, owner of Minnesota-based Radio City.

Ed Griffin, president of Import Communications, notes that as amateur radio operators, we don't need to have certified equipment. "We can operate equipment that has certification for other services, like land mobile, as long as we are using it in a band that we're licensed to use," He says, "All the manufacturers have been applying for Part 90 certification mainly because they sell thousands of these radios that are actually used for land mobile service."

Amateur radio operators don't need FCC certification for equipment they use on the ham bands. *MT* publisher, Bob Grove W8JHD, notes, "That's how hams use old police radios on the ham bands and can even build their own transmitters."

But, it is out of courtesy for others using the radio spectrum that we make an effort to transmit a clean signal. At the recent Dayton Hamvention, the ARRL had a spectrum analyzer set up to check any radios that showed up. As you might guess, the ones that failed were mostly older releases of these import radios. According to Part 97 amateur rules, a 30-225 MHz transmitter having a mean power of 25 watts or less, the mean power of any spurious emission supplied to the antenna transmission line must not exceed 25 µW and must be at least 40 dB below the mean power of the fundamental emission, but need not be reduced below the power of 10 µW.

Programming

Save yourself a lot of aggravation. Chinese manuals are generally poorly written and can take some patience to decipher. Instead of manual programming by keypad, buy the programming cable and use the software designed for your radio. The programming experience will go a lot more smoothly. Better yet, use Chirp (**http://chirp.danplanet.com/projects/chirp/wiki/Home**), a free, open-source program that supports most

Accessory antennas Nagoya NA701 ($5-15 from various online dealers) and Diamond RH771 ($10-15 online)covers 136-175 MHz/400-480 MHz. Antennas like these, tuned for the amateur bands, can provide improved performance and better harmonic suppression.

Brand	TX Freq. MHz	RX Freq. MHZ	H/L Output	Watts Battery	Memory Channels	PL Tone	FCC Certified	PT. 90 Scan Mode	Voice Prompt	Comments
Wouxon KG-UV3D	*144-148 *420-450	136-174 420-520	5/1 VHF 4/1 UHF	1700mAh	199	yes	yes	yes	yes	144/220 MHz version available
Wouxon KG-UV6D	136-174 420-520	136-174 420-520	5/2 VHF 4/2 UHF	1700mAh	199	yes	yes	yes	yes	
Wouxon KG-UVD1P	*144-148 *420-450	136-174 400-480	5 VHF 4 UHF	1700mAh	199	yes	yes	yes	yes	144/220 MHz version available
Baofeng UV-5RA	136-174 400-480	136-174 400-480	4/1 VHF 4/1 UHF	1800mAh	128	yes	yes	yes	yes	
Baofeng UV-B6	136-174 400-470	136-174 400-470	4/1 VHF 4/1 UHF	2000mAh	99	yes	**	yes	yes	
Baofeng UV-3R MK II	136-174 400-470	136-174 400-470	2 VHF <2 UHF	1500mAh	99	yes	yes	yes	no	
TYT THUVF-1A	136-174 400-470	136-174 400-470	5/1 VHF 4/1 UHF	1500mAh	199	yes	yes	yes	yes	
TDXone TD-Q8HT	136-174 400-520	136-174 400-520	5/1 VHF 5/1 UHF	1800mAh	128/ band	yes	yes	yes	yes	

**Limited to transmit on amateur radio bands*
***meets wide/narrow band and 2.5kHz step criteria*
Buying Tips: Be sure the radio has a current Part 90 certification. Buy from a reputable dealer who will give you a warranty and can verify it meets Part 97 emissions standards. Be sure to get a programming cable and software.

TYT TH-UVF-1A ($100) covers 2-meters/440 MHz with .5 to 4 watts transmit, 7.4V 1500 mAh Li-ion battery, drop-in charging base, AC adapter, SMA type antenna, belt clip and carrying strap. (Courtesy: Universal Radio)

Chinese radios as well as ones from Kenwood, Icom and Yaesu.

Buy a cable that's been tested and is guaranteed by the dealer and which is accompanied with its own drivers, probably on a mini CD. There are lots of bargain cables on eBay, but you take your chances finding drivers that work with your computer. Many of these cheaper cables use a knockoff copy of the Prolific chipset, which may not work with currently available drivers. I've found that these work only with the 3.20 and earlier drivers because Prolific has essentially locked out the pirated chips using code which is incompatible with their new drivers. However, cables with the FTDI chipset have proven to be reliable and have been recommended by radio owners on various message boards.

The programming process using software, either from the manufacturer or Chirp, is fairly straightforward and uses a spreadsheet format to enter information: channel number, frequency, offset, PL tones, power, etc. With Chirp, you can compose and save a file for each radio it supports – which comes in handy if you have more than one HT or some mobile radios as well. Information can be copied from file to file, saving you time.

Warranties

Chinese radios seem to fall into two categories: disposables, which generally run $90 or less, and the higher quality ones that sell in the $100-200 range. Most hams look at the inexpensive radios as throwaways if they break down; a tradeoff for the low price. This is a practical philosophy, since sending them back to China for warranty service is rather expensive.

But, some of the more expensive Chinese radios may be worth the effort in seeking repair or replacement, in or out of warranty. That's where buying from a U.S. distributor, such as Universal Radio, provides some advantages. Kevin Karanmanos of Powerwerx says, "Buy from a reputable dealer that's been around for awhile, and make sure they can provide at least a one-year warranty for the equipment and accessories."

This Wouxon KG-UVD1P ($110 at Universal Radio) includes the extended life 1700 mAh battery pack, and a heavier duty textured case. It's available in 2-meter/440 MHz and 2-meter/220 MHz models ($111).

What's Available

Keeping an up-to-date list is a bit like changing a tire on a moving car. New models are constantly appearing on the market at prices that frequently change. The accompanying chart, showing information on several current radios as of the time this article was written, might help make sense of the many available models. All claim to have current Part 90 certification or meet the requirements. Data for the chart was gathered from manufacturer specs and importers of the radios. Just about all the models include a built-in flashlight and 76-108 MHz FM broadcast radio receiver, in addition to the typical two-way radio features.

Prices are based on lowest available street price from U.S. dealers as this article was going to press. Radios ordered from Asian dealers will likely be somewhat less. Though Amazon.com is American-based, some sellers in their marketplaces are foreign companies, a fact that you should consider if a warranty is an important selling point.

SOURCE LIST:

Ed Griffin, Import Communications 704.463.5820 info@importcommunications.com
Kevin Karamanos, Powerwerx 800.321.0073 Kevin@powerwerx.com
Dan Fish, Radio City, 763.786.4475 sales@radioinc.com
Additional information: *San Francisco Examiner*, "Chinese Radios Are a Big Hit with American Operators," by Peter Miller **www.examiner.com/article/chinese-radios-are-a-big-hit-with-american-operators**

Wouxon KG-UVD1P ($110) features 5 watts VHF, 4 watts UHF, Li-ion battery, intelligent drop-in charger, flexible SMA-J (female) antenna and belt clip.

Amateur Radio/SWL Apps for iOs and Android

By Thomas Witherspoon K4SWL
(All graphics courtesy of the author)

Advances in technology have always gone hand-in-hand with our radio hobby – indeed, in many cases, those advances *originated* with our hobby. Because of this, it should comes as no surprise that, in a world where we are rapidly replacing home computing with mobile computing, radio hobbies are "app-ly" supported in the the mobile realm.

Although it is beyond the scope of this article to include a *comprehensive* list of all radio-hobbyist-themed apps for the iOS and Android, nor will it include proprietary apps (those which complement a particular radio or accessory); nonetheless, what follows is an overview of select apps that I myself have used and reviewed, with, of course, a focus on those I have found especially useful.

Ham Radio Apps

If you're an amateur radio operator, you're in luck when it comes to apps. There are a multitude out there, and most are either free or very inexpensive. Below, I've categorized these by major function, beginning with those apps that help you get your ham radio license in the first place.

Exam preparation

Amateur Radio Exam Prep (iOS/Android; $4.99) There are several ham radio exam apps out there, but I find this one to be the best. It's simple, adaptive, and keeps track of the elements and questions you incorrectly answer. While it costs $4.99 per exam (Tech, General and Extra), you can try the free version first, which allows you to explore and learn two of the exam elements before buying. Still, a much better deal and far more portable than an exam book.

Ham Radio Exam (iOS; *Free*) A very simple exam study tool, Ham Radio Exam allows you to cruise exam question pools and note the correct answer. You can also take sample tests and focused quizzes. While not quite as versatile as paid apps (like Amateur Radio Exam Prep, above), it may be all you need to get your ticket!

Operation

EchoLink (iOS/Android; *Free*) Why not turn your smartphone into an HT? After all (as I often say), phones *are* actually radios, right? I only recently discovered the EchoLink app, but it has quickly become *the most useful* ham radio app I use. From this app you can talk to any repeater connected to the EchoLink network; all you need is a WiFi connection or cellular data service. I recently traveled to Belize City and used EchoLink to connect with hams in the U.S. and Canada and even check into a net. It worked flawlessly. I couldn't recommend it more. Did I mention it's absolutely free, with *no* ads?

Maidenhead (iOS; *Free*) A very simple app to track and display your Maidenhead designation in a matter of seconds. Also, check out **Ham Square (iOS; *Free*)** and/or **HamGPS (Android; *Free*)**. All three of these apps use your smartphone's GPS to quickly resolve your Maidenhead location.

Repeater Book (iOS/Android; *Free*) An absolutely *revolutionary* app, in my opinion. Using your phone's GPS, you can quickly reference local repeaters (any band, any mode) with full details, as you travel. This free app has replaced my need for the annual repeater atlas (which I've always found to be a little unhandy to use). Live in, or travelling to, the UK? Repeater Book has a version for the UK, as well.

No more fumbling through a thick repeater atlas when you're traveling! Repeater Book uses your phone's built-in GPS and a large database of repeater frequencies to discover local repeaters.

QRZ Callsign Search (iOS/Android; *Free*) The companion app to the popular call sign database site, **QRZ.com**. Their app is very basic, but makes it easy and convenient to do call sign lookups, although I do wish you could log contacts to QRZ.com via the app (hint, hint, developers!). Also, check out **HamRadio Call (iOS/Android; *Free*)** as it even shows a map pinpoint for the QTH address on record.

PSK31 Pad (iOS; $2.99) Launch this app, place it in front of your radio which you've tuned to a PSK31 signal, and it decodes on the fly. Very simple to use, and quite effective as long as your microphone is near the radio speaker. Meanwhile, **Droid PSK (Android; $5.49)** will decode and even *encode* PSK31, if you want that feature.

Morse It for iOS is a great tool for learning CW. In this case, I placed it in front of my receiver and decoded a CW exchange between two hams at 19 WPM.

Hellschreiber (iOS; $2.99) Decode and send Hellschreiber text *without* a PC. Place your mobile device near the speaker of your transceiver and this app will decode Hellschreiber on the fly. Connect the audio output from the headphone jack of your mobile device to your transceiver and you can even send Hellschreiber.

Reference

Ham Radio Handbook (iOS; *Free*) This is a simple app that puts a few vital pieces of information in front of you. I wish I had this in my early days on the air, as it has a simple list with all of the Q-codes, country call signs, band plans, an RST generator, and it even pulls current solar data. Also, check out **Ham Radio Reference (iOS; *Free*)** and **HamIAm (iOS; *Free*)**.

Ham Radio Tools (Android; *Free*) A very simple reference guide that includes logging (even the ability to *export and import* logs). It also has short Q-code reference sheet, common formulas, and an antenna calculator. It has a very intuitive interface and no ads.

HamLog Mobile Logging (iOS; $0.99) An all-in-one app for the mobile operator. This app will export your logs to most any logging program, including *Logbook of the World*. The newest version even includes a rig control interface. This app also includes many ham reference guides.

HamAntCal (iOS; *Free*) Need to calculate the length of a resonant dipole for the field? HamAntCal is a very simple application to help you do just that. Simply choose a configuration (Half Wavelength, Quarter Wavelength or Inverted Vee) and it will do the math for you.

Morse It (iOS; $0.99) This app not only reads, but teaches CW. This is a 99¢ app, which, like many, offers several premium add-ons at additional cost. I like the interface and simplicity of this Morse trainer. It also serves as a Morse code reader. Simply place your iOS device in front of your radio's speaker and watch it decode Morse code in real time. I've noticed that it decodes CW fairly well around 13-20 WPM; any slower or faster sometimes leads to more error. Still, it's a great app for those who want to learn code, or who want to translate what they hear on the radio.

Morse Code Trainer (Android; *Free*) This is another excellent CW trainer, and will work on even the oldest Android OS versions.

MUF Predictor (Android; *Free*) Enter your transmitter and receiver location, and this simple calculator will help you determine maximum usable frequency.

DXing Spots/Databases

iCluster DX DB (iOS; *Free*) This app allows you to create alarms for needed DX countries, call signs, modes and more with a nice, simple layout. You can also filter spot results with the same criteria. Use multiple cluster servers, including your own, via telnet or the web. The app is free, but if you pay a $1.99 sponsorship fee, it enables a map mode which shows DX on a map. **DX Hunter (iOS; $9.99)** is more advanced and even sends push notifications from spot servers.

DX Cluster (Android; $2.49) Much like *DX Hunter*, the primary purpose of this Android app is to operate in the background and send notifications when needed DX stations are spotted.

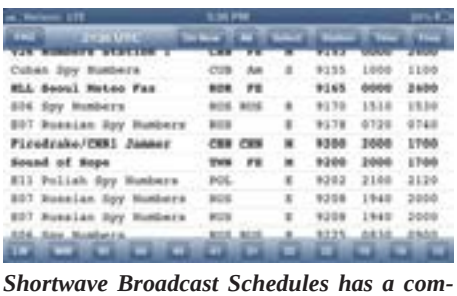
SOTA Goat (iOS; $4.99) If you like to activate summits (via *Summits On The Air*) or log them, this is a fantastic app. It's one of the best designed apps for this purpose I've seen. *SOTA Goat* has a clear, intuitive interface, and is true to the iOS look and feel. Hands down, it has the best user interface of *any* ham radio application. With *SOTA Goat* in hand, you can plot and activate a summit while notifying the SOTA community automatically. Best yet, most of the app's functions (including their summit database and map) are available *offline*! Yes, it's $4.99, but if you're into SOTA, it's worth every penny.

SWL Apps

Shortwave Broadcast Schedules (iOS; $1.99/Android; $0.99) In my opinion, this is *the best app* for mobile SWLing. I used this app on my iPhone while travelling in Central America this summer, and could immediately pull up shortwave schedules even without an Internet connection. It has a very easy function for updating schedules, and can even be set to check for updates each time you open the app. And, you can sort listings by what's on the air now, by station, by time, by frequency, and more. Also, you can quickly pull up frequencies for a particular meter band at the touch of a button.

HF Weather Fax (iOS/Android; $2.99) A super-simple app for decoding HF weather fax transmissions on the fly. Simply start the app and place your device in front of the radio speaker.

SSTV (iOS; $2.99) As with HF Weather Fax, simply launch the app, and place it in front of your radio. You can even leave it unattended and it will decode and save the images automatically. Supports all major SSTV protocols. This is also the best app I've seen for decoding pirate radio eQSLs on the go!



Shortwave Broadcast Schedules has a comprehensive listing of scheduled shortwave broadcasts and is very easy to use.

Scanning Aps

Scanner Radio (Android; *Free*) A brilliant, free scanner application which streams scanner feeds from across the planet; intuitive *and* easy to use.

Scanner Radio Pro ($2.99) eliminates ads.

Action Scanner (iOS; *Free*) Easy to use and loaded with scanner feeds. Although I prefer the search functionality in Scanner Radio, Action Scanner is a great app for iOS with many accolades. The Pro version is only $2.99; its advantage is more feeds, the ability to record, and much more.

The Android App Scanner Radio is my favorite for streaming scanner feeds from across the globe.

Radio-Related Apps and Tools

Following are a couple of handy apps that, while not *necessarily* intended for ham radio, SWLing, or scanning, are nonetheless indispensable to me as a radio hobbyist; you may find them just as useful as I do:

TuneIn (iOS/Android; *Free*) This remarkable app turns your Android or iOS device into a web radio; it makes your local station a global one. I use TuneIn to listen to AM stations in Australia, music from Paris, *The International Radio Report* on CKUT, the many *World Radio Network* stations, and even some international broadcasters that are no longer on shortwave radio. I now have TuneIn on all of my mobile devices.

TeamViewer (iOS/Android; *Free*) *TeamViewer* is a remote access program that allows you to login to and use your home computer. I routinely use it to control my WinRadio Excalibur SDR while travelling.

As I mentioned before, this list is, by no means, comprehensive. These are simply some of the apps I feel are well supported and have had enough time on the market to shake out some of the bugs.

Do I *really* need a smartphone to experiment with apps?

I know many people who do not care for a smartphone and prefer the standard-featured flip phone. I, too, would be in this camp if I didn't travel so often. The good thing is, there's no need to buy a smartphone and then pay for 3G or 4G services to use the apps listed above. There are many devices that run iOS and Android that are not phones at all, and simply use WiFi connections for Internet access.

If you like Apple's iOS platform, then you will want to consider an iPod touch, iPad or iPad Mini. If you prefer the Android operating system, then look at a no-contract Android phone or one of the many tablets on the market, like the Nexus 7. While the Kindle Fire is also based on the Android operating system, I've noticed that many of these apps are simply not available through Amazon. You'll note that I did not cover the Windows mobile operating system; this is because there simply aren't a lot of apps out there to choose from for this system.

In short, if you wish to use mobile apps for your radio activities, I would encourage you to consider only iOS or Android-based devices. A smartphone? That's entirely optional.

What's on My App Wish List?

I would *love* to see a comprehensive app come along that has the functionality and utility of PC programs like FLdigi. This would make a mobile device perfect for decoding digital text programs like *VOA Radiograms*; it would also make them available to people who can't afford or don't have the infrastructure for a standard computer (as in many developing countries or even DXing locales). This may take more innovation on the processing front and more global adoption, but it is happening at a very rapid pace.

I would also like to see the ARRL develop an app for the popular *Logbook of the World*; for the serious DXer who needs mobile verification, this would be quite handy.

Going Forward

Ironically, mobile technologies have drawn many who would otherwise have become ham radio or shortwave radio enthusiasts; after all, these technologies make global communications seem effortless. Still, I find that nearly any technology ultimately complements these hobbies. I turn to my smartphone for shortwave schedules, to conveniently decode Pirate Radio SSTV QSL cards, to listen to scanner feeds, and even connect to local repeaters and check in on nets.

Indeed, the rapid pace of innovation on the app front is both encouraging and energizing, but it also makes it challenging to keep up! If you like, check in on *The SWLing Post* and *QRPer.com*, where I plan to post updates and reviews of new apps as they become available.

*Thomas Witherspoon (K4SWL) is the founder and director of the charity Ears To Our World (**http://earstoourworld.org**), curator of the Shortwave Radio Archive (**http://shortwavearchive.com**) and actively blogs about shortwave radio on the SWLing Post (**http://swling.com/blog**).*

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L.A.'s New Public Safety System and Scanning Nebraska

Like many large metropolitan areas across the country, public safety agencies in Los Angeles currently use a variety of radio technologies on a number of different frequencies. This makes it difficult for neighboring first responders to communicate with each other during mutual aid events. In addition, many of these independent systems are overloaded, exceeding their design capacity as populations and service demands increase.

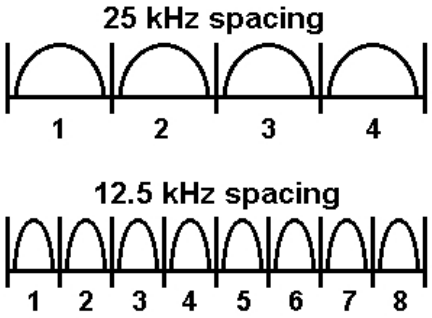
The Los Angeles Regional Interoperable Communications System Authority (LA-RICS) was formed to construct, own, operate and maintain an interoperable public safety radio system across Los Angeles County, a 4,000 square mile area with 10 million residents. LA-RICS is intended to provide voice and data services for all first responders and their support organizations by replacing the older and smaller systems operated by individual jurisdictions. By eliminating duplicative costs as well as pooling existing frequencies and repeater sites from these smaller systems, LA-RICS plans to provide better interoperability between agencies and greater overall capacity.

LA-RICS intends to ultimately operate two distinct wireless systems. The first is a traditional Land Mobile Radio (LMR) voice network that will use both analog and APCO Project 25 (P25) digital standards from 109 existing repeater sites. The second system will use a new technology called Long Term Evolution (LTE) from more than 250 repeater sites that will provide voice and high-speed ("broadband") data connectivity for public safety and commercial users.

❖ LA-RICS LMR

This summer LA-RICS chose Motorola to design, build and maintain the LMR system, scaled to provide communications for more than 80 public safety agencies in the Los Angeles region, totaling more than 34,000 law enforcement, fire and medical personnel. It will operate in the Ultra High Frequency (UHF) and 700 MHz bands, giving it the flexibility to operate on current and future public safety spectrum as the Federal Communications Commission (FCC) creates new regulations.

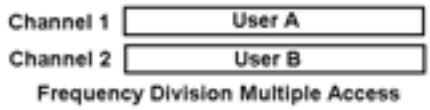
Motorola proposed the use of P25 Phase 2 for the LA-RICS LMR. Phase 1 of the P25 standards support full digital operation and meet FCC narrowbanding requirements for operation on channels that are 12.5 kHz wide. These are considered "narrow" because they are half the size of a traditional 25 kHz channel. The FCC requires narrowband operation in order to increase the number of users in a given amount of spectrum. By moving from channels that are 25 kHz wide to channels that are only 12.5 kHz wide, the FCC effectively doubles the number of available channels and can therefore expect to accommodate twice as many users. Equipment manufacturers have been able to meet this requirement through better components, tighter tolerances and improved product engineering.

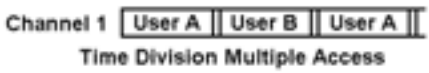


Despite the additional capacity gains achieved through narrowbanding, the FCC intends to require even more narrow channels, down to 6.25 kHz, within the next five years. Project 25 will meet this future requirement with Phase 2 standards, which are currently defined for trunked systems.

P25 Phase 2 uses a technique called Time Division Multiple Access (TDMA) to share a single 12.5 kHz channel between two users. This effectively meets the expected 6.25 kHz per user FCC requirement by splitting the channel into two "slots," allowing each user to operate only during its assigned slot. P25 Phase 2 defines a slot to be 30 milliseconds long, so one user will transmit or receive for 30 milliseconds, then wait for 30 milliseconds for the other user to take a turn, then transmit for another 30 milliseconds, and so on. The repeater site will provide a "master clock" signal to all TDMA radios, allowing them to accurately synchronize to their assigned slot.

In order to fit two independent digital voice signals into a single 12.5 kHz wide channel, P25 Phase 2 specifies the use of a newer voice encoder and decoder ("vocoder") called AMBE+2 (Advanced Multi-Band Excitation) rather than the older IMBE (Improved Multi-Band Excitation) vocoder used in Phase 1. The new vocoder uses fewer binary digits ("bits") to represent the same amount of sound than the old one, allowing both voice signals to fit in the channel.





Trunking in P25 Phase 2 will remain basically the same, still operating at 9600 baud and remaining compatible with Phase 1 radios, but some messages will now contain additional information related to TDMA activity. Phase 2 TDMA radios are expected to be "backward-compatible," meaning that they are able to operate in both the new TDMA shared mode as well as the older unshared Phase 1 mode. This becomes important when the system controller is assigning a talkgroup to a voice channel. For example, if all radios in a conversation are capable of TDMA operation, then that conversation can be assigned to a TDMA (shared) channel. However, if even one radio in the conversation is an older Phase 1 model that cannot support TDMA, the system must assign a normal (unshared) channel for the conversation and all of the radios will then operate under Phase 1 standards.

The LA-RICS contract with Motorola is worth $280 million if all the various options are exercised. Build-out is expected to take about five years. The project has a number of risks, including obtaining environmental and local authority approvals as well as landowner agreements for some of the repeater sites. These risks may lead to delays and increased costs as the project moves forward.

For those of you who follow social media, LA-RICS has a Twitter account called "TheLARICS" (no spaces or hyphens) that carries information about various network activities.

❖ Nebraska Wireless Interoperable Network

A consortium of local governments in Nebraska is establishing a statewide data network called the Nebraska Regional Interoperability Network (NRIN) as part of the Nebraska Wireless Interoperable Network (N-WIN).

More than 200 sites across the state, including communications towers, water towers, tall buildings and even grain elevators will be linked together via microwave. The build-out is being managed by the Nebraska Emergency Management Agency (NEMA). The intent of NRIN is to allow Public Safety Answering Points (PSAPs) to utilize shared network resources, especially those serving rural areas. The Nebraska Public Power District (NPPD) will also use it to communicate with repair and maintenance crews. Future plans include the ability of local public safety agencies to join the network.

NRIN will be organized into eight regional rings that will carry Internet Protocol (IP) traffic over microwave links, specifically data, voice and video related to emergency communications. Existing towers and equipment will be used wherever possible. Completion of all the rings is expected by late summer of next year.

Another component of N-WIN that will benefit from this new data network is Nebraska's Statewide Radio System (SRS), a Project-25 digital trunked radio system operating in the VHF band. It was developed through a partnership between the state government and Nebraska Public Power District (NPPD), the largest electric utility in the state. Both partners were looking for better radio communications throughout the state and rather than each build a separate network, they agreed to split the cost of developing a single, shared network for use by public safety personnel and utility crews.

Phase 1 of SRS went live in September 2009, providing coverage in the western quarter of the state, called the Panhandle region. Additional phases brought coverage eastward, and in 2011 the $17 million system was fully operational. It currently serves a dozen state agencies, the Lincoln County Sheriff's Office, and the NPPD from 51 repeater sites across all 93 counties in the state.

However, not all is well with SRS. The system generated more than 500 problem reports in 2012 and has failed more than once during critical situations where law enforcement officers were wounded. In some of these incidents officers ended up using personal cellular telephones and even writing messages that were delivered by hand. Problems include garbled transmissions, lack of signal, and constant busy indicators when trying to contact dispatchers.

In May the state legislature voted to spend $1.4 million to add three new repeater sites intended to eliminate dead spots where there is poor or non-existent coverage.

It's been an uphill battle for the state to convince local agencies to join the system, not only because of publicized problems but also because of cost. Many agencies are still using analog radios and cannot afford to purchase the new digital radios that are required to join the system.

❖ Nebraska Common Usage Channels

To improve interoperability, Nebraska has a plan for a network of analog base stations that will use common, well-defined frequencies that will allow the Nebraska State Patrol (NSP) to communicate with local first responders, regardless of what equipment they may be using. Each of these base stations will operate on 12.5 kHz (narrowband) channels and transmit at 100 watts. Analog modulation will be used as the "lowest common denominator" to support the largest number and variety of radios.

Due to the large number of local agencies using VHF (Very High Frequency) radios, base stations are expected to provide VHF coverage in all areas of the state. Ultra High Frequency (UHF) coverage is needed along the Interstate 80 corridor and all areas south of the Interstate, as well as other areas that are already using UHF radios. Base stations providing service in the 800 MHz band will be needed in those areas where local agencies currently operate or are planning to operate in the band.

The following is a list of base station frequencies and the associated channel names. Frequencies identified as "Transmit and Receive" will operate in simplex mode, meaning that both the base station and the mobile radios will transmit and receive on that frequency. Frequencies marked as "Transmit" or "Receive" are operating in duplex mode, where the base station transmits on the "Transmit" frequency and receives the mobile's transmission on the "Receive" frequency.

Frequency	Name	Traffic
155.7525	VCALL10	Transmit and Receive
154.4525	VTAC12	Transmit and Receive
158.7375	VTAC13	Transmit and Receive
159.4725	VTAC14	Transmit and Receive
453.2125	UCALL40	Transmit and Receive
453.4625	UTAC41	Transmit and Receive
453.7125	UTAC42	Transmit and Receive
453.8625	UTAC43	Transmit
458.8625	UTAC43	Receive
851.0125	8CALL90	Transmit and Receive
851.5125	8TAC91	Transmit
806.5125	8TAC91	Receive
852.0125	8TAC92	Transmit
807.0125	8TAC92	Receive
852.5125	8TAC93	Transmit
807.5125	8TAC93	Receive
853.0125	8TAC94	Transmit
808.0125	8TAC94	Receive

There are also two talk-around channels that can be used by the radios to communicate directly with each other without needing the base station (to "talk around" the repeater).

Frequency	Name	Traffic
151.1375	VTAC11	Transmit and Receive (Mobile Only)
155.4750	VLAW31	Transmit and Receive (Mobile Only)

❖ Monitoring

Nebraska's SRS can be monitored by most late model digital scanners. Because it is a "pure Project 25" trunked system, meaning that it uses the P25 "9600-baud" standard for trunking control rather than the older Motorola "3600-baud" channel, you will need a scanner that can monitor the P25 control channel. First generation digital models like the Uniden BC250D and BC785D cannot do this and thus cannot track conversations on the system. Later models like the Uniden BC296D and BC796D as well as the Radio Shack PRO-96 and PRO-2096 may work but will require the use of a band plan in order to properly track activity in the VHF band.

The following scanners are able to track the SRS without difficulty:

Manufacturer	Scanners
GRE	PSR-500, PSR-600, PSR-800
Radio Shack	PRO-18, PRO-106, PRO-197
Uniden	BCD396T, BCD396XT, BCD996T, BCD996XT, HomePatrol-1

The following is a list of frequencies in the use and the county in which the associated repeater site is located. VHF typically has good propagation characteristics, so you should be able to monitor these sites from a significant distance.

County	Frequencies
Antelope	154.7625, 154.9425, 155.3175, 155.5050
Arthur	154.8750, 155.5800, 155.8200, 156.2400
Boyd	154.1300, 154.6800, 155.1900, 155.4600
Buffalo	154.1750, 154.3700, 154.9650, 155.4375
Burt	169.8125, 172.5875, 172.7750, 173.8250
Cass	169.7750, 172.5750, 172.7500, 173.8250
Cedar	154.0100, 154.6800, 155.3100, 155.5650
Chase	155.2500, 155.5050, 155.8050, 156.1200
Cherry	154.3400, 154.7250, 155.1075, 155.4150
Cherry	154.4075, 154.8675, 155.1300, 155.5200
Cheyenne	154.4000, 154.7100, 155.1150, 155.6100
Custer	154.2950, 154.9050, 155.5200, 155.7300
Custer	155.0100, 155.2425, 155.5350, 155.9550
Dakota	169.7750, 172.5750, 172.7500, 173.7625
Dawes	154.3325, 154.8450, 155.1450, 155.5050
Dawson	154.2725, 154.6575, 155.3550, 155.6775
Douglas	171.4375, 172.2875, 172.6000, 173.7625
Franklin	154.1600, 154.3550, 154.7100, 154.9800
Furnas	154.4300, 154.8450, 155.4450, 155.7900
Gage	154.3100, 154.9650, 155.1900, 155.6550
Garden	154.7250, 154.9425, 155.6325, 155.8875
Garden	154.7850, 155.5425, 155.7225, 156.1275
Grant	154.2125, 154.6575, 154.9125, 155.1675
Greeley	154.8450, 155.1900, 155.4600, 155.6400
Hamilton	154.3250, 154.6950, 154.9125, 155.3100, 155.5275
Hayes	154.7850, 155.0700, 155.3700, 155.6550
Holt	155.4300, 155.6925, 155.8725, 156.2325
Johnson	169.8125, 171.7500, 173.4500, 173.8125
Keith	155.1900, 155.4075, 155.6625, 155.9625
Keya Paha	154.9575, 155.2500, 155.6025, 155.8800
Kimball	155.1450, 155.4600, 155.7300, 156.0900
Knox	154.6950, 154.9200, 155.3700, 155.6475
Lancaster	154.2125, 154.6875, 154.9350, 155.5800
Lincoln	155.4300, 155.6400, 155.8950, 156.1350
Madison	154.3250, 154.9050, 155.2500, 155.5875
Morrill	154.6800, 155.3625, 155.7975, 156.2175
Nuckolls	154.1825, 154.4000, 154.6650, 154.8750
Otoe	154.7850, 155.0850, 155.4600, 155.7000
Phelps	154.2200, 154.9350, 155.5050, 156.1275
Platte	155.1375, 155.5350, 155.9100, 156.1500
Polk	154.6575, 155.3550, 155.6250, 155.9700
Red Willow	154.0850, 154.3400, 154.6800, 155.0100
Richardson	169.7875, 171.7750, 172.5875, 172.7750
Rock	154.1900, 154.8225, 155.1000, 155.4450
Saunders	169.7875, 171.2625, 172.6250, 173.9125
Scotts Bluff	154.2875, 154.6950, 155.1900, 155.6925
Seward	154.1600, 154.8600, 155.5650, 156.2100
Sheridan	154.3625, 154.6725, 155.0325, 155.4375
Sheridan	154.8075, 155.0925, 155.5650, 155.8650
Sioux	154.1825, 155.4000, 155.6625, 156.1425
Thomas	155.0625, 155.3625, 155.7000, 156.2100
York	154.4225, 154.7775, 155.5125, 156.1425

Some reported talkgroups on the system are as follows:

Dec	Hex	Description
3002	BBA	State Patrol Troop A (Dispatch 5 Encrypted)
3010	BC2	State Patrol Troop B (Encrypted 2)
3012	BC4	State Patrol Troop B (Encrypted 1)
3013	BC5	State Patrol Troop B (Encrypted 4)
3014	BC6	State Patrol Troop B (Encrypted 3)
3015	BC7	State Patrol Troop B
3020	BCC	State Patrol Headquarters (Dispatch Beatrice)
3022	BCE	State Patrol Troop E (Dispatch Interstate 80)
3025	BD1	State Patrol Troop C (Encrypted)
3028	BD4	State Patrol Troop C (Car-to-Car 1)
3029	BD5	State Patrol Troop C (Car-to-Car 2)
3030	BD6	State Patrol Troop C (Car-to-Car 3)
3031	BD7	State Patrol Troop C (Car-to-Car Encrypted)
3034	BDA	State Patrol Troop B (Encrypted 5)
3036	BDC	State Patrol Troop D (Encrypted)
3039	BDF	State Patrol Troop D (Car-to-Car)
3044	BE4	Nebraska Department of Roads (All)
3046	BE6	Nebraska Department of Roads (District 5)
3047	BE7	Nebraska Department of Roads (District 4)
3048	BE8	Nebraska Department of Roads (District 7)
3049	BE9	Nebraska Department of Roads (District 6)
3052	BEC	State Patrol Troop E (Encrypted)
3055	BEF	State Patrol Troop E (Aircraft)
3060	BF4	Mutual Aid (Statewide)
3071	BFF	State Patrol Headquarters (Dispatch 1)
3073	C01	State Patrol Headquarters (Dispatch 3)
3075	C03	State Patrol Troop A (Dispatch 1)
3076	C04	State Patrol Troop A (Dispatch 2 Encrypted)
3077	C05	State Patrol Troop A (Dispatch 3)
3078	C06	State Patrol Troop A (Dispatch 4 Encrypted)
3079	C07	State Patrol Troop B (Dispatch 1)
3081	C09	State Patrol Troop C (Dispatch 3)
3083	C0B	State Patrol Troop D (Dispatch 1)
3085	C0D	State Patrol Troop D (Dispatch 3)
3087	C0F	State Patrol Troop B (Dispatch 3)
3089	C11	State Patrol Troop E (Dispatch)
3092	C14	State Patrol Troop C (Dispatch 1)
3094	C16	State Patrol Headquarters (Encrypted)
3097	C19	State Patrol Headquarters (Car-to-Car 1)
3098	C1A	State Patrol Headquarters (Car to Car 2)
3106	C22	State Patrol Headquarters (Dispatch Lincoln)
3110	C26	State Patrol Troop B (Operations)
3114	C2A	State Patrol (Dispatch Omaha)
3117	C2D	State Fire Marshal (Tactical)
3118	C2E	State Fire Marshal (Tactical 2)
3124	C34	Nebraska Department of Roads (Statewide)
3252	CB4	NPPD Switching 3
3522	DC2	NPPD Lexington Service Center
3524	DC4	NPPD Kearney Tranmission Crew
3526	DC6	NPPD Switching 1
3527	DC7	NPPD Switching 2
3529	DC9	NPPD Kearney Contol 2
3530	DCA	NPPD Norfolk Dispatch
3532	DCC	NPPD Kearney Control
3534	DCE	NPPD Plattsmouth Service
3535	DCF	NPPD York Service
3538	DD2	NPPD Work 1
3539	DD3	NPPD Work 2
3540	DD4	NPPD McCook Service
3541	DD5	NPPD Doniphan Service
3543	DD7	NPPD Norfolk Service
3544	DD8	NPPD Work 3
3545	DD9	NPPD South Sioux City Service
3546	DDA	NPPD Norfolk Technical Operations Center
3547	DDB	NPPD Norfolk Transmission Crew
3549	DDD	NPPD Chadron Control
3550	DDE	NPPD Ogallala
3551	DDF	NPPD Work 4
3552	DE0	NPPD North Platte Transmission Crew
3558	DE6	NPPD Work 5
3559	DE7	NPPD Vehicle Maintenance
3563	DEB	NPPD Vehicle Maintenance
3564	DEC	NPPD Technical Operations Center
4502	1196	Lincoln Electric Systems
6000	1770	Radio Testing and Maintenance
6001	1771	Radio Testing and Maintenance
50010	C35A	Nebraska Emergency Management Agency
50030	C36E	Nebraska Emergency Management Agency
51500	C92C	Lincoln County Law Enforcement
60005	EA65	State Fire Marshal (Dispatch District B)
60006	EA66	State Fire Marshal (Dispatch District C)
60132	EAE4	Lincoln Correctional Center
60251	EB5B	Nebraska Game and Parks (Dispatch Panhandle)
60263	EB67	Nebraska Game and Parks (Dispatch Eastern)

More information on Project 25 as well as other radio-related topics are available on my web site at **www.signalharbor.com**. I welcome your questions, comments and frequency lists via electronic mail to *danveeneman@monitoringtimes.com*.

ASK BOB
GENERAL QUESTIONS RELATED TO RADIO

Bob Grove, W8JHD
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Correction from September's Ask Bob

Sharp-eyed reader, Carl Schmidt WA8ZTZ, caught a slip of my math fingers in the September column. While I was correct that an S-meter shows 6 dB signal change per S unit, that is a voltage change, not a power change, and it is produced by a factor of two; either doubling the voltage or halving the voltage.

Since the impedance (RF resistance) remains the same, Ohm's law shows that when the voltage doubles or halves, the amps will double or halve as well (ohms = volts / amps), so the power will change by a factor of four (watts = amps x volts).

Q. *I live in a townhouse and currently have an HF dipole in my attic for my ham antenna. It worked fairly well for me, 138 countries and counting, but my reception isn't all that great due to electrical noise. What are your thoughts on the LF Engineering H-900 outside on the deck at night or even in the window in my shack. (Brian Keefe K3BAK)*

A. Assuming you are using coax lead-in with your DX-EE, the noise is directly attributable to the antenna location. Since you can't (or at least choose not to) put the antenna outdoors due to its size, I think you would be way ahead in reception with the H800 or H900 mounted outside instead.

This active antenna is very popular for receiving and we get many good comments from users. Try to keep it outdoors as far from household noise generators such as electrical wiring, electronic appliances, and fluorescent lights as possible.

Q. *I have an old portable radio that shuts down if I brush against the cord on the AC adapter. I can get it operational again if I slightly re-position the wire. I'm not sure whether the adapter is defective or if the radio jack is somehow causing the problem. (Steve Thompson, Scottsdale, AZ)*

A. There is either a loose connection at the jack (most likely) or at the adaptor. There could be an intermittent short circuit caused from stretching or wiggling the wire, thus developing a bare spot between the two conductors, most likely at the plug.

If you can get a voltmeter, simply attach the prods securely to the plug at the end of the AC adapter cable and wiggle the wires at both ends to see if that causes the reading to jump up and down. If it does, that's where the problem is.

If it's at the plug, you may need to snip it off and solder a replacement on it. If it's at the adapter end and you can't see what the problem is, you'll probably have to replace the adapter.

If it's not on the adapter or cable, then it could be a loose connection on the jack in the radio. This can be caused by corrosion (twist the plug back and forth in the jack to see if you can duplicate the problem), or by an internal contact in that jack that makes and breaks a connection from the batteries when the AC adapter is plugged in or out.

Q. *I just got a TV dish installed. Why do I lose the signal when rains move in? (Mark Burns, Terre Haute, IN)*

A. The signals at the ultra-high (microwave) frequencies that the satellites broadcast on are absorbed by moisture. That's why receiving dish antennas have to be pointed away from intruding leafy trees, and why even rain-saturated clouds can block signals.

Q. *Why did the government switch from the long-standing Data Encryption Standard (DES) to the Advanced Encryption Standard (AES) for communications privacy?*

A. DES, developed around 1977, has been cracked. AES, developed in 2000, is considered secure. According to the Journal of Computing (**http://arxiv.org/ftp/arxiv/papers/1003/1003.4085.pdf**), for even the shortest key length (128 bits), it would take a computer running at 50 billion keys per second 5,000,000,000,000,000,000,000 (five quintillion) years to crack!

Q. *There seems to be an increasing interest in vinyl phonograph records. Why? (Mark Burns, Terre haute, IN)*

A. Psychologically, it helps people escape from some of the harsh realities of present-day life, returning them to those times perceived as simpler and happier. It has "retro" appeal, like '50s or '60s music, disco, and vacuum tube amplifiers. Technically, some report a perceived "smoothness" to vinyl sound (and tube-type amplifiers) that they can't seem to find in digital recording and solid-state sound equipment.

Q. *I am just getting back into shortwave listening and would appreciate a few hints about antenna installation. (Steve McLaughlin, NM)*

A. Most important is distance from interference generators such as indoor electronic accessories, household wiring, and power lines. It would be best to run the wire away from the house to a tree rather than confine the antenna to the roof. Definitely bring the signal in through coaxial cable to prevent the intrusion of indoor electrical interference on the feedline.

A height of at least 15 feet above ground has always worked well for me. Wire length of some 25 to 50 feet or so is certainly adequate. Since you are going to be tuning your receiver over a 30:1 change in frequency range, there is no specifically-resonant antenna length.

An east/west wire alignment is fine, since that means the wire's axis will be receiving north/south off its sides, favoring Europe and Asia as well as South America and, to a degree, Africa. Lesser heard will be off the ends of the wire.

An actual earth ground is probably unnecessary. You can try a ground rod to see if it helps reduce interference, but it won't increase signal strength.

The use of a lightning arrestor is recommended. Nothing can survive a direct lightning strike, but nearby strokes can induce high voltages on an antenna line that can damage a radio, and the arrestor short-circuits these harmlessly.

Q. *I bought a rooftop scanner antenna, but it's not picking up signals as well as the little indoor 18" whip. I've even replaced the antenna and balun transformer with the same results. What gives? (Gary Hickerson, email)*

A. Assuming that the balun transformer is OK and that it's properly connected to the two sets of elements, the problem is most certainly in the cable or connectors.

Make sure you have a center conductor long enough to come about flush with the socket onto which it screws. Test the cable with an ohmmeter for shorts and opens. You should get a reading of a few ohms from end to end of the center wire and the same when you measure shield to shield, but you should not get any reading when you measure center wire to shield.

Occasionally, while fitting a connector to a socket, the center wire gets bent over; check that, too.

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.)

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CLP44: Cuba's Getting Strange Again

A long time ago, in a country not far away, the Cuban foreign ministry used a world-spanning radio teletype (RTTY) network for diplomatic communications. At the time, a lot of countries had these. Today, most are gone.

The headquarters station identified as MINREX, the *Ministerio de Relaciones Exteriores*. Embassies usually identified as "EMBACUBA" plus the country name. Press briefings, sometimes ending with "PRENSA MINREX," were sent in Spanish or French plain text. Stations also sent offline encrypted messages in 5-figure groups.

Cuban foreign ministry logo.

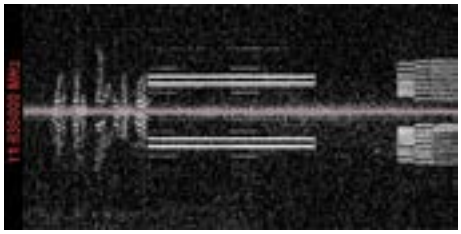
All of this vanished around the turn of the century, the same way most RTTY did. By now, it's long gone. Or is it?

❖ CLP44?

"CLP" was the call sign prefix used by all stations. CLP1 was the Ministry in Havana. CLP13 was in New York City, presumably attached to the United Nations mission in some way.

No one expected to hear CLP44, the old Zimbabwe embassy call, ever again on the radio. But someone did. Around the start of September, at the height of the Syria chemical weapons crisis, listeners on both sides of the Atlantic heard a number of transmissions from CLP44, CLP10 (unknown), and CLP5 (formerly Algiers).

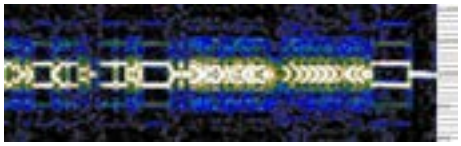
Everything about this communication is bizarre. For a start, they'd ditched RTTY for PSK31, an amateur radio digital mode. The PSK stands for phase-shift keying, and 31 is the baud rate. For hair-splitters, the rate is actually 31.25 but, either way, this translates out as SLOW.



Spectrum showing HM01 speech and data initiation (Courtesy: the author).

The slow speed was designed in, because it is perfect for ham "rag chewing," where people sit and shoot the breeze, or in this case, the bits. It's called "keyboard to keyboard" contact, though most hams also include an automatic "brag file" with details of their location, equipment, software, and the like.

All of this makes PSK31 very popular with hams. It's insect-like whine can be heard around 14070 kilohertz (kHz) any time the band is open. It's easy to copy, and lots of free software decodes it.



Received PSK31 signal showing phase reversals (Courtesy: the author).

Indeed, the Spanish speakers at the CLP stations "talked" like hams. Now, any operator chatter is probably between technically inclined peers, and so it often looks a bit like ham radio. Here, though, it looked a lot like ham radio.

The essential content was signal reports, as one would expect. Everything else could have been two guys having at it on 20 meters. They laughed the way hams do on-air, by sending "HI," the ancient Morse version of the modern Internet's "LOL." They joked about their low-end terminals, just Windows computers running a popular ham package. They even said "73" (best regards) and "88" (love and kisses).

One rarely, if ever, sees signal testing, during a grave international crisis, in which someone says love and kisses. Are these guys legitimate, or just having some fun? Is Cuba, as is its way, adapting common off-the-shelf freeware on old computers for more serious stuff? This wouldn't be the first time, as witness the use of PSK31 for the "numbers," before those went to another amateur mode called Redundant Digital File Transfer (RDFT).

Right now, it's all typically mysterious. The frequencies used were 19051.8 and 19150 kHz. So far nothing's made it to California, so this editor cannot verify these.

Let's hope this continues. We need some fun right now.

❖ Cuban Numbers Update

Right now, Cuban "numbers" stations are more interesting for what they are NOT doing. The voice "female," designated V02a on the official Enigma list, is nearly gone, except for the usual oops-wrong-mode engineering goofs. Enigma, of course, is ENIGMA 2000, the online incarnation of the authoritative European Numbers Information Gathering and Monitoring Association.

Nearly all current broadcasts use the "hybrid" mode, Enigma HM01, where the voice identifies messages that are then sent digitally. It uses Redundant Digital File Transfer (RDFT), another ham mode, which does exactly what the name implies.

One owes it to themselves to hear HM01. It's strange. The signal is plain old double-sideband, full-carrier, amplitude modulation (AM).

Originally, many people thought it was utterly demented to send amateur sound-card digital-tone modes over what is essentially a broadcast transmitter. However, this may have actually been innovative. Voice of America and Radio Australia are now experimenting with a similar idea, using the more robust multiple frequency-shift keying (MFSK) mode.

HM01 is the descendent of Cuba's original digital numbers experiments, which started out, once again, in PSK31. This explains why Enigma designated the original all-digital broadcasts as SK01. SK01, by whatever mode, also appears to be gone. HM01 is definitely the mode of choice for nearly everything from Cuba.

HM01 is still using an extensive weekly cycle. The best idea is to grab hold of an Enigma newsletter and use their handy chart. They'd love to see your reports as well, preferably in a log format that is also published there.

Transmissions tend to start on the hour, plus or minus Cuban sloppiness, around 10 times a day. Look for them on 5855, 9065, 9155, 9240, 9330, 10345, 10715, 11435, 11530, 11635, 12120, 12180, 13435, 14375, 16180, 17450, and 17480. Thanks to Enigma for these.

Cuban Morse code, Enigma M08a, is not dead, despite persistent rumors of its demise. It's down to about three schedules. These are weekdays at 2000 Coordinated Universal Time (UTC) on 7554 kHz, and at least a couple of times a week at 2300 on 8009. These are usually straight on-off-keyed "continuous wave" (CW), though modulated CW is sometimes used.

For whatever reasons, U.S. listeners seem less interested in Cuban numbers than before. Perhaps it is because the messages do not change anywhere near as often as they once did. Perhaps it is the general opacity of RDFT, with its lack of readily available and reliable decoding software. Or maybe it's just the lack of that mysterious "female" voice.

❖ UVB-76 Syria Messages?

Much is made of the Russian "Buzzer" on 4625 kHz AM, with a reduced carrier and a largely suppressed lower sideband. Its call isn't really UVB-76, and most current messages go out with the identifier or call-up "MDZhB." "Zh" is a Cyrillic character transliterated into the Latin alphabet.

These messages, Enigma S28, are presumably strategic broadcasts, a bit like the U.S. SKYKING. However, there are far more rare.

There's no attempt at dummy traffic. When something happens, there'll be a brief flurry, then it's back to the buzz for weeks at a time.

For whatever it's worth, a very impressive run of 12 such messages went out at a time very close to when news broke of the chemical attack in Syria. Russia has a definite interest in the region, and this is probably not random. UVB-76, or whatever, is definitely worth checking any time things heat up over there.

❖ Two to Go

There has been some interest in continuing the logs after this column ceases to exist. Well, why not? This column's blog will continue, though it would be fun to think of a new name for it. Just keep sending them to the same e-mail address as now. It's too much trouble to change the name of that one. It'll stay **mtutilityworld@gmail.com**.

Another good place to pick up timely utility information is via Internet Relay Chat (IRC). IRC doesn't have the best reputation. It's best not to download anything. It's also pretty geeky. However, the server they use, StarChat, seems safe enough. The channels are named #monitor and #wunclub. "Wun" stands for Worldwide Utility News, the predecessor to UDXF. There's also a robotic logging system available by subscription.

A worthwhile message board is at **www.hfunderground.com.** This is Chris Smolinski's HF Underground site, which also includes a wiki and a blog. While it started out specializing in pirate radio and numbers, it's grown to include forums on just about anything that communicates via radio waves. I'll be back next month to wrap up a long and successful run.

ABBREVIATIONS USED IN THIS COLUMN

ALE.....Automatic Link Establishment
AM.....Amplitude Modulation
BOM.....Australian Bureau of Meteorology
Camslant.....Communications Area Master Station, Atlantic
Camspac.....Communications Area Master Station, Pacific
CW.....On-off keyed "Continuous Wave" Morse telegraphy
DHFCS.....UK Defense High-Frequency Communications Service
DSC.....Digital Selective Calling
E07a.....Numbers in English machine voice from Russia
E11/E11a.....“Stritch” family numbers, in English
FAX.....Radiofacsimile
FEMA.....U.S. Federal Emergency Management Agency
FSK.....Frequency-Shift Keying
G11.....“Stritch” family numbers, in German
HFDL.....High Frequency Data Link
HFGCS.....High Frequency Global Communications System
HiFer.....High Frequency Experimental Radio
HM01.....Cuban AM “hybrid” mode, voice plus digital
ID.....Station identification
LSB.....Lower Sideband
M03.....CW version of “Stritch” family
M12.....Russian CW version of E07, etc
M21.....Russian CW time stamped tracking datagrams
M51.....French CW training, format like FAV22
M89.....Chinese CW numbers with changing 4-figure calls
MARS.....U.S. Military Auxiliary Radio System
MCW.....Modulated CW, includes AM with tones
MFA.....Ministry of Foreign Affairs
MFSK.....Multiple Frequency-Shift Keying
MX.....Generic for Russian single-letter beacons/markers
NATO.....North Atlantic Treaty Organization
NAWS.....Group call: Notice to Allied War Ships
NDB.....Non-Directional Beacon
NOAA.....U.S. Natl. Oceanic and Atmospheric Administration
Pactor.....Packet Teleprinting Over Radio, modes I-IV
RAF.....UK Royal Air Force
RTTY.....Radio Teletype
S28.....Russian “buzzer”/ UVB-76/ MDZhB; strategic msgs
Selcal.....Selective Calling
SHARES.....Shared Resources, U.S. Federal frequency pool
Sitor.....Simplex Telex Over Radio, modes A & B
TSC.....Tactical Support Center
UK.....United Kingdom
Unid.....Unidentified
U.S.....United States
USAF.....U.S. Air Force
USCG.....U.S. Coast Guard
USN.....U.S. Navy
USS.....United States Ship
VHF.....Very High Frequency (30-300 megahertz)
Volmet.....Scheduled, formatted, aviation weather broadcasts
XPA.....Russian Polytone, 20-tone mode

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 ().

18.1 RDL-Russian military stragegic broadcast, routine 5-figure-group message in FSK Morse, at 1337 (MPJ-UK).
332.0 SHM-NDB, Shoreham, UK, ID in MCW at 2158 (Robert Homuth-UK Remote).
339.0 BIA-NDB, Bournemouth, UK, MCW ID at 2143 (Homuth-UK).
351.0 WOD-NDB, Woodley, UK, MCW ID at 2144 (Homuth-UK).
383.0 ALD-NDB, Alderney, UK, MCW ID at 2146 (Homuth-UK).
391.5 EAS-NDB, Southampton/ Eastleigh Airport, MCW ID at 2147 (Homuth-UK).
414.0 BRI-NDB, Bristol, UK, MCW ID at 2148 (Homuth-UK).
421.0 BUR-NDB, Burhnam, UK, MCW ID at 2154 (Homuth-UK).
1640.0 WPSH468-Manville, NJ Department of Emergency Management, recorded female with information bulletins, then repeat of the VHF NOAA weather broadcast, at 1316 (Mario Filippi-NJ).
3815.0 269-Unknown agency, numbers in German (G11), callup 269/38 and 5-figure-group message, at 2000 (MPJ-UK).
4517.0 AFE5DM-USAF MARS, IL, net control with voice and data modes, at 0210 (Jack Metcalfe-KY).
4593.5 Unid-USAF MARS, with unknown stations discussing hurricane readiness, at 0006 (Filippi-NJ).
4610.0 GYA-UK Navy, Northwood, FAX Western Europe chart, at 0045 (Filippi-NJ).
4625.0 MDZhB-12 voice messages on Russian AM "Buzzer" (S28), starting with "MDZhB 01 394 GARDKOT 26 57 70 11, Priyom," at 0826 (Boender-Netherlands). *[This is right after news of the Syria chemical attack. -Hugh]*
4703.0 Golf Whiskey-U.S. Navy, busy tracking net with Hotel, Sierra, and Tango, at 2310 (Metcalfe-KY).
4904.0 Unid-Russian Air Defense (M21), usual CW null-message tracking strings, at 2014 (MPJ-UK).
5125.0 VTK3-Indian Navy, Tuticorin, CW marker at 1855 (MPJ-UK).
5287.0 31V3-Swedish Military, calling 32V1, ALE at 1612 (Boender-Netherlands).
5361.5 B04MECARIBOU-U.S. National Guard, ME, also PRO12, ALE soundings at 0105 (Metcalfe-KY).
5680.0 Kinloss Rescue-UK Aeronautical Rescue Coordination Centre, Scotland, working Rescue 169 (RAF Sea King helo) regarding a patient, at 1704 (MDMonitor-Netherlands Remote).
5687.0 DHM91-German Air Force transport command, Münster, radio checks with GAF 101, at 1658 (MDMonitor-Netherlands).
5790.0 DQ10-Algerian military, calling EH15, also on 5790, 8080, and 11973; ALE at 1835 (Boender-Netherlands).
5815.0 270-G11, null-message callup 270/00, at 1755 (MPJ-UK).
6358.5 PBB-Dutch Navy, Den Helder, RTTY channel availability marker at 0643 (Boender-Netherlands).
6501.0 NMN-USCG Camslang Chesapeake, VA, "Iron Mike" voice with maritime weather forecast including Tropical Storm Dorian, at 1126 (Filippi-NJ).
6524.0 798-M03, CW callup 798/31 and 5-figure-group message, at 1535 (MPJ-UK).
6606.0 4XZ-Israeli Navy, CW ID and coded messages in 5-letter groups, at 0215 (Tony Agnelli-FL).
6685.0 Davlenie-Russian Air Force, Taganrog; radio checks in Russian with Korsar (Pskov), Klarnetist (Tver), and Proselok (Bryansk); at 1802 (MDMonitor-Netherlands).
6777.5 140SHP-U.S. 140th Military Intelligence Batallion (Combat Electronic Warfare Intelligence), Larissa, Greece, calling 2SHER, ALE at 1836 (Boender-Netherlands).
6865.0 XSS-UK DHFCS, Forest Moor, working XPU in ALE; similar on 8107, 11217, 12230, and 16350; at 1103 (Boender-Netherlands).
7320.0 Unid-Probable U.S. truck drivers, extensive off-color chatter, at 2224 (Metcalfe-KY).
7378.5 NNN0HTE-U.S. Navy MARS, net with NNN0LBJ, at 2227 (Metcalfe-KY).
7441.5 011CDCNHQ-New frequency for U.S. Centers for Disease Control, GA, also on 9250.5 (another new one), with ALE soundings at 1950 (Metcalfe-KY).
7473.0 147-Russian Intelligence "English Man" (E07a), null-message callup 147/00, parallel on 8173, AM at 2020 (MPJ-UK).
7588.5 AAR6IN-U.S. Army MARS, in propagation tests, also on 8066 and 9303.5, at 1900 (Metcalfe-KY).
7837.0 650-Unknown agency, CW numbers (M03), callup 650/36 and 5-figure-group message, at 1115. 650-M03, different CW 5-figure-group message, also at 1115 (MPJ-UK).
7837.2 270-M03, CW callup 270/30 and 5-figure-group message jammed by another CW station, at 1115. 437-M03, CW null-message callup 437/00, at 1420 (MPJ-UK).
7975.0 NS4NS13-Possible U.S. military, calling NS6NS13, also on 9069, ALE at 1258 (Metcalfe-KY).
8066.0 Alamo Command-U.S. National Guard, TX, working Sierra 6 and AAR6IN (U.S. Army MARS), at 1915 (Metcalfe-KY).
8132.0 BP21-German Federal Police boat 21 *Bredstedt* (DLGZ), working BPLEZS, control in Cuxhaven, at 1653 (MPJ-UK).
8416.5 NMC-USCG Camspac Pt. Reyes, CA, navigation messages in Sitor-B, at 0120. NMF-USCG, Boston, MA, Sitor-B bulletin about survivors in a lifeboat, at 0200 (Agnelli-FL).

8473.0 WLO-ShipCom, AL, RTTY weather for Gulf and North Atlantic, at 0030 (Agnelli-FL). WLO-RTTY "RYRY" test loop, at 1216 (Filippi-NJ).

8885.0 VT-JWE-Old reg for A6-EYZ, an Air Seychelles A330 flight SEY086, HFDL position for Al Muharraq, Bahrain, at 2022 (MPJ-UK).

8909.0 Aircraft 3097-Russian strategic forces, message relay in Russian through Aircraft 05543 to Otchtiska, at 2119 (MDMonitor-Netherlands).

8942.0 "07"-HFDL ground station, Shannon, Ireland, squitters at 0728. DAH100-Air Algerie flight, HFDL position for Shannon, at 0733 (Boender-Netherlands). Navy TH 101-Unknown USN aircraft, oceanic air traffic control with Singapore and Ho Chi Minh Ville, at 1115 (Larry Van Horn-NC).

8971.0 Quartet 713-USN P-3C, clear and secure with Fiddle (TSC Jacksonville, FL), at 1946 (Metcalfe-KY). Cardfile 71E-USN P-3C, clear and secure with High Voltage (TSC Jacksonville), at 2245 (Allan Stern-FL).

8977.0 VQ-BHE-Air Bridge Cargo B747 freighter, flight RU0740, HFDL log-on with Reykjavik, at 2022 (MPJ-UK).

8983.0 Camslant-USCG Camslant Chesapeake, working Coast Guard 1503, an HC-130H, at 2325 (Stern-FL).

9025.0 170041-USAF C-5B #87-0041, ALE sounding at 0010 (MDMonitor-Netherlands). 40185-USAF KC-10A tanker #84-0185, ALE sounding at 1915 (PPA-Netherlands).

9028.0 Golf Foxtrot-USN tracking net for the USS *George H.W. Bush* Battle Group, working Uniform and Sierra, at 1923 (Metcalfe-KY).

9031.0 Dry Sand-U.S. military, coordinating data training on another frequency with Bill Hawk, at 1935 (Metcalfe-KY).

9043.0 A76-Chinese military, working M01, ALE at 1822 (PPA-Netherlands).

9045.0 "Aircraft N21NE"-Gulfstream G-V bizjet, quick radio check with (sounded like) Gulfstream Radio, at 1815 (Metcalfe-KY).

9057.0 AA1-Israeli Air Force, ALE sounding at 1857 (PPA-Netherlands).

9106.0 RGI-Saudi Arabian military, calling JDI, ALE at 0049. WWLNNN-USN MARS station NNN0WWL, NC, ALE sounding at 0503. KGD34NCC-SHARES net control, VA, ALE sounding at 2359 (Boender-Netherlands).

9110.0 NMF-USCG, Boston, MA, FAX weather chart at 2114 (Boender-Netherlands).

9117.0 JDN-Saudi Arabian Air Force, calling RGN, also on 12115, ALE at 2131 (Boender-Netherlands).

9122.5 WUG 6-U.S. Army Corps of Engineers, MN, no joy calling WUG 7 (unknown), at 1923 (Metcalfe-KY).

9176.0 257-Russian Intelligence CW (M12), callup "257/1 4579 98" and 5-figure-group message, at 1700. 257-M12, "257/1 8819 108" and 5-figure-group message, CW at 1800. 257-M12, "257/1 7463 66" and 5-figure-group message, CW at 1900 (MPJ-UK).

9213.5 Unid-French military CW training (M51), coded drill messages in 5-letter groups, at 2130 (Metcalfe-KY).

9610.0 466-Unknown agency, numbers in English (E11), callup 466/31 and 5-figure-group message, at 1045 (MPJ-UK).

10000.0 PPE-Brazilian Observatorio Nacional, standard time ticks ("Hora Legal Brasileira") and voice announcements, no reception time given (Fotios Padazopulos-Greece).

10087.0 9V-SLJ-Silkair A320, flight MI0509, HFDL log-on with Krasnoyarsk, Russia, at 2016. VP-BJH-Nordwind Airlines A320, flight RA1952, HFDL log-on at 2017. B-5129-China Southern Airlines B737, flight CZ6185, HFDL position at 2017 (MPJ-UK).

10194.0 WGY912-FEMA Mt. Weather Emergency Assistance Center, VA, ALE text message (as FCSFEM2), and voice phone patch with WGY905 (ALE call FR5FEM), FEMA Region 5, IL, at 1513 (Metcalfe-KY).

10236.0 Unid-Probable Chinese military, 4+4 data modem idler in LSB, then messages in 4-number groups, similar on 10413, at 1038 (Eddy Waters-Australia).

10343.0 124-M12, callup "124/1 2425 62" and 5-figure-group message, CW at 1830 (MPJ-UK).

10487.0 959-E11a, callup 959/30 and 5-figure-group message, at 1710 (MPJ-UK).

10588.0 CAOFEM001-FEMA Caribbean Area Office, PR, also on 12216, ALE sounding at 0455 (Boender-Netherlands).

10715.0 Unid-Cuban hybrid mode numbers (HM01), alternating machine voice and data transfers, AM at 1045 (Agnelli-FL).

10787.0 Unid-Russian Polytone (XPA), MFSK-20 sequential tone message decoded to "173 173 173 000," then "03621 00001 00000 10140," at 1750 (MPJ-UK).

10871.7 "D"-Russian Navy CW cluster beacon (MX), slow CW ID at 0024 (Filippi-NJ).

10942.0 Unknown-Ground station with selcal CM-BS, then voice in Portuguese, at 1142 (PPA-Netherlands).

11030.0 VMC-Australian BOM, Charleville, FAX Indian Ocean chart, at 1918 (PPA-Netherlands).

11033.0 99910-Egyptian MFA, Cairo, working 11105, Rome, at 1820 (PPA-Netherlands).

11039.0 DDH9-German Weather Office, Pinneberg, RTTY ID at 1710 (PPA-Netherlands).

11073.5 "B-3-Y"-Unknown NATO trigraph, passing tracking data in German-accented English to "M-0-S," at 1906 (PPA-Netherlands).

11086.5 KVM70-NOAA, HI, FAX streamline and surface analysis charts, at 1206 (Filippi-NJ). GYA-UK Royal Navy, Northwood, FAX forecast chart at 1718 (PPA-Netherlands).

11111.0 STAT21-Tunisian Interior Ministry, working TUN, also on 16285.0, ALE at 1236 (Boender-Netherlands).

11128.0 A97-Unknown Chinese net, calling L06, ALE at 1617 (Boender-Netherlands).

11159.0 Unid-Rebroadcast of RAF Volmet, weather for global destinations from a fast-talking computer "female," at 0647 (Waters-Australia) *[Probably a temporary transmission for a military exercise in Canada. - Hugh]*

11175.0 Offutt-USAF HF-GCS, NE, patching unknown E-6B to orderwire controller, at 1905 (Stern-FL). Sofa Bed-U.S. military, called Mainsail, then patch to Ten Spot (Offutt AFB, NE), at 2136 (Jeff Haverlah-TX). Reach 776-USAF Air Mobility Command transport, HF-GCS patch via Mainsail station to Red River, at 2244 (Metcalfe-KY).

11205.0 Tascomm-UK Terrestrial Air-Sea Communications, passing Akrotiri (Cyprus) weather to Ascot 3240, an RAF transport, at 1334 (MDMonitor-Netherlands).

11215.0 400001-Unknown Mauritanian net, calling 400004, ALE, at 1834 (Boender-Netherlands).

11226.0 JTY-USAF, Yokota, Japan, ALE sounding at 1924 (Boender-Netherlands).

11354.0 52851-Russian Navy AN-26 transport, no joy calling Priboj (Central Sector, Moscow) in Russian, then raises Kraket (Western Sector, Kaliningrad), at 1105 (MDMonitor-Netherlands).

11360.0 Korsar-Russian Air Force, Pskov, radio checks in Russian with Polis (Orenburg), Proselok (Bryansk), Davlenie (Taganrog), and Klarnetist (Tver), at 1200. Korsar, flight following with 85041, a TU-154M transport, at 1657 (MDMonitor-Netherlands).

11435.0 938-M12, callup "938/1 2355 63" and 5-figure-group message, CW at 1830 (MPJ-UK).

11494.0 N15-USCG HC-144 Ocean Sentry, COTHEN ALE sounding, at 0531 (Boender-Netherlands).

11635.0 HM01, machine voice and digital, AM at 1830 (Agnelli-FL).

12110.0 2010-Turkish Red Crescent, calling 4014, ALE at 1257 (Boender-Netherlands).

12209.0 8341-Turkish Civil Defense, ALE sounding at 0455 (Boender-Netherlands).

12218.0 991-M12, callup "991/1 7783 73" and 5-figure-group message, CW at 1520 (MPJ-UK).

12365.0 VMC-BOM, Charleville, maritime weather observations and ID as "VMC Australia East;" then gave frequencies for VMW (Australia West, Wiluna), which was then weak on 12362, at 1133 (Filippi-NJ).

12577.0 563948000-Singapore flag oil tanker *Savannah* (S6AK), DSC safety test with Ankara, Turkey, at 1959 (MPJ-UK).

12590.0 KLB-ShipCom, WA, CW ID in Sitor-A marker, at 1309 (Filippi-NJ).

12613.0 XSQ-Guangzhou Radio, China, CW ID in Sitor-A marker, at 1210 (Filippi-NJ).

12789.9 NMG-USCG, New Orleans, FAX 24-hour surface forecast chart for Caribbean, at 1315 (Filippi-NJ).

12843.0 HLO-Seoul Radio, Republic of Korea, CW marker with listening frequencies, at 1222 (Filippi-NJ).

13019.0 HEB43-GlobaLink Berne Radio, Switzerland, Pactor-III idler and CW ID, at 1030 (MPJ-UK).

13101.0 GWPWRM-Brazilian Navy frigate *Rademaker* (F49), calling GWP, ALE at 0015 (Filippi-NJ).

13303.0 OD-MEB-Middle East Airlines A330, flight ME0223, HFDL position for Canarias, at 1637 (MPJ-UK).

13369.0 314-M12, callup "314/1 1604 117" and 5-figure-group message, CW at 2100 (MPJ-UK).

13564.0 GNK-KC9GNK "Hifer" beacon, WI, CW ID at 0043 (Filippi-NJ).

13722.0 985-E11a, callup 985/10 and 5-figure-group message, at 1400 (MPJ-UK).

13918.0 991-M12, callup "991/1 2917 219" and 5-figure-group message, CW at 1500 (MPJ-UK).

13927.0 AFA5RS-USAF MARS, radio check with King 79, an HC-130P, at 2047 (Stern-FL).

14378.0 349-E07a, null-message callup 349/00, AM at 1900 (MPJ-UK).

14396.5 KAG69-U.S. Federal Bureau of Investigation, CO, SHARES net with KGG83A (FBI, VA), and control station NCS012, at 1530 (Metcalfe-KY).

14452.5 CIW63T-Canadian Forces Affiliate Radio System, radio checks with CIW516 and CIW321 at 1610 (Metcalfe-KY).

14484.0 Head Master-U.S. military, large exercise with WGY 911 (Fema Region 1, MA), Looking Glass (probable airborne command post), Desert Eagle (U.S. Army MARS, AZ), and many other Army MARS stations, at 1600 (MDMonitor-MD).

14518.0 986-E11a, callup 986/10 and 5-figure-group message, at 1810. 988-E11a, callup 988/10 and message in 5-figure groups, also at 1810 (MPJ-UK).

15867.0 N03-USCG HC-144A, calling LNT (Camslant), COTHEN ALE at 0051 (Boender-Netherlands).

16283.6 KWV71-U.S. Department of State, Ankara, Turkey embassy, calling KGA29, unknown, ALE at 0617 (Boender-Netherlands).

16330.0 161-Poss Chinese military or government, working 162, ALE at 1109 (MPJ-UK).

16332.0 "C"-Russian Navy CW cluster beacon (MX), Moscow, repeating ID at 1414 (MPJ-UK).

16809.0 WLO-ShipCom, AL, CW ID in Sitor-A marker, at 1213 (Filippi-NJ).

16986.0 CTP-Portuguese Navy, Oeiras, short RTTY NAWS markers with single-tone idle in between, at 2109 (Metcalfe-KY).

18273.0 Unid-Russian intelligence or MFA, FSK message number 002, at 1530 (MPJ-UK).

18581.0 MXHN-Probable Chinese military, call to VWXR and message in 4-figure groups, in a format resembling M89, but sent with 4+4 modem in LSB, at 0640 (Waters-Australia).

20167.0 Baked Pie-U.S. military, calling Goal Post, then working Trident, at 2308 (MDMonitor-MD).

21928.0 "16"-HFDL ground station, Agana, Guam, some weak squitters copied, at 2346 (Hugh Stegman-CA).

27781.25 Unid-UK Citizen's Band channel 19, many operators in FM, at 1600 (Homuth-UK).

28226.0 PY2RFF/B-Amateur propagation beacon, Sao Paolo, Brazil, CW ID and grid square (GG67al), at 2343 (Filippi-NJ).

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U.S. Agencies Still Found on HF

Although officially disbanded by Presidential Order in July 2012, the National Communications System (NCS) and elements, such as the SHARES (Shared Resources High Frequency Radio Program) and telecommunications NS/EP (National Security & Emergency Preparedness) networks, continue to be heard on the shortwave bands using digital systems.

❖ AT&T and NS/EP Stations

The May 2010 edition of this column first covered the activities of these MIL-188-141A ALE (Automatic Link Establishment) equipped stations operating from strategic (major telephone switching center) locations around the country. After an apparent hiatus, they have again appeared on the same channels as before, but with a different identifier structure and with some new or different locations. Here are the channels used by the network:

2194, 2289, 3155, 3170, 4438, 5005, 6765, 6803.1, 7300, 7480.1, 7697.1, 9496, 10155, 11451, 12225, 14360, 14396.5 (Voice), 15175, 15605, 18035, 18063 and 20095 kHz USB

The new ALE identifiers and corresponding locations heard so far are as follows:

ANCRAK100	Anchorage, AK
ATLNGA106	Atlanta, GA
DLLSTX133	Dallas, TX
DNVRCO138	Denver, CO
GLPTMS144	Gulfport, MS
HFESIL147	Hoffman Estates, IL
JCVLFL155	Jacksonville, FL
LSVLKY173	Louisville, KY
MDTNNJ187	Middletown, NJ
MILNHI185	Mililani, HI
MRDNCT179	Meriden, CT
MRTHFL176	Marathon, FL
NWORLA191	New Orleans, LA
PTLDOR194	Portland, OR
RENONV197	Reno, NV
RVSDMO200	Riverside, MO
SCRMCA203	Sacramento, CA
SNANTX206	San Antonio, TX
SNDGCA209	San Diego, CA
SULVSC217	Summerville, SC
SVNHGA213	Savannah, GA
WPTNNJ220	Westampton, NJ
CONTROL222	Unidentified
ADMIN223	Unidentified
XNDR260	Windermere, FL (Net Control Station)

Note that the previous Net Control Station, located in Chapin, South Carolina, appears to have been replaced by Windermere, Florida. All the commercial decoder manufacturers provide decoders for MIL-188-141A ALE, as does the "Grandaddy" of them all, PC-ALE, on which development continues in a number of versions including MARS-ALE. Mac OS X users can use Black Cat System's *Multimode*. See the "Resources" section below for details of where to download ALE decoder software.

❖ NCS PacTOR Stations

The amateur radio operated MARS (Military Affiliate Radio System) portion of the NCS network also continues to be heard on HF radio using at least the following channels for PacTOR traffic (there are probably more to be found given the large frequency spread):

6801.5, 9051 and 18938 kHz (center of data, subtract 1.5 kHz for USB channel)

Most traffic is carried using PacTOR-III which can be decoded using Sorcerer (see Resources) and other more sophisticated decoders, but a number of the more active stations are now using the PacTOR-IV (Dragon) modem which remains unsupported by any of the decoder software packages. There are often lengthy sequences of selcals preceding message exchanges as a station hunts through a fixed list of call signs looking to make a connection. These too can be decoded by any software capable of decoding the I, II, III or IV standards. NCS stations use the following PacTOR identifiers, together with their approximate locations and the corresponding MARS station call signs, where known:

NCS009-7	Ames, IA (EN32ea)
NCS015	Unidentified
NCS018-7	Lincoln, NE (EN10qu) aka AAT7WE
NCS050, 311, 314 & 316	Unidentified
NCS350-5	Dewitt, MI (EM72qu) aka NNN0EPY
NCS353-6 & 354-3	Unidentified
NCS355-8	Aurora, CO (DM79op) aka NNN0ANH
NCS356-5	Unidentified
NCS357-3	nr Moorefield, WV (FM09me)
NCS358-4	Unidentified
NCS360-3	Arlington, VA (FM18kv)
NCS361-4	Paducah, KY (EM57qb)
NCS363-0, 380-3	Unidentified
NCS399-4	nr Chapin, SC (EM94hd)
NCS400-4, 401-M, 403-2 & 404-6	Unidentified
NCS404-M	Central Quebec (FN28pt) possible operator error in grid locator
NCS405-M	Central Quebec (FN28pt) possible operator error in grid locator
NCS406-6, 406-7 & 407-M	Unidentified
NCS409-9	San Diego, CA (DM12kr)
NCS412-5	Unidentified
NCS413-M	nr Marshalltown, IA (EN31kw)
NCS414-M	Unidentified
NCS415-0	Anchorage, AK (BP51bf)
NCS416-6, 417-4 & 418-4	Unidentified
NCS419-8	Denver, CO (DM79mr)
NCS420-4 & 421-9	Unidentified
NCS422-6	nr Angleton, TX (EL29gf)
NCS423-4	Jacksonville, FL (EM90eh)
NCS424-7	nr Topeka, KS (EM29eh)
NCS425-5	Unidentified
NCS426-6	nr San Antonio, TX (EL09sd)
NCS427-4	Unidentified
NCS428-1	Meriden, CT (FN31om)
NCS429-4	Miami, FL (EL95us)
NCS430-4	Unidentified
NCS431-0	Portland, OR (CN85pm)
NCS432-3	Unidentified
NCS433-9	nr Sacramento, CA (CM98ho)
NCS434-6, 435-4, 436-4 & 437-4	Unidentified
NCS438-4	nr Covington, GA (EM83cm)
NCS439-9	Reno, NV (DM09cm)
NCS440-2	Unidentified
NCS441-7	Kansas City, MO (EM29qe)
NCS442-4	Unidentified

Note that the suffix of each identifier is the FEMA region in which the station is located. The "M" suffix is probably reserved for mobile stations. The station locations have been determined by monitoring the Maidenhead (grid) locators that are transmitted as part of the AirMail mailbox software connection "handshake" as messages are passed from station-to-station. Here is a typical exchange between NCS355-8 and NCS424-7 revealing the former's location as DM79op (Aurora, Colorado):

[AirMail-3.081-B2FHIM$]
(am|em:h1,g:DM79op)
DE NNN0ANH CO [NCS355-8] SHARES BBS, REGION VIII (NORTHERN)
SCANNING *ALL FREQ'S* SYSOP PHONE: 303-766-2969 OPR: CARL
HAVE YOU PICKED A HOME BBS YET?
TYPE I FOR SHARES INFO.NAVY MARS STATIONS USE YOUR AX25 CALLSIGN FOR CONNECTIONS.
No Traffic
NCS424-7 de NCS355-8>

See the Resources section for a great website that allows you to find the geographical area covered by a given grid locator or vice-versa.

❖ Digital Digest Archive on Kindle

With the announced closure of this fine publication next month, I plan to publish an archive of back issues of Digital Digest as Kindle e-books in the coming months, perhaps even by the time you read this column. I will start with this year's columns and continue back, by year, to 1998.

As regular readers will know, with HF digital utilities, old habits die hard and operating methods, message formats and channels often stand the passage of time and migration to new generations of standards and equipment. That 2005 column covering the activities of the Venezuelan Navy and their MIL-188-141A ALE and MIL-188-110A 2400bd HF modems may well have currency as the organization moves towards new Third Generation (3G) standards. If you'd like to be kept up-to-date with these plans, please send a quick message to **digital.digest.archives@gmail.com.**

❖ Resources

PC-ALE & F6CTE ALE Decoder Software **hflink.com/software**
MARS-ALE Decoder Software **www.n2ckh.com**
Black Cat Systems Multimode **www.blackcatsystems.com/software**
Sorcerer Decoder Software **dl.dropboxusercontent.com/u/301213/sorcerer-v1.0.1.exe**
Maidenhead Grid Locator Lookup **f6fvy.free.fr/qthLocator/fullScreen.php**

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Best Advice? Better Antennas!

There are lots of nooks and crannies in amateur radio, and hams come in all shapes, sizes, and flavors. And, when it comes to advice, one size certainly doesn't fit all. Still, with those caveats in mind and with *MT* winding down its long publishing run next month, it's probably now or never when it comes to giving advice.

As I write this, I'm sort of picturing us sitting across from one another at a coffee shop, snacks and caffeinated beverages at hand. You – the collective You – might be a beginning ham looking for input about the real nuts and bolts of the hobby, the hidden gems we all wish we would have discovered earlier than we did. You might also be a more experienced operator who has already uncovered a few of those hard-won gems. We can *trade* gems, then. It's all good. Gems are gems and, as my YL frequently reminds me, you can never have too many gems (she makes jewelry)!

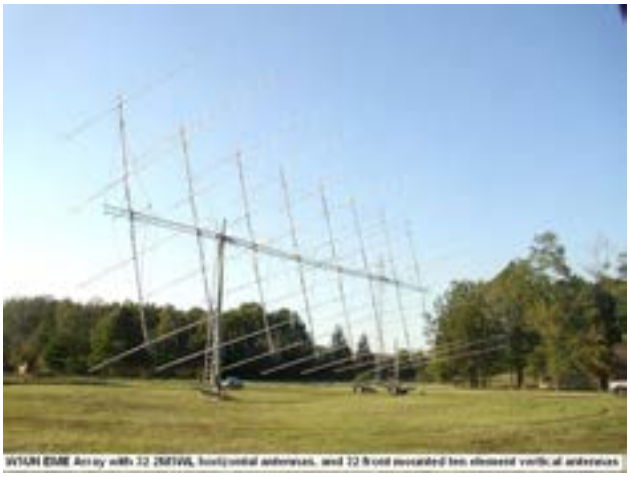
So, here goes. These are a few of the most important things I've learned in my 35+ years as a ham, including some of the stuff I wish I had known *way back when*.

"It's the Antenna, Stupid!"

To keep his candidate focused, James Carville, Democratic strategist and advisor to former President Bill Clinton during his 1992 presidential campaign, tacked a sign on the wall that said, in part, "It's the economy, stupid!" The message escaped from Mr. Clinton's Arkansas Campaign HQ and went on to become part of the cultural landscape. I use it here to make a similarly important point: For almost every ham in every situation, your antenna will determine your success, and what you can and can't experience, as a ham.

We are all created equal in the eyes of the FCC (maligning another great sentiment), but our antennas are *not*! Let me give you a few examples of just how much they shape our radio destiny.

My father, who lives outside of town, can't get cable TV and can't really receive OTA signals, either, especially after the digital transition. He went with a mini-dish satellite TV system because the antennas were compact and he didn't want to mess up the aesthetics of his yard. I put up the standard 18-inch dish that came with his receiver and aligned it carefully. His signal strengths were excellent, as was his reception quality – unless it was cloudy or stormy (which it frequently is in the upper Midwest). With storm clouds overhead, or during rain events, his "picture" was jittery or nonexistent. He wasn't pleased, so I replaced his mini-dish with a 30-inch dish (that wasn't quite as mini). After that, no matter how dark the clouds or biblical the downpour, his reception was perfect. The antenna, which provided maybe 6 dB more gain at best, made all the difference.



Dave Blashke W5UN experiences 2 meters in ways most of us can't quite imagine. Shown here is his famous MBA – the Mighty Big Array of 32 10-element Yagis that have made him the go-to guy for hams looking to make their first moonbounce QSO for the past 25+ years. The array can elevate and rotate to track the moon. The far end sits on a truck chassis that "drives" the antennas around in a fixed circle! As long as Dave and his MBA are on one end of the QSO, the antenna on the other end can be rather modest (even a single big Yagi!). A DXer since 1952, W5UN knows without a doubt that the antenna makes all the difference. His 11-Band DXCC, 160-Meter WAZ and the first DXCC ever awarded on 2 meters, speak volumes! (This photo, plus videos, can be found at www.w5un.net)

As a condo-dwelling ham who has to use attic antennas, my system's performance deficit is all too apparent. If only to drive the point home, one day, a ham friend who lives about five miles away called to excitedly alert me to a big opening on 6 meters. I quickly turned my rig on to hear...absolutely nothing! He was still on the phone, so we quickly synchronized listening frequencies. There was still nothing on my end, but I could hear what he was hearing through the cell phone: loud, faraway stations and plenty of them! I had an attic-mounted 40-meter loop. He had a seven-element Yagi at 75 feet. My house was 100 feet higher in elevation, but he had a seven-element Yagi at 75 feet! Get the picture? Near as I could tell, his setup – including obvious and not-so-obvious factors – had 20 to 30 dB of extra performance. Ouch! Because of his antenna, he "had" amateur radio, while I had none. His antenna made all the difference.

The same factors hold true in almost every scenario. If you can't access a particular repeater, for example, whether you're using the rubber ducky antenna on your H-T or the beam on your tower, that repeater *doesn't actually exist*, and you can't have any of the experiences you'd otherwise have if you could access it. And, lest you think an amplifier might help, think again. An amplifier might help others hear you, but it won't help you hear them. The antenna makes all the difference.

Unfortunately, most hams never have the opportunity to hear what they've been missing – what the bands sound like on the business end of an awesome antenna. The difference is staggering. Those fortunate enough to have truly impressive antennas have a completely different experience of amateur radio. They hear signals that, for the average ham with a low dipole in the backyard (or a loop in the attic), *don't even exist*. Their amateur radio is *completely different* than our amateur radio.

I had come up through the home-grown ranks as a teen-age ham, and nobody in my rather small circle of ham buddies had an HF antenna that was more impressive than a tri-band Yagi at 40 feet. Now, compared to my present antenna, that was a "killer setup," but I didn't hear what a "10%" antenna sounded like until I got to the East Coast.

As a junior editor at *QST*, I had access to W1AW and W1INF (then the employee club station). On a fine Sunday morning in 1989 I found myself at the controls of W1AW, ready to work European ops on 10-meter SSB. Because simply signing W1AW as a call sign had plenty of "non-aluminum gain," and because the barefoot transceiver was connected to a six-element beam at nearly 100 feet, I was cautioned to make only a short CQ call to minimize the pileups.

That advice seemed ridiculous to me at the time, as I was used to hearing the bands from the Upper Midwest RF Sink Hole. Nonetheless, I complied. After I found a clear spot near 28.700 MHz (yes, we had actual propagation back in the day, so 28.3 to 28.6 MHz was filled with signals), I made a *very short* call: "CQ 10 CQ 10 CQ 10 meters, this is W1AW, Whiskey One Alfa Whiskey, calling CQ." Boom! There must have been 50 stations calling me from all over Europe, parts of Russia and even Israel. Signals were big and steady, and I worked ops from everywhere with a singular ease that was *never* evident from Minnesota or North Dakota (and believe me, signing a North Dakota call sign provides plenty of "gain"). The antenna made all the difference.

During that same period, because I was working at ARRL HQ, I had access to the sexiest

radios of the day. These included the latest and greatest radios from all of the usual manufacturers, plus some really interesting rigs from the fringe. W1INF had an exotic Signal One CX-7A (or was it a CX-11?) and a rarely seen Collins KWM-380. They were cool.

Even cooler, Ulrich Rohde, of Rohde & Schwarz, noted German designer of spy radios for three-letter government agencies, dropped by one day with several of his company's latest offerings. They were so sleek, clean and futuristic they looked like medical equipment, not radios! Better yet, we editors were asked to take them home for some off-site playtime and to get together in a few weeks, after swapping radios periodically, to discuss our impressions. As I was putting my first candidate in the back seat of my car, another editor suggested I take great care of the unit, as it sold for $35,000! Now, I *always* take great care of amateur radios, but damn!

Of course, because it incorporated many of the design techniques that would advance the radio art in another 10 years, the R&S über-radio sounded *extra fantastic*, as do many modern radios, as does my Elecraft KX3 SDR (see the Buyer's Guide in this issue) which, although affordable, still sits at the top of the receiver performance chart at the Sherwood Engineering web site. But for all its awesomeness, it couldn't hear *any* of the 6-meter signals that my buddy could hear (described above) with his "much less awesome" transceiver. Despite my far superior radio, time-tested operating skills and knowledge of Morse code, he "had" radio and I had "nothing" (but an awesome radio that was, at that time, receiving electrical noise from my PCs and household appliances).

The antenna makes all the difference, and I'd happily trade my KX3 for a middle-of-the-road transceiver from 1970 if I could have a "stupidly awesome antenna" (or three). After all, I worked plenty of DX with a Tempo One or a TS-520S back in the day, and I know they'd make short work of the bands today if they were connected to a killer antenna. It would be awesome! Somebody please make it happen!

No single antenna works best everywhere, for every situation, but take it from me, the amateur radio you experience with a fantastic antenna is quite different from the amateur radio you're probably used to. It's like seeing the world in black-and-white when it suddenly changes to full color.

Unfortunately, it's not a great time for antenna farming in today's era of deed restrictions, homeowner associations and the like. That puts many of us firmly into territory summarized so eloquently by former Defense Secretary Donald Rumsfeld: "There are known knowns; there are things we know that we know. There are known unknowns; that is to say, there are things that we now know we don't know. But there are also unknown unknowns – there are things we do not know we don't know."

Wow! If you're never heard the RF world through the "ears" of an awesome antenna, I'm guessing that would be an "unknown, unknown!" In all seriousness, your antenna *defines* your experience of amateur radio. Whatever it takes – learning, time, energy, money – that's what it takes to dramatically expand your experience of amateur radio. Even if you're starting with a typical backyard antenna, optimize its height, design, feed line, etc, and save the high-end radios, amplifiers and goodies for later. Want even more antenna advice? Here goes!

If you can't take the tower to the antenna, take the antenna to the tower, because "higher is better." Shown here, working a VHF contest from a 9,000-foot "tower" in California, is veteran "hilltopper" David Palmer, KB5WIA. The three-hour climb to get to the top can be challenging, but having line of sight to "everywhere" makes up for it! For more photos, see http://kb5wia.blogspot.com. (Photo by Melanie Palmer and courtesy of David Palmer KB5WIA.)

❖ Higher is Better

In most situations, antennas perform better the higher you mount them. A dipole at 50 feet outperforms a dipole at 25 feet. A dipole at 100 feet outperforms a beam at 25 feet. Higher is better.

❖ Horizontal Loops – Best All-Around HF Antenna

Jealously guarded secrets by most who use them, horizontal loop antennas are the best single-wire, multiband antennas. They're fantastic stateside and DX performers that tune up easily on all bands *at or above the fundamental frequency* and can be made to work well on frequencies below their design frequencies if fed with open-wire feed lines, something dipoles and vertical loops can't do.

Horizontal loops suffer minimally from static and man-made noise and they "hear" well compared to most dipoles and verticals. If fed with balanced lines they can also exhibit impressive immunity from locally generated computer noise and electrical RFI.

When mounted close to the ground (an unfortunate reality for most of us and a real performance killer for dipoles and Vs) the performance of horizontal loops is startlingly better, which is why I don't even bother with dipoles and Vs unless I can get them way up in the air. See this column in the April and May, 2011, issues for more info.

❖ RG-6—Best All-Around Coax

Really good 50-ohm coax is expensive, hard to find, and the connectors are difficult to attach correctly unless you do it all the time. Really good 75-ohm cable TV coax is inexpensive, available everywhere (Wal-Mart, for example), and the connectors are super-easy to attach, even for relative beginners. For most ham applications below 2 meters, 75-ohm RG-6 works better than typical ham coax and has many other advantages, including superior shielding (RG-6 is at least double-shielded), reduced attenuation and superior frequency response.

Because RG-6, like its little brother RG-59 (do not use!), is designed to use compression-style F-connectors, attaching them with an inexpensive tool is a breeze and requires no voodoo. With a variety of readily available adapters, you can transform an F-connector into PL-259s, BNCs, or whatever you need.

RG-6 can handle plenty of RF power, but if you "feel the need for speed" or want to use a super-long run, use RG-11. The connectors and the compression tool with which to attach them are a bit more expensive, but the process is just as easy.

The alleged impedance mismatch between 50 and 75-ohm coax? Unless you're building phasing lines for multi-element verticals, it's a complete non-issue. Your radio won't care, and neither should you! See this column in the March 2011 issue for details.

❖ Amplifiers are Rarely Necessary

Until you've optimized your antenna system, linear amplifiers won't be much of a benefit. Going from 100 to 1,500 watts of RF output only boosts your signal a measly two S-units, but does nothing to boost your reception. And, two S-units is nothin'. Going from 100 W to 5 W only drops your signal by two S-units. That's why QRP "works." Plus, amplifiers are expensive, heavy, bulky, may require 240-V AC, and so on.

Antenna gain, on the other hand, boosts signal strength in *both* directions. It's a much better deal, and it's "RF environmentally friendly." After you've maxed your antenna system, if you *still* need more oomph, it's time to consider your remaining options, including amplifiers.

❖ Gooch's Paradox

Simply stated, Gooch's Paradox reads: "RF Gotta Go Somewhere." The unstated corollary, meanwhile, might read: "RF Ain't Gotta Go Anywhere Useful." Unless we're talking about RFI (which is prime territory for invoking The Gooch) it's probably clear by now that, from my experience, the best way to make RF go in useful, wonderful, directions as a ham is to elevate your antenna (pun intended) above all else.

So, friends, that's my best advice. Oh, and be sure to learn Morse code. See how I snuck that in there?

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Radio-Electronics Kits for Young Experimenters

Very few of us learned our radio and electronics skills through formal education. For most, this type of education wasn't even offered at the primary or secondary education level. Instead, we came to radio and electronics through a long process of self-directed discovery, typically during our early teenage years. We learned electronics through association with friends, relatives or mentors who happened to materialize at just the right moment when curiosity and discovery seemed elusive partners.

Snap Circuits kits are for kids age 8 and up. Putting together an electronics project is easy for children as young as five, but requires close adult supervision. (Courtesy: Author)

As parents, or even grandparents, we find ourselves wanting to share our enthusiasm for our hobby with our children or grandchildren, but lack a coherent course to pursue. The roles have switched and now we are the mentors, but where do we start? One place to start is with the basics of all electronics, an understanding of the fundamentals through the use of simple, easy-to-use electronics kits.

In the mid-1980s I bought the Radio Shack 50-in-One electronics and magnetic project kit for my daughter who, at the time, was probably 8 or 10 years old. We put together many of the projects and, while the kit is crude by today's standards, we learned a lot about the functions of the most basic electronic parts. That basic knowledge came in handy a few years later when we studied for our amateur radio licenses together. She must have remembered it as a good time because, this year for my birthday, she gave me the Snap Circuits Green electronics kit to use with her daughter, now almost 6 years old.

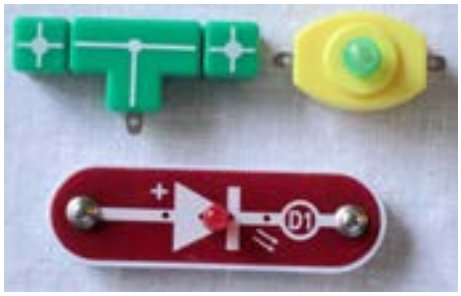
A successful project, that really works, satisfies experimenters of all ages. This Snap Circuits Green kit ($70 at Radio Shack) teaches alternative energy concepts including solar, wind, water and human power. (Courtesy: Author)

❖ Levels of Learning

All kits identify the components with their schematic representation, though some do this better than others. While being able to identify the parts schematically is helpful, it's not necessary in order to have success with the projects. But, if the user spends any amount of time working with the components, knowing the function of the parts, proper alignment, their capabilities and their schematic symbols will become ingrained.

I found that the components and their connectors in the Learning Mates Electricity and Magnetism Experiment set were small and difficult to put together. The connecting tabs could be easily bent (especially if in the hands of the less patient). The Snap Circuits' clever use of metal snaps made it easier to assemble and lock components together. Layout with Snap Circuits was, well, a snap!

The use of a see-through, plastic-grid, breadboard in the Snap Circuits sets lets builders snap components in place securely on the grid and build from there. Large components, such as the red LED, press switch and power supply are uniform in size, easy to grasp, and come with the schematic symbol printed clearly on the top.



Snap Circuits connectable parts vs. Learning Mates' connectable parts. (Courtesy: Author)

Snap Circuits UC30 upgrade kit ($35) lets experimenters expand existing kits for new adventures. This kit includes parts to put together an AM radio. (Courtesy: Snap Circuits)

While most kits don't supply batteries, the Snap Circuits sets include a sealed 100 mAH Ni-Mh rechargeable battery pack, good for hundreds of charges. In fact, among the first projects is to build a battery charger to charge the power supply using a supplied photovoltaic solar panel.

One of the most important aspects of project building is troubleshooting and that's talked about on page one in the Snap Circuits' manual. The resulting layering of components, while snapping the circuit together, leaves upper level components less stable on the grid than those lying directly on the grid. This can lead to accidental disconnects and is the first place to look when troubleshooting. Even so, this method of connectivity is easier for small experimenters to handle and to see.

In the manual, users are instructed to, "Always check your wiring before turning on a circuit." When I'm doing a project with a child I try not to intervene unless asked and, if the project doesn't work at first, I ask, "Does the circuit match the drawing in the manual?" That leads to a careful check of polarity and securing connectors. If there's an issue, it's almost always caused by an improperly installed part. When children discover these problems on their own, it's a better lesson learned.

❖ Then vs. Now

The old Radio Shack 50-in-One kit was pretty flimsy, but it was more RF-oriented. The project layout board featured a crystal radio tuner, a code practice oscillator (with grueling dot-dash, A-Z alphabet, guaranteed to put anyone off learning Morse code) and a plan for building a simple, wireless AM microphone (using the earphone as a microphone). One of the big drawbacks of their crystal set was that, unless you happened to live in a major city, the radio might not appear to tune anything, especially during the daytime, when such a set would most likely be tried. That sort of unintentional failure can really dampen enthusiasm for doing more.

In the 1980s Radio Shack sold a lot of these 50-in-One project kits. This one still had the price tag: $12.95. (Courtesy: Author)

Some new kits feature radio-related circuits. The Snap Circuits Green has a see-through FM radio tuner that may be powered by batteries or alternative energy (solar cell or wind power devices which are included). While the radio is cute, there's no discussion here about how FM radio broadcasting and reception works. To be fair, this kit is about alternative energy sources, not about how radio works. But, by contrast, the 30 year-old Radio Shack manual explains the function of the RF coil, tuning capacitor, diode and earphone in describing the process of AM reception on a crystal set.

There are stand-alone kits that are more heavily radio-influenced, including the Elenco MX-901SW ($14 from Amazon.com) shortwave radio kit which tunes shortwave in two bands; 6-8 MHz and 12-18 MHz and requires a 9-volt battery. More complicated and capable shortwave, AM, and AM/FM radio kits are available, but require soldering, a task best left to older kids.

However, if your child or grandchild has a hankering to expand his or her horizons and you've got the cash, consider some of the more elaborate kits such as the Elenco 300-in-1 Electronics Project Lab ($154). This kit includes eight radio circuit projects including the obligatory crystal set, a transistor radio, AM transmitter, Morse code transmitter and more. The solder-free, plug-in style project board features lots of LEDs, knobs, and a real IC-style breadboard. Op amps and ICs as well as transistors are covered, and this set even includes testing and measuring circuits for some sophisticated electronic fun and learning.

Science Kits.com's solder-free, 300-in-One Electronics Science Lab costs $116 (Courtesy: Science Kits.com)

On the absolutely absurd end of the scale is the Elenco 500-in-1 Electronics Project Lab ($400) that comes with its own hard-shell briefcase. This kit covers everything in the previous kit but includes a lot of computer basics such as microprocessor instructions and programming as well as software projects.

Elenco two-band shortwave radio kit ($15), tunes 6-8 and 12-18 MHz (9-volt battery not included). (Courtesy: Amazon.com)

❖ Learning Together by Playing Together

Kids like just about anything that will mean playing with or just being with their moms, dads or grandparents. It's not hard to get them to take an interest in the things that interest you. But, you've got to dial it back to make the jump from putting together simple electronic projects to your amateur radio or shortwave listening hobby. Unless the goal is simply to put together kits, you'll need to demonstrate what these kits are for.

You can easily capture a child's interest by having them listen to your radios. To someone who's never heard them before, the police band can sound exactly the same as the air-band; people talking rapidly in some kind of coded language. Explaining what the various frequencies are for and interpreting the calls on the scanner can lead to more interest in the subject. Seeing an aircraft flying overhead and thinking that you can actually listen to the pilot of that plane talking to a local air traffic control tower can be fascinating to a kid.

It's the same for developing an interest in amateur radio. Tuning around 80 meters and hearing a bunch of old guys crabbing about medical ailments will be a great turn-off for kids. But, sitting them down to the computer and bringing up your PSK31 program and tuning into the less crowded, but DX-heavy, 15 or 10 meter bands, and watching the conversations scroll across the screen, can get their attention, especially if you can explain where the parties to the QSO are located.

It's not far from there that you can show them how to listen to the International Space Station, how to make sense of the jumble of tones in the CW portion of every band and tuning in the exotic sounds of international shortwave broadcasters.

❖ Continuing Self-Education

Forget the kids and grandkids. There's another aspect to these kits that you might really appreciate; your own continuing self-education. One really great way to understand electronics is by doing, and, these kits will get you going. Afraid to tackle some of the more sophisticated, expensive, QRP CW transceiver kits available? Try the learning-to-solder kits first. This is a great way to develop the kind of construction techniques necessary to build the more sophisticated kits on the market. Instead of botching an expensive kit, learn on an inexpensive teaching-tool kit. And, if your child or grandchild is old enough (10 years and up) they can learn soldering with you. You never know what might come of it.

But, when you do work with kids on these projects, know when to pack it in. Your enthusiasm may be far greater than theirs. Let them learn at their own pace and if they balk at continuing, don't push it. The chances are that they won't end up with electrical engineering degrees or in careers as computer scientists, but just knowing enough to understand the basics is more than most will ever know.

Resources

Science Kits.com offers a variety of simple electronics kits from various companies and includes a shortwave radio kit ($20) and an AM/FM radio kit ($17)
www.sciencekits.com/electron.html

Snap Circuits kits from Elenco include base models for up to 100 experiments ($35) to Snap Circuits Extreme ($140) with up to 750 experiments.
http://www.snapcircuits.net/

Learning Mates Electricity and Magnetism Experiment Set ($45) for age 8 and up.
www.scientificsonline.com/electricity-magnetism.html

Edmund Scientific Co. has a wealth of kits available at **www.scientificsonline.com/electronic-lab-300-in-1.html**

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Shortwave Today: Cold War Ghosts, Blues and Laughs

Welcome to the penultimate edition of Programming Spotlight. Next month I will be sharing some reflections on this fabulous hobby, the people who share it and the radio stations and personalities who have made and continue to make it all possible. This month, we'll shine the Programming Spotlight on some stations which remain on the shortwave bands and continue to offer quality, entertaining and thought provoking programming. We'll look at programming from Canada, Asia and the Pacific regions and a few gems that never seem to get the attention they deserve.

November in my native Canada is usually cold, blustery and dull. That's anything but the case when it comes to shortwave programming out of this country. While the output is now limited to a handful of relatively low power stations, programming is still top notch. Here is news to warm the coldest autumn heart. **CFVP** 6030 kHz shortwave in Calgary, Alberta, which relays AM 1060 **CKMX**, is switching formats along with its parent station and from September 12, will be known as *"Funny 1060"* with an all-comedy format. This should make this tough catch stand out...just listen for the laughs in the static!

As before, Harold Sellers, long time leader of the Ontario DX Association, continues to be the QSL Manager for **CFVP**. The station is designing new QSL cards and you can send a report to Harold at *qslcalgary@gmail.com*. I had a look at the new website for *Funny 1060* and it looks like it has quite a bit of potential. It bills itself as the best of stand up comedy. Not sure this format would be sustainable in the long run, but it is a trend in Canada. 820 **CHAM** in Hamilton, Ontario already went all-comedy some time ago. Interestingly, **CFRB/CFRX** 1010/6070 in Toronto seems to have abandoned its overnight comedy programming (unless you consider centre-right commentary comedy!).

CKZN in Newfoundland (itself a separate radio country, for those keeping score) continues to broadcast on 6160 kHz. The station brings you programming from **CBC Radio One.** Listen mornings for some interesting local programming and occasionally you will hear the distinctive Newfoundland accent. A visit to Newfoundland is still prominent on my bucket list of places to go (although sadly it seems my bucket list has a hole in it). Still, it is a treat to visit the easternmost province of Canada, even if it is only via a pair of headphones.

During the Cold War, **Radio Bucharest**, as it was then known was amusingly doctrinaire, yet quite independent of the Soviet party line, parroted by other East Bloc nations. Today, **Radio Romania International** could be considered "the last man standing" from the old Warsaw Pact nations. **RRI** is a breath of fresh air on the shortwave bands (and that inter-web-thingy all the kids talk about). Every evening one can hear delightful programming from this fascinating country. For instance, on Monday nights, one can hear such excellent programming as *Pro Memoria* which looks at the history of the Romanians. It is particularly interesting, as the views expressed often repudiate those of the Ceaucescu-era broadcasts. Listening in 1985, one could never imagine this station saying anything nice about the wartime government of Romania! This is followed by *Earth News*, which brings you information on environmental topics in Romania. This is followed by a real treat for those who love eclectic music, a program called *Romanian Hits*. If you love music this segment is a must hear! Try **Radio Romania International** at 0000 UTC on 9700 or 11955 kHz (subject to change with the fall season).

Radio România Internațional

Speaking of music, there are two really great programs that cover the Blues. One, *Saturday Night Blues* on **CBC Radio One** is no longer available on shortwave, since the demise of the **CBC Northern Quebec Shortwave Service**. But, check out **WRMI** in Miami UTC Mondays at 0100 (possibly an hour later once the clocks change) on 9955 kHz. At that time one can hear *Blues Radio International*. The program features live recordings from the *Blues Music Awards*, and live radio interviews and performances by musicians. It is a mix of both classic blues, and new music and musicians. If you like this kind of music, give this program a try on 9955 kHz. If the Cubans are making reception difficult, it also streams online via the **WRMI** website. The blues is an under-appreciated genre and kudos to **WRMI** for including it in their schedule

A reminder that Keith Perron is doing his part to keep programming on the short waves alive. You can listen to **PCJ Radio International's** weekly current affairs program *Focus Asia Pacific*, hosted by long-time **Radio Netherlands** stalwart Andy Sennitt. This is followed by *The Happy Station Show* on UTC Sundays at 1330 UTC. The frequency is 11835 kHz. It is targeted to East and Southeast Asia, so reception may prove difficult in North America, but hey, its worth a shot!

Funny 1060 Calgary (Courtesy: Funny1060.com)

Not getting enough Cold War rhetoric...try the **Voice of Korea** from north of the 38th parallel on the Korean Peninsula. Your chance to hear martial music and vitriol from the world's first hereditary communist monarchy. The Kim family has run the place since 1945 and you will hear all about them in every broadcast. The former **Radio Pyongyang** can be heard daily at 1000 on 11710 kHz. It is truly a blast from the past!

❖ We get mail...

Hello Fred...Enjoyed your article "Quality Programs from Russia & China." I just visited the **Voice of Russia** website, it sure beats trying to listen to Russia over-the-air. Only one frequency used by Russia now, 9665 kHz? It is weak compared to **Radio Moscow** years ago when it put powerful signals into Missouri! This evening was bad with its speech 90 percent buried in noise and fading, which is the case most nights here in St. Louis recently. Maybe propagation will get better after summer weather turns into fall.

Perhaps one reason is that in recent times I had to give up using good desktop radios (like the Kenwood R-1000 I used to have) and outdoor antennas when I moved. I now live in an apartment in a hollow and can't put up an outside wire. So, I go outside using any of several portable multi-band radios with built in whip antennas, the best being a year old Kaito 1103.

Something must have happened to the ionosphere in the past 50 years. I think propagation is very poor recently compared to years ago, and a big reason SWLing and international shortwave broadcasting is on the wane is because of it having become much harder for people with ordinary radios to find more than a tiny handful of listenable signals. I have tried to revive my interest in SWLing since the good days of the 1960s, but am getting fed up with the noise and fading unless I tune in to strong **China Radio International,** sometimes Cuba halfway listenable. Had a nice signal from Romania a few days ago. I try for pirates around 6925-50 on weekends but very seldom get any. Hope I can find articles and tips like yours after *Monitoring Times* is gone. (Walter B.)

While *Monitoring Times* may be winding down, you can still keep up to date on all things shortwave, online. I will continue to share my thoughts about shortwave programming, past, present and future, via Facebook, my website **www.doghousecharlie.com** and other places I will mention in my final column next month.

Gayle Van Horn, W4GVH
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QSL Contact Updates - Part 2

Additional updates for veri-signers, contacts for station personnel, websites and postal addresses to complement your QSL quest. If reporting via postal addresses, enclose mint postage of the country you are reporting to. This will cover the return postage from the station to you. Bill Plum's stamp service is the best source for shortwave hobbyist and amateur radio operators. Request Bill's current price list at *plumdx@msn.com* or send a SASE to Bill Plum's Airmail Postage and DX Supplies, 12 Glenn Road, Flemington, NJ 08822 USA.

Don't forget enclosures are always a nice touch. A few to consider are; souvenir postcards, business cards, photos of you or your listening post, local tourist brochures or extra station decals and stickers. Stations always appreciate comments or questions about their programming, or travel queries. References to their country in the news may be of interest, but stay clear of hot spot politics.

AUSTRIA
Radio Ö1 International, Argentinierstrasse 30a, A-1040 Wien, Austria **www.oe1.orf.at** *roi.service@orf.at*

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Cultura Manaus, Mrs. Terezinha Patric, QSL Manager *radiocultura@hotmail.com* Rua Barcelos, s/n Praça 14, 69020-200 Manaus, AM, Brasil. **www.tvcultura.am.gov.br**
Radio 9 de Julho, Jose Renato Perreriá, Director. Rua Manoel de Arzão 85, Frequensia do Ó, 02730 São Paulo, SP, Brasil **www.radio9jelho.co.br** *radio9dejulho@terra.com.br*
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Ichtys Radio via HCJB Weenermoor, Germany. Sven Tasche, Leader *sve.tasche@gmail.com.* Z.HD, Sven Tasche, Rudolf Breitscheid Str. 3, DE-01945 Ruhland, Germany.
Hamburger Lokalradio, Kulturzentrum Lola, DE-21031 Hamburg, Germany **www.hhlr.de**
Missiomswerk Werner Heukelbach, Sülemickstraße, 15, D-51700 Bergneustadt, Germany. **www.missionswerk-heukelbach.de** *info@missionswerk-heukelbach.de*
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HONDURAS
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Radio Misiones Internacional, Apartado 20583, Comayagüela, Honduras (or) IMF World Misiones, P.O. Box 6321, San Bernardino, CA 92412

INDONESIA
Adventist World Radio-Asia/Pacific, Ruiko Palm Spring, Blok A-4. # 6-8, Batam Center, Batam 29461, Indonesia **www.awr.org**

ISRAEL
Galei Tzahal/Israel Defence Forces Radio, Military Post Office Box 01005, 23 Yehuda Hayamit, Jaffa, Israel **www.glz.co.il** *gtz@galatz.co.il*

JAPAN
Radio Japan/NHK World, English Section, 2.1, Jinnan 2-chome, Shibuya-ku, Tokyo 150-8001, Japan **www.nhk.or.jp/nhkworld** *nhkworld@nhk.jp*

MALAYSIA
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MOROCCO
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FEBC Philippines, P.O. Box 1, 0560 Valenzuela City, Philippines reception-*reports@febcintl.org* (or) *info@febc.org.ph*

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Voice of America relay station, Helena Menzies, Station Manager's Secretary *hmenezes@sto.ibb.gov* IBB Transmitting Station, Caixa Postal 522, São Tomé e Principe.

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BBC Indian Ocean Relay Station, P.O. Box 448, Victoria, Mahé, Seychelles José Tambara, Senior Engineer *jose.tambara@babcock.se* **www.bbc.co.uk/worldservice/**

SLOVENIA
Radio Murski Val, Jerneja Pirnat. Ul. Arhitekta Novaka 13, SI-9000 Murska Sobota, Slovenia **www.radiomurskival.si**

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Russia- RWM, National Research Institute for Radio Engineering Measurements (FSUE (VNIIFTRI), Moscow Region, 141570 Mendeleevo, Russia **www.vniiftri.ru** *office@vniiftri.ru* (or) *logp@irk.ru*

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Radio Nord Revival, Ronny Forslund, QSL Manager, Vita Huset, S-17995 Svartsjo, Sweden

TAIWAN
Voice of Guang Hua, P.O. Box 1700, Taipei City 10099 Taiwan **www.khmusic.com.tw**

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Luxembourg-LX0HF Propagation Beacon, reseau Luxembourgeois des Amateurs d'Ondes Courtes a.s.b.i., P.O. Box 1352, L-1013 Luxembourg
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Vietnam-XVT Da Nang Radio, Dai Thong Duyen Hai Da Nang, 261 Nguyen Van Linh, Da Nang, Vietnam

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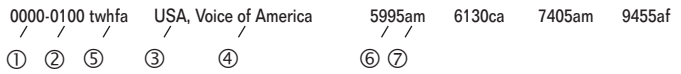
How to Use the Shortwave Guide



CONVERT YOUR TIME TO UTC

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

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

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

FIND THE STATION YOU WANT TO HEAR

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

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

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

CHOOSE PROMISING FREQUENCIES

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

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

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

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

Target Areas

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

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

MT MONITORING TEAM

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Thank You to …

BCL News; Cumbre DX; DSWCI/DX Window; Hard-Core DX; DX Mix News; WWDX Club/Top News. George Baxter/R Australia; Greece; Georgi Bancov/Balkan DX; Ivo Ivanov, Bulgaria; Sean Gilbert UK/WRTH; Wolfgang Bueschel, Stuttgart, Germany.

SHORTWAVE BROADCAST BANDS

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

Notes

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

"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 the MTXtra SW Guide 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	0030		Australia, ABC/R Australia	17750as		
0000	0030		Egypt, R Cairo	9965na		
0000	0030		USA, VO America	7430va	9790va	12015va
			17820va			
0000	0035		Vanuatu, R Vanuatu	3945do	7260do	
0000	0043		India, AIR/Natl Channel		9425do	9470do
0000	0045		India, AIR/External Svc		9690as	9705as
			11710as	13605as		
0000	0045	DRM	India, AIR/External Svc		11645as	
0000	0056		Romania, R Romania Intl		9700na	11955na
0000	0100		Anguilla, Caribbean Beacon/Univ Net			6090ca
0000	0100		Australia, ABC/R Australia		9660va	12080pa
			15240va	15415va	17795pa	19000va
			21740va			
0000	0100		Australia, NT VL8A Alice Springs			4835do
0000	0100		Australia, NT VL8K Katherine		5025do	
0000	0100		Australia, NT VL8T Tennant Creek			4910do
0000	0100		Canada, CFRX Toronto ON		6070do	
0000	0100		Canada, CFVP Calgary AB		6030do	
0000	0100		Canada, CKZN St Johns NF		6160do	
0000	0100		Canada, CKZU Vancouver BC		6160do	
0000	0100		China, China R International		6020as	6075as
			6180as	7350as	7415as	9570na
			11790as	11885as	13750as	15125as
0000	0100	1st fa	Finland, Scandinavian Weekend R			6170eu
0000	0100		Germany, HCJB Germany		3995eu	7365eu
0000	0100	Sun	Germany, Mighty KBC Radio		7375eu	
0000	0100		Germany, R 6150	6070eu		
0000	0100		Guatemala, R Verdad		4055do	
0000	0100		Guyana, Voice of Guyana		3290do	
0000	0100		Honduras, R Luz y Vida		3250do	
0000	0100		India, AIR/Imphal	4775do		
0000	0100		India, AIR/Kohima	4850do		
0000	0100		India, AIR/Mumbai	4840do		
0000	0100		India, AIR/Port Blair		4760do	
0000	0100		Malaysia, RTM/Kajang		5965do	6050do
0000	0100		Malaysia, RTM/Traxx FM		7295do	
0000	0100		Mexico, R Educacion		6185do	
0000	0100		Micronesia, V6MP/Cross R/Pohnpei			4755as
0000	0100		New Zealand, R New Zealand Intl			15720pa
0000	0100	DRM	New Zealand, R New Zealand Intl			17675pa
0000	0100		Papua New Guinea, Wantok R Light			7325do
0000	0100		Solomon Islands, SIBC		9545do	
0000	0100		Spain, R Exterior de Espana		6055na	
0000	0100		Thailand, R Thailand World Svc		15275na	
0000	0100		UK, BBC World Service		5970as	6195as
			7320as	9410as	9740as	11750as
			12095as	15335as	15755as	`7685as
0000	0100		USA, AFN/AFRTS	4319usb	5765usb	12759usb
			13362usb			
0000	0100	smtwh	USA, Overcomer Ministry		7490na	
0000	0100		USA, Overcomer Ministry		3185na	
0000	0100		USA, WBCQ Monticello ME		7490na	9330na
0000	0100	fas	USA, WBCQ Monticello ME		5110na	
0000	0100		USA, WEWN/Irondale AL		11520af	
0000	0100	twhfas	USA, WHRI Cypress Crk SC		5920va	
0000	0100		USA, WINB Red Lion PA		9265am	
0000	0100		USA, WRMI Miami FL		9955am	
0000	0100		USA, WTWW Lebanon TN		5085sa	5830na
0000	0100		USA, WWCR Nashville TN		4840eu	5935af
			6875eu	7520ca		
0000	0100	irreg	USA, WWRB Manchester TN		3185na	3215na
0000	0100	Sun/irreg	USA, WWRB Manchester TN		5050na	
0015	0100		India, AIR/Chennai	4920do		
0020	0100		India, AIR/Hyderabad		4800do	
0020	0100		India, AIR/Thiruvananthapuram		5010do	
0025	0100		India, AIR/Aizawl	5050do		
0025	0100		India, AIR/Bhopal	4810do		
0025	0100		India, AIR/Jaipur	4910do		
0025	0100		India, AIR/Jeypore	5040do		
0030	0100		Australia, ABC/R Australia		17750va	
0030	0100		India, AIR/Srinagar	4950do		
0030	0100	twhfa	Serbia, International R Serbia		9685na	
0030	0100		USA, VO America	9325va	15290va	
0030	0100		USA, WHRI Cypress Crk SC		7315ca	

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

0100	0115	mtwha	Australia, HCJB Global Australia			15400as
0100	0115	Sat/Sun	Canada, Bible VO Broadcasting			9490as
0100	0130	Sun	Serbia, International R Serbia		9685na	
0100	0130		Vietnam, VO Vietnam/Overseas Svc			12005na
0100	0200		Anguilla, Caribbean Beacon/Univ Net			6090ca
0100	0200		Australia, ABC/R Australia		9660va	12080pa
			15160pa	15240va	15415va	17750va
			17795pa	19000va		
0100	0200		Australia, NT VL8A Alice Springs			4835do
0100	0200		Australia, NT VL8K Katherine		5025do	
0100	0200		Australia, NT VL8T Tennant Creek			4910do
0100	0200		Canada, CFRX Toronto ON		6070do	
0100	0200		Canada, CFVP Calgary AB		6030do	
0100	0200		Canada, CKZN St Johns NF		6160do	
0100	0200		Canada, CKZU Vancouver BC		6160do	
0100	0200		China, China R International		6020as	6175eu
			6180as	9410eu	9470eu	9535as
			9570na	9580na	9675eu	11870as
			15125as	15785as		
0100	0200		Cuba, R Havana Cuba		5040ca	6000na
			6165na			
0100	0200	1st fa	Finland, Scandinavian Weekend R			6170eu
0100	0200		Germany, HCJB Germany		3995eu	7365eu
0100	0200	Sun	Germany, Mighty KBC Radio		7375eu	
0100	0200		Germany, R 6150	6070eu		
0100	0200		Guatemala, R Verdad		4055do	
0100	0200		Guyana, Voice of Guyana		3290do	
0100	0200		Honduras, R Luz y Vida		3250do	
0100	0200		India, AIR/Aizawl	5050do		
0100	0200		India, AIR/Bhopal	4810do		
0100	0200		India, AIR/Chennai	4920do		
0100	0200		India, AIR/Gangkok		4835do	
0100	0200		India, AIR/Hyderabad		4800do	
0100	0200		India, AIR/Imphal	4775do		
0100	0200		India, AIR/Jaipur	4910do		
0100	0200		India, AIR/Jeypore	5040do		
0100	0200		India, AIR/Kohima	4850do		
0100	0200		India, AIR/Mumbai	4840do		
0100	0200		India, AIR/Port Blair		4760do	
0100	0200		India, AIR/Srinagar	4950do		
0100	0200		India, AIR/Thiruvananthapuram		5010do	
0100	0200		Malaysia, RTM/Kajang		5965do	6050do
0100	0200		Malaysia, RTM/Traxx FM		7295do	
0100	0200		Mexico, R Educacion		6185do	
0100	0200		Micronesia, V6MP/Cross R/Pohnpei			4755as
0100	0200		New Zealand, R New Zealand Intl			15720pa
0100	0200	DRM	New Zealand, R New Zealand Intl			17675pa
0100	0200		Papua New Guinea, Wantok R Light			7325do
0100	0200		Solomon Islands, SIBC		9545do	
0100	0200		Taiwan, R Taiwan Intl		11875as	
0100	0200		UK, BBC World Service		9500as	12095as
			15310as			
0100	0200		USA, AFN/AFRTS	4319usb	5765usb	12759usb
			13362usb			
0100	0200		USA, Overcomer Ministry		3185na	
0100	0200	smtwhf	USA, Overcomer Ministry		7490na	
0100	0200		USA, VO America	7430va	9780va	15205as
0100	0200		USA, WBCQ Monticello ME		7490na	9330na
0100	0200	fas	USA, WBCQ Monticello ME		5110na	
0100	0200		USA, WEWN/Irondale AL		11520af	
0100	0200	twhfa	USA, WHRI Cypress Crk SC		5920va	
0100	0200		USA, WHRI Cypress Crk SC		9860na	
0100	0200		USA, WINB Red Lion PA		9265am	
0100	0200		USA, WRMI Miami FL		9955am	
0100	0200	irreg	USA, WRNO New Orleans LA		7506na	
0100	0200		USA, WTWW Lebanon TN		5085sa	5830na
			9479na			
0100	0200		USA, WWCR Nashville TN		3215eu	4840na
			5935af	7520ca		
0100	0200	irreg	USA, WWRB Manchester TN		3185na	3215na
0100	0200	Sun/irreg	USA, WWRB Manchester TN		5050na	
0100	0200		Vanuatu, R Vanuatu	7260do		
0128	0200		India, AIR/Leh	4660do		
0130	0200	twhfas	Albania, R Tirana	9850va		
0130	0200		India, AIR/Chennai/FM Gold		7270do	
0130	0200	twhfa	USA, VO America	9820va		
0130	0200	mtwhf	USA, WRMI/R Slovakia Intl relay			9955am
0140	0200		Vatican City State, Vatican R		11730as	15470as

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

0200	0215		India, AIR/Bhopal	4810do		
0200	0215		India, AIR/Hyderabad		4800do	
0200	0215		India, AIR/Imphal	4775do		
0200	0215		India, AIR/Srinagar	4950do		
0200	0215		India, AIR/Thiruvananthapuram		5010do	
0200	0230		Thailand, R Thailand World Svc		15275na	
0200	0230		USA, WRMI/R Prague relay		9955am	
0200	0245		India, AIR/Chennai	4920do		
0200	0300		Anguilla, Caribbean Beacon/Univ Net			6090ca
0200	0300	twhfa	Argentina, RAE	11710am		
0200	0300		Australia, ABC/R Australia		9660va	12080pa
			15160pa	15240va	15415va	17750va
			17795pa	19000va		
0200	0300		Australia, NT VL8A Alice Springs			4835do
0200	0300		Australia, NT VL8K Katherine		5025do	
0200	0300		Australia, NT VL8T Tennant Creek			4910do
0200	0300		Canada, CFRX Toronto ON		6070do	
0200	0300		Canada, CFVP Calgary AB		6030do	
0200	0300		Canada, CKZN St Johns NF		6160do	
0200	0300		Canada, CKZU Vancouver BC		6160do	
0200	0300		China, China R International		11770as	13640as
0200	0300		Cuba, R Havana Cuba		6000na	6165na
0200	0300		Egypt, R Cairo	9720na		
0200	0300	1st fa	Finland, Scandinavian Weekend R			6170eu

0200	0300		Germany, HCJB Germany	3995eu	7365eu
0200	0300		Germany, R 6150 6070eu		
0200	0300		Guatemala, R Verdad	4055do	
0200	0300		Guyana, Voice of Guyana	3290do	
0200	0300		Honduras, R Luz y Vida	3250do	
0200	0300		India, AIR/Aizawl 5050do		
0200	0300		India, AIR/Chennai/FM Gold	7270do	
0200	0300		India, AIR/Gangkok	4835do	
0200	0300		India, AIR/Jaipur 4910do		
0200	0300		India, AIR/Jeypore 5040do		
0200	0300		India, AIR/Kohima 4850do		
0200	0300		India, AIR/Leh 4660do		
0200	0300		India, AIR/Mumbai 4840do		
0200	0300		India, AIR/Port Blair	4760do	
0200	0300		Malaysia, RTM/Kajang	5965do	6050do
0200	0300		Malaysia, RTM/Traxx FM	7295do	
0200	0300		Mexico, R Educacion	6185do	
0200	0300		Micronesia, V6MP/Cross R/Pohnpei		4755as
0200	0300		New Zealand, R New Zealand Intl		15720pa
0200	0300	DRM	New Zealand, R New Zealand Intl		17675pa
0200	0300		Papua New Guinea, Wantok R Light		7325do
0200	0300		Philippines, R Pilipinas Overseas Svc 15285me 17820me		11880me
0200	0300		Solomon Islands, SIBC	9545do	
0200	0300		South Korea, KBS World R	9580sa	9690as
0200	0300		UK, BBC World Service	15310as	17790as
0200	0300		USA, AFN/AFRTS 4319usb 13362usb	5765usb	12759usb
0200	0300		USA, Overcomer Ministry	3185na	
0200	0300	smtwhf	USA, Overcomer Ministry	7490na	
0200	0300		USA, WBCQ Monticello ME	7490na	9330na
0200	0300	fas	USA, WBCQ Monticello ME	5110na	
0200	0300		USA, WEWN/Irondale AL	11520af	
0200	0300		USA, WHRI Cypress Crk SC 9860na	5920va	7315ca
0200	0300		USA, WINB Red Lion PA	9265am	
0200	0300		USA, WRMI Miami FL	9955am	
0200	0300	irreg	USA, WRNO New Orleans LA	7506na	
0200	0300		USA, WTWW Lebanon TN	5085sa	5830na
0200	0300		USA, WWCR Nashville TN 5890ca 5935af	3215eu	4840na
0200	0300	irreg	USA, WWRB Manchester TN	3185na	3195na
0200	0300	Sun/irreg	USA, WWRB Manchester TN	5050na	
0200	0300		Vanuatu, R Vanuatu 7260do		
0215	0230		Nepal, R Nepal 5005do		
0215	0300		Myanmar, Myanma R	9731do	
0225	0300		India, AIR/Bhopal 7430do		
0225	0300		India, AIR/Hyderabad	7420do	
0225	0300		India, AIR/Imphal 7335do		
0225	0300		India, AIR/Srinagar 6110do		
0230	0300		India, AIR/Delhi 4870do		
0230	0300		India, AIR/Thiruvananthapuram	7290do	
0230	0300		Myanmar, Myanma R	5985do	
0230	0300		Vietnam, VO Vietnam/Overseas Svc		12005na
0245	0300		Zambia, Zambia Natl BC	5915do	6165do
0255	0300	Sun	Swaziland, TWR Africa	3200af	

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

0300	0310		India, AIR/Delhi 6030do		
0300	0320		Vatican City State, Vatican R	15460as	
0300	0325	Sun	Swaziland, TWR Africa	3200af	
0300	0330		Egypt, R Cairo 9720na		
0300	0330		India, AIR/Delhi 4870do		
0300	0330		Myanmar, Myanma R	5985do	
0300	0330		Philippines, R Pilipinas Overseas Svc 15285me 17820me		11880me
0300	0330		Vatican City State, Vatican R	7360af	9660af
0300	0355	mtwhf	South Africa, Channel Africa	3345af	5980af
0300	0356		Romania, R Romania Intl 17800as	7350na	9645na
0300	0356	DRM	Romania, R Romania Intl	15340as	
0300	0400		Anguilla, Caribbean Beacon/Univ Net		6090ca
0300	0400		Australia, ABC/R Australia 15415va 17750va 21725va	9660va	15160pa
0300	0400		Australia, NT VL8A Alice Springs		4835do
0300	0400		Australia, NT VL8K Katherine	5025do	
0300	0400		Australia, NT VL8T Tennant Creek		4910do
0300	0400		Canada, CFRX Toronto ON	6070do	
0300	0400		Canada, CFVP Calgary AB	6030do	
0300	0400		Canada, CKZN St Johns NF	6160do	
0300	0400		Canada, CKZU Vancouver BC	6160do	
0300	0400		China, China R International 11770as 13750as 15785as	9690am 15110as	9790na 15120as
0300	0400		Clandestine, R Miraya	11560af	
0300	0400		Cuba, R Havana Cuba	6000na	6165na
0300	0400	1st fa	Finland, Scandinavian Weekend R		6170eu
0300	0400		Germany, R 6150 6070eu		
0300	0400		Guatemala, R Verdad	4055do	
0300	0400		Guyana, Voice of Guyana	3290do	
0300	0400		Honduras, R Luz y Vida	3250do	
0300	0400		India, AIR/Aizawl 5050do		
0300	0400		India, AIR/Bhopal 7430do		
0300	0400		India, AIR/Chennai 7380do		
0300	0400		India, AIR/Chennai/FM Gold	7270do	
0300	0400		India, AIR/Gangkok	4835do	
0300	0400		India, AIR/Hyderabad	7420do	
0300	0400		India, AIR/Imphal 7335do		
0300	0400		India, AIR/Jaipur 4910do		
0300	0400		India, AIR/Kohima 4850do		
0300	0400		India, AIR/Leh 4660do		
0300	0400		India, AIR/Mumbai 4840do		
0300	0400		India, AIR/Srinagar 6110do		
0300	0400		India, AIR/Thiruvananthapuram	7290do	
0300	0400		Malaysia, RTM/Kajang	5965do	6050do
0300	0400		Malaysia, RTM/Traxx FM	7295do	
0300	0400		Mexico, R Educacion	6185do	
0300	0400		Micronesia, V6MP/Cross R/Pohnpei		4755as
0300	0400		New Zealand, R New Zealand Intl		15720pa
0300	0400	DRM	New Zealand, R New Zealand Intl		17675pa
0300	0400		Oman, R Sultanate of Oman	13600af	
0300	0400		Papua New Guinea, Wantok R Light		7325do
0300	0400		Solomon Islands, SIBC	9545do	
0300	0400		Taiwan, R Taiwan Intl	15320as	
0300	0400		Turkey, VO Turkey 6165as	9515va	
0300	0400		UK, BBC World Service	12095as	15365as
0300	0400		USA, AFN/AFRTS 4319usb 13362usb	5765usb	12759usb
0300	0400		USA, Overcomer Ministry	3185na	
0300	0400	twhfa	USA, Overcomer Ministry	5890na	
0300	0400		USA, VO America 4930af	6080af	9885af
0300	0400		USA, WBCQ Monticello ME	7490na	9330na
0300	0400		USA, WEWN/Irondale AL	11520af	
0300	0400		USA, WHRI Cypress Crk SC	7385na	9825eu
0300	0400		USA, WRMI Miami FL	9955am	
0300	0400	irreg	USA, WRNO New Orleans LA	7506na	
0300	0400		USA, WTWW Lebanon TN	5085sa	5830na
0300	0400		USA, WWCR Nashville TN 5890ca 5935af	3215eu	4840na
0300	0400	irreg	USA, WWRB Manchester TN	3185na	3195na
0300	0400	Sun/irreg	USA, WWRB Manchester TN	5050na	
0300	0400		Vanuatu, R Vanuatu 7260do		
0300	0400		Zambia, Zambia Natl BC	5915do	6165do
0315	0400		India, AIR/Port Blair	4760do	
0315	0400	mtwhfa	India, AIR/Port Blair	7390do	
0315	0400	Sun	India, AIR/Port Blair	4760do	
0330	0400		Iran, VOIRI/VO Justice	13650eu	15470eu
0330	0400		Vietnam, VO Vietnam/Overseas Svc		6175na

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

0400	0401		India, AIR/Gangkok	4835do	
0400	0415		India, AIR/Kohima 4850do		
0400	0415	Sat	India, AIR/Port Blair	4760do	
0400	0427		Iran, VOIRI/VO Justice	13650eu	15470eu
0400	0430	mtwhfa	India, AIR/Chennai 7380do		
0400	0430		India, AIR/Chennai/FM Gold	7270do	
0400	0430		India, AIR/Jaipur 4910do		
0400	0430	Sun	India, AIR/Leh 4660do		
0400	0430		India, AIR/Thiruvananthapuram	7290do	
0400	0430		USA, WHRI Cypress Crk SC	7385na	
0400	0435	mtwhfa	India, AIR/Jeypore 5040do		
0400	0445	Sun	India, AIR/Jeypore 5040do		
0400	0447	mtwhfa	India, AIR/Bhopal 7430do		
0400	0455	mtwhf	South Africa, Channel Africa	3345af	
0400	0457		Germany, Deutsche Welle	9470af	12045af
0400	0457		North Korea, VO Korea 9730as 11735ca	7220as 13760sa	9445as 15180sa
0400	0458		New Zealand, R New Zealand Intl		15720pa
0400	0458	DRM	New Zealand, R New Zealand Intl		17675pa
0400	0500		Anguilla, Caribbean Beacon/Univ Net		6090ca
0400	0500		Australia, ABC/R Australia 15160pa 15240va 17800as 21725va	9660va 15415va	12080pa 17750as
0400	0500		Australia, NT VL8A Alice Springs		4835do
0400	0500		Australia, NT VL8K Katherine	5025do	
0400	0500		Australia, NT VL8T Tennant Creek		4910do
0400	0500		Canada, CFRX Toronto ON	6070do	
0400	0500		Canada, CKZN St Johns NF	6160do	
0400	0500		Canada, CKZU Vancouver BC	6160do	
0400	0500		China, China R International 15785as 17730va	13750as	15120as 17855va
0400	0500		Clandestine, R Miraya	11560af	
0400	0500		Cuba, R Havana Cuba	6000na	6165na
0400	0500	1st fa	Finland, Scandinavian Weekend R		6170eu
0400	0500		Germany, Deutsche Welle	9810af	
0400	0500		Germany, R 6150 6070eu		
0400	0500		Guatemala, R Verdad	4055do	
0400	0500		Guyana, Voice of Guyana	3290do	
0400	0500	Sun	India, AIR/Chennai 7380do		
0400	0500	Sun	India, AIR/Hyderabad	7420do	
0400	0500	Sun	India, AIR/Imphal 7335do		
0400	0500	Sun	India, AIR/Port Blair	7390do	

0400	0500		India, AIR/Srinagar	6110do		
0400	0500		Malaysia, RTM/Kajang	5965do	6050do	
0400	0500		Malaysia, RTM/Traxx FM	7295do		
0400	0500		Mexico, R Educacion	6185do		
0400	0500		Micronesia, V6MP/Cross R/Pohnpei		4755as	
0400	0500		Papua New Guinea, Wantok R Light		7325do	
0400	0500		Solomon Islands, SIBC	9545do		
0400	0500		UK, BBC World Service	11940af	12095as	15365as 15420af
0400	0500	DRM	UK, BBC World Service	3955eu		
0400	0500		USA, AFN/AFRTS	4319usb	5765usb	12759usb 13362usb
0400	0500		USA, Overcomer Ministry	3185na	5890na	
0400	0500		USA, VO America	4930af	4960af	6080af 9885af 12025af
0400	0500		USA, WBCQ Monticello ME	9330na		
0400	0500		USA, WEWN/Irondale AL	11520af		
0400	0500		USA, WHRI Cypress Crk SC	9825me		
0400	0500		USA, WRMI Miami FL	9955am		
0400	0500		USA, WTWW Lebanon TN	5085sa	5830na	
0400	0500		USA, WWCR Nashville TN	3215eu	4840na	5890ca 5935af
0400	0500	irreg	USA, WWRB Manchester TN	3185na		
0400	0500		Vanuatu, R Vanuatu	7260do		
0400	0500		Zambia, Zambia Natl BC	5915do	6165do	
0400	0500	irreg	Zimbabwe, VO Zimbabwe	4828af		
0430	0500		India, AIR/Kohima	6065do		
0430	0500	Sat/Sun	India, AIR/Thiruvananthapuram	7290do		
0430	0500	mtwhf	Swaziland, TWR Africa	3200af		
0430	0500		USA, VO America	4930af	4960af	6080af 12025af
0455	0500	irreg	Nigeria, VO Nigeria	15120eu		
0459	0500		New Zealand, R New Zealand Intl		11725pa	
0459	0500	DRM	New Zealand, R New Zealand Intl		11675pa	

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

0500	0501		India, AIR/Srinagar	6110do		
0500	0505	Sat	India, AIR/Hyderabad	7420do		
0500	0510		India, AIR/Kohima	6065do		
0500	0527		Germany, Deutsche Welle	5905af	9470af	
0500	0530		Australia, ABC/R Australia	17750as	17800as	
0500	0530	Sun	India, AIR/Bhopal	7430do		
0500	0530	Sun	India, AIR/Jaipur	4910do		
0500	0530		Japan, R Japan/NHK World	5975as	11970af	
0500	0530		Vatican City State, Vatican R	11625af	13765af	
0500	0557		North Korea, VO Korea	13650as	15105as	
0500	0600		Anguilla, Caribbean Beacon/Univ Net		6090ca	
0500	0600		Australia, ABC/R Australia	9660va	12080pa	13630pa 15415va 21725va
0500	0600		Australia, NT VL8A Alice Springs		4835do	
0500	0600		Australia, NT VL8K Katherine	5025do		
0500	0600		Australia, NT VL8T Tennant Creek		4910do	
0500	0600		Bhutan, Bhutan BC Svc	6035do		
0500	0600		Canada, CFRX Toronto ON	6070do		
0500	0600		Canada, CKZN St Johns NF	6160do		
0500	0600		Canada, CKZU Vancouver BC	6160do		
0500	0600		China, China R International	11710af	11895as	15465as 15350as 17505va 17730va 17855va
0500	0600		Clandestine, R Miraya	11560af		
0500	0600		Cuba, R Havana Cuba	6010na	6060na	6125am 6165na
0500	0600	1st Sat	Finland, Scandinavian Weekend R		5980eu	
0500	0600		Germany, Deutsche Welle	9800af	15275af	
0500	0600		Germany, R 6150	6070eu		
0500	0600		Guatemala, R Verdad	4055do		
0500	0600		Guyana, Voice of Guyana	3290do		
0500	0600	Sat/Sun	India, AIR/Thiruvananthapuram	7290do		
0500	0600		Malaysia, RTM/Kajang	5965do	6050do	
0500	0600		Malaysia, RTM/Traxx FM	7295do		
0500	0600		Mexico, R Educacion	6185do		
0500	0600		Micronesia, V6MP/Cross R/Pohnpei		4755as	
0500	0600	DRM	New Zealand, R New Zealand Intl		11675pa	
0500	0600	irreg	Nigeria, VO Nigeria	15120af		
0500	0600		Papua New Guinea, Wantok R Light		7325do	
0500	0600		Solomon Islands, SIBC	9545do		
0500	0600	mtwhf	South Africa, Channel Africa	7230af		
0500	0600	mtwhf	Swaziland, TWR Africa	4775af		
0500	0600	Sat/Sun	Swaziland, TWR Africa	3200af	4775af	
0500	0600		Swaziland, TWR Africa	9500af		
0500	0600		UK, BBC World Service	3255af	5875af	6005af 6190af 7355af 11945af 15420af
0500	0600	DRM	UK, BBC World Service	3955eu		
0500	0600		USA, AFN/AFRTS	4319usb	5765usb	12759usb 13362usb
0500	0600		USA, Overcomer Ministry	3185na	5890na	
0500	0600		USA, VO America	4930af	6080af	12025af 15580af
0500	0600		USA, WBCQ Monticello ME	9330na		
0500	0600		USA, WEWN/Irondale AL	11520af		
0500	0600		USA, WHRI Cypress Crk SC	9825me		
0500	0600		USA, WRMI Miami FL	9955am		
0500	0600		USA, WTWW Lebanon TN	5085sa	5830na	
0500	0600		USA, WWCR Nashville TN	3215eu	4840na	5890ca 5935af
0500	0600	irreg	USA, WWRB Manchester TN	3185na		
0500	0600		Vanuatu, R Vanuatu	7260do		
0500	0600		Zambia, Zambia Natl BC	5915do	6165do	
0500	0600	irreg	Zimbabwe, VO Zimbabwe	4828af		
0515	0530		Rwanda, R Rep Rwandaise	6055do		
0525	0600		Vanuatu, R Vanuatu	3945do		
0530	0556		Romania, R Romania Intl	9700eu	17760pa	21500pa
0530	0556	DRM	Romania, R Romania Intl	11875eu		
0530	0557		Germany, Deutsche Welle	9800af		
0530	0600		Australia, ABC/R Australia	17750va		
0530	0600	irreg	Congo Dem Rep, R Kahuzi	6210do		
0530	0600		Germany, Deutsche Welle	15275af		
0530	0600	Sun	India, AIR/Hyderabad	7420do		
0530	0600		India, AIR/Mumbai	7240do		
0530	0600		Nigeria, FRCN Abuja	7275do		
0530	0600		Thailand, R Thailand World Svc	17770eu		
0535	0547		New Zealand, R New Zealand Intl		15720pa	
0548	0600		New Zealand, R New Zealand Intl		11725pa	
0555	0600		Mali, ORTM/R Mali	5995do		

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

0600	0627		Germany, Deutsche Welle	15275af		
0600	0630		Germany, Deutsche Welle	15440af	17800af	
0600	0630	Sat/Sun	India, AIR/Thiruvananthapuram	7290do		
0600	0655	mtwhf	South Africa, Channel Africa	7230af	15255af	
0600	0657		North Korea, VO Korea	7220as	9445as	9730as
0600	0700		Anguilla, Caribbean Beacon/Univ Net		6090ca	
0600	0700		Australia, ABC/R Australia	9660va	11945va	13630pa 15240va 15415va 17750va 21725va
0600	0700		Australia, NT VL8A Alice Springs		4835do	
0600	0700		Australia, NT VL8K Katherine	5025do		
0600	0700		Australia, NT VL8T Tennant Creek		4910do	
0600	0700		Bangladesh, Bangla Betar/Home Svc		4750as	
0600	0700		Canada, CFRX Toronto ON	6070do		
0600	0700		Canada, CFVP Calgary AB	6030do		
0600	0700		Canada, CKZN St Johns NF	6160do		
0600	0700		Canada, CKZU Vancouver BC	6160do		
0600	0700		China, China R International	11710af	11870me	15140me 15350as 17505va 17710as
0600	0700		China, VO the South China Sea	13660as		
0600	0700	irreg	Congo Dem Rep, R Kahuzi	6210do		
0600	0700		Cuba, R Havana Cuba	6010na	6060na	6125am 6165na
0600	0700	1st Sat	Finland, Scandinavian Weekend R		5980eu	
0600	0700	wa/irreg	Germany, Hamburger Lokalradio		7265eu	
0600	0700		Germany, R 6150	6070eu		
0600	0700		Guyana, Voice of Guyana	3290do		
0600	0700		India, AIR/Chennai	7380do		
0600	0700		India, AIR/Hyderabad	7420do		
0600	0700		India, AIR/Imphal	7335do		
0600	0700		India, AIR/Mumbai	7240do		
0600	0700		Malaysia, RTM/Kajang	5965do	6050do	
0600	0700		Malaysia, RTM/Traxx FM	7295do		
0600	0700		Mali, ORTM/R Mali	5995do		
0600	0700		Micronesia, V6MP/Cross R/Pohnpei		4755as	
0600	0700	DRM	New Zealand, R New Zealand Intl		9890pa	
0600	0700		New Zealand, R New Zealand Intl		11725pa	
0600	0700		Nigeria, FRCN Abuja	7275do		
0600	0700	irreg	Nigeria, VO Nigeria	15120af		
0600	0700		Papua New Guinea, R Central	3290do		
0600	0700		Papua New Guinea, R East New Britain		3385do	
0600	0700		Papua New Guinea, R Vanimo	3205do		
0600	0700		Papua New Guinea, R Western	3305do		
0600	0700		Papua New Guinea, Wantok R Light		7325do	
0600	0700		Russia, VO Russia	21800pa	21820pa	
0600	0700	DRM	Russia, VO Russia	11830eu		
0600	0700		Solomon Islands, SIBC	9545do		
0600	0700		Swaziland, TWR Africa	4775af	6120af	
0600	0700		UK, BBC World Service	6005af	6190af	7355af 9860af 12095af 15105af 15420af 17640af
0600	0700	DRM	UK, BBC World Service	5875eu	7325eu	
0600	0700		USA, AFN/AFRTS	4319usb	5765usb	12759usb 13362usb
0600	0700		USA, Overcomer Ministry	3185na	5890na	
0600	0700		USA, VO America	6080af	12025af	15580af
0600	0700		USA, WBCQ Monticello ME	9330na		
0600	0700		USA, WEWN/Irondale AL	11520af		
0600	0700		USA, WHRI Cypress Crk SC	9825me		
0600	0700		USA, WRMI Miami FL	9955am		
0600	0700		USA, WTWW Lebanon TN	5085sa	5830na	
0600	0700		USA, WWCR Nashville TN	3215eu	4840na	5890ca 5935af

0600	0700	irreg	USA, WWRB Manchester TN	3185na		
0600	0700		Vanuatu, R Vanuatu	3945do	7260do	
0600	0700		Zambia, Zambia Natl BC	5915do	6165do	
0600	0700	irreg	Zimbabwe, VO Zimbabwe	4828af		
0615	0700	Sat	USA, WHRI Cypress Crk SC	9825me		
0630	0645	mtwhfa	Vatican City State, Vatican R	15595me		
0630	0700		Germany, Deutsche Welle	15440af	17800af	
0630	0700		India, AIR/Bhopal	7430do		
0630	0700	mtwhfa	India, AIR/Imphal	7335do		
0630	0700		India, AIR/Jaipur	7325do		
0630	0700	Sun	India, AIR/Leh	6000do		
0630	0700		India, AIR/Srinagar	6110do		
0630	0700		India, AIR/Thiruvananthapuram	7290do		
0630	0700		Vatican City State, Vatican R	13765af	15570af	
0657	0700		Germany, TWR Europe	6105eu		

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

0700	0730		Myanmar, Myanma R	5985do		
0700	0735		Vanuatu, R Vanuatu	7260do		
0700	0745	Sat/Sun	Canada, Bible VO Broadcasting		5945eu	
0700	0750		Austria, TWR Europe	7400eu		
0700	0750		Germany, TWR Europe	6105eu		
0700	0758		New Zealand, R New Zealand Intl		11725pa	
0700	0758	DRM	New Zealand, R New Zealand Intl		9890pa	
0700	0800		Anguilla, Caribbean Beacon/Univ Net		6090ca	
0700	0800		Australia, ABC/R Australia	7410va	9475as	
			9660va	9710va	11945va	12080pa
			13630pa	15240va		
0700	0800		Australia, NT VL8A Alice Springs		4835do	
0700	0800		Australia, NT VL8K Katherine	5025do		
0700	0800		Australia, NT VL8T Tennant Creek		4910do	
0700	0800		Bangladesh, Bangla Betar/Home Svc		4750as	
0700	0800	irreg	Cameroon, CRTV/R Buea	6005do		
0700	0800		Canada, CFRX Toronto ON	6070do		
0700	0800		Canada, CFVP Calgary AB	6030do		
0700	0800		Canada, CKZN St Johns NF	6160do		
0700	0800		Canada, CKZU Vancouver BC	6160do		
0700	0800		China, China R International	11895as	13660as	
			13710eu	15350as	15465as	17480va
			17490eu	17540as	17710as	
0700	0800		China, Xizang PBS	4905do	4920do	6025do
			6110do	6130do	6200do	9490do
			9580do			
0700	0800	irreg	Congo Dem Rep, R Kahuzi	6210do		
0700	0800	1st Sat	Finland, Scandinavian Weekend R		5980eu	
0700	0800	wa/irreg	Germany, Hamburger Lokalradio		7265eu	
0700	0800		Germany, R 6150	6070eu		
0700	0800		Guyana, Voice of Guyana	3290do		
0700	0800		India, AIR/Aizawl	7295do		
0700	0800		India, AIR/Bhopal	7430do		
0700	0800		India, AIR/Chennai	7380do		
0700	0800		India, AIR/Hyderabad	7420do		
0700	0800		India, AIR/Imphal	7335do		
0700	0800		India, AIR/Jaipur	7325do		
0700	0800		India, AIR/Jeypore	6040do		
0700	0800		India, AIR/Kohima	6065do		
0700	0800		India, AIR/Leh	6000do		
0700	0800		India, AIR/Mumbai	7240do		
0700	0800		India, AIR/Port Blair	7390do		
0700	0800		India, AIR/Srinagar	6110do		
0700	0800		India, AIR/Thiruvananthapuram	7290do		
0700	0800		Malaysia, RTM/Kajang	5965do	6050do	
0700	0800		Malaysia, RTM/Traxx FM	7295do		
0700	0800		Mali, ORTM/R Mali	5995do		
0700	0800		Micronesia, V6MP/Cross R/Pohnpei		4755as	
0700	0800		Nigeria, FRCN Abuja	7275do		
0700	0800		Papua New Guinea, R Central	3290do		
0700	0800		Papua New Guinea, R East New Britain		3385do	
0700	0800		Papua New Guinea, R Northern	3345do		
0700	0800		Papua New Guinea, R Vanimo	3205do		
0700	0800		Papua New Guinea, R Western	3305do		
0700	0800		Papua New Guinea, Wantok R Light		7325do	
0700	0800		Russia, VO Russia	13785as	17500as	21800pa
			21820pa			
0700	0800	DRM	Russia, VO Russia	11830eu		
0700	0800		Solomon Islands, SIBC	5020do	9545do	
0700	0800	mtwhf	South Africa, Channel Africa	9625af		
0700	0800		Swaziland, TWR Africa	4775af	6120af	
			9500af			
0700	0800		UK, BBC World Service	6190af	11770af	
			12095af	13660af	15400af	15420af
			17640af	17830af		
0700	0800	DRM	UK, BBC World Service	5875eu	7325eu	
0700	0800		USA, AFN/AFRTS	4319usb	5765usb	12759usb
			13362usb			
0700	0800		USA, Overcomer Ministry	3185na		
0700	0800	sm	USA, Overcomer Ministry	5890na		
0700	0800		USA, WBCQ Monticello ME	9330na		
0700	0800		USA, WEWN/Irondale AL	11520af		
0700	0800		USA, WRMI Miami FL	9955am		
0700	0800		USA, WTWW Lebanon TN	5085sa	5830na	
0700	0800		USA, WWCR Nashville TN	3215eu	4840na	
			5890ca	5935af		
0700	0800	irreg	USA, WWRB Manchester TN	3185na		
0700	0800		Vanuatu, R Vanuatu	3945do		
0700	0800		Zambia, Zambia Natl BC	5915do	6165do	
0730	0800		Australia, HCJB Global Australia		15490as	
0730	0800		Sudan, VO Africa/Sudan R	9505af		
0759	0800		New Zealand, R New Zealand Intl		9700pa	
0759	0800	DRM	New Zealand, R New Zealand Intl		9890pa	

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

0800	0830		Australia, HCJB Global Australia		15490as	
0800	0830		Australia, NT VL8A Alice Springs		4835do	
0800	0830		Australia, NT VL8K Katherine	5025do		
0800	0830		Australia, NT VL8T Tennant Creek		4910do	
0800	0830		Sudan, VO Africa/Sudan R	9505af		
0800	0900		Anguilla, Caribbean Beacon/Univ Net		6090ca	
0800	0900		Australia, ABC/R Australia	5995as	7410va	
			9475as	9580pa	9710va	11945va
			12080pa	15240va		
0800	0900		Bangladesh, Bangla Betar/Home Svc		4750as	
0800	0900		Bhutan, Bhutan BC Svc	6035do		
0800	0900	irreg	Cameroon, CRTV/R Buea	6005do		
0800	0900		Canada, CFRX Toronto ON	6070do		
0800	0900		Canada, CFVP Calgary AB	6030do		
0800	0900		Canada, CKZN St Johns NF	6160do		
0800	0900		Canada, CKZU Vancouver BC	6160do		
0800	0900		China, China R International	11620as	11895as	
			13710as	15350as	15465as	17480va
			17490eu	17540as		
0800	0900	irreg	Congo Dem Rep, R Kahuzi	6210do		
0800	0900	1st Sat	Finland, Scandinavian Weekend R		6170eu	
0800	0900	Sat/Sun	Germany, Mighty KBC Radio	6095eu		
0800	0900		Germany, R 6150	6070eu		
0800	0900		Guyana, Voice of Guyana	3290do		
0800	0900		India, AIR/Aizawl	7295do		
0800	0900		India, AIR/Bhopal	7430do		
0800	0900		India, AIR/Chennai	7380do		
0800	0900		India, AIR/Imphal	7335do		
0800	0900		India, AIR/Jaipur	7325do		
0800	0900		India, AIR/Jeypore	6040do		
0800	0900		India, AIR/Kohima	6065do		
0800	0900		India, AIR/Leh	6000do		
0800	0900		India, AIR/Mumbai	7240do		
0800	0900		India, AIR/Port Blair	7390do		
0800	0900		India, AIR/Srinagar	6110do		
0800	0900		India, AIR/Thiruvananthapuram	7290do		
0800	0900	Sat	Italy, IRRS Shortwave	9510va		
0800	0900		Malaysia, RTM/Kajang	5965do	6050do	
0800	0900		Malaysia, RTM/Traxx FM	7295do		
0800	0900		Mali, ORTM/R Mali	9635do		
0800	0900		Micronesia, V6MP/Cross R/Pohnpei		4755as	
0800	0900		New Zealand, R New Zealand Intl		9700pa	
0800	0900	DRM	New Zealand, R New Zealand Intl		9890pa	
0800	0900		Nigeria, FRCN Abuja	7275do		
0800	0900	irreg	Nigeria, VO Nigeria	15120af		
0800	0900	mtwhfs	Palau, T8WH/World Harvest R	9930as		
0800	0900		Papua New Guinea, R Central	3290do		
0800	0900		Papua New Guinea, R East New Britain		3385do	
0800	0900		Papua New Guinea, R Northern	3345do		
0800	0900		Papua New Guinea, R Vanimo	3205do		
0800	0900		Papua New Guinea, R Western	3305do		
0800	0900		Papua New Guinea, Wantok R Light		7325do	
0800	0900		Russia, VO Russia	13785as	17500as	21800va
			21820pa			
0800	0900	DRM	Russia, VO Russia	9850eu	11830eu	
0800	0900		Solomon Islands, SIBC	5020do	9545do	
0800	0900	mtwhf	South Africa, Channel Africa	9625af		
0800	0900	Sun	South Africa, SA Radio League	7205af	17660af	
0800	0900		South Korea, KBS World R	9570as		
0800	0900		USA, AFN/AFRTS	4319usb	5765usb	12759usb
			13362usb			
0800	0900		USA, Overcomer Ministry	3185na	5890na	
0800	0900		USA, WBCQ Monticello ME	9330na		
0800	0900		USA, WEWN/Irondale AL	11520af		
0800	0900	mtwhfs	USA, WHRI Cypress Crk SC	11565pa		
0800	0900		USA, WRMI Miami FL	9955am		
0800	0900		USA, WTWW Lebanon TN	5085sa	5830na	
0800	0900		USA, WWCR Nashville TN	3215eu	4840na	
			5890ca	5935af		
0800	0900	irreg	USA, WWRB Manchester TN	3185na		
0800	0900		Vanuatu, R Vanuatu	3945do		
0800	0900		Zambia, Zambia Natl BC	5915do	6165do	
0815	0830		Nepal, R Nepal	5005do		
0830	0900		Australia, NT VL8A Alice Springs		2310do	
0830	0900		Australia, NT VL8K Katherine	2485do		
0830	0900		Australia, NT VL8T Tennant Creek		2325do	
0830	0900		India, AIR/External Svc	7250as	7340as	
			9595as	11620as		
0850	0900	smtwhf	Singapore, TWR Asia	15200as		

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

0900	0920		India, AIR/Chennai	7380do		
0900	0930		India, AIR/Leh	6000do		
0900	0930		Mongolia, VO Mongolia	12085as		
0900	0930	smtwhf	Singapore, TWR Asia	15200as		
0900	0931		India, AIR/Bhopal	7430do		
0900	0931		India, AIR/Jaipur	7325do		
0900	0931		India, AIR/Port Blair	7390do		
0900	0945		India, AIR/Jeypore	6040do		
0900	1000		Anguilla, Caribbean Beacon/Univ Net		6090ca	
0900	1000		Australia, ABC/R Australia	9580pa	11945va	
0900	1000		Australia, NT VL8A Alice Springs		2310do	
0900	1000		Australia, NT VL8K Katherine	2485do		
0900	1000		Australia, NT VL8T Tennant Creek		2325do	
0900	1000		Bangladesh, Bangla Betar/Home Svc		4750as	
0900	1000	irreg	Cameroon, CRTV/R Buea	6005do		
0900	1000		Canada, CFRX Toronto ON	6070do		
0900	1000		Canada, CFVP Calgary AB	6030do		
0900	1000		Canada, CKZN St Johns NF	6160do		
0900	1000		Canada, CKZU Vancouver BC	6160do		
0900	1000		China, China R International	11620as	13790as	
			15270eu	15350as	17490eu	17570eu
			17650pa	17750as		
0900	1000	irreg	Congo Dem Rep, R Kahuzi	6210do		
0900	1000	1st Sat	Finland, Scandinavian Weekend R		6170eu	
0900	1000	Sat/Sun	Germany, Mighty KBC Radio	6095eu		
0900	1000		Germany, R 6150	6070eu		
0900	1000		India, AIR/Aizawl	7295do		
0900	1000		India, AIR/External Svc	7250as	7340as	
			9595as	11620as		
0900	1000		India, AIR/Imphal	7335do		
0900	1000		India, AIR/Mumbai	7240do		
0900	1000		India, AIR/Port Blair	7390do		
0900	1000		India, AIR/Srinagar	6110do		
0900	1000		India, AIR/Thiruvananthapuram	7290do		
0900	1000		Malaysia, RTM/Kajang	5965do	6050do	
0900	1000		Malaysia, RTM/Traxx FM	7295do		
0900	1000		Mali, ORTM/R Mali	9635do		
0900	1000		Micronesia, V6MP/Cross R/Pohnpei		4755as	
0900	1000	3rd Sun	Netherlands, XVRB/Music Museum		6045eu	
0900	1000	DRM	New Zealand, R New Zealand Intl		9890pa	
0900	1000		New Zealand, R New Zealand Intl		9700pa	
0900	1000		Nigeria, FRCN Abuja	7275do		
0900	1000	irreg	Nigeria, VO Nigeria	9690af		
0900	1000		Palau, T8WH/World Harvest R	9930as		
0900	1000		Papua New Guinea, R Central	3290do		
0900	1000		Papua New Guinea, R East New Britain		3385do	
0900	1000		Papua New Guinea, R Northern	3345do		
0900	1000		Papua New Guinea, R Vanimo	3205do		
0900	1000		Papua New Guinea, R Western	3305do		
0900	1000		Papua New Guinea, Wantok R Light		7325do	
0900	1000		Russia, VO Russia	21800va	21820va	
0900	1000	DRM	Russia, VO Russia	9850eu	11830eu	
0900	1000		Solomon Islands, SIBC	5020do	9545do	
0900	1000	mtwhf	South Africa, Channel Africa	9625af		
0900	1000		USA, AFN/AFRTS	4319usb	5765usb	12759usb
			13362usb			
0900	1000		USA, Overcomer Ministry	3185na	5890na	
0900	1000		USA, WBCQ Monticello ME	9330na		
0900	1000		USA, WEWN/Irondale AL	11520af		
0900	1000	Sun	USA, WHRI Cypress Crk SC	11565pa		
0900	1000		USA, WRMI Miami FL	9955am		
0900	1000		USA, WTWW Lebanon TN	5085sa	5830na	
0900	1000		USA, WWCR Nashville TN	4840na	5890ca	
			5935af	15825eu		
0900	1000	irreg	USA, WWRB Manchester TN	3185na		
0900	1000		Vanuatu, R Vanuatu	3945do		
0900	1000		Zambia, Zambia Natl BC	5915do	6165do	
0930	1000	fs	China, VO the Strait	6115do		
0930	1000	Sun	Italy, IRRS Shortwave	9510va		
0930	1000		Saudi Arabia, BSKSA/External Svc		15250af	

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

1000	1000		USA, KNLS Anchor Point AK	9655as		
1000	1020	mtwhf	Singapore, TWR Asia	11840pa		
1000	1030	Sun	India, AIR/Thiruvananthapuram	7290do		
1000	1030		Japan, R Japan/NHK World	9625as	9695as	
1000	1030	Sat	Singapore, TWR Asia	11840pa		
1000	1030		Vietnam, VO Vietnam/Overseas Svc		9840as	
			12020as			
1000	1031	Sun	India, AIR/Bhopal	7430do		
1000	1035		India, AIR/Mumbai	7240do		
1000	1057		North Korea, VO Korea	11710ca	11735as	
			13650as	15180sa		
1000	1058		New Zealand, R New Zealand Intl		9700pa	
1000	1058	DRM	New Zealand, R New Zealand Intl		9890pa	
1000	1100		Anguilla, Caribbean Beacon/Univ Net		11775ca	
1000	1100		Australia, ABC/R Australia	9580pa	12065pa	
1000	1100	Sat/Sun	Australia, ABC/R Australia	5995as	6080as	
			6150as	9475va	9710va	12080pa
1000	1100		Australia, NT VL8A Alice Springs		2310do	
1000	1100		Australia, NT VL8K Katherine	2485do		
1000	1100		Australia, NT VL8T Tennant Creek		2325do	
1000	1100		Bangladesh, Bangla Betar/Home Svc		4750as	
1000	1100	irreg	Cameroon, CRTV/R Buea	6005do		
1000	1100		Canada, CFRX Toronto ON	6070do		
1000	1100		Canada, CFVP Calgary AB	6030do		
1000	1100		Canada, CKZN St Johns NF	6160do		
1000	1100		Canada, CKZU Vancouver BC	6160do		
1000	1100		China, China R International	11610as	11620as	
			11635as	13590as	13620as	13720as
			13790pa	15190as	15210pa	15350as
			17490eu			
1000	1100	irreg	Congo Dem Rep, R Kahuzi	6210do		
1000	1100	1st Sat	Finland, Scandinavian Weekend R		6170eu	
1000	1100	Sat/Sun	Germany, Mighty KBC Radio	6095eu		
1000	1100		Germany, R 6150	6070eu		
1000	1100		India, AIR/External Svc	7270as	13605as	
			13695pa	15030as	15410as	17510pa
			17895pa			
1000	1100		India, AIR/External Svc	7250as	7340as	
			9595as	11620as		
1000	1100		India, AIR/Kohima	4850do		
1000	1100		India, AIR/Srinagar	6110do		
1000	1100	irreg	Indonesia, VO Indonesia	9526pa		
1000	1100	Sun	Italy, IRRS Shortwave	9510va		
1000	1100		Malaysia, RTM/Kajang	5965do	6050do	
1000	1100		Malaysia, RTM/Traxx FM	7295do		
1000	1100		Mali, ORTM/R Mali	9635do		
1000	1100		Micronesia, V6MP/Cross R/Pohnpei		4755as	
1000	1100		Nigeria, FRCN Abuja	7275do		
1000	1100	irreg	Nigeria, VO Nigeria	9690af		
1000	1100		Papua New Guinea, R Central	3290do		
1000	1100		Papua New Guinea, R East New Britain		3385do	
1000	1100		Papua New Guinea, R Northern	3345do		
1000	1100		Papua New Guinea, R Vanimo	3205do		
1000	1100		Papua New Guinea, R Western	3305do		
1000	1100		Papua New Guinea, Wantok R Light		7325do	
1000	1100		Russia, VO Russia	11530as	12030as	
1000	1100	DRM	Russia, VO Russia	9850eu		
1000	1100		Saudi Arabia, BSKSA/External Svc		15250af	
1000	1100		Solomon Islands, SIBC	5020do	9545do	
1000	1100	mtwhf	South Africa, Channel Africa	9625af		
1000	1100		UK, BBC World Service	6195as	9740as	
			15285as	17660as	21660as	
1000	1100	Sat/t	UK, BBC World Service	17760as		
1000	1100	mf	UK, BBC World Service	17705as		
1000	1100	wa	UK, BBC World Service	17840as		
1000	1100		USA, AFN/AFRTS	4319usb	5765usb	12759usb
			13362usb			
1000	1100		USA, Overcomer Ministry	3185na	5890na	
1000	1100		USA, WBCQ Monticello ME	9330na		
1000	1100		USA, WEWN/Irondale AL	11520af		
1000	1100	Sun	USA, WHRI Cypress Crk SC	11565pa		
1000	1100	Sun	USA, WINB Red Lion PA	9265am		
1000	1100		USA, WRMI Miami FL	9955am		
1000	1100		USA, WTWW Lebanon TN	5085sa	5830na	
1000	1100		USA, WWCR Nashville TN	4840na	5890ca	
			5935af	15825eu		
1000	1100	irreg	USA, WWRB Manchester TN	3185na		
1000	1100		Vanuatu, R Vanuatu	3945do		
1000	1100		Zambia, Zambia Natl BC	5915do	6165do	
1030	1100		India, AIR/Gangkok	4835do		
1030	1100		India, AIR/Imphal	4775do		
1030	1100		India, AIR/Port Blair	4760do		
1030	1100		Iran, VOIRI	21505va	21640va	
1059	1100		New Zealand, R New Zealand Intl		9700pa	
1059	1100	DRM	New Zealand, R New Zealand Intl		9890pa	

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

1100	1115	mwh	Australia, HCJB Global Australia		15490as	
1100	1127		Iran, VOIRI	21505va	21640va	
1100	1130	Sun	Canada, Bible VO Broadcasting		21480as	
1100	1130		India, AIR/External Svc	7250as	7340as	
			9595as	11620as		
1100	1130	f/DRM	Japan, R Japan/NHK World	9760eu		
1100	1130	Sat/DRM	South Korea, KBS World R	9760eu		
1100	1130		Vietnam, VO Vietnam/Overseas Svc		7285as	
1100	1156		Romania, R Romania Intl	15210eu	15430eu	
			17510eu	17670af		
1100	1200		Anguilla, Caribbean Beacon/Univ Net		11775ca	
1100	1200		Australia, ABC/R Australia	5995as	6080as	
			6140as	6150va	9475as	9580pa
			11945va	12065pa		
1100	1200	DRM	Australia, ABC/R Australia	12080pa		
1100	1200		Australia, NT VL8A Alice Springs		2310do	
1100	1200		Australia, NT VL8K Katherine	2485do		
1100	1200		Australia, NT VL8T Tennant Creek		2325do	
1100	1200		Bangladesh, Bangla Betar/Home Svc		4750as	
1100	1200	irreg	Cameroon, CRTV/R Buea	6005do		
1100	1200	Sat	Canada, Bible VO Broadcasting		21480as	
1100	1200		Canada, CFRX Toronto ON	6070do		

1100	1200		Canada, CFVP Calgary AB	6030do		
1100	1200		Canada, CKZN St Johns NF	6160do		
1100	1200		Canada, CKZU Vancouver BC	6160do		
1100	1200		China, China R International	5955as	11660as	
			11795as	13650as	17490eu	
1100	1200	irreg	Congo Dem Rep, R Kahuzi	6210do		
1100	1200	1st Sat	Finland, Scandinavian Weekend R		6170eu	
1100	1200	Sat/Sun	Germany, Mighty KBC Radio	6095eu		
1100	1200		Germany, R 6150	6070eu		
1100	1200		India, AIR/Gangkok	4835do		
1100	1200		India, AIR/Imphal	4775do		
1100	1200		India, AIR/Jeypore	5040do		
1100	1200		India, AIR/Kohima	4850do		
1100	1200		India, AIR/Port Blair	4760do		
1100	1200		India, AIR/Srinagar	6110do		
1100	1200		India, AIR/Thiruvananthapuram	5010do		
1100	1200	Sun	Italy, IRRS Shortwave	9510va		
1100	1200		Malaysia, RTM/Kajang	5965do	6050do	
1100	1200		Malaysia, RTM/Traxx FM	7295do		
1100	1200		Mali, ORTM/R Mali	9635do		
1100	1200		Micronesia, V6MP/Cross R/Pohnpei		4755as	
1100	1200		New Zealand, R New Zealand Intl		9700pa	
1100	1200	DRM	New Zealand, R New Zealand Intl		9890pa	
1100	1200		Nigeria, FRCN Abuja	7275do		
1100	1200	irreg	Nigeria, VO Nigeria	9690af		
1100	1200		Papua New Guinea, R Central	3290do		
1100	1200		Papua New Guinea, R East New Britain		3385do	
1100	1200		Papua New Guinea, R Northern	3345do		
1100	1200		Papua New Guinea, R Vanimo	3205do		
1100	1200		Papua New Guinea, R Western	3305do		
1100	1200		Papua New Guinea, Wantok R Light		7325do	
1100	1200		Russia, VO Russia	11530as	12030as	15670as
1100	1200	DRM	Russia, VO Russia	9850eu		
1100	1200		Saudi Arabia, BSKSA/External Svc		15250af	
1100	1200		Solomon Islands, SIBC	5020do	9545do	
1100	1200	mtwhf	South Africa, Channel Africa	9625af		
1100	1200		Taiwan, R Taiwan Intl	7445as	9465as	
1100	1200		UK, BBC World Service	6195as	9740as	
			15285as	17660as		
1100	1200	mf	UK, BBC World Service	17705as		
1100	1200	wa	UK, BBC World Service	17840as		
1100	1200	Sat/t	UK, BBC World Service	17760as		
1100	1200		USA, AFN/AFRTS	4319usb	5765usb	12759usb
			13362usb			
1100	1200		USA, Overcomer Ministry	3185na		
1100	1200	twhfa	USA, Overcomer Ministry	5890na		
1100	1200		USA, WBCQ Monticello ME	9330na		
1100	1200		USA, WEWN/Irondale AL	11520af		
1100	1200	Sun	USA, WHRI Cypress Crk SC	7315ca		
1100	1200	Sun	USA, WINB Red Lion PA	9265am		
1100	1200		USA, WRMI Miami FL	9955am		
1100	1200		USA, WTWW Lebanon TN	5085sa	5830na	
1100	1200		USA, WWCR Nashville TN	4840na	5890ca	
			5935af	15825eu		
1100	1200	irreg	USA, WWRB Manchester TN	3185na		
1100	1200		Vanuatu, R Vanuatu	3945do		
1100	1200		Zambia, Zambia Natl BC	5915do	6165do	
1115	1145	f	Canada, Bible VO Broadcasting		21480as	
1120	1200		India, AIR/Srinagar	4950do		
1130	1145	smtha	Australia, HCJB Global Australia		15490as	
1130	1145	f	USA, Eternal Good News	15525as		
1130	1200		Guatemala, R Verdad	4055do		
1130	1200		India, AIR/Aizawl	5050do		
1130	1200		India, AIR/Bhopal	4810do		
1130	1200		India, AIR/Jaipur	4910do		
1130	1200		India, AIR/Leh	4660do		
1130	1200	f	Vatican City State, Vatican R	17590me	21560me	
1130	1200		Vietnam, VO Vietnam/Overseas Svc		9840as	
			12020as			
1150	1200		USA, Overcomer Ministry	9930sa		

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

1200	1215		India, AIR/Srinagar	6110do		
1200	1227		Saudi Arabia, BSKSA/External Svc		15250af	
1200	1230		Japan, R Japan/NHK World	9695af	11740as	
1200	1230		Vanuatu, R Vanuatu	3945do		
1200	1259		New Zealand, R New Zealand Intl		9700pa	
1200	1300		Anguilla, Caribbean Beacon/Univ Net		11775ca	
1200	1300		Australia, ABC/R Australia	6080as	6140as	
			6150va	9475as	9580pa	11945va
1200	1300	DRM	Australia, ABC/R Australia	5995as		
1200	1300		Australia, NT VL8A Alice Springs		2310do	
1200	1300		Australia, NT VL8K Katherine	2485do		
1200	1300		Australia, NT VL8T Tennant Creek		2325do	
1200	1300		Bangladesh, Bangla Betar/Home Svc		4750as	
1200	1300	irreg	Cameroon, CRTV/R Buea	6005do		
1200	1300		Canada, CFRX Toronto ON	6070do		
1200	1300		Canada, CFVP Calgary AB	6030do		
1200	1300		Canada, CKZN St Johns NF	6160do		
1200	1300		Canada, CKZU Vancouver BC	6160do		
1200	1300		China, China R International	6010as	9460as	
			9600as	9645as	9730as	11650as
			11660as	11690va	11980as	13645as
			13650eu	17490eu	17630eu	
1200	1300	irreg	Congo Dem Rep, R Kahuzi	6210do		
1200	1300		Ethiopia, R Ethiopia/Natl Svc	9705do		
1200	1300	1st Sat	Finland, Scandinavian Weekend R		6170eu	
1200	1300	Sat/Sun	Germany, Mighty KBC Radio	6095eu		
1200	1300		Germany, R 6150	6070eu		
1200	1300		Guatemala, R Verdad	4055do		
1200	1300		India, AIR/Aizawl	7295do		
1200	1300		India, AIR/Bhopal	4810do		
1200	1300		India, AIR/Chennai	4920do		
1200	1300		India, AIR/Gangkok	4835do		
1200	1300		India, AIR/Imphal	4775do		
1200	1300		India, AIR/Jaipur	4910do		
1200	1300		India, AIR/Jeypore	5040do		
1200	1300		India, AIR/Kohima	4850do		
1200	1300		India, AIR/Leh	4660do		
1200	1300		India, AIR/Port Blair	4760do		
1200	1300		India, AIR/Srinagar	4950do		
1200	1300		India, AIR/Thiruvananthapuram	5010do		
1200	1300		Malaysia, RTM/Kajang	5965do	6050do	
1200	1300		Malaysia, RTM/Traxx FM	7295do		
1200	1300		Mali, ORTM/R Mali	9635do		
1200	1300		Nigeria, FRCN Abuja	7275do		
1200	1300	irreg	Nigeria, VO Nigeria	9690af		
1200	1300	Sat/Sun	Palau, T8WH/World Harvest R	9930as		
1200	1300		Papua New Guinea, R Central	3290do		
1200	1300		Papua New Guinea, R East New Britain		3385do	
1200	1300		Papua New Guinea, R Fly	3915do	5960do	
1200	1300		Papua New Guinea, R Northern	3345do		
1200	1300		Papua New Guinea, R Vanimo	3205do		
1200	1300		Papua New Guinea, R Western	3305do		
1200	1300		Papua New Guinea, Wantok R Light		7325do	
1200	1300		Russia, VO Russia	11530as	15670as	
1200	1300		Solomon Islands, SIBC	5020do	9545do	
1200	1300		UK, BBC World Service	5820as	5840as	
			6195as	9740as	11750as	
1200	1300	ws	UK, BBC World Service	5875as		
1200	1300		USA, AFN/AFRTS	4319usb	5765usb	12759usb
			13362usb			
1200	1300		USA, KNLS Anchor Point AK	7355as		
1200	1300	mtwhf	USA, Overcomer Ministry	9980na		
1200	1300		USA, Overcomer Ministry	3185na	9930sa	
			9980na	17750me		
1200	1300		USA, VO America	7575va	9510va	12075va
			12150va			
1200	1300		USA, WBCQ Monticello ME	9330na		
1200	1300		USA, WEWN/Irondale AL	15610eu		
1200	1300		USA, WHRI Cypress Crk SC	9795am		
1200	1300		USA, WRMI Miami FL	9955am		
1200	1300		USA, WTWW Lebanon TN	5085na	5830na	
1200	1300		USA, WWCR Nashville TN	7490af	9980ca	
			13845na	15825eu		
1200	1300	irreg	USA, WWRB Manchester TN	3185na		
1200	1300		Zambia, Zambia Natl BC	5915do	6165do	
1215	1300		Egypt, R Cairo	17870as		
1230	1245	smtwhf	Australia, HCJB Global Australia		15340pa	
1230	1300		Bangladesh, Bangla Betar	15105as		
1230	1300		India, AIR/Mumbai	4840do		
1230	1300		South Korea, KBS World R	6095as		
1230	1300		Thailand, R Thailand World Svc	9390as		
1230	1300		Turkey, VO Turkey	15450va		
1230	1300		Vietnam, VO Vietnam/Overseas Svc		9840as	
			12020as			

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

1300	1330		Egypt, R Cairo	17870as		
1300	1330		Japan, R Japan/NHK World	15735as		
1300	1330		Turkey, VO Turkey	15450eu		
1300	1357		North Korea, VO Korea	9435na	11710na	
			13760eu	15245eu		
1300	1400		Anguilla, Caribbean Beacon/Univ Net		11775ca	
1300	1400		Australia, ABC/R Australia	5940as	6150va	
			9475as	9580pa	9965as	12065pa
			12085as			
1300	1400	DRM	Australia, ABC/R Australia	5995as		
1300	1400		Australia, NT VL8A Alice Springs		2310do	
1300	1400		Australia, NT VL8K Katherine	2485do		
1300	1400		Bangladesh, Bangla Betar/Home Svc		4750as	
1300	1400	irreg	Cameroon, CRTV/R Buea	6005do		
1300	1400		Canada, CFRX Toronto ON	6070do		
1300	1400		Canada, CFVP Calgary AB	6030do		
1300	1400		Canada, CKZN St Johns NF	6160do		
1300	1400		Canada, CKZU Vancouver BC	6160do		
1300	1400		China, China R International	5955as	9570na	
			9730as	9760pa	9765va	9870as
			11660as	11760pa	11980as	13610eu
			13755as	17630eu		
1300	1400	irreg	Congo Dem Rep, R Kahuzi	6210do		
1300	1400	1st Sat	Finland, Scandinavian Weekend R		6170eu	

1300	1400	Sat/Sun	Germany, Mighty KBC Radio	6095eu	
1300	1400		Germany, R 6150	6070eu	
1300	1400		Guatemala, R Verdad	4055do	
1300	1400		India, AIR/Aizawl	7295do	
1300	1400		India, AIR/Bhopal	4810do	
1300	1400		India, AIR/Chennai	4920do	
1300	1400		India, AIR/Gangkok	4835do	
1300	1400		India, AIR/Imphal	4775do	
1300	1400		India, AIR/Jaipur	4910do	
1300	1400		India, AIR/Jeypore	5040do	
1300	1400		India, AIR/Kohima	4850do	
1300	1400		India, AIR/Leh	4660do	
1300	1400		India, AIR/Mumbai	4840do	
1300	1400		India, AIR/Port Blair	4760do	
1300	1400		India, AIR/Srinagar	4950do	
1300	1400		India, AIR/Thiruvananthapuram	5010do	
1300	1400	irreg	Indonesia, VO Indonesia	9526as	
1300	1400		Malaysia, RTM/Kajang	5965do	6050do
1300	1400		Malaysia, RTM/Traxx FM	7295do	
1300	1400		Mali, ORTM/R Mali	9635do	
1300	1400		New Zealand, R New Zealand Intl		6170pa
1300	1400		Nigeria, FRCN Abuja	7275do	
1300	1400	irreg	Nigeria, VO Nigeria	9690af	
1300	1400		Papua New Guinea, R Central	3290do	
1300	1400		Papua New Guinea, R East New Britain		3385do
1300	1400		Papua New Guinea, R Fly	3915do	5960do
1300	1400		Papua New Guinea, R Northern	3345do	
1300	1400		Papua New Guinea, R Vanimo	3205do	
1300	1400		Papua New Guinea, R Western	3305do	
1300	1400		Papua New Guinea, Wantok R Light		7325do
1300	1400		Russia, VO Russia 12030as	15670as	
1300	1400	DRM	Russia, VO Russia	9850eu	
1300	1400		Solomon Islands, SIBC	5020do	9545do
1300	1400		South Korea, KBS World R	9570as	15575na
1300	1400		Tajikistan, VO Tajik	7245va	
1300	1400		UK, BBC World Service	5820as	5840as
			6195as 9740as	15310as	17790as
1300	1400	ws	UK, BBC World Service	5875as	
1300	1400		USA, AFN/AFRTS 4319usb	5765usb	12759usb
			13362usb		
1300	1400		USA, KJES Vado NM	11715na	
1300	1400		USA, Overcomer Ministry	9370na	9930sa
			15205eu 17750me		
1300	1400	Sat/Sun	USA, VO America 7575va	9510va	12075va
			12150va		
1300	1400		USA, WBCQ Monticello ME	9330na	
1300	1400		USA, WEWN/Irondale AL	15610eu	
1300	1400	Sat/Sun	USA, WHRI Cypress Crk SC	9795am	9840na
1300	1400		USA, WRMI Miami FL	9955am	
1300	1400		USA, WTWW Lebanon TN	9930sa	
1300	1400		USA, WTWW Lebanon TN	9479na	9930sa
1300	1400		USA, WWCR Nashville TN	7490af	9980ca
			13845na 15825eu		
1300	1400	irreg	USA, WWRB Manchester TN	9370na	
1300	1400		Zambia, Zambia Natl BC	5915do	6165do
1320	1400		India, AIR/Natl Channel	9425do	9470do
1330	1400	f	Clandestine, JSR Shiokaze	6020as	
1330	1400		India, AIR/External Svc	9690as	11620as
			13710as		
1330	1400		Vietnam, VO Vietnam/Overseas Svc		9840as
			12020as		

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

1400	1425	mtf	Singapore, TWR Asia	15190as	
1400	1430		Australia, ABC/R Australia	9475as	9965as
			12085as		
1400	1430	f	Clandestine, JSR Shiokaze	6020as	
1400	1430		Japan, R Japan/NHK World	11705af	15735as
1400	1430		Laos, Lao National R	6130as	
1400	1430	h	Singapore, TWR Asia	15190as	
1400	1430		Thailand, R Thailand World Svc	9950as	
1400	1435	sw	Singapore, TWR Asia	15190as	
1400	1445	Sun	USA, Pan Am Broadcasting	15205as	
1400	1500		Anguilla, Caribbean Beacon/Univ Net		11775ca
1400	1500		Australia, ABC/R Australia	5940as	5995va
			9580pa 12065pa		
1400	1500		Australia, NT VL8A Alice Springs		2310do
1400	1500		Australia, NT VL8K Katherine	2485do	
1400	1500		Australia, NT VL8T Tennant Creek		2325do
1400	1500		Bangladesh, Bangla Betar/Home Svc		4750as
1400	1500	irreg	Cameroon, CRTV/R Buea	6005do	
1400	1500	Sun	Canada, Bible VO Broadcasting		17495as
1400	1500		Canada, CFRX Toronto ON	6070do	
1400	1500		Canada, CFVP Calgary AB	6030do	
1400	1500		Canada, CKZN St Johns NF	6160do	
1400	1500		Canada, CKZU Vancouver BC	6160do	
1400	1500		China, China Natl R/CNR11	4905do	4920do
			6130do		
1400	1500		China, China R International	5955as	9765va
			9870as 11665me	11675as	11765as
			13710eu 13740na	17630eu	
1400	1500	irreg	Congo Dem Rep, R Kahuzi	6210do	
1400	1500	1st Sat	Finland, Scandinavian Weekend R		5980eu
1400	1500	wa/irreg	Germany, Hamburger Lokalradio		7265eu
1400	1500	Sat/Sun	Germany, Mighty KBC Radio	6095eu	
1400	1500		Germany, R 6150	6070eu	
1400	1500		Guatemala, R Verdad	4055do	
1400	1500		India, AIR/Aizawl	7295do	
1400	1500		India, AIR/Bhopal	4810do	
1400	1500		India, AIR/Chennai	4920do	
1400	1500		India, AIR/External Svc	9690as	11620as
			13710as		
1400	1500		India, AIR/Gangkok	4835do	
1400	1500		India, AIR/Imphal	4775do	
1400	1500		India, AIR/Jaipur	4910do	
1400	1500		India, AIR/Jeypore	5040do	
1400	1500		India, AIR/Kohima	4850do	
1400	1500		India, AIR/Leh	4660do	
1400	1500		India, AIR/Mumbai	4840do	
1400	1500		India, AIR/Natl Channel	9425do	9470do
1400	1500		India, AIR/Port Blair	4760do	
1400	1500		India, AIR/Srinagar	4950do	
1400	1500		India, AIR/Thiruvananthapuram	5010do	
1400	1500		Malaysia, RTM/Kajang	5965do	6050do
1400	1500		Malaysia, RTM/Traxx FM	7295do	
1400	1500		Mali, ORTM/R Mali	9635do	
1400	1500		Mexico, R Educacion	6185do	
1400	1500		New Zealand, R New Zealand Intl		6170pa
1400	1500		Nigeria, FRCN Abuja	7275do	
1400	1500	irreg	Nigeria, VO Nigeria	9690af	
1400	1500		Oman, R Sultanate of Oman	15140eu	
1400	1500		Papua New Guinea, R Central	3290do	
1400	1500		Papua New Guinea, R East New Britain		3385do
1400	1500		Papua New Guinea, R Northern	3345do	
1400	1500		Papua New Guinea, R Vanimo	3205do	
1400	1500		Papua New Guinea, R Western	3305do	
1400	1500		Papua New Guinea, Wantok R Light		7325do
1400	1500		Russia, VO Russia 4960va	9900me	11530as
			12030as 15670as		
1400	1500		Solomon Islands, SIBC	5020do	9545do
1400	1500		South Korea, KBS World R	9640as	
1400	1500		UK, BBC World Service	11890as	15310as
1400	1500	DRM	UK, BBC World Service	5845as	
1400	1500		USA, AFN/AFRTS 4319usb	5765usb	12759usb
			13362usb		
1400	1500		USA, KJES Vado NM	11715na	
1400	1500		USA, Overcomer Ministry	9370na	9655eu
			9930sa 9980na	13810me	
1400	1500	Sat	USA, Overcomer Ministry	15420na	
1400	1500	mtwhf	USA, VO America 7575va	12150as	15490as
1400	1500		USA, VO America 4930af	6080af	15580af
1400	1500		USA, WBCQ Monticello ME	9330na	
1400	1500	Sat	USA, WBCQ Monticello ME	15420na	
1400	1500		USA, WEWN/Irondale AL	15610eu	
1400	1500	Sun	USA, WHRI Cypress Crk SC	9795am	9840na
			21600af		
1400	1500		USA, WINB Red Lion PA	13570am	
1400	1500		USA, WJHR Intl Milton FL	15550usb	
1400	1500	Sat/Sun	USA, WRMI Miami FL	9955am	
1400	1500		USA, WTWW Lebanon TN	9479sa	9930sa
1400	1500		USA, WTWW Lebanon TN	9479na	9930sa
1400	1500		USA, WWCR Nashville TN	7490af	9980ca
			13845na 15825eu		
1400	1500	irreg	USA, WWRB Manchester TN	9370na	
1400	1500		Zambia, Zambia Natl BC	5915do	6165do
1415	1430		Nepal, R Nepal	5005do	
1415	1430	mtwhfa	USA, Pan Am Broadcasting	15205as	
1415	1500		India, AIR/External Svc	9910as	11670as
1420	1455		Swaziland, TWR Africa	6025af	
1430	1500		Australia, ABC/R Australia	9475va	11835as
1430	1500	Sat	Canada, Bible VO Broadcasting		17495as
1430	1500		India, AIR/Delhi	4870do	
1430	1500	Sun	Palau, T8WH/World Harvest R	15550as	

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

1500	1530		Australia, ABC/R Australia 11835as	12065pa
1500	1530		Australia, HCJB Global Australia	15340pa
1500	1530		India, AIR/Delhi 4870do	
1500	1530		India, AIR/External Svc 9910as	11670as
1500	1530	Sun	Italy, IRRS Shortwave 15190va	
1500	1530		Vietnam, VO Vietnam/Overseas Svc	7285as
			9840as 12020as	
1500	1550		New Zealand, R New Zealand Intl	6170pa
1500	1557		North Korea, VO Korea 9435na	11710na
			13760eu 15245eu	
1500	1600		Anguilla, Caribbean Beacon/Univ Net	11775ca
1500	1600		Australia, ABC/R Australia 5940as	5995va
			7240pa 9475va	
1500	1600		Australia, NT VL8A Alice Springs	2310do
1500	1600		Australia, NT VL8K Katherine 2485do	
1500	1600		Bangladesh, Bangla Betar/Home Svc	4750as
1500	1600		Bhutan, Bhutan BC Svc 6035do	
1500	1600	irreg	Cameroon, CRTV/R Buea 6005do	
1500	1600		Canada, CFRX Toronto ON 6070do	

1500	1600		Canada, CFVP Calgary AB	6030do		
1500	1600		Canada, CKZN St Johns NF	6160do		
1500	1600		Canada, CKZU Vancouver BC	6160do		
1500	1600		China, China R International	5955as	6095me	
			7325as	7395as	9720me	9800as
			9870as	13640eu	13740na	15245eu
1500	1600	irreg	Congo Dem Rep, R Kahuzi	6210do		
1500	1600	1st Sat	Finland, Scandinavian Weekend R			5980eu
1500	1600		Germany, R 6150	6070eu		
1500	1600		Guatemala, R Verdad	4055do		
1500	1600		India, AIR/Aizawl	7295do		
1500	1600		India, AIR/Bhopal	4810do		
1500	1600		India, AIR/Chennai	4920do		
1500	1600		India, AIR/Gangkok	4835do		
1500	1600		India, AIR/Imphal	4775do		
1500	1600		India, AIR/Jaipur	4910do		
1500	1600		India, AIR/Jeypore	5040do		
1500	1600		India, AIR/Kohima	4850do		
1500	1600		India, AIR/Leh	4660do		
1500	1600		India, AIR/Mumbai	4840do		
1500	1600		India, AIR/Natl Channel	9425do	9470do	
1500	1600		India, AIR/Port Blair	4760do		
1500	1600		India, AIR/Srinagar	4950do		
1500	1600		India, AIR/Thiruvananthapuram	5010do		
1500	1600		Malaysia, RTM/Traxx FM	7295do		
1500	1600		Mali, ORTM/R Mali	9635do		
1500	1600		Mexico, R Educacion	6185do		
1500	1600		Nigeria, FRCN Abuja	7275do		
1500	1600	irreg	Nigeria, VO Nigeria	15120af		
1500	1600		Papua New Guinea, R Northern	3345do		
1500	1600		Papua New Guinea, R Vanimo	3205do		
1500	1600		Papua New Guinea, R Western	3305do		
1500	1600		Papua New Guinea, Wantok R Light			7325do
1500	1600		Russia, VO Russia	4960va	6185as	9900me
1500	1600		Solomon Islands, SIBC	5020do	9545do	
1500	1600	mtwhf	South Africa, Channel Africa	9625af		
1500	1600		UK, BBC World Service	7565as	9410as	
			9735as	11675as	11890as	12095as
			15420af			
1500	1600	DRM	UK, BBC World Service	5845as		
1500	1600		USA, AFN/AFRTS	4319usb	5765usb	12759usb
			13362usb			
1500	1600		USA, KNLS Anchor Point AK	9920as		
1500	1600		USA, Overcomer Ministry	9370na	9655eu	
			9955ca	9980na	13810me	
1500	1600		USA, VO America	4930af	6080af	7540va
			7575va	12150va	15490as	15580va
			17895va			
1500	1600		USA, VO America	6140as	9400as	9760as
1500	1600		USA, WBCQ Monticello ME	9330na		
1500	1600	Sat	USA, WBCQ Monticello ME	15420na		
1500	1600		USA, WEWN/Irondale AL	15610eu		
1500	1600		USA, WHRI Cypress Crk SC	17510eu		
1500	1600		USA, WINB Red Lion PA	13570am		
1500	1600		USA, WJHR Intl Milton FL	15550usb		
1500	1600	Sat/Sun	USA, WRMI Miami FL	9955am		
1500	1600		USA, WTWW Lebanon TN	9479na	9930sa	
1500	1600		USA, WTWW Lebanon TN	9479na	9930sa	
1500	1600		USA, WWCR Nashville TN	9980ca	12160af	
			13845na	15825eu		
1500	1600	irreg	USA, WWRB Manchester TN	9370na		
1500	1600		Zambia, Zambia Natl BC	5915do	6165do	
1525	1555	Sat/Sun	Swaziland, TWR Africa	6025af		
1530	1545		India, AIR/External Svc	9910as		
1530	1550	smtwhf	Vatican City State, Vatican R	11850af	15110as	
1530	1550	smtwhf/DRM	Vatican City State, Vatican R	17550as		
1530	1600		Australia, ABC/R Australia	11660as	11880va	
1530	1600	DRM	Belgium, The Disco Palace	15775as		
1530	1600	Sat	Canada, Bible VO Broadcasting			17600as
1530	1600	smtwa	Germany, AWR Europe	15335as		
1530	1600		Iran, VOIRI	13780va	15515va	
1530	1600		Mongolia, VO Mongolia	12015as		
1530	1600		Myanmar, Myanma R	5985do		
1530	1600	Sat	Vatican City State, Vatican R	11850as	15110as	
			17550as			
1551	1600		New Zealand, R New Zealand Intl			7330pa
1551	1600	DRM	New Zealand, R New Zealand Intl			6135pa

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

1600	1627		Iran, VOIRI	13780va	15515va	
1600	1630		Australia, ABC/R Australia	9540as		
1600	1630	DRM	Belgium, The Disco Palace	15775as		
1600	1630		India, AIR/Aizawl	7295do		
1600	1630		Indonesia, AWR Asia/Pacific	15360as		
1600	1630		Myanmar, Myanma R	5985do		
1600	1630	Sun	Palau, T8WH/World Harvest R	15505as		
1600	1630		Vietnam, VO Vietnam/Overseas Svc			7220me
			7280eu	9550me	9730eu	
1600	1650	DRM	New Zealand, R New Zealand Intl			6135pa
1600	1650		New Zealand, R New Zealand Intl			7330pa
1600	1657		North Korea, VO Korea	9890va		11645va
1600	1700		Anguilla, Caribbean Beacon/Univ Net			11775ca
1600	1700		Australia, ABC/R Australia	5940as		5995va
			7240pa	9475va	11660as	11880va
1600	1700		Australia, NT VL8A Alice Springs			2310do
1600	1700		Australia, NT VL8K Katherine	2485do		
1600	1700		Bangladesh, Bangla Betar/Home Svc			4750as
1600	1700		Bhutan, Bhutan BC Svc	6035do		
1600	1700	irreg	Cameroon, CRTV/R Buea	6005do		
1600	1700		Canada, CFRX Toronto ON	6070do		
1600	1700		Canada, CFVP Calgary AB	6030do		
1600	1700		Canada, CKZN St Johns NF	6160do		
1600	1700		Canada, CKZU Vancouver BC	6160do		
1600	1700		China, China R International	6060as	7235as	
			9570af	11900af	11940eu	11965eu
			13760eu	15250va		
1600	1700		China, Xizang PBS	4905do	4920do	6025do
			6110do	6130do	6200do	7255do
			7385do			
1600	1700		Clandestine, R Dialogue	12105af		
1600	1700	irreg	Congo Dem Rep, R Kahuzi	6210do		
1600	1700		Egypt, R Cairo	15345af		
1600	1700	irreg	Ethiopia, R Ethiopia/Intl Svc	7235va	9560va	
1600	1700	1st Sat	Finland, Scandinavian Weekend R			5980eu
1600	1700		Germany, R 6150	6070eu		
1600	1700		Guatemala, R Verdad	4055do		
1600	1700		India, AIR/Bhopal	4810do		
1600	1700		India, AIR/Chennai	4920do		
1600	1700		India, AIR/Imphal	4775do		
1600	1700		India, AIR/Jaipur	4910do		
1600	1700		India, AIR/Jeypore	5040do		
1600	1700		India, AIR/Kohima	4850do		
1600	1700		India, AIR/Leh	4660do		
1600	1700		India, AIR/Mumbai	4840do		
1600	1700		India, AIR/Natl Channel	9425do	9470do	
1600	1700		India, AIR/Port Blair	4760do		
1600	1700		India, AIR/Srinagar	4950do		
1600	1700		India, AIR/Thiruvananthapuram	5010do		
1600	1700		Malaysia, RTM/Kajang	5965do	6050do	
1600	1700		Malaysia, RTM/Traxx FM	7295do		
1600	1700		Mali, ORTM/R Mali	9635do		
1600	1700		Nigeria, FRCN Abuja	7275do		
1600	1700		Papua New Guinea, Wantok R Light			7325do
1600	1700		Russia, VO Russia	4960va	6035as	6185as
			9490as			
1600	1700		Solomon Islands, SIBC	5020do	9545do	
1600	1700		South Korea, KBS World R	9515eu	9640as	
1600	1700		Taiwan, R Taiwan Intl	6180as	15485as	
1600	1700		UK, BBC World Service	3255af	6190as	
			7565as	9410as	9910as	11675as
			11890as	12095af	15420af	17640af
			17830af			
1600	1700	DRM	UK, BBC World Service	5845as		
1600	1700		USA, AFN/AFRTS	4319usb	5765usb	12759usb
			13362usb			
1600	1700		USA, Overcomer Ministry	9370na	9955ca	
			9980na			
1600	1700	Sat	USA, Overcomer Ministry	15420na		
1600	1700		USA, VO America	4930af	6080af	15580af
1600	1700		USA, VO America	11915va	13570af	15470va
			17895va			
1600	1700		USA, WBCQ Monticello ME	9330na		
1600	1700	Sat	USA, WBCQ Monticello ME	15420na		
1600	1700		USA, WEWN/Irondale AL	15610eu		
1600	1700		USA, WHRI Cypress Crk SC	21630af		
1600	1700		USA, WINB Red Lion PA	13570am		
1600	1700		USA, WJHR Intl Milton FL	15550usb		
1600	1700	Sat/Sun	USA, WRMI Miami FL	9955am		
1600	1700		USA, WTWW Lebanon TN	9479sa	9930sa	
1600	1700		USA, WTWW Lebanon TN	9479na	9930sa	
1600	1700		USA, WWCR Nashville TN	9980ca	12160af	
			13845na	15825eu		
1600	1700	irreg	USA, WWRB Manchester TN	9370na		
1600	1700		Zambia, Zambia Natl BC	5915do	6165do	
1600	1700	irreg	Zimbabwe, VO Zimbabwe	4828af		
1615	1630		Vatican City State, Vatican R	15595me		
1630	1700	mwf	Indonesia, AWR Asia/Pacific	15360as		
1630	1700	m	South Africa, SA Radio League	3230af		
1630	1700		Turkey, VO Turkey	15520as		
1630	1700	mtwhf	USA, VO America	11905af		
1630	1700	mtwhf	USA, VO America/S Sudan in Focus			9490af
			11655af	13870af		
1651	1700		New Zealand, R New Zealand Intl			730pa
1651	1700	DRM	New Zealand, R New Zealand Intl			6135pa

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

1700	1710	irreg	Congo Dem Rep, R Kahuzi	6210do		
1700	1710		Pakistan, R Pakistan	11570eu	15265eu	
1700	1715		Bangladesh, Bangla Betar/Home Svc			4750as
1700	1715	tf	Canada, Bible VO Broadcasting			15215me
1700	1730		Australia, ABC/R Australia	11660as		
1700	1730	h	Canada, Bible VO Broadcasting			15215me

1700	1730		India, AIR/Mumbai	4840do		
1700	1730	m	South Africa, SA Radio League	3230af		
1700	1730		Turkey, VO Turkey	15520as		
1700	1730		Vietnam, VO Vietnam/Overseas Svc			9625eu
1700	1739		India, AIR/Chennai	4920do		
1700	1739		India, AIR/Srinagar	4950do		
1700	1740		India, AIR/Jeypore	5040do		
1700	1741		India, AIR/Jaipur	4910do		
1700	1742		India, AIR/Bhopal	4810do		
1700	1745	DRM	New Zealand, R New Zealand Intl			6135pa
1700	1745		New Zealand, R New Zealand Intl			7330pa
1700	1755	mtwhf	South Africa, Channel Africa	15235af		
1700	1756	DRM	Romania, R Romania Intl	9535eu		
1700	1756		Romania, R Romania Intl	11740eu		
1700	1800		Anguilla, Caribbean Beacon/Univ Net			11775ca
1700	1800		Australia, ABC/R Australia	5995va		9475as
			9500va	9580pa	11880va	
1700	1800		Australia, NT VL8A Alice Springs			2310do
1700	1800		Australia, NT VL8K Katherine	2485do		
1700	1800	Sat/Sun	Canada, Bible VO Broadcasting			15215me
1700	1800		Canada, CFRX Toronto ON	6070do		
1700	1800		Canada, CFVP Calgary AB	6030do		
1700	1800		Canada, CKZN St Johns NF	6160do		
1700	1800		Canada, CKZU Vancouver BC	6160do		
1700	1800		China, China R International	6090as		6140as
			6165me	7235as	7265af	7410as
			7420as	9570as	9695eu	11900af
			13570eu	13760eu		
1700	1800		Clandestine, SW R Africa	4880af		
1700	1800		Egypt, R Cairo	15345af		
1700	1800	1st Sat	Finland, Scandinavian Weekend R			5980eu
1700	1800		Germany, R 6150	6070eu		
1700	1800		Guatemala, R Verdad	4055do		
1700	1800		India, AIR/Natl Channel	9425do		9470do
1700	1800		Malaysia, RTM/Kajang	5965do		6050do
1700	1800		Malaysia, RTM/Traxx FM	7295do		
1700	1800		Mali, ORTM/R Mali	9635do		
1700	1800		Mexico, R Educacion	6185do		
1700	1800		Nigeria, FRCN Abuja	7275do		
1700	1800		Papua New Guinea, Wantok R Light			7325do
1700	1800		Russia, VO Russia	4960va	6035as	6185as
			9420as			
1700	1800	DRM	Russia, VO Russia	9820as		
1700	1800		Solomon Islands, SIBC	5020do		9545do
1700	1800	Sat/Sun	Swaziland, TWR Africa	3200af		
1700	1800		Taiwan, R Taiwan Intl	15690af		
1700	1800		UK, BBC World Service	3255af		6190 f
			6195as	9410as	12095af	15400af
			15420af	17795af	17830af	
1700	1800	DRM	UK, BBC World Service	5845as		
1700	1800		USA, AFN/AFRTS	4319usb	5765usb	12759usb
			13362usb			
1700	1800		USA, Overcomer Ministry	9370na		9955ca
1700	1800	Sat/Sun	USA, Overcomer Ministry	9980na		
1700	1800		USA, VO America	6080af	11795af	15580af
			17895af			
1700	1800		USA, WBCQ Monticello ME	9330na		15420na
1700	1800		USA, WEWN/Irondale AL	15610eu		
1700	1800		USA, WHRI Cypress Crk SC	21630af		
1700	1800		USA, WINB Red Lion PA	13570am		
1700	1800		USA, WJHR Intl Milton FL	15550usb		
1700	1800	Sat/Sun	USA, WRMI Miami FL	9955am		
1700	1800		USA, WTWW Lebanon TN	9479na		9930sa
1700	1800		USA, WWCR Nashville TN	9980ca		12160af
			13845na	15825eu		
1700	1800	irreg	USA, WWRB Manchester TN	9370na		
1700	1800		Zambia, Zambia Natl BC	5915do		6165do
1700	1800	irreg	Zimbabwe, VO Zimbabwe	4828af		
1720	1740	Sat/Sun	USA, VOA/Studio 7	4930af		5940af
			15455af			
1730	1800		Australia, ABC/R Australia	6080as		
1730	1800		Philippines, R Pilipinas Overseas Svc			9915me
			11720me	15190me		
1730	1800		Sudan, VO Africa/Sudan R	9505af		
1730	1800	mtwh	USA, VOA/Studio 7	4930af		5940af
			15455af			
1730	1800		Vatican City State, Vatican R	11625af		13765af
			15570af			
1745	1800		Bangladesh, Bangla Betar	7250eu		
1745	1800		India, AIR/External Svc	7550eu		9445va
			9950eu	11580af	11670eu	11935af
			13695af	17670af		
1745	1800	mtwhf	Swaziland, TWR Africa	3200af		
1746	1800		New Zealand, R New Zealand Intl			9615pa
1746	1800	DRM	New Zealand, R New Zealand Intl			7330as

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

1800	1815	Sat	Canada, Bible VO Broadcasting			9430me
			11855as			
1800	1830		Japan, R Japan/NHK World	9590af		11885af
1800	1830		Sudan, VO Africa/Sudan R	9505af		
1800	1830		USA, VO America	6080af	15580af	17895af
1800	1830	Sat/Sun	USA, VO America	4930af		
1800	1830	f	USA, VOA/Studio 7	4930af		5940af
1800	1836		New Zealand, R New Zealand Intl			9615pa
1800	1836	DRM	New Zealand, R New Zealand Intl			7330pa
1800	1857		North Korea, VO Korea	13760eu		15245eu
1800	1900		Anguilla, Caribbean Beacon/Univ Net			11775ca
1800	1900	mtwhf	Argentina, RAE	15345eu		
1800	1900		Australia, ABC/R Australia	6080as		9475as
			9500va	9580pa	9710va	11880va
1800	1900		Australia, NT VL8A Alice Springs			4835do
1800	1900		Australia, NT VL8K Katherine	2485do		
1800	1900		Bangladesh, Bangla Betar	7250eu		
1800	1900	Sat/Sun	Canada, Bible VO Broadcasting			15215me
1800	1900	Sun	Canada, Bible VO Broadcasting			6130eu
1800	1900		Canada, CFRX Toronto ON	6070do		
1800	1900		Canada, CFVP Calgary AB	6030do		
1800	1900		Canada, CKZN St Johns NF	6160do		
1800	1900		Canada, CKZU Vancouver BC	6160do		
1800	1900		China, China R International	6175eu		9600eu
			13760eu			
1800	1900		Clandestine, SW R Africa	4880af		
1800	1900	1st Sat	Finland, Scandinavian Weekend R			6170eu
1800	1900		Germany, R 6150	6070eu		
1800	1900		Guatemala, R Verdad	4055do		
1800	1900		India, AIR/External Svc	7550eu		9445va
			9950eu	11580af	11670eu	11935af
			13695af	17670af		
1800	1900		India, AIR/Natl Channel	9425do		9470do
1800	1900	fas	Italy, IRRS Shortwave	7290va		
1800	1900		Kuwait, R Kuwait	15540va		
1800	1900		Malaysia, RTM/Kajang	5965do		6050do
1800	1900		Malaysia, RTM/Traxx FM	7295do		
1800	1900		Mali, ORTM/R Mali	5995do		
1800	1900		Mexico, R Educacion	6185do		
1800	1900		Nigeria, FRCN Abuja	7275do		
1800	1900	irreg	Nigeria, VO Nigeria	7255af		
1800	1900		Papua New Guinea, Wantok R Light			7325do
1800	1900		Philippines, R Pilipinas Overseas Svc			9915me
			11720me	15190me		
1800	1900		Russia, VO Russia	4960va	9900va	
1800	1900		South Korea, KBS World R	7275eu		
1800	1900	Sat/Sun	Swaziland, TWR Africa	3200af		
1800	1900		Swaziland, TWR Africa	9500af		
1800	1900		Taiwan, R Taiwan Intl	6155eu		
1800	1900		UK, BBC World Service	3255af		6190af
			7375as	11810af	12095af	15400af
			15420af	17795af		
1800	1900		USA, AFN/AFRTS	4319usb	5765usb	12759usb
			13362usb			
1800	1900	mtwhf	USA, Overcomer Ministry	9980na		
1800	1900	Sat	USA, Overcomer Ministry	9955ca		
1800	1900	Sun	USA, Overcomer Ministry	9370na		9955ca
1800	1900		USA, Overcomer Ministry	9700eu		
1800	1900		USA, WBCQ Monticello ME	9330na		15420na
1800	1900		USA, WEWN/Irondale AL	15610eu		
1800	1900		USA, WHRI Cypress Crk SC	9840na		21630af
1800	1900		USA, WINB Red Lion PA	13570am		
1800	1900		USA, WJHR Intl Milton FL	15550usb		
1800	1900	Sat/Sun	USA, WRMI Miami FL	9955am		
1800	1900		USA, WTWW Lebanon TN	9479na		9930sa
1800	1900		USA, WWCR Nashville TN	9980ca		12160af
			13845na	15825eu		
1800	1900	irreg	USA, WWRB Manchester TN	9370na		
1800	1900		Zambia, Zambia Natl BC	5915do		6165do
1800	1900	irreg	Zimbabwe, VO Zimbabwe	4828af		
1815	1845	Sun	Canada, Bible VO Broadcasting			9430me
1825	1900		Vanuatu, R Vanuatu	3945do		
1830	1845	Sat	Canada, Bible VO Broadcasting			6130eu
1830	1845		Rwanda, R Rep Rwandaise	6055do		
1830	1900	Sun	Canada, Bible VO Broadcasting			9635as
1830	1900	irreg/DRM	Nigeria, VO Nigeria	15120af		
1830	1900		Serbia, International R Serbia	6100eu		
1830	1900		South Africa, AWR Africa	11840af		
1830	1900		Turkey, VO Turkey	9785eu		
1830	1900		USA, VO America	4930af	15580af	
1830	1900	mtwhf	USA, VOA/Studio 7	5940af	15455af	
1837	1900		New Zealand, R New Zealand Intl			9615pa
1837	1900	DRM	New Zealand, R New Zealand Intl			9630pa
1845	1900	irreg	Guinea, RTV Guinee	7125do		

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

1900	1915	Sun	Canada, Bible VO Broadcasting			9635as
1900	1930		Germany, Deutsche Welle	11800af		11865af
			15275af			
1900	1930		Philippines, R Pilipinas Overseas Svc			9915me
			11720me	15190me		
1900	1930		Turkey, VO Turkey	9785eu		
1900	1930		USA, VO America	4930af	9850af	15580va
1900	1930		Vietnam, VO Vietnam/Overseas Svc			7280eu
			9730eu			

SHORTWAVE GUIDE

1900	1945		India, AIR/External Svc	7550eu	9445eu	
			9950eu	11580af	11670eu	11935af
			13695af	17670af		
1900	1950		New Zealand, R New Zealand Intl		9615pa	
1900	1950	DRM	New Zealand, R New Zealand Intl		9630pa	
1900	1957		North Korea, VO Korea	7210af	9875va	
			11635va	11910af		
1900	2000		Anguilla, Caribbean Beacon/Univ Net		11775ca	
1900	2000		Australia, ABC/R Australia	6080as	9500va	
			9710va	11660va		
1900	2000		Australia, NT VL8A Alice Springs		4835do	
1900	2000		Australia, NT VL8K Katherine	2485do		
1900	2000		Canada, CFRX Toronto ON	6070do		
1900	2000		Canada, CFVP Calgary AB	6030do		
1900	2000		Canada, CKZN St Johns NF	6160do		
1900	2000		Canada, CKZU Vancouver BC	6160do		
1900	2000		China, China R International	7295va	9435af	
			9440af			
1900	2000		Egypt, R Cairo	15290af		
1900	2000	1st Sat	Finland, Scandinavian Weekend R		6170eu	
1900	2000		Germany, Deutsche Welle	7340af	11865af	
1900	2000		Germany, R 6150 6070eu			
1900	2000		Guatemala, R Verdad	4055do		
1900	2000		India, AIR/Natl Channel	9425do	9470do	
1900	2000	irreg	Indonesia, VO Indonesia	9526eu		
1900	2000		Kuwait, R Kuwait 15540eu			
1900	2000		Malaysia, RTM/Kajang	5965do	6050do	
1900	2000		Malaysia, RTM/Traxx FM	7295do		
1900	2000		Mali, ORTM/R Mali	5995do		
1900	2000		Micronesia, V6MP/Cross R/Pohnpei		4755as	
1900	2000		Nigeria, FRCN Abuja	7275do		
1900	2000	irreg	Nigeria, VO Nigeria	7255af		
1900	2000		Papua New Guinea, R Central	3290do		
1900	2000		Papua New Guinea, R East New Britain		3385do	
1900	2000		Papua New Guinea, R Northern	3345do		
1900	2000		Papua New Guinea, R Vanimo	3205do		
1900	2000		Papua New Guinea, R Western	3305do		
1900	2000		Papua New Guinea, Wantok R Light		7325do	
1900	2000		Solomon Islands, SIBC	5020do	9545do	
1900	2000	mtwhf	Spain, R Exterior de Espana	9665eu	11615af	
1900	2000		Swaziland, TWR Africa	3200af		
1900	2000		Thailand, R Thailand World Svc	9390eu		
1900	2000		UK, BBC World Service	3255af	6190af	
			11810af	12095af	15400af	15420af
			17795af			
1900	2000		USA, AFN/AFRTS	4319usb	5765usb	12759usb
			13362usb			
1900	2000	mtwhfa	USA, Overcomer Ministry	9955ca		
1900	2000		USA, Overcomer Ministry	9370na	9700eu	
			9980na	11850af		
1900	2000		USA, VO America 7485va			
1900	2000		USA, WBCQ Monticello ME	15420na		
1900	2000	at	USA, WBCQ Monticello ME	7490na		
1900	2000		USA, WEWN/Irondale AL	15610eu		
1900	2000		USA, WHRI Cypress Crk SC	9840na	21630af	
1900	2000		USA, WINB Red Lion PA	13570am		
1900	2000		USA, WJHR Intl Milton FL	15550usb		
1900	2000	Sat/Sun	USA, WRMI Miami FL	9955am		
1900	2000		USA, WTWW Lebanon TN	9479na	9930sa	
1900	2000		USA, WWCR Nashville TN	9980ca	12160af	
			13845na	15825eu		
1900	2000	irreg	USA, WWRB Manchester TN	9370na		
1900	2000		Vanuatu, R Vanuatu 3945do			
1900	2000		Zambia, Zambia Natl BC	5915do	6165do	
1900	2000	irreg	Zimbabwe, VO Zimbabwe	4828af		
1905	1920	Sat	Mali, ORTM/R Mali	9635do		
1930	2000		Iran, VOIRI	9400eu	9715eu	11750af
			11885af			
1930	2000		South Africa, RTE R Worldwide	5820af		
1930	2000	Sun	USA, Pan Am Broadcasting	9515af		
1930	2000		USA, VO America 4930af	15580as		
1951	2000	DRM	New Zealand, R New Zealand Intl		11675pa	

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

2000	2020	tf	Belarus, R Belarus	7255eu	11730eu	
2000	2027		Iran, VOIRI	9400eu	9715eu	11750af
			11885af			
2000	2030	mtwhfa	Albania, R Tirana 7465va			
2000	2030		Australia, ABC/R Australia	6080as	9500va	
2000	2030		Egypt, R Cairo	15290af		
2000	2030	Sat/Sun	Swaziland, TWR Africa	3200af		
2000	2030		USA, VO America 4930af	15580af		
2000	2030		Vatican City State, Vatican R	11625af	13765af	
2000	2057		Germany, Deutsche Welle	11865af		
2000	2100		Anguilla, Caribbean Beacon/Univ Net		11775ca	
2000	2100		Australia, ABC/R Australia	9580pa	11650va	
			11660va	12080pa	15515va	
2000	2100		Australia, NT VL8A Alice Springs		4835do	
2000	2100		Australia, NT VL8K Katherine	2485do		
2000	2100		Australia, NT VL8T Tennant Creek		2325do	
2000	2100		Canada, CFRX Toronto ON	6070do		
2000	2100		Canada, CFVP Calgary AB	6030do		
2000	2100		Canada, CKZN St Johns NF	6160do		
2000	2100		Canada, CKZU Vancouver BC	6160do		
2000	2100		China, China R International	5960eu	5985af	
			7285eu	7295va	9440af	
2000	2100	f	Clandestine, JSR Shiokaze	6075as		
2000	2100		Cuba, R Havana Cuba	11760am		
2000	2100	1st Sat	Finland, Scandinavian Weekend R		6170eu	
2000	2100		Germany, R 6150 6070eu			
2000	2100		Guatemala, R Verdad	4055do		
2000	2100		India, AIR/Natl Channel	9425do	9470do	
2000	2100		Kuwait, R Kuwait 15540eu			
2000	2100		Malaysia, RTM/Kajang	5965do	6050do	
2000	2100		Malaysia, RTM/Traxx FM	7295do		
2000	2100		Mali, ORTM/R Mali	5995do		
2000	2100		Mexico, R Educacion	6185do		
2000	2100		Micronesia, V6MP/Cross R/Pohnpei		4755as	
2000	2100		New Zealand, R New Zealand Intl		11725pa	
2000	2100		Nigeria, FRCN Abuja	7275do		
2000	2100		Papua New Guinea, R Central	3290do		
2000	2100		Papua New Guinea, R East New Britain		3385do	
2000	2100		Papua New Guinea, R Northern	3345do		
2000	2100		Papua New Guinea, R Vanimo	3205do		
2000	2100		Papua New Guinea, R Western	3305do		
2000	2100		Papua New Guinea, Wantok R Light		7325do	
2000	2100		Solomon Islands, SIBC	5020do	9545do	
2000	2100		UK, BBC World Service	11810af	12095af	
			15400af			
2000	2100		USA, AFN/AFRTS	4319usb	5765usb	12759usb
			13362usb			
2000	2100		USA, Overcomer Ministry	9370na	9700eu	
			11775af	11850af		
2000	2100	mtwhfa	USA, Overcomer Ministry	9955ca		
2000	2100	Sat/Sun	USA, Overcomer Ministry	9980na		
2000	2100		USA, WBCQ Monticello ME	15420na		
2000	2100	mtwhf	USA, WBCQ Monticello ME	7490na		
2000	2100		USA, WEWN/Irondale AL	15610eu		
2000	2100	Sun	USA, WHRI Cypress Crk SC	17510va		
2000	2100		USA, WINB Red Lion PA	13570am		
2000	2100		USA, WJHR Intl Milton FL	15550usb		
2000	2100	Sat/Sun	USA, WRMI Miami FL	9955am		
2000	2100		USA, WTWW Lebanon TN	9479na	9930sa	
2000	2100		USA, WWCR Nashville TN	9980ca	12160af	
			13845na	15825eu		
2000	2100	irreg	USA, WWRB Manchester TN	9370na		
2000	2100		Vanuatu, R Vanuatu 3945do	7260do		
2000	2100		Zambia, Zambia Natl BC	5915do	6165do	
2000	2100	irreg	Zimbabwe, VO Zimbabwe	4828af		
2020	2100		Belarus, R Belarus 7255eu	11730eu		
2030	2045		Thailand, R Thailand World Svc	9390eu		
2030	2056	DRM	Romania, R Romania Intl	9800eu		
2030	2056		Romania, R Romania Intl	11745na	11975eu	
			13800na			
2030	2100		Australia, ABC/R Australia	9500va	11695va	
2030	2100		Turkey, VO Turkey 7205va			
2030	2100		USA, VO America 4930af	6080af	15580af	
2030	2100	Sat/Sun	USA, VO America 4940af			
2030	2100		Vietnam, VO Vietnam/Overseas Svc		7220me	
			7280eu	9550eu	9730eu	
2045	2100		India, AIR/External Svc	7550eu	9445eu	
			9910pa	11620pa	11670eu	11740pa
2045	2100	DRM	India, AIR/External Svc	9950eu		
2051	2100	DRM	New Zealand, R New Zealand Intl		17675pa	

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

2100	2130		Australia, NT VL8A Alice Springs		4835do	
2100	2130		Australia, NT VL8K Katherine	2485do		
2100	2130		Australia, NT VL8T Tennant Creek		2325do	
2100	2130		Austria, AWR Europe	11955af		
2100	2130		Serbia, International R Serbia	6100eu		
2100	2130		South Korea, KBS World R	3955eu		
2100	2130		Turkey, VO Turkey 7205va			
2100	2150		New Zealand, R New Zealand Intl		11725pa	
2100	2150	DRM	New Zealand, R New Zealand Intl		17675pa	
2100	2157		North Korea, VO Korea	13760eu	15245eu	
2100	2200	irreg	Angola, Angolan Natl R	7217af		
2100	2200		Anguilla, Caribbean Beacon/Univ Net		11775ca	
2100	2200		Australia, ABC/R Australia	9500va	9660va	
			11650va	11695va	13630pa	15515va
2100	2200		Belarus, R Belarus 7255eu	11730eu		
2100	2200		Canada, CFRX Toronto ON	6070do		
2100	2200		Canada, CFVP Calgary AB	6030do		
2100	2200		Canada, CKZN St Johns NF	6160do		
2100	2200		Canada, CKZU Vancouver BC	6160do		
2100	2200		China, China R International	5960eu	7205af	
			7285eu	7325af	7415eu	9600eu
2100	2200		Egypt, R Cairo	11890eu		
2100	2200	1st fa	Finland, Scandinavian Weekend R		6170eu	
2100	2200		Germany, Deutsche Welle	11800af	11865af	
			12070af			
2100	2200		Germany, R 6150 6070eu			
2100	2200		Guatemala, R Verdad	4055do		

2100	2200		India, AIR/External Svc		7550eu	9445eu
			9910pa	11620pa	11670eu	11740pa
2100	2200	DRM	India, AIR/External Svc		9950eu	
2100	2200		India, AIR/Natl Channel		9425do	9470do
2100	2200		Malaysia, RTM/Kajang		5965do	6050do
2100	2200		Malaysia, RTM/Traxx FM		7295do	
2100	2200		Mali, ORTM/R Mali		5995do	
2100	2200		Mexico, R Educacion		6185do	
2100	2200		Micronesia, V6MP/Cross R/Pohnpei			4755as
2100	2200		Nigeria, FRCN Abuja		7275do	
2100	2200		Papua New Guinea, R Central		3290do	
2100	2200		Papua New Guinea, R East New Britain			3385do
2100	2200		Papua New Guinea, R Northern		3345do	
2100	2200		Papua New Guinea, R Vanimo		3205do	
2100	2200		Papua New Guinea, R Western		3305do	
2100	2200		Papua New Guinea, Wantok R Light			7325do
2100	2200		Solomon Islands, SIBC		5020do	9545do
2100	2200	Sat/Sun	Spain, R Exterior de Espana		9570af	9660eu
2100	2200	mtwhf	UK, BBC World Service		9915af	11810af
			12095af			
2100	2200		USA, AFN/AFRTS	4319usb	5765usb	12759usb
			13362usb			
2100	2200		USA, Overcomer Ministry		9370na	9700eu
			9955ca	9980na	11775af	15390sa
			15620na			
2100	2200		USA, VO America	6080af	15580af	
2100	2200	Sun	USA, WBCQ Monticello ME		7490na	
2100	2200		USA, WEWN/Irondale AL		15610eu	
2100	2200	Sun	USA, WHRI Cypress Crk SC		17510va	
2100	2200	m	USA, WINB Red Lion PA		9265am	
2100	2200		USA, WJHR Intl Milton FL		15550usb	
2100	2200	Sat/Sun	USA, WRMI Miami FL		9955am	
2100	2200		USA, WTWW Lebanon TN		9479na	9930sa
2100	2200		USA, WWCR Nashville TN		6875eu	9350af
			9980ca	13845na		
2100	2200	irreg	USA, WWRB Manchester TN		3215na	9370na
2100	2200		Vanuatu, R Vanuatu	3945do		
2100	2200		Zambia, Zambia Natl BC		5915do	6165do
2100	2200	irreg	Zimbabwe, VO Zimbabwe		4828af	
2125	2200		Vanuatu, R Vanuatu	3945do	7260do	
2130	2200		Australia, NT VL8A Alice Springs			4835do
2130	2200		Australia, NT VL8K Katherine		5025do	
2130	2200		Australia, NT VL8T Tennant Creek			4910do
2151	2200		New Zealand, R New Zealand Intl			15720pa
2151	2200	DRM	New Zealand, R New Zealand Intl			17675pa

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

2200	2230		India, AIR/External Svc		9910pa	11620pa
			11670eu	11740pa		
2200	2230	DRM	India, AIR/External Svc		9950eu	
2200	2245		Zambia, Zambia Natl BC		5915do	6165do
2200	2256		Romania, R Romania Intl		7430eu	9540eu
			9790as	11940as		
2200	2300		Anguilla, Caribbean Beacon/Univ Net			6090ca
2200	2300		Australia, ABC/R Australia		9610as	9660as
			11695as	12080pa	13630pa	15240va
			15415va	15515va		
2200	2300		Australia, NT VL8A Alice Springs			4835do
2200	2300		Australia, NT VL8K Katherine		5025do	
2200	2300		Australia, NT VL8T Tennant Creek			4910do
2200	2300		Canada, CFRX Toronto ON		6070do	
2200	2300		Canada, CFVP Calgary AB		6030do	
2200	2300		Canada, CKZN St Johns NF		6160do	
2200	2300		Canada, CKZU Vancouver BC		6160do	
2200	2300		China, China R International		9590as	
2200	2300		Egypt, R Cairo	9965eu		
2200	2300	1st fa	Finland, Scandinavian Weekend R			6170eu
2200	2300		Germany, R 6150	6070eu		
2200	2300		Guatemala, R Verdad		4055do	
2200	2300		Guyana, Voice of Guyana		3290do	
2200	2300		India, AIR/Natl Channel		9425do	9470do
2200	2300		Malaysia, RTM/Kajang		5965do	6050do
2200	2300		Malaysia, RTM/Traxx FM		7295do	
2200	2300		Mali, ORTM/R Mali		5995do	
2200	2300		Mexico, R Educacion		6185do	
2200	2300		Micronesia, V6MP/Cross R/Pohnpei			4755as
2200	2300		New Zealand, R New Zealand Intl			15720pa
2200	2300	DRM	New Zealand, R New Zealand Intl			17675pa
2200	2300		Nigeria, FRCN Abuja		7275do	
2200	2300		Papua New Guinea, R Central		3290do	
2200	2300		Papua New Guinea, R East New Britain			3385do
2200	2300		Papua New Guinea, R Northern		3345do	
2200	2300		Papua New Guinea, R Vanimo		3205do	
2200	2300		Papua New Guinea, R Western		3305do	
2200	2300		Papua New Guinea, Wantok R Light			7325do
2200	2300		Russia, VO Russia	9465ca		
2200	2300		Solomon Islands, SIBC		5020do	9545do
2200	2300		South Korea, KBS World R		11810eu	
2200	2300		Turkey, VO Turkey	9830va		
2200	2300		USA, AFN/AFRTS	4319usb	5765usb	12759usb
			13362usb			
2200	2300	mtwhf	USA, Overcomer Ministry		9955ca	9980na
2200	2300		USA, Overcomer Ministry		9370na	15390sa
			15620na			
2200	2300	smtwh	USA, VO America	5915va	7480va	7575va
			12150va			
2200	2300		USA, WBCQ Monticello ME		7490na	
2200	2300		USA, WEWN/Irondale AL		15610eu	
2200	2300	Sat/Sun	USA, WHRI Cypress Crk SC		11775eu	
2200	2300	Sat/Sun	USA, WRMI Miami FL		9955am	
2200	2300		USA, WTWW Lebanon TN		9479na	9930sa
2200	2300		USA, WWCR Nashville TN		6875eu	9350af
			9980ca	13845na		
2200	2300	irreg	USA, WWRB Manchester TN		3215na	9370na
2200	2300		Vanuatu, R Vanuatu	3945do	7260do	
2220	2300		India, AIR/Srinagar	4950do		
2230	2300		Indonesia, AWR Asia/Pacific		15320as	
2230	2300		USA, VO America	5820va	7460va	9570va
2245	2300		India, AIR/External Svc		9690as	9705as
			11710as	13605as		
2245	2300	DRM	India, AIR/External Svc		11645as	

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

2300	0000		Anguilla, Caribbean Beacon/Univ Net			6090ca
2300	0000		Australia, ABC/R Australia		9660va	9855as
			12080pa	15240va	15415va	17795pa
			19000va	21740va		
2300	0000		Australia, NT VL8A Alice Springs			4835do
2300	0000		Australia, NT VL8K Katherine		5025do	
2300	0000		Australia, NT VL8T Tennant Creek			4910do
2300	0000		Canada, CFRX Toronto ON		6070do	
2300	0000		Canada, CFVP Calgary AB		6030do	
2300	0000		Canada, CKZN St Johns NF		6160do	
2300	0000		Canada, CKZU Vancouver BC		6160do	
2300	0000		China, China R International		5915as	5990ca
			7350eu	7410as	11690as	11790as
			11955as			
2300	0000		Cuba, R Havana Cuba		11880af	
2300	0000		Egypt, R Cairo	9965na		
2300	0000	1st fa	Finland, Scandinavian Weekend R			6170eu
2300	0000		Germany, R 6150	6070eu		
2300	0000		Guatemala, R Verdad		4055do	
2300	0000		Guyana, Voice of Guyana		3290do	
2300	0000		India, AIR/External Svc		6055as	9690as
			9705as	11710as	13605as	
2300	0000	DRM	India, AIR/External Svc		11645as	
2300	0000		India, AIR/Natl Channel		9425do	9470do
2300	0000		Malaysia, RTM/Kajang		5965do	6050do
2300	0000		Malaysia, RTM/Traxx FM		7295do	
2300	0000		Mali, ORTM/R Mali		5995do	
2300	0000		Mexico, R Educacion		6185do	
2300	0000		Micronesia, V6MP/Cross R/Pohnpei			4755as
2300	0000		New Zealand, R New Zealand Intl			15720pa
2300	0000	DRM	New Zealand, R New Zealand Intl			17675pa
2300	0000		Papua New Guinea, R Central		3290do	
2300	0000		Papua New Guinea, R East New Britain			3385do
2300	0000		Papua New Guinea, R Northern		3345do	
2300	0000		Papua New Guinea, R Vanimo		3205do	
2300	0000		Papua New Guinea, R Western		3305do	
2300	0000		Papua New Guinea, Wantok R Light			7325do
2300	0000		Russia, VO Russia	9465ca		
2300	0000		Solomon Islands, SIBC		5020do	9545do
2300	0000		UK, BBC World Service		3915as	6195as
			7490as	9740as	9890as	11850as
			12010as			
2300	0000		USA, AFN/AFRTS	4319usb	5765usb	12759usb
			13362usb			
2300	0000		USA, Overcomer Ministry		9370na	
2300	0000		USA, VO America	5895va	7480va	7575va
			12150va			
2300	0000		USA, VO America	5820va	7460va	9490va
			11840va			
2300	0000		USA, WBCQ Monticello ME		7490na	
2300	0000	Sat/Sun	USA, WBCQ Monticello ME		5110na	
2300	0000		USA, WEWN/Irondale AL		15610eu	
2300	0000	Sat/Sun	USA, WHRI Cypress Crk SC		11775eu	
2300	0000	smtwhf	USA, WHRI Cypress Crk SC		7315ca	
2300	0000	m	USA, WINB Red Lion PA		9265am	
2300	0000		USA, WTWW Lebanon TN		9479na	9930sa
2300	0000		USA, WWCR Nashville TN		6875eu	9350af
			9980ca	13845na		
2300	0000	irreg	USA, WWRB Manchester TN		3215na	9370na
2300	0000		Vanuatu, R Vanuatu	3945do	7260do	
2300	2305		Nigeria, FRCN Abuja		7275do	
2300	2315		India, AIR/Srinagar	4950do		
2300	2315	smtwh	Moldova, R PMR/Transistria		9665eu	
2300	2330		Australia, ABC/R Australia		9610as	11695as
2300	2355		India, AIR/Port Blair		4760do	
2330	0000		Australia, ABC/R Australia		17750va	
2330	0000	Sat/Sun	Indonesia, AWR Asia/Pacific		17650as	
2330	0000		Vietnam, VO Vietnam/Overseas Svc			9840as
			12020as			
2355	0000		India, AIR/Mumbai	4840do		

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Monitoring the Customs COTHEN HF Network

"I do not hear the United States Coast Guard on HF anymore. Where have they moved to?"

This is a very common query I see nearly every day on various radio hobby newsgroups and in mail sent to this column. Some say they have moved all their operations to military satellites. One fellow even said they have all gone fiber optic cable. I had a good laugh at that one, since Coast Guard cutters go to sea, that would be one heck of a long fiber optic cable.

While some of the common frequencies that have been noted for many years are still around (e.g., 5690, 8983, etc.), they are not used as much as they once were because the Coast Guard has joined its mates in the Department of Homeland Security (DHS), the U.S. Customs Service, and several other agencies on the Cellular Over the Horizon Enforcement Network (COTHEN) radio system.

COTHEN is one of the world's largest HF networks and is administered by the United States Customs and Border Protection (CBP). CBP developed, purchased and deployed the "High Frequency" COTHEN communications radio network back in 1984 in order to meet CBP's tactical long-range radio communications requirements. It combines radio, computer, and a tactical voice-privacy unit into a state-of-the-art communications system that meets the demanding requirements of Customs' tactical interdiction aircraft and boats in their fight against smuggling activities.

❖ COTHEN Today

Today this national/international network is comprised of land-based, fixed station transceiver systems, remote command and control systems, marine mobile systems, airborne mobile systems, transportable transceiver systems and many special purpose ancillary systems controlled by cellular switching technology. Each system that comprises COTHEN is specifically designed to support tactical law enforcement officers. The network is completely frequency adaptive and has voice type 1-3 encryption and Over the Air Rekey (OTAR) capability.

COTHEN is now a primary means of long-range communications for many agencies and has been modernized in the last two years. Agencies with mobiles participating in the COTHEN network include: Customs and Border Protection Air and Marine Platforms, United States Coast Guard, Operations Bahamas, Turks and Caicos (OPBAT)/Drug Enforcement Agency (DEA), U.S. Army Special Operations Airborne Regiment, U.S. Army Corps of Engineers, U.S. Marshals Service, Department of Health and Human Services, Federal Emergency Management Agency (FEMA) Net, Shared Resources (SHARES) Emergency Net, and DHS.

The center of the network is the Technical Service Center (TSC) in Orlando, Florida. The TSC is manned 24/7 to support field users in their communication requirements, tactical, emergency or disaster response, such as during the emergency response to Hurricane Katrina.

COTHEN is an all purpose communications network. COTHEN can receive calls from air, sea, or shore and maintain seamless communications regardless of the origin of the call. Once an asset is connected to the network, the TSC monitors the call and the communications. The signals travel across land lines in order to use a combination of transmission sites to optimize the signal for both the receiver and the sender.

At the sectors, Remote Communications Consoles (RCC) provides a graphical interface for watch standers that depict the assets online within the network. The operator can see what assets are engaged in communications within the network and the quality of the links with each asset.

The COTHEN network itself selects the most optimal transmission sites through software. This way the most optimal site manages the radio call.

COTHEN uses the Automatic Link Establishment (ALE) protocol to select the best transmission frequency from the unit to a COTHEN site and vice versa. ALE is a software based communications protocol that establishes radio links and eliminates human error. This ensures maximum connectivity between assets. The ALE radio frequently sends and receives signals (known as soundings) in order to determine the optimal operating frequencies for that particular radio and location. Based on these soundings, the radio is able to automatically connect or "handshake" with other radios without requiring the user to manage the frequencies.

Through the use of ALE techniques and the COTHEN network, the Coast Guard has been able to optimize its HF communications capabilities. This system is intended to improve high frequency communications specifically between Sectors and their assets, such as aircraft and cutters.

There are 19 transmission sites that span the nation in order to form one unified coverage area. The map included with this column and the station list below identifies all of the primary ground stations and their three letter/digit identification that they use on the COTHEN network. This list and map appeared in a 2008 open source study conducted about this system we found on the Internet.

CS8	ABQ	Stanley NM
CS1	ATL	Warm Springs GA
CS9	CDI	Cedar Island NC
JOE	CDR	Marion IA
CS7	DEN	Agate CO
FL2	FTM	Sarasota FL
CS6	KCM	Kansas City MO
CS4	LUV	Lovelock NV
CS2	MEM	Senatobia MS
CS3	OKO	Chichasha OK
MC2	OKD	Chichasha OK
	PR1	Islote PR
MC4	RNO	Simpson NV
CS5	RSH	Concord NC
FL1	SAR	Limestone FL
TST	SEA	Clinton, NC
	SS1	Cedar Rapids IA
MC3	VGS	Longandale NV
CR1-CR8	Directional Site	Omaha NE

Each of these transmission sites has two antennas; Omni TSI 530 and Directional TSI 540. The omni-directional antenna radiates power uniformly in one plane. These antennas are generally used for air support. Directional antennas radiate more power in one direction than in any other. They are particularly useful for marine support.

Each site transmits 1-kW of power and is connected to one another with 56-k bit phone lines. The connection of the sites by phone line unifies the each site's coverage area so that the network provides one large coverage area rather than 19 individual ones.

Since the original net was set up with the sites above, additional sites have been added to provide expanded near cellular like coverage on this HF network. These expanded regional communications node sites include:

CNT	CBP Central RCN
COE	Army Corps of Engineers RCN Mobile, AL
CRB	CBP Caribbean RCN
CSK	CBP Alaska RCN Kodiak, AK
EST	CBP Eastern RCN
LNT	CG RCN CAMSLANT Chesapeake, VA
NRT	Unknown RCN
OPB	CBP RCN OPBAT Service Center Nassau Bahamas
OPS1	Unknown RCN
OPS2	CG RCN CAMSLANT Chesapeake, VA
OPS3	Unknown RCN
PAC	CG RCN CAMSPAC Point Reyes, CA
STR	CBP RCN Customs National Law Enforcement Comm Center Orlando FL
TERM	Unknown RCN
TRC	Unknown RCN
TSC	CBP RCN Customs Technical Service Center Orlando, FL
WST	CBP Western RCN

❖ COTHEN Frequencies Continue to Increase

This part of the COTHEN equation has changed significantly since the Coast Guard has started using the system for flight following and other communications (See *MT* Milcom February 2009 for further details).

Original COTHEN Frequencies: 7527.0 8912.0 10242.0 11494.0 13907.0 15867.0 18594.0 20890.0 23214.0 25350.0 kHz ALE/USB

As we go to press we found the following 16 frequencies are being used by participants in the COTHEN network.

5732.0 5909.5 7527.0 8912.0 10242.0 11494.0 12222.0 13312.0 13907.0 14582.0 15867.0 18594.0 20890.0 23214.0 24838.5 25350.0 kHz ALE/USB.

I am still sifting through some more possible frequencies for COTHEN, so keep an eye on my *MilcomMP* blog at **http://mt-milcom.blogspot.com** for future frequency and station lists.

❖ Who are the COTHEN Military Players?

Even though COTHEN is run by the Customs Service, a non-DoD agency, as I mentioned above, we see more than just the U.S. Coast Guard on this HF radio network. I have seen FEMA ground stations, FEMA auxiliary stations, State EOCs, Department of Agriculture (Animal and Plant Health Inspection EOC), and Department of Justice stations. We believe that some of the tri-graph ALE addresses we see on this system belong to U.S. Navy assets. We have a whole series of ALE addresses that are assigned to the U.S. Army Corps of Engineers. Table One is a current list of some of the more recent stations that have been seen/heard/listed on COTHEN.

If we have a major natural disaster such as a hurricane, earthquake, etc., this is one net you want to be part of your listening mix. It is one of the most important government/military networks that I monitor on HF.

❖ The Future of COTHEN and the Coast Guard

Finally, we recently received official word on the role of the Coast Guard and this COTHEN net in future years. In written testimony dated July 31, 2013, submitted by the U.S. Coast Guard Assistant Commandant for Capability, Rear Admiral Mark Butt, given during a House Committee on Transportation and Infrastructure, he wrote the following about COTHEN:

"To improve the reliability of long range communications and leverage existing resources, the Coast Guard has partnered with CBP in transitioning existing High Frequency (HF) radio systems to function with CBP's Cellular Over The Horizon Enforcement Network (COTHEN) Automatic Link Establishment (ALE) System. The Coast Guard has completed the deployment of COTHEN Remote Control Consoles (RCCs) to all Sector, District and Area Command Centers.

"The RCCs allow the Command Centers to access the CBP's high frequency automatic link establishment (HF-ALE) network for long range tactical communication with all aircraft.

"The Coast Guard and CBP are researching how to increase the COTHEN coverage by merging it with select Coast Guard-owned sites in Alaska, Guam, Boston, Point Reyes CA, and Hawaii to improve coverage system-wide, and specifically in the Arctic."

Expect to see a lot more Coast Guard activity on the COTHEN system in the years to come. And that does it for this edition of *MT*'s *Milcom* column. Until next month 73 and good hunting.

TABLE ONE: COAST GUARD ASSETS ON COTHEN

Ground Stations

ALE Address	Station
01Z	CG District 1 Boston MA
05Z	CG District 5 Portsmouth VA
07Z	CG District 7 Miami FL "Miami Ops"
08Z	CG District 8 New Orleans LA
11Z	CG District 11 Alameda CA
14Z	CG District 14 Honolulu HI
C##	Army Corps of Engineers ground stations and mobiles. (Voice Call: Charlie ##) The Corps of Engineers has 15 Deployable Tactical Operations System Emergency Command and Control Vehicles and 3 Mobile Communications Vehicles used to support FEMA and DHS communications during a crisis/disaster. There are 15 ECCVs located across the continental U.S. as follows: 6-Mobile AL; 3-Sacramento CA; 1-Baltimore MD; 1-Nashville TN; 1-St. Louis MO; 1-Ft. Worth TX; 1-Los Angeles CA; 1-Portland OR. There is one MCV at each of the following locations: San Juan PR; Mobile AL; Baltimore MD.
COLDBAY	Air Facility Cold Bay AK
NMH	TISCOM, Alexandria VA
NOJ	COMMSTA Kodiak AK
STP	Loran Station, Saint Paul Island AK
TISCOM	USCG Telecommunications and Information Systems Command, Alexandria VA
UCG	CAMSPAC Point Reyes CA

P##	USCG Air Station RCCs
P02	CGAS Clearwater FL
P03	CGAS Elizabeth City NC
P08	CGAS New Orleans LA
P16	CGAS Miami FL
P18	CGAS Sacramento CA
P21	ATC Mobile AL
P23	CGAS Savannah GA
P26	CGAS Atlantic City NJ
P30	CGAS Houston TX
P31	CGAS Detroit, MI
P33	CGAS San Francisco CA
P36	CGAS New Orleans LA
P39	CGAS North Bend OR
P40	CGAS Borinquen PR

Z##	USCG Sector RCCs	
Z01	Portland ME	Sector Northern New England
Z02	Boston MA	Sector Boston
Z03	Woods Hole MA	Southeast New England
Z04	New Haven CT	Sector Long Island
Z05	Staten Island NY	Sector New York
Z06	Philadelphia PA	Sector Delaware
Z07	Baltimore MD	Sector Baltimore
Z08	Portsmouth VA	Sector Hampton Roads
Z09	Wilmington NC	Sector North Carolina
Z10	Charleston SC	Sector Charleston
Z11	Jacksonville FL	Sector Jacksonville
Z12	Miami FL	Sector Miami
Z13	Key West FL	Sector Key West
Z14	St. Petersburg FL	Sector St. Petersburg
Z15	San Juan PR	Sector San Juan
Z16	Mobile AL	Sector Mobile
Z17	New Orleans LA	Sector New Orleans
Z18	Galveston TX	Sector Houston-Galveston
Z19	Corpus Christi TX	Sector Corpus Christi
Z23	Detroit MI	Sector Detroit
Z27	San Francisco CA	Sector San Francisco
Z28	Los Angeles CA	Sector Los Angeles
Z29	San Diego CA	Sector San Diego
Z30	Seattle WA	Sector Puget Sound
Z35	Juneau AK	Sector Juneau
Z38	Humboldt Bay OR	Sector Humboldt Bay
Z99	Chesapeake VA	CAMSLANT

Coast Guard Aircraft

ALE Address	Aircraft Type
00#	HC-130Js
5##	HC-130Hs
7##	HC-130Hs
F##	HU-25 Falcons
J##	MH-60J/MH-60T helicopters
K##	MH-65Cs/MH-65Ds
L##	MH-65Cs
N##	HC-144As

Coast Guard Cutters

ALE	Address
LLL	Last three letters of the Coast Guard Cutter international call sign

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When Federal Frequencies Aren't Federal Frequencies

When I first became interested in monitoring the frequencies used by federal agencies, I wasn't really aware of the actual bands in which those frequencies were located. It took some trial and error, along with reading various reference books on the subject that gave me a much clearer understanding of where to look for federal communications.

As has been discussed in the column previously, the primary spectrum where you will find the most federal agency radio traffic will be in several bands of frequencies. These bands include 138 to 144 MHz, 148 to 150.8 MHz, 162 to 174 MHz and 400 to 420 MHz. The 138 to 150 MHz frequencies are primarily used by the various military services of the Department of Defense, with some exceptions for FEMA and a few other agencies. But, within the definitive VHF and UHF bands of federal frequencies, there are some channels on which you might find activity that are not part of the federal government.

The National Telecommunications and Information Agency (NTIA), part of the Department of Commerce, oversees the federal government radio spectrum. The Federal Communications Commission is responsible for the licensing and coordination of non-federal frequencies. You might be surprised to find out that there are some frequencies scattered throughout the federal VHF and UHF bands that are licensed by the FCC to various business, local government and public safety agencies. It should be noted that federal government frequencies are not listed in the FCC licenses, but you can find these shared frequencies in the license database.

Many of these frequencies carry some special authorizations and are licensed for "secondary" use with federal users. This means that FCC licensees can not be guaranteed that they will have exclusive use of these frequencies at all times. However, as a practical matter, federal users are somewhat rare on many of these frequencies, but can still be heard. There are detailed descriptions of these frequencies and uses available in the NTIA "Red Book," available in print or on line at: ***www.ntia.doc.gov/page/2011/manual-regulations-and-procedures-federal-radio-frequency-management-redbook***

Let's take a look at some of these non-federal frequencies you will likely stumble upon when searching the federal spectrum. 166.2500 and 170.1500 MHz are both allocations available for something called Broadcast Remote Pickup. Often, radio or television stations use these to communicate with units doing remote broadcasts, or in some cases, these frequencies carry a feed of the radio or television station program audio with the ability for production staff to interrupt the program audio with cues to people in the field. There are also some fire departments, particularly in the eastern United States, that have use of these frequencies. As mentioned earlier, these frequencies can have federal users as well. Customs and Border Protection (CBP) are using 166.2500 MHz as the input to a repeater on 170.6250 MHz at San Francisco International Airport (SFO).

163.2500 MHz is an interesting frequency in the federal VHF band, particularly in how some agencies might be using it on the sly. The frequency should be well known to most scanner frequency enthusiasts as a nationwide medical paging channel. In almost any region of the country you can hear some voice or paging data related to hospitals or medical care centers. Near my home, Yamhill County, Oregon, has been licensed on this frequency for their county wide EMS dispatching. For years I have had reports of federal law enforcement agencies, particularly Border Patrol or Customs and Border Protection Field Operations using this as a secret "tactical" channel. I have never confirmed this use as such, but it is certainly possible.

173.0750 MHz is licensed nationwide to the Lojack theft tracking devices. This system has small transmitters that can be installed in subscribers' vehicles and activated when a vehicle is stolen. I often hear from people claiming to have heard bursts of P25 activity on this frequency, but I believe the data bursts that the Lojack system uses may sound similar, but is not APCO P-25. Although this frequency is allocated to theft-tracking nationwide, there are still a number of agencies that have federal allocations here, including the Air Force, Army, FBI, FAA and NOAA.

There is another group of VHF channels that may be used near you for something different. The frequencies 173.2250, 173.2750, 173.3250 and 173.3750 MHz were all originally assigned as Relay Press or Motion Picture service by the FCC. Many newspapers and film production companies still hold licenses on these channels. Some additional 12.5 kHz "splinter" channels around these frequencies, such as 173.2375 and 173.2625 MHz are also being licensed by the FCC for businesses radio service.

Another cluster of frequencies have an interesting use and an interesting history as well.

169.4450, 169.5050, 170.2450, 170.3050, 171.0450, 171.1050, 171.8450, 171.9050

These are all available for low powered wireless microphones. Many scanner listeners have reported some police agencies that use the dashboard-mounted cameras to record traffic stops can use one of these frequencies for the wireless microphone that the police officer wears while outside the car. In addition, most consumer-grade wireless microphones will often use one or more of these frequencies for use with PA systems at meetings or large gatherings.

The interesting history of these frequencies that I have heard from several sources is that they were allocated at the request of the National Football League. In 1975, when they first started using a wireless microphones on the referees at NFL football games, they had a difficult time coming up with consistently clear frequencies at the various NFL stadiums. Wireless microphone technology was pretty

basic back in those days, so to avoid interference issues, the FCC and NTIA set aside these specific channels for use at stadiums across the country. But, these frequencies will NOT likely be used by law enforcement agencies for undercover body microphones, or "bugs."

While searching the federal VHF and UHF bands, you will often come across frequencies that have short bursts of data on them. Sometimes they sound like short tones, other times bursts of digital noise. These frequencies are used for purposes of transmitting hydrological and meteorological data from remote sensors or monitoring devices. In most cases the data is shared between local, state and federal agencies for flood control and environmental monitoring.

169.4250	170.2625	171.1000	406.1250
169.4375	170.2750	171.1125	406.1750
169.4500	170.2875	171.1250	412.6625
169.4625	170.3000	171.8250	412.6750
169.4750	170.3125	171.8375	412.6875
169.4875	170.3250	171.8500	412.7125
169.5000	171.0250	171.8625	412.7250
169.5125	171.0375	171.8750	412.7375
169.5250	171.0500	171.8875	412.7625
170.2250	171.0625	171.9000	412.7750
170.2375	171.0750	171.9125	415.1250
170.2500	171.0875	171.9250	415.1750

There are a number of federal VHF channels allocated to forest firefighting activities that are available to non-federal fire fighting agencies as well. These frequencies are assigned by region, so check them for activity in your area.

East of the Mississippi River:
170.4750, 171.4250. 171.5750, 172.2750

West of the Mississippi River:
170.4250, 170.5750, 171.4750, 172.2250, 172.3750

The number of available public safety frequencies in the FCC controlled spectrum is rapidly running low. Even with 700 and 800 MHz trunking systems becoming more prevalent in public safety communications systems, VHF and UHF channels are still in demand. Many states that are building wide area trunking systems are now turning towards the federal bands in their search for frequencies.

The state of Wisconsin was allowed to utilize a number of underutilized VHF frequencies from the Department of Defense spectrum between 138 and 144 MHz for their statewide APCO P25 digital trunked radio system, known as Wisconsin Interoperable System for Communications, or WISCOM. You can see the system details here: **www.radioreference.com/apps/db/?sid=6364**

More recently the states of Missouri and Maine are tapping the federal VHF bands in order to fill a need for channels in planned trunked radio systems. The Missouri state system, known as MOSWIN, has a mixture of VHF high-band and 700/800 MHz sites scattered around the state. The Missouri MOSWIN system details can be seen here: **www.radioreference.com/apps/db/?sid=6847**

The Maine State Communications Network, or "MCSCommNet," is another APCO P-25 digital trunked system using a mix of VHF public safety and federal government VHF frequencies. The latest updates on the Maine statewide system are here:
www.radioreference.com/apps/db/?sid=6703

In all of these cases, the frequencies were acquired and licensed by the FCC after negotiations and coordination with the NTIA, and there are very likely agreements in place for usage of these trunked systems by federal agencies, as needed. So, keep all this in mind when searching out activity in the federal bands. It's not always obvious who might be the actual user of these frequencies!

❖ DHS OIG Report on Radio Systems

Recently there have been several reports issued on difficulties with communications in the Department of Homeland Security (DHS). These reports have detailed problems with upgrading outdated radio systems as well as poor execution and training of DHS personnel on radio usage and channel designations. Now, a new report has been released exposing the inefficiency of how the DHS communications budgets are being used.

In August, 2013, the Office of the Inspector General (OIG) of DHS issued a report on an audit they conducted of DHS agencies and their radio communications equipment and how it was being used and upgraded. This report also has some interesting statistics on the number of radios and the radio systems that each of these has for their use. You can find a copy of the report here: **www.oig.dhs.gov/assets/Mgmt/2013/OIG_13-113_Aug13.pdf**

In this report, they focused on the seven agencies within DHS – Customs and Border Protection (CBP), Federal Emergency Management Agency (FEMA), the Federal Law Enforcement Training Center (FLETC), Immigrations and Customs Enforcement (ICE), the Transportations Security Administration (TSA), the U.S. Coast Guard (USCG) and the United States Secret Service (USSS). Each of these agencies was audited as to how they inventoried and deployed their radio assets, and how their communications budgets were being used. In most cases, agencies were not utilizing radios that were already purchased, but simply sat in storage. In other cases, the report mentioned outdated equipment that needed replacing, but no budget being allocated for new equipment.

❖ New CBP Channels

One of the early items I first published in the Fed Files column was a complete list of the Customs and Border Protection (CBP) VHF NET channels used nationwide. These frequencies supported the majority of the nationwide CBP VHF radio network, utilized by not only agencies from the DHS, but other subscribing agencies as well. You can find this list on the Fed Files blog: **http://mt-fedfiles.blogspot.com/2006/06/dhs-cbp-channel-lineup.html**

In the past few years, these frequencies have begun to be supplemented with additional, previously unused VHF frequencies. Along the southern California border with Mexico, a slew of new frequencies were seen active with what was once referred to as the Border Patrol Encrypted Voice Radio Project (EVRP), now part of the overall Integrated Wireless Network program (IWN). This area remained in sort of a world of its own for many years, while the rest of the southern United States border continued utilizing the legacy Border Patrol analog radio system. In 2011, many new P-25 digital radio frequencies started appearing in Southern Arizona, Tucson Sector area. And in the last year, new P25 digital frequencies have been seen all along the Southern Texas border area, with some new CBP operational channels now appearing up into the Houston and Galveston area.

Early in 2013, the CBP Border Patrol in South Texas switched over to new frequencies and P25 digital radios after many years of remaining in the analog mode. Here are some of the reported frequencies and some guesses as to what they are used for. As always, the frequencies are in megahertz and shown with their P25 Network Access Code (NAC), if known:

162.2875, NA50
163.0625, NA40
163.4750, NA61
163.5250, NA10
163.6500, NA60
163.9750, NA21
164.4375, NA51
164.7375, NA41
166.9875, N310
168.3875, N312
169.2625, N293 – CBP AIR 3
169.5750, NA80
169.6000, NA20
169.6375, NA31 – WESLACO 2
169.6625, NA30 – WESLACO 1
170.1250, NA40
170.3375, NA50
170.4375, NA61
170.5375, NA40 – HARLINGEN 1
170.9875, NA60
171.1875, NA20 – MCALLEN 1
171.1875, NB20
171.3250, NA11 – RIO GRANDE CITY 2
171.3250, NA41 – HARLINGEN 2
171.6625, NA12 – RIO GRANDE CITY 1
171.6625, NA51
171.7125, NA22 – MCALLEN 2
171.9625, NA10 – RIO GRANDE CITY
171.9875, N311
172.2375, NC20
172.2625, NA21 – MCALLEN
172.7125, NA60

Some new CBP channels are being heard up in the Houston area as well. Here is what has been reported so far:

170.1000, N301 – DNET 200
170.1250, N301
170.1250, N304
170.4625, N301 – DNET 201
171.6625, N301

Next month, the final Fed Files column will appear in the pages of the last issue of *Monitoring Times*. But is this the end of the Fed Files? Absolutely not! Further details will be revealed in the December column, but I can let you know that in addition to the Fed Files blog page, the Fed Files is now on Twitter. Follow me @TheFedFiles for further details!

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Amateur Radio Satellite Update

In this last installment of this amateur radio satellite column, I thought it would be helpful to look ahead to a couple of future CubeSats that are now slated for launch in the coming months as well as bring you up to date on the very latest happenings with AMSAT's ongoing FOX project.

One or more of these satellites may already be in orbit and operational as you read this. However, it is important to remember that predicting exact launch dates and times is in many ways much like predicting the weather…you're doing well if you get it right 50% of the time! What's even harder to predict is whether or not any of these satellites will actually become active on orbit!

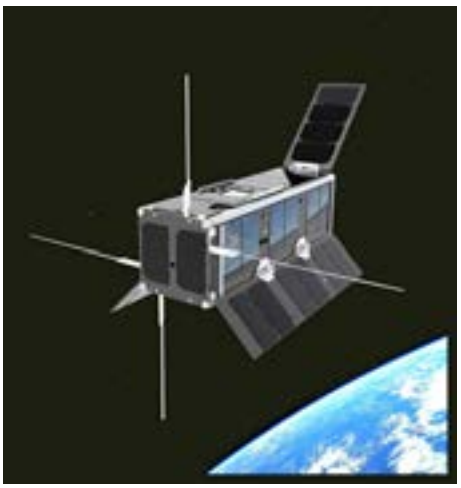
❖ UKube-1

At press time (mid-September, 2013) Ukube-1 was slated for launch in late September or early October, 2013. UKube-1 will be Scotland's first satellite and has been designed, along with several onboard experiments, to carry a set of AMSAT-UK FUNcube circuit boards which will provide a 1200 bps BPSK telemetry beacon on 145.915 MHz, a linear transponder downlink on 145.930-145.950 MHz for SSB/CW communications, with a linear transponder uplink on 435.080-435.060 MHz.

Members of the UKube-1 team are all smiles as they pose with the fruits of their labor, the flight model Ukube-1. (Courtesy: Clyde Space)

In addition, UKube-1 is also designed to carry a 1200 bps BPSK telemetry beacon on 145.840 MHz and a myPocketQub 442 on 437.425-437.525 MHz with 11-mW output using spread spectrum emission techniques along with a 1-watt transmitter on 2401.0 MHz built by students and staff at the Cape Peninsula University of Technology (CPUT), Cape Town, South Africa. This transmitter will downlink high data rate mission data using up to 1 Mbps QPSK or OQPSK modulation.

Gunter's Space Page (**space.skyrocket.de/doc_chr/lau2013.htm**) lists UKube-1 as manifested on a Soyuz-2-1b Fregat-M rocket to be launched from the Baikonur Launch Complex



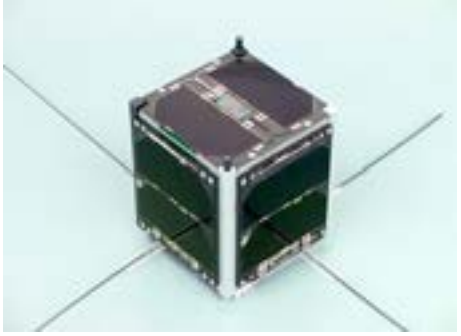
An artist's concept of how the UKube-1 satellite might look on orbit (Courtesy: Clyde Space)

in Kazakhstan with a tentative launch date of 25 September 2013. More information about Ukube-1's amateur radio and other experiments can be found at: **amsat-uk.org/tag/ukube-1.**

❖ FUNcube-1

AMSAT-United Kingdom, in collaboration with AMSAT-New Zealand, are working on a new amateur satellite project called FUNcube that features a 435 to 145 MHz linear transponder for SSB/CW operation. The project has received major funding from the Radio Communications Foundation (RCF) in Great Britain and is being developed in collaboration with ISIS-Innovative Solutions in Space B.V.

FUNcube was conceived as an educational CubeSat with the goal of both interesting and then educating young people about radio, space, physics and electronics. It will support the United Kingdom's educational Science, Technology, Engineering and Mathematics (STEM) initiatives as well as provide an additional resource for the GB4FUN Mobile Communications Center in England. The target audience for FUNcube consists of primary and secondary school pupils. To further this aim, FUNcube's 145 MHz telemetry beacon will provide a strong signal for school pupils to receive using just simple antennas and ground station equipment.



The flight model of FUNcube-1 is shown here with its VHF and UHF antennas deployed. (Courtesy: AMSAT-UK)

A wide-band, relatively low-cost receiver board (called a "FUNcube Dongle") has also been developed to aid in achieving FUNcube's educational goal. The dongle can be connected to the USB port of a laptop (along with a simple receiving antenna) so as to display telemetry and messages from the satellite in an interesting way. The satellite will also contain a materials science experiment from which the students can receive telemetry data that they can compare to the results they obtained from similar reference experiments in the classroom.

Howard Long G6LVB puts the finishing touches on the flight model FUNcube-1 satellite. (Courtesy: AMSAT-UK)

FUNcube-1 is now slated for launch in November, 2013, on a Dnepr rocket from the Dombarovsky launch complex near Yasny in Russia. As discussed earlier, FUNcube will carry a 1200 bps BPSK telemetry beacon on 145.935 MHz, a linear transponder with a downlink pass band of 145.950-145.970 MHz for SSB/CW communications with an uplink receiver that will tune from 435.150-435.130 MHz.

However, if the launch of UK-Tube -1 (above) goes ahead as planned in late October, then some of FUNcube's circuitry may actually be in orbit before the FUNcube-1 satellite makes it into its own orbit.

More information about the FUNcube project is contained on AMSAT-UK's Web site at: **amsat-uk.org/funcube/funcube-cubesat.** Information about the FUNcube Dongle is at: **amsat-uk.org/funcube/funcube-dongle-sdr.** Indeed, for those not otherwise equipped to receive the "birds," obtaining a low-cost FUNcube Dongle may be just your ticket to allow you to begin doing so.

Engineering model of FOX-1A's 2-meter transmitter board. (Courtesy: AMSAT-NA)

Dave Sumner K1ZZ, ARRL Chief Executive Offer (center) holds the FOX-1A engineering prototype as Barry Baines WD4ASW, AMSAT-NA President (left) and Tony Monteiro AA2TX, AMSAT-NA VP of Engineering (right) look on at the 2013 Dayton Hamvention (Courtesy: Author)

❖ AMSAT FOX-1A Progress

Work continues apace on AMSAT's FOX-1 Satellite. AMSAT's vice-president of engineering, Tony Monterio AA2TX, reports that 8 of the satellite's 12 circuit boards are now flight-ready. Recently, the RF team completed the final schematic design review of the RF transmitter card. While the review took only a couple of hours, it represented the completion of many months of design, prototyping and test work.

The transmitter power amplifier prototype showed greater than 450 mW at the minimum battery voltage of 3.3 Volts and around 750 mW at the maximum battery voltage of 4.2Volts. While this output may appear miniscule by HF standards, it is more than enough to present a solid downlink signal on the ground from Low Earth Orbit. Keep in mind that AO-51 routinely operated with an output power of only ½ a watt and SO-50 produces a workable downlink signal while operating with even less power than that.

Tests on FOX-1's RF prototype indicate that the total card will draw less than 1 watt at the maximum battery voltage and considerably less at lower voltages. When idling (i.e. not keyed) the transmitter should draw less than 30 mW. Obtaining these results from such small components is a marvelous piece of engineering and will (hopefully) give FOX-1 an easily workable downlink signal from orbit with small antennas.

Tony also reported that, in late June, 2013, the International Amateur Radio Union (IARU) frequency coordinator, Hans van de Groenendaal ZS6AKV, has now coordinated FOX-1's operating frequencies. Its uplink will be on 435.180 MHz FM, and its downlink will be on 145.980 MHz FM.

In other FOX-1 construction news, Mark Kanawati N4TPY, of AMSAT's Fox-1 partner SpaceQuest (www.spacequest.com), recently reviewed and approved AMSAT's design for the satellite's solar panels. SpaceQuest will be doing the installation of the solar cells on the satellite's printed solar panels that also contain the solar panel circuitry. Each of these solar panels will accommodate two Boeing/Spectrolab solar cells. There is a hole in the Z-Axis (bottom) solar panel to accommodate the lens of the camera module that is being built by students at Virginia Tech University.

❖ FOX-1A Launch

Tony has also been attending regular online meetings with the authorities coordinating the launch of all the CubeSats flying on the L-55 "GRACE" mission that also includes Fox-1.

As discussed previously, GRACE is a National Reconnaissance Office (NRO) mission and the Office of Space Launch (OSL), not NASA, provides these launches. So FOX-1 is considered a NASA-sponsored mission.

One of the things Tony has since learned is that OSL has some different standards and launch requirements than the CubeSat Design Specification from NASA and that AMSAT may need to make some minor modifications in the design of FOX-1 to meet their requirements. It also appears AMSAT may need to provide substantial additional documentation (including such things as test reports) in a timely manner when asked or the satellite will be bumped from the flight.

While these requirements will add a certain additional level of stress to the FOX-1 development effort, they are not unusual when the "paying customer" has such a costly satellite riding on the same launch. Tony and his team remain confident they can accommodate all of these additional requirements so as to not jeopardize the launch of FOX-1, which is now slated for sometime in November, 2014. You can stay tuned to all the very latest developments about FOX-1 at the AMSAT Web site: **www.amsat.org.**

❖ Sign Off

As this will be my final satellite column in *Monitoring Times*, needless to say, it's been a real pleasure sharing learning with you these past few years. I invite you to drop me an e-mail (at **kb1sf@hotmail.com)** if you have any other questions about this absolutely fascinating aspect of our wonderful amateur radio hobby. I look forward to hearing from you.

I also hope you will accept my invitation to join and then continually support your national AMSAT member society in whatever way you can. Remember, satellites don't last forever, and new amateur radio satellite modes and techniques are continually evolving. Joining and then remaining a member of AMSAT, a well as generously supporting AMSAT's various fund raising activities, remains the single best way to insure new amateur radio satellites, carrying the latest technology, will be built and launched well into the future. Only with the financial assistance of radio amateurs (and others like you) will these ambitions projects, vital to the very future of our amateur radio service, come to fruition. See you on the birds!

SELECTED FREQUENCY AND MODE DATA:

SATELLITE	Uplink (MHz)	Downlink (MHz)	Mode
UKube-1	435.080 - 435.060	145.930 - 145.950, 145.915, 145.840, & 437.475, 2401.0	SSB/CW 1200 bps BPSK 1 Mbps QPSK
FUNcube-1	435.150 - 435.130	145.950 - 145.970 145.935	SSB/CW 1200 bps BPSK
FOX-1	435.180	145.980	FM Voice

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Logging On

With the winter longwave season now in high gear, this seems like a good time to discuss logging your DX catches. A good log can help you spot changes in the band and allow you to gauge current conditions by checking what has been heard in the past. A log also provides a tangible record of your best DX, something that can be gratifying to review in the "off season," when longwave may be in the doldrums. A logsheet is a time-tested way to chart your DXing progress, so this month we'll discuss how to make one that suits the special needs of the longwave DXer.

A log doesn't have to be anything fancy. You can make up a ruled sheet, and run photocopies of it as needed. Or, for those wishing to go first class, a log can be kept on a computer using a spreadsheet or word processing program. This has the added advantage of letting you sort the log into different formats (by ID, frequency, or date, for example), and also allows easy sharing of your log with others via e-mail.

What categories should your log contain? Just as with shortwave logs, it's important to show the date, time, frequency, ID, signal strength and location of the station heard. But that's pretty much where the similarity ends. There are some additional categories that should be considered for the LW DXer…

Serial No.—Many beacon chasers like to assign a sequential number to each log entry. This makes it easy to keep track of your total loggings at a glance and provides a convenient reference point when searching for a specific entry later on.

ID Pitch—The two tone pitches you'll hear from most navigation beacons are 1020 Hz and 400 Hz. Traditionally, U.S. beacons use the 1020 Hz tone and Canadian beacons use the 400 Hz tone. There are exceptions to the rule, however, where just the opposite is true, and these are considered somewhat rare catches – all the more reason to have it down on paper! If you're really advanced and have a way to actually *measure* the tone frequency from a station, you'll see that not all tones are exactly on 1020 or 400 Hz, but may vary slightly. Some listeners enjoy charting these differences and putting them in their logs.

Distance—The airline distance in miles (or kilometers) from your station to the beacon site is very useful information for DXing. One technique for determining rough distance is to have a map posted in your shack with your location marked by a thumbtack. Attached to the thumbtack is a movable strip of paper that has been marked off in miles (or kilometers) for quick measurement. There are also online resourcesthat will give a more precise measurement of distance. One such tool can be found at **www.indo.com/distance**/.

Beacon Power—To put a logging in the right perspective, it's helpful to know the transmitting power of the station. For instance, hearing a 2,000-watt beacon 500 miles away may be fairly routine, but pulling in a 25-watt beacon at that distance would certainly be a good catch by any standards. Showing the power in your log can help put things in the proper context.

Service—In this space, you could have a code letter to signify the type of station you heard: **A**=aeronautical, **P**=private, **L**=lowfer experimenter,**B**=broadcaster, etc.

IDs per minute—This is the number of *complete* identifications that are sent by a beacon in one minute. This is, in effect, the "fingerprint" of the station. It can be very helpful to include this information in a verification letter as proof of reception.

Remarks—A space should be left to note special information about a logging such as whether or not the transmission included a voice message (now a rarity, except in Alaska), ID errors, local WX conditions at the time of reception, QSL information, and so on. An excellent website for determining the location and other details about a beacon can be found at: **www.classaxe.com/dx/ndb/rna/**.

❖ Mailbag&Loggings

Carl Schmidt WA8ZTZ (MI) sent some recent loggings and photos of his King Radio KR-80 ADF receiver, a radio intended for mounting in an aircraft using a standard 3 1/8" instrument hole. He notes that many beacons heard at his location are Canadian, and the locations can go by various names, including English, French, Indian (native) and with various spellings. He finds it interesting to locate them on a map, which often requires some research and provides a good geography and history lesson! A sampling of his logs (greater than 100 miles distance) appears below.

Beacon Loggings from MI

kHz	ID	Location
254	5B	Summerside, PEI
350	DF	Deer Lake, NF
360	PN	Port Menier, QC
390	JT	Stephenville, NF
391	MA	Maniitsoq, GRLD
396	YPH	Port Harrison/Inukjuak, QC

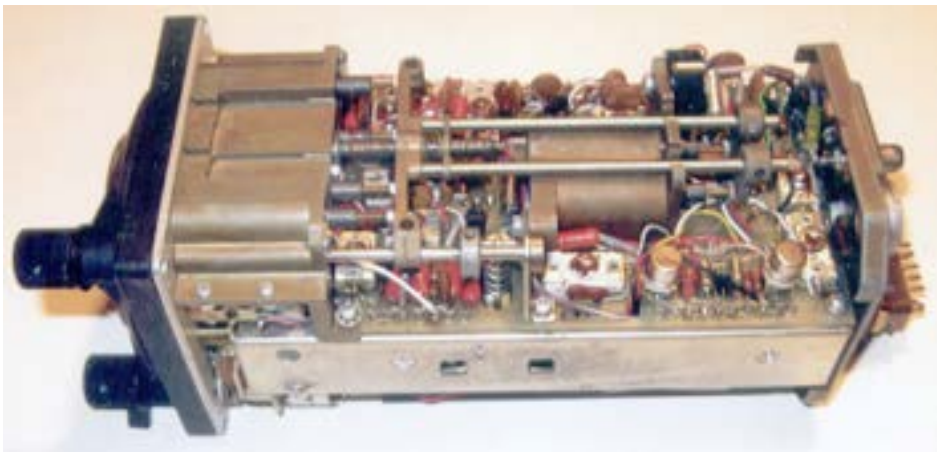
Richard PalmerW7KAM(MO) sent an extensive list of loggings from his location in Missouri. For these intercepts he used an Icom R-75, Clifton Z1501active antenna, and a Timewave DSP-599zx audio processor. A selection of his logs are shown below

Beacon Loggings from MO

kHz	ID	ST/PR	Location
200	UAB	BC	Anahim Lake
201	BV	OK	Bartleville
344	JA	FL	Jacksonville
344	TKH	LA	Tallulah
374	EE	MN	Alexandria
380	BBD	TX	Brady
382	MW	IL	Marion
388	AM	FL	Tampa
391	DDP	PR	San Juan
410	GDV	MT	Glendive
414	OOA	IA	Oskaloosa

❖ Building "Helper Loops"

In the July issue, Joe Majewski WA1WRH (NH) was searching for information on a compact LF "helper" loop to place near his portable, air-coupled LF receivers. I was able to point Joe toward a commercially made unit, the Q-Stick by Radio Plus+, which is described at **www.dxtools.com/QStick.htm**. I use one of these antennas with a Sony 2010 receiver and find it quite effective.



Carl Schmidt WA8ZTZ (MI) sent this photo of his King Radio KR-80 ADF Receiver. (Photo courtesy of Carl Schmidt)

Another loop fan, John Stoll (NY), wrote with helpful details on building these types of loops using ferrite rods. John writes:

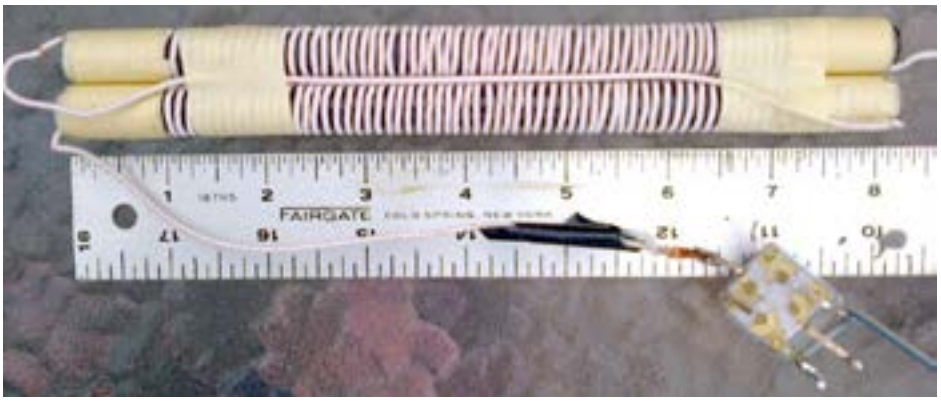
"Here is how to make a 'helper loop' for your LW portable: Buy two ferrite rods. I purchased two of them from eBay, which were 8" long. The diameter of these rods is 7/16 inch. I did *not* 'math out' the type of rod, this is merely what I found and bought. Obtain a roll of wire, 24 to 30 gauge will work, then wind the wire around the rods one rod at a time. I did 11 turns of wire per inch for the entire rod. Do *not* cut the wire when you finish the first rod. I used 1-inch wide paper tape to hold things as I was starting to wind or at certain points in winding, since it is easy to remove later, yet holds things in place so you don't need multiple hands to hold everything. The easy way to wind on a rod is to not start exactly at the end, but to tape the wire to the rod an inch or so in from the end, leaving 10 inches or more sticking out straight along the rod. After winding the rest of the rod and taping the end to keep it from unraveling, go back to your starting point, remove the paper tape, and then wind back to the end of the rod. Now tape the end.

"After winding the first rod completely, I then take the roll of wire, bring the wire down to the starting point of the first rod, and now start winding the second rod. Complete that to the end, again winding 11 turns to the inch. When done, again tape the end to keep things wound tight, and you may now unroll another 12 inches or so and cut the wire. Bring that end down to a variable capacitor. I used one from a transistor radio. The cap had a value of around 300 pf, and when I finally 'tuned' it, it was about halfway meshed. The other end of the cap goes to your original wire end for the first rod. I taped the two wired rods together so the wire ends of the two combined rods each connect to the cap. If you don't have a signal generator, then tune your portable to a signal on LF, bring the two rods close to the internal rod inside the radio case, and then try to 'tune' the cap. With mine, I can start with no heard signals, and bring signals up to about 60% of the signal strength meter on my Grundig Eton G3 portable. Nice improvement.

"The loop shown in the picture was thrown together out of common materials, just to show how to crank one out for yourself. No pre-planning or designing was done. I do have to shorten the wiring, and put it in some sort of tubular (non-conductive) case. For my G3, if I move my loop in front of the LCD display, I lose *all* stations regardless of strength, and hear nothing but hash noise generated by the LCD panels. If I move the loop to the back where the internal loop is, all of a sudden, I get a huge improvement, but it has to be right up against the case.

"Perhaps the induced signal would have been better if I wound the wire around both rods at the same time, as if both rods were really one. Honestly, this is why I used tape to hold things together, as I can undo/redo things for experimentation. When I finally get a working model, the glue gun will come out. Perhaps I need better rods, or more or less wire. Either way, I have a working model right now. Perhaps I can improve it, but right now it makes a very noticeable improvement.

"So my experiment was a success. Positives: Cheap, reliable, small. Negatives: The loop must be pressed directly against the case by the internal rod antenna. It isn't good enough to create a 'hot zone,' as with a Select-A-Tenna used on the AM Broadcast Band. I have portables which can be six inches away from the Select-A-Tenna, not even parallel to it, and see a great signal improvement. However, the Select-A-Tenna is also a much larger unit, so creating that 'hot zone' to place the portable in may require a larger device. Creating an LF version of that antenna would be nice! For now, give this homebrew loop a try. We aren't talking about a lot of time, effort or expense. I hope your results are as good or better than mine!"



A "Helper Loop" can be easily built with ferrite rods, some wire, and a variable capacitor. (Photo courtesy of John Stoll)

Many thanks John. I hope many of our readers will give this a try. As you note, the most important thing is to start experimenting and see what kind of results you get. Also, I like the advice about not making things too permanent right away, as it allows one to more easily "tweak" the design and try new ideas.

In a follow-up note, John passed along this additional information and tips:

Two longer ferrite rods are shown in the photo above (purchased later), and they are wound in series.

The wire used was Litz, 220/44, also obtained on eBay. Litz wire is made up of separately insulated strands, and can be especially effective for use at lower RF frequencies. However it is more challenging to prepare for soldering due to the multiple strands it contains. He dipped the ends of his wire in drain cleaner for 10 minutes, then rinsed *thoroughly*. Conventional solid wire would work well, too, and is more easily obtained.

Indoor reception with a ferrite loop may be a challenge due to electrical interference. If reception is noisy, try to find a spot outdoors, away from buildings and electrical systems.

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Finishing up the Echophone EC-1

In the October issue, we started a new restoration project: a little Echophone EC-1, also known as the Echophone Commercial. We discussed the history of this S-38 ancestor, particularly how it came to be manufactured by the Hallicrafters company. We also described the EC-1's basic design features and compared them to those of the other models in this series of radios. Finally, we opened the cabinet so that we could assess the general condition of the set.

The condition was great! Except for a coating of easily removed fine dust, the radio's innards looked almost like new. And, since it had obviously been stored under good environmental conditions, I decided to try applying power without recapping. My decision was also influenced by the very dense wiring style that had been used. It looked as if the parts had been installed in layers, resulting in many of the capacitors being buried under other components.

❖ Preliminary Steps

This month's work session began with the tubes. As usual, I tested each one and made sure that all of them were in their correct sockets. I also sprayed contact cleaner (sparingly) on the contacts of the bandswitch and into any openings I could find in the other switches and the volume control. Then I began my usual powering up routine.

Since the EC-1 happens to be an AC-DC radio, which could have a dangerously "hot" chassis if connected directly into the line, I plugged it into my isolation transformer. That, in turn, was plugged into an auto-transformer unit that allows me to increase the line voltage in three steps. I also set up a multimeter to monitor B-plus voltage so that I could make sure it was present and increasing as the line voltage was increased. Otherwise, I would immediately shut off the radio and begin checking for problems.

Everything went smoothly as I increased the voltage. There was no smoke, and pretty soon I heard a soft hum in the speaker. But, though some static was heard, as I turned the volume control – showing that the audio circuits seemed to be functioning – the receiver was otherwise dead. For awhile I thought I might be in for a long troubleshooting session, but then I smiled when I saw that the "Standby" switch on the front panel was set to "On."

Turning it off brought the set to life. I was picking up stations all over the broadcast band on my short basement antenna and was able to hear at least a few stations on each of the shortwave bands. I let the set it run for 20 minutes or so, watching it carefully, just to make sure that there were no components waiting to fail. With the set in operating condition, I was now in a position to touch up the alignment.

❖ Some Alignment Background

Since the next issue of *MT* will be the final one, this is the last alignment I'll be doing in "Radio Restorations." So, I thought I might take a little extra time to review some background on the procedure before carrying it out.

The realignment of a superheterodyne involves tweaking the frequency response of its three or four main sections. These are the antenna stage, where the signals enter the receiver; the RF stage (not present in simple receivers such as the EC-1), where the signals receive preliminary amplification; the oscillator/mixer , where all the received signals are converted from their original frequencies to a standard lower frequency (known as the IF or "intermediate frequency"); and the IF channel, where the converted signals are amplified.

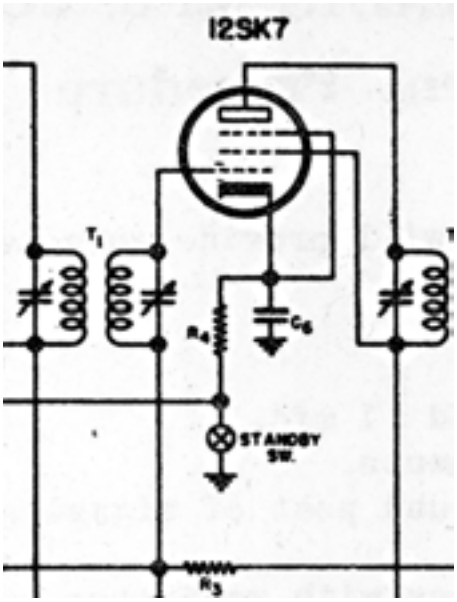
The tweaking requires that modulated RF signals of the correct frequencies for the sections involved be injected into the receiver while the receiver's output is observed on an appropriate indicating device. The signal generator, of course, must be capable of producing modulated signals in the tuning range of each of the bands covered by the receiver and at the much lower frequency of the IF channel.

Signal injection points for the various tests are usually specified in the manufacturer's service literature, but it is generally left up to the service person to come up with a suitable output indicating device. The choice depends on the type of equipment on hand and the ease of getting to the proper connection point in the receiver.

The easiest connection point to use is the speaker voice coil. It is usually quite convenient to hook onto the two little riveted terminals mounted on the speaker frame. However, a very sensitive indicating instrument is needed. In my experience even a VTVM, set to the lowest AC voltage range, will probably be insufficient. If you have a lab grade AC VTVM, such as one of the Ballantine models, you may be able to get away with it.

BAND	Signal Generator Frequency Setting	Dummy Antenna	Pad	Trimmers
I.F.	455 kc	.1 mfd.	none	# 1-2-3-4 on top of IF can
1	600 kc	200 mmf	#5	none
	1800 kc	200 mmf	none	#6-7
2	2.5 mc	400 ohm	#8	none
	7.0 mc	400 ohm	none	#9-10
3	no padding condenser on this band			
	28 mc	400 ohm		#11-12

This chart from Hallicrafters service notes for the EC-1 shows the alignment procedure in a nutshell.



Diode load resistor R3 (at bottom of picture) feeds AVC voltage to the control grid of the 12SK7 IF amplifier through the secondary of IF transformer T1.

A very practical hookup that will work, even with a non-electronic multimeter, is to connect the meter, set to a convenient AC range, from the plate of the audio output tube to ground in series with a capacitor (about 0.1 uf) to block the DC. This usually provides plenty of voltage to operate the meter. However, my favorite output indicating scheme is a VTVM on a low negative DC range, connected from the receiver's automatic volume control (AVC) line to ground.

The AVC, of course, is a system for evening out the volume as a radio listener tunes across the dial. Without it, if the listener cranked up the volume to hear a weak station and then tuned to a much stronger one, he might have his ears blasted with sound. However, with AVC, a portion of the audio signal at the detector is rectified and fed back as negative bias to the control grid (s) of all IF stages as well as the RF amplifier, if present. This reduces the gain of the stages: the louder the signal, the greater the bias, and the lower the gain.

This, of course, has the desirable effect of keeping the volume reasonably consistent throughout the radio's tuning range. So, measuring the AVC voltage is a very good indication of signal strength, though it does require the use of a very high impedance instrument such as a VTVM. And, a very nice side effect is that the AVC voltage is independent of the volume control position, which can be set at minimum. Anyone

who has done alignments using either of the other two methods will appreciate this feature! Not having to listen to a signal's 400 Hertz note while working one's way through the many adjustments of a multi-band receiver is a minor blessing.

Speaking of the volume control setting, when using methods other than AVC voltage measurement to indicate signal strength, it is advisable to set the radio's volume control at maximum. The reason for this is to keep the signal being injected from the signal generator into the receiver at the minimum level needed to obtain a stable indication. A signal input that is too high will trigger some AVC action, tending to flatten out the voltage peaks you are looking for as you tweak the various adjustments. This is also a concern when using the AVC voltage measurement method but, as mentioned, that method is not affected by the volume control setting.

❖ Preparing to Align the EC-1

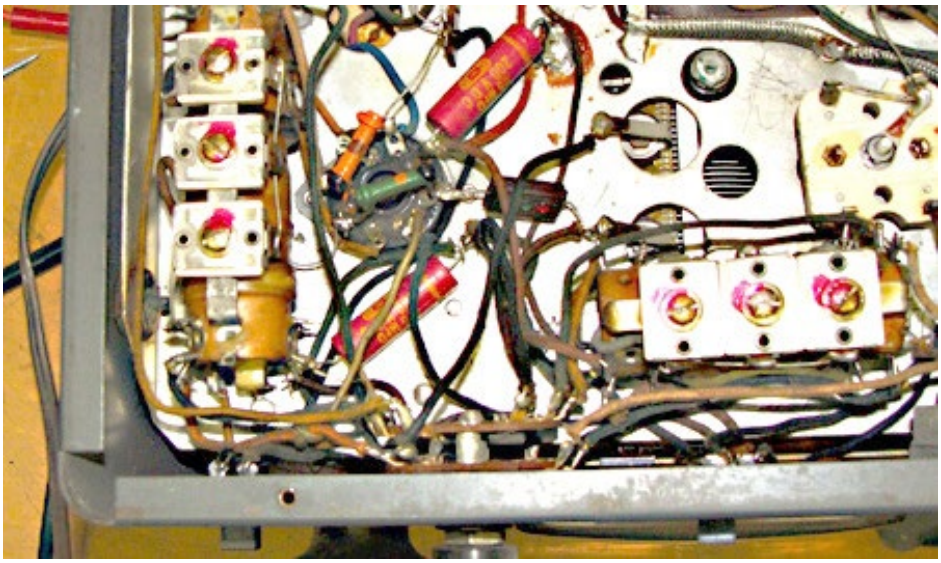
The first step in carrying out any receiver alignment is to obtain the manufacturer's service data, which will contain the recommended alignment procedure. Although I do have a full set of Rider's Manuals, I found it more convenient to download the EC-1 information from **www.nostalgiaair.org**. Most anything from Rider's seems to be available for free downloading from that site. I'm including with this article a copy of the basic alignment chart taken from the EC-1 data.

Notice that for each bandswitch position the procedure specifies test frequency settings, the type of "dummy antenna" to be used when adjusting for maximum output at each setting, and numbers indicating the location of the adjustment points (trimmers and padders) to be "tweaked."

The "dummy antenna" term calls for some explanation. This component is placed in series with the signal generator lead during alignment of radios that are normally connected to an outside antenna. Its purpose is to simulate the presence of the antenna while the radio is on the test bench so that the alignment can be conducted under more natural conditions. Some years ago, the Radio Manufacturer's Association specified a simple circuit containing resistance, capacitance and inductance to be the standard dummy antenna. But, as is the case here, manufacturers often used single resistors or capacitors for this purpose.

Looking over the alignment procedure for the EC-1, I noticed a couple of startling omissions that had to be dealt with before work could proceed. First, the points where the signal was to be injected into the radio for the various tests were not shown. Second, though there was a good drawing of the location of the trimmers under the chassis, the numbers coding their locations to the adjustment notes were missing.

I happened to have a copy of the service notes for the Hallicrafters S-38 handy, and since the EC-1 was an ancestor of the S-38, I thought that the S-38 signal injection points would work. They were simple enough: connect to the stator of the front section of the tuning capacitor for alignment of the IF transformers; connect to the A1 antenna terminal (leaving the A2 terminal grounded) for all other adjustments.



Trimmers for the oscillator and RF sections are mounted neatly atop the tuning coils for their bands.

As for the missing numbers, I got out my copy of Riders Volume 14, where the EC-1 service notes reside, in hopes that I might have an edition of the notes in which the trimmer numbers were not missing. In that I was disappointed, but I found something almost as good. A previous owner of the manual had helpfully penciled in the missing numbers. He must have had the same problem I did and gone to the trouble of tracing the wiring. Thank you very much, thoughtful previous owner!

Now I had a working radio and all the necessary reference data, so I was ready to begin the alignment procedure. And, the first step would be to set up my signal strength indicator. I knew enough not to even try the "VTVM across the speaker voice coil" approach. Also, as it happens, the dense wiring around the audio output stage made the plate connection of the tube almost inaccessible. So, I was left with the alternative that was my favorite anyway; measuring the AVC voltage.

The connection point happened to be fairly easy to find. Working with the schematic, I was able to follow a lead from the ungrounded end of the volume control across the chassis to the very easy to spot 2-megohm diode load resistor. The other end of the resistor, which was connected to the grid of the 12SK7 IF amplifier, was the location I needed. Connecting my VTVM from there to ground and tuning through various stations in the broadcast band, I was able to get solid readings on the minus 5-volt DC scale. I could now proceed with the actual alignment.

❖ Completing the Alignment

Following the alignment chart shown elsewhere in this article, I began with the alignment of the IF transformers (trimmers 1-4 found on top of the cans). Connecting the signal generator to the stator of the front tuning capacitor through a 0.1 uF capacitor as specified, I set it for 455 kHz with a minimal outlet level. I got a nice strong stable reading on the meter and, one by one, I adjusted the four trimmers for maximum output.

Moving right along to the recommendations for band-1, I connected the generator output lead to the antenna terminal through a 200 uuF capacitor and tuned both the radio and the generator to 600 kHz. The padder, at position 5, was quickly adjusted for maximum output on the meter and I was ready to proceed to the second adjustment for band-1. For this, I tuned both the receiver and the generator to 1800 kHz and adjusted the trimmers at positions 6 and 7 for maximum output.

The adjustments for band 2 and 3 were made in the same manner, except that I used a 390-ohm resistor dummy antenna (the closest standard value to the specified 400) for band-2 and band-3.

After completion of the alignment, this compact and modest little set turned in an excellent performance on both the broadcast and shortwave bands. I'm sure that most of those who laid out the 25 bucks or so to purchase the EC-1 in the 1940s felt that they got their money's worth!

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ANTENNA TOPICS

Dan Farber, AC0LW
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Copper Water Piping: A Greatly Improved Ground

Welcome back, my friends. This time around I'd like to look at a sort of "Part Two" of my discussion in a previous column about using cold-water piping as a station ground.

I was raised on the whole "cold-water pipe ground" concept. I remember as a young boy in the 1960s seeing this recommended over and over as a competent ground for the various crystal sets, one-tube regenerative "bloopers," and eventually superhet receivers that I endlessly cobbled together in the basement. When my uncle, KH6BOR, shipped me his old Hammarlund HQ-140-X and Johnson Viking Ranger as a Christmas gift in 1970, I continued this tradition, hooking the old Hammarlund to my cold-water pipe ground and my longwire, eagerly copying CW operators and working toward my Novice ticket. When I did become a licensed ham, the old Ranger also worked against this same ground.

Over the years, I usually defaulted to this familiar grounding arrangement, rarely being able to use a "real" ground of ground rods, screen, etc., due to having to settle for a station on the second or even third floor. As many of us have found out the hard way, a ground wire two or three stories long will try to act like an antenna itself, spraying RF throughout the house and the neighborhood, making things worse than if there had been no ground at all. I operated this way, ground-free, when confined to the third floor, laying lengths of wire on the floor to serve as a counterpoise so I could transmit.

Material	ρ (Ω•m) at 20 °C Resistivity
Silver	1.59×10^{-8}
Copper	1.68×10^{-8}
Annealed copper	1.72×10^{-8}
Gold	2.44×10^{-8}
Aluminum	2.82×10^{-8}
Calcium	3.36×10^{-8}
Tungsten	5.60×10^{-8}
Zinc	5.90×10^{-8}
Nickel	6.99×10^{-8}
Lithium	9.28×10^{-8}
Iron	1.0×10^{-7}
Platinum	1.06×10^{-7}
Tin	1.09×10^{-7}
Carbon steel	(10^{10})

Table showing relative conductivity of various metals. (Courtesy: About.com)

The gnarly, old galvanized ground. (Courtesy: Author)

The classy, new copper ground. (Courtesy: Author)

In contrast, the cold-water piping of a given house, perhaps due to the complex network of shapes in all the twists and turns and offsets, generally gave good performance. And, of course, it is a dependable *safety* ground, since the house electrical panel is grounded to the cold-water line.

There's just one fly in the ointment when it comes to a house as old as my little bungalow, built in 1911. All those houses I'd lived in earlier in life were new enough to have been built using copper piping for the water system. This old house, though, had galvanized pipe throughout. There is no way I can estimate its age; surely it didn't date clear back to 1911? But it was undoubtedly very old. I threatened for years to wreck it out and replace it with copper. Well, I finally got around to it.

❖ Figures Don't Lie

The chart (Fig 1) shows dramatically how much better as a conductor copper is than, well, just about anything other than silver. I doubt seriously that I could have afforded silver piping for my house water system. Copper, though, obviously way outscores iron and steel. From this conductivity viewpoint, copper piping is a far better ground than galvanized iron piping. Ironically, the industry's original motivation had nothing to do with the material being a good conductor; at the beginning of the 20th century, houses stopped being built with *lead* piping water systems, due to the, ahem, rather poisonous nature of lead. Lead had been used for supply and drain piping, because it was easy to work. Methods of mass-manufacturing lengths of pipe had not been developed yet. Lead water routing is truly ancient; the Romans had water conduits made from lead; indeed, the English word "plumber" comes from the Latin for lead, *plumbum.*

Iron pipe became economical to make, and rapidly replaced the deadly lead. Since black iron pipe rusts so easily, galvanized iron pipe came to be preferred. It still rusts on the *inside*, though. It is some testimony to my devotion to my radio hobby, that my motivation to change over to copper came less from squeamishness about rusty drinking water, and more from a desire for a better ground! I should add that copper water piping has been in general use since the 1920s and that the gnarly old galvanized piping I wrecked out may, indeed, have been nearly 100 years old.

❖ Getting It Done

If you've never run much copper pipe, let me tell you, it's a joy to work with compared to threaded pipe. I've spent many years as a mechanic and handyman, wrestling with threaded pipe: Threads are prone to leak; the threaded end is mechanically weaker than the rest of the pipe; short lengths threaded on both ends ("nipples") have to be bought since you can't make them at home even if you

have a threading machine; hand-threading pipe is a horrible chore, and so on.

Copper is absolute bliss by comparison. You can cut piping to length easily with a hacksaw, and pre-assemble large sections of pipe and fittings to see how they'll work out; then, when you're happy, sweat-solder all the fittings, and you're done! Also, copper pipe has a slick, finished appearance that makes the old galvanized iron look like, well, crap. And it'll never rust, on the inside or the outside.

❖ What A Difference a Pipe Makes

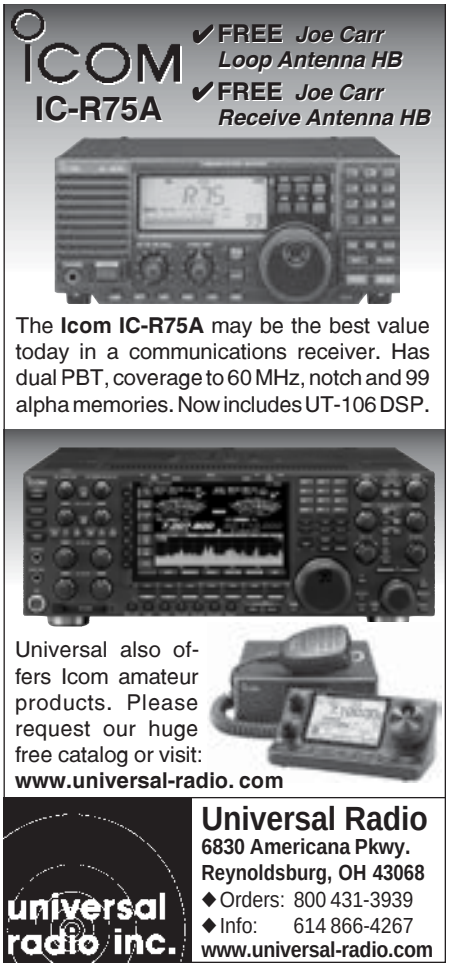
As you might have guessed, after I completed the re-piping and tested for leaks, and gloried in the pressure and volume now available from my shower, and delighted in the toilet refilling in twenty seconds (it had been a two minute ordeal before), I just had to clamp my station ground circuit to the shiny new copper cold-water pipe right above my operating position and give the radio a whirl.

First, I tried just listening; I wanted to see how much the higher-quality ground might have improved reception. From my overview of the shortwave broadcast bands, and then my tours of the various HF ham bands, I concluded that it wasn't so much a case of increased signal strength as it was a lessening of *noise*, that is to say, an improved signal-to-noise ratio. Nighttime brought the delightful experience of being able to hear faint signals on the lower bands that had no doubt been buried in the noise before. Even with my big dipole in "T-vertical" mode, the listening was less fatiguing due to the reduced noise.

But the real thrill came when I started loading up the antenna to transmit. Operating 160 meters with my 102 foot dipole, even in T-vertical mode, had always been a marginal experience at best; after all, 102 feet is less than a quarter-wave at 1.8 MHz, and a quarter-wave is the generally accepted minimum length to get a dipole to load up with ladder line and a good tuner. Apparently the quality of the copper pipe ground was enough of a factor to improve things. Not a whopping amount, mind you, but I can now operate the low band at a full 100 watts without the tuner popping and sizzling. RST reports on 160, 80 and 40 are consistently better than they used to be. That's good, because winter is upon us, time to glory on the low bands! And, as a bonus, I feel a bit safer with my house's electrical system grounded to a conductor I can count on.

❖ And So...

If you are one of the rare dinosaurs like I was, with cruddy, old galvanized water piping, you owe it to yourself to invest in copper piping. It's healthier, it'll last much longer, it looks great, and your radio will thank you. Join me here in December, and we'll take one last grand whack at the world of antennas. Until then, happy operating!



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Translator Madness

(Photos courtesy of the author)

The FCC accepts applications for new broadcast stations only during certain "filing windows." For 30 days in June and July, applications were accepted for new FM stations. FM translator applications were last accepted during a 2003 window. Thousands were filed, and the Commission put processing on hold. That freeze has finally thawed, and processing of some of these applications has resumed.

An FM translator is a low-powered station which serves only to rebroadcast the programming of some other station. Translators are not allowed to originate programming of their own. When they were first authorized, translators could only be used to receive the signal of an FM station over the air and rebroadcast it on a different frequency. Over the years, the FCC has gradually relaxed this requirement.

First, they allowed a translator to receive the signal to be relayed by a direct connection, as long as the translator was located within the area the "main" station was predicted to serve. Then, they decided to allow a direct connection for translators operating below 92 MHz FM regardless of the location of the translator. Next, translators were allowed to rebroadcast the signals of AM stations. And finally, they have been allowed to pick up the digital subchannels of FM stations broadcasting in HD, and convert those digital signals to analog.

The Commission maintains the fiction that these translator stations only rebroadcast the signals of other stations. In practice, FM translators have become low-powered FM radio stations in their own right. They have also become quite valuable. And, they have become very much sought after. As of early September, nearly 900 of the applications from the 2003 window have been "accepted for filing." I believe most of these applications will be approved and will eventually result in new "mini FM stations."

Some are already on the air. In my vicinity, six new small FM stations have appeared on the air in 2013. Two rebroadcast the HD2 digital subchannels of existing stations; three rebroadcast AM stations. The sixth rebroadcasts a regular FM station. In this last case, the regular station being rebroadcast is in Twin Falls, Idaho, while the translator rebroadcasting it is located in Nashville. That's a pretty long direct connection! I'm sure a satellite transponder is used.

WCRT-1160 and WCRT-FM1 103.9

W210CD broadcasts on 89.9 FM from a TV tower northwest of the city. It rebroadcasts the HD2 subchannel of WPRT-FM 102.5 "The Game." That HD2 subchannel in turn rebroadcasts the signal of WAYM 88.7 "Way FM." This translator fills in a gap in the coverage of Way FM's contemporary Christian music programming.

W240CA operates on 95.9 FM. It rebroadcasts the signal of AM station WNSR-560, an all-sports outlet. WNSR is a Class D station with very low nighttime power. Their FM relay, on the other hand, is not required to reduce power at sunset.

W244CW transmits on 96.7 FM from a tower in the southeastern suburb of Smyrna. The AM station it relays, WMTS 810, is limited to six watts of power at night. As in the case of W244CW, that major nighttime power reduction does not apply to the FM signal. WMTS broadcasts to the Hispanic population of Rutherford County.

W248BM is on 97.5 FM from a tower in Murfreesboro, Tennessee. It rebroadcasts the HD2 digital subchannel of WBUZ 102.9 "The Buzz." That HD2 subchannel in turn rebroadcasts the signal of WPRT-FM 102.5 "The Game." WPRT's own signal is broadcast from a tower to the northwest of Nashville and doesn't reach Murfreesboro, 30 miles southeast of the city.

W264CK is yet another all-sports station on the FM dial. It broadcasts on 100.7 FM from the WKFN-AM 540 tower in Clarksville. And, it simulcasts the AM 540 programming.

Finally, W288BG broadcasts on 105.5 (with a permit to move to 105.3). This station rebroadcasts KAWZ 89.9 FM. KAWZ is a Twin Falls, Idaho religious station.

These are just the stations that are already operating. The FCC has issued permits for five additional stations. Two will likely use HD2 subchannels to relay another out-of-state religious station. One will join W288BG in rebroadcasting KAWZ. One is listed as relaying a 100,000-watt classic rock station. This one will probably actually relay the rock station's HD2 subchannel – which, in turn, rebroadcasts 50,000-watt AM news-talk station WLAC-1510. Yes, a 50,000-watt AM station feels it needs the coverage improvement afforded by a low-powered FM relay. The last of these newly permitted stations will rebroadcast low-power FM (LPFM) station WRFN. Given the severe technical limitations imposed on LPFM stations, WRFN's translator will reach far more listeners than the main station it relays.

WENO-760 and WECV-89.1

And, we're not done yet. These are just the translators which have already been approved. Remember, there are 900 acceptable applications on file on which the FCC has not yet acted. Hundreds of these will be approved.

The stations above are, of course, centered on Nashville. Similar new blood will appear on the FM band all across the country. Even in New York, applicants believe there are opportunities for new translators. Stay tuned. Your FM dial will see some interesting changes.

❖ TV channel 56: Not Really Gone

It's now been more than four years since the end of full-power analog television. With the analog shutdown, TV channels 52-69 were also removed from television service. Or so we thought.

DXers find the strangest things. There really was no good reason to continue scanning channel 56 for TV signals after the analog shutdown; there wasn't supposed to be anything there. But there is something up there. In eleven cities, digital TV signals have reappeared on this supposedly dead channel.

The programming is rather boring. It's a static Dish Network logo with no audio. If you are one of the few viewers with a special "Mobile" digital TV (a so-called "M/H" receiver), there is actual programming available. The programming

is not very exciting though. There are several subchannels, all broadcasting the same video loop explaining how to operate a Dish Network receiver (or broadcasting the "Your Dish Network receiver is turned off" screen...).

It's not entirely clear what Dish is attempting to achieve here. One might presume the idea is to provide some kind of over-the-air subscription TV service. The selection of sites seems a bit random: Tuscaloosa, Alabama; Dickerson, Maryland; Jacksonville, Florida; Janesville, Wisconsin; Superior Township, Michigan; Kannapolis, North Carolina; Durham, North Carolina; Cleveland; Mount Pleasant, Pennsylvania; and West Bend, Wisconsin. And, for some reason, eight different sites in the greater Atlanta area.

This network may not end with these eleven cities. The same firm holds leases on the same channel 56 spectrum at 166 different sites across the U.S. Again, stay tuned; something interesting is going to happen on channel 56. Or, maybe not.

WNVL-1240 and a back-up antenna for FM stations WKDF and WGFX

❖ Vanishing TV

Every three years, TV stations must make a decision with regard to carriage on cable. If a station chooses "must-carry," the cable system must carry the station, but the station may not charge the cable operator for that carriage. Alternatively, a station may choose to negotiate a "retransmission consent" agreement. The station may ask for some kind of compensation in return for allowing the cable operator to carry their signal. If an agreement cannot be reached, the cable system must stop carrying the TV station. For the most part, only "Big 4" network affiliates have enough leverage to ask for retransmission consent compensation , i.e., ABC, CBS, Fox, NBC.

Most of these retransmission negotiations are completed in a friendly and prompt manner. Unfortunately, sometimes they aren't. CBS disappeared from certain Time-Warner's cable systems for much of August. The two parties were unable to reach an agreement on renewal of their carraige. Stations owned by Journal Broadcast Group are still "off the air" on Time-Warner as I write.

Cable operators claim the TV stations are demanding outrageous increases in retransmission rights fees, increases that will have to be passed on to consumers as increased cable rates. For their part, TV stations claim the increases are only a few pennies per subscriber.

I should note that, as an employee of a local TV station, I'm not entirely objective on this issue. For decades, cable systems were allowed to use the signals of local TV stations to sell their service, without being required to share their profits with the stations without which they would have had no business. Stations were required to provide their programming to cable for free even after it became clear cable was creating extra competition for the television market.

Broadcasters should, and do, expect competition. They do not expect to be required to subsidize that competition. Imagine that "Burger World" is having trouble, because everyone prefers McDonalds' fries. So, Burger World lobbies for a law requiring McDonalds' to allow Burger World to sell McDonalds' fries – and to sell those fries without paying for them. That, in my opinion, is what many cable operators expect to be allowed to do with the programming produced by TV stations.

❖ Bits & Pieces

Another all-digital AM test was held in mid-August, and this time it was a big one. WBT-1110 Charlotte is one of the biggest AM signals on the dial. This test ran for three hours on two consecutive nights. Reports have the all-digital signal heard in many places across the East. Reception was not as reliable as I would have expected. I have not seen any reports of how it worked in the immediate Charlotte area.

TV stations have been disappearing at an alarming rate in Canada. The CBC closed literally thousands of analog stations last summer. Over-the-air TV is completely gone in Newfoundland, except in the capitol. Montreal, however, now has a new over-the-air station; CFHD-DT operates on RF channel 47. It will be an ethnic station with programming in 17 languages directed at 18 ethnicities. The station will be known as "Ici," French for "This Is." It's also a bilingual acronym for "International Channel/ Canal International."

On the TV front in the U.S., home shopping has returned to over-the-air TV in most of the country. QVC has appeared on a .5 subchannel on the Ion stations. These are the stations with "PX" in their call letters, formerly known as "Pax."

STATION REPORT

New stations on the air:

Merrill, Oregon	1240	KRJW 1,000/1,000 ND

Stations deleted:

Grand Forks, B.C.	860	CBRJ going to FM
Kedgwick, N.B.	990	CBAF-20 going to 98.1 FM
Hartsville, South Carolina	1490	WJDJ

Web links for this month's column:

americanbandscan.blogspot.com - My AM DX blog.
www.rabbitears.info/echostar.php?request=list - A listing of the mystery channel 56 TV stations operated by Dish Network.
www.fcc.gov/guides/cable-carriage-broadcast-stations - FCC FAQ on cable carriage of TV stations.
hraunfoss.fcc.gov/edocs_public/attachmatch/DA-13-1675A2.pdf - A partial list of FM translators likely to be granted by the FCC this fall.

WiNRADiO G315 Wide-Coverage SDR Receiver

By Bob Grove W8JHD

Thinking back, it wasn't all that long ago that, if you bought a desktop receiver, it would go up to 30 MHz and have knobs. But all that has changed. Forward-thinking revolutionaries like WiNRADiO, an Australian entrepreneurial company, have made receiving equipment smaller, lighter, more functional, upgradable, wider in frequency coverage, and even more affordable when considering their reception capabilities. But they don't have knobs – your computer does all the work.

One of the most popular of this generation of computer-hosted receivers is WiNRADiO's G315 which comes in two versions: G315i (mounts internally in a desktop computer's PCI slot), and the G315e (external "brick" which connects to a computer's USB port).

Because of its high performance and low cost, it has been eagerly accepted by government, military, industrial, laboratory, and consumer users. As a software defined radio (SDR), it is software-upgradable and offers a number of optional functions. Its accuracy and dependability qualifies it as a laboratory test instrument.

With a considerably-wide frequency range on its own (9 kHz – 1800 MHz), an optional DNC-3500 frequency converter can extend its range up to 3500 MHz. No mental math is necessary as in the old analog days; the attachment of the converter automatically prompts the receiver to display the correct receive frequency.

What's in the Box?

The G315 comes with application software, a comprehensive user's manual, a low-noise linear power supply (not a noisy switching power supply!), a short test antenna, USB cable for your computer, and a BNC antenna adapter which fits the receiver's SMA connector.

Your computer can handle it as long as it has at least a 500 MHz Pentium CPU and a free USB socket. Platforms include Windows 98, ME, 2000, XP, and VISTA 7 or 8.

Reception Modes

Right out of the box the G315 can demodulate AM, synchronous AM, USB, LSB, ISB, DSB, CW, and narrow FM. And if WFM is required for monitoring FM broadcasts, the receiver can be ordered as a G315e/WFM or G315i/WFM with that capability installed as well. For shortwave devotees, a DRM decoder is available in downloadable software.

The G315 panel is a busy, highly-informative place. (Courtesy: WiNRADiO)

Traditionally, signal strength indicators (S meters) have been calibrated in seemingly-arbitrary "S units." While each S unit typically represents a signal strength change of 6 dB, and this can be expressed in microvolts of signals strength, the user may choose any of these scales for the on-screen S meter as referenced to the quiet -140 dBm noise floor.

For razor-sharp reception, the IF bandwidth is continuously variable in 1 Hz steps from 1-15 kHz. A noise blanker and notch filter assist in weak-signal recovery. An integrated recorder is provided for filing and playback of received signals.

And, a Spectrum Analyzer

I don't know how folks who are serious about their listening can get along without a spectrum display, but the G315 has one. It's in real-time, meaning there's no perceptible delay between signal reception and presentation on the screen. While it's only a 20 kHz span, this is often enough for spotting weak signals within short frequency ranges.

The display has crisp 16 Hz resolution and allows pre-detection recording as done by intelligence agencies like NSA, CIA and DIA. The entire 20 kHz can be recorded and played back later with variable selectivity settings to define what signals were present and monitor them again and again as necessary.

WR-G315E MANUFACTURER SPECIFICATIONS

Receiver Type:	DSP-based SDR with DDS-based dual-conversion superheterodyne front end
Frequency Range:	9 kHz - 1800 MHz (3500 or 8599 MHz with optional AMFE unit, except cellular radiotelephone frequencies where required by law)
Tuning Resolution:	1 Hz
Modes:	AM, AMS, LSB, USB, DSB, ISB, CW, FM (wide-FM with optional WFM demodulator)
Image Rejection:	2-100 MHz 60 dB typical and 100-1000 MHz 50 dB typical
IP3:	0 dBm @ 20kHz
Spurious-Free Dynamic Range:	90 dB
MDS:	-135 dBm
Phase Noise:	-148 dBc/Hz @ 100 kHz
Internal Spurious:	Typically less than equivalent antenna input of-105 dBm
RSSI Accuracy:	2 dB typ.
RSSI Sensitivity:	-137 dBm
Bandwidth:	50 - 15000 Hz (adjustable in 1 Hz steps), 230 kHz (WFM option only)
Scanning Speed:	50 channels/s

Sensitivity (AM/SSB/CW 10dB S/N and FM 12dB SINAD):

Mode	0.15 500 MHz	500 1800 MHz
AM, AMS (30% modulation)	108dBm (0.89µV)	104dBm (1.4µV)
AM, AMS (80% modulation)	116dBm (0.35µV)	112dBm (0.56µV)
LSB, USB, ISB, DSB	119dBm (0.25µV)	115dBm (0.40µV)
CW	126dBm (0.11µV)	122dBm (0.18µV)
FM	113dBm (0.50µV)	109dBm (0.80µV)
WFM (WFM optiononly)	104dBm (1.40µV)	102dBm (1.78µV)

Intermediate Frequencies:	IF1: 109.65 MHz and IF2: 16 kHz
Roofing Filter:	2 by 4-pole 20 kHz crystal filter
Tuning Accuracy:	1-ppm (25°C ±2°C)
Frequency Stability:	0.5 ppm (0 to 60° C)
Antenna Input:	50 ohms (SMA connector)
Maximum Input Level:	+18 dBm
Output:	Digitized IF and audio signal over USB interface
Interface:	USB (1.0 and 2.0 compatible)
Weight:	15.1 oz (430 grams)
Dimensions:	6.5 inches (166 mm) long by 3.8 inches (97 mm) wide by 1.6 inches (41 mm) high

Test and Measurement Facility

A test function automatically sets the receiver up to display frequency error of the received signal, AM depth of an amplitude modulated signal with one percent accuracy, and the FM deviation to determine whether a received AM signal meets the new bandwidth requirements.

Accessories

With VHF and UHF signals frequently distant and/or weak, an optional LNA-3500 preamplifier is available. With response from 30-3500 MHz, the low-noise amplifier offers 20 dB mid-band gain (500 MHz) as well as an astounding +30 dBm third-order intercept figure (intermodulation rejection).

The little in-line amp requires 7-15 volts DC and may be powered directly through a side jack, or through the coax by a bias-T power injector, such as the BT-3500. The LNA-3500 is an independent accessory that can be used with other VHF/UHF receivers as well.

Special Purpose Options

Many professional users have requirements not encountered by most listeners. Intermediate frequency (IF)

outputs of custom signal processing would be an example. On special order, the G315 may present a 109.65 MHz wideband output, a 16 kHz narrowband output, or a more conventional 10.7 MHz wideband output for third-party accessory processors and spectrum displays.

Another factory order can specify an input from a reference oscillator (any frequency between 8 and 20 MHz is acceptable and addressable by the receiver's software), or offer the receiver's own internal reference oscillator to synchronize other associated accessories.

❖ Special Pricing

As a service to our loyal readers, Grove Enterprises is offering their remaining stock of the G315 at a special discount price while our inventory lasts. Phone toll free (800) 438-8155 or visit our website: **www.grove-ent.com.**

WiNRADiO G313 SDR Shortwave Receiver

Many of us remember the days in which we would dream of owning a Collins, JRC or Drake communications receiver. We may even recall revered names of yesteryear like Hammarlund, National and Hallicrafters.

But the days of heavy, tube-laden, or even more recent transistor-punctuated, analog shortwave receivers is gone. ICOM's R75 remains as a virtual stand-alone among the former competitors.

Computers have ushered in a new age of listening, the software defined radio (SDR). New names like WiNRADiO, Perseus and Bonito now compete for the market's attention and sales.

❖ Let's take a look

With WiNRADiO currently a leader in SDR offerings, we'll see what their popular G313 has to offer. Its on-screen display looks identical to its wide-frequency-coverage counterpart, the G315. There's a good reason for that; their circuitry architecture is essentially the same.

As with its higher-frequency-capable model, the G313 requires a PC CPU of at least 500 MHz time-base. Unlike its partner, it actually has slightly better third-order image handling: +3 dB, making it less vulnerable to shortwave's typical strong-signal overload.

Like its twin, it also offers a real-time spectrum analyzer with a 20 kHz span (visible bandwidth). The filter can be mouse-cursor driven to change the received signal continuously anywhere between 1 and 15 kHz.

Similar to the G315, the receiver comes in two styles, the G313i (internal) as a modular plug-in to a desktop computer's PCI port, and a G313e (external) module to be accessed through a USB cable. The G313e and G315e are both housed in a rugged, cast aluminum case measuring 6-1/2" long by 3-3/4" wide and about 1-1/2" high. Weight is a little above one pound.

Shortwave listeners will appreciate the G313's IF shift which allows the receiver's passband to be cursor-dragged to another frequency, removing adjacent-channel interference. Or, if it's your preference, you may also invoke the passband tuning to adjust the filter position in either SSB or CW mode without changing the signal frequency.

The spectrum display provides visual confirmation of these filtering gestures as they are conducted.

❖ Higher frequency

Since the upper frequency cutoff is 30 MHz, some listeners may opt for a VHF converter that extends the range to 180 MHz. This allows coverage of several populated portions of the spectrum, including land mobile low and high bands (30-50 and 150-174 MHz), civilian aircraft (108-137 MHz), amateur six and two meters (50-54 and 144-148 MHz), military VHF (138-144 and 148-150 MHz), and a wireless mike/base relay band (72-76 MHz).

Like the G315, the G313 is being offered by Grove Enterprises at a special discount price to *MT* readers until our limited supply is exhausted.

MFJ-4225MV Switching Power Supply

It would seem that there could be nothing simpler to design or acquire than a suitable power supply for your receiver or transceiver. After all, you simply need to change 120 volts AC to 12 volts (usually) DC, right? A transformer, a couple of diodes rectifiers, and an electrolytic filter capacitor should do the job.

But, the transition from resilient tube-type radios to more delicate solid-state circuitry has mandated a little more. The voltage must be better controlled, and even occasional transient spikes of higher voltage must be prevented. Thus, new power supply design is more complicated.

❖ Good Physical Design

The 4225MV is equipped with separate analog meters to show voltage and current. Output power is provided on front-panel terminals; a cigarette-lighter jack is also present for common mobile DC cords.

The DC output voltage is specified as adjustable from 9-15 volts DC (ours showed 6.5-14 volts). AC inputs may be selected anywhere from 85-135 or 170-260 volts AC. Ripple is stated as below 35 mV with 1.5 percent regulation under full load.

Oddly, the designers chose to have the panel meter lights and fan LED dim and brighten, as well as the fan speed ride up and down, depending upon the setting of the DC output voltage. We haven't figured that one out since we would want to see the meter readings and have the fan efficiently dissipate heat regardless of the output voltage setting.

The MFJ-4225MV is handsome and compact. (Courtesy: MFJ Enterprises)

❖ The Downside of Switching Power Supplies

While in the golden, olden days a husky transformer was used, new power supplies are designed with switching circuitry to avoid the former heavy and expensive beasts. But switching circuitry carries with it a price of its own: electrical noise interference.

You have probably heard these artifacts while tuning the AM broadcast and lower shortwave bands. They present as either broadbandwidth buzzes or strong carriers at repetitive intervals like every 30-40 kHz or so. The most common offenders are the little, lightweight, "wall-wart" accessories used to recharge camera batteries or even supply operating power to modern electronic gadgets. Yes, these are switching power supplies, universally replacing the heavier, more expensive cubes.

Much larger supplies for powering transmitting equipment are readily available. We verified the radiation of noise spikes generated by an Astron SS30M, and decided to take a look at, and listen to, the MFJ-4225MV switching power supply, which is advertised as "hash free," with the promise that you will hear "none in your receiver."

We connected the 4225 to a WiNRADiO G39DDCe spectrum-analyzing receiver. While there was no whine or buzzing "hash" to be heard, it did radiate switching-generated spurs on harmonic frequencies beginning at 36 kHz (on our sample) and which finally disappeared in the low shortwave range when listening with an outdoor antenna separated about 50 feet from the power supply. For most communications applications, the spikes won't present a problem since the noise is most prominent the lower you tune below 1-2 MHz.

Admittedly, even the $5000 G39DDCe comes equipped with a switching power supply, and its radiated noise is present on the lower frequencies and is prominently visible on its own spectrum display.

❖ In Conclusion

The lightweight (3.7 lbs.), compact (5.25 inches wide by 4.5 inches high by 6 inches deep), MFJ-4225MV switching power supply is conveniently laid out, easy to read, professional in appearance, and offers plenty of power at a reasonable price. The MFJ-4225MV is available for $99.95 from MFJ Enterprises, Starkville, Mississippi, (**mfjenterprises.com**) and from authorized *MT* advertisers.

Loyd Van Horn, W4LVH
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Internet Radio Essentials

One of the more common questions that I am asked from readers is, "What equipment do I need if I want to listen to Internet radio in my home, car, or at work?" A lot of times, it really depends on what your preferences are.To be fair, you can do all three of those with one device. But, if you are looking for options or certain requirements, I think I can help at least point you in the right direction.

❖ At Home

The at-home Internet radio listening experience is the original way that people were plugging in to their favorite radio stations online. Used to be, the only way to listen to Internet radio was to be sitting in front of your computer and listening through whatever speakers or headphones you had plugged into it. Not exactly a convenient format, but back then, we were in front of computers more and for longer periods.

Thankfully, though, there have been many advancements in the technology of at-home Internet radio listening. While the computer option is still available for those who prefer it, these newer choices open the window for more people to enjoy Internet radio streaming in ways they hadn't even previously imagined. Which option works for you is really a matter of preference, but the following are some good options to consider:

Smart television, such as a Blu-ray player or Roku-type device: For those with a preference for their Internet radio to come through their home theater or home-entertainment system, one of these is usually the best choice. In addition to Internet radio, you also open the door for streaming video through providers such as Netflix and Amazon Instant Video. There are a number of televisions, Blu-ray players, streaming devices such as Roku, Apple TV and Google's Chromecast, and gaming consoles that have built-in app support for streaming services such as Pandora and Slacker. In my home, my Sony Blu-ray player fits the bill of bringing streaming media via my WiFi network through my home theater system.

Vizio 24-inch smart-TV brings 1040p video and Pandora audio among many other apps. (Courtesy: Vizio)

Wi-Fi Radio: In the early days of Internet radio, this was the first advancement in technology, the dedicated unit with built-in speakers that streamed Internet radio broadcasts. Quality ran the gamut from small units with speakers that were on par with handheld transistor radios, to sophisticated units with app-support, remote controls, large hi-fi speakers and lavish wood cabinets. In my home, I have several of these devices with my favorites being my Sangean WFR-1 and my Logitech Squeezebox. While very different, both of these devices fit my needs for whatever listening conditions I am looking to do at home.

Logitech UE Smart Radio can be your scanner, shortwave radio, AM/FM radio or subscription radio with Pandora or Sirius/XM, all in one portable set with decent audio. All you need is a WiFi connection. (Courtesy: Logitech)

Mobile Devices: Today, many are relying solely on their smartphone or tablet for Internet radio. Combined with a quality set of headphones, speakers or dedicated docking station, you can get really good quality audio from your device. Also, if you do have a streaming player connected to your TV or home theater system, many mobile devices have apps or capability to stream audio and video content from your device directly to your home theater system.

❖ In The Car

One of the more exciting developments of the past five years is the explosion of streaming audio options that can follow you into your automobile. We are no longer tethered to our smartphones, thanks to an increase in app-based technology directly in the audio systems in today's autos. Gone are the days of carrying around large binders of CDs of your favorite music. Today's drivers are a few taps away from an entire world of streaming audio options.

Smartphones and Mobile Devices: Still the *de facto* way to bring streaming audio into your car, the use of a smartphone to stream apps like Pandora or TuneIn is still very popular among those with automobiles that were built prior to 2012. There are lots of accessories that help you route the audio through your audio system, too. Some newer cars have docking hookups or auxiliary jacks to allow you to plug the audio from your smartphone directly into your sound system. Some autos even have hookups to allow charging your smartphone. Other options include the venerable FM transmitter which has a small micro-transmitter that allows you to "broadcast" your smartphone's audio through an FM broadcast frequency that can be picked up by your car's FM stereo.

Built-in App Support: More and more automakers are catching on that consumers want to take their "always connected" status with them into their cars. As such, automakers are now including touch-screen audio systems in their vehicles that include apps with built-in navigation, Bluetooth phone pairing and Internet radio apps. Even for those who have older vehicles that don't have built-in options, there is a growing selection of aftermarket audio head-units that incorporate this technology.

❖ At Work and Beyond

Whether you are sitting at your desk at work, lounging in a beach chair watching the waves crash the shore, sitting in line at the grocery store waiting to pay for your food or sitting on the metro train on your commute to work, you can still "take it with you."

Smartphones and Mobile devices: The catch-all option for Internet radio is the smartphone. You have an Internet connection anywhere you can get a cell phone signal, built-in speakers and headphone jack, and a plethora of apps to choose from. This makes it the perfect option for those wanting to take their Internet Radio with them no matter where they are.

Mobile Hotspot: With the number of people buying tablets, smart phones and other mobile devices, there is an increase in the market for mobile hotspots. These are small boxes that convert a cellphone signal into a WiFi signal for multiple devices to use. They can be secured to prevent strangers from sucking up your bandwidth and data usage. Especially for families that have multiple devices in use at the same time when they leave the house, the mobile hotspot can be a cost-effective way to put an Internet connection in the hands of those using devices that are Wi-Fi only.

These are just the tip of the iceberg, and technology is continuing to evolve before our eyes. With the promise of web-connected eyewear, watches and other new devices around the corner, there are going to be more ways than ever to take your favorite Internet radio station with you.

GLOBALNET LINKS

Sony Blu-Ray Players - **http://store.sony.com/c/Blu-ray-Disc-and-DVD-Players/en/c/S_Blu-Ray_Disc**
CNet TV Review (including Smart TVs) - **http://reviews.cnet.com/tvs/**
Apple TV - **www.apple.com/appletv/**
Chromecast - http://www.google.com/intl/en/chrome/devices/chromecast/#netflix
Roku – **www.roku.com**
Logitech UE (replaced the Squeezebox) - **http://ue.logitech.com/**

What's NEW

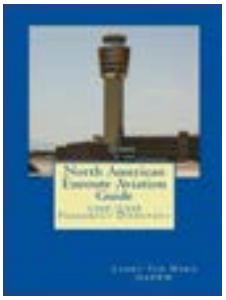
Tell them you saw it in Monitoring Times

Larry Van Horn, New Products Editor

Teak Publishing Announces New E-book

Teak Publishing, owned by *MT* Staffers Larry and Gayle Van Horn, is pleased to announce a new Amazon e-book that will be released shortly – *North American Enroute Aviation Guide.*

This new publication covers the VHF/UHF frequencies broken down by frequency used by various air traffic control area control centers in the United States, Puerto Rico, Canada and Mexico.



You do not have to live near a military base or civilian airfield to hear aircraft communications. The Area Control Center is responsible for controlling all aircraft flying in its area of control. In the United States, the Federal Aviation Administration (FAA) is responsible for controlling all IFR (Instrument Flight Rules) aircraft during the enroute phase of a flight.

Unfortunately, most FAA records available in the public domain and scanner websites are notoriously inaccurate. Teak Publishing has worked with monitors nationwide to provide the most current frequency information for all 22 Air Route Traffic Control Centers nationwide, including Alaska and Hawaii.

If you want to monitor military and civilian aircraft that are flying over your area then this new e-book is a must-have for your reference library. And, there is no need to worry if you do not own a Kindle reader. You can still read our Kindle electronic reader books or any Kindle books with Amazon's free reading apps.

There are "free" Kindle reading apps for the Kindle Cloud Reader, Smartphones (iPhone, iTouch, Android, Windows Phone and Blackberry); computer platforms (Windows XP, Vista, 7 and 8 and Mac); Tablets (iPad, Android and Windows 8), and, of course, all of the Kindle family of readers including the Kindle Fire series. A Kindle e-book allows you to buy your book once and read it anywhere. You can get more detail on these apps by checking out this link to the Amazon website at **www.amazon.com/gp/feature.html?ie=UTF8&docId=1000493771.**

The *North American Enroute Aviation Guide* by *MT* Milcom columnist Larry Van Horn N5FPW is in the final stages of production for publication and will be available for purchase worldwide from Amazon.com when this issue goes to press.

Be sure to monitor the Teak Publishing company Internet blogs – *The Military Monitoring Post* (**http://mt-milcom.blogspot.com/**) and *The Shortwave Central* (**http://mt-shortwave.blogspot.com/**) for availability and pricing for this new publication, and additional e-books that are currently in production.

2013-2014 NRC AM Radio Log Released

The National Radio Club (NRC) has announced the release of their 34th annual edition of the *AM Radio Log*, a source for information on AM radio stations in the United States and Canada. The new edition contains 274 pages of data and cross references as well as 20 pages of instructions in a 8-1/2 inches by 11 inches size, three-hole punched, U.S. loose-leaf format that fits nicely in a three-ring, one-inch binder. With over 7,000 updates since the last edition were published last September, additional references include call letters of FM simulcasts along with the AM station listings; regional groups of stations in the groups section (this is a separate section of the log book); a cross-reference of those stations that are licensed to use IBOC (In Band On Channel, known as HD-Radio®) audio, and a comprehensive list of FM translators that are now simulcasting with AM broadcasters.

Pricing for this year's edition has increased due to the increasing costs of printing and postage with U.S. NRC Club members paying $23, U.S. non-members $29, Canada member/non-member price $35, and member/non-member overseas rate set at $39.

To order the *AM Log* by credit card using PayPal visit **www.nrcdxas.org**. U.S. orders are shipped postpaid USPS media rate. Overseas orders are shipped by USPS global priority mail. To order by snail mail and for more information send correspondence to NRC Publications, P.O. Box 473251, Aurora, Colorado 80047-3251.

Coaxial Dynamics Model 81021 Average Reading Dual Socket Wattmeter

Coaxial Dynamics has recently developed a new wattmeter for the consumer and government marketplace. The new Model 81021 Average Reading Dual Socket Wattmeter allows you to measure both forward and reflected RF power with the flip of a switch. The Model 81021 uses standard elements to accurately detect average RF power from 100 mw to 10 kW over a frequency range of 0.45 MHz to 2.3 GHz.

Complete with an internal dual socket 7/8 inch line section and quick match RF connectors, the Model 81021 offers the speed and reliability you expect from Coaxial Dynamics. A convenient front panel switch gives the user the ability to display forward or reflected power on the analog meter.

The Model 81021 is easy to use. No additional black boxes or delicate remote sensors are needed. You simply connect the Wattmeter in-line between the RF source and the antenna or load, insert the appropriate elements and select either the forward or reflected switch position. The RF power is visually identified directly on the large 4 ½ inch mirrored scale.

This is a versatile and strong unit that can take some punishment. The Model 81021 uses a heavy gauge metal case to protect the wattmeter from impact shock and a leather strap makes for safe and comfortable handling. For added convenience, two sockets for storage of additional elements are located on the back of the unit. Our use of a rugged shock mounted meter with a mirrored-backed scale along with superior taut band technology provides reliable and accurate readings, plus the integrity that satisfies both the U.S. Navy and Canadian standards for bounce and vibration. This is your assurance of complete accuracy.

Your confidence in the quality and dependability of the Model 81021 Wattmeter is assured with the Coaxial Dynamics two year limited warranty.

You can get more information on this product from the Coaxial Dynamics website at **www.coaxial.com/** or Coaxial Dynamics, 6800 Lake Abram Drive, Middleburg Hts., Ohio, 44130, Phone: 440-243-1100, Toll Free: 1-800-CO-

AXIAL (262-9425), Fax: 440-243-1101 or via e-mail: **sales@coaxial.com**.

Model 81021 Specifications
Power Range: ..... 100 mW to 10 kW
Frequency Range: 450 kHz MHz to 2.3 GHz
VSWR: ..... 1.05:1 Max (with Type N connectors)
Accuracy: ..... ±5% when used with proper Coaxial Dynamics line sections and elements
Impedance: ..... 50 Ohms Nominal
Connectors: ..... Type N Female standard (see note below)
Dimensions: ..... 7.25 inches (18.4 cm) high by 5 inches (12.7 cm) wide by 4 inches (10.2 cm) deep
Weight: ..... 3.8 lbs. (1.7 kg)
Finish: ..... Textured Blue Polyurethane Enamel
Note: ..... Other Quick Match Connectors are available.

DX Engineering UC8 Network Enabled Controller

DX Engineering has led the market by producing advanced remote antenna and phasing relay switching units for years, each with individual manual switch consoles for control. Now, DX Engineering has introduced the software configurable UC8 Series Universal Controllers. They may be programmed to control any of the DX Engineering or COMTEK remote switch or phasing units, or custom programmed to control virtually any 12 or 24 VDC switching or phasing relay system.

The UC8 Universal Controllers allow Internet remote programming and control of your antenna switching and phasing applications.

The UC8 Universal Controller with eight positions has the same sturdy construction and attractive styling of their other control boxes, and is available in two versions, for a choice of manual operation mode:

- DXE-UC8-R with a rotary knob to allow "scrolling" the positions and comparing results with minimum hand movement.
- DXE-UC8-P with pushbuttons for each position for instant access.

Programming of functions and remote control are achieved with the supplied software, either by USB or Ethernet connections. Both DHCP and static IP addresses are supported. The UC8 can be addressed directly through the Ethernet port as part of a network, or through a LAN or remote PC and the USB interface.

The UC8 controllers can be user-programmed to operate with DXE's two-antenna or three-antenna PROSTACK switches, eight-port RR8-series antenna switches, transmit four square, receive four square, or receive eight circle. Within each controller mode, the available configurations are predefined and can be assigned to any of the output lines. You can use the default setup or arrange outputs in whatever order you like to accommodate other manufacturers' switches, or your own custom switching application. Whether your application requires one-of-eight, BCD logic or simultaneous multiple line switching, the UC8 can be programmed to provide it with simple mouse clicks.

The software dynamically allows changes of settings, as well as remote control of the currently selected position. Once programmed, the configuration profile may be saved to the PC for backup or later recall in a multiple use application.

You can integrate the UC8 into your remote system by either having USB interface to a local PC, or use a browser remotely to navigate to the UC8's IP address through the Ethernet port (no software needed in this case).

The UC8 requires 12 VDC at 500mA for operation in addition to the current being drawn by the relays in your switch. If the total combined current is 1A or less, the DXE-PSW-12D1A is a cost effective power source. Since many stations already have a well regulated nominal 12 VDC power source for station transceivers and accessories, we recommend using it to provide plenty of overhead current capacity.

As a unique feature, the UC8 also provides 24 VDC switching voltage at up to 500mA with an up-converter by a mouse click in the programming mode – without the cost and complexity of a higher voltage power supply.

You can get more information from DX Engineering, P.O. Box 1491, Akron, Ohio 44309-1491, Phone: (800) 777-0703 Tech Support and International: (330) 572-3200 Fax: (330) 572-3279 or via e-mail: **DXEngineering@DXEngineering.com**. The company website has their complete product line online at **www.dxengineering.com**.

Hy-Gain Multi-Band Patriot Vertical Antennas

If space is a premium at your QTH and appearance matters, let Hy-Gain open the door to one of ham radio's most attractive and popular bands (80-meters) with the new AV-680. This is your best choice for unparalleled versatility and band coverage from 6-80 Meters.

Hy-Gain's Patriot HF vertical antennas are the best built, best performing and best priced multi-band vertical antenna on the market today. Make full use of your sunspot cycle with Patriot's low angle signal.

Instead of typical traps, Hy-Gain's resonators are placed in parallel not in series. End loading of the lower HF bands allows efficient operation with a manageable antenna height.

The AV-680 is fully tunable in the 80-meter ham band with coverage from 3.5-4.0 MHz. It's a great way to join new local nets and roundtables, explore the 75-meter DX window, or add exciting digital frequencies to your operating repertoire. Simply pick the band segment you wish to use, set the 80/75-meter resonator, and you're in business.

- No ground or radials needed – effective counterpoise replaces radials, end fed with broadband matching unit.
- Automatic band switching – single coax cable feed, each band is individually tunable, wide VSWR bandwidth.
- Sleek and low-profile – low wind surface area, small area required for mounting, mounts easily on decks, roofs and patios.
- Built-to-last – Hy-Gain's Patriot series antennas boast a high wind survival due to its sleek, but sturdy frame. The matching unit is made from all Teflon insulated wire.
- Top loading parallel resonators – best vertical-element efficiency.
- Full ground independence: – no unsightly wire add-on radials.
- Top-to-bottom 3.5 to 4.0 MHz coverage – pin-point accuracy for rock-bottom SWR on any frequency you choose.
- Single coax feed and with 100 percent automatic band selection.
- Low profile – most compact ground-independent antenna available.
- Legal-limit 1500-Watt PEP power handling on SSB and CW.
- 9-band vertical covers 80/40/30/20/17/15/12/10/6-meters.

Adding 75/80-meter coverage without compromising the Patriot's classic performance, ground independence, and tiny footprint was no small task. Yet, the AV-680 size, weight, and wind loading are nearly identical to the Hy-Gain AV-640 with no unsightly radial extensions, traps, or top heavy vertical structures to render it less attractive or unsafe.

Band selection remains fully automatic, all components handle maximum legal power, and you won't need a tuner with your solid-state rig.

The AV-680's expanded-frequency Matchbox™ circuit ensures low SWR readings on every band, along with an upgraded balun design that concentrates all of your power in the antenna where it belongs.

You can get more information on the Hy-Gain website at **www.hy-gain.com**, by telephone: General information (800) 973-6572 and (662) 323-9538; Technical support (662) 323-9538; Fax (662) 323-5803 or via mail at Hy-Gain, 308 Industrial Park Road, Starkville, Mississippi 39759

Books and equipment for announcement or review should be sent to What's New, c/o Monitoring Times, 7540 Highway 64 West, Brasstown, NC 28902. Press releases may be faxed to 828-837-2216 or emailed to Larry Van Horn, *larryvanhorn@monitoringtimes.com*.

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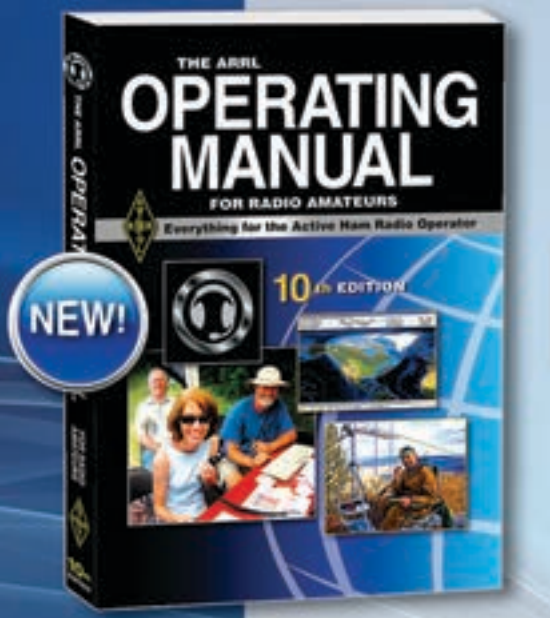

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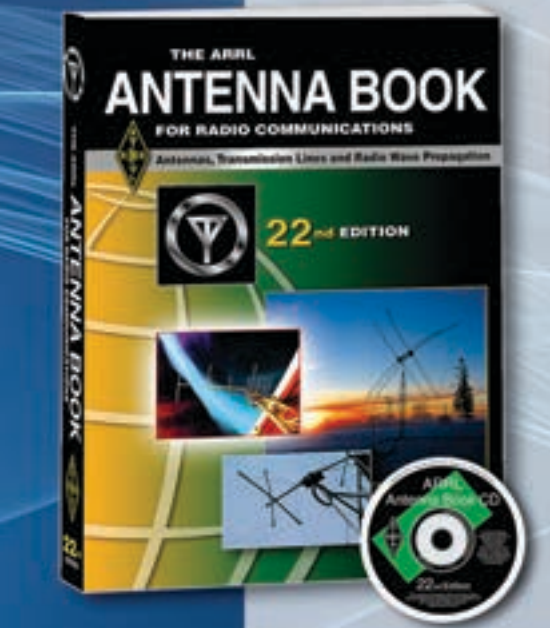

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*System Requirements: Windows® 7, Windows Vista®, or Windows® XP, as well as Macintosh® systems, using Adobe® Acrobat® Reader® software. The Acrobat Reader is a free download at www.adobe.com. PDF files are Linux readable. The ARRL Antenna Book utility programs are Windows® compatible, only. Some utilities have additional limitations and may not be compatible with 64-bit operating systems.

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