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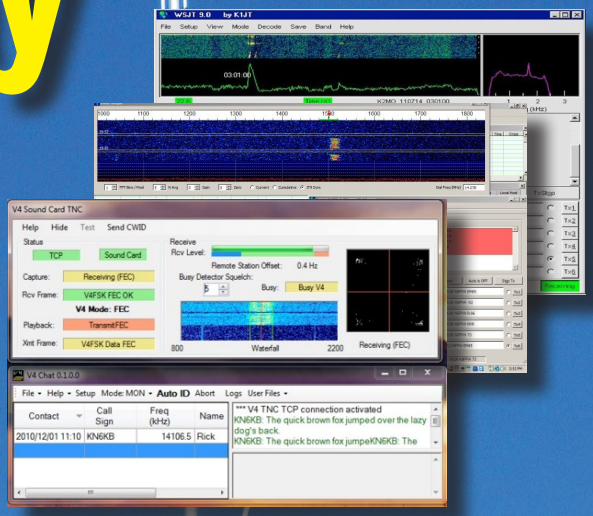
Amateur Radio Today



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Monitoring Times

Vol. 32 No. 5 May 2013

Amateur Radio Today

Years ago a "futurist" report famously included amateur radio among the list of ideas that had outlived their usefulness. While video stores, landline telephones, and the U.S. Postal Service have done a dramatic fade in the last ten years, amateur radio is still very much alive.

One reason it continues to thrive is that, unbeknownst to non-ham futurists, amateur radio continues to evolve; discovering new modes, such as JT65, while retaining the skills needed for the continuation of old modes, such as CW. In addition, hams continue to pioneer new communications fields such as CubeSats; doing with volunteer imagination what "start up" companies would need millions in "angel funding" to do.

And, unlike app-crazed, social networkers, whose MySpace and Napster websites are cyber-ghost towns, hams rarely throw anything away. That's why on nearly every band you'll hear AM operators using vintage equipment along with JT9 operators using Software Defined Radios.

This month *MT* celebrates the new and the old in amateur radio.

On Our Cover

In background: Cushcraft R9 all-band vertical antenna (Courtesy: Cushcraft). Clockwise from top: MFJ Sound Card Radio interface (Courtesy: MFJ Enterprises); Digital mode screens (Courtesy: Larry Van Horn N5FPW); Elecraft KX3 transceiver (Courtesy: Elecraft); Fox-1 Amateur Radio CubeSat (Courtesy: Keith Baker KB1SF).

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

Continuously amazing, the AR6000 professional grade receiver features:

- 40 kHz ~ 6 GHz coverage with no interruptions
- Multimode AM, FM, WFM, FM Stereo, USB, LSB and CW
- Tuning steps of 1 Hz up to 3.15 GHz; 2 Hz from 3.15 ~ 6 GHz
- Receiver is programmable and manageable through a USB computer interface
- Up to 2,000 alphanumeric memory channels
- Analog S-meter, large tuning dial, front panel power, volume & squelch controls
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- Fast Fourier Transform algorithms
- An SD memory card port can be used to store recorded audio
- Two selectable antenna input ports plus optional remote antenna selector

Add to the capabilities of the AR6000 with:

- Optional APCO-25 decoder
- Optional interface unit enables remote control via the internet
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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

Whatever happened to High Fidelity Audio?

Don Ramos writes:

"Re: The lack of audio quality in many audio devices (the 'Beginner's Corner' March *MT*), mainly the portable MP3 players and Apple's very popular iPod and iPhone: I think you are right in stating these devices do not have very good sound quality. They are sold with the common white ear buds you see everywhere. I think you are also right to state most of the music heard over these devices are pirated, with no assurance of great sound quality that you and I come to expect from either the old vinyl records or CDs.

"But, you have to realize that these devices are sold for the convenience of use they offer. They are also sold to help make a user look 'cool.' Great sound quality is not an objective of these devices.

"However, I believe all is not lost. Within the last year, I have been noticing many young guys wearing what appear to be hi-fi headphones, the kind I used to wear for listening back in the 1980s. I understand some guys are getting tired of the poor sound of the ear buds and are looking to improve their listening experience, using these headphones without having to buy external speakers. I see guys walking with their audio device either in their hands or on a belt and wearing headphones that would look more at home in a living room than a public street. It does look strange at first, but it is getting common to see this, though it does make one look geeky. I think the trend is limited to guys, since I don't see gals doing this. Maybe they don't want their hair messed up or to look like a space alien.

"I think another reason this is happening is the popularity of music DJs who have gained a reputation for being hip and are shown mixing records or CDs using heavy headphones, not ear buds. Again, there is the 'cool' factor, but if guys can be shown that great sound can be had with a little effort, maybe they will start demanding better audio and perhaps others will follow their lead. Who knows, we could be looking at a mini hi-fi resurgence! Thanks for an engaging topic."

Skullcandy MP3 Headphones: Better audio and cool look! (Courtesy: Skullcandy)

Donald Strumpf writes:

"I read your article [on Hi-Fi audio] with great interest. I agree that over-the-air audio has gone down hill, but Internet radio is not too bad. If you go to Shoutcast.com, choose classical music as your genre, and then click on the bitrate header, it will arrange the stations in order of highest bitrate. There are a number of 256 kb/s stations listed and even a few 320 kb/s. With a decent pair of headphones or speakers with a sub-woofer connected to your computer, the results are pretty good.

"Since *MT* has an older audience, their ability to hear good music might have some limitations. My audiologist tells me that most people keep the ability to hear the high frequencies (despite legends to the contrary), but they lose it in the treble section. Unfortunately, the most affected frequencies are for the human voice. Hence people have difficulty talking and hearing one another when they have hearing problems. The good news for me is that I'm not into choral music, so instrumental classical music for me is just fine.

"My MP3 player only has 4 GB of memory. I used to rip my CDs with MP3 down to 256 kb/s or 320 kb/s and then copy them to the little MP3 player. The MP3 files are much smaller than the WAV files on the CDs. However, I discovered FLAC (Free Lossless Audio Codec **http://flac.sourceforge.net**) which compresses files but is lossless (unlike MP3 which is lossy). I now copy the FLAC files to my little MP3 player. Fortunately, it can also play FLAC files. So I think I am listening to the full CD now."

Shortwave Programs on Shortwave

Darrell Anderson writes:

"Where can I find programs on shortwave similar to the program which was on for so many years on HCJB, 'DX Party Line?'"

While the Internet has replaced the bulk of shortwave-related programming information, there are still folks out there promoting shortwave programming. Here's what I have found:

Longtime shortwave broadcaster Keith Perron produces the one-hour weekly program Media Network Plus (PCJ Radio) which airs 0200 UTC on Fridays on WRMI 9955 kHz. His programs are also available as podcast at: ***www.pcjmedia.com/medianetworkplus.***

Radio Havana airs "DXers Unlimited" with Arnie Coro CO2KK on 6000, 6060, 6140, or 6125 kHz Sundays at 2312 UTC

Glenn Hauser's program "World of Radio" airs on a number of shortwave stations including WBCQ where it airs on 5111 kHz Fridays at 0230 UTC and on WMRI, Miami on 9955 kHz Tuesdays at 1200 UTC, Wednesdays at 0430 UTC and Saturdays at 1600 UTC.

If you have access to the Internet, the following three blogs have a lot of updates on shortwave programming.

MT's Gayle Van Horn has the most authoritative shortwave blog: ***http://mt-shortwave.blogspot.com***

Thomas Witherspoon K4SWL covers the latest shortwave news including SWL radio reviews at his website: http://swling.com

Dan Robert's "The Shortwave Report" ***www.outfarpress.com/shortwave.shtml.*** *– Editor*

Sangean WFR-28 vs. UE Smart Radio

Thomas Fleckenstein writes:

"Re: Your response to James in the 'Letters' column of the March issue of *MT*, the Sangean WFR-28 vs. the Logitech UE Smart Radio. A couple of things should be noted. The WFR-28 (I just bought one) does have a built-in charger for NiMH batteries although the manual is a little vague on this. It charges the batteries when the radio is plugged-in, but turned-off. Also, since the radio costs over $25 dollars, shipping is free from Amazon whether or not you are a Prime customer. I am very satisfied with the WFR-28!"

WFR-28 (Courtesy: Sangean)

Future of Dashboard Radio

Longtime *MT* reader and regular contributor Mario Filippi writes about AT&T and General Motors teaming up to equip most of their 2014 vehicles with WiFi 4G capability: "Interesting on how this might play out with traditional (AM/FM) mobile media, and with Siruis/XM subscribership. Maybe Internet radio is the wave of the future in the automobile industry. If, of course, you can afford the monthly subscription fee."

There's no doubt in my mind that Internet radio is the future of radio in the car dash. HD-Radio is hamstrung by its own technology: Unless you live in a city, it doesn't work, you're stuck with analog radio. Satellite radio is great but at $17/month for a few hours/week of listening to a limited channel line-up (many with commercials!) it just isn't that attractive. WiFi radio, on the other hand, serves city and country commuter well. And, the tiny bandwidth WiFi radio requires won't tax anybody's 4G system.

But, the devil is in the details. For instance, Toyota offers a WiFi interconnect called Entune which uses apps on your smartphone (you do have a smartphone, don't you?) which is free for the first three years and $10 - $14/month afterwards (Sirus/XM is another $17/month extra). Ford offers its Sync (HD-Radio built in!) which basically does the same thing as Entune does; connects through your smartphone. Chevy does the same thing with MyLink. These are a long way from a real integrated WiFi radio option, but I'm sure that's not more than a year or two away. Especially since buyers will be asking for it. – Editor

COMMUNICATIONS

by Ken Reitz KS4ZR

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

Update on Narrowbanding by *MT* Publisher, Bob Grove W8JHD

In spite of previous *MT* coverage on narrowbanding, earlier known as spectrum re-farming, we still receive questions about how this will affect communications. Briefly stated, most land mobile licensees in the VHF high band and UHF are required to use no more than 12.5 kHz transmit bandwidth. But more specifically:

Except for those licensees granted a waiver, all FCC Part 90 Private Land Mobile licensees, including law enforcement, firefighting, emergency medical, transportation departments, mass transit agencies (including railroads, community watches, schools and school buses), public utilities (voice and data), business industrial land mobile, private land mobile paging, and radiolocation using 150-174 and 421-512 MHz, must now restrict their FM bandwidths to no more than 12.5 kHz. No conversion from analog to digital mode is required, nor is any change in frequency.

Users *not* subject to the current narrowbanding requirement include amateur radio, aeronautical services, marine radio, General Mobile Radio Service (GMRS), Citizens Band (CB), Family Radio Service (FRS), Multiple Use Radio Service (MURS), broadcasting, and exclusive paging channels.

Licensees formerly using 25/12.5 kHz radios in the wider mode merely needed to switch over to the narrow mode. Those purchasing newer radios selected 12.5/6.25 kHz models in anticipation of eventual further narrowing requirements (not yet set) and may currently use either bandwidth that suits their requirements.

The narrowing of bandwidth results in approximately 3 dB reduction in signal strength which may require some system remodeling where long-range dependability is in question.

Prof to NTIA: LTE System Vulnerable to Attack

A research professor from Virginia Tech made public comments on the vulnerability of the nation's LTE system to the National Telecommunications and Information Administration (NTIA) on the Development of the Nationwide Interoperability Public Safety Broadband Network. The professor wrote, "Preliminary research has been performed to show the extent to which LTE is vulnerable to jamming. It was shown that extremely effective attacks can be realized, using fairly low complexity. It would be in the interest of public safety to put forth an effort to find solutions to the described problem, and ultimately improve the wireless interface of Public Safety LTE." He also noted, " The availability of low-cost and easy to use software defined radios makes this threat even more realistic." The extent of the professor's remarks may be read here: **www.ntia.doc.gov/files/ntia/va_tech_response.pdf**

South Bend, IN Radio System Failure

Almost as if to make the professor's point, a news report on WBND-TV South Bend, Indiana, detailed the confusion that city's police force battled when their new Motorola 800 MHz radio system suffered what the station described as a "massive communications failure." After working around the clock, technicians had 50 percent of the system up and running. Police reporting to their shifts were told to dig up their old analog gear to use while various workarounds were tried. Without being specific, the report cited a "tower issue" as the culprit for the failure.

VOA Decries China Jamming Efforts

In late February reports of jamming of English language BBC shortwave broadcasts to China surfaced. Shortly afterward the Voice of America (VOA) experienced similar efforts to interfere with its broadcasts into China. The Broadcasting Board of Governors, the federal agency overseeing U.S. foreign broadcasters, issued a statement quoting VOA Director David Ensor as saying, "Monitors listening to VOA broadcasts say this interference 'appears intentional,' and is strongest in regions around Tibet and along the Indian border. The Chinese government has for years jammed VOA and Radio Free Asia Chinese and Tibetan language programs and blocked VOA vernacular language websites, but English language programs have historically not been blocked." According to BBG, "Monitors say the interference affects about 75 percent of the English language transmissions to China and is similar to the type of jamming aimed at VOA Horn of Africa broadcasts, which are targeted by equipment installed by China in Ethiopia." VOA broadcasts to China on radio, direct-to-home satellite Radio and TV, and the Internet.

Ex-ham Fined for Interfering on 14.312 MHz

Certain frequencies on various ham bands are notorious for exemplifying the worst possible on-air amateur activity. The nature of such transmissions, short duration on HF frequencies, make them nearly impossible to trace. But, every now and then, the FCC gets lucky and bags one of the offenders. That's what happened December 18, 2012.

Responding to complaints from the amateur radio community, agents from the Kansas City FCC office monitored the frequency 14.312 MHz. Using direction finding techniques they located the source of the transmissions to an antenna mounted on a pole next to a residence in Bolivar, Missouri.

According to FCC documents, "…the agents inspected the unlicensed radio transmitter, which was located in a bedroom in the Bolivar residence. Mr. Bruegman was the only person present in the bedroom and the only male in the residence during the inspection. Mr. Bruegman admitted to the agents that he owned the radio transmitter. The agents observed that the transmitter was turned on and tuned to 14.311 MHz. Mr. Bruegman told the agents that he had no current Commission licenses, but that he previously held an Amateur Radio license, call sign KC0IQN. Mr. Bruegman told the agents he would remove the microphone from his transmitter and only use it as a receiver." Bruegman, a former Technician Class licensee, failed to impress the FCC and was issued a Notice of Apparent Liability for Forfeiture in the amount of $10,000.

Ham Fined $25,000 for Police Radio Interference

On 14 different days during October and November of last year, the Brevard County (Florida) sheriff's department were victims of on-air harassment by a male voice operating on the frequency they used for the county jail. They complained to the FCC after they couldn't convince the individual to stop. Audio recordings showed that the individual was "transmitting vulgar language, sound effects, previously recorded prison communications, and threats to prison officials," according to FCC documents. Field agents from the Tampa office of the FCC were dispatched to do a little on-air detective work.

Monitoring the frequency (465.300 MHz), the signal was traced to a residence in Cocoa, Florida. During an inspection at the residence the man, identified in FCC documents as Terry VanVolkenburg KC5RF, "initially showed the agents an amateur radio, incapable of transmitting on 465.300 MHz, but eventually produced an Alinco DJ-C5 portable radio transceiver that could operate on 465.300 MHz," according to the FCC's Notice of Apparent Liability for Forfeiture.

The FCC noted that the Advanced Class licensee, "did not specifically admit that he had interfered with the prison's communications system, but when asked about the transmissions on 465.300 MHz and the interference to the prison's communications systems, he stated that he chose 465.300 MHz because the prison's transmissions on that frequency were strong; that he was only using 300 milliwatts and did not think that he 'could talk over anyone and therefore wasn't interfering with anyone…'" He promised the interference wouldn't happen again.

The FCC was apparently disinclined to accept the promise on face value. The base fine for operating without a license is $10,000 and for interfering, $7,000. But, because of the threatening nature of the interference, the FCC was moved to increase the fine an additional $8,000 for a total of $25,000.

Digital World Extends Amateur Horizons

By Larry Van Horn N5FPW

Who would have thought several decades ago, when amateur radio operators first introduced them into their shacks, that the personal computer would help create a revolution in ham radio? In those early days of computers we used the PC to do code practice, perform electronic formula computations, and execute some basic amateur radio record keeping functions. But just as the PC evolved, so has our capability in the ham shack.

With the advent of more powerful computers and the sound card, hams have become increasingly active using digital modes. In 1998 Peter Martinez G3PLX, was the first amateur to exploit the computer soundcard by creating the PSK31 mode, a keyboard-to-keyboard digital mode that let amateurs text each other via radio. Since that milestone event, sound cards have become more powerful and versatile, resulting in digital communications becoming one of the fastest growing segments of the amateur radio hobby.

MFJ-1273B Sound Card Radio Interface ($60). (Courtesy: MFJ Enterprises)

In this article I will explore some new digital modes currently being used by the amateur radio community.

What You Need to Get Started

If all you want to do is to receive some digital communications or you are a shortwave radio listener, all you will need is a computer equipped with a soundcard, an audio cable, a shortwave receiver with SSB capability and a soundcard software package (See Table 1) that will decode the digital signals you want to receive.

If you are a licensed amateur radio operator, replace the receiver with a transceiver, add a hardware interface between the computer and the transceiver and you can get in on the fun of working the world via digital modes.

The simplest and quickest computer to radio interface is to connect the line output from the sound card to the transceiver audio input with a 100:1 voltage divider to reduce the voltage output, and the sound card line input to the audio output of the radio. You can use the transceiver VOX to switch from receive to transmit and back. You can learn more about this method on the WM2U website (See our resource guide in Table 2).

If you have two thumbs, burn yourself frequently with a soldering iron or just have some cash to spare, you can purchase one of the commercial interface units that are available in the ham radio marketplace. Manufacturers such as MFJ, RigExperts, Saratoga, Tigertronics, and West Mountain Radio all make inexpensive interface units (see our link to the DX Zone Digital and Packet Radio Resource Guide).

When setting up to transmit or receive, almost all sound card digital modes use the Upper Side Band (USB) mode on our transceivers. More conventional digital modes such as Clover, RTTY, PACKET, AMTOR and PACTOR typically use Lower Side Band (LSB).

Before we move on there is one important point that needs to be mentioned. Most of the problems setting up the computer, interface, and radio can be attributed to the proper setup of the soundcard and mixer panels on the computer. Del Schier, K1UHF, wrote an excellent article on this in the October 2003 issue of *QST*. The good people at West Mountain Radio (see table 2 for their link) have made this article available in PDF form on their website. I highly recommend that you download this file and study it thoroughly. It will save you a lot of time and grief when you start setting up your station to work the various digital sound card modes.

JT65: A New Digital-Mode Player

There are three new and exciting digital modes that have gained popularity since my 2005-08 articles were written and that is what I will discuss in this article.

By far the single most popular mode to appear on the digital scene since Martinez released his PSK31 software, is the JT65 mode. Originally developed by Joe Taylor K1JT for moon bounce applications, where signals are extremely weak, JT65 has now burst on the HF scene thanks in part to Joe Large W6CQZ and his JT65-HF software package. Joe's software package makes working this mode much easier than using the WSJT software earlier produced by Joe Taylor.

microHAM USB Interface III ($149 + $65 for rig cable). (Courtesy: microHAM)

The 65-tone digital mode uses sophisticated digital signal processing techniques and message redundancy to get its weak signals through in the crowded digital HF bands. One of the 65 tones is a 1270.5 kHz synchronizing tone and the other 64 tones are used to carry the information.

Timing is everything when operating in this mode. Your computer clock must be accurate to within two seconds of the station you are communicating with. Each JT65 transmission lasts precisely 46.8 seconds.

During each transmission only a small amount of information is sent using the 65 tones – about 13 characters. The program sends the information over and over. The good news is that even though as much as 80 percent of the transmission can be lost, the software will still be able to decode the transmission.

Don't expect lengthy rag chews with your fellow hams using JT65. A JT65 contact, much like other weak signal contacts (i.e. moon bounce, meteor scatter, amateur satellite), are designed to exchange the bare minimum information needed to qualify as a QSO. You will exchange call signs, signal reports, and grid squares. During a JT65 QSO stations take turns transmitting. Stations transmit on the even or odd minute and then listen in the following minute.

Want to hear what these modes sounds like? Tune your radio to 14076 kHz and listen for what sounds like someone playing music. Look for JT65 activity on other bands including 1838, 3576, 7039 (European stations), 7076, 10139, 18102, 21076, 24920 and 28076 kHz.

JT65 is an excellent digital mode for low power and antenna restricted stations and you can work some pretty good stuff from time to time. I now have a Worked All States (WAS) award using this mode and have worked both Indonesia and India, only two of the many countries active on this new digital powerhouse mode.

V4 Protocol

Another new mode gaining popularity is the V4 protocol developed by Rick Muething KN6KB. V4 is a soundcard digital protocol optimized for keyboard operation over the HF bands and will operate in either FEC or ARQ modes.

It uses 4FSK modulation and a strong Viterbi FEC encoding scheme, robust even in weak signal or poor propagation conditions. The protocol runs approx 55 wpm and fits in a 200 Hz bandwidth. Transmission is not compressed so monitoring of either FEC or ARQ is possible by third parties. There is an auto ID mode that is convenient for net operation. The initial code is for 7 bit ASCII but it is designed to support more complex multi-byte character sets UTF-8 as well. Look for V4 signals around 7073, 10136 and 14073 kHz.

The Newest Digital Mode

Just when you thought we had run out of new modes to invent, Joe Taylor strikes again with a new 9-FSK digital communications mode for two-way QSOs.

Joe wrote in a recent RGSB LF Yahoogroup

post, "I invite you to try a new digital mode called JT9 that is designed especially for making amateur QSOs at MF and LF frequencies. JT9 uses the structured messages introduced in 2003 for the JT65 mode, now widely used for EME and for QRP operations on HF. JT9 can operate at signal levels as low as -27 dB (in a 2500 Hz reference bandwidth), with one-minute timed transmissions. It also offers slower transmissions of 2, 5, 10 and 30 minutes duration, and the slowest mode can decode signals as weak as -40 dB. With one minute transmissions, sub-mode JT9-1 has a total bandwidth of just 15.6 Hz – less than one-tenth the bandwidth of a JT65A signal. The other sub-modes are narrower still. A JT9-30 signal occupies about 0.4 Hz total bandwidth.

"Note that these JT9 sensitivity levels are comparable to or better than those of WSPR, which uses simpler messages and is not intended for making two-way QSOs. JT9 has much higher throughput and reliability than QRSS CW, including DFCW modes."

JT9 is implemented in an experimental version of WSJT called WSJT-X. See Joe's Princeton.edu website in Table 1 for further details and software downloads.

I'm proud to say I have already made my first JT9 contact on 14078 kHz, using Joe's shiny new software, with K5RCD Randall in Texas and have a Logbook of the World (LOTW) confirmation to show for it.

A Final Digital Thought . . .

The world of amateur radio digital communications has grown by leaps and bounds in the last ten years, and shows no signs of slowing down. It is a lot of fun to make a contact with a fellow ham using low power and receiving a weak signal. It is even more fun to carry on an international text conversation with others from all over the world.

So, check out our resource list, download some software and give the digital modes a listen. I guarantee you won't be on the sidelines long. And, maybe I will CU on my waterfall soon!

Table 1 – Digital Modes Program Sampler

Program	URL
AAVoice$	**www.dxsoft.com/en/products/aavoice/**
AGW Packet Engine	**www.agwtracker.com/**
Airlink Express	**www.airlinkexpress.org/**
APRS ($ and freeware)	**www.winaprs.org/** and **www.agwtracker.com/**
APRSISCE32/64	**http://aprsisce.wikidot.com/**
APRSPlotter$	**www.coaa.co.uk/aprsplotter.htm**
BeaconsSee$	**www.coaa.co.uk/beaconsee.htm**
BlackCat CW Keyer (Mac)$	**www.blackcatsystems.com/software/bccwkeyer.html**
BQP32 Discussion Group	**http://groups.yahoo.com/group/BPQ32/**
Chip 64/125 (IZ8BLY)	**http://antoninoporcino.xoom.it/Chip64/index.htm**
ChromaPix$	**www.barberdsp.com/**
Clicklock	**www.qsl.net/zl1bpu/SOFT/click.htm**
CMSK LF/MF	**www.qsl.net/zl1bpu/CMSK/cmsk.htm**
CocoaModem (Mac)	**www.w7ay.net/site/Applications/cocoaModem/**
CW Decoder	**www.amqrp.org/projects/cwdecod/decoder.htm**
CWGet$ and CWType	**www.dxsoft.com/en/products/cwget/**
CW Skimmer and Server$	**www.dxatlas.com/CwSkimmer/**
DigiPan	**www.digipan.net/**
DigiPic	**www.qsl.net/kh6ty/digipic/**
DigiPlex	**www.qsl.net/lu7did/digiplex.htm**
DigiTalk	**www.qsl.net/kh6ty/digitalk.htm**
Digital Narrowband TV	**www.qsl.net/zl1bpu/NBTV/Digital.htm**
DIGTRX	**www.qsl.net/py4zbz/hdsstv/HamDRM.htm**
DominoEX	**www.qsl.net/zl1bpu/MFSK/DEX.htm**
DX PSK	**http://dxfile.free.fr/dxpsk.htm**
DX4WIN$	**www.dx4win.com/** (Contest logger with CQ/RTTY/PSK31 decode capability)
EasyPal	**www.kc1cs.com/**
EchoLink	www.**echolink.org/register_data.jsp**
Email User Client Software	**www.winlink.org/ClientSoftware**
Faros$	**www.dxatlas.com/Faros/** (NCDXF Beacon Monitor)
FDMDV	**http://n1su.com/fdmdv/** (Frequency Division Multiplex Digital Voice)
Fldigi (Linux/Windows/Mac)	**www.w1hkj.com/Fldigi-2.x.html**
FlexNet	**www.afthd.tu-darmstadt.de/~flexnet/**
FTV$	**http://ftv.3amsystems.com/**
GenLog	**www.qsl.net/w3km/** (Contest logger with CW keyer capability)
gMFSK (Linux)	**http://gmfsk.connect.fi/**
Ham Dream (DRM)	**www.qslnet.de/member/hb9tlk/**
Ham Fax (Linux)	**http://hamfax.sourceforge.net/**
Ham Mode Software Packages (K3PGP)	**www.k3pgp.org/software.htm**
Ham Radio Deluxe/DM780$	**http://hrdsoftwarellc.com/**
Hellschreiber (IZ8BLY)	**http://antoninoporcino.xoom.it/Hell/index.htm**
HF (Linux)	**www.baycom.org/~tom/ham/linux/hf.html**
Hybrid FM Narrowband TV	**www.qsl.net/zl1bpu/NBTV/Hybrid.htm**
Intercom	**http://pa3byz.homeip.net/rttymade.htm**
HamScope	**www.qsl.net/hamscope/**
Jason (LF)	**www.weaksignals.com/jason/**
JT65-HF and JT-Alert	**http://iz4czl.ucoz.com/index/0-28** and **http://sourceforge.net/projects/jt65-hf/files**
JVComm32$	**www.jvcomm.de/**
KG-STV	**www.g0hwc.com/kg-stv-english.html**
LinPSK (Linux)	**http://linpsk.sourceforge.net/**
Logger 32	**www.logger32.net/** (Logging program that includes MMVARI/MMTTY software packages)
Mac Ham Files (KC8JHS)	**www.qsl.net/kc8jhs/download.html**
MEPT-JT	**www.qsl.net/zl1bpu/MFSK/MEPT-JT.htm**
MFSK16	**www.qsl.net/zl1bpu/MFSK/M16.htm**
MF TeleType	**www.polar-electric.com/MFTT/index.html**
MixW$	**http://mixw.net/**
MMTTY/MMSSTV/MMVARI	**http://hamsoft.ca/**
MRP40$	**www.polar-electric.com/Morse/MRP40-EN/index.html**
MSK-Hell (ZL2AFP)	**www.qsl.net/zl1bpu/HELL/MSK/LF_mskhell.htm**
MT63 (IZ8BLY)	**http://antoninoporcino.xoom.it/MT63/index.htm**
Multimon (Linux)	**www.baycom.org/~tom/ham/linux/multimon.html**
MultiMode (Mac)$	**www.blackcatsystems.com/software/multimode.html**
MultiPSK$	**http://f6cte.free.fr/index_anglais.htm** (SWL/Ham multimode software package – select non-professional modes in this package are free)
N1MM Logger	**www.n1mm.com/** (Contest/Logging program that interfaces with the MMVARI, MMTTY and FLDigi software packages)
NBTV 32 Line	**www.qsl.net/g4hbt/nbtv/nbtv32.zip**
OFDM Narrowband TV	**www.qsl.net/zl1bpu/NBTV/OFDM.htm**
Opera	**http://rapidshare.com/files/3019514661/Opera%201.4.7.zip** (Experimental QRSS Beacon Mode)
Paxon	**www.paxon.de/**
Phase Shift (Linux)	**www.qsl.net/n1vtn/phaseshift.html**
PC ALE	**www.n2ckh.com/PC_ALE_FORUM/**
Precision CW (CCW)	**www.qsl.net/dj7hs/download.htm**
ProSkan$ (DOS)	**http://webpages.charter.net/jamie_5/**
PSK31LX (Linux)	**http://wa0eir.home.mchsi.com/**
PSK31SBW	**www.qsl.net/wm2u/p31sbw108.zip**
PSK63	**www.qsl.net/kh6ty/psk63/**
PSK-GNR	**www.wd5gnr.com/pskgnr.htm**
PSK Software by Peter Martinez	**www.aintel.bi.ehu.es/software.html**
QSSTV	**http://users.telenet.be/on4qz/**
QuickMix	**www.ptpart.co.uk/assets/unsupported/quickmixin.zip** (Sound card audio mixer software)
QuickPSK	**www.qsl.net/kh6ty/psk63/**
ROS	**http://rosmodem.wordpress.com/** (Mode is NOT authorized for use by US hams)
SlowFeldXPAS	**www.lsear.freeserve.co.uk/aircraft%20scatter.html** (Aircraft scatter comm software)
Smart PSK	**http://dxfile.free.fr/dxpsk.htm**
Software Packet TNC (UZ7HO)	**http://uz7ho.org.ua/packetradio.htm**
SSTV32$	**http://webpages.charter.net/jamie_5/**
Stream (MFSK8/16)	**http://antoninoporcino.xoom.it/Stream/index.htm**
TrueTTY$	**www.dxsoft.com/en/products/truetty/**
TWCW/TWPSK (Linux)	**http://wa0eir.home.mchsi.com/**
UI-View APRS Client	**www.ui-view.org/**
UISS (Win/Linux)	**http://users.belgacom.net/hamradio/uiss.htm** (Packet program for decoding amateur spacecraft activity)
V4 Chat/Protocol	**http://groups.yahoo.com/group/V4Protocol/**
Voice Key Express	**www.qsl.net/n7qjp/**
W1SQLpsk	**www.faria.net/w1sql/**
W95SSTV	**www.barberdsp.com/w95sstv/w95sstv.htm**
WinAPRS	**www.winaprs.org/downloads/WinAPRS/**
WinDRM	**http://n1su.com/windrm/**
WinHell	**www.qsl.net/pa3bqs/**
WinLink 2000	**www.winlink.org/**
WinMOR (WLK2)	**www.winlink.org/WINMOR**
WinMSDSP 2000	**www.qsl.net/w8wn/hscw/msdsp.html**
WinPack	**www.apritch.myby.co.uk/uiv32.htm**
WinPSK	**www.moetronix.com/ae4jy/winpsk.htm**
WinPSKSE	**www.hamsource.com/winpskse/**
WinSkan$	**http://webpages.charter.net/jamie_5/**
WinWarbler	**www.dxlabsuite.com/winwarbler/**
WOLF	**www.scgroup.com/ham/wolf.html**
WO-PSK	**www.qsl.net/zs5wo/**
WriteLog	**www.writelog.com/** (Contest logger with CQ/RTTY/PSK31 decode capability)
WSJT (Win/Linux)	**http://physics.princeton.edu/pulsar/K1JT/** (FSK441 / JT6M / JT65 / JT2 / JT4 / WSPR)
WSJT-X	**http://physics.princeton.edu/pulsar/K1JT/** (New JT9 weak signal mode for LF/MF)
WSPR	**http://physics.princeton.edu/pulsar/K1JT/** (Weak Signal Propagation Reporter)
WS Tools (Linux)	**www.qsl.net/g4klx/software.htm** (Weak signal JT modes)
WXSat	**www.hffax.de/**
ZL2AFP PSK Sounder	**www.qsl.net/zl1bpu/SOFT/PSKSounder.htm**

$ indicates software that must be registered and purchased.

Table 2 – MT Digital Resource Guide

AC6V Digital Modes Software List	**http://ac6v.com/software.htm#DIGITAL**
Amateur Radio Sound Blaster Software Collection	**www.muenster.de/~welp/sb.htm**
Digital and Packet Radio Resource Guide	www.dxzone.com/catalog/Manufacturers/Digital_and_Packet_Radio/
Digital Radio (Discussion Group)	**http://groups.yahoo.com/group/digitalradio/**
KE0VH Digital Interface Project	**www.hamuniverse.com/ke0vhproject.html**
Olivia – The Magic Band	**http://hflink.com/olivia/** and **http://www.oliviamode.com/**
PSK31 by WM2U	**www.qsl.net/wm2u/psk31.html**
PSK31 Official Homepage	**http://aintel.bi.ehu.es/psk31.html**
PSKReporter	**http://pskreporter.info/pskmap.html**
Sound Card Interfacing by WM2U	**www.qsl.net/wm2u/interface.html**
The In's and Out's of a Sound Card	**www.westmountainradio.com/pdf/Ins&Outs.pdf**

MT's Digital Mode Operating Guide

By Larry Van Horn N5FPW

From the ARRL *The Considerate Operator's Guide* webpage: "Nothing in the rules recognizes a net's, group's or any individual's special privilege to any specific frequency. Section 97.101(b) of the Rules states that 'Each station licensee and each control operator must cooperate in selecting transmitting channels and in making the most effective use of the amateur service frequencies. No frequency will be assigned for the exclusive use of any station." No one "owns" a frequency.

"It's good practice–and plain old common sense–for any operator, regardless of mode, to check to see if the frequency is in use prior to engaging operation. If you are there first, other operators should make an effort to protect you from interference to the extent possible, given that 100% interference-free operation is an unrealistic expectation in today's congested bands."

In keeping with the spirit of the rules above, the listing below should be considered a guide only and not required frequencies. You may have to tune up and down a few kHz to find other active stations.

The 20 meter digital frequencies are probably the most active in the digital world, so be mindful of others and other modes!

Region 1 Europe digital mode frequencies are typically in the lower portion of the band, which is an SWR bonus if your antenna is tuned for the CW portion of the band. Frequencies listed below are for dial QRG. New modes and other additions are always welcomed. Please contact the author, *MT* Assistant/Technical Editor Larry Van Horn N5FPW at larryvanhorn@monitoringtimes.com

160 Meters

1800-1810	RTTY Contest/USA
1804.0	Hellschreiber
1805.0	JT65-HF Alternate
1807.0	MT63 and MFSK Region 2
1807 and up	PSK31 and QPSK31 USA
1808.0	Olivia CQ 500/16 and Contestia
1808.5	Olivia CQ 500/16 and Contestia
1822.0	MT63
1835-1845	RTTY contest
1836.0	JT9 Modes
1836.6	Weak Signal Propagation Reporter (WSPR) (JT Modes part os WSJT suite)
1838.0	JT65-HF Primary, Olivia 500/16 Region 1, Contestia, MT63 and MFSK
1838 and up	PSK31 and QPSK31 Europe Primary
1838-1843	RTTY DX/Europe/Africa
1838.5	Olivia 500 Region 1 and Contestia
1840.0	ROS (This mode is not currently legal for use in the United States)
1890.0	SSTV

80 Meters

3520-3530	RTTY Japan
3522.0	Olivia CQ 500/16 East Asia, Olivia CQ 1000/32 East Asia and Contestia
3570-3600	RTTY Contest
3576.0	JT65-HF Primary
3577.0	Olivia CQ 500/16, Olivia CQ 1000/32 Region 2 and Contestia
3577-3580	ROS (This mode is not currently legal for use in the United States)
3580 and up	PSK31 and QPSK31 Primary
3580-3600	RTTY USA
3580-3620	RTTY Europe/Africa
3580-3589	Hellschreiber
3582.5	Olivia CQ 500/16 Primary, Contestia, MFSK16 and MT63 500Hz short interleave
3583.0	ROS (This mode is not currently legal for use in the United States)
3584.0	MFSK
3585.0	MT63 1000Hz Long and ROS (This mode is not currently legal for use in the United States)
3585-3600	Automatic Stations/Packet
3587.0	ROS (This mode is not currently legal for use in the United States)
3588.0	PSKMail (PSK500R) Europe
3590.0	MT63, PAX and RTTY DX
3592.6	Weak Signal Propagation Reporter (WSPR) (JT Modes part os WSJT suite)
3594-3594.2	Weak Signal Propagation Reporter
3595.0	ROS (This mode is not currently legal for use in the United States)
3596.0	ALE Channel 1 - High frequency network and emergency/disaster relief (Data)
3597.0	PSKMail (PSK250) USA
3603-3606	ROS (This mode is not currently legal for use in the United States)
3610.0	PAX2
3615.0	Olivia CQ 1000/32 Region 1 and Contestia
3620.0	Olivia CQ 1000/32 Australia, Contestia and Hellschreiber
3713.0	Digital SSTV
3791.0	ALE Channel 2 - International/Regional and emergency/disaster relief (Voice)
3845.0	Analog SSTV
3986-3989	Digital Voice Net North America Alternate
3991=3994	Digital Voice Net North America Primary
3996.0	ALE Channel 3 - North America (Voice)

60 Meters

5287.20	Weak Signal Propagation Reporter (WSPR) (JT Modes part os WSJT suite) (Not available in the US)
5330.50	Emcomm - Phone (USB), Data traffic file transfer, RTTY and CW
5346.50	Emcomm - Phone (USB), Data traffic file transfer, RTTY and CW
5357.00	Emcomm - Digital calling, data emcomm nets and digi QSO, Phone (USB), Data rraffic file transfer, RTTY and CW
5367.00	ROS (This mode is not currently legal for use in the United States)
5371.50	Emcomm - Phone (USB), Data traffic file transfer, RTTY, CW and ALE Channel 4 - Emergency/Disaster relief non-automatic (Voice/Data)
5403.50	Emcomm - Phone (USB), Data traffic file transfer, RTTY and CW
5404.25	Olivia CQ 500/16 Region 1 only - no USA and Contestia

40 Meters

7025-7040	RTTY Japan
7025-7050	RTTY USA
7025-7100	RTTY Contest
7025.5	Olivia CQ 500/16 East Asia and Contestia
7030-7040	Hellschreiber
7035-7040	PSK31 and QPAK31 - Region 1/3 Primary
7035-7045	RTTY Europe/Africa
7036.0	JT65-HF Alternate
7037.0	MT63 Europe
7038.6	Weak Signal Propagation Reporter (WSPR) (JT Modes part os WSJT suite)
7039.0	JT65-HF and ROS (This mode is not currently legal for use in the United States)
7040.0	RTTY DX
7041.0	JT65-HF
7042.0	PAX and PAX2
7042.5	Olivia CQ 500/16 Primary and Contestia
7044.0	ROS (This mode is not currently legal for use in the United States)
7046.0	ROS (This mode is not currently legal for use in the United States)
7048.0	ROS (This mode is not currently legal for use in the United States)
7053-7056	ROS (This mode is not currently legal for use in the United States)
7072.0	MFSK Region 2
7072.5	Olivia CQ 500/16 Region 2 and Contestia
7073.0	V4 Protocol
7076.0	JT65-HF USA Primary
7077-7084	Hellschreiber
7080 and up	PSK31 and QPAK31 Region 2
7080-7125	RTTY USA
7090.0	CHIP64/128
7100-7105	Automatic Stations/Packet
7102.0	ALE Channel 5 - High frequency network and emergency/disaster relief (Data)
7103.0	PSKMail (PSK250) USA
7115.0	ROS (This mode is not currently legal for use in the United States)
7171.0	Analog SSTV
7173.0	Digital SSTV
7185.5	ALE Channel 6 - International/Regional and emergency/disaster relief (Voice)
7191.0	PSKMail (PSK500R) Australia
7245.0	Facsimile
7250.0	Digital Voice Modes
7286-7289	Digital Voice Net North America Alternate
7291-7294	Digital Voice Net North America Primary
7296.0	ALE Channel 7 - North America (Voice)

30 Meters

10120-10150	RTTY USA
10124-10127	Digital SSTV and DRM Modes
10132-10134	ROS (This mode is not currently legal for use in the United States)
10136.0	V4 Protocol
10137.0	JT65-HF Alternate, MT63 and Hellschreiber
10138.0	JT65-HF Alternate
10138.5	Olivia CQ 500/16 and Contestia
10138.7	Weak Signal Propagation Reporter (WSPR) (JT Modes part os WSJT suite)
10139.0	JT65-HF Primary
10140-10150	MFSK Modes, DominoEX and Thor
10140 and up	PSK31, QPSK31, PSK63 (and higher), PSK63F, PSK125, PSKFEC31, PSKAMxx, Throb and Throbx
10140-10150	RTTY Europe/Africa and Automatic Stations/Packet
10140.0-10140.1	Extreme narrow bandwidth techniques (DFCW, Jason, QRSS and WOLF)
10140.1-10140.2	MEPT-JT Mode and Weak Signal Propagation Reporter
10141.5	Olivia CQ 500/16 and Contestia
10142.5	Olivia CQ 500/16 and Contestia
10144.0	Hellschreiber Region 1
10145.5	ALE Channel 8 - High frequency network and emergency/disaster relief (Data)
10146.0	PSKMail (PSK500R) Europe Main Backbone
10147.0	PSKMail (PSK250) USA Main Backbone
10147.5	PSKMail (PSK500R) Australia
10148.0	PAX, PAX2 and PSKMail (BPSK250)
10148-10149	APRS Robust Packet OFDM
10149.1-10149.5	APRS - 300 baud FSK packet network for geo-position reporting. mobiles, portables and marine

20 Meters

14060-14120	RTTY Contest
14063-14069	Hellschreiber
14064.5	Clover
14065.0	Clover
14070 and up	PSK31 Primary
14071.5-14073.5	PPSK63 (and higher), PSK63F, PSK125, PSKFEC31 and PSKAMxx
14072-14084	MFSK Modes, DominoEX, Thor, Throb and Throbx
14073.0	V4 Protocol
14073.0	Hellschreiber
14073.65	Olivia CQ 500/16 and Contestia

14074.65	Olivia CQ 500/16 Primary and Contestia
14075.0	JT65-HF Alternate, PAX, and PAX2
14076.0	JT65-HF Primary
14077.0	CHIP64/128
14077.65	Olivia CQ 500/16 and Contestia
14080-14100	RTTY USA/Europe/Africa
14095-14099.5	Automatic Stations/Packet
14095.6	Weak Signal Propagation Reporter (WSPR) (JT Modes part os WSJT suite)
14097-14097.2	Weak Signal Propagation Reporter (WSPR)
14098.1-14098.5	APRS - 300 baud FSK packet network for geo-position reporting. mobiles, portables and marine
14100.0	IBP/NCDXF Beacons
14100.5-14112	Automatic Stations/Packet
14106.0	MT63
14109.0	MT63
14110.6-14102.8	Winlink 2000 Network (Pactor 3)
14101-14102	APRS Robust Packet OFDM
14101.0	ROS (This mode is not currently legal for use in the United States)
14101.6-14103.8	Winlink 2000 Network (Pactor 3) 14102.7 Center
14101.8-14104.0	Winlink 2000 Network (Pactor 3) 14102.9 Center
14102.1-14104.3	Winlink 2000 Network (Pactor 3) 14103.2 Center
14103.0	ROS (This mode is not currently legal for use in the United States) and Robust Packet (RPR) 300/600 bps OFDM 500 Hz BW
14103.1-14105.3	Winlink 2000 Network (Pactor 3) 14104.2 Center
14103.8-14106.0	Winlink 2000 Network (Pactor 3) 14104.9 Center
14105.0	105 Packet Net (LSB)
14105.5	Olivia CQ 1000/32 and Contestia
14105.6-14107.8	Winlink 2000 Network (Pactor 3) 14106.7 Center
14105.8-14108.0	Winlink 2000 Network (Pactor 3) 14106.9 Center
14106.5	Olivia CQ 1000/32 and Contestia
14107.0	ROS (This mode is not currently legal for use in the United States)
14107.8-14110.0	Winlink 2000 Network (Pactor 3) 14108.9 Center
14108.1-14110.3	Winlink 2000 Network (Pactor 3) 14109.2 Center
14108.8-14111.1	Winlink 2000 Network (Pactor 3) 14109.9/14110.0 Center
14109.0	Mostly MT63, some MFSK, occasional Q15X25 (Packet Radio Mode) and ALE Channel 9 - High frequency network and emergency/disaster relief (Data)
14109.5	Q15X25 (Packet Radio Mode)
14109.9-14112.1	Winlink 2000 Network (Pactor 3) 14111.0 Center
14110.0	PSKMail (PSK500R) Europe/PSKMail (PSK250) USA and CHIP64/128
14110.8-14113.1	Winlink 2000 Network (Pactor 3) 14111.9/14112.0 Center
14111.0	Q15X25 (Packet Radio Mode)
14111.8-14114.1	Winlink 2000 Network (Pactor 3) 14112.9/14113.0 Center
14112.0	PAX2
14112.5-14115.5	ROS (This mode is not currently legal for use in the United States)
14112.8-14115.1	Winlink 2000 Network (Pactor 3) 14113.9/14114.0 Center
14113.0	Q15X25 (Packet Radio Mode)
14114.0	MT63
14114.9-14117.1	Winlink 2000 Network (Pactor 3) 14116.0 Center
14115.0	Q15X25 (Packet Radio Mode)
14116.0	ROS (This mode is not currently legal for use in the United States)
14116.8-14119.0	Winlink 2000 Network (Pactor 3) 14117.9 Center
14118.0	ROS (This mode is not currently legal for use in the United States)
14119.5-14121.7	Winlink 2000 Network (Pactor 3) 14120.6 Center
14230.0	Analog SSTV
14233.0	Digital SSTV
14236.0	Digital Voice International Callig Frequency (Frequency Division Multiplex Digital Voice)
14245.0	SSTV (SSTV repeater Australia)
14346.0	ALE Channel 10 - International/Regional and emergency/disaster relief (Voice)

17 Meters

18098 .0	JT65-HF Alternate
18100.0	MT63 and other modes
18100 and up	PSK31 and QPSK31 Primary
18100-18110	RTTY USA/Europe/Africa
18102.0	JT65-HF Primary
18102.65	Olivia CQ 500/16 Primary and Contestia
18103.65	Olivia CQ 500/16 and Contestia
18104.0	Hellschreiber
18104.6	Weak Signal Propagation Reporter (WSPR) (JT Modes part os WSJT suite)
18105.0	MT63
18105-18110	Automatic Stations/Packet
18106.0	JT65-HF and ALE Channel 11 - High frequency network and emergency/disaster relief (Data)
18107.0	ROS (This mode is not currently legal for use in the United States)
18110.0	IBP/NCDXF Beacons
18111.0	ROS (This mode is not currently legal for use in the United States)
18112.0	PAX2
18117.5	ALE Channel 12 - International/Regional and emergency/disaster relief (Voice)
18162.5-18165	Digital Voice International Callig Frequency (18162.5)

15 Meters

21060-21150	RTTY Contest
21072.0	MFSK Modes, DominoEX and Thor
21074.0	Hellschreiber
21076.0	JT65-HF Primary
21080 and up	PSK31, QPSK31, PSK63 (and higher), PSK63F, PSK125, PSKFEC31 and PSKAMxx Primary
21080-21110	RTTY USA
21080-21120	RTTY Europe/Africa
21086.5	Olivia CQ 500/16 Primary and Contestia
21087.0	Olivia CQ 500/16 and Contestia
21090-21100	Automatic Stations/Packet
21094.6	Weak Signal Propagation Reporter (WSPR) (JT Modes part os WSJT suite)
21096.0	ALE Channel 13 - High frequency network and emergency/disaster relief (Data)
21109.0	MT63 and other modes - MT63 on sked
21110.0	ROS (This mode is not currently legal for use in the United States)
21112.0	PAX2
21115.0	ROS (This mode is not currently legal for use in the United States)
21129.5	Olivia CQ 500/16 and Contestia
21150.0	IBP/NCDXF Beacons
21150-21160	Automatic Stations/Packet
21152.5	Olivia CQ 1000/32 and Contestia
22152.5-21155.5	ROS (This mode is not currently legal for use in the United States)
21153.5	Olivia CQ 1000/32 and Contestia
21340.0	SSTV
21345.0	Facsimile
21432.5	ALE Channel 14 - International/Regional and emergency/disaster relief (Voice)

12 Meters

24910-24930	RTTY USA/Europe/Africa
24916.0	ROS (This mode is not currently legal for use in the United States)
24917.0	JT65-HF Primary
24920.0	MT63 and other modes
24920.0	JT65-HF Alternate
24920 and up	PSK31 and QPSK31
24921.5	Olivia CQ 500/16 and Contestia
24924.0	Hellschreiber
24924.6	Weak Signal Propagation Reporter (WSPR) (JT Modes part os WSJT suite)
24925-24930	Automatic Stations/Packet
24926.0	ALE Channel 15 - High frequency network and emergency/disaster relief (Data)/ROS (This mode is not currently legal for use in the United States)
24930.0	IBP/NCDXF Beacons
24930.0	MT63 in Europe, although this is the upper edge of the CW/data subband in the US and is the 12m NCDXF beacon frequency
24932.0	ALE Channel 16 - International/Regional and emergency/disaster relief (Voice), PAX2
24937.0	ROS (This mode is not currently legal for use in the United States)

10 Meters

28050-28150	RTTY Europe/Africa
28060-28150	RTTY Contest
28076.0	Hellschreiber
28076.0	JT65-HF Primary, Olivia CQ 500/16 Primary and Contestia
28076.5	Olivia CQ 500/16 and Contestia
28080-28100	RTTY USA
28120.0	MT63 and other modes
28120 and up	PSK31 and QPSK31 Primary
28120-28189	Automatic Stations/Packet
28124.6	Weak Signal Propagation Reporter (WSPR) (JT Modes part os WSJT suite)
28126-28126.2	Weak Signal Propagation Reporter (WSPR)
28146.0	ALE Channel 17 - High frequency network and emergency/disaster relief (Data)
28185.0	ROS (This mode is not currently legal for use in the United States)
28190-28225	Propagation Beacons
28200.0	IBP/NCDXF Beacons
28214.6	Weak Signal Propagation Reporter (WSPR)
28225.5-28228.5	ROS (This mode is not currently legal for use in the United States)
28295.0	ROS (This mode is not currently legal for use in the United States)
28297.0	ROS (This mode is not currently legal for use in the United States)
28302.0	PAX2
28312.5	ALE Channel 18 - International/Regional and emergency/disaster relief (Voice)
28680.0	SSTV
28690.0	SSTV (SSTV repeaters)
28700.0	SSTV

6 Meters

50.076	JT65-HF Terrestrial
50.0865	Olivia CQ 500/16 Region 1 and Contestia
50.160	JT65-HF Terrestrial
50.215-50.250	JT6M (Center 50.230)
50.230	FSK441A
50.245	ROS (This mode is not currently legal for use in the United States)
50.250	PSK31 and RTTY
50.255-50.285	FSK441 and JT6M meteor scatter
50.260	FSK441A calling frequency (Meteor scatter contacts only)
50.276	JT65-HF Terrestrial
50.260	JT65-HF Terrestrial
50.280	PSK2K calling frequency (Meteor scatter contacts only)
50.286	Hellschreiber
50.2865	Olivia CQ 500/16 Region 1 and Contestia
50.290	JT65-HF Terrestrial, MFSK and calling frequency for PSK31 and Hell modes
50.2915	Olivia CQ 500/16 Region 2 and Contestia
50.293	Weak Signal Propagation Reporter (WSPR) (JT Modes part os WSJT suite)
50.285	ROS (This mode is not currently legal for use in the United States)
50.297	ROS (This mode is not currently legal for use in the United States)
50.300	Operating Frequency for RTTY and MFSK
50.620	Automatic Stations/Packet and 6-Meter APRS meteor scatter channel
50.680	SSTV

2 Meters

144.076	JT65-HF Terrestrial
144.116	JT65-HF Terrestrial
144.120	JT65-HF Terrestrial
144.1355	Olivia CQ 500/16 Region 1 and Contestia
144.140	FSK441A calling frequency (Meteor scatter contacts only)
144.160	JT65-HF Terrestrial and ROS (This mode is not currently legal for use in the United States)
144.180	PSK2K calling frequency (Meteor scatter contacts only)
144.1-144.2	Earth-Moon-Earth Digital Modes
144.230	FSK441A
144.235	JT44/JT65
144.330	FSK441A
144.335	JT44/JT65
144.390	APRS
144.489	Weak Signal Propagation Reporter (WSPR) (JT Modes part os WSJT suite)
144.620	PAX and PAX2
144.980	ROS (This mode is not currently legal for use in the United States)
145.500	SSTV (National SSTV simplex frequency for FM)
145.550	PSK31, Hellschreiber and MFSK
145.600	Alternate SSTV
145.650	Alternate digital
147.585	2-Meter APRS meteor scatter channel

1.25 Meters

222-222.025	Earth-Moon-Earth Digital Modes
222.085	FSK441A calling frequency (Meteor scatter contacts only)

The Original Digital Mode: Learning and Using Morse Code Today

By Kirk A. Kleinschmidt NT0Z (Photos courtesy of the author)

DX propagation on the HF bands has been pretty minimal the past few years, and because some forecasters are now suggesting that 2013 may represent the best HF propagation we'll see in decades, I was extra eager to get on the air during this year's ARRL DX Contest! The CW contest weekend is first (February), followed by the SSB contest weekend (March), two weeks later.

My station, definitively not a Big Gun, isn't really even a Little Pistol. I presently run five watts to an attic loop antenna. But hey, you use whatever's available, right? So, with 35 years of casual contesting experience to bolster my efforts, I forged ahead. Both weekends benefitted from openings on 15 and 10 meters and, thanks to a bit of trans-equatorial propagation (TEP), DX stations from every continent except Antarctica were logged, including two "all time new" DXCC Entities.

Highlights included Senegal on three bands, Siberia via fluttery trans-polar propagation (haven't heard *that* in many moons!), ZL, KH6 and KL7 on 40 meters, almost every Caribbean entity except Guantanamo Bay, and no fewer than six stations in the Canary Islands, including one on 80 meters (EA8 is right in the middle of a magical propagation vortex)!

Indoor antenna aside, these are solid results for several hours' of QRP contesting, but if you think the results were evenly split between the two weekends, you'd be very wrong. More than 125 QSOs took place on CW, while only *four* were made on SSB.

This illustrates one of Morse code's huge advantages over SSB and is one reason Morse code is still popular in the modern, "no-code" era: Morse code gets through with much less power. Because the brain applies its own "internal DSP" when receiving CW, and because CW signals occupy 1/10th the bandwidth of SSB signals (250 Hz vs. 2.5 kHz), Morse code communications have about a 12 dB signal-to-noise ratio (SNR) advantage over SSB. That means that a 100-W CW signal has the "talk power" of a 1,500-W SSB signal! My recent experience in the DX Contest certainly makes that apparent.

And, if a 12-dB SNR advantage isn't enough, there are other benefits to using Morse. CW gear is much simpler and easier to build, and if you want to experience the joys of building and using your own radio gear, CW is an almost universal access point.

The simplicity of CW is also apparent when it comes to emergency communications (not to mention the 12-dB SNR advantage, which also applies).

CW QSOs occupy much less space than SSB QSOs. In a technical sense, about 10 CW QSOs occupy the space of one SSB QSO (in the real world we'll call it four or five). To accommodate crowded bands, there's nothing like a 10:1 or 5:1 bandwidth advantage.

When it comes to RFI, CW (and most digital modes) is your best friend. With AM, FM and SSB, your modulated voice is much more likely to point the finger back to you if your neighbors hear it coming from their clock radio. With CW, unless they happen to know Morse code from their Navy years, not so much!

Although you may have to upgrade your license to operate there, the bottom 25-kHz of four HF bands are exclusively reserved for Extra-class hams (in the U.S.). They offer a lot of rare DX that just doesn't seem to show up anywhere else. It's mostly tradition (and non-U.S. frequency allocations), but as long as that tradition lasts, those CW-only, 25-kHz sub-bands are golden DX nuggets.

As of 2013, there have never been more hams in the U.S. Surprisingly, even though the code is no longer required for licensure, Morse activity on the bands hasn't diminished a bit. And, for most on-air contests (which make for easy, accurate tracking of submitted logs), CW activity is also at historic levels!

Although they're not technically the same, in this article I use "CW" and "Morse code" interchangeably. Turning an RF carrier on and off in some kind of agreed-upon sequence constitutes "continuous wave" (CW), and although Morse code *is* CW, an RF carrier could be switched on and off in any number of "non-Morse" patterns (codes). It could also be left on continuously (as a beacon), making for a truly continuous wave.

Learning Morse the Right Way

It's unfortunate, but most hams, me included, learned Morse code *the wrong way*, and it's cost us dearly. So, if you haven't begun your learning process you can do yourself a *huge favor* by learning the code in a way that will support and reinforce your lifelong fluency, rather than sabotage it.

So, what's the *wrong* way to learn the code? *Visually*, or by training yourself to remember code elements as a series of patterns, the way you'd learn it from a book or from the Boy Scouts. Morse code is an auditory language, an ear-brain process of musical sounds and phrases. If you learn it as a collection dot and dash patterns, memorized from a chart or database, you'll inadvertently add an extra, unwanted, step to your neurological Morse code process that will *greatly hamper your speed and fluency*!

Most people who learn Morse this way have difficulty moving beyond 7-10 words per minute, which was sufficient to pass the 5-WPM Novice-class Morse proficiency test back in the day, but far short of true on-air fluency. Even after 35 years, my speed bump, because of my "extra translation step," is about 22 WPM for conversations and about 35 WPM for short contest exchanges. So, if you come across a table of Morse code dot-and-dash patterns in a book — look away. *Seriously*!

You want to speak Morse effortlessly, not as a second language that has to be meticulously translated letter by letter, word by word. Lucky for you, there are two easy ways to accomplish this, and both are widely available.

Learning Morse the right way comes down to choosing between two big names: Farnsworth or Koch. Each developed an excellent system for effectively learning Morse code and using it fluently *after* mastering the basics.

Farnsworth and Koch teach the code at full speed, adjusting the spacing between full-speed letters and words or limiting the number of characters learned (at full speed) before adding another. Each system is *way better* than learning the code visually or at slow speeds.

Right from the start, the Farnsworth and Koch methods help you understand "didahdit" instead of "dot dash dot." You internalize the character as a complete sound, not a series of disconnected elements that have to be pains-

Learning the code:

http://cw.hfradio.org—The NW7US International Morse Code Resource Center. Propagation guru Tomas David Hood, NW7US, is also a Morse junkie, and his site is filled with highly curated info and links about learning and using the code.

www.ac6v.com/morsepages.htm—AC6V's exhaustive list of Morse-related stuff. It's not curated, but it's gigantic!

www.arrl.org/Learning-Morse-Code—The ARRL's "Learn Morse Code" site has links to articles, courses, trainers, books and tools, all aimed at helping you learn Morse.

www.g4fon.net—Ray Goff G4FON's free Koch Method CW Trainer software, now in version 9. Koch-style trainer with optional QSB, QRN, chirp and drift! Very nice, and the price is right! Works in most flavors of Windows (author tested in XP) and reportedly in Linux via Wine.

http://lcwo.net—The Learn CW Online site by Fabian Kurz DJ1YFK hosts a comprehensive Koch-style trainer with speed-building and QSO simulation features. Free with simple registration!

Organizations:

www.naqcc.info—The North American QRP CW Club is dedicated to low-power hamming and helping its members learn and become proficient in Morse operation. Membership is free for hams and SWLs. The club boasts 6,500 members in all states and 90 countries. Features include awards, contests, challenges, nets and more.

www.skccgroup.com—The Straight Key Century Club (SKCC) is a fast-growing group of mechanical-key CW operators, now more than 10,000 strong. Membership is free for any licensed amateur, and although the club focuses on the use of straight keys, bugs and mechanical "side-swipers."

www.fists.org—The International Morse Preservation Society (FISTS), founded in the UK, recently celebrated its 25th birthday. The Society, with a global membership in the thousands, encourages CW operation by established and beginning ops. Its sole membership requirement? "A love of Morse code and a concern for its perpetuation."

takingly translated. By learning the code the right way, higher speeds and greater fluency are assured.

Regardless of the method, persistence pays off. Some days, learning Morse seems effortless, while others seem frustrating. As with learning a new language, just keep at it, and try to work the code into your everyday life. You don't even need a keyer or a radio. It sounds silly, but many ops report success by merely "thinking" the code in their heads as they see stop signs, billboards, license plates or TV commercials.

There are many Farnsworth and Koch learning resources (tapes, CDs, online and on-the-air), free and paid. See the Resources box for links. One way to gauge or improve your code proficiency is with on-air practice bulletins, which add completely new material to your pre-recorded trainings. The ARRL's bulletin station, W1AW, transmits code practice bulletins on multiple frequencies every day, so it's easy to find fresh practice material. You'll have to have access to *QST* to confirm what you've just heard (the practice text is taken from a recent issue), but you can receive Morse code proficiency certificates to chart your milestones.

Some local clubs transmit Morse practice materials on VHF or UHF repeaters, so check with your nearby amateur radio clubs to see what's available. Some clubs also have code classes (beginner and "speed improvement") "code helpers" (Elmers) or means to pair you with others who are learning the code.

With all of this talk about properly *receiving* Morse code, make sure you put enough time and resources into properly *sending* the code, too. If you don't have access to in-person coaches or Elmers who can be invaluable in this part of the process, make sure you at least record your own sending (or QSOs) to see what you're *actually* sending, as opposed to what you *think* you're sending! Even experienced CW ops are sometimes surprised to hear their own code if they're not used to it.

In the "bug era" there was a certain amount of wistful romanticizing about an individual's "personal style" in sending the code. Because most bugs featured automatic dits and manual dahs, it was easy to send exaggerated dahs or staccato, extra-fast dits (on purpose, not to mention by accident)! These practices gave rise to terms such as the Lake Erie Swing and the Banana Boat Swing.

Needless to say, I recommend striving for machine-perfect code and letting your sparkling and unique personality shine through in *what* you say, not how you say it! With straight keys and keyers, most badly sent Morse takes the form of run-together characters or missing dits and dahs. It's easy to develop twitches, glitches and idiosyncrasies, so regularly listening to your own sending and nipping these tendencies in the bud is the best treatment!

Using Morse on the Air

From a ham radio perspective, once you've "learned the code," you still need to learn how to use the code to make on-air contacts: answering and calling CQ, tuning our radios to the right frequency, mastering Q signals and Morse code abbreviations, handling interference, proper procedures for nets and pileups, etc. Like anything else, learning and practicing the basics will get you started, while mastering the nuances will take time.

This is a subject that could easily fill a book or two, and I recommend starting with *Ham Radio for Dummies*, a Wiley and Sons book written by Ward Silver, N0AX (revised edition soon to hit the shelves), and *The ARRL Operating Manual*, the perennial benchmark for operating practices, CW and otherwise. Both are available from your local library or your favorite amateur radio bookseller.

Making the leap from "book learning" to "street smarts" as a Morse op won't happen overnight, and it won't happen without actually using the code on the air (listening to the mechanics of on-air QSOs first, then by transmitting), sweaty palms and all! Thankfully, there are organizations and on-air nets devoted to helping you learn the ins-and outs of becoming a proficient CW operator.

When it comes to learning and using "the original digital mode," there's no time like the present. Even in the 21st century, the advantages of Morse are still going strong and the bands are filled with CW activity from every state and every corner of the globe (and likely will be for years to come). So, choose Mr. Farnsworth or Mr. Koch (or both), follow up with the goodies in the Resources box and grab a paddle. The modern world of Morse awaits!

On-Air Code Practice:

www.arrl.org/w1aw-operating-schedule—Among other things, ARRL Headquarters station W1AW transmits daily (M-F) code-practice sessions on 1.8025, 3.5815, 7.0475, 14.0475, 18.0975, 21.0675, 28.0675 and 147.555 MHz. Slow code session speeds are 5, 7-1/2, 10, 13 and 15 words per minute, while fast code session speeds are 10, 13, 15, 20, 25, 30 and 35 words per minute. Achievement certificates are available.

THE AMERICAN RADIO RELAY LEAGUE, INC.

Headquarters, Newington, Connecticut, U. S. A.

Certificate of Code Proficiency

By this certificate and any appended endorsements to show additional qualifications, the Communications Department of the American Radio Relay League expresses its recognition of merit and progress in code proficiency on the part of

KIRK KLEINSCHMIDT, WDØBDA

who has this date demonstrated skill in the basic art of the true amateur, reception by ear of the International Morse or Continental Code. Our examination of copy submitted as his work in copying by ear indicates absolute accuracy in his performance at a speed of 10 words per minute for a period of at least one minute of plain-language automatic tape-sent text averaging five characters to the word, which we hereby certify. Date of the A. R. R. L. transmission from W1AW, November 17, 1977.

Endorsement Here

George Hart, W1NJM
Communications Manager, A.R.R.L.

Author's Certificate of Code Proficiency from 1977.

KEYS AND KEYERS

Keyboards and computers aside, the devices we use to send code are pretty much unchanged since Marconi's era. A key is a key. What matters is how you use it!

Straight keys: A straight key, the most basic way to turn an RF carrier on and off, is all about the user, who adjusts the length and timing of all dits, dahs and spaces manually. Straight keys are simple, reliable and nostalgic, but many operators find them fatiguing or impractical to use at higher speeds or for any significant length of time. This is as true today for beginning hams as it was for Civil War telegraphers!

Bugs: To improve speeds and alleviate user fatigue, the early 1900s saw the rise of semi-automatic mechanical keys called "bugs," or "Vibroplex keys," named after the company that made them popular (still in business today). Unlike straight keys, which almost always use an up-and-down keying motion, pressing a bug's paddle to the left allows users to manually make dahs just like a straight key. Pressing the paddle to the right starts a pendulum in motion that automatically makes dits (at one speed only). Contrary to their historic, nostalgic and collectible nature, it's difficult for most users to send proper code with a bug (as evidenced by a lot of horrible on-air Morse-mangling!).

Paddles and Keyers: Most hams use single- or dual-lever paddles with an electronic keyer (external or built into their rigs). Push the paddles or levers one way for dahs, the other for dits (user's choice). The electronic keyer handles speed, weighting (the exact timing relationship of dits and dahs), and mode (in this context, the exact nature of how inputs from various paddle types are processed). In all cases the paddles talk to the keyer, the keyer talks to your transmitter, and Morse comes out.

As you learn about paddles and keyers you'll see references to "Mode A," "Mode B," "iambic," "squeeze keying," and so on. These refer to specific keyer modes, and there are several main variations in how specific keyers process inputs from single- and dual-lever paddles. Most ops develop a strong preference early in the learning process. You probably will, too.

PCs and Keyboards: Feel free to use PCs for code practice chores, but unless you have special needs, save these for contesting (macro exchanges) and ultra-high-speed code *after* you've mastered the art.

Code Readers: Whether stand-alone units, PC software or functionality built into your rig, code readers can receive, decode and display Morse code in real time — or so says the marketing copy! But, they can't really help you *learn* the code, which is primarily an ear-brain process and not an eye-brain process.

MT

Build Your Own HF Ham Radio Antenna

By Bob Grove W8JHD

A common question, often brought up during antenna discussions, is whether a good transmitting antenna is also a good receiving antenna. The answer is yes. Then the corollary inevitably arises: Is a good receiving antenna also a good transmitting antenna? That answer is, not necessarily.

The primary function of a shortwave receiving antenna is to bring the level of desired signals above the receiver's own self-generated noise. Once that has been accomplished, any further signal magnification brings with it natural atmospheric noise as well as environmental electrical interference which accompanies all signals in this part of the spectrum.

In comparison, transmitting antennas are designed to radiate as much of the transmitter-generated signal as possible. This means that special consideration must be given to the wire gauge, impedance matching, line loss, and any other power-robbing elements of the system.

For this article, I'll concentrate on wire antennas easily constructed at home using simple, inexpensive materials that perform as well as more expensive, commercial antennas. Wire antennas are most commonly found in the high frequency (HF) range which cover the 2-30 MHz range and is commonly referred to as shortwave.

Location, Location...

Whether you're transmitting or receiving, the positioning of any antenna is of vital importance. Unless the earth is being used as part of the grounding element of the antenna as it often is with verticals, it should be high and in the clear. It would be hard to think of a worse location than in the basement of a metal-sided building!

A vertically polarized antenna can be mounted at ground level, away from obstructions, on a pole or tower, or even on a rooftop. Most HF verticals require a ground counterpoise, an array of conductors radiating from the base to provide the reflection that an earth ground is incapable of producing. Dirt is not an efficient conductor, it is more like a giant resistor, especially dry sand or clay soils!

Horizontal antennas, on the other hand, are balanced systems requiring no ground. They do, however, have to be suspended high enough above the ground to avoid whatever reflection that soil has. A horizontal antenna close to ground reflects upward, making it fine for communicating with an aircraft overhead, but not for much on the horizon!

Gain

The gain of an antenna is relative; it must be compared to some standard as a baseline. In most cases, that comparison antenna is a half-wave dipole for a particular frequency, and it makes no difference whether we are talking about low frequency wires hundreds of feet in length, or a UHF element a few inches long. The unit for comparison is the decibel (dB), and in this case where the reference is a halfwave dipole, gain is expressed in decibels above a dipole (dBd).

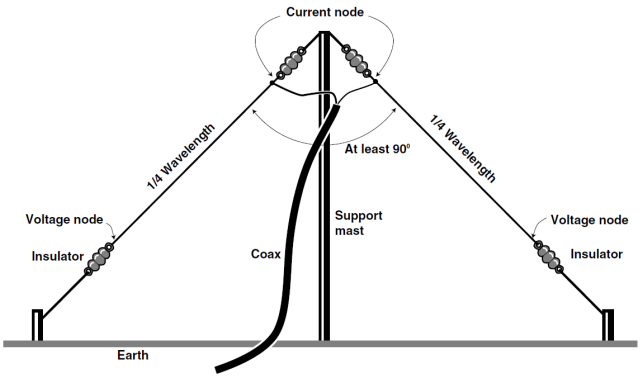
Manufacturers often prefer to use a theoretical, non-existent baseline, the isotropic radiator, a pinpoint radiating uniformly in every direction in a ball shaped pattern. The isotropic radiator would add slightly over two decibels to the gain of a dipole, and it would be expressed in dBi. Thus an antenna with a gain over a dipole of 3 dB might have an isotropic gain figure of about 5.1 dBi.

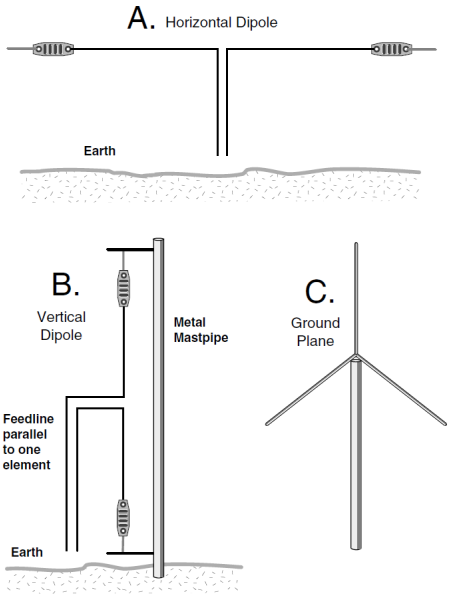
Configuration

Whether you're considering a single-element antenna, multiple antennas for frequency agility, or a more complex array for gain and directivity, the choices are abundant. The most common shortwave antenna is the center-fed dipole (flat top, doublet, T-aerial), a horizontal wire fed at the center. It has a pattern favoring signals coming in (and going out) at its sides, while nulling (minimizing) the pattern at its ends.

If you leave one end of a dipole high, and lower the other to just about the ground, you have a "sloper" which favors signals, both transmitted and received, in the direction of the slope.

The inverted-V and inverted-L are descriptive of two wire antenna configurations resembling those two letters seen upside down. Their singular advantage is to save space without a consequential reduction in performance.





Longwires are long in terms of wavelength. A 136 foot horizontal wire may be a half wavelength on 80 meters, but it's a longwire by two wavelengths on 20 meters.

A random wire antenna is just what its name suggests. It is not planned for a specific frequency, but simply long enough to get good reception and be able radiate well when impedance-adjusted with a transmatch.

Wire

Whether you are planning to build a rotatable beam or simply stretch a wire, a bill of materials must be anticipated.

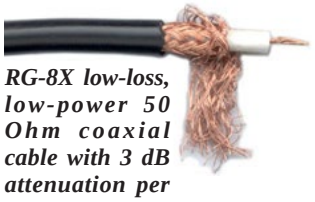
Wire antennas, most often variants of a center-fed, half-wave dipole at the frequency of interest, may be solid or stranded. To protect against wind, falling branches, and ice, use stranded wire for its flexibility. It makes absolutely no difference whether the wire is insulated or uninsulated, the plastic covering is transparent to radio waves.

FlexWeave Antenna Wire: 100 feet of 14 gauge is $22. (Courtesy: Universal Radio)

Some bare wire comes with enamel coating making it less susceptible to corrosion. Of course the enamel must be scraped off for soldering at the feedpoint. After the connections are made, the bare, soldered joints should be sprayed with acrylic to resist corrosion.

A wire gauge of #14 is quite satisfactory for nearly any antenna design. Since it will come as a spool or coil, don't stretch it out like a giant spiral; unroll it a turn at a time so that it lies flat. This prevents it from kinking, thus weakening it under strain of wind and ice load.

9913F7 RG8 premium low-loss coaxial cable: 50 Ohm with a 10 AWG center conductor with 95% braid and 100% foil shielding with 1.1 dB attenuation per 100 feet at HF is $1.25/foot when ordered by the foot. (Courtesy: Universal Radio)



RG-8X low-loss, low-power 50 Ohm coaxial cable with 3 dB attenuation per 100 feet at HF costs about 36 cents per foot in bulk. (Courtesy: Universal Radio)

Copper-clad steel wire is the toughest, but a little more difficult to manage since it is prone to spiraling unless pulled tight. Even aluminum clothesline, which can't be soldered, will work provided the mechanical joints between the aluminum wire and copper feedline are well coated to prevent electrolytic corrosion.

Insulators

Glass and porcelain insulators are used at the ends of wire antennas for suspension. The wire element should be sized to length from the feedline connection to the end loop where it bends through the insulator hole and back on itself to be twist-wrapped on the wire. It's a good idea to solder that twist wrap for security, then spray the soldered twist with acrylic to resist corrosion.

On the far end of the insulator, another hole is provided for a tether. It may be wire, but polypropylene and nylon are easier to work with. The tethers may be wrapped around secure tree limbs or trunks, or even led over a limb, then down to the base of the trunk for easy raising and lowering of the antenna.

So how do you get the tether up that high in the first place? Many seasoned veterans simply tie a rock to the end of a thin rope and throw the rock over a limb. Others have even used a bow and arrow on a string. EZ Hang even makes a slingshot to get that line over a limb. Then there's the rare individual who simply likes to climb trees!

In the absence of trees, commercial sources of poles, masts and towers are available.

Transmission Line

While flat line (window line, ladder line, twin lead, open wire) is traditionally granted the lowest loss characteristics, it is vulnerable to picking up radio frequency interference (RFI) from nearby power lines and electrical/electronic appliances. It can't be run against metal surfaces or across wiring, nor bent sharply, and it's difficult to navigate through walls to the radio shack. And once it's there, it requires a balun (balanced to unbalanced) transformer to mate with the unbalanced coax connector (typically an SO-239) on the radio equipment.

Coaxial cable is far more friendly for transmission line. The most commonly used coax for typical 50 ohm systems are RG-8/U and RG-58/U, both of which attach to conventional PL-259 (sometimes called "UHF," a misnomer) male connectors. RG-213/U is a more ruggedized, mil-spec version of the RG8/U, and is an overkill for most ham radio applications.

RG-58/U is thinner and therefore far more flexible than RG-8/U, and is well suited to power levels in the 100 watt range of typical HF transceivers. As with any transmission line, the higher the frequency, the higher the loss in the form of heat across the dielectric (inner insulation). But even on 10 meters (28 MHz band), the loss for a 100 foot length is only about 2 dB, barely noticeable even on the weakest signal level.

RG-8/U in comparison loses about 1 dB to heat at that frequency, and it's virtually impossible to hear that loss which is also only 1 dB less than RG-58/U. However, for longer line lengths and higher power with an external linear amplifier, the RG-8/U justifies its cost.

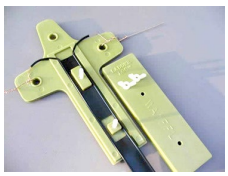
So what about RG-6/U, the low loss, low cost cable used in the TV industry? It handles 100 watts, has about the same loss characteristic as expensive RG-8/U, and even though it best fits the type F screw-on TV connector, low-cost adapters are readily available for any other mating duty including PL-259/S0-238 requirements on all HF transceivers.

It also has 100% shielding, making it more immune to extraneous RFI pickup than RG-58/U which does not have 100% shielding. Of course, purists will argue that there will be some additional loss because the TV coax is 75 ohm, not 50 ohm. What they don't argue, though, is that over the wide frequency ranges that hams use their antennas, the system impedance doesn't remain 50 ohms, either. That's where "tuners" come in.

Connectors

Coax connectors come in a variety of styles, including PL-259, N, BNC, F, SMA, and TNC. But for the shortwave spectrum, the PL-259 and its mated SO-239 are universally preferred.

The end of the coax is first trimmed step by step, revealing the length of bare center wire, the inner braided shield, and the terminal edge of the outer vinyl jacket.



Ladder-Loc® WA1FFL ladder line center connector. (Courtesy: Universal Radio)

For RG-58/U cable, the PL-259 employs a reducing sleeve to accommodate the smaller cable diameter. The sleeve is not used with RG-8/U. But both require solder, and 60 percent tin, 40 percent lead is the most common alloy.

Electrical solders usually have a core of rosin which aids the process by preventing oxides from depositing on the connection while the solder is molten. Never use acid core solder on electronic connections; it will etch and corrode metal components.

Tuning the antenna

For maximum performance of any antenna, the transceiver needs to match the impedance of the antenna system. This is commonly done with a transmatch, more popularly known as an antenna tuner. But this reference is misleading. Nothing in the shack can tune an antenna.

While the feedpoint impedance of any antenna will change over a range of frequencies, the feedline impedance never changes. What the transmatch does is to add capacitance and/or inductance to offset that mismatch at the rig. It's called conjugate matching. The impedance is still mismatched at the antenna, but it looks right at the transceiver.

Balun Transformers

What is a balanced antenna? One that is symmetrical on each side of its feedline, and electrical voltages and currents are identical, although in opposite phase, in each wire. A center-fed dipole and most beam antennas are excellent examples. They should be fed with flat line.

But we most commonly feed any antenna with coax, so what happens? The imbalance between the balanced feedline and the unbalanced antenna causes some current to flow on the outside of the coax shielding which is radiated, thus reducing the apparent gain of the antenna with wasted, randomly radiated, signal power.

Unadilla W2AU 4:1 balun ($29). (Courtesy: Universal Radio)

The common cure is the balun transformer mentioned earlier. It can be a stand-alone accessory, or may be implemented in a transmatch. Most commercial baluns have a pair of wire terminals, screw eyes or screws on one end for attachment to the elements of a dipole, and an SO-238 connector on the other end to mate with a conventional PL-259 male connector on the coax.

Depending on their turns ratio, balun transformers can have impedance matches of 1:1 and much higher. For example, a 50 ohm cable would be attached to a 200 ohm dipole feedpoint with a 4:1 balun.

In Conclusion

This article is intended to present a general orientation toward wire antennas used for transmitting and receiving in the popular shortwave bands. For a more comprehensive look at antennas, for these and other frequency bands, we highly recommend the encyclopedic ARRL Antenna Book published by the American Radio Relay League. A sampling of sources for this publication as well as antennas and accessories are listed below.

RESOURCES PARTS AND PUBLICATIONS

ARRL Handbook for Radio Communications (**http://www.arrl.org/shop**)
ARRL Antenna Book (**http://www.arrl.org/shop**)
EZ Hang (**ezhang.com**)
Ham Radio Outlet (**hamradio.com**)
Grove Enterprises (**grove-ent.com**)
Hy-gain (**hy-gain.com**)
MFJ Enterprises (**mfjenterprises.com**)
Rohn Products (**radiancorp.com**)
Texas Towers (**texastowers.com**)
Unadilla (**unadilla.com**)
Universal Radio (**universal-radio.com**)

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Improving Reception and Hamfest Hunting

One of the fundamental problems of radio reception is receiving a signal with sufficient strength and clarity to understand the message it carries. Modern scanners can be difficult to troubleshoot when reception is less than ideal. This month we take a look at improving the performance of a modern scanner, then step back and discuss how to enjoy the hunt for older scanners and other electronic equipment.

Hi Dan,

My name is Bob and I am a scanner listener. I was wondering if you could tell me how to improve the reception on my Uniden Home Patrol scanner. I have a new Home Patrol scanner, fresh out of the box and I set it next to my Pro-96 scanner and the Uniden will receive about 20% of the transmissions that the Pro-96 does, this is in the digital voice mode, P-25. I have tried to adjust the squelch both ways and the range on the Uniden, but it does not help. Have tried the attenuation on and off as well. I normally keep the squelch to a minimum on the Uniden Home patrol and the attenuation off. I called Uniden and they said they have not heard of this and could not help me. I live in Richfield, Minnesota and listen to mostly police and fire in the Twin Cities area. Any help would be much appreciated.

Thank you,
Bob in Minnesota

The HomePatrol-1 is a desktop scanner made by Uniden, introduced in 2010. It is designed to be easy to use, requiring only the entry of a ZIP code before scanning local activity.

The Radio Shack Pro-96 is a handheld scanner built by GRE and first sold in 2003. It has a good reputation, although it is showing its age with some of the newer public safety radio systems, which often require additional programming steps to get it to track properly.

Here are some suggestions on improving HomePatrol-1 reception:

1. The first step is to be sure that the unit has the most recent firmware. Go to the HomePatrol-1 website at **www.homepatrol.com** and look for the latest version. If your unit is out of date, follow the instructions to download and install the newest version. In general, new versions of firmware will cure problems and fix reported problems, although there have been a few instances of new firmware for other scanner models making certain problems worse.

2. Double check the "Location" that you have the scanner set to. If it has the wrong location, it may not load the systems that are close by and instead load those that are farther away. The use of a ZIP code causes the scanner to set its location somewhere within 10 miles of the center of the entered ZIP code. Setting the location using the "City" method places the scanner within 20 miles and the "Auto Locate" feature within 30 miles. Clearly, using the ZIP code that is closest to your actual location is best. You could try entering adjacent ZIP codes to see if one works better than another for your target system.

3. Double check the attenuation setting. At the very top of the display screen, the third word ("Atten") is the attenuation setting. With the attenuation on, the sensitivity of the scanner is greatly reduced. Touching the word will change the setting.

4. Many public safety systems are simulcast, meaning that the same information is transmitted from multiple repeater sites at the same moment. You may wish to confirm that the Home Patrol and the Pro-96 are both listening to the same repeater site. Try removing all of the sites except for the one or two that are closest.

Create a "Test" favorite and copy only the nearest system into it. Then set the scanner to load only the "Test" favorite and not the entire database. This will allow you to narrow down the problem. If there are no channels loaded when you use just the "Test" favorite, then you likely have a location problem. If the channels load but you have poor reception, then either there is a programming problem or a signal reception issue.

5. Double-check the setting by tapping the "Range" button on the main screen. This will adjust the range up or down; a greater range will include more systems to be scanned, while a lesser range will include fewer systems.

6. Reduce other activities the scanner may be performing. Turn off weather alert, priority scanning and the Close Call feature.

7. The Home Patrol comes from the factory with a rather poor antenna. To eliminate the possibility of indoor blockages, take the unit outside and try testing it again.

If you have the "Extreme" upgrade, you can use the Trunked System Analysis Tools to monitor the system in question and check the System Load/Reception Status for each site. This will give you signal quality information to help determine which changes actually improve things.

❖ Hamfests

Hamfests, swap meets, or boot sales (for our British friends), can be an enjoyable and rewarding part of a monitoring hobby. Many local amateur radio clubs organize regular swap meets at local venues, typically offering spots for indoor vendors and outdoor tailgating. Among these sellers you can find all sorts of electronic bounty, from old scanners and antennas to books, batteries, cables and other supplies.

These hamfests are typically held on weekend mornings. Bring comfortable walking shoes and a backpack or other means of carrying your treasures. It's also helpful to carry small bills and some quarters, allowing you to pay exactly without waiting for the seller to find the right change.

An excellent place to look for hamfest listings is the American Radio Relay League (ARRL) web site, at **www.arrl.org/hamfests-and-conventions-calendar.**

❖ Dayton Hamvention®

The largest hamfest of all can be found each year in Ohio. The annual Hamvention will be held this year from Friday, May 17 through Sunday, May 19 at the Hara Arena in Dayton. Since 1952 this event has brought thousands of amateur radio operators, electronics enthusiasts, and curious hobbyists to southwest Ohio for a technology-centered three-day weekend. It is the largest gathering of its kind in the world, with nearly 25,000 people attending in 2012.

The Hamvention is the place where big-name equipment manufacturers announce new products, vendors sell new and used gear, and old friends meet up to swap stories and shop the indoor and outdoor bargains. Inside Hara Arena are more than 500 exhibit spaces with new equipment, materials, books and supplies for nearly every aspect of the hobby. More than 2,000 spaces in the outdoor flea market offer new, used and vintage equipment of all sizes and shapes. Finding that classic radio, old part, or mystery mechanism in one of the outdoor spaces is a time-honored tradition and part of the classic Hamvention experience.

You can read more about the Hamvention **www.hamvention.org** and plan your visit from there.

❖ Dayton, Ohio

The City of Dayton, located in southwestern Ohio, is home to about 140,000 residents. The city operates a Motorola Type II SmartNet trunked radio system carrying analog traffic. The system uses the following frequencies: 854.0375, 854.1625, 854.5375, 854.6625, 856.2125, 856.4625, 856.7125, 856.9625, 857.2125, 857.4625, 857.7125, 857.9625, 858.2125, 858.4625, 858.7125, 858.9625, 859.2125, 859.4625, 859.7125 and 859.9625 MHz. The four control channels are 854.5375, 857.2125, 858.2125 and 859.2125 MHz

Decimal	Hex	Description
36816	8FD	Fire (All Call)
36848	8FF	Fire (Dispatch)
36880	901	Fireground (Operations 51)
36976	907	Fireground (Operations 52)
37040	90B	Fireground (Operations 53)
37072	90D	Fireground (Operations 54)
37136	911	Fireground (Operations 55)
37168	913	Fire (Special Events)
37232	917	Fire (Common with Police)
37264	919	Fireground (Operations 56)
37328	91D	Fireground (Operations 57)
37360	91F	Emergency Medical Services (Medic 5A)
37392	921	Emergency Medical Services (Medic 5B)
37424	923	Fire (Unit-to-Unit)
37456	925	Fire (Support)
37488	927	Fire Prevention Bureau
37520	929	Emergency Medical Services
37552	92B	Fire (Administration)
37584	92D	Regional Fire Investigation Unit
37616	92F	Fire (Announcements)
37680	933	Good Samaritan Hospital
37712	935	Kettering Memorial Hospital
37744	937	Miami Valley Hospital
37776	939	Grandview Hospital
37808	93B	Veteran's Administration Hospital
37840	93D	Wright Patterson Medical Center
38032	949	Careflight Helicopter
38096	94D	Children's Medical Center
38128	94F	Fire Department Training
38160	951	Urban Search and Rescue
38192	953	Urban Search and Rescue
38224	955	Fire (Announcements)
38256	957	Fire (Announcements)
38288	959	Fire (Announcements)
38480	965	Fireground (Operations 58)
38544	969	Emergency Medical Services (Medic 5C)
46352	B51	Police (Radio Technicians)
46416	B55	Police (All Call)
46448	B57	Police (Dispatch West)
46480	B59	Police (Records)
46512	B5B	Police (Dispatch East)
46544	B5D	Police (Car-to-Car)
46576	B5F	Police (Tactical 1)
46608	B61	Police (Tactical 2)
46640	B63	Police (Task Force)
46672	B65	Police (Detectives)
46704	B67	Police (Command)
46736	B69	Police (Internal Affairs)
46768	B6B	Police (Special Events)
46800	B6D	Police (Traffic)
46832	B6F	Police (Special Weapons and Tactics)
46864	B71	Police (Hostage Negotiation Team)
46896	B73	Police (Tactical 3)
46928	B75	Police (Municipal Court)
46960	B77	Airport Emergency
46992	B79	Airport Maintenance
47024	B7B	Airport Fire
47056	B7D	Airport Police (Tactical)
47088	B7F	Airport (Command)
47120	B81	Airport (Administration)
47152	B83	Airport (Repeater)
47184	B85	Airport Maintenance (Channel 2)
47216	B87	Airport (Common)
47472	B97	Airport Police (Information)
47984	BB7	Airport Police (Dispatch)
47792	BAB	Police (Car-to-Car East)
47824	BAD	Police (Car-to-Car West)
48944	BF3	Airport Shuttle Bus
49488	C15	Fireground (Operations 64)
49520	C17	Fireground (Operations 65)
49552	C19	Airport (Training)
49648	C1F	Fire (Announcements)
50000	C35	Police (Records 2)
50032	C37	Police (District 1 Tactical)
50064	C39	Police (District 2 Tactical)
50096	C3B	Police (District 3 Tactical)
50128	C3D	Police (District 5 Tactical)
50160	C3F	Police (Central Business District)
50192	C41	Police (Downtown)

❖ Montgomery County, Ohio

Dayton is the county seat of Montgomery County, which itself has a population of about 535,000. It operates a separate Motorola Type II Smartnet system, also with analog voice traffic.

Monitoring the Montgomery County system is a bit more complicated because it was rebanded last year, having moved to new frequencies. As we've covered in previous columns, rebanding is the process of moving public safety frequencies away from commercial radio systems like Nextel that were causing interference. Rebanding creates a particular problem for scanning Motorola trunked systems because of the way channel assignments are carried on control channels. The bottom line is that most scanners require an additional programming step in order to properly track rebanded systems.

For the Montgomery County system, a table with the following frequencies, spacings and offsets should be used.

Band Plan	Lower Frequency	Higher Frequency	Spacing	Offset
1	851.0250	854.0000	25	440
2	851.0125	868.9875	25	0

Be sure to program all of the listed voice and control frequencies and turn off any "control channel only" feature your scanner may have. It is also worthwhile to confirm that your scanner has the latest firmware necessary to support rebanded systems.

Older scanners like the Pro-96 require the use of a computer running the WIN96 program. Specifically, in the program select 'custom tables', then 'extended tables' then select '800 MHz Rebanded'. Save the frequency list with this selection and upload it into the scanner.

The rebanded frequencies are 851.0625, 851.1750, 851.3125, 851.3750, 851.5750, 851.8000, 851.8500, 852.1000, 852.1625, 852.3500, 852.6250, 852.6500, 853.2000, 853.2500, 853.5000, 853.5750, 853.7500 and 853.8500 MHz.

Decimal	Hex	Description
16	001	Sheriff (Announcements)
48	003	Sheriff (Dispatch North)
112	007	Sheriff (Records)
144	009	Sheriff (Dispatch South)
176	00B	Detectives (Primary)
208	00D	Detectives (Special Investigations)
240	00F	Sheriff (Car-to-Car)
272	011	Detectives (South)
304	013	Sheriff (Civil Division)
336	015	County Jail
496	01F	Sheriff (Tactical 1)
528	021	Sheriff (Tactical 2)
560	023	Sheriff (Tactical 3)
592	025	Sheriff (Tactical 4)
624	027	Sheriff (Special Services)
656	029	U.S. Marshal Service
688	02B	Sheriff (Special Operations)
784	031	Sheriff (Emergency Services Unit)
816	033	Sheriff (Hostage Negotiation Team)
848	035	Sheriff (Administration)
1008	03F	Organized Crime Unit
1040	041	Organized Crime Unit
2032	07F	County Emergency Operations (Channel A)
2064	081	County Emergency Operations (Channel B)
2352	093	County Hazardous Materials Team
2384	095	County Office of Emergency Management
2416	097	County Court (Bailiffs)
2448	099	County Court (Security 1)
2480	09B	County Court (Security 2)
2512	09D	County Prosecutors Office (Channel 1)
2544	09F	County Prosecutors Office (Channel 2)
2928	0B7	Secured Treatment Offender Program
2960	0B9	County Firing Range
4656	123	County Fire (Operations 89)
5008	139	Juvenile Offender Corrections (Reception)
5040	13B	Juvenile Offender Corrections (Detention)
5104	13F	County Fire (Operations 83)
5296	14B	County Fire (Operations 102)
5328	14D	County Fire (Operations 103)
5424	153	County Court (Baliffs)
5776	169	Urban Search & Rescue
5808	16B	County Fire (Operations 106)
6448	193	Huber Heights Medical Center (Channel 1)
6512	197	Huber Heights Medical Center (Channel 2)
6928	1B1	Southview Hospital
6960	1B3	Sycamore Hospital
7056	1B9	Sheriff (Records South)
7088	1BB	Trotwood Police (Channel 1)
7120	1BD	Trotwood Police (Channel 2)
7152	1BF	Trotwood Police (Channel 3)
7184	1C1	Trotwood Police (Detectives)
7216	1C3	Trotwood (Citywide)
7664	1DF	County Fire (Operations 85)
7696	1E1	County Fire (Operations 87)
8496	213	County Fire (Operations 105)
8944	22F	Urban Search & Rescue
9168	23D	County Emergency Medical Services (MEDIC 8A)
9264	243	County Fire (Operations 84)
9360	249	County Fire (Operations 86)
9456	24F	County Fire (Operations 88)
11280	2C1	Hospital Net (Primary)
12496	30D	County Emergency Medical Services (MEDIC 8C)
12816	321	County Emergency Medical Services (MEDIC 8B)
12912	327	County Fire (Operations 82
13232	33B	County Fire (Dispatch)
13488	34B	Miami Valley Hospital
13648	355	County Fire (Dispatch Alternate)
13680	357	County Fire (Operations 104)

❖ Air Force Museum

While you're in Dayton, a worthwhile side trip is the National Museum of the U.S. Air Force, located six miles northeast of Dayton at Wright-Patterson Air Force Base. The museum houses more than 300 aircraft, spacecraft and missiles from the dawn of aviation to the present day. More than 1.3 million people visit the museum each year. It's a 20-minute drive from Hara Arena and is a must-see for any aviation enthusiast.

Wright-Patterson AFB operates a Motorola Type II Smartnet that carries voice traffic in APCO Project 25 digital format. Frequencies are 406.1625, 406.3625, 406.5625, 406.7625, 406.9625, 408.5625, 408.7625, 408.9625, 409.1625, 409.3625, 409.5625, 409.9625, 410.1625, 410.3625, 410.5625 and 410.7625 MHz.

Because the system uses the old Motorola 3600-baud control channel, your scanner will likely need the following custom frequency table in order to properly track activity on the system.

Base	Spacing	Offset
406.3500	12.5	380

There are a number of active talkgroups on the system, as you would expect from an active Air Force base. In addition to flight operations and normal housing and support activities, Wright-Patterson also has research and analysis sections. And, for those of a much more conspiratorial bent, perhaps you will overhear reference to the infamous "Hangar 18" where UFO technology is rumored to be reverse engineered.

Decimal	Hex	Description
16	001	Wright-Patterson Ground Control (simulcast 121.800 MHz)
48	003	Ramp Operations 2
112	007	Base Housing
144	009	Explosive Ordinance Detachment
176	00B	Crash and Fire Rescue
208	00D	Hazardous Materials
272	011	Fireground
304	013	Fireground
336	015	Fireground
368	017	Mutual Aid (Patch to 154.280)
464	01D	Base Operations 3
496	01F	Base Operations
528	021	Air Force Museum (Operations)
592	025	Fire and Emergency Medical Services (Dispatch)
624	027	Fire Prevention
656	029	Fireground
688	02B	Fireground
720	02D	Base Utility Maintenance 1
784	031	Base Steam Plant
816	033	Runway Clearing Operations
848	035	Base Building Maintenance 5
880	037	Forestry
912	039	Transportation
944	03B	Transportation (Bus and Taxi)
976	03D	Fueling (Dispatch)
1008	03F	Air Wing Fleet Service
1040	041	Security (Unit-to-Unit)
1072	043	Flight Line
1136	047	Flight Line
1200	04B	Supply (Munitions)
1232	04D	Supply
1408	058	Cable Maintenance
1520	05F	Special Operations 1
1552	061	Special Operations 2
1616	065	Army National Guard (Command)
1648	067	Army National Guard (Security)
1776	06F	Disaster Preparedness
2384	095	Security (Hospital)
3216	0C9	Aircraft Maintenance
3280	0CD	Aeromedical Evacuation (Operations)
6416	191	Inspector General
7568	1D9	Coal Plant Operations
7600	1DB	Boilers Operations
7664	1DF	Base Water Distribution
7696	1E1	Base Grounds (Channel 1)
8016	1F5	Security (Dispatch)
8048	1F7	Security (Operations)
8080	1F9	Security (Detail)
9840	267	Parts Deport
10224	27F	Base Grounds (Channel 2)
10512	291	Radar Maintenance
10672	29B	Air Wing (Operations)
10832	2A5	Air Force Museum (Unit-to-Unit)
10960	2AD	Fire (Unit-to-Unit)
11024	2B1	Security (Tactical)
11056	2B3	Security (Tactical)
11088	2B5	Security (Tactical)
11216	2BD	Transportation
11248	2BF	Air Wing (Operations)
11280	2C1	Air Wing (Operations)
11312	2C3	Air Wing (Maintenance)
14128	373	Physical Plant Engineering
14160	375	Base Grounds (Channel 3)
14192	377	Physical Plant Engineering
14224	379	Base Grounds (Channel 4)
14416	385	Security (Hospital)
14448	387	Visitor Coordination 1
14480	389	Visitor Coordination 2
14512	38B	Tower Operations
14576	38F	Security Drills
14640	393	Transportation
14672	395	Maintenance (Dispatch)
14704	397	Emergency Medical Services (Dispatch)
14752	39A	Laser Targeting
14768	39B	Laser Range
14800	39D	Air Force Museum (Maintenance)
14848	3A0	Air Wing (Ground Movement)
17008	427	Air Wing (Operations)
19216	4B1	Outdoor Recreation - Multi-Talk
19312	4B7	Kitty Hawk Recreation Area - Multi-Talk
25648	643	Air Force Material Command
28080	6DB	Off-Base Housing Maintenance
48336	BCD	Base Alarm Systems
48720	BE5	Street Maintenance

Your comments, questions and reception reports are welcome via electronic mail at danveeneman@monitoringtimes.com. There is more scanner-related information on my website at **www.signalharbor.com.** If I don't see you in Dayton, happy scanning!

ASK BOB
GENERAL QUESTIONS RELATED TO RADIO

Bob Grove, W8JHD
bobgrove@monitoringtimes.com

Q. *Can I use a 25 foot infrared (IR) emitter mono extension cable with a 3.5mm mono jack to extend the length of my Sangean wind-up reel wire antenna with a 3.5mm jack? I want to extend the length of the antenna 25 feet longer than it already is. Would that improve the reception even more or would it sacrifice the reception on the shortwave bands? (Dean, email)*

A. Since the cable is a two-wire device, it's either shielded or has two parallel wires with one of them grounded at the plug. That configuration would reduce signal pickup rather than increase it. Of course you could simply connect the cable to the end of your Sangean wind-up antenna in a random fashion, not allowing the shell of the cable to be plugged into the radio. But you could do that with any random length of wire.

I question whether it would do much to improve reception, but only make all signals stronger, thus creating the possibility of overloading the radio so as to create spurious interfering signals over the bands.

The key to good reception is the location of the antenna. In this case, if you attempt to increase the length of an indoor antenna, which is suffering the indignities of electrical interference from wiring and appliances, the pickup of that interference will just get worse with a longer antenna.

The best location for any shortwave antenna is outdoors, high, away from power lines, and fed with coaxial cable to the radio.

Q. *I am interested in listening to AIR New Delhi (Vividh Bharati) with its 500 kW power on 9870 KHz from New Delhi, India. Will I able to hear it with my shortwave radio? (Nawal Pandey, Plymouth, MA)*

A. I presently have my receiver tuned to 9870 kHz and hear what sounds like sitar music in the background, but with considerable interference. At certain times the signal will be heard, but it depends upon several factors, including:

1. The season
2. The time of day
3. The direction their transmitting antennas are sending the signal
4. What other stations may be using the same frequency
5. Local electrical interference
6. The receiver you are using
7. Your antenna and its location and direction.

Q. *I am installing an HF antenna and a tuner for my transceiver. The ground wire is 15 feet long into a five foot ground pipe. Will this be adequate? (Joe, Seattle, WA)*

A. Effectiveness of your ground will depend primarily on two things: the conductivity of the soil, and the frequency you are operating on. Moist loam will work better than dry clay. The higher the frequency, the worse the 15 feet of wire will respond as a good ground. The height and polarization (vertical or horizontal) of the antenna will play an additional part in the effectiveness of the ground. A horizontal wire should be as high as possible, at least a quarter wavelength at the lowest operating frequency is a reasonable rule of thumb.

Q. *My Sangean ATS909 radio has the RDS feature for the FM band which tells me what station I'm listening to and the name of the song that's playing. Why don't they use this same technology with shortwave? (James, email)*

A. The bandwidth required for digital subcarriers to convey additional information is much greater than allowed for a SW signal. The FM broadcast band has channel separation of 200 kHz while SW broadcasters are found on 5 kHz intervals.

Q. *My scanner no longer has any audio. What can I look for? (Terry Hanson, email)*

A. There are several possibilities. It could be a bad speaker or earphone jack, and you can determine that by plugging in an earphone to see if you can hear sound. If not, try the factory reset procedure.

Can you still see a digital display, and is it showing that the radio is scanning? If so, does it stop occasionally on an active channel even though you don't hear it?

Did you have any advance warning like sound cutting on or off, or did you have to turn the volume or squelch control back and forth because it was intermittent so that it may require an electrical cleaning spray?

These are the simple things. If it doesn't pass those tests, it probably needs bench work.

Q. *My area went iDEN standard TDMA. Is it possible for my digital scanner to pick up the signals? (Danielle Rock, email)*

A. There are several types of digital communication in use for spectrum efficiency by allowing multiple users to share the same frequency pool simultaneously. Unfortunately for the scanner user, with the singular exception of APCO P-25, none of these digitized techniques can be monitored on a scanner because of privacy laws. When their active frequencies are tuned in, all you hear is an increase in background hiss accompanied by occasional tones or buzzing sounds.

Q. *What are the parameters which must be met before UL approval must be sought? I never see UL on car switches or fuses. (Mark, IN)*

A. Underwriters Laboratory is a private business that certifies the safety of electrical products on a client-by-client basis. It has no legal status, but their reputation is held in high regard, so many companies require the UL certification when they buy products.

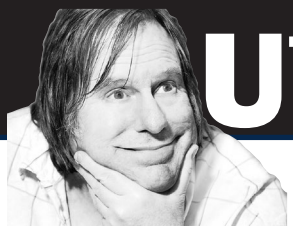
Q. *My cell phone battery charger will charge for a period of time, then shut off. If I remove the battery, then plug it back in, it charges again briefly. Is this normal? (Ben Nye, Westbury, NY)*

A. It sounds as if your cell phone charger is doing its job properly. There are three common types of chargers:

1. The trickle charger which delivers a low current charge for 12-16 hours,
2. The voltage-sensing charger which periodically samples the battery's state of charge ("terminal voltage"), and
3. The smart charger which delivers a relatively high current rate for a short time.

It would appear that your charger is capable of determining the terminal voltage of your battery to control the time period remaining for a full charge.

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



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Asian Radio Heats Up

While everyone's been focused on the Middle East and North Africa, Asia has definitely warmed up on the radio. Here on the West Coast, often described as "The Land that Short Wave Forgot," the trans-Pacific paths are becoming considerably more interesting. Here are a few examples.

❖ Firedrake

China's Firedrake is the largest and most intrusive jamming system since the Cold War ended and the Russian noisemakers went to Gene Scott and Voice of Russia. It's also been called the Fire Dragon and the Chinese Music Jammer. Firedrake, though, is the name that stuck.

Oddly, the fearsome Firedrake is a creature of European, not Chinese, folklore. The huge, fire-breathing dragon slain by Beowulf, at the cost of his own life, flew on giant bat wings. It swooped down suddenly from the sky, incinerating anyone facing its wrath.

The name, then, remains appropriate. This Chinese government network has been doing just that since at least 2006. It blows fire, in the form of classical, dragon-dance music, in wide-band amplitude modulation (AM), pretty much anywhere its operators desire. These frequency-agile, super-powerful transmitters have rarely spared utility or amateur bands.

Much of this has historically been in pursuit of the elusive "Sound of Hope," (SOH) a semi-clandestine broadcast from Taiwan. SOH is operated by the apparently well-funded Falun Gong movement, which has long been persecuted by the Chinese government.

The only constraint on the resulting Whack-A-Mole game seems to be propagation. Yesterday, around 0100 UTC, the dragon was heard here blasting seven frequencies. Five of these have been attributed to SOH by reliable broadcast lists.

Two of the jammed SOH frequencies, 16100 and 16920 kilohertz (kHz), became 15-kHz holes in the maritime band. The other targets were on 15800, 17170, and 17450 kHz. The two remaining frequencies, 15610 and 17730, were equally toasted Radio Free Asia broadcasts.

This dragon has always attacked at will. Israel's famous "Yankee Hotel Foxtrot," a now-defunct numbers broadcast, got the heat once. Currently, Firedrake seems to have added the BBC World Service to its target list.

At least some of the transmitters are said to be located on Hainan Island. This is southwest of Hong Kong and near China's border with Viet Nam. Some years back, the music was traced to a 60-minute loop running in one stereo channel of a Chinese satellite audio transponder. The other

channel had China National Radio, Program One (CNR1). Both have been used for jamming.

Additional frequencies found here this year include 14750, 14800, and 17645. Others have reported the beast on 11500, 13130, 13970, and 15900. The complete list of frequencies affected over the years would pretty much take up the rest of this column.

❖ Chinese Numbers

This region's best-known numbers station probably comes from Taiwan. It is another broadcast/ utility hybrid, sending daily music, followed by numbers from a rather seductive female voice in Standard Chinese (Mandarin). Its identifier has been translated several ways over the years, but the one currently accepted is "New Star Radio Station."

This broadcast has the designator of V13, as given by the European Numbers Information Gathering and Monitoring Association (ENIGMA 2000). It is presumably aimed at deep-cover agents operating in the Chinese People's Republic. Oddly, it seems immune from the wrath of the Firedrake.

V13 is often reported by veteran Dutch listener Ary Boender, who uses a remote Internet receiver in Hong Kong. This year, he's had good luck finding the version identifying as Program Number Three. He recently grabbed it on 7654 kHz upper sideband (USB), at 0700 and 0800 UTC, and on 7688 kHz USB, at 0612 and 1212.

Provided that it's transmitting, listeners on the U.S. West Coast should have no problem, beyond the late local hours. Perhaps it's time to set a recorder overnight.

Over on the mainland, the Chinese military has used a continuous wave (CW) Morse code numbers system for many years. ENIGMA calls this one M89. All call signs have four alphanumeric characters. These call signs can persist for a very long time, or return after years of absence. Stations work the same other ones on a regular basis, with automated call-ups but otherwise live operators. They pass chatter and coded message traffic.

Ary has recently reported M89 on 3330, 3793, 3797, and 4590, all around 1727-1729 UTC. This activity can be found on other frequencies clear up to ten or fifteen megahertz (MHz). There are several other Chinese numbers stations using voice or CW.

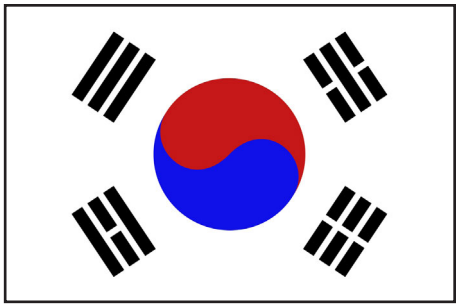
Lately, China has joined the digital age, with a headache-inducing rapid-fire broadcast called The Chinese Robot. This is a "female," obviously from a voice chip. "She" sends hours of numbers in Standard Chinese, all at a robotic, rapid clip.

This one has been designated VC01, for voice chip station number one. Boender has recently heard it on 5232 and 7938 kHz, upper or lower sideband (LSB), at various times between 0700 and 1500 UTC. It's widely thought that VC01 is part of an air defense system.

❖ Korea

The two Koreas have been quite the hot spot lately, as the North's new Dear Leader feels his young oats. The saber-rattling is getting intense on all sides, with at least one nuclear bomb test by the DPRK, and some huge joint exercises by the U.S. and South Korea. At press time, activity on many U.S. Air Force frequencies has picked up markedly in anticipation of these.

Both Koreas have used numbers stations in the past. A South Korean broadcast, designated V24, is frequently audible on the U.S. West Coast. Its CW Morse code "sister" is M94. Both are found on frequencies between five and seven megahertz, again in the Pacific Time wee hours (1100-1700 UTC).



While V24/M94 is quite active, North Korea's old numbers broadcasts haven't been heard in years. One of these used huge Radio Pyongyang/ Voice of Korea transmitters to send coded messages with appropriately revolutionary music.

Today, the Voice of Korea still broadcasts a full schedule which is audible worldwide. It's quite the Cold War propaganda relic, for anyone actually missing the fun times of the late 1970s. Check the broadcast listings for this one.

A more arcane utility catch is the North Korean foreign ministry, which maintains a diplomatic radio network for its various embassies. It turns up all time in this column's log section, usually on frequencies above 15 MHz, as heard by Eddy Waters in Australia. However, it can

come up just about anywhere. It is frequently written up as an intruder in the 14 and 21 MHz amateur bands.

The transmission mode is, alas, not decodable by listeners. It is a system peculiar to North Korea, using Automatic Repeat reQuest (ARQ). It's usually at 600 baud with a shift of 600 hertz (600/600), though a 1200/1200 version has also been reported worldwide.

❖ Japan

Japan's fishery is an important industry, heavily subsidized on all levels of government. The latest discovery here is on 16976.8 kHz, in CW.

Every day, a station identified as "JUW" comes up soon after 0000 UTC. The same guy puts out a wavery, hello-all-stations (CQ) call, with sending that sounds like he's using two rusty spoons. On occasion, some unheard vessel answers on some unknown duplex frequency. The resulting cryptic exchange is usually over in seconds.

This mysterious call isn't in the sequences assigned to the fishery. The Google trail, in any language, goes cold after its use by a vessel sunk in World War II.

Then, of course, it's hard to ignore the Japanese whaling fleet. This is true even though the action is all down in Antarctica, and will be long gone by the time this column runs.

This year, listeners in Australia and New Zealand reported Japanese ship-to-ship chatter from the factory vessel *Nisshin Maru*, the bunker fuel tanker *Sun Laurel*, and the heavy military icebreaker *Shirase*. USB and AM were heard in the 40-meter amateur band (illegally), and also on 2325, 2326, and 2346 kHz. There's reportedly been a lot of mode and frequency hopping to avoid monitoring.

Everyone's passionately for or against this enterprise, and the global diplomatic fuss isn't going away any time soon. There'll be more radio strangeness before this one's over.

ABBREVIATIONS USED IN THIS COLUMN

ALE ..... Automatic Link Establishment
AM ..... Amplitude Modulation
ARQ ..... Automatic Repeat reQuest
Camslant ..... Communications Area Master Station, Atlantic
Camspac ..... Communications Area Master Station, Pacific
COTHEN ..... Customs Over-The-Horizon Enforcement Network
CW ..... On-off keyed "Continuous Wave" Morse telegraphy
DSC ..... Digital Selective Calling
E06 ..... Russian "English Man," callup and messages
E11c ..... "Stritch" family in English, null-message format
EAM ..... Emergency Action Message
FAX ..... Radiofacsimile
FEMA ..... U.S. Federal Emergency Management Agency
G11 ..... "Stritch" family in German, group count and message
HFDL ..... High-Frequency Data Link
HFGCS ..... High-Frequency Global Communications System
HM01 ..... Cuban Intelligence, alternates voice & digital
ID ..... Station identification
LDOC ..... Long-Distance Operational Control
LSB ..... Lower Sideband
M06 ..... Czech Intelligence "OLX," with 5-letter groups
MARS ..... U.S. Military Auxiliary Radio System
Meteo ..... Meteorological; weather office
MFA ..... Ministry of Foreign Affairs
NAT ..... North Atlantic oceanic air control, families A-F
Navtex ..... Navigational Telex
NDB ..... Non-Directional Beacon (Aero).
Pactor ..... Packet Teleprinting over Radio, modes I-IV
RTTY ..... Radio Teletype
S28 ..... Russian voice messages on "UVB-76"
Selcal ..... Selective Calling
Sitor ..... Simplex Telex Over Radio, modes A & B
TACAMO ..... TAke Charge And Move Out
UK ..... United Kingdom
Unid ..... Unidentified
U.S. ..... United States
USAF ..... U.S. Air Force
USCG ..... U.S. Coast Guard
V13 ..... Taiwan music and numbers in Standard Chinese
VC01 ..... Chinese "Voice Chip" data broadcast
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 ().

518.0 "B"-Bermuda Radio (ZBR), Navtex weather at 0423 (Mario Filippi-NJ).
520.0 F9-NDB, Miramichi, New Brunswick, Canada, CW ID at 0351 (Filippi-NJ).
521.0 GM-NDB, Greenville, SC, CW ID at 0351 (Filippi-NJ).
523.0 ZLS-NDB, Stella Maris Airport, Bahamas, CW ID at 0558 (Filippi-NJ).
1656.0 Unid-Chipiona Radio, Spain, navigation warnings in English and Spanish, at 2105 (PPA-Netherlands).
1677.0 EJM-Malinhead Coast Guard Radio, Ireland, navigation warnings at 2035 (PPA-Netherlands).
1680.0 LFL-Rogaland/Floroe Radio, Norway, phone call through male operator, at 2016 (PPA-Netherlands).
1752.0 EJK-Valentia Coast Guard Radio, Ireland, weather forecast at 2042 (PPA-Netherlands).
1888.0 IPD-Civitavecchia Radio, Italy, gale warnings in Italian, at 1758 and 2019 (PPA-Netherlands).
2187.5 H9NC-Panama flag container ship *Bremen Bridge*, DSC safety test with V7PV3, Marshall Islands flag oil tanker *Al Samriyah*, at 2112 (MPJ-UK).
2677.0 Unid-French search and rescue, Griz Nez, weather in French at 1940 (PPA-Netherlands).
2679.0 4XZ-Israeli Navy, Haifa, coded CW message in 5-letter groups, also on 2860, at 0259 (Filippi-NJ).
2749.0 Halifax-Canadian Coast Guard, Nova Scotia, female voice with Notices to Mariners, at 0254 (Filippi-NJ).
2760.0 Unid-Cuban marine information broadcast, with a male reading maritime weather observations in Spanish, at 0315 (Tony Agnelli-FL).
2776.0 Unid-Possible "OLX" CW numbers station (M06), Czech Republic, message of random-sounding letters, at 0449 (Filippi-NJ).
2971.0 Shanwick-NAT-D, working a Speedbird (British Airways) flight, at 0333 (Allan Stern-FL).
3413.0 Shannon Volmet, male and female voices with aviation weather for Europe, at 0507 and 0640 (Filippi-NJ).
3455.0 New York-Caribbean air route control, working USAF Air Mobility Command transport Reach 803, at 0325 (Stern-FL).
3476.0 Gander-NAT-F, selcal check with Aeroflot 151, at 0437 (Filippi-NJ).
3756.2 Unid-German Red Cross, calling DEK40 and DEK38 in Pactor-I, at 2003 (PPA-Netherlands).
3783.0 2011-Moroccan police, calling 2412, also on 3805, at 2012 (PPA-Netherlands).
3855.0 DDH3-Deutscher Wetterdienst (German Weather Service), Pinneberg, FAX surface chart at 0517 (Filippi-NJ).
4014.0 Unid-Probable U.S. Navy/ Marine Corps MARS, voice net at 0021 (Mark Morgan-OH).
4079.0 TMP-Unlicensed temperature beacon, CA, CW ID plus temperature (38 F), at 1123 (Ary Boender-U.S. Remote).
4102.3 "W"-Unlicensed wind beacon, CA, CW ID and dits for wind speed, at 1133 (Boender-U.S.).
4190.0 Unid-Mexican Navy, probably Pacific Coast, voice and Tadiran data mode at 0445 (Agnelli-FL).
4220.0 Unid-Likely Russian air defense, automated CW strings at regular intervals, padded with the "?" for null items, at 0527 (Filippi-NJ).
4316.0 NMG-USCG, New Orleans, LA, "Iron Mike" voice with Gulf weather, at 0410 (Filippi-NJ).
4441.0 266-"Strich" family numbers in German (G11), preamble 266/31 and 5-number groups, at 2000 (MPJ-UK).
4453.5 NNN0TUL-U.S. Navy/ Marine Corps MARS net, working several stations at 2330 (Jack Metcalfe-KY).
4560.0 TAH-Istanbul Radio, Turkey, Sitor-A weather at 2005 (MPJ-UK).
4595.0 4XZ-Israeli Navy, CW marker and coded message in 5-letter groups, at 1838 (PPA-Netherlands).
4625.0 "UVB-76"-Russian "Buzzer" marker (S28), usual AM buzzes but with spurious emissions on 4667, 4709, 4752, and 4795; at 1834 (Boender-Netherlands).
4665.0 Priyom-Russian military, female making short transmissions in Russian at regular intervals, at 0553 (Michel Lacroix-France).
4724.0 Andrews-USAF HFGCS, with Skyking message "Tango Whiskey India," at 0530 (Stern-FL).
4769.0 Unid-Russian intelligence, RTTY message in 5-figure groups with CW operator chatter before and after, at 1915 (MPJ-UK).
4836.0 Unid-Russian intelligence numbers in English (E06), testing with repeated "1, 2, 3, 4," at 1945 (PPA-Netherlands).
4909.0 757-"Strich" family, English null messages (E11c) "757/2200 00" three days at 2000 (MPJ-UK).
5035.0 MX54-Algerian military, calling FN40; similar on 5354.5, 5756, 5805, and 6925; ALE at 2017 (PPA-Netherlands).
5195.0 DRA5-German amateur propagation beacon, Sheggerott, CW marker at 1949 (MPJ-UK).
5232.0 The Chinese Robot-Chinese air defense (VC01), rapid-fire machine numbers in LSB, at 1245, 1654, and 1729 (Boender-Hong Kong Remote).
5352.0 TWVS2-Spanish Guardia Civil, Salamanca, calling TXX2, similar on 5357, ALE at 2020 (PPA-Netherlands).

5354.8 OK0EPB-Czech experimental time beacon, CW time pips and ID, at 1533 (MPJ-UK).
5355.0 DIAMANTI-Albanian police, calling DRINI, also on 5379 and 5400, ALE at 0504 (PPA-Netherlands).
5383.5 NNN0HBI-U.S. Navy/ Marine Corps MARS, net with NNN0YDK and others, at 0008 (Metcalfe-KY).
5550.0 New York-Caribbean air route control, selcal check EL-CQ for Speedbird 272, a British Airways B767 reg G-BNWV, at 0312 (Stern-FL).
5598.0 Reach 157-USAF, working Shanwick (NAT-A), at 1731 (Lacroix-France).
5622.0 B-6135-China Southern Airlines, A330 flight CSN346, HFDL Position for Krasnoyarsk, Russia, at 2357 (MPJ-UK).
5655.0 Manila-East Asian air route control, Philippines, working Cebu Pacific Airlines flight 808, an A320 reg RP-C3268, at 2006 (PPA-Netherlands).
5670.0 Colombo-Southeast Asian air route control, Sri Lanka, selcal BQ-FH to a Cathay Pacific Airways B777 reg B-HNH, at 2049 (PPA-Netherlands).
5680.0 Rescue 131-UK Royal Air Force Sea King helicopter, working Kinloss Rescue, Scotland, at 1658 (Lacroix-France).
5696.0 Camslant-USCG Camslant Chesapeake, VA, working CG Rescue 2004, an HC-130, at 0204 (Stern-FL).
5720.0 OH-BLQ-Blue1 flight KF0725, a B717, HFDL position for Reykjavik, Iceland, at 2129 (MPJ-UK).
5776.0 Unid-Possible French military, long exchange in badly sent straight-key CW, passing many numbered messages in French plaintext, at 0653 (Filippi-NJ).
6338.0 NMF-USCG, Boston, MA, FAX ice chart at 0449 (Filippi-NJ).
6433.0 272-G11, preamble 272/32, then 5-figure groups, at 1755 (MPJ-UK).
6501.0 NMN-USCG Camslant, VA, Iron Mike with Atlantic weather, at 0405 (Filippi-NJ).
6532.0 G-VEIL-Virgin Atlantic flight VS0601, A340 "Queen of the Skies," HFDL log-on with Shannon, Ireland, then went to 11348 for Canarias, at 2324 (MPJ-UK).
6535.0 Dakar-African air route control, Senegal, working aircraft with selcal checks and position reports, at 0330 (Agnelli-FL). B-6347-Sichuan Airlines A320, HFDL log-on with Hat Yai, Thailand, at 2350 (MPJ-UK).
6586.0 New York-Caribbean air route control, selcal check with Air Transat 683, an A330, at 0309 (Stern-FL).
6604.0 New York Volmet, aviation weather for eastern U.S. airports, at 0011 (Morgan-OH).
6640.0 New York LDOC, working N340GA, a Gulfstream GV-SP on a possible test flight, at 0505 (Stern-FL).
6655.0 AWM-Regional air route control, Chennai, India, working Emirates flight UAE343, a B777 reg A6-ECY, at 1927 (PPA-Netherlands).
6661.0 Mumbai-Regional air route control, India, selcal BG-EL for Qatar Airways flight 304, an A321 reg A7-AIA, at 1935 (PPA-Netherlands).
6671.0 Unid-Two males joking and laughing in Spanish, at 0016 (Morgan-OH).
6676.0 AWB-Mumbai Volmet, India, aviation weather for Mumbai and Karachi, at 1929 (PPA-Netherlands).
6712.0 "03"-HFDL ground station, Reykjavik, Iceland, sending arrival data to VP-BUM, an Aeroflot A321, at 2057 (MPJ-UK).
6754.0 Trenton Military-Canadian Forces Volmet, aviation weather for Canadian airports, at 2330 (Morgan-OH).
6826.0 Unid-Possible Libyan net, traffic in Arabic, at 1644 (Lacroix-France).
6903.5 AAA4FL-U.S. Army MARS, FL, working another MARS station, at 1958 (Metcalfe-KY).
6908.6 Kokomo-U.S. interagency task force, Key West, FL, working unknown aircraft with call ending in "913," at 2314 (Metcalfe-KY).
6996.0 Showdown 495-U.S. Army MARS special call sign, radio check at 1952 (Metcalfe-KY).
7311.0 AAA3RD-U.S. Army MARS, control for Region 3 net with AAA3DE, others, at 2005 (MDMonitor-MD).
7654.0 New Star Radio Station-Taiwanese intelligence (V13), Program 3 with music and coded messages, at 0700 and 0800 (Boender-Hong Kong Remote).
7688.0 V13, in progress at 0612 (Boender-Hong Kong).
7880.0 DDK3-German meteo, Pinneberg, FAX surface chart for Europe, at 0519 (Filippi-NJ).
8040.0 GYA-UK Royal Navy, Northwood, FAX surface chart at 0438 (Filippi-NJ).
8047.0 Romeo 2-Unknown station, reading short paragraphs in possible signal intelligence training, at 2014 (Metcalfe-KY).
8107.0 SVJ4-Athens Meteo, FAX weather chart at 0901 (Lacroix-France).
8140.0 BMF-Taipei Meteo, Taiwan, FAX satellite picture at 1924 (PPA-Netherlands).
8414.5 005671000-Bangkok Radio, Thailand, answering DSC call from 441377000, refrigerated cargo vessel *Cherrystar*, (DSNK2), at 1921 (PPA-Netherlands).
8415.0 NMC-USCG Camspac Point Reyes, CA, Sitor-B maritime weather at 0128 (Filippi-NJ).
8437.0 KSM-Maritime Radio Historical Society, Pt. Reyes, CA, CW marker at 2323 (Filippi-NJ).
8459.0 NOJ-USCG, Kodiak, AK, FAX 48-hour prognostic chart at 0437 (Filippi-NJ).
8472.0 WLO-ShipCom, Mobile, AL, RTTY Gulf marine broadcast, at 1355 (Filippi-NJ).
8776.0 Unknown-Probable U.S. military TACAMO aircraft, with EAM and call sounding like "You But," at 0915 (Agnelli-FL).
8834.0 5Y-KYD-Kenya Airways B737 flight KQ0511, HFDL log-on with Johannesburg, South Africa, at 0029 (MPJ-NL).
8864.0 N410LM-Gulfstream V bizjet, answered selcal GM-AR from Gander (NAT-C) for a weather warning, at 2130 (Patrice Privat-France).
8885.0 5A-LAO-Libyan Airlines A320 flight LAA659, HFDL position for Al-Muharraq, at 2119 (MPJ-UK).
8894.0 Algiers-African air route control, Algeria, working Turkish airlines 631, at 1840 (PPA-Netherlands).
8912.0 LGV-USCG Cutter *Legare* (WMEC 912/ NLGV), COTHEN ALE sounding, at 1828 (PPA-Netherlands).
8918.0 Venom 52-U.S. military, self-identified as an E-6B, position for New York (Caribbean air route control), at 0950 (Agnelli-FL). *[?????? -Hugh]*
8942.0 HL-7794-Asiana Airlines A330 flight OZ0733, HFDL position for Shannon, at 1647 (MPJ-UK).
8971.0 Red Talon 718-U.S. Navy P-8 Poseidon, calling Fiddle (Jacksonville, FL), no joy, at 1922 (MDMonitor-MD).
8977.0 SU-GCI-EgyptAir A330 flight MSR678, HFDL position for Reykjavik, at 1701 (MPJ-UK).
8983.0 Camslant-USCG, calling 6507, an aircraft, at 2057 (PPA-Netherlands).
8990.0 BE1CH-Algerian police, Béchar, calling MO1, ALE at 0905 (Lacroix-France).
8992.0 McClellan-USAF HFGCS, CA, EAM at 1829 (PPA-Netherlands).
9065.0 Unid-Cuban "Hybrid" station (HM01), digital bursts announced by Spanish machine voice, at 0803 (PPA-Netherlands).
9067.7 Unid-Egyptian MFA, Cairo, Sitor-A selcal OOVF (Pyongyang, North Korea), at 1944 (PPA-Netherlands).
9110.0 NMF, grainy FAX ice chart at 0446 (Filippi-NJ).
10075.0 4K-SW808-Silk Way West Airlines B767 flight ZP9124, HFDL log-on and position for Al-Muharraq, at 2033 (MPJ-UK).
10084.0 UK-32019-Uzbekistan Airways A320 flight HY0696, HFDL log-on with Auckland, at 1518 (MPJ-UK).
10093.0 "09"-HFDL ground station, Barrow, AK, uplink to G-VATL, Virgin Atlantic A340 "Miss Kitty," at 1818 (PPA-Netherlands).
11175.0 Reach 241-USAF transport, attempting patch with Sigonella HFGCS, Italy, at 0949 (Lacroix-France). Suitable-U.S. military, requesting the current Zulu exercise frequency from Labor Day *[ID'd as Poker Face on MARS freqs -Hugh]*, who then calls Handball (likely E-4B), at 1634. Andrews-USAF HFGCS, going to 11220 for exercise messages from Handball, at 1716 (Stern-FL).
11220.0 Andrews-USAF HF-GCS, came from 11175 with Handball and took data messages, at 1717 (Stern-FL).
11232.0 Trenton Military-Canadian Forces, getting Bermuda arrival time from Canforce 2532, at 1601 (Stern-FL). Trenton Military-Canadian Forces, working CT-142 trainer Gonzo 5C in an exercise, gave secondary frequency of 13257, at 2030 (LJP-MD).
11345.0 Stockholm-LDOC, Sweden, patch to Medlink for Qatari 866, an A320 with a sick passenger, at 1427 (Lacroix-France).
12356.0 XVG-Hai Phong Radio, Viet Nam, working unknown vessel at 1443 (Lacroix-France).
12577.0 004122100-Shanghai Radio, China, DSC to 413896000, Chinese flag bulker *Sheng Wang Hai* (BRNJ), at 1211 (PPA-Netherlands).
12586.0 UDK-Murmansk Radio, Russia, two Sitor-B navigation messages in Russian, at 1200 (Privat-France).
12783.5 9MR-Malaysia Navy, Johor Baharu , RTTY test loop at 1005 (Eddy Waters-Australia).
13118.0 ABA-Maltese Maritime Squadron net control, Hay Wharf, Floriana, calling A2A and A4A, offshore patrol vessels P52 and P51, ALE at 1459 (MPJ-UK).
13351.0 "05"-HFDL ground station, Auckland, New Zealand, uplink to B-6325 (Sichuan Airlines A320), at 1020 (PPA-Netherlands).
13910.5 Desert Eagle-U.S. Army MARS control station, Ft. Huachuca, AZ, exercise voice and data messages with "8YG," at 1847 (MDMonitor-MD).
13927.0 AFA5QW-USAF MARS, IN, patch to Hilda Global (Scott AFB), for Reach 395, a C-130J #94-8152, returning to base with #3 engine shut down, at 1606. AFA2CU-USAF MARS, VA, patch to Niagara Falls Joint Air Reserve Station for Bison 87, a C-130H #92-3287, declaring maintenance status Alpha-2 for autopilot malfunction, at 1850 (Stern-FL).
14298.0 973-Unknown, possibly China, calling 532, ALE at 1018 (Waters-Australia).
14484.0 Desert Eagle-Ft. Huachuca MARS, exercise with High Card Sierra (not heard), at 1500 (MDMonitor-MD).
14741.5 Unid-North Korean MFA, Pyongyang, encrypted messages in 600/600 ARQ; also on 16018.5, 16246.5, and 17238.5; at 1025 (Waters-Australia).
14776.0 FC0FEM-FEMA Region 10, Bothell, WA, ALE sounding at 1731 (MPJ-UK).
15632.0 718-E11c, null-message preamble 718/00, at 1155 (MPJ-UK).
16134.0 KVM70-U.S. government, HI, FAX satpic and 24-hour surface forecast, at 1858 (Filippi-NJ).
16892.0 XSG-Shanghai Radio, China, CW ID in Sitor-A marker, at 0902 (Waters-Australia).
16898.5 XSG, Sitor-B weather in English, at 0857 (Waters-Australia).
16976.0 PWZ 33-Brazilian Navy, Rio de Janiero, Pactor-I weather at 0625 (Waters-Australia).
16976.8 JUW-unknown Japanese station, daily all-stations calls in bad hand-sent CW, at 0000 (Hugh Stegman-CA). JFG-Shizuokaken Fishery Radio, Japan, all-stations calls and messages at 0807 (Waters-Australia).
17928.0 G-VGAS-Virgin Atlantic A340 "Vargas Girl," flight VS0026, HFDL position for Canarias, at 1611 (MPJ-UK).
17985.0 MM62229-Italian Air Force KC-767, position for Reykjavik, at 1420 (MPJ-UK).
18594.0 LNT-USCG Camslant, VA, working F35, USCG HU-25C #2135, at 1520 (MPJ-UK).
20123.7 Unid-Egyptian MFA, encrypted ARQ message, at 1508 (MPJ-UK).
20550.0 CAPRI-Moroccan military, calling B3 in ALE, at 1644 (MPJ-UK).
20963.5 XSS-UK Defence High-Frequency Communications System, ALE ID and encrypted data, at 0845 (Waters-Australia).
21982.0 CS-TFW-Arik Air flight 5K0101, an A340 named "Our Lady of Perpetual Help," passing HFDL position to Al-Muharraq, Bahrain, at 1130 (MPJ-UK).
24526.0 FC8FEM-FEMA Region 8, Denver, CO, ALE sounding, also on 24883.6, at 1531 (MPJ-UK).
28166.0 XE2O-Amateur CW beacon, Allende, Mexico, ID at 1524 (Filippi-NJ).
28183.1 XE1RCS-Amateur CW beacon, Mexico City, ID at 1516 (Filippi-NJ).

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Chilean Navy HF Digital Operations

This month we take an in-depth look at the various digital signals you can read from the Chilean navy networks. Chile's navy has operated an ALE (Automatic Link Establishment) equipped HF radio network for well over a decade. Numbering some 70 ships and 25,000 personnel, the navy operates the majority of its surface fleet from the base at Valparaiso and its submarines from the base at Talcahuano. There are also smaller bases at Iquique, Easter Island, Puerto Montt, Punta Arenas and Puerto Williams. The Chileans also maintain the Captain Arturo Prat Base on Antarctica. Chilean naval units have been heard using ALE on the following channels over the years:

2716, 4635, 6300, 6847, 6848, 6995, 7726, 8042, 8080, 8096, 8140, 8161, 8682
9198, 10148, 10155, 10197, 10201, 11429, 11454, 12103, 13469, 13490, 15805
16093, 16180, 17466, 18185, 18635, 18735, 19044, 19810, 20400 and 20965 kHz

Until a few years ago, the Lower Sideband (LSB) was used extensively but now the majority of activity appears to be carried on the Upper Sideband (USB), so remember to set your receiver accordingly. During early evening here on the U.S. East Coast, 6848 and 8096 kHz USB are usually particularly active channels. The daytime channels of 17466 and 19810 kHz USB also provide consistent signals to the U.S.

Tactical identifiers are used on the ALE-controlled network, with none having been positively associated with a particular base or vessel:

0ER, 0R0, 1FG, 23E, 23F, 23R, 24A, 24E, 3RO, 49F, 4P0
APM, ASI, ATL
BG9, BPP, BRE, BRS, BUR, BVG
CA2, CAS, CCC, COS, CRP, CVA
DAD, DAE, DCC, DCH
ECC
FAG, FFA, FGT, FIQ, FKW, FLC, FON, FPM, FSS, FST, FTE, FVJ
G3W, GBR, GRZ, GVA
HLA
IMN
KJD
LIO
MDN, MXS
OFM
P7H, PPZ
RGL, RGT
TAC
VFO

Network data is carried in three main ways, the first two of which use the more robust versions of ALE's "text message" function, the DTM (Data Text Message) and DBM (Data Block Message) modes. You can often hear "overs" of more than 15 or 20 minutes of this encrypted traffic. Both DBM and DTM use the same 8 tone, 125 bd FSK modulation scheme but DTM has a much more staccato sound to it compared with regular ALE signals as the stations send short data packets and acknowledgements back and forth rapidly. I have seen these exchanges begin with an UUF (User Unique Function) code of "124 67 65 8" for DTM, and "124 67 66" for DBM, as you can see in the examples below between stations "CAS" and "FKW" and "CRP" and "FON" using each mode:

[TO] FKW[UUF] 124 67 65 8 [THIS IS] CAS
[TO] CAS[FROM] FKW
[DTM ARQ]
[THIS IS] FKW
0 (!\jx@w~
[FROM] FKW [DTM ARQ]
[THIS IS] FKW
[TO] FKW
Lew~
[THIS IS] CAS
[TO] CAS [DTM ARQ]
[FROM] CAS
L<:T5kfx [DTM ARQ]
[THIS IS] FKW
JDv\D [DTM ARQ]

[FROM] FON[UUF] 124 67 66 [CRC OK]
[TO] CRP[FROM] FON [DBM ARQ]
[TO] FON[FROM] CRP
[THIS IS] CRP [DBM ARQ]
[THIS IS] FON
[TO] FON[FROM] CRP [DBM]
6ap\!as|r-f7 `w~$~A,q'.c-a7W%\IC/sWC
!,vUqR~'amf{5u%;\
l(BVG|%.x^4)T9a+SCW{b%4=.2HniUoCoGu:WF?}}'FBW
tM@a>F}g
%:~7V|qYTq\/KU`#I6
[CRC OK]
[THIS IS] CRP
[TO] CRP
[TO] FON[FROM] CRP [DBM]
qK.][?.)WB>S[}xwHS(N~{OY"Di5j}:<^:UZqNx!
bm=jpu&]pgGww#&D{6+3eML a#7Yux:35q+:v_
,`A/MMF eOrzMm_<R1[M\i+cXS
[CRC OK]

Free decoding software like PC-ALE and the user-supported MultiPSK (see Resources) are able to copy this traffic. The UUF is a set of manufacturer-specific ALE codes that can be used to trigger special functions between stations like select different modems for data transfer. Besides DTM and DBM text messaging, the Chilean naval units can also send longer data messages and files using the Racal "SkyFax" MSM1250 modem. This is a 10 channel system where each channel is modulated with 125 bps data, giving a total throughput of 1250 bps, though the system can adapt to poor conditions by reducing the overall data rate. Both the WaveCom series of decoders and those from Hoka are able to decode SkyFax. However, as in the case of the DBM and DTM traffic, most of the messages are encrypted. The UUF code for the SkyFax modem is "124 67 65" and here's an example of the decoded text using the Hoka Code300-32 software:

[START OF MESSAGE]
2372419857141l3.MSJ
çK,k'ïãJ8t²?ÇÙº¼/·r#·I ?iGÍx.^ûaºþP©ºKROsy:\ðï_ü¨*¦bSa?
?5)¾ñ³),,9¥xïµ¾Xùµé?H»a? l§èí%µURàT°?`???vºH?Å
?ù¶`å?ã?ÚÜñå.?Ä\ux*¿pS?W]ìÀß|?0#=Ñ#«x·zm$_
Ü÷¹ÈH>Á´f?3+ÛH¦l¨yHào^ÚÚ½MÐã¼È?pzø1£
@ª-£m`à?¡1ï¥ùì`æw0G$àK%?PÞ«4_?í?
{message section clipped for brevity}
ÅÜzæÿ<:é9Ï@G1õ©¹û²Ôb?!aoju"W£àY?y%ÎkÛ?s)*2
¤%??[s*5põuöCh%ËòËß%ë°[g¥ëj??aAOßl´c?ó??
°æ?0 ?"ÓrÙ?è©??aJ{p
PKC®BäV?Ô(|@`Ö¿/ýE4Q`2372419857141l3.msjPKC?.
Bf?Ü Ywobreshipcom.txtPK"1?*C:\SHIPGM^BQT\
IngresAn üZ41985714113.msj
[END OF MESSAGE]

Note that the message files appear to have a suffix of .MSJ and there are certainly indications that they are wrapped in PKZip-type compression judging by the other filenames that you can see as towards the end of the message.

Chilean Navy Weather Service

You can also hear the Chilean navy base at Playa Ancha, Valparaiso, callsign CBV, and Punta Arenas, callsign CBM, using HF's venerable fax mode. Transmissions can be heard daily on the following frequencies (center of data):

4228, 8677 and 17146.4 kHz (CBV, Valparaiso)
4322 and 8696 kHz (CBM, Punta Arenas)

You can see the full transmission schedule by consulting the Resources section.

Chilean Navy Navigation Service

Finally, a number of Chilean Navy bases also participate in the GMDSS (Global Maritime Distress & Safety System) network sending NAVTEX on mainly 518 kHz but also 490 kHz. The stations, along with their message indicators are as follows:

Antofagasta (A, H)
Isla de Pascua (Easter Island) (F, G)
Magallanes (E, L)
Puerto Montt (D)
Talcahuano (C, J)
Valparaiso Playa Ancha (B, I)

MultiPSK will decode both HF Fax and NAVTEX, as do a number of other free and commercial software packages including Fldigi (many different Operating Systems) and those from Black Cat Systems (iPhone, iPad and Apple OS X). That's all for this month. Until next time, 73 and enjoy your digital utility listening.

RESOURCES

Chilean Navy Fax Schedule: **meteoarmada.directemar.cl/prontus_meteo/site/artic/20100817/pags/20100817162223.html**
PC-ALE: **hflink.com/pcale/**
MultiPSK: **f6cte.free.fr/index_anglais.htm**
Fldigi : **www.w1hkj.com/Fldigi.html**
MultiMode: **www.blackcatsystems.com**

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Why Contesting?

During a recent ham radio coffee klatch, two techie friends (who are new hams) were surprised to hear that I was making preparations to work a couple of RTTY contests, and that my "scheduled" ham radio activities would be slightly interrupting our regular non-ham activities. Although they clearly "got" the forces and motivations behind DXing (they were rabid TV DXers), it was clear that they didn't "get" contesting. At least not right away. I think that part of the problem stemmed from the fact that the broadcast stations they were aggressively seeking were essentially "always" transmitting, and that there was no great need to operate when the DX stations were available.

The first thing they brought up about contesting, however, was the degree to which contests, seeming like a wild free-for-alls, can really disrupt normal operations on any particular band. And they certainly can! Amateur radio contests are part NASCAR and part Formula One: a bit of good-natured pushing and shoving in a structured framework designed to ensure fairness and the safety of everyone involved.

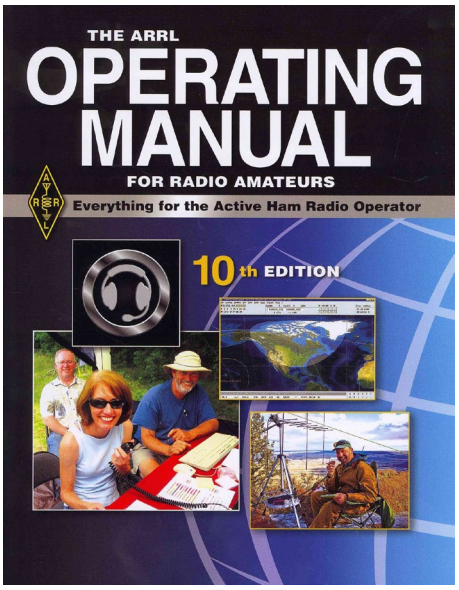
From a "citizens" perspective, however, a big contest weekend can seem like a swarm of Le Mans racers sweeping through an otherwise sleepy little town. Try as you might, you can't just stand in the middle of the street. You participate in the race or you move to a quiet side street (or band, mode) until the race is over. Hello, WARC bands!

This aspect of radio contesting addresses the human (and human ham operator) need to compete, win, vanquish, dominate, etc. In Russia, China and many European countries, organized ham radio contesting is called "radiosporting," and it's a state-recognized and state-supported avenue of competition, just like figure skating, football, etc!

Held once every four years, the *de facto* Olympics of radiosporting is the World Radiosport Team Championship, which returns to the United States in 2014 for the first time since 1990, when the first WRTC was held in Seattle. Nearly 60 teams of top radio contesters from all over the world will converge on New England in July of 2014. Each team will have identical stations (the same short towers with the same tribanders and the same dipoles) and will operate as a "contest within a contest" inside the 2014 IARU HF World Championship contest. Unlike NASCAR or Formula One, you can compete in the IARU contest and work any or all of the world-class teams!

As with any other sport, participating in amateur radio contests is a great way to improve your operating skills, test your mettle on the (non-lethal!) field of battle, improve your station, etc.; all worthwhile pursuits.

There are contesters and there are *contesters,* just like there are golfers and there is *Tiger Woods*. Unless you pay a million bucks for the privilege, as an everyday golfer you'll likely never get to play against Tiger Woods. In ham radio contests, the opposite is true. Everyone works the same contest, the same bands and the same modes, but there are multiple entry categories to account for location, power output, experience, etc. So although you will play with every Tiger Woods in the contest, you're scored against your peers—*thankfully!* Until Tiger *is* your peer, anyway!



Now in its 10th edition, the ARRL Operating Manual has a large, comprehensive section about ham radio contesting.

The Benefits of Casual Contesting

During any given contest, hundreds or thousands of actual hams are participating, meaning that they're "in the contest" and intend to submit a log to the contest sponsor and hopefully win an achievement plaque or certificate. Many more ops participate casually, with no intent to submit a log. But why? Well, all of the above-mentioned reasons still apply, but the biggest reason is the availability of stations.

As a beginning ham, I wanted to cover my shack walls with QSL cards, awards and contest achievement certificates, and I began my quest to earn Worked All States and DXCC by listening to QSOs and determining each op's QTH "by ear." If I heard a call sign from a "needed state or country" I called the op after his existing QSO was complete and tried my best to work "the new one." In the beginning, when just about every state or DXCC entity was a new one, this worked well. But soon I started looking for faster ways to find less-available states and entities.

To put Wyoming in the log I checked into the Colorado-Wyoming Slow-Speed CW net one night after supper. That got me Wyoming and Montana! I scoured the *ARRL Net Directory* (now free and online at **www.arrl.org/arrl-net-directory**) looking for geographically targeted nets that I could access. To put North and South Dakota into the log I checked into the Piconet All Day Watch (which, unfortunately, isn't actually all day anymore. See **http://piconet3925.com**) on 75 meters until I heard stations checking in from Fargo and Sioux Falls. Even in neighboring Minnesota, Dakota hams can be hard to find.

My progress was slow but steady overall, and using those time-tested methods paid big dividends in the long run. Listening to hundreds of QSOs is never a bad thing for beginning ops, and it's still something I recommend to this day. But there are *much faster* ways to qualify for achievement awards and to put contest certificates on the wall. The fastest, of course, is contesting itself.

The true "wallpaper-gathering" power of contesting didn't really sink in until I worked a few rounds of the ARRL Sweepstakes, the fall DX contests and Field Day (lately it's been the ARRL VHF QSO Party for VUCC and WAS on 6 meters). Compared to the less efficient methods I started with as a kid, simply working a contest or two even casually can slingshot your totals in a day or a weekend.

Three years ago, a beginning ham friend worked 40 states on 6 meters, and 96 of the 100 grid squares required to qualify for the VUCC award, in *one weekend* during the ARRL VHF QSO Party! And he had made fewer than 20 QSOs in his entire ham radio career prior to working that contest! Those totals might have taken *years* to accomplish without participating in contests.

You can experience a similar jumpstart. With an average station you can work all 50 states or 100 DXCC entities in a single weekend. And even if you only work 44 states or 77 countries, that's still an amazing outcome.

Don't worry if your killer instinct is a bit rusty. Although frantic at times, radio contesting is friendly and accommodates all levels of participation. You can work as many (or as few) stations as you want in pursuit of your personal goals without turning in a log and officially competing. Just do your own thing, and if you want to turn in an official log, do that, too. With plenty of free contest logging software and Internet-based log submissions, the "submitting" part today is easier than ever before.

Typically, radio contests are on-air events in which hams work as many different stations as they can in a defined period of time (often a weekend, but there are plenty of contests and "sprints" that last only a few hours). Depending on the particular contest, a premium is placed

BEGINNER-FRIENDLY CONTESTS

Months	*Contest*	*Activity*
Feb, Oct	School Club Roundup	Everyone works everyone, especially school clubs
Feb, Mar	ARRL DX Contest	DX works only W/VE stations
Apr, Aug, Dec	ARRL Rookie Roundup	Beginners work everyone, veterans work beginners
Mar, May	CQ WPX Contest	Everyone works everyone
Jun	ARRL Field Day	Mostly W/VE
Jun	ARRL VHF QSO Party	Magic Band mayhem!
Oct, Nov	CQ World Wide DX	Everyone works everyone
Nov	ARRL Sweepstakes	W/VE stations work W/VE only
Dec	ARRL 10-Meter	Everyone works everyone

on working stations in different geographical regions (states, countries, ARRL Sections, *CQ* Magazine zones, grid squares, islands, etc), or stations with different call sign prefixes (KA0AAA, KB0AAA, KC0AAA, and so on).

The regions or differing prefixes are called "multipliers," and in a simplified sense, contest scores are determined by multiplying the number of two-way contacts (QSOs) by the number of multipliers (subject to the fine points of each particular contest, of course!).

When the dust settles, the entrants with the highest scores (there are usually several categories of competition, such as power level, number of station operators, bands used, and so on) receive certificates or plaques and have their scores listed in ham magazines and on web sites. Everyone competes together, but like a large marathon, participants are only competing against others in specific categories (if they're officially competing at all).

Regardless of band and mode, contest operating is *fast*, with typical SSB, CW or digital QSOs taking only a few seconds. Ops exchange signal and location reports, and perhaps consecutive serial numbers or power-level identifiers. Typically, extraneous chatting or ragchewing is frowned upon. Contest QSOs are all about working stations as fast as possible. Be brisk and stay focused. Contesting might seem overwhelming at first, but you'll get the hang of it once you give it a go.

Table 1 lists a few major contests that see widespread activity. There are dozens more contests spread throughout the year. *CQ* and *QST* feature monthly contesting columns, and many ham radio web sites have contest listings, tips and other useful information (see WA7BNM's contest info site at **www.hornucopia.com/contestcal**, **www.arrl.org/contests** and **www.contesting.com** for starters). These are good places to look for up-to-date contest information and contesting how-to articles. *The ARRL Operating Manual* has plenty of detailed information on the fine points of contesting. If you're lucky you can find a copy at your local library.

The nature of competitive sport drives some hams to use gigantic antennas, amplifiers and top-of-the-line transceivers. But, there's no need to be intimidated by this because you won't be competing against these heavy-hitters until you're a heavy-hitter yourself! Actually, these Big Gun stations benefit you greatly because *they need your QSO* and they have the exotic hardware and experience to dig your signal out of the noise. These mega-stations really *work for you*, so enjoy the fact that they're there and get started.


5QRP CONTEST AWARD

Amateur Radio Club International

PROUDLY PRESENT THIS ACHIEVEMENT CERTIFICATE TO

KIRK KLEINSCHMIDT OPERATOR OF AMATEUR RADIO STATION WDØBDA, WHO HAVING SUBMITTED SATISFACTORY PROOF OF TWO-WAY RADIO COMMUNICATIONS WITH OTHER AMATEUR STATIONS DURING THE 1986 Hootowl Sprint QRP CONTEST, WHILE RUNNING 3.8 WATTS OR LESS OUTPUT WON THIS AWARD FOR THE FOLLOWING OFFICIAL SCORE:

47,616 Points 2nd Place Overall / 1st Place North Dakota

IN RECOGNITION OF THIS ACHIEVEMENT, THIS CERTIFICATE IS HEREBY AWARDED THIS 10th DAY OF August 1986.

SOLAR POWER

Eugene C. Smith Jr.
Contest Chairman

Certificate No. 184

While signing WD0BDA (my first call sign) from my Ten-Tec Argonaut 509 QRP transceiver, I took "second place overall, first place North Dakota" in the 1986 QRP ARCI Hoot Owl Sprint QRP Contest. Having an exotic North Dakota multiplier undoubtedly helped.

CONTESTING TIPS FOR BEGINNERS

Find some elbow room: The low end of any contest sub-band is probably jammed with Gig-Gun stations and thousands of calling stations. To enjoy the contest in a less-frantic environment, move up in frequency, even if you have to move a bit higher than the "designated" frequencies for a particular contest. For example, on 20-meter CW, 14.000 to 14.040 MHz will be filled with wall-to-wall signals, but 14.050 to 14.080 MHz will be much less-frenzied but still productive, and 14.080 to 14.100 will still produce QSOs, but at an even slower pace. During a recent RTTY contest I was making QSOs as high as 14.125 MHz! Once you get comfortable and get your contesting chops built up a bit you can slide down in frequency and battle it out.

Start locally, compete globally: To experience contesting in a friendly, supportive environment, participate in a local Field Day effort or find local hams, through clubs or other means, who regularly participate in contests. This is a great way to get your feet wet without having to go it alone.

Think small: Not every competition is a globe-spanning cacophony. There are dozens of smaller, more focused contests throughout the year, including state QSO parties, which are about as friendly and laid-back as they come. Once you've worked a couple of these, the larger contests won't seem so intimidating.

Stations galore: Ever wonder how many hams live in Montana, New Hampshire or the Canary Islands? During major contests you'll hear one (or 17) stations from hard-to-find states and DXCC entities. With this crazy signal density, "everybody's on." You could spend days looking for Hawaii or Alaska to finish your Worked All States Award, or you could work them both (several times each) in one afternoon in any of a dozen contests each year. DX, too.

Don't be a Chatty Cathy: By design, contest QSOs are quick, quick, quick! So focus on how fast you can rack up juicy contacts and save any friendly banter for after the contest. Ragchewing is to commuting as contesting is to racing. You can enjoy both—but not at the same time!

Sundays are less frantic: Major contests usually start on Friday evenings (local time) and run through Sunday evening (local time). Competition on Friday nights can be insane. As an "average Joe," you'll hear the juicy stations, but you may not work them until a few hundred (or thousand) other ops already have them in the log. On Sunday afternoon, though, the Big Juicy stations will be *begging* for you to call them. You'll almost feed sad when you hear, "Anyone, anywhere, this is Papa Forty-Nine X-ray calling CQ contest," repeated over and over. When you call them, however, you'll have a new one in your logbook!

Stay up late: Just like any other "school night," most ops can't stay up all night to play on the radio, and if you can, competition is greatly reduced. Patiently working the contests from 1 AM through 5 AM is one of my secret weapons for HF contests (that's mostly useless for VHF contests!). Propagation will shift to the lower bands, but the lack of competition makes it very profitable.

Slow-speed Morse is still okay: When I was a beginning ham there was a special contest for beginning Morse ops called the Novice Roundup, where beginners could learn contesting and Morse skills at the same time, at a manageable pace. That's not as true today, but most contests still accommodate slow-speed CW QSOs in the upper parts of the contest sub-bands. Taking the place of the Novice Roundup are organizations such as the North American QRP CW Club which is dedicated to slow-speed CW operating and contesting, with an emphasis on providing help to beginning CW ops.

Ken Reitz, KS4ZR
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Beginner to Veteran Ham in 5 Easy Steps

While there's no substitute for experience, when it comes to being an amateur radio operator, you can shorten the road to being a successful ham by following these simple steps.

❖ Get the Right Gear to Start

There's plenty of equipment out there and the first decision you're likely to make is: should you buy new or used? New is fine but expensive. And, a great piece of ham gear with a little mileage on it is still a great piece of gear. Either way, the best place to begin your research is **www.eham.net**. This is the national water cooler for hams. Every conceivable category of equipment is found on its seemingly innumerable web pages. On the left hand side of the home page click on "reviews." There are 77 categories of ham-related products for you to investigate. Click on "Transceivers HF (Amateur including HF+6+VHF models)" and you'll have to choose among some 350 different rigs.

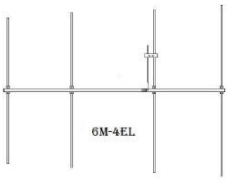
The list includes nearly everything ever made for the amateur radio market so you'll have to sort through some really vintage/collectible gear such as Swan, Tempo, Heathkit, Hallicrafters, Collins and Drake. Then there are the "new-comers" to the amateur transceiver market, Kenwood, Yaesu, Icom, Ten-Tec, and Elecraft. There are a dozen other makers in between.

All equipment on eham.net is rated on a scale of 1 to 5, but you'll notice that nearly all listed gear rates a 4+. Does that mean it's all great? Not exactly. Some transceivers may have only one or two enthusiastic reviewers while others could have hundreds. The thousands of hams who have posted their reviews will help you be the judge.

❖ Put up an Effective Antenna

It really doesn't matter what kind of a rig you end up with if you don't have an effective antenna. That doesn't necessarily mean expensive or large. Each year during Field Day I try to use a no-cost, easily available item as an antenna. One year I used a small spool of magnet wire strung on random trees at random heights. One year I used a downspout connected to a twenty foot section of rain gutter just eight feet off the ground. Another year I used a 21 foot aluminum extension ladder which was leaned against the side of the house.

Radio Shack 20-176 omni-directional, all-band scanner antenna ($30) doubles as a low-power, two-meter/70 cm antenna. (Courtesy: Radio Shack)



Blue Star's 4-element 6 meter beam ($120) is low-priced, light-weight and effective. (Courtesy: Blue Star Antennas)

All I had was a 10 foot length of coax to go from the antenna and ground to a transmatch that was connected to the transceiver. On each make-shift antenna, over a period of just a few hours, I worked hams in dozens of states up to a thousand miles away on 80 through 10 meters, operating less than 10 watts. Imagine what can be done operating at 100 watts with a permanent antenna designed specifically for the bands you want to work!

Hy Power OCF80Q 80 through 6 meter off-center fed dipole wire antenna ($130) has everything you need to start operating. (Courtesy: Universal Radio)

All antennas present some sort of compromise. The lower in frequency you want to operate the more compromise you'll have to make, especially if you don't have the real estate for a full-sized antenna.

The cheapest, most effective antenna for 80 and 40 meters is a wire antenna. You can make your own wire antennas cut to the HF bands you want to operate, but you'll find ready-made wire antennas are cheaper than the cost of buying the parts. A good case in point is the Hy Power OCF80Q antenna I found at Universal Radio. It's an off-center fed, wire antenna ($130) that comes complete with end insulators and 4:1 balun, all hooked up and ready to install; you'll have to add your own feed line. It covers all bands from 80 through 6 meters, will handle up to 250 watts and, at 135 feet long, will fit most suburban lots.

For those with even less property available, say a condominium with only a patio-sized backyard, the simplest and most effective all-band antenna is a vertical. Many companies make such antennas including GAP, MFJ, and Cush-Craft. The MFJ 2990 ($360) gives total band coverage from 160 meters through 6 meters on a single pole 43 feet tall. That works out to just $36 per band! I challenge anyone to find 10 individual antennas for all those bands and average just $36 per antenna. Here's a list of the vertical antennas offered by Universal Radio: **www.universal-radio.com/catalog/hamants.html.**

Because of its low radiation angle, the simplest and most effective antenna for 10 meters is a vertical, such as MFJ's model 1790 ($70). Unlike a fixed, horizontal wire antenna, a vertical radiates equally in all directions, letting propagation take the signal where the band is open, and it has a low radiation angle, perfect for DX on 10. You can find it here: **www.mfjenterprises.com/10meter.php**

A beam antenna for 6 meters is about the same size as a VHF-TV antenna. Blue Star Antennas' 4-element 6 meter beam is very effective, can mount on your TV antenna rotator and costs just $120 **www.bluestarantennas.com**.

The cheapest 2 meter/70 cm antenna, Radio Shacks's 20-176 ($30). It can double as your all-band scanner antenna and is easily attic-mounted. To target repeaters and follow 2 meter/70 cm propagation, use the Grove Scanner Beam ($70).

❖ Know How to Operate Your Rig

Operator error is commonplace among hams on the air. I hear it on all bands. Usually it's a matter of not being familiar enough with the labyrinthine menus today's rigs employ to make the most of the few buttons on the front panel. Another problem is the ratio of finger size to button size; big fingers plus tiny buttons equals mistakes.

MFJ 2990 all-band vertical antenna ($360) covers 160 meters through 6 meters. (Courtesy: MFJ Enterprises)

Today's rigs allow customization of your transmit audio. Take some time with another ham on-air to adjust the audio for maximum clarity. Do this with several different hams on different occasions (the first ham might have had funny ideas about how you should sound). Even though polishing your audio won't technically give you more power, better audio helps you to be heard. Swapping your rig's original microphone for a more competent

SignaLink USB interface ($110) handles all modes and connects between your rig and computer. (Courtesy: SignaLink)

aftermarket mic may also give you more clarity.

Learn how to operate your VFOs, VOX and full break-in modes. Most rigs have at least two VFOs (allowing you to tune the rig to two different frequencies). This is how you can operate "split," transmit on one frequency and listen on another. Not knowing how to operate split will keep you from working most DXpeditions, as almost all work split.

Learn how to operate VOX (Voice Operated Transmission). VOX mode lets you have more conversational QSOs with other hams. Adjust the VOX so that it opens the mike and hangs just enough to let you take a breath before cutting you off. Instructions for doing so are in the owner's manual. Be aware that if you're rig is in VOX mode, any sound in your shack could activate the transmitter and allow the sound onto the air.

Break-in, or QSK, is basically VOX for CW operators. It lets you hear if someone is replying in between CW characters and it allows CW to be more conversational. Some ops like the transmitter to shut off between characters in a word, others prefer the transmitter to "hang" a little, as in voice transmissions. It's all up to your individual style.

❖ Learn to Operate New Modes

About ten years ago I was stymied by the doldrums of a low sunspot cycle. My favorite band, 10 meters, was closed most of the time. Hams who had previously spread out along the upper HF bands retreated to 20 meters, making it so crowded it was hardly worth turning on the rig. Then I got a tip from my colleague, Larry Van Horn N5FPW about PSK31, a low-power, weak-signal digital mode.

It was brand new territory for me in those days and I was skeptical. But, armed with a SignaLink interface ($110) and free HamScope software (**www.qsl.net/hamscope**), I began by venturing onto what appeared to be a dead 15 meter band. I had dialed up and down 15 meters and there wasn't a signal to be heard. I tuned to 21.070 MHz (the main 15 meter PSK31 frequency) and watched the HamScope screen. Was there a little blip on the spectrum display? It certainly didn't look like much. I put the cursor on the tiny blip and clicked. In a second the screen began to display the CQ and call sign of a ham from Greece. Fumbling with the mouse and unfamiliar with the command buttons I somehow worked the station and sat back amazed.

Since then I've worked more than 200 countries in PSK31 and RTTY (which, for awards programs, are considered the same mode), including some "rare DX," and I've dabbled in Slow Scan TV (SSTV) and newer modes such as JT65, a super weak signal mode. Since that first contact I've paid little attention to sunspot counts or propagation forecasts; with digital modes it just doesn't matter. This could end up being very important as we are now about at the peak of the current solar cycle; it gets worse for the next 11 years. For more details on digital operating read Larry's feature article in the front of this issue.

❖ The Smart Way to Chase DX

You should know that, if you hang around amateur radio long enough, there's really no such thing anymore as "rare DX." Over the last 25 years I've seen a great number of DXpeditions mounted to all the "rare" DXCC entities. The only truly rare DX prefix is P5 (North Korea). Even China, considered rare until the 2008 Olympics, has been found on all bands and modes since that event opened the door to the world for Chinese hams. For all the rest, you'll have plenty of time to work the DX. And, that gets to the main point of working DX: patience.

I've worked and confirmed over 250 DXCC entities, which is not a big deal since there are 340 entities on the official list. Incidentally, they don't call them countries because some are so small they'll only accommodate a handful of hams (and other wild life) during a DXpedition. Some are basically rocks that are just above sea level. One such entity was so small, they had to construct wooden supports so operators could stay above the high tide line. So, if you don't panic, you'll have plenty of time to work the DX. Oh, and don't worry about the rocks disappearing because of global warming, new rocks will be found, new "entities" will be approved, and DXpeditions will be dispatched to work the ever-hungry DX crowd.

The easiest way to find the DX is to monitor DX postings on **http://dxcluster.ham-radio.ch.** Simply click on the band you want to monitor, say 20 meters (14 MHz), and look for rare DX. As this is written, a DXpedition to Clipperton Island (TX5K) is in operation on all bands and modes; another DXpedition to Burkina Faso (XT2TT) is also in progress. In addition, individual operators from Rwanda (9X0NH), Togo, and more are also on and that's just on 12 meters!

It's one thing to find the DX but working it is another. First, don't worry about trying to work the DX on the first or second day of a DXpedition. Let all the big guns do their thing; once they're gone the DX can hear smaller signals nicely. Second, work the DX in digital mode. There are far fewer hams operating digital modes, so there's far less competition. In addition, digital modes require far less power, rendering the big guns irrelevant. Third, work the bands most advantageous to your part of the world. Check the signal strength of the DX operation on all the bands; when propagation is favoring your area, you'll have more success being heard. Fourth, pay close attention to how the DX is operating. If they are asking for, "EU (Europe) only," don't call. Wait until they say, "North America only." If they're operating split (transmitting on one frequency and listening to a group of frequencies five kHz up or down the band), stake out a place within those frequencies and give your call when they say, "QRZ?" Despite the din on the frequency, if you wait, you'll be heard.

Having a decent transceiver, that you are competent in operating, with clear audio connected to a great antenna, you won't need a tower with an impressive beam or linear amplifier. You'll be able to work the world and be heard locally as well. By knowing where to look for DX and showing a lot of patience, you'll be amazed at how quickly you can rack up the DXCC entities!

PROGRAMMING SPOTLIGHT

WHAT'S ON WHEN AND WHERE?

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Shortwave Radio: Helping Understand Today's News

Welcome to the May edition of *Programming Spotlight*. This month we shine the spotlight on breaking news coverage from China and the Vatican and some programming gems from a few other stations throughout the world. Also note that many times and frequencies may have changed by the time you read this. Consult the *Shortwave Guide* in the pages of this magazine for updates.

Radio is a great tool to have around in our busy lives. For instance, as I type this, I am listening to the **Voice of Greece** on 9420 kHz, an always enjoyable experience, especially when the signal is strong. The station is best heard between 0000 and 0200 UTC most nights. It always has an eclectic mix of tunes, tonight featuring a lot of pop music, as well as Greek traditional melodies.

WYFR was once heard as well as the BBC or Radio Moscow. It still puts a solid signal into Southern Ontario on most nights on 6115 kHz between about 2300 and 0400 UTC. These broadcasts are heavy on music, featuring a mix of Christian Contemporary and traditional hymns. I find it very relaxing after a long day.

Another delightful option for long-term listening is 9570 kHz. This frequency carries programming from **China Radio International**. From 0000-0200 one can listen to the CRI English language service. From 0200-0357 it switches to Chinese. In some ways I prefer listening to this later programming block. I may not speak the language, but I find the program is often loaded with contemporary and traditional Chinese melodies that are worth the price of admission. And I love listening to the sing-song nature of the language. It's fun to listen to other languages, even if one doesn't necessarily understand them.

CRI Live Team (Courtesy: CRI English)

In March, North Korea, or the Democratic People's Republic of Korea (DPRK, as it styles itself), has been in the news a great deal. As is often the case with this country, it is hard to figure out just what is going on there. Not surprisingly from a country once referred to as the Hermit Kingdom, it is a very secretive, introverted nation. It is a kingdom in another sense as the leadership has passed down through three generations of the Kim family, making that country the world's first Communist hereditary monarchy! I like to call it The Land of the Rising (grand)Son. The current leader is Kim Jong Un, grandson of Kim Il-Sung, the founder and leader for 40 or so years.

Listening to the **Voice of Korea**, one is reminded of Winston Churchill's quote about Russia: "It is a riddle, wrapped in a mystery, inside an enigma." One is also reminded of another Winston, the main character in Orwell's 1984. The language of the broadcasts is often Orwellian in nature. North Korea is the last of the true Stalinist states. It is not always easy to hear North Korea and, speaking from experience, I have had mixed results hearing it with any regularity. Nevertheless, give it a try at 1300 and 1500 UTC on 9335 and 11710 kHz. Also try 9975 kHz at 1900. Let us know what you hear from this enigmatic country!

Vietnam is no longer heard via Sackville, however it can be heard via transmitters in the U.K. Reception is a bit more problematic now, but one can hear the daily English broadcast at 0100, 0230 and 0330 UTC on 9640 kHz. Vietnamese can be heard at 0130 UTC. The daily half hour broadcast includes news and features and always concludes with wonderful Vietnamese music. Vietnam is a key player in South East Asia and the **Voice of Vietnam** keeps you in touch with events in the country and the region.

In February came the surprise announcement that Pope Benedict would be stepping down, the first Pope to leave office alive in 600 years. In March, the Papal Conclave was held (as this is written the results are not yet known). It has been fascinating to listen to coverage of these events. While **Vatican Radio** no longer broadcasts to North America on shortwave, reception of the English broadcast to Africa at 0300 on 9660 kHz is not too shabby. Events of this magnitude are relatively rare but when they do happen, **Vatican Radio** is the place to hear about them. The broadcasts are full of information and informed commentary on this ancient ritual of electing a Pope. I am not even Catholic, yet I find myself immersed in the history and pageantry of these relatively rare events.

Facade of St. Peter's Basilica (Courtesy: www.cia.gov)

Just in the past decade, **Vatican Radio** has covered Papal visits, events such as the World Youth Festivals, the decline and death of John Paul II, his funeral and the election of his successor. These are important matters to the world's one billion Catholics, and of interest to observers of other faiths as well. **Vatican Radio** coverage is top notch. And, even when nothing momentous is happening, **Vatican Radio** programs offer an unique insight into Catholic affairs that is always interesting.

For example, tune in UTC Sundays to hear Jill Bevilacqua present *Sunday Gospel*, followed by Joan Knows, featuring **EWTN** Rome Bureau Chief Joan Lewis with a Vatican week in review.

WEWN complements the coverage from **Vatican Radio**, in both Spanish and English for North America. Extensive live coverage of events as the Papal Conclave opened, and the first balloting began, filled the broadcast day in both languages. It was an intriguing contrast, all this modern communication technology such as radio, television and the Internet used to cover an essentially ancient ritual and process including the very low tech sending up of smoke signals to indicate a ballot result or lack thereof.

In mid-March, **China Radio International** (CRI) offered extensive "live" coverage of the Chinese People's Political Consultative Conference held at the Great Hall of the People. It was heard in English to North America. This took up most of the 0100 UTC hour's programming. The station later returned to "regularly scheduled" programming.

I am too young to remember the blatant propaganda of the Cultural Revolution era, but even during my 30+ years of listening, great changes have occurred in both the tone and content of **CRI** programming. This is definitely not Chairman Mao's radio station any more.

There was a time when a live **CRI** broadcast was unheard of. **CRI** is a rapidly evolving radio station and one never ceases to be impressed by the changes and improvements there. China is still a one party state, nevertheless **CRI** does not just report on the "good stories" out of China. And, with the strange and alarming behavior of its neighbor North Korea, it is a news source from the region well worth monitoring.

The **Voice of Turkey** offers a brief Turkish-by-radio course on UTC Tuesdays called *Let's Learn Turkish*. It is a five minute segment at the end of the broadcast. UTC Saturday nights on the **Voice of Turkey** tend to feature some great Turkish music and *DX Corner*. Give the **Voice of Turkey** a listen on 9655 kHz at 0400 UTC.

Radio Taiwan International can still be heard on 6115 and 15440 kHz at 2200 UTC with all of the quality programming we have come to expect over the years. This too is a good source for news from this uncertain region as well as some very entertaining features. One of these programs is *Soundwaves*, a weekly program offering a glimpse of the very vibrant pop music scene in Taiwan. Shirley Lin hosts this jam packed 30-minute program offering the latest releases and many favorites. Check her out on UTC Mondays during the last half of the one hour broadcast, right after *Chinese To Go*, a weekly Chinese by radio course.

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QSLing ARRL Field Day

If you are a rabid QSL junkie and love to receive cards and certificates in the mailbox, mark June 22-23, 2013 on your radio listening calendar. Every year in June, amateur radio operators throughout the United States set aside one 24-hour session to make as many contacts as possible on any and all amateur bands (excluding the 30, 17 and 12 meter bands).

While doing so, many hams operate in abnormal situations or less than optimal conditions. They may be operating from a wide variety of remote locations, with an assortment of varied equipment and antennas. A premium is placed during this contest on developing skills to meet the challenges of emergency preparedness as well as to acquaint the general public with the capabilities of amateur radio.

This translates to an increased number of hams and amateur radio clubs on the air in the United States and Canada, trying to work each other over a 24 hour period. The club Field Day operations are usually excellent verifiers. Many shortwave listeners work all 50 states and all Canadian provinces during an American Radio Relay League (ARRL) Field Day weekend.

While the hams are out in the field roughing it, the shortwave listener can stay in the comfort of the radio shack or listening post, and rack in the contacts for their logbook. QSLing couldn't be easier. Note the call sign, frequency, time, date, who they worked, and a signal report, noted on any style of postcard, and provide a self-addressed stamped envelope. From there you await QSLs and certificates in your mailbox.

Need the operator's address? It's as close as your Internet connection. Go to **www.qrz.com**, register a username and password, type in the call sign you heard, and view the ham's postal mail address and additional QSL information. Consult the ARRL website at **www.arrl.org** for upcoming news and rules about the 2013 Field Day.

Dayton Hamvention® ...A Must-See Event May 17-19

Most operators will tell you a trip to the annual ham convention in Dayton, Ohio, rates high among their lifetime goals. Hams and those like minded, gather once a year to the largest hamfest in North America. Each year, hobbyists from across the globe gather at the Hara Arena in Trotwood, Ohio, near Dayton. The mega-fest offers exhibit space, demonstrations, forums, and a flea market. The Department of Homeland Security's Office of Emergency Communications will provide training in conjunction with the Hamvention. A full-day course to obtain your Technician Class Amateur Radio license is available too. For information on purchasing tickets online, go to the **www.hamvention.org** or join the Facebook page at **www.facebook.com/Hamvention**. Can't make it this year? Watch live on the Internet from W5KUB's Helmet Cam at **http://w5kub.com**.

AMATEUR RADIO

Andorra-C37N, 14.0 MHz. Full data color antenna/scenery card, unsigned. Back side of card features ARO DX group. Received in 65 days via ARRL bureau. (Larry Van Horn, NC)

Italy-W3SGT, 18.102 MHz. Full data color global map card, signed by Alessandro Kosoveu. Received in 65 days via ARRL bureau. (Van Horn).

Japan-JO3TAP, 7 MB/JT65A. Full data classic style card with Kodak Autographic No. 1A-1918 featured, unsigned. Received in 65 days via ARRL bureau. (Van Horn)

Russia-RN3AUR, 21076.0 kHz/JT65. Full data color winter scenery card of two Russian basilicas, unsigned. Received in 65 days via ARRL bureau. (Van Horn).

Special Event Calendar

A sampling of amateur radio events and QSLing information. All times UTC, frequencies MHz.

Armed Forces Day

May 18, 1400-2000. W9DUP DuPage Amateur Radio Club. Operating on: 145.430-600, 28.400, 14.290, 7.250. Certificate. Brian Eder, PO Box 71, Clarendon Hills, IL 60514-00. **www.w9dup.org**

Air Power Armed Forces Day

May 18-19, 0920-0420, W2GSB, Farmingdale, New York. Great South Bay Amateur Radio Club. 14.325, 14.070, 7.255, 3.975. QSL. W2GSB/APM, P.O. Box 1356, West Babylon, NY 11704. Armed Forces Day operating from inside the hanger that houses many of the aircraft that helped save our freedom. This is an annual event that pays honor to the those that have protected our freedoms and country. While we are one the air you may hear the roar of a P51 or even the Texan A6. This is a live operating hanger and museum. We will be on SSB PSK CW. **ww.gsbarc.org**

W9IMS Indy 500 Special Event

May 20-26, 2300-2200. W9IMS, Indianapolis, Indiana, Motor Speedway Amateur Radio Club. 21.350, 14.245, 7.240, 3.840. Certificate and QSL. IMS ARC, P.O. Box 30954, Indianapolis, IN 46230. **www.w9ims.org**

Helen to the Atlantic Hot Air Balloon Race

May 25-June 2, 0000-2359. W4B, Helen, Georgia Gateway Amateur Radio Club. 21.355, 18.145, 14.260, 7.265. Certificate and QSL. Gateway Amateur Radio Club, P.O. Box 691, Cleveland, GA 30528. The only long distance hot air balloon race in the United States. Operating from home stations on various frequencies. On Saturday June 1, the club will be operating from downtown Helen, Georgia near race headquarters from 1500-2100, or near posted frequencies. **www.helenballoon.com**; *wc4x@arrl.org*. **www.qrz.com/db/w4b**

D-Day Commemoration

June 1-9, 0600-2000. W2W, Baltimore, Maryland Amateur Radio Club of the National Electronics Museum. 14.241, 14.041, 7.241, 7.041. Certificate and QSL. D-Day Special Event Station, P.O. Box 1693, MS 4015, Baltimore, MD 21203. Daily, with activity primarily June 6 and June 8-9. **www.ww-2.us**

Women's Air Race Classic

June 20-22, 1900-1800. W1A, Fayetteville, AR. ARKANHAMS. 14.440, 14.305, 14.280, 14.265. QSL. Joe Dunn, 167 Ireland, Springdale, AR 72762. This is an all women air race. It will begin in Pasco, Washington and terminate in Fayetteville, Arkansas. It is limited to 55 pilots. Please join us using W1A **www.airraceclassic.org**

150th Anniversary of the Battle of Hanover and Gettysburg

June 30 and July 1, 2, 3, 1100-0100. W1G, East Berlin, Pennsylvania. WO4L. 24.950, 21.350, 14.250, 3.780. Certificate and QSL. Bob Hess/W1G, 74 Curtis Dr, East Berlin, PA 17316. **www.qrz.com/db/wo4l**.

Blanford Racecourse Shutter Telegraph Over 200 Years

June 30-July 6, 0900-1900. GB2BRT, Blandford, Dorset, England. RSGB. 21.300, 14.300, 7.195. QSL. RSGB Bureau or John Wakefield, Oakhurst, Lower Common Road, West Wellow, Romsey, Hampshire SO51 6BT, England. **www.qrz.com/db/gb2brt.**

How to Use the Shortwave Guide

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

① ② ⑤ ③ ④ ⑥ ⑦

CONVERT YOUR TIME TO UTC

Broadcast time on ① and time off ② are expressed in Coordinated Universal Time (UTC) – the time at the 0 meridian near Greenwich, England. To translate your local time into UTC, first convert your local time to 24-hour format, then add (during Daylight Saving Time) 4, 5, 6 or 7 hours for Eastern, Central, Mountain or Pacific Times, respectively. Eastern, Central, and Pacific Times are already converted to UTC for you at the top of each hour.

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

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

FIND THE STATION YOU WANT TO HEAR

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

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

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

CHOOSE PROMISING FREQUENCIES

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

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

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

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

Target Areas

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

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

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Thank You to …

AOKI; BCL News; Cumbre DX; DSWCI/DX Window; Hard-Core DX; DX Re Mix News; British DX Club; WWDX Club/Top News. Alokesh Gupta, New Delhi, India; Derek Kickbush/R Australia HCJB Global; Tom Taylor, UK; Ashik Eqbal Tokon, Rajshahi, Bangladesh; Brenda Constantino/WYFR; Georgi Bancov/Balkan DX; Ivo Ivanov, Bulgaria; Sean Gilbert UK/WRTH 2013; Wolfgang Bueschel, Stuttgart, Germany.

SHORTWAVE BROADCAST BANDS

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

Notes

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

0000 UTC - 8PM EDT / 7PM CDT / 5PM PDT

0000 0030	Egypt, R Cairo	9965am	11510al	
0000 0030	USA, BBG/VO America	7560as		
0000 0030 twhfa	USA, WHRI Cypress Creek SC			9895ca
0000 0030 sm	USA, WHRI Cypress Creek SC			7335ca
0000 0045	India, AIR/External Svc	9690as	9705as	
	11710as	13605as		
0000 0045 DRM	India, AIR/External Svc	11645as		
0000 0057	China, China R International			6005eu
	6020as	6180eu	7350as	7415as
	9425as	9570as	11650as	11790as
	11885as			
0000 0100	Anguilla, University Network			6090na
0000 0100	Australia, ABC/R Australia	9660pa	12080pa	
	15240pa	15415pa	17795pa	19000pa
	21740pa			
0000 0100	Australia, NT VL8A Alice Springs			4835do
0000 0100	Australia, NT VL8K Katherine			5025do
0000 0100	Australia, NT VL8T Tennant Creek			4910do
0000 0100	Canada, CFRX Toronto ON	6070do		
0000 0100	Canada, CFVP Calgary AB	6030do		
0000 0100	Canada, CKZN St Johns NF	6160do		
0000 0100	Canada, CKZU Vancouver BC			6160do
0000 0100 Sun	Germany, Mighty KBC Radio			7375eu
0000 0100	Germany, R 6150	6070eu		
0000 0100	Malaysia, RTM Kajang/Traxx FM			7295do
0000 0100	Micronesia, V6MP/Cross R/Pohnpei			4755 as
0000 0100	New Zealand, R New Zealand Intl			15720pa
0000 0100 DRM	New Zealand, R New Zealand Intl			17675pa
0000 0100	Palau, T8WH/World Harvest R			17650as
0000 0100	Russia, VO Russia	7290ca		
0000 0100	Thailand, R Thailand World Svc			13745na
0000 0100	UK, BBC World Service	5970as	6195as	
	7360as	9410as	9740as	11750as
	12095as	13725as	15335as	15755as
0000 0100	USA, AFN/AFRTS	4319usb	5765usb	
	12759usb	13362usb		
0000 0100	USA, Overcomer Ministry	3185na		
0000 0100	USA, WBCQ Monticello ME	7490na	7490na	
	9330na			
0000 0100 fas	USA, WBCQ Monticello ME	5110na		
0000 0100	USA, WEWN/EWTN Irondale AL			11520af
0000 0100	USA, WHRI Cypress Creek SC			5920eu
0000 0100	USA, WINB Red Lion PA	9265ca		
0000 0100	USA, WRNO New Orleans LA			7505na
0000 0100	USA, WTWW Lebanon TN	5085sa		5830na
0000 0100	USA, WWCR Nashville TN	4840eu		5935af
	6875eu	7520ca		
0000 0100	USA, WWRB Manchester TN			3185na
	3215na			
0000 0100	USA, WYFR/Family R	6115na		
0030 0100	Australia, ABC/R Australia	17750as		
0030 0100	USA, WHRI Cypress Creek SC			7335ca

0100 UTC - 9PM EDT / 8PM CDT / 6PM PDT

0100 0115 mtwha	Australia, HCJB Global Australia			15400as
0100 0115 Sat/Sun	Canada, Bible Voice Broadcasting			7395as
0100 0130	Vietnam, VO Vietnam/Overseas Svc			9640na
0100 0156	Romania, R Romania Intl	6145na		7325na
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/R Australia	9660pa	12080pa	
	15160pa	15240pa	15415as	17750pa
	17795pa	19000pa		
0100 0200	Australia, NT VL8A Alice Springs			4835do
0100 0200	Australia, NT VL8K Katherine			5025do
0100 0200	Australia, NT VL8T Tennant Creek			4910do
0100 0200	Canada, CFRX Toronto ON	6070do		
0100 0200	Canada, CFVP Calgary AB	6030do		
0100 0200	Canada, CKZN St Johns NF	6160do		
0100 0200	Canada, CKZU Vancouver BC			6160do
0100 0200	Cuba, R Havana Cuba	5040ca		6000na
	6165na			
0100 0200 Sun	Germany, Mighty KBC Radio			7375eu
0100 0200	Germany, R 6150	6070eu		
0100 0200	Malaysia, RTM Kajang/Traxx FM			7295do
0100 0200	Micronesia, V6MP/Cross R/Pohnpei			4755 as
0100 0200	New Zealand, R New Zealand Intl			15720pa
0100 0200 DRM	New Zealand, R New Zealand Intl			17675pa
0100 0200	Palau, T8WH/World Harvest R			17650as
0100 0200	Russia, VO Russia	7290ca		
0100 0200	South Korea, KBS World R	9690as		
0100 0200	Taiwan, R Taiwan Intl	11875as		
0100 0200	UK, BBC World Service	5940eu	5970as	
	9740as	11750as	12095as	15310as
	15335as	15755as	17685as	
0100 0200	USA, AFN/AFRTS	4319usb	5765usb	
	12759usb	13362usb		
0100 0200	USA, BBG/VO America	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	USA, WBCQ Monticello ME	7490na	9330na	
0100 0200 fas	USA, WBCQ Monticello ME	5110na		
0100 0200	USA, WEWN/EWTN Irondale AL			11520af
0100 0200	USA, WHRI Cypress Creek SC			5920eu
0100 0200 m	USA, WHRI Cypress Creek SC			9605ca
0100 0200 twhfas	USA, WHRI Cypress Creek SC			7315sa
0100 0200	USA, WINB Red Lion PA	9265ca		
0100 0200	USA, WRNO New Orleans LA			7505na
0100 0200	USA, WTWW Lebanon TN	5085sa		5830na
0100 0200	USA, WWCR Nashville TN	3215eu		4840na
	5935af	7520ca		
0100 0200	USA, WWRB Manchester TN			3185na
	3215na			
0100 0200	USA, WYFR/Family R	6115na		
0115 0120 mtwhf	Kyrgyzstan, Kyrgyz Radiosu	4010do		
0120 0200	Myanmar, Thazin R	6030do		
0120 0200 mtwhfa	Sri Lanka, SLBC	6005as	9770as	15745as
0130 0200 twhfa	Serbia, International R Serbia			6190eu
0140 0159	Vatican City State, Vatican R	7410as		9560as

0200 UTC - 10PM EDT / 9PM CDT / 7PM PDT

0200 0230	Thailand, R Thailand World Svc			15275na
0200 0230	USA, KJES Vado NM	7555na		
0200 0257	China, China R International			11785as
	13640as			
0200 0300	Anguilla, University Network			6090na
0200 0300 twhfa	Argentina, RAE	11710am		
0200 0300	Australia, ABC/R Australia	9660pa	12080pa	
	15160pa	15240pa	15415as	17750pa
	17795pa	19000pa		
0200 0300	Australia, NT VL8A Alice Springs			4835do
0200 0300	Australia, NT VL8K Katherine			5025do
0200 0300	Australia, NT VL8T Tennant Creek			4910do
0200 0300	Canada, CFRX Toronto ON	6070do		
0200 0300	Canada, CFVP Calgary AB	6030do		
0200 0300	Canada, CKZN St Johns NF	6160do		
0200 0300	Canada, CKZU Vancouver BC			6160do
0200 0300	Cuba, R Havana Cuba	6000na		6165na
0200 0300	Egypt, R Cairo	9720na	9315al	
0200 0300	Germany, R 6150	6070eu		
0200 0300	Malaysia, RTM Kajang/Traxx FM			7295do
0200 0300	Micronesia, V6MP/Cross R/Pohnpei			4755 as
0200 0300	New Zealand, R New Zealand Intl			15720pa
0200 0300 DRM	New Zealand, R New Zealand Intl			17675pa
0200 0300	Palau, T8WH/World Harvest R			17650as
0200 0300	Philippines, R Pilipinas Overseas Svc			15285me
	17700me	17820me		
0200 0300	Russia, VO Russia	7290ca		
0200 0300	South Korea, KBS World R	9580sa		9640as
0200 0300 mtwhfa	Sri Lanka, SLBC	6005as	9770as	15745as
0200 0300	UK, BBC World Service	5875eu	5940eu	
	7435af	12095as	15310as	
0200 0300	USA, AFN/AFRTS	4319usb	5765usb	
	12759usb	13362usb		
0200 0300	USA, Overcomer Ministry	3185na		
0200 0300 mtwhf	USA, Overcomer Ministry	7490na		
0200 0300	USA, WBCQ Monticello ME	7490na	9330na	

0200 0300 fas USA, WBCQ Monticello ME 5110na
0200 0300 USA, WEWN/EWTN Irondale AL 11520af
0200 0300 USA, WHRI Cypress Creek SC 5920eu 7315sa
0200 0300 USA, WINB Red Lion PA 9265ca
0200 0300 USA, WRNO New Orleans LA 7505na
0200 0300 USA, WTWW Lebanon TN 5085sa 5830na
0200 0300 USA, WWCR Nashville TN 3215eu 4840na 5890ca 5935af
0200 0300 USA, WWRB Manchester TN 3185na 3195na
0200 0300 USA, WYFR/Family R 6115na
0215 0227 Sun Nepal, R Nepal 5005do
0215 0300 Myanmar, Myanma R 9731do
0230 0300 twhfas Albania, R Tirana 6100na
0230 0300 Myanmar, Myanma R 5985do
0230 0300 Vietnam, VO Vietnam/Overseas Svc 9640na
0255 0300 Sun Swaziland, TWR Africa 3200af

0300 UTC - 11PM EDT / 10PM CDT / 8PM PDT

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 5985do
0300 0330 Philippines, R Pilipinas Overseas Svc 15285me 17700me 17820me
0300 0330 Sat Sri Lanka, SLBC 6005as 9770as 15745as
0300 0357 China, China R International 9460am 9690na 9790as 11785as 13620as 15110as 15120as
0300 0400 Anguilla, University Network 6090na
0300 0400 Australia, ABC/R Australia 9660pa 12080pa 15160pa 15240as 15415pa 15515pa 17750pa 19000pa 21725pa
0300 0400 Australia, NT VL8A Alice Springs 4835do
0300 0400 Australia, NT VL8K Katherine 5025do
0300 0400 Australia, NT VL8T Tennant Creek 4910do
0300 0400 Canada, CFRX Toronto ON 6070do
0300 0400 Canada, CFVP Calgary AB 6030do
0300 0400 Canada, CKZN St Johns NF 6160do
0300 0400 Canada, CKZU Vancouver BC 6160do
0300 0400 Cuba, R Havana Cuba 6000na 6165na
0300 0400 Germany, R 6150 6070eu
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 13600af
0300 0400 Palau, T8WH/World Harvest R 17650as
0300 0400 Russia, VO Russia 7290ca
0300 0400 mtwhf South Africa, Channel Africa 3345af 6155af
0300 0400 Taiwan, R Taiwan Intl 15320as
0300 0400 UK, BBC World Service 3255af 5940eu 6140af 6190af 7255af 7435af 9410eu 9460af 12035af 12095eu 15310as 17790as
0300 0400 USA, AFN/AFRTS 4319usb 5765usb 12759usb 13362usb
0300 0400 USA, BBG/VO America 4930af 6080af 9855af 15580af
0300 0400 USA, Overcomer Ministry 3185na
0300 0400 mtwhf USA, Overcomer Ministry 7490na
0300 0400 USA, WBCQ Monticello ME 7490na 9330na
0300 0400 USA, WEWN/EWTN Irondale AL 11520af
0300 0400 USA, WHRI Cypress Creek SC 7520eu
0300 0400 USA, WINB Red Lion PA 9265ca
0300 0400 USA, WRNO New Orleans LA 7505na
0300 0400 USA, WTWW Lebanon TN 5085sa 5830na
0300 0400 USA, WWCR Nashville TN 3215eu 4840na 5890ca 5935af
0300 0400 USA, WWRB Manchester TN 3185na 3195na
0300 0400 USA, WYFR/Family R 6115na
0330 0400 Iran, VO Islamic Rep of Iran/VO Justice 9710eu 11700eu 11770eu
0330 0400 USA, WHRI Cypress Creek SC 6175ca
0330 0400 Vietnam, VO Vietnam/Overseas Svc 9640na

0400 UTC - 12AM EDT / 11PM CDT / 9PM PDT

0400 0427 Iran, VO Islamic Rep of Iran/VO Justice 9710eu 11700eu 11770eu
0400 0455 Turkey, VO Turkey 7240as 9655na
0400 0456 Romania, R Romania Intl 6130na 7305na 15220as 17870as
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/R Australia 9660pa 12080pa 15160pa 15240pa 15415as 15515pa 21725pa
0400 0500 Australia, NT VL8A Alice Springs 4835do
0400 0500 Australia, NT VL8K Katherine 5025do
0400 0500 Australia, NT VL8T Tennant Creek 4910do
0400 0500 Canada, CFRX Toronto ON 6070do
0400 0500 Canada, CKZN St Johns NF 6160do
0400 0500 Canada, CKZU Vancouver BC 6160do
0400 0500 Cuba, R Havana Cuba 6000na 6165na
0400 0500 Germany, R 6150 6070eu
0400 0500 Malaysia, RTM Kajang/Traxx FM 7295do
0400 0500 Micronesia, V6MP/Cross R/Pohnpei 4755 as
0400 0500 Palau, T8WH/World Harvest R 17650as
0400 0500 mtwhf South Africa, Channel Africa 7230af
0400 0500 Sun Sri Lanka, SLBC 6005as 9770as 15745as
0400 0500 UK, BBC World Service 3255af 6005af 6190af 7255af 9410eu 11760eu 12015af 12035af 12095af 15310as
0400 0500 USA, AFN/AFRTS 4319usb 5765usb 12759usb 13362usb
0400 0500 USA, BBG/VO America 4930af 4960af 9885af 15580af
0400 0500 USA, Overcomer Ministry 3185na 5890na
0400 0500 mtwhf USA, WBCQ Monticello ME 7490na
0400 0500 USA, WBCQ Monticello ME 9330na
0400 0500 USA, WEWN/EWTN Irondale AL 11520af
0400 0500 Sat USA, WHRI Cypress Creek SC 9640eu
0400 0500 smtwhf USA, WHRI Cypress Creek SC 9640eu
0400 0500 USA, WINB Red Lion PA 9265ca
0400 0500 USA, WRNO New Orleans LA 7505na
0400 0500 USA, WTWW Lebanon TN 5085sa 5830na
0400 0500 USA, WWCR Nashville TN 3215eu 4840na 5890ca 5935af
0400 0500 USA, WWRB Manchester TN 3185na 3195na
0415 0420 mtwhf Kyrgyzstan, Kyrgyz Radiosu 4010do
0430 0500 Myanmar, Thazin R 9460do
0430 0500 mtwhf Swaziland, TWR Africa 3200af
0430 0500 USA, WHRI Cypress Creek SC 6175ca
0455 0500 mtwhf Nigeria, VO Nigeria 15120eu
0459 0500 New Zealand, R New Zealand Intl 11725pa
0459 0500 DRM New Zealand, R New Zealand Intl 13730pa

0500 UTC - 1AM EDT / 12AM CDT / 10PM PDT

0500 0527 Germany, Deutsche Welle 5905af
0500 0527 Vatican City State, Vatican R 7360af 13765af
0500 0530 Germany, Deutsche Welle 7425af 11800af
0500 0530 Japan, R Japan/NHK World 9770sa 11740na 17660va
0500 0557 China, China R International 7220as 11880as 15350as 15465as 17505va 17540va 17725va 17855va
0500 0557 North Korea, VO Korea 13650as 15100as
0500 0600 Anguilla, University Network 6090na
0500 0600 Australia, ABC/R Australia 9660pa 12080pa 13630pa 15240pa 15415as 15515pa 21725pa

0500 0600	Australia, NT VL8A Alice Springs	4835do
0500 0600	Australia, NT VL8K Katherine	5025do
0500 0600	Australia, NT VL8T Tennant Creek	4910do
0500 0600	Bhutan, Bhutan BC Svc 6035do	
0500 0600	Canada, CFRX Toronto ON 6070do	
0500 0600	Canada, CKZN St Johns NF 6160do	
0500 0600	Canada, CKZU Vancouver BC	6160do
0500 0600	Cuba, R Havana Cuba 6010na 6060na 6125am 6165na	
0500 0600	Eqt Guinea, Pan Am BC/R Africa	15190af
0500 0600	Germany, Deutsche Welle 9470af	
0500 0600	Germany, R 6150 6070eu	
0500 0600	Malaysia, RTM Kajang/Traxx FM	7295do
0500 0600	Micronesia, V6MP/Cross R/Pohnpei	4755 as
0500 0600	Myanmar, Thazin R 9460do	
0500 0600	New Zealand, R New Zealand Intl	11725pa
0500 0600 DRM	New Zealand, R New Zealand Intl	13730pa
0500 0600 mtwhf	Nigeria, VO Nigeria 15120af	
0500 0600	Palau, T8WH/World Harvest R	17650as
0500 0600 mtwhf	South Africa, Channel Africa	7230af
0500 0600	Swaziland, TWR Africa 3200af 9500af	
0500 0600	UK, BBC World Service 6005af 7255af 9410af 11760eu 15310as 15360va 15400af 15420af 17640af	
0500 0600 DRM	UK, BBC World Service 3955eu	
0500 0600	USA, AFN/AFRTS 4319usb 5765usb 12759usb 13362usb	
0500 0600	USA, BBG/VO America 4930af 6080af 9885af 15580af	
0500 0600	USA, Overcomer Ministry 3185na 5890na	
0500 0600	USA, WBCQ Monticello ME 9330na	
0500 0600	USA, WEWN/EWTN Irondale AL	11520af
0500 0600 Sat	USA, WHRI Cypress Creek SC	9615af
0500 0600	USA, WTWW Lebanon TN 5085sa 5830na	
0500 0600	USA, WWCR Nashville TN 3215eu 4840na 5890ca 5935af	
0500 0600	USA, WWRB Manchester TN	3185na
0502 0600	Swaziland, TWR Africa 6120af 9500af	
0515 0530	Rwanda, R Rep Rwandaise 6055do	
0530 0557	Germany, Deutsche Welle 9470af	11800af
0530 0600	Australia, ABC/R Australia 17750as	
0530 0600	Thailand, R Thailand World Svc	12015eu
0530 0600	USA, WHRI Cypress Creek SC	6195ca

0600 UTC - 2AM EDT / 1AM CDT / 11PM PDT

0600 0630	China, Xizang PBS 6025do 6130do 9580do	
0600 0630	Myanmar, Thazin R 9460do	
0600 0650 DRM	New Zealand, R New Zealand Intl	13730pa
0600 0650	New Zealand, R New Zealand Intl	11725pa
0600 0657	China, China R International	11750af
	11770me 11880as 13645as 15145as 15350as 15465as 17505va 17540as 17710va	
0600 0657	North Korea, VO Korea 7220as 9345as 9730as	
0600 0700	Anguilla, University Network	6090na
0600 0700	Australia, ABC/R Australia 9660pa 11945pa 12080pa 13630pa 15240pa 15415as 17750pa 21725pa	
0600 0700	Australia, NT VL8A Alice Springs	4835do
0600 0700	Australia, NT VL8K Katherine	5025do
0600 0700	Australia, NT VL8T Tennant Creek	4910do
0600 0700	Canada, CFRX Toronto ON 6070do	
0600 0700	Canada, CFVP Calgary AB 6030do	
0600 0700	Canada, CKZN St Johns NF 6160do	
0600 0700	Canada, CKZU Vancouver BC	6160do
0600 0700	Cuba, R Havana Cuba 6010na 6060na 6125am 6165na	
0600 0700	Eqt Guinea, Pan Am BC/R Africa	15190af
0600 0700	Germany, Deutsche Welle 13780af 17800af	
0600 0700	Germany, R 6150 6070eu	
0600 0700	Malaysia, RTM Kajang/Traxx FM	7295do
0600 0700	Micronesia, V6MP/Cross R/Pohnpei	4755 as
0600 0700 mtwhf	Nigeria, VO Nigeria 15120af	
0600 0700	Palau, T8WH/World Harvest R	17650as
0600 0700	Russia, VO Russia 11635eu 21800va 21820va	
0600 0700 mtwhf	South Africa, Channel Africa 15255af	7230af
0600 0700	Swaziland, TWR Africa 3200af 9500af	6120af
0600 0700	UK, BBC World Service 6005af 6190af 9410af 9460af 12095af 15360eu 15400af 15310as 15420af 17790as	
0600 0700 DRM	UK, BBC World Service 3955eu	
0600 0700	USA, AFN/AFRTS 4319usb 5765usb 12759usb 13362usb	
0600 0700	USA, BBG/VO America 6080af 9885af 15580af	
0600 0700	USA, Overcomer Ministry 3185na 5890na	
0600 0700	USA, WEWN/EWTN Irondale AL	11520af
0600 0700 Sat	USA, WHRI Cypress Creek SC 9615af	7315sa
0600 0700	USA, WTWW Lebanon TN 5830na	
0600 0700	USA, WWCR Nashville TN 3215eu 4840na 5890ca 5935af	
0600 0700	USA, WWRB Manchester TN	3185na
0617 0630 Sun	Nepal, R Nepal 5005do	
0630 0656	Romania, R Romania Intl 7310eu 17780as 21600pa	
0630 0657	Vatican City State, Vatican R 11625af	13765af
0630 0700 wa	Germany, Hamburger Lokalradio	7265eu
0630 0700 DRM	Romania, R Romania Intl 9600eu	
0651 0700 DRM	New Zealand, R New Zealand Intl	11675pa

0700 UTC - 3AM EDT / 2AM CDT / 12AM PDT

0700 0730	Myanmar, Myanma R 5985do	
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/R Australia 7410pa 9475pa 9660pa 9710pa 11945pa 12080pa 13630pa 15240pa	
0700 0800	Australia, NT VL8A Alice Springs	4835do
0700 0800	Australia, NT VL8K Katherine	5025do
0700 0800	Australia, NT VL8T Tennant Creek	4910do
0700 0800	Canada, CFRX Toronto ON 6070do	
0700 0800	Canada, CFVP Calgary AB 6030do	
0700 0800	Canada, CKZN St Johns NF 6160do	
0700 0800	Canada, CKZU Vancouver BC	6160do
0700 0800	Eqt Guinea, Pan Am BC/R Africa	15190af
0700 0800 wa	Germany, Hamburger Lokalradio	7265eu
0700 0800	Germany, R 6150 6070eu	
0700 0800	Malaysia, RTM Kajang/Traxx FM	7295do
0700 0800	Micronesia, V6MP/Cross R/Pohnpei	4755 as
0700 0800	Palau, T8WH/World Harvest R	17650as
0700 0800	Russia, VO Russia 11635eu 12015eu 15745as 21800va 21820va 21840as	
0700 0800 mtwhf	South Africa, Channel Africa	9625af
0700 0800	Swaziland, TWR Africa 3200af 6120af 9500af	
0700 0800	UK, BBC World Service 5875eu 6190af 13820af 11770af 12095af 13820af 15310as 15400af 15575va 17640af 17660eu 17790as 17830as	
0700 0800 DRM	UK, BBC World Service 5875eu 7355eu	
0700 0800	USA, AFN/AFRTS 4319usb 5765usb 12759usb 13362usb	
0700 0800	USA, Overcomer Ministry 3185na 5890na	
0700 0800	USA, WEWN/EWTN Irondale AL	11520af
0700 0800	USA, WHRI Cypress Creek SC 9615af 9930as	7315sa
0700 0800	USA, WTWW Lebanon TN 5830na	
0700 0800	USA, WWCR Nashville TN 3215eu 4840na 5890ca 5935af	
0700 0800	USA, WWRB Manchester TN	3185na
0730 0744	Vatican City State, Vatican R 15595va	
0730 0800	Australia, HCJB Global Australia	15490as
0759 0800	New Zealand, R New Zealand Intl	9765pa
0759 0800 DRM	New Zealand, R New Zealand Intl	9870pa

0800 UTC - 4AM EDT / 3AM CDT / 1AM PDT

0800 0830	Australia, HCJB Global Australia	15490as
0800 0830	Australia, NT VL8A Alice Springs	4835do
0800 0830	Australia, NT VL8K Katherine	5025do
0800 0830	Australia, NT VL8T Tennant Creek	4910do
0800 0830 Sun	Canada, Bible Voice Broadcasting	7220eu
0800 0830	USA, WHRI Cypress Creek SC	11565pa
0800 0845 Sat	Canada, Bible Voice Broadcasting	7220eu
0800 0850	Austria, TWR Europe 7400eu	
0800 0850	Germany, TWR Europe 6105eu	
0800 0857	China, China R International	9415as
	11785as 11880as 15350as	15465as
	15625va 17490eu 17540as	
0800 0900	Anguilla, University Network	6090na
0800 0900	Australia, ABC/R Australia 5995pa	7410pa
	9475pa 9580pa 9710pa	11945pa
	12080pa 15240pa	
0800 0900	Canada, CFRX Toronto ON 6070do	
0800 0900	Canada, CFVP Calgary AB 6030do	
0800 0900	Canada, CKZN St Johns NF 6160do	
0800 0900	Canada, CKZU Vancouver BC	6160do
0800 0900	Eqt Guinea, Pan Am BC/R Africa	15190af
0800 0900	Germany, R 6150 6070eu	
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 mtwhf	Nigeria, VO Nigeria 15120af	
0800 0900	Palau, T8WH/World Harvest R	17650as
0800 0900	Russia, VO Russia 9625eu	11635eu
	15745as 21800va 21830va	21840as
0800 0900 DRM	Russia, VO Russia 9625eu	
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 6190af	12095af
	15310as 15400af 15575va	17640af
	17660eu 17790eu 17830af	21470af
0800 0900 DRM	UK, BBC World Service 5875eu	7355eu
0800 0900	USA, AFN/AFRTS 4319usb	5765usb
	12759usb 13362usb	
0800 0900	USA, KNLS Anchor Point AK	7355as
0800 0900	USA, Overcomer Ministry 3185na	5890na
0800 0900	USA, WEWN/EWTN Irondale AL	11520af
0800 0900	USA, WHRI Cypress Creek SC	7315sa
	9930as	
0800 0900	USA, WTWW Lebanon TN 5830na	
0800 0900	USA, WWCR Nashville TN 3215eu	4840na
	5890ca 5935af	
0800 0900	USA, WWRB Manchester TN	3185na
0815 0827	Nepal, R Nepal 5005do	
0830 0900	Australia, NT VL8A Alice Springs	2310do
0830 0900	Australia, NT VL8K Katherine	2485do
0830 0900	Australia, NT VL8T Tennant Creek	2325do
0850 0900 mtwhf	Guam, KTWR/TWR Asia 15200as	

0900 UTC - 5AM EDT / 4AM CDT / 2AM PDT

0900 0930 mtwhf	Guam, KTWR/TWR Asia 15200as	
0900 0930	Mongolia, Voice of Mongolia	12085as
0900 0930	USA, WHRI Cypress Creek SC	6195sa
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/R Australia 9580pa	11945pa
0900 1000	Australia, NT VL8A Alice Springs	2310do
0900 1000	Australia, NT VL8K Katherine	2485do
0900 1000	Australia, NT VL8T Tennant Creek	2325do
0900 1000	Canada, CFRX Toronto ON 6070do	
0900 1000	Canada, CFVP Calgary AB 6030do	
0900 1000	Canada, CKZN St Johns NF 6160do	
0900 1000	Canada, CKZU Vancouver BC	6160do
0900 1000 Sat/Sun	Germany, Mighty KBC Radio	6095eu
0900 1000	Germany, R 6150 6070eu	
0900 1000 Sat	Italy, IRRS Shortwave 9510va	
0900 1000	Malaysia, RTM Kajang/Traxx FM	7295do
0900 1000	Micronesia, V6MP/Cross R/Pohnpei	4755 as
0900 1000 DRM	New Zealand, R New Zealand Intl	9870pa
0900 1000	New Zealand, R New Zealand Intl	9765pa
0900 1000 mtwhf	Nigeria, VO Nigeria 9690af	
0900 1000	Palau, T8WH/World Harvest R	17650as
0900 1000	Russia, VO Russia 9625eu	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	15285af
	15310as 15400af 15575af	17760as
	17790as 17830af	
0900 1000	USA, AFN/AFRTS 4319usb	5765usb
	12759usb 13362usb	
0900 1000	USA, Overcomer Ministry 3185na	5890na
0900 1000	USA, WEWN/EWTN Irondale AL	11520af
0900 1000	USA, WHRI Cypress Creek SC	9930as
	11565pa	
0900 1000	USA, WTWW Lebanon TN 5830na	
0900 1000	USA, WWCR Nashville TN 4840na	5890ca
	5935af 15825eu	
0900 1000	USA, WWRB Manchester TN	3185na
0905 0910	Pakistan, R Pakistan External Svc	15725eu
	17700eu	
0930 1000 fs	China, VO the Strait 6115do	

1000 UTC - 6AM EDT / 5AM CDT / 3AM PDT

1000 1000	USA, KNLS Anchor Point AK	7355as
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 1058 DRM	New Zealand, R New Zealand Intl	9870pa
1000 1100	Anguilla, University Network	11775na
1000 1100	Australia, ABC/R Australia 6020pa	9580pa
	11945pa	
1000 1100 Sat/Sun	Australia, ABC/R Australia 9475pa	
1000 1100	Australia, NT VL8A Alice Springs	2310do
1000 1100	Australia, NT VL8K Katherine	2485do
1000 1100	Australia, NT VL8T Tennant Creek	2325do
1000 1100	Canada, CFRX Toronto ON 6070do	
1000 1100	Canada, CFVP Calgary AB 6030do	
1000 1100	Canada, CKZN St Johns NF 6160do	
1000 1100	Canada, CKZU Vancouver BC	6160do
1000 1100 Sat/Sun	Germany, Mighty KBC Radio	6095eu
1000 1100	Germany, R 6150 6070eu	
1000 1100	India, AIR/External Svc 7270as	13605as
	13695pa 15030as 15410as	17510pa
	17895pa	
1000 1100	Indonesia, VO Indonesia 9526va	
1000 1100	Malaysia, RTM Kajang/Traxx FM	7295do
1000 1100	Micronesia, V6MP/Cross R/Pohnpei	4755as
1000 1100 mtwhf	Nigeria, VO Nigeria 9690af	
1000 1100	Russia, VO Russia 7260as	9625eu
	15745as	
1000 1100 DRM	Russia, VO Russia 9625eu	
1000 1100	Saudi Arabia, BSKSA/European Pgm	15250as
1000 1100 mtwhf	South Africa, Channel Africa	9625af
1000 1100	UK, BBC World Service 6190af	6195as
	9740as 11760va 12095af	15285as
	15310as 15575eu 17790as	
1000 1100 Sat/Sun	UK, BBC World Service 17830af	
1000 1100	USA, AFN/AFRTS 4319usb	5765usb
	12759usb 13362usb	
1000 1100	USA, Overcomer Ministry 3185na	5890na
1000 1100	USA, WEWN/EWTN Irondale AL	11520af
1000 1100	USA, WHRI Cypress Creek SC	7315sa
	9930as 11565pa	

1000 1100		USA, WTWW Lebanon TN	5830na		
1000 1100		USA, WWCR Nashville TN	4840na	5890ca	
		5935af	15825eu		
1000 1100		USA, WWRB Manchester TN			3185na
1030 1100		Iran, VO Islamic Rep of Iran	21575va	21610va	
1030 1100	Sun	Italy, IRRS Shortwave	9510va		
1059 1100		New Zealand, R New Zealand Intl			15720pa
1059 1100	DRM	New Zealand, R New Zealand Intl			9870pa

1100 UTC - 7AM EDT / 6AM CDT / 4AM PDT

1100 1105		Pakistan, R Pakistan External Svc			15725eu
		17700eu			
1100 1115	mwh	Australia, HCJB Global Australia			15400as
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 1200		Anguilla, University Network			11775na
1100 1200		Australia, ABC/R Australia	5995pa	6020pa	
		6080as	6140as	9580as	11945pa
1100 1200	DRM	Australia, ABC/R Australia	12080pa		
1100 1200		Australia, NT VL8A Alice Springs			2310do
1100 1200		Australia, NT VL8K Katherine			2485do
1100 1200		Australia, NT VL8T Tennant Creek			2325do
1100 1200		Canada, CFRX Toronto ON	6070do		
1100 1200		Canada, CFVP Calgary AB	6030do		
1100 1200		Canada, CKZN St Johns NF	6160do		
1100 1200		Canada, CKZU Vancouver BC			6160do
1100 1200	Sat/Sun	Germany, Mighty KBC Radio			6095eu
1100 1200		Germany, R 6150	6070eu		
1100 1200	Sun	Italy, IRRS Shortwave	9510va		
1100 1200		Malaysia, RTM Kajang/Traxx FM			7295do
1100 1200		Micronesia, V6MP/Cross R/Pohnpei			4755as
1100 1200		New Zealand, R New Zealand Intl			15720pa
1100 1200	DRM	New Zealand, R New Zealand Intl			9870pa
1100 1200	mtwhf	Nigeria, VO Nigeria	9690af		
1100 1200		Russia, VO Russia	7260as	9560as	
		9625eu			
1100 1200	DRM	Russia, VO Russia	9625eu	11640as	
1100 1200		Saudi Arabia, BSKSA/European Pgm			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	17790as	17830af
1100 1200		USA, AFN/AFRTS	4319usb	5765usb	
		12759usb	13362usb		
1100 1200		USA, Overcomer Ministry	3185na	5890na	
1100 1200		USA, Overcomer Ministry	13570as		
1100 1200		USA, WEWN/EWTN Irondale AL			11520af
1100 1200		USA, WHRI Cypress Creek SC			7315ca
		9930as	11565pa		
1100 1200		USA, WTWW Lebanon TN	5830na		
1100 1200		USA, WWCR Nashville TN	4840na	5890ca	
		5935af	15825eu		
1100 1200		USA, WWRB Manchester TN			3185na
1115 1130	f	Canada, Bible Voice Broadcasting			15390as
1130 1145	smtha	Australia, HCJB Global Australia			15340as
1130 1200	Sun	USA, WINB Red Lion PA	135710ca		
1130 1200	f	Vatican City State, Vatican R	17590va	21650va	
1130 1200		Vietnam, VO Vietnam/Overseas Svc			9840as
		12020as			

1200 UTC - 8AM EDT / 7AM CDT / 5AM PDT

1200 1230		Japan, R Japan/NHK World			11740as
		15190na			
1200 1230		Saudi Arabia, BSKSA/European Pgm			15250as
1200 1230	asmtwh	USA, WHRI Cypress Creek SC			9930as
1200 1256		Romania, R Romania Intl	15460eu	17530eu	
		17765af	21570af		
1200 1257		China, China R International			5955as
		7250as	9460as	9600as	9645as
		9730pa	9760as	11760as	11980as
		12015va	13655eu	13790eu	17490eu
1200 1259		New Zealand, R New Zealand Intl			15720pa
1200 1300		Anguilla, University Network			11775na
1200 1300		Australia, ABC/R Australia	6080as	6140as	
		9580as	11945pa		
1200 1300	DRM	Australia, ABC/R Australia	5995as		
1200 1300		Australia, NT VL8A Alice Springs			2310do
1200 1300		Australia, NT VL8K Katherine			2485do
1200 1300		Australia, NT VL8T Tennant Creek			2325do
1200 1300		Canada, CFRX Toronto ON	6070do		
1200 1300		Canada, CFVP Calgary AB	6030do		
1200 1300		Canada, CKZN St Johns NF	6160do		
1200 1300		Canada, CKZU Vancouver BC			6160do
1200 1300		Ethiopia, R Ethiopia/Natl Svc			9705do
1200 1300	Sat/Sun	Germany, Mighty KBC Radio			6095eu
1200 1300		Germany, R 6150	6070eu		
1200 1300	Sun	Italy, IRRS Shortwave	9510va		
1200 1300		Malaysia, RTM Kajang/Traxx FM			7295do
1200 1300	mtwhf	Nigeria, VO Nigeria	9690af		
1200 1300	DRM	Russia, VO Russia	9625eu		
1200 1300		Russia, VO Russia	5885as	7260as	
		9560as	9625eu	12075as	
1200 1300		UK, BBC World Service	5875as	6190af	
		6195as	9740as	11760va	11895as
		12095af	15310as	17640af	17790as
		17830af	21470af		
1200 1300		USA, AFN/AFRTS	4319usb	5765usb	
		12759usb	13362usb		
1200 1300		USA, BBG/VO America	7520va	9640va	
		11750va	12150va		
1200 1300		USA, KNLS Anchor Point AK			7355as
		9615as			
1200 1300		USA, Overcomer Ministry	3185na		
1200 1300	mtwhf	USA, Overcomer Ministry	5890na		
1200 1300		USA, Overcomer Ministry	13570as		
1200 1300		USA, WBCQ Monticello ME	9330na		
1200 1300		USA, WEWN/EWTN Irondale AL			11520af
1200 1300		USA, WHRI Cypress Creek SC			9840na
		11565pa			
1200 1300	Sun	USA, WINB Red Lion PA	13570ca		
1200 1300		USA, WTWW Lebanon TN	5830na		
1200 1300		USA, WWCR Nashville TN	7490af	9980ca	
		13845na	15825eu		
1200 1300		USA, WWRB Manchester TN			3185na
1215 1300		Egypt, R Cairo	17870as		
1230 1245	smtwhf	Australia, HCJB Global Australia			15400pa
1230 1300		Bangladesh, Bangladesh Betar/Ext Svc			
		15105as			
1230 1300		South Korea, KBS World R	6095as		
1230 1300		Thailand, R Thailand World Svc			9720as
1230 1300		USA, WHRI Cypress Creek SC			9930as
1230 1300		Vietnam, VO Vietnam/Overseas Svc			9840as
		12020as			

1300 UTC - 9AM EDT / 8AM CDT / 6AM PDT

1300 1315		Palau, T8WH/World Harvest R			11925as
1300 1330		Egypt, R Cairo	17870as		
1300 1330		Japan, R Japan/NHK World			11730as
1300 1357		China, China R International			5995as
		7300na	9570as	9655pa	9730va
		9765as	9870as	11760as	11900as
		11980as	13670eu	13790eu	
1300 1357		North Korea, VO Korea	7570eu	9335na	
		11710na	12015eu		
1300 1400		Anguilla, University Network			11775na
1300 1400		Australia, ABC/R Australia	5940as	6020pa	
		9580pa	11945pa		
1300 1400	DRM	Australia, ABC/R Australia	5995pa		
1300 1400		Australia, NT VL8A Alice Springs			2310do
1300 1400		Australia, NT VL8K Katherine			2485do
1300 1400		Canada, CFRX Toronto ON	6070do		
1300 1400		Canada, CFVP Calgary AB	6030do		
1300 1400		Canada, CKZN St Johns NF	6160do		
1300 1400		Canada, CKZU Vancouver BC			6160do

1300 1400 Sat/Sun	Germany, Mighty KBC Radio				6095eu
1300 1400	Germany, R 6150	6070eu			
1300 1400	Indonesia, VO Indonesia	9526va			
1300 1400	Malaysia, RTM Kajang/Traxx FM				7295do
1300 1400	New Zealand, R New Zealand Intl				5950pa
1300 1400 mtwhf	Nigeria, VO Nigeria	9690af			
1300 1400 DRM	Russia, VO Russia	9625eu			
1300 1400	Russia, VO Russia	7260as	9560as	12075as	
1300 1400	South Korea, KBS World R	15575as			
1300 1400	Tajikistan, VO Tajik	7245va			
1300 1400	UK, BBC World Service	5875as	6190af	6195as	9410as
	9740as	11760as	11890as	12095af	15310as
	15400as	17790as	17830af	21470af	
1300 1400	USA, AFN/AFRTS	4319usb	5765usb	12759usb	13362usb
1300 1400 Sat/Sun	USA, BBG/VO America	7520va	9640va	11750va	12150va
1300 1400	USA, KJES Vado NM	11715na			
1300 1400 mtwhf	USA, Overcomer Ministry	9980na			
1300 1400	USA, Overcomer Ministry	15370na			
1300 1400	USA, WBCQ Monticello ME	9330na			
1300 1400	USA, WEWN/EWTN Irondale AL				15610eu
1300 1400	USA, WHRI Cypress Creek SC				9930as
	11565pa				
1300 1400 Sat/Sun	USA, WHRI Cypress Creek SC				9840na
1300 1400 Sun	USA, WINB Red Lion PA	13570ca			
1300 1400	USA, WTWW Lebanon TN	9479na			
1300 1400	USA, WWCR Nashville TN	7490af	9980ca	13845na	15825eu
1300 1400	USA, WWRB Manchester TN				9370na
1315 1345	Bangladesh, Bangladesh Betar/Ext Svc				
	7250as				
1330 1400 f	Clandestine, JSR/Shiokaze/Sea Breeze				
	5910as	5985as	6135as		
1330 1400	India, AIR/External Svc	9690as	11620as	13710as	
1330 1400	Turkey, VO Turkey	12035eu			
1330 1400	Vietnam, VO Vietnam/Overseas Svc				9840as
	12020as				
1345 1400 f	Australia, HCJB Global Australia				15400pa

1400 UTC - 10AM EDT / 9AM CDT / 7AM PDT

1400 1415 Sun	USA, Pan Am Broadcasting	15205as			
1400 1425 mtf	Guam, KTWR/TWR Asia	15190as			
1400 1425	Turkey, VO Turkey	12035eu			
1400 1430 f	Clandestine, JSR/Shiokaze/Sea Breeze				
	5910as	5985as	6135as		
1400 1430 h	Guam, KTWR/TWR Asia	15190as			
1400 1430	Japan, R Japan/NHK World				11695as
	11705al	11925as			
1400 1430	Laos, LNR Natl Svc/Vientane				6130do
1400 1430	Serbia, International R Serbia				9635eu
1400 1430	Thailand, R Thailand World Svc				9950as
1400 1430	USA, WHRI Cypress Creek SC				9950as
1400 1435 sw	Guam, KTWR/TWR Asia	15190as			
1400 1457	China, China R International				5955as
	7300na	9460as	9765pa	9795as	9870as
	11665eu	13625as	13685as	13740va	17630va
1400 1500	Anguilla, University Network				11775na
1400 1500	Australia, ABC/R Australia	5940as	5995pa	9580pa	11945pa
1400 1500	Australia, NT VL8A Alice Springs				2310do
1400 1500	Australia, NT VL8K Katherine				2485do
1400 1500	Australia, NT VL8T Tennant Creek				2325do
1400 1500 Sun	Canada, Bible Voice Broadcasting				15470as
1400 1500	Canada, CFRX Toronto ON	6070do			
1400 1500	Canada, CFVP Calgary AB	6030do			
1400 1500	Canada, CKZN St Johns NF	6160do			
1400 1500	Canada, CKZU Vancouver BC				6160do
1400 1500	Eqt Guinea, Pan Am BC/R Africa				15190af
1400 1500 Sat/Sun	Germany, Mighty KBC Radio				6095eu
1400 1500	Germany, R 6150	6070eu			
1400 1500	India, AIR/External Svc	9690as	11620as	13710as	
1400 1500	Malaysia, RTM Kajang/Traxx FM				7295do
1400 1500	New Zealand, R New Zealand Intl				5950pa
1400 1500 mtwhf	Nigeria, VO Nigeria	9690af			
1400 1500	Oman, R Sultanate of Oman				15560af
1400 1500	Russia, VO Russia	4960va	6235as	7260as	9560as
	12075as				
1400 1500	South Korea, KBS World R	9640as			
1400 1500	UK, BBC World Service	5845as	5875as	6190af	11760as
	11890as	12095af	15310as	15400as	17640af
	17830af	21470af			
1400 1500	USA, AFN/AFRTS	4319usb	5765usb	12759usb	13362usb
1400 1500 mtwhf	USA, BBG/VO America	7520va	9760va	12150va	
1400 1500	USA, BBG/VO America	4930af	6080af	15580af	17530af
	17725af				
1400 1500	USA, KJES Vado NM	11715na			
1400 1500	USA, KNLS Anchor Point AK				7355as
	9615as				
1400 1500 mtwhf	USA, Overcomer Ministry	9980na	13570ca	13810me	
1400 1500	USA, Overcomer Ministry	9370va	9460eu		
1400 1500	USA, WBCQ Monticello ME	9330na			
1400 1500 Sat	USA, WBCQ Monticello ME	15420na			
1400 1500	USA, WEWN/EWTN Irondale AL				15610eu
1400 1500 Sat/Sun	USA, WHRI Cypress Creek SC				9840na
	21600af				
1400 1500 Sun	USA, WINB Red Lion PA	13570ca			
1400 1500	USA, WJHR Intl Milton FL	15550	lsb		
1400 1500	USA, WRNO New Orleans LA				7505na
1400 1500	USA, WTWW Lebanon TN	9479na			
1400 1500	USA, WWCR Nashville TN	7490af	9980ca	13845na	15825eu
1400 1500	USA, WWRB Manchester TN				9370na
1415 1427	Nepal, R Nepal	5005do			
1415 1430	USA, Pan Am Broadcasting	15205as			
1425 1455	Swaziland, TWR Africa	6025af			
1430 1445 Sun	USA, Pan Am 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	Palau, T8WH/World Harvest R				11925as
1430 1500	USA, WHRI Cypress Creek SC				9965as

1500 UTC - 11AM EDT / 10AM CDT / 8AM PDT

1500 1530	Australia, ABC/R Australia	11945pa			
1500 1530	Australia, HCJB Global Australia				15400pa
1500 1530 Sun	Canada, Bible Voice Broadcasting				13740as
1500 1530 Sun	Germany, R Santec	15190as			
1500 1530 Sun	Italy, IRRS Shortwave	15190va			
1500 1530	Vietnam, VO Vietnam/Overseas Svc				7285as
	9840as	12020as			
1500 1550	New Zealand, R New Zealand Intl				5950pa
1500 1557	China, China R International				5955as
	6095eu	7325eu	7405as	9435me	9525as
	9650as	9720eu	9785eu	9870na	13685af
	13740eu	17630af			
1500 1557	North Korea, VO Korea	7570eu	9335na	11710na	12015eu
1500 1600	Anguilla, University Network				11775na
1500 1600	Australia, ABC/R Australia	5940as	5995pa	7240pa	9475as
	11660as				
1500 1600	Australia, NT VL8A Alice Springs				2310do
1500 1600	Australia, NT VL8K Katherine				2485do
1500 1600	Canada, CFRX Toronto ON	6070do			
1500 1600	Canada, CFVP Calgary AB	6030do			
1500 1600	Canada, CKZN St Johns NF	6160do			
1500 1600	Canada, CKZU Vancouver BC				6160do
1500 1600	Eqt Guinea, Pan Am BC/R Africa				15190af
1500 1600 Sat/Sun	Germany, Mighty KBC Radio				6095eu
1500 1600	Germany, R 6150	6070eu			
1500 1600	Malaysia, RTM Kajang/Traxx FM				7295do
1500 1600 mtwhf	Nigeria, VO Nigeria	15120af			
1500 1600	Palau, T8WH/World Harvest R				15680as

1500 1600		Russia, VO Russia	4960va	5900as	
		11985me			
1500 1600 mtwhf		South Africa, Channel Africa		9625af	
1500 1600		UK, BBC World Service	5845as	5875as	
		5975as	6190af	6195as	9410as
		9490af	9740as	9505af	11760eu
		12095af	15400af	17640af	17830af
		21470af			
1500 1600		USA, AFN/AFRTS	4319usb	5765usb	
		12759usb	13362usb		
1500 1600		USA, BBG/VO America	4930af	6080af	
		7520va	9930va	11840va	12150va
		13570va	17725af	17895af	
1500 1600		USA, KJES Vado NM	11715na		
1500 1600 mtwhf		USA, Overcomer Ministry	9980na	13570ca	
		13810me			
1500 1600 Sat		USA, Overcomer Ministry	15420na		
1500 1600		USA, WBCQ Monticello ME	9330na		
1500 1600 Sat		USA, WBCQ Monticello ME	15420na		
1500 1600		USA, WEWN/EWTN Irondale AL		15610eu	
1500 1600 Sat		USA, WHRI Cypress Creek SC		21630af	
1500 1600 Sun		USA, WHRI Cypress Creek SC		17570eu	
1500 1600 Sat/Sun		USA, WHRI Cypress Creek SC		9840na	
1500 1600 Sun		USA, WINB Red Lion PA	13570ca		
1500 1600		USA, WJHR Intl Milton FL	15550	lsb	
1500 1600		USA, WRNO New Orleans LA		7505na	
1500 1600		USA, WTWW Lebanon TN	9479na		
1500 1600		USA, WWCR Nashville TN	9980ca	12160af	
		13845na	15825eu		
1500 1600		USA, WWRB Manchester TN		9370na	
1515 1530 Sat		Canada, Bible Voice Broadcasting		13740as	
1525 1555 Sat/Sun		Swaziland, TWR Africa	6025af		
1530 1545		India, AIR/External Svc	9910as		
1530 1549 smtwhf		Vatican City State, Vatican R	7485as		
1530 1550 smtwhf		Vatican City State, Vatican R	15595as		
1530 1550 smtwhf/DRM		Vatican City State, Vatican R		15775as	
1530 1600		Afghanistan, R Afghanistan	7200as		
1530 1600		Australia, ABC/R Australia	11880pa		
1530 1600 DRM		Belgium, The Disco Palace	12115as		
1530 1600 h		Canada, Bible Voice Broadcasting		13740as	
1530 1600		Iran, VO Islamic Rep of Iran	13785va	15525va	
1530 1600		Mongolia, Voice of Mongolia		12015as	
1530 1600		Myanmar, Myanma R	5985do		
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		7285pa	

1600 UTC - 12PM EDT / 11AM CDT / 9AM PDT

1600 1627		Iran, VO Islamic Rep of Iran	13785va	15525va	
1600 1630		Australia, ABC/R Australia	9580as		
1600 1630 DRM		Belgium, The Disco Palace	12115as		
1600 1630		Indonesia, AWR Asia/Pacific		15215as	
		15660as			
1600 1630		Myanmar, Myanma R	5985do		
1600 1630 Sun		USA, WINB Red Lion PA	13570ca		
1600 1650 DRM		New Zealand, R New Zealand Intl		7285pa	
1600 1650		New Zealand, R New Zealand Intl		9765pa	
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 1657		Vietnam, VO Vietnam/Overseas Svc		7216me	
		7280eu	9550me	9730eu	
1600 1658		Taiwan, R Taiwan Intl	9440as	15485as	
1600 1700		Anguilla, University Network		11775na	
1600 1700		Australia, ABC/R Australia	5940as	5995pa	
		7240pa	9475as	11660pa	11880pa
1600 1700		Australia, NT VL8A Alice Springs		2310do	
1600 1700		Australia, NT VL8K Katherine		2485do	
1600 1700		Canada, CFRX Toronto ON	6070do		
1600 1700		Canada, CFVP Calgary AB	6030do		
1600 1700		Canada, CKZN St Johns NF	6160do		
1600 1700		Canada, CKZU Vancouver BC		6160do	
1600 1700		Egypt, R Cairo	15345af		
1600 1700		Eqt Guinea, Pan Am BC/R Africa		15190af	
1600 1700		Ethiopia, R Ethiopia/External Svc		7235af	
		9558af			
1600 1700 wa		Germany, Hamburger Lokalradio		7265eu	
1600 1700 DRM		Germany, Mighty KBC Radio		9755eu	
1600 1700		Germany, R 6150	6070eu		
1600 1700		Malaysia, RTM Kajang/Traxx FM		7295do	
1600 1700		Palau, T8WH/World Harvest R		15680as	
1600 1700		Russia, VO Russia	4960va	5885as	
		5900as	5995as	7390as	
1600 1700		South Korea, KBS World R	9515eu	9640as	
1600 1700		UK, BBC World Service	3255af	5845as	
		5975as	6190af	9410va	9505as
		9915eu	12095af	15400af	17640af
		17830af	21470af	21660af	
1600 1700		USA, AFN/AFRTS	4319usb	5765usb	
		12759usb	13362usb		
1600 1700		USA, BBG/VO America	4930af	6080af	
		15580af	17895af		
1600 1700 mtwhf		USA, Overcomer Ministry	9980na		
1600 1700		USA, Overcomer Ministry	9370va		
1600 1700		USA, WBCQ Monticello ME	9330na		
1600 1700 Sat		USA, WBCQ Monticello ME	15420na		
1600 1700		USA, WEWN/EWTN Irondale AL		15610eu	
1600 1700		USA, WHRI Cypress Creek SC		9840na	
		21630af			
1600 1700		USA, WJHR Intl Milton FL	15550	lsb	
1600 1700		USA, WRNO New Orleans LA		7505na	
1600 1700		USA, WTWW Lebanon TN	9479na		
1600 1700		USA, WWCR Nashville TN	9980ca	12160af	
		13845na	15825eu		
1600 1700		USA, WWRB Manchester TN		9370na	
1630 1700		Indonesia, AWR Asia/Pacific		15660as	
1630 1700 m		South Africa, R Mirror Intl	4895af		
1630 1700 mtwhf		USA, BBG/VO America/S Sudan in Focus			
		11905af	13625af		
1630 1700 Sat/Sun		USA, WINB Red Lion PA	13570ca		
1645 1700 mw		Canada, Bible Voice Broadcasting		9715me	
1645 1700 thfas		Canada, Bible Voice Broadcasting		9715me	
1651 1700		New Zealand, R New Zealand Intl		9765pa	
1651 1700 DRM		New Zealand, R New Zealand Intl		9630pa	

1700 UTC - 1PM EDT / 12PM CDT / 10AM PDT

1700 1710		Pakistan, Azad Kashmir R	3975do	4790do	
1700 1710		Pakistan, R Pakistan External Svc		15725eu	
		17700eu			
1700 1715 f		Canada, Bible Voice Broadcasting		9715me	
1700 1730		Australia, ABC/R Australia	11660as		
1700 1730 DRM		Germany, AWR Europe	9755eu		
1700 1730 m		South Africa, R Mirror Intl	4895af		
1700 1745 h		Canada, Bible Voice Broadcasting		9715me	
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/R Australia	5995pa	9475as	
		9500pa	9580pa	11880pa	
1700 1800		Australia, NT VL8A Alice Springs		2310do	
1700 1800		Australia, NT VL8K Katherine		2485do	
1700 1800 tas		Canada, Bible Voice Broadcasting		9715me	
1700 1800		Canada, CFRX Toronto ON	6070do		
1700 1800		Canada, CFVP Calgary AB	6030do		
1700 1800		Canada, CKZN St Johns NF	6160do		
1700 1800		Canada, CKZU Vancouver BC		6160do	
1700 1800		Egypt, R Cairo	15345af		
1700 1800		Eqt Guinea, Pan Am BC/R Africa		15190af	
1700 1800		Germany, R 6150	6070eu		
1700 1800		Malaysia, RTM Kajang/Traxx FM		7295do	
1700 1800 DRM		New Zealand, R New Zealand Intl		9630pa	
1700 1800		New Zealand, R New Zealand Intl		9765pa	
1700 1800		Palau, T8WH/World Harvest R		15680as	
1700 1800		Russia, VO Russia	4960va	5900as	
		5955as	7390as		
1700 1800 mtwhf		South Africa, Channel Africa		15235af	
1700 1800		Swaziland, TWR Africa	3200af		

1700 1800 Sat/Sun	Swaziland, TWR Africa	3200af			
1700 1800	UK, BBC World Service	3255af	5845as		
	5975as	6190af	12095af	15400af	
	15420af	17640af	17830af	21660af	
1700 1800	USA, AFN/AFRTS	4319usb	5765usb		
	12759usb	13362usb			
1700 1800	USA, BBG/VO America	6080af	13755af		
	15580af	17895af			
1700 1800 mtwhf	USA, Overcomer Ministry	9980na			
1700 1800 Sat	USA, Overcomer Ministry	15420na			
1700 1800	USA, Overcomer Ministry	9370va	9625me		
1700 1800	USA, WBCQ Monticello ME	9330na			
1700 1800 Sat	USA, WBCQ Monticello ME	15420na			
1700 1800	USA, WEWN/EWTN Irondale AL		15610me		
1700 1800	USA, WHRI Cypress Creek SC		9840na		
	21630af				
1700 1800 Sat/Sun	USA, WINB Red Lion PA	13570ca			
1700 1800	USA, WJHR Intl Milton FL	15550	lsb		
1700 1800	USA, WRNO New Orleans LA		7505na		
1700 1800	USA, WTWW Lebanon TN	9479na			
1700 1800	USA, WWCR Nashville TN	9980ca	12160af		
	13845na	15825eu			
1700 1800	USA, WWRB Manchester TN		9370na		
1715 1729	Vatican City State, Vatican R	11935va			
1730 1757	Vatican City State, Vatican R	11625af	13765af		
	15570af				
1730 1800	Australia, ABC/R Australia	6080pa			
1730 1800	Turkey, VO Turkey	11730as			
1745 1800	Bangladesh, Bangladesh Betar/Ext Svc				
	7250eu				
1745 1800	India, AIR/External Svc	7550eu	9445va		
	9950eu	11580af	11670eu	11935af	
	13695af	17670af			

1800 UTC - 2PM EDT / 1PM CDT / 11AM PDT

1800 1815 Sat	Canada, Bible Voice Broadcasting		7365me		
1800 1825	Turkey, VO Turkey	11730as			
1800 1830	Japan, R Japan/NHK World		15720af		
1800 1830 irreg	Tanzania, Zanzibar BC/VO Tanzania		11735do		
1800 1830	UK, BBC World Service	5975as	7600as		
1800 1830	USA, BBG/VO America	6080af	13755af		
	15580af				
1800 1830 Sat/Sun	USA, BBG/VO America	4930af			
1800 1830	Vietnam, VO Vietnam/Overseas Svc		5955eu		
1800 1850	New Zealand, R New Zealand Intl		9765pa		
1800 1850 DRM	New Zealand, R New Zealand Intl		9630pa		
1800 1856 DRM	Romania, R Romania Intl	9780eu			
1800 1856	Romania, R Romania Intl	7300eu			
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/R Australia	6080pa	9475as		
	9500pa	9580as	11880pa		
1800 1900 Sat/Sun	Australia, ABC/R Australia	9710as			
1800 1900	Australia, NT VL8A Alice Springs		2310do		
1800 1900	Australia, NT VL8K Katherine		2485do		
1800 1900	Bangladesh, Bangladesh Betar/Ext Svc				
	7250eu				
1800 1900 Sat/Sun	Canada, Bible Voice Broadcasting		9715me		
1800 1900 Sat	Canada, Bible Voice Broadcasting		9470me		
1800 1900 Sun	Canada, Bible Voice Broadcasting		6030eu		
1800 1900	Canada, CFRX Toronto ON	6070do			
1800 1900	Canada, CFVP Calgary AB	6030do			
1800 1900	Canada, CKZN St Johns NF	6160do			
1800 1900	Canada, CKZU Vancouver BC		6160do		
1800 1900	Eqt Guinea, Pan Am BC/R Africa		15190af		
1800 1900	Germany, R 6150	6070eu			
1800 1900	India, AIR/External Svc	7550eu	9445va		
	9950eu	11580af	11670eu	11935af	
	13695af	17670af			
1800 1900	Kuwait, R Kuwait	15540eu			
1800 1900	Malaysia, RTM Kajang/Traxx FM		7295do		
1800 1900 mtwhf	Nigeria, VO Nigeria	15120af			
1800 1900	Palau, T8WH/World Harvest R		15680as		
1800 1900	Russia, VO Russia	4960va	11985va		
1800 1900	South Korea, KBS World R	7275eu			
1800 1900	Swaziland, TWR Africa	3200af	9500af		
1800 1900 Sat/Sun	Swaziland, TWR Africa	3200af			
1800 1900	UK, BBC World Service	3255af	5875eu		
	5945eu	6190af	9430af	11810af	
	12095af	15400af	17640af		
1800 1900	USA, AFN/AFRTS	4319usb	5765usb		
	12759usb	13362usb			
1800 1900	USA, KJES Vado NM	15385pa			
1800 1900 mtwhf	USA, Overcomer Ministry	9980na			
1800 1900	USA, Overcomer Ministry	9370va	9625me		
1800 1900	USA, WBCQ Monticello ME	9330na			
1800 1900 Sat	USA, WBCQ Monticello ME	15420na			
1800 1900	USA, WEWN/EWTN Irondale AL		15610me		
1800 1900	USA, WHRI Cypress Creek SC		9840na		
	9930as	21630af			
1800 1900	USA, WINB Red Lion PA	13570ca			
1800 1900	USA, WTWW Lebanon TN	9479na			
1800 1900	USA, WWCR Nashville TN	9980ca	12160af		
	13845na	15825eu			
1800 1900	USA, WWRB Manchester TN		9370na		
1815 1845 Sat	Canada, Bible Voice Broadcasting		6030eu		
1815 1845 Sun	Canada, Bible Voice Broadcasting		9470me		
1830 1845	Rwanda, R Rep Rwandaise	6055do			
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/VO America	4930af	6080af		
	13755af	15580af			
1851 1900	New Zealand, R New Zealand Intl		11725pa		
1851 1900 DRM	New Zealand, R New Zealand Intl		15720pa		

1900 UTC - 3PM EDT / 2PM CDT / 12PM PDT

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 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/R Australia	6080pa	9500as		
	9580pa	11660as	11880pa		
1900 2000 Sat/Sun	Australia, ABC/R Australia	9710as			
1900 2000	Australia, NT VL8A Alice Springs		2310do		
1900 2000	Australia, NT VL8K Katherine		2485do		
1900 2000	Canada, CFRX Toronto ON	6070do			
1900 2000	Canada, CFVP Calgary AB	6030do			
1900 2000	Canada, CKZN St Johns NF	6160do			
1900 2000	Canada, CKZU Vancouver BC		6160do		
1900 2000	Egypt, R Cairo	15290af			
1900 2000	Eqt Guinea, Pan Am BC/R Africa		15190af		
1900 2000	Germany, R 6150	6070eu			
1900 2000	Indonesia, VO Indonesia	9526va			
1900 2000 fas	Italy, IRRS Shortwave	7290va			
1900 2000	Kuwait, R Kuwait	15540eu			
1900 2000	Malaysia, RTM Kajang/Traxx FM		7295do		
1900 2000	Micronesia, V6MP/Cross R/Pohnpei		4755as		
1900 2000	New Zealand, R New Zealand Intl		11725pa		
1900 2000 DRM	New Zealand, R New Zealand Intl		15720pa		
1900 2000 mtwhf	Nigeria, VO Nigeria	7255af			
1900 2000	Palau, T8WH/World Harvest R		15680as		
1900 2000 mtwhf	Spain, R Exterior de Espana	9605af	9665eu		
1900 2000	Swaziland, TWR Africa	3200af			
1900 2000 Sat/Sun	Swaziland, TWR Africa	3200af			
1900 2000	Thailand, R Thailand World Svc		9585eu		
1900 2000	UK, BBC World Service	3255af	5875eu		
	5945eu	6190af	9410af	9430af	
	11810af	12095af	15400af		
1900 2000	USA, AFN/AFRTS	4319usb	5765usb		
	12759usb	13362usb			
1900 2000	USA, BBG/VO America	4930af	6080af		
	15580af				

1900 2000 mtwhf	USA, Overcomer Ministry	9980na	13570ca	
1900 2000	USA, Overcomer Ministry	9370va	9625me	
	9835af	13570ca		
1900 2000 Sat/Sun	USA, Overcomer Ministry	9980na		
1900 2000	USA, WBCQ Monticello ME	9330na	15420na	
1900 2000 twhfa	USA, WBCQ Monticello ME	7490na		
1900 2000	USA, WEWN/EWTN Irondale AL		15610me	
1900 2000	USA, WHRI Cypress Creek SC		9840na	
	21630af			
1900 2000	USA, WINB Red Lion PA	13570ca		
1900 2000	USA, WTWW Lebanon TN	9479na	9930sa	
1900 2000	USA, WWCR Nashville TN	9980ca	12160af	
	13845na	15825eu		
1900 2000	USA, WWRB Manchester TN		9370na	
1905 1920 Sat	Mali, ORTM/R Mali	9635do		
1930 1957	Germany, Deutsche Welle	12070af	15275af	
1930 2000	Iran, VO Islamic Rep of Iran	6040eu	7345eu	
	12670af	15450af		
1930 2000	Serbia, International R Serbia		6100eu	
1930 2000	Turkey, VO Turkey	6050eu		
1930 2000 Sun	USA, Pan Am Broadcasting	9685af		

2000 UTC - 4PM EDT / 3PM CDT / 1PM PDT

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 Sat/Sun	Swaziland, TWR Africa	3200af		
2000 2030	Turkey, VO Turkey	6050eu		
2000 2030	USA, BBG/VO America	4930af	6080af	
	15580af			
2000 2030 mtwhf	USA, Overcomer Ministry	13570ca		
2000 2030 Sun	USA, Pan Am Broadcasting	9685af		
2000 2050	New Zealand, R New Zealand Intl		11725pa	
2000 2050 DRM	New Zealand, R New Zealand Intl		15720pa	
2000 2057	China, China R International		5960eu	
	5985af	7285eu	7295va	7415eu
	9440af	9600eu	11640eu	13630eu
2000 2057	Germany, Deutsche Welle	9655af		
2000 2100	Anguilla, University Network		11775na	
2000 2100	Australia, ABC/R Australia	9580pa	11650pa	
	11660pa	12080pa	15515pa	
2000 2100	Australia, NT VL8A Alice Springs		2310do	
2000 2100	Australia, NT VL8K Katherine		2485do	
2000 2100	Australia, NT VL8T Tennant Creek		2325do	
2000 2100	Belarus, R Belarus	6155eu	11730eu	
2000 2100 DRM	Belgium, The Disco Palace	17875na		
2000 2100	Canada, CFRX Toronto ON	6070do		
2000 2100	Canada, CFVP Calgary AB	6030do		
2000 2100	Canada, CKZN St Johns NF	6160do		
2000 2100	Canada, CKZU Vancouver BC		6160do	
2000 2100 f	Clandestine, JSR/Shiokaze/Sea Breeze			
	5910as	5965as	6110as	
2000 2100	Cuba, R Havana Cuba	11760am		
2000 2100	Eqt Guinea, Pan Am BC/R Africa		15190af	
2000 2100	Germany, R 6150	6070eu		
2000 2100	Italy, IRRS Shortwave	7290va		
2000 2100	Kuwait, R Kuwait	15540eu		
2000 2100	Malaysia, RTM Kajang/Traxx FM		7295do	
2000 2100	Micronesia, V6MP/Cross R/Pohnpei		4755as	
2000 2100	Palau, T8WH/World Harvest R		15680as	
2000 2100	UK, BBC World Service	3255af	6190af	
	9410af	9430af	11810af	12095af
	15400af			
2000 2100	USA, AFN/AFRTS	4319usb	5765usb	
	12759usb	13362usb		
2000 2100 mtwhf	USA, BBG/VO America	9480va		
2000 2100	USA, Overcomer Ministry	9370va	9980na	
2000 2100 mtwhfa	USA, WBCQ Monticello ME	7490na		
2000 2100	USA, WBCQ Monticello ME	9330na	15420na	
2000 2100	USA, WEWN/EWTN Irondale AL		15610me	
2000 2100	USA, WHRI Cypress Creek SC		9505eu	
	21630af			
2000 2100	USA, WINB Red Lion PA	13570ca		
2000 2100	USA, WTWW Lebanon TN	9479na	9930sa	
2000 2100	USA, WWCR Nashville TN	9980ca	12160af	
	13845na	15825eu		
2000 2100	USA, WWRB Manchester TN		9370na	
2030 2045	Thailand, R Thailand World Svc		9535eu	
2030 2100	Australia, ABC/R Australia	9500pa	11695as	
2030 2100	USA, BBG/VO America	4930af	6080af	
	7560as	15580af		
2030 2100 Sat/Sun	USA, BBG/VO America	4930af		
2030 2100	Vietnam, VO Vietnam/Overseas Svc		7216me	
	7280eu	9550me	9730eu	
2045 2100	India, AIR/External Svc	7550eu	9445eu	
	9910pa	11620pa	11670eu	11740pa
2045 2100 DRM	India, AIR/External Svc	9950eu		
2051 2100 DRM	New Zealand, R New Zealand Intl		17675pa	

2100 UTC - 5PM EDT / 4PM CDT / 2PM PDT

2100 2115 mtwhf	Moldova, R PMR/Pridnestrovye		7290eu	
2100 2130 mtwhfa	Albania, R Tirana	7465eu		
2100 2130	Australia, NT VL8A Alice Springs		2310do	
2100 2130	Australia, NT VL8K Katherine		2485do	
2100 2130	Australia, NT VL8T Tennant Creek		2325do	
2100 2130	Austria, AWR Europe	9830af		
2100 2150	New Zealand, R New Zealand Intl		15720pa	
2100 2150 DRM	New Zealand, R New Zealand Intl		17675pa	
2100 2157	China, China R International		5960eu	
	7205af	7285eu	7405af	7415eu
	9600eu			
2100 2157	North Korea, VO Korea	7570eu	12015eu	
2100 2200	Angola, R Nac de Angola/Intl Svc		7217af	
2100 2200	Anguilla, University Network		11775na	
2100 2200	Australia, ABC/R Australia	9500pa	9660as	
	11650pa	11695pa	12080pa	13630pa
	15515pa	21740pa		
2100 2200	Belarus, R Belarus	6155eu	11730eu	
2100 2200	Canada, CFRX Toronto ON	6070do		
2100 2200	Canada, CFVP Calgary AB	6030do		
2100 2200	Canada, CKZN St Johns NF	6160do		
2100 2200	Canada, CKZU Vancouver BC		6160do	
2100 2200	Egypt, R Cairo	11890eu	12050al	
2100 2200	Eqt Guinea, Pan Am BC/R Africa		15190af	
2100 2200	Germany, Deutsche Welle	11800af	12070af	
2100 2200	Germany, R 6150	6070eu		
2100 2200	India, AIR/External Svc	7550eu	9445eu	
	9910pa	11620pa	11670eu	11740pa
2100 2200 DRM	India, AIR/External Svc	9950eu		
2100 2200	Malaysia, RTM Kajang/Traxx FM		7295do	
2100 2200	Micronesia, V6MP/Cross R/Pohnpei		4755 as	
2100 2200	Palau, T8WH/World Harvest R		15680as	
2100 2200	Syria, R Damascus	9330va		
2100 2200	UK, BBC World Service	3255af	3915as	
	5875as	5905as	5995af	6190af
	6195as	9410af	9915af	12095af
2100 2200	USA, AFN/AFRTS	4319usb	5765usb	
	12759usb	13362usb		
2100 2200	USA, BBG/VO America	6080af	15580af	
2100 2200	USA, Overcomer Ministry	9370va		
2100 2200 Sat/Sun	USA, Overcomer Ministry	9980na		
2100 2200	USA, WBCQ Monticello ME	7490na	9330na	
2100 2200	USA, WEWN/EWTN Irondale AL		15610me	
2100 2200	USA, WHRI Cypress Creek SC		9490eu	
	21630af			
2100 2200	USA, WINB Red Lion PA	9265ca		
2100 2200	USA, WTWW Lebanon TN	9479na	9930sa	
2100 2200	USA, WWCR Nashville TN	6875eu	9350af	
	9980ca	13845na		
2100 2200	USA, WWRB Manchester TN		3215na	
	9370na			
2130 2156 DRM	Romania, R Romania Intl	6030eu		
2130 2156	Romania, R Romania Intl	7310na	7380eu	
	9435na			
2130 2200	Australia, NT VL8A Alice Springs		4835do	
2130 2200	Australia, NT VL8K Katherine		5025do	
2130 2200	Australia, NT VL8T Tennant Creek		4910do	
2130 2200	Turkey, VO Turkey	9610as		
2145 2200 mtwhf	Moldova, R PMR/Pridnestrovye		7290eu	
2151 2200	New Zealand, R New Zealand Intl		15720pa	
2151 2200 DRM	New Zealand, R New Zealand Intl		17675pa	

2200 UTC - 6PM EDT / 5PM CDT / 3PM PDT

2200 2225	Turkey, VO Turkey	9610as		
2200 2230	India, AIR/External Svc	9910pa	11620pa	
	11670eu	11740pa		
2200 2230 DRM	India, AIR/External Svc	9950eu		
2200 2230	Serbia, International R Serbia		6100eu	
2200 2230	South Korea, KBS World R	3955eu		
2200 2245	Egypt, R Cairo	11890eu	12050al	
2200 2257	China, China R International		5915eu	
2200 2300	Anguilla, University Network		6090na	
2200 2300	Australia, ABC/R Australia	9660as	9855as	
	12080pa	13630pa	15230pa	15415pa
	15515pa	21740pa		
2200 2300	Australia, NT VL8A Alice Springs		4835do	
2200 2300	Australia, NT VL8K Katherine		5025do	
2200 2300	Australia, NT VL8T Tennant Creek		4910do	
2200 2300	Canada, CFRX Toronto ON	6070do		
2200 2300	Canada, CFVP Calgary AB	6030do		
2200 2300	Canada, CKZN St Johns NF	6160do		
2200 2300	Canada, CKZU Vancouver BC		6160do	
2200 2300	Cuba, R Havana Cuba	11880af		
2200 2300	Eqt Guinea, Pan Am BC/R Africa		15190af	
2200 2300	Germany, R 6150	6070eu		
2200 2300	Malaysia, RTM Kajang/Traxx FM		7295do	
2200 2300	Micronesia, V6MP/Cross R/Pohnpei		4755 as	
2200 2300	New Zealand, R New Zealand Intl		15720pa	
2200 2300 DRM	New Zealand, R New Zealand Intl		17675pa	
2200 2300	Palau, T8WH/World Harvest R		15180na	
	15680as			
2200 2300	Russia, VO Russia	9395ca		
2200 2300 Sat/Sun	Spain, R Exterior de Espana	6125eu		
2200 2300	Taiwan, R Taiwan Intl	6115na	15440na	
2200 2300	UK, BBC World Service	3915as	5875as	
	5885af	5905as	6135as	6195as
	7490as			
2200 2300	USA, AFN/AFRTS	4319usb	5765usb	
	12759usb	13362usb		
2200 2300 smtwhf	USA, BBG/VO America	5895va	7365va	
	7425va	7480va	11860va	
2200 2300	USA, Overcomer Ministry	5900eu	9370va	
	9980na			
2200 2300	USA, WBCQ Monticello ME	7490na	9330na	
2200 2300	USA, WEWN/EWTN Irondale AL		15610me	
2200 2300	USA, WHRI Cypress Creek SC		9490eu	
	9505eu			
2200 2300	USA, WINB Red Lion PA	9265ca		
2200 2300	USA, WTWW Lebanon TN	9479na	9930sa	
2200 2300	USA, WWCR Nashville TN	6875eu	9350af	
	9980ca	13845na		
2200 2300	USA, WWRB Manchester TN		3215na	
	9370na			
2230 2300	China, Xizang PBS	4905do		
2230 2300	Indonesia, AWR Asia/Pacific		15320as	
2245 2300	India, AIR/External Svc	9690as	9705as	
	11710as	13605as		
2245 2300 DRM	India, AIR/External Svc	11645as		

2300 UTC - 7PM EDT / 6PM CDT / 4PM PDT

2300 0000	Anguilla, University Network		6090na	
2300 0000	Australia, ABC/R Australia	9660as	9855as	
	12080pa	15230pa	15415pa	17795pa
	19000pa	21740pa		
2300 0000	Australia, NT VL8A Alice Springs		4835do	
2300 0000	Australia, NT VL8K Katherine		5025do	
2300 0000	Australia, NT VL8T Tennant Creek		4910do	
2300 0000	Canada, CFRX Toronto ON	6070do		
2300 0000	Canada, CFVP Calgary AB	6030do		
2300 0000	Canada, CKZN St Johns NF	6160do		
2300 0000	Canada, CKZU Vancouver BC		6160do	
2300 0000	Egypt, R Cairo	9965am	11510al	
2300 0000	Germany, R 6150	6070eu		
2300 0000	India, AIR/External Svc	6055as	9690as	
	9705as	11710as	13605as	
2300 0000 DRM	India, AIR/External Svc	11645as		
2300 0000	Malaysia, RTM Kajang/Traxx FM		7295do	
2300 0000	Micronesia, V6MP/Cross R/Pohnpei		4755 as	
2300 0000	New Zealand, R New Zealand Intl		15720pa	
2300 0000 DRM	New Zealand, R New Zealand Intl		17675pa	
2300 0000	Palau, T8WH/World Harvest R		7385na	
	15680as			
2300 0000	Romania, R Romania Intl	6015eu	7220eu	
	9530as	11810as		
2300 0000	Russia, VO Russia	9395ca		
2300 0000	UK, BBC World Service	3915as	5875as	
	5980as	6135as	6195as	7490as
	9740as	11955as		
2300 0000	USA, AFN/AFRTS	4319usb	5765usb	
	12759usb	13362usb		
2300 0000	USA, BBG/VO America	5830va	7365va	
	7480va	11860va		
2300 0000	USA, Overcomer Ministry	9370va		
2300 0000 mtwhf	USA, Overcomer Ministry	9980na		
2300 0000	USA, WBCQ Monticello ME	7490na	9330na	
2300 0000 Sat/Sun	USA, WBCQ Monticello ME	5110na		
2300 0000	USA, WEWN/EWTN Irondale AL		15610me	
2300 0000 smtwhf	USA, WHRI Cypress Creek SC		7315ca	
	9490eu			
2300 0000 Sat	USA, WHRI Cypress Creek SC		7315ca	
	9505eu			
2300 0000 smtwhf	USA, WHRI Cypress Creek SC		9490eu	
2300 0000	USA, WINB Red Lion PA	9265ca		
2300 0000	USA, WTWW Lebanon TN	5085na	9479na	
2300 0000	USA, WWCR Nashville TN	6875eu	9350af	
	9980ca	13845na		
2300 0000	USA, WWRB Manchester TN		3215na	
	9370na			
2300 2355	Turkey, VO Turkey	5960na		
2300 2357	China, China R International		5915as	
	5990ca	6145na	7350eu	7415as
	9535as	11790as		
2330 0000	Australia, ABC/R Australia	17750pa		
2330 0000 tw	Indonesia, AWR Asia/Pacific		17700as	
2330 0000	USA, WYFR/Family R	6115na		
2330 0000	Vietnam, VO Vietnam/Overseas Svc		9840as	
	12020as			

India, AIR/Aizawl ..... www.allindiaradio.org/
India, AIR/Bhopal ..... www.allindiaradio.org/
India, AIR/Chennai ..... www.allindiaradio.org/
India, AIR/Chennai/FM Gold ..... www.allindiaradio.org/
India, AIR/Delhi ..... www.allindiaradio.org/
India, AIR/External Svc ..... www.allindiaradio.org/
India, AIR/External Svc/Haj Season ..... www.allindiaradio.org/
India, AIR/Gangkok ..... www.allindiaradio.org/
India, AIR/Guwahati ..... www.allindiaradio.org/
India, AIR/Hyderabad ..... www.allindiaradio.org/
India, AIR/Imphal ..... www.allindiaradio.org/
India, AIR/Itanagar ..... www.allindiaradio.org/
India, AIR/Jaipur ..... www.allindiaradio.org/
India, AIR/Jeypore ..... www.allindiaradio.org/
India, AIR/Kohima ..... www.allindiaradio.org/
India, AIR/Kolkata ..... www.allindiaradio.org/
India, AIR/Kuresong ..... www.allindiaradio.org/
India, AIR/Leh ..... www.allindiaradio.org/
India, AIR/Lucknow ..... www.allindiaradio.org/
India, AIR/Mumbai ..... www.allindiaradio.org/
India, AIR/Natl Channel ..... www.allindiaradio.org/
India, AIR/Port Blair ..... www.allindiaradio.org/
India, AIR/Shillong ..... www.allindiaradio.org/
India, AIR/Shimla ..... www.allindiaradio.org/
India, AIR/Srinagar ..... www.allindiaradio.org/
India, AIR/Thiruvananthapuram ..... www.allindiaradio.org/
India, AIR/Uttaranchal Prg ..... www.allindiaradio.org/
India, AIR/Vivdh Bharati ..... www.allindiaradio.org/
India, Athmeeya Yatra R/GFA ..... www.ayasia.org
India, TWR India www.radio882.com
Indonesia, RRI Makassar ..... www.rrimakassar.com/
Indonesia, VO Indonesia ..... www.voi.co.id
Iran, VO Islamic Palestinian Revol ..... www.irib.ir
Iran, VO Islamic Rep of Iran ..... www.irib.ir
Iran, VO Islamic Rep of Iran/Al Quds TV ..... www.irib.ir
Iran, VO Islamic Rep of Iran/Mashad Prg ..... www.irib.ir
Iran, VO Islamic Rep of Iran/VO Justice ..... www.irib.ir
Israel, Galei Tzahal ..... www.glz.msn.co.il
Israel, Kol Israel ..... www.intkolisrael.com
Italy, IRRS SW ..... www.nexus.org
Japan, R Japan/NHK World ..... www.nhk.or.jp/english/
Japan, R Nikkei/Pgm 1 ..... www.radionikkei.jp
Japan, R Nikkei/Pgm 2 ..... www.radionikkei.jp
Jordan, R Jordan ..... www.jrtv.jo/rj
Kuwait, R Kuwait ..... www.media.gov.kw/
Kuwait, R Kuwait/General Svc ..... www.media.gov.kw/
Kuwait, R Kuwait/Holy Qur'an Svc ..... www.media.gov.kw/
Kyrgyzstan, Kyrgyz Radiosu ..... www.ktr.kg
Laos, LNR Natl Svc/Vientane ..... www.lnr.org.la/
Laos, LNR Prov Svc/Houa Phan/Sam Neua ..... www.lnr.org.la/
Madagascar, AWR Africa www.awr2.org/
Mali, ORTM/R Mali ..... www.ortm.ml
Mauritania, R Mauritanie ..... www.mauritania.mr
Mexico, R Educacion ..... www.radioeducacion.edu.mx/
Mexico, R Mil Onda Corta ..... www.radiomil.com.mx
Mexico, R Universidad ..... www.uaslp.mx
Micronesia, V6MP/Cross R/Pohnpei ..... www.pmapacific.org/
Moldova, R PMR/Pridnestrovye ..... www.radiopmr.org
Mongolia, Mongolian R/Pgm 2 ..... www.mnb.mn
Mongolia, Voice of Mongolia ..... www.vom.mn/
Morocco, R Marocaine ..... www.snrt.ma
Morocco, R Mediterranee Intl/Medi 1 ..... www.medi1.com
Nepal, R Nepal ..... www.radionepal.org/
New Zealand, R New Zealand Intl ..... www.rnzi.com
Nigeria, VO Nigeria ..... www.voiceofnigeria.org
North Korea, VO Korea ..... www.vok.rep.kp
Oman, R Sultanate of Oman ..... www.oman-tv.gov.om
Pakistan, R Pakistan External Svc ..... www.radio.gov.pk
Pakistan, R Pakistan/Dom SW Svc ..... www.radio.gov.pk
Palau, T8WH/World Harvest R ..... www.whr.org/
Papua New Guinea, Wantok R Light ..... www.wantokradio.org
Peru, La Voz de la Selva ..... www.radiolavozdelaselva.org/
Peru, R Altura ..... www.radioalturatv.com
Peru, R Ancash ..... www.ancash.org
Peru, R Bethel ..... www.bethelradio.fm/
Peru, R del Pacifico ..... www.grupopacifico.org/radio.html
Peru, R JPJ del Peru ..... www.radiojpj.com
Peru, R Libertad de Junin ..... www.rlibertadjunin.com/
Peru, R Logos ..... www.ethnicradio.org
Peru, R Maranon ..... www.radiomaranon.org.pe
Peru, R Melodia ..... www.radiomelodia.com.pe
Peru, R Quillabamba ..... http://quillabambanoticias.org
Peru, R Santa Rosa ..... www.radiosantarosa.com.pe/
Peru, R Sicuani ..... www.radiosicuani.org.pe
Peru, R Victoria ..... www.ipda.com.pe/
Peru, R Vision ..... www.visionradioperu.com
Peru, R Voz Cristiana ..... www.radiovozcristianaperu.com
Philippines, FEBC Philippines ..... www.febc.ph
Philippines, R Pilipinas Overseas Svc ..... www.pbs.gov.ph/
Philippines, R Veritas Asia ..... www.rveritas-asia.org
Poland, Polish R/External Svc ..... www.polskieradio.pl
Romania, R Romania Intl ..... www.rri.ro/
Russia, GTRK/Adygeya ..... www.rri.ro/
Russia, R Rossii ..... www.radiorus.ru
Russia, VO Russia ..... http://english.ruvr.ru/
Rwanda, R Rep Rwandaise ..... www.orinfor.gov.rw/
Rwanda, TWR Africa ..... www.twrafrica.org/
Saudi Arabia, BSKSA/Call of Islam ..... www.saudiradio.net/
Saudi Arabia, BSKSA/External Svc ..... www.saudiradio.net/
Saudi Arabia, BSKSA/First General Pgm ..... www.saudiradio.net/
Saudi Arabia, BSKSA/Quran Pgm ..... www.saudiradio.net/
Saudi Arabia, BSKSA/Second General Pgm ..... www.saudiradio.net/
Serbia, International R Serbia ..... http://voiceofserbia.org
Solomon Islands, SIBC ..... www.sibconline.com.sb
South Africa, AWR Africa www.awr2.org/
South Africa, Channel Africa ..... www.channelafrica.org
South Africa, CVC 1 Africa R www.1africa.tv
South Africa, R Sonder Grense ..... www.rsg.co.za
South Africa, RTE R Worldwide www.rte.ie/radio1/
South Africa, TWR Africa ..... www.twrafrica.org/
South Korea, KBS World R ..... www.worldkbs.co.kr
Spain, R Exterior de Espana ..... www.rtve.es/
Sri Lanka, AWR Asia www.awr2.org/
Sri Lanka, SLBC ..... www.slbc.lk
Sudan, Sudan RTV/Sudan R ..... www.sudanradio.info/
Swaziland, TWR Africa ..... www.twrafrica.org/
Sweden, IBRA Radio ..... www.ibra.org/
Switzerland, Stimme Des Trostes ..... www.missionswerk-arche.ch
Syria, R Damascus ..... www.radio-damascus.net/
Taiwan, AWR Asia www.awr2.org/
Taiwan, R Taiwan Intl ..... www.rti.org.tw
Taiwan, R Taiwan Intl ..... http://english.rti.org.tw/
Thailand, R Thailand World Svc www.hsk9.org/
Tunisia, RTV/R Tunisia ..... www.radiotunisienne.tn/
Turkey, VO Turkey ..... www.trt-world.com/
Uganda, Dunamis SW ..... www.biblevoice.org/
Uganda, UBC Radio ..... www.ubconline.co.ug
UK, BBC World Service ..... www.bbc.co.uk/worldservice/
UK, FEBA Radio ..... www.febaradio.net
USA, AFN/AFRTS ..... http://myafn.dodmedia.osd.mil/
USA, BBG/R Free Asia ..... www.rfa.org/english/
USA, BBG/R Free Europe/R Liberty ..... www.rferl.org/
USA, BBG/R Marti ..... www.martinoticias.com
USA, BBG/RFE/RL/R Farda ..... www.radiofarda.com
USA, BBG/RFE/RL/R Free Afghanistan ..... www.azadiradio.org/
USA, BBG/VOA ..... www.voanews.com
USA, BBG/VOA/Aap Ki Dunyaa ..... www.voanews.com/urdu/news
USA, BBG/VOA/Afia Darfur R ..... www.afiadarfur.com
USA, BBG/VOA/Deewa R ..... www.voanews.com
USA, BBG/VOA/R Ashna ..... www.voanews.com/dari
USA, BBG/VOA/R Mashaal ..... www.mashaal.org
USA, BBG/VOA/Studio 7 ..... www.voanews.com
USA, BBG/VOA/Sudan in Focus ..... www.voanews.com
USA, KNLS Anchor Point AK ..... www.knls.org/
USA, Overcomer Ministry ..... www.overcomerministry.org
USA, WBCQ Monticello ME ..... www.wbcq.com/
USA, WEWN/EWTN Irondale AL ..... www.ewtn.com/
USA, WHRI Cypress Creek SC ..... www.whr.org/
USA, WINB Red Lion PA ..... www.winb.com
USA, WRMI Miami FL ..... www.wrmi.net/
USA, WRMI/R Prague relay ..... www.wrmi.net/
USA, WRMI/R Slovakia Intl relay ..... www.wrmi.net/
USA, WRNO New Orleans LA ..... www.wrnoradio.com
USA, WTWW Lebanon TN ..... www.wtww.us/
USA, WWCR Nashville TN ..... www.wwcr.com
USA, WWRB Manchester TN ..... www.wwrb.org/
USA, WYFR/Family R Worldwide ..... www.familyradio.com/
Uzbekistan, CVC/The Voice Asia ..... www.christianvision.com/
Vatican City State, Vatican R ..... www.vaticanradio.org/
Vietnam, VO Vietnam 1/Buon Ma Thuot ..... www.vov.org.vn
Vietnam, VO Vietnam 1/Hanoi ..... www.vov.org.vn
Vietnam, VO Vietnam 1/Son Tay ..... www.vov.org.vn
Vietnam, VO Vietnam 1/Xuan Mai ..... www.vov.org.vn
Vietnam, VO Vietnam 2/Xuan Mai ..... www.vov.org.vn
Vietnam, VO Vietnam 4/Buon Ma Thuot ..... www.vov.org.vn
Vietnam, VO Vietnam 4/Xuan Mai ..... www.vov.org.vn
Vietnam, VO Vietnam/Overseas Svc ..... www.vov.org.vn
Yemen, Rep of Yemen R/R Sana'a ..... www.adenradio.net
Zambia, Christian Voice ..... www.voiceafrica.net
Zambia, CVC Intl/1 Africa www.1africa.tv
Zambia, Zambia Natl BC ..... www.znbc.co.zm
Zimbabwe, VO Zimbabwe/Ext Svc ..... www.zbc.co.zw
Zimbabwe, Zimbabwe BC ..... www.zbc.co.zw

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Blog: http://mt-milcom.blogspot.com
Twitter: MilcomMP

Monitoring the Busiest Air Station in the Marine Corps

We have had a request from one of our readers for military frequency information from the state of Arizona. One of the great bases from that state is the Marine Air Corps Station in Yuma.

Marine Corps Air Station Yuma or MCAS Yuma (ICAO: KNYL) is the home to multiple squadrons of AV-8B Harrier IIs of the 3rd Marine Aircraft Wing, Marine Aviation Weapons and Tactics Squadron 1 (MAWTS-1), and Marine Fighter Training Squadron 401 (VMFT-401), an air combat adversary squadron of the 4th Marine Aircraft Wing of the Marine Corps Reserve.

F-35 JSF takeoff (Photo courtesy of DoD).jpg

The station is located 2 miles (3 km) from the city of Yuma, Arizona. A joint civilian-military airport, MCAS Yuma shares facilities with Yuma International Airport and occupies approximately 3,000 acres, most of which is flat desert wilderness.

MCAS Yuma is currently the busiest air station in the Marine Corps, offering excellent year-round flying conditions and thousands of acres of open terrain for air-to-ground weapons ranges and associated restricted airspace for military flight operations. During the 1960s, 70s and early 1980s, MCAS Yuma was home to VMFAT-101, the Marine Corps' Fleet Replacement Squadron (FRS) for the F-4 Phantom II, training U.S. Marine Corps, U.S. Navy and NATO/Allied flight crews and maintenance personnel in the F-4B, F-4J, F-4N and F-4S.

Following the transfer of VMFAT-101 to MCAS El Toro, California in the 1980s, MCAS Yuma became the principal Fleet Marine Force Pacific operating base for the AV-8 Harrier and AV-8B Harrier II under the cognizance of Marine Aircraft Group 13 (MAG-13).

Marine Aviation Weapons and Tactics Squadron 1 (MAWTS-1) is a major aviation command at MCAS Yuma, conducting training for all Marine Corps tactical aviation units, most notably the Weapons and Tactics Instructor (WTI) course. Marine Fighter Training Squadron 401 (VMFT-401) is a Marine Air Reserve squadron also based at MCAS Yuma, containing both active duty and Selected Marine Corps Reservists, providing aerial adversary/aggressor services and dissimilar air combat training (DACT) for all U.S. military services and selected NATO, Allied and Coalition partners.

MCAS Yuma is currently programmed to become the Marine Corps' initial operating base for the F-35B variant of the F-35 Lightning II Joint Strike Fighter (JSF), the first of which arrived on November 16, 2012.

This is one base that is busting at the seams with military aircraft communications. Our exclusive *MT Milcom* frequency and call sign guide to MCAS Yuma follows.

ATC Frequencies

Approach Control 124.700 257.750 281.400 281.425 (ex-281.000) 305.200 343.650 372.000 374.800
ATIS 118.800 291.625 (ex-273.200)
Clearance Delivery 118.000 336.400
Command Post 337.900
CTAF/UNICOM 119.300
Departure Control 125.550 281.000 374.800
Ground Control 121.900 314.000 (ex-315.700) 340.200
Ground Controlled Approach 227.125 (ex-254.000) 270.800 279.525 (ex-301.200)
Local Control 239.275 353.750
Pilot-to-Dispatcher (PTD) 357.150
PMSV Metro 120.700 120.725 349.750
Prescott Radio ..... 122.200 (RCO)
San Diego Radio ..... 122.600 (RCO)
Tower ..... 119.300 360.850 (Secondary) 361.200 382.000 382.800

Aeronautical Frequencies

3MAW Tactical/Training 229.225 268.025 (A/A) 268.225 271.150 285.725 310.600 318.350 320.950 340.150
Base Training 313.675 314.275 374.075
Bombing Range Coordination Net (AM Mode) 140.950
Civilian DoD Contractors 275.200 314.325 314.600 382.600
Emergency Evacuation Helicopter Control 262.600
Instructor/Student Air-Air Training
139.275 140.000 141.700 143.700 148.750 148.875 149.100
Marine Air Group 13 (MAG-13) Helicopter Squadron Common 352.075
Marine Air Group 16 (MAG-16) Helicopter Air-Air/Air-Ground
225.925 250.725 251.425 253.875 256.450 258.925 263.350 270.650 274.875 275.475 275.650 277.150 279.075 281.650 284.850 303.550 307.550 309.875 314.150 347.800 349.250
Marine Air Group 39 (MAG-39) Helicopter Squadron Flight Ops
225.475 255.225 268.625 271.425 305.150 309.725 336.850
Marine Air Group 39 (MAG-39) Pilot-to-Dispatcher (PTD) 302.300
Marine Air Control Squadron 1 (MACS-1) Aircraft Maintenance Crews
254.025 254.175 263.475 274.625 276.375 299.575
Marine Air Control Squadron 1 (MACS-1) Helicopter-Ground Training
370.825 371.250 378.475 379.775
Marine Air Control Squadron 1 (MACS-1) Training
236.275 251.350 253.125 263.425 348.875 377.000
Marine Wing Support Squadron 371 (MWSS-371) Training
233.750 238.025 249.925
MAWTS1 Training (Air-Ground-Air)
225.625 226.275 226.725 227.200 227.975 229.625 231.675 233.450 234.550 235.450 238.550 239.400 240.550 241.950 242.375 243.625 244.850 245.675 247.125 249.750 250.675 251.875 252.300 253.975 254.725 255.300 256.300 257.350 258.250 259.250 260.150 261.325 262.650 263.450 264.150 265.150 266.325 267.600 268.200 269.725 270.000 271.700 273.850 274.850 275.150 276.550 277.700 278.900 279.700 281.700 282.000 283.350 284.050 285.000 288.500 289.600 290.800 292.100 293.500 298.400 299.625 302.350 303.175 305.450 306.700 307.450 308.650 309.100 310.900 311.350 312.200 313.600 314.250 315.850 316.350 318.900 319.050 323.750 324.775 326.700 326.800 327.625 336.300 336.750 339.650 341.800 342.300 343.300 346.600 349.500 350.150 351.175 353.425 354.400 355.500 357.300 358.800 360.250 361.250 362.950 363.475 364.125 365.950 367.325 369.425 371.650 374.275
MAWTS1 Weapons and Tactics Instruction Training 236.850 237.475 248.475
MTACS-38 Helicopter-Ground Training 363.400 379.850
Range Control and Safety Net (AM Mode)
32.050 38.625 38.650 38.750 38.950 40.0125 40.050 40.3375 40.830 42.450 141.5125 141.850 143.075 143.175 149.325 149.575 149.750 150.425 266.900 276.000 299.700 310.000 328.200
Unknown Maintenance 253.400 281.175
Unknown Squadron/Wing Common 264.300 266.675 274.525 283.125 298.500 301.900 302.325 336.200 336.500 336.700
Unknown user/usage 299.300
Visiting Squadron Air-Air 236.450 249.950
Visiting Squadron Common 233.800 262.900 262.975 275.575 285.100 285.375 290.100 301.000 305.125 310.300 311.900 316.400 318.500 322.850 328.100 354.500 363.400
VMFT-401 Adversary Squadron Snipers/MAG-41
250.150 (A/A) 250.300 (A/A) 268.300 (A/A) 273.725 275.975 305.300

Ground LMR Frequencies

3M Coordinators Training 138.550 142.050
3MAW Maintenance Coordinators 143.650 148.850
Base Training 139.450 140.925 141.675 142.025 143.375 148.850 148.925 149.525 150.600
C3 Communications 149.275
Contingency (AM Mode) 148.625
Defense Logistics Agency Safety Net 141.725
Flight Line Maintenance 141.3375
Range Operations C2 for Range Scoring Net 141.100
Electronics Testing/Training 140.325
Emergency Medical Coordination Net 141.950 150.775
Exercise 139.725
Fire Department ..... 138.675 138.800 (Fire Ground) 138.975 (Fire Alarm) 140.100 (Crash)
MACS-1 Training 32.450 36.550 41.900
Maintenance 138.525 143.300 149.125
MWSS-371 Training 30.550 40.450 40.550
NCIS 140.775/140.075 140.650
Paging System 149.050

Provost Marshal Tactical Net ..... 140.250 (Secondary) 141.000 (Primary)
Supply and Logistics Support..... 142.650

LMR Trunk Radio Systems

The trunk radio system at MCAS Yuma are part of the P25 Enterprise-LMR MCI West Regional Trunk Radio System. Published sites in recent DoD publications include the following:

Site MCAS Yuma	386.6875 387.1750 387.9500 388.3125 388.7375 388.8875 389.0625
Site Black Mountain	385.0250 385.7000 385.9500 386.0625 386.7875 387.3750 387.5375 388.1375 388.4375 389.1250
Site Childs	386.0625 386.6000 387.4750 387.7250 389.1250
Site Dry Wells	385.7000 385.9500 387.2375 388.4000 389.1375 389.3125
Site El Centro (CA)	385.8375 386.8875 386.9375 387.2500 387.5750
Site EW West	386.3500 386.4875 386.6375 388.3875 389.6250
Site Oatman	385.0125 385.9875 386.3000 386.4500 388.5375
Site Spring Hill (CA)	385.0125 386.4500 386.6000 388.2750 388.5375
Site Telegraph Pass	385.0125 385.0875 385.2625 385.6750 386.1500 386.7500 387.4250 388.1250 388.5375
Site Yodaville	385.7125 385.8625 386.9375 387.3250 387.6250 387.7750 387.9750 389.2125 389.7625

❖ 3rd Marine Air Wing

The units based at MCAS Yuma are under the operational control of the 3rd Marine Air Wing (3MAW). The 3rd MAW is the major west coast aviation unit of the United States Marine Corps. It is headquartered at Marine Corps Air Station Miramar, California and provides the aviation combat element for I Marine Expeditionary Force. The wing is made up of a headquarters squadron, four flying groups, an aviation command and control group and an aviation engineering group. The command structure and units associated with the 3MAW are listed below.

Marine Aircraft Group 11 (MAG-11) MCAS Miramar
VMFA (AW)-225 Vikings F/A-18D Hornet (CE) Call sign: Viking ##
257.525 268.050 313.750
VMFA-232 Red Devils F/A-18D Hornet (WT) Call sign: Devil ##
253.800 263.500 318.850 327.250
VMFA-314 Black Knights F/A-18C (VW/NG) Call sign: Knight ##
283.300
VMFA-323 Death Rattlers F/A-18C (WS/NK/NE) Call sign: Snake ##
250.800 312.250 277.275 278.075 337.150
VMFAT-101 Sharpshooters F/A-18C (SH) Call sign: Shooter ##
236.450 249.950 266.675 274.525 298.500 320.650 322.250 381.925
VMGR-352 Raiders KC-130J (QB) Call sign: Raider ##
249.800 249.875 (Refueling Tactical Secondary) 249.950 (Refueling Primary) 250.750 251.475
MALS-11 Devilfish Maintenance Squadron

Marine Aircraft Group 13 (MAG-13) MCAS Yuma
VMFA(AW)-121 Green Knights F-35B Lightning II (VK) (Squadron moved from Miramar and stood up at Yuma on 9/28/2012) No known frequencies at press time.
VMA-211 Wake Island Avengers AV-8B Harrier (CF) Call sign: Wake
271.200 273.800 305.125 310.300 316.950 317.375 318.500 318.750 328.100 363.400
VMA-214 The Black Sheep AV-8B Harrier (WE) Call sign: Blacksheep ##
269.700 296.900 308.225
VMA-311 Tomcats AV-8B Harrier (WL) Call sign: Cat ##
293.100 320.575 322.150
VMA-513 Flying Nightmares (WF) Call sign: Nightmare
318.925 326.925 336.075 357.700
MALS-13 Black Widows Maintenance Squadron

Marine Aircraft Group 16 (MAG-16) MCAS Miramar
HMH-361 Flying Tigers CH-53E Super Stallion (YN) Call sign: Tiger ##
253.300 310.725 MHz
HMH-462 Heavy Haulers CH-53E Super Stallion (YF) Call sign: Thunder ##
253.300 339.725
HMH-465 Warhorse CH-53E Super Stallion (YJ) Call sign Warhorse ##
250.200 250.825
HMH-466 Wolfpack CH-53E Super Stallion (YK) Call sign: Wolfpack ##
274.350 354.700
VMM-161 Grey Hawks MV-22 Osprey (YR) Call sign: Greyhawk ##
250.275 267.700
VMM-163 Ridge Runners MV-22 Osprey (YP) Call sign: Unknown
268.475
VMM-165 White Knights MV-22B Osprey (YW) Call sign: Lady Ace ##
275.425 299.700
VMM-166 Sea Elk MV-22B Osprey (YX) Call sign: Lucky ##
258.325
VMM-363 Lucky Red Lions MV-22 Osprey (YZ)
MALS-16 Forerunners Maintenance Squadron

Marine Aircraft Group 39 (MAG-39) MCB Camp Pendleton
HMLA-169 Vipers AH-1W Super Cobra attack and UH-1Y Huey utility helicopters (SN) Call sign: Viper ##
293.825 326.650
HMLA-267 Stingers AH-1Z Viper attack and UH-1Y Huey utility helicopters (UV) Call sign: Stinger ##
309.925 327.225
HMLA-369 Gunfighters AH-1W SuperCobra attack and UH-1Y Huey utility helicopters (SM) Call sign: Gunfighter ##
233.425 271.425 302.300
HMLA-469 Vengeance AH-1W Cobra attack and UH-1Y Venom utility helicopter (SE) Call sign: Vengeance ##
350.075
HMLAT-303 Atlas AH-1W Cobra attack, UH-1Y Venom utility, UH-1Y Venom and AH-1Z Viper helicopters (QT) Call sign: Atlas ##
354.950
HMM-268 Red Dragons CH-46E Sea Knight transport helicopters (YQ)
357.475
HMM-364 Purple Foxes CH-46E Sea Knight transport helicopters (PF)
284.075
HMMT-164 Knightriders Fleet Replacement Squadron, Call sign: Knightrider ##
273.125 273.925
MALS-39 Hellhounds Maintenance Squadron

Marine Air Control Group 38 (MACG-38) MCAS Miramar
3LAAD 3rd Low Altitude Air Defense Battalion 3d LAAD air defense unit Camp Pendleton
MACS-1 Marine Air Control Squadron 1 Falconers MCAS Yuma
MASS-3 Marine Air Support Squadron 3 Blacklist MCB Camp Pendleton Area 32
MTACS-38 Marine Tactical Air Command Squadron 38 Icepack MCAS Miramar
MWCS-38 Marine Wing Communications Squadron 38 Red Lightning MCAS Miramar
VMU-1 Marine Unmanned Aerial Vehicle Squadron 1 Watchdogs RQ-7 Shadow and ScanEagle MCAGCC Twentynine Palms
VMU-3 Marine Unmanned Aerial Vehicle Squadron 3 Phantoms RQ-7 Shadow MCAGCC Twentynine Palms
249.500 250.850 274.425

Marine Wing Support Group 37 (MWSG-37) MCAS Miramar
MWSS-371 Marine Wing Support Squadron 371 Sandsharks MCAS Yuma (see Yuma frequency listings above)
MWSS-372 Marine Wing Support Squadron 372 Diamondbacks MCB Camp Pendleton
MWSS-373 Marine Wing Support Squadron 373 Ace Support MCAS Miramar
MWSS-374 Marine Wing Support Squadron 374 Rhinos MCAGCC Twentynine Palms

Marine Wing Headquarters Squadron 3 (MWHS-3) MCAS Miramar

❖ FAA/DoD NOTAM Frequency Changes

Finally of good friend Jack NeSmith passes along the following frequency changes for civilian and military frequencies.

32.500	Biggs AFF (KBIF), TX R-5107 A/K AND R-5103 A/B/C Ground
34.500	Biggs AFF (KBIF), TX R-5107 A/K AND R-5103 A/B/C Air-Air West
36.500	Biggs AFF (KBIF), TX R-5107 A/K AND R-5103 A/B/C Air-Air East
119.675	Alexandria International (KAEX), LA Ground Controlled Approach (GCA) ex-125.400
126.200	Lawson AAF (KLSF), GA Lawson Doughboy
134.100	Biggs AFF (KBIF), TX Airspace Information Center (AIC)
134.750	Hill AFB (KHIF), UT PTD ex-139.300
138.550	John Murtha Johnstown (KJST), PA ARNG Ops (Keystone Ops)
139.125	Cairns AAF (KOZR), AL Shell Ops
140.500	Cairns AAF (KOZR), AL Hanchey Tower
140.550	Esler Regional (KESF), LA Airspace Rotary Wing/ATC Training Services
142.125	Cairns AAF (KOZR), AL Lowe Ops
142.300	JNGB McEntire (KMMT), SC Base Ops/PTD ex-149.625
225.125	Esler Regional (KESF), LA Airspace Rotary Wing/ATC Training Services
227.400	Lawson AAF (KLSF), GA Lawson Doughboy
233.450	Muir AAF (KMUI), PA Bollen Range (Primary)
233.700	Eastern WV Regional (KMRB), WV Tower ex-275.800/236.600
236.775	Mayport NS (KNRB), FL ATIS
237.200	Biggs AFF (KBIF), TX Bliss Radio ex-397.700
239.000	Alexandria International (KAEX), LA Ground Controlled Approach (GCA)
239.150	Muir AAF (KMUI), PA Bollen Range (Secondary)
244.500	Cairns AAF (KOZR), AL Shell Ops
245.500	Cairns AAF (KOZR), AL Toth ATCT South Primary
251.125	Biggs AFF (KBIF), TX ATC Ground
261.300	Camp Guerney (K7V6), WY Tactical Ops
269.250	MCAS New River (KNCA), NC Clearance Delivery ex-239.025
269.525	Muir AAF (KMUI), PA Ground Control
284.600	NAS/JRB New Orleans (KNBG), LA Local Control ex-360.200
290.225	Toledo Express (KTOL), OH ATIS ex-217.300
324.100	Minneapolis/St. Paul International (KMSP), MN ANG Base Ops
351.675	NAS/JRB Fort Worth (KNFW), TX ATIS
360.200	MCAS New River (KNCA), NC Unicom

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

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2013 Federal Super-Scanning Events

The first two months of 2013 saw several large scale public events that mobilized many federal resources and provided some interesting opportunities for federal agency communications monitoring. It appears in this post 9/11 world that any large gathering of the general public, from a sporting event to a political convention, is likely to generate some sort of federal agency response. In some cases is may be just a few FBI agents to coordinate any federal agencies involvement with supporting local public safety. The arrival of the disabled cruise ship *Carnival Triumph* in Mobile, Alabama had some federal response from the CBP and Coast Guard and some college football games are now getting TSA Behavior Detection Officers keeping an eye on the crowd. At other events, it may mean federal agencies actually coordinating all agencies and operations.

Large-scale public events such as these are still considered a National Security Special Event. When an event is designated a National Special Security Event, the U.S. Secret Service assumes the role as the lead federal agency for the design and implementation of the operational security plan. The FBI takes the lead role in counter-terrorism and intelligence and FEMA is in charge of federal emergency incidence response.

I was able to actually attend one of these early 2013 events and monitor the goings on there in person. And there were many scanner listeners out there at other events taking notes and providing some details as to what went on. I want to offer a special thanks to everyone who anonymously provided additional information and frequencies from these events.

Inauguration (Courtesy: senate.gov)

Presidential Inauguration, Washington D.C.

January 21st, 2013 saw the Inauguration of President Barak Obama for his second term in office. The last Presidential Inauguration in 2008 generated massive amounts of communications related to the inaugural itself and many related activities in the Washington, D.C. area. This year was no exception, but some listeners reported slightly smaller crowds and less communications activity this time around.

On January 10th, listeners heard the U.S. Park Police dispatcher call out officers to have their radios re-programmed prior to the start of the inaugural events. There was some speculation on what was being programmed into the radios, possibly new frequencies or encryption capabilities. Some suggested that the U.S. Park Police were going to be utilizing the federal Integrated Wireless Network (IWN) VHF trunked radio system for the inauguration, but follow up reports don't seem to support this theory. There were also reports of the news media complaining about "the jammer" being turned up at some point during the inaugural events. And at one point, several listeners heard what was most likely encrypted voice on the 243.0 MHz UHF "GUARD" channel. As usual, lots of interesting stuff to be heard in Washington, D.C.! Here's a list of some of the federal frequencies that were busy during the 57th Presidential Inauguration:

162.2500	173.8	Capitol Police Ch. 4
162.6125	127.3	Capitol Police Ch. 5
163.3250	N001	
163.4875	N001	"Security room"
164.6500	N001	Secret Service TANGO
164.8875	N001	Secret Service OSCAR
165.5375	146.2	Capitol Police Ch. 2
165.6375	N611	"CSR" "Hawkeye"
165.6875	N001	Secret Service - Washington Field Office
166.3125	N001	
166.7250	127.3	Park Police Ch. 1
167.0375	N001	Secret Service Executive Protection
167.3125	N167	FBI
167.4125	N167	FBI
167.7125	N167	FBI
168.8375	N293	
169.2250	110.9	Capitol Police Ch. 1
169.4500	N301	CBP
169.5750	N1A3	
169.7750	N4C5	NPS George Washington Parkway
169.9250	N001	White House Communications Agency (WHCA) DELTA
170.0000	N004	Secret Service - Blair House
170.1750	156.7	Capitol Police Ch. 3
170.5125	N4C5	NPS National Mall & Memorial Parks - Medical
172.2250	N001	Secret Service
172.4750	N4C5	NPS National Mall & Memorial Parks
172.7500	N4C5	NPS National Mall & Memorial Parks
173.5250	167.9	Capitol Police Ch. 11
243.0000	AM	UHF Guard
407.6000	N0F0	State Department Diplomatic Protection Details
407.7875	D364	Capitol Motor Pool
408.6000	N0F0	State Department Diplomatic Protection Details
409.0000	N447	Disaster Medical Assistance

Super Bowl XLVII, New Orleans

This year's Super Bowl game in New Orleans, Louisiana was the center of attention in early February 2013. I was temporarily based in New Orleans for over two weeks in preparation for the television broadcasts of the big game. And no, I didn't kick the plug out and cause the power failure in the Superdome during the third quarter of the game.

While there was quite a bit of Super Bowl related federal communications heard, there didn't seem to be quite the quantity of active frequencies that have been heard at past Super Bowl events. It could have been that some of the federal agency and local interoperability communications were carried on the statewide 700/800 MHz P-25 trunked radio system known as the Louisiana Wireless Information Network, or LWIN. But there was still plenty in the federal radio spectrum to hear.

As with past Super Bowl games, there was a combat air patrol of Air National Guard F-16 fighter jets that patrolled the airspace above New Orleans during the game. At lower altitudes, the Coast Guard as well as Customs and Border Protection Office of Air and Marine provided helicopters and fixed-wing aircraft that monitored any aircraft that flew through the restricted airspace over the Superdome. Daily patrols of the Coast Guard HH-65 and CBP AS-350 helicopters were a daily occurrence starting about a week before the big game.

Some notes regarding the aircraft operations around the Super Bowl: The CBP Office of Air & Marine provided several OMAHA aircraft for the event, apparently staged at the Naval Air Station

Super Dome and helicopter (Courtesy: U.S. Coast Guard)

Notice to Airmen Super Bowl (Courtesy: FAA)

Joint Reserve Base New Orleans. OMAHA 1, 2, 4, 5 were heard on the air. The F-16 combat air patrol mentioned that they were "zapping small airports" around New Orleans. Not sure what the terms "Good Zap", "Bravo-Bravo" and "Timber Jackal sweet" mean, but if any military monitors out there have any ideas, please let me know!

Some additional interesting items that I observed while in New Orleans – It appears that some of the busier frequencies belonged to the U.S. Department of Energy. About a week before the big game, a DoE helicopter began flying tracks over downtown New Orleans with what appeared to be sampling or sensing pods. It was measuring the normal background radiation signatures of the area before the event, so they would be able to detect any unusual changes in radioactivity.

The Department of Energy frequencies of 164.3500 MHz and 171.2000 MHz were both very active, not only when the helicopter was flying, but all other times as well. Some traffic heard seemed to indicate that these frequencies might have been the primary Super Bowl operational channels for many agencies in addition to the DoE. There were some references to the CBP Vehicle and Cargo Inspection Systems (VACIS) operations on these channels as well. Some DoE security officers from the Strategic Petroleum Reserve Security Police were providing security checkpoint and K-9 support.

The Secret Service was busy in New Orleans as well. Besides a visit from Vice President Biden prior to the Super Bowl, they were providing protection for various visitors to the area, including DHS Secretary Napolitano. The USSS set up a repeater in New Orleans using 166.4000 MHz in and 165.3750 MHz out. I haven't heard a temporary repeater setup for the Secret Service in a while.

And, as a reminder that you never know what you might hear, I came across several out of town units from an unknown agency on a simplex analog channel. They were trying to figure out how to get across one of the downtown Mardi Gras parade routes to their hotel and were cut off by all the closed streets. A lot of fun to listen to!

Here are some of the listings of what was heard before and during Super Bowl XLVII:

133.1000	AM	New Orleans Downtown Heliport
136.3750	AM	DHS Customs & Border Protection (CBP) aircraft
138.1250	192.8	
150.3375	N293	
162.0500	N293	Cost Guard NET 108
162.0625	N653	Federal Interoperability, input to 171.4375
162.6125	127.3	
162.9125	N069	DHS Immigrations & Customs Enforcement (ICE)
163.0000	N293	
163.0500	N293	Coast Guard NET 112
163.1125	N169	DHS ICE
163.1125	N496	
163.1875	N167	FBI
163.3000	N301	DHS CBP
163.7000	N169	DHS ICE
163.7500	N167	FBI
163.9625	N167	FBI, input to 167.4375 MHz
164.2250	N100	
164.3500	NE03	Department of Energy (DoE)
164.3750	N293	
164.5500	N7FE	
164.6500	N001	Secret Service TANGO
164.7750	N301	CBP NET 16
164.7875	N169	DHS ICE
164.8375	N293	
165.2375	N301	DHS CBP NET 1
165.2875	N650	BATFE NET 1
165.3750	N001	Secret Service CHARLIE
165.4125	N301	DHS CBP NET 13
165.8375	N452	DHS Common
166.2000	N293	Veterans Affairs Medical Center – security
166.4000	N001	Secret Service GOLF, input to 165.3750 repeater
166.4375	N003	Federal Agency Common
166.6500	N167	FBI
167.2375	N167	FBI
167.4375	N167	FBI
167.5625	N167	FBI
167.6125	N167	FBI
168.4875	146.2	
168.5875	N169	DHS ICE Common
168.8625	N001	
169.1625	N300	
169.2625	N452	
169.4125	N325	"LA145" call sign heard
169.4500	N301	DHS CBP NET 2
170.6250	N167	FBI
170.7500	N293	U.S. Marshals, Federal Courthouse Security
170.7875	N452	DHS Common, input to 165.8375
170.9125	N167	FBI
170.9250	N167	FBI
171.0750		
171.2000	N293	
171.2000	NE03	Department of Energy
171.2500	N069	DHS ICE
171.4375	N653	Federal Interoperability repeater New Orleans
171.6125	N167	FBI
171.6625	N100	
171.9750	179.9	Unknown agency, maintenance operations
173.0375	167.9	Federal Interagency Response I/R 9
241.0000	AM	OMAHA aircraft
282.6000	AM	Aerial refueling
271.0000	AM	OMAHA aircraft with "BIGFOOT" and "WATCHDOG"
327.8000	AM	Houston Center ARTCC
406.4375	N2E4	NASA Michoud Assembly Facility trunked system C82E
406.5375		TRBO digital – most likely VAMC
406.6375	N2E4	NASA Michoud Assembly Facility trunked system C82E
406.6625	N110	
406.8375	N2E4	NASA Michoud Assembly Facility trunked system C82E
407.1750	N2E4	NASA Michoud Assembly Facility trunked system C82E
407.2375	N2E4	NASA Michoud Assembly Facility trunked system C82E
407.6375	N2E4	NASA Michoud Assembly Facility trunked system C82E
407.9375		TRBO digital – most likely VAMC
408.0875	N2E4	NASA Michoud Assembly Facility trunked system C82E
409.6750	N156	DEA
409.9375	N482	U.S. Postal Inspection Service
410.3750	N293	
410.8000	N742	Federal Protective Service
413.9625	N201	
413.9750	N156	DEA
414.7500	N482	U.S. Postal Inspection Service
415.8000	N742	Federal Protective Service
419.8000	N742	Federal Protective Service, input to 410.8 MHz

2013 NBA All Star Game, Houston

Although on a smaller scale than our first two events, the 2013 NBA All Star events during February 15th – 17th also provided some federal activity that was related to the activities at the Toyota Center and other facilities in downtown Houston, Texas. As with the NCAA Final Four in Houston in 2011, the federal response was:

161.2050	146.2	AMTRAK Police
162.9000	N653	Federal Interoperability, input to 170.7250 MHz
162.9750	N653	Federal Interoperability, input to 171.4375 MHz
163.7000	N169	ICE Nationwide TAC 1
168.5875	N169	ICE Nationwide TAC 2
170.7250	N653	Federal Interoperability 1 "COMMAND"
170.9375	N167	FBI
171.4375	N653	Federal Interoperability 2 "PATCH"
171.6125	N167	FBI
171.6875	N167	FBI
172.2125	N167	FBI
172.2875	N167	FBI
271.0000	AM	NORAD Combat Air Patrol
410.8000	N798	Federal Protective Service, Houston

So, never assume that there won't be some sort of federal activity at the next big sporting event of public gathering. Keep searching those federal frequency bands because you never know when you might find something interesting!

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Hot Spots, Flight Numbers, and More

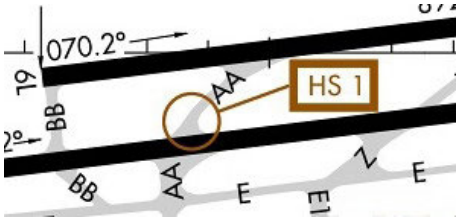
Aircraft communications listening can be an interesting challenge. There are many things to learn and the more you listen, the better you will become at understanding the rapid-paced exchanges between pilots and air traffic controllers.

This particular column explores a few separate topics and perhaps ones that you have had questions about. Let's take a look!

What is a Hot Spot?

No, for this column, it isn't where Wi-Fi Internet is available or about popular night clubs. The FAA describes it this way: "A hot spot is defined as a location on an airport movement area with a history of potential risk of collision or runway incursion, and where heightened attention by pilots and drivers is necessary. By identifying hot spots, it is easier for users of an airport to plan the safest possible path of movement in and around that airport. Planning is a crucial safety activity for airport users – pilots and air traffic controllers alike." You may hear a ground controller issue cautions as planes are taxiing.

For an example, let's use Los Angeles International (KLAX). Go to **SkyVector http://skyvector.com/airports/United%20States** and type in "KLAX" in the search box. When that comes up, click on the Airport Diagram, the second item down on the left. This will yield the current version of the diagram. Hot spots are identified in the graphic but with no accompanying written explanations.



An example of how a hot spot is depicted on an airport diagram. (Courtesy: FAA)

You can find hot spot descriptions here: **www.faa.gov/airports/runway_safety/hotspots/hotspots_list/**. Select the link that includes your airport of interest, and for this example, "Southwest U.S.: AZ, CA, CO, NM, NV, UT." Scroll to LOS ANGELES INTL (LAX) and you will see all the hot spots listed with their descriptions. For HS 1, "Pilots sometimes fail to hold short of Rwy 24L when exiting Rwy 24R at Twy AA." ("Rwy" is a runway. "Twy" is a taxiway.) The more you examine the details of airport diagrams, the more understandable they will become. This may help with airport diagram symbols: **http://aeronav.faa.gov/content/aeronav/online/pdf_files/legendAD.pdf**

What is an Intersection?

No, it isn't where Fifth and Main streets cross but the concept is similar. There are published routes in the sky, and though you can't see them directly, they often cross. Some of these crossing points become named and published as intersections referenced by controllers. Also, an intersection can be named where a specific VOR radial intersects a published route. Similarly, an intersection can be defined by the crossing of specific VOR radials from two different VOR stations. (For helpful VOR navigation info see: **www.navfltsm.addr.com/vor-nav.htm.**)

All intersection names have five letters, and though often spelled strangely, they are pronounceable. Here are some examples: SIGNA, YUBBA, COLOM, DALON, and RANGO. Actually, RANGO is within a short driving distance from my house. It is in a grassy meadow area surrounded by oaks and pines, well, not exactly. It is a vertical line from a point on the ground on up. If a plane passes through this invisible line at one altitude or another, it is passing though RANGO.

If you hear an intersection called out, you can look it up here: **www.airnav.com/airspace/fix/.** The return on the search will include the latitude/longitude, "Navaid radial/DME," the category of aeronautical chart it is shown on, nearest city, and nearest airports.

To see the intersection on a chart, go to **http://skyvector.com/** and enter the five-letter name in the small search box at the left and click "Go." Check the different charts to see how it is depicted.

To see the intersection location on the ground, go to **https://maps.google.com/maps?hl=en**, copy and paste the latitude/longitude from the AirNav.com search result into the Google search box, but, you must replace the dashes with spaces for it to work. You can click on the satellite icon at the top right to see how it might look from a plane. Zoom in or out as desired.

To see an intersection in the sky, just look up. Well, you won't see one but, when atmospheric conditions are right, you may see contrails crossing. If you see them frequently in the same place in the sky from a given location on the ground, it could be a published intersection. For some people, it can be fun to try to figure out which they may be.

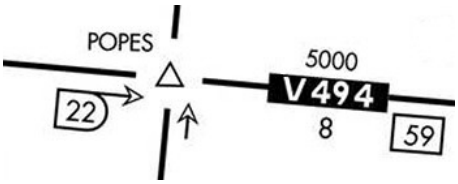


Chart example of an intersection. The POPES intersection is defined by the Santa Rosa VOR (STS) 077 degree radial crossing the Scaggs Island VOR (SGD) 349 degree radial and also where Route V494 crosses Route V87. Look up POPES using SkyVector to see it in the larger context (Enroute L-2 and L-3 charts).

You might hear a clearance delivery controller say something like this, relating to an airliner's upcoming departure: *Maintain runway heading until 1500', then turn right heading 140 degrees to intercept the Marysville 154 degree radial. Intercept and proceed via the Marysville 154 degree radial to LIAMM intersection, then turn left heading 120 degree to intercept and proceed via the Sacramento 090 degree radial to FROGO intersection. As you can see, this initial departure routing includes two intersections.*

What is "Contact Departure?"

Each air traffic controller position has its own function and its own frequencies. The tower controller controls air traffic that is landing, departing, or within the airport control area. Controllers "hand off" planes to the next controller in line when they near an airspace boundary.

One Sunday, late in the day, I picked up someone from Sacramento International (KSMF). I waited in their free cell phone lot until I received a call from my passenger saying that she was at the curb waiting for me.

I listened to the Approach/Departure, Tower, and Ground Control frequencies at the airport while I waited. I arrived early so had plenty of time to listen. Runways 16L and 16R were active, as opposed to Rwys 34L/34R, the same two stretches of pavement but in the opposite direction. Things like wind direction and noise abatement agreements can determine the active runways.

The cell phone lot was on the departure end of Rwys 16L/16R. The reception was wonderful, of course, compared to listening from 50 miles away at home. Hearing the Tower telling departing aircraft to "contact departure" is common and I hear it all the time *but* I never knew exactly where the planes were in the air when this happened.

When I was sitting in the cell phone lot I could see exactly where this happened. It was a very consistent location for each runway from aircraft to aircraft. I scaled it from a Google satellite view and it was about 4500 feet from the end of the runway. I had imagined that it was a little further than that.

If you are curious about the KSMF cell phone parking lot's location (Lot 8) or simply interested enough to follow along, see: **www.sacramento.aero/smf/about/maps/#intmap_map-pointer-283.** This image clearly shows the lot but not the runways. For

that, go to **http://skyvector.com/airports/United%20States** and enter KSMF in the search box, and then to help complete the picture, click on "Satellite View of KSMF" at the left. Zoom in/out as needed to see the runway ends. The cell phone lot is just off the left end of Crossfield Dr. The aircraft departing Rwys 16L/16R are still in a steep climb as they passed over Crossfield. I would guess that at Interstate 5 or just before, the Tower says to "contact departure."

The typical exchange is brief – Tower: *Delta Twenty-One Eighty-One, contact departure.* Pilot: *Delta Twenty-One Eighty-One, good day*. The pilot then contacts the departure controller on a frequency given to him during the Clearance Delivery phase before taxiing.

❖ What is a Flight Number?

It depends on who is using it. Some airlines are more straightforward than others. Here is one of the more confusing ones, U.S. Airways. The public is more accustomed to seeing "U.S. Airways Flight 1256." An air traffic controller on the radio will use the call sign "CACTUS Twelve Fifty-Six" for the flight. The written identifier for this flight is "AWE1256."

Airliners also contact their company offices ("ops") at airports using assigned frequencies in the 128.825-132.00 MHz band. Hobbyists call them "company frequencies." One instance is when an arriving airliner is in range of its destination airport, the pilot will call in to initiate the contact and simply say *San Francisco Ops, 1256. Only the numerical digits of the flight number are given since that company's operations know what airline it is and what flights are expected.*

It can take a while to become familiar with flight numbers and call signs. Until you do, one FAA reference ties them all together. It is FAA *Order JO 7340.2, Contractions*. It can be browsed on line or downloaded and saved to your hard drive for reference. Go to **www.faa.gov/air_traffic/publications/**. (If you like to read and learn, there is no end to the information available in all the documents you will see listed.) Once there, scroll down to "JO 7340.2C PDF, HTM" (The letter on the end of the order number, "C" in this case, is just the version and will change as successive editions are published.) For the downloadable version, click on "PDF." For the on-line, browseable version, click on "HTM."

"This order contains the approved word and phrase contractions used by personnel of the Federal Aviation Administration (FAA). It is also used by other agencies that provide air traffic control, communications, weather, charting, and associated services."

To decode a call sign you hear on the radio, scroll to *Chapter 3. ICAO Aircraft Company Three-Letter Identifier and/or Telephony Designator Assignments and U.S. Special Telephony/Call Signs, Section 2. Telephony/Aircraft Company/Three-Letter Designator Decode*. When that comes up, click on the letter "C" (for the CACTUS example) under *Section 2*. You will find it in the "Telephony" column.

To decode the three-letter company identifier, look in the next section down. Under *Section 3 THREE-LETTER DESIGNATOR/AIRCRAFT COMPANY/TELEPHONY DECODE*, click on the latter "A" for the AWE example. It will be listed in the "3-Ltr" column.

This is a Cirrus SR-22, the example aircraft type used in the text. Sometimes it can be nice to have aircraft images to go along with what we hear on the radio. (Photo courtesy: Cirrus Aircraft)

If you start with just "U.S. Airways," click on the letter "U" under *"Section 1 AIRCRAFT COMPANY/TELEPHONY/THREE-LETTER DESIGNATOR ENCODE."* It will be listed in the "Company" column and the other information will be in the "Country," "Telephony," and the "3Ltr" columns.

To simplify all this, download and save the PDF version (526 pages, 5.5 MB). Use the search feature in your PDF reader and it will find all instances of the search term no matter the section or column.

❖ "Say Type Aircraft"

Pilot: *Request flight following to Echo One Six at eight thousand five hundred feet.* (E16 is South County Airport of Santa Clara County.) Controller: *Seven Four Seven, say type aircraft*. Pilot: *We are a Sierra Romeo twenty-two slash Golf*. Perhaps you have heard similar references to "type aircraft."

To sort this out and still using FAA *Order JO 7340.2, Contractions*, see *Chapter 5. Aircraft Type Designators, Section 2. Decode*. In the HTM version, click on "S." Scroll to "SR22" (Sierra Romeo twenty-two). The "Type/Wt Class" column shows "L1P/Lt." The "Model" column shows SR-22. The "Manufacturer" column shows "CIRRUS."

To decode "L1P/Lt.," see *Chapter 5. Aircraft Type Designators, Explanation of Codes*. From the "AIRCRAFT TYPE" table, "L" means "Land Based Aircraft." From the "NUMBER OF ENGINES" table, "1" means "One Engine." From the "TYPE OF ENGINES" table, "P" means "Piston." From the "WEIGHT CLASS" table, "Lt." means "Light ICAO designated aircraft of 15,500 lbs or less."

Above, you can see that the pilot tacked on "slash Golf." It is one among many "Aircraft Equipment Suffixes." You must go elsewhere to decode this. Return to **www.faa.gov/air_traffic/publications/,** scroll to "JO 7110.65U PDF, HTM" and select your choice of PDF (downloadable – 610 pages, 3 MB) or HTM (browse on line). With the HTM version, go to *Chapter 2. General Control, Section 3. Flight Progress Strips, 2-3-6. AIRCRAFT TYPE*, and scroll to *TBL 2-3-10 Aircraft Equipment Suffixes.* With the PDF version, enter "/G" (less quotes) in the PDF reader search box. In either case, you will see that "/G" is "Global Navigation Satellite System (GNSS), including GPS or WAAS, with en route and terminal capability."

The pilot reported his aircraft type as "Sierra Romeo twenty-two slash Golf." From that, you (and air traffic control) can determine that it is a Cirrus model SR-22, a land-based, light aircraft with a single, piston engine that has Global Navigation Satellite System capability.

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Amateur Radio on Longwave

U.S. hams have been restricted to "two hundred meters and down" ever since the beginning of regulation in 1912. At that time it was believed that longer wavelengths provided greater range (something which is arguably true when considering only ground wave propagation), and the longwaves were reserved for commercial, maritime, and military users. Hams got what was left over—essentially 1500 kHz and up. Most people felt these frequencies were essentially useless for long range communication.

As is well known today, hams proved the higher frequencies to be *anything* but useless. With the discovery and use of skywave transmission, amazing distances were achieved on the higher bands, even with relatively low power. The race was soon on for others to flock to this new frontier, and longwave became less and less prevalent for two-way communication.

Experimenters have not been completely absent from longwave throughout the years, however. First, there were some special permits issued to allow hams to still use lower frequencies for long range traffic handling. Also, in more recent times, a sliver of license-free spectrum has existed from 160 to 190 kHz where work has been carried out by so-called "Lowfers" on a fairly regular basis. Lowfer activity in the U.S. blossomed in the early 1970s, and continues today with innovative digital modes.

The restrictions on this band are severe: Only one watt of input power is allowed, and antennas must not exceed 50 feet/15 meters in length (including the feedline). On the plus side, virtually any transmission mode is allowed (excluding spark), provided out-of-band signals are attenuated by at least 20 dB. While this is *not* ham radio in the strict sense of the term, many hams do experiment here (along with many non-hams) and some amazing distances have been achieved. These hardy experimenters helped prove the viability of low power communication on longwave. As such, a lot of the credit for the current interest in LF ham operation rightly goes to them.

New Bands?

The exciting news this year has been that *two* allocations below 500 kHz are being studied for possible use by U.S. hams. The first of these is 472 to 479 kHz which was allocated for amateur use during the 2012 World Radiocommunication Conference (WRC-12). It must be adopted by member countries before it can actually be utilized by amateurs. Several countries have already opened up the band, including Australia, the Czech Republic, Germany, Greece, Norway, the Philippines, Monaco, Sweden, and others. The ARRL has submitted a Petition for Rulemaking to the FCC seeking implementation of the 472 to 479 kHz allocation, and hopes are high that this action will be carried out. Interference from Power Line Carrier (PLC) systems is thought to be a minimal risk here, because few such systems operate this high in the band.

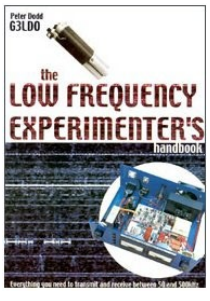
In recent years, a number of U.S. hams have received special experimental licenses for parts of the upper LW spectrum ranging from about 460 to 515 kHz. One of the most active experiments is being conducted by the WD2XSH group of stations operating from 505 to 510 kHz. Complete data on this ARRL-sponsored network is available at **www.500kc.com**. A sub-page lists other U.S. experimental stations on the air, and a quick review makes it clear that there is a *lot* of work going on at this end of the band. Also, at the time of this writing, *no* interference complaints have been received by the WD2XSH group—despite logging nearly 140,000 hours of operation since 2006.

A second area of encouragement for U.S. hams is the possibility of a new band from 135.7 to 137.8 kHz (nominally 136 kHz). The FCC has opened an inquiry to determine the pros and cons of such an assignment. At this end of the spectrum, PLCs are more numerous and the question of co-existence with them will be studied closely. While PLCs are unlicensed devices with no official protection from interference, they have been active for decades, and are used for critical monitoring and control of the electric grid. As such, they have been treated as an "established" service over the years, and the power industry has been very protective of their favored status.

Now it's time for some editorializing… that's what column editors do, right? Remember BPL? I find it most ironic that the electric utility industry had no qualms about deploying these broadband systems on unshielded power lines with little concern for interference to licensed users, yet they demand near "sacred" status for their Part 15 PLC operations on longwave. Why a 2 kHz allocation with power limits poses a threat to their operations is beyond me. The whole issue of spectrum management is a complex affair, but it appears that science is only one element in the decision-making process.

LW Ham Resources

An informative book for those seeking more information on amateur/experimental operation on longwave has been authored by Peter Dodd, G3LDO, under the title of *The Low Frequency Experimenter's Handbook*. It is available from several sources, including Universal Radio Inc. at **www.universal-radio.com/catalog/books/4452.html**.



The Low Frequency Experimenter's Handbook is an invaluable aid to getting on the air below 500 kHz. See text for where to find it.

There is at least one commercial transmitter kit now available for the 450 to 550 kHz band, and that is the JUMA TX500. It is produced by Finnish amateurs OH2NLT and OH7SV. More complete information on this and other LW equipment in kit form can be found at **www.jumaradio.com**.

Visit **www.lwca.org** for listings of currently active stations on both the 136 kHz and 160-190 kHz bands. John H. Davis maintains this information, and also has a monthly column in the LWCA's journal, *The Lowdown*.

Mailbag

I was pleased to hear from DXing friend Ken Alexander VE3HLS (ON) recently. He set up a new listening post with a G31DDCExcalibur Software-Defined Receiver (SDR), and writes: "I finally got a good antenna put together for use with my Excalibur receiver and what a great session I had this evening! The loop is a new Wellbrook medium-aperture type. I made a semi-rigid rotatable loop for it the other day. It's sitting out in the back yard on a TV antenna tripod and is aimed roughly to null most of the Toronto AM broadcast stations."

DX Logs of Ken Alexander (Ontario)

Freq	ID	Location	Distance (km)
204	YFY	Iqaluit, NU	2,289.1
206	QI	Yarmouth NS	1,080.0
207	CL	Charlo NB	1,092.8
208	YSK	Sanikiluaq NU	1,383.1
212	SJ	St John NB	1,085.3
215	ZWW	Winnipeg MB	1,488.2
216	ME	Matane QC	1,051.1
233	GP	Gaspe QC	1,263.3
254	5B	Gunisao Lake, MB	1,614.9
260	YAT	Attawapiskat ON	1,005.4
266	YZX	Greenwood NS	1,140.5
269	UDE	Delta MB	1,571.3
279	SI	Simiutaq, GRL	2,841.6
280	QX	Gander, NL	1,961.8
281	CA	Cartwright, NL	1,944.3
284	RT	Rankine Inlet, NU	2,234.4
305	YQ	Churchill, MB	1,905.7
317	VC	La Ronge, SK	2,208.2
323	UWP	Argentia, NL	2,000.1
350	NY	Enderby, BC	3,021.0
395	YL	Lynn Lake, MB	2,067.3
396	JC	Rigolet, NL	1,883.6
400	QQ	Comox, BC	3,456.7
402	MQ	Miquelon, FR	1,818.6
406	YLJ	Meadow Lk, SK	2,375.7

"I had such a good session I didn't log anything that was less than 1,000 kilometers away. The highlights of the evening were SI Greenland on 279 kHz, and two beacons from British Columbia; NY (Enderby) on 350 kHz and QQ (Comox) on 400 kHz." A selection of Ken's

most distant loggings are shown below. I hope to present more of them next month. Anyone else out there using an SDR receiver for beacon hunting who would like to share their catches?

More on Consolan

We provided some details of Consolan/Consol stations in the last issue as a follow-up to our *Gone but not Forgotten* column featured in December 2012. Ralph Craig AJ8R, has kindly given us a description of the system here in the U.S. Ralph has a background in navigation systems for aircraft, and I found his write-up to be especially informative. While there is not enough room for all of his material, here is an overview how Consol/Consolan got started, and how Nantucket Island played into the picture, which many will recognize as the site of the beacon TUK (194 kHz).

"During WWII the Germans needed a navigation system that could give better results than dead reckoning or celestial navigation, which was so often affected by cloudy weather. They developed a system called Sonne that utilized low frequencies and allowed finding a ship's location up to 1,000 miles offshore. This permitted their submarine to transit the Bay of Biscayne to bases in France and the coastal waters off of Norway to bases on that coast. In a strange happening of war the British, through surveillance and espionage, learned of this system and used it in their attacks on the subs transiting the Bay of Biscayne. After the war, the Europeans developed a system called Consol essentially copying the German system.

"Later, during the cold war, the U.S. needed a system to provide known tracks for aircraft penetrating U.S. Airspace and created a new system called Consolan. There were Consolan systems serving approaches to San Francisco, Miami, and New York allowing aircraft to be carefully tracked. While the Consol system in Europe operated in the 250-350 kHz range, Consolan in the U.S. operated a bit lower in frequency. There was one near San Francisco (192 kHz), another near Miami (193 kHz?), and two in New York. There was also a system in New Jersey operating on frequencies near 515 kHz. This station was never fully commissioned as each time it was turned on, interference was caused to many Marine stations operating on nearby frequencies. After many modifications it was still causing interference and was not commissioned.

"A second system for New York was on Nantucket Island where I was stationed for a time. It operated on 194 kHz. If you monitored the low frequencies 60 years ago you undoubtedly heard the "beep, beep, beep" of these stations. When a better system of navigation was deployed (LORAN C operating on 100 kHz), Consolan systems were decommissioned. Nantucket became an HH (High power Homing) beacon, "TUK," and it continued well into recent times. The closing of the Consolan system was much opposed by the fishing industry. Although designed for the aircraft industry the systems were much used by marine traffic, as well. The Consolan system required the simplest and most inexpensive equipment; a receiver with a BFO covering the LF band, and a map."

And, Finally...

Mario Filippi N2HUN wrote with an update to his restoration efforts on his Coastal Navigator RDF receiver. He writes: "A while back you covered some information about my RDF radio, which had a bee's nest in it. After lots of trying, I only got it to work on the AM and LW band, but could not revive the shortwave portion of the radio. Not having a manual was the problem, so I decided to leave it be, and use it as an AM radio in my basement shop. It performs very well as an AM radio. I can hear stations at night from Canada and even Cuba occasionally, because I can rotate the directional ferrite antenna."

Mario Filippi recently restored this Coastal Navigator RDF Receiver.

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Classic References for Your Bookshelf

Joe Amara writes that he and a friend have just finished "waking up " a Zenith Trans-Oceanic by carrying out a complete recap. They'll do a realignment in their next work session and, down the line, they are looking to put together a battery pack for the set.

After reading about my difficulties with the IF transformers from the S-38D, Rick Ketterman proclaimed that my project was suffering from "the dreaded SMD–otherwise known as the silver mica disease." Rick ran into the same problem unexpectedly when restoring a spice rack radio. He might have discontinued the project then and there except he had already started to strip the finish on the louvered cabinet. He didn't need to be hit with all that extra detail, but he soldiered on to a successful conclusion. His next project: an S38-D restoration inspired by the restoration recently completed in this column.

Ron Tang, a retired electronic tech, writes that my transformer problems brought back memories. He has replaced maybe 100 of that style during his working life. They were manufactured by Miller Coil and sold under the brand name K-Tran. In the FM and TV applications that Ron was dealing with, these transformers caused audio distortion as the internal capacitors began to fail.

Jim Falls K6FWT has been working on a couple of World War II communications receivers: a BC-312 and a BC-348. Coincidentally, both had developed problems in the BFO circuitry. The BC-312 fix required a creative solution. The trouble was traced to a near-shorted capacitor in the BFO can, but one of the leads from the capacitor was inaccessible. So Jim clipped the accessible lead, which had been connected to ground, and wired the replacement cap from ground to the stub of the lead from the near-shorted capacitor. The strategy worked very well and full operation was restored.

❖ Last Month

In the April column, we took care of the two defective IF transformers in the S38-D by replacing them with an identical but good set removed from an old clock radio. Near the end of the column, we removed the cover of one of the defective units to investigate the possibility of repairing it, just as a learning exercise. At that time the rivet holding the plate covering the built-in capacitors was drilled out so that the plate could be removed.

This exposed the capacitors so that they could be removed (not yet done), paving the way to install modern silver micas in their place. The size of the silver micas would have to be determined by trial and error, and I had intended to have that done in time to report on the results in this column. My time for bench work was very limited this past month so I skipped to the next topic on my mind–which happens to be discussing useful books for radio hobbyists.

❖ Developing a Useful Reference Library

I've always felt that having a comprehensive library of reference books is as important to the antique radio hobbyist as having a well equipped workbench. Since we're in between projects right now, I thought this might be a good time to tell you about some of the books I've found particularly valuable in my own work. A number of these books, though out of print, are still available new from hobby book dealers such as Antique Radio Classified (**www.antiqueradio.com**) or Radio Daze (**www.radiodaze.com**). General book dealers such as Amazon (**www.amazon.com**) shouldn't be overlooked. They may happen to have just the book you are looking for, perhaps even offering it used at reduced cost.

Never pass up an opportunity to scout for books at any radio meet or flea market you might attend. This is where you will find the older volumes not available in retail outlets, and you may also be fortunate enough to find newer books at much lower prices than you'd have to pay to a dealer.

The book list I'll be giving you is not meant to be a definitive review of everything available in the field. It is simply a collection of titles that I've found useful in my own work. If favorites of yours are missing, consider yourself encouraged to pass along their titles and descriptions to me for sharing with other readers in a future column.

❖ Radio Repair and Restoration

How to Repair Old-Time Radios by Clayton Hallmark, Tab Books, Blue Ridge Summit PA, 1979, 259 pages, soft cover. Written in an easygoing chatty style, the book is very well illustrated with photos and schematics. The author doesn't hesitate to provide short discussions of theory.

Fixing up Nice Old Radios by Ed Romney, Romney, Emlenton PA., 1990, 186 pages, soft cover, comb bound. Romney's approach is highly individualistic, you might call it quaint, but there is no doubt about the depth of his knowledge about antique radios. The book provides some basic theory to begin with and then discusses restoration by circuit type beginning with regenerative sets and concluding with complex communication receivers. Case studies involving actual receivers are used throughout.

Practical Radio Servicing; Profitable Radio Troubleshooting; Elements of Radio Servicing, all by William Marcus and Alex Levy, McGraw-Hill Book Company, New York, NY, 1955, 1956, hard cover. Also, *Television and Radio Repairing, William Markus (McGraw-Hill, 1961); Radio Servicing, Abraham Marcus (Prentice- Hall, New York, NY, 1954); Radio and Television Receiver Troubleshooting and Repair, Alfred A. Ghirardi and J. Richard Johnson (Rinehart Books, New York, NY, 1952),* all hardcover. I assume that these Marcus and Markus folks are somehow related. Must be an interesting back story there! At any rate, I often turn to these books, all written for the Radio/TV serviceman, for practical advice in solving specific problems. The last two books (from Prentice-Hall and Rinehart) are set up for classroom use and tend to provide more detailed discussions.

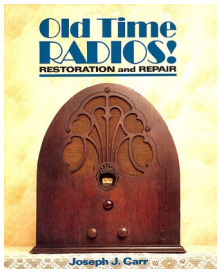
Modern Radio Servicing by Alfred A. Ghirardi, Murray Hill Books, 1935, 1318 pages, hard cover. This fat, blue volume by a respected writer on radio topics is a major source of information on dealing with mid 1930s radio technology. Part 1 is a review of test equipment–still informative although its discussions about building one's own are of limited interest today.

Part 2 covers approaches to servicing broadcast receivers of different designs. Part 3 is devoted to dealing with specialized sets such as auto, all-wave, marine and Hi-Fi. Part 4 offers listings of vacuum tube characteristics and basing diagrams.

❖ Radio Theory

Because my involvement in the radio hobby is mainly repair and restoration, I don't find myself referring to theory books very often. I do keep a library of college level engineering books on hand for answers to occasional searching questions as well as few hobby or service technician-level references for everyday use. Among these are:

Old Time Radios Restoration and Repair by Joseph A. Carr, Tab Books, Blue Ridge Summit, PA, 1991, 256 pages, soft cover. Yes, I know the title says "Restoration and Repair," and that description does not give lie to the contents. There's even a fascinating chapter on salvaging electronic equipment that has been in floods. But this is a writer who loves to explain theory, which is deftly and lucidly interspersed with the practical material.



Basic Radio Course by John T. Frye, Radcraft Publications, New York, NY, 1951, 175 pages, hard cover. If anyone should know how to present radio theory with a light touch it would be the author of the beloved "Carl and Jerry" series that ran in *Popular Electronics* in the 1950s. The series documented the fictional radio adventures of two close college friends. Slender as it is, Frye's volume is divided into 26 chapters so that the material is presented in easy to digest chunks. Approximately the first half of the book is devoted to basic electrical and electronic principles. In the second half, Frye discusses the various stages of a superheterodyne receiver beginning with the power supply and proceeding from the audio stages backwards through to the antenna.

Radio Physics Course by Alfred A. Ghirardi, Radio & Technical Publishing Co., New York, NY, 1933, 972 pages, hard cover. Though this is a very different book from the John Frye volume just discussed, its basic organization is the same. The profusely illustrated book begins with basic electrical and electronic principles, then moves on to a stage by stage treatment of various radio receiver designs, proceeding through to the antenna and ground. Although an excellent reference source, the volume is also set up so it can be used as either a classroom or self study text. Like its companion volume *Modern Radio Servicing*, the book gives us valuable insights into radio technology of the 1930s.

❖ Reference

Of course, all the books in my radio library are, broadly speaking, reference books. But this category includes volumes that I keep on hand to look up specific pieces of information. Many of them are in my library because of my special areas of interest, but I'll try to give you examples that might have a more general appeal.

Radio Manufacturers of the 1920s by Alan Douglas, Sonoran Publishing, Chandler, AZ, 1988, three volumes averaging 250 pages each, soft cover. This is an uncontested bible for anyone involved with the collecting of 1920s radios. The series provides company histories for some 70 of the largest manufacturers of the era and, insofar as possible, shows illustrations and dates for every advertised model of every manufacturer.

Behind the Front Panel by David Rutland, Wren Publishers, Philomath, Oregon, 1994, 158 pages. If the Alan Douglas book is a bible for radio manufacturers and products of the 1920s, this book is one for the radio designs of the period. Well illustrated with circuit diagrams and photographs, and using straightforward language, the author reviews all important 1920s radio designs from crystal sets to eight-tube superheterodynes.

Philco Radio 1928-1942 by Ron Ramirez and Michael Prosise, Schiffer Publishing, Atglen, PA, 1993, 190 pages, soft cover. This book's 16 chapters, broken down by years, trace the company's history from its very beginnings in 1892 through 1942. For each year, or group of years, there is text outlining the important milestones followed by photographs and descriptions of the radio models released. The volume contains some 450 photographs, over half of them in color.

Communications Receivers Past and Present 1942-1997 by Fred Osterman, Universal Radio Research, 1998, 473 pages. Provides complete specifications for communications receivers produced by major manufacturers from 1942-1997. Over 770 sets are pictured and described.

Perpetual Trouble Shooter's Manuals (aka "The Rider Manuals"), John F. Rider Publisher, New York, NY. This massive set of books occupies over seven feet of shelf space and contains schematics, alignment instructions and other data for virtually every radio model manufactured in the U.S. from the mid-1920s to the mid-1950s. Complete sets of Rider's are available in CD form but there is no easy way to check for completeness or uniformly good reproduction quality and, unfortunately I don't have enough information to recommend a good source.

To properly access the Rider manuals one needs a complete index. The individual Rider volumes had indexes – if the original owner happened to install them when received from Rider. But these are of limited use. I purchased my index in the form of three reprints covering volumes 1-15, 16-22 and 23 (the final volume of the set)

RCA Receiving Tube Manual Technical Series RC-14, RCA Manufacturing Co., Harrison, NJ, 1940, 255 pages, digest size, soft cover. A good tube manual covering basic characteristics and basing diagrams is obviously a must in every antique radio hobbyist's shop. The ones from RCA were revised and reissued frequently. I have an RC-30 in my collection with a 1975 copyright. My RC-14 is old enough to include the early battery set tubes, which is as early as we need to get. Later manuals may delete these tubes or relegate them to a "seldom used tubes" category giving limited information. Before purchasing any tube manual, RCA or otherwise, check to see if it has full entries for the 00-A, 01-A, 11 and 12. Then you can be sure that it will also include any other early tubes you would be likely to run into.

❖ History

Even if your antique radio interest is mainly collecting or restoration, I recommend that you read some radio history to better understand the context in which the radios you are working with were manufactured and used. And for that I highly recommend the following books.

A Tower in Babel: A History of Broadcasting in the United States to 1933 by Erik Barnouw, Oxford University Press, New York, NY, 1966, 345 pages, hard cover.

The Golden Web: A History of Broadcasting in the United States 1933 to 1953 by Erik Barnouw, Oxford University Press, New York, NY, 1968, 391 pages, hard cover.

The third volume in this series, which is not in my collection, is subtitled *The Image Empire,1953.*

ANTENNA TOPICS

BUYING, BUILDING AND UNDERSTANDING ANTENNAS

Dan Farber, AC0LW
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Getting Loaded: Making Short Antennas Work

Welcome back, my friends. We've talked many times about using ladder line and a tuner, or even single-wire feed and a tuner, to enable a host of oddball non-resonant antennas, often gaining multiband capability in the process. This isn't always a solution for everyone, though. The mobile operator definitely isn't thinking about tuners and ladder line, but rather a "plug 'n' play" scenario where coaxial cable and a properly adapted antenna allow one to just get on the air with minimum fuss.

The police are already nervous about texting and driving, so it would make us all look pretty lame to read in the news that "the horrible accident was caused by a distracted driver adjusting his tuner for lowest possible SWR." Also, many home station operators dislike the "messy" appearance that ladder line or similar feed can have, preferring the ability to conceal coaxial cable. Yet this same home station may not be able to use full-sized antennas, due to space limitations, spousal objections, or the ubiquitous, insidious Antenna Gestapo.

Portable operators, too, usually prefer as few pieces of gear to tote as possible, so if there's an alternative to lugging a tuner along, they're interested. It is these scenarios, shortened antennas, fed with coaxial cable, that we'll look at this time around.

Hit the Road, Jack!

Let's consider the mobile operator first. A moment's reflection tells us that a shortened vertical is virtually the default antenna for a moving or stationary vehicle, due to the laws of physics; a 100 foot dipole or three-element beam just can't be deployed on the roof or rear bumper of any vehicle they're likely to let you take on the public streets. The six or ten meter operator can actually mount a full-sized quarter-wave vertical, since even the one for ten meters is only eight and a half feet long. Any longer, though, and bridges and overpasses become a real hazard to try driving under. So to operate lower frequencies, we need to accept a shortened vertical with some form of *loading.*

Loading is probably as apt a term as any. The short vertical is too "light," so we make it "heavier" to put a "load" on the transmitter; 50 ohms, if all goes ideally. What we're actually doing is making the antenna *electrically* longer without much changing its *physical* length. There are two basic ways we can do this: we can add capacitance to the far end of the vertical, or we can add inductance somewhere in series with the vertical.

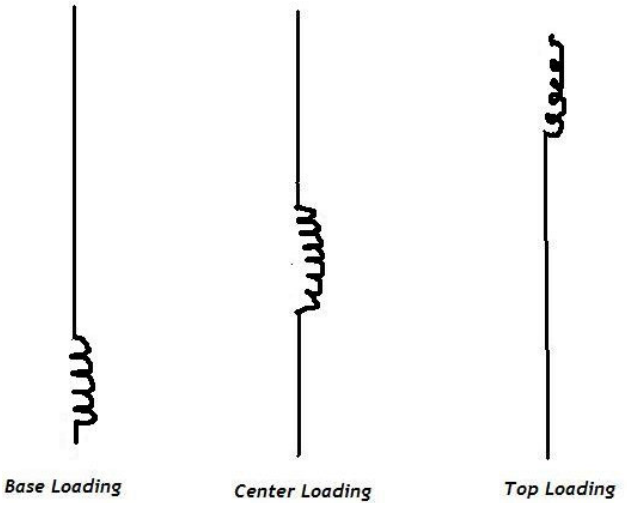

Figure 2: A loading coil usually is added at base, sometimes center or top, of a short vertical. (Drawing by author)

Since, in this first scenario, we're considering mobile operation, we'll set the "capacitance hat," as it's called, aside for now; these tend to have startling effects on the aerodynamics of a flexible vertical when the vehicle is moving! (News flash: Pedestrians decapitated by flailing "samurai antenna!") So, we're left with the *loading coil.*

Three basic paradigms exist for loading coils added to a vertical. *Base loading*, *center loading*, and *end loading* tell us right where the coil is placed. Theoretically, you could place the coil anywhere along the length of the vertical, but for points other than these three, the two ends and the center, the math gets pretty complicated. For mobile operation, the base-loaded vertical is the most common, for obvious aerodynamic reasons.

Now, it's important to understand that while the loading coil makes the vertical *electrically* longer, this only serves to bring the feedpoint impedance to near 50 ohms. It does *not* make the short vertical more efficient, because its *radiation resistance* is still very low. In such a scenario an efficient ground becomes even more important for best results. Fortunately for the mobile operator, the metal skin of a car or truck's body makes a nice ground plane. Serious mobile operators carefully ground-strap together all the metal of the body and frame to make as efficient a ground plane as possible.

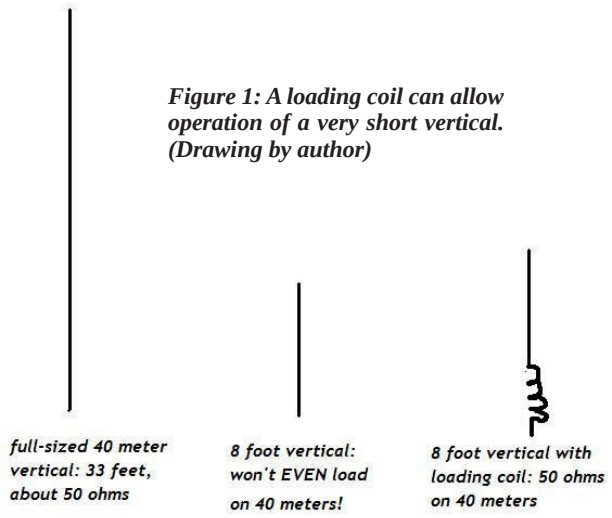

Figure 1: A loading coil can allow operation of a very short vertical. (Drawing by author)

Take A Hike!

It's a similar scenario for the portable operator, although antenna height is much more flexible. Here it's more a matter of how much the intrepid hiker/ham wants to haul along, rather than an issue of fitting under overpasses. Also, the stationary aspect of portable operating means aerodynamics are much less of a problem, so loading coils can be located at the center or the top of a vertical; the capacity hats I mentioned earlier become feasible too. The same result obtains; one can operate the lower bands without having to carry enormous antennas around. The portable op can often raise the shortened vertical on a mast or other pole and improve results considerably; guy wires to support such a pole are routinely used as a ground plane. Again, the thing to keep in mind is that some *efficiency* is sacrificed for the sake of *portability.*

My Chameleon V1 vertical allows me to operate clear down to 40 meters, yet it is only eight feet long; full-sized verticals would be nice, but a 33 foot long vertical for 40 meters is not something to pack on the trail. The V1, on the other hand, dismantles to two four-foot sections that are much more manageable to tote around. Good coax and my rig complete a tunerless, minimal setup, easy enough to haul around and set up quickly. I can throw the ensemble together quickly, get on the air, and easily break it all down and haul it elsewhere. The V1 is a special case, as the loading coil is wound onto the structure of the antenna itself, rather than being a distinct entity at the base of the whip. The results, though, are the same, a short vertical with its own loading coil allows operation on every HF band (OK, every HF band above 7 MHz).

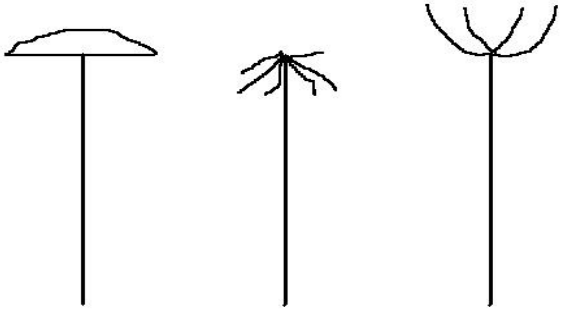

Figure 3: Various bits of metal, limited only by imagination, can form a "capacitance hat" to improve loading of a short vertical. (Drawing by author)

❖ Bring It On Home

For the home station, loading coils for verticals help to work around the laws of physics too. Operation on 160 or 80 would be impossible for many of us, if we couldn't accept some form of loading of a short antenna. A full-sized quarter-wave vertical for 160 would be 130 feet long; few of us have the wherewithal, or legal freedom, to raise such a structure in the neighborhoods we live in. On the other hand, thanks to the concept of the loading coil, we can get on 160 with verticals that are considerably shorter; antennas in the 16 to 48 foot length category are routinely used on Top Band this way. Again, it will not have the efficiency of a full-sized vertical; but most of us will cheerfully accept a route that allows us some sort of reduced operation on a given band, rather than resign ourselves to not operating that band at all.

On 80 meters it's even more encouraging, since the same short vertical is proportionally twice as close to "full length" as it is on 160. Indeed, loaded verticals probably allow more of us to operate these two lowest bands than any other commonly-applied workaround; verticals have such a tiny footprint compared to putting up any wire antenna long enough to get out on the low bands. It's important to keep in mind that the best possible ground arrangement will be crucial to the success of the shortened vertical; get out that lawn edger to make shallow trenches and start laying those radials!

❖ In Conclusion...

To sum up: loading makes a short vertical electrically longer, allowing us to feed it with coax and no tuner. It doesn't make the short antenna any more efficient, but rather makes it usable at all. For mobile or portable operation, or for stealthy or just space-restricted hams at home, loading systems, mainly loading coils, are the "magic solution" that enable us to get on the air with short verticals. Now, get out there and put one up. Happy operating!

Keith Baker, KB1SF / VA3KSF
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Amateur Radio Satellite Update

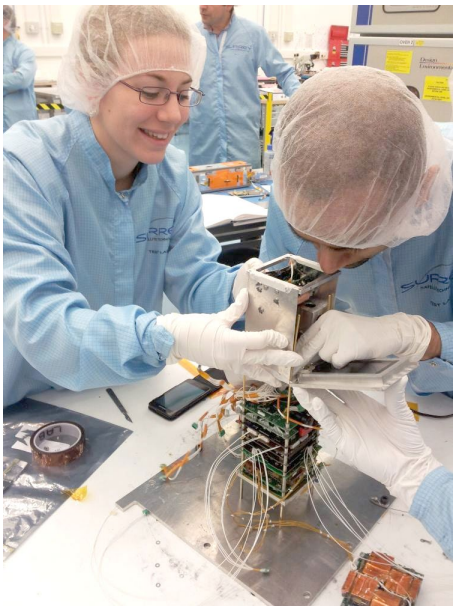
Up to now, I've been sharing information about how to listen for or, if properly licensed, communicate through our ever-growing fleet of amateur radio satellites that have been launched in the last few years. In this column I'll pass along the very latest information about another recent amateur radio satellite launch and discuss some of the regulatory issues now facing the Amateur Satellite Service in the United States. I'll also report on some very good news about the future of the AMSAT organization in North America.

So, first, let's shine the spotlight on yet another CubeSat that was in orbit and still operational at press time (early March, 2013). However, as I've said before, it's important to remember that because lifetimes of these satellites are relatively short, it may (or may not) still be operating by the time you read this.

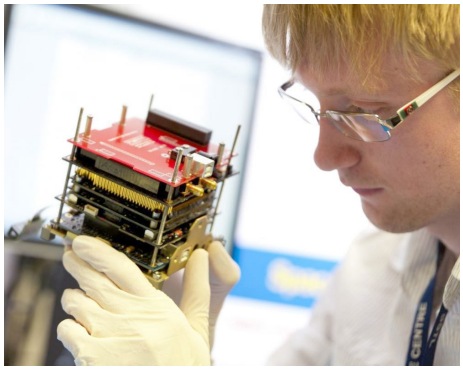
❖ STRaND-1

The United Kingdom's first CubeSat, STRaND-1, was launched on Monday, February 25, 2013 at 1231 UTC on the PSLV-C20 rocket from the Indian Space Research Organization (ISRO) Satish Dhawan Space Centre. Deployment from the launch vehicle into a 785 km orbit took place about 20 minutes later. The first signals from STRaND-1 were received by Nader Omer ST2NH in Sudan at 1555 UT and by the Surrey Space Centre in Guildford, England that same evening.

STRaND stands for *S*urrey *T*raining, *R*esearch and *N*anosatellite *D*emonstration and the program is intended to be a long-term arrangement between the commercial space company Surrey Satellite Technology (SSTL) and academic researchers at the Surrey Space Centre (SSC) at the University of Surrey. STRaND-1 is intended to be the first of a long line of planned STRaND CubeSats.



STRaND-1 took just 3 months to build and uses a Google Nexus One smartphone with an Android operating system. (Courtesy: AMSAT-UK)



Dr. Chris Bridges with the flight model of STRaND-1. (Courtesy: AMSAT-UK)

The SSTL employees and SSC researchers involved with the STRaND program are all volunteers. It is a condition of the program that volunteers from SSTL and SSC use their own free time for STRaND activities such as during lunches and breaks. As a result, the project has no formal staff or funding and is entirely dependent on volunteers.

What's even more amazing is that the STRaND-1 CubeSat was built and tested in *just three months* and carries a Google Nexus One smart phone with an Android operating system all designed to demonstrate the feasibility of using cheap smart phone electronics to control a spacecraft. STRaND-1 carries an amateur radio AX.25 packet radio downlink on 437.568 MHz using a 9600 baud FSK modulated data HDLC frame with NRZI encoding. More information about STRaND-1 (and links to information about how to decode its telemetry) can be found on the AMSAT-UK Web site at: **http://amsat-uk.org/satellites/strand-1/.**

Dr. Susan Jason works on STRaND-1 prior to launch. (Courtesy: AMSAT-UK)

STRaND-1 was successfully launched on PSLV-C20 from the Satish Dhawan Space Centre in India on February 25th, 2013. (Courtesy: ISRO)

❖ AMSAT-NA's ITAR Hassle

In years past, AMSAT-North America (AMSAT-NA) has worked closely with other AMSAT organizations around the world to build and launch our fleet of amateur radio satellites. Unfortunately, that all changed in the late 1990s when a Chinese rocket carrying a U.S.-built telecommunications satellite failed on launch. The satellite ended up (quite literally) in a hotel near the launch site killing several people.

The exhaustive investigation that followed (primarily for insurance purposes) came to the attention of several members of the U.S. Congress who believed that, as a result of trying to find the cause of the launch failure, sensitive U.S. space technologies were also being passed to the Chinese. That realization, in turn, resulted in a 1999 U.S. law that greatly strengthened the International Traffic in Arms Regulations (ITAR), a set of United States government regulations that control the export and import of defense-related articles and services on the United States Munitions List (USML).

Prior to 1999, the export of AMSAT-NA's

satellites to other nations for launch and collaboration with our foreign compatriots was exempt from such tight controls.

However, the 1999 law placed ALL United States-built satellites and associated space hardware (including AMSAT's satellites) on this list. That action instantly made AMSAT-NA a "munitions" supplier!

What's more, these newly strengthened ITAR regulations dictated that, not only space hardware and software, but also *any* information pertaining to defense and military related technologies (for items listed on the U.S. Munitions List which AMSAT's satellite now were) could only be shared with "U.S. Persons," that is, citizens of the United States.

This action amounted to a "gag order" on all of our technical collaboration with other AMSAT organizations in the rest of the world unless specific authorization from the Department of State was received or a special exemption was sought. Furthermore, U.S. Persons (including organizations) faced heavy fines if they had, without authorization or the use of an exemption, provided non-U.S. citizens with access to ITAR-protected articles, services or technical data.

For AMSAT-NA, this all came to a head when one of our own volunteer experimenters was officially cited for collaborating with our German AMSAT compatriots on their Phase 3-E amateur radio satellite then under construction in Germany. At that point, all such collaboration had to cease lest the AMSAT organization as a whole invite a heavy fine.

Unfortunately, for the last several years, AMSAT-North America has been completely hamstrung from working with other AMSAT organizations in other parts of the world by the current U.S.-imposed ITAR regulations. What's more, ITAR has also hampered AMSAT-NA's collaboration to work with U.S.-based university organizations, as many of their students whom we might come in contact with while working on our (or their) satellites are foreign nationals.

❖ Relief in Sight?

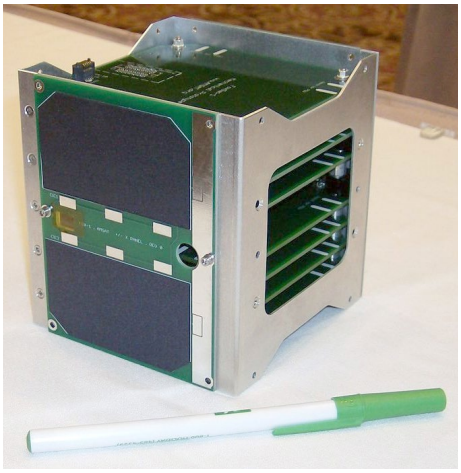
Fortunately, the current U.S. Congress has now realized that such tight export controls have decimated the U.S.-based commercial communications satellite industry and have actually caused the United States to lag behind the rest of the world in the research and development of space technology. In addition, other nations have since found ways to work around these strict U.S. regulations by building and marketing so-called "ITAR-free" satellites that can be launched on *any* nation's rockets without going through the (expensive) hassle of gaining U.S. government permission.

As a result, the National Defense Authorization Act for fiscal year 2013 repealed the 1999 law and now gives the President the authority to place such items (subject to appropriate national security review) on the far less stringent (and far more business friendly) Commerce Control List for these so-called "dual use" technologies.

Unfortunately, at press time, the implementing regulations surrounding the new law had yet to be written. As AMSAT does not build and launch "commercial" satellites, it remains to be seen whether AMSAT-NA will once again be free to collaborate on future satellite projects with our fellow amateur satellite builders in other countries. Fingers crossed that we will ultimately be able to do so.

❖ AMSAT FOX Project Update

At deadline (early March, 2013) AMSAT's experimenters were proceeding apace to prepare our FOX-1 satellite for launch. You'll recall that FOX-1 was selected for a free launch on one of the National Aeronautics and Space Administration's (NASA) Educational Launch of Nanosatellite (ELaNa) missions as an auxiliary payload. To date, a full-scale structural engineering model of FOX-1 has since been constructed and the FOX team was reporting good progress integrating the various components into a working satellite. Their aim was to have the flight-model satellite completed and ready for launch by this coming summer (July 2013), although a firm launch date from NASA has yet to be established.



The Structural Engineering Model of AMSAT's FOX-1 Satellite was unveiled at the October 2012 AMSAT-NA Annual Meeting in Orlando, Florida. (Courtesy: Author)

❖ More Good News for AMSAT

On February 26th, NASA announced the winning projects for the fourth round of their CubeSat Launch Initiative. Project selection was based on technical feasibility and the assessed merit for conducting technology demonstrations, STEM (Science, Technology, Engineering and Math) education, and science research. Selected projects then become eligible for a free launch on NASA missions as auxiliary payloads on launches planned for 2014, 2015 and 2016. The 24 winning CubeSat proposals came from universities, a Florida high school, non-profit organizations and NASA field centers. And AMSAT's entry was one of them!

AMSAT-NA partnered with the Institute for Space and Defense Electronics (ISDE) at Vanderbilt University to develop our winning proposal. The official name of the project is RadFxSat and NASA selected it at priority 15 out of the 24 winners.

AMSAT and ISDE plan to fly a FOX-1 type satellite (initially dubbed "FOX-2") with a sophisticated space radiation effect experiment to be developed by ISDE. This experiment is intended to improve computer modeling of radiation effects and help improve the survivability of modern semiconductor devices in the harsh radiation environment of Earth orbit. AMSAT is particularly interested in this area of science research since it directly affects the on-orbit lifetimes of our amateur radio satellites.

AMSAT's Vice President of Engineering, Tony Monteiro AA2TX (left) shows off the FOX-1 Structural Engineering Model to two of AMSAT's Past Presidents, Tom Clark K3IO (center) and Bill Tynan W3XO (right). (Courtesy: Author)

This project also represents an exciting "first" for AMSAT as the satellite's primary mission will be scientific research. AMSAT believes that partnering on science and education missions will open up new launch opportunities for AMSAT satellites in the future.

Of course, RadFxSat will also carry the same amateur radio FM transponder as Fox-1 but on a different frequency pair. Our AMSAT experimenters also believe the satellite will generate enough power to run the FM transponder simultaneously with the science mission most of the time. Needless to say, the transponder capability was an important component of our NASA ELaNa proposal since it will enhance the opportunities for formal science, technology, engineering and math (STEM) education via "hands-on" school activities using an actual communications satellite. It also allows informal groups such as the Boy Scouts, Girl Scouts and ham radio clubs to introduce radio and satellite communications to our young people. AMSAT aims to show that STEM education can be both exciting and fun!

❖ Wrap Up

That's all for this time. I'm getting lots of feedback from readers that this column is proving very helpful in getting them up and running on the "birds." However, I suspect many of you still have some questions about some of the finer points of amateur satellite operation. If you are one of them, feel free to drop me a note at: keithbaker@monitoringtimes.com with any remaining questions you may have about this exciting part of our wonderful hobby. I'll do my very best to reply. Remember, the only silly question is the one you don't ask! In future columns, I'll also continue our survey of those amateur satellites now in orbit, as well as some that are now on the drawing boards. See you then!

Elecraft KX3

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

You may have noticed that in the past few years, while more and more software defined radios (SDRs) are appearing on the market, fewer and fewer traditional tabletop shortwave receivers are being introduced. Most of the receivers in production, meanwhile, are quite mature, having been in production for years. For those of us who still have an appreciation for the traditional front panel, tuning knob, and portability of an all-in-one tabletop receiver, perhaps we should look to the active ham radio transceiver market.

Introducing the Elecraft KX3

In 2011, Elecraft introduced the KX3, a portable SDR transceiver with a full-featured knob-and-button user interface that doesn't require connection to a computer to operate. At the Dayton Hamvention that year, the KX3 instantly drew crowds, as it was unlike any other transceiver on the market. I was there and like others in the crowd around the Elecraft booth, I was eager to try out this full-featured transceiver, especially upon learning that even the basic, no-options model has a *general coverage* receiver.

A ham transceiver with "general coverage," incidentally, means that its receiver is not limited to the ham bands only; these receivers typically receive between 100 kHz and 30 MHz (i.e., the full shortwave radio spectrum). That morning at the Hamvention, I quickly made my way to one of Elecraft's owners, Wayne Burdick, to ask him, "Would the KX3 make for a good shortwave radio receiver?" Wayne's prompt response: *"Yes."* I just had to get my hands on one to find out.

A Closer Look

Though the KX3 was introduced in the summer of 2011, it didn't start shipping until a few months later, and there was a backlog of orders for it. Fortunately, my good friend, Dave Anderson K4SV, was among the first purchasers of the KX3, and he was generous enough (and trusting!) to let me borrow it.

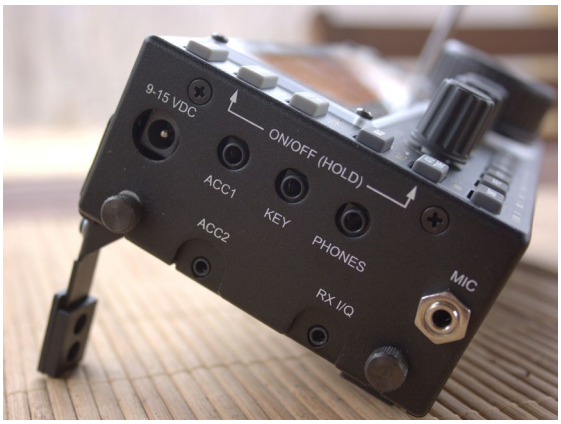
At first glance the KX3 resembles *just the faceplate* of a tabletop radio: it has a large tuning knob, wide, clear amber backlit display, and a traditional set of function buttons and multi-function knobs, but not much else. Or so it appears, as there's no bulky chassis.

Connections for microphones, DC power, headphones, IQ out, key and PC interface are located on the left side panel of the radio, while the RF connection (a female BNC) is on the right side panel. The KX3 has built-in folding feet, quite sturdy, that allow the radio to be tilted at a comfortable angle for tabletop operation.

To best evaluate the KX3, I'll first discuss some of the features that would interest a ham radio operator, and then focus on those best suited to the SWLer.

Everything for the Ham

If you're a ham, you'll love the feature set on the KX3. It must have one of the most comprehensive features sets on any radio I've ever used. At a bare-bones level, meaning without adding any options, the basic KX3 is truly an all-in-one QRP transceiver.

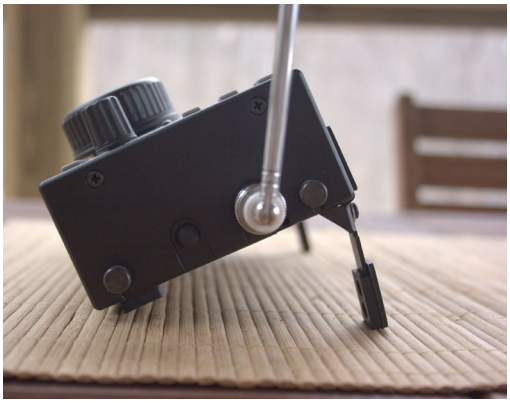


Of course, it will function on any mode: USB, LSB, CW, data, AM and FM. The output power is adjustable from 0 to 10 Watts. You can easily adjust the DSP (Digital Signal Processing) filters, AF, RF, passband, and notch filters all from dedicated buttons and knobs. It even has memory keyers for both CW and voice.

You say you prefer digital modes? Not only will the KX3 natively decode RTTY and PSK31 and display the scrolling text on the display, but you can also send RTTY and PSK31 without a PC. How? Simply set the appropriate data mode and use your key to tap out your message in CW. Though you will hear the CW side tone, the KX3 will transform your code into RTTY or PSK-31, and send. Hypothetically, armed with only a KX3, you could run a RTTY contest from the field with *no* computer.

The variable DSP filtering is most impressive and the KX3's ability to block adjacent signals is benchmarked. Indeed, if you look at Sherwood Engineering's receiver test data rankings (**www.sherweng.com/table.html**), which are sorted by third-order dynamic range (narrow spacing), the KX3 is second only to the Hilberling PT-8000A, an $18,000 transceiver.

With the installation of the $170 optional internal automatic antenna tuner (the KXAT3), you will be able to tune most any wire antenna on the go, with no need to carry an external ATU. In short, for the ham, the KX3 offers a cornucopia of features, too numerous to list here; but I can at least tell you that I discover something new on this radio almost every day and continue to be amazed by the features on this transceiver, especially considering that it costs only $1000 ($900 in no-solder modular kit form).



For the SWLer

I've written about the KX3 as a ham radio transceiver, but how does it stack up if your primary interest is to just sit back and listen to broadcasts? Short answer: *Very, very well.* The KX3 is loaded with features that would please even the most discriminating DXer.

First, on the faceplate, the KX3 has a multi-function knob that controls both the AF and RF gains. It's very simple to use, even though I'm not a fan of switching between the AF/RF gains controls on the same knob. AF gain is what most of us refer to as a volume control and many dedicated shortwave receivers lack an RF gain control even though it's a vital tool for broadcast listening in noisy conditions. By default, the KX3 RF gain is set to zero; turning

the RF pot counter-clockwise will decrease RF gain.

The KX3 also has three different preamp settings, which are useful for amplifying weak stations, as well as an attenuator for local or strong broadcasters. The KX3 has passband and notch filtering, and an auto-notch function that effectively deals with heterodynes from nearby carriers. The KX3 also has DSP noise-reduction (NR) for noisy band conditions (or to help a signal "pop" out from the noise) and noise blanking (NB) for local RFI.

Many automatic gain control (AGC) parameters are adjustable, too, so they can be tweaked for AM fading and weak-signal DXing. The fact is, the KX3 has more built-in receiver controls than the dedicated tabletop shortwave receivers I've owned.

❖ Audio

To be clear, however, there is one negative in the architecture of the KX3 when viewed through the eyes of a SWLer. The KX3 is designed around the amateur radio operator and AM bandwidth is narrower than you will find on most dedicated tabletop shortwave receivers. The KX3's AM bandwidth can only be widened to 4.2 kHz,-a figure that almost made me dismiss this radio's SWLing abilities out of hand.

What the KX3 lacks in wide bandwidth is made up for by the 32-bit floating point DSP architecture. I'm not sure how, but the KX3's audio fidelity "sounds" much wider than 4.2 kHz. When using headphones or amplified speakers, the bass response rivals some of my tube receivers. There are even adjustable 8-band audio equalizer settings to improve this further.

In addition, Elecraft has unique audio effects available in the audio effects menu. One I've found very valuable in broadcast listening is called "delay," a stereo simulation effect that broadens the mono sound in such a way that the audio sounds even richer.

❖ Memories, Scanning and Tuning

The KX3 has 100 general-purpose VFO A/B memories with optional alphanumeric labels. It also supports channel-hopping or scanning within any number of labeled memory groups. Auto scan is simple and works in both muted and (my favorite) non-muted, or continuous, modes.

The KX3 can also use the "K3 Memory" application from Elecraft's K3 transceiver, which allows for longer labels and the instant selection of desired memories from a PC. The "K3 memory" application is a free software download on Elecraft's website.

The tuning knob on the KX3 is substantial and of good quality. The drag can be easily adjusted with a supplied hex wrench. The tuning rate can be adjusted to .5 kHz increments, allowing you to quickly tune through the band. The small multi-function knob next to the main tuning knob can also be set for a 1 kHz rate.

At first glance, you might not realize that the KX3 has a direct frequency-entry keypad. Check out the photo, however. The buttons and multi-function knobs in the lower left quadrant of the KX3 double as number pad, decimal point, and an "enter" button for a keypad. I thought this a bit odd at first, but now find I use this all the time.

❖ Optional ATU: Worth the Cost

As I mentioned earlier, the optional automatic antenna tuner, the KXAT3, makes a lot of sense for the ham who operates portable. If you are a licensed amateur radio operator, the ATU can be a powerful tool for matching random length, or multi-band antennas to your desired broadcast band by tuning to a nearby ham band frequency. Of course, the L and C parameters of the tuner can be manually adjusted to optimize without transmitting.

In addition, if you like medium wave (MW) DXing, the ATU comes with MW (AM broadcast band) filtering that tracks the VFO, improving image rejection between 300-1,000 kHz. I have tested the KX3 on medium wave both with and without the ATU installed and find that it certainly improves reception. The ATU is very easy to install, almost "plug and play."

❖ Oh, Yes, and it's an SDR, Too!

As if the KX3 didn't do just about everything, it also has a quadrature down-sampling mixer compatible with PC-based SDR (software-defined radio) applications. This means, via a shielded stereo audio patch cable and a supplied USB control cable, you can connect the KX3 to your PC and use a freeware SDR application like HDSDR to turn your KX3 into a proper software-defined receiver.

SDR functionality is limited to receiver functionality, and depending on the bandwidth and sampling rate, will be dependent on the quality of your sound card. The true benefit is the ability to see a wide – 48 kHz or more – chunk of spectrum.

❖ Summary

Every radio has its pros and cons. When I begin a review of a radio, I take notes from the very beginning so that I don't forget some of my initial impressions. Here is the list I formed over the time I've spent evaluating the KX3. Note that I created this list with the shortwave listener in mind, not necessarily the ham radio operator.

Pros:

World class, benchmarked receiver performance with high-performance 32-bit floating-point DSP.
Rich, full audio fidelity on AM despite limited bandwidth (see con below).
AF and effective RF gain controls.
Adjustable filters (no optional roofing filters needed for SWLing).
Auto-notch, which helps eliminate annoying heterodynes, even in AM.
Internal ATU option brings improved MW filtering and hams have the ability to tune a random length antenna.

Natively decode (170 Hz) 60-WPM RTTY and display it right on the KX3's VFO B display, which is alphanumeric.
Battery operation via 8 AA batteries.
Lightweight.
Dedicated headphone jack.
For non-ham radio operators, the transceiver can be disabled and re-activated once you have a license with a simple hardware adjustment. No need to fear accidental transmission.
For hams, or those who plan to become one, the KX3 is a QRP transceiver in the top of its class.

Cons:

AM bandwidth limited to 4.2 kHz (see pro).
Hand mic connector is the less standard 3.5 mm audio plug.
Built-in speaker is small with limited volume and fidelity, it's only intended as a back-up when headphones or external powered speakers are unavailable.
AA batteries fit a bit tightly in the internal holder and can present a challenge to remove.
Medium wave reception is mediocre, but with the optional ATU, is improved.

❖ Did I Buy One? Confession time

I must admit, I was appreciating my friend Dave's KX3 very much. I have three hobbies: shortwave radio listening, ham radio, and traveling. After using the KX3 for a few hours, I knew it would be my perfect companion. Not only is it a top-notch amateur radio transceiver, it's also an excellent shortwave radio receiver. It's portable, but also makes an excellent tabletop radio. It's an all-in-one radio, but can also double as an SDR when connected to a PC.

Needless to say, I bought one. It was only fair to Dave, who needed to discover for himself what his loaned-out rig could do.

The KX3 is a game changer for me. Though I've always carried portable transceivers in my travels, I've also had to carry a separate tabletop receiver and an SDR or portable radio for my SWLing. *No more.*

Moreover, I like the broadcast audio on the KX3 well enough to record and archive shortwave broadcasts, which I frequently do for my blog, *The SWLing Post.* In my shack, I'm even considering purchasing Elecraft's 100 watt amplifier and doing away with my 100 watt tabletop transceiver.

As for support, I have absolutely no worries here. I've been an Elecraft customer for years and I can tell you that they believe in and stand behind their products.

I encourage you to try on the KX3 as well. It may very well be all the radio you'll ever need.

Loyd Van Horn, W4LVH
globalnetmt@gmail.com
Twitter: @GlobalnetMT

Let Your Router do the Talking: VoIP

I have held back from discussing one of the bits of online communications that has seen relatively explosive growth in the past 10 years: Voice over Internet Protocol (VoIP).

Partly, this is because VoIP is not something that necessarily falls into the 'streaming' category in the traditional sense, the way radio or television streams are available. Traditionally, VoIP is a more personal form of communication, like a telephone conversation.

However, even that dynamic is changing thanks to services like Google Plus Hangouts and EchoLink for amateur radio operators.

Essentially, in all forms, VoIP takes audio or video that is created from an analog source (voice, video) and turns it into a digital signal that can be sent over the Internet. There are many types of VoIP services, but most folks probably are thinking about some of the home phone providers such as Vonage, MagicJack or even VoIP services from your cable providers such as AT&T's U-Verse.

There are three types of platforms for VoIP telephone service:

ATA (Analog Telephone Adaptor): This is what many who use VoIP are using, as you are using an adaptor to use your traditional landline telephone through a VoIP service such as Vonage. The ATA is basically an analog-to-digital converter that takes the signals produced by your voice and converts them into data packets that are sent over the Net.

IP Phones: They look like the real thing, but instead of a traditional "phone jack" these use an Ethernet connection to connect to your router or VoIP device. You may also be able to access VoIP service through a WiFi phone, that connects via a WiFi connection from your router or a hot spot.

PC-to-PC: No phone lines, no phones, just a computer, microphone and either headphones or a speaker are needed. Normally, the only costs associated with this type of VoIP connection is the costs of the software needed, although there are many freeware options out there.

Any of these are viable methods for "cutting the cord" and releasing yourself from long distance charges of a traditional phone provider. There are many companies offering VoIP phone service, I have listed links to a few of these in the GlobalNet links section at the end of this column.

But, traditional phone calls aren't all you can do with VoIP technology. If a picture is worth a thousand words, how valuable is a video conversation with the person you are trying to reach?

One of the areas in VoIP that is growing rapidly is the video conference/video chat segment. Led by providers such as Google Plus and Skype, users around the world are able to join in face-to-face conversations with each other.

I was finally able to experience the wonder of this technology during a recent amateur radio contest. Even though we were separated by nearly a three hour drive, my father, Larry N5FPW, and I were able to "contest together" through a Skype connection and the built-in camera on my iMac. With more and more computers and laptops made with built-in cameras, not to mention the plethora of mobile devices and tablets with cameras, video conferencing is going to become an increasingly popular and heavily used form of communication.

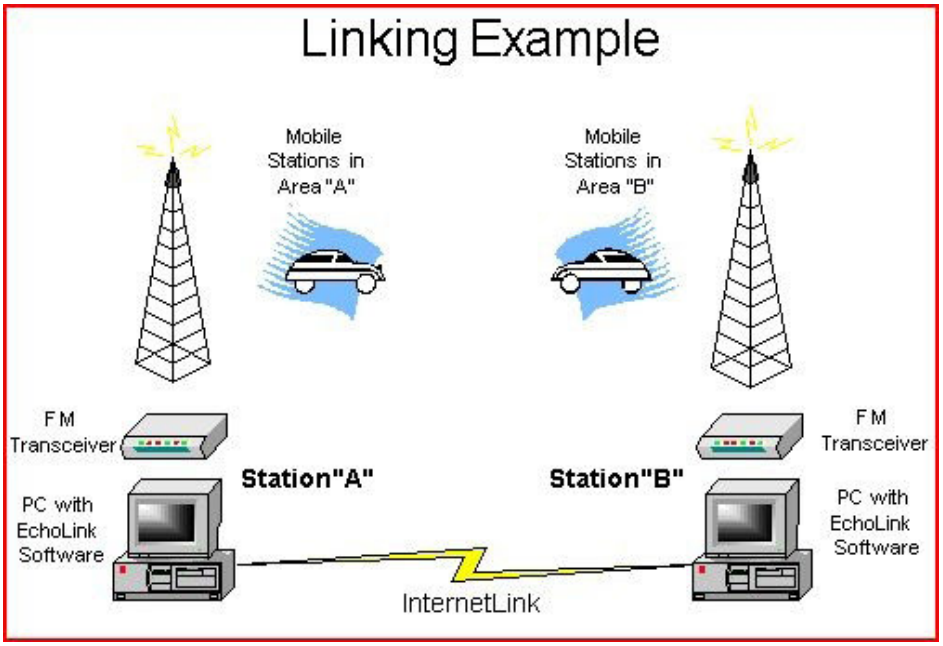
Never ones to miss out on a trend, amateur radio operators are in fact usually among the first to adopt new technologies, often years before it becomes mainstream. VoIP is no different, with IRLP and services link EchoLink as examples.

Combining the ingenuity of amateur radio with the power of the Internet, IRLP services such as EchoLink allow amateur radio operators to communicate with the world, with no concern over propagation, expensive equipment or erecting massive towers.

IRLP services link repeaters or even single-operators to the Internet so that hams around the world can communicate. I recently had a nice conversation with some hams conducting a local morning time Net through their local repeater down in Australia. What did I use to make such a contact? My iPhone, using an EchoLink app, while sitting in a parking lot on my lunch break at work. I often will check in to the nightly Net on my local repeater using my EchoLink app, as reception through my handheld 2-meter HT is not very strong.

You can also use EchoLink on a computer, using headphones or a speaker along with a microphone. There are even hams who have sophisticated setups involving microphones and speech processing, all for use on EchoLink.

You can even combine technologies to get the most of the total VoIP experience! You can use Skype to coordinate meeting some of your ham friends on EchoLink. The great thing about VoIP is that it is continuing to evolve and grow as a technology.



How Echolink works. (Courtesy: Echolink.org)

GlobalNet Mailbag

I Received an email this month from Brian KB9ZPK asking for my thoughts on the C.Crane WiFi radio. He read my review of this little box of wonders and is considering picking up one for himself.

I can tell you that everything written in my review I stand behind. The C.Crane WiFI is sitting in my ham shack, directly behind me as I type. It is currently blasting out the sounds of GhanaWaves radio, with great audio quality. I love the fact it has a remote control that was included with it, or if I prefer, an app for my smartphone that allows me to control it.

It is cost effective, has a small footprint, if space is a consideration, and it has always been reliable for me. It doesn't have all of the features of a Logitech UE or some of the newer models of WiFi radio. However, if you just want to stream Internet Radio in your home through a dedicated device, it is a great choice.

If you have a question or comment for me, send them to me at globalnetmt@gmail.com.

GlobalNet Links

Vonage VoIP Telephone Service - **www.vonage.com/**
Skype - **www.skype.com/en/**
EchoLink - **www.echolink.org/**
Sunrocket Phone Services - **http://sunrocket.com/**
Cnet Internet Phone Reviews - **http://reviews.cnet.com/4520-9140_7-5131559-1.html?tag=nav**

What's NEW

Tell them you saw it in Monitoring Times

Larry Van Horn, New Products Editor

Sangean DT-110CL

This Sangean DT-110CL digital AM/FM stereo pocket radio weights less than five ounces yet packs a terrific wallop which includes auto-scan, auto-preset and one touch recall of your preset stations. For such a small package the 110CL provides the listener with extraordinary sensitivity and selectivity, clear audio quality and performance.

This ultra compact 110CL can pull in most weak stations that you were probably never able to receive before. Deep Bass Boost (DDB) provides extra bass boost needed when you listening to your favorite FM music stations. Your earphone acts as an FM antenna and built-in ferrite core AM antenna provide you great AM reception. Manual tuning is easy and storing your favorites is just as easy. If you're seeking an amazingly compact digital AM/FM pocket radio, you'll have to go long way if you can find any better.

Some of the features you will find in this compact portable include: PLL synthesized digital tuning; 24 memory presets; stereo headphone jack; LCD display; 90 minute auto shutoff; frequency coverage FM 87.5-108 MHz/AM 520-1710 kHz; and deep bass boost.

The Sangean DT-110CL portable receiver measures 3 4/5-inches wide by 2 2/5-inches high by 4/5-inch deep and weighs 2.6 ounces. This compact portable is available from Grove Enterprises and sells for $42.00.

Alinco DR-635T

The Alinco DR-635T is a new twin band mobile transceiver that has transmit capability in the amateur 2-meter and 70 cm bands with transmit coverage from 144 to 147.995 and 430-449.995 MHz. The unit has expanded receive coverage from 87.5 to 173.995 and 335 to 480 MHz. This includes the VHF air band in AM mode and the FM broadcast band in Wide FM mode. A dual band receiver is available with VHF/VHF, UHF/UHF, VHF/UHF and UHF/VHF capability and cross-band repeat is supported. 200 alphanumeric memories are available for storing transmit and receive frequencies.

Power output of the DR-635T on VHF is 50/20/5 watts and in the 70cm UHF band 35/20/5 watts.

The large, easy-to-read three color (blue, violet or amber) LCD shows status icons and six character alphanumeric tags. CTCSS & DCS encode/decode/scan is included plus four different tone bursts. Other features include: Auto power off, time out timer, tone burst, scan, channel lock-out, dimmer, VFO auto program, narrow FM, power supply and voltage display. The front panel can act as a remote via the optional EDS-9 separation kit. A fan on the rear panel insures cool operation during transmit. The advanced 10F3 digital mode with speech compression technology is available via an optional EJ-47U board and 1200/9600 bps packet operation can be performed with an optional EJ-50U.

The supplied EMS-57 electret condenser DTMF hand microphone supports parameter setting and direct frequency entry. The radio also comes with DC cable, mobile mounting bracket with hardware, anti-theft (ACC on/off) function cable and anti-theft sticker.

Alinco DR-635T Specifications

General

Frequency range
TX: VHF 144-147.995 MHz and UHF 430-449.995 MHz
RX: 87.5-107.995MHz (WFM), 108-173.995 MHz and 335-479.995 MHz

Modulation: 16K0F3E (FM), 8K50F3E (Narrow FM), F1E (digital voice), F1D (9600bps)/ F2D (1200bps), A3E (RX only/AM)

Channel Steps: 5, 8.33, 10, 12.5, 15, 20, 25, 30, 50, 100 KHz

Memory channel: VHF 80 channels / UHF 80 channels / Free-programmable 40 channels / one channel VHF Call and one channel UHF Call.

Antenna impedance: 50 ohm unbalanced, internal duplexer - single antenna connector

Frequency stability: +/- 2.5 ppm

Power Supply Requirement: 13.8V DC +/- 15% negative ground

Current Drain: Approximately 11amps transmit high / 700 mA receive maximum / 500 mA receive squelched

Usable temperature range: -10c to +60c (14F to 140F)

Dimensions: 5.5-inches wide by 1.6-inches high by 7.3-inches deep, 140mm (W) X 40mm (H) X 185mm (D)

Weight: Approximately 35.3 ounces or 1-kg

Transmitter

Output: High VHF 50W / UHF 35W, Mid 20W, Low 5W

Modulation System: Variable Reactance Frequency Modulation

Max. Frequency Deviation: +/- 5 kHz (FM) +/- 2.5 kHz (NFM)

Spurious emissions: Less than -60dB

Receiver

Receive system: Double conversion super heterodyne

Intermediate Frequencies: 1st 21.7 MHz/ 450 kHz and 2nd 45.1 MHz/ 455 kHz

Sensitivity (-12dB SINAD): Main band -14dBu (0.20uV) or better/Sub band -12dBu (0.25uV) or better

Squelch: -18 dBu (0.1uV) or less

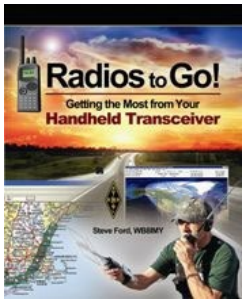
Selectivity: FM: -6dB: 12 kHz or more, -60dB: 28 kHz or less

Audio Output: 2W or more (8ohm 10% THD)

The DR-635T is available from Grove Enterprises for $320.

Radios to Go!

Modern technology has allowed manufacturers to pack a wealth of features into handheld transceivers. With so many features, however, it isn't always easy to get the full benefit from your investment. Even the user manuals don't tell the whole story. Your radio may have "hidden" capabilities that aren't described in the manual at all.



For example, did you know that a dual-band 2-meter/70 cm handheld transceiver can be used to communicate through amateur radio satellites? It's true, but you usually won't see this discussion in your average user manual.

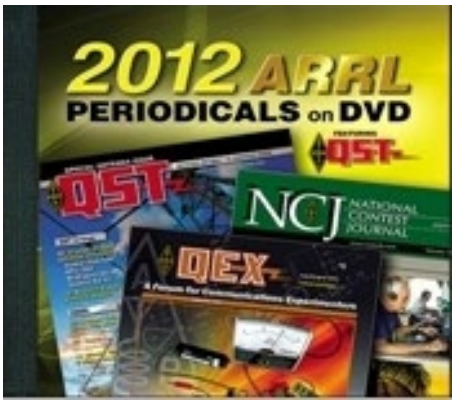
If you own a handheld transceiver, or if you're trying to decide which transceiver to buy, *Radios to Go!* by Steve Ford WB8IMY, is the essential guide. Some of the helpful topics covered in this ARRL publication include:

- Why Are They Called HTs? (And Which One Should I Buy?)
- The Care and Feeding of Batteries
- Memories
- Scanning
- Alphabet Soup: CTCSS, DTMF and DCS
- IRLP and EchoLink
- Antennas
- Microphones and Headsets
- Software Management
- Expanding Your Horizons: APRS and Satellites

This 112 page soft cover publication sells for $18.00 and is available from ham dealers such as Universal Radio, an *MT* advertiser.

ARRL Periodicals DVD 2012 for Windows and Macintosh

The ARRL's popular print journals are now available on a compact, fully-searchable DVD. Every word and photo published during 2012 is included! The three publications included on this DVD include: *QST* – The official membership



journal of ARRL, *NCJ National Contest Journal*, and *QEX* – the forum for communications experimenters. In addition, the 2012 periodicals DVD includes source code for software projects and PC board patterns, section news, contest soapbox and results.

This DVD is fully searchable. You can search the full text of every article by entering titles, call signs, names – any word. You can see every word, photo (most in color), drawing and table in technical and general-interest features, columns and product reviews, plus all advertisements published in the ARRL's publications in 2012. And you can print what you see, or copy it into other applications.

System Requirements: Microsoft Windows and Macintosh systems, using the industry standard Adobe® Acrobat® Reader® software. The Acrobat Reader is a free download at **www.adobe.com**. Windows 8 compatible. DVD requires Microsoft Windows or Macintosh.

This DVD sells for $25.00 and is available from ham dealers such as Universal Radio.

MS-8118 G3 Multichannel Radio Monitoring System

The task of multichannel radio frequency surveillance and monitoring would typically involve a number of separate radio receivers, audio recorders and other discrete components interconnected into bulky and expensive systems.

The WiNRADiO MS-8118/G3 Multichannel Monitoring System provides an elegant, fully integrated solution, specifically designed for computer-controlled automatic monitoring of frequencies ranging from VLF frequencies up to low microwave, in all major modulation modes. The system is designed to monitor radio frequencies on multiple channels simultaneously; record digitized signals on the hard disk for easy later retrieval, and performs automatic decisions based on the received signals.

This system is based on a ruggedized heavy-duty 19-inch rack mounted industrial computer. The front panel features a high-contrast wide-angle display. There is provision for connection of an external keyboard and mouse. The system is capable of simultaneous independent monitoring of up to eight channels from VLF to SHF frequencies.

The built-in hard disk allows a typical storage of several months of continuous recording, and a re-writable CD-ROM or DVD drive makes archiving of recordings easy. The unit is capable of unattended operation and, if the client/server option is fitted, it can be operated remotely via a standard TCP/IP connection such as LAN or the Internet. The recorded audio can also be remotely searched and streamed to the operator.

WiNRADiO software-defined receivers are at the heart of this multichannel radio monitoring system and make it possible to achieve the necessary high level of integration and performance.

Frequencies from 9 kHz up to 8.6 GHz can be monitored and logged. The receivers offer an unparalleled flexibility, given their software-defined architecture, excellent dynamic range, and high sensitivity. Many useful features complement the receivers, making them capable of filling not only the role of a search and monitoring receiver, but also that of a measuring receiver, such as the calibrated S-meter showing the received signal levels in dBm, µV or S-units, down to the -140 dBm noise floor, several spectrum analyzers, and many other features.

The MS-8118/G3 can be custom-fitted with a combination of receivers for different frequency ranges and capabilities, to optimize the system for a specific application and to maintain a minimum cost. The MS-8118/G3 makes it possible for the user to control each individual receiver separately and observe its operational status, as well as set the system parameters for multichannel monitoring and surveillance operations.

Each receiver can operate totally independently, as a high-performance scanner with additional advanced facilities for automated task scheduling, spectrum analysis, signal strength logging, channel occupancy analysis, programmable audio recording, and many other features. Alternatively, the receivers can work in "master/slave" roles, where a "master" search receiver hands off its found frequency to a "slave" for monitoring, while continuing search.

The informative graphical user interface of the MS-8118/G3 system makes it possible for the user to observe the status of the individual receiver channels at a glance, and set-up monitoring tasks for a wide range of applications ranging from conventional logging and time-schedule recording, to sophisticated, fully automated, remotely-controlled radio surveillance operations.

The MS-8118-CSO client/server optional software makes it possible to operate the system remotely via a computer network or a dial-up telephone connection. The software provides a TCP/IP control path for the receivers and streaming audio feedback in real-time.

The software also allows the client (the local computer) to initiate audio recording to the server's hard disk. Associated functions allow the client to search and stream the stored audio files over the network.

The MS-8118-CSO client/server option supports multiple simultaneous client connections (several physically separate users can listen to individual channels of a remote server independently) as well as multiple simultaneous server connections (several users can select amongst several servers). A variety of sampling rates and compression algorithms are supported, for optimum sound quality and storage space.

This WiNRADIO multichannel radio monitoring system is shipped in a specially designed ruggedized 19-inch rack-mounted chassis with built-in shock absorbers, to ensure safe shipping. The unit can then be either removed from the enclosure, or operated from inside it. This is particularly useful for mobile operation.

For stationary applications, various rack-mount options are also available, ranging from single-unit arrangements to large-scale installations. For these, WiNRADiO provides complete turn-key solutions including antennas and antenna distribution units.

The following specifications refer to the standard MS-8108 model. These basic specifications are to be taken as a guide only as the exact types of the receivers and the computer configuration can all be customized to suit customer specific requirements.

Computer: 19-inch rack/panel mount, heavy duty
Receivers: WiNRADiO G3-Series software-defined
Frequency range: 9 kHz to 8.6 GHz (customer-specified)
Power: Selectable 100/120 or 220/240 VAC, 50 or 60 Hz, 110 W max
Dimensions: 19-inch rack-mount, Height: 4U (6.9" = 177mm), Depth: 16.5" (415 mm)
Weight: 42.9 lb (19.5 kg)

The MS-8118 G3 Multichannel Radio Monitoring System is available from Grove Enterprises. Contact Grove Enterprises at 800-438-8155 or 828-837-9200 for current pricing and to order.

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*.

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.

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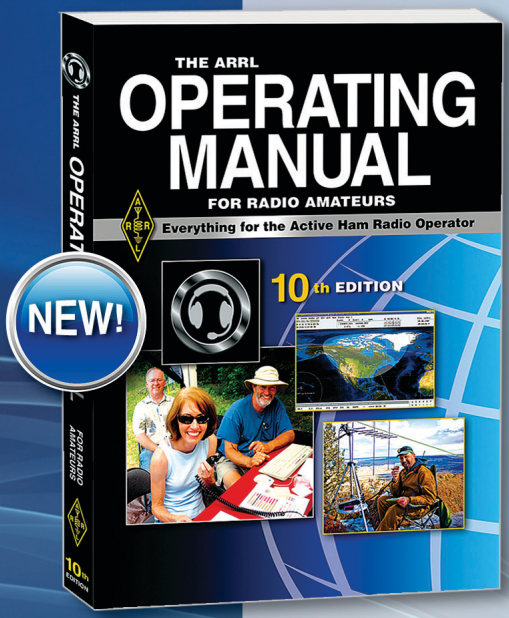

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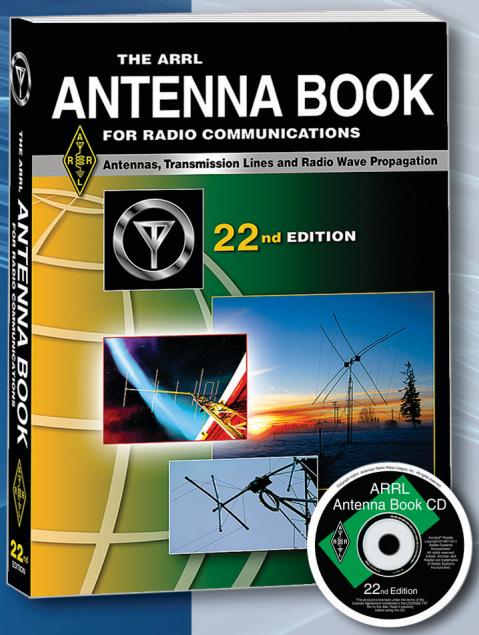

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Softcover Book and CD-ROM. Retail **$49.95**

*System Requirements: Windows® 7, Windows Vista®, or Windows® XP, as well as Macintosh® systems, using Adobe® Acrobat® Reader® software. The Acrobat Reader is a free download at www.adobe.com. PDF files are Linux readable. The ARRL Antenna Book utility programs are Windows® compatible, only. Some utilities have additional limitations and may not be compatible with 64-bit operating systems.

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IC-R6 Pocket Compact

- RX: .100–1309.995MHz*
- AM, FM, WFM
- 1300 Alphanumeric Memory Channels
- 100 Ch/Second High Speed Scan
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Electronic advertisements feature active links for each radio.

*Frequency specs may vary. Refer to owner's manual for exact frequency specs. [1]Optional CT-17 required. [2]Optional CS-RX7 required.

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