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Internet Streaming - Computers - Antique Radio



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## Communications Technology



### ***In this issue:***

- Radio Frequency Interference
- Tracking RF Radiation
- Air Travel and Your Radios
- MT Reviews: Grundig G2 Portable Reporter

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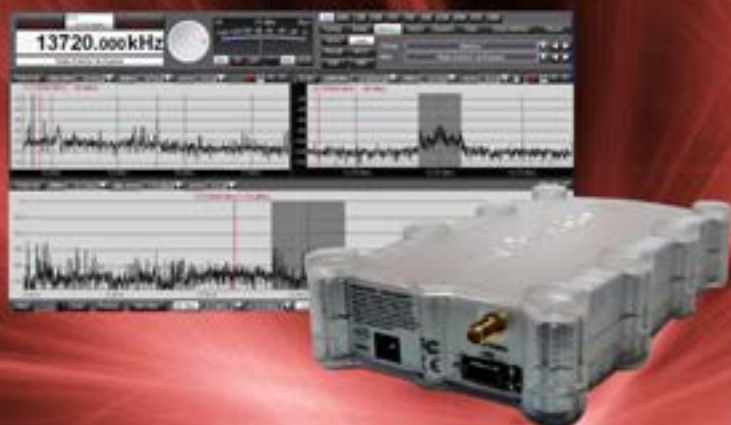
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PAR NOAA Weather Filter 162 MHz	FTR 162DS	\$69.95
GRE Superamplifier	PRE 1	\$53.95
Noise Cancelling Mobile Speaker	SPK 7	\$8.95
DC Cord for Uniden Hp1	DCC09	\$19.95

# Which WiNRADiO receiver are *you* going to win (yes, this means get it for *free*!) this Christmas?



## WinRadio Excilbur Pro

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

### CONCLUSION

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

[www.wrth.com](http://www.wrth.com)

Overall rating ★★★★★

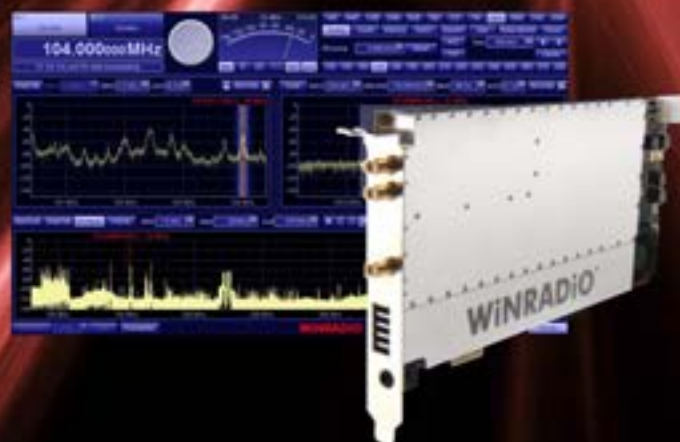
## review

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

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

### summary

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



## FIRST LOOK

MT Takes a Look at the Latest Tech

By Bob Grove, WB1HD

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

I ordinarily find something to complain about in my reviews, but trying to find something I don't like about the G39DDC has left me at a loss, and that's a gain for this winner.

Go to [www.winradio.com/mtwin](http://www.winradio.com/mtwin) to find out.

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

# Monitoring Times

Vol. 32 No. 1

January 2013



## MT Looks at Technology

Americans love technology. We stand in line for hours awaiting the sale of the next iPhone or hot new video game, we talk and play on these devices incessantly.

We buy the latest flat screen TV sets, tablet computers and apps for all our devices by the millions.

The burgeoning growth of wireless devices and other technology has brought radio fans a downside as great as the attraction: increased radio frequency interference (RFI) and RF radiation (RFR). But, as you'll read, there's really little help for either malady.

In addition, our columnists weigh in with their own takes on current radio-related technology.

Kent Britain WA5VJB shows how to build expanded emergency power supplies to keep those devices operating when power goes down.

Loyd Van Horn reviews a new wireless device to let any TV set stream online movies, no matter how old it is.

Kevin Carey looks at technology that's giving new life to the basement band.

Larry Van Horn takes a look at technology and milsat monitoring.

### On Our Cover

Top: Microwave, cell phone, FM, TV and amateur radio repeater towers atop mountain overlooking Charlottesville, Virginia.

Bottom: Transmitting and receiving satellite and microwave dishes for Channel 29 WVIR-TV, Charlottesville, Virginia. (Photos by Ken Reitz KS4ZR)

## C O N T E N T S

### Radio-Frequency Interference:.....8 Part 15, Part Physics, Part Frustration!

By Kirk Kleinschmidt NT0Z

All that sizzles, cracks, pops and warbles in your radio may not be the natural sounds of the ether. In fact, in some cases there's more man-made hash on the bands than nature alone can provide. From the neighbor's new plasma TV set to your own washing machine and digital cable-TV installation, nighttime listening on HF can be more nightmare than listening.

MT's On the Ham Bands columnist, Kirk Kleinschmidt NT0Z, knows a lot about RFI. Thanks to the spectrum feature on his Software Defined Radio, he can examine it up close and on any band. Kirk explores the problems of RFI; where it comes from, why it seems to be allowed and what you can, or can't, do about it.



### Tracking RF Radiation ..... 11

By Ken Reitz KS4ZR

The problem with RF radiation is that it doesn't glow. If it did, we might have an entirely different view of how RF radiation standards should be written. As it is though, the unseen waves of RF radiate in all directions from our cell phones, power lines, handi-talkies, and nearly everything else in our radio rooms.

Are we safe? Yes and no, according to all governmental and non-governmental organizations. But, there is controversy; the FCC hasn't revised cell phone radiation standards in 17 years, during which time cell phone numbers grew 10 fold and went from simple "dumb phones" to "smart phones" that we can't seem to turn off.



### Air Travel and Technology:..... 14

#### Taking Your Radios with You When You Fly

By Chris Parris

Many MT readers find themselves in the air for business or pleasure and want to take their hobby with them as they travel. What are the things you can and cannot do with your gear in the airport, on the plane on the ground or in the air?

MT Fed Files writer Chris Parris fills us in on the details and he ought to know; he racks up 100,000 air miles per year in his work. That has given him plenty of quality time in airports and an insider's view on what you can hear and when you're allowed to hear it.



## R E V I E W S

### Roku: One Smart Little Box!.....56

By Loyd Van Horn W4LVH

Still watching TV on that old CRT-TV set but want to stream Netflix or listen to Pandora? You can, with the help of Roku, a \$50 add-on to any existing non-streaming TV set. Loyd likes it!



### Grundig G2 Portable Reporter .....57

By Larry Van Horn N5FPW

Over the years, Grundig/Eton has made some top-quality portable shortwave radios. But, Larry Van Horn says, this is not one of them.

# AR5001D Wide Coverage Professional Grade Communications Receiver

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Available in both professional and consumer versions, the AR5001D features wide frequency coverage from 40 KHz to 3.15 GHz\*, with no interruptions.

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Discover the next generation in AOR's legendary line of professional grade desktop communications receivers.

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- Up to 2000 alphanumeric memories (50 channels X 40 banks) can be stored
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- Fast Fourier Transform algorithms
- Operated by a Windows XP or higher computer through a USB interface using a provided software package that controls all of the receiver's functions
- An SD memory card port can be used to store recorded audio
- Analog composite video output connector
- CTCSS and DCS squelch operation
- Two selectable Type N antenna input ports
- Adjustable analog 45 MHz IF output with 15 MHz bandwidth
- Triple-conversion receiver exhibits excellent sensitivity
- Powered by 12 volts DC (AC Adapter included), it can be operated as a base or mobile unit
- Professional (government) version is equipped with a standard voice-inversion monitoring feature

**Add to the capabilities of the AR5001D with options:**

- Optional APCO-25 decoder
- Optional LAN interface unit enables 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
- Optional AR-I/Q Windows software facilitates the easy storage and playback of transmissions captured within the selected spectrum in conventional modes, or, signals can be subjected to further analysis
- Optional GPS board can be used for an accurate time base and for time stamping digital I/Q data



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



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*MFJ-1790 10-Meter Vertical; SCS PTC-IIIusb HF Radio Modem; N3FJP Logging and Contest Software; Parabolic Dish Kit for 40-kHz Ultrasonic Applications; Sangean WFR-28 Wi-Fi Radio; Yaesu FT-1DR; Kenwood TS-990S*

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-addressed, stamped envelope if you wish the columnist to reply.

# WORLD RADIO TV HANDBOOK

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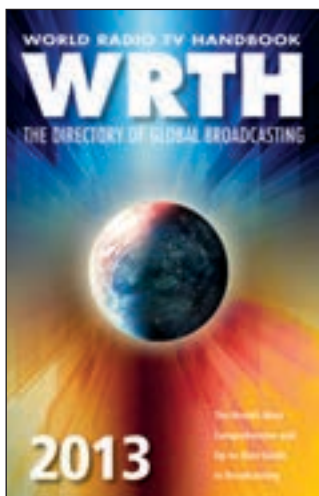
# WRTH 2013

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

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

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

- National and International broadcasts and broadcasters by country with frequencies, powers, languages, contacts, and more, including Clandestine and other target broadcasters
- MW frequency listings by region. International and domestic SW frequency listings, as well as DRM listings
- International SW broadcasts in English, French, German, Portuguese & Spanish.
- Reference section with Transmitter locations, DX clubs, Internet Resources, and much more



Available December 2012

## SOME COMMENTS ON WRTH 2012

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

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

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

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

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

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

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

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



# to the editors

editor@monitoringtimes.com

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

## Bob Grove Asks the Questions

In a reverse of form, *MT* Publisher Bob Grove asks Uniden about how they will handle new scanner models after the January first deadline for implementing narrow bandwidths in the Private Radio sector of licensees. "Will you simply utilize both 12.5 and 25 kHz filter bandwidths? I know that further narrowing to 6.25 kHz is coming eventually and some agencies are already adopting it. Does this mean that future models will incorporate all three bandwidths? And, how about APCO P-25; will this mode now be more universally employed?"

Paul Opitz, Senior Product Manager, Radio Products, Uniden America Corporation responds:

*"All of our Trunktrackers have supported NFM and narrow steps for many years, so no change needed, there. We have been in the process of updating our conventional scanners over the past year. BC125AT includes narrowband steps for UHF/VHF as well as NFM mode so that the audio level is correctly balanced. BC75XLT started shipping in December, and with that we'll retire both the BC72XLT and the BC95XLT.*

*"BC355N was released in 2012 to replace the BC355C, the only change being narrowband steps and NFM. That leaves the BC340CRS and BC370CRS which will be replaced by a single model early this year.*

*"APCO Project 25 support will remain only in the top-end scanners (development, licensing, and support costs really make driving this as a feature into lower-cost models infeasible)."*

## International Readers' Views

Ronald Edberg, from the U.K. writes regarding the November Radio Buyer's Guide issue::

"A very good issue with lots of good information. I am not sorry I subscribe to your excellent magazine. In light of Sandy, I would like to know if *MT* can run more detailed articles about powering table top receivers and transmitters. I am having trouble locating reliable emergency power web sites. Many are rip-offs or unreliable. Can *MT* help out here? I believe this is a crucial point.

"Second, VHF and UHF here in Britain are completely encrypted except for the Air and Ambulance bands. In my opinion, much of World Band News is a bit watered down. Therefore, it is sometimes hard to get enthusiastic about buying new equipment or the hobby itself. Twenty years ago things were much more exciting and interesting. Encryption has really damaged the hobby in my opinion."

*Thank you for your comments, Ronald. Regarding emergency power, in the April 2011 issue of MT there's a very well done article about Solar Power for Amateur Radio which is applicable for receive-only situations as well, particularly for extended outages. It's on pages 12-15 of that issue and explains various types of batteries, their pros and cons as well as equipment used to charge batteries. The article was written by Ian Cummings*

*KB1SG who is the lead engineer for CTSolar www.ctsolar.com.*

*Regarding the second issue, many radio hobbyists stateside have the same complaint. That's one reason we try to make each issue of Monitoring Times as broad in scope as possible. We hope to engage our readers in all forms of radio listening from the "Basement Band" to UHF satellites and to entice everyone to expand their radio horizons.*  
-- Editor

Nils Schiffhauer DK8OK, from Hamburg, Germany, writes:

"Regarding Simon Brown HB9DRV's new SDR-COM 2.0, I was stunned by the features of the beta version which became publicly available in December 2012. The module "IQ file analysis" fascinated me most. There you can call an IQ file of some MHz of width and hours or even days of time, then just point and click, and just his signal will be heard.

"I made a sneak preview of this module and uploaded it to YouTube: <http://www.youtube.com/watch?v=ZX6lVHh1lYA> It shows some applications for shortwave listeners, broadcasters, and utility DXers. The video was made with SDR-IP receiver. Simon seems to be open to offer/adapt this also to other receivers/transceivers.

"The idea of Software Defined Radios (mainly transceivers) led me to the simple idea of considering a future SDR just like a 'modem' for accessing the 'cloud' of shortwave. The next step in SDRs will not only be hard and firmware, but software so that shortwave reception/transmission of the future may look much like the Internet. After reaching a state where most antennas and HF environments limit the receiver, we now are at the age of software and its applications. This will herald many changes and make shortwave very interesting for the years ahead."

*Thank, Nils, for this remarkable demonstration of what we might all be able to listen to in the near future. I invite readers to view Nils' video demonstration (it has easy to understand English captions) and consider, as he did, the exciting future of shortwave radio.-- Editor*

## WxSat FAX Info

Gary Shapiro WD8DOT writes:

"In the past you have printed articles about satellite weather FAX. I am trying to find free software on the Internet. Can you recommend a web site and can you give me a list of current satellite weather FAX frequencies?"

*Here are three sites that should be helpful. The first lists frequencies for both polar orbiting and geosynchronous satellites: <http://homepage.ntlworld.com/phqfh1/status.htm>*

*WXSat software info for direct reception via polar satellites as well as HF is here: [http://www.hffax.de/html/hauptteil\\_wxsat.htm](http://www.hffax.de/html/hauptteil_wxsat.htm). And, this site has great beginner WXSAT info: <http://www.g4ilo.com/wxsats.html>. -- Editor*

## DRM on an SDR

Robin Spalding N6RLS from Berkeley, California writes:

"I just opened the November (digital) issue and was very interested in the article on SDR Transceivers. As a ham, I still use a very analog transceiver (Yaesu FT-897) but as an SWLer, I am now using the RFSpace SDR-IQ receiver (with HSDSR or SDR-Console software) and loving it.

"I think the best solution for many hams is already happening as newer 'standard' knob-happy transceivers increasingly have SDR circuitry inside; now all we need is a more elegant way to access these SDR capabilities while still operating a more traditional form transceiver. I would love to be able to get something like the new Yaesu FT-3000 or the Kenwood TS-990 (\$\$\$!) and have the option to plug in a keyboard and (at least 2) monitor screen(s) and have the SDR options available, or use the knobs, i.e. a hybrid transceiver.

"Speaking of the TS-990, I was stunned to see the lack of an HDMI output on the back. An older type connector is there (DVI) which is almost never found on new video display screens. Perhaps Kenwood includes an HDMI to DVI converter cable with the transceiver.

"The Flex units are very nice, but too 'computer.' The new 6000 is slick, but again, no knobs, and somewhat pricey. Also, the multiple screens capability is becoming more desirable as the amount of operating data available increases. Who wants to be flipping between screen displays all the time while operating? I want the combo (spectrum/waterfall) stuff on one screen, along with frequency and other related data, and a second screen running with other info available from the transceiver at the same time. No (or at least less) switching between data on a single-screen display.

"On another subject, I'd love to see a detailed article on how to implement and use DRM on the HSDSR software with an SDR receiver, such as my RFSpace SDR-IQ. What additional software is needed and exactly how do you set it up?"

*This is official third-party DRM software and it might work better for you: [www.winradio.com/home/download-drm.htm](http://www.winradio.com/home/download-drm.htm). It's from WiNRADiO, but if you click on the "agree" at the bottom you'll be directed to DRM demodulator general-purpose software for third-party receivers that have a 12 kHz IF output. You can download the software here but you'll need to purchase a software key (at a cost of 50 Euros) to operate it which is found here: <https://robogroup.com/winradio/drmkey.htm>. WiNRADiOs have this software built-in.*

*Once you have it loaded on your computer and opened, tune to any of the DRM frequencies listed in the current MT SW guide. Depending on your antenna and the station you're trying to receive you may have to tune up or down from the listed frequency to get a lock on the DRM signal. Your manual may have some instruction on DRM reception. Since you're in California your best bet is going to be Radio New Zealand International. It may be your only shot. DRM transmissions don't do well past about 1,500 miles, less when conditions are poor. Let me know what you hear. -- Editor*





# COMMUNICATIONS

by Ken Reitz KS4ZR

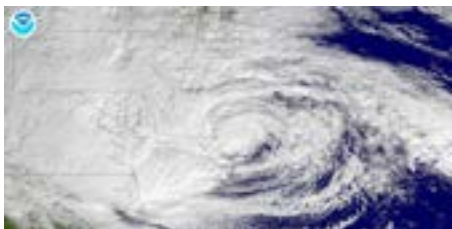
Communications is compiled and edited by Ken Reitz KS4ZR (kenreitz@monitoring-times.com) based on clippings and links provided by our readers. Many thanks to this month's fine reporters: Anonymous, Bob Grove, Norm Hill, R. C. Johnson, Lynn Kelly, Steve Karnes, Larry Van Horn and Dave Zantow.

## Sandy Aftermath Mixed Results

The devastating hurricane/nor'easter known as Superstorm Sandy, ripped through the Caribbean, rode up the U.S. East Coast and into legendary storm status in late October. More than 8 million in the New York tri-state area lost power, cable-TV, Internet access and cell phone service as the storm swept power lines down, flooded streets and destroyed homes in its path. Damage estimates related to the storm by the end of November were close to \$50 billion, making it the second most expensive storm after Hurricane Katrina. The U.S. death toll from the storm was said by many news sources to have reached 90.

For U.S. broadcasters, the FCC kept its Operations Center open 24/7 as a sort of station hot-line to clear regulatory issues with stations possibly operating outside their license authorization. It also activated the Disaster Information Reporting System (DIRS), "a voluntary, web-based system that communications providers, including wireless, wireline, broadcast, cable and Voice over Internet Protocol providers can use to report communications infrastructure status and situational awareness information during times of crisis," according to an FCC press release.

Also according to FCC information, 25 percent of all cell towers and broadband service was down in a ten state region. A smaller number of 911 call centers were reported out, but no firm statistics were released. It was also reported that there were fewer landline outages.



**Superstorm Sandy bears down on the heavily populated U.S. East Coast on October 29, 2012. (Courtesy: NOAA)**

As might be expected, with so many hams in the New York/New Jersey area, amateur radio operators in the path of the storm were active before and after it made landfall. Numerous media reports spoke of amateur radio operators relaying storm information on various nets.

Area college stations also stepped up to serve including Princeton's WPRB, New York University's WNYU, and Seton Hall's WSOU, while Haverford College launched their station online during the peak of the storm.

In the aftermath of the storm, many, including FCC chief Chenachowski, seriously speculated on alternative plans for communications including emergency balloons or drone aircraft which could be deployed to stricken regions in

the future, hoisting WiFi antennas aloft so precious Internet streaming could go uninterrupted.

## Las Vegas Trashes \$42 Million Dollar Radio System

An article in the *Las Vegas Review-Journal* from October 29 reports that, "After two years of battling dropped calls and dead zones in the department's new radio system, Clark County Sheriff Doug Gillespie has opted to drop Desert Sky." The \$42 million system, built by the Harris Corporation, had been installed in 2010 and operated with mixed results (see Scanning Report on page 16 for more details).

This system is similar to the \$2 billion system the state of New York previously terminated and the \$14 million, ten year project scuttled in Lancaster, Pennsylvania. The big problem with the Las Vegas system appears to be the voice segment, according to the article, which noted that the estimate to fix that segment would be an additional \$15 to \$20 million and take 16 to 24 months to build.

## LightSquared: It's (almost) Alive!

The would-be Internet broadband company LightSquared wrote the book on how not to win friends (on the FCC) and influence enemies (the entire GPS industry). Last year it went down in flames after the FCC scuttled its temporary operating authorization and the National Telecommunications and Information Agency (NTIA, the brains behind the 2009 DTV switch) decided that alleged interference with GPS units couldn't be technically overcome.

Now, according to *CommLawBlog.org*, the company, languishing in bankruptcy, is trying an end-around the FCC by filing for a different set of operating frequencies; this time the frequencies lie near those used by NOAA geosynchronous weather satellites (are they paying for this advice?). As this is written, the proposal is in the comment stage. In light of the invaluable imagery those satellites provided during Superstorm Sandy, it's easy to imagine the comments.

## Russian Glonass Satellite Scandal

An article in November from the *Ottawa Citizen*, among other publications, reported on an *RIA Novosti* news item in which, "the chief designer or Russia's scandal-hit Glonass satellite navigation system, Yury Urlichich, was fired from his job." *RIA Novosti* noted, "Russia's rival to GPS was rocked by fraud allegations earlier this month, with the Interior Ministry accusing unnamed Glonass officers of embezzling 6.5 billion rubles (\$200 million) of program's funds. The crackdown on Glonass was backed on Sunday by head of the Kremlin administration, Sergei Ivanov, an ex-Defense Minister and alleged

Rogozin ally who said that the investigation into the Glonass fraud was ongoing since 2010."

The Glonass system, in planning and development since 1970, but barely functional, has had a number of launch failures in addition to problems with corruption. This latest revelation adds to the already shaky reputation of the Russian space system on which the U.S. and the International Space Station depend for the safe launch and landing of its astronauts as well as the launch of many of the world's communications satellites.

## BBC To Test MW Shut-off

A report in UK-based *Radio Today Industry News* from late October noted that the BBC is "testing the switch-off of medium wave transmissions for certain stations." Apparently, a five week trial in Nottingham and Kent resulted in few listeners complaining about the loss of service. The effort is, of course, budget based and two new stations were added to the "test" list.

This comes at the same time the FCC is seeking an AM test station in the U.S. which would agree to shut off its analog transmitter and broadcast full time in the HD-Radio digital standard (In Band on Channel, known as IBOC). That experiment would test the digital system by itself, instead of in hybrid mode where both analog and digital services are broadcast at once, with the digital side only 10 percent of the analog power.

## FCC Clamps Down (Again) on S. E. Florida

The unlicensed FM capital of the U.S. has got to be southeast Florida, the place where FCC field agents get no rest. The Commission slammed four separate pirates with Forfeiture Orders and they were hitting them hard; one was given a \$10,000 fine, one a \$15,000 fine and two were given \$20,000 fines. Field agents also awarded a man in Iowa City, Iowa a \$10,000 fine for his pirate FM station.

## English FM Debuts in Moscow

"Is big deal for American expats, Natasha!" Yes, Russian-weary English speaking expats can now tune in a local FM radio station in Moscow, owned by the city no less, to hear news and entertainment in English for the first time. Moscow FM, 105.2 MHz, the city's only English speaking FM radio station, was launched in mid-November and will air news from government-funded English language TV channel Russia Today (RT). In between news programs, the station will air rock and pop tunes from the 1970s to present, carefully avoiding having to play the Beatles' "Back in the U.S.S.R." which was released in 1968.

# Radio-Frequency Interference: Part 15, Part Physics, Part Frustration!

By Kirk A. Kleinschmidt NTOZ

*Other than having a poor antenna or no radio at all, RFI impacts your radio experience more than just about anything else. Here's a look at how the FCC sees RFI, where to find expert help and information, and how to start the "cleaning" process.*

Unless you live in the government-imposed "quiet zone" around a radio astronomy installation, chances are good that you have, or will, encounter one of the most frustrating problems facing modern hams and SWLs: Radio-Frequency Interference (RFI).

RFI is just about everywhere, of course, because we're surrounded with electronic stuff that emits radio signals, wanted and unwanted, pretty much around the clock. From microwave ovens, to computers, to electrical machinery, our world is now almost all electronic, and all of these electronic devices are connected by an interwoven web of networks, wired and wireless, and driven by the oldest electrical network of them all: the AC power grid. According to ARRL EMC Engineer Mike Gruber, W1MG, the most frequent RFI complaints concern unknown sources. Once the source is known, power line noise tops the charts.

The net result (pun intended) of all of that buzzing, ringing and chirping is a near-constant background thrumming of RF and electrical noise that ranges from barely detectable (remote or controlled environments), to annoying and inconvenient (many urban and suburban locations), to impossible (hard-core industrial settings or areas adjacent to high-power transmitter sites).

Ironically, radios are now computers, just as computers are now radios! Unless you built it yourself or it's a bona fide antique, your radio almost certainly contains microprocessors and digital displays. Your computer definitely contains multiple RF oscillators, operating from "kilohertz to gigahertz," and many of the signals produced are inadvertently radiated (a transmitter). The ultimate irony is when the computer part of a radio interferes with the receiver part, which happens when RF noise emitted by the receiver's switching power supply or digital display circuitry interferes with the reception of

desired radio signals (which, unfortunately, isn't all that rare!)

When you mix pickles with peanut butter, for example, you don't necessarily get a peanut butter cup (as you do when you serendipitously mix chocolate with peanut butter). The forced mixing of two incompatible ingredients can result in something truly awful, even if you enjoy each ingredient separately. Similarly, when the government "mixes" the needs of hams and SWLs with the needs of others to enjoy the technology that now defines modern society, and adds in the financial interests of corporations and manufacturers who need to make profits, and the political needs of elected and appointed officials to sustain their positions, the result can be awful.

Although few RFI solutions arrive on a silver platter, there are steps we can take to minimize (or even eliminate) RFI, and there is a lot of information and assistance available to hams and SWLs who are looking to improve their ability to receive RF signals in a modern monitoring environment.

## The FCC's Perspective

We view our radio hobby in a practical, seat-of-the-pants, fashion, but the government (represented most directly to hams and SWLs by the FCC) has a much different perspective and a jumble of potentially competing interests: laws (old, existing and upcoming), politics and technologies, it needs to reconcile. And, like all bureaucracies, nothing is straightforward.

As part of Title 47 of the overall Code of Federal Regulations (CFR), the FCC rules that govern RF signals from broadcasters to hams to electric blankets and everything in-between, are labyrinthine and have developed over decades that span tremendous technological development.

What started with AC generators, spark-

gap transmitters and crystal detectors is now an unimaginably large collective of "electronic everything." Because rules have been added to rules which have been added to rules, the FCC Rules overall are a complex genealogical patchwork that's broken into "Parts" that often defy complete understanding and are subject to

intense political forces.

Although there are Parts that define dos and don'ts for broadcasters, satellite operators, etc. the most relevant parts for hams and SWLs are Part 97 (which defines the Amateur Radio Service), and Parts 15 and 18, which define the RF signals that can be radiated (and received) by the "unlicensed" electronic and medical devices that comprise the sea of RF-producing stuff that accompanies modern civilization. Some basic definitions are also found in Part 2.

Part rule maker and part referee, the FCC broadly categorizes and "protects" the various services. When determining which users can use a range of frequencies, the FCC differentiates between primary, secondary, and unlicensed users.

In the simplest sense, primary users receive the greatest protection, so if a secondary user is doing something that interferes with the activities of a primary user, the secondary user must immediately stop doing that thing (the 30-meter amateur band is a good example, with ham activity secondary to government and military users throughout). Further, secondary users must accept any and all interference from primary users. Unlicensed users, living at the bottom of the food chain, have to keep their noses squeaky clean at all times and had better not interfere with anybody!

From a practical perspective, some users are more protected than others, with public safety services being explicitly protected. Although both are primary users on most of their frequencies, interfering with air traffic control and public safety radio systems, for example, will provoke a much more aggressive response from the FCC than will interfering with an amateur radio operator or an SWL.

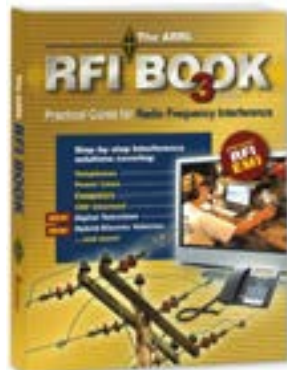
## Helpful Definitions

Many of the devices that ultimately interfere with ham and SWL activities are defined by Parts 15 and 18, which cover all kinds of electronic devices that generate RF signals. These include computers, electrical devices such as fluorescent lights, low-power unlicensed transmitters, digital devices in homes and businesses, etc. Before we proceed, some definitions and distinctions are in order.

**Interference:** An interfering signal, whether "received" through the antenna, the power line, a data line or directly by a receiver's internal components, that degrades or prevents reception of information (signals) that would otherwise be possible if the interference wasn't present.

**Harmful interference:** An emitted, radiated or inducted signal that endangers the functioning of radio navigation or safety services, or seriously degrades, obstructs or repeatedly interrupts licensed radiocommunications services operating in accordance with applicable FCC

*Now in its third (and significantly updated) edition, the popular ARRL RFI Book is a treasure trove of expert advice on handling every type of RFI situation, including vehicles, TVs, stereos, computers, AV gear, telephones and more. Included are step-by-step troubleshooting procedures, a thorough primer on EMC/RFI fundamentals and an exhaustive list of resources. This 320-page reference sells for \$30 and is available from your favorite amateur radio bookseller or from [www.arrl.org](http://www.arrl.org). (Courtesy: ARRL)*



rules. The Amateur Radio Service, as with nearly every other licensed service, is afforded protection from harmful interference (and must not interfere with other “more protected” services such as public safety and navigation services, or primary users on bands where amateur operation is secondary).

**Spurious emission:** For devices that are designed to generate RF signals, a spurious emission is any transmitted radio signal that’s not intentionally created. These include harmonics, parasitics, mixing products or intermodulation products.

**Intentional radiator:** Devices (transmitters) intended to generate and transmit/emit RF energy by radiation or induction. Examples include cordless and cellular phones, wireless computer network adapters and garage-door openers.

**Unintentional radiator:** Devices that intentionally generate RF signals internally, or use RF signals to communicate with other devices by wires or cables, but aren’t intended to emit these signals by radiation or induction. Examples include computers, LCD monitors and TVs, cable TV set-top boxes—even superhet and regenerative shortwave receivers!

**Class A digital device:** Class “A” digital devices (computers, copiers and electronic equipment) are marketed for use in a commercial, industrial or business environments.

**Class B digital device:** Class “B” digital devices (computers, TVs and other household electronic devices) are marketed for use by the general public in residential environments where the likelihood of RFI is greater. Class “B” devices have much stricter RF emission limits.

**Incidental radiator:** Devices that generate RF during normal operation, although the devices aren’t designed to emit RF energy. Examples include motors, electrical switches, etc.

**Carrier-current system:** Systems or components that transmit RF energy by conduction via electric power lines. Examples include in-home computer networking devices compliant with Home Plug Power Line Alliance standards and wider-coverage, high-speed Internet connections to homes and businesses using Broadband Over Powerline (BPL) technologies. Designed to solve “last mile” Internet distribution problems, most BPL systems are huge spectrum polluters, and hams and others have been fighting their adoption for more than 10 years. Emerging enhancements to the AC power grid (“smart grid systems” and “smart power meters”) also use carrier-current technologies that can negatively impact radio reception.

## Where Theory Meets Practice

Modern environments are RF-noisy and there’s no practical way to get past that short of taking your receiver to a remote, isolated location. Because we share the airwaves with a wide

variety of services and devices that generate RF, intentional and otherwise, we have to be realistic about what we can fix and what we can’t. Even the FCC, a giant bureaucratic monolith of an organization, understands this and defines “protections” for most services accordingly.

One of the most significant distinctions the FCC makes is between interference and harmful interference. At some point or another, any receiver on any frequency will encounter some kind of interference. But does that interference rise to the level of “harmful interference?” FCC Rules don’t numerically define “harmful” and, as frustrating as that might be, it’s only practical. This distinction is a prime example of where theory meets practice.

Let’s say, for example, that you’re a ham and/or an SWL, and while listening to a broadcast station or fellow ham operator, a neighbor’s new microprocessor-controlled washing machine starts up and, in addition to producing sparkling clean clothes for your neighbor, also generates an RF signal that interferes with your reception (making your experience much less “sparkling”). To clean up loose ends, let’s also stipulate that your station is fully legal, compliant and uses sound engineering practices.

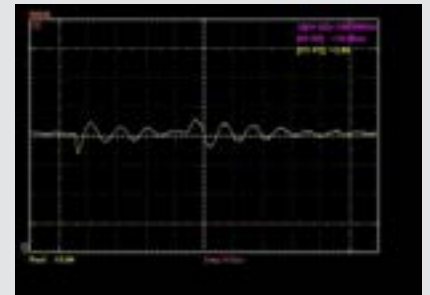
Because you’re listening to a licensed broadcast service or a licensed ham operator (and may also be a licensed ham operator yourself), you’re now clearly the victim of harmful interference, right? After all, the washing machine isn’t supposed to radiate RF signals. It’s an unintentional radiator and, because it’s designed for home use, is probably required to conform to more-restrictive Class B RF emission specs, right? Yes, but...is it “harmful interference” as defined by the FCC? Hams and SWLs are particularly hard hit in these situations because our receivers are *so much* more sensitive than most other devices in the field. That nasty, raspy gush of RF coming from the washing machine may completely wipe out your shortwave receiver but go completely unnoticed by a broadcast TV or FM receiver, a TV-attached video game system, etc.

So, if the washing machine RFI is barely detectable at your receiver, it’s interference, but is it harmful? Not unless you’re on one end of a lifesaving emergency contact. (When lives are at stake, all interference is harmful!) If the RFI puts in an S5 signal but the station you’re intentionally receiving is a solid S9, is that harmful interference? Probably not. If the RFI completely wipes out your receiver but your neighbor only uses the washing machine for an hour a week, is that harmful? Probably not! How about an hour a day? Still, probably not, but you’re getting closer to the line. As you’ll recall, according to the FCC, harmful interference “seriously degrades, obstructs or repeatedly interrupts licensed radiocommunications services,” and even though you’re legitimately using such a service, the interference isn’t necessarily harmful.

## Switching Power Supplies: The Good, the Bad and the Ugly

Over the past 10-15 years, high-current, DC-powered devices (from computers, welders, to microwave ovens, to ham radios) previously powered by physically bulky/heavy analog supplies are now mostly powered by lightweight/compact switching (also called switch-mode) supplies. These devices are lightweight and much less expensive but, because of how switching supplies work their magic, the potential ripple, noise and RF crud that can accompany them can be devastating to radio users, amateur and professional (and may not equal the overall performance of older analog supplies). The same issues can be found in DC-AC inverters and portable power generators that incorporate inverters.

For the past several years, in articles and product reviews, *QST* has been addressing these issues and evaluating the RF/noise performance of switching power supplies likely to be used by hams and SWLs. The price points of the various supplies don’t always correlate with their noise performance, and despite the differences shown in lab tests, the real-world effects on various receivers don’t always correlate, either.



The oscilloscope trace here shows the 13.6-V dc powering my HF transceiver as supplied by a 12-year-old, 45-A (750-W) switching DC supply that I lovingly call “my welder.” Used mostly for charging large batteries, despite the fact that this supply was designed to provide clean, noise-free DC power, the ‘scope shows a real mess. That squiggly trace shows what appears to be an RF oscillation that’s “modulating” the DC line! The frequency varies at random between 90 kHz and just more than 1 MHz, with a 500-mV P-P amplitude. Yikes!

The funny thing is, the transceiver, a Yaesu FT-897, doesn’t seem to be bothered as much as you’d think. The receiver is a bit quieter when powered by a deep-cycle battery or my trusty Kenwood PS-50 analog supply from the 1980s, but nothing like the nightmare that the ‘scope would suggest.

I prefer analog supplies for my ham gear and, thankfully, they’re still readily available. If your radio’s manufacturer doesn’t offer an analog external supply, most ham and SWL resellers carry the Astron line, which includes models that supply 4-70 A. The RS-20, which puts out 20 A max, has been popular among hams for decades and costs about \$120 (\$50-\$75 on eBay).

AM broadcast band listeners and BCB DX-ers really suffer from RFI because the effects of most garden variety RFI and power line noise are more pronounced at lower frequencies. In Rochester, Minnesota, where I live, if I turn to 830 kHz to listen to WCCO, a 50-kW “clear channel” station in Minneapolis, all I hear is RF hash, whether I’m in my car, downtown, or in the ‘burbs. This is far from scientific, but back in the day I could listen to WCCO day or night with no problem.



This WiNRADiO G39DDC spectrum scan from 3.5 to 7.5 MHz shows the “lumpy and bumpy” nature of the composite RF background noise typically experienced by hams and SWLs in urban and suburban environments. (Scan courtesy of Bob Grove W8JHD)

## Modern Problems

As intended by the FCC, Class A digital devices would exclusively be installed in commercial and industrial settings, while Class B digital devices, with much stricter RFI engineering requirements, would be installed in residential settings (and commercial settings if appropriate). Back in the day this “class separation” was probably more straightforward, but there are now all kinds of situations that see Class A devices being installed in residential settings.

The importation of foreign-made electronics, for example, used to be more structured. Nowadays, with the rise of online commerce, buyers can easily purchase electronic devices designed and manufactured for less-restrictive markets on eBay and elsewhere, effectively circumventing any testing and regulatory standards.

You can walk into any big-box home renovation store and buy Class A lighting and electrical devices without proving that you’re a contractor (who should know better), etc. And when you take those devices home and plug them in, when they rip up the bands like a non-stop lightning storm you probably won’t even know they’re intended only for commercial installation.

In a related sense, another misconception shared by many is the assumption that the FCC rigorously tests electronic devices for standards compliance, much like a giant Underwriter’s Laboratory or *Consumer Reports*. In reality, the FCC doesn’t test much of anything. Through a variety of internal and external processes it creates, standardizes and documents a device’s RFI compliance requirements (and a great many other requirements), and it may ultimately be involved with enforcing that compliance in a far future sense (after a critical mass of complaints or evidence is presented after the fact), but the FCC is *unlikely to ever test an electronic device before it’s released for sale*.

Most actual testing is farmed out to the manufacturers themselves, who test their own devices or contract compliance testing to a third party. Say what! Most companies handle this process on the straight and narrow, but whenever profits are at stake, it’s fair to assume that standards compliance can take a back seat to cash flow. It’s sort of like asking the fox to guard the hen house!

## Let’s Get Practical

In the day-to-day struggle with RFI, determining whether an interfering signal meets the definition of harmful probably isn’t germane. Even if it’s not harmful as defined by the FCC, it still may be “harmful” to you, so learning how to identify, investigate and suppress interference sources is a practical, useful and necessary skill. We don’t have nearly enough space to cover those skills here, however, but I did address some key issues in a previous article, *MT’s Guide to Finding and Fixing RFI* in the April 2012 issue, and they’re addressed in great detail in *The ARRL RFI Book*, which is the definitive technical and regulatory resource for hams, SWLs and industry users. If you don’t have a copy, get one.

Local amateur radio clubs are often excellent places to get help, so don’t think you have to

### Shutting Out the Rest of the World

For most hams and SWLs, RFI can be a real annoyance, but for RF performance engineers, it can be killer! At first glance you probably can’t tell that this lovely collection of test equipment in the ARRL Laboratory is housed inside an RF-tight metal box (Faraday cage), but it is! Up close, the metallic wall and floor seams make the place look a lot like a submarine. The precision-engineered door seal, shown to the left of the door handle, makes an RF-tight seal when the massive latch is locked in the closed position (also like a submarine).

When closed, the “screen room” attenuates RF signals from the outside world (suburban Newington, Connecticut) by about 100 dB—about half that when the door is open. Most suburban environments aren’t that noisy, but with a half-dozen bulletin transmitters at W1AW blazing away with thousands of watts on the non-WARC ham bands less than 200 feet away (plus several visitor and employee HF/VHF stations on the premises), the need for RF silence becomes apparent. Lest they forget, a screen room W1AW monitor receiver alerts engineers when W1AW is transmitting bulletins! (Photos courtesy of Mike Gruber, W1MG, and the ARRL.)



“go it alone.” In addition to providing the usual technical assistance, hams and ham clubs are often used to working with local cable, broadcast and power company reps in resolving RFI issues. And don’t worry if you’re an SWL and not a ham: Local clubs will welcome you and, at worst, may “encourage” you to get your ham license!

The American Radio Relay League, the national association for amateur radio in the U.S., offers its members a tremendous array of

### REFERENCES

The main web links included here will take you to hundreds of relevant and related links. In conjunction with *The ARRL RFI Book*, they provide the most comprehensive and up-to-date information available on the subject of defeating (or coexisting with) RFI.

ARRL RFI Links: [www.arrl.org/radio-frequency-interference-rfi](http://www.arrl.org/radio-frequency-interference-rfi)  
ARRL’s FCC RFI Info Page: [www.arrl.org/fcc-rfi-information](http://www.arrl.org/fcc-rfi-information)  
ARRL BPL: [www.arrl.org/broadband-over-powerline-bpl](http://www.arrl.org/broadband-over-powerline-bpl)  
ARRL BC Station Interference: [www.arrl.org/broadcast-station](http://www.arrl.org/broadcast-station)  
ARRL Part 15 Info: [www.arrl.org/part-15-radio-frequency-devices](http://www.arrl.org/part-15-radio-frequency-devices)  
FCC Publication (PDF): Consumer Facts on RFI: <http://transition.fcc.gov/cgb/consumerfacts/interference.pdf>  
FCC: Where to file interference reports and what to include (web and telephone complaints): [www.fcc.gov/guides/interference-defining-source](http://www.fcc.gov/guides/interference-defining-source)

information, telephone consultation, and other resources when it comes to finding and fighting RFI. Even if you’re not a ham, the League’s \$39 annual membership may be money well spent in your quest to enjoy radio. See the Resources Sidebar for the ARRL links: They’re free and quite valuable when it comes to understanding complex technical and regulatory issues, translating “FCC-speak” into English, and navigating the FCC’s radio-related nooks and crannies.

So, if you’re experiencing an RFI issue, take advantage of all available information and resources and *exhaust all local options* before you file a complaint with the FCC. Because the agency has a great many pressing concerns to deal with across a huge regulatory and political landscape (and a limited budget and staff), unless you’re reporting interference to a public safety radio system, it’s impractical to expect an immediate, satisfying response to your officially filed complaint.

Possible exceptions are power company related issues. Power companies have *de facto* monopolies and are, therefore, tightly regulated when it comes RFI (and many other) issues. But the FCC hands many power company RFI issues off to the ARRL (a willing partner that can expeditiously help end users and reduce FCC workload and involvement), *so you might as well start there*. And if all other local options have been exhausted, the ARRL and the FCC have each been successful in persuading local utilities, municipalities (and even recalcitrant neighbors) to fix noisy, non-compliant devices. Ironically, most RFI issues are caused by devices in your own home, so learning how to handle them appropriately makes most official complaints unnecessary.

Phone numbers and links to the FCC’s web-based complaint system (including detailed information on how to file and document your complaint) are included in the Resources Box. If you do file, be sure to provide as much data as you can, including times, dates, frequencies, etc., including digital audio or video recordings, if possible.

## High-Tech Helpers

Like death and taxes, ongoing RFI is an absolute certainty, so in addition to finding and fixing it at the source (which isn’t always possible), you may find relief in using different antennas (noise-shielded loops instead of verticals or dipoles, for example), noise blankers, digital-signal processors, antenna phasers (configured as noise-reduction phasers) and even remote stations. Especially for RX-only installations, the hardware to locate your receiver and antennas at a remote, noise-free location (backed by high-speed Internet) is now “off the shelf” and reasonably affordable. If you live in an industrial city, installing your radio gear at a friend’s rural home or farm may provide a boost to your signal-to-noise ratio that is unobtainable any other way.

In a decade or two, when computers might use light-based or organic processors and fiber-optic interconnects, RFI may be less of an issue. Until then, we soldier on using the best information and practices at hand (or we move to Nunavut!).

# Tracking RF Radiation

By Ken Reitz KS4ZR

**T**he era covering the last hundred years is often thought of as the electronic age. The build out of a national electrical grid, the creation of thousands of radio and television stations, satellite communications, cable-TV, the invention of radar are all just a few of the more obvious touchstones of electronics that didn't exist 100 years ago.

The Information Age, which in a way is the crowning achievement of the electronic age, has brought us miniature devices comprised of microscopic components that are wirelessly hooked to an entirely new grid, bringing access to information, entertainment, education and nearly constant contact with our friends and relatives in a fashion from which none of us seem able to escape.

But, there is controversy. These devices all emit some level of radio frequency (RF) radiation. Our increasing use of and dependency on such devices has slipped up on us in a no-questions-asked trade: we'll take the fantastic convenience and relatively small cost while paying little attention to the possible problems, if indeed there are any problems, these devices might create.

RF radiation exposure is coming from an increasing number of sources both in frequency bands and from sources less than a decade old; too new to be properly assessed by scientists equipped to study their effects. As a result, the entire human population is hurtling at an increasing speed down a highway lined with an increasing

number of electronic devices, increasingly used and with virtually no oversight as to whether or not we might be safe in doing so; in other words, no brakes.

Among those in our population most exposed to RF radiation are amateur radio operators who, like all others, live in densely populated places packed with higher concentrations of electric devices, using all available sources of RF radiation including cell phones and wireless routers, as well as five watt, 2 meter handi-talkies, one hundred watt HF transceivers, one kilowatt RF amplifiers and radiating antennas sometimes closer to us than they should be.

What are the sources of RF radiation in our daily lives and what are the actual threats such radiation might pose? First, I'll look at the fastest growing, most ubiquitous electronic device in the world; the cell phone, then I'll look at common amateur radio equipment.

## Quantifying Cell Phone Radiation

According to CTIA, the national wireless association, in 1985 there were just over 340,000 cell phone subscribers. Ten years later in 1995 that number jumped to 33.8 million. The FCC last reviewed safety standards for cell phone use in 1996 but by 2008 there were 270 million subscribers. In 2012 there were 321 million U.S. subscribers. There are roughly ten times the num-

ber of cell phone subscribers now than there were the last time the FCC saw fit to look at radiation standards. Yes, that's more than the population of the U.S. because many people, particularly those in business, have more than one cell phone and families typically have several subscriptions with children increasingly having their own cell phones.

During this timeframe, cell phone antenna tower numbers grew from 599 in 1985 to 38,650 in 1996, the last time the FCC visited their safety standards. Today, according to CTIA data, 285,561 towers are supporting more than 2 million individual cell phone antennas from the various service providers across the U.S.

CTIA notes that the amount of time spent on our phones has grown as quickly; from an average of 115 minutes per month (nearly 2 hours) per average subscriber in 1995, to 708 minutes by 2008 (nearly 12 hours per month, per subscriber). In 2012 that number jumped again to 1,170 minutes (almost 20 hours per month per subscriber), according to Neilsonwire.com. At the end of 2009, according to the World Health Organization (WHO), globally there are 4.6 billion mobile phone subscriptions.

## Specific Absorption Rate

One of the concerns with all RF radiation is Specific Absorption Rate (SAR). According to the FCC, "SAR is a measure of the rate of RF (radio frequency) energy absorption by the body from the source being measured – in this case, a cell phone. SAR provides a straightforward means for measuring the RF exposure characteristics of cell phones to ensure that they are within the safety guidelines set by the FCC." Straightforward and, at the same time, a little misleading. As critics point out, the method of testing SAR of each new mobile phone as it comes to market does not look at the way consumers actually use the product.

And, while a user's manual and the FCC might tell the user to use a hands-free device or to maintain one-half to one inch space between the phone and the user's skin, there's no way to know how many consumers read such advice and/or comply. Furthermore, SAR is greater when next to soft tissue (groin, belly or back area just above the hip) than other parts of the body (the thick skulls of many an amateur radio operator, for instance). It's possible that stuffing the phone in your front pants pocket, shirt pocket or carrying the device in a holder on your hip while the device is on might not be a great idea.

Worse, children, often under the age of five, are using such devices regularly. There are even reports of parents downloading "kid-friendly" apps onto their smartphones and using them as e-sitters. The children hold the devices in their unprotected laps or next to their developing skulls.



*Participants at an alternative energy event in northern Virginia in October 2007 hold unattached florescent light bulbs under 500 kilovolt electricity distribution lines. The bulbs are lit by the ambient power leaking from the lines above. Those particular lines have since been replaced with 1,000 kilovolt lines. A 1995 report from the American Physical Society states, "The scientific literature and the reports of reviews by other panels show no consistent, significant link between cancer and power line fields." (Courtesy: Cory Koral K2WV)*

## No Fear but Plenty of Caution

Wait a minute, where's the "nanny-state" when you really need it? There are several federal agencies charged with protecting American citizens from the harmful effects of such things as RF radiation. Among these are the EPA, the Federal Drug Administration (FDA), the Federal Communications Commission (FCC) the U.S. Department of Labor's Occupation Safety and Health Administrations (OSHA), just to name a few. Each agency could not be more clear in stating, as the FCC does, that, "the weight of scientific evidence has not effectively linked exposure to radio frequency energy from mobile devices with any known health problems."

The FCC also notes that recently there have been troubling reports to the contrary but wants you to understand that, "While these assertions have gained increased public attention, currently no scientific evidence establishes a causal link between wireless device use and cancer or other illnesses." No thanks, of course, to the FCC, which hasn't changed its cell phone standards in 17 years.

Even commercial publication interests such as CNet.com, which last summer published a list of the 20 highest and 20 lowest radiation-rated cell phones, based on FCC standards, stated, "It's important to note that in publishing this list, we are in no way implying that cell phone use is harmful to your health. Research abounds, but there still is not conclusive or demonstrated evidence as to whether cell phones cause adverse health effects in humans. While some studies have found a possible link between long-term (10 years or longer) cell phone use and brain tumors, decreased sperm count, and other ailments, other research has found no such effects." This list, updated October 29, 2012, may be found here: <http://reviews.cnet.com/cell-phone-radiation-levels>

While emphasizing the notion that cell phone radiation has not been proved harmful, every agency nonetheless issues guidelines on safe use of such devices, though loaded with enough weasel words to satisfy the most litigious attorney.

**FCC:** "Even though no scientific evidence currently establishes a definite link between wireless device use and cancer or other illnesses, and even though all cell phones must meet established federal standards for exposure to RF energy, some consumers are skeptical of the science and/or the analysis that underlies the FCC's RF exposure guidelines. Accordingly, some parties recommend taking measures to further reduce exposure to RF energy. **The FCC does not endorse the need for these practices**, but provides information on some simple steps that you can take to reduce your exposure to RF energy from cell phones. **For example**, wireless devices only emit RF energy when you are using them and, the closer the device is to you, the more energy you will absorb." The emphasis is theirs.

**FDA:** "Many people are concerned that cell phone radiation will cause cancer or other serious health hazards. The weight of scientific evidence has not linked cell phones with any health problems." Covering themselves, the

## Radio Frequency Radiation Resources

Research on Radio Frequency Radiation (RFR) is very much a do-it-yourself study. Consumers attempting to do so may quickly become bewildered by reports from government and non-governmental organizations that issue sometimes difficult to follow and seemingly contradictory guidelines based on old data. Here are some web sites to help you do your own research and come to your own conclusions.

Who owns the towers around you and what are they transmitting? You can find out here: [www.antennasearch.com](http://www.antennasearch.com).

Information relating to amateur radio RF safety is found on the ARRL RF Safety Committee web page: [www.arrl.org/arrl-rf-safety-committee](http://www.arrl.org/arrl-rf-safety-committee)

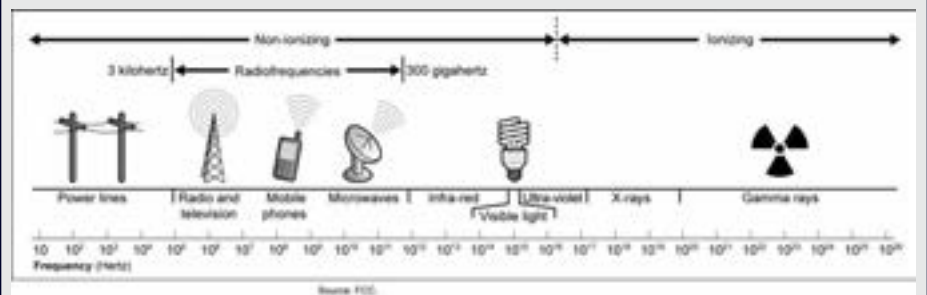
Find the Specific Absorption Rate (SAR) for your particular wireless device by going here: <http://transition.fcc.gov/oet/ea/fccid>. Enter the FCC ID number (in two parts as indicated: "Grantee Code" is comprised of the first three characters, the "Equipment Product Code" is the remainder of the FCC ID). Then click on "Start Search." The grant of equipment authorization for this particular ID number should appear. The highest SAR values reported in the equipment certification test data are usually included in the comments section of the grant of equipment certification. Be aware that any stated SAR will depend considerably on how the equipment is used.

An opposing view of the safety of cell phones and wireless devices is found at the Environmental Health Trust (EHT) and their website: <http://ehtrust.com>.

com. EHT founder, Dr. Devra Davis, may be seen on C-SPAN2 BookTV presenting information from her book, *Disconnect: The Truth About Cell Phone Radiation, What the Industry Has Done to Hide It, and How to Protect Your Family*, published by Dutton. That presentation from 2010 is found here: <http://www.c-spanvideo.org/program/Disconn>. A later video presentation with new data and a more in-depth look at more current research may be found here: <http://articles.mercola.com/sites/articles/archive/2012/06/16/emf-safety-tips.aspx>

This past July the Government Accountability Office (GAO) issued a report asking the FCC to reassess mobile phone standards. You may find a summary of the report here: [www.gao.gov/products/GAO-12-771](http://www.gao.gov/products/GAO-12-771). To read the entire report in PDF format, click on "View Report."

The World Health Organization (WHO) notes in its fact sheet on *Electromagnetic Fields and Public Health* dated June 2011, "The electromagnetic fields produced by mobile phones are classified by the International Agency for Research on Cancer as possibly carcinogenic to humans." Even so, it points out that, "Studies are ongoing to more fully assess potential long-term effects of mobile phone use." And, "WHO will conduct a formal risk assessment of all studied health outcomes from radio frequency fields exposure by 2012." Unfortunately, the results of that study were not available as of late November 2012. You may read the WHO fact sheet here: [www.who.int/mediacentre/factsheets/fs193/en/index.html](http://www.who.int/mediacentre/factsheets/fs193/en/index.html)



Government Accountability Office radiation

FDA notes, "But if you are concerned about avoiding even potential risks, you can take a few simple steps to minimize your RF exposure: Reduce the amount of time spent using your cell phone. Use speaker mode or a headset to place more distance between your head and the cell phone."

**EPA:** "Although there is not sufficient evidence to conclude that there is a definite risk associated with long-term cell phone use, people who are concerned can take simple steps to reduce exposure: reducing the number/length of calls; Use 'hands-free' devices - Using 'hands-free' devices can help to keep mobile phones away from the head."

**OSHA:** Refers readers to FCC and ARRL guidelines regarding limiting exposure to RF radiation. Unfortunately, most links to ARRL topics on OSHA's web site are 16 years old and may not be the best data available.

## Safe RF Practices in Amateur Radio

Amateur radio operators are some of the most tech-savvy and safety conscious people in today's society. The American Radio Relay League (ARRL) developed amateur radio guidelines through the ARRL RF Safety Committee

which were based on the FCC/EPA measurements and other data. For the most part, hams will regard them as making sense, though I doubt that many operators, particularly mobile operators, heed the guidelines.

Hams are encouraged to make sure that RF radiation is confined to radiating elements of their antennas and not their feed lines and that all persons should stay away from any transmitting antenna while it is in use. The RF Safety Committee also notes, "This is especially true for mobile or ground-mounted vertical antennas. Avoid transmitting with more than 25 watts in a VHF mobile installation unless it is possible to first measure the RF fields inside the vehicle. At the 1 kW level, both HF and VHF directional antennas should be at least 35 ft above inhabited areas. Avoid using indoor and attic-mounted antennas if at all possible."

The committee warns operators not to operate high-power amplifiers with the covers removed, particularly at VHF and UHF frequencies. At UHF and SHF frequencies, "never look into the open end of an activated length of waveguide or point it toward anyone. Never point a high-gain, narrow-bandwidth antenna (a paraboloid, for instance) toward people. Use caution in aiming an EME (moonbounce) array toward the horizon; EME arrays may deliver

an effective radiated power of 250,000 watts or more.”

With regard to HTs, hams are admonished to, “keep the antenna away from your head and use the lowest power possible to maintain communications. Use a separate microphone and hold the rig as far away from you as possible.” This is not the practice in real-life, however. Many hams, if they use a separate microphone on their HT will use the belt-clip that came with the HT and absorb much of the EMR directly into the soft-tissue area below the ribcage and above the hip. I have never personally observed a ham holding his or her HT out at arm’s length and talking into a separate microphone.

“The IEEE guideline excludes any transmitter with an output below 7 watts because such low-power transmitters would not be able to produce significant whole-body heating. (However, recent studies show that hand-held transceivers often produce power densities in excess of the IEEE standard within the head.)” With most hand-held units it’s impossible to use a 2 meter/70 cm HT, capable of putting out 5 watts, with the antenna further than five inches away from the head.

Regarding power supplies and linear amplifiers, the RF Safety Committee recommends, “Don’t stand or sit close to a power supply or linear amplifier when the AC power is turned on. Stay at least 24 inches away from power transformers, electrical fans and other sources of high-level 60-Hz magnetic fields.”

## Is there Danger from your Router?

Wireless home routers, which let your WiFi radios access the Web, let you operate your iPad, Kindle Fire, streaming TV set or laptop computer anywhere in your home without your computer being turned on, are found in most homes and apartments today. You’ll also find them throughout college campuses, hotels, even some entire downtown areas. Do they present a hazard? Not according to Princeton University which performed a test in 2007 in their Firestone Library which, like most college libraries, is well covered with WiFi access.

Using radiation staff specialists from the New Jersey Department of Environmental Protection, a survey of RF levels throughout the library was performed. The survey noted that the RF levels present in all locations around the library were so low that they were at the bottom of the detectable limits of the RF survey equipment used.

The university concluded, “It is the general consensus of the scientific community that the level of RF exposure due to wireless networks is so low compared to the many other RF sources in the modern environment that health concerns from WiFi exposure are not an issue. The results of the survey of Firestone Library support the



**Cobra HH Road Trip hand-held CB; four watts at 10 meters, best used with mag-mount roof antenna (provided). (Courtesy: Cobra Electronics)**

data and conclusions from other WiFi surveys. We can reasonably say that the wireless networks at Princeton University do not present a hazard to persons working or otherwise spending time in University buildings.”

The World Health Organization (WHO) backs this claim up in a research fact sheet stating, “Considering the very low exposure levels and research results collected to date, there is no convincing scientific evidence that the weak RF signals from [cell phone] base stations and wireless networks cause adverse health effects.” Unfortunately, the fact sheet itself is now seven years old and the international exposure guidelines quoted in the fact sheet date back 15 years, pre-dating the advent of the explosion of smartphone usage.

## Slow-Lane Policy Development

In July 2012 the U.S. Government Accountability Office (GAO) issued a 46 page report titled, “Telecommunications: Exposure and Testing Requirements for Mobile Phones Should be Reassessed.” After an introduction reciting the litany that, “research to date has not demonstrated adverse human health effects of exposure to radio-frequency (RF) energy from mobile phone use,” the report notes that the FCC RF energy exposure limits, “may not reflect the latest research and testing may not identify maximum exposure in all possible usage conditions.” The report acknowledges that the FCC last looked at mobile phone guidelines 17 years ago.

In a beautiful bit of buck-passing, the report notes, “The FCC told GAO that it relies on the guidance of federal health and safety agencies when determining the RF energy exposure limit, and to date, none of these agencies have advised FCC to change the limit. However, FCC has not formally asked these agencies for a reassessment. By not formally reassessing its current limit, FCC cannot ensure it is using a limit that reflects the latest research on RF energy exposure. FCC has also not reassessed its testing requirements to ensure that they identify the maximum RF energy exposure a user could experience. Some consumers may use mobile phones against the body, which the FCC does not currently test and could result in RF energy exposure higher than the FCC limit.”

It stretches all credibility to imagine that *some* consumers may use mobile phones against the body. When was the last time (or for that matter, the first time) you saw a consumer holding their

mobile phone one-half to one inch away from their body as recommended by some cell phone manufacturers?

Furthermore, virtually all men keep their mobile phones in a front pants pocket or shirt breast pocket with only the thin cloth of their pants or shirt pocket to separate the device from their skin. Keep in mind that smartphones, when turned on, continuously transmit varying levels of RF as the device searches the surroundings for the strongest cell tower signal with which to communicate.

I did an informal survey with members of the MT staff to see how they use their mobile phones. All are extremely tech-savvy, many have been among the first to use new communications technology and all understand the concept of radio frequency radiation. Most reported that they carry their devices in a front pants pocket, shirt pocket or on a belt clip. Few use a hands-free device. One wisely carried her phone in her purse.

Have you read your mobile phone’s RF warning? Don’t bother looking for it because, according to the GAO report, “there are no federal requirements that manufacturers provide information to consumers about the health effects of mobile phone use.”

## Forging Your Own Policy

In the summer of 2012, just prior to the release of the GAO report, the FCC announced that it would *consider* asking for more research on the subject but, as of late November, no date to begin such research has been set.

Several important studies regarding RF radiation are currently underway, some were due at the end of 2012 (though they had not been presented as this is written), some are due this year and others are due next year. But, scientists remind us that such research can take years to conduct properly. It can take several decades more before a real causal link can be established and by then you may have wished you had developed your own policy regarding RF radiation.

So, follow the advice issued by all the government and non-governmental agencies: Limit

the amount of time you use your cell phone; turn it off when it’s in your pants or shirt pocket; use a hands-free device that actually works, and take care with handling such devices to your children or grandchildren. In the shack, move your power supply two feet away from your operating position; make sure you don’t have stray RF in the shack; use a speaker/mic or headset boom mic with your HT and transmit while holding the HT (not while it’s still on your belt); get rid of your HF amplifier (get a better antenna instead, it’s more effective on the air and you’ll save on your electric bill as well), and, when introducing youngsters to amateur radio teach them about RF radiation.



**Midland GXT860 five watt GMRS HT; buy the boom/mic headset and hold the HT away from your body when transmitting . (Courtesy: Midland Radio)**

# Air-Travel and Technology: Taking Your Radios with You when You Fly

By Chris Parris

**P**ersonal electronics have revolutionized everyone's daily lives. Smart phones, pad computers, miniature music and video players are commonplace these days. Many people carry these devices with them all the time, since most such devices are small and light enough to take with anywhere. People like having something to keep themselves productive and entertained, especially when traveling. But what about the devices that many radio hobbyists carry with them, namely scanners or two-way radios? What are the issues with taking radio equipment with you when traveling by plane?

A recent posting on an Internet radio forum brought up the subject that I thought would be of interest to *Monitoring Times* readers; traveling onboard an airplane with a scanner or two-way radio. This question comes up in radio-related discussion forums every other month (or so it seems) and I see so much half-baked and absolutely incorrect information provided in some postings about why and how you can or cannot use a scanner on board while flying that I thought I would try and put things in perspective.

Bringing a scanner, amateur radio transceiver or commercial two-way radio on board in your carry-on baggage is perfectly legal and acceptable. The Transportation Security Administration (TSA) has never restricted the carrying of personal electronics through their checkpoints at airports. I fly commercially over 100,000 miles each year and often travel with multiple scanners in my carry-on bags. I have only had one TSA agent ever ask about them. He knew what they were and just wanted to ask what I liked listening to and what was a good model to buy these days. Make sure you do have the batteries charged so that, if requested, you can show that the radio powers up and functions, although I have never been asked to do so.

So, you get through the security checkpoint and put your shoes back on, now what? Can you listen to the airport operations, maybe even our pilot talking to the control tower? While sitting at the gate and waiting to board, absolutely. I do that all the time and enjoy monitoring the ground operations of the airlines as well at the air traffic control frequencies. This

is also a good time to use the "Close Call" or other near-field search function. You might be surprised at the new frequencies you can find active.

Be discrete and don't bother the folks sitting near you who may not want to listen to your radio. Be sure to use earphones or headphones. I always carry a couple of sets of spare batteries. If there are flight delays or weather, it beats paying a small fortune for batteries at the airport sundries shops.

Once onboard the aircraft, it's best to simply leave the radio or scanner turned off and stowed in your carry-on bag. In some instances, you can probably get away with having the scanner on for a short time while boarding is taking place. But make sure it is turned off and put away when the door is closed and the plane pushes back from the gate. The flight attendants will make the standard announcement about powering down all electronics for takeoff.

That announcement has stirred up some controversy in recent years. Many technology writers and tech geeks on the Internet have complained that the rules covering electronics

on aircraft are no longer needed. They say that passengers on commercial flights should be free to use their music players and cell phones all the time, even make calls in flight.

Phones, computers, music players and portable game systems all have microprocessors at the heart of their operations. When operating, these chips can emit small amounts of radio frequency interference which, multiplied by dozens or even hundreds of passengers, could potentially interfere with electronics, navigation or communications systems that are found on commercial aircraft.

There has been some anecdotal evidence of personal electronic devices causing problems with aircraft operations. Back when laptop computers were just getting to be commonplace on board airplanes, a British Airways flight experienced problems with its autopilot that were apparently related to a first-class passenger using his laptop computer. When the computer was on, the autopilot exhibited some unexpected errors that disappeared when the portable computer was shut off.

It is simply not practical or feasible to test and certify every piece of consumer electronic equipment that comes on the market for Federal Aviation Administration standards. So, rather than throwing caution to the wind, the FAA decided to limit electronics use to normal flight above 10,000 feet. Turning off electronics during takeoff and landing limits the potential for interference problems during the most critical times of the flight.

But the rules about not using electronic gadgets during takeoff and landing are not only related to electronic interference. There are safety issues as well. The airlines do not want passengers distracted or unable to hear instructions from the flight crew in case of an emergency. Landings and takeoffs are referred to as "critical phases" of flight, so someone listening to his or her music with earphones may not be able to hear a call for everyone to react to a possible emergency situation. The airlines want everyone on board to be able to hear and react as quickly as possible. U.S. airlines don't currently restrict headphones during takeoff and landing, but Canadian airlines do, and request passengers not have anything on their ears during those times.

How about in flight? Once you

ELECTRONIC DEVICES	
STAGE OF FLIGHT	DEVICES PERMITTED
<b>DEPARTURE:</b> at gate, only when cabin door is open <b>ARRIVAL:</b> leaving to gate area	 Mobile phones and two-way radios  PDAs and other electronic devices <p><b>MUST BE TURNED OFF:</b> during taxi, takeoff and landing</p>
<b>IN FLIGHT:</b> above 10,000 feet in altitude <b>ON GROUND:</b> when main cabin door is open	 Noise-canceling headphones  GPS devices  Personal computers*  Entertainment players and receivers (audio and/or video, such as iPods, mp3 players, MP3, CD/MiniDisc/MP3, DVD players, and camcorders)  Calculators  Electronic games* <p>* must be used with sound off or with headsets at all times</p> <p><b>MUST BE TURNED OFF:</b> during taxi, takeoff and landing</p>
<b>NEVER PERMITTED</b>	 TVs  Radio receivers and/or transmitters (including AM/FM/SW, CB and scanner)  Remote control toys and personal air purifiers

Permitted/Not Permitted In-flight or On-ground

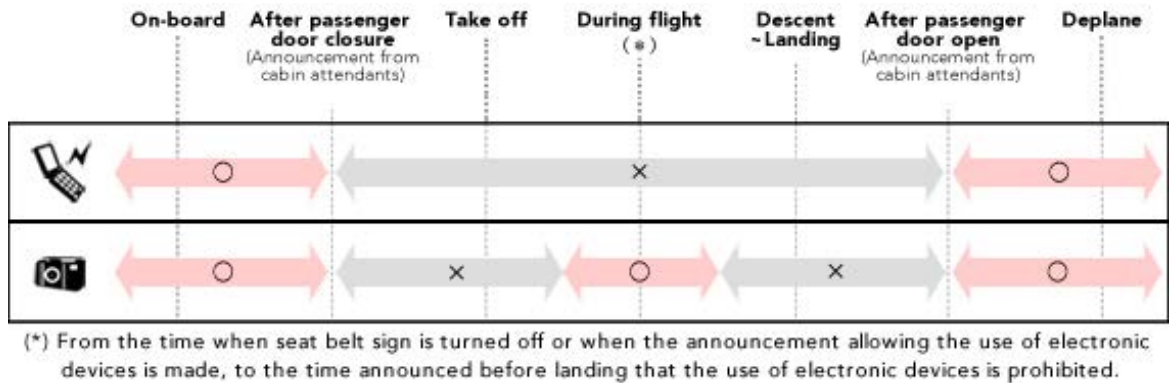


get up in the air can you turn the scanner on and listen? No. All radios, scanners, two-ways, even AM/FM portables are specifically prohibited from being used on board commercial airliners at any time. All radio receivers have local oscillators that radiate some RF energy, even more than computer processors. Even a receiver or scanner can potentially cause interference issues with the airplanes navigation or communications systems.

What about all the electronics that are installed on the aircraft? Many commercial flights these days have video displays, satellite TV, music systems and even Wi-Fi for connecting with the Internet while in flight. Any electronic device that is to be installed on board a commercial aircraft must be certified under federal airworthiness certification. These devices go through all sorts of testing to guarantee that it will not interfere with existing aircraft systems or cause other problems, such as fire hazards or off-gassing from certain plastics.

The FAA allows each airline to set rules as to what kinds of personal electronics may be used on board. They currently allow the use of most electronics, with some exceptions, while in flight above 10,000 feet. They require that all electronics be turned off during the takeoff and landing stages of the flight.

As far as I have been able to determine, there are no U.S. airlines that currently allow the use of a scanner or radio receiver on board during flight. At one time, I do know



*Japan Airlines Dos and Don'ts in the air. (Courtesy: JAL)*

that Southwest and Delta Airlines did actually allow scanners on board and stated so in their on-board information cards. But sometime in the mid-to-late 1990s, all airlines standardized the requirements for allowed electronics while the aircraft is in flight and any sort of receiver, radio or television, is no longer allowed.

But what if you could use your scanner in flight? What do you think you might be able to hear? I have actually used my scanner in flight a few times. The first few times I tried it was years ago, aboard Delta and Southwest flights, back when they allowed the use of scanners in flight. Seated next to a window and holding the antenna up in the window opening, I was able to hear quite a few signals. I remember hearing a LOT of interfering signals overlapping each other on some frequencies, as well as VHF paging data channel interference. At the altitudes a commercial flight operates, 25 to 40 thousand feet, you would be picking up signals from many miles away! I also recall hearing signals that would come in very clearly, but then fade away quickly, due to the speed of the airplane that I was monitoring from.

There is currently one method to listen to in-flight aircraft communications legally and without even bringing your radio. United Airlines has offered for many years the option to listen to the live air traffic audio through the on-board audio entertainment system. The audio program is titled "From The Cockpit", but is often referred to by veteran air travelers as "Channel 9", because the cockpit radio chatter can be heard by selecting channel 9 on the on board audio system. Recently, United issued some good news for Channel 9 enthusiasts when they announced they were adding the feature to former Continental aircraft in their fleet.

Technically speaking, there is one radio receiver that you could use on board, theoretically without causing interference from its local

oscillator. It is a "passive" aircraft receiver, such as the Ramsey ABM-1 Air Band Monitor Receiver, offered in a kit form or already built. This is basically a crystal radio set designed

for the VHF air band. It picks up any strong signals in the 108-138 MHz band and feeds those signals into an earphone. There is no tuning to any frequency, just whatever strong signals in the VHF aviation band it picks up, you hear. Although Ramsey makes the case that it shouldn't interfere with anything, it does use a battery for the audio amplifier and it still needs to be turned off during takeoff and landing.

Do you still really, really want to use your scanner on board? Some have suggested asking the pilot. It is certainly worth a try. I have flown with some commercial pilots who were also amateur radio operators and were curious about the scanner on my belt when boarding the plane. They might be up to the request, but I would say most are not. They know the regulations that the FAA and the airline have in place and would probably not

be willing to bend the rules.

Which brings us to the next subject, the argument over who's right. Many posters in these on-line forums like to try stirring things up by saying you have the right to use whatever you want on board, and the flight attendant can't stop you. Some have even provided suggestions for covert use of radios, computers and phones without the flight attendants noticing. I would say that, these days, trying to argue with any airline flight crew is ill-advised. At best, it will get you a talking to by the airport police when you land at your destination, at worst an arrest when the plane lands and getting banned from flying whatever airline you had your ticket with.

So, please don't be afraid to travel with your radios. Use them when on the ground and when allowed by the airline rules and the airplane crewmembers, but don't abuse the privilege, and don't try to get away with anything sneaky. Safe travels!



*AOR AR8200 MKIII B scanner. (Courtesy: Grove Enterprises)*



*Ramsey Aircraft Monitor: OK or not OK? (Courtesy: Grove Enterprises)*





## EDACS, Open Sky and Hot Air Balloons

As many scanner owners know all too well, there are some systems that cannot be monitored by even the most current scanners on the market. Proprietary technology from radio system vendors, which locks their customers into an expensive monopoly provider relationship, also prevents open access and oversight by journalists, local residents, and off-duty personnel. This month we take a look at two such technologies and report on some recent political decisions that directly affect their deployment.

### ❖ Albuquerque, New Mexico

Dear Dan,

The November column about EDACS digital and encryption format is very interesting, and it reminds me of a question that I have about our EDACS Public Safety system here in Albuquerque.

What is the advantage of having only one side of the conversation in digital format? For example, for all of the city and county fire department talk groups the dispatcher can be heard in analog format but the vehicles cannot be heard on the scanner because they are in digital format. Only the analog dispatcher side of the conversation is heard. What is the advantage of this arrangement where one side of the conversation is analog and the other side digital?

The police departments also used to operate this way, but shortly after the 10 codes were done away with, the police departments went totally digital on both sides of the conversation. The only totally analog things left on the Public Safety system are airport operations and the dogcatcher.

And just for your information, this year I went to the Albuquerque International Balloon Fiesta and I brought my scanner to monitor their frequencies that are listed in the FCC database. Of the many frequencies listed, I found that only a few were active:

Frequency	Description
451.5625	Repeater/456.5625 mobiles Command Center
452.6375	Repeater/457.6375 mobiles Unknown function, but golf carts were heard on it
462.225	Repeater/467.225 mobiles Emergencies and flight safety
469.0375	Mobiles Unknown function
120.650	Broadcast of unofficial Internet automated weather observations in the area

William in New Mexico

Bernalillo County and the City of Albuquerque, located near the center of New Mexico, operate an EDACS (Enhanced Digital Access

Communications System) network from seven sites located around the county. The network is organized as three smaller systems; two carry public safety activity and one is dedicated to public works.

Because these are EDACS radio systems, the frequencies are organized according to Logical Channel Number (LCN). Listeners must program each frequency in the corresponding memory location in order to follow system activity correctly.

LCN	Public Safety 1	Public Safety 2
01	851.2500	851.2250
02	851.5625	851.4750
03	851.7625	851.7375
04	851.9750	851.9500
05	852.2500	852.2000
06	852.6000	852.4750
07	852.9750	852.7125
08	853.2625	852.9500
09	853.5000	853.2375
10	853.7500	
11	851.1125	
12	851.4500	
13	851.7125	
14	852.0625	
15	852.4500	

Voice activity on the system, as William notes, can be either analog or digital. The digital voice is in a proprietary format called ProVoice, which is a marketing term for the EDACS implementation of a digital voice encoder/decoder called IMBE (Improved Multi-Band Excitation). A commercial company called Digital Voice Systems, Inc. developed IMBE as an efficient way to represent analog speech sounds as a series of digital information bits.

Those digital bits, along with control and error correction information, can then be transmitted to radio receivers, where the bits are turned back into analog sound. APCO Project 25 (P25) digital systems also use IMBE in the open standard Common Air Interface (CAI), but the control and error correction information are organized differently, so a ProVoice transmission is not compatible with a P25 receiver and vice versa.

### ❖ Mixed Mode Operation

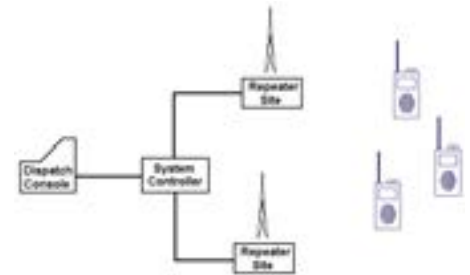
As to William's question about why a dispatcher transmits in analog but users respond in digital format, there could be several reasons.

The first and most common reason in cases like this is economic. EDACS, like many public safety radio networks, was marketed as a system that could be upgraded and enhanced as budgets



permit. The baseline EDACS product supports relatively low cost analog radios, allowing municipalities to save money by purchasing basic mobile and portable radios for their users. As the needs of the municipalities grow and mature, the EDACS infrastructure could be upgraded to support digital voice traffic, encryption, and other advanced services.

In order for users to take advantage of these upgrades, they would need more capable and expensive radios. Instead of having to give all their users new radios, a municipality could choose to buy new radios just for the few users that really need the new features, while allowing the remaining users to continue to work with the less expensive units. The result is budgetary savings but a system that has a variety of radios with varying capabilities. With such a mixed system, the lowest common denominator that all radios can process is analog transmissions. When the dispatcher transmits in analog format, he or she can be assured that all of the radios in the field will be able to hear the call.



For the Fire Department specifically, a second reason for analog dispatch transmissions could be for volunteer and off-duty personnel who do not always carry EDACS radios but need to be alerted or want to stay informed about emergencies. In many parts of the country, volunteer firefighters and medical technicians are "called out" for duty via relatively inexpensive one-way pagers that are only capable of receiving analog transmissions. Similarly, off-duty personnel may not have access to their duty radio but want to be aware of fires and medical calls that may take place during their off hours. Analog dispatches allow these individuals to keep informed using less expensive and more easily obtained pagers and scanners.

In some cases there may be equipment limitations that prevent digital transmissions. Each step in the chain from dispatcher to repeater site must support digital operation in order for the transmission to go out in digital format. If the dispatcher's console is missing a necessary piece of equipment or software, if the system controller is programmed incorrectly, if the repeater site transmitter doesn't support digital operation, or any part in between lacks digital capability, the result will be an analog transmission. Since repeater sites contain both transmitters and receivers, it is possible in some rare cases that the

transmitters don't support digital transmission but the receivers support digital reception.

## ❖ Albuquerque Analog Activity

Unfortunately for William and other Bernalillo County residents, most of the public safety activity on the EDACS network is in ProVoice digital format. Because there is no consumer scanner on the market today that can monitor ProVoice, that activity remains hidden from residents and other local listeners. However, there is still some analog activity on the system, reportedly on the following talkgroups:

Dec	AFS	Description
337	02-101	Animal Control
338	02-102	Animal Control
528	04-020	Albuquerque Police All Call
529	04-021	Albuquerque Police Records Check
530	04-022	Albuquerque Police Dispatch (Foothills)
531	04-023	Albuquerque Police Dispatch (Northeast)
532	04-024	Albuquerque Police Dispatch (Southeast)
533	04-025	Albuquerque Police Dispatch (Southwest)
534	04-026	Albuquerque Police Dispatch (Valley)
535	04-027	Albuquerque Police Dispatch (Northwest)
538	04-032	Albuquerque Police Tactical
849	06-101	Metropolitan Detention Center (Operations)
854	06-106	Metropolitan Detention Center (Medical)
855	06-107	Metropolitan Detention Center (Maintenance)
1029	08-005	Fire Station Intercom
1030	08-006	Fire Station Intercom
1031	08-007	Fire Station Intercom
1032	08-010	Fire Station Intercom
1033	08-011	Fire Station Intercom
1034	08-012	Fire Station Intercom
1035	08-013	Fire Station Intercom
1036	08-014	Fire Station Intercom
1041	08-021	Albuquerque Fire Dispatch
1281	10-001	Fire Station Intercom

## ❖ Hot Air Balloons

The Albuquerque International Balloon Fiesta ([balloonfiesta.com](http://balloonfiesta.com)) is an annual hot air balloon convention held during early October. It is the largest event of its kind in the world, with 600 balloons of different shapes and sizes participating in various competitions.

The Federal Communications Commission (FCC) frequency database, called the Universal Licensing System (ULS), shows a number of Ultra High Frequency (UHF) radio frequencies assigned to the Albuquerque International Balloon Fiesta organization.

If you're curious, the FCC database can be accessed via the World Wide Web at [wireless2.fcc.gov/UlsApp/UlsSearch/searchLicense.jsp](http://wireless2.fcc.gov/UlsApp/UlsSearch/searchLicense.jsp)

The Balloon Fiesta frequencies appear under call sign WQCB498 and are identified as one of three types. The first type is fixed location transmitter frequencies used from the Balloon Fiesta headquarters on Alameda Boulevard. These fixed location frequencies are paired with

the second type, which are mobile frequencies exactly 5 MHz higher. The mobiles are licensed for operation within 20 miles (32 kilometers) of headquarters.

Fixed	Mobile
451.5625	456.5625
452.6375	457.6375
462.2250	467.2250

The third type are mobile frequencies that are not paired with a fixed location frequency. They are also limited to operation within 20 miles of headquarters. Frequencies of this type listed in the database are: 451.7375, 451.7625, 452.2875, 452.4125, 452.5125, 452.6875, 452.7625, 461.6875, 462.1875, 463.2125, 463.4125, 463.8625, 464.1625, 464.3625, 466.5125, 468.4625, 468.8625 and 469.0375 MHz.

## ❖ OpenSky in Nevada

Another proprietary radio technology that cannot be monitored by scanners is called OpenSky. It has a long and checkered history in the public safety marketplace with a growing list of unhappy former customers, the largest of which is the State of New York, which terminated a \$2 billion contract in 2009.

OpenSky was based on an earlier voice and data network originally built for FedEx. It is a fully digital network that uses protocols designed for a now defunct service called Cellular Digital Packet Data (CDPD). On paper it looks like a very efficient system, able to carry four conversations in the same amount of frequency spectrum in which other technologies can only carry two. It can handle data as easily as voice and uses a voice encoder/decoder from DVSI called Advanced MultiBand Excitation (AMBE) that is even more efficient than IMBE. Unfortunately, looking good on paper doesn't always translate to good in the real world.



The Las Vegas Metropolitan Police Department (LVMPD) began looking for an upgrade to their old radio system in 2003 and eventually awarded a contract for a "Desert Sky" public safety radio system in 2006. It is built on OpenSky technology and went live in early 2011, providing voice and data services appropriately scaled to handle the 50,000 voice transmissions per day generated by officers and administration.

This past October, the \$42 million system went bust. The Clark County Sheriff declared it to be an unreliable failure after two years of troublesome operation. Even after numerous tweaks and repeated fixes it continues to suffer dead zones, lost transmissions and poor audio quality. According to reports, officers often use cell phones to talk with each other because their radios are so unreliable. Poor coverage may also have played a part in the shooting death of an unarmed man in 2011.

The current plan is for LVMPD to keep the OpenSky data capability, which apparently

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works well enough, but search for a replacement voice system that has been estimated to cost at least \$15 million and may take a year and half to design, build and install.

## ❖ OpenSky in Florida

More than a decade ago a number of municipalities in northern Palm Beach County, Florida formed the Municipal Public Safety Communications Consortium (MPSCC) for the purpose of sharing the costs of building and operating a public safety radio system. In 2001, for reasons that no one involved now seems to recall, the MPSCC decided to purchase an OpenSky system. The system finally went live in 2010.

The smaller MPSCC communities of Juno Beach, Jupiter, Palm Beach and Palm Beach Gardens are currently using the OpenSky system, having transitioned to it one by one over the past two years.

As a member of the consortium, the City of West Palm Beach spent \$5 million on OpenSky equipment and infrastructure but never actually switched over. To this day, city departments and personnel are still using an older Motorola analog trunked radio system.

West Palm Beach technical staff produced reports in 2009 and 2010 that were critical of the system, citing dead spots, transmissions that were never received, jury-rigged interconnections, and the difficulty of operating a proprietary system. City officials buried the reports for political reasons and continued the push to join the OpenSky system. Investigation by the local newspaper eventually led to resignations and a subsequent election brought in a new mayor.

According to city officials, Harris Corporation has informed them that OpenSky will not work properly in the downtown area of West Palm Beach due to the density of buildings. The system failed a test in 2009 but apparently passed a limited review in 2011, although it is not clear exactly what criteria were used during these events.

West Palm Beach had been paying more than 40% of the consortium's expenses, up to \$170,000 a year, and was looking at spending an additional \$1.6 million for about 400 mobile and portable radios.

In November 2012, West Palm Beach commissioners officially decided not to join the OpenSky system, opting instead to pursue an open bid process to find a replacement for the existing analog radio system. That replacement is expected to follow open Project 25 standards rather than a proprietary technology. Initial estimates from consultants hired by the city showed a P25 system from Harris would cost about \$8 million while a P25 system from Motorola would be somewhere between \$5 million and \$6 million.

## ❖ West Palm Beach, Florida

Until the political shenanigans get worked out and a replacement radio system is built, you can monitor the existing Motorola Type II Smartnet system in West Palm Beach. All voice traffic is analog, so any scanner capable of trunk-tracking will be able to follow talkgroup conversations.



Frequencies used on the system are 853.5375, 853.5875, 853.7375, 854.9625, 856.4375, 856.7125, 856.9625, 857.4375, 857.7125, 857.9625, 858.4375, 858.7125, 858.9625, 859.2125, 859.7125, 859.9625 and 860.7125 MHz.

Talkgroups on the system include the following:

Decimal	Hex	Description
16	001	Police and Fire (Common)
48	003	School Alarms
80	005	Interagency
112	007	Police, Fire and Public Works (Common)
1584	063	Police Vehicle Maintenance
1616	065	Police (Dispatch North)
1648	067	Police (Dispatch South)
1712	06B	Police (Wants and Warrants)
1744	06D	Police (Tactical North)
1776	06F	Police (Tactical South)
1840	073	Citizen's Observer Patrol ("Eyewatch")
1904	077	Police (Supervisors)
1936	079	Police (Staff Services)
1968	07B	Police (Special Events)
2160	087	Police (Tactical)
2192	089	Police (Tactical)
2224	08B	Police (Tactical)
2256	08D	Training 1
2288	08F	Training 2
2320	091	Training 3
2352	093	Police (SWAT)
3120	0C3	Police (Investigations)
3216	0C9	Fire-Rescue (Dispatch)
3248	0CB	Fire-Rescue (Medical)
3280	0CD	Fire-Rescue (Tactical 1)
3312	0CF	Fire-Rescue (Tactical 2)
3344	0D1	Fire-Rescue (Tactical 3)
3376	0D3	Fire Prevention
3408	0D5	Fire-Rescue (Administration)
4816	12D	City Services
4848	12F	Trash Collection 1
4880	131	Trash Collection 2
4944	135	Budget Department
4976	137	Construction Services Department
4992	138	Traffic Engineering
5008	139	Traffic Operations
5072	13D	Street Maintenance
5136	141	Electrical Maintenance
5168	143	Emergency Operations Center
5200	145	Water Telemetry
6416	191	Water Department (Administration)
6448	193	City Utilities
6480	195	City Utilities

## ❖ OpenSky2

Even with the documented problems and poor reputation of OpenSky technology, for more than two years now Harris Corporation has



been promoting their "OpenSky2" technology, which they claim has more than a dozen new capabilities and features, including improved audio quality and more reliable coverage. Despite being a proprietary product, Harris markets OpenSky2 as "fully interoperable" through the use of a hardware and software package called VIDA (Voice, Interoperability, Data and Access) that allows connections between OpenSky, analog and Project 25 radio systems. VIDA uses common Internet Protocol (IP) data transport technology to move voice and data between these different systems.

## ❖ OpenSky2 comes to D.C.

In 2009, Washington Gas, a natural gas utility serving the District of Columbia, Maryland, Virginia and West Virginia, selected Harris to build a network that integrates an OpenSky network with a small P25 system. Washington Gas has about 1,000 employees and service personnel who make use of both voice and data services on the network. The announced plan was for 20 OpenSky repeater sites operating in the 900 MHz band throughout most of the service region while four VHF repeater sites in the mountainous areas of Virginia would follow P25 protocols. The idea with this kind of mixed system is to enable more efficient use of frequencies in metropolitan areas through OpenSky technology but employ a more robust system in the steep, challenging terrain of the Appalachian Mountains.

In November 2012, Harris announced that Washington Gas upgraded their network to the OpenSky2 product and that there were now 22 OpenSky repeater sites. Integration of the two different technologies was accomplished through what they call the "VIDA network." So far it appears Washington Gas is happy with the result.

## ❖ OpenSky in Georgia

The City of Macon, Georgia recently agreed to a \$7 million contract with Harris to install a hybrid network and supply almost 700 radios. A P25 system operating from three repeater sites in the 800 MHz spectrum will provide voice service for public safety personnel while an OpenSky "overlay" will link mobile laptops to municipal computers via OpenSky data modems.

That's all for this first month of the New Year. More information on EDACS, ProVoice, OpenSky and related radio topics can be found on my website at [www.signalharbor.com](http://www.signalharbor.com). I welcome your comments, questions and reception reports via e-mail at [danveeneman@monitoringtimes.com](mailto:danveeneman@monitoringtimes.com). Until next month, happy scanning!



**Q.** *What will narrowbanding actually do?*

**A.** There is a great deal of confusion and misinformation circulating regarding the new FCC rules.

The FCC mandate to narrow the channel bandwidths for VHF/UHF FM communications applies only to private land mobile licensees (public safety, business and industrial), both analog and digital, in the 150-174 and 421-512 MHz bands.

It does not affect amateur radio, CB, GMRS, FRS, MURS, marine radio, aircraft, TV, FM broadcasting, or NOAA weather. Nor does it apply to the 30-50, 72-76, 216-222, 700, 800, or 900 MHz bands. It has no effect on federal government communications since they are already narrowband.

After January 1, 2013, all private land mobile transmissions other than paging in the 150-174 and 421-512 MHz ranges must employ no greater than 12.5 kHz bandwidths, rather than the former 25 kHz bandwidth allowance. This makes room for two signals in the spaces between former, consecutive, single-signal channels.

For example, where two former licensees could occupy adjacent channels such as 460.250 MHz and 460.275 MHz, now another licensee may be sandwiched between them on 460.2625 MHz. This should relieve a great deal of the current congestion on these bands.

Current licensees do not have to change their authorized frequencies, only reduce their bandwidths. Theoretically, this results in a 3 dB reduction in signal strengths. In many cases, the 3 dB lower signal strength won't be noticed, but where it is, the loss can be made up for with higher power, directional antennas, and a taller mast.

**Q.** *What are some of the common frequencies used by law enforcement video and wireless mikes on police stops? (Jim Smith, email)*

**A.** The most common are in the 169-172, 174-218, and 902-928 MHz ranges. Former 698-806 MHz frequencies have been banned by the FCC. Newer units use the 2.4 GHz WiFi band, and some are in the 5.8 GHz microwave band.

**Q.** *Three of the speakers in my car have gone silent, and the wiring under the dashboard is a maze. Is it possible to use a portable AM/FM radio with some type of ad-*

*ditional antenna in my car? (Joe Majewski, email)*

**A.** If three speakers have gone out, unless you've been tinkering with the wiring, it's most likely the speakers. I have a Jeep with two dead speakers out of four. In my case, heavy bass notes blew the voice coils, so the radio amplifier is obviously capable of putting out more power than the speakers could take. (I like drums!)

If you can get to the speakers, simply take a standard flashlight battery (AA, C, D, it doesn't matter) and with a couple of wire leads, briefly touch the two terminals of the speaker. You should hear a prominent "thump" from the speaker if it's good. If you don't hear anything, this confirms the death of the speakers.

Measure the size of the speakers and record the precise spacing of the mounting holes. I'll bet you can find cheap replacements inside some stereo speaker cabinets at a thrift shop. The front grills commonly pull off those cabinets to inspect the speakers. If you can't find them there, you might need to try the autosound department in a discount store.

So far as the AM/FM portable in the car, you can probably unplug the antenna cable from the rear of your automotive radio and rig a way to hook it to the portable; you may need an extension of coaxial cable. It would be best to use a radio that has an external antenna jack.

You can't beat the original vehicle antenna which is close to quarter-wave resonant for the FM band on many models.

**Q.** *I have a 50' outside antenna mounted quite high. Is there any point to owning a tabletop if I already have a multiband portable radio? (Daniel Alpern, email)*

**A.** The advantages of a tabletop receiver over a portable include the ability to separate closely-spaced signals (selectivity), reject strong-signal overload (dynamic range), reduce phantom signals (images), attenuate electrical interference (noise limiting), use an external antenna instead of the internal ferrite rod for local AM broadcast reception, and fine-tune single side-band (SSB) modes.

**Q.** *The alternator on my truck puts out 13.8 volts. Does this mean that the battery is trickle charging all the time? (M.B., email)*

**A.** Yes, until (if ever) the battery's terminal potential builds up to 13.8 volts.

**Q.** *I will be installing a wire antenna for shortwave reception. How long can the ground wire be to the grounding post? Will the length of coax make any difference? (Greg Hemmings, N4WVE)*

**A.** A ground wire on an antenna won't actually increase signal strengths above the noise floor, but under some conditions will reduce electrical interference from nearby sources. Since the coax shield is attached to the receiver's chassis, simply grounding the receiver should provide the same results. A good ground wire should be as short as possible, and fairly large in diameter to increase the efficiency because of "skin effect" at radio frequencies. Coax shield is commonly used, as is standard gauge house wire.

So far as the length of the coax, the same rule applies: The shorter the better to avoid resistive losses in the cable. At shortwave frequencies, standard RG-58/U is fine up to lengths of 100 feet or so. Above that it would be better to switch to a lower-loss cable like RG-59/U or, even better, RG-6/U TV cable. The better cable is mandatory at VHF and UHF where cable loss is more prevalent.

**Q.** *My old Ford Mustang had an ammeter in which a needle pointed to either charge or discharge. Is this better than a voltmeter? (Mark, email)*

**A.** An ammeter reveals how much current is being drawn, but that can happen with a good or bad battery, or a partially-discharged good battery, so it doesn't diagnose the battery's condition.

A voltmeter, on the other hand, will show the terminal voltage when the car isn't running, indicating whether the battery is holding a charge. It will also reveal how badly that voltage drops when it's trying to start the engine, revealing the battery's condition. I'd go with the voltmeter.

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



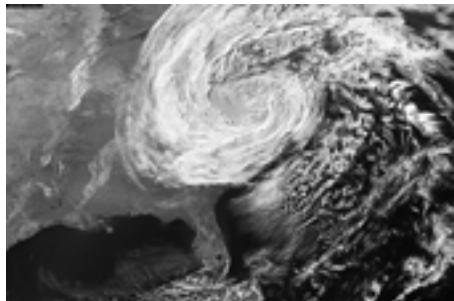
## Utility Bands Active for Superstorm Sandy

**B**y now, everyone's heard of Sandy, the unusually vigorous, late-season hurricane which happened to show up at the precise worst place at the precise worst time. It then combined with a couple of strong weather events in their own right. Then came a bingo of worst-case wind and tide conditions all at once, to produce a calamity previously beyond imagination.

It's likely that the only beneficiary of that historic catastrophe is this column's Hurricane Frequency List. As of late October, it was doomed. This very January column was to suggest that everyone stop using it. No more.

Some might think that a lot of fuss is being made about this list. This has to do with its history. The first version was thrown together for some long-forgotten storm back in a day when utility hunters exchanged information via USENET, CompuServe, and Genie. It went viral for some reason, turning up on the web sites of some pretty important emergency agencies. Various versions, with varying numbers of outdated entries, can be found all over the Internet.

In those fabled days of yore, one really could



Satellite image of Sandy, 10/30/12 (Courtesy NOAA/NASA GOES Project)

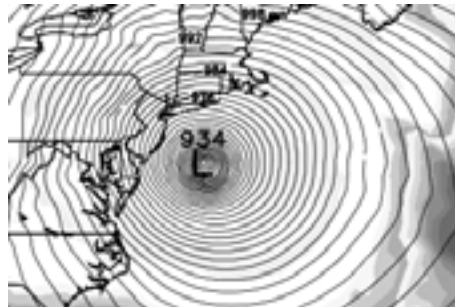
tune to some of these frequencies and hear the fading signals from improvised stations in the hardest-hit areas, or the first reports from military aircraft flying over devastation scenes. News media would air live audio straight from ham radios, which were often the primary information source.

Surely, one might say, all this has gone to Twitter and Facebook. That was the feeling here too. However, Sandy did actually demonstrate that some situations are still dire enough that the only recourse is plain, old-fashioned, shortwave radio.

Therefore, the list survives, though it will need a full rewrite. Some Sandy communications appear in this month's log section, and readers are encouraged to send in logs of whatever they heard. Here are some of the radio happenings.

### HMS Bounty

The old tall sailing ship *Bounty* continues to make history, though in a rather tragic way. A full-sized, fully operational replica was built for the 1962 Marlon Brando movie, and it continued to be used for events and other film shoots. On



Model predicted record low pressure (Courtesy European Centre for Medium-Range Weather Forecasts)

October 29, this historic vessel was caught in the storm, and it sank off Cape Hatteras. One crew member died, and at this time the captain is missing and presumed dead as well.

Listeners in the area reported hours of U.S. Coast Guard search-and-rescue communications on 5696.0 kilohertz (kHz), upper-sideband mode (USB). Some of this traffic appears, with attribution, in this column's log section.

This frequency, along with 8983 and 15088, is an air-to-ground channel used for safety and flight following by the Coast Guard's Camslant Chesapeake (VA), and Camspac Point Reyes (CA). Camslant stands for Communications Area Master Station, Atlantic, and Camspac is similar for the Pacific.

Not long ago, there was some question as to whether these three frequencies would be completely dropped as part of the Coast Guard's consolidation of much of its air-ground communication on another U.S. government net called COTHEN. This stands for Customs Over-The-Horizon Enforcement Network. It was originally used for just that: customs and drug enforcement. It still is, but with the coming of new Automatic Link Establishment (ALE) technology and more interoperable radios, it's now a favorite for more routine comms.

Katrina had more activity on COTHEN than the older frequencies, but this time, it seems the other way around. At one point, Camslant was heard working a C-130 and two helicopters over the *Bounty* search area. The search went on for quite some time.

COTHEN, however, remains a good place to catch the Coast Guard, with ALE autolinking and follow-on comms in voice and a couple of more secure digital modes. Its expanded frequency list is as follows: 4164.5, 5250.0, 5732.0, 5909.5, 7527.0, 8912.0, 10242.0, 11494.0, 12222.0, 13312.0, 14582.0, 15867.0, 18594.0, 20890.0, 23214.0, and 25350.0. These are all USB mode, and most of what you hear is the ALE soundings that help the automated network find the best calling frequencies.

These soundings aren't as dull as one would think. They show who is on. They're a good way to find new players, such as the 939ICE heard

last night. That's a new one here, and presumably belongs to an Immigration and Customs Enforcement (ICE) unit. A large number of aircraft and a few Coast Guard cutters are also up, and at least some of these are likely working the Sandy disaster.

### FEMA

The U.S. Federal Emergency Management Agency (FEMA) ramped up its activity as the storm approached. Some lucky people might have caught FEMA's new ALE system, which includes a text chat mode.

Here, though, it was all soundings. Literally days of these were logged and scrutinized, mostly in a search for that elusive FEMA Region 2, which serves New York, New Jersey, Puerto Rico, and the U.S. Virgin Islands. For whatever reason, it is hardly ever heard on the radio, and it still hasn't been heard here. Everything else, though, is hopping.

There's been some confusion about FEMA's ALE call signs. Most of these use a convention of F[letter][figure]FEM for the primary region stations. The letter is usually R ("Region") or C (possibly "Communications"). The FEM, of course, stands for FEMA. After this, other associated stations will postpend 3-figure numbers padded with zeroes, such as FC8FEM001, FC8FEM002, and so on.



NHC advisory 10/28/12 (Courtesy NWS National Hurricane Center)

Of course, there are exceptions. CAOFEM001 sounds as if it should be California, but it is more likely to be a Caribbean office. The ever-busy Region 8 now has a FC8FEM001006. FS1FEM is the Mt. Weather emergency center (ex-"Special Facility").

The most active frequencies found here include 4780, 7428, 9462, 10194, 10242, 10588, 10899, 12129, 12216, 13446, 13894, 14776, 14836, 14885, 15708, 19969, 21866, and 24526. These are all USB and ALE.

### SHARES/ MARS

SHARES stands for SHARED RESources. It is a cooperative frequency pool for at least 20 U.S. Federal agencies, though about half the players are in MARS (Military Auxiliary Radio System).

SHARES activates for disasters or national

security events. It conducts a number of regional nets. It doesn't seem as if these ever really do much of anything, but they are a good place to catch some pretty arcane operations of the U.S. government.

Listeners in the region heard SHARES voice nets in USB on 3047.0 (unknown), 4458.0 (Northern Region), 5063.5 (Northern), 5236.0 (Northeast on national night primary), 6765.0 (Northern), 6845.0 (Northeast Coordination Net), and 14396.5 (national daytime primary). Except for the loud control stations, most SHARES radios are small, and signals can be maddeningly weak.

MARS and US Coast Guard Auxiliary were also found on their own frequencies, such as 5353.5 (CG Aux), 6985.5 (Army MARS, with traffic), 13910.5 (Army MARS), 14392 (Air Force MARS Mission Support Net), and quite a few others that will hopefully find their way into future log sections. Send 'em in!

## More on AFRTS/AFN Disappearance

There is finally a definitive story on the reported "decommissioning" of the U.S. Navy facility on Saddlebunch Key, which (among other things) broadcast a voice channel for the American Forces Radio/ Television Service (AFRTS) and its American Forces Network (AFN).

A report in the Key West *Citizen* states that the Naval Computer and Telecommunications Station was indeed closed, effective September 21, 2012. Its "plain, whitewashed" buildings and antenna site were returned to the Naval Air Station Key West for other use.

The reason given is consolidation of Navy shortwave radio with Air Force communication assets in Puerto Rico and Maryland. While these are not identified, they are presumably the Air Force High-Frequency Global Communications System (HFGCS) stations at Andrews Air Force Base, MD, and Salinas, PR. The HFGCS is in fact available to any military users authorized by the Department of Defense, and it is already being used by the Navy.

Bravo Zulu, Key West!

## Velocity

On October 28, 2012, the Virgin Australia Group airlines officially changed all of their voice radio call signs to "Velocity" plus the usual flight numbers. This is also the name of their frequent flyer program.

"Velocity" replaces the four voice calls (Vee-Oz, Bluebird, Bluey, and Virgin) in prior use. Similarly, the four previous three-letter designators issued by the International Civil Aviation Organization (ICAO) have all been changed to "VOZ."

VOZ, and the two letter International Air Transport Association (IATA) designator "DJ," will show up in the 6-character group used to identify flights on the High-Frequency Data Link (HFDL) system. These will postpend three or four figures (respectively) for the flight number.

The call has already been heard on the aero bands. One early hit was on 8867 kHz USB, where the aircraft was working Auckland air traffic control in New Zealand.

## ABBREVIATIONS USED IN THIS COLUMN

AFB..... Air Force Base  
 ALE..... Automatic Link Establishment  
 ARQ..... Automatic Repeat reQuest  
 Camslant..... Communications Area Master Station, Atlantic  
 COTHEN..... Customs Over-The-Horizon Enforcement Network  
 CW..... On-off keyed "Continuous Wave" Morse telegraphy  
 DSC..... Digital Selective Calling  
 FAX..... Radiofacsimile  
 FEMA..... U.S. Federal Emergency Management Agency  
 FSK..... Frequency Shift Keying  
 HFDL..... High-Frequency Data Link  
 HFGCS..... High-Frequency Global Communications System  
 ID..... Station identification  
 LSB..... Lower Sideband  
 M03..... Unknown agency, usually CW 5-figure groups  
 M12..... Russian intelligence CW numbers  
 M89..... Chinese military CW coded/group call signs  
 MARS..... U.S. Military Auxiliary Radio System  
 Meteo..... Meteorological; weather office  
 MFA..... Ministry of Foreign Affairs

MRHS..... Maritime Radio Historical Society  
 MX..... Generic for Russian single-letter beacons/markers  
 NDB..... Non-Directional Beacon (Aero).  
 Pactor..... Packet Teletyping Over Radio, modes I-IV  
 RO/RO..... Roll On/Roll Off  
 RTTY..... Radio Teletype  
 S06s..... Russian intelligence, slow-zero variant  
 Selcal..... Selective Calling  
 SESEF..... Shipboard Electronics Systems Evaluation Facility  
 SHARES..... SHARed RESources, U.S. Federal frequency pool  
 Sitor..... Simplex Telex Over Radio, modes A & B  
 TACAMO..... Take Charge And Move Out  
 UK..... United Kingdom  
 Unid..... Unidentified  
 U.S..... United States  
 USS..... United States Ship  
 USAF..... U.S. Air Force  
 USCG..... U.S. Coast Guard  
 Volmet..... Scheduled, formatted, aviation weather broadcasts

All transmissions are USB (upper sideband) unless otherwise indicated. All frequencies are in kHz (kilohertz) and all times are UTC (Coordinated Universal Time). "Numbers" stations have their ENIGMA (European Numbers Information Gathering and Monitoring Association) designators in ( ).

353.0 KIL-NDB, Kiel Holtenau, Germany, CW ID at 1958 (Ary Boender-Netherlands).  
 359.0 LOR-NDB, Lorient, France, CW ID at 2002 (Boender-Netherlands).  
 360.5 MAK-NDB, Mackel, Belgium, CW ID at 2000 (Boender-Netherlands).  
 444.0 NRD-NDB, Nowa Ruda, Poland, CW ID at 2024 (Boender-Netherlands).  
 448.0 HLV-NDB, Holesov, Czech Republic, CW ID at 2026 (Boender-Netherlands).  
 505.0 WEXXGR/1-600 meter amateur experimental beacon, CW ID at 0048 (Mario Filippi-NJ).  
 1709.0 4POF-CW fishing gear marker beacon; similar beacons on 1723, 1724, 1726, 1752, 1779, 1785, 1787, 1791, 1797, and 1801; at 0416 (Filippi-NJ).  
 2187.5 Astrakhan-Russian marine rescue center, acknowledging DSC safety test from vessel MB-1204 (UGVH), at 2252 (MPJ-UK).  
 4207.5 3FTZ4-Panama flag RO/RO cargo vessel *Gazalle*, DSC safety test with Greek flag vessel *Hellenic Trader*, at 2259 (MPJ-UK).  
 4332.0 4XZ-Israeli Navy, Haifa, CW message in 5-letter groups, at 0214 (Filippi-NJ).  
 4603.0 FR2FEM-FEMA Region 2, NY, ALE sounding at 0324. FC8-FEMA Region 8, CO, calling NV9 (NV Division of Emergency Management), ALE at 1145 (MDMonitor-MD).  
 5115.0 AFA7MRD-USAF MARS, voice and data with AAM7EMO, at 1339 (Jack Metcalfe-KY).  
 5202.0 AAR6JN-U.S. Army MARS net with AAR6TX, AAR6TG, and others, at 1311 (Metcalfe-KY).  
 5238.0 NCS 303-SHARES control station, active for hurricane Sandy, taking check-ins at 2350 (MDMonitor-MD).  
 5394.5 AAN5EOC-U.S. Army MARS, in exercise Palisades 2 (simulated nuclear emergency in MI), voice, ALE, and digital modes with AAR5UT, AAM5RE, AAM5MI, and AAR5NG; went to 7431.5, at 1318 (Metcalfe-KY).  
 5470.0 Unid-Russian intelligence machine-voice numbers (S06s), callup "934 578 6" and message in 5-figure groups, ended "00000," repeated on 6340 at 0610; at 0600 (Boender-Netherlands).  
 5667.0 SVA991-Saudi Arabian Cargo MD-11F freighter reg HZ-AND, answered selcal PS-DL from Bahrain, at 1945 (Patrice Privat-France).

5696.0 Camslant Chesapeake-USCG, VA, working Coast Guard Rescue 2003 (an HC-130) over the tall sailing vessel *Bounty* sinking in hurricane Sandy, at 1213 (MDMonitor-MD).  
 5708.0 FUE-French Navy, Brest, working unknown ship in firing exercise, at 0847 (Michel Lacroix-France).  
 5741.0 OSN-Belgian Navy, RTTY channel availability marker, at 1957 (ALF-Germany).  
 5754.0 I3BP-Tactical call used by control station in exercise Combined Endeavor 2012, ALE link check and modem data, also on 6804 and 6835, at 1000 (ALF-Germany).  
 6340.5 NMF-USCG, Boston, FAX Atlantic surface analysis chart, at 1740 (Filippi-NJ).  
 6390.0 AQP4-Karachi Wireless, Pakistan, CW marker at 1731 (MPJ-UK).  
 6410.0 S06s, callup "893 570 6" and message, repeated on 7340 at 1010; at 1000 (Boender-Netherlands).  
 6649.0 THY16-Turkish Airlines B777 reg TC-JJO, working Atlántico (South American air control, Recife, Brazil), at 0553 (Privat-France).  
 6697.0 MKL-UK Royal Navy, working unknown vessel, at 1652 (Lacroix-France).  
 6712.0 Andrews-USAF, Andrews AFB, MD, with SKYKING broadcast at 0820 (Lacroix-France).  
 6793.0 Unid-Russian military, CW messages to RMU in 5-figure groups, at 0940 (ALF-Germany).  
 6840.0 NYZ-ID of Chinese military calling marker (M89), calling NYZ at 1722 (MPJ-UK).  
 6848.0 W4I-Unknown station, calling for ALE link check with ALENET (collective call), which was answered by N7D, at 0800 (ALF-Germany).  
 6897.8 S3D0060-Moroccan meteo, Pactor-I log-in as 1s3d0060, and into Pactor-II traffic. At 0216 (ALF-Germany).  
 6943.0 Kufka 46-Unknown Russian military, calling unknown station in Russian, at 2322 (ALF-Germany).  
 6949.0 Y4YS-Tactical call for control station in Combined Endeavor 2012, ALE link checks with 2ZC2 and 6H2S, at 1200(ALF-Germany).  
 6950.0 GD00-Austrian military, radio checks in German with GD10 and GD20, at 1925 (ALF-Germany).

6987.0 Unid-North African military station, French and Arabic radio checks with XI, FR, 3I, and others, at 1955 (ALF-Germany).

7302.0 AFF6AR-USAF MARS net with AFF6BZ, AFA6JH, and AFA6PJ, at 1325 (Metcalfe-KY).

7345.0 AAV5IS-U.S. Army MARS, working NNNORBD, U.S. Navy/Marine Corps MARS, at 1319 (Metcalfe-KY).

7348.0 CAOFEM001-FEMA Caribbean Area Office, Puerto Rico, ALE sounding at 0325(Alf-Germany). WGY901-FEMA Region 1, MA, calling WGY923, PA, ALE and voice at 1802 (Metcalfe-KY). FC4FEM-FEMA Region 4 communications, voice call WGY904, GA, ALE chat with GA4FEM (WGY944/ GA State EOC), at 1313 (Metcalfe-KY).

7361.5 AASFBN-U.S. Army Aviation Support Facility, calling helicopter R23972; aircraft also sounded on 4775.5, 5283.5, 5833.5, 7718.5, 8065, 8171.5, 9081.5, 10275, 10797.5, 11439.5, 12170, 12196, and 14794.5; at 1937 (Metcalfe-KY).

7431.5 AANSEOC-U.S. Army MARS, came from 5394.5 for exercise with many other stations in voice, RTTY, ALE, and digital.; at 1452 (Metcalfe-KY).

7457.0 AFF4AL-USAF MARS, voice and data at 1336 (Metcalfe-KY).

7475.0 Unid-U.S. Navy link coordination net for the USS Harry S Truman (CVN-75) battle group, at 1537 (Metcalfe-KY).

7527.0 LGV-USCG Cutter *Legare* (WMEC 912), ALE sounding, also on 13907, at 1215 (MDMonitor-MD).

7535.0 Fighting *Freddy*-U.S. Navy destroyer USS *Gonzalez* (DDG 66), hours of all-mode testing with Norfolk SESEF, at 1353 (Metcalfe-KY).

7598.0 53-Italian Carabinieri, roll call of many numbered stations at 0901 (Lacroix-France).

7615.0 Avenging Spirit-CAP headquarters special-use call, checking into the Daytime Communicators Net, at 1401 (Metcalfe-KY).

7630.5 AFA2RU-USAF MARS, working mobile station AFA2WL, at 1326 (Metcalfe-KY).

7677.0 ENTERPTACCHAT-Possible USS *Enterprise* tactical ALE chat, calling LSFPTAC-CHAT, a landing support party, at 1457 (MDMonitor-MD).

7692.0 3BX-Royal Moroccan Gendarmerie; ALE link checks with B2A, JC2, and F2A; at 0000 (ALF-Germany).

7700.9 Unid-Possible Chinese MFA, Beijing, coded messages and operator chatter using international procedural signals, in LSB multiple 4-tone FSK; also on 10448.9 and 10952.9, at 1010 (Eddy Waters-Australia).

7710.0 VFF-Canadian Coast Guard, Iqaluit, FAX ice chart for Baffin Bay, at 0207 (Filippi-NJ).

7795.0 SO6s, callup "196 870 5" and message, repeated on 8695 at 0710; at 0700 (Boender-Netherlands).

7903.5 SL1-U.S. Federal Bureau of Investigation, St. Louis, MO; ALE link checks with S11 (Springfield, IL), IP1 (Indianapolis, IN), and HQ1 (Headquarters in DC); at 0000 (ALF-Germany).

7910.0 BOZ-Colombian Navy, ALE link check with KM2, also on 9090, at 0058 (ALF-Germany).

8055.0 Tango Hotel-Unknown North African station, calling Bravo Delta Mobile, at 2344 (ALF-Germany).

8190.0 BALLALI-Italian Financial Police vessel *Ballali* (G-105), calling CAGLIARI, Cagliari provincial command, also on 12431, ALE at 0700 (Privat-France).

8201.0 *Mary B*-Gulf of Mexico shrimp boat, reports with *Gulf Tiger*, at 0200 (Tony Agnelli-FL).

8419.0 WLO-ShipCom, AL, marker and working unknown vessel in Sitor-A, at 0345 (Robbie Spain-WY).

8472.0 WLO-ShipCom, AL, RTTY Gulf weather, then repeated in Sitor-A, at 1216 (Filippi-NJ).

8550.0 CTP-Portuguese Navy, Oeiras, RTTY marker at 0142 (Filippi-NJ).

8682.0 NMC-USCG, Pt. Reyes, CA, FAX sea state analysis, 0255 (Filippi-NJ).

8867.0 Brisbane-South Pacific air route control, Australia, working ZK-OJD, an Air New Zealand A310 flight ANZ855, at 1930 (Privat-France).

8879.0 G1A8108-Garuda Indonesia flight, working Mumbai (Indian Ocean air control, India), at 1713 (Privat-France).

8885.0 "15"-HFDL ground station, Al-Muharrag, Bahrain, uplink to M-IABU, a Klaret Aviation A340, at 2349 (MPJ-UK).

8891.0 CPA841-Cathay Pacific Airways, working Iceland (Polar Route air control), at 1845 (Privat-France).

8912.0 LNT-USCG Camslant Chesapeake, VA, calling J22, COTHEN ALE at 1316 (MDMonitor-MD).

8933.0 United 895-United Airlines B747 reg N118UA, came from 11342 for selcal check BQ-CE, at 1942 (Allan Stern-FL).

8968.0 DL0005DAT-USAF E-3B number 82-0005, ALE sounding at 2037 (MDMonitor-MD).

8977.0 4K-AZ81-Azerbaijan Airlines B767, flight J20080, working HFDL ground station 03, Reykjavik, Iceland, at 2247 (MPJ-UK).

8992.0 Sam Worth-U.S. military, possible airborne command post, had been Carpenter the previous UTC day, "standing by for traffic" at 0000 (Jeff Haverlah-TX).

9025.0 B5Z159-U.S. Army 159th Aviation Regiment, VA, Company "B" of Battalion 5 (General Support), ALE sounding at 1944 (MDMonitor-MD).

9090.0 BOO-Colombian Navy, ALE text message in Spanish to KN2, at 0002(Alf-Germany).

9150.0 Unid-"Strich" family CW numbers (M03), sending V's at 1109, then callup "272/00," at 1115. M03, CW callup "437/00," at 1320 (MPJ-UK).

9176.0 Unid-Russian intelligence CW numbers (M12), callup "256/1 2647 78," message in 5-figure groups, and ending "0 0 0 0 0," at 1740. (MPJ-UK).

9295.0 SCTF2-U.S. National Guard SC Task Force 2, calling SCJOC, SC Joint Operations Center, at 1551 (Metcalfe-KY).

10024.0 N450PG-Private Gulfstream 450 bizjet, calling Bogota (South American air route control, Colombia), no joy, at 0730 (Privat-France).

10066.0 CPA017-Cathay Pacific Cargo B747 freighter, reg B-LID, working Hat Yai HFDL, Thailand, at 1706 (Lacroix-France).

10075.0 "15"-Al-Muharrag HFDL sending weather observations to CN-ROY, a Royal Air Maroc B737, at 2012 (MPJ-UK).

10343.0 M12, CW callup "124/1 1711 42" and message, repeated at 1830, 1850, and 1912, at 1800 (MPJ-UK).

10493.0 KFD913-U.S. Department of Agriculture, WV, calling WGY 9485, a FEMA auxiliary station, no joy at 1554. K6KAR-National Hurricane Center Hurricane Watch Net manager, presumably operating out of band with permission, calling WGY903 (FEMA Region 3, PA) and FR3FEM (same) repeatedly with no joy, ALE at 1756 (Metcalfe-KY). [All Sandy related.-Hugh]

10588.0 FC1FEM-FEMA Region 1, MA, calling NH1FEM (NH Emergency Management), ALE at 1510. FC8FEM, Region 8, CO, calling NH1FEM, ALE at 1513. FC1FEM, calling R11FEM (Rhode Island Emergency Management), ALE at 1530. FC1FEM, calling FR2FEM (Region 2, New York City), ALE at 1545. FC1FEM, calling NY2FEM (NY State Emergency Management), ALE at 1600. DE3FEM (DE Emergency Management), calling FC1FEM, ALE at 1615. FC1FEM, calling PA3FEM (PA Emergency Management), ALE at 1525 (MDMonitor-MD). [All Sandy related.-Hugh]

10700.0 ALE2-Unknown station, ALE linking and data exchange with ALE1, at 1451 (Metcalfe-KY). [Freq is usually Nigerian police, but they use different calls.-Hugh]

11175.0 Astro Cat-Unknown U.S. military, patch via McClellan HFGCS, CA, to unknown office regarding parts stocks, at 1345 (Metcalfe-KY). Peach 70-USAF E-8C, radio check with Puerto Rico HFGCS, at 1930 (Stern-FL). Andrews-USAF, Andrews AFB, MD; 32-character EAM simulcast on 6739, 8992, 13200, and 15016; then "standing by for traffic," at 2330 (Haverlah-TX).

11220.0 Offutt-USAF HFGCS, NE, patching Lima Lima 573, a U.S. Navy P-3, to Jacksonville Duty Office, FL, at 2207 (Stern-FL).

11342.0 Fixer 50-Unknown U.S. Military test flight, came from Offutt HFGCS for a selcal check DS-GM, told by New York LDOC that they were on the frequency illegally, and gone, at 1826 (Stern-FL).

11396.0 Djakarta-Southeast Asia air route control, Indonesia, working A6-EBL, an Emirates B777 flight UAE359, at 1910 (Privat-France).

11454.0 TDGAAR-U.S. Army MARS, voice call AAR1DG, calling 3PBFAA, also on 6907 and 7431.5, at 1607 (Metcalfe-KY).

11635.0 SO6s, callup "352 981 6," repeated on 10420 at 0810; at 0800 (Boender-Netherlands).

12124.3 WGY9470-FEMA auxiliary station, VA, ALE sounding at 2022 (Metcalfe-KY).

12365.0 VMC-Charleville Meteo, Australia, weather broadcast at 1544 (Lacroix-France).

12603.5 SVO-Olympia Radio, Greece, Sitor-B bulletins in Greek, simulcast on 22387.5, at 0611 (Waters-Australia).

12750.0 NMF-USCG, Boston, FAX weather chart at 1549 (Lacroix-France).

12993.0 KSM-MRHS commercial coastal station, CA, CW marker at 0254 (Spain-WY).

13261.0 Emirates 412-Emirates A380 reg A6-EDC, answered selcal from Brisbane, at 0721 (Privat-France).

13446.0 FL4FEM-FL Division of Emergency Management, Tallahassee, FL, calling AL4FEM (AL Emergency Management Agency), at 1600 (MDMonitor-MD).

13907.0 LNT-USCG Camslant, calling N14 (HC-144A #2314), COTHEN ALE at 1930. OPB-U.S. Drug Enforcement Administration Operations, Bahamas and Tortugas, Nassau, calling J27 (USCG MH-60T #6027), COTHEN ALE at 2139 (MDMonitor-MD).

13927.0 AFA5QW-USAF MARS, IN, patch to Offutt AFB, NE, for Cast Off (likely E-6B TACAMO), at 1529. Air Evac 32041-IL Air National Guard C-130H number 93-2041, patches to Scott AFB and Fayetteville via USAF MARS AFN4PP (FL) and AFA9AY (CA), at 2210 (Stern-FL).

14396.5 NCS 312-U.S. National Communications System, net control for weekly SHARES national net during Sandy, checking in many MARS stations; also heard NCS 035, NCS 050, WGY9491 (FEMA), KLM569 (Department of Veterans' Affairs), others; starting at 1430 (MDMonitor-MD).

14742.0 Unid-Unknown station sending data messages in short bursts with header "ABCDEF6," also on 20114, at 0916 (Waters-Australia).

14925.0 NAI-Finnish MFA, possibly Nairobi, Kenya, but more likely testing a new radio at home, working ANK, Ankara, Turkey, ALE at 1628 (MPJ-UK).

15016.0 Real Silk-U.S. military, EAM and "standing by for traffic," only simulcast on 11175, at 2340 (Haverlah-TX).

15034.0 Gander-North Atlantic Volmet, Newfoundland, weather observations for Canadian airports, weak at 0320 (Spain-WY).

15867.0 LT2-Unknown COTHEN asset, working J37 (USCG MH-60T #6037), COTHEN ALE at 1540 (MDMonitor-MD).

16213.3 7NCS-Philippines Navy, short Pactor-II messages and with "CENTRO 1NCS de 7NCS," at 0855 (Waters-Australia).

16806.5 NMF-USCG, Boston, Sitor-B hurricane warnings for Sandy, at 1710 (MPJ-UK).

16895.0 ZSC-Globe Wireless, Cape Town, South Africa, idling in Globe Data mode; also on 16898.5 16901, and 22540; at 0803 (Waters-Australia).

16898.5 XSG-Shanghai Radio, China, many Sitor-B bulletins using 4-figure-group code for Chinese characters, at 0712 (Waters-Australia).

17445.0 AAZ-U.S. Army MARS gateway station, probably Ft. Huachuca, AZ, RTTY testing and service message at 2025 (Mike Chace-Ortiz-ME).

17478.5 F040LN-U.S. National Guard, FL; ALE calling H090IN (HI), C010TN (CT), C090AN (CA), D030EN (DE), G090UN (Guam?), HQ701-2-3-5-8N (various headquarters), and more; starting at 1646 (Chace-Ortiz-ME).

17912.0 "14"-HFDL ground station, Krasnoyarsk, Russia, squitters and uplinks to several China Eastern Airlines flights, at 0705 (Waters-Australia).

18000.0 Halifax Military-Canadian Forces, Halifax, NS, working unknown aircraft at 1906 (MDMonitor-MD).

19754.0 LPD-Globe Wireless, Buenos Aires, Argentina, Globe Data idler, also on 22600, at 0846 (Waters-Australia).

19789.4 CPK-Santa Cruz, Bolivia, Globe Data idler, also on 22847.4, at 0831 (Waters-Australia).

21928.0 "16"-HFDL ground station, Guam, squitters and uplinks to aircraft at 0712 (Waters-Australia).

21949.0 "06"-HFDL ground station, Hat Yai, Thailand, squitters and uplinks to aircraft at 0707 (Waters-Australia).





## go2: A New Kid On the Digital-Signals-Decoder Block?

This month, there's news of a semi-professional software decoder and we profile a few interesting networks that you can tune into and help investigate.

### ❖ Go2

Shoc, a long-time Swiss partner of Wavecom have apparently said their farewells recently. Filling the gap in Shoc's digital decoding department is a very interesting-looking suite called "go2SIGNALS". The suite comprises four modules, each with a different but important purpose:

go2MONITOR is the core module and is used to tackle a variety of different challenges in HF, VHF and UHF monitoring. It handles SDR (Software Defined Receivers) control, recording, classification and decoding of signals using a built-in database of signal types. Communication can be monitored in automatic, semi-automatic or manual fashion. All that's required is one of a number of common SDR boxes on the market today. It can also be hooked into a TCP/IP network for remote or custom applications. As you might expect for such a high-end product, there is a very extensive list of data modes supported, including the all-important and now widely used HF 3rd Generation (3G protocols) as are many and different (SDR) receivers.

go2DECODE handles everything to do with signal processing, classification, analysis, decomposition and speech detection. New or customer systems can be added with a "Decoder Description Language," which sounds very handy.

go2RECORD is the part of the system that monitors, records, plays-back and allows extraction of wideband signals and can "watch" a 4, 8 or 16 MHz swath of the spectrum in one operation.

go2ANALYSE is the main suite, toolkit and provides all the required tools to analyze, decompose known or unknown digital signals.

Although still displaying on the Shoc website as "preliminary," some very interesting and detailed screenshots are shown, so its release can't be too far away. Prices are also yet to be published but I fully expect something in the range of Hoka or Wavecom pricing to compete at this level of features and functions. Stay tuned!

### ❖ Pakistani Police

In the September 2011 issue of this column I mentioned a PacTOR-based network that I'd been following for many months through a number of channel changes. The operators chat infrequently in either English or Urdu after messages have been sent. After weeks of not hearing the network, a new daytime frequency of 16.996.2 MHz (center of data) was found by

a UDXF member in October.

Signals continue to be very weak here on the East Coast of the U.S. but the stations are nevertheless audible at scheduled times of 1030, 1130, 1230 or 1330 UTC each day except Friday, the Moslem holy day. Best guess now is that these stations are probably operated by the small contingent of Pakistani police officers supporting the UN peacekeeping efforts in Darfur. Channels used are 16.996.2, 19.188.2, 19.288.2 and 19.348.2 MHz (center of data). Many decoders like MultiPSK can decode the selcal and operator chatter, so definitely an interesting catch if you can hear them.

### ❖ New West African Net?

Yet another PacTOR-based network has been taking a lot of my time lately, but yielding little of late. Perhaps you can help crack this one which was first encountered in 2010 on 14.808 MHz (center of data).

Station "MA1ES" called "PA1RI" for a few seconds before sending a .GIF image using a non-standard PacTOR CRC (error check) of 30038, one that was certainly completely new to me. That's about all I heard for a while until I saw "MA1ES" logged by a fellow UDXF member, but this time using PacTOR-III. I quickly checked the remainder of his logs and had 15841.1 and 13.296.5 MHz to check in addition.

A few more weeks of intensive monitoring of these call signs resulted in the following new selcalls being noted:

AB1UJ  
BA1NJ  
MA1ES  
NO1UA  
PA1RI  
SE1CR

While MA1ES and SE1CR still have me stumped, guessing AB1UJ is Abuja, BA1NJ Banjul and NO1UA Nouakchott makes this very likely some kind of net connecting Paris to West African capitals. A small NGO perhaps? Only time will tell!

### ❖ Polish Army in Afghanistan

With recent announcements to withdraw from their base in Afghanistan, it may soon be your last chance to hear the Polish Army's HF network back to base in Warsaw. Operation is regular and provides strong signals into the U.S. using MIL-188-141A ALE and MIL-188-110A serial tone modem for data from their Harris gear. Occasionally, you'll even hear them on voice. Here are some channels to listen out for:

6514.5, 7640.8, 8756, 8805, 12183.9, 13848.9, 14700, 14696.7, 14969.5, 14851, 16010.5, 16105, 16555, 17055, 18610, and 18556 kHz USB

ASKAR64	Camp Ghazni, Afghanistan
IGIELIT37	
MORTON25	HQ Warsaw
SUDANIT42	
WATFORD87	

Here you can see the FS1052 Data Link Protocol headers including the email addresses of the wireless messaging terminals at either end of the link. Don't try emailing your QSL card to these email addresses, however; this is strictly private networking!

```
21 20 19 18 17 16 15 14 13 12 11 10 9 8
7 6 5 4 3 2 1 0
DATA RATE 600 LONG INTERLEAVER
*****\oúTILEIGIRAK-
SA8D7346ð2aëñ
?Ywmtuser@IGIELIT37.AFGCOMNET.PLß??N
8wmtuser@ASKAR64.AFGCOMNET.
PL?]?¥Vko£Fy\Kb£ñpt?
p"R[%8?Ávivg/Cl?Wáy²Á?16ðbúxw?PÚ]
µ*??;÷Usi=3AyOp\s?!
```

### ❖ Sigmira and STANAG4285

My dad passed along word of a new version of the Sigmira decoder after reading a competition between that software and MultiPSK for decoding STANAG4285 in the UK's "Radio User" magazine. As you probably recall from past columns, STANAG4285 is a 2400 bd modem standard widely used by NATO navies and often the culprit of the "loud, rushing sound" as it is often described by new listeners. It's very prevalent throughout the maritime bands where it has long-replaced the old 50, 75, 100 and 150 bd/850 RTTY or RATT circuits.

Tuning '4285 takes some practice, but try setting the decoder to 600 bps, long interleaver with ITA2 (5N1) coding and tuning to 12313.2 (USB). You should be rewarded with text from IDR, the call sign of the Italian Navy in Rome, looking something like this:

```
//ss3i(0)/ss4i(0)/ss5i(0)/ss6i(0)//
```

Sigmira is a very capable decoder and is developing well. It's also free, so if you like what you see, send the developer a tip. See the Resources section for the website.

That's it for this month. Please keep the letters and emails about subjects or systems you'd like to see covered here. I'll be happy to oblige!

### Resources

go2SIGNALS <http://www.shoc.ch/go2signals.html>  
Sigmira <http://www.saharlow.com/technology/sigmira/>

## Hamsphere: Simulated Radio, Real Fun!

Last month's column introduced the recurring theme, "Solar Cycle Defiance," which looks at ways to enjoy amateur radio that don't depend on elevated sunspot counts and a cooperative ionosphere. We started with meteor-scatter which substitutes ionized meteor trails for energized ions in the ionosphere. Because meteor burns happen every day (sometimes dozens, sometimes thousands), we can enjoy their benefits daily, even if Old Sol is taking a complete vacation.

This month's "defiance" is even farther "out there," as it works just fine, 24 hours a day, seven days a week, 365 days a year; no ionosphere required. It's not ham radio exactly, precisely. But, if you close your eyes, you won't be able to tell the difference. For thousands of worldwide users, licensed and otherwise, it's just what the doctor ordered. The radio may be simulated, but the fun is totally real, and the visceral experience is uncanny.

I'm talking about Hamsphere ([www.hamsphere.com](http://www.hamsphere.com)), an Internet-based, virtual ham radio simulator that lets users communicate with thousands of ham operators and radio enthusiasts in nearly 200 countries using amateur radio protocols via a virtual, simulated ionosphere along with shortwave-like propagation effects. As you'll see, Hamsphere isn't a simple VOIP transceiver simulator, it simulates amateur radio as a whole, including the ionosphere, noise, interference, fading, voice and data modes, PC logging, LOTW, nets, awards, QSL cards, QSL bureaus, even contests and QSO parties! The quality, cost and convenience of the Hamsphere system really sets it apart, and this type of sophisticated simulated ham radio, with not a single watt of RF emitted, deserves your consideration.

### Like a Video Game for Hams

Computers, the Internet and "smart" devices (phones, tablets, TVs, etc.) are an inseparable part of our everyday lives, and if you think about it, almost everything that's "fun" these days is also "simulated" (as is everything scientific, from nuclear bombs, to drugs, to economics). You can play tennis at your community courts, or you can "play" tennis on your favorite TV-attached gaming system. You can buy a Ferrari at your local dealer (for \$100,000 or so), or you can simulate the experience by playing *Need for Speed* on your shiny new PC (with a



*Hamsphere's simulated ham radio looks and works like a typical amateur radio SDR transceiver. The chat window/spotting cluster display at the left is just a bonus! Get yours at [www.hamsphere.com](http://www.hamsphere.com)*

half-dozen of your Internet friends from around the world).

Similarly, you could buy a beautiful (and expensive) place in the country (selling your affordable urban, deed-restricted rambler), complete with space for an awe-inspiring antenna farm, or you can experience amateur radio (minus the radio) through the magic of a simulated digital transceiver and a global, simulated ionosphere that supports and enables the efforts of thousands of real radio enthusiasts.

Hamsphere is like a video game for hams (and non-hams who want to learn about amateur radio while "playing radio"). The Hamsphere transceiver looks and works like an actual radio, and the people you QSO with are hams or radio enthusiasts who use ham radio protocols. As I said, if you close your eyes you really can't tell that Hamsphere is a simulation.

### Hamsphere 3.x

Created by programmer Kelly Lindman 5B4AIT, a Scandinavian ham who now lives in Cyprus, Hamsphere 3.0 supports voice and data QSOs via a virtual multiband transceiver. Because no RF is emitted you don't have to be a licensed ham to use the system. After a free trial period, Hamsphere membership costs 30 Euros a year (about \$38 at press time, which is about \$3.16 a month). Because it's JAVA-based, Hamsphere 3.x runs on Windows, Linux and



*Because Hamsphere knows the call sign, location and name of every user, the transceiver features a built-in, semi-automatic logbook that makes QSL card exchanges and awards-tracking a snap. Shown here are my first two QSOs with VK7AE and 29HS132.*

Mac PCs, and apps are available for Apple and Android-based tablets and smartphones. (True to form, smartphone users sign "portable" as they use their phones and tablets like mobile HTs!)

The main part of the software transceiver has the usual VFO and frequency controls. It's based on SDR technology, and the radio has an SDR-like band-scope display that makes it easy to find signals. The radio also has adjustable AGC and filter bandwidths, memories, sophisticated speech processing, and more. As I said, it's a simulated radio, and it looks and "works" the part. The left side of the rig includes a chat window, a DX Cluster and a server selector (there are several Hamsphere servers globally), which makes for easy point-and-click tuning.

The most startling thing about Hamsphere is that it sounds like real radio: pops, clicks, heterodynes, off-frequency "Donald Ducks" and all. Although the global system uses VOIP technology to transport audio streams back and forth between users and servers, as part of Hamsphere's sophisticated simulation technology, audio signals are converted to DSB (double sideband) signals in the system's SDR-based DSP engine! When you tune off frequency with your radio's VFO, hams and "broadcast stations" (yes, they're there, too!) sound "mistuned" and "off frequency," just like real life!

For an even more immersive experience, the system simulates ionospheric and propagation effects, man-made and atmospheric noise, interference; even broadcast, spy, numbers and pirate radio signals! As you listen, signals and noise levels fade up and down, and interfering signals pop in and out. It's eerie! As your voice QSOs progress, for example, the occasional "chirp chirp chirp" from simulated SITOR/AMTOR stations might fade in and out, and because the system is "open," other ops can QRM you by transmitting on frequency (although this doesn't often happen in a malicious way).

SWLs have plenty to listen to as well, as Hamsphere includes a "shortwave broadcast band," complete with a half-dozen voice and music broadcasts (DSB signals like any other on the system) that are also subject to noise, fading and propagation. Users can gain "broadcast rights" and program their own content. When I was tuning around I listened to Leo Laporte's "The Tech Guy" AM radio show and an older TWIAR (This Week in Amateur Radio) podcast, stuff I'd actually like to find on the shortwave bands!

## A Couple of QSOs

If you like DX ragchews but don't have the RF or the aluminum to make them happen, Hamsphere is for you! Earlier tonight I had a nice chat with Andre VK7AE, who lives on the scenic northern coast of Tasmania and has been a ham for many years. With a Five-Band DXCC plaque on the shack wall as proof of his "real world" radio prowess, you'd think that Andre would be enjoying radio the old-fashion way instead of "simulating radio" on Hamsphere. But Andre, who got started on the Hamsphere system in 2008, likes the system's reliability and the "real radio" feel. He also likes to practice foreign language QSOs, which Hamsphere provides aplenty.

We worked via SSB on 7.030 MHz (don't try that in real life!), and Andre was kind enough to show me the ropes of setting my mic gain and TX power. The Hamsphere transceiver has a selectable speech processor, a mic gain control, an ALC modulation meter, and users have to adjust their settings to keep from overdriving the DSB-based radio system. It's a lot like working through a satellite transponder. If your signal is too "big" it will hog transponder resources and produce splatter, just like real life.

I hadn't yet noticed an idiosyncrasy of my transceiver (during testing on 1.82345 MHz, which is an echo recorder that lets you hear your own signal, my ALC levels seemed fine, but during an extended go-round my levels drifted up and I received a large red warning message from the server itself to "reduce my mic gain!"). Yikes! I was already a LID!

Andre also showed me the basics of using the built-in automatic logbook and QSL card systems. Talk about slick. Real-time, persistent logging, LOTW-like awards-tracking services and an instantaneous QSL Bureau are also part of Hamsphere!

After a half-hour or so, VK7AE's buddy, Tony 29HS132, from "The Republic of Ireland," broke in and we began a roundtable QSO. Tony, a salty character with a fine and definite brogue, has been a steady Hamsphere user for four years (he's now a system moderator), but he's not a licensed ham, as his call sign, 29HS132, indicates. Keeping to form, Hamsphere has its own "simulated ITU" that issues call signs based on prefix (29), "ham sphere" (HS), and suffix (132). As I understand, Tony was the 132nd "licensee" from Ireland (prefix 29). Licensed hams use their own call signs, while unlicensed ops receive unique "HS" call signs when registering with the system.

This QSO reminded me of the good old days. It was 10 in the evening for me, 4 AM for Tony, and 1 PM the next day for Andre. I can barely remember when the ionosphere was that accommodating. Not that we had armchair copy. There was plenty of QSB, including a couple of deep dips, but the chat/cluster window made it clear that Andre was still on frequency. Sure enough, signals came back up and we continued. The two gents went straight into my electronic logbook and



*One of the most fascinating features of the newest version of Hamsphere is an integrated QSL design and QSL exchange system. Shown here is VK7AE's QSL card, made out to me and filled in with my call sign and QSO data, delivered in real-time as we talked. The system further tracks this "confirmed QSO" for awards purposes! Through a variety of online templates the system will help you make a standard card or let you upload images to make a unique QSL. Just to be Old School, I printed Andre's card on a color inkjet printer and pinned it to my bulletin board!*

QSL cards were promptly exchanged and received. Wow!

A few years ago (before Hamsphere included the logbook, QSLs, etc) I worked Gerard, 19HS114, from The Netherlands. He was never a ham but had spent some time on 11 meters "back in the day." We thought it was somehow funny that we were both 47 years old and that we both used to listen to Radio Nederland, broadcast from Hilversum, Holland.

Rich, 2HS706, a veteran CBER from Liverpool, New York, likes Hamsphere because the system's simulated 11-meter propagation (it's a Hamsphere "band") is a whole lot better than the actual propagation on 27 MHz nowadays. Before we made much progress, however, the Hamsphere server (there was only one back then) went down for maintenance (it was in the middle of the night, when the ionosphere can easily crash!).

## Other Features

The latest version of the Hamsphere system is brimming with features, including nine virtual ham bands (plus 11 meters and a realistic 48-meter broadcast band); a DSB XCVR with a virtual power output of 1 to 2500 W, receiver bandwidths of 3.8, 2.8 and 0.8 kHz; an FFT-based bandscope, an S-meter, a digital VFO with 10-Hz increments and 9 programmable memories; speech processing and adjustable VOX; a DX spotting cluster and semi-automatic logbook; QSL cards and a QSL exchange; smartphone apps for Apple and Android (not in free trial); digital and analog SSTV; a large auto-tracked awards program; on-air contests; 24-hour support; comprehensive user forums; an e-mail-based DX alert system; and a blogging platform for users. Phew! There are actually *more* features, but I don't have the space to address them here. You can see them all at [www.hamsphere.com](http://www.hamsphere.com).

## Just Try It!

If you encounter some online grousing and griping about how systems like Ham-

sphere "aren't real radio," be sure to try it on for size before making a decision. Like the video games and simulators we all enjoy in other areas of life, Hamsphere knows it's not "real," but its ever-improving simulation of global amateur radio systems is fun, it connects us with real-life radio enthusiasts who speak our language, and it's tremendously educational. Hamsphere provides hands-on training for thousands of users and has helped some 600 users to date get their real-world tickets.

Hamsphere is much more reality-based than many other simulators. When I'm flying a 747 in a computer flight simulator, for example, the experience is interesting, inspirational and enjoyable (especially when I survive crashes, etc), but in no way do I *really* feel like I'm flying a big jet. The same goes for driving that simulated Ferrari while fleeing from simulated police cars. With Hamsphere, at least, the simulation is much more like the real thing (sitting in a "shack" with a PC screen, a headset mic and a software radio that looks, works and sounds like the real thing, all the while talking to other hams who are exclusively using ham protocols). That, folks, is awfully hard to differentiate from ham radio!

If you're a typical ham with a dipole and a 100 watt transceiver, you'll never (or rarely) have the opportunity to have interesting, lengthy ragchews with DX ops the likes of which Hamsphere provides on a daily basis. If you live in an area where effective antennas are impossible, Hamsphere is as close to having a kilowatt amplifier and a stack of beam antennas as you're likely to get. If you're a beginning ham or are interested in becoming a ham, Hamsphere can provide unparalleled hands-on training, even if there aren't any Elmers in your home town. And if you are a ham, as are about a third of Hamsphere users, there's nothing keeping you from enjoying real and simulated radio. As my Elmer used to say, "Radio is radio," and Hamsphere, built with SDR technology and brimming with DSB signals, *is* radio.

In the spirit of Solar Cycle Defiance and all-around good fun, I *simu-dare* you to try it!



## Product Recommendations Update

One of the most frustrating things about writing product reviews is that it almost seems manufacturers take such reviews as a cue to discontinue the product. I mentioned, in the November issue of this column, the nearly universal disappearance of table-top HD radios a few years ago. Though there were a lot of excellent HD radios on the market, the public was not interested, so the manufacturers discontinued them. I mentioned in November the Boston Acoustics HD Receptor as one such product I wished I had bought, but didn't, and now it's gone. As I scrutinize the same column, I'm painfully aware that they've done it to me again. The Boston Acoustics Solo II mentioned in the column as a replacement for the Receptor has also been discontinued.

This particular case points up the further frustration of Google. When I Google that particular product, as this is written, the top five on the list of sellers that claim to have the product turn out to be "out of stock," "unavailable," or "discontinued." Even on Overstock.com, where they had discounted the product to \$103, it is no longer available. Why would they do that? Well, they want you to go to their web site and, if it happens that the product you were looking for isn't available, they're hoping you'll stick around and see what else they have as a possible replacement. But, if you're not really looking for substitutes you'll be as frustrated as I was.

In this case, the substitute on offer is the Boston Acoustics Duo-i Plus, essentially an upgraded version of the Solo II, except that it has two speakers, an iPod/iPhone docking station and a \$250 price tag. If you were just looking for a great monaural AM/FM table radio, you were too late, but if you want a great, full-featured stereo WiFi AM/FM table radio, get it while it's still in production!

### ❖ Sangean HDT-1X

For several years the Sangean HDT-1X was at the top of my recommended list for component AM/FM HD-Radio tuners. It outperforms my Onkyo stereo receiver on both AM and FM bands, has excellent features (including a very sensitive signal strength meter) and, so far, was the best HD receiver on the market. About two years ago I noticed that Crutchfield had stopped carrying it; "discontinued," their web site noted. I asked the manufacturer about it and was assured that it was still in production. Maybe it was, but shortly after my inquiry, the product was no where to be found at any price. I'm just glad I had the sense to buy it when it was available. It has been my main AM/FM HD-DX tuner since. I still haven't found anything better.



Look familiar? UE Smart Radio from Logitech (left) replaces the Squeezebox Radio (right) and, on the outside, they are practically identical. (Courtesy: Author)

### ❖ Logitech Squeezebox Radio

I bought the Logitech Squeezebox Radio as my first Internet radio two and a half years ago and have been singing its praises since. When friends and relatives are visiting I do a demonstration of the product that usually results in an immediate online purchase, it's just that great of a product. It did have a couple of drawbacks, most notably it didn't come with a battery back-up or remote control, but it was an otherwise outstanding WiFi radio. Since then I've looked at many new and different models of WiFi sets and found that none came close to the Squeezebox's features, including audio fidelity and full-color, full-data screen display. With their \$50 optional battery pack and remote control it became a very versatile and portable Internet radio.

Sure enough, last fall Logitech unceremoniously discontinued the product, which had been on the market just three years, and faced howls of protest from its legion of Squeezebox fans. On the plus side, its replacement, the Logitech UE Smart Radio (\$180), which is practically identical, is actually better. To their credit, Logitech was quick to address the issues raised by Squeezebox owners on their official blog [blog.logitech.com](http://blog.logitech.com):

"All of you who own a Logitech Squeezebox Radio will have the option to upgrade to the Logitech UE Smart Radio platform, and take advantage of the new and improved software and mobile apps. This upgrade is completely optional, and those that don't want to alter their Logitech Squeezebox experience will not be required to. If you are a mixed Squeezebox household, I wanted to make sure you knew that while the Logitech UE Smart Radio can play alongside existing Logitech Squeezebox products, it will operate and be controlled separately.

"Also, we will continue to provide troubleshooting and support for Logitech Squeezebox users at [www.logitech.com/support/speakers-audio](http://www.logitech.com/support/speakers-audio). The current [mysqueezebox.com](http://mysqueezebox.com) website and Squeezebox Controller Mobile App will continue to work with existing Logitech

Squeezebox devices. The new [www.uesmartradio.com](http://www.uesmartradio.com) website and Logitech UE Smart Radio Controller App is designed for Logitech UE Smart Radios, as well as those who upgrade from a Logitech Squeezebox Radio."

The new product comes with a rechargeable battery built-in (a considerable plus that makes the product portable, within your home router's reception range) and is controllable via your smartphone or iPad. Sorry, there's no separate remote control available, so if you don't have either of those devices you'll just have to sit close by to change channels, raise the volume or search for new stations. However, I found that the original Squeezebox remote works with the UE Smart Radio (order one before they're gone!).

The Smart Radio lets you add popular services to the home page of the receiver such as:

**Live Radio** by Tunein: Finds most of the local radio stations in your local area, depending on where your Internet Service Provider (ISP) is located, including the local EMS and police scanner retransmissions. In my case it provided the scanner services from several counties away. But, I had no trouble searching for my local services and adding them to my "favorites" list for easy retrieval.

**Absolute Radio UK:** Offers British-based Absolute Radio 1215 (rock) and Absolute Classic Rock, both DJ announced and ad-supported.

**AccuRadio:** 40 commercial-free and announcer-free music genres including Classical, Piano Jazz, Classic Rock, Indie Rock, Celtic, Latin, World, you name it. The mix is well done and the channels go deep into each style.

**BBC:** 13 BBC services, including World Service and BBC 4 Longwave are available.

**CBC:** Including CBC Radio 1 (13 provinces and territories, Arts, News and Current Affairs as well as Regional podcasts); CBC Radio 2 (covers five time zones), and CBC Radio 3. CBC music genre programming is blocked to U.S. listeners.

**Live365:** Hundreds of ad and premium services. Ad-supported channels are free after an account

has been set up, premium VIP streams are as low as \$6 per month. Five day free trial when you set up an account. Many Live365 programmers may be found through a simple search on most WiFi radios.

**Sky.fm:** 40 ad-supported music channels or choose SkyFM Premium (\$5 per month or \$50 annual subscription) and get ad-free, better audio stream and unlimited listening.

**SomaFM:** Begun in San Francisco's Market Street area more than ten years ago, SomaFM brings the public radio, listener-supported funding concept to streaming audio. It features 18 channels of the hippest, indie-records sounds with channel names such as Drone Zone, Suburbs of Goa, Secret Agent, Space Station Soma, Sonic Universe, Digitalis and well, you get the picture. My favourite channel for now is Mission Control which features vintage NASA mission audio (including Apollo moon missions) combined with ambient music. Far out!

You may also add pay services such as Pandora One (\$36 per year gives you unlimited listening, slightly better audio fidelity and no commercials); Rhapsody (\$10 per month gives you unlimited streaming, no advertising for one device; \$15 per month for 3 mobile devices), MOG (\$5 per month with annual subscription), another custom stream service with 14 day free trial on a 320 kbps stream.

When you first set up an account for your SmartRadio you can also sign up for a one-month trial subscription to Sirius/XM Internet streams, a pretty good deal; if you don't care for the hundred plus channels offered, the service will be turned off after the 30 day period. If you do like it, you'll be charged \$14.50 per month. The big advantage with using your SmartRadio for Sirius/XM at home is that you don't need to fool with stringing an antenna up and it won't matter if you can't "see" the Sirius/XM satellites.

You can even add "natural sounds," which include not quite realistic "lapping waves" and "ocean surf." To add new services all you have to do is log in at [uesmartradio.com](http://uesmartradio.com) and click on those services you wish to add, they magically appear on your Smart Radio in seconds.

## ❖ Wireless Scanning

Jim Stellema KA8ZXJ recently wrote, "Is there such a thing as an adaptor for a scanner radio or any radio that has an earphone jack, to make it like a Bluetooth or wireless? I listen to the scanner while in bed with an ear-bud, but it get's tangled or pulls out of my ear. And, when doing yard work it will get pulled out of my ear. I would like something wireless. Is there such a thing?"

Yes, but there's no cheap way to do it. I use a C. Crane Part 15 FM transmitter (about \$60) into which I can plug any source: transceiver, scanner, stereo, etc. and broadcast on the FM band to any radio in the house. I use a WorkTunes ear protector AM/FM headset (about \$50) when I'm doing yard work. I can listen cord-free that way while I'm working anywhere outside with a 100-200 foot range. It's great to plug the transmitter into an Internet radio too; radio from all over the world in my headset outside! You can also try a wireless headphone adapter such



*C. Crane FM transmitter (\$60) and AO WorkTunes (now 3Miekk) AM/FM headset (\$40). (Courtesy: Author)*

as this one from Amazon: [www.amazon.com/?ie=UTF8&page=1&rh=n%3A172282%2Ck%3Awireless%20headphone%20adapter](http://www.amazon.com/?ie=UTF8&page=1&rh=n%3A172282%2Ck%3Awireless%20headphone%20adapter). With this method you basically just take the output from your scanner and transmit it to wireless headphones. There are models that are over-the-ear and in-the-ear; the in-the-ear would work best for your application.

Here's Jim's follow up:

"From eBay I purchased the BluBridge mini-jack (\$25) and from Amazon I purchased the LG TONE HBS-700 Bluetooth Stereo Headset (\$46), which is an ear bud type headset. Each product comes with a small user manual which is easy to understand. After pairing the transmitter and the headset, which was very easy, I put them to use. First, I used them on my Sony walkman, as seen in the picture, and it worked great. One caveat is that the Sony walkman is very directional but the Bluetooth worked as it should. Then I tried it on the Uniden BC246T scanner and it worked fine. This Bluetooth setup will work on any piece of electronics that has a 1/8 inch earphone jack and has a range is about 30 feet.

"I wanted something like this when I work out in the yard, mowing, raking etc, I carry the radios in my pocket. I found it works well indoors too, I can listen to a scanner while watching TV and not disturbing my wife, a plus. I tried this Bluetooth setup on the TV and it worked great except that there was a slight delay in the audio to lip movement. All in all I am happy with this setup and I'm not tied to the radio with wires."



*One reader's solution to listening privately to his scanner at home. (Courtesy: Jim Stellema KA8ZXJ)*

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## Music Makes the World Go 'Round

**W**elcome to the January 2013 Programming Spotlight, the Mayans notwithstanding. It is hard to believe that 2012 is finished and another new year has begun. The new year brings many opportunities to hear some new and diverse programming on the shortwave bands. This month we shine the Programming Spotlight on some of this diverse music, Asia-Pacific affairs and programs from an old friend.

One of the highlights of January is Orthodox Christmas. The sounds associated with this occasion include some of the most hauntingly beautiful and spiritually uplifting music one will ever hear. The **Voice of Russia** is sure to feature this music in early January editions of *Religion and Society* on UTC Sundays at 0200. Try 7250 kHz. Other programs will probably feature this music so listen often. Orthodox Christmas is on Monday, January 7, 2013.

Speaking of the **Voice of Russia**, after discussing *Folk Box* in a recent edition of the column, I received this email from reader Rob Holman in Flat Rock, Michigan: "I discovered *Folk Box* on **Voice of Russia** a few years ago and try to catch it on shortwave when I can. I know it's available as a podcast on the **VoR** website and have occasionally listened to the show there, but it's still a thrill to me to listen on shortwave radio. *Folk Box* does have a diverse selection of tunes. With Russia being such a geographically large country, the cultures and styles of folk music are amazingly different. I've been a 'world music discoverer' since the 1970s and I'm still hearing music that is new to me. Hopefully this will continue as the world's cultures are getting very homogenized! I plan to tune (mouse?) in to your new endeavor *The Radio Time Capsule*. Good luck with it. I enjoy your *Monitoring Times* articles each month."

Thank you Rob for the feedback. It is always good to hear from readers. I like your statement that you are a 'world music discoverer.' I have always loved music from all over the world, all forms, all styles. Growing up I had my music (Top 40 radio), my father was a country and big band fan, my mother favored standards and softer pop, and my friends liked classical music. I was exposed to everything and then I discovered shortwave.

Shortwave radio was, and still is, a great way to discover a vast array of music and musical styles from around the world. One can stumble onto any number of fascinating musical treats just by travelling up and down the dial. Two examples come to mind. A few years ago I happened to tune in to a seemingly obscure frequency which was carrying what I presumed to be some sort of Chinese opera. At first I was amused by it, derisively referring to it in my notebook "Radio Edith Bunker," because of the vocal style of the singer. Yet, I kept listening

and found it to be quite entrancing. I have no idea to this day what it was all about, yet it was a memorable and entertaining experience.

At other times I have tuned into Arabic broadcasts and have heard some pretty wonderful music. While I am good with many languages, Chinese and Arabic are lost on me, but that doesn't prevent me from enjoying some of the programming. Stations from the Arab world often have some very enjoyable output, from the melodic sounding Arabic language, to the incredibly beautiful sounding call to prayer. And in between, the music is unique and stunning. While spinning the dials, or scanning the frequencies, give these stations a chance to sink in. You'll be glad you did.

In late October a strange music loop, mostly in French was heard via Sackville on 5960 kHz. It was apparently the **Radio Canada International** transmitters playing out the last days on air. They offered an eclectic mix of mostly French, smooth, jazzy tunes. It just goes to show you that the shortwave bands are full of surprises. You never quite know what you are going to get and half the fun is in the discovery!

### ❖ Treats from Australia

For early risers, **Radio Australia** has always been a popular listening choice. Over the years, 9580 kHz has been a reliable source of news and entertainment. One program is of particular interest for news junkies such as myself. I like to catch the last hour or so of *Live Talk with Tracee Hutchison*. When I get up the program is in progress. It can be heard from 0800-1100 UTC weekdays. Tracee has over 30 years of broadcasting experience and it shows in the presentation. She is a real pro.

The program looks at any number of stories happening in Australia and around the world. In late October it was particularly interesting to hear the coverage of Hurricane Sandy, then dominating headlines around the planet. That storm caused much havoc in broad swathes of the United States and Canada. Even here in the Niagara region of Southern Ontario, the storm blasted us. A very unusual circumstance indeed.

Reports on the storm damage, the economic impact and recovery efforts were concise and informative.

*Live Talk* combines the talents and news resources of both the **ABC** and **Radio Australia**, making for a very informative program for those in Australia wanting to

know about world events, and for those abroad who want to know what is happening in Australia. Of course the always authoritative **Radio Australia** newscasts keep one up-to-date on all the important news of the day.

At 1100 UTC weekdays, *Live Talk* is followed by *Asia-Pacific* the long-running **Radio Australia-ABC** co-production. As the name implies, *Asia-Pacific* focuses on events and news in the Asia-Pacific region. It is a fast-paced half hour of news and features about a region which all too often is neglected in the North American media.

Recent editions have covered parliamentary elections in Vanuatu, concerns about the Chinese banking sector (record profits but loads of bad debt) and the draw down of Australian forces from Afghanistan.

*Asia-Pacific* is hosted by Sen Lam and is one of the most comprehensive programs available about this increasingly important region. Make **Radio Australia** a regular morning routine for news and current affairs with a different perspective.

Before we leave the discussion of radio stations in the South Pacific, a reminder that this is summer time in the region and you will hear a lot of summer fill-in programming. Sometimes it is a disappointment to find out a favorite program is on summer hiatus, but just as often one discovers a real gem in the mix.

### ❖ Deutsche Welle Shortwave Possibilities

**Deutsche Welle** has severely curtailed its shortwave broadcasting but one can still potentially hear it via this medium. During the winter season, **DW** can be heard via the Kigali, Rwanda relay station, beaming programming to its principal target area in Africa. This makes **DW** something of a DX target, but one may still hear some old favorites. My reception conditions of late have been pretty sketchy, more a function of my location than anything else. Nevertheless, I have tentatively heard **DW** at 0400 UTC on 9420 kHz. Try for them at that time on 5905, 7285, 9420 or 9470 kHz. I miss the regular North American Service, which I always found well produced and informative. Many long-running **DW** programs have been axed for some time, but some old favorites remain such as *Inside Europe* (UTC Mondays), *Living Planet* (UTC Fridays) and *Spectrum* (UTC Tuesdays). Give these frequencies a try for a chance to listen to a once very popular radio station.

Finally, as Rob mentioned in his email, I have been doing a radio show on **Radio Scooter International**. It has given me a new appreciation for all those people in the broadcasting world who get behind the microphone every day.



*Radio Australia decal from the 1980s (Courtesy: Author)*



## Stamps and More for 2013 QSLing

The radio hobby, whether medium wave, shortwave or amateur radio, agree there is only one source for foreign stamps and DX supplies. Bill Plum's Airmail Postage and DX Supplies, offers hobbyists a source for worldwide postal stamps, that can be enclosed within outgoing reception reports.

Stamps are enclosed in a glassine envelope, eliminating the worry of stamps sticking to your letter. Among the DX supplies are European Air Mailer and European Air Return Envelopes, an excellent alternative to the smaller U.S. sized airmail envelopes. To learn more about Bill's products line or the current postage stamp price list, send email to [plumdx@msn.com](mailto:plumdx@msn.com) or write him at: Bill Plum's Airmail and DX Supplies, 12 Glenn Road, Flemington, NJ 08822.

**Radio Algérienne** has resumed broadcasting on shortwave, using transmitters in Issoudun, France. The current Arabic schedule is available in *MTXpress*. Send program

details to: Radio Algérienne, 21 Boulevard des Martyrs, 16000, Algiers, Algeria. Streaming audio at [www.radioalgerie.dz/](http://www.radioalgerie.dz/)

Victor Goonetilleke informs DXers of a new contact from **Bhutan Broadcasting Service**. Victor states, "they have no QSL cards, so he is sending personal replies. I prepared my QSL text, which he can cut and paste for ease." Send program details to Kaka Tshering, General Manager at [kakatschering@bbs.bt](mailto:kakatschering@bbs.bt)

Curious about the presence of shortwave during the Cold War era? It was a time when a plethora of stations flooded the airwaves with an entertaining and ideological stance of East against West. *The Glory Days of Shortwave Radio* is presented by Georgi Bancov of SWL DX Bulgaria. The 41 minute video brings an extensive video of interval signals, identifications and QSLs, presented in alphabetical order by-country at [www.youtube.com/watch?v=sf\\_UzdVtYKQ](http://www.youtube.com/watch?v=sf_UzdVtYKQ)

ing, plus prepared QSL card returned as verified. Received in nine days for an AM report, prepared QSL card and one mint stamp. Station address: 111 Broadway, 3<sup>rd</sup> Floor, New York, NY 10006. (Van Horn) Streaming audio [www.wor710.com/](http://www.wor710.com/)

WQLR 1660 kHz AM. *The Fan*. Full data prepared QSL card returned as verified by Peter F. Tani, V.P. of Operations, plus coverage map and sticker. Received in nine days for an AM report, prepared QSL card and one mint stamp. Station address: 4200 West Main, Kalamazoo, MI 49006 (Van Horn) Streaming audio <http://1660thefan.com/>

### MYANMAR

Radio Thazin, 7110 kHz. Generic style email reply, thanking me for listening. Email indicated though a new station, they are trying to get better performance. Received for monitoring their English program 1430-1500 UTC. Reply received in less than two hours for email to [thazinradio@yahoo.com](mailto:thazinradio@yahoo.com) (Ron Howard, CA/DX Fossils/NASWA)

### SOMALILAND

Radio Hargeisa, 7120 kHz *The Voice of the Republic of Somaliland*. No data E-QSL confirming reception only, from Saafi Ali, Online Officer. Received for an E-report to [radiohargaysa@hotmail.com](mailto:radiohargaysa@hotmail.com) (Howard)

### UTILITY

Brazil-Babitonga Patrol Ship, 12681 kHz. Full data prepared QSL card returned as verified by 1<sup>st</sup> Lt. Raphael Cruz Rangel de Souza. Received in 92 days for a utility report. QSL address: Comando Do 5<sup>o</sup> Distrito Naval, Av. Almirante Cerqueira e Souza, 70 Rio Grande, RS Brazil. (Roberto Landolfo/UDXF)

Germany-Hamburg Radio, 13146 kHz. Full data QSL card, signed by Reiner Dietzel. Received in 23 days for a utility report. Station address: DP07 Seefunk, Esteich 84, 21129 Hamburg, Germany, (Patrick Robic, Austria/UDXF)

Honduras-Cenamer Radio, 10024 kHz. No data letter and prepared QSL card returned, signed by Jorge Rodriguez, Jefe Unidad de Coordinación de Búsqueda y Salvamento. Received in 58 days. QSL address: Corporación Centroamericana de Servicios de Navegación Aérea COCESNA, Centro Coordinador de Salvamento, RCC Centroamerica, Apartado Postal No. 660, Tegucigalpa M.D.C., Honduras. (Robic)

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[www.dxtreme.com](http://www.dxtreme.com) - Log DXtremely with DXtreme Software!

### BANGLADESH

Bangladesh Betar, 7250 kHz. Full data color *Tribal Girl* card in headdress. signed by Abu Tabib Md. Zia Hasan, Senior Engineer. Received in 30 days, by postal mail, in reply to email report to [rrd@dhaka.net](mailto:rrd@dhaka.net) with attached audio clip. Station address: Research & Receiving Center, Bangladesh Betar 121, Kazi Nazrul Islam Avenue, Shabag Dhaka-100, Bangladesh. (Supratik Sanatani, Kolkata, India/playdx) Streaming audio [www.betar.org.bd/](http://www.betar.org.bd/)

### GUATEMALA

Radio Verdad 4055 kHz. Full data QSL and personal letter signed by Dr. Edgar A. Madrid, Director, plus pennant and station info pamphlet. Received in four weeks for an English report and currency. Station address: Apartado Postal 5, Chiquimula, Guatemala. (Artur F Llorella, Catalonia, Spain/HCDX) Streaming audio [www.radioverdad.org](http://www.radioverdad.org) Email: [radio.verdad.em@gmail.com](mailto:radio.verdad.em@gmail.com)

### MEDIUM WAVE

Luxembourg-RTL 236 kHz AM. Full data station QSL card, unsigned. Received in 18 days for an AM report. Station address: 45, boulevard Pierre Frieden, L-1543 Luxembourg. (Christian Ghibaudo/playdx) Streaming audio [www.rtl.lu/](http://www.rtl.lu/)

Mexico-XEFD 590 kHz AM. Full data prepared QSL card returned as verified by Ing. Sergio Gutierrez. Received in 93 days for fourth follow-up. Previously sent reports in 2001, so actually seven follow-ups. QSL address: Blvd. Hidalgo 200-A, Fracc Polanco, 88710 Reynosa, Tamaulipas, Mexico. (John Wilkins, Wheat Ridge, CO/NRC DX News 80-03) Streaming audio via tunein <http://tunein.com>

USA-KCCY, 1350 kHz AM. *Pueblo's Legendary Country*. Full data prepared QSL card returned as verified by Jenna J. Mangino, plus note.

Received in seven days from follow-up. Station address: 1350 KCCY, 106 West 24<sup>th</sup> Street, Pueblo, CO 81003 (Wilkins). Streaming audio via iHeart [www.1350kccy.com](http://www.1350kccy.com)

USA-KCJJ, 1630 kHz AM. *The Mighty 1630*. Full data prepared QSL card returned as verified by Tom S., General Manager. Received in nine days for an AM report, prepared QSL card and one mint stamp. Station address: KCJJ Radio, 845 Quarry Road, Suite 120, Coralville, IA 52241 P.O. Box 2118, Iowa City, IA 52244. (Loyd Van Horn, SC) Website: [www.1630kcjj.com/](http://www.1630kcjj.com/)



WBT 1110 kHz AM. *Charlotte's News Talk*. Full data station logo card with illegible signature. Received in seven days for an AM report, prepared QSL card (not returned) and one mint stamp. Station address: One Julian Price Place, Charlotte, NC 28208 (Van Horn) Streaming audio [www.wbt.com/](http://www.wbt.com/)

WFBL 1390 kHz AM. *CNY Talk Radio*. No data email response from Don Wagner, General Manager [d.wagner@imgiradio.com](mailto:d.wagner@imgiradio.com). Received several hours after email follow-up. Original AM report sent with two mint class stamps. Station address: CNY Talk Radio, 8456 Smokey Hollow Road, Baldwinsville, NY 13027. (Al Muick, PA/HCDX) Website: [www.wflb.com/](http://www.wflb.com/)

WOR 710 kHz AM. Full data station card, signed by Timothy Reill, W2TRP, V.P. of Engineer-

## HOW TO USE THE SHORTWAVE GUIDE

0000-0100 twhfa USA, Voice of America 5995am 6130ca 7405am 9455af  
 ① ② ⑤ ③ ④ ⑥ ⑦

### CONVERT YOUR TIME TO UTC

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

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

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 broadcast ⑤ will appear in the column following the time of broadcast, using the following codes:

<u>Codes</u>	
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 condi-

tions, 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

### MT MONITORING TEAM

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### Additional Contributors to This Month's Shortwave Guide:

*Thank You to ...*

AOKI; BCL News; Cumbre DX; DSWCI/DX Window; Hard-Core DX; DX Re Mix News 751-755; HFCC; BCDX/WWDX Club/Top News.

A.J. Janitschek/RFA; Adrian Sainsbury/R NZ Int'l; Alan Roe, UK/Contact; Aleksandr Diadischev, Ukraine; Alokesh Gupta, New Delhi, India; Andreas Volk, Germany/ADDX; Arnulf Piontek, Berlin, Germany; Ashik Eqbal Tokon, Rajshahi, Bangladesh; Cladius Dedio/AWR; Dan Elyea/WYFR; Dr. Hansjoerg Binner, Germany; Derek Kickbush/HCJB Australia; Nigel Holmes/R Australia; Brenda Constantino/WYFR; Elena Osipova/VO Russia; Georgi Bancov, Bulgaria; Ivo Ivanov, Bulgaria; Harold Frodge, MI; Jose Jacobs, India/DXIndia; Juan Franco Crespo/RHC; Mauno Ritola, Italy; Michael Puetz/MB; Sean Gilbert UK/WRTH 2012; 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	Egypt, R Cairo	9965am	11510al
0000 0030	USA, BBG/VOA	7560as	
0000 0045	India, AIR/External Svc	6055as	9690as
		9705as	11710as 13605as
0000 0045 DRM	India, AIR/External Svc	11645as	
0000 0045	USA, WYFR/Family R Worldwide		11650as
0000 0057	China, China R International		6005eu
		6020as	6180eu 7350as 7415as
		9425as	9570as 11650as 11790as
		11885as	
0000 0100	Anguilla, University Network		6090na
0000 0100	Australia, ABC NT Alice Springs		4835do
0000 0100	Australia, ABC NT Katherine		5025do
0000 0100	Australia, ABC NT Tennant Creek		4910do
0000 0100	Australia, ABC/R Australia	9660pa	12080pa
		15240pa	15415pa 17795pa 19000pa
		21740pa	
0000 0100	Bahrain, R Bahrain		6010me
0000 0100	Canada, CFRX Toronto ON	6070na	
0000 0100	Canada, CFVP Calgary AB	6030na	
0000 0100	Canada, CKZN St Johns NF		6160na
0000 0100	Canada, CKZU Vancouver BC		6160na
0000 0100 Sun	Germany, Mighty KBC Radio		9450eu
0000 0100	Malaysia, RTM Kajang/Traxx FM		7295do
0000 0100	Micronesia, V6MP/Cross R/Pohnpei		4755 as
0000 0100	New Zealand, R New Zealand Intl		15720pa
0000 0100 DRM	New Zealand, R New Zealand Intl		17675pa
0000 0100	Russia, VO Russia		7250na
0000 0100	Spain, R Exterior de Espana		6055na
0000 0100	Thailand, R Thailand World Svc		13745na
0000 0100	UK, BBC World Service	5970as	6195as
		7360as	9410as 9740as 11750as
		12095as	13725as 15335as 15755as
0000 0100	USA, Amer Forces Network/AFRTS		4319usb
		5765usb	12759usb 13362usb
0000 0100	USA, Overcomer Ministry		3185na
0000 0100 Sat/Sun	USA, WBCQ Monticello ME		5110am
0000 0100	USA, WBCQ Monticello ME		7490am
		9330am	
0000 0100	USA, WEWN/EWTN Irondale AL		11520af
0000 0100	USA, WHRI Cypress Creek SC		5920va
		7315ca	9860na
0000 0100	USA, WINB Red Lion PA		9265am
0000 0100	USA, WTWW Lebanon TN		5755va
0000 0100	USA, WWCR Nashville TN	3195eu	5070af
		9980af	13845af
0000 0100	USA, WWRB Manchester TN		3185na
		3215na	9370na
0000 0100	USA, WYFR/Family R Worldwide		6145na
		17580as	
0000 0100	Zambia, Christian Voice		4965af
0030 0100	Australia, ABC/R Australia		17750as
0030 0100 mtwhf	USA, WRMI/R Slovakia Intl relay		9955am
0035 0045	India, AIR/Aizawl		5050do 7295do
0035 0045	India, AIR/Chennai		4920do
0035 0045	India, AIR/Guwahati		4940do
0035 0045	India, AIR/Hyderabad		4800do
0035 0045	India, AIR/Imphal		4775do
0035 0045	India, AIR/Port Blair/Andaman & Nicobar		4760do
0035 0045	India, AIR/Shimla		4965do 6020do
0035 0045	India, AIR/Thiruvananthapuram		5010do

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

0100 0115 Sat/Sun	Canada, Bible Voice Broadcasting		7395as
0100 0130	Vietnam, VO Vietnam/Overseas Svc		9470na
0100 0157	China, China R International		6020as
		6075eu	6175eu 7350as 9410as
		9420na	9570na 9580as 11650as
		11885as	
0100 0200	Anguilla, University Network		6090na
0100 0200	Australia, ABC NT Alice Springs		4835do
0100 0200	Australia, ABC NT Katherine		5025do
0100 0200	Australia, ABC NT Tennant Creek		4910do

0100 0200	Australia, ABC/R Australia	9660pa	12080pa
		15160pa	15240pa 15415as 17750pa
		17795pa	19000pa
0100 0200	Bahrain, R Bahrain		6010me
0100 0200	Canada, CFRX Toronto ON		6070na
0100 0200	Canada, CFVP Calgary AB		6030na
0100 0200	Canada, CKZN St Johns NF		6160na
0100 0200	Canada, CKZU Vancouver BC		6160na
0100 0200 Sun	Germany, Mighty KBC Radio		9450eu
0100 0200	Malaysia, RTM Kajang/Traxx FM		7295do
0100 0200	Micronesia, V6MP/Cross R/Pohnpei		4755 as
0100 0200	New Zealand, R New Zealand Intl		15720pa
0100 0200 DRM	New Zealand, R New Zealand Intl		17675pa
0100 0200	Romania, R Romania Intl		6145na
0100 0200	Russia, VO Russia		7250na 7290na
0100 0200	Taiwan, R Taiwan Intl		11875as
0100 0200	UK, BBC World Service		5940eu 5970as
		9740as	11750as 12095as 15310as
		15335as	15755as 17685as
0100 0200	USA, Amer Forces Network/AFRTS		4319usb
		5765usb	12759usb 13362usb
0100 0200	USA, BBG/VOA	9435va	11705va 15155va
0100 0200	USA, KJES Vado NM		7555na
0100 0200	USA, Overcomer Ministry		3185na
0100 0200 mtwhf	USA, Overcomer Ministry		7490na
0100 0200 Sat/Sun	USA, WBCQ Monticello ME		5110am
0100 0200	USA, WBCQ Monticello ME		7490am
0100 0200 m	USA, WHRI Cypress Creek SC		9605na
0100 0200	USA, WHRI Cypress Creek SC		9840na
		9860na	
0100 0200	USA, WINB Red Lion PA		9265am
0100 0200	USA, WTWW Lebanon TN		5745va
0100 0200	USA, WWCR Nashville TN		3195eu 4840na
		5890af	5935af
0100 0200	USA, WWRB Manchester TN		3195na
		5050na	
0100 0200	USA, WYFR/Family R Worldwide		6145na
0100 0200	Zambia, Christian Voice		4965af
0120 0200 mtwhfa	Sri Lanka, SLBC	6005as	9770as 15745as
0130 0200 twhfa	Serbia, International R Serbia		6190va
0140 0159	Vatican City State, Vatican R	7410as	9560as

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

0200 0230	Thailand, R Thailand World Svc		13745na
0200 0230	USA, KJES Vado NM		7555na
0200 0230 Sat	USA, WBCQ Monticello ME		5110am
0200 0257	China, China R International		11785as
		13640as	
0200 0300	Anguilla, University Network		6090na
0200 0300 twhfa	Argentina, RAE		11710am
0200 0300	Australia, ABC NT Alice Springs		4835do
0200 0300	Australia, ABC NT Katherine		5025do
0200 0300	Australia, ABC NT Tennant Creek		4910do
0200 0300	Australia, ABC/R Australia	9660pa	12080pa
		15160pa	15240pa 15415as 17750pa
		17795pa	19000pa
0200 0300	Bahrain, R Bahrain		6010me
0200 0300	Canada, CFRX Toronto ON		6070na
0200 0300	Canada, CFVP Calgary AB		6030na
0200 0300	Canada, CKZN St Johns NF		6160na
0200 0300	Canada, CKZU Vancouver BC		6160na
0200 0300	Cuba, R Havana Cuba		6000na 6165na
0200 0300	Egypt, R Cairo		9720na 9315al
0200 0300	Malaysia, RTM Kajang/Traxx FM		7295do
0200 0300	Micronesia, V6MP/Cross R/Pohnpei		4755 as
0200 0300	New Zealand, R New Zealand Intl		15720pa
0200 0300 DRM	New Zealand, R New Zealand Intl		17675pa
0200 0300	Palau, T8WH/World Harvest R		17800as
0200 0300	Philippines, R Pilipinas Overseas Svc		11880me
		15285me	17700me
0200 0300	Russia, VO Russia		7150ca 7290am
		15630na	17665na 17690na
0200 0300	South Korea, KBS World R		9580sa 9640as
0200 0300 mtwhfa	Sri Lanka, SLBC	6005as	9770as 15745as

0200 0300	UK, BBC World Service	5875eu	5940eu
	7435af 12095as 15310as		
0200 0300	USA, Amer Forces Network/AFRTS	4319usb	
	5765usb 12759usb 13362usb		
0200 0300	USA, Overcomer Ministry	3185na	
0200 0300 mtwhf	USA, Overcomer Ministry	7490na	
0200 0300 Sat/Sun	USA, WBCQ Monticello ME	5110am	
0200 0300	USA, WBCQ Monticello ME	7490am	9330am
0200 0300	USA, WEWN/EWTN Irondale AL	11520af	
0200 0300	USA, WHRI Cypress Creek SC	5920va	
0200 0300	USA, WINB Red Lion PA	9265am	
0200 0300	USA, WTTW Lebanon TN	5745va	
0200 0300	USA, WWCR Nashville TN	3215eu	4840na
	5890af 5935af		
0200 0300	USA, WWRB Manchester TN	3195na	
	5050na		
0200 0300	USA, WYFR/Family R Worldwide	5985ca	
	6145na		
0200 0300	Zambia, Christian Voice	4965as	
0215 0227	Nepal, R Nepal	5005do	
0230 0300 twhf	Albania, R Tirana	6100na	
0230 0300	Myanmar, Myanma R/Yangon	9731do	
0230 0300	Vietnam, VO Vietnam/Overseas Svc	9470na	
0245 0300	India, AIR/Bhopal	4810do	
0245 0300	India, AIR/Guwahati	4940do	
0245 0300	India, AIR/Hyderabad	7420do	
0245 0300	India, AIR/Imphal	4775do	7335do
0245 0300	India, AIR/Itanagar	4990do	
0245 0300	India, AIR/Jaipur	4910do	7325do
0245 0300	India, AIR/Jeyapore	5040do	
0245 0300	India, AIR/Kolkata	4820do	7210do
0245 0300	India, AIR/Kuresong	4895do	
0245 0300	India, AIR/Lucknow	4880do	7440do
0245 0300	India, AIR/Shillong	4970do	
0245 0300	India, AIR/Shimla	4965do	6020do
0245 0300	India, AIR/Thiruvananthapuram	5010do	
0255 0300 Sun	Swaziland, TWR Africa	3200af	

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

0300 0315	India, AIR/Aizawl	5050do	7295do
0300 0315	India, AIR/Imphal	4775do	7335do
0300 0315	India, AIR/Itanagar	4990do	
0300 0315	India, AIR/Shillong	4970do	
0300 0320	Vatican City State, Vatican R	15460as	
0300 0325 Sun	Swaziland, TWR Africa	3200af	
0300 0327	Vatican City State, Vatican R	9660af	11625af
0300 0330	Egypt, R Cairo	9720na	9315al
0300 0330	Myanmar, Myanma R/Yangon	9731do	
0300 0330	Philippines, R Pilipinas Overseas Svc	11880me	
	15285me 17700me		
0300 0357	China, China R International	9460am	
	9690na 9790as 11785as 13620as		
	15110as 15120as		
0300 0400	Anguilla, University Network	6090na	
0300 0400	Australia, ABC NT Alice Springs	4835do	
0300 0400	Australia, ABC NT Katherine	5025do	
0300 0400	Australia, ABC NT Tennant Creek	4910do	
0300 0400	Australia, ABC/R Australia	9660pa	12080pa
	15160pa 15240as 15415pa 17750pa		
	19000pa 21725pa		
0300 0400	Bahrain, R Bahrain	6010me	
0300 0400	Canada, CFRX Toronto ON	6070na	
0300 0400	Canada, CFVP Calgary AB	6030na	
0300 0400	Canada, CKZN St Johns NF	6160na	
0300 0400	Canada, CKZU Vancouver BC	6160na	
0300 0400	Cuba, R Havana Cuba	6000na	6165na
0300 0400	Malaysia, RTM Kajang/Traxx FM	7295do	
0300 0400	Micronesia, V6MP/Cross R/Pohnpei	4755 as	
0300 0400	New Zealand, R New Zealand Intl	15720pa	
0300 0400 DRM	New Zealand, R New Zealand Intl	17675pa	
0300 0400	Oman, R Sultanate of Oman	15355af	
0300 0400	Palau, T8WH/World Harvest R	17800as	
0300 0400	Russia, VO Russia	7250am	7290na
	15630na 17665na 17690na		
0300 0400 mtwhf	South Africa, Channel Africa	3345af	
	6155af		

0300 0400 Sun	Sri Lanka, SLBC	6005as	9770as	15745as
0300 0400	Taiwan, R Taiwan Intl		15320as	
0300 0400	UK, BBC World Service	3255af	5940eu	
	6140af 6190af 7255af 7435af			
	9410eu 9460af 12035af 12095eu			
	15310as 17790as			
0300 0400	USA, Amer Forces Network/AFRTS	4319usb		
	5765usb 12759usb 13362usb			
0300 0400	USA, BBG/VOA	4930af	6080af	9855af
	15580af			
0300 0400	USA, Overcomer Ministry	3185na		
0300 0400 mtwhf	USA, Overcomer Ministry	7490na		
0300 0400	USA, WBCQ Monticello ME	7490am	9330am	
0300 0400	USA, WEWN/EWTN Irondale AL	11520af		
0300 0400	USA, WHRI Cypress Creek SC	5920va		
	7385na 9825va			
0300 0400	USA, WTTW Lebanon TN	5745va		
0300 0400	USA, WWCR Nashville TN	3215eu	4840na	
	5890af 5935af			
0300 0400	USA, WWRB Manchester TN	3195na		
	5050na			
0300 0400	USA, WYFR/Family R Worldwide	11740ca		
0300 0400	Zambia, Christian Voice	4965as		
0330 0400	Iran, VO Islamic Rep of Iran/VO Justice			
	9710eu 11700eu 11770eu			
0330 0400	Vietnam, VO Vietnam/Overseas Svc	9470na		
0335 0345	India, AIR/Kolkata	4820do	7210do	

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

0400 0427	Iran, VO Islamic Rep of Iran/VO Justice	9710eu	11700eu	11770eu
0400 0457	China, China R International		9460na	
	13620va 15120as 17725va 17855va			
0400 0457	Germany, Deutsche Welle	5905af	7285af	
	9470af 9800af			
0400 0457	North Korea, VO Korea	7220as	9345as	
	9730as 11735ca 13760sa	15180sa		
0400 0458	New Zealand, R New Zealand Intl		15720pa	
0400 0458 DRM	New Zealand, R New Zealand Intl		17675pa	
0400 0500	Anguilla, University Network		6090na	
0400 0500	Australia, ABC NT Alice Springs		4835do	
0400 0500	Australia, ABC NT Katherine		5025do	
0400 0500	Australia, ABC NT Tennant Creek		4910do	
0400 0500	Australia, ABC/R Australia	9660pa	12080pa	
	15160pa 15240pa 15415as 21725pa			
0400 0500	Bahrain, R Bahrain	6010me		
0400 0500	Canada, CFRX Toronto ON	6070na		
0400 0500	Canada, CKZN St Johns NF	6160na		
0400 0500	Canada, CKZU Vancouver BC		6160na	
0400 0500	Cuba, R Havana Cuba	6000na	6165na	
0400 0500	Malaysia, RTM Kajang/Traxx FM		7295do	
0400 0500	Micronesia, V6MP/Cross R/Pohnpei		4755 as	
0400 0500	Romania, R Romania Intl	6130na	7305na	
	15220as 17870as			
0400 0500	Russia, VO Russia	9830na	15630na	
0400 0500 mtwhf	South Africa, Channel Africa		7230af	
0400 0500 Sun	Sri Lanka, SLBC	6005as	9770as	15745as
0400 0500	Turkey, VO Turkey	7240as	9655va	
0400 0500	UK, BBC World Service	3255af	6005af	
	6190af 7255af 9410eu 11760eu			
	12015af 12035af 12095af 15310as			
0400 0500	USA, Amer Forces Network/AFRTS	4319usb		
	5765usb 12759usb 13362usb			
0400 0500	USA, BBG/VOA	4930af	4960af	9885af
	15580af			
0400 0500	USA, Overcomer Ministry	3185na	5890na	
0400 0500	USA, WBCQ Monticello ME	9330am		
0400 0500	USA, WEWN/EWTN Irondale AL	11520af		
0400 0500	USA, WHRI Cypress Creek SC	5920va		
	7385na 9825va			
0400 0500	USA, WTTW Lebanon TN	5745va		
0400 0500	USA, WWCR Nashville TN	3215eu	4840na	
	5890af 5935af			
0400 0500	USA, WWRB Manchester TN	3185na		
	5050na			
0400 0500	Zambia, Christian Voice	4965as		

0430 0500 mtwhf	Swaziland, TWR Africa	3200af	
0455 0500	Nigeria, VO Nigeria	15120af	
0459 0500	New Zealand, R New Zealand Intl	11725pa	
0459 0500 DRM	New Zealand, R New Zealand Intl	13730pa	

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

0500 0527	Germany, Deutsche Welle	5905af	
0500 0527	Vatican City State, Vatican	R7360af	13765af
0500 0530	Germany, Deutsche Welle	9420af	9800af
	11800af		
0500 0530	Japan, R Japan NHK World		9770sa
	11740na	17660va	
0500 0557	China, China R International		7220as
	11880as	15350as	15465as
	17540va	17725va	17855va
0500 0557	North Korea, VO Korea	13650as	15100as
0500 0600	Anguilla, University Network		6090na
0500 0600	Australia, ABC NT Alice Springs		4835do
0500 0600	Australia, ABC NT Katherine		5025do
0500 0600	Australia, ABC NT Tennant Creek		4910do
0500 0600	Australia, ABC/R Australia	9660pa	12080pa
	13630pa	15240pa	15415as
			21725pa
0500 0600	Bahrain, R Bahrain	6010me	
0500 0600	Bhutan, Bhutan BC Svc	5030do	6035do
0500 0600	Canada, CFRX Toronto ON	6070na	
0500 0600	Canada, CKZN St Johns NF	6160na	
0500 0600	Canada, CKZU Vancouver BC		6160na
0500 0600	Cuba, R Havana Cuba	6010na	6060na
	6125am	6165na	
0500 0600	Eqt Guinea, Pan American BC/R Africa		15190af
0500 0600	Malaysia, RTM Kajang/Traxx FM		7295do
0500 0600	Micronesia, V6MP/Cross R/Pohnpei		4755 as
0500 0600	New Zealand, R New Zealand Intl		11725pa
0500 0600 DRM	New Zealand, R New Zealand Intl		13730pa
0500 0600	Nigeria, VO Nigeria	15120af	
0500 0600	Russia, VO Russia	9830na	15630na
0500 0600 mtwhf	South Africa, Channel Africa		7230af
0500 0600	Swaziland, TWR Africa	3200af	9500af
0500 0600	UK, BBC World Service	3955eu	6005af
	7255af	9410af	11760eu
	15360va	15400af	15420af
			17640af
0500 0600	USA, Amer Forces Network/AFRTS		4319usb
	5765usb	12759usb	13362usb
0500 0600	USA, BBG/VOA 4930af	6080af	9885af
	15580af		
0500 0600	USA, Overcomer Ministry	3185na	5890na
0500 0600	USA, WBCQ Monticello ME	9330am	
0500 0600	USA, WEWN/EWTN Iroindale AL		11520af
0500 0600	USA, WHRI Cypress Creek SC		5920am
	7385na	9825va	
0500 0600	USA, WTTW Lebanon TN	5745va	
0500 0600	USA, WWCR Nashville TN	3215eu	4840na
	5890af	5935af	
0500 0600	USA, WWRB Manchester TN		3185na
0500 0600	Zambia, Christian Voice	6065af	
0502 0600	Swaziland, TWR Africa	6120af	9500af
0530 0557	Germany, Deutsche Welle	9470af	11800af
0530 0600	Australia, ABC/R Australia	17750as	
0530 0600	Thailand, R Thailand World Svc		12015va

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

0600 0630	China, Xizang PBS	6025do	6130do
	9580do		
0600 0630 Sat/Sun	USA, WRMI/R Prague relay	9955ca	
0600 0650 DRM	New Zealand, R New Zealand Intl		13730pa
0600 0657	China, China R International		11750af
	11770me	11880as	13645as
	15350as	15465as	17505va
	17710va		17540as
0600 0657	North Korea, VO Korea	7220as	9345as
	9730as		
0600 0700	Anguilla, University Network		6090na
0600 0700	Australia, ABC NT Alice Springs		4835do
0600 0700	Australia, ABC NT Katherine		5025do

0600 0700	Australia, ABC NT Tennant Creek		4910do
0600 0700	Australia, ABC/R Australia	9660pa	11945pa
	12080pa	13630pa	15240pa
	17750pa	21725pa	15415as
0600 0700	Bahrain, R Bahrain		6010me
0600 0700	Canada, CFRX Toronto ON		6070na
0600 0700	Canada, CFVP Calgary AB		6030na
0600 0700	Canada, CKZN St Johns NF		6160na
0600 0700	Canada, CKZU Vancouver BC		6160na
0600 0700	Cuba, R Havana Cuba	6010na	6060na
	6125am	6165na	
0600 0700	Eqt Guinea, Pan American BC/R Africa		15190af
0600 0700	Germany, Deutsche Welle	13780af	17800af
0600 0700	Malaysia, RTM Kajang/Traxx FM		7295do
0600 0700	Micronesia, V6MP/Cross R/Pohnpei		4755 as
0600 0700	New Zealand, R New Zealand Intl		11725pa
0600 0700	Nigeria, VO Nigeria		15120af
0600 0700	Russia, VO Russia		21800pa
0600 0700 DRM	Russia, VO Russia		11635eu
0600 0700 mtwhf	South Africa, Channel Africa		7230af
	15255af		
0600 0700	Swaziland, TWR Africa	3200af	6120af
	9500af		
0600 0700	UK, BBC World Service	3955eu	6005af
	6190af	9410af	9460af
	15360eu	15400af	15420af
	17640af	17790as	15310as
0600 0700	USA, Amer Forces Network/AFRTS		4319usb
	5765usb	12759usb	13362usb
0600 0700	USA, BBG/VOA 6080af	9885af	15580af
0600 0700	USA, Overcomer Ministry	3185na	5890na
0600 0700	USA, WBCQ Monticello ME	9330am	
0600 0700	USA, WEWN/EWTN Iroindale AL		11520af
0600 0700	USA, WHRI Cypress Creek SC		5920am
	7385na	11910va	
0600 0700	USA, WTTW Lebanon TN	5745va	
0600 0700	USA, WWCR Nashville TN	3215eu	4840na
	5890af	5935af	

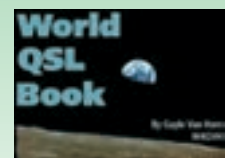
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0600 0700	USA, WWRB Manchester TN	3185na
0600 0700	Zambia, Christian Voice	6065af
0600 0700	Zambia, CVC Intl/1 Africa	13590af
0617 0630 Sun	Nepal, R Nepal	5005do
0630 0645	India, AIR/Guwahati	4940do 7280do
0630 0645	India, AIR/Hyderabad	7420do
0630 0645	India, AIR/Mumbai	4840do 7240do
0630 0645	India, AIR/Thiruvananthapuram	5010do
0630 0657	Vatican City State, Vatican R	11625af
	13765af	
0630 0700 DRM	Romania, R Romania Intl	9600eu
0630 0700	Romania, R Romania Intl	7310eu 17780pa
	21600pa	
0645 0700 mtwhf	Israel, Kol Israel	9955na
0651 0700 DRM	New Zealand, R New Zealand Intl	11675pa

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

0700 0730	Myanmar, Myanma R/Yangon	9731do
0700 0757	China, China R International	11785as
	11880as	13645eu 15125as 15350as
	15465as	17490eu 17540as 17710as
0700 0758	New Zealand, R New Zealand Intl	11725pa
0700 0758 DRM	New Zealand, R New Zealand Intl	11675pa
0700 0800	Anguilla, University Network	6090na
0700 0800	Australia, ABC NT Alice Springs	4835do
0700 0800	Australia, ABC NT Katherine	5025do
0700 0800	Australia, ABC NT Tennant Creek	4910do
0700 0800	Australia, ABC/R Australia	7410pa 9475pa
	9660pa	9710pa 11945pa 12080pa
	13630pa	15240pa
0700 0800	Bahrain, R Bahrain	6010me
0700 0800	Canada, CFRX Toronto ON	6070na
0700 0800	Canada, CFVP Calgary AB	6030na
0700 0800	Canada, CKZN St Johns NF	6160na
0700 0800	Canada, CKZU Vancouver BC	6160na
0700 0800 mtwhfa	Ecuador, HCJB/LV de los Andes	3995eu
0700 0800	Eqt Guinea, Pan American BC/R Africa	15190af
0700 0800	Malaysia, RTM Kajang/Traxx FM	7295do
0700 0800	Micronesia, V6MP/Cross R/Pohnpei	4755 as
0700 0800	Papua New Guinea, R Fly	3915do
0700 0800	Russia, VO Russia	15745as 21800va
	21820va	
0700 0800 DRM	Russia, VO Russia	11635eu
0700 0800 mtwhf	South Africa, Channel Africa	9625af
0700 0800	Swaziland, TWR Africa	3200af 6120af
	9500af	
0700 0800	UK, BBC World Service	5875eu 6190af
	7355eu	13820af 11770af 12095af
	13820af	15310as 15400af 15575va
	17640af	17660eu 17790as 17830af
0700 0800	USA, Amer Forces Network/AFRTS	4319usb
	5765usb	12759usb 13362usb
0700 0800	USA, Overcomer Ministry	3185na 5890na
0700 0800	USA, WBCQ Monticello ME	9330am
0700 0800	USA, WEWN/EWTN Irontdale AL	11520af
0700 0800	USA, WHRI Cypress Creek SC	5920am
	7385na	
0700 0800	USA, WTTW Lebanon TN	5745va
0700 0800	USA, WWCR Nashville TN	3215eu 4840na
	5890af	5935af
0700 0800	USA, WWRB Manchester TN	3185na
0700 0800	Zambia, Christian Voice	6065af
0700 0800	Zambia, CVC Intl/1 Africa	13590af
0730 0744	Vatican City State, Vatican R	15595va
0730 0745	India, AIR/Aizawl	5050do 7295do
0730 0745	India, AIR/Chennai	4920do 7380do
0730 0745	India, AIR/Guwahati	4940do 7280do
0730 0745	India, AIR/Imphal	4775do 7335do
0730 0745	India, AIR/Jaipur	4910do 7325do
0730 0745	India, AIR/Kolkata	4820do 7210do
0730 0745	India, AIR/Shimla	4965do 6020do
0730 0800	Australia, HCJB Global Australia	11750pa
0759 0800	New Zealand, R New Zealand Intl	9765pa
0759 0800 DRM	New Zealand, R New Zealand Intl	9870pa

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

0800 0830	Australia, ABC NT Alice Springs	4835do
0800 0830	Australia, ABC NT Katherine	5025do
0800 0830	Australia, ABC NT Tennant Creek	4910do
0800 0830	Australia, HCJB Global Australia	11750pa
0800 0830 Sun	Canada, Bible Voice Broadcasting	5945eu
0800 0830	France, R France International	9955na
0800 0845 Sat	Canada, Bible Voice Broadcasting	5945eu
0800 0850	Austria, TWR Europe	7400eu
0800 0850	Germany, TWR Europe	6105eu
0800 0857	China, China R International	9415as
	11785as	11880as 15350as 15465as
	15625va	17490eu 17540as
0800 0900	Anguilla, University Network	6090na
0800 0900	Australia, ABC/R Australia	5995pa 7410pa
	9475pa	9580pa 9710pa 11945pa
	12080pa	15240pa
0800 0900	Bahrain, R Bahrain	6010me
0800 0900	Canada, CFRX Toronto ON	6070na
0800 0900	Canada, CFVP Calgary AB	6030na
0800 0900	Canada, CKZN St Johns NF	6160na
0800 0900	Canada, CKZU Vancouver BC	6160na
0800 0900	Eqt Guinea, Pan American BC/R Africa	15190af
0800 0900 Sat	Italy, IRRS SW	9510va
0800 0900	Malaysia, RTM Kajang/Traxx FM	7295do
0800 0900	Micronesia, V6MP/Cross R/Pohnpei	4755 as
0800 0900	New Zealand, R New Zealand Intl	9765pa
0800 0900 DRM	New Zealand, R New Zealand Intl	9870pa
0800 0900	Nigeria, VO Nigeria	15120af
0800 0900 mtwhfs	Palau, T8WH/World Harvest R	9930as
0800 0900	Palau, T8WH/World Harvest R	17650as
0800 0900	Papua New Guinea, R Fly	3915do
0800 0900	Russia, VO Russia	15745as 21800va
	21820va	
0800 0900 DRM	Russia, VO Russia	9625eu 11635eu
0800 0900 mtwhf	South Africa, Channel Africa	9625af
0800 0900 Sun	South Africa, R Mirror Intl	7205af 17760af
0800 0900	South Korea, KBS World R	9570as
0800 0900	UK, BBC World Service	5875eu 6190af
	7355eu	12095af 15310as 15400af
	15575va	17640af 17660eu 17790as
	17830af	21470af
0800 0900	USA, Amer Forces Network/AFRTS	4319usb
	5765usb	12759usb 13362usb
0800 0900	USA, Overcomer Ministry	3185na 5890na
0800 0900	USA, WBCQ Monticello ME	9330am
0800 0900	USA, WEWN/EWTN Irontdale AL	11520af
0800 0900	USA, WHRI Cypress Creek SC	5920am
	7385na	
0800 0900	USA, WTTW Lebanon TN	5745va
0800 0900	USA, WWCR Nashville TN	3215eu 4840na
	5890af	5935af
0800 0900	USA, WWRB Manchester TN	3185na
0800 0900	Zambia, Christian Voice	6065af
0800 0900	Zambia, CVC Intl/1 Africa	13590af
0815 0827	Nepal, R Nepal	5005do
0830 0845	India, AIR/Aizawl	5050do 7295do
0830 0845	India, AIR/Chennai	4920do 7380do
0830 0845	India, AIR/Hyderabad	7420do
0830 0845	India, AIR/Imphal	4775do 7335do
0830 0845	India, AIR/Kolkata	4820do 7210do
0830 0845	India, AIR/Shillong	4970do 7315do
0830 0845	India, AIR/Thiruvananthapuram	5010do
0830 0900	Australia, ABC NT Alice Springs	2310do
0830 0900	Australia, ABC NT Katherine	2485do
0830 0900	Australia, ABC NT Tennant Creek	2325do
0830 0900	India, AIR/Itanagar	4990do
0850 0900 mtwhf	Guam, KTWR/TWR Asia	15200as

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

0900 0930 mtwhf	Guam, KTWR/TWR Asia	15200as
0900 0930 mtwhfa	USA, WRMI/R Prague relay	9955ca
0900 0957	China, China R International	9415as
	15210as	15270eu 15350as 17490eu
	17570eu	17650eu 17690va 17750va

0900 1000	Anguilla, University Network	6090na	
0900 1000	Australia, ABC NT Alice Springs	2310do	
0900 1000	Australia, ABC NT Katherine	2485do	
0900 1000	Australia, ABC NT Tennant Creek	2325do	
0900 1000	Australia, ABC/R Australia	9580pa	11945pa
0900 1000	Bahrain, R Bahrain	6010me	
0900 1000	Canada, CFRX Toronto ON	6070na	
0900 1000	Canada, CFVP Calgary AB	6030na	
0900 1000	Canada, CKZN St Johns NF	6160na	
0900 1000	Canada, CKZU Vancouver BC	6160na	
0900 1000	Germany, Mighty KBC Radio	6095eu	
0900 1000	Malaysia, RTM Kajang/Traxx FM	7295do	
0900 1000	Micronesia, V6MP/Cross R/Pohnpei	4755 as	
0900 1000 DRM	New Zealand, R New Zealand Intl	9870pa	
0900 1000	New Zealand, R New Zealand Intl	9765pa	
0900 1000	Nigeria, VO Nigeria	9690af	
0900 1000	Palau, T8WH/World Harvest R	9930as	
0900 1000	Papua New Guinea, R Fly	3915do	
0900 1000	Russia, VO Russia	7205as	15745as
	21800va	21820va	
0900 1000 DRM	Russia, VO Russia	9625eu	
0900 1000 mtwhf	South Africa, Channel Africa	9625af	
0900 1000	UK, BBC World Service	6190af	6195as
	9740as	11895as	12095af 15285as
	15310as	15400af	15575va 17640af
	17660eu	17760as	17790as 17830af
	21470af		
0900 1000	USA, Amer Forces Network/AFRTS	4319usb	
	5765usb	12759usb	13362usb
0900 1000	USA, Overcomer Ministry	3185na	5890na
0900 1000	USA, WBCQ Monticello ME	9330am	
0900 1000	USA, WEWN/EWTN Irondale AL		11520af
0900 1000	USA, WHRI Cypress Creek SC		11565pa
0900 1000	USA, WHRI Cypress Creek SC		7315am
	7385na		
0900 1000	USA, WTWW Lebanon TN		5745va
0900 1000	USA, WWCR Nashville TN		3215eu 4840af
	5890af	5935af	
0900 1000	USA, WWRB Manchester TN		3185na
0900 1000	USA, WYFR/Family R Worldwide		9465as
0900 1000	Zambia, Christian Voice		6065af
0900 1000	Zambia, CVC Intl/1 Africa		13590af
0905 0910	Pakistan, PBC/R Pakistan		15725as 17720as
0930 1000 fs	China, VO the Strait		6115do
0930 1000 Sun	Italy, IRRS SW		9510va

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

1000 1018 mtwhf	Guam, KTWR/TWR Asia	11840pa	
1000 1030 Sat	Guam, KTWR/TWR Asia	11840pa	
1000 1030	Japan, R Japan NHK World		9625as
	11740as		
1000 1030	Vietnam, VO Vietnam/Overseas Svc		9840as
	12020as		
1000 1057	China, China R International		5955na
	7215as	11640as	13590as 13720as
	15190as	15210pa	15350as 17490eu
	17690va		
1000 1057	North Korea, VO Korea	6170va	9335sa
	9850as		
1000 1058	New Zealand, R New Zealand Intl		9765pa
1000 1100	Anguilla, University Network		11775na
1000 1100	Australia, ABC NT Alice Springs		2310do
1000 1100	Australia, ABC NT Katherine		2485do
1000 1100	Australia, ABC NT Tennant Creek		2325do
1000 1100	Australia, ABC/R Australia		6020pa 9580pa
	11945pa		
1000 1100 Sat/Sun	Australia, ABC/R Australia		9475pa
1000 1100	Bahrain, R Bahrain		6010me
1000 1100	Canada, CFRX Toronto ON		6070na
1000 1100	Canada, CFVP Calgary AB		6030na
1000 1100	Canada, CKZN St Johns NF		6160na
1000 1100	Canada, CKZU Vancouver BC		6160na
1000 1100	Germany, Mighty KBC Radio		6095eu
1000 1100	India, AIR/External Svc		7270as 13605as
	13695pa	15030as	15410as 17510pa
	17895pa		
1000 1100	Indonesia, VO Indonesia		9526va

1000 1100	Malaysia, RTM Kajang/Traxx FM		7295do
1000 1100	Micronesia, V6MP/Cross R/Pohnpei		4755as
1000 1100 DRM	New Zealand, R New Zealand Intl		9870pa
1000 1100	Nigeria, VO Nigeria		9690af
1000 1100	Palau, T8WH/World Harvest R		17650as
1000 1100	Russia, VO Russia		7205as 7260as
	11680as	15745as	
1000 1100 DRM	Russia, VO Russia		9625eu
1000 1100	Saudi Arabia, BSKSA/External Svc		15250as
1000 1100 mtwhf	South Africa, Channel Africa		9625af
1000 1100	UK, BBC World Service		6190af 6195as
	9740as	11760va	12095af 15285as
	15310as	15575eu	17640af 17790as
	21470af		
1000 1100 Sat/Sun	UK, BBC World Service		17830af
1000 1100	USA, Amer Forces Network/AFRTS		4319usb
	5765usb	12759usb	13362usb
1000 1100	USA, KNLS Anchor Point AK		9615as
1000 1100	USA, Overcomer Ministry		3185na 5890na
1000 1100	USA, WBCQ Monticello ME		9330am
1000 1100	USA, WEWN/EWTN Irondale AL		11520af
1000 1100	USA, WHRI Cypress Creek SC		7315am
	7385na		
1000 1100	USA, WTWW Lebanon TN		5745va
1000 1100	USA, WWCR Nashville TN		4840na 5890af
	5935af	6875af	
1000 1100	USA, WWRB Manchester TN		3185na
1000 1100	USA, WYFR/Family R Worldwide		9465as
1000 1100	Zambia, Christian Voice		6065af
1000 1100	Zambia, CVC Intl/1 Africa		13590af
1030 1100	Iran, VO Islamic Rep of Iran		21575va 21610va
1030 1100	Mongolia, Voice of Mongolia		12085as
1030 1100	USA, WINB Red Lion PA		9265am
1059 1100	New Zealand, R New Zealand Intl		17675pa

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

1100 1104	Pakistan, PBC/R Pakistan		15725as 17720as
1100 1127	Iran, VO Islamic Rep of Iran		21575va 21610va
1100 1130 Sat/Sun	Canada, Bible Voice Broadcasting		15390as
1100 1130 f/DRM	Japan, R Japan NHK World		9760eu
1100 1130 Sat/DRM	South Korea, KBS World R		9760eu
1100 1130 mtwhf	UK, BBC World Service		15400af
1100 1130	Vietnam, VO Vietnam/Overseas Svc		7285as
1100 1157	China, China R International		5955as
	9570as	11650as	11795as 13590as
	13645as	13665as	13720as 17490va
1100 1158 DRM	New Zealand, R New Zealand Intl		9870pa
1100 1200	Anguilla, University Network		11775na
1100 1200	Australia, ABC NT Alice Springs		2310do
1100 1200	Australia, ABC NT Katherine		2485do
1100 1200	Australia, ABC NT Tennant Creek		2325do
1100 1200	Australia, ABC/R Australia		5995pa 6020pa
	6080as	6140as	9580as 11945pa
1100 1200 DRM	Australia, ABC/R Australia		12080pa
1100 1200	Bahrain, R Bahrain		6010me
1100 1200	Canada, CFRX Toronto ON		6070na
1100 1200	Canada, CFVP Calgary AB		6030na
1100 1200	Canada, CKZN St Johns NF		6160na
1100 1200	Canada, CKZU Vancouver BC		6160na
1100 1200 Sat/Sun	Germany, Mighty KBC Radio		6095eu
1100 1200	Malaysia, RTM Kajang/Traxx FM		7295do
1100 1200	New Zealand, R New Zealand Intl		17675pa
1100 1200	Nigeria, VO Nigeria		9690af
1100 1200	Russia, VO Russia		7205as 7260as
	9560as	11680as	15740as
1100 1200 DRM	Russia, VO Russia		9625eu 11640as
1100 1200	Saudi Arabia, BSKSA/External Svc		15250as
1100 1200 mtwhf	South Africa, Channel Africa		9625af
1100 1200	Taiwan, R Taiwan Intl		7445as 9465as
1100 1200	UK, BBC World Service		6190af 6195as
	9740as	11760va	11895as 12095af
	15285as	15310as	17640af 17790as
	17830af	21470af	
1100 1200	USA, Amer Forces Network/AFRTS		4319usb
	5765usb	12759usb	13362usb
1100 1200	USA, Overcomer Ministry		3185na 5890na
	15565as		

1100 1200	USA, WBCQ Monticello ME9330am	
1100 1200	USA, WEWN/EWTN Irondale AL	11520af
1100 1200	USA, WHRI Cypress Creek SC	7315am 9795am
1100 1200	USA, WINB Red Lion PA	9265am
1100 1200	USA, WTWW Lebanon TN	5745va
1100 1200	USA, WWCR Nashville TN	4840na 5890af 5935af 6875af
1100 1200	USA, WWRB Manchester TN	3185na
1100 1200	Zambia, Christian Voice	6065af
1100 1200	Zambia, CVC Intl/1 Africa	13590af
1115 1130 f	Canada, Bible Voice Broadcasting	15390as
1130 1145 f	Palau, T8WH/World Harvest R	15525as
1130 1200 f	Vatican City State, Vatican R17590va	21650va
1130 1200	Vietnam, VO Vietnam/Overseas Svc	9840as 12020as
1135 1145	India, AIR/Aizawl	5050do 7295do
1135 1145	India, AIR/Shillong	4970do

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

1200 1225	Saudi Arabia, BSKSA/External Svc	15250as
1200 1230	Japan, R Japan NHK World	11740as 15190na
1200 1257	China, China R International	5955as 7250as 9460as 9600as 9645as 9730pa 9760as 11760as 11980as 12015va 13655eu 13790eu 17490eu
1200 1258	New Zealand, R New Zealand Intl	17675pa
1200 1300	Anguilla, University Network	11775na
1200 1300	Australia, ABC NT Alice Springs	2310do
1200 1300	Australia, ABC NT Katherine	2485do
1200 1300	Australia, ABC NT Tennant Creek	2325do
1200 1300	Australia, ABC/R Australia	6080as 6140as 9580as 11945pa
1200 1300 DRM	Australia, ABC/R Australia	5995as
1200 1300	Bahrain, R Bahrain	6010me
1200 1300	Canada, CFRX Toronto ON	6070na
1200 1300	Canada, CFVP Calgary AB	6030na
1200 1300	Canada, CKZN St Johns NF6160na	
1200 1300	Canada, CKZU Vancouver BC	6160na
1200 1300	Ethiopia, R Ethiopia/Natl Pgm	9705do
1200 1300 Sat/Sun	Germany, Mighty KBC Radio	6095eu
1200 1300	Malaysia, RTM Kajang/Traxx FM	7295do
1200 1300	Nigeria, VO Nigeria	9690af
1200 1300	Palau, T8WH/World Harvest R	9930as
1200 1300	Romania, R Romania Intl	15460eu 17530eu 17765af 21570af
1200 1300 DRM	Russia, VO Russia	9625eu
1200 1300	Russia, VO Russia	4780as 5885as 9560as 12075as
1200 1300	South Korea, KBS World R	15575na
1200 1300	UK, BBC World Service	5875as 6190af 6195as 9740as 11760va 11895as 12095af 15310as 17640af 17790as 17830af 21470af
1200 1300	USA, Amer Forces Network/AFRTS	4319usb 5765usb 12759usb 13362usb
1200 1300	USA, BBG/VOA 7520va	9640va 11750va 12150va
1200 1300	USA, KNLS Anchor Point AK	9615as
1200 1300	USA, Overcomer Ministry	3185na 15565as
1200 1300 mtwhf	USA, Overcomer Ministry	5890na 13570ca
1200 1300	USA, WBCQ Monticello ME9330am	
1200 1300	USA, WEWN/EWTN Irondale AL	11520af
1200 1300	USA, WHRI Cypress Creek SC	9795am 9840na
1200 1300	USA, WINB Red Lion PA	9265am
1200 1300	USA, WTWW Lebanon TN	9479va
1200 1300	USA, WWCR Nashville TN	5935na 9980af 15825eu
1200 1300	USA, WWRB Manchester TN	3185na 9370na
1200 1300	Zambia, Christian Voice	6065af
1200 1300	Zambia, CVC Intl/1 Africa	13590af
1215 1300	Egypt, R Cairo	17870as
1225 1245	India, AIR/Imphal	4775do
1230 1245	India, AIR/Aizawl	5050do 7295do

1230 1245	India, AIR/Chennai	4920do
1230 1245	India, AIR/Hyderabad	4800do
1230 1245	India, AIR/Imphal	4800do
1230 1245	India, AIR/Jeyppore	5040do
1230 1245	India, AIR/Kuresong	4895do
1230 1245	India, AIR/Port Blair/Andaman & Nicobar	4760do
1230 1245	India, AIR/R Kashmir	4950do
1230 1245	India, AIR/Shillong	4970do
1230 1245	India, AIR/Thiruvananthapuram	5010do
1230 1300	Bangladesh, Bangladesh Betar	15105as
1230 1300	South Korea, KBS World R	6095as
1230 1300	Thailand, R Thailand World Svc	9720pa
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	11730as
1300 1357	China, China R International	5995as 7300na 9570as 9655pa 9730va 9765as 9870as 11760as 11900as 11980as 13670eu 13790eu
1300 1357	North Korea, VO Korea	7570eu 9335na 11710na 12015eu
1300 1400	Anguilla, University Network	11775na
1300 1400	Australia, ABC NT Alice Springs	2310do
1300 1400	Australia, ABC NT Katherine	2485do
1300 1400	Australia, ABC/R Australia	5940as 6020pa 9580pa 11945pa
1300 1400 DRM	Australia, ABC/R Australia	5995pa
1300 1400	Bahrain, R Bahrain	6010me
1300 1400	Canada, CFRX Toronto ON	6070na
1300 1400	Canada, CFVP Calgary AB	6030na
1300 1400	Canada, CKZN St Johns NF6160na	
1300 1400	Canada, CKZU Vancouver BC	6160na
1300 1400 Sat/Sun	Germany, Mighty KBC Radio	6095eu
1300 1400	Indonesia, VO Indonesia	9526va
1300 1400	Italy, IRRS SW	15190va
1300 1400	Malaysia, RTM Kajang/Traxx FM	7295do
1300 1400	New Zealand, R New Zealand Intl	5950pa
1300 1400	Nigeria, VO Nigeria	9690af
1300 1400	Palau, T8WH/World Harvest R	9930as
1300 1400 DRM	Russia, VO Russia	9625eu
1300 1400	Russia, VO Russia	4780as 7205as 7260as 9560as 12075as
1300 1400	South Korea, KBS World R	9570as
1300 1400	Tajikistan, VO Tajik	7245va
1300 1400	UK, BBC World Service	5875as 6190af 6195as 9410as 9740as 11760va 11890as 12095af 15310as 15400af 17640af 17790as 17830af 21470af
1300 1400	USA, Amer Forces Network/AFRTS	4319usb 5765usb 12759usb 13362usb
1300 1400 Sat/Sun	USA, BBG/VOA 7520va	9640va 11750va 12150va
1300 1400	USA, KJES Vado NM	11715na
1300 1400 mtwhf	USA, Overcomer Ministry	9980na 13570ca
1300 1400	USA, Overcomer Ministry	9370na
1300 1400	USA, WBCQ Monticello ME9330am	
1300 1400	USA, WEWN/EWTN Irondale AL	15610eu
1300 1400 Sat/Sun	USA, WHRI Cypress Creek SC	9795na 9840am
1300 1400	USA, WINB Red Lion PA	13570am
1300 1400	USA, WTWW Lebanon TN	9479va
1300 1400	USA, WWCR Nashville TN	7490af 9980af 13845eu 15825eu
1300 1400	USA, WWRB Manchester TN	9370na
1300 1400	USA, WYFR/Family R Worldwide	11540as
1300 1400	Zambia, Christian Voice	6065af
1300 1400	Zambia, CVC Intl/1 Africa	13590af
1315 1345	Bangladesh, Bangladesh Betar	7250as
1330 1400	India, AIR/External Svc	9690as 11620as 13710as
1330 1400	Turkey, VO Turkey	12035eu
1330 1400	Vietnam, VO Vietnam/Overseas Svc	9840as 12020as

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

1400 1425	mthf	Guam, KTWR/TWR Asia	15225as	
1400 1430		Japan, R Japan NHK World	11695as	
		11705al	11925as	
1400 1430		Serbia, International R Serbia	9635eu	
1400 1430		Thailand, R Thailand World Svc	9950va	
1400 1430		Turkey, VO Turkey	12035eu	
1400 1430	Sun	USA, Pan Amer Broadcasting	15205as	
1400 1435	swa	Guam, KTWR/TWR Asia	15225as	
1400 1445	Sat	Guam, KTWR/TWR Asia	11580as	
1400 1457		China, China R International	5955as	
		7300na	9460as	9765pa
		9870as	11665eu	13625as
		13740va	17630va	13685as
1400 1500		Anguilla, University Network	11775na	
1400 1500		Australia, ABC NT Alice Springs	2310do	
1400 1500		Australia, ABC NT Katherine	2485do	
1400 1500		Australia, ABC NT Tennant Creek	2325do	
1400 1500		Australia, ABC/R Australia	5940as	5995pa
		9580pa	11945pa	
1400 1500		Bahrain, R Bahrain	6010me	
1400 1500	Sun	Canada, Bible Voice Broadcasting	15470as	
1400 1500		Canada, CFRX Toronto ON	6070na	
1400 1500		Canada, CFVP Calgary AB	6030na	
1400 1500		Canada, CKZN St Johns NF	6160na	
1400 1500		Canada, CKZU Vancouver BC	6160na	
1400 1500		Eqt Guinea, Pan American BC/R Africa	15190af	
1400 1500	Sat/Sun	Germany, Mighty KBC Radio	6095eu	
1400 1500		India, AIR/External Svc	9690as	11620as
		13710as		
1400 1500		Italy, IRRS SW	15190va	
1400 1500		Malaysia, RTM Kajang/Traxx FM	7295do	
1400 1500		New Zealand, R New Zealand Intl	5950pa	
1400 1500		Nigeria, VO Nigeria	9690af	
1400 1500		Oman, R Sultanate of Oman	15140va	
1400 1500		Russia, VO Russia	4780as	7260as
		12075as	13790me	
1400 1500		South Korea, KBS World R	9640as	
1400 1500		UK, BBC World Service	5845as	5875as
		6190af	6195as	9740va
		11890as	12095af	17640af
		21470af		17830af
1400 1500		USA, Amer Forces Network/AFRTS	4319usb	
		5765usb	12759usb	13362usb
1400 1500	mthwf	USA, BBG/VOA 7520va	9760va	12150va
1400 1500		USA, BBG/VOA 4930af	6080af	15580af
		17530af	17725af	
1400 1500	mthwf	USA, Overcomer Ministry	9980na	13570ca
		13810me		
1400 1500		USA, Overcomer Ministry	9370va	9460eu
1400 1500		USA, WBCQ Monticello ME	9330am	
1400 1500	Sat/Sun	USA, WBCQ Monticello ME	15420am	
1400 1500		USA, WEWN/EWTN Irondale AL	15610eu	
1400 1500	Sat/Sun	USA, WHRI Cypress Creek SC	9795am	
		9840am	21670va	
1400 1500		USA, WJHR Intl Milton FL	15550usb	
1400 1500		USA, WTWV Lebanon TN	9479va	
1400 1500		USA, WWCR Nashville TN	7490af	9980af
		13845eu	15825eu	
1400 1500		USA, WWRB Manchester TN	9370na	
1400 1500		USA, WYFR/Family R Worldwide	11540as	
1400 1500		Zambia, Christian Voice	6065af	
1400 1500		Zambia, CVC Intl/1 Africa	13590af	
1415 1427		Nepal, R Nepal	5005do	
1415 1430	mthwfa	USA, Pan Amer Broadcasting	15205as	
1420 1440		India, AIR/Itanagar	4990do	
1425 1455		Swaziland, TWR Africa	6025af	
1430 1445		India, AIR/Aizawl	5050do	7295do
1430 1445		India, AIR/Gangkok	4835do	
1430 1445		India, AIR/Jeyapore	5040do	
1430 1445		India, AIR/Mumbai	4840do	7240do
1430 1445	Sun	USA, Pan Amer Broadcasting	15205as	
1430 1500		Australia, ABC/R Australia	9475as	11660as
1430 1500	Sat	Canada, Bible Voice Broadcasting	15470as	
1430 1500		China, China Business R	6190do	7220do
1430 1500		China, China Natl R/CNR11	4905do	
		4920do	6130do	

1430 1500		Myanmar, Thazin BC Sta	7110do	
1430 1500		USA, WRMI/R Prague relay	9955ca	
1445 1500		Australia, HCJB Global Australia	15340as	
1450 1500		India, AIR/Itanagar	4990do	
1450 1500		India, AIR/Kuresong	4895do	

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

1500 1530		Australia, ABC/R Australia	11945pa	
1500 1530		Australia, HCJB Global Australia	15340as	
1500 1530	Sun	Canada, Bible Voice Broadcasting	13740as	
1500 1530	mthwf	USA, Overcomer Ministry	13570ca	
1500 1530		Vietnam, VO Vietnam/Overseas Svc	7285as	
		9840as	12020as	
1500 1550		New Zealand, R New Zealand Intl	5950pa	
1500 1557		China, China R International	5955as	
		6095eu	7325eu	7405as
		9525as	9650as	9720eu
		9870na	13685af	13740eu
				17630af
1500 1557		North Korea, VO Korea	7570eu	9335na
		11710na	12015eu	
1500 1600		Anguilla, University Network	11775na	
1500 1600		Australia, ABC NT Alice Springs	2310do	
1500 1600		Australia, ABC NT Katherine	2485do	
1500 1600		Australia, ABC/R Australia	5940as	5995pa
		7240pa	9475as	11660as
1500 1600		Bahrain, R Bahrain	6010me	
1500 1600		Canada, CFRX Toronto ON	6070na	
1500 1600		Canada, CFVP Calgary AB	6030na	
1500 1600		Canada, CKZN St Johns NF	6160na	
1500 1600		Canada, CKZU Vancouver BC	6160na	
1500 1600		Eqt Guinea, Pan American BC/R Africa	15190af	
1500 1600	Sat/Sun	Germany, Mighty KBC Radio	6095eu	
1500 1600	Sat	Italy, IRRS SW	15700va	
1500 1600		Malaysia, RTM Kajang/Traxx FM	7295do	
1500 1600		Nigeria, VO Nigeria	15120af	
1500 1600		Russia, VO Russia	4780as	9735me
		9880as	11985me	
1500 1600	mthwf	South Africa, Channel Africa	9625af	
1500 1600		Uganda, Dunamis Shortwave	4750do	
1500 1600		UK, BBC World Service	5845as	5875as
		5975as	6190af	6195as
		9490af	9505as	9740as
		12095af	15400af	17640af
		21470af		17830af
1500 1600		USA, Amer Forces Network/AFRTS	4319usb	
		5765usb	12759usb	13362usb
1500 1600		USA, BBG/VOA 4930af	6080af	7520va
		9930va	11840va	12150va
		17725af	17895af	13570va
1500 1600		USA, KNLS Anchor Point AK	9655as	
1500 1600	mthwf	USA, Overcomer Ministry	9980na	13810me
1500 1600	Sat	USA, Overcomer Ministry	11900me	15420na
1500 1600		USA, WBCQ Monticello ME	9330am	
1500 1600	Sat/Sun	USA, WBCQ Monticello ME	15420am	
1500 1600		USA, WEWN/EWTN Irondale AL	15610eu	
1500 1600	Sat/Sun	USA, WHRI Cypress Creek SC	9795am	
		9840am		
1500 1600	Sun	USA, WHRI Cypress Creek SC	21630af	
1500 1600		USA, WINB Red Lion PA	13570am	
1500 1600		USA, WJHR Intl Milton FL	15550usb	
1500 1600		USA, WTWV Lebanon TN	9479va	
1500 1600		USA, WWCR Nashville TN	7490af	9980af
		13845eu	15825eu	
1500 1600		USA, WWRB Manchester TN	9370na	
1500 1600		USA, WYFR/Family R Worldwide	6280as	
		13690as	15520as	
1500 1600		Zambia, Christian Voice	6065af	
1500 1600		Zambia, CVC Intl/1 Africa	13590af	
1515 1530	Sat	Canada, Bible Voice Broadcasting	13740as	
1525 1555	Sat/Sun	Swaziland, TWR Africa	6025af	
1530 1545		India, AIR/Aizawl	5050do	7295do
1530 1545		India, AIR/Bhopal	4810do	7430do
1530 1545		India, AIR/Chennai	4920do	
1530 1545		India, AIR/External Svc	9910as	
1530 1545		India, AIR/Guwahati	4940do	
1530 1545		India, AIR/Hyderabad	4800do	

1530 1545	India, AIR/Imphal	4775do	
1530 1545	India, AIR/Itanagar	4990do	
1530 1545	India, AIR/Jaipur 4910do	7325do	
1530 1545	India, AIR/Jeyppore	5040do	
1530 1545	India, AIR/Kuresong	4895do	
1530 1545	India, AIR/Lucknow	4880do	7440do
1530 1545	India, AIR/Port Blair/Andaman & Nicobar	4760do	
1530 1545	India, AIR/R Kashmir	4950do	
1530 1545	India, AIR/Shillong	4970do	
1530 1545	India, AIR/Shimla	4965do	6020do
1530 1545	India, AIR/Thiruvananthapuram		5010do
1530 1549 smtwhf	Vatican City State, Vatican R	7485as	
1530 1550 smtwhf	Vatican City State, Vatican R	15595as	
1530 1550 smtwhf/DRM	Vatican City State, Vatican R	15775as	
1530 1600	Afghanistan, RTV Afghanistan		7200as
1530 1600	Australia, ABC/R Australia	11880pa	
1530 1600 DRM	Belgium, The Disco Palace	12115as	
1530 1600 h	Canada, Bible Voice Broadcasting		13740as
1530 1600	Iran, VO Islamic Rep of Iran	13785va	13785va
		15525va	
1530 1600	Mongolia, Voice of Mongolia		12015as
1530 1600 smtwa	Sri Lanka, AWR Asia	15255as	
1530 1600 Sat	Vatican City State, Vatican R	7585as	15595as
1530 1600 Sat	Vatican City State, Vatican R	15775as	
1551 1600	New Zealand, R New Zealand Intl		9765pa
1551 1600 DRM	New Zealand, R New Zealand Intl		7440pa

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

1600 1627	Iran, VO Islamic Rep of Iran	13785va	13785va
		15525va	
1600 1630	Australia, ABC/R Australia	9580as	
1600 1630 DRM	Belgium, The Disco Palace	12115as	
1600 1630	Guam, AWR Asia/Pacific	15215as	15660as
1600 1630	Vietnam, VO Vietnam/Overseas Svc	7220me	
		7280eu	9550me 9730eu
1600 1650 DRM	New Zealand, R New Zealand Intl		7440pa
1600 1657	China, China R International		6060as
		6155as	7235af 7255af 7420af
		7435eu	9435eu 9460eu 9570eu
		9600eu	9875as
1600 1657	North Korea, VO Korea	9990va	1154va
1600 1658	Taiwan, R Taiwan Intl	9440as	15485as
1600 1700	Anguilla, University Network		11775na
1600 1700	Australia, ABC NT Alice Springs		2310do
1600 1700	Australia, ABC NT Katherine		2485do
1600 1700	Australia, ABC/R Australia	5940as	5995pa
		7240pa	9475as 11660pa 11880pa
1600 1700	Bahrain, R Bahrain	6010me	
1600 1700	Canada, CFRX Toronto ON	6070na	
1600 1700	Canada, CFVP Calgary AB	6030na	
1600 1700	Canada, CKZN St Johns NF	6160na	
1600 1700	Canada, CKZU Vancouver BC		6160na
1600 1700	Egypt, R Cairo	15345af	
1600 1700	Eqt Guinea, Pan American BC/R Africa		15190af
1600 1700	Ethiopia, R Ethiopia	7235va	9560va
1600 1700	Malaysia, RTM Kajang/Traxx FM		7295do
1600 1700	New Zealand, R New Zealand Intl		9765pa
1600 1700	Palau, T8WH/World Harvest R		15530as
1600 1700	Russia, VO Russia	4780as	5885as
		5995as	9735as 9880as
1600 1700	South Korea, KBS World R	9515eu	9640as
1600 1700	Uganda, Dunamis Shortwave		4750do
1600 1700	UK, BBC World Service	3255af	5845as
		5975as	6190af 9410va 9505as
		9915eu	12095af 15400af 17640af
		17830af	21470af 21660af
1600 1700	USA, Amer Forces Network/AFRTS		4319usb
		5765usb	12759usb 13362usb
1600 1700	USA, BBG/VOA	4930af	6080af 15580af
		17895af	
1600 1700 mtwhf	USA, Overcomer Ministry	9980na	
1600 1700	USA, Overcomer Ministry	9370va	
1600 1700	USA, WBCQ Monticello ME	9330am	
1600 1700 Sat/Sun	USA, WBCQ Monticello ME	15420am	
1600 1700	USA, WEWN/EWTN Irondale AL		15610eu

1600 1700 Sat/Sun	USA, WHRI Cypress Creek SC		9795am
1600 1700	USA, WHRI Cypress Creek SC		9840na
		11630af	
1600 1700	USA, WINB Red Lion PA	13570am	
1600 1700	USA, WJHR Intl Milton FL	15550usb	
1600 1700	USA, WTWW Lebanon TN	9479va	
1600 1700	USA, WWCR Nashville TN	9980af	12160af
		13845eu	15825eu
1600 1700	USA, WWRB Manchester TN		9370na
1600 1700	USA, WYFR/Family R Worldwide		11850as
1600 1700	Zambia, Christian Voice	6065af	
1600 1700	Zambia, CVC Intl/1 Africa	13590af	
1630 1700	Guam, AWR Asia/Pacific	15660as	
1630 1700 m	South Africa, R Mirror Intl	4895af	
1630 1700	USA, BBG/VOA/Sudan in Focus		9490af
		11655af	13800af
1645 1700 mw	Canada, Bible Voice Broadcasting		9715me
1645 1700 thfas	Canada, Bible Voice Broadcasting		9715me
1651 1700	New Zealand, R New Zealand Intl		9890pa

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

1700 1710	Pakistan, PBC/R Pakistan	11575eu	
1700 1715 f	Canada, Bible Voice Broadcasting		9715me
1700 1730	Australia, ABC/R Australia	11660as	
1700 1730 m	South Africa, R Mirror Intl	3230af	
1700 1730	Vietnam, VO Vietnam/Overseas Svc		9625eu
1700 1745 h	Canada, Bible Voice Broadcasting		9715me
1700 1750 DRM	New Zealand, R New Zealand Intl		9890pa
1700 1750	New Zealand, R New Zealand Intl		9765pa
1700 1757	China, China R International		6090as
		6100as	6140as 6155eu 6165as
		7205af	7255as 7410as 7420af
		7425eu	7435af 9460eu 9570eu
1700 1758	Taiwan, R Taiwan Intl		15690af
1700 1800	Anguilla, University Network		11775na
1700 1800	Australia, ABC NT Alice Springs		2310do
1700 1800	Australia, ABC NT Katherine		2485do
1700 1800	Australia, ABC/R Australia	5995pa	9475as
		9500pa	9580pa 11880pa
1700 1800	Bahrain, R Bahrain	6010me	
1700 1800 tas	Canada, Bible Voice Broadcasting		9715me
1700 1800	Canada, CFRX Toronto ON	6070na	
1700 1800	Canada, CFVP Calgary AB	6030na	
1700 1800	Canada, CKZN St Johns NF	6160na	
1700 1800	Canada, CKZU Vancouver BC		6160na
1700 1800	Egypt, R Cairo	15345af	
1700 1800	Eqt Guinea, Pan American BC/R Africa		15190af
1700 1800	Malaysia, RTM Kajang/Traxx FM		7295do
1700 1800	Russia, VO Russia	4780as	7240as
		7330eu	9735va 9880as
1700 1800 mtwhf	South Africa, Channel Africa		15235af
1700 1800	Swaziland, TWR Africa	3200af	
1700 1800 Sat/Sun	Swaziland, TWR Africa	3200af	
1700 1800	UK, BBC World Service	3255af	5845as
		5975as	6190af 12095af 15400af
		15420af	17640af 17830af 21660af
1700 1800	USA, Amer Forces Network/AFRTS		4319usb
		5765usb	12759usb 13362usb
1700 1800	USA, BBG/VOA	6080af	13755af 15580af
		17895af	
1700 1800 mtwhf	USA, Overcomer Ministry	9980na	
1700 1800 Sat	USA, Overcomer Ministry	15420na	
1700 1800	USA, Overcomer Ministry	9370va	11900me
1700 1800	USA, WBCQ Monticello ME	9330am	15420am
1700 1800	USA, WEWN/EWTN Irondale AL		15610me
1700 1800	USA, WHRI Cypress Creek SC		9840na
		21630af	
1700 1800	USA, WINB Red Lion PA	13570am	
1700 1800	USA, WJHR Intl Milton FL	15550usb	
1700 1800	USA, WTWW Lebanon TN	9479va	
1700 1800	USA, WWCR Nashville TN	9980af	12160af
		13845eu	15825eu
1700 1800	USA, WWRB Manchester TN		9370na
1700 1800	USA, WYFR/Family R Worldwide		7395af
		17545af	
1700 1800	Zambia, Christian Voice	4965as	



1700 1800	Zambia, CVC Intl/1 Africa	13590af	
1715 1729	Vatican City State, Vatican R	11935va	
1730 1745	India, AIR/Bhopal	4810do	7430do
1730 1745	India, AIR/Chennai	4920do	
1730 1745	India, AIR/Guwahati	4940do	
1730 1745	India, AIR/Hyderabad	4800do	
1730 1745	India, AIR/Imphal	4775do	
1730 1745	India, AIR/Jaipur	4910do	7325do
1730 1745	India, AIR/Kuresong	4895do	
1730 1745	India, AIR/Lucknow	4880do	7440do
1730 1745	India, AIR/R Kashmir	4950do	
1730 1745	India, AIR/Shimla	4965do	6020do
1730 1745	India, AIR/Thiruvananthapuram	5010do	
1730 1757	Vatican City State, Vatican R	11625af	13765af 15570af
1730 1800	Australia, ABC/R Australia	6080pa	
1730 1800 Sun	Italy, IRRS SW	7290va	
1730 1800	Turkey, VO Turkey	11730va	
1745 1800	Bangladesh, Bangladesh Betar	7250eu	
1745 1800	India, AIR/External Svc	7550eu	9445va 9950eu 11580af 11670eu 11935af 13695af 17670af
1751 1800	New Zealand, R New Zealand Intl	11725pa	
1751 1800 DRM	New Zealand, R New Zealand Intl	11675pa	

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

1800 1815 Sat	Canada, Bible Voice Broadcasting	7365me	
1800 1830	Japan, R Japan NHK World	15720af	
1800 1830	Moldova, R PMR/Pridnestrovye	7290eu	
1800 1830 DRM	Romania, R Romania Intl	5895eu	
1800 1830	Tanzania, Zanzibar BC/VO Tanzania	11735do	
1800 1830	Turkey, VO Turkey	11730va	
1800 1830	UK, BBC World Service	5975as	7600as
1800 1830	USA, BBG/VOA 6080af	13755af	15580af
1800 1830 Sat/Sun	USA, BBG/VOA 4930af		
1800 1850 DRM	New Zealand, R New Zealand Intl	11675pa	
1800 1857	China, China R International	6100eu	7405eu
1800 1857	North Korea, VO Korea	7570eu	12015eu
1800 1858	Taiwan, R Taiwan Intl	3965eu	
1800 1900	Anguilla, University Network		11775na
1800 1900 mtwhf	Argentina, RAE	15345eu	
1800 1900	Australia, ABC NT Alice Springs	2310do	
1800 1900	Australia, ABC NT Katherine	2485do	
1800 1900	Australia, ABC/R Australia	6080pa	9475as 9500pa 9580as 11880pa
1800 1900 Sat/Sun	Australia, ABC/R Australia	9710as	
1800 1900	Bahrain, R Bahrain	6010me	
1800 1900	Bangladesh, Bangladesh Betar	7250eu	
1800 1900 Sat/Sun	Canada, Bible Voice Broadcasting	9715me	
1800 1900 Sat	Canada, Bible Voice Broadcasting	9470me	
1800 1900 Sun	Canada, Bible Voice Broadcasting	6030eu	
1800 1900	Canada, CFRX Toronto ON	6070na	
1800 1900	Canada, CFVP Calgary AB	6030na	
1800 1900	Canada, CKZN St Johns NF	6160na	
1800 1900	Canada, CKZU Vancouver BC	6160na	
1800 1900 mtwhfa	Ecuador, HCJB/LV de los Andes	3995eu	
1800 1900	Eqt Guinea, Pan American BC/R Africa	15190af	
1800 1900	India, AIR/External Svc	7550eu	9445va 9950eu 11580af 11670eu 11935af 13695af 17670af
1800 1900 fa	Italy, IRRS SW	7290va	
1800 1900	Kuwait, R Kuwait	15540eu	
1800 1900	Malaysia, RTM Kajang/Traxx FM	7295do	
1800 1900	New Zealand, R New Zealand Intl	11725pa	
1800 1900 DRM	Romania, R Romania Intl	9780eu	
1800 1900	Romania, R Romania Intl	11955eu	
1800 1900	Russia, VO Russia	4780as	7330eu 9735va 11985va
1800 1900	South Korea, KBS World R	7275eu	
1800 1900	Swaziland, TWR Africa	3200af	9500af
1800 1900 Sat/Sun	Swaziland, TWR Africa	3200af	
1800 1900	UK, BBC World Service	3255af	5875eu 5945eu 6190af 9430af 11810af 12095af 15400af 17640af

1800 1900	USA, Amer Forces Network/AFRTS	4319usb	
	5765usb 12759usb	13362usb	
1800 1900	USA, KJES Vado NM	15385na	
1800 1900 mtwhf	USA, Overcomer Ministry	9980na	
1800 1900	USA, Overcomer Ministry	9370va	
1800 1900	USA, WBCQ Monticello ME	9330am	15420am
1800 1900	USA, WEWN/EWTN Irondale AL		15610me
1800 1900	USA, WHRI Cypress Creek SC		9840na 21630af
1800 1900	USA, WINB Red Lion PA	13570am	
1800 1900	USA, WJHR Intl Milton FL	15550usb	
1800 1900	USA, WTWW Lebanon TN	9479va	
1800 1900	USA, WWCR Nashville TN	9980af	12160af 13845eu 15825eu
1800 1900	USA, WWRB Manchester TN		9370na
1800 1900	USA, WYFR/Family R Worldwide		5905af 9610af 9925af 13750af
1800 1900	Zambia, Christian Voice	4965af	
1800 1900	Zambia, CVC Intl/1 Africa	13590af	
1815 1845 Sat	Canada, Bible Voice Broadcasting		6030eu
1815 1845 Sun	Canada, Bible Voice Broadcasting		9470me
1830 1900 Sun	Italy, IRRS SW	7290va	
1830 1900 mtwhf/DRM	Nigeria, VO Nigeria	15120af	
1830 1900	South Africa, AWR Africa	11830af	
1830 1900	UK, BBC World Service	6005af	9410af
1830 1900	USA, BBG/VOA 4930af	6080af	13755af 15580af
1851 1900 DRM	New Zealand, R New Zealand Intl	15720pa	
1851 1900	New Zealand, R New Zealand Intl	11725pa	

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

1900 1930	Germany, Deutsche Welle	11800af	12070af 15275af
1900 1930	Vietnam, VO Vietnam/Overseas Svc	7280eu	9730eu
1900 1945	India, AIR/External Svc	7550eu	9445eu 9950eu 11580af 11670eu 11935af 13695af 17670af
1900 1950	New Zealand, R New Zealand Intl	11725pa	
1900 1957	China, China R International		7295va 9440af
1900 1957	North Korea, VO Korea	7219eu	9975va 11535va 11910af
1900 2000	Anguilla, University Network		11775na
1900 2000	Australia, ABC NT Alice Springs		2310do
1900 2000	Australia, ABC NT Katherine		2485do
1900 2000	Australia, ABC/R Australia	6080pa	9500as 9580pa 11660as 11880pa
1900 2000 Sat/Sun	Australia, ABC/R Australia	9710as	
1900 2000	Bahrain, R Bahrain	6010me	
1900 2000	Canada, CFRX Toronto ON	6070na	
1900 2000	Canada, CFVP Calgary AB	6030na	
1900 2000	Canada, CKZN St Johns NF	6160na	
1900 2000	Canada, CKZU Vancouver BC	6160na	
1900 2000	Egypt, R Cairo	15290af	
1900 2000	Eqt Guinea, Pan American BC/R Africa		15190af
1900 2000	Indonesia, VO Indonesia	9526va	
1900 2000	Kuwait, R Kuwait	15540eu	
1900 2000	Malaysia, RTM Kajang/Traxx FM		7295do
1900 2000	Micronesia, V6MP/Cross R/Pohnpei		4755as
1900 2000 DRM	New Zealand, R New Zealand Intl	15720pa	
1900 2000 mtwhf/DRM	Nigeria, VO Nigeria	15120af	
1900 2000	Russia, VO Russia	7330eu	
1900 2000 mtwhf	Spain, R Exterior de Espana	9605af	9665af
1900 2000	Swaziland, TWR Africa	3200af	
1900 2000 Sat/Sun	Swaziland, TWR Africa	3200af	
1900 2000	Thailand, R Thailand World Svc		9585eu
1900 2000	UK, BBC World Service	3255af	5875eu 5945eu 6190af 9410af 9430af 11810af 12095af 15400af
1900 2000	USA, Amer Forces Network/AFRTS	4319usb	
	5765usb 12759usb	13362usb	
1900 2000	USA, BBG/VOA 4930af	6080af	15580af
1900 2000 mtwhf	USA, Overcomer Ministry	9980na	13570ca
1900 2000	USA, Overcomer Ministry	9370va	9700eu 9835af 13570ca

1900 2000	Sat/Sun	USA, Overcomer Ministry	9980na	
1900 2000		USA, WBCQ Monticello ME9330am	15420am	
1900 2000		USA, WEWN/EWTN Irondale AL	15610me	
1900 2000		USA, WHRI Cypress Creek SC	9840na	
		21630af		
1900 2000		USA, WINB Red Lion PA	13570am	
1900 2000		USA, WJHR Intl Milton FL	15550usb	
1900 2000		USA, WTWV Lebanon TN	9479va	
1900 2000		USA, WWCR Nashville TN	9980af	12160af
		13845eu	15825eu	
1900 2000		USA, WWRB Manchester TN	9370na	
1900 2000		USA, WYFR/Family R Worldwide	9775af	
		9925af		
1900 2000		Zambia, Christian Voice	4965af	
1900 2000		Zambia, CVC Intl/1 Africa	13590af	
1905 1920	Sat	Mali, ORTM/R Mali	9635do	
1930 1957		Germany, Deutsche Welle	12070af	15275af
1930 2000		Eqt Guinea, Pan American BC/R Africa	9515af	
1930 2000		Iran, VO Islamic Rep of Iran	6040eu	7345eu
		12670af	15450af	
1930 2000		Serbia, International R Serbia	6100eu	
1930 2000		Turkey, VO Turkey	6050eu	
1930 2000	Sat	USA, Pan Amer Broadcasting	9515af	
1951 2000		New Zealand, R New Zealand Intl	17675pa	

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

2000 2027		Iran, VO Islamic Rep of Iran	6040eu	7345eu
		12670af	15450af	
2000 2027		Vatican City State, Vatican R		11625af
		13765af		
2000 2030		Australia, ABC/R Australia	6080pa	500as
2000 2030		Egypt, R Cairo	15290af	
2000 2030		Eqt Guinea, Pan American BC/R Africa	9515af	
2000 2030		Moldova, R PMR/Pridnestrovye		7290eu
2000 2030	Sat/Sun	Swaziland, TWR Africa	3200af	
2000 2030		Turkey, VO Turkey	6050eu	
2000 2030		USA, BBG/VOA 4930af	6080af	15580af
2000 2030	mtwhf	USA, Overcomer Ministry	13570ca	
2000 2057		China, China R International	5960eu	
		5985af	7285eu	7295va
		9440af	9600eu	11640eu
		9655af		13630eu
2000 2057		Germany, Deutsche Welle	9655af	
2000 2100		Anguilla, University Network		11775na
2000 2100		Australia, ABC NT Alice Springs		2310do
2000 2100		Australia, ABC NT Katherine		2485do
2000 2100		Australia, ABC NT Tennant Creek		2325do
2000 2100		Australia, ABC/R Australia	9580pa	11650pa
		11660pa	12080pa	15515pa
2000 2100		Bahrain, R Bahrain	6010me	
2000 2100		Belarus, R Belarus	7255eu	11730eu
2000 2100	DRM	Belgium, The Disco Palace	17875na	
2000 2100		Canada, CFRX Toronto ON	6070na	
2000 2100		Canada, CFVP Calgary AB	6030na	
2000 2100		Canada, CKZN St Johns NF		6160na
2000 2100		Canada, CKZU Vancouver BC		6160na
2000 2100		Cuba, R Havana Cuba	11760am	
2000 2100		Eqt Guinea, Pan American BC/R Africa	15190af	
2000 2100		Kuwait, R Kuwait	15540eu	
2000 2100		Malaysia, RTM Kajang/Traxx FM	7295do	
2000 2100		Micronesia, V6MP/Cross R/Pohnpei	4755as	
2000 2100	DRM	New Zealand, R New Zealand Intl	15720pa	
2000 2100		New Zealand, R New Zealand Intl	17675pa	
2000 2100		Russia, VO Russia	7330eu	
2000 2100		South Africa, CVC 1 Africa R		9505af
		13590af		
2000 2100		UK, BBC World Service	3255af	6190af
		9410af	9430af	11810af
		15400af		12095af
2000 2100		USA, Amer Forces Network/AFRTS	4319usb	
		5765usb	12759usb	13362usb
2000 2100	mtwhf	USA, BBG/VOA 9480va		
2000 2100		USA, Overcomer Ministry	7290eu	9370va
		9700eu	9990af	
2000 2100		USA, Overcomer Ministry	9980na	

2000 2100		USA, WBCQ Monticello ME7490am	9330am	
		15420am		
2000 2100		USA, WEWN/EWTN Irondale AL	15610me	
2000 2100	mtwhfa	USA, WHRI Cypress Creek SC	21630af	
2000 2100		USA, WHRI Cypress Creek SC		17510va
2000 2100		USA, WINB Red Lion PA	13570am	
2000 2100		USA, WJHR Intl Milton FL	15550usb	
2000 2100		USA, WTWV Lebanon TN	9479va	
2000 2100		USA, WWCR Nashville TN	9980af	12160af
		13845eu	15825eu	
2000 2100		USA, WWRB Manchester TN	9370na	
2000 2100		USA, WYFR/Family R Worldwide	15195af	
2000 2100		Zambia, Christian Voice	4965af	
2000 2100		Zambia, CVC Intl/1 Africa	13590af	
2030 2045		Thailand, R Thailand World Svc		9535eu
2030 2100		Australia, ABC/R Australia	9500pa	11695as
2030 2100		USA, BBG/VOA 4930af	6080af	7560as
		15580af		
2030 2100	Sat/Sun	USA, BBG/VOA 4930af		
2030 2100		Vietnam, VO Vietnam/Overseas Svc	7220me	
		7280eu	9730me	9730eu
2045 2100		India, AIR/External Svc	7550eu	9445eu
		9910pa	11620pa	11670eu
2045 2100	DRM	India, AIR/External Svc	9950eu	

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

2100 2130	mtwhfa	Albania, R Tirana	7465eu	
2100 2130		Australia, ABC NT Alice Springs		2310do
2100 2130		Australia, ABC NT Katherine		2485do
2100 2130		Australia, ABC NT Tennant Creek		2325do
2100 2130		Austria, AWR Europe	9830af	
2100 2150		New Zealand, R New Zealand Intl		17675pa
2100 2150	DRM	New Zealand, R New Zealand Intl		15720pa
2100 2157		China, China R International	7205af	7285eu
		7405af	7415eu	9600eu
2100 2157		North Korea, VO Korea	7570eu	12015eu
2100 2200		Angola, Angolan National R		7217af
2100 2200		Anguilla, University Network		11775na
2100 2200		Australia, ABC/R Australia	9500pa	9660as
		11650pa	11695pa	12080pa
		15515pa	21740pa	
2100 2200		Bahrain, R Bahrain	6010me	
2100 2200		Belarus, R Belarus	7255eu	11730eu
2100 2200		Canada, CFRX Toronto ON	6070na	
2100 2200		Canada, CFVP Calgary AB	6030na	
2100 2200		Canada, CKZN St Johns NF		6160na
2100 2200		Canada, CKZU Vancouver BC		6160na
2100 2200		Egypt, R Cairo	11890eu	12050af
2100 2200		Eqt Guinea, Pan American BC/R Africa	15190af	
2100 2200		Germany, Deutsche Welle	11800af	12070af
2100 2200		India, AIR/External Svc	7550eu	9445eu
		9910pa	11620pa	11670eu
2100 2200	DRM	India, AIR/External Svc	9950eu	
2100 2200		Malaysia, RTM Kajang/Traxx FM	7295do	
2100 2200		Micronesia, V6MP/Cross R/Pohnpei	4755 as	
2100 2200		Russia, VO Russia	5940eu	
2100 2200		South Africa, CVC 1 Africa R		9505af
		13590af		
2100 2200		Syria, R Damascus	9330va	
2100 2200		UK, BBC World Service	3255af	3915as
		5875as	5905as	5995af
		6195as	9410af	9915af
				12095af
2100 2200		USA, Amer Forces Network/AFRTS	4319usb	
		5765usb	12759usb	13362usb
2100 2200		USA, BBG/VOA 6080af	15580af	
2100 2200		USA, Overcomer Ministry	9370va	9700eu
2100 2200	Sat/Sun	USA, Overcomer Ministry	9980na	
2100 2200		USA, WBCQ Monticello ME7490am	9330am	
2100 2200		USA, WEWN/EWTN Irondale AL	15610me	
2100 2200		USA, WHRI Cypress Creek SC		17510va
2100 2200		USA, WINB Red Lion PA	9265am	
2100 2200		USA, WJHR Intl Milton FL	15550usb	
2100 2200		USA, WTWV Lebanon TN	9479va	
2100 2200		USA, WWCR Nashville TN	6875eu	9350af
		9980af	13845eu	

2100 2200	USA, WWRB Manchester TN	3185na
	3215na 9370na	
2100 2200	USA, WYFR/Family R Worldwide	12070af
2100 2200	Zambia, Christian Voice	4965af
2100 2200	Zambia, CVC Intl/1 Africa	13590af
2130 2200	Australia, ABC NT Alice Springs	4835do
2130 2200	Australia, ABC NT Katherine	5025do
2130 2200 DRM	Romania, R Romania Intl	6030eu
2130 2200	Romania, R Romania Intl	7310na 7380eu
	9435na	
2130 2200	Turkey, VO Turkey	9610va
2145 2200	India, AIR/R Kashmir	4950do
2151 2200	New Zealand, R New Zealand Intl	15720pa
2151 2200 DRM	New Zealand, R New Zealand Intl	17675pa

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

2200 2230	India, AIR/External Svc	9910pa 11620pa
	11670eu 11740pa	
2200 2230 DRM	India, AIR/External Svc	9950eu
2200 2230	Moldova, R PMR/Pridnestrovye	7290eu
2200 2230	Serbia, International R Serbia	6100eu
2200 2230	South Korea, KBS World R	3955eu
2200 2230	Turkey, VO Turkey	9610va
2200 2245	Egypt, R Cairo	11890eu 12050al
2200 2257	China, China R International	5915eu
2200 2300	Anguilla, University Network	6090na
2200 2300	Australia, ABC NT Alice Springs	4835do
2200 2300	Australia, ABC NT Katherine	5025do
2200 2300	Australia, ABC/R Australia	9660as 9855as
	12080pa 13630pa 15230pa 15415pa	
	15515pa 21740pa	
2200 2300	Bahrain, R Bahrain	6010me
2200 2300	Canada, CFRX Toronto ON	6070na
2200 2300	Canada, CFVP Calgary AB	6030na
2200 2300	Canada, CKZN St Johns NF	6160na
2200 2300	Canada, CKZU Vancouver BC	6160na
2200 2300	Eqt Guinea, Pan American BC/R Africa	15190af
2200 2300	Malaysia, RTM Kajang/Traxx FM	7295do
2200 2300	Micronesia, V6MP/Cross R/Pohnpei	4755 as
	as	
2200 2300	New Zealand, R New Zealand Intl	15720pa
2200 2300 DRM	New Zealand, R New Zealand Intl	17675pa
2200 2300 Sat	Palau, T8WH/World Harvest R	9930as
2200 2300 Sat/Sun	Russia, VO Russia	7250am 11830na
2200 2300	Spain, R Exterior de Espana	6125eu
2200 2300	Taiwan, R Taiwan Intl	6115na 15440na
2200 2300	UK, BBC World Service	3915as 5905as
	5875as 5885af 6135as 6195as	
2200 2300	USA, Amer Forces Network/AFRTS	4319usb
	5765usb 12759usb 13362usb	
2200 2300 smtwhf	USA, BBG/VOA	5895va 7365va 7425va
	7480va 11860va	
2200 2300	USA, Overcomer Ministry	9370va 9980na
	9990af	
2200 2300	USA, WBCQ Monticello ME	7490am
	9330am	
2200 2300	USA, WEWN/EWTN Irondale AL	15610me
2200 2300	USA, WHRI Cypress Creek SC	11775va
	13620na 17510va	
2200 2300 twhf	USA, WINB Red Lion PA	9265am
2200 2300	USA, WTWW Lebanon TN	9479va
2200 2300	USA, WWCR Nashville TN	6875eu 9350af
	9980af 13845eu	
2200 2300	USA, WWRB Manchester TN	3185na
	3215na 9370na	
2200 2300	Zambia, Christian Voice	4965af
2215 2300	USA, WYFR/Family R Worldwide	6145va
2230 2300	China, Xizang PBS	4905do
2230 2300	Guam, AWR Asia/Pacific	15320as
2230 2300	USA, WYFR/Family R Worldwide	6145na
	11580af 15255af	
2245 2300	India, AIR/External Svc	6055as 9690as
	9705as 11710as 13605as	
2245 2300 DRM	India, AIR/External Svc	11645as
2245 2300	India, AIR/R Kashmir	4950do

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

2300 0000	Anguilla, University Network	6090na
2300 0000	Australia, ABC NT Alice Springs	4835do
2300 0000	Australia, ABC NT Katherine	5025do
2300 0000	Australia, ABC/R Australia	9660as 9855as
	12080pa 15230pa 15415pa 15230pa	
	15415pa 17795pa 19000pa 21740pa	
2300 0000	Bahrain, R Bahrain	6010me
2300 0000	Canada, CFRX Toronto ON	6070na
2300 0000	Canada, CFVP Calgary AB	6030na
2300 0000	Canada, CKZN St Johns NF	6160na
2300 0000	Canada, CKZU Vancouver BC	6160na
2300 0000	Egypt, R Cairo	9965am 11510al
2300 0000	India, AIR/External Svc	6055as 9690as
	9705as 11710as 13605as	
2300 0000 DRM	India, AIR/External Svc	11645as
2300 0000	Malaysia, RTM Kajang/Traxx FM	7295do
2300 0000	Micronesia, V6MP/Cross R/Pohnpei	4755 as
2300 0000	New Zealand, R New Zealand Intl	15720pa
2300 0000 DRM	New Zealand, R New Zealand Intl	17675pa
2300 0000	Romania, R Romania Intl	6015eu 7220eu
	9530as 11810as	
2300 0000	Russia, VO Russia	7250am 7290am
2300 0000	Turkey, VO Turkey	5960va
2300 0000	UK, BBC World Service	3915as 5875as
	5980as 6135as 6195as 7490as	
	9740as 11955as	
2300 0000	USA, Amer Forces Network/AFRTS	4319usb
	5765usb 12759usb 13362usb	
2300 0000	USA, BBG/VOA	5830va 7365va 7480va
	11860va	
2300 0000	USA, Overcomer Ministry	9370va
2300 0000 mtwhf	USA, Overcomer Ministry	9980na
2300 0000	USA, WBCQ Monticello ME	7490am 9330am
2300 0000 Sat/Sun	USA, WBCQ Monticello ME	5110am
2300 0000	USA, WEWN/EWTN Irondale AL	15610me
2300 0000	USA, WHRI Cypress Creek SC	13620na
	17510va	
2300 0000 Sun	USA, WHRI Cypress Creek SC	11775va
2300 0000 mtwhfs	USA, WHRI Cypress Creek SC	7315ca
2300 0000	USA, WINB Red Lion PA	9265am
2300 0000	USA, WTWW Lebanon TN	9479va
2300 0000	USA, WWCR Nashville TN	3195eu 5070af
	9980af 13845eu	
2300 0000	USA, WWRB Manchester TN	3185na
	3215na 9370na	
2300 0000	USA, WYFR/Family R Worldwide	6145na
	15255as 11580sa	
2300 0000	Zambia, Christian Voice	4965af
2300 2357	China, China R International	5915as
	5990ca 6145na 7350eu 7415as	
	9535as 11790as	
2330 0000	Australia, ABC/R Australia	17750pa
2330 0000 tw	Guam, AWR Asia/Pacific	17700as
2330 0000	Vietnam, VO Vietnam/Overseas Svc	9840as
	12020as	

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# Technology and Milcom Satellite Monitoring

(All Photos are courtesy of the Department of Defense)

**N**ew technologies and services have created explosive demand for radio spectrum, not only within the civilian sector, but also in the military sector. Spectrum is a finite resource – more cannot be made – and by any measure under current rules, demand is outstripping supply. Fortunately, the same technologies that create exploding demand can provide the solution to this problem, by letting more devices use spectrum than is now possible.

Each year in the January issue of *Monitoring Times* we focus on technology and radio monitoring. Nowhere in radio monitoring has technology been more evident than in the area of military monitoring. In this edition of *Milcom* we will look at one of the areas of military monitoring where technology is at the fore front; military satellites (milsat) communications (comms).

## ❖ UHF Military Satellite Monitoring

The military has a wide variety of military satellite communication system all throughout the VHF/UHF/Microwave spectrum. Most of what can be heard on most of these systems is what a friend of mine calls “all those extremely annoying noises.”

The last bastion of military satellites communication monitoring lies in the 225-400 MHz military aircraft band. But before we delve into this portion of the spectrum, I need to pass along a caveat. Satellite monitoring is one of those areas of the radio hobby that is not an easy thing to do from a hardware point of view, and when you compare that setup against the small amount of clear communications that can be heard, frankly, milsat monitoring frustrates most radio hobbyists.

Many years ago in another life, or so it seems to me, there were a lot more UHF milsat communications in the clear. But as the amount of military satellite traffic continued to increase, the need for more satellite capability also increased. The Department of Defense had to turn to more advanced technologies in order the pack more communications into the same amount of radio spectrum that they had available.

## ❖ The Current DoD Milsat Bandplan Overview

The global frequency plan for the UHF Follow-On (UHF F/O)-UHF system channels, together with some FLTSAT channels, falls in the 243-270 MHz (downlink) and 293-318 MHz (uplink) bands. The UHF F/O frequency plans provide 84 separate 5-kHz channels and 68 separate 25-kHz channels. These are usually spaced at 10-kHz and 50-kHz intervals in order to provide guard bands. Each channel requires an uplink and a downlink that are separated in frequency. Ad-

ditionally, four downlink 25-kHz channel frequencies are assigned to fleet broadcast service, only two of these being available in a single-coverage region.

Due to TDMA (time division multiple access), each 25-kHz channel is roughly equivalent in capacity to five 5-kHz channels. Each 5-kHz-equivalent channel can support various services, such as 4.8 kbps half-duplex, 2.4 kbps full-duplex, or 2.4 kbps half-duplex with one-half rate FEC coding. Omitting the broadcast channels, the UHF-F/O plan provides a maximum of  $4(21+5 \times 17) = 424$  5-kHz equivalent channels in an overlap coverage region.

In practice, some channels are unavailable, due to interference or malfunction. The fraction of these channels accessible to an earth terminal varies from 50 percent (single satellite coverage region) to 100% (overlap coverage region between adjacent satellites). The total bandwidth used by the UHF-F/O plan, including guard bands and up/down links is about 8.5-MHz.

So what satellites can we hear in this UHF radio spectrum? The satellite systems list is considerably shorter than in years past when we look at the UHF spectrum. In our survey this month we will look at the FLTSATCOM (one bird remains), AFSATCOM system, UHF-F/O satellite constellation, and Milstar constellation, but I will limit our frequency coverage to satellites heard over the continental United States.

## ❖ Fleet Satellite Communications (FLTSATCOM)

The FLTSATCOM system provided near global operational communications for naval aircraft, ships, submarines and ground stations. It also provided communications between the National Command Authority (NCA) and the strategic nuclear forces as well as between other high-priority users. High priority users include the White House Communications Agency, reconnaissance aircraft, Air Intelligence Agency and ground forces (e.g., Special Operations Forces). FLTSATCOM satellites operated primarily



Artist rendition of a Block 2 Military FLTSATCOM satellite in orbit

in the UHF band, but uses SHF for the Navy's shore-based Fleet Satellite Broadcast uplink. Some of the later satellites also carry EHF transponders for use with MILSTAR ground terminals.

All of the FLTSATs have been retired as primary communications platforms and replaced by UHF F/O satellites (already in orbit). This was done after the EAM dissemination and nuclear reporting mission of AFSATCOM transitioned to Milstar. At this point we have one FLTSATCOM satellite left in a backup role and that is FTSATCOM F-8 located at 15.4 degrees using the Bravo bandplan. It is a bird that can only be heard from the East Coast.

The frequencies associated with the last FLTSATCOM are listed below.

FLTSATCOM Band Plan B (FLTSATCOM F-8/USA-46 at 14.7 deg West)  
25 kHz wideband data fleet broadcast  
250.550 MHz

Fleet Relay 25 kHz bandwidth frequencies  
252.050 253.750 255.450 257.050  
258.550 265.450 266.950 268.350  
269.850 MHz

AFSATCOM 5 kHz narrow bandwidth frequencies  
244.045 244.055 244.060 244.065  
244.070 244.075 244.080 244.085  
244.090 244.095 244.100 244.110 MHz

Channel 23 wideband 500-kHz bandwidth transponder frequencies (25 kHz spacing)  
261.450 - 261.950 MHz

## ❖ Air Force Satellite Communications System (AFSATCOM)

The AFSATCOM system provided secure, reliable and survivable two-way global communications between the National Command Authority (NCA) and strategic nuclear forces. The AFSATCOM system was used for EAM dissemination, JCS/CINC Internetting, CINC force direction message dissemination, force report back and other high-priority user traffic dissemination. Strategic nuclear forces included ICBM launch and control centers, B-52, B-1B and B-2 bombers and nuclear capable submarines (SSBNs).

On the FLTSATCOM satellites, all twelve 5 kHz narrow band channels and the one 500 kHz wide-band channel were dedicated to the AFSATCOM mission. Seven of the twelve 5 kHz narrow-band channels were regenerative and could only be used for 75-bps digital communications (not voice).

In addition to FLTSATCOM satellites, AFSATCOM also had transponders on board other host satellites to provide coverage over the North Pole. There are two systems in use for polar coverage: the Satellite Data System

(SDS) and Package D, a piggy-back payload on classified host vehicles. SDS satellites included a payload similar to the twelve-channel 5 kHz system carried onboard the FLTSATs. All twelve of these frequencies were regenerative and could only be used for 75- bps data. Package D satellites provided a UHF package similar to the SDS satellites.

As noted above, the mission of the AFSATCOM system appears to have been taken over by the Milstar satellite constellation. I still see a lot of spread spectrum communications on what appears to be AFTSATCOM frequencies, but the days of the 75-bps channels appear to be over.

The following is a list of known AFSATCOM transponders:

FLTSATCOM/UFO Satellites - 243.945-244.010, 244.045-244.110, 244.145-244.210 MHz  
 SDS Satellites - 243.695-243.760 and 243.855-243.920 MHz  
 Package D satellites Unknown

### ❖ UHF Follow-on (UHF F/O)

The UHF F/O system consists of eight (plus one spare) satellites, located in the same geosynchronous orbital positions as FLTSATCOM (two UHF F/Os at each FLTSAT location).

The Navy owns the FLTSATCOM and UHF F/O systems and is responsible for the system configurations and for their communications support to all services. The main mission of UHF F/O is to support global communications to naval forces.

UHF F/O provides channels to replace the 5-kHz narrow-band channels previously available on FLTSATCOM and replaces the 500-kHz DOD wide-band channel with an appropriate number of 5- and 25-kHz channels. UHF F/O does not replace the regenerative, frequency-hopped 5-kHz channels serving the EAM dissemination and nuclear reporting mission of AFSATCOM. The Milstar system and the EHF transponders on UHF F/O fulfill these latter requirements.

Each UHF F/O has 18 channels of 25-kHz bandwidth and 21 channels of 5-kHz bandwidth; essentially doubling the FLTSATCOM capability. Since there are two satellites at each orbital position, 78 UHF channels will be available over the Atlantic, Pacific and Indian Ocean regions as well as CONUS. There are no 500-kHz wide-band channels on UHF F/O. Flights four through ten have EHF transponders for use by Milstar ground terminals. Flights eight through ten also carry EHF Ka-band transponders for use by the Global Broadcast Service (GBS) to broadcast missile warning, intelligence, video, and imagery data to tactical units.

All UHF F/Os are electromagnetic pulse (EMP) protected. Although each channel can relay signals from all current military UHF SATCOM radios (those that do not require processed channels), the JCS requires all UHF SATCOM radios operate in the Demand Assigned Multiple Access (DAMA) mode unless a waiver has been granted. DAMA is a modified time sharing technique to allow more users to share the same UHF channel, 5-kHz or 25-kHz.

None of the 25 kHz bandwidth frequencies listed in our list below has constant clear voice comms and clear voice comms are sporadic at best. These clear voice comms may be as a result of a DAMA mode malfunction (some of the VSAT references we hear) or analog comms allowed on a waiver.



Artist rendition of a UHF F/O military communications satellite in orbit

The two main Continental United States UHF F/O satellites are UFO-5 at 99.4 deg West and UFO-6 at 105.5 deg west.

UHF F/O Band Plan November UFO-5 at 99.4 deg West  
 5-kHz bandwidth frequencies  
 243.915 243.925 243.935 243.945  
 243.955 243.965\* 243.975 243.985  
 248.845 248.855 248.865 248.875  
 248.885 248.895 248.905 248.915  
 248.925 248.935 248.945 248.955  
 248.965\* MHz

Notes:

- 1) All of the channels above carrying digital data streams transmitting continuously
- 2) Asterisks indicate frequencies carrying digital data streams that are being keyed, similar to ANDVT type comms.

25-kHz bandwidth frequencies  
 251.850 Known as SAT-B, possible Army / Air Force Special Ops assignment.  
 253.550 Digital comms  
 255.250 Unknown user/usage, occasional pirate activity  
 256.850 ANDVT comms, occasional pirate activity  
 258.350 Digital comms  
 260.375 Navy frequency known as TSCOM-1  
 260.475 Known as CONR-1 and VSAT, this appears to be a major CONUS military assignment and has been recently the most active.  
 261.575 Known as CONR-3 and C SARSAT, frequency carries a wide variety activity including USAF SAR activity.  
 261.675 Probable Air Force assignment  
 261.775 Unknown user/usage  
 261.875 Army assignment including Hunter AAF activity  
 263.575 Probable Marine Corps assignment  
 263.675 Unknown user/usage  
 265.250 CN401 Net: JIATF South/Coast Guard clear/ANDVT comms  
 266.750 Identified as SAT Bravo and SAT Echo  
 268.150 Unknown user/usage  
 269.650 Probable Army assignment

UHF F/O Band Plan Quebec UFO-6 at 105.5 deg West  
 5-kHz bandwidth frequencies  
 244.155 244.165 244.175 244.185 244.195  
 244.205 244.215 244.225 249.235  
 249.245 249.255 249.265 249.275  
 249.285 249.295 249.305 249.315  
 249.325 249.335 249.345 249.355 MHz

Notes:

- 1) All of the channels above carrying digital data streams transmitting continuously

25-kHz bandwidth frequencies  
 252.150 Unknown user/encrypted comms, occasional pirate activity  
 253.850 Unknown user/usage  
 255.550 Probable Army assignment, occasional pirate activity  
 257.150 Possible JIATF assignment, encrypted comms  
 258.650 Air Force comms, occasionally identified as TAC-10 / ANDVT, occasional pirate activity including voice inversion encryption  
 260.625 Probable Marine Corps assignment, occasional pirate activity  
 260.725 Air Force SAR assignment, occasional pirate activity  
 262.125 Possible Army / Air Force Special Ops assignment.  
 262.225 Unknown user/usage  
 262.325 Unknown user/usage  
 262.425 Unknown user/usage  
 263.825 Unknown user/usage  
 263.925 Unknown user/usage, occasional pirate activity  
 265.550 Unknown user/usage, occasional pirate activity  
 267.050 Frequency associated with NORAD AICC, occasional pirate activity  
 268.450 Digital comms  
 269.950 Air Force/Navy/Marine Corps activity heard here

### ❖ Milstar

Milstar provides highly robust, secure and survivable communications among fixed-site and mobile terminals. The name "Milstar" originated as the acronym for Military Strategic and Tactical Relay satellite system. In the early 1990s the acronym was adopted as the system name, and is therefore not written in capital letters.

Operating primarily in the Extremely High Frequency (EHF) and Super High Frequency (SHF) bands, Milstar satisfies the U.S. military's communications requirements with worldwide, anti-jam, scintillation resistant, Low Probability of Intercept (LPI) and Low Probability of Detection (LPD) communications services.



Artist rendition of a Milstar military communications satellite in orbit

There is a UHF component to Milstar that may be a UHF legacy/backup system to the old AFSATCOM system. The signal uses a spread spectrum mode and the modulation, when monitored in the sideband mode sounds like water dripping. It has been dubbed by milsat monitors as the "water dripper."

My latest monitoring shows a "dripper" operating from 243.789 to 243.8485 MHz from USA 157 (Milstar 4/DFS-4) at 67/9 deg West.

And that does it for this month. *MT's Milcom* will continue to watch for milsat activity in the milair UHF spectrum and will report future results in this column as it becomes available. Until next time, 73 and good hunting.



# DEA Communications In Transition

**A**s new communications technologies become available, federal agencies are sometimes, but not always, eager to embrace change. For years, the digital communications mode known as APCO P-25 has been increasingly utilized by federal agencies across the country. In some cases, due to budget pressures or even politics, agencies have been forced to put off communications upgrades as long as they could. But as the mandate for federal narrow banding approached and the pressures of “interoperability” between federal agencies mounted, some remaining government offices still utilizing analog radio systems have finally begun to purchase new equipment and move towards digital radio operation. One federal agency that has seemingly waited as long as they could was the Drug Enforcement Administration (DEA).



There are several possible reasons for the delay in the DEA getting an updated radio system. First was their expected participation in the Justice Department’s Integrated Wireless Network (IWN), a digital trunked radio system that had been planned for nationwide deployment. Upgrades to the DEA radio systems were on hold pending the build out of federal IWN sites. However, as has been covered in recent Fed Files columns, the IWN has run into substantial funding problems and is pretty much dead in the water, for now. However, in the areas currently served by the existing IWN network sites, the DEA appears to be a full time subscriber.

Secondly, the DEA has traditionally utilized many frequencies in the federal 406-420 MHz UHF band. This band had previously had no official allocation requirements for repeater input or output frequencies. The DEA set up their radio channels as they saw fit when the agency began operations in 1973. Since then, re-channeling by the National Telecommunications and Information Administration (NTIA), who are in charge of federal frequency allocations, established that the federal UHF band should use a standard repeater “offset” of 9 MHz. In general, frequencies from 406-410 MHz are to be used as repeater output frequencies, while the inputs to these repeaters will be 9 MHz higher. Frequencies from 411 to 414 MHz are available for simplex channels. Some cases of using non-standard repeater pairs are still being seen.

Also, there is some evidence that with all the attention that the fight against terrorism is getting these days, the DEA and their fight against illegal narcotics has not gotten as much attention or as large a piece of the Justice Department funding as in the past. But the DEA is clearly still in business and still using radios.

In early 2010, reports started coming in

to the Fed Files about new digital APCO P-25 activity that might be the DEA. In some areas, they simply converted their 418 MHz channels from analog to P-25 digital, using a P-25 NAC of N156 instead of the CTCSS tone of 156.7 Hz. In other areas, particularly Southeast Texas and the Gulf Coast, listeners reported new digital channels in the 409 MHz region that were apparently DEA surveillance and operational channels. Currently, in some regions of the country, the DEA has upgraded to full time digital operations of their communications systems. In others, the radios operate in a “mixed” mode with analog still being utilized and some digital usage of simplex for surveillance operations.

Here are some currently confirmed DEA frequency assignments in the federal 406-420 MHz band. When programming these into your scanner, be sure and pay attention to the use of PL tones or P25 NACs. If they are still analog, they will be using a CTCSS tone of 156.7 Hz. If they are using P25 digital they will use a NAC of N156. Many of the channel numbers or designations have been confirmed, but as with many of the older channel numbers, the channel names may vary from DEA region to region.

- 408.2750
- 408.3000
- 408.3250
- 408.3750
- 409.6250 – New F1
- 409.6750 – New F6
- 409.8125 – New F7
- 409.8250 – New F8
- 409.9000 – New F9
- 409.9500 – New F10
- 409.9875
- 410.4125 – New F11
- 410.8125
- 411.1250 – New Simplex 1
- 411.1250 – Input to 419.2500
- 411.1500
- 411.1750
- 412.0000 – HIDTA F6
- 412.1250 – HIDTA F10
- 412.2000 – New Simplex 2
- 412.4500
- 412.4750
- 412.5250 – Input to 414.5500
- 412.5500
- 413.6250
- 413.6750
- 413.7000
- 413.7500
- 413.9750 – New Simplex 3
- 413.9750 – Input to 417.7500 & 419.2250
- 414.0000
- 414.0250 – HIDTA F3
- 414.0500 – HIDTA F4
- 414.0750
- 414.1000
- 414.1250
- 414.1500 – HIDTA F5
- 414.1750
- 414.2000 – New Simplex 4
- 414.2250
- 414.2750
- 414.3000

- 414.3250
- 414.3500 – HIDTA F7
- 414.4000
- 414.4250 – Input to 419.2750
- 414.4500 – New Simplex 5
- 414.4500 – HIDTA F8
- 414.4750 – HIDTA F9
- 414.5000 – HIDTA F2
- 414.5250 – Input to 419.3000
- 414.5500 – HIDTA F1
- 414.5750
- 414.6000 – Input to 419.2000
- 415.5000
- 415.6000 – Input to 418.8250
- 416.0500 – Input to 418.6250
- 416.1000
- 416.1500
- 416.2000 – Input to 418.9500
- 416.2750
- 416.3250 – Input to 418.9000
- 416.3750 – Input to 418.7750
- 417.0250 – Input to 418.9750
- 417.0500
- 417.0750
- 417.1000
- 417.1250 – Input to 412.0000
- 417.1500
- 417.1750 – Input to 412.1250
- 417.2750
- 417.3250
- 417.4000 – Input to 419.0000
- 417.4500
- 417.5000
- 417.5500
- 417.7500
- 418.0000
- 418.0500 – Simplex (Federal Itinerant Frequency)
- 418.0750 – Simplex (Federal Interagency Com-  
mon)
- 418.1250
- 418.1750 – Simplex
- 418.2000 – Simplex
- 418.2250 – Simplex
- 418.3250 – Simplex or input to 409.3250
- 418.5000 – Simplex
- 418.5750 – Simplex (federal itinerant)
- 418.6250 – Old F1, input to 409.6250
- 418.6500 – Simplex
- 418.6750 – Old F4 simplex, input to 409.6750
- 418.7000 – Simplex
- 418.7500 – Old F3 simplex
- 418.7750 – Simplex
- 418.8000 – Simplex
- 418.8125 – Input to 409.8125
- 418.8250 – Old F5, input to 409.8250
- 418.8500
- 418.8750 – Simplex
- 418.9000 – Old F2, input to 409.9000
- 418.9000 – Old F2
- 418.9250
- 418.9500 – Old F6, input to 409.9500
- 418.9750 – Old F8
- 419.0000
- 419.2000
- 419.2250 – Simplex
- 419.2500
- 419.2750
- 419.3000
- 419.3250 – input to 414.3500
- 419.3750 – input to 414.4500
- 419.4000 – input to 414.4750
- 419.4250 – Old input 414.5000, input to  
413.9750
- 419.4500

419.5000  
 419.5250 – Old F10  
 419.9750 – Input to 413.9750

In the frequency listings above, HIDTA stands for High Intensity Drug Trafficking Area and is a program that concentrates resources on major drug trafficking areas in the United States. HIDTA operations normally involve federal support of local police operations that are involved in drug enforcement.

In addition to the normal UHF channels the DEA uses, there have been some reports of VHF activity that may be the DEA. In 2008, the Department of Justice Wireless Management Office (WMO) offered this quote in their budget request to Congress:

“The DEA’s legacy radio system is UHF-based, and not compatible with any other Department components’ VHF system. It is not practical or feasible to convert DEA to VHF as an interim action (DOJ examined this alternative thoroughly, but found it to be operationally unworkable because of the way DEA operates its surveillance and task force operations.)”

Despite this information, the DEA has apparently been using some VHF channels in limited areas. Whether these are an attempt at interoperability with other federal agencies, or just a first step to actually moving to VHF channels full time is unknown. Again, the activity monitored was mostly P-25 digital with a NAC of N156.

162.7875  
 163.2000  
 164.5500  
 164.8625  
 165.4125  
 165.5125  
 165.5625  
 165.5875  
 165.8500  
 166.4625  
 168.8625  
 170.5750  
 170.5875  
 170.9000  
 171.4500  
 171.5875  
 171.6000  
 171.6500  
 172.0000  
 172.1000  
 172.2000  
 172.3000  
 172.7250  
 173.6000  
 173.8625

As these changes continue with the DEA, I will attempt to keep them organized and updated on the Fed Files blog page. You can check for updates at the page here: <http://mt-fedfiles.blogspot.com/p/dea-frequency-updates.html>

## ❖ TSA Expanding The Reach

The Transportation Security Administration (TSA) is one federal agency has been the target of controversy since the agency was started. They have been criticized for their sometimes-intrusive searches of the flying public and for



*TSA Explosive Detection K9 vehicles at the Pittsburgh International Airport. (Courtesy: Author)*

their public face of blue-shirted agents patting air travelers down and looking through all of our personal possessions when we are trying to get on an airplane.

I recently read the book “Permanent Emergency” by Kip Hawley and Nathan Means. Hawley was the TSA Administrator from July 27, 2005 to January 20, 2009. Whether you simply tolerate or even hate the TSA, the book provides some very interesting insights into the reasoning and motivation for the TSA and what they do. It also shows that the TSA is not just about checking your carry-on bags at the airport.

As they are part of the Department of Homeland Security, the TSA is constantly seeking new technological innovations to support their mission: preventing a possible terrorist or hijacking situation from transportation systems around the country. However, many people assume that they are only interested in air travel. Please note that the first word in their name is “transportation,” not “airport,” and the TSA is already involved in monitoring travel and shipping via air, sea and land based transport.

The most often monitored communications of the TSA involve airport security. But some frequencies have been monitored and confirmed as activity unrelated to air travel. I recently received a report of TSA radio traffic at the International Bridge in Eagle Pass, Texas. At some large public events TSA Behavior Detection Officers may be assisting event security by watching the crowds for suspicious activity. Some Visible Intermodal Prevention and Response (VIPR) teams have been seen riding buses and trains, and TSA National Explosives Detection Canine Teams have been operating in air terminals, seaports or warehouse areas.

Here are some of the

confirmed TSA frequencies being used around the country. They have been using both P-25 digital radios, and limited use of analog radios with voice-inversion at airport checkpoints. In most cases the communications is simplex and fairly low power. Many cities have repeaters on 172.9000 MHz, which in some cases have been enhanced to provide wider area coverage than just the local airports.

162.2750  
 163.3125  
 163.6250  
 164.7875  
 165.0750  
 166.2875  
 166.4625  
 166.7875  
 168.0875  
 168.6125  
 168.8375  
 168.9625  
 169.1625  
 169.3000  
 170.1625  
 170.3375  
 170.9375  
 171.7625  
 172.1500  
 172.9000  
 173.7750

As with the DEA frequencies, I have been keeping a updated listing for confirmed TSA radio frequencies in use, and you can check it out on the Fed Files blog page here: <http://mt-fedfiles.blogspot.com/p/tsa-frequency-updates.html>

That is all for the first Fed Files of 2013. I will be back in March with more federal monitoring information and frequencies!

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## “For Everything, There is a Season...”

**A**s January starts a new year, it is the middle of the cold season here in Kingston, Ontario. I am sure we will have had more snow than last year so my pit stop on the snow blower will be time not wasted. Also, my antenna maintenance will be put to good use as I have more time to monitor the DX bands. The Ontario Hydro people have been busy in my area and have cut the branches of many trees that were getting into the power lines. This has reduced the noise level here and is one thing you should check into if you get a lot of power line noise. Branches touching power lines can produce a great deal of aggravating noise.

Time changes and shorter days mean the lower HF bands will be more active and better DX will be available. Bermuda Radio on 2.582 MHz comes in on a regular basis. My wife and I are looking forward to two months in Myrtle Beach, South Carolina as well. This will be our fifth year to spend over a month there.

As the season wound down towards winter there was a lot of activity here. We had the *Sedna Desgagnes* aground just above the Prescott Ogdensburg Bridge. She was aground for over a week and required lightering to get her free. Another ship had a mechanical problem and had to be escorted down the Seaway. The *Phoenix Star* struck sunken Rock Shoal, near Alexandria Bay, New York, and we had a car roll off a ferry as it crossed the Seaway channel. This produced a lot of interesting chatter on the VHF marine bands. I have actually picked up an older, small-channel capacity scanner that I have dedicated to the marine channels active in this area.



*Bendix 2 MHz radio aboard the Jaques Cartier in the 1940s.*

The Seaway has now closed and the control stations have gone quiet until the spring. The daily bulletins about water temperature at the St. Lambert Lock, ice conditions, and the number of salt water vessels left in the Seaway were interesting as usual. Water levels in the Great Lakes have been near record lows and the bulletins showing levels in the area below chart datum have kept every mariner on their toes.



*Jaques Cartier when she was a ferry.*

The local traffic now centers on winter layup and dry-docking of some vessels. The control stations will become active around March 25, depending on the severity of the winter and ice cover. The first traffic usually relates to the operations of a large icebreaker as they open the river channel to navigation. However, the local ferries keep going thanks to bubble systems which keep the water circulating in their track and give an ice free channel.

Thus VBR Prescott Marine Radio keeps operating on the Kingston tower and also keeps the 24 hour weather broadcast on 161.775 MHz (channel 83B). Even though the Coast Guard Cutter *Cape Hearne* has gone for the winter, we usually still hear some calls for marine incidents over the winter. They usually involve



*MV Canadian Empress in dry-dock for inspection before winter layup and maintenance.*

snow mobiles or people who have gone out on the ice when they really should not have.

The aircraft for CFB Trenton use channel 82A, 157.125MHz to check in when they leave on training or search missions. I have learned to do a scan of the marine channels on a regular basis. You will find that local companies use the marine channels for some interesting communications. Louis Basin in Quebec City uses channel 71 to arrange use of its lock to admit smaller craft to the harbour due to the fact the St. Lawrence River is tidal there.

The local river pilots use channel 77 to talk amongst themselves while some local tour boats use channel 63. Have a good scan of the entire marine channels and you may find a surprise or two. Be sure to use a scanner and check which duplex channels become simplex channels depending on whether you are using American or Canadian channel settings. Check both sides of the duplex channels as some of them are now used for Canadian Weather broadcasts and AIS data.

More ships and pleasure craft are using AIS (Automatic Identification System) on a compulsory or voluntary basis. You may want to invest in an AIS receiver as they seem to be coming down in price. A computer program such as Shipplotter will display the data. A good VHF antenna will get you decent range.

I have also heard that the Canadian commercial channels are going from 25 to 12.5 kHz spacing in the relatively near future. According to a commercial technician, Don Gilroy VE3MNE, 6.25 kHz spacing will come after that.

As a reminder, the exodus to southern waters of pleasure craft will be concluding. I am sure the radio traffic on the Intra-Coastal waterway will have increased significantly. I look forward to monitoring in Myrtle Beach and hearing some Canadian yachts head north in late March. Our rental accommodations are higher this year and I expect some better range for VHF/UHF radio. I hope to do a bit of listening in Charleston, South Carolina and Savannah, Georgia, this spring. I still listen to channel 16 (156.8 MHz), 2.182 MHz and 4.125 MHz over the winter to hear what might be going on.

It was heartening to hear that most of the crew of the *HMS Bounty* were rescued after she sank off North Carolina, during hurricane Sandy. The unfortunate loss of two crew members could have been part of a much higher toll. Two years ago, I was asked to do some trips on the *MV Canadian Empress* as the mate had received an offer to voyage on the *Bounty*. The pictures of her with her decks awash were sad to see.

However, I have found out the rescue of the people was mainly brought about by amateur radio. Doug Faunt N6TQS, was one of the crew members. He is an avid member of DXpeditions and loves to travel on these replica ships. He was



a deckhand and ship's electrician. He had some HF amateur gear aboard the ship. They called on HF and also called on the Maritime Mobile HF Net, but it was not active at the time. Finally they used Winlink and actually sent an email to the Coast Guard. A C-130 Hercules was there within an hour and a helicopter followed shortly thereafter.

According to Faunt, it was the captain of the vessel, Robin Walbridge KD4OHZ, who actually sent the message. Alas, he was one of the two people who perished in the tragedy. It is sad and ironic that the other fatality was Claudine Christian. She is a direct descendant of Fletcher Christian, famous in the original *Mutiny on the Bounty*.

The Hurricane watch net convened on 14.300 and 7.268 MHz during the storm. I heard many reports and traffic from affected areas of the northeast United States. I was pleased to help our local emergency communications group monitor frequencies and provide weather information. Our highest wind gust here was 55 mph. Along with many cellular telephone failures during Superstorm Sandy, this shows that amateur radio and dedicated volunteer operators still have a place in emergency communications.

I did monitor some SAR traffic during the search for survivors and heard some traffic on 5.696 and 8.983 MHz USB. I have these two USCG frequencies and 5.717 MHz for the Canadian Coast Guard in my HF receiver.

Be sure to check 2.598, 2.749 and 2.670 MHz USB for weather and other notices affecting shipping on the East Coast. 2.670 and 2.054 MHz can be heard on the West Coast. The USCG weather broadcasts, mentioned in many columns, are also interesting. I often hear Kodiak Alaska here during the winter.

Navtex on 518 and 490 kHz can also be monitored better in the winter season. 518 kHz is the major frequency for this area. A computer and a program such as MultiPSK which will decode Amtor-FEC (Navtex) is all that is required. I plan to update my copy of MultiPSK which is a free download for the basic version.

On amateur radio, the Waterways Net on 7.268 MHz, Maritime Mobile Service Net on 14.300 and the Pacific Seafarers Net on 21.412 MHz will have more marine mobiles checking in. Be sure to monitor your local HF and VHF nets as you may find some marine stations checking in.

## ❖ Reader's Comments

I have received some interesting comments from my readers! Richard Dillman, an *MT* subscriber, from the Marine Radio Historical Society, thanked me for the mention of their station and schedule in the last column. He also asked me to keep him informed when I will be working from the battleship *North Carolina* and to try and get a message to their amateur station K6KPH, if possible. I have no definite dates for this column but will send the info to *Monitoring Times* when I get things confirmed. The staff at the ship museum has been most kind and cooperative.

Jim Hastings W2RFM sent me some interesting email. The picture of the *Jaques Cartier*

got his attention. At one time, she was a ferry and ran around Rimouski Quebec. The Horne's Ferry people bought her and ran her in this area for a while. She was too big for the job and they offered it to the Wolfe Island Council for the Wolfe Island-Kingston run. They turned the offer down and she went back to Quebec to be built as a tour boat. It is amazing how one gets information on vessels. Jim sent me some great photos of her as a ferry and also the 2 MHz AM marine radio she had aboard.

He also mentioned he wants to be kept informed about the 100<sup>th</sup> anniversary of VBH Kingston Marine Radio Station. Both he and I talked to this station on HF. I have started to get support from local organizations to have this become a reality. Unfortunately, the actual site has quite an RF noise problem. A new welcome center for Fort Henry uses many plasma televisions and the noise is incredible. We are looking into the site and getting ready. We may even have the use of a spark gap transmitter which we will ask permission to use for a short time. Dave Lawrence VA3ORP is attempting to get the rig loaned to us. I hope to have more information about this in my July column.

George Clogg, an *MT* reader, from Salt Springs Island, British Columbia, is pleased that some Canadian radio information is in the column. He was wondering if he can hear any of the marine traffic that is on the satellites. I really am not a satellite expert but I wonder if someone can give me info on receiving marine satellite traffic. I know that VBR transmits bulletins for the Canadian Arctic as they are a 24 hour station. I hope someone will give me some info as to what can be heard, if anything and equipment needed.

## ❖ Requests of Readers

I have two requests for readers of this column. First of all, I need you to report what you monitor, times and frequencies. Marine radio information or radio information with a marine interest would be most helpful. Many people travel and want to monitor ships, harbor tugs, etc. Whether it is HF, VHF, company frequencies or related shore-side channels, it is of interest to the marine radio monitor. Many of the readers are also ship enthusiasts and knowing the traffic in an area can get us to see a certain ship or get a photograph etc. I was monitoring Seaway websites and the control radio channels to see when the *Amherst Islander* will transit the Seaway. She used to do the Amherst Island ferry run here until she was replaced. After being idle, on Lake Erie, for some years she has finally been sold and is heading to Honduras. Hopefully, I got a good picture of her last trip in Canadian waters.

Secondly, I am interested in contacting people who would be interested in expanding the 100<sup>th</sup> anniversary of Canadian Marine Radio on the Great Lakes. There were stations in Thunder



*Phoenix Star, a classic "laker," on her second trip with the new name, above lock #3 of the Welland canal.*

Bay (Port Arthur), Sault Ste. Marie, Sarnia, Warton, Port Burwell (which was originally, I think, at South East Shoals), Toronto and Kingston. Hopefully, we can get people on the amateur bands from all locations. I would also like to hear from people who worked at these stations. I particularly would like to hear from people who worked at VBH (or relatives). Any photographs of the station and equipment would be of great value.

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## Technology on Longwave

**T**here is a tendency to associate longwave with proven, mature technologies as well as vintage radio topics. We don't typically think of cutting-edge developments or innovative technologies being played out on the frequencies below 500 kHz. Part of the reason for this is that much of radio's history began on longwave, well before the exodus to shortwave in the 1920s. Once many users left the band, primary attention was focused on reaching ever higher frequencies. To some extent, this upward climb continues today. 700 MHz public service band, anyone?

Although often overlooked as a breeding ground for technology, longwave communications has developed steadily through the years. In recent times we've seen surprising uses for the band in both the commercial and amateur/experimental realms. We'll cover some of these innovations this month, and see why longwave is an ideal place to develop them.

### ❖ DGPS

The Differential Global Positioning System (DGPS) makes precision use of GPS possible to local users. Using former marine beacon frequencies in the 285-325 kHz range, these stations broadcast correction signals to GPS users in the vicinity of the station. Since the precise location of the transmitting site is known, a GPS receiver at the site compares this location with what is reported by GPS. The difference is then broadcast to users in the vicinity, and corrections can be applied to GPS receivers. These small, but measureable differences are valuable to those using GPS in busy harbors and other congested areas where the margin for error is small.



*DGPS stations like this one in Cape Ray, Newfoundland, broadcast high precision correction signals to GPS users in the vicinity (file photo).*

When DGPS stations first took to the air, they continued to transmit their usual Morse Code identifiers. The only clue that something was different was the "warbling" note heard on the ID. After the system proved to be successful, these stations went to full-time DGPS transmission, and the 285-325 kHz band is now sprinkled with these data streams. You can decode DGPS IDs using specialized software

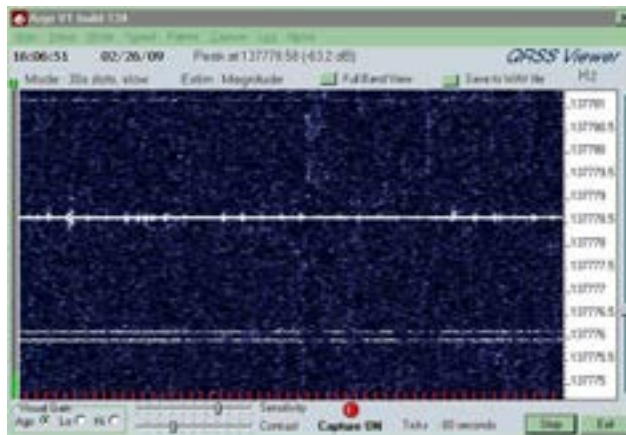
such as RadioRaft ([www.pervisell.com/ham/raft\\_en.htm](http://www.pervisell.com/ham/raft_en.htm)).

### ❖ Weak Signal Modes

Low frequency enthusiasts are used to dealing with weak signals. Lower stations have been dealing with extreme odds for years due to a 1-watt power limit and a 50 foot/15 meter length limit on antennas. When you add natural static levels to the mix, it's easy to see why the odds are stacked against Lowfers from the beginning. Nevertheless, experimenters have found ways to improve their chances of being heard, including the use of computer-assisted modes such as BPSK (Binary Phase Shift Keying), and QRSS.

BPSK techniques were being used on longwave well before their common use on the amateur bands. Longwave proved to be an ideal testing ground for phase shift keying techniques. Distance records on the Lowfer band used to be measured in terms of 300 miles or so, but with the advent of weak signal technologies, it's not unusual to see distances in the 700+ mile range today. Intercontinental transmissions have even been achieved.

QRSS is a mode that takes advantage of the extremely narrow receiving bandwidths that can be used with slow speed Morse Code (CW) transmissions. The slower the sending speed the narrower the bandwidth, so QRSS uses extremely slow speeds (such as 30 seconds to send a dot!) and this is processed at the receiving end by software that displays any messages received. In practical use, a receiving station can "park" on a frequency overnight and search for QRSS signals received. Today, most serious Lowfers spend at least some time in QRSS mode. A QRSS viewer program, such as ARGO can be used to decode these signals (see [www.weaksignals.com](http://www.weaksignals.com)).



*QRSS signals can be viewed with a software program such as ARGO for display on any PC (file photo).*

### ❖ WWVB

While the station itself is not new, WWVB at 60 kHz is seeing new applications for automated timekeeping and high precision frequency control. Recent upgrades to the station have improved signal strengths all over North America, and it can be used with devices having very small receiving antennas. Wall clocks, appliances, and even some high-end wristwatches utilize WWVB's binary coded decimal signal to keep precise time and automatically adjust for daylight savings changes. Laboratories also use the signal for precise calibration of test equipment and monitoring devices.

If you tune to 60 kHz with a conventional receiver in CW or SSB mode, you're likely to hear WWVB as an on/off keyed station sounding something like Morse Code. I get at least a few inquiries per year on this signal from folks wondering what the code is. Now you know! Feeling adventurous? Why not take the plunge and build your own experimental WWVB receiver-decoder-display, using plans such as the ones offered online at [www.ringolake.com/pic\\_proj/WWVB/wwvb.html](http://www.ringolake.com/pic_proj/WWVB/wwvb.html).

### ❖ NAVTEX

NAVTEX (Navigational Telex) is an automated teleprinter service run by the U.S. Coast Guard and the maritime authorities of many other nations. The service can be received on 518 kHz, and in some places (primarily outside the U.S.) on 490 kHz. This free and open service is used to send navigation, weather, and safety-related information to ships located within 200 miles or so of coastal areas. If you are able to hear NAVTEX signals, you can decode them yourself using software such as SeaTTY available at [www.dxsoft.com/en/products/seatty](http://www.dxsoft.com/en/products/seatty).

### ❖ Compact Antennas

Although this subject really encompasses many technologies, much of the pioneering work on compact antennas for receiving and transmitting was carried out on longwave frequencies. The reason? The lower one goes in frequency, the longer the natural resonant length of an antenna becomes. For example, a common quarter-wave vertical antenna for the middle of the Lowfer band (say 175 kHz) would measure

about 1,350 feet! This is obviously too long for practical use by most experimenters, not to mention the legal limit of 50 feet for license-free transmitting in the 160-190 kHz band.

As a result of practical and legal limitations, Lowfers have been very creative in developing small antennas to get the job done. The use of vertical antennas, using top hat capacitance, extensive ground radial systems, and specialized "Litz" wire for loading coils, are all well understood in the serious Lowfer community, and important achievements have been made using these techniques. While efficiencies of Lowfer antennas rarely exceed 5%, this is enough to get a signal into the air, and is quite an amazing figure when you consider the 50-foot limitation that Lowfers operate under. It has been said that this is akin to using a paperclip for an antenna on 20 meters!

## ❖ Mailbag

I was pleased to hear from many readers for this month's issue of *Below 500 kHz*. Loggings and letters are *always* welcome and form a large basis of this column. While e-mail messages are preferred, I attempt to answer every letter received, so if you're not online, feel free to send a regular postal letter, as that method still works with me.

Reader Ron Perdue wrote in with the good news that he's located a troublesome noise source at his receiving location. He explains: "I have found the source of the buzzing sound on the LF band, and it is coming from the water heater control panel in the basement. I used my Grundig G3 portable rig to pinpoint the noise. Now the question is, would an AC line interference filter work to eliminate it? If so, what brand would you recommend?"

Hello Ron, I'm glad to hear you found the source of your noise. Good detective work! Since it appears the noise is being radiated primarily through the air and not through the AC house wiring, I would say that an AC line filter would provide only limited relief. It may be possible to improve the grounding and/or shielding of the control panel to improve the situation. I once solved a pesky static problem from a blower motor by simply connecting a heavy wire from the frame of the motor to a good grounding point. These types of problems are always tricky, because the interference can vary on different frequencies and at different times of the day, depending on when an appliance is operating at peak load. In your case, your best bet might be using an antenna that is located some distance from the house and fed with a shielded line.

If you want to try an AC line filter, Universal Radio does carry a quality unit at [www.universal-radio.com/catalog/protect/4743.html](http://www.universal-radio.com/catalog/protect/4743.html). You may have to change the wiring at your control panel so that it has a standard AC plug, but that shouldn't take much effort. 73, & best LW DX.

Doug Robertson (CA) enjoyed our November article on resources for locating beacons. He adds: "Here is another site for finding and identifying airport low frequency Non-Directional Beacons-NDBs using a

computer. Go to [www.airport-data.com](http://www.airport-data.com) and enter an airport on the A-D Home Page under Search Airport. Under the airport page, scroll down to Radio Navigation Aids. That will show any nearby NDBs with ID letters, name, (kHz) frequency, magnetic variation and nautical mile distance from the airport. The airport can be entered in the A-D site several ways: by name, by airport code (if known), nearest city or county name for USA airports. Nearby my location is KOXR, for example, and one NDB at Pacoima, CA is listed: ID-PAI, (kHz) Frequency 370.00, Variation 15 east and Distance 39.6 nautical miles. World airports are available also on this site for international readers' beacon findings."



Reader Mike Martel is seeking any user documentation for this Raytheon GM 114B RDF receiver (photo courtesy Mike Martel).

Mike Martel KC2MQH (NJ) writes: "In the November issue of *MT* I saw the pictures of two RDFs that a reader restored. I have a Raytheon model GM 114B that I've had for about five years but have had no luck finding information about it, particularly a schematic diagram. Attached is a photo of the unit."

Hello Mike, let's see what our readers can come up with. More than once I've been surprised with just what people have out there! I was able to find your unit (or at least a very similar one) pictured at my favorite web site for RDFs: [www.angelfire.com/space/proto57/rdf.html](http://www.angelfire.com/space/proto57/rdf.html). The site had this to say about it: "A compact, quality tube unit from Raytheon. Receives on Beacon, Broadcast and Marine bands. It operates on both an A/B battery and 110 volt AC line current. From the late 1940s, early 50s. There is another variation on this unit, with only beacon and broadcast bands. For some models there is a nice red "Raytheon" logo badge on the front."

## ❖ Loggings

Mario Filippi N2HUN (NJ) contributed the loggings shown in the table below. He uses a Ten Tec RX-320D receiver and an S9 43-foot vertical antenna with 53 ground radials installed. Many thanks for the loggings, Mario, and keep up the good work.

### Selected Beacon Loggings from NJ

kHz	ID	ST/PR/ITU	CITY
326	FC	NB	Frederickton
329	CH	SC	Charleston
336	BDB	VA	Melfi-Accomac
344	PIX	PA	Picture Rocks
373	AEA	VA	South Hill
375	ZYG	QC	Salluit
379	YPQ	ON	Peterborough
382	LQ	MA	Boston
384	F8	QC	Victoriaville
385	ZDH	ON	Toronto
391	3B	ON	Brockville
397	ZHA	ON	Hamilton
400	PTD	NY	Potsdam
401	Y8	QC	Drummondville
403	ZTO	ON	Toronto
404	CKI	SC	Kingstree
410	JU	NC	Jefferson
414	3U	QC	Ottawa
415	BCB	CYM	Cayman Brac
417	HHG	IN	Huntington
417	HQT	NC	Coats-Harnett
423	PCW	OH	Pt. Clinton
477	WD2XSH/31	VA	Exp. Station
515	OS	OH	Columbus
516	YWA	ON	Petawawa
524	RVJ	GA	Reidsville Jail
526	ZLS	BAH	Stella Maris

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## Howard Project on Ice; More Tube Lore

It has always been my policy to present our Radio Restorations projects in “real time.” Rather than completing a project in advance, and then reporting on it after the fact, I like to have the reader looking over my shoulder, so to speak, as I carry out the work. Over the years I have been doing this, many have told me that they enjoy this feature, and I enjoy it too. I think that the immediacy of the experience makes the column a lot more lively.

But there is a downside to this. If I hit a snag in a project and lose patience to the point where I’d like to shelve it, well, there I am red faced and with no choice other than to admit the problem. This is such a time

The Howard 430 project has presented mechanical puzzles almost from the very beginning. For starters, the method of removing the chassis from the cabinet (or the cabinet from the chassis as it turned out) was quite a mystery, though it proved to be really simple once I learned the trick from some on-line research. The next problem was how to gain access to the dial drive mechanisms. This radio has three dial cord systems: one for the bandswitch indicating needle; one for the bandspread indicating needle and one for the main tuning dial.

### ❖ Getting to the Dial Systems

Both the bandswitch and main tuning dial systems needed repair but the removal of the cabinet did nothing to improve access nor did the subsequent removal of the plate with the dial scales. I was still looking at an impregnable wall of metal that would somehow have to be penetrated in order to examine and repair the broken cords. Careful study revealed that this metal barrier was actually composed of two plates.

The bottom section seemed to be the most logical one to remove, but there were a few obstacles. Mounted on it were the BFO shield can, the bandswitch and volume controls, the main tuning drive shaft and the bandspread

capacitor frame. With those items disconnected, all that remained to free the section was the removal of the three machine screws that fastened the section to the chassis.

But that was easier said than done. Those screws were frozen solid! I believe it was because of a chemical reaction between the screws (which were probably zinc plated) and the copper chassis. I eventually broke them loose after soaking the threads overnight with WD-40, though even my best-fitting screwdriver tended to slip in the slots. In fact, one slot had become so chewed up that I had to deepen it with a mini hacksaw to restore a proper grip.

When I was finally able to remove the plate, I had access to the dial systems at last, but my troubles were far from over! The first thing I wanted to accomplish was the restringing of the band indicator needle. For your reference, I’m reprinting the Howard dial restringing schematic (it originally appeared in the November issue) in this column.

### ❖ Restringing the Band Indicator

Notice that the band indicator cord (extreme left in the schematic) starts by wrapping around what looks like a little drum at the bottom of the diagram. From there, it wraps around a capstan holding the pointer needle and is then secured, through a tension spring, to an anchor point. Simple enough, right? Wrong!

What I was confronted with was the free end of a broken cord issuing from some unseen spot near the bandswitch. The little drum—or whatever it is—is totally buried, inaccessible, and not even visible. But the good news is that the cord was apparently still properly wound around it. Putting tension on the cord with a pair of pliers, I operated the bandswitch and was



Odd piece of hardware from junk box was used to support drive pulley temporarily in working position (see text).

gratified to feel the cord moving in and out as I cycled the switch through its various positions.

All I had to do was tie a new piece of dial cord to the remaining stub of the old one and then complete the hookup. The problem was that the stub was just not long enough for me to tie the new piece on. Luckily my son was due to visit that evening, so I pressed him into service, and thanks to his dexterity the job was done in about five minutes. I was then fortunate enough to find a replacement spring that was just the right size in my junk box and, after that, completing the job was easy.

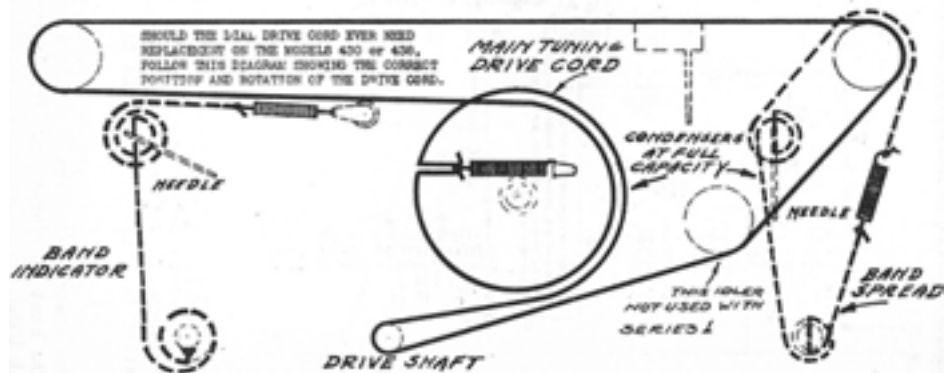
I was spared the job of restringing the bandspread dial drive (far right on the schematic) because it was intact. The real problem surfaced when I tried to restring the cord for the main tuning drive (center portion of schematic). You’ll note that it has a few more twists and turns than the other two dial systems, but it doesn’t look that complicated.

### ❖ The Tuning Drive Problem

However, there was a major complicating factor in the form of the part labeled “drive shaft” to the left of center at the bottom of the schematic. Despite appearances, it’s not mounted in the same plane as the rest of the system but on the just-removed metal plate that holds the other controls. The tuning knob fits on one end of the shaft and a slotted drive pulley fits on the other.

After the dial cord is threaded as shown in the diagram, the metal plate is installed in such a way that the loop in the cord drops into the slot in the drive pulley at the position shown. If all goes well, turning the knob turns the pulley, which drags along the dial cord, which turns the large pulley at the center of the diagram, which moves the rotor of the tuning capacitor.

The problem stems from the fact that the design of the drive system prevents the dial



Dial Cord Stringing Diagram for Howard 430

cord from being looped all the way around the drive pulley, limiting the friction that can be developed between cord and pulley. And so, to operate reliably, the cord must be under as much tension as possible.

Yet, seemingly there was no easy way to arrive at the proper cord length so that the tension spring would be almost fully extended when the cord was installed. That's because the drive pulley could not easily be included in the measurement. For it to be in its proper place, the metal mounting plate would have to be installed but, with that plate installed, there is no access to the various pulleys and capstans over which the cord would have to be strung. The geniuses at Howard who drew the dial cord schematic might have helped by specifying a length for the cord

## ❖ A Clever Idea that Didn't Work

I spent a couple of days, on and off, trying to arrive at a cord installation that would be suitably tight once the drive pulley on the metal plate was installed. I'm including a picture that shows the most ingenious of the unsuccessful ideas that I tried. What I did was to find an odd hardware bracket that happened to have two holes in about the right positions.

I temporarily removed the drive pulley from the drive shaft and installed it in one of the holes. The bracket was fastened to the front apron of the chassis via a machine screw passed through the other hole. I then adjusted the bracket, swiveling it on the mounting screw, until the drive pulley was sitting in a position very close to where it would be when properly installed on the metal plate.

After installing the dial cord according to the schematic and with maximum tension, I removed the bracket and pulley, replaced the pulley (coated with drive cord anti-slip solution) on the plate, maneuvered the pulley into the vacated loop, and installed the plate. But all the work and planning was for naught. No amount of knob twirling would make the tuning capacitor rotor budge an iota! And this is the point at which I lost patience with the project.

As I recall, I've only terminated a "Radio Restorations" project once before, a Philco table model that was loaded with those annoying proprietary Bakelite block capacitors. Later, though, I did find a way to attack the problem, picked up the project again and carried it to a successful conclusion which was reported in this column. Perhaps that will happen someday with the Howard 430, but for now up on the shelf it goes!

## ❖ Heater Voltages and Tube Nomenclature

Having the Howard project come to an unexpected and sudden end has left me with part of a column to fill. But, as it happens, I do have a little more to add to the tube heater voltage story that I discussed in the last issue. Back in 1933, the number of tube types was expanding so that the system of serial numerical identifica-

tion (24-A, 26, 27, 71-A, 80, . . . etc) was becoming clumsy and unworkable. At that time, the Radio Manufacturer's Association developed a new system that has remained in use ever since, and the tube's heater voltage is a key element in that system.

The first character, or characters, in a tube designation is a number that indicates its heater voltage. This is followed by a letter, or group of letters, generally assigned in alphabetical order, except that letters towards the end of the alphabet are usually reserved for rectifiers. Then follows a figure indicating the number of useful elements in a tube. Additional letters or letter groups may indicate other characteristics, among them the style of the tube envelope. It isn't my intention to go into this system in detail, but let's look at a few example tube designations: 1R5, 6K7G, 6SK7GT, 12SK7, 7Q7, 50L6 and 5Z3.

The 1R5 is a miniature tube intended for use in portable radios. Its filament (since there is no cathode we don't call it a heater) operates from 1.5 volts. For use in the tube designation, the decimal portion of the number is dropped. There is no special envelope designation for a miniature tube.

The 6K7G has a 6.3-volt heater, making its first numeral a 6. The "G" ("glass") at the end of the designation indicates that its envelope is the tall glass (double dome) type. This tube has its control grid brought out to a cap at the top of the tube.

The following tube in the list, the 6SK7GT, is electrically identical to the 6K7G, but its designation reflects two mechanical differences. The "S" ("single ended") prefix to the letter designation indicates that there is no grid cap. The control grid connection is brought out to one of the pins at the base of the tube like the connections from the other tube elements. The "GT" ("glass tubular") suffix indicates that this tube has the smaller, cylindrical base.

The 12SK7 is electrically identical to the previous two tubes except that its heater operates from 12.6 volts. And since it doesn't have a "G" or "GT" suffix, its envelope is metal rather than glass.

That brings us to the 7Q7. Because of its initial numeral, you would expect its heater voltage to be 7 or 7 and some change. But surprise! It has a standard 6.3-volt heater. The "7" designation simply indicates that this is a Loktal type. Loktal tubes, originally introduced by Sylvania, all have tubular glass envelopes. They have a base somewhat similar to the more familiar Octal types. Like the Octals, Loktals have a central keyed post at the center of the base. However, the end of the post carries a groove that is engaged by a locking spring built into the tube socket.



Photo of Loktal tube shows groove in keyed locating post.

The locking feature of these tubes was supposed to be especially useful in auto radios. But, in fact, ordinary Octal types were used extensively in auto radios and there were few problems with them jumping out of their sockets. The Loktal feature was essentially a marketing gimmick.

Moving right along, now, to the 50L6GT. As its designation implies, it has a 50-volt heater and a tubular glass envelope. This is a member of the famous "All American Five" tube complement used in so many of the inexpensive AC-DC radios of the 40s and 50s. Their higher voltage heaters made it possible for them to be lit by placing them in series across the 120-volt line. The final item on the list, the 5Z3, is a rectifier as its end-of-the-alphabet designator implies. Its filament (no cathode) is rated at five volts.

That finishes up our column for this month. Come back next month for the start of a brand new project which, I'm sure, will have a better outcome!



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## Basket Weave Antennas

This is one of those topics that I have been wanting to talk about for several years, but it's really hard to find one of these vintage antennas in order to get a good photograph of it.

In figure 1 I show two tuned circuits, both tuned to the middle of the AM broadcast band. Note that the Hi L, or the design with the most coil, has the narrower response. The Hi Q circuit is much better at rejecting image frequencies and it will even give you a slightly higher detected voltage on a crystal radio; in short, for best results, you want lots of coil.

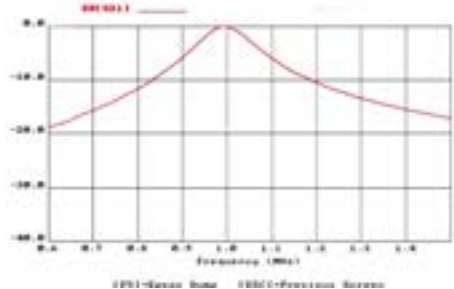
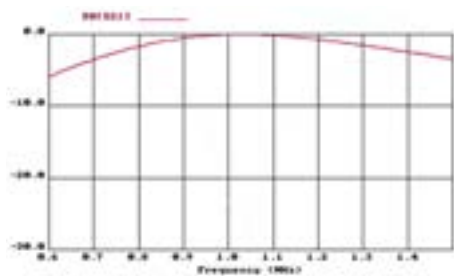


Figure 1 Frequency Response of Hi C and Hi L Tuned Circuits

Now for the technical problem. We want to tune the entire 550-1640 kHz broadcast band with a single tuning capacitor, but as you can see in Figure 2,



Figure 2 Stray Capacitance Between wires

the wires form little capacitors between them. This is known as stray capacitance and on the typical 275 uH on a straight wound coil, the stray capacitance is bigger than the minimum value of the tuning capacitor. In short, you have the circuit in Figure 3 and we are no longer able to tune to the high end of the broadcast band. We have learned to tolerate band switches on our shortwave radios, but the average house-



Photo A Basket Weave AM Broadcast Antenna

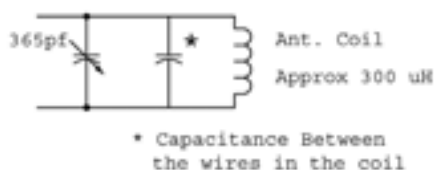


Figure 3 Equivalent Circuit Including Stray Capacitance

wife would not be fond of switching between Band 500-1000 kHz and Band 1000-1700 kHz on their All American Five AM clock radio.

Now comes the "Basketweave" or "Beehive" wind for the antenna coil in Photo A. By winding the coil in the interweave pattern you still have the same number of turns in the coil, but less capacitance between the wires. The wires have more space between them and far less capacitance. Now the coil can have a few dozen more winds, a better Q, better signal selectivity, more sensitivity and still tune the entire AM band from 550 to 1640 kHz. Next time you are looking at vintage radios between about 1920 and 1960 and you see coils with a staggered winding form, you'll now know why they did that!

### Emergency Radio Solutions

After all the power outages from Hurricane Sandy I hope none of our readers are reading this column by candle light. And, while a bit off-topic from my usual column, there are a couple of emergency power tricks I wanted to point out. This is especially important when you need to stretch that backup power for equipment like ham repeaters, computer routers, medical equipment or that cell phone.



Photo B Daisy Chained UPS

One of the easiest ways is to do this is to plug an Uninterruptible Power Supply (UPS) into another Uninterruptible Power Supply. That is, daisy-chain a couple of UPS' as in Photo B. They are cheap enough, commonly available and there is a lot to be said for connecting equipment on a priority basis. By that I mean, have everything plugged into the first UPS and only the most important items plugged into the last UPS. You just might make that last UPS the one with the biggest battery.

For those who are a bit more handy with a soldering iron, you can add an external battery as in Photo C. Be sure to watch the voltage and don't mix battery types. That is, make sure you don't replace a UPS that had Ni-MH batteries with a lead acid gel cell. The battery chargers are not compatible between the two different battery types.

When New Orleans flooded 7 years ago, the police radios went down by the third day.



Photo C UPS With High Capacity External Battery

Oh, the main base stations remained on the air, but no one had ever ordered cigarette lighter power cords for the officers' HTs. Simple 12

Volt chargers could have been so valuable during that emergency.



Photo D 12 Volt USB and Inverter Supplies

In Photo D are two ways to recharge your portable devices. Many cell phones today have USB charging cables. I highly recommend one of those 12 V DC/5 V USB plugs in your emergency supplies. I got this one at a local Dollar Store, yep, for \$1. A few dollars more, but equally handy, are the 12 V DC/120 V AC converters. Now you can power most light duty electronic products such as laptops, tablets, LCD TV sets and products you only have the 120 V AC chargers for. Most telephone cell sites have several sources of backup Power. Make sure you have a few backup plans to keep the smart phone charged.

The quickest way to contact me is at kent-britain@monitoringtimes.com or snail mail to the QRZ.COM address for WA5VJB.

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## DIY Personal Computers, Part II

In my October column, I talked about do-it-yourself PCs. A number of you asked if it was really that easy to make your own. So, this time I thought I'd delve into it a little more. The quick answer is that it is pretty easy to assemble the hardware, but installing Windows can be a little tricky.

Let's re-examine what kind of computer you need to handle shortwave listening or inter-communication with a receiver or transceiver.

### ❖ DIY Must-Haves

It must have USB or RS-232 I/O. Many rigs still use RS-232 interfaces, but most PC motherboards do not support this anymore. Fortunately, there are still USB-to-RS-232 interface cables available.

It must have an Ethernet port. OK, it might be a stretch to say that *must* have this, since opening up your PC to the Internet also exposes it to viruses and other threats. But many apps, including Windows, need access to the Internet to register themselves and to perform updates. So it is best to make sure you have this interface. If you don't need constant access to the Internet, you can always disconnect the cable or disable any WiFi that might be built-in.

It would be nice to have support for two monitors at the same time. In Windows, this is usually called "Extended Desktop" mode, where two monitors create a much wider screen area. This is useful especially when running screen intensive apps like DXLab Suite or Ham Radio Deluxe. Even when you have a high-resolution display (say, 1920 x 1200 or more pixels), it's incredibly easy to fill it up! Fortunately, many motherboards have this feature, generally providing at least VGA and DVI interfaces, and sometimes also an HDMI interface, which also carries stereo sound channels.

It must have a separate sound "card." This is probably the single biggest reason not to use a laptop! Motherboards, in both laptops and desktops, usually have the equivalent of a cheap sound card built in that's adequate for casual listening and recording, but not suitable for high-performance applications like DSP. The electrical noise on a motherboard usually is so high that it restricts the available dynamic range to about 80 dB, when we would really like to have 120 or so. This means that you have to pick a motherboard that has support for plug-in cards, and thus you need to decide what type of expansion slots you need. These days, PCI Express slots are most common and available in several sizes. You typically do not need very many slots since there is so much standard I/O on the motherboard. Figure on one PCI-e slot as a minimum, to handle the sound card.

It needs a power supply, but instead of a big, bulky AC supply, consider a DC-DC converter, which is very small, and run your PC from the

12V power supply that you probably already have! Your power supply only needs to provide about 8 Amps at 12-14V.

You need mass storage. Disk drives should be as large as you can afford, since apps and the data they produce seem to keep getting bigger all the time. Solid state drives are now available, which are quiet and extremely fast but are more expensive and don't have as much memory capacity as hard (mechanical) disk drives. You don't typically need anywhere near a Terabyte drive. For example, I have an HP desktop of recent vintage with a Terabyte drive on it, and it has "only" used 133 Gigabytes so far. And I'm a pretty intense computer user.

You need as much program memory, or RAM, as you can afford. This, along with CPU clock speed, determines how fast the computer will actually run. Too little memory means the O/S will have to do a lot of swapping of program code, which takes time. Some apps may not even work if you put too little RAM in your PC. Buy the maximum amount of memory that will fit, and get the fastest memory that's compatible with the CPU.

You need a software installation medium. This generally means a CD or DVD-ROM. But you don't need to get a case that allocates room for one. You can buy a stand-alone DVD-ROM with a USB interface that derives power from a USB port too. This way, especially if you are trying to make your PC as small as possible for portability, you don't need to allocate space for a DVD-ROM inside the case.

You need a processor, or CPU. Here, you need to be careful to choose one that has enough processing power for the applications you want to run, and also one that is compatible with the motherboard. So be sure to read the motherboard CPU compatibility specs along with those of the processor.

You need a case for everything. Many inexpensive cases are available, but since this is a DIY article, I am lobbying for a DIY case! Find a small aluminum or steel chassis and put the mounting holes in it yourself!

### ❖ Software

All right, so you can get all these pieces from your favorite online store (or even at some local PC shops). Get or make a case that suits you, bolt it all together, and voilà, you have a PC.

Well, not quite. You now need to install Windows. You could, of course, also install DOS or Linux, but since most people who are making a PC will also be installing Windows, this discussion will focus on Windows.

OK, so you bought your favorite version of O/S, and it was delivered on a DVD-ROM. How is a PC that has never been booted before supposed to read the O/S off of a DVD-ROM? Let's answer that with a little trip down memory lane! When I was a freshman in college in 1969 (yikes), I couldn't wait to play with the minicomputers in the Aerospace and Mechanical Engineering Building. I majored in Electrical Engineering, but quickly found out that the AME building had some DEC PDP-8's in a back room. These 12-bit computers had cool toggle switches and lights on the front panel. The "Read-In-Mode", or "RIM" loader consisted of a handful of instruction codes that could be entered into its "core memory," that taught it just enough to be able to read paper tape. The "real" O/S was thus read into memory by a paper tape reader. I used to purposely crash the RIM loader so that I could manually re-enter it from the front panel. What power! I was king of the world.



Anyway, it's not all that different today. PC motherboards come with a permanent memory chip with just enough code to teach the CPU how to read an O/S into its memory from an I/O device such as a floppy disk (not used too much anymore), a DVD-ROM, or even a USB or Ethernet port. It also has rudimentary support for a monitor, usually at some low resolution, and a keyboard. This is called the "Basic Input/Output System", or BIOS. You've probably seen reference to this when you turn on a "store-bought" PC.

As it wakes up, there's usually a comment somewhere on the screen about pressing a key such as DEL or function key F8 to enter the BIOS. If you haven't ever tried this, do it sometime! There is always a way out of this little program ("Exit without saving changes") if you accidentally change something and can't figure out what! You'll see things like the clock, type of interfaces and disk drive information.



I ordered my PC parts from TigerDirect. The Windows DVD was marked "For Distribution only with a PC" and "This OEM software may not be delivered unless accompanied by the required hardware under the Microsoft OEM System Builder License located at <http://microsoft.com/oem/sblicense>. End-user support is the responsibility of the installer of this software." This pretty much means you are on your own regarding support. But hey, how hard can it be? Anyway, the instructions said to insert the DVD into the reader and follow instructions on the screen. And indeed it was that simple. After an hour or so of software installation, Windows came up and I was ready to go.

Or so I thought. The screen resolution was still not as high as the monitors I wanted to use, and I could not find the "Extended Desktop" in the control panel Display Settings. The motherboard, it turns out, was also shipped with a "Driver CD." I figured that perhaps Windows just needed to know about my specific hardware, and it can only do that if the right software is there for it to read. So I put the CD in and found some drivers for the display and sound interface and Ethernet. Once those were installed, Windows recognized everything and the PC was ready to use.

## ❖ Not so fast

About a month later, I turned the PC on and it woke up with a black screen and a scary-looking error message saying that it had detected that this was a pirated copy, not a legitimate copy of Windows! In a panic, I called TigerDirect, and they assured me it was a legitimate copy and that I should call Microsoft. I went to another PC that was working and found the Microsoft tech support web site. From there, I was able to get a support tech to call me, and he helped me work through the problem. So, although not painless, this problem was resolved within a few hours. I was actually fairly surprised at how helpful the Microsoft support was.

I also had to install the driver that came with the ASUS sound card. However, the disk provided in the box did not want to install properly on 64-bit Windows 7 Pro. This was easily solved by a visit to [www.service.asus.com](http://www.service.asus.com) to get a compatible driver.

If you'd like to replicate the PC that I

made and have used successfully to interface to radios and run typical programs, a shopping list is shown below. Bear in mind that CPUs, memory, motherboards and interface types change frequently, so items shown here may have been replaced by newer models.

## MAKE YOUR OWN PC SHOPPING LIST

*Note: Item numbers from TigerDirect ([www.tigerdirect.com](http://www.tigerdirect.com)) are shown in brackets except where noted otherwise.*

### Motherboard

Biostar TH61 ITX Intel 6 Series Motherboard - mini-ITX, Socket H2 (LGA1155), Intel H61 Express, 1600MHz DDR3, SATA II (3Gb/s), 8-CH Audio, Gigabit LAN, USB 3.0, PCIe 3.0 (about \$70)

*Note: TigerDirect no longer carries this motherboard. However, it is available from other places. For example, Newegg.com carries it. Their product ID is N82E16813138327. (About \$80)*

If you want to order everything from TigerDirect, here's a reasonable substitute:

Intel BOXDH77DF Intel 7 Series Motherboard - Mini-ITX, Socket H2 (LGA1155), Intel H77 Express, 1600MHz DDR3, SATA III (6Gb/s), RAID, 10-CH Audio, Gigabit LAN, USB 3.0, PCIe 3.0 [I69-2247] (About \$130)

### CPU

Intel Core i7-2600K BX80623172600K Unlocked Processor - Quad Core, 8MB L3 Cache, 1MB L2 Cache, 3.40 GHz (3.80 GHz Max Turbo), Socket H2 (LGA1155), 95W, Fan, Retail [I69-2600K] (About \$300; you can also use an i5, about \$100 cheaper. The key is "Socket H2", which must match the socket described for the motherboard)

### Memory

Kingston HyperX Genesis 8GB (2 x 4GB), PC3-12800, DDR3-1600MHz, 9-9-9-27 CAS Latency, Intel XPM Ready Desktop Memory Kit [K24-9917] (About \$35)

### High-Def Sound Card

Asus Xonar Essence STX PCIe Sound Card

[A455-2630] (About \$185). Remember that the sound card is not required unless you are doing intensive DSP, which requires very good quality not typically available on a motherboard.

### Disc Drive

PNY P-SSD2S128GM-CT01RB Optima Solid State Drive - 128GB, 2.5", SATA II (About \$130)

TigerDirect no longer carries this model; however any SATA II or III disk can be used, and remember that bigger is better. Here's a Kingston model that will work fine:

Kingston SH103S3/120G HyperX 120GB Solid State Drive (SSD) - 120GB, SATA III, 2.5" [K24-2107] (About \$95)

### O/S

Microsoft Windows 7 Professional 64BIT Operating System Software - OEM DVD [M17-7306]

*Note: If you want to be an early adopter of Windows 8, you can try product ID M17-8100 (About \$100)*

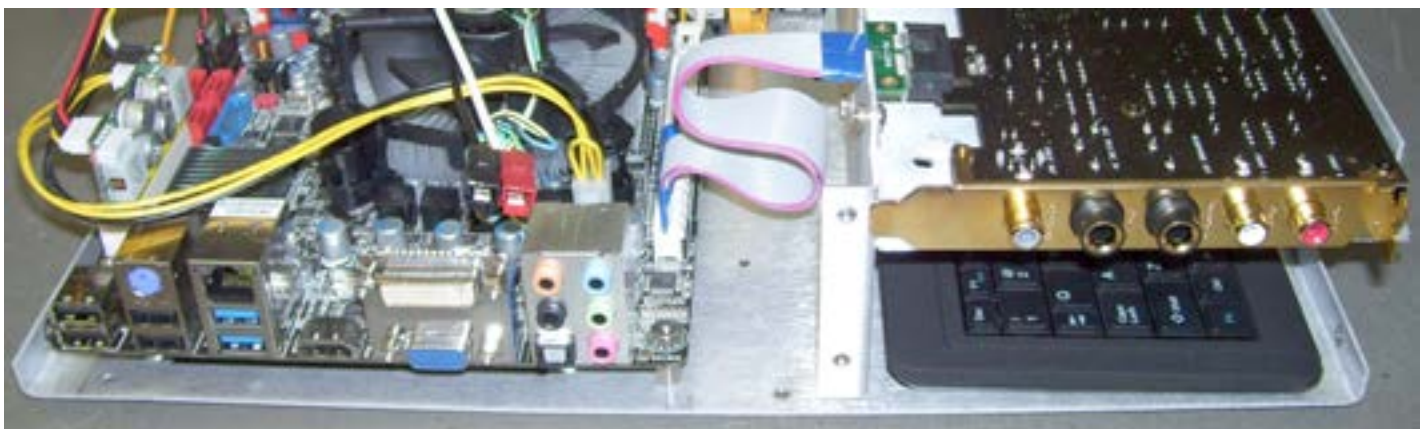
DC Power Supply (Requires 12VDC input power from a separate power supply)

Mini-Box ([www.mini-box.com](http://www.mini-box.com)) picoPSU-160-XT (About \$50)

### Keyboard, Mouse, Monitor

You will have to find a keyboard, mouse and monitor that suits you! I recommend a wireless keyboard since they are easier to carry around. You do need a USB adapter with these, but the motherboard I have suggested has ample USB ports and the adapters are typically one-piece devices that plug right in to the port without using wires or wall warts. As for monitors, check Office Depot, Office Max, Staples and Best Buy (or their international equivalents) for the best deals on lightweight flat panel monitors with 1920 x 1200 resolution and VGA, DVI and/or HDMI interfaces. Some monitors have VESA compatible mounting holes on the back, allowing you to secure them to walls or tables (or even the PC case itself, although that may take some creativity!)

I'd love to hear from readers who have used this list and built their own PC. I want to hear about your trials and tribulations, and your successes!



# Roku: One Smart Little Box!

By Loyd Van Horn W4LVH

I am one of those guys always looking for the next gadget that will change my life, or at least how I am entertained. This is especially true if it comes with a streaming audio or video angle.

From iPods and iPhones, to WiFi radios galore, I have tried just about every new device that has come my way. Most are pretty much the same, while some really stand out as game-changers.

One of those for me was Apple TV. It gave me a centralized device for streaming my music from my phone, through Netflix, or from my computer.

I love my Apple TV device, but there has always been something nagging at me about it. I always have felt restrained, only able to play in the sandbox that Apple has created. I have always wished I could add apps for other services, especially Amazon's Instant Video or Pandora.

The answer, for me, was Roku.

Roku, much like Apple TV, is a small-footprint set-top box that gives you streaming content for video and music. The advantage here, though, is flexibility, both in the hardware and the software content.

## ❖ Out of the Box

Roku is pretty basic in design and function. You set it up to access your wireless network and away you go. The LT model that I purchased at \$49 does not have an Ethernet connection option, but the high-end Roku 2 XS does. It retails for about \$99, the same as the Apple TV.

There are several different Roku devices available, that come at varying price points. This is the first time you get to choose from available options with Roku. My Apple TV works only by HDMI connection, and I only have one-HDMI television in the house. However, I wanted a streaming content provider to put Netflix in the bedroom. So, I looked at the Roku LT. It maxes out at a resolution of 720p, which is perfect since I am using an old-fashioned tube television in the bedroom. It also allows me to connect to my television via RCA video and audio cables.

With this one device, I am able to breathe new life into an otherwise out-dated television.

This thing is small and lightweight. It will not take up a large amount of space amongst your home theater gadgets. The included remote is also small and easy to use. On the LT model I purchased, there are large buttons to give you instant access to Netflix, Crackle and Pandora.

For those with an iOS or Android device, you also can download an app that provides remote control of your Roku device and a few other goodies.



## ❖ Performance Test

The next great thing about the Roku is that it provides you with multiple apps that it calls 'channels' that you can download (many for free) that give you flexibility to enjoy the content that matters most to you. In addition to Netflix, Crackle (streaming video and movies) and Pandora, there are downloadable apps for HBO Go, Weather Underground, Amazon Instant Video, even TuneIn digital radio.

A recent upgrade allows users to search for content across all of these providers. So, if I want to search for which channel is going to have episodes of "Arrested Development," I search once, and it shows me all of the options that are available to me. This sure beats searching in each individual provider's channel, which is what I have to do currently with Apple TV.

Picture quality and streaming reliability seem to be rock-solid. One of the chief complaints I have of Apple TV is that the Netflix app will routinely be 'out of service.' I haven't experienced this with Roku yet. Even on my old CRT television, the picture quality looks great and the audio is pristine; no digital "lossy" sound.



**MT RATING: 4 3/4 STARS**



**Overall:** 4.75 out of 5 stars – Easy-to-use, reliable, affordable and flexible – probably every TV I own from this point on will have a Roku connected to it.

Roku recently released an upgrade that allows me to stream music and photos from my iOS or Android device through the Roku player. I have tested this feature, called Play on Roku, on both my iPhone and Kindle Fire versions of the app and it works wonderfully. The next step for them would be to add streaming video mirroring and possibly, a Roku 'icon' much like the Apple AirPlay icon, that would allow me to stream YouTube videos and more natively from my device.

My favorite app here, and one that would be worth the purchase price alone, is the Amazon Instant Video channel. Through this channel, subscribers to the Amazon Prime service can stream instant videos through their Roku device. You can even rent/purchase movies from Amazon that stream from the cloud. This is one function I have often wished my Apple TV device could support.

Roku isn't about just video, though. There are also channels for Pandora and TuneIn radio. You can stream your favorite music from Pandora, or listen to your favorite stations from TuneIn directly from the Roku device. I am even able to see radar and weather updates for my area directly from Weather Underground through that Roku channel. This comes in handy when severe weather is around.

With the exception of Netflix and Hulu Plus, most of what you will find available through the Roku device you won't find on Apple TV. This extra bit of flexibility (and lower price point for the LT model) made the Roku a no-brainer addition to my home entertainment setup.

## ❖ Final Word

I love my Roku, there isn't much here that I would improve upon, with the exception of more options for streaming from my mobile devices through their remote control app. The device itself though gives you plenty of options to choose from when it comes to device setup and even the content providers available.

My favorite part of the Roku is that through its flexibility, I am able to use it with any television I own, both new HDTV and old CRT models. I can run basic RCA cables or high-definition HDMI. For the LT version, \$50 makes this an extremely affordable home entertainment option, especially considering the amount of free content that is available through various providers (Pandora, TuneIn, Crackle, etc.).

For those of you without a smart TV, do yourself a favor, get a Roku. Very rarely will you be able to purchase something for so little, and get so much.

# Grundig G2 Reporter Portable

By Larry Van Horn, MT Assistant/Technical Editor

**W**hen I first opened the box of the Grundig G2 Reporter portable, I was immediately impressed with the size of the radio (less than 1-inch thick) and I thought that I had finally found a portable with a lot of neat features that would be the perfect traveling companion for me.

First, before I get into this review, let me say that I have been a fan of a few of the Eton Corp (makers of the Grundig line of radios) portable radios over the years. I have owned more than my share of them.

Unfortunately, as I dug deeper into the features and performance of this radio, my thoughts of a traveling companion quickly evaporated and I was not as hopeful in the end as I was when I first started my testing. This is not one of my favorite Eton portable radios.

## ❖ The Unit Basic Features

The G2 Reporter is an AM, FM, FM stereo and continuous shortwave portable with shortwave frequency coverage from 2.3 to 23 MHz (no SSB capability) and 5 kHz only tuning steps. You can select specific shortwave broadcast bands (60m, 49m, 41m, 31m, 25m, 22m, 19m, 16m, and 13m bands are available) by repeatedly pressing the SW button. The radio also features three FM tuning ranges – North America (87-108 MHz), Japan (76-90 MHz), or School (64-108 MHz) bands. The tuning range for AM goes from 520-1710 kHz with either 9-kHz or 10-kHz spacing.

The unit has a dual sound speaker system and a line input jack (on left hand side of the radio) that gives you the capability to play your personal audio device such as a Smartphone, iPod or tablet through the G2. You can also use this to record from another source; just plug in, press record, and start playing whatever you want to record. A built-in MP3/WAV recording system lets you make verbal notes via the built-in microphone, external microphone or even record radio programming directly off the air.

Radio can be recorded in either a 129-kbps WAV format or 40-kbps MP3 format. The MP3 format does sound pretty bad on playback. The built-in card slot on the bottom panel can be used with microSDHC cards up to 16-GB in size for playback of MP3 or WMA files. This function will let you play your own music library through the G2. There is an eight preset electronic audio equalizer you can select when playing your MP3 and WMA files.

Via the internal audio system, you can set it to your music file tracks, repeat a track, or repeat all. The tempo can be adjusted and if you have lyrics in LRC format with your music files, it can display those.

There is a 248 channel memory system for storing radio frequencies with memory scan,

auto tuning storage as well as keypad entry.

The G2 can be set to operate in English, Chinese, Japanese, Korean, French, German, Italian, Dutch, Portuguese, Spanish, Swedish, Czech, Polish, Russian, Turkish, Hebrew and Thai.

Other features include a clock timer, lock, rechargeable 3.7V 1050 mAh lithium battery, tuning indicator and backlit LCD with adjustable contrast. The mini USB 2.0 jack facilitates charging and field upgrades.

The radio includes the following accessories: a USB cable, mini stereo to mini stereo audio cable, cloth carrying pouch and printed multi-language owner's manual.

Here is one of the first caveats I must pass along regarding this radio. This radio requires a USB port, such as can be found on a PC to recharge the built-in battery. If you do not have an available USB port, then you will have to purchase the USB charge adapter. The USB port is merely for charging the radio and not powering the radio.

## ❖ The Good

I like the small, slim, and light weight of this AM/FM/SW radio. I also like the expanded audio feature set with the 4-GB of internal storage and the microSD slot for recording as well as playback of MP3/WMA files. The line-in jack is also a neat function so I effectively have an audio-only type docking port for personal audio devices. I was very impressed with the FM reception of this radio. It was very good when I compared it with several other portables in the shack head-to-head.

There is support for RDS (radio data system) information, but you have to turn it on every time you switch to FM (the same goes for changing from mono to stereo).

## ❖ The Bad

This radio runs on a rechargeable lithium ion battery pack that charges by the USB cable

only (USB charger not included). You can't just pop in some AA batteries and continue operating the unit. Since its battery pack is not something you can pick up anywhere, you're stuck when you are out and the battery dies. Another problem that our unit had was once the battery was removed and then put back into the unit again, the unit was completely inoperative due to two of the three spring clip connectors being sprung.

Bottom line on the battery: no computer, no charging the battery and no firmware updates.

This unit also has a flimsy stand; and operating it can be confusing. For instance, the radio has built-in alarm and sleep timer functions, however, setting up these alarm function requires much more effort than it probably should.

The owner's manual is another area of concern and probably the cause of most of the operating issues associated with the G2. It is a typical Chinese to English translation-style manual and is very difficult to follow.

## ❖ And The Ugly

There is no external antenna jack, so you can't improve the shortwave reception using that method. Also the AM broadcast band reception is acceptable for local and regional station reception, but is next to useless for distant radio reception.

The G2 can also display text documents on its tiny screen; a feature Grundig calls an "e-book function." I own a couple of devices that I use to read e-books on, but this e-book function is, well frankly, a joke. While it would be possible to read an entire book four lines at a time, it's nothing I would want to do.

I have seen several reports that the audio system has an issue with serious intermittent MP3 player dropouts and/or skipping. While I did not observe that with the unit I tested, I do have a concern that quality control or component issues may be a problem associated with this unit.

There are a lot more small items I could point out, but available space doesn't permit me to point all of them out.

## ❖ The Bottom Line

The Eton Grundig G2 Reporter is more than just a little portable radio, but it does have some serious drawbacks you need to be aware of before you consider buying it. Grundig squeezed quite a bit of functionality into its ultra compact body, letting you do things like record radio and play MP3s. However, if what you're most interested in is shortwave radio, you'll probably want to invest in one of Grundig's larger models simply because using the G2 can be frustrating. Grundig G2 Reporter MSRP is \$150.



MT RATING: 2 STARS





# Will Apple Shut Down Pandora's Box?

By Loyd Van Horn, W4LVH

It looks as though the Mayan calendar hoopla has gone the way of Y2K and Harold Camping, because here we are, celebrating the dawn of another new year.

Are any of us really surprised?

Aside from that whole "end of the world" thing, one of the bright points of seeing the arrival of 2013 is we get to see what happens on several fronts in the Internet radio industry. Perhaps none of these developments has been scrutinized quite as heavily as Apple's bid for its own Pandora-style Internet radio service.

It has been no secret that Apple has been wooing every record label and industry executive for quite sometime now, in hopes that they could cash in with their own Internet radio service. It would be modeled much like the Pandora approach, but with more flexibility for the user.

Pandora's agreements with record labels limit the number of times an artist's songs can be played in a given hour, or how many times that users can skip songs in an hour. Apple is looking to loosen these restrictions, in exchange for a slightly larger slice of the advertising pie.

Yes, the Apple radio service would rely heavily on advertising through Apple's iAd service. As of press time, negotiations are riding mostly on the percentage of this advertising that record labels and artists would receive. The going thought is that with a bigger cut of the pie, Apple might be able to have more freedom for their users.

One absolute is that Apple is looking for this to be an entirely app-driven experience through iPod, iPhone and iPad devices. There is currently no web-browser interface anticipated. It might be a bit short-sighted for Apple to make this unavailable to users. Pushing an app is one thing, but eliminating an entire interface option for users who like to listen to services like Pandora and Jango while at work or at home seems a bit odd.

Regardless, Apple's radio service looks to be a huge factor in the success of Pandora. Pandora shares dropped as much as 12 percent when word first was released that Apple was talking to record labels. When several high-profile Apple announcements passed with no word of a radio service, Pandora's shares bounced back a bit.

No matter how this pans out, the rise of streaming music and Internet radio is starting to become big business, when you have large, established companies such as Apple and Amazon looking to cash in.

## ❖ Netflix up for grabs?

Here is a pretty significant, although subtle, development for another major player in the streaming content world. Billionaire Carl Icahn recently took a 10 percent ownership stake in Netflix.



Icahn has a history of making similar moves that are then followed by a push from him to an overall sale of the company. This is leading to speculation among many that Netflix could soon be in play for new ownership.

In what could turn out to be a 'you-heard-it-here-first' scenario, many believe that Amazon might be the leading candidate, although there are those who dismiss this. If, and this is a big if, Netflix is up for play to new owners, Amazon makes perfect sense. They already have a streaming video service through their Amazon Prime Instant Video. Combining the two services and obtaining all of those subscribers would instantly make Amazon the king of streaming video. Even the DVD portion of the business would make sense for Amazon, since they are such a large player in the DVD-sales industry.

On top of that, Amazon has a device through its Kindle Fire tablet that would be a perfect tie-in to boost both sales of the device and subscriptions of the service. Imagine buying a Kindle Fire and getting the new Amazon Instant Video (with Netflix) free for a year or two. That might just entice some folks away from purchasing a new iPad or other tablets.

However this shakes out, whether it is Amazon, Google, or even a company such as Verizon or AT&T, that makes a play at Netflix, one thing is for sure, streaming video is becoming a seriously big business.

## ❖ Lessons from Sandy

To all those who have scorned my ramblings over the years that streaming radio pro-

vides another venue for radio enthusiasts, not a replacement, you need look no further than Hurricane Sandy for my rebuttal.

When much of the Northeast went dark during the storm, cell phone batteries quickly died with no means of recharging. No cell phones meant no streaming radio, Twitter, Facebook or any other source of information. Where did residents turn? Our old friend, radio.

Residents were breaking out dusty crank-powered radios, old battery powered units that hadn't seen action in years. They were even tuning into (gasp) AM radio!



We will not see traditional radio disappear in our lifetime. It may change, stations may reduce in numbers or in the amount of constant local content, but when the chips are down and people need a voice in the dark, radio is where they turn.

This has been proven time and time again from Katrina, to Sandy and to nearly every major snowstorm that has ever caused massive power outages.

That isn't to say that radio is immune to the effects of such disasters. WINS, 1010 AM in New York went off the air due to effects of the storm. There were reports circulating much of that evening that powerful WCBS, 880 AM, too would soon be silent, as water gathered at the base of their transmitter.

The message though, is clear. Enjoy Internet radio and streaming video for what it is, a convenient way to access content from around the world, without worry of effects from propagation, need for expensive equipment or any technical expertise.

When it is needed though, traditional radio will be there like an old friend, ready to help provide a voice when all other means are silent.

Until next month, 73s and happy listening!



## GLOBALNET LINKS

Apple's Online Radio Service to Challenge Pandora in 2013 - [www.businessweek.com/news/2012-10-25/apple-s-online-radio-service-to-challenge-pandora-in-2013](http://www.businessweek.com/news/2012-10-25/apple-s-online-radio-service-to-challenge-pandora-in-2013)  
Icahn puts Netflix on Block - [www.bloomberg.com/news/2012-10-31/icahn-acquires-10-of-netflix-mulls-ways-to-maximize-value-1.html](http://www.bloomberg.com/news/2012-10-31/icahn-acquires-10-of-netflix-mulls-ways-to-maximize-value-1.html)

# What's NEW

Tell them you saw it in Monitoring Times

Larry Van Horn, New Products Editor

## MFJ-1790 10-Meter Vertical

Ten meters has been wide open lately and, when it is, you can literally work the world. The beauty of ten meters is that it doesn't take much power or much of an antenna to rack up the stations in your logbook.



MFJ has a new ten meter vertical that is extremely lightweight for portable use, has a low angle of radiation for DX work (helps to reduce interference and noise), and comes with a vertical and horizontal mounting bracket.

The new MFJ-1790 has an 11-foot radiator and two 6-foot radials both made of aluminum and weighs less than 3 lbs. The MFJ-1790 sells for MSRP \$70 and is available from MFJ ([www.mfjenterprises.com](http://www.mfjenterprises.com)) and many ham radio dealers and *MT* advertisers.

## SCS PTC-IIIusb HF Radio Modem

Special Communications Systems (SCS) and their North American distributor Farallon Electronics have released the PTC-IIIusb HF radio modem. This modem comes with an USB interface to PC, certified USB drivers, 2 MB of internal memory, and a Motorola DSP.



The modem includes a built-in VHF/UHF packet feature, GPS NMEA data input and a Bluetooth option, transceiver frequency control for most radio models, and uses a temperature compensated crystal oscillator for frequency stability.

### PTC-IIIusb Specifications

Audio input impedance/level: 47 k ohms at 10 mVp-p to 2Vp-p

Audio output impedance/level: 1 k ohm at maximum 3 Vp-p (open circuit), adjustable in 1 mV steps

Audio processing: Digital signal processor DSP56303 clocked at 100 MHz and includes

768 kByte additional DSP-RAM for data and program

Central processor: Motorola MC68360 QUICC 32 bit CMOS CPU clocked at 25 MHz

ROM memory – Maximum 256 kByte, CMOS, FLASH-ROM for easy updates

RAM memory – Static: 2 MByte, CMOS

System monitoring: With an internal processor watchdog

Operating temperature: -10 to +50 C

Front panel: Eight LEDs split into various functional groups. On/Off Touch sensor switch

Rear panel: Power supply, DIN Socket for transceiver audio, DIN socket for transceiver remote control, GPS connector - 3 wire screw terminal, USB "B" connector

Power Supply: +10 to +20 V DC, 300 mA max.

Reverse polarity protected, Fuse self resetting

Dimensions: 4.92-inches wide by 1.69-inches high by 5.43-inches deep

Weight: 15.87 oz

This unit comes with Pactor III mode enabled in addition to Pactor I and II. The PTC-III USB comes with an installation guide, USB cable, audio cable (connector at one end, raw wires at the other end), power connector and CD-ROM. The unit sells for \$1,148 and is available from Farallon Electronics ([www.farallon.us](http://www.farallon.us))

## Parabolic Dish Kit for 40-kHz Ultrasonic Applications

Have ever had that burning desire to monitor insects, animals, fish and bats in the 40-kHz portion of the radio spectrum? If the answer is yes, then Midnight Science Ultrasonics (a part of the Xtal Set Society website) has a new 12-inch clear plastic dish antenna that will aid you in your monitoring quest.



This new dish can be used with their RX1 or RX2 ultrasonic receivers. In addition to monitoring Mother Nature in this frequency range, these ultrasonic systems are very useful in tracking down radio interference caused by sparking of AC power distribution systems. Very narrow sensor beam widths are desirable for this sort of application and this new 12-inch parabolic dish is the perfect antenna in this regard.

This antenna has an 8-inch focal length and is designed to work with a 400SR16 or similar

piezo transducer (PST). It is rated to achieve a pressure gain over the sensor alone at 40-kHz of 27 to 28 dB Pa and narrow the field of view from 50 degrees to less than 3 degrees.

A weak spark (generated by 400 volts or more on a AC power distribution line) or bat transmissions will produce pressure waves with an RMS pressure of roughly 0.5 to 5.0 Pa (75 micro-psi) at ten feet. The dishes pinpoint the source location and the added receiver provides for recording or headphone reception.

In addition to the new 12-inch model, Midnight Science also has an 8-inch model. These parabolic dish kits include the dish, piezo sensor, sensor PCB, three struts, instrumentation bracket, pistol grip, and hardware. The kit manual includes assembly instructions, mounting techniques for the Ultra-RX1 or Ultra-RX3, a discussion on parabolic dish gain, and references. Assembly time is about one hour, and requires pliers, screw drivers, and soldering iron. If kit building is not your thing, you can get it assembled along with the Ultra-RX3, but you will have to allow a week or two extra for shipment.

You can get more information on this and all of the Midnight Science ultrasonic products at [www.midnightscience.com/ultrasonics.html](http://www.midnightscience.com/ultrasonics.html). You can also see all of the Xtal Society products from the main page on their website at [www.midnightscience.com/index.html](http://www.midnightscience.com/index.html).

## N3FJP Logging and Contest Software

Radio hobbyists have come a long way from the days of paper logbooks and filing cards to record and preserve the contact we make or hear. These days we have a plethora of logbook software options available to us. One of these products is the Amateur Contact Log by Scott Davis N3FJP.



The Amateur Contact Log has a large feature list including:

- Award Tracking: Track Worked All States, Worked All Counties, Worked All Countries, DXCC, VUCC, Grids, Zones, IOTAs, Lighthouses and many other achievements.
- Customizable user interface: You can choose

to display any of the 32 data fields you want and decide where you want them. A DX spotting window can be set to any size you like. You can also change the font sizes of all the fields, lists and text boxes as well.

- Includes a database of counties and countries.
- Query by band, mode, or power level to easily track your accomplishments by individual and multiple criteria.
- Lists previous contact details with the station currently being worked including name, dates of previous contact(s), QTH, etc. just by typing the call in the call field and hitting the Tab key.
- A bearing and distance calculator from your QTH for DX contacts and grid squares.
- Full support for standard Amateur Data Interchange Format (ADIF) import and export. Export your whole log or selected records in ADIF for applications such as eQSL and the ARRL's LoTW (Log Book of the World).
- Easily import data from other N3FJP contesting software via the ADIF standard logbook interface format.
- Easily manage your log and Logbook of the World. ACLog will sign and upload your contacts to LoTW and download your confirmations from LoTW.
- Upload QSOs directly to eQSL one record at a time or via ADIF.
- Interfaces with most Elecraft, Icom, Kenwood, Ten Tec and Yaesu radios.
- Provides DX spotting via Telnet, your packet TNC or AGW Packet Engine. Audio alert for needed spots.
- Send keyboard CW via your comm port or WinKey and play Wave files via your sound card.
- Quickly print basic QSL label strips and address labels (does not support label printers and labels are not customizable through AC Log).
- Interfaces with the QRZ CD, the Ham Call Buckmaster CD databases and their respective Internet lookup services.
- Interfaces with K7RE RTTY program and the Who's On The Air (WOTA) database.

This logbook is one of many individual products that are available from this software supplier. Some of the other software packages are for individual amateur radio contests, including: 10 Meter Contest Log, 10-10 QSO Party Log, ARRL 160 Meter Contest Log, ARRL RTTY Round-Up Contest Log, CQ 160 Meter Contest Log, CQ WPX Contest Log (including a network version), CQ World Wide DX Contest Log (including a network version), Field Day Contest Log (including a network version), FISTS Sprint Log, IARU HF Contest Log, International DX Contest Log (including a DX and network versions), Kids Day Log, Kids Roundup Log, NAQP Contest Log (including a network version), NA Sprint Contest Log, November Sweepstakes Contest Log, QRP ARCI Contest Log, RAC Contest Log, State QSO Party Logs, Stew Perry Contest Log, and VHF Contest Log (including a network version).

N3FJP also has the following amateur radio specialty software available: Amateur Exam Study Program 1.3, CW Practice 1.1, Ham Club Database, Emergency Manager Network Log, and a Net Manager Log program.

You can get more details on all of Scott's software packages, including special pricing and package deals on his website at [www.n3fjn.com](http://www.n3fjn.com).

## Sangean WFR-28 Wi-Fi Radio

The Sangean Ultra-Compact Portable Wi-Fi Internet Radio (WFR-28) is a combination Internet radio and audio media streaming device (Wi-Fi Internet / FM-RBDS / Network Player / USB Portable Radio) that is fully portable. With it users can listen to 13,000 plus radio stations from NPR, FOX news, CNN, BBC, CBS to KROQ, and over 35,000 podcasts as well as to your regular FM Band with RDS (Radio Data System).



Additional features include Frontier Silicon's IR 2.2 network audio software that provides the most complete, versatile and easy-to-use software available for the next generation Internet-connected audio systems.

The WFR-28 has a built-in external telescopic antenna for FM reception. You can save your favorite Internet stations as well as your FM stations into one of your 10 memory presets.

The WFR-28 has three alarm selections: Internet Radio, FM Radio or Buzzer Alarm.

You can wake to your favorite choice of Internet radio station or FM station or, if you must, a classic buzzer alarm. Whichever you choose, a gradual alarm feature gently raises the alarm volume, so it's not too jarring. Dual alarm lets you set separate wake times.

### WFR-28 Feature Set

- Internet radio (over 13,000 stations) / FM-RDS waveband
- Ten station presets (five iRadio and five FM)
- USB MP3 playback
- MP3 and WMA compatible
- Network music player
- Plays music stored on your computer
- Search by country, genre and my favorite radios
- Plug and Play
- UPnP / DMR music streaming (DLNA 1.5 compliant)
- Bass and treble control
- Normal / Flat / Jazz / Rock / Movie / Classic / Pop / News sound effect
- Two alarm timer by FM, Internet radio or buzzer
- Sleep timer
- Snooze function
- Plays on rechargeable and dry-cell batteries
- Built-in rapid battery charger
- I/O jacks: DC in, aux-in, line-out, headphone and USB socket

There is also an iSangean app that enables remote control of the WFR-28 for your iPhone or iPod touch. The app allows selection of Internet radio stations, selection and control of media for UPnP/DLNA music streaming from a local computer, server or NAS device, as well as control of FM radio and other functions (where these functions are present on the radio). The "Now Playing" screen provides radio station or

media information with direct control of the radio volume.

You can get more details on this product from the Sangean ([www.sangean.com](http://www.sangean.com)) and it is available from Grove Enterprises for \$150 plus shipping.

And finally two new amateur radio transceiver pre-production announcements from Yaesu and Kenwood.

## Yaesu FT-1DR

Yaesu has announced the pending release of a new handheld, the Yaesu FT-1DR. The FT1D digital portable transceiver is the first amateur radio dual band digital/analog transceiver employing advanced C4FM FDMA digital technology that opens the door for thrillingly entirely new digital communication features.

According to the preliminary information we have received, the FT-1DR will be a 2-meter/70-cm 12.5 kHz C4FM FDMA transceiver. It will be water spray resistant (IPX5 rating), has an AF dual monitor, large dot matrix LCD screen, wideband receive capability, built-in GPS antenna and an internal AM bar antenna. No other specifications are currently available.



## Kenwood TS-990S

JVC Kenwood Corporation has recently announced the prototype of a state-of-the-art amateur transceiver scheduled soon for worldwide launch under the Kenwood brand.



The main features of this new transceiver includes a frequency range of HF + 50 MHz; output power: 5W-200W; modes: SSB, CW, FSK, PSK, FM, AM; built-in switching power supply; built-in antenna tuner; com ports: USB A/B port and LAN port; dual TFT display and a dual receiver capability.

Pricing and availability has not yet been announced for North America on either of these radios and the information shown is preliminary and subject to change without notice or obligation.

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](mailto:larryvanhorn@monitoringtimes.com).

When ordering or inquiring about the products mentioned in this column, be sure to tell them that you saw it in the pages of *Monitoring Times* magazine.

# The Best in Radio Communications

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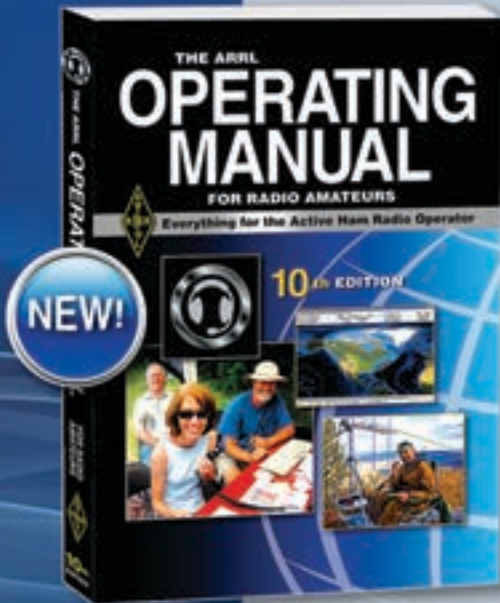
## The ARRL Handbook—2013 Edition

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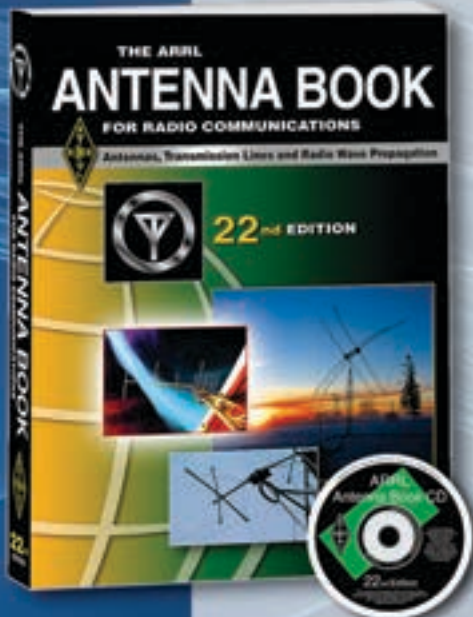


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