Volume 17, No. 10 October 1998

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Monitoring Times

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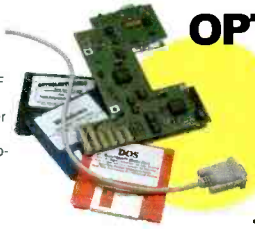

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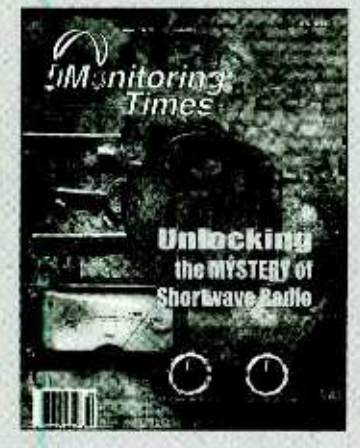
Vol. 17, No. 10 October 1998



Cover Story

Unlocking the Secrets on Shortwave Radio

By Larry Van Horn

Bleep, bleep, bleep ... bra-a-a-ap ... tweedle-deedle-deee! It's enough to scare off any beginner to shortwave listening, but most of these noises are anything but "spooky." It's the sound of the everyday work world using the efficiency of digital communications to carry out its business.

What kind of business is transacted on shortwave radio? What kinds of digital modes are these? Larry Van Horn helps to demystify many of the most common modes, and suggests frequencies where you can tune them in and say "Oh-h, so *that's* what that sound is!" Starts page 8.

To represent our focus on "spooks," encryption, and other weird and wonderful signals to be found on your radio, our cover was specially designed by Ron Brown PhotoGraphics, copyright.

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The WYFR Story 12

By Hans Johnson

The largest private shortwave station in the United States, WYFR, is celebrating its 25th year of broadcasting, but the station's prior history goes back several incarnations—as experimental station W1XAL; World Radio University for the Listener (WRUL), which was taken over by the US government during WWII; and as commercial station WNYW.

Cryptography - Language of Spies 18

By Dan Veeneman

Cryptography is the science of secure communications in the presence of adversaries, and it can be as simple or as complicated as you want to make it. The author walks you through a simple, but very effective example. Encryption is also a very hot issue for business, law enforcement, and Internet users, and Congress is in the middle of the controversy.

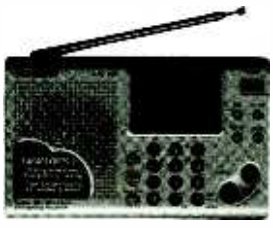
Now it Can be Told - and Toured 22

By Jesse Finkelstein

"Project Greek Island" is a relic of the Cold War — a giant complex hidden underneath the five-star Greenbrier Resort and intended to house the entire U.S. Congress in the event of a nuclear war. Legislation is pending to turn it into a casino.

Reviews:

The reviews you've been waiting for: Parnass credits the **AOR AR8200** with flexibility, operational complexity, and richness of features (p.87); Magne says the brand new **Sangean ATS 404** is flexible to tune and has a nice roster of features (p.88). Ham Bands columnist Kerschner is smitten with the **Kenwood VC-H1** slow scan TV—small, self-contained, and reasonably inexpensive (p.70). Elliott finds the **Kenwood FreeTalk FRS** radios great for beginners (p.71). Donnell gives the **Radio Max** scanner control software program a successful workout (p.85), and Catalano does the hardware connections to test the new, external, PC-based **WiNRADiO WR1500e** (p.90).



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SW8	$779.95 + $10 UPS
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ICF-2010	$349.95 + $7 UPS
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WASHINGTON WHISPERS

By Fred Maia, W5YI
fmaia@internetMCI.com

In the Data Stream

• **A message encoded by the U.S. Government's 56-bit data encryption standard has been broken** in a computer industry contest in less than three days. A custom-built computer tested 88 billion different combinations each second for 56 hours until it found the correct one. Previous contests enlisted computers linked together through the Internet, but took weeks or even months to complete. Three days is a new record.

The contest was intended to alert the government that the once-thought-secure standard is in jeopardy of being deciphered by enemy governments at whim.

The answer, say computer experts: "It's time for those 128-, 192- and 256-bit keys."

• **Spread Spectrum** (SS) is a technique whereby microscopic bits of the transmitted radio signal are distributed over a wide segment of spectrum and reassembled according to a formula. The signal power density is typically very low and the duration of a transmission on any frequency in the segment of the spectrum can be but a fraction of a second. The big advantage of SS systems is that they can share spectrum despite a number of stations already occupying the band. Spread Spectrum was originally developed for the U.S. military as a way of transmitting undetectable communications under the noise level.

The FCC said they were working on a Notice of Proposed Rulemaking to eliminate rules that restrict amateur stations to transmitting only frequency hopping and direct sequencing spreading techniques. Adoption is anticipated.

• **FBI says it must stay current with evolving technology.** The Justice Dept. has asked Congress to add language to an appropriations bill that would provide police with the precise location of cellular telephone users.

The surveillance information would be provided without a court order when there is suspicion of a felony, pursuit of a fugitive or where human safety is in jeopardy.

A triangulation scheme currently being deployed by 911 emergency centers is used to pinpoint users by measuring variances in signal strength. Civil-liberties advocates are calling it a dangerous and unconstitutional invasion of privacy.

• **The FCC has entered into an agreement with APCO** which looks toward resolving interference complaints plaguing police and public safety radio. APCO is the Association of Public Safety Communications Officials.

Under the agreement, APCO will follow an FCC technical and administrative standard to collect all information relevant to process a compliance or interference matter.

This is the second such FCC/industry agreement that the Commission has entered into. A similar Memorandum of Understanding (MOU) was recently signed with the Industrial Telecommunications Association, Inc., covering interference to business band users caused by non-compliant and/or unlicensed operators.

• **On July 29th, the FCC approved the use of stratospheric platforms** as telecommunications stations. They will operate in the 47.2-48.2 GHz band which the FCC will auction. COMSAT has been awarded the contract to provide the proprietary high-speed Internet and data system aboard the Sky Station.

The Sky Station system is a network of lighter-than-air platforms (each about the size of a football field) which are held in a geostationary position about 70,000 feet above the Earth. It is basically a repeater aboard a zero-pressure balloon hovering over major metropolitan areas. Ultimately at least 250 Sky Station platforms will be deployed worldwide over large cities.

Each 1,000 kilometer footprint is expected to provide service within three years to millions of subscribers. Internet speeds are planned to be 2 Mbps (uplink) and 10 Mbps (downlink) — more than 300 times faster than most of today's dial-up modems.

The ITU last year designated 600 MHz of spectrum worldwide for use by high altitude Stratospheric Telecommunications System (STS) platforms.

• **The FCC has adopted rules that protect Vehicle Radar Collision Avoidance Systems** from interference by amateur stations in the 76-77 GHz band. Amateur operation is being suspended — at least temporarily — in this portion of the 4-millimeter band.

To offset any potential impact on amateur service operations resulting from this suspension, the FCC has amended its rules to establish a co-primary allocation in the 77.5-78 GHz band for the Amateur and Amateur-Satellite Services.

The Commission stated its intention to revisit the issue of whether the 76-77 GHz band can be shared with amateur stations or other users within five years and that if it were to become apparent that particular types of radio services or devices will not interfere with vehicle radar systems or if adequate sharing criteria can be established, the restriction could be lifted.

• **The future of the multi billion-dollar 502-ton International Space Station (ISS) is in doubt.** The five-year construction project is off to a bad start and Congress wants some answers. While sixteen countries are involved, the primary contractors are the United States and Russia. It will take some 45 American shuttle flights and 15 Russian rocket launches to build the ISS.

The first two ISS modules, the Functional Cargo Block and the Unity Node made by the United States are now due to be launched in November with the third element due for lift-off in April. But completion of the critical Russian-funded and constructed Service Module is way behind schedule due to chronic financing problems.

The Russian Space Agency needs $100 million now, but the Russian government has yet to provide the money. To bail Russia out, NASA wants to "borrow" money from its fiscal 1999 appropriations to "lend" to Russia to get the project back on track. NASA also has plans on the back burner to make a $170 million substitute model called the Interim Control Module if Russia reneges.

Space station critics want to kill the project entirely. Meanwhile, the end is near for the troubled 12-year old Russian *Mir* space station. It will be retired — ditched in the ocean — in June 1999, six months earlier than expected.

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BACK BY POPULAR DEMAND — AND IT'S FREE

The Grove Buyer's Guide has always been eagerly sought by scanner and shortwave listeners alike. Formerly sewn into *Monitoring Times*, the Guide is now 32 pages, and available by quarterly mailings. Filled with bargains, best buys, and recommendations, it's now ready for your fall listening and the gift giving season!

Whether your listening interests are in scanning or shortwave, the best equipment and the best buys are at your fingertips. Grove's friendly, competent service personnel are legend. If you need guidance in making the proper selection, just ask our technical support division. These trained personnel are active listeners as well, using equipment featured in the Grove Buyer's Guide. They speak with authority.

Sample Product Listings

DRAKE SW8

This combination desktop/portable world band receiver from R.L. Drake–with improved sensitivity, selectivity, and noise reduction–is an excellent value for all-around DXing.

Frequency Range: 100 kHz-30 MHz, 87-108, 118-137 MHz
Keypad Entry: Yes, plus tuning dial
Tuning Steps: 50 kHz FM; 100 Hz AM
Display: Backlit LCD
Dimmer: On/off
Receiving Modes: AM, AM synch., WFM, LSB, USB
: 70 channels
mode
(Typical): 2 W @ 4 ohms
udio Output: Yes
gth Ind.: Analog S-Meter
ersion Scheme: Double up-conversion
itivity (Typical): 0.5 uV
Selectable Atten.: Yes
IF Selectivity (-6/-60dB): (-6/-50dB): AM Narrow 4/6 kHz, SSB 2.3/4.5 kHz
Antenna Connector: SO239, Push terminals, Integral whip
Dimensions (W"xH"xD"): 11.5x5.25x13
Power Requirement(s): 6-9 VDC/6 cells
Accessories Incl.: Telescopic whip/AC adaptor/manual

ACCESSORIES

ANT 2	Grove Skywire	$ 39.95
ANT 24	Stoner-Dymek SW/LW Active Antenna	$179.95
CAS 10	Carrying Case	$ 49.95
SPK 13	SP-200B Sound Enhancer	$199.95

ORDER RCV 19 only $779.95

The Popular Sony ICF-20

This full-featured radio for the serious shorwave listener enjoys a reputation of distinction among the "powerful portables." Synchronous detection allows interference-free reception on many stations difficult to hear on other radios.

ACCESSORIES

ANT 3	Grove Mini-Skywire	$ 29.95
ANT 21	Select-A-Tenna	$ 59.95
ANT 32	KIWA Pocket-Loop Antenna	$119.95
SPK 13	SP-200B Sound Enhancer	$199.95

ORDER RCV 2 only $349.95

Frequency Range: 150 kHz-30 MHz 76-108, 116-136 MHz
Keypad Entry: Yes, plus tuning dial
Tuning Steps: 100 Hz/1 kHz
Display: Backlit LCD
Dimmer: On/off
Receiving Modes: AM, USB, LSB, WFM, synch. det
Memory: 32 channels
Clock: 12/24 hr./alarm/sleep
Audio Output (Typical): 380 mW
Signal Strength Ind.: LED bargraph
Conversion Scheme: Double up-conversion
Antenna Connector: 1/8" miniplug
Dimensions (W"xH"xD"): 11.37x6.25x2.16
Power Requirement(s): 120VAC or 3D/2AA cells
Accessories Incl.: Earphone/AC adaptor/wire antenna/telescopic antenna/strap/external antenna adaptor/SW Guidebook

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Monitoring Times and Satellite Times to Merge

Satellite Times, our sister magazine, was intended to address space communications, the emerging frontier. It was an outstanding vehicle for unique, high-quality articles on space-related stories from spy satellites to the space shuttle to astronomy.

Unfortunately, its sphere of influence was more limited than we expected, and subscriptions never met the level required to sustain it. With an impending cost increase in paper and postage, we were forced to terminate the project. As Bob Grove, the publisher, paraphrased an old joke wryly, "The operation was a success, but the patient died!"

We did attempt to find an interested party to maintain the magazine's momentum, but the businesses we contacted had their own pressures and deadlines.

In the end, the "Monitoring Times" style of magazine that treats technical topics in a readable, straightforward manner seems to remain our own, unique vision, and it is a logical solution for the magazines to join forces.

Next month you will begin to see the results of this merger as we add more pages and widen the coverage of *MT*'s already broad spectrum. We welcome *Satellite Times* readers to the "new" *Monitoring Times*. We invite all our readers to bask in the wealth of information now available to you in our pages, support our new advertisers, and to contact us about additional topics you'd like to see in coming months. And if you have questions about any of these areas of communications, please feel free to write to our editors for clarifications.

"*MT* is an education," one reader wrote recently — but we hope you'll agree that it's also a heck of a lot of fun!

What Privacy?

We've received numerous clippings from newspapers and magazines that refute the notion that our lives are private. Our e-mail, computers, phones, bathrooms, dressing rooms, and even the company water cooler may be bugged, videotaped, viewed or tape recorded. Computer files and e-mail you thought you deleted can be recreated. And we all know about the vulnerability of cordless and cellular phones.

As surveillance equipment gets smaller and more affordable (and our society gets more litigious?) more and more ordinary people are spying on each other. We have met Big Brother ... and he is us!

BULLETIN BOARD

October 2-4: Hamilton, ON
The Ontario DX Association invites radio enthusiasts of all interests and all levels to Radio Fest 98, themed "Communications Into Our Future." Special guests will include Larry Magne, John Figliozzi, Kim Andrew Elliott and Bruce Elving. Location: Mohawk College. Exhibits, used equipment, seminars, Sat. banquet (keynote speaker, Larry Magne), Sun. breakfast (speaker, Dr. Elving). $15 for the entire convention, $5 for one-day attendance. Talk-in 442.800+. For further information: **www.durhamradio.ca/odxa/** E-mail: *70400.2660@compuserve.com*; Ontario DX Association, P.O. Box 161, Station A, Willowdale, Ontario M2N 5S8, Canada

October 4: Queens, NY
Hall of Science ARC hamfest at the NY Hall of Science parking lot, Flushing Meadow Corona Park, 47-01 111th St. Talk-in 444.200 PL 136.5. Admission by donation, 9 am. Info (evenings) Stephen Greenbaum WB2KDG (718) 898-5599, *WB2KDG@bigfoot.com*

October 11: Wallingford, CT
6th Annual Nutmeg Hamfest (CT state convention) is being held at Mountainside, a fantastic new special event facility located on High Hill Road 2 miles from Exit 15 off I-95. General admission $6. VE testing (preregister with Joel Curneal (203) 235-6932) For other information contact Gordon Barker-K1BIY, 9 Edge Wood Rd, Portland, CT 06480, (860) 342-3258 or **www.qsl.net/nutmeghamfest,** *nutmeghamfest@qsl.net*

October 18: Sellersville, PA
RH Hill ARC is sponsoring a hamfest at the rebuilt Sellersville Fire House, Rt 152, 5 mi. S of Quakertown, 8 mi. N of Montgomeryville. Talk-in 145.31. VE testing 10-1, bring documents. Admission $5. Info: Linda Erdman KA3TJZ (215) 679-5764, 2220 Hill Rd, Perkiomenville, PA 18074, **www.rfhill.ampr.org**

Canceled: The Palm Beach County, FL Hamfest scheduled for October 17 and 18, 1998, has been cancelled due to contract problems with the South Florida Fairgrounds Expo Center. The search is underway for a new location for the 1999 Hamfest.

CLUB NEWS:
New Club - Inland NorthWest Radio Activity Network is a monitoring group with an interest in most communications systems in the WA, ID, OR area. There is no cost; all you need is an E-mail box and to be a resident of one of the three states listed. Send your enquiry to *i.n.w.r.a.n@juno.com*

Triangle Area Scanner/SW Listening Group: Meets the third Monday of each month at the El Rodeo restaurant on Pleasant Valley Road (off Glenwood Ave. in Raleigh). Meal at 6:30 and meeting starts 7:30. Monday night net is temporarily suspended until 146.64 repeater is back in service. There are no dues or fees for participating in the Triangle Scanner/SWL SIG. Info: e-mail Bob Zeher (*ke4jvy@juno.com*) or Kelly Mills (*ae4fg@juno.com*)

Hackers, Hackers Everywhere

Every year there are about 250,000 attempts to hack past the Pentagon's security, according to congressional researchers. This past year an organized effort successfully accessed unclassified Pentagon payroll and personnel data. It was thought to be the work of youthful hackers: "Hacking today is a recognized sport," said Strassmann, the Pentagon's former information technology chief.

Pagers have been a favorite target of hackers of another kind. White House pagers have not only been intercepted in Washington, D.C., but so apparently were pager messages from law enforcement agencies protecting the President when he visited Dallas this past summer, according to an WFAA-TV report.

The hacker who contacted WFAA said he wanted to expose security flaws to force companies to better protect data and privacy. PageNet said new security measures would be in place by the end of this year.

Security against hackers was of very high concern during the President's recent testimony to the Grand Jury, according to a CNN story. Even though no part of the signal was transmitted by wireless means, the picture being shown the jury could be vulnerable unless shielded. Radiation from a TV or monitor screen is vulnerable to the "Tempest receiver," which can be bought or built using information off the Internet.

Then there are the hackers that boasted to a Senate committee that they could cripple the Internet in a half-hour. In the opinion of Senator John Glenn, "In some ways it's a whole new way of making warfare. I don't think that overstates it one bit."

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Hacking with the NSA

Under an agreement on shared security interests, Britain's Menwith Hill serves as a remote monitoring post for the NSA.

In June of 1997 the National Security Agency (NSA) demonstrated that they could hack into the Pacific Command's battle-management computers and U.S. power grids. Now the National Aeronautics and Space Administration (NASA) has asked the NSA to try to penetrate its networks to expose vulnerabilities.

The study breaks new ground for the NSA, since it is barred from participating in domestic activities unless invited. John Pike of the Federation of American Scientists said, "This is the next big step in NSA's expanding role in domestic information security ... There are concerns about the potential for abuse of this type of activity."

The NSA's usual activity is global snooping. According to a European Commission report quoted by *The Weekly Telegraph*, "Within Europe all e-mail, telephone and fax communications are routinely intercepted by the United States National Security Agency..."

The report, entitled *Assessing the Technologies of Political Control*, was the first solid confirmation of a satellite network dubbed Echelon. "The Echelon system works by indiscriminately intercepting very large quantities of communications and then siphoning out what is valuable using artificial intelligence aids ... to find key words."

The report recommends: "The European Parliament should reject proposals from the United States for making private messages via the global communications network (Internet) accessible to US intelligence agencies."

Wanting it Both Ways

Reliable security and limited access may be mutually exclusive. A US governmental panel tasked with designing a federal computer system that would include "backdoors" was unable to do so by the two-year deadline. The group (which referred to itself as "Bob" instead of TACDFIPSFKMI) said it "encountered some significant technical problems that, without resolution, prevent the development of a useful FIPS" (Federal Information Processing Standard).

Bruce Schneier, a cryptographer and critic of the government's insistence on access to encryption, said the panel failed because of the impossibility of meeting the needs of both law enforcers and industry, according to a Reuters report.

The battle is shaping up with law enforcement agencies (who fear strong encryption will be used for criminal purposes) insisting on gaining access, being pitted against industry groups, Internet users, and Congressional leaders pushing for strong privacy protection.

According to the Reuters article by Aaron Pressman, foreign governments are also concerned that the policy will enable U.S. government agencies to read their e-mail. ... (Guess what? Looks like they already do!)

For more discussion on all these issues and proposed legislation, visit the Center for Democracy and Technology website at **www.cdt.org/crypto**

Felons tracked by satellite

Global Positioning Satellites have a new use. They can enable corrections officers to track violent felons or sex offenders within five feet of their location. Wesley Wayne Miller was convicted of a particularly gruesome murder of a high-school classmate. Now, after sixteen years in prison he's occasionally allowed to leave his cell in Tarrant County, Texas, but he wears an electronic monitor on one ankle and a satellite tracking device on the other.

Ohio has also joined Texas, Nebraska, and New Jersey in trying this system which is also being used to keep tabs on suspects awaiting trial and those serving sentences outside of prison. The system requires the wearer to remain within a few feet of a transceiver pack. Ohio says the cost of tracking via satellite is less expensive than the $40-70 per day cost of a day in jail.

Tracking Tripp

Monica Lewinsky's friend, Linda Tripp, was the hottest story in Washington for a time, and every reporter wanted to get to her. In a phone interview with the *Kansas City Star*, Tripp's lawyer Jim Moody claimed that a tracking chip was found in a bouquet of flowers intended for her. "I think it was just a reporter trying to find out where Linda was hiding," he said.

Moody said he decided to have some fun by tossing the chip into a luggage rack on a train bound for Florida.

Neighborhood Tormenter Sentenced

In Virginia Beach, Virginia. John A. Halstead, Jr, was convicted of 21 offenses and sentenced to 40 months in jail for invading the private phones and lives of his neighbors.

Using a scanner, Halstead intercepted cellular and cordless phone calls, deciphered their touch tone security codes, and mapped out the neighborhood. For two years he controlled the telephones and answering machines and disrupted the lives of the neighborhood with harrassing, sometimes pornographic, and sometimes threatening messages and constantly ringing phones. He gained such expertise that, had he not bragged about his exploits, he might never have been caught, according to the prosecutor.

It was a situation that had no sentencing guidelines, said Circuit Judge Frederick Lowe. A psychologist testified that Halstead (who in the final months before he was caught rarely left his bedroom) suffered from a schizoid-type personality disorder.

"Communications" is compiled and edited by Rachel Baughn, with help from these fine folks who sent in clippings from their world of radio: Anonymous, NY; Bill from Kent; Harry Baughn, NC; Graeme Browning, CDT; E. Hochstatter, WA; Maryanne Kehoe, GA; Gerald Kercher, CT; Kevin Klein, WI; Michael Lenane, FL; Larry Magne, PA; Doug Robertson, CA; Ed Savage, AR; Ed Schwartz, IL; Bob Scott, VA; Richard Sklar, WA; Gayle and Larry Van Horn, NC.

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Unlocking the Mysteries of Shortwave Radio

By Larry Van Horn
***MT* Staff Writer**

Think back to the first time you ever sat down in front of a shortwave radio. As you turned that radio dial for the first time, a plethora of non-verbal radio signals could be heard coming from the speaker. In fact, the one thing that impresses and scares most newcomers is the large variety of whistles, tones, grunts, squeals and other audio radiating from your shortwave radio speaker. While these noises can confound and confuse the newcomer, they also add a certain amount of mystery and intrigue to spanning the world via shortwave radio.

Where do these signals come from and what are all those weird noises that you hear on your shortwave radio? It's time to unlock some of the mystery signals on shortwave radio.

A WORLD FULL OF DIGITAL SIGNALS

Although there's plenty on shortwave to keep us guessing, most of the mystery signals that a newcomer encounters on shortwave are very easy to explain. They are nothing more than digital transmission modes. These digital modes carry text and graphic information, and if you have a suitable decoder and receiver, you can usually read or see the information being transmitted. So let's take a quick tour of some of the easier to hear signal types and take some of the mystery out of listening to shortwave.

Beginner's Hint: When tuning the shortwave bands for digital signals be sure to select the BFO (beat frequency oscillator) sideband or upper/lower sideband mode on your receiver. I normally tune around the shortwave spectrum in the upper sideband mode to look for both voice and data signals.

There are certain types of signals that you will never decode because they are being sent by the U.S. military and are encrypted (or coded). These are usually **radio teletype (RTTY)** which are being sent at 75 words per minute (wpm) with 850 Hertz (Hz) shift. Tune around 12700 kHz during daylight hours and 4280 kHz during the overnight hours for examples of this sort of transmission.

If you are looking for some U.S. military RTTY transmissions in the clear (unencrypted), try tuning in 3228 or 5904 kHz during evening hours in North America for the U.S. Air Force Air Weather Service broadcasts from Offutt Air Force Base (AFB). You can also hear other RTTY AWS broadcasts from U.S. Navy transmitters in Key West, Florida, on 7784, 9830, 11118, 12835 and 19359 kHz.

GOES WEFAX image courtesy of OFS Weatherfax

Another common signal the listener will encounter is the **facsimile (fax)** broadcast. Most people are familiar with the office fax machine, and the shortwave version of this type of transmission does pretty much the same thing. Fax broadcasts on shortwave are used primarily to send weather charts and satellite photographs.

The easiest fax signal to hear on shortwave is broadcast from the U.S. Navy station in Norfolk, Virginia (NAM). Look for their 120 revolutions per minute (rpm) signal (standard based on the drum rotation speed of older mechanical fax machines) on 3357, 8080, 10865, 15959 and 20015 kHz.

Another digital mode that is still used in the shortwave spectrum is **Morse code**. Yes, Bunky, I said Morse code! Morse code is the simplest of digital modes, since it is nothing more than on/off keying of the transmitter used in various sequences to form letters, numbers and punctuation. Morse code or continuous wave (CW) transmissions can be found throughout the shortwave spectrum, but they will be especially concentrated in the lower portions of the high frequency (HF) amateur radio bands. Check out the following frequency ranges for CW signals: 3500-3750, 7000-7150, 10100-10150, 14000-14150, 18068-18110, 21000-21200,

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24890-24930, and 28000-28300 kHz.

Computer enthusiasts are familiar with the term **ASCII (American Standard Code for Information Interchange)** and this mode is used in the HF world primarily on amateur radio frequencies. One consistent ASCII broadcaster is the American Radio Relay League (ARRL) in Newington, Connecticut. The official League station W1AW sends teleprinter bulletins several times a day on 3625, 7095, 14095, 18102.5, 21095, and 28095 kHz. W1AW bulletins are sent at 45.45-baud RTTY (Baudot) and 100-baud AMTOR, 110-baud FEC Mode B, and ASCII. The ASCII broadcasts are sent only as time allows. You can get a complete schedule in the latest issue of *QST* magazine or at the League website: **http://www.arrl.org**.

Amateur radio operators practice packet comms during Field Day in Carey, NC. (Photo by Harry Baughn)

Another mode widely used by amateurs and some other utility stations is **packet (Ax25)**. If you want a taste of what packet signals sound like, tune through the following frequency ranges: 3620-3635, 7100-7105, 10140-10150, 14100.5-14112, 18015-18110, 21090-21100, 24925-24930 and 28120-28189 kHz.

Amateur operators also transmit a form of television signals called **Slow Scan TV (SSTV)** on shortwave frequencies. If you want to hear what those signals sound like, tune your receiver to the following frequencies: 3845, 7171, 14230, 21340 and 28680 kHz.

ERROR CORRECTION MODES

SITOR-A, also known as ARQ, TOR/ARQ or AMTOR-A, is a common synchronous transmission and automatic repetition digital mode used by amateurs, marine services and some diplomatic agencies. You can find a large concentration of SITOR-A or SITOR-B (see below) signals in the narrowband direct printing marine sub-bands. Search the following frequency ranges with your receiver and decoder for coastal stations using the SITOR modes: 4210.5-4219, 6314.5-6330, 8416.5-8436, 12579.5-12656.5, 16807-16902.5, 19681-19703, 22376.5-22443.5 and 26101-26120.5 kHz.

SITOR-B, also called FEC, TOR/FEC, AMTOR-B and NAVTEX, is primarily used for one-way broadcast information transmissions such as marine traffic lists, weather, and navigation bulletins. A great frequency to test your SITOR-B tuning ability is the worldwide NAVTEX (navigational and meteorological warnings and urgent information for ships) frequency of 518 kHz, right below the AM broadcast band. Another NAVTEX frequency to monitor using the SITOR-B mode is 4209.5 kHz.

You will also find SITOR-B activity on the following frequencies:

Distress and Safety: 2174.5, 4177.5, 6268, 8376.5, 12520 and 16695 kHz
Marine Safety Information: 4210, 6314, 8465, 12579, 16806.5, 19680.5, 22376 and 26100.5 kHz

Digital Selective Calling (DSC) is a variation of the SITOR-B mode, but it uses a special set of 127 symbols in addition to a 10-bit error correction code. DSC signals are short, usually lasting about 6-7 seconds. This system is used to establish initial contact between ships and shore stations. These DSC transmission are part of a bigger system known as the global maritime distress and safety system (GMDSS). For more information on GMDSS, see the story *Safety at Sea Goes Hi-Tech* by Jon Van Allen in the August 1995 issue of *Monitoring Times*.

The following frequencies utilize the GMDSS/DSC mode:

Coast/Intership: 2177 kHz
Distress and Safety: 2187.5, 4207.5, 6312, 8414.5, 12577 and 16804.5 kHz
Ship Stations: 2189.5, 4208-4209, 6312.5-6313.5, 8415-8416, 12577.5-12578.5, 16805-16806, 18898.5-18899.5, 22374.5-22375.5 and 25208.5-25209.5
Coastal Stations: 4219.5-4220.5, 6331-6332, 8436.5-8437.5, 12657-12658, 16903-16904, 19703.5-19704.5, 22444-22445 and 26121-26122 kHz

PACTOR is a system designed to use the burst capability of packet with the error correction techniques of SITOR. This mode is used by amateur radio and military affiliate radio service (MARS) operations, government agencies, and agencies such as the United Nations and the International Red Cross.

If you want to hear what AMTOR and PACTOR modes sound like, try tuning in the U.S. Navy MARS International Digital Network (IDN). You will hear quite a bit of activity on the frequencies noted in table one.

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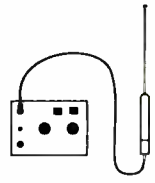

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November 19, 1997 — Anytime, Anywhere. **USS George Washington** *(CVN73) is enroute to the Arabian Gulf in response to rising tensions between the United Nations and Iraq. (U.S. Navy photo by Photographer's Mate Second Class Robert Catalano)*

CIVILIAN AIRCRAFT BAND DIGITAL SIGNALS

Aircraft band scanner enthusiasts are familiar with the term **ACARS** (Aircraft Communication and Reporting System), but recently ACARS testing has been conducted in the HF spectrum. ACARS relays Aircraft Operational Control (AOC), Airline Administrative Control (AAC), and Air Traffic Control (ATC) messages between ground-based organizations and the aircraft cockpit.

In addition to the VHF (118-136 MHZ) ACARS frequencies which scanner enthusiasts are familiar with, ACARS coverage is also available worldwide through ARINC's GLOBALink satellite service (Inmarsat) and GLOBALink/HF service. It is expected that GLOBALink/HF service will have worldwide coverage by end of 1998. The primary frequency being reported with HF ACARS messaging (or HF Datalink) is 13340 kHz.

If you tune around the civilian HF aircraft frequencies, you might occasionally hear ground stations sending tones to various aircraft and receiving the answer back using voice communications. Due to the background noise level experienced on HF radio frequencies, air crews usually prefer to turn down the audio level of their HF receiver until alerted via **selective calling (SELCAL)** of a message specifically intended for their aircraft.

When an aeronautical ground station wishes to communicate with an aircraft, they enter into a SELCAL encoder the 4-letter code of that aircraft, and transmit that code over the assigned HF radio channel. All aircraft monitoring that channel receive the SELCAL broadcast, but only those that have been programmed with that 4-letter code will respond by sounding a chime or otherwise alerting the crew. The crew will then set their volume control higher to listen to the voice traffic from the ground station.

Each code comprises two pairs of tones, the first pair being transmitted for approximately 1 second, and the second pair being transmitted for the same duration following a 0.2 second pause. The individual tone frequencies are known by a letter designator A through M, plus P, Q, R and S, but not including the letter I. This allows for a total of 10,920 SELCAL codes.

A typical SELCAL code is "AB-CD," which indicates that the frequencies designated by letters "A" and "B" would be sent simultaneously for 1 second, followed - after a pause of 0.2 seconds - by the simultaneous 1 second transmission of tones "C" and "D." Duplicate letters (tones) are not permitted in either pair, since simultaneous transmission of two tones of the same frequency would not be distinguishable by the aircraft's SELCAL decoder from any other combination of tones containing that frequency. Also, the same tone is not permitted to be used in both the first and second pair.

A comprehensive SELCAL database can be found on the Irish Aviation Internet website at: **http://ireland.iol.ie/~markzee/selcaldb.htm**

You can tune through the following frequency ranges for civilian aircraft communications:

2850-3025, 3400-3500, 4650-4700, 5480-5680, 6525-6683, 8815-8960, 10005-10100, 11270-11400, 13260-13360, 17900-17970, 21870-22000, and 23200-23350 kHz.

Digital systems enable aircraft to leave routine reporting and messaging tasks to be done automatically without tying up valuable air time.

US Army MARS station manager Sgt John Norton erects a "sleeping Vee" antenna at Camp Freedom in Kuwait City, as the oil fires burn behind him.

TWO GREAT RESOURCES

Unfortunately, space doesn't permit us to include more of the mysterious and digital signals that can be heard on shortwave. But there are a couple of excellent sources of information if you want to continue exploring the HF spectrum. If you have the Internet, be sure to stop by the Worldwide Utility News website maintained by Jason Berri at **http://www.gem.net/~berri/wun/**. Here you will find an excellent resource called the *Digital Signals FAQ* written by Stan Scalsky and Mike Chace. This FAQ is a goldmine of information on digital signal types found in the radio spectrum.

An excellent frequency guide that ought to be on your reference shelf is the Klingenfuss *1998 Guide to Utility Radio Stations* (available from Grove). This by-frequency reference will help the monitor identify a wide variety of digital signals and reduce the amount of unknown signals that the radio monitor has to contend with.

So, fire up that shortwave radio and give the dial a spin. It's time to take some of the mystery out of shortwave radio listening.

Table One: U.S. Navy MARS International Digital Network

Mailbox Station	Assigned Selcal	Dial Freq	Mode	Freq	Location
NNN0MDA	NMDA	13540.0	A/P	13538.8	Edelman, PA
NNN0MDJ	NMDJ	13540.0	A/P	13536.8	San Diego, CA (SCA)
		10259.5	A/P	10256.3	(Alternate Frequency)
NNN0MDE	NMDE	14760.5	A/P	14759.3	San Antonio, TX (STX)
		11070.0	A/P	11066.8	(Alternate Frequency)
NNN0MDI	NMDI	14935.5	A	14932.3	San Diego, CA (SCA)
NNN0MDL	NMDL	14935.5	A	14932.3	NAS Whidbey Island, WA
NNN0FLH	NFLH	14935.5	A/P	14934.3	Jacksonville, FL
NNN0ASL	NASL	14935.5	A/P	14934.3	Honolulu, HI

A=Amtor P=Pactor

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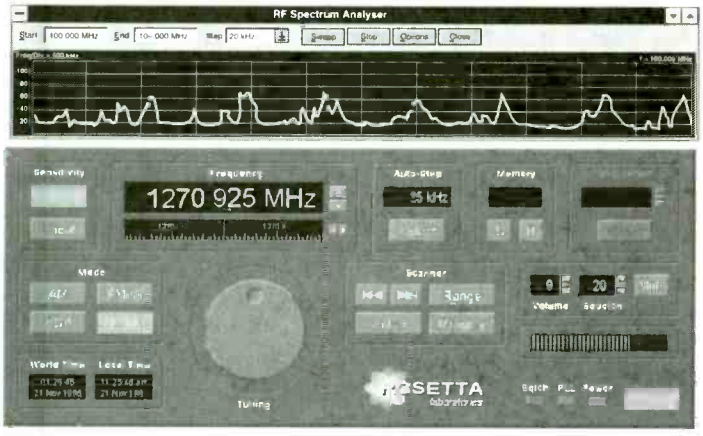

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ANT 9	Professional Wideband Discone	$87.95
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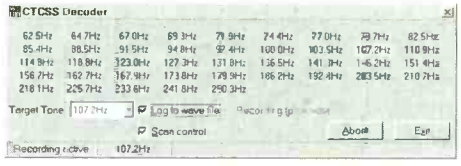

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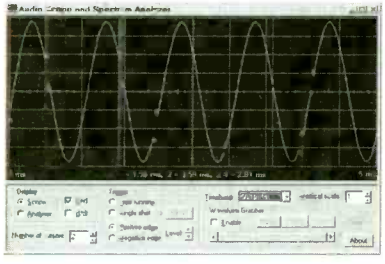

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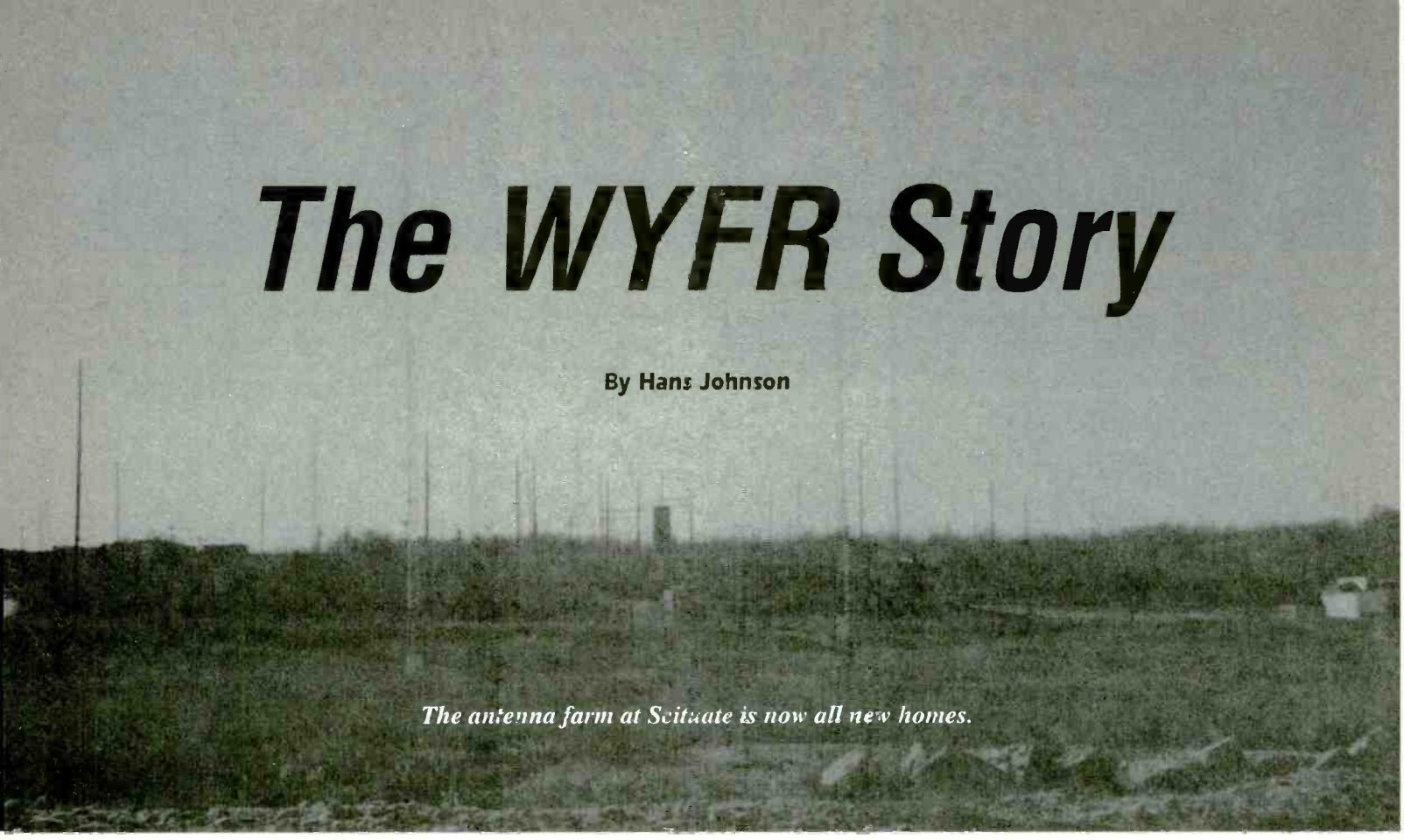
The WYFR Story

By Hans Johnson



The antenna farm at Scituate is now all new homes.

The American shortwave scene is no stranger to excitement. Stations come and go; some are beset by controversy, while others struggle simply to stay on the air. The largest private shortwave station in the United States, WYFR, stays out of the limelight and quietly and effectively carries out its work. 1998 is a special year for this station as they celebrate their 25th year of broadcasting Christian programs on shorwave.

One cannot tell the story of Your Family Radio (YFR) without discussing the history of the station's original transmitter site in Scituate, Massachusetts. The site's pre-WYFR history spans half a century and some pretty interesting things happened along the way. Understanding this history is also the key to understanding WYFR's management and subsequent closure of Scituate.

In Service of its Country

In the Depression year of 1936, W1XAL moved from Boston to Scituate. Like the other 30 some odd shortwave stations in the United States, the station was experimental and noncommercial. In 1939, the experimental designation ended for all stations. Run by the University Club of Boston, the station took the call letters of WRUL or World Radio University for the Listener.

During the early days of World War II, its broadcasts warned Norwegian ships at sea that Germany had attacked Norway. This gave 900 merchant ships the warning they needed to avoid capture by the Nazis.

The United States government still did not have its own shortwave facilities when it entered World War II in December 1941, so it took over the private stations in the United States, including WRUL. The station resumed some of its own programming in 1947 and moved its studios to New York City a few years later. The station promoted American products to Latin America and was the fifth most popular station in Latin America.

A close-up of the 16 meter antenna arrays.

WRUL's best known program was *The Voice of Freedom*, beamed to the Middle East and Europe. The VOA lease did not completely end until 1954.

Family Radio started its first station in 1959, but its involvement with shortwave was still over a decade away. In the meantime, WRUL went through its most interesting years ever. As part of its campaign to overthrow Castro, the CIA used shortwave broadcasting. While most of these efforts were over the infamous Radio Swan, WRUL also played a role. Concurrent with its efforts in establishing Radio Swan in early 1960, the CIA used Pan American Broadcasting to make arrangements for Cuban exile groups to purchase time over WRUL.[1] The CIA may have also played a role in providing funding as well as some of the broadcast material for these programs.[2]

A division of the Mormon Church acquired the station in 1962 for less than two million dollars, but only owned it for a few months when a new situation emerged. During the height of the Cuban missile crisis, the government took over the station for three weeks, using it for the Spanish service of VOA. The station later received a citation for its service.[3]

An Uneasy Beginning

Freed at last from government service,

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WRUL attempted to become a true commercial station. In an attempt to increase listeners, WRUL made arrangements with R. L. Drake to have a simple-to-operate shortwave receiver built. WRUL became WNYW, Radio New York Worldwide, in 1966 as part of the promotion of its commercial image.

The station failed to draw listeners and ultimately sold the station to WYFR in 1973.[4]

One of the things that killed WNYW was fire. Not one fire, but several fires due to several causes. There was plenty of wood around, both in the building and outside. The open-wire transmission lines arced because of a marginal design — and also from vandalism by locals who were upset about interference on their TV sets and threw bits of metal into the lines to cause arcing.

The worst fire in 1967 destroyed all four of the station's transmitters and caused $1,000,000 dollars in damage. Another large fire in 1972 was the final nail in WNYW's coffin. They sold the station to WYFR the following year.

For almost a year prior to the purchase, WYFR had been buying 16 transmitter hours a day on WRUL. Then on October 20, 1973, WYFR took over the station, having completed several years of negotiations for its purchase. The site had four transmitters, two 50 kW and two 100 kW coupled to nine rhombic antennas. Transmissions could be beamed to Europe, and by reversing the antennas, to Latin America. WYFR started with broadcasts in English and Spanish.

The WNYW transmitter building in Scituate, Mass. (plus DXers Mike Macken and Bob Butterfield)

Several changes occurred immediately as the station changed hands. The format went back to non-commercial. WYFR was (and is) funded by listener donations to Family Radio's network of AM and FM stations. Most of the former technical staff left as WYFR was not able to offer the same wages as WNYW. The new staff, however, was quite dedicated and one of their first projects was to cut undergrowth around the station so as to facilitate maintenance and improve signals. Station engineers also personally dealt with interference complaints from neighbors. Harold Camping, President of Family Radio, laid out WYFR's strategy:

"We have no long range goal that we want to be so big or do so much. We try and make wise decisions. If some project appears to be sound, then we proceed."

One of the Gates shortwave transmitters.

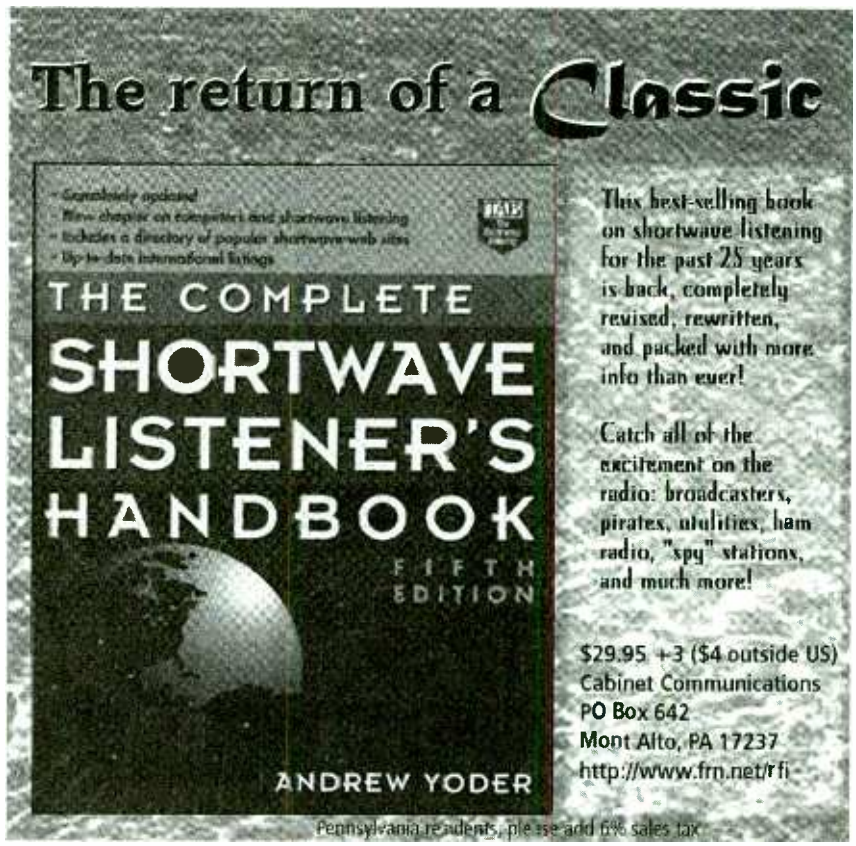
Smart Moves

Indeed, looking at any long range goals was impossible as there was a major problem with the Scituate site. When built, the radio site at Scituate was in a rural area. But by the 1970s, the 40 acre leased site was surrounded by a residential area.

On such a small site, the antennas experienced cross coupling. They also provided insufficient gain because they were too small. WYFR wanted to install better antennas, but the site simply did not have room to accommodate them. They did add an additional 100 kW transmitter shortly after purchasing the station.

The search for a new site started and Okeechobee, Florida, was soon chosen. Here, WYFR leased 660 acres about 20 miles north of Lake Okeechobee. This area of Florida was settled quite late, with settlers arriving here only in the 1930s. They cleared much of the land, but tracts of virgin swamp and forest remain even today on the site. WYFR shares the property with a local rancher who grazes his cattle here. Large citrus groves are also in this part of Florida and sod grass is another big crop.

WYFR moved carefully to the new site. The first transmitter, a 100 kW one, was



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Pictures of the transmitter site in Okeechobee in 1988, showing some of the dedicated staff working on the Continental and Gates transmitters, and the wooden support poles, some of which were transported from the Scituate site.

moved from Scituate to Okeechobee in late 1977. The transmitter was coupled to a double rhombic antenna at the new site, broadcasting to Europe and South America. The transmitters were moved one by one down to Florida, so WYFR operated two sites for a few years. By late 1979, WYFR had moved all the transmitters to Okeechobee. They also moved all the antennas and towers, plus some of the wood support poles. A rather unusual incident did occur at Scituate before the move was complete, according to WYFR documents:

"Possibly WYFR is the only radio station ever to have an antenna taken out of service by a house. The station sat on a low hill overlooking the Atlantic with one antenna very close to the ocean. During a severe 1978 winter storm, enormous waves coming over the sea wall tore a house off its foundations. The rogue smashed into a 90-foot tall rhombic support pole, snapping the pole in two."

What became of Scituate, a site with over 40 years of shortwave radio history?

At the request of the lease-holder, WYFR left some of the wooden support poles. According to Chris Lobdell, a local DXer, the site has been developed into a rather nice selection of upscale single family and townhouse homes.

WYFR grew steadily throughout the years, adding more transmitters and targeting more areas. An example would be the start of transmissions to Western Canada in 1981. The growth was steady, planned, and very smart.

A dramatic demonstration of this smart growth occurred on New Year's Day 1982. WYFR surprised everyone with the start of what it calls its radio trade alliance with the Voice of Free China (now Radio Taipei International) of Taiwan. Using VOFC facilities, Family Radio now had several hours of programming a day to India (English and Hindi) and mainland China (Mandarin). In exchange, the reception of VOFC to the Western Hemisphere vastly improved as they were now using WYFR facilities for several hours.

After a trial period of several months, the stations formalized this arrangement that continues to this day. It was a brilliant move by both sides. India and China are difficult areas to reach, particularly for a Christian broadcaster. In one quick move, WYFR had broadcasts to both these areas. Taiwan, because of its political status, would have had difficulties in setting up time exchange agreements with most stations. Now it had an excellent site for covering North America, and a much better one for covering Europe. Neither station had to invest in an additional transmitter site (this was before the time purchasing revolution) and each gained many new listeners.

For reasons of confidentiality, WYFR won't discuss the details of this arrangement. It is extensive, though. Radio Taipei International has 27 transmitter hours daily from WYFR, while WYFR has 24 a day via RTI.[5]

WYFR literature describes the arrangement as an exchange of "comparable combination of transmitters and antennas."

WYFR pulled a similar coup with BBC in 1996. Although a much smaller exchange, WYFR programs in Arabic are transmitted from a site in the United Kingdom, while BBC programs in English are carried via Florida.

The Quiet Broadcaster with a Big Voice

Today, WYFR is broadcasting in 11 languages from three different countries.

The heart of the Okeechobee operation is a 80 ft. by 200 ft. building that houses offices

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and transmitters. This building lies in the center of the site, transmission lines running out in many directions to the antennas erected along the borders of the site. A combination of antennas is used, including a dipole curtain, log periodics, and double-rhombics. A total of fourteen 50 and 100 kW Continental and Harris transmitters are used, including the five Scituate transmitters. Although many of these transmitters are on for up to 14 hours a day, WYFR is able to maintain and repair them so that the station can broadcast its extensive lineup.

Keep in mind that Okeechobee is WYFR's transmitter facility only. The station's Christian programs are produced in Oakland, California, and then sent to Florida.

There are some interesting aspects to transmitting from South Florida. Power drop-outs can be a real problem during the summer months, when thunderstorms are a daily occurrence. Lightning will trip circuit breakers, and on a day with a lot of thunderstorms the staff can be quite busy resetting them. The station simply uses too much power to install diesel generators to produce power when the local power is knocked out.

This section of Florida is quite dry from November to April. Fields are burned during this time of the year to clear brush. Pieces of carbonized grass can blow from fires miles away onto WYFR's site. This grass can land on the transmission lines. Operators have to be alert, perhaps even shutting a transmitter down temporarily, to prevent arcing that could burn up the transmission lines.

For many years, the station has enlisted listeners as monitors. In the fall of 1977, I served as a monitor for WYFR. Being a monitor was heady stuff for a teenager, so I took it seriously. I can still remember filling out the monitoring sheets neatly, while listened to WYFR's signal on my Panasonic RF-2200. Over 20 years later, the monitoring program continues. Dan Elyea, Station Manager of WYFR, elaborates: "The monitoring program is still going at a fair level, but we really need monitors in Latin America."

Smart growth turned WYFR into the largest private broadcaster in the United States. This growth, coupled with alliances and exchanges, has also made this station a very effective broadcaster.

The author would like to thank Dan Elyea, Station Manager of WYFR, for his outstanding assistance to the author in preparing this article. I would also like to thank Nick Grace for his help on WRUL's role in broadcasts to Cuba. Thanks also to Richard Homeres of WYFR and Chris Lobdell for photographs.

1 This apparently was the extent of Pan American's involvement. Metro Media, part of CBS, was the owner at this time, according to most secondary sources. Most of Pan American's records, including any that would have shown which groups they brokered for, were destroyed years ago when Pan American moved to California. [Author's interview with Pan American, February 9, 1998.]

2 See *Clandestine Radio Broadcasting* by Lawrence Soley and John Nichols for a good account.

3 See *The Image Empire* by Eric Barnouw, which seems to provide the most accurate account of this takeover.

4 See *Broadcasting Bedfellows* by Richard A. Seifert in the August 1996 *Monitoring Times* for an excellent account of the Drake-WNYW partnership.

5 See 1998 *World Radio TV Handbook*

PROGRAM PERSONNEL

Thomas Schaff maintains the global perspective as International Program Manager. Programming is prepared in Oakland, California.

Alan Thayer, Program announcer - French programs

Julie Hesse, Correspondence, announcer - German programs

Vivian Ho, Correspondence, announcer - Chinese programs

Isabella Sighamony, Correspondence, announcer - Hindi programs

Helenita Pizarro, Correspondence, announcer - Portuguese programs

Guillermo Navarrete, Correspondence - Spanish mail

Taida Yefimov, Program announcer - Russian programs

Peter Petrenko, Program producer and duplicator

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WYFR Broadcasting Schedule

For English see *English Language Shortwave Guide*, p. 39

Russian to Europe and Africa

UTC	Freqs kHz
0300-0400	7355, 9355
0400-0500	9355
1505-1705	9955
1700-1800	15600,17750
2200-2300	15695-15715

Spanish to Mexico and Central America

1100-1200	9605, 11725
1200-1400	11725, 15130, 15145
1400-1500	15130
2200-0000	11740
0000-1500	9715, 11815
0500-0600	9705, 11815
1000-1100	6085
1100-1300	6085, 11970
1300-1400	6085
2200-0100	5985
0100-0300	5985, 15255
0300-0500	5985

Spanish to South America

0800-1000	9550, 11855
1000-1100	6175, 9500, 11855
1100-1200	9370, 13695
2300-0100	15215, 17750, 17845
0100-0200	17750

Spanish to Caribbean

1000-1100	6085
1100-1300	6085, 11970
1300-1400	6085
2200-0100	5985
0100-0300	5985, 15255
0300-0500	5985

Spanish to Europe

2200-2300	15695, 15715

German to Europe and Africa

0300-0400	9985
0400-0500	7355, 11580
0500-0600	7355, 9355
1700-1800	15665
1900-2000	7555, 15715
0600-0700	9355, 13695, 15170
1800-1900	15600, 17750, 21525
2000-2100	17750, 21725

French to Canada

UTC	Freqs kHz
1100-1200	9505
1200-1300	13695
2300-0000	6085
1000-1100	9625, 11970
2300-0100	15255

French to Europe and Africa

0600-0700	9355, 13695, 15170
1800-1900	15600, 17750, 21525
2000-2100	17750, 21725

French to Lesser Antilles

1000-1100	9625, 11970
2300-0100	15255

Italian to Europe and N. Africa

0600-0700	7520, 11580
0700-0800	9355
1800-1900	15715
2100-2200	15715, 17555

Portuguese to Africa

0400-0500	15170
1900-2000	21525

Portuguese to Brazil

0800-0900	9605, 11770
0900-1000	6175, 9605, 9625, 11770
2200-2300	15130
2300-0000	17725
0000-0100	15130, 17725, 17805
0100-0200	17725

Hindi to India

0000-0100	11550
1510-1610	11550

Chinese Language to China

2100-0000	6300, 9280
1102-1602	6300, 9280

Arabic

0500-0600	13695, 15170
1600-1700	15665
1700-1800	21525
1800-1900	13710

Source: WYFR website **http://www.framilradio.com**
Times and frequencies can be expected to vary for winter season.

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Cryptography — The Secret Language of Spies

By Dan Veeneman

"23187... 46982... 69335... 15948..."

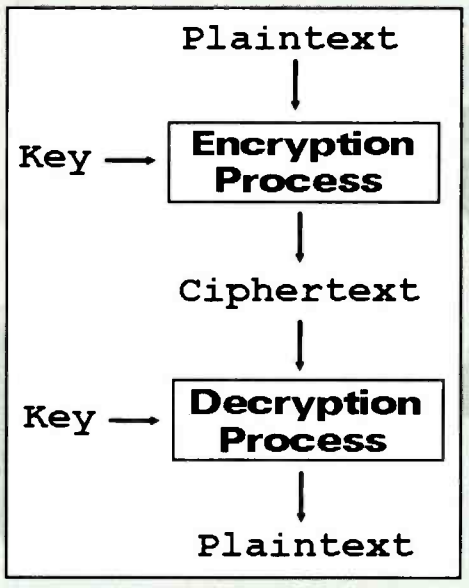
If you've listened to shortwave for any length of time you've probably run across them. A mysterious voice announcing a long series of numbers, perhaps destined for some unknown spy in a foreign land. Although shrouded in secrecy, these numbers are assumed to be some kind of encrypted message, making sense only after being decoded by some clandestine listener.

Cryptography is the science of secure communication in the presence of adversaries. In any encryption system, the message to be sent, called the *plaintext*, is encrypted in some way to produce *ciphertext*, which is then transmitted. Encryption systems typically require a secret piece of information, called a *key*, in order to scramble the message. On the receiving end, the key is used to decrypt the ciphertext and produce the original plaintext. Should the ciphertext be intercepted, an eavesdropper would be unable to decrypt it without the proper key, even if the encryption method was known.

Despite the lack of concrete details about these mysterious numbers stations, over the years it has been assumed that the numbers are really messages encrypted using a *one-time pad*.

One-Time Pad

The only provably secure cryptographic system was created by Gilbert Vernam in 1917, who originally developed it to protect electronically transmitted messages. His invention automatically enciphered individual characters as they were entered into a teletypewriter as well as automatically deciphering them at the receiving end. This kind of character-by-character encryption is called a *stream cipher*, and Vernam's particular method is unbreakable if used correctly. His invention is now referred to as the one-time pad cryptosystem, and has been extended to both manual and computerized operations.



The key in a one-time pad system is a series of random numbers. Vernam's invention used long strips of paper tape, but in the manual version of the system numbers are printed on small pads of paper that are easily concealed. Each sheet of paper in the pad is used only once, then discarded and permanently destroyed. (It has been reported that the Central Intelligence Agency has a special type of paper that turns into chewing gum when it contacts saliva.) There are two copies of the one time pad: the person wishing to send a message and the intended recipient both have identical pads.

An Example

With all that in mind, let's take a look at a contrived example.

Spy headquarters is preparing to send an operative out into the field. During training the operative learned that most cryptographic systems involve mathematical operations, where it's much easier to deal with numbers than letters. Spy HQ has established a simple coding scheme where each letter of the alphabet is assigned a number. The letter A has a value of 1, the letter B has a value of 2, and so on up to Z, which has a value of 26 (see Table 1).

Table 1: Letter-number pairings.

Letter	Value
A	1
B	2
C	3
...	...
Z	26

In addition to a false passport and some local currency, the operative is issued a small pad of paper with a series of random letters printed on each page. This one-time pad contains the keys for the operative to decrypt messages that will be sent in the future. Spy HQ keeps an identical copy of the pad. Some time passes and the operative becomes active in the target country, occasionally listening to shortwave radio for any messages that may be destined for him.

At some point Spy HQ wishes to send a message instructing him to purchase a particular magazine. Using the letter-to-number conversion table, Spy HQ converts the phrase MONITORING TIMES into the numbers 13 15 14 09 20 15 18 09 14 07 20 09 13 05 19 (skipping the space). This is the plaintext message.

To encrypt the message Spy HQ will use a page from the one-time pad. For this example we'll say the next page of the pad has the key SECRET LISTENERS written on it, although

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in practice the key would be a random string of numbers. Again ignoring spaces, SECRET LISTENERS is encoded as 19 05 03 18 05 20 12 09 19 20 05 14 05 18 19.

The simplest encryption method is to add the plaintext number to the corresponding key number for each letter in the message (see Figure 1).

```
13 15 14 09 20 15 18 09 14 07 20 09 13 05 19
MONITORING TIMES
19 05 03 18 05 20 12 09 19 20 05 14 05 18 19
SECRET LISTENERS
-- -- -- -- -- -- -- -- -- -- -- -- -- -- --
32 20 17 27 25 35 30 18 33 27 25 23 18 23 38
```

FIGURE 1: *Adding each plaintext number to the corresponding key number.*

Since the letter encoding scheme only goes up to 26, Spy HQ "wraps around" the sums that exceed 26 by subtracting 26 and using the difference (see Figure 2). This operation is called taking the modulus and is done in many situations involving counting. (For instance, there are twelve hours on the face of a normal clock, and after reaching 12 we "wrap around" and continue counting at 1. This is called taking the hour "modulo 12.")

```
32 20 17 27 25 35 30 18 33 27 25 23 18 23 38
-26 -26 -26-26 -26-26 -- -- -- -- -- -26
06 20 17 01 25 09 04 18 07 01 25 23 18 23 12
```

FIGURE 2: *Taking the addition result modulo 26.*

So Spy HQ's encoded message is 06 20 17 01 25 09 04 18 07 01 25 23 18 23 12 (the nonsensical FTQAYIDRGAYWRWL), which is transmitted over the air at a time when the operative is scheduled to be listening.

On the receiving end the operative uses the identical key from his one-time pad to recover the message. Each key value is subtracted from the corresponding ciphertext letter to produce the plaintext (see Figure 3).

```
06 20 17 01 25 09 04 18 07 01 25 23 18 23 12
19 05 03 18 05 20 12 09 19 20 05 14 05 18 19
-13 15 14-17 20-11-08 09-12-19 20 09 13 05 -07
```

FIGURE 3: *Decoding the received message by subtraction.*

The values that fall below 1 are "wrapped around" to a positive value by adding 26 (Figure 4).

```
-13 15 14-17 20-11-08 09-12-19 20 09 13 05 -07
+26 +26 +26+26 +26+26 +26
13 15 14 09 20 15 18 09 14 07 20 09 13 05 12
```

FIGURE 4: *Taking the difference modulo 26.*

This gives the operative the original plaintext message of MONITORING TIMES.

An eavesdropper listening to the same shortwave station would have just the numbers 06 20 17 01 25 09 04 18 07 01 25 23 18 23 12, spelling FTQAYIDRGAYWRWL. If Spy HQ and the operative are following all the rules to maintain security, the best the eavesdropper can do is try out every possible key. This method is called *brute force* decryption, but in a one-time pad system where the key is as long as the message, even that drastic step won't help. The eavesdropper, in fact, will end up with all possible solutions.

For example, decrypting FTQAYIDR GAYWRWL using the key NSNVVHL YTLKCJKM produces the result RACE CARS MONTHLY and the key RSWRJUCFMZECFRT will produce NATIONAL TATTLER, both of which make sense but neither of which are correct. Since any key in a secure one-time pad is equally likely, the eavesdropper has no hope of determining the true plaintext using brute force.

■ Keeping it Secure

In order for a one-time pad system to remain secure, several rules must be followed:

Example One-Time Pad

```
48173 19839 90183
51834 00182 47865
01983 47362 3  2
60120 98754 2  874
```

First, the contents of the one-time pads must be kept secret. This is fairly obvious, but important. Anyone discovering the pads, if they didn't shoot the owner on sight for being a spy, could make a copy of the pad and decrypt the messages themselves. Intelligence and law enforcement agencies routinely perform "black bag jobs" to covertly break in and steal keys used by embassies, corporations, and even private individuals. This is probably the most damaging situation for the one-time pad user, since the only thing worse than no security is a false sense of security.

Second, the pads must not be reused. Two-time pads are not mathematically secure, and in fact the reuse of pads allowed the National Security Agency (NSA) to break thousands of Soviet KGB and GRU messages in the 1940's.

Third, the contents of the pads must be unpredictable. Regardless of whether the spy keeps the pads a secret and doesn't reuse them, if the numbers are somehow predictable it would be the equivalent of the adversary having their own copy of the pad. Numerous modern software programs that offer "one-time pads" have this weakness — their method of creating "random" numbers is often pre-

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dictable, allowing a snoop to reproduce the key and decode messages.

■ Randomness

Do these numbers seem random and unpredictable: 212, 198, 216, 32, 175, 100? If you think so, you don't commute on Interstate 95 north of Washington, D.C. These are the Maryland route numbers, in order, of the exits off northbound I-95 after leaving the D.C. beltway. They may look random, but they are very predictable once you know the pattern.

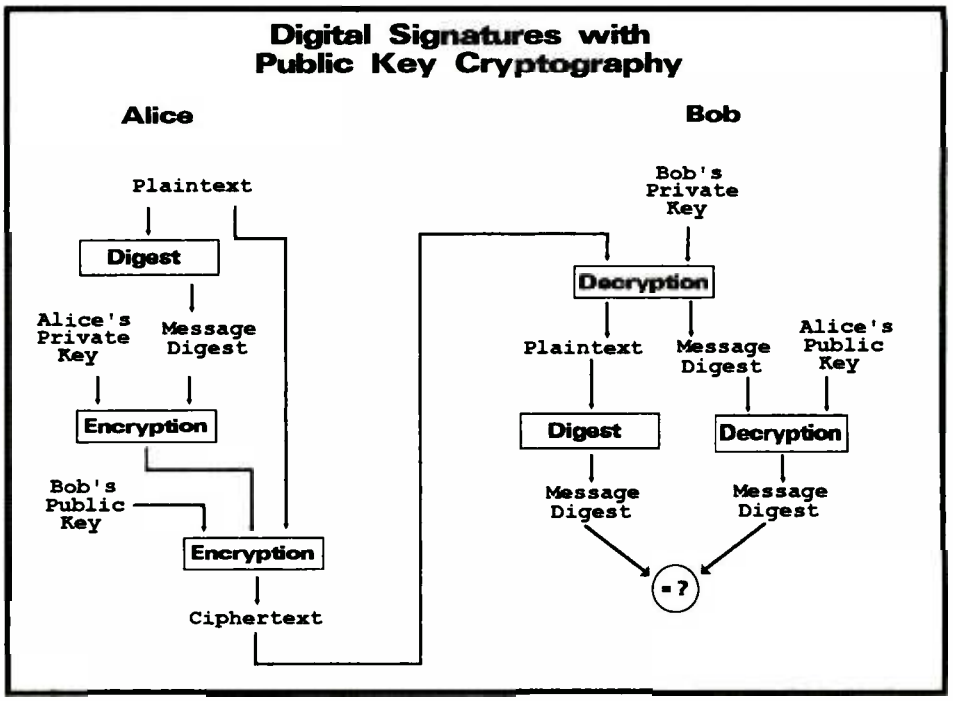
It's surprisingly difficult to generate really unpredictable numbers. For those of you who may be planning to use the random number function available in most programming languages for cryptography, please think again. Just like the Maryland route numbers, the output from these functions look random but are predictable and repeatable. In fact, a couple of years ago a serious weakness in Netscape's web browser was revealed after researchers discovered the random number generator used in the browser was very weak. This weakness would have allowed eavesdroppers to easily decode protected web connections, including the details of any financial transactions.

■ Key Length

In a secure one-time pad system the key must be as long as the message. If you want to send a message containing two thousand characters, you need a key that is also 2,000 characters long. If you want to encrypt a computer file that is two megabytes (2 million characters) with a one-time pad, you will need a key that is also two megabytes. If you want to protect a digital video signal that carries hundreds of thousands of characters each second, you probably won't use a one-time pad. Creating, delivering, and securing large keys is a very difficult problem, limiting true one-time pad systems to very specific uses, such as clandestine operatives in foreign countries.

For the rest of us, practical limits on the amount of key information we can handle necessitate the use of other encryption systems. In *block ciphers* the key length is much less than the length of the message, and is used in a different way. The plaintext message is broken up into small pieces called blocks, and each block is encrypted by the key. There are a wide variety of block ciphers that operate in different ways, but as a general rule the smaller the key the less secure any message encrypted with that key will be.

Keys in modern cryptographic systems are measured by the number of bits they contain. A bit is the smallest unit of information, either a 0 or a 1. The Data Encryption Standard (DES), a popular cipher, uses keys that are 56 bits long, allowing approximately 72 quadrillion (72,057,594,037,927,936) possible keys. As we'll see, this isn't nearly enough. Skipjack, a cipher invented inside the NSA and classified secret until very recently, uses 80 bit keys. The International Data Encryption Algorithm (IDEA) uses keys that are 128 bits long. Other ciphers of varying strength and complexity exist as well, each with their own key lengths. All other things being equal, one additional bit doubles the amount of work necessary to brute force a solution.



The United States government considers cryptography to be an implement of war, and closely controls the export of strong cryptography. Until recently, ciphers using more than 40 bits of key were usually denied export permits with the justification that such systems were too difficult for the government to crack and would therefore jeopardize national security. Even 56-bit DES has been denied export in many circumstances, despite its availability overseas. In addition, domestic law enforcement representatives have been wringing their hands in public, fretting that the widespread use of strong cryptography would render their wiretaps useless and frustrate their investigative efforts. In an effort to convince law makers of the dangers of strong cryptography, the Federal Bureau of Investigation (FBI) has testified before Congress numerous times about the impossibility of cracking encrypted messages protected by cipher systems such as DES.

■ DES Cracking

The Data Encryption Standard (DES) is a Federal Information Processing Standard (FIPS) approved by the National Bureau of Standards (now the National Institute of Standards and Technology, NIST) in 1977. In the intervening decades it has been scrutinized by numerous experts in cryptography, none of whom have found a significant weakness in its fundamental design. What is weak is the inadequate size of the key.

As mentioned above, brute force cracking is the process of decrypting a message using every possible key to find the one that works. To motivate practical research, in 1997 a company named RSA Data Security offered a prize for cracking a message encrypted using DES. Hundreds of volunteers ran customized key search software in their spare time on available computers, exchanging results and passing key information over the Internet. The message was broken after five months of effort across several thousand computers. At the beginning of this year the prize was offered again with a different message, and an improved search method yielded the key in only 39 days, again broken by a group effort of thousands of computers coordinated over the Internet.

A third challenge was broken in July by the Electronic Frontier Foundation (EFF), who used a single custom-built machine to crack the code in less than three days. For well under $250,000 the EFF had built a "DES Cracker" from a personal computer and an array of

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custom microchips that could break a DES-encrypted message in reasonable time without having to coordinate with anyone. They also showed that the government had been playing fast and loose with the truth in their testimony of how difficult it is to break DES messages.

■ Public Key Systems

Existing encryption systems fall into two categories. Private key systems, sometimes called secret key systems, use the same key on the sending and the receiving ends. One-time pad and DES cipher methods are private key systems.

Public key systems, on the other hand, make use of a public/private key pair. The public key is published and available for anyone to see while the private key is kept secret by the owner. The public and private keys are mathematically related to each other, but for all practical purposes it is impossible for an adversary given the public key to determine the private key.

For an overview of the use of a public key system let me introduce some characters that have become standard in the cryptologic literature. The protagonists in our story are Alice and Bob, who want to communicate securely while an adversary, say Louis, wishes to intercept and read everything they send to each other.

To send a message in a public key system, Alice creates a message destined for Bob. She encrypts the message using Bob's public key and sends it to him. When Bob receives the message he uses his private key and decodes the message. Since no one else knows Bob's private key, no one else will be able to decode the message.

Although Alice is sure that Bob is the only one that can read the message, how can Bob be sure the message really came from Alice? Perhaps our snoop Louis has effected a *man-in-the-middle* attack and intercepted Alice's message, altering it or replacing it with another message of his own creation before sending it on to Bob.

■ Digital Signatures

So far we've been talking about *confidentiality*, that is, keeping the contents of the message secret. Cryptography can also help us with *authentication*, that is, proving that a message really came from a particular person.

To foil Louis, Alice can take some additional steps that will prove to Bob she is really the author of the message he receives. Before sending the message, Alice generates what's called a *message digest*, a kind of digital fingerprint that identifies the contents of the message. This digest is based on the exact contents of the message, and no two messages will have the same digest. Alice then encrypts the digest with her private key and sends it along with the encrypted message to Bob. This is the equivalent of Alice signing the letter, and in fact this called a *digital signature*.

As before, Bob receives the encrypted message and decrypts it using his private key. He also decrypts the encrypted digest using Alice's public key. Bob then runs the plaintext message through a message digest function to produce a local fingerprint. If the digest decrypted with Alice's public key matches the digest he just computed, Bob can be sure that the message was not altered and was, in fact, sent by Alice and not an impostor.

All of these features are available in a program called *Pretty Good Privacy*, which was one of the first publicly-available programs to provide strong encryption. PGP uses public key cryptography to protect message confidentiality and assure authentication of the sender. (*MT's Computers & Radio also reviewed a data encryption program called Cyberlock in the August issue - ed.*)

■ A Challenge

As a final challenge, see if you can decrypt the following one-time pad message. Spy HQ has sent you the message **BABPFQH WZGIRPFNWBCOS** and the next key on your one-time pad is **LISTENING AND LEARNING**.

What is Spy HQ trying to remind you? The answer will appear in my *PCS Front Line* column in the December issue of *Monitoring Times*. For those of you who can't wait, the answer will also be available on my website, which will also have a computer program to assist you. Details below.

■ Further Reading

For more on the history of code making and code breaking, David Kahn's *The Codebreakers* is an authoritative account of the use and misuse of cryptography.

For those more technically inclined, Bruce Schneier's *Applied Cryptography* is one of the most popular books detailing modern cryptographic systems and how to implement them.

The American Cryptogram Association is a non-profit, volunteer organization dedicated to the creation and solution of cryptographic challenges of various sorts. More information on the ACA is available by writing to ACA Treasurer, 1118 Via Palo Alto, Aptos, CA, 95003.

All of this information and more is available on my website at **www.decode.com**.

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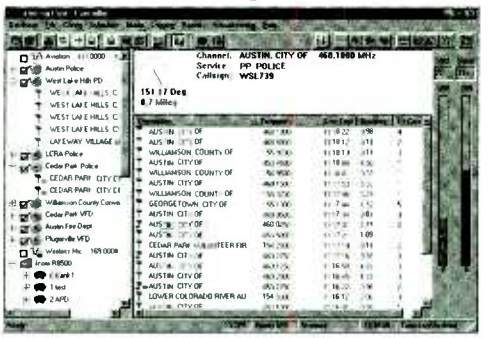

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Now It Can Be Told - and Toured

A Look Inside the Secret Congressional Cold War Hideout

By Jesse A. Finkelstein

The five-star Greenbrier Resort proved an effective cover for a retreat of a much different sort.

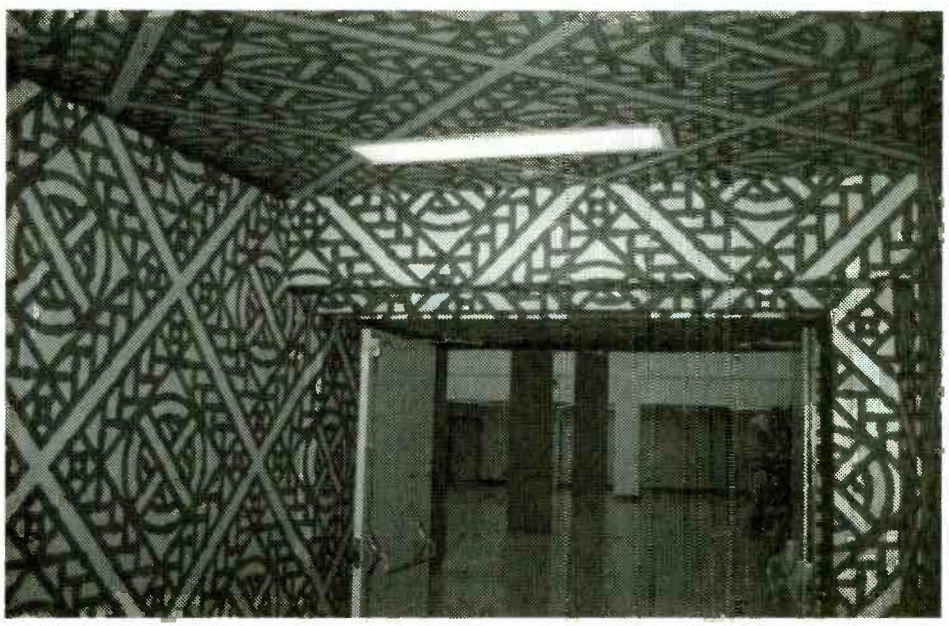
White Sulphur Springs, West Virginia, has long been the home of the 6500 acre Greenbrier Resort, a five star resort known for its golf courses, tennis courts, exercise facilities and fine food. However, until only a few years ago, only a small number of security-cleared individuals were aware that the hotel also served as a support facility for a giant secret underground complex intended to house the entire U. S. Congress in the event of nuclear, biological or chemical war. Following the 1995 decommissioning of the facility, code named "Project Greek Island," it is now possible to tour this important piece of cold war history and understand the critical communications function that it was intended to provide.

Project Greek Island began as the idea of Present Eisenhower, a frequent visitor to the Greenbrier. The 1958 federal budget contained a $15 million entry for "Project Greek Island" without further identification. Construction of the secret facility, which is the size of two football fields distributed among three levels, took place over a three year period beginning in 1958. The building activity was disguised as construction of a large exhibition hall and underground storage facility for the hotel.

A portion of the completed structure was in fact used for corporate exhibition activities for a number of years. This area, which had a 20 foot high ceiling, would have been filled with desks and office equipment for congressional staffers in the event of an emergency. Construction was deliberately stretched out over a period of time, using dozens of workers in discrete teams to complete small portions of the project in order to limit the number of people who were aware of the entire facility.

Project Greek Island was built under mountainous terrain, with all portions between 53 and 92 feet underground. Despite the efforts to make the shelter as bombproof as possible, it is unlikely it would have survived a blast closer than seven miles away.

When secured in "lock down" mode, Project Greek Island could hold 1,100 people, including the entire membership of the U.S. Congress and their senior support staffs. Supplies on hand could sustain this group for a period of 30 to 60 days. To protect against attack, the walls consisted of six foot poured concrete, with three foot thick concrete floors and ceilings. Four large doors protected access, the largest of them weighing 25 tons, with 18 ton hinges. Despite its weight, this door was balanced so as to require only two pounds of



Entry from the hotel to the "Exhibition Hall." Note the multi-layered construction of the doorway, which allowed the facility to be secured by a massive multi-ton steel door.

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pressure to close it. Potentially curious onlookers were dissuaded from investigation by large signs warning that high voltage equipment and wiring endangered those who might seek closer inspection.

Before decommissioning Project Greek Island, 33 trailer truckloads of materials were taken out of the shelter. The feds removed not only all classified, but nearly all usable electronics. Thus, a visitor to the large communications center sees rows of empty racks, which at one time housed the most sophisticated satellite and ground-based communications systems then available.

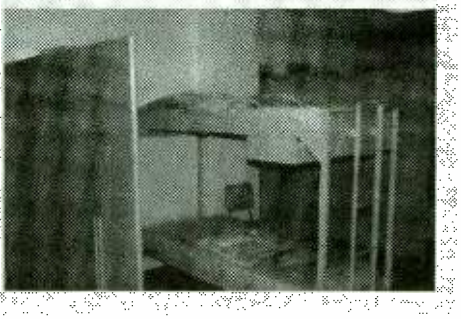
The systems in place during operation allowed for contact with the President, other governmental offices (to the extent that they survived) and with the "Looking Glass" patrol of the U. S. Air Force, which kept a flying command post in the air 24 hours a day during the cold war. Apparently, a variety of antennas could be raised above ground or lowered by remote control to facilitate transmission and reception in a number of modes. Unfortunately, the only visible vestige of the communication center is an antiquated telephone operator station, complete with patch cords.

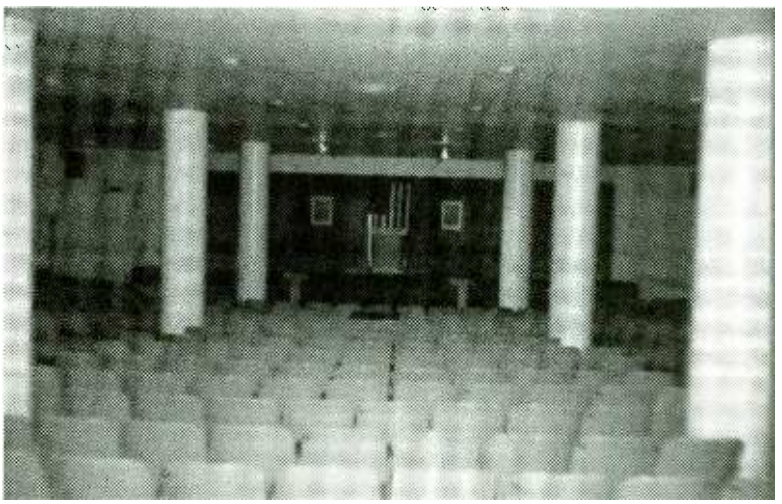
One of the most interesting facets of communications at Project Greek Island is still intact: the briefing room. The briefing room contains a podium and seats for approximately 30 people. One wall features clocks displaying GMT, as well as local time in Moscow, Tokyo, London, Baghdad and several other cities.

Suspended from the ceiling is a roughly 15 foot square photo of the capital dome, with a tree displaying fall foliage in the foreground. The reverse side is an identical photo, showing a winter scene. Another board is stowed away for use in spring or summer, and four similar boards contain seasonal images of the White House. These boards formed backgrounds for videotaping statements by congressional leaders, allowing the implicit inference that Washington was still intact (regardless of whatever devastation and destruction may have occurred).

The "luxurious" bedroom of the Speaker of the House

The remainder of the Congress shared bunks





The House Chamber

The cafeteria

The communication room apparently did not have any direct television broadcast capability, and it was intended that any statements would be taped for later distribution.

The shelter did *not* include spacious living quarters, requiring members of congress to share bunk bed facilities in 18 dormitories. The Speaker of the House and the Senate Majority Leader, however, were given more luxurious private bedrooms with separate sitting areas.

Power for the facility was provided by three diesel engines, each run in rotation and capable of producing 7500 kW. Each generator produced enough power to support a small city of approximately 30,000. To prevent detection, 13 foot long mufflers deadened the sound so that it was barely perceptible at ground level. The facility has constantly flowing 72 degree filtered air. Detection equipment allowed the evaluation of external conditions to determine whether the internal water supply was required.

Project Greek Island sits partially under the famed Greenbrier Clinic, which would have been the source of medical personnel (all previously security cleared and sworn to secrecy) in the event that the shelter was used. During the facility's tenure as an active installation, all medications taken by any member of congress were catalogued and stockpiled on a regular basis. Maintenance and food preparation personnel were security cleared employees of the Greenbrier.

Perhaps the most interesting rooms are the auditoriums set aside for meeting of the House and Senate. Each auditorium is configured with individual microphones, allowing Senators and Representatives to address the Chair from their seats. In furtherance of hiding the purpose of the facility, these auditoriums (which are located immediately adjacent to the exhibition hall) were actually used for concerts and employee meetings over the years.

Although the Greenbrier (which is owned by CSX Corporation) has maintained the facility for public tours to date, proposed legislation would allow the conversion of the shelter into a large underground casino.

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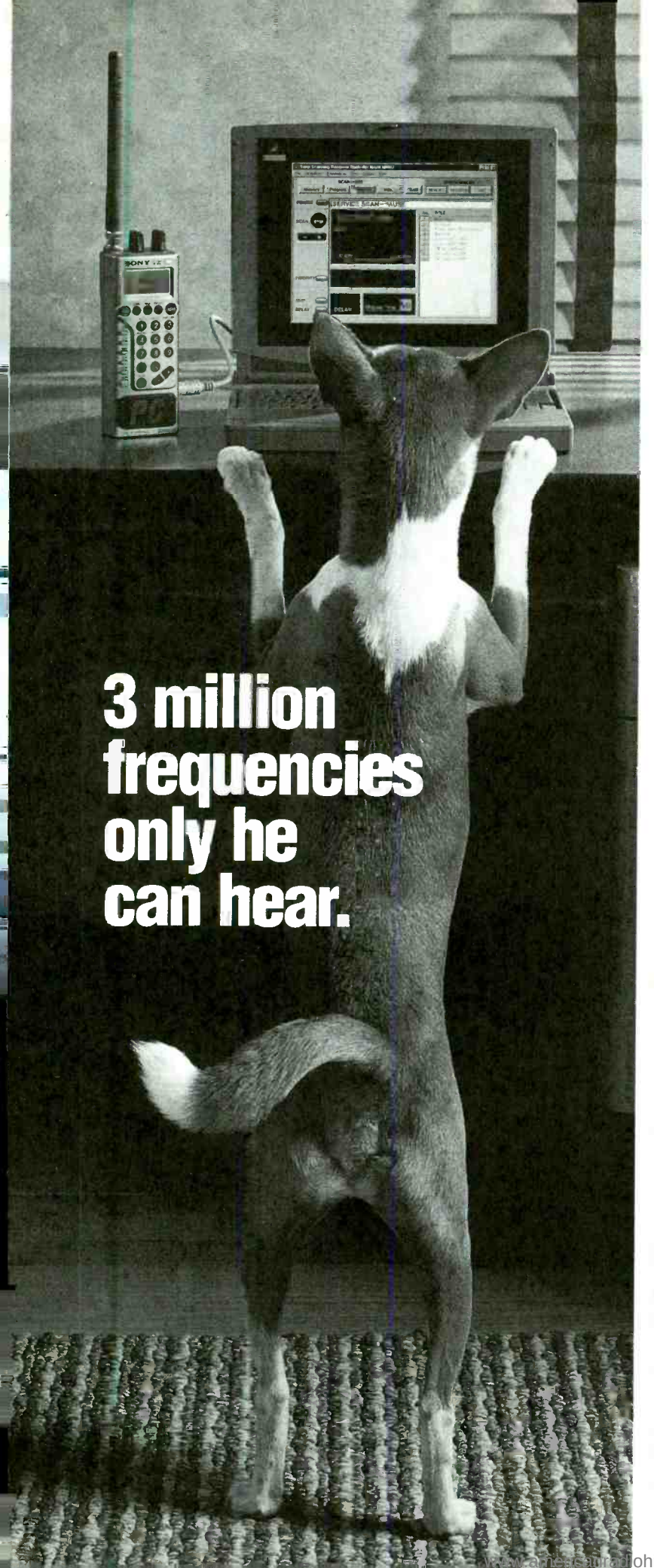

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Richard Barnett
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Random Scan

Join me for some random thoughts on scanning this month ... and speaking of random scanning, wouldn't that be an interesting feature for a scanner? Let the scanner take over and do whatever it wants for a while — scan, search, service search, stop and sit on any ol' channel for a while. Why not? We let machines do so much else for us in life nowadays.

Actually, it's been a pet peeve of mine that scanners cannot scan and search at the same time. Computer-control scanning programs have long allowed us to scan then search, then scan again, all with the press of a computer key. Sure, a computer has a ton more horsepower than a scanner, but we're only talking about the ability to stop the scan and start a search, all without user intervention.

When would you use such a feature? Scanning and searching at the same time goes to the heart of the purpose of a scanner. With scan and search, you could scan those frequencies of primary importance to you and search for new and interesting frequencies as well. You could have a routine where you search for active channels on a new small band segment each day, such as 163-165 MHz on day one and 165-167 MHz on day two, etc. This way, you could hear what you need to hear during scan, but at the same time conduct a thorough search for formerly unknown activity in your area.

(I've raised this concept with the manufacturers: Let's hope that they take the idea to heart. At first it was thought that manufacturers never incorporated this feature in a scanner because they would prefer you to buy two scanners! This isn't the case, though. They simply never thought of it before.)

✔ Mobile data terminals (MDTs) are becoming increasingly prevalent nowadays, but has scanning really been hurt? Manufacturers of MDTs may suggest to their public safety customers that voice communications are a thing of the past. Not only do newer MDT communications methods help insure privacy, but they also streamline the data collection and recording functions so onerous to many police and fire departments. Everything today has to be logged, and the nature of the MDT operation insures instant logging of calls for assistance, addresses, response times, dispositions, etc.

Mobile data terminals are an unquestioned asset to public safety operations. During a ride-along I took some years ago with the Massachusetts State Police in a two-man cruiser patrolling Boston area parkways, the officer in the front passenger seat spent much of the shift banging away on the keypad of his MDT checking any and all suspicious license plates that came into his view.

Before MDTs, these officers had to be much more circumspect about which license plate were called in to dispatch for a query. There is only so much air time available and only so much manpower available at the dispatcher's desk to run license checks. For these simple inquiries MDTs have been a godsend to law enforcement in particular. Officers can check dozens of plates during a shift and the voice two-way radio is not cluttered with the mundane chatter of these reports. It certainly must be much easier for patrol officers to keep their ears tuned to their regular two-way radio when so much of this non-essential communications is transmitted via the MDT.

Along with license plate checks, officers use MDTs to send private messages to one another. MDTs can be used to send information, such as social security numbers, a patient's health information, and similar sensitive details over a relatively secure, unmonitorable, network.*

The Boston Police Department is one example of many large city police forces that use MDTs to broadcast low-priority calls, such as "Take a report on a vandalized car at such and such an address." These calls will be queued-up in an officer's MDT and, as he or she has time, the officer will take care of these less-pressing matters.

MDTs provide other functions as well. A police

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officer can write up his report of an incident on the MDT and not have to come in to the station to do the work. A fire officer might receive information on the location of all the hydrants surrounding a fire scene. In the future (and in some cases even today), MDTs will transmit mug shots, fingerprints, and more.

So, what's the total impact on scanning? Well, taken together, you could well make the argument that MDTs have been a boon to our hobby. Getting all this boring, non-emergency radio traffic off the primary voice-channel air has made scanning more pleasant, for one. If we don't have to listen to license plate checks we're less likely to get tired and bored of the radio. Secondly, if public safety administrators know that they have a secure method to transmit sensitive information, then they may be less likely to seek alternative modes of voice communications, such as digital or encryption, to protect this data.

Should we worry that all data, including emergency broadcasts, may be sent via MDT one day? Just think of the one-man patrol car in the midst of a chase trying to inform other officers of his location. Drinking and driving certainly don't mix. Typing and driving mix even less so!

(* Floating around the Internet there are programs to decode transmissions from older MDT systems. This is not a big secret, but it is illegal, as we understand it, to use this software. Newer MDT systems incorporate encryption or other methods to deter interception and decoding of the data stream.)

✔ Don't you just love scanning a trunked system (Motorola analog)? Many people have reported that they prefer using their Uniden TrunkTracker to scan and search a trunked system more than a conventional two-way system of a comparable-sized agency. Why is that?

The TrunkTracker offers new challenges in scanning. Trunked systems are so flexible that new "talkgroups" of users constantly pop up and it becomes necessary to try to determine who is using the new group. In a conventional system, if a new "channel" becomes active it means a new frequency must have been licensed, and therefore it's very easy to find and identify (not to mention that new frequencies aren't licensed every day of the week for a particular agency). Perhaps it's just the idea that we finally have a method to monitor many of these systems that has us so giddy about trunking.

These scanners have to go one step further in the future, though. (There are actually many steps we would like to see taken, but some features are more desired than others). With the hundreds, if not thousands, of active IDs on a trunking system, the user needs a way to identify talkgroups and subfleets beyond the numeric, or in the case of some of the software available, hexidecimal codes. We desperately need the ability to "alpha-tag" the IDs. Even the high-end hobbyist will tire of trying to remember that 32032 is the Springfield PD East Side Patrol channel.

✔ Wouldn't it be great if you could operate a GPS unit on a plane? I've often thought about taking a DeLorme GPS on a flight and sticking it in the window, attaching that to my laptop and running an FCC database CD-ROM with which I load my AOR AR-8000. I would love to know my exact position on a flight at every moment and then be able to scan (at least UHF and 800 MHz which come in great on an airliner). Delta and a few other carriers allow you to use a scanner, but, I've been told, a GPS receiver pointed out a plane window would never see enough satellites (altitude notwithstanding) to get a solid position reading.

✔ Why haven't the mainstream scanner manufacturers (GRE and Uniden) given us CTCSS and DCS operation in a scanner? (CTCSS is Continuous tone-coded squelch system, also known as PL or Private Line and DCS, Digital Coded Squelch or DPL, Digital Private Line.) RELM has incorporated this feature in a mobile and portable model to great success.

RELM was wise not to introduce just another "me-too" product, as RCA did in their early units. CTCSS/DCS was the defining feature for RELM along with alphanumerics on their MS-200 mobile. The question for the larger scanner makers probably comes down to market interest vs. price.

How many more customers would buy their products and spend extra money for them if they had CTCSS/DCS, features which cut down on interference and help you hear only those communications you wish to hear? The newbies to the scanning

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don't know they need it. Experienced hobbyists, as well as public safety and news media professionals, demand it. We think it's worth the added cost in anything except a low-end introductory model.

✔ And now for the really random: Don't you just love to monitor the fire towers during the summer months? Unfortunately, many fire towers have closed due to budget constraints and other factors, but those that are left are still great to tune in. They report smoke and then have to determine the exact position of the fire. Local departments, along with state or county fire agencies, are called in to fight the blaze so activity springs up on numerous frequencies.

✔ Has anyone had much luck understanding and following the communications of casino security departments? The numerous times this editor has monitored in Las Vegas the conversations were very quick and muted while obscure casino lingo and code words made deciphering the activity quite difficult. Perhaps someone who lives in Las Vegas or Atlantic City, who has a trained ear for this very unique type of radio traffic, has had better luck.

✔ Just what is the allure of monitoring drive-through restaurant communications? "Two big Macs and a side of fries please." Snore. Yet, we know a number of people who do listen.

There can be only one answer. If you look at the FCC database today there are seemingly more frequencies for the driver to talk with the order taker and the order taker to talk back to the driver than there are police and fire licenses! Dairy Queen, McDonalds, Dunkin' Donuts, Hardees, and on, and on, and on. Some individual fast-food joints have dozens of licenses (does each headset in the store have a different frequency?).

Hobbyists who listen to this drivel must be undertaking the challenge of figuring out which frequencies are actually used at a particular location. Let's hope so, anyway.

■ New FCC Service Codes

This is the first year that the new FCC service codes are appearing and they're making editing the upcoming year's edition of *Police Call* a little more tricky. Here's what's going on: The FCC, in an effort to streamline licensing and make more frequencies available to everyone, has created new license classifications. "PW" indicates public safety/public service, similar in many ways to the old PL (or local government) code. Police departments which, for example, had licensed 155.490 under "PP," now are using this new "PW" designator.

While a frequency such as 155.490 is easy to identify as commonly police, there is a chance that a "Davis, City of" license with the PW service code may be the sewer department and not a police department channel (unless it is a license renewal which, in almost all cases, indicates no change of usage). This makes it more of a challenge for hobbyists to identify which agency within a city, county or state is using a frequency and, similarly, it makes it more of a challenge for the editors of *Police Call* to add the "plug-in" of explanatory data for the reader.

The most common new code found in the latest batch of licensing data from the FCC is "IG" or general business. This is not simply a new designator for "IB," which has been around for years and is used at 151, 154, 461-470 MHz and other standard business frequencies. No, this new catch-all can be used by railroads (commonly LR), towing (commonly LA), utilities (commonly IW), and others. Working with IG licenses makes editing efforts more complex, but not impossible. You can, of course, read the name or dba name of each IG licensee and quickly determine the usage. For the most part, IG licenses at 451 MHz are utilities (as they had been when they were identified as IW), IG licenses at 150.845 and are still towing, etc.

This is not always the case, though. One rare example we spotted during the editing process involved the Checker Taxi Association , WPLX895, with a transmitter site in Gretna in St. Charles Parish, Louisiana, with a licensee (company headquarters) address of Chicago, Illinois. Not only were the four taxi licenses in the 451 MHz band (instead of the standard 452 MHz UHF cab frequencies), they were also trunked! (That is, we assume they're trunked, since they were licensed under the YG designation.)

This is one of the first clear examples we've seen of a business trunked system in the UHF band which is not owned and operated by a two-way company which is leveraging its multiple community repeater licenses by trunking them — and thus permitting greater loading of their channels. Here, a single company is trunking its own channels. At first we wondered why a cab outfit would do this. If a call goes out for an available cab to go to a customer's location, they would want all their taxis to hear the broadcast. There is no need for multiple "talkgroups" in such a business.

Then we recalled that many cab outfits have expanded to provide wheelchair van services, courier services, and the like. It's conceivable that the unique taxi MDT units might also share time on the system. It's feasible that a busy company, such as one near the large city of New Orleans, might have different talkgroups which cover the city, others the suburbs, etc. It would be interesting to hear this outfit. We would guess that they're using a version of LTR (logic trunking radio) of some sort. New Orleans has never been a hotbed of scanning, but if a reader out there is in the area and would monitor the system for us, we certainly would appreciate hearing any details.

With the new channels available (7.5 kHz splits in VHF, for example); new service codes with wider latitude allowable in licensing to both public safety and business; new radio technologies; and the availability of funds in this healthy economy, there has been an explosion of new and changing licensing. Whether you go to published directories such as *Police Call,* records on CD-ROMs, or electronic licensing records on the Internet, it will be important to consult these licensing resources to update the new channels in your area.

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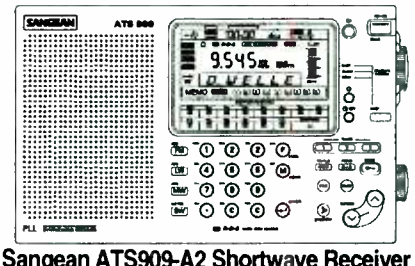

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Hugh Stegman, NV6H
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Spook Radio: Trick or Treat?

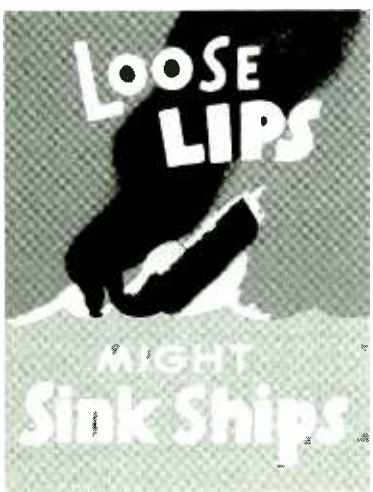
It's Halloween. Let's talk about "spook" radio, the shadowy, shortwave world of spies, agents, moles, terrorists, drug runners, money launderers, and other nice people. Let's get into things so secret that nobody knows whether they're hoaxes and diversions (tricks) or real intelligence work (treats).

When the Cold War ended and superpower tensions relaxed, most people figured shortwave (HF) spook radio for dead. Instead, agencies added schedules and frequencies, as regional squabbles increased the need for intelligence. We've never heard more intrigues. Let's pull up the sheets on some of this stuff.

■ Cuba

We've talked about Cuban numbers before. Cuba's DGI (General Directorate of Intelligence) and its Electronic Warfare Battalion both run impressive radio facilities. So does Russia, which intercepts U.S. communications from a huge base near Havana.

One station, the "Atención" ("Attention!") Spanish voice, is especially good for beginners, because of its paint-peeling power levels. Broadcasts are AM, just plain old amplitude modulation. At about 10 to 15 minutes before the hour, they'll run dead carrier, then they nearly always start talking right on the hour.



Many frequencies repeat weekly. John Maky was nice enough to e-mail this column a great schedule, which I've been busy checking out. 4479 kHz is good on Wednesdays at 0300 UTC, or Fridays at 0400. Also try 4028 at 0500 Fridays, or 7726 at 0500 Wednesdays and Sundays. Keep in mind that all these early morning times come the night before in the United States. While tuning, I also hit on 4329, 6782, 6786, 6795, 6797, 6983, and 9153, all AM.

Cam Castillo, a listener in Panama, reports heavy use of 6980 kHz, almost daily, at various times from 0200 to 1100 UTC. Radio for Peace International, a Costa Rican broadcaster, recently moved to 6975, citing interference from this and other stations.

Not all Spanish Ladies are Fidel's handiwork. The Russian one, thought to at least have a Cuban relay, sounds very similar. However, transmissions end with zeroes instead of the Cuban *final* (end).

Cuban numbers are entertaining. They're forever on the thin edge of total disaster. Tapes play backwards or change in the middle. Radio Havana Cuba bleeds into open carriers. Sometimes, RHC itself broadcasts backward opera music, tones, or even Radio Reloj, a Cuban news network. Are these also spook messages?

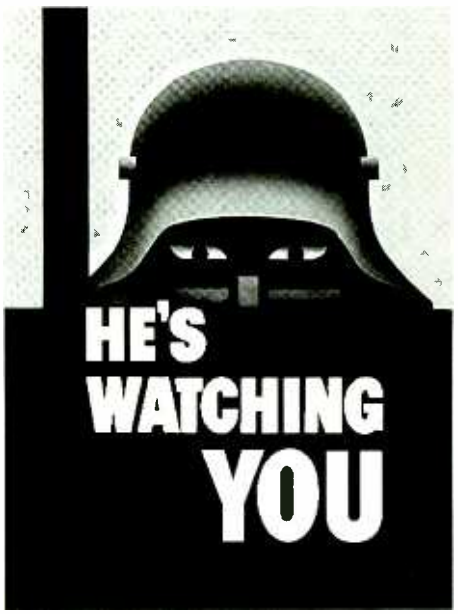
Other Cubans come and go. They yell, mumble, or run jamming that sounds more like a malfunctioning diesel generator. Finally, there's the Morse code station, possibly DGI, that maintains a large schedule on frequencies such as 4027 kHz CW (continuous wave), on or next to the voice channel.

Like most CW spooks, the Morse station uses "cut" numbers, where shorter letters are sent instead. On occasion, I've heard similar numbers sent in audio tones after a voice message. The Cuban letter substitution, though, is non-intuitive, and great for confusing newcomers.

But then, confusion is what Cuban HF has always done best.

■ Russia

The late USSR and its allies were great



sources of spook transmissions. These were usually in Morse code, RTTY, or their Cyrillic-alphabet variations.

The Afghanistan war was USSR's last gasp. Several nets of Soviet spies checked in nightly in CW on dying radios that made every possible sound except proper code.

Today, Russian spies tend to have better equipment. FAPSI, the Federal Agency for Government Communications and Information, is perhaps that country's best-funded agency. President Boris Yeltsin created FAPSI in 1993 out of the late KGB's electronic intelligence operations. It employs thousands, all over the world.

FAPSI voice numbers come in Russian, Czech, German, English, and Spanish. They're in upper sideband (USB), with or without a slightly reduced carrier. There's still CW, and plenty of RTTY, using three-letter callsigns. Try 11637, 13452, 13556, 14434, 14731, 14843, 14941, 16218, 17464, 19088, and 20117 kHz.

■ Europe/Mideast

Spook radio started in Europe, and the Iron Curtain kept it going for decades. Then

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the curtain went away, but the spooks didn't.

Europeans like to play folk songs, noises, or musical scales when transmissions begin. Listeners' descriptive names for German language stations include "Tyrolean Music," "Swedish Rhapsody," "The Gong," and "Saxophone."

Names of Slavic language broadcasts include "Aida," "Drums and Trumpets," "Russian Man," "Czech Lady," "Three-Note Oddity," and "Zyt Zyt." Romania has the "Skylark," named for a national song. There are also Hungarian and Polish language transmissions.

The Middle East has a motley crew of spies, anti-government clandestines, and the Israeli Mossad, which we've talked about before. Currently, Mossad is often on 6840 kHz, a popular spook frequency for generations. Their voice markers and weird, phonetic letters have pretty well run the U.S. Central Intelligence Agency (CIA) off this channel.

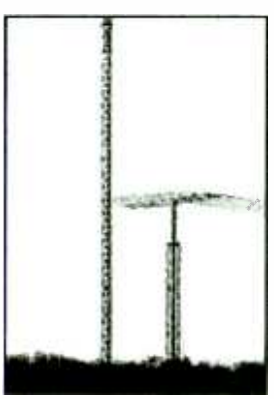
England

Two large stations are run by the Secret Intelligence Service, better known by its other name of MI6 (Military Intelligence, Group 6). They are named "The Lincolnshire Poacher" and "Cherry Ripe," from the traditional British folk themes run at the beginning of every broadcast.

The Poacher, with its happy old outlaw tune, is thought to transmit from Cyprus, to MI6 agents in Iraq and/or Iran. Due to relentless jamming, it uses a bewildering number of parallel channels and hourly schedules on weekdays. Good places to lurk are 14487, 15682, and 16084 kHz, hourly from 1000 to 1800 UTC, plus 5746, 6959, 7337, 9251, and 11545, from 1600 hourly to 2200.

For a real test of your DX ear, try the Poacher's favorite hiding spot. It's the international maritime channel 1248 on 12603 kHz. Amid withering blasts of the "legal" stations' SITOR (RTTY teleprinting over radio), our USB Poacher chatters away. Try each hour from 1400 to 1900 UTC. When your brain gives out, they'll be parallel on at least one of 7337, 11545, or 13375.

Cherry Ripe uses a different song, this one about a fair maiden, but with a similar format. An Asian or Pacific site is suspected. Times are currently 0000, 0100, 1000, 1200, 1300, 2200, and 2300. Frequencies will be parallel on some of these: 7484, 8320, 9263, 9884, 11570, 12056, 13688, 13866, 14469, 15624, 17499, 19884, 20474, 21866, and 23461. Higher frequencies are used in the U.S. afternoon.



USA

"Cynthia," a play on the letters "CIA," maintains what most listeners call "The Counting Stations." For whatever reason, broadcasts begin with a repeated count from one to zero. They're usually female voices, in Spanish, English, and only rarely in other languages. The one in German has apparently retired.

The Counter has expanded to a large weekly cycle of so many times and frequencies that the schedule would fill this column. For years, though, there's been Spanish at 0100 UTC from various locations in the southeastern U.S. One of these is probably the National Communication System's Warrenton Training Center, a possible spook hangout near Warrenton and nearby Remington, Virginia. An adjacent base, the closed Vint Hill Farm, was used by KKN 50, a CW station also suspected of passing spook traffic at times.

Currently, the Counter is on 15478 and 16050 kHz, Wednesday and Friday. At 0000, 4640 and 5046 kHz are a good bet for English. John Maky reports English on 10223 and 13906 kHz several weekdays at 1200 UTC, and 7547 and 10529 kHz at 1300 UTC. Nearly all Counter transmissions use R3E emission. This is upper sideband with a reduced carrier, which sounds good in AM mode and even better in USB.

In the U.S., it's popular to suspect the CIA for just about anything strange on the air. When Cynthia's receiving station in Liberia was down, one of the Voice of America's last HF feeders sent classical music, every afternoon, without any announcements. When the Liberian receivers came back up, the music stopped. Was information being encoded into tune selection or length, as VOA has been suspected of doing in the past? In any event, the CIA has since found a more stable country for its African radio operations.

Just Plain Strange

Asian spooks love to use large, government broadcasters. North Korea's Radio Pyongyang, the last of the Cold War propaganda mills, also runs numbers. Taiwan has the strangest station of all, New Star Broadcasting, which plays music and entertains the spooks while they get their coded messages.

Then there's all the unidentified noise. Some stations, like the "Backward Music" on 5180 kHz, seem to be jammers, in this case aimed at a European spy broadcast. Others, like the "Whale Sound Station," are either secret U.S. military projects or just malfunctioning transmitters. In the 75-meter ham band, "The Pip" has beeped at Europeans for years. Others include "Buzzer," "Crackle," "Saw Whine," "Polytone," and "Bugle." Who are these? Nobody knows.

Finally we have all the illegal activities. By now, just about everyone with something to hide has tried shortwave. Drift netting is banned, but the fishing boats' radio beacons are still heard. The whole spectrum between 26 MHz maritime and 28 MHz amateur comes alive every fall. Most of this chatter is just hobby skip-shooting. Some, however, is thought to come from drug runners and international terrorists. How do you tell the difference? You don't.

Boo. Happy Halloween!

Software for the Shortwave Listener...

SWBC Schedules - Broadcast frequencies and programs, updated weekly+ ... $35/year

Smart Lowe Control 32 - NEW - Smart control for the Lowe HF-150 ... $60 Win95

Smart R8 Control - Smart control for the Drake R8/R8A/R8B ... $25 DOS/$40 Win/$60 Win95

Smart Audio Control - Audio scope and spectrum analyzer for your PC ... $25 Win/$35 Win95

SWBC Interval Signals - Turn your PC into a virtual shortwave receiver ... $5 DOS/$30 Win

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Utility Loggings

Hugh Stegman

UTILITY WORLD

Abbreviations used in this column

AB	Air Base	GHFS	Global High Frequency System
ACARS	Aircraft Communications Addressing and Reporting System	HF	High Frequency (3-30 MHz)
AFB	Air Force Base	ITU	International Telecommunications Union
AFN	American Forces Network	MFA	Ministry of Foreign Affairs
AFRTS	Armed Forces Radio/Television Service	Pol-ARQ	Polish diplomatic ARQ teleprinter system
AM	Amplitude Modulation	PTT	Post, Telegraph, and Telephone administration
ARQ	Synchronous transmission and automatic repetition teleprinter system	RFPI	Radio For Peace International, Costa Rica
AWS	Air Weather Service	RTTY	Radio Teletype
CW	Morse code telegraphy ("Continuous Wave")	RYs	RTTY test message; "RYRYRY...."
DSN	Digital Switched Network	Swed-ARQ	Swedish diplomatic ARQ teleprinter system
DUP-ARQ	Hungarian diplomatic teleprinting system	UK	United Kingdom
EAM	Emergency Action Message	Unid	Unidentified
FAX	Facsimile	US	United States
FEC-A	One way traffic FEC teleprinter system		

All transmissions are USB (upper sideband) unless otherwise indicated. All frequencies are in kHz (kilohertz) and all times are UTC (Coordinated Universal Time).

4168.0 ABJ-Italian Navy, Augusta, also RTTY on 4169, at 2259. (Ary Boender-Netherlands)

4278.5 AFN-American Forces Network, continuous rebroadcast of US military radio programming, simulcast on 12689.5, at 1348. (Larry Van Horn-NC) *NAR, the U.S. Navy comm station in Key West, FL, is repeating the satellite downlink audio, in USB, on frequencies allocated for ship CW and RTTY, without the knowledge (or authorization!) of AFRTS, possibly to fill a hole in satellite coverage. AFN has been off HF since the 1980s. Real nice to hear them back. -Hugh*

4460.0 FTJ 2-Mossad, Israel, AM numbers at 2000. (Boender-Netherlands)

4724.0 Andrews-US Air Force GHFS, Andrews AFB, MD, with 128-character EAM at 0550. (Jeff Haverlah-TX)

5038.0 FOY-French Air Force, Orleans, with RTTY test tape at 2205. (Boender-Netherlands)

5091.0 JSR 2-Mossad, Israel, numbers in AM at 2100. (Boender-Netherlands)

5178.0 Unid-Backwards Music Station, strange tones at 2156. (Boender-Netherlands) *Possibly a jammer aimed at Cherta on 5180. -Hugh*

5180.0 Unid-Cherta numbers station at 2100. (Boender-Netherlands)

5245.0 MRC01-Royal Air Force Cadets, England, big net at 1004. MRV92-Royal Tournament, London, working several other stations at 1946. (Boender-Netherlands)

5347.5 A1-Dutch Army, tactical traffic, also using RTTY on 5349, at 2134. (Boender-Netherlands)

5365.0 Unid-The Russian Man, numbers in AM at 2100. (Boender-Netherlands)

5428.0 Unid-CW numbers station, ended "000," began 1900. (Boender-Netherlands)

5680.0 Kinloss Rescue-weather traffic with Alpine 24, at 0640. (Boender-Netherlands)

5800.0 Juncture-US Air Force, raised Nightwatch 01, the airborne command post, at 0112. (Haverlah-TX)

5914.7 KAWN-US Air Force AWS, Saddlebunch Key, marine weather in RTTY at 0550. (Bob Hall-RSA)

6396.8 KAWN-US Air Force AWS, Saddlebunch Key, aero weather in RTTY at 0559. (Hall-RSA)

6458.5 AFN-American Forces Network, different program than 4278.5 and 12689.5, at 0600. (Hugh Stegman-CA)

6695.0 Unid-"The Whale Station" with creepy whale-like tones, at 1934. Unid-Backwards Music Station, weird tones, also on 6753, at 2255. (Boender-Netherlands)

6739.0 Offutt, US Air Force GHFS, Offutt AFB, NE, sent out seven EAMs in a half hour, starting at 0431. (Haverlah-TX)

6753.0 Unid-Backwards Music Station, weird tones, also on 6695, at 2256. (Boender-Netherlands)

6797.0 Unid-Cuban "Atencion" number station, AM, tape stops dead at 0550. One minute later, the Cuban-style cut number sequence, "GAGGA ?ARUA" (81881 ?1641) is sent once in audio-tone Morse. One minute after this, station drops carrier, at 0552. (Stegman-CA)

6797.0 Unid-Cuban cut numbers station, 5-letter groups in CW at 0800. (Boender-Netherlands)

6900.0 Lincolnshire Poacher, British numbers at 2000. (Boender-Netherlands)

6975.0 Unid-Cuban "Atencion" station, AM numbers, heavy interference with Hauser's "World of Radio" on RFPI, might be strong bleed from 6980, twice at 0200. (Camilo Castillo-Panama)

6980.0 Unid-Cuban "Atencion" station, AM numbers, different days at 0205, 0210, 0800, 1100, 1103, 1109, and 1110. All this activity ran RFPI off the frequency. (Castillo-Panama) *These daily appearances are strange for this station. -Hugh*

6992.5 MFJ04-Royal Navy Cadets, England, big net at 1043. (Boender-Netherlands)

7912.7 9JZ-Lusaka Air, Zambia, ended RTTY weather broadcast with "GUD NITE STATION CLOSED," at 1601. (Hall-RSA)

8978.5 Reykjavik Air-Iceland ACARS data link, at 2215. (Boender-Netherlands)

9016.0 WAR 46-US Joint Alternate Command Post, PA, signal checks and EAMs with Nightwatch 01, Juncture, and Bear Trap, probably US Air Force, starting at 0300. (Haverlah-TX)

9285.0 Unid-Backward Music Station, weird tones at 2254. (Boender-Netherlands)

9441.0 Unid-Polytone station, weird tones, no message, at 0600. (Boender-Netherlands)

10162.7 DOR-MFA Sofia, Bulgaria, encrypted RTTY at 1623. (Hall-RSA)

11041.0 Unid-Polytone station, weird tones, long message, at 0620. (Boender-Netherlands)

11154.0 DZFG-MFA, Belgrade, Yugoslavia, with encrypted RTTY traffic at 0952. (Boender-Netherlands)

11175.0 Slam 51-US Air Force, with DSN patch via Thule AB to Thunder Ops at 0352. Eagle Provider-US Navy ship afloat, also identifying with standard trigraph "H-0-M," in patch via Thule to C-5-N, described as a naval computer and comm station, reporting all comms except HF down, at 0433. Frequent interruptions from Offutt, US Air Force GHFS, with long EAM. Dark 51-US Air Force, patch via Offutt to Blue Thunder at 1539. (Haverlah-TX)

11341.9 MFA, Copenhagen, Denmark, with plain text RTTY at 0938. (Boender-Netherlands)

11401.7 Unid-Unlisted Piccolo, could not decode, at 1656. (Hall-RSA) *Piccolo is a multi-tone teleprinting mode with a semi-musical sound, associated with the British military. -Hugh*

11437.9 MFA, Copenhagen, Denmark, with plain text RTTY at 0948. (Boender-Netherlands)

12141.0 Unid-Polytone station, weird tones, long message, at 0640. (Boender-Netherlands)

12211.7 PWX33-Brazil Navy, RTTY bulletin at 1100. (Hall-RSA)

12689.5 AFN-American Forces Network, continuous rebroadcast of US military radio programming, in USB, simulcast on 12689.5, both USB, at 1348. (Van Horn-NC) *See my comments on 4278.5. -Hugh*

13242.0 WAR 46-US Joint Alternate CP, working Nightwatch 01 at 2056. (Haverlah-TX)

13440.0 Air Force 2-US Vice-Presidential plane, in phone patch to Crown (White House communications office), SAM (Special Air Mission) 4, Mike 4, and CommNav, all trying to correct problem with satellite link from aircraft, at 2230 (Pete Costello)

13538.0 ZRO3-Pretoria Meteorological, RSA, FAX charts with good reception at 0727. (Hall-RSA)

13551.5 RFFA-Ministry of Defense, Paris, France, list of staff promotions and appointments in FEC-A, at 1721. (Hall-RSA)

14432.0 PTT, Lumumbashi, with ARQ telex in French, headed "URGENT POUR GECAMINES KINSHASA," at 0843. (Hall-RSA)

14487.0 Lincolnshire Poacher, British numbers, also on 15682 and 16084, all jammed, at 1200. Lincolnshire Poacher, also on 15682, at 1400. (Boender-Netherlands)

16027.6 NPN-US Navy, Guam, FAX chart, poor transmission, at 1206. (Hall-RSA)

16106.9 SAM-MFA, Stockholm, Sweden, Swed-ARQ traffic to Damascus at 0752. (Hall-RSA)

16335.0 FZS63-St Denis Meteorological, Reunion Island, weather in RTTY at 1235. (Hall-RSA)

16357.0 OLZ-MFA, Prague, Czech Republic, RTTY news at 0810. (Hall-RSA)

16453.5 HGX21-MFA Budapest, Hungary, 5-letter groups in DUP-ARQ at 1556. (Hall-RSA)

16904.6 FUV-French Navy Djibouti, RTTY RYs at 0906. (Hall-RSA)

16947.5 6WW-French Navy, Dakar, Senegal, RTTY RYs, also on 16951.2 and 16955, at 0828. (Hall-RSA)

17038.5 URL-Sevastopol, Russia, could not decode strange RTTY, not 3-shift Cyrillic, at 0915. (Hall-RSA)

17055.0 MGJ-Royal Navy, Faslane, Scotland, RTTY at 1645. (Hall-RSA)

17139.0 GYA-Royal Navy Whitehall, England, RTTY fleet broadcast at 1618. (Hall-RSA)

17416.8 SAM-MFA, Stockholm, SWED-ARQ to Addis Ababa and Djibouti, at 0730. (Hall-RSA)

17423.0 Minrex, Havana, Cuba, not listed anywhere, Spanish news in RTTY at 0900. (Hall-RSA)

17428.5 SAM-MFA Stockholm, Sweden, 5-letter groups in SWED-ARQ at 1212. (Hall-RSA)

17430.5 9VF209-Kyodo, Singapore, Japanese newspaper FAX at 1043. (Hall-RSA)

18064.0 MFA-Warsaw, Polish news in Pol-ARQ at 1620. (Hall-RSA)

20925.0 NOJX-French MFA, N'Djamena, ARQ for Paris at 0930. (Hall-RSA)

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Who Uses Digital Modes?

Welcome to another Digital Digest. Over the past month, several *MT* readers have asked for a basic overview of the types of stations utilizing digital modes, specifically in the shortwave bands, as well as monitoring equipment currently available to the hobbyist today. In this month's column, we address this request and take a brief hiatus from examining specific modes.

Utility stations generally operate within one of three broad classifications: aeronautical, maritime, or point-to-point. Each of these may be designated as either *fixed* or *mobile* with respect to location.

Unlike the international shortwave broadcasters, utility station traffic is intended only for the parties involved, and is therefore confidential in nature.

Utility stations use a variety of modulation types. These include the "3 Rs":

Radiotelephony (Voice - ISB, independent side band)
Radiotelegraphy (Morse Code/CW)
Radioteletype (RTTY and all other digital modes)

Introduction to Digital Monitoring Equipment

To monitor digital transmissions you require a decoder. Decoders are available as independent outboard units or as an integral part of your personal computer system. In either case, they take the audio signal from your receiver and convert it to intelligible form to be displayed on a video monitor or the decoder's own "marquis-like" display. Many of today's decoders are also capable of translating Morse code (CW). Only very recently have decoders become available for ACARS and pager modes in the VHF/UHF bands.

A stable shortwave communications receiver is also required for serious non-voice utility monitoring.

Many of us "old-timers" in the hobby originally started by listening to the international shortwave broadcasters and gradually began to tune to other AM transmissions in the shortwave bands. A limited number of aeronautical stations and numerous Cable and Wireless transmissions began to appear. The introduction of Single Side Band (SSB) and the increasing popularity of Baudot RTTY on the airwaves saw the introduction of outboard digital decoders.

Only the strongest and cleanest signals could be decoded by the early AEA, HAL and Kantronics units — More sophisticated monitoring required more expensive equipment, often in the form of surplus commercial hardware. Then in the 70's, Infotech introduced its high end/high priced line of decoders. The Wavecom was introduced in Europe, but never gained much popularity in North America.

And so RTTY monitoring continued to be a practice requiring additional peripheral equipment and much experimentation until the 80's.

Perhaps the most significant factor in the rise of popularity of digital communications for the hobbyist was the introduction of the personal computer. A relatively simple interface, coupled with intelligent software, now provides not only a means of decoding but also of analyzing digital transmissions. As new digital communication protocols are introduced, progressive software engineers can implement new code routines to process them.

In next month's column we'll take detailed look at the decoders currently available for monitors today — both outboard, self-contained units as well as the popular computer interfaces. So as they say in the broadcasting business — stay tuned!

HF Communications Using Digital Modes

Aeronautical
- Aeronautical Fixed Telecommunications Network (AFTN) Stations
- Aeronautical Actual and Forecast Weather
- Terminal Area Forecasts (TAF)
- Aircraft Flight Plans and Arrival/Departure Messages
- Notices To Airmen (NOTAMS)
- ACARS (Air/Ground aviation Messages and aircraft telemetry)

Maritime
- Inland Stations
  - Great Lakes Weather and Traffic
  - Telex Traffic to Individual Vessels
- Coastal Stations
  - Weather Synopsis, Reports, Watches and Warnings
  - Ice Berg Alerts (North Atlantic)
  - HYDROLANT/HYDROPAC Broadcasts
  - NAVTEX and NAVAREA Broadcasts
  - Telex Traffic to Individual Vessels
  - News, Sports & Financial Reports
- Vessels/Ships
  - Global Maritime and Distress System
  - AMVER Position Reports
  - Telex Traffic to Shore Stations
  - Soviet Fishing Fleet

Point-To-Point
- Military
  - World Air Forces, Navies and Armies
  - Coded and"In-the-Clear" Message Traffic
  - Military Flight Plans and Routings
  - FAX Charts and Maps (Weather and Tactical)
  - Naval High Seas Weather Broadcasts
  - MARS (Military Affiliate Radio System) Traffic
  - Coast Guard (American and Canadian)
- Coast Guard Communication Stations/CG Cutter Traffic
  - FAX Weather Charts and Maps
  - Ice Berg Alerts (North Atlantic)
  - HYDROLANT/HYDROPAC Broadcasts
  - NAVTEX and NAVAREA Broadcasts
  - Various Maritime Service Broadcasts
  - Satellite Photo Rebroadcasts
- Press Agencies
  - International News Agency Broadcasts
  - Newspaper Press Photos (FAX)
  - Non-Latin Alphabet Press (FAX)
  - Chinese, Russian, Arabic, Japanese
- Meteorological Stations (Worldwide)
  - Forecast and Actual Weather Broadcasts
  - Weather Charts and Maps
  - Orbiting Weather Satellite Photos
- Diplomatic/Government Embassies
  - Inter-embassy Traffic
  - Ministry of Foreign Affairs Press Bulletins
- Law Enforcement
  - INTERPOL Traffic
  - Police Communications
- Science and Research
  - Antarctic Research Stations
  - Astronomical Observatories
- International Relief Agencies
  - United Nations Agencies
  - International Red Cross/Red Crescent Society
- Point-to-Point Circuits
  - International Banks and Financial Agencies
  - International Business Corporations
  - Pager Communications

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Two Views on Clean Signals

■ Orban 9105a Splatter Generator

"All the stories of splatter I've been hearing lately," says Bob Zanotti of Switzerland in *Review of International Broadcasting*, "are surely caused by improper use of high-level audio processing, probably from the Orban 9105a. Technicians sometimes have no idea about the weaknesses of their transmitters, since they were never pushed this hard before. The Orban is the best processing in the world, but it's guaranteed to bring out every modulation anomaly in a transmitter.

"Complaints to 'offending' stations are the best approach. Some stations may already *know* about the problem, but don't do anything until complaints are received. Mentioning that an Orban 9105a might be involved may strengthen the argument and even help the technicians solve the problem, because adequate warnings about these problems are supplied with every unit. Orban also has a Website with email access for first-rate technical support. So no excuses!"

■ A Modest Proposal to Clean Up Shortwave

"I'm not a DXer, although I did listen to your shows on RCI. Still, it seems that there is not much being done for the silent majority that is the SWL audience.

"Now that so many shortwave services are available on satellite or on the SAP or audio subcarrier of satellite or cable television, it seems that there is less of a need for those services to hog so much of the shortwave spectrum. It also seems that fewer frequencies could work as well for them, if they were more intelligently chosen.

"I'd like to propose compiling via internet a North America-wide database of listening conditions for these stations, so that it can be seen which frequencies are redundant and can be dropped, or are problematic and should be moved or dropped, or are doing so well their power can be cut. Most of these stations target North America separately, and should be interested in such information. They may even be willing to pay seeing that they can't monitor the entire continent themselves. With a bit of programming, and compliance by our informants, the reports could be compiled automatically by computer.

"I'll volunteer to monitor BBC and DW in the 49 metre band, since they seem to be the worst offenders. Ultimately, I'd like to get them down to the point where I can pick them up on only two frequencies at any given time, and hear what I've been missing on the vacated frequencies. Also, one of my gripes with BBC frequency changes, is that they usually seem to close down on frequencies that are strong, and then continue on those that are weak. Why not stay on the strong frequency until it becomes weak? At least I won't have to change frequencies." (Edward "Maximo" Lachman, *lachmaem@email.uc.edu*)

AFGHANISTAN R. Voice of Sharia, 7200v, the Taleban-government station, heard with English at 1645-1700, *Newsdesk* and comments about their victory in the north; mostly poor, sometimes fair to even good reception (Mikhail Timofeyev, Russia)

ANTARCTICA LRA36, Radio Nacional Arcángel San Gabriel, 15476, is currently broadcasting only Mons, Tues & Fris *1230-1430* (ex-Mon, Wed & Fri 1900-2100). In July the temperature is -20°C there!! (Gabriel Iván Barrera, Argentina, *BC-DX*)

AUSTRALIA *Cumbre DX* was able to follow up with Hugh MacKenzie of Australian Armed Forces Radio, who had this to say about his station: "The reason that we are using two frequencies is that we are now broadcasting to two different areas: 14790U is a domestic service for forces exercising in Australia or ships in Australian waters. 15635U is directed to Papua New Guinea where we have forces working in disaster relief and as peace monitors in Bougainville." MacKenzie added that broadcasting on two frequencies was a very sudden decision and is a trial. Both are coming from Belconnen and the power is 10 kW. "We also have an additional broadcast on Thursdays for the Australian ships in the RIMPAC exercise off of Hawaii." (via Hans Johnson, Copyright *Cumbre DX*)

BELARUS R. Minsk, English schedule given last month confirmed, plus Tue & Thu 1930-2000, 2030-2100 on 11960, 7210, all to Eu, one hour later in winter; see **http://www.nestor.minsk.by/radiod/indexen.htm**(BBC Monitoring)

BULGARIA The Friday broadcast of R. Varna in Bulgarian, 2100-2115 relays National service Horizont, 2115-0100 own program *Hello Sea*; is operating "incognito" on the Bulgarian National Radio. The national organization isn't paying for that special broadcast. The SW freq of v9774.8 isn't coordinated by the HFCC organization. The SW transmitter is put together from old former jammer parts, with an estimated power of 100 kW. (Rumen Pankov, Bulgaria, *BC-DX*) Reminds me, that the azimuth of the ex-jamming antenna is about 10° towards Moscow (Wolfgang Büschel, ed., *BC-DX*)

CANADA [non] R. Voice of Canada, or "RAC" changed frequencies in July, including 15245 ex-15560 at 2000-2200 and no more English at 2100. These guys have no business representing Canada to the world, and I am drafting a complaint to the government (Ernie Behr, Ont., *WORLD OF RADIO*)

COLOMBIA Rdif. Nacional, 4955, has another English program in addition to *On Line* Tue-Sat 0200-0300—*Un inglés en Bogotá*, presented by Johnny Welsh, the Press Officer of the British Embassy in Colombia, scheduled Sat 2330-2400 but on July 19 aired 0130-0200. Despite the title, meaning "An Englishman in Bogotá," it is entirely in English. And 4955 has a transmitter problem. Manager, Mrs Athala Morris, says she is appointing an engineer to take care exclusively of the SW; also, 15 megapesos have been set aside to replace the final tube (Henrik Klemetz, DSWCI *DX Window*)

Clandestines: V. de la Resistencia, 6239.8v is scheduled as 2000-2200 daily, on 6226 kHz per their own announcements. Music only during the two first half-hours. R. Patria Libre, 6250.0 in a 40-minute transmission on July 29 said their schedule from that date onwards would be 1800-1830 and 2200-2230 daily. But was silent at 1800 on Aug 1 (Henrik Klemetz, *ibid.*)

COSTA RICA TIAWR has been running *Wavescan* 24 hours later than before, UT Tue after 0000 at least on 9725, 13750 (Jim Moats, gh)

CZECH REPUBLIC R. Prague since July has experimented with combining two 100 kW transmitters, and based on reception reports will evaluate in October whether to continue. Includes Spanish at 2300 on 9485 to SAm, 0200 on 6200 to CAm (Jorge Aloy, *Mundo Radial*) Also English??

ETHIOPIA [non] R. Rainbow, V. of Peace and Brotherhood (Amharic: *Kestedamena radiyo ye selamena yewendimamach dimtse*), reportedly operated by opposition Research and Action Group for Peace in Ethiopia and the Horn of Africa (RAGPEHA), heard via hired transmitters in Germany; c/o RAPEHGA, P O Box 140 104, 53056

All times UTC; All frequencies kHz; * before hr = sign on, * after hr = sign off; // = parallel programming; + = continuing but not monitored; 2 x freq = 2nd harmonic; J-98=May-Sept; Z-98=Summer season; W-98=Winter season; [non] = Broadcast to or for the listed country, but not necessarily originating there.

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Bonn. Weekly in Amharic: Sat 0100-0200 Am 9855, Sun 0900-1000 Eu 5910, Thu 1600-1700 Af 15105 (BBC Monitoring)

GEORGIA With Voice of Hope moved to Germany (see below), I doubt that the Georgians will find new foreign clients for their bad-shaped Dusheti transmitters. Maybe they rent airtime for a good price, but other companies offer a much higher technical standard (Kai Ludwig, Germany)

GERMANY As of 1 August 1998, High Adventure Ministries (The Voice of Hope) has suspended its European service from Dusheti, Georgia on 12125 and has begun broadcasting its European service from Jülich, Germany. The schedule is: 1800-2159 on 6015, Christian programs in English. High Adventure is also using Germany for its South Asia programs 1330-1530 on 15715, both 100 kW. QSL if reports accompanied by IRCs (Peter Darg, *World of Radio*)

If you want to have a look at the antenna field, transmitter hall and main control room at Jülich, check out the subpages under **http://www.telekom.de/angebot/rundfunk/rsender/lmk/** where Deutsche Telekom offers its "T-Media-Broadcast" services, which also includes "shortwave - broadcasting with future," as they headline the respective page (Kai Ludwig, Germany, *Review of International Broadcasting*)

HONDURAS La Voz de la Mosquitia, 4910, is repaired, but won't be back on until October 1st, when missionaries will return to teach a class and supervise the station's operation. At this time, they will operate their "big" transmitter, ex-military with a power of 500 watts, resuming schedule of 2300-0300. Bulk of programming will be in Miskito, but there will still be English and Spanish. Nominal schedule will also be dependent on sufficient fuel for the generators, which represent the station's only means of power. All this per Larry Hooker, who helped repair the transmitter earlier this year. The station took a lightning strike in 1997 that knocked it off the air (via Hans Johnson, Copyright *Cumbre DX*)

IRELAND [non] RTE Aug 4 adds two new frequencies to its daily SW transmissions to give better coverage in Africa and SE Asia, including Australia. The half-hour news and sports bulletin goes to Africa via Ascension on 17885 at 1730 and to SE Asia via Singapore on 11740 at 1000. The bulletin is already transmitted on 12160 at 1830 and 5070 at 1000 [WWCR] (Wesley Boyd, RTE)

ITALY I have set up the English version of the web site dedicated to the RAI Shortwave Center of Prato Smeraldo. You can find photos, information and history of the biggest shortwave site in Italy. There are a lot of photos of the SW transmitter and the antenna towers also: **http://www.mediasuk.org/rai**(Andrea Borgnino via Marie Lamb, *Cumbre DX*)

KASHMIR Voice of Independent Kashmir. Organization: Kashmiri Mojahedin. Address: P.O. Box 102, Muzaffarabad, Azad Kashmir, Pakistan. Languages: Urdu, Kashmiri, English. Identification: (Urdu) *Ni sera-i hurriyat-i Kashmir hai.* 1530-1730 3835, 5300, 6300 (Mekhonoshin, Russia via CSC via *Clandestine Radio Watch*)

KURDISTAN Voice of Iraqi Kurdistan (Kurdish: *era dangi kurdistana iraqiya;* Arabic: *sawt al-hizb al-dimuqrati al-kurdistani al-iraqi*) broadcasts in support of the Kurdistan Democratic Party (KDP) led by Mas'ud Barzani. This schedule is as announced by the radio. Frequencies, times and duration of broadcasts are subject to change. Broadcasts may be one hour *later* in winter. UK Address: KDP Press Office, PO Box 7725, London SW1V 3ZD, UK. Tel: +44-171-931-7764; Fax: +44-171-931-7765; Email: kdpeurope@aol.com URL: **http://www.kdp.pp.se/** Studio at Salah al-Din. Daily in Kurdish/Arabic to Mideast on 4085v: 0245-0500 & 1645-1900 (BBCM)

Voice of the People of Kurdistan (Kurdish: *aira dangi gelli kurdistana*; Arabic: *sawt sha'b kurdistan*) was first observed on 23rd October 1988, but may have been in existence for some time before then. It supports the Patriotic Union of Kurdistan (PUK) led by Jalal Talabani. The radio has in the past used frequencies around 15060-v, 7270-v, 6295-v, 5845-5880-v, 4000-4200-v and 3930-3960-v. PUK website: **http://www.puk.org** E-mail: *webmaster@puk.org* *All frequencies and transmission times are highly variable.* In Kurdish/Arabic to Mideast daily at 1445-1800 on 4060v, repeated at 0200-0500 on same, 1130-1330 on 6015-6030v (BBC Monitoring)

KYRGYZSTAN Kyrgyz Radio First Program, Domestic Service, includes some English newscasts in daytime and at 2310-2320 daily on 4050, 4010 as monitored; one hour later in winter (BBCM)

MALTA Checking some links, I discovered that the Voice of the Mediterranean now has an *official* Web site at **http://vol.net.mt/com/vom/** VoM celebrates, if that's the right word, 10 years of broadcasting in September (Andy Sennitt, DSWCI *DX Window Caught in the Web*)

MEXICO RMI, 9705, seems to have improved audio processing; sounds better now (George Thurman, *Review Of International Broadcasting*) But still slightly low in frequency, so presumably not 'new' transmitter (gh)

NEW ZEALAND The Ministry of Foreign Affairs has approved cutbacks in Radio New Zealand International's programme and broadcasting output. With New Zealand's official shortwave voice already running on a very tight budget, the cut of NZ$166,000 (about US$85,000) or 13 percent reduction in annual funding means a significant cutback in programming services.

The breakfast session will be retained but from 10.30am till 10.15pm NZT (2230-1015 UT at midyear) RNZI will relay Radio New Zealand's 'National Radio' domestic service. The only exceptions are expected to be an RNZI Pacific Islands news bulletin insert at 4.00pm (0400 UT) and occasional Cyclone Warning Broadcasts. The Foreign Affairs Ministry has made a small grant (US$9000) to ensure the latter unique service is maintained.

The only Pacific Island language programming to be retained will be the local morning news broadcasts in Samoan, Cook Islands Maori, Tongan and Niuean.

Evening programming to be dropped includes the popular Pacific Islands language music request programmes and a number of English language features including Rudi Hill's *On the March*.

Speaking on behalf of the NZ Radio DX League, the largest shortwave listener organization in the Southern Hemisphere and presently celebrating its 50th anniversary, Bryan Clark notes that 1998 is also RNZI's 50th birthday. The first official shortwave broadcasts from the 7.5 kilowatt transmitters at Titahi Bay north of Wellington took place on 25 September 1948. Bryan says the year-to-year funding review by the Foreign Affairs amounts to a slow strangulation of the broadcaster and its dedicated staff, who provides incredible value for money with an annual operating budget of under US$700,000 (via Paul Ormandy, swl@qth.net)

Mailbox broadcast times altered: UT Mon 2135 on 17675, Wed 1735 on 6145, Fri 1930 on 9875 (Adrian Sainsbury, RNZI) Making it a lot harder to hear in NAm; best chance the first airing. All the Rudi Hill shows are gone, but someone else's *Band Programme* airs Fri 0830 (gh)

RNZI Frequency Schedule until 25 October 1998

	UT	kHz
Mon-Fri	1650-1751	6145
Sun-Thu	1752-1951	11675
Fri-Sat	1752-1958	"
Sun-Thu	1952-0458	17675
Fri-Sat	1959-0458	"
Daily	0459-0705	11905
Daily	0706-1015	9700
OFF-AIR	1015-1650	
Occasional Use for Sporting Broadcasts	1206-1650	6100

RNZI has new address: *info@rnzi.com* and website changed to **http://www.rnzi.com** (Adrian Sainsbury, Frequency Manager, Radio New Zealand International)

NICARAGUA Update on R. Miskut, 5770. Operations now feature the new transmitter with full authorized power [previously given as 500 watts] to new dipole antenna. Future plans include the possibility of additional power. New towers are currently under construction for new SW and FM antennas. The FM sister operation, R. Bilwi on 104 MHz, is continuing and will have a power increase during next year. Advertising income or NGO sources of support for this indigenous and unique broadcasting facility are essential if operations are to continue. SW broadcasts currently run from 1200 to 0430 UT (John Freeman, Tech Systems)

PARAGUAY R. Nacional, 9737.6 in the clear with Singapore 9740 auroraled out, Friday at 1044 tune in to mailbag, all in Spanish with letters from NY, NY; Italy; David Martin in Australia; Argentina, many reporting "perfect" reception. Well, it would be more "perfect" now if the modulation weren't low and distorted. 1053 ID as "Onda Tricolor de Radio Nacional del Paraguay" (gh)

NIGERIA [non] V. of Free Nigeria, not heard since early July Sat at 1900 on either 11645 or 12015 (Ernie Behr, Ont., *World of Radio*)

Voice of Free Nigeria — Mukhtar Dan'Iyan, Pres of the Free Nigeria

DX Listening Digest

More broadcasting information by country compiled by Glenn Hauser

Review of International Broadcasting

SW Programming, opinion, equipment, satellite monitoring.

Samples $2.50 each (outside North America US $3 or 6 IRCs)
10 issue subscriptions $26 in USA, or both for $49
Glenn Hauser, Box 1684-MT, Enid, OK 73702

www.americanradiohistory.com

Movement, told *Cumbre DX*: "We ended our radio broadcasts a few weeks ago after Abiola's death. Since Abacha's [former leader] died last June, Abu-Bakr [present Nigerian leader] has convinced most Nigerians that things are going to be OK. Since Abiola's death, many who were elected with him are no longer demanding to take office. People are saying, Abacha's gone, Abiola's gone, the problem [of tension in Nigeria] is over.

"The Free Nigeria Movement will be holding a referendum in the coming weeks to decide what our future message, if any, will be. The old message [end of military rule] is simply no longer effective." When asked, he said that they did not go off for financial reasons. Dan'lyan added that they were well heard in Nigeria although there had been a few attempts to jam them. They never did receive any listeners letters direct from Nigeria; all of these were confiscated (they tried some themselves as a test), but they did receive letters from Nigerians who were able to have them mailed from abroad. He did not hold up much hope of the station returning to the air, but wouldn't say that it would never return (via Hans Johnson, *Cumbre DX* Copyright Aug 9)

Via WGTG, 9400, Radio SNBS has started late the last two Saturdays, 1936 or so. Usually a short commentary on the political situation by Maureen Gold, followed up by the exact same three songs. Same problem as Radio New Nigeria had, not really able to produce sufficient programming with enough variety. Some breaks in transmissions, still sounds like a telephone feed. Program cut off in progress both weeks at 2000 (Hans Johnson, *Cumbre DX*)

ROMANIA ROMPRES, press radioteletype on F1B, 50 baud as monitored in July: M-F 0900-0945 English, 0945-1030 French to Eu on YOJ27-9797; M-Sa 1040-1130 English to As on YOM21-12110; M-F 1530-1615 & Sat 1530-1600 French; Sat 1600-1630 & M-F 1615-1700 English all to Eu on YOG59-6972 (BBC Monitoring)

SAINT HELENA Radio St. Helena Day, the updated dates and times for Radio St. Helena are Sat 24th Oct 1998, 11092.5 usb mode, 1900-2300 (Art Preis via Juergen Kubiak, *BC-DX*)

TAHITI Relieved to note RFO back on 15170, good strength and audio, pop vocal around 0250 (Randy Stewart, MO, *Review of International Broadcasting*) But still callously blocked by WYFR after 0350 (gh)

TAJIKISTAN R. Dushanbe, 7245, 1636-1759*, Dari at the beginning, then Arabic at 1700 and Persian at 1715, 1645-1659 English with opening ID as "This is Dushanbe - the capital of the Republic of Tajikistan," schedule and news with major reports about Democratic People's Party of Tajikistan and UN development program for Tajikistan (Mikhail Timofeyev, Russia, DSWCI *DX Window*)

External English scheduled 0345-0400 on 11620, 9905, 7245; 1645-1700 7245 (BBCM)

Greetings from Radio Tajikistan English Service. Dear friend. Hello. We all are very glad to have your letter. We are very sorry to send you letter in due time. We have send QSL card to you. We hope you will receive it soon. Any way now are very serious about our listeners. Could you inform us about you more. If it's possible then send some DX clubs e-mail addresses. We want to co-operate with them please send your own photography. Take a snap of your QSL collections. We are eager to collect our listeners' pictures for our QSL collections. Our new address: English Service, International Service, Radio Tajikistan, Post Box-108, Dushanbe 734025, Tajikistan. With best wishes. (Nasrullo Ramazonov, Parvez Satter, liton@td.silk.org via Zacharias Liangas, Greece, *hard-core-dx*)

TIBET [non] Clandestine from Lithuania: 9710, Radio Free Tibet of the Overseas Chinese. I asked my wife, who is fluent in Chinese, to listen to a recording of this. Exact announcement is *Ziyou Xizang Huayi Diantai* meaning "Radio Free Tibet of the Overseas Chinese." The whole program at 1301-1332 was in Standard Chinese rather than in any kind of Tibetan dialect. Announced schedule: Mondays and Wednesdays at 1900 Lhasa time, 2100 Beijing time, 1300 UT. No address was given. They also announced something for Tuesdays and Thursdays; so may be in Standard Chinese on Mon/Wed, Tibetan on Tue/Thu? Or are the transmissions on Tue/Thu repeats of the ones on Mon/Wed? This one needs more research (Harald Kuhl, Germany, *Cumbre DX*)

TURKEY VOT made one frequency change Aug 1 for English to Asia at 1230-1330: 17830 ex-15290 (TRT via Larry Russell)

UKOGBANI BBC is planning to cut back on high brow radio programmes aimed at the middle classes and channel the money into pop shows — more resources for Radio One, less for speech-based Radio Four and classical Radio Three. More money is also planned for Radio Five Live, the sport and news service. A BBC insider says "The big set programmes like the Proms and the Reith Lectures will survive, but the intelligent, complex features, documentaries and dramas will go. It is being done by stealth." (*Sunday Times* via Tim Arnold via Rick Lewis) Refers to domestic services, but we're apprehensive about impact on the World Service (gh)

UKRAINE Following your reports on RUI I checked out the 2100 transmission on July 25. I heard them on 6020 7180 7240 7380 7410 and 13590. They had the DX programme at 2145. At the end, the presenter announced that 12040 and 9550 had been off the air since late June. They were broadcast from Mykolayiv to NAm. Transmissions on these frequencies had ceased due to the failure of the National Radio Company to pay rental fees. Presenter also said 7150 and 12050 at 0400-1600 had ceased (Mike Barraclough, England, *Review Of International Broadcasting*)

USA WBCQ, Maine, authorized on 7415 at 2200-0600 from Sept 1 (George Jacobs & Associates via Jim Moats) Brother Stair now expected to buy little if any time on WBCQ (Randi Steele via George Thurman)

WGTG-2 resumed testing Aug 9 on 9505 with 340-degree rhombic. This unit was about to go into regular service. Dave Frantz tells me that yet another FCC surprise inspection took place in July, and everything was OK. WGTG continues to be harrassed, perhaps by land-development interests in the neighborhood. He is gathering evidence that other stations pose a far greater risk of RF radiation, such as WSB-750 whose tower is in the middle of a shopping center it owns; and WWBS Macon, GA, is likely to have even more severe risks and problems transmitting from downtown rather than a rural area (gh)

After illicitly photocopying engineering and legal documents of WGTG while "relieving" the Frantzes from constant running of the station, the Fundamental Broadcasting Network, which WGTG cancelled in March, has applied to build its own SW station at its North Carolina HQ (Dave Frantz, WGTG)

WINB - look for this station to continue as it has been, according to station engineer, Fred Wise — mostly Christian music. The station isn't being marketed, but customers do find it at times now through the E-mail address. There are no plans to either create another shortwave transmitter from the second transmitter WINB has (actually WGY's old AM transmitter and purchased over 20 years ago) or to revive the Latin American antenna (taken out in an accident four years ago). Wise mentions that they do still receive reception reports from Europe and Mexico (the European antenna was made switchable after the accident), but 50 kW doesn't get through like it used to, particularly during crowded band conditions (via Hans Johnson, *Cumbre DX* Copyright)

WMLK upgrade plans from July *The Sacred Name Broadcaster*: WMLK says that they have begun an upgrade process: 1. Improve the original 50 kW (converted MW) transmitter, and construct a new antenna capable of higher power. 2. Convert their second 50 kW (MW) transmitter to 100 kW SW. 3. Recondition original transmitter, and upgrade it to 100 kW. 4. Then combine the two for 200 kW of power. They say they've "cut back on some of the broadcast time in order to begin work on improving the transmitter." WMLK has regularly exposed the pagan origins of popular holidays using secular sources. They also claim that Jesus was killed on a tree, not a cross. So maybe mainstream Christianity is wrong about the cross (Larry Russell, MI, *World of Radio*)

If you visit the WRMI street address, you may find a dark building even when WRMI is on the air. Although some production takes place there, tapes are actually played from the transmitter site, which is very hot and incorrectly air-conditioned. The new log-periodic antenna droops and looks rather flimsy; how will it hold up to the next hurricane? (*Review Of International Broadcasting*)

The AFRTS relays from Key West on 4278.5, 6458.5, 12689.5, which might continue until November, were unhelpful in providing a complete program schedule; a few we monitored were subject to pre-emption by ball games afternoons and evenings; *Paul Harvey* noon 0348-0359 still with all commercial breaks removed; *Paul Harvey's Rest of the Story* 0425 weeknights; *Perspective* from ABC Sunday 1130; *NPR Weekend Edition* Sat & Sun 1200-1400; *NPR Morning Edition* weekdays 1000-1200, DST timings (gh)

VOA scheduled on short notice special 2-hour radio dramas it produced, 3 consecutive Sundays in July and August at 1300-1500 pre-empting *News Now* (*Communications World*)

WORLD OF RADIO on WWCR: added new early time of Thu 1600 on 15685; for latest sked see our website below. Remember that all WWCR programming shifts one UT hour later when standard time returns Oct. 25 (gh)

VENEZUELA Ecos del Torbes, 4980, Sat program *Recordando: A Gozar Muchachos* at 2205-2300, produced by Dr. Simon Zaidman, is gradually turning into a show where considerable attention is given to listeners abroad independently of the program they are reporting. Midway into it there is an English ID, and a few weeks ago, a letter from ex-East Germany was read on the show, receiving favorable comments by the people in the studio as the German DXer had correctly given the names of various of the program hosts. A few Venezuelan football narrators on assignment in France during the Football World Cup were amazed at the crisp signal Ecos del Torbes is putting into Europe. And on the July 25 show, a recording made by Bert Larsson, in Hallsberg, Sweden, was played (Henrik Klemetz, DSWCI *DX Window*)

VIETNAM The angel who has been putting all the Home (National) Service transmitters back on even frequencies also knows how to fix modulation problems. For years, the Hmong (National 3) service has been a distorted mess around 6164v. Not any more. It is now on nominal 6165 with good modulation and signal. Heard at 1215 with the tonal singing that these guys are famous for and //5035. I say turn this boy loose in the provinces next. By way of review—4958/9v is now on 4960; 5034v is now on 5035 (nominal is 5030 though); 5924v is now on 5925, 6164v is now on 6165, 10059v is now on 10060, 12035.2 is one I can't hear; can anyone confirm that it is on 12035-even now? (Hans Johnson, *Cumbre DX*)

Until the Next, Best of DX and 73 de Glenn!

http://www.angelfire.com/ok/worldofradio

www.americanradiohistory.com

Broadcast Loggings

GLOBAL FORUM

Gayle Van Horn

0028 UTC on 4960.1
DOMINICAN REP.: Radio Cima Cien. Spanish. Merengue music program...with their distinctive heavy, up-tempo march beat and initial drum roll. Two salsa tunes to "desde la República Dominicana transmite Radio Cima Cien." (Gayle Van Horn, Brasstown, NC)

0030 UTC on 5012
DOMINICAN REP.: Radio Cristal Intl. Classic jazz standards music program including *Ain't Misbehavin'* and *I Can't Give You Anything But Love*. "Radio Cristal...la voz de la Republica Dominicana," frequency quote and info to national anthem and 0103*. (Van Horn, NC) Station address: Apartado Postal 894, Santo Domingo, Dominican Republic. *(Don't forget return postage -ed.)*

0058 UTC on 6010
ITALY: RAI. Report on the film exhibition in Rome. (Bob Fraser, Cohasset, MA) Station website: **<http://www.mediasuk.org/rai>**

0130 UTC
Radio Satélite. Spanish. Evening communicados and announcements about city Santa Cruz. Occasional national news brief and sound effect bites. Station ID to panpipe music. Station is very weak. (Frank Hillton, Charleston, SC)

0150 UTC on 6479.72
PERU: Radio Altura. Spanish. Announcer's chat at tune-in to mentions of Huarmaca, Peru. Station slogans and jingles to frequency quote. ID at 0201, numerous time checks, best to monitor in LSB (lower side band). Fairly weak. (Dave Valko, PA/*The Four Winds*).

0155 UTC on 4955
COLOMBIA: Radiodifusión Nacional. Closing Spanish talk to English programming (0200-0300/Mon-Sat.) weak signal and fair audio level. IDs, freqs and talk to promo "Radio Nacional...to Colombia and the world." Very nice Colombian uptempo cumbia music. (Van Horn, NC) Address: Edificio Inravisión, CAN, Av. Eldorado, Santafé de Bogotá, D.C., Colombia. (Van Horn, NC) - *Replies slowly - ed.*

0231 UTC on 6115
PERU: Radio Unión. Spanish mentions of Lima into musical program. Station ID as, "exitos en Unión la Radio," audible to 0247. Peru's **Radio Satélite** audible on 6725.5 at 0240. (Nicholas Eramo, Buenos Aires, Argentina/*TFW*)

0245 UTC on 5010
ECUADOR: Radiofónicas Populares. Spanish. Fair signal quality for Andean music and chat. Station identification to time check. (Tom Banks, Dallas, TX)

0302 UTC on 5960
CYPRUS: (non) Radio Monte Carlo. Arabic *Panorama* news show in progress with items on Ankara and Arafat. Station ID to items on Beirut, Lebanon, Libya and Israel. News on Washington, DC, and Clinton's mess. *Panorama* mentioned plus station ID. Music bridge to closing info and 0320*. (Van Horn, NC) this station's programming is prepared in Cyprus and transmitted via Radio Canada Intl's Sackville, Canada, transmitter. *-ed.*

0320 UTC on 6105
BRAZIL: Radio Cultura. Portuguese. Announcer's mention of city Foz do Iguacu. Brazilian music program to ID as, "voce esta em la simtonia da Radio Cultura." Brazil's **Radio Educao Rural** heard on 4755 at 0330 with IDs, and jingles, 0400*. (Sam Wright, Biloxi, MS)

0344 UTC on 9690
SPAIN: China Radio Intl relay. Discussion on world religions, closing this segment of *Focus* program at 0345. Signal strong and steady. (Michael C. McCarty, Galloway, OH) Multilingual website: **<http://www.rne.es>**

0416 UTC on 4914.6
PERU: Radio Cora. Spanish. Musical program, comments from announcer on English musician. Commercials to ID as, "yo soy Cora...amigos de Cora bienvenidos a esta cita con música Argentina." (Nicolas Eramo, Buenos Aires, Argentina/*TFW*)

0700 UTC on 5950
TAIWAN: (non) Radio Taipei Intl via Okeechobee, Fl. News to 0714, features and elementary Chinese program. (Chris, Stroup, Norman, OK) Website: **<http://www.cbs.org.tw/eng/e-english.htm>**

0848 UTC on 6005
JAPAN: NHK-Sapporo. Home service relay in USB (upper sideband) with radio drama, fair signal. **BBC's Yamata, Japan** relay heard on 6065 at 0900, fading up to World Service English newscast. (Paul Ormandy, New Zealand/*TFW*)

1020 UTC on 11634
PHILIPPINES: FEBC. Religious text to hymns and vocals. Station ID to brief newscast, fair signal with fading. (Frank Hillton, Charleston, SC) Website: **<http://www.febc.org/>**

1230 UTC on 13730
AUSTRIA: Radio Austria Intl. Profile on the love letters of Johann Strauss. (Fraser, MA) Multilingual website: **<http://www.orf.at/roi/>**

1442 UTC on 17630
GABON: Africa Numero Un. French service with news of Brazzaville and Libreville to African hilife music. Musical jingle IDs to public service announcements. Recheck 1743 on 15475 to west Africa and east North America, Male DJ's pop music and native mbira instrumental. IDs, freqs, and address. Time tips to 1859*. Sign-on 1900 on 9580 in French with ID. (Hillton, SC)

1708 UTC on 21460
COSTA RICA: Radio For Peace Intl. *Disability Radio Worldwide* program in progress at tune-in. Fair signal for *Radio Nation* program. (McCarty, OH) website: **<http://www.clark.net/pub/cwilkins/rfpi>**

1820 UTC on 15265
UNITED ARAB EMIRATES: Radio Dubai. Arabic programming to "Radio Dubai" ID. Newstext to 1850. Good signal quality. (Tom Banks, Dallas, TX) *UAE TV on C-band satellite Galaxy 7, transponder 10 with Arabic and English programming. - ed.*

1847 UTC on 5036
CENTRAL AFRICAN REP: RTV-Centrafrique. French. Hard to copy signal while male announcer speaks of a music festival. Time tips at 1900 to clear "Centrafrique, Bangui" identification. Weak to poor quality. (Piet Pijpers, Netherlands/*TFW*)

1850 UTC on 5009.5
MADAGSCAR: Radio Madagasikara. Fair quality for regional music program to vernacular text. National anthem for 1902 sign-off. (Pijpers, NLD/*TFW*) *Address: Boite Postal 1202, Antananarivo, Madagascar. Replies slowly, $1.00 required. -ed.*

1905 UTC on 11990
KUWAIT: Hip-hop vocals (*We Need to Hook Up*) to canned ID for FM service at 1910. Still audible at 2020 recheck with pop vocal tune from Bel Biv Devoe (*Poison*). (David Neibauer, Lexington, KY) *C-Band service, Radio Kuwait TV can be seen on GE-2 (W2) transponder 6 with Arabic and English programming. - ed.*

1920 UTC on 9575
MOROCCO: Radio Medi 1. Pop music at tune-in to 2000 ID. Arabic newscast of fair quality, audible past 2015. (Hillton, SC) French website: **<http://www.medi1.com/>** (Harold Frodge, Midland, MI)

2105 UTC on 5025
BENIN: ORTB. Mentions of Benin and Parakou at tune in. Ethnic folk tune to French text at 2130 introducing radio drama. Slight interferences amid poor to fair signal quality. (Pijpers, NLD/*TFW*)

2115 UTC on 15135
RWANDA: Deutsche Welle relay. Sportscast to more on Clinton's mess. Item on Turkish criminal to be deported, and the Techno Music Festival to 2150*. (Stroup, OK) *C-band satellite for Deutsche Welle TV on GE-1 (W1) transponder 22 with German and English programming. -ed.*

2316 UTC on 9900
EGYPT: Radio Cairo. World news topics to identification, fair signal quality. (McCarty, OH) Real Audio available: **<http://www.sis.gov.eg/vidaudio/html/audiofm.htm>**

Thanks to our contributors — Have you sent in YOUR logs?
Send to ***Gayle Van Horn****, c/o Monitoring Times (or e-mail gayle@grove.net)*
English broadcast unless otherwise noted.

www.americanradiohistory.com

Gayle Van Horn, gayle@grove.net

You Can't Beat It...No Way...No How...

HEY! You with the headphones on! Guess by now you've noticed the summer radio static is outta here — and isn't it about time? Ready or not, DX season is here!

Have you checked your antennas...and perhaps added a few new ones? Got a new logbook, how about a station/country hit list?

Supplies in order? If not, Bill Plum's Stamp Service can send you his latest price list for a self-addressed envelope to: 12 Glenn Rd., Flemington, NJ 08822-3322.

Did you update your *Passport to World Band Radio* reference book for 1999? This is a "must have" to every serious shortwave listener. Call Grove Enterprises order line at 1-800-438-8155 for pricing information (BOK18-99).

Need some DX info? October 24th marks the annual broadcast from Radio St. Helena, starting 1900-2300 UTC on 11.092 MHz USB. Their website **<http://www.sthelena.se/>** contains links and more regarding this popular broadcast.

Don't forget Halloween is this month, which means the best night of the year for the absurd to pop up. Check out George Zeller's *Outer Limits* column for maildrop addresses and more.

The World Harvest Radio QSL cards have been completely redesigned for WHRI and KWHR to complement WHRA, the newly acquired transmitter site in Greenbush, Maine. While each one is different, they are all designed to work together as a set. Submit your reception reports for each station to: World Harvest Radio, P.O. Box 12, South Bend, IN 46614. Fax (219) 291-9043 or email **<whr@lesea.com>**

What about snacks? Surely you don't DX without them. Plenty of coffee (or cola) ... and I'm not talking decaf! If you really want to get serious put in a sleeping bag for quick naps during an "all-night session."

Did you remember Radio Australia **<http:www/abc.net.au/>** is being verified by the Australian Radio DX Club Inc.? (ARDXC) All reception reports should be sent to; c/o John Westland-Manager, GPO Box 428G, Melbourne VIC 3001 Australia.

So there you have it...a quick run through to prepare you for the DX season plus some QSLing tips. Here's hoping your DX is awesome this year...one you can't beat...no way!

CAMBODIA

National Radio of Cambodia, 11940 kHz. Hand written full page letter signed by Kem Yam-Director of International Relations. Two station stickers and a schedule enclosed. Received in 60 days for an English report, one U.S. dollar, one International Reply Coupon (IRC) IRC and Cleveland postcard. Station address: Monivong Boulevard No. 106, Phnom Penh, Cambodia. (Lee Silvi, Mentor, OH)

CANADA

CBN-Newfoundland CKZN 6160 kHz. Three QSL cards unsigned. Received for English reports from a year ago and from 1996. Station address: Transmission & Distribution Dept., P.O. Box 12010-Station A, St John's NF Canada A1B 3T8. (Silvi, OH) Full data map card signed by S. Williams in 876 days for an English report. (Charlie Washburn, North Perry, ME)

CHILE

Radio Voz Cristiana, 21550 kHz Local QSL card unsigned. Received in 20 days for an English report and mint stamps. QSL address: P.O. Box 2889, Miami, FL 33144. (Frank Hillton, Charleston, SC).

FM

WUCX-90.1 MHz FM. Personal handwritten letter from Howard Sharper-Prod. Manager, plus business card, program info booklet, *Jazz 90* newsletter, coverage map and station souvenirs. Received for an English FM report. Station address: Delta Public Radio, University Center, Bay City, MI 48710. (Israel D. Moore, Livingston, AL)

WRCT-88.3 MHz FM. Full data prepared QSL card signed by Neil A. Donnelly-Gen. Manager. Received in 2 months for an English FM report and mint stamps. Station address: 5000 Forbes Ave., Pittsburgh, PA 15213. (Robert Ross, London, Ont, Canada/*AmFmTvDx*)

LAOS

Lao National Radio, 6130 kHz. Partial data verification letter signed by Miss Vichitsavanh Chanthery-Announcer (English Section). Received in 166 days for an English report, tape recording, Maine postcard, used stamps and two U.S. dollars. Station address: P.O. Box 310, Vientiane, Lao Democratic Rep. (Washburn, ME)

LEBANON

Voice of Hope, 11530 kHz. Verification via email from Gary Hull-Station Manager, within hours of sending report via email. Email reply indicated they are considering a new 11 MHz frequency due to Radio Free Asia interference. (Silvi, OH) Station website: **<http://www.highadventure.org/voh_midd.html>**

LIBYA

Radio Jamahiriya, 15415 kHz. Full data *African Service* color rainbow QSL card unsigned. Received in 77 days for a taped report and one U.S. dollar. QSL address: European Branch Office, P.O. Box 17, Hamrum, Malta. (Randy Stewart, Springfield, MO)

MEDIUM WAVE

Adelaide 5FAN-891 kHz AM/Naracoorte 5PA-1161 kHz AM. Full data cards for each station, signed by Sue Townsend-AO. Station souvenirs enclosed. Received in 23 days for a taped report. Station address: GPO 9994, Adelaide SA Australia 5001. (Patrick Martin, Seaside, OR)

CKTB-AM 610 kHz. Partial date verification on station letterhead signed by Jamie O'Brien and Tim Denis-*On Air Personalities* duo, plus coverage map. Received in 17 days for an AM report. Station address: 1 St. Paul Street-Suite 610, St. Catherines, ON Canada L2R 7L2. (Harold Frodge, Midland, MI)

WILM-AM 1450 kHz. Full data *Special DX Test QSL* on station letterhead signed by Allan Loudell-Program Manager, plus station stickers. Received in eight days for an AM report. Station address: 1215 French Street, P.O. Box 1990, Wilmington, DE 19899-1990. (Frodge, MI)

PIRATES

Anteater Radio, 6955 kHz USB. Full data semi-truck and ant card signed by Peter Worth. Letter, truckers' safety pamphlet and large rubber ant enclosed. Received in 38 days for a pirate report and three mint stamps. QSL maildrop: P.O. Box 1, Belfast, NY 14711. (Bill Wilkins, Springfield,MO)

Radio Eclipse, 6955 kHz USB. Full data *Season Finale* card signed by Steve Mann. Received in 231 days for a pirate report and three mint stamps. QSL maildrop: P.O. Box 28413, Providence, RI 02908. (Wilkins, MO)

Free Hope Experience, 6955 kHz USB. Full data UFO card signed by Maj. Spook. Received in 25 days for a pirate report and three mint stamps. QSL maildrop: P.O. Box 109, Blue Ridge Summit, PA 17214. (Anonymous, PA)

ST. HELENA

Radio St. Helena, 11092 USB kHz. Full data map/logo card signed by Derek Richards-Manager. Received in 269 days for an English report and three IRCs. Station address: The Castle, Jamestown, St. Helena, South Atlantic Ocean. (Washburn, ME; Wilkins, MO)

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How to Use the Shortwave Guide

1: Convert your time to UTC.

Eastern and Pacific Times are already converted to Coordinated Universal Time (UTC) at the top of each page. The rule is: convert your local time to 24-hour format; add (during Daylight Savings Time) 4, 5,6,or 7 hours for Eastern, Central, Mountain or Pacific Times, respectively.

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 (8:30 pm Eastern, 5:30 pm Pacific).

2: Choose a program or station you want to hear.

Some selected programs appear on the lower half of the page for prime listening hours—space does not permit 24-hour listings.

Occasionally program listings will be followed by "See X 0000." This information indicates that the program is a rerun, and refers to a previous summary of the program's content. The letter stands for a day of the week, as indicated below, and the four digits represent a time in UTC.

S: Sunday T: Tuesday H: Thursday A: Saturday
M: Monday W: Wednesday F: Friday

3: Find the frequencies for the program or station you want to hear.

Look at the page which corresponds to the time you will be listening. Comprehensive frequency information for English broadcasts can be found at the top half of the page. All frequencies are in kHz.

The frequency listing uses the same day codes as the program listings; if a broadcast is not daily, those day codes will appear before the station name. Irregular broadcasts are indicated "tent" and programming which includes languages besides English are coded "vl" (various languages).

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

Not all stations can be heard and none all the time on all frequencies. To help you find the most promising frequency, we've included information on the target area of each broadcast. Frequencies beamed toward your area will generally be easier to hear than those beamed elsewhere, even though the latter will often still be audible. Every frequency is followed by one of these target codes:

am:	The Americas	as:	Asia
na:	North America	au:	Australia
ca:	Central America	pa:	Pacific
sa:	South America	va:	various
eu:	Europe	do:	domestic broadcast
af:	Africa	om:	omnidirectional
me:	Middle East		

Consult the propagation charts. To further help you find the right frequency, we've included charts at the back of this section which take into account conditions affecting the audibility of shortwave broadcasts. Simply pick out the region in which you live and find the chart for the region in which the station you want to hear is located. The chart indicates the optimum frequencies for a given time in UTC.

Hot News

Compiled by Jim Frimmel

SINGAPORE. Just received at press time is a new program lineup for Radio Singapore International. New features include *Indonesia Today, Currencies, Currency Crisis for Beginners, Limelight, Eco-Destinations, In Transit, and Love Songs.* Broadcast times remain 1100-1400 UTC; frequency 6015 kHz remains the same but 6155 kHz is changed to 6150 kHz.

NORTH CAROLINA. Eric Rudolph, Atlanta bombing suspect and one of the FBI's 10 most wanted fugitives, was holed up in the Nantahala National Forest practically in *Monitoring Times'* backyard as of mid-August. Rudolph is thought to be carrying a shortwave radio, and speculation is that it might be a BayGen wind-up radio.

WORLD RADIO NETWORK (WRN). Baltimore's WJHU (88.1 FM) became the first public broadcasting station in the U.S. to carry WRN's overnight shortwave service. The trial service commenced on August 1st and could be heard from midnight to 5:00 am Mon-Fri and midnight to 6:00 am Sat-Sun. National Public Radio (NPR) was expected to offer the service to other network stations in September. Many stations were already carrying BBC programs during this same time period. According to WRN, WJHU has been receiving positive response from their listeners.

INTERNET RADIO. The number of live broadcasts via the internet climbed to 1549 in August. (The breakdown is 825 radio stations, 559 international broadcasters, 43 networks, and 122 internet-only broadcasters.) The number of broadcasters with a presence on the web has skyrocketed to a total of 5401. American and Canadian broadcasters accounted for more than 79% of these with Texas having the most stations represented (7%). The most popular station format is country (18%).

PERSONAL DIGITAL ASSISTANT (PDA) USERS. The number of handheld computers in use today has increased dramatically. If you are using your PalmPilot or other PDA for radio-listening purposes, we would like to hear about it. Let us know what you are doing, the type of PDA and the software being used. Send snail mail to Jim Frimmel, c/o Monitoring Times, or e-mail to *frimmel@startext.net.* We'll follow-up with the results in a future column.

SPORTS ON SHORTWAVE. Shortwave listeners who are also baseball and football fans have had many opportunities to hear play-by-play broadcasts since the USN Communications Station in Key West began relaying Armed Forces Radio and Television Service (AFRTS) programming on 12689.5 kHz in late July. If you haven't tuned in yet, you had better hurry; transmissions are expected to cease sometime this month.

www.americanradiohistory.com

0000 UTC SHORTWAVE GUIDE 8:00 PM EDT 5:00 PM PDT

Frequencies

0000-0100	Anguilla,Caribbean Beacon	6090am			
0000-0100	Australia, Radio	9660pa	12080as	15240pa	17715pa
		17795pa	21740pa		
0000-0100 vl	Australia, VL8K Katherine	5025do			
0000-0100 vl	Australia, VL8T Tent Crk	4910do			
0000-0015	Cambodia, Natl Radio Of	11940as			
0000-0100	Canada, CBC N Quebec Svc	9625do			
0000-0100	Canada, CFRX Toronto	6070do			
0000-0100	Canada, CFVP Calgary	6030do			
0000-0100	Canada, CHNX Halifax	6130do			
0000-0100	Canada, CKZN St John's	6160do			
0000-0100	Canada, CKZU Vancouver	6160do			
0000-0100	Costa Rica, Adv World R	5030am	9725am	15460am	
0000-0100	Costa Rica,RF Peace Intl	6975am	15050am		
0000-0005	Croatia, Croatian Radio	9925am			
0000-0027	Czech Rep, Radio Prague	5930na	7345na		
0000-0100	Ecuador, HCJB	9745na	12015na	21455am	
0000-0030	Egypt, Radio Cairo	9900am			
0000-0100	Germany,Overcomer Ministr	3975eu	9500as		
0000-0015 vl	Ghana, Ghana Broadc Corp	3366do	4915do		
0000-0045	India, All India Radio	7410as	9705as	9950as	11620as
0000-0100	Ireland, Unt Christian BC	6200do			
0000-0015	Japan, R Japan/NHK World	6155eu	6180eu	9665af	11705na
		11815as	13650as		
0000-0100	Liberia,LCN/R Liberia Int	5100do			
0000-0100	Malaysia, Radio	7295do			
0000-0100 vl	Namibia, NBC	3270af	3289af		
0000-0030	Netherlands, Radio	6020na	6165na	9845na	
0000-0100	New Zealand, R NZ Intl	17675pa			
0000-0057	North Korea, R Pyongyang	11845ca	13650sa	15230na	
0000-0100 vl	Papua New Guinea, NBC	9675do			
0000-0100	Philippines, FEBC/R Intl	15450as			
0000-0030 mtwhfa	Serbia, Radio Yugoslavia	9580na	11870na		
0000-0100	Singapore,RCorp Singapore	6150do			
0000-0100	Spain, R Exterior Espana	6055am			
0000-0100	Thailand, Radio	9655as	11905as	15395na	
0000-0100	UK, BBC Asian Service	3915as	6195as	7110as	9410as
		11945as	11955as	15280as	15310as
		15360as	17790as		
0000-0100	UK, BBC World Service	5970sa	5975am	6175na	9590am
		9915sa	12095sa		
0000-0100 t	UK, Merlin Network One	9645eu	11985na	13690na	
0000-0100	Ukraine, R Ukraine Intl	5905eu	5915eu	6020eu	7180na
		7240eu	9445na	9550na	12040na
		12050na			
0000-0100	USA, KAIJ Dallas TX	5810am			
0000-0100	USA, KTBN Salt Lk City UT	7510am			
0000-0100	USA, KWHR Naalehu HI	17510as			
0000-0100	USA, Voice of America	7215as	9770as	11760as	15185as
		15290as	17735as	17820as	
0000-0030 twhfa	USA, Voice of America	5995am	6130ca	7405am	9455ca
		9775am	11695ca	13740am	
0000-0100	USA, WEWN Birmingham AL	5825eu	13615na		
0000-0100 twhfa	USA, WGTG McCaysville GA	5085am			
0000-0100	USA, WHRI Noblesville IN	5745am			
0000-0100	USA, WINB Red Lion PA	11950am			
0000-0100	USA, WJCR Upton KY	7490na	13595na		
0000-0100	USA, WRMI/R Miami Intl	9955ca			
0000-0100 wfas	USA, WSHB Cypress Crk SC	7535am			
0000-0100 wf	USA, WSHB Cypress Crk SC	15285am			
0000-0100 irreg	USA, WWBS Macon GA	11905na			
0000-0100	USA, WWCR Nashville TN	5070am	7435am	9475am	13845am
0000-0100	USA, WYFR Okeechobee FL	5950na	6085na	9505na	
0015-0100	Japan, R Japan/NHK World	6155eu	6180eu	9665af	11705na
0030-0100	Austria, R Austria Intl	9655na			
0030-0100	Iran, VOIRI	7260eu	9022eu	9685eu	
0030-0100	Lithuania, Radio Vilnius	9855am			
0030-0100	Netherlands, Radio	6020na	6165na	9845na	9855as
		11655as	12090as		
0030-0100	Sri Lanka, Sri Lanka BC	9730as	15425as		
0030-0100	UK, BBC Asian Service	9410as	11955as		
0045-0100	Albania, R Tirana Intl	6115na	7160na		
0050-0100	Italy, RAI Intl	6010na	9675na	11800na	

Selected Programs

Sundays

0000 Australia, Radio: RA News.
0000 Germany, Deutsche Telekom: The Overcomer Broadcast.
0004 Czech Rep, Radio Prague: Encore.
0005 Australia, Radio: Oz Sounds #2.
0010 Spain, R Exterior de Espana: Window on Spain.
0025 Netherlands, Radio (am): Insight.
0030 Australia, Radio: Correspondents' Report.
0030 Ecuador, HCJB Quito (am): Musical Mailbag.
0033 Spain, R Exterior de Espana: Spanish Poparama.
0038 Netherlands, Radio (am): Newsline.
0050 Italy, RAI: News.
0054 Netherlands, Radio (am): Weekend.

Mondays

0000 Czech Rep, Radio Prague: News.
0000 Egypt, Radio Cairo: Egyptian Music.
0000 Yugoslavia, Radio: News.
0003 North Korea, R Pyongyang: News.
0005 Czech Rep, Radio Prague: The Week in Politics.
0005 Egypt, Radio Cairo: Islamic Civilization.
0009 Serbia, RYugoslavia: Cultural Panorama.
0011 Spain, R Exterior de Espana: Visitors Book.
0012 Czech Rep, Radio Prague: From the Weeklies.
0015 Yugoslavia, Radio: Weekly Concert.
0018 Czech Rep, Radio Prague: Media Check.
0036 Netherlands, Radio (am): Sincerely Yours.
0040 Spain, R Exterior de Espana: Radio Club.
0049 Lithuania, Radio Vilnius: Folklore.
0055 Netherlands, Radio (am): Sounds Interesting.

Tuesdays

0000 Australia, Radio: RA News.
0000 Czech Rep, Radio Prague: News.
0000 Spain, R Exterior de Espana: The News from Spain.
0003 Czech Rep, Radio Prague: Current Affairs.
0006 Czech Rep, Radio Prague: Press Review.
0009 Czech Rep, Radio Prague: Magazine '98.
0010 Australia, Radio: Asia Pacific.
0012 North Korea, R Pyongyang: Commentary.
0030 Ecuador, HCJB Quito (am): Focus on the Family.
0030 Spain, R Exterior de Espana: Press Review.
0033 Spain, R Exterior de Espana: Entertainment in Spain.
0038 Netherlands, Radio (am): Newsline.
0045 Albania, Radio Tirana: News.
0045 Spain, R Exterior de Espana: Spanish Course by Radio.
0050 Italy, RAI: News.

Wednesdays

0000 Australia, Radio: RA News.
0000 Ecuador, HCJB Quito (am): Insight for Living.
0000 Spain, R Exterior de Espana: The News from Spain.
0000 USA, KTBN Salt Lk City UT: Behind the Scenes.
0000 USA, WEWN Birmingham AL: Mother Angelica Live Family Night.
0015 Egypt, Radio Cairo: News.
0020 North Korea, R Pyongyang: Music.
0030 Ecuador, HCJB Quito (am): Focus on the Family.
0030 North Korea, R Pyongyang: Feature Report.
0030 Spain, R Exterior de Espana: Spanish Music.
0034 Spain, R Exterior de Espana: Press Review.
0039 Lithuania, Radio Vilnius: Press Review.
0039 Spain, R Exterior de Espana: Kaleidoscope.
0040 Netherlands, Radio (am): Newsline.
0050 Italy, RAI: News.

Thursdays

0000 Australia, Radio: RA News.
0000 Ecuador, HCJB Quito (am): Insight for Living.
0000 North Korea, R Pyongyang: Anthem.
0000 USA, WINB Red Lion PA: The People's Gospel Hour.
0003 North Korea, R Pyongyang: News.
0012 North Korea, R Pyongyang: Commentary.
0015 USA, KTBN Salt Lk City UT: Principles of Biblical Economics.
0025 Netherlands, Radio (am): Press Review.
0030 Australia, Radio: Book Talk.
0030 Ecuador, HCJB Quito (am): Focus on the Family.
0030 Lithuania, Radio Vilnius: News.
0030 Netherlands, Radio (am): News.
0030 USA, WINB Red Lion PA: Music.
0038 Netherlands, Radio (am): Newsline.
0050 Italy, RAI: News.

Fridays

0000 Australia, Radio: RA News.
0000 Czech Rep, Radio Prague: News.
0000 Ecuador, HCJB Quito (am): Insight for Living.
0000 Germany, Deutsche Telekom: The Overcomer Broadcast.
0003 North Korea, R Pyongyang: News.
0005 Czech Rep, Radio Prague: Current Affairs.
0008 Czech Rep, Radio Prague: Press Review.
0012 Czech Rep, Radio Prague: Economic Report.
0016 Czech Rep, Radio Prague: I'd Like You to Meet.
0025 Netherlands, Radio (am): Press Review.
0030 Ecuador, HCJB Quito (am): Focus on the Family.
0030 Lithuania, Radio Vilnius: News.
0038 Netherlands, Radio (am): Newsline.
0050 Italy, RAI: News.
0054 Netherlands, Radio (am): Media Network.

Saturdays

0000 Germany, Deutsche Telekom: The Overcomer Broadcast.
0000 North Korea, R Pyongyang: Anthem.
0000 Spain, R Exterior de Espana: The News from Spain.
0000 Serbia, RYugoslavia: News.
0003 North Korea, R Pyongyang: News.
0026 Spain, R Exterior de Espana: Press Review.
0030 Ecuador, HCJB Quito (am): Focus on the Family.
0030 Lithuania, Radio Vilnius: News.
0032 Spain, R Exterior de Espana: Arts Review.
0035 Iran, Voice of: News.
0038 Lithuania, Radio Vilnius: Local Scene.
0047 Iran, Voice of: Political Commentary.
0050 Italy, RAI: News.
0050 Spain, R Exterior de Espana: A Spanish Course by Radio.
0057 Iran, Voice of: Listeners' Special.

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Frequencies

0100-0200	Anguilla,Caribbean Beacon	6090am			
0100-0200	Australia, Radio	9660pa	12080as	15240pa	15415as
		17715pa	17750as	17795pa	21740pa
0100-0200 vl	Australia, VL8K Katherine	5025do			
0100-0200 vl	Australia, VL8T Tent Crk	4910do			
0100-0200	Canada, CBC N Quebec Svc	9625do			
0100-0200	Canada, CFRX Toronto	6070do			
0100-0200	Canada, CFVP Calgary	6030do			
0100-0200	Canada, CHNX Halifax	6130do			
0100-0200	Canada, CKZN St John's	6160do			
0100-0200	Canada, CKZU Vancouver	6160do			
0100-0129	Canada, R Canada Intl	5960am	9535am	9755am	11715am
		13670am			
0100-0200	Costa Rica,RF Peace Intl	6975am	15050am		
0100-0105	Croatia, Croatian Radio	9925am			
0100-0200	Cuba, Radio Havana	6000na	9820na	13605na	
0100-0127	Czech Rep, Radio Prague	6200na	7345na		
0100-0200	Ecuador, HCJB	9745na	12015na	21455am	
0100-0150	Germany, Deutsche Welle	6040na	6085na	6145na	9640na
		11810am			
0100-0200	Germany,Overcomer Ministr	3975eu	9500as		
0100-0115	Ghana, Ghana Broadc Corp	3366do	4915do		
0100-0130	Hungary, Radio Budapest	9580na	11685na		
0100-0200	Indonesia, Voice of	9525as	11765as	15510as	
0100-0125	Iran, VOIRI	7260eu	9022eu	9685eu	
0100-0200	Ireland, Unt Christian BC	6200do			
0100-0110	Italy, RAI Intl	6010na	9675na	11800na	
0100-0200	Japan, R Japan/NHK World	6150af	11860as	11870af	15570as
		15590as	17810as	17835sa	21610pa
		21670pa			
0100-0200	Liberia,LCN/R Liberia Int	5100do			
0100-0130	Lithuania, Radio Vilnius	9855am			
0100-0200	Malaysia, Radio	7295do			
0100-0200 vl	Namibia, NBC	3270af	3289af		
0100-0125	Netherlands, Radio	6020na	6165na	9845na	9855as
		11655as	12090as		
0100-0200	New Zealand, R NZ Intl	17675pa			
0100-0200 vl	Papua New Guinea, NBC	9675do			
0100-0200	Philippines, FEBC/R Intl	15450as			
0100-0200	Russia,Voice of Russia WS	7105na	7180na	12050na	15425na
		15520na			
0100-0200	Singapore,RCorp Singapore	6150do			
0100-0130	Slovakia, R Slovakia Intl	5930na	7300af	9440sa	
0100-0200	Spain, R Exterior Espana	6055am			
0100-0200	Sri Lanka, Sri Lanka BC	9730as	11904as		
0100-0130	Switzerland, Swiss R Intl	9885na	9905ca		
0100-0200	UK, BBC Asian Service	5965as	6195as	9410as	9605as
		11955as	15280as	15310as	15360as
0100-0200	UK, BBC World Service	5970sa	5975am	6175na	9590am
		9915sa	12095sa		
0100-0200	USA, KAIJ Dallas TX	5810am			
0100-0200	USA, KJES Mesquite NM	7555am			
0100-0200	USA, KTBN Salt Lk City UT	7510am			
0100-0200	USA, KWHR Naalehu HI	17510as			
0100-0200	USA, Voice of America	7115as	7200as	9635as	11705as
		11725as	11820as	15250as	17740as
		17820as			
0100-0200 twhfa	USA, Voice of America	5995am	6130am	7405am	9445am
		9775am	13740am		
0100-0200	USA, WEWN Birmingham AL	5825eu	13615na		
0100-0200 twhfa	USA, WGTG McCaysville GA	5085am			
0100-0200	USA, WHRI Noblesville IN	5745am	7315am		
0100-0200	USA, WINB Red Lion PA	11950am			
0100-0200	USA, WJCR Upton KY	7490na	13595na		
0100-0200	USA, WRMI/R Miami Intl	9955ca			
0100-0200	USA, WRNO New Orleans LA	7355na			
0100-0200 twhfas	USA, WSHB Cypress Crk SC	7535am			
0100-0200 irreg	USA, WWBS Macon GA	11905na			
0100-0200	USA, WWCR Nashville TN	3215am	5070am	7435am	13845am
0100-0200	USA, WYFR Okeechobee FL	6065na	9505na	15165as	
0100-0130	Uzbekistan, R Tashkent	7190as	9375as	9530as	9715as
0100-0127	Vietnam, Voice of	5940am	7250am		
0125-0200	Netherlands, Radio	9855as	11655as	12090as	
0129-0159	Canada, R Canada Intl	5960am	9755am		
0129-0159 sm	Canada, R Canada Intl	9535am	11715am	13670am	
0130-0200	Albania, R Tirana Intl	6246na	7160na		
0130-0150	Greece, Voice of	7450na	9375na	9420na	11645na
0130-0200 m/vl	Guatemala, TGNA/R Cultural	3300do			
0130-0200	Sweden, Radio	9435as	11985au		
0140-0200	Vatican State, Vatican R	5980as	7335as	9650as	

Selected Programs

Sundays

0100 Italy, RAI: Letter from Italy.
0100 Switzerland, Swiss Radio Intl: News.
0100 Ecuador, HCJB Quito (am): Latin and International News.
0105 Switzerland, Swiss Radio Intl: Newsnet.
0105 Australia, Radio: The Europeans.
0106 Italy, RAI: Light Music.
0106 Germany, Deutsche Welle: Weekend Review.
0109 Ecuador, HCJB Quito (am): HCJB DX Partyline.
0114 Germany, Deutsche Welle: Spectrum.
0115 Switzerland, Swiss Radio Intl: The Name Game (1).
0115 Switzerland, Swiss Radio Intl: Capital Letters (2/4).
0123 Spain, R Exterior de Espana: Distance Unknown.
0130 Greece, Voice of: News.
0133 Spain, R Exterior de Espana: Spanish Poparama.
0152 Vatican State, Vatican Radio: News.

Mondays

0100 Germany, Deutsche Welle: News.
0100 Spain, R Exterior de Espana: News.
0100 Ecuador, HCJB Quito (am): Latin and International News.
0100 USA, KAIJ Dallas TX: World University Network.
0105 Switzerland, Swiss Radio Intl: Newsnet.
0106 Germany, Deutsche Welle: Mailbag North America.
0107 Canada, RCI Montreal: The Arts in Canada.
0111 Spain, R Exterior de Espana: Visitors Book.
0115 Germany, Deutsche Welle: Arts on the Air.
0130 Guatemala, TGNA: Music in the Post Meridian.
0130 Netherlands, Radio: News.
0136 Netherlands, Radio: Wide Angle.
0133 Spain, R Exterior de Espana: Radio Club.
0150 Vatican State, Vatican Radio: The Backgrounder.
0154 Netherlands, Radio: Siren Song.

Tuesdays

0100 Spain, R Exterior de Espana: The News from Spain.
0100 Canada, RCI Montreal: RCI News.
0105 Switzerland, Swiss Radio Intl: Newsnet.
0109 Czech Rep, Radio Prague: Magazine '98.
0110 Australia, Radio: Science Show.
0111 Canada, RCI Montreal: Spectrum.
0111 Cuba, Radio Havana Cuba: Stories Making News in Cuba.
0111 Russia, Voice of: Commonwealth Update.
0132 Russia, Voice of: Folk Box.
0133 Germany, Deutsche Welle: Man and Environment.
0133 Spain, R Exterior de Espana: Entertainment in Spain.
0135 Cuba, Radio Havana Cuba: Timeout.
0138 Netherlands, Radio: Newsline.
0140 Cuba, Radio Havana Cuba: Spotlight on the Americas.
0146 Albania, Radio Tirana: Feature Program.

Wednesdays

0100 Italy, RAI: Light Music.
0100 Croatia, Croat an Radio: News.
0100 Czech Rep, Radio Prague: News.
0100 Germany, Deutsche Welle: News.
0100 USA, KAIJ Da las TX: World University Network.
0105 Switzerland, Swiss Radio Intl: Newsnet.
0106 Germany, Deutsche Welle: NewsLink.
0110 Czech Rep, Radio Prague: Talking Point.
0110 Ecuador, HCJB Quito (am): Studio 9.
0130 Germany, Deutsche Welle: Insight.
0130 Ecuador, HCJB Quito (am): El Mundo Futuro.
0130 Netherlands, Radio: News.
0135 Cuba, Radio Havana Cuba: Timeout.
0138 Netherlands, Radio: Newsline.
0140 Cuba, Radio Havana Cuba: DXers Unlimited.

Thursdays

0100 Switzerland, Swiss Radio Intl: News.
0100 Australia, Radio: RA News.
0100 Costa Rica, R for Peace Intl: RFPI's Mailbag.
0100 Ecuador, HCJB Quito (am): News.
0100 Japan, Radio: News.
0105 Switzerland, Swiss Radio Intl: Newsnet.
0106 Germany, Deutsche Welle: NewsLink.
0110 Ecuador, HCJB Quito (am): Studio 9.
0115 Japan, Radio: 44 Minutes.
0117 Japan, Radio: Guest Corner.
0130 Germany, Deutsche Welle: Living in Germany.
0130 Ecuador, HCJB Quito (am): Ham Radio Today.
0138 Netherlands, Radio: Newsline.
0145 Vatican State, Vatican Radio: Mailbox.
0152 Vatican State, Vatican Radio: News.

Fridays

0100 Australia, Racio: RA News.
0130 USA, Voice of America: News (Special English).
0100 Ecuador, HCJB Quito (am): News.
0100 USA, WINB Red Lion PA: Wake Up and Live.
0106 Germany, Deutsche Welle: NewsLink.
0110 Ecuador, HCJB Quito (am): Studio 9.
0115 USA, WINB Red Lion PA: Music.
0130 Germany, Deutsche Welle: Spotlight on Sport.
0130 Ecuador, HCJB Quito (am): Woman to Woman.
0130 Greece, Voice of: News.
0130 Albania, Radio Tirana: News.
0140 Vatican State, Vatican Radio: United Nations Radio.

Saturdays

0100 USA, WYFR Okeechobee FL: Patterns in Music.
0100 Spain, R Exterior de Espana: The News from Spain.
0100 Australia, Radio: RA News.
0100 Ecuador, HCJB Quito (am): News.
0100 USA, KAIJ Dallas TX: World University Network.
0102 Italy RAI: Light Music.
0105 Switzerland, Swiss Radio Intl: Newsnet.
0105 Australia, Radio: Oz Sounds #1.
0106 Germany, Deutsche Welle: NewsLink.
0110 Ecuador, HCJB Quito (am): Studio 9.
0130 Germany, Deutsche Welle: German by Radio.
0130 Australia, Radio: Arts Australia.
0130 Ecuador, HCJB Quito (am): Musica del Ecuador.
0136 USA, Voice of America: Communications World (A).
0150 Spain, R Exterior de Espana: A Spanish Course by Radio.

RadioMap™

Transmitter sites in your area are researched and marked on a beautiful 8-1/2 x 11 full color plot. See FCC licensed sites from VLF through microwave including police, fire, cellular phone sites, business, industrial, broadcasters and selected FAA transmitter sites. Callsigns, frequency assignments, and names provided. Ham radio stations not included.

You choose the map center location, your neighborhood, near your office, around sports stadiums, anywhere within the United States. We adjust map coverage for best readability, depending on transmitter site density.

Invaluable to radio professionals and hobbyists for identifying towers, sources of radio interference etc. Send nearest street intersection and check for $29.95 payable to Robert Parnass.

Robert Parnass, M.S.
Radio Electronics Consulting
2350 Douglas Road, Oswego, IL 60543

www.americanradiohistory.com

Frequencies

0200-0300	Anguilla,Caribbean Beacon	6090am			
0200-0300 twhfa	Argentina, RAE	11710am			
0200-0300	Australia, Radio	9660pa	11880as	12080as	15240pa
		15415as	15510pa	17715pa	17750as
		21725pa			
0200-0300 vl	Australia, VL8K Katherine	5025do			
0200-0300 vl	Australia, VL8T Tent Crk	4910do			
0200-0300 mwfas	Belarus, R Belarus Intl	7210eu	11670eu		
0200-0300	Bulgaria, Radio	9485na	11720na		
0200-0300	Canada, CBC N Quebec Svc	9625do			
0200-0300	Canada, CFRX Toronto	6070do			
0200-0300	Canada, CFVP Calgary	6030do			
0200-0300	Canada, CHNX Halifax	6130do			
0200-0300	Canada, CKZN St John's	6160do			
0200-0300	Canada, CKZU Vancouver	6160do			
0200-0229	Canada, R Canada Intl	9535am	9755am	11715am	13670am
0200-0300 twhfa	Colombia, Rdif Nacional	4955va			
0200-0300	Costa Rica,RF Peace Intl	6975am	15050am		
0200-0205	Croatia, Croatian Radio	9925na			
0200-0300	Cuba, Radio Havana	6000na	9820na	13605na	
0200-0300	Ecuador, HCJB	9745na	12015na	21455am	
0200-0300	Egypt, Radio Cairo	9475na			
0200-0230	Finland, YLE/R Finland	9780eu	11900am		
0200-0250	Germany, Deutsche Welle	7285as	9615as	9690as	11945as
		11965as	12045as		
0200-0300	Germany,Overcomer Ministr	3975eu	9500as		
0200-0300	Ireland, Unt Christian BC	6200do			
0200-0300 as/vl	Italy, IRRS	7120va			
0200-0300	Kenya, Kenya Broadc Corp	4885do	4935do		
0200-0215 thfa/vl	Kyrgyzstan, Kyrgyz Radio	4050do			
0200-0300	Malaysia, Radio	7295do			
0200-0250	Myanmar, Radio	7185do			
0200-0300 vl	Namibia, NBC	3270af	3289af		
0200-0225	Netherlands, Radio	9855as	11655as	12090as	
0200-0300	New Zealand, R NZ Intl	17675pa			
0200-0230 m	Norway, Radio Norway Intl	11600as	11990na		
0200-0300 vl	Papua New Guinea, NBC	9675do			
0200-0300	Romania, R Romania Intl	6155na	9570na	9690as	11740as
		11940as	15380as		
0200-0300	Russia,Voice of Russia WS	7105na	7180na	12050na	15425na
		15520na			
0200-0300	Singapore,RCorp Singapore	6150do			
0200-0300	South Korea, R Korea Intl	7275am	11725am	11810am	15575am
0200-0300	Sri Lanka, Sri Lanka BC	9730as	15425as		
0200-0300	Taiwan, Radio Taipei Intl	5950na	7130as	9680na	11740am
		11825pa	15345as		
0200-0300 vl	Tanzania, Radio	5050do			
0200-0300	UK, BBC African Service	6135af			
0200-0300	UK, BBC Asian Service	9605as	11955as	15280as	15310as
		15360as			
0200-0300	UK, BBC World Service	5970sa	5975am	6175na	6195eu
		9410eu	9590am	9915sa	
0200-0300	USA, KAIJ Dallas TX	5810am			
0200-0230	USA, KJES Mesquite NM	7555am			
0200-0300	USA, KTBN Salt Lk City UT	7510am			
0200-0300	USA, KWHR Naalehu HI	17510as			
0200-0300	USA, Voice of America	7115as	7200as	11705as	11725as
		11820as	15250as	17740as	17820as
0200-0300	USA, WEWN Birmingham AL	5825eu			
0200-0300 twhfa	USA, WGTG McCaysville GA	5085am			
0200-0300	USA, WHRI Noblesville IN	5745am	7315am		
0200-0300	USA, WINB Red Lion PA	11950am			
0200-0300	USA, WJCR Upton KY	7490na	13595na		
0200-0300	USA, WRMI/R Miami Intl	9955ca			
0200-0300	USA, WRNO New Orleans LA	7355na			
0200-0300 s	USA, WSHB Cypress Crk SC	5850na			
0200-0300 h	USA, WSHB Cypress Crk SC	7535am			
0200-0300 irreg	USA, WWBS Macon GA	11905na			
0200-0300	USA, WWCR Nashville TN	3215am	5070am	5935am	7435am
0200-0300	USA, WYFR Okeechobee FL	6065na	9505na		
0215-0225	Nepal, Radio	5005do	7165do		
0225-0300	Netherlands, Radio	9855as	11655as		
0229-0259 sm	Canada, R Canada Intl	9535am	9755am	11715am	13670am
0230-0300	Austria, R Austria Intl	9655na	9870sa	13730sa	
0230-0257	Czech Rep, Radio Prague	9480me	11600as		
0230-0300	Hungary, Radio Budapest	9840na	11910na		
0230-0245	Pakistan, Radio	7485as	13610as	15485as	
0230-0300 vl	Philippines, R Pilipinas	11885as	15120as	15270as	
0230-0300	Sweden, Radio	7135am	9495am		
0230-0300	UK, BBC World Service	9895am			
0230-0300	Vietnam, Voice of	5940am			
0250-0300 sf	Greece, Voice of	7450na	9375na	9420na	11645na
0250-0300	Vatican State, Vatican R	7305ca	9605am		

Selected Programs

Sundays

0200 Germany, Deutsche Telekom: The Overcomer Broadcast.
0200 USA, KTBN Salt Lk City UT: Carman.
0200 USA, WWCR #1 Nashville TN: Open Bible Dialogue.
0210 Australia, Radio: Fine Music Australia.
0230 Australia, Radio: The Religion Report.
0250 Greece, Voice of: News.
0250 Vatican State, Vatican Radio: With Heart and Mind.
0258 Vatican State, Vatican Radio: On-the-Air.

Mondays

0200 Germany, Deutsche Welle: News.
0200 Australia, Radio: RA News.
0205 Canada, N Quebec Svc: Sunday Showcase.
0206 Germany, Deutsche Welle: Weekend Review Two.
0206 USA, WHRI Noblesville IN (Angel 2): Radio Free America (live).
0211 Russia, Voice of: Moscow Mailbag.
0215 Germany, Deutsche Welle: Marks and Markets.
0215 Egypt, Radio Cairo: News.
0215 Taiwan, Radio Taipei Intl: Jade Bells and Bamboo Pipes,
0230 Bulgaria, Radio: History Club.
0230 Egypt, Radio Cairo; Music.
0230 USA, KWHR Naalehu HI: The Voice of Power.
0230 Sweden, Radio: Sounds Nordic (2/4).
0232 Russia, Voice of: Timelines.
0236 Netherlands, Radio: Sincerely Yours.
0244 Bulgaria, Radio: Answering Your Letters.
0250 Vatican State, Vatican Radio: And So They Came to Rome.

Tuesdays

0200 Canada, RCI Montreal: CBC Radio News.
0200 Bulgaria, Radio: News.
0200 USA, WEWN Birmingham AL: Catholic World Today.
0206 Germany, Deutsche Welle: NewsLink.
0211 Canada, RCI Montreal: Spectrum.
0211 Russia, Voice of: Moscow Mailbag.
0215 Taiwan, Radio Taipei Intl: People.
0230 Germany, Deutsche Welle: Man and Environment.
0230 Taiwan, Radio Taipei Intl: Trends.
0230 USA, WEWN Birmingham AL: IMRA Report on Missionaries.
0235 Cuba, Radio Havana Cuba: Feature Report.
0245 Taiwan, Radio Taipei Intl: Let's Learn Chinese.
0247 Sweden, Radio: SportScan.
0255 Vatican State, Vatican Radio: As Romans Turn.

Wednesdays

0200 Canada, RCI Montreal; CBC Radio News.
0200 Australia, Radio: RA News.
0200 Cuba, Radio Havana Cuba: International News.
0200 USA, KAIJ Dallas TX: World University Network.
0206 Germany, Deutsche Welle: NewsLink.
0211 Canada, RCI Montreal: Spectrum.
0214 Cuba, Radio Havana Cuba: Stories Making News in Cuba.
0215 Bulgaria, Radio: Events and Development.
0220 Cuba, Radio Havana Cuba: Spotlight on the Americas.
0223 Cuba, Radio Havana Cuba: Feature Report.
0230 Germany, Deutsche Welle: Insight.
0230 Ecuador, HCJB Quito (am): Unshackled.
0235 Cuba, Radio Havana Cuba: Be My Guest,
0242 Cuba, Radio Havana Cuba: Feature Report.
0250 Vatican State, Vatican Radio: The Rome Report.

Thursdays

0200 Canada, RCI Montreal: CBC Radio News.
0200 Argentina, RAE: News.
0200 Australia, Radio: RA News.
0200 Ecuador, HCJB Quito (am): Rock Solid!
0200 Vatican State, Vatican Radio: Would You Believe It?
0206 Germany, Deutsche Welle: NewsLink.
0211 Canada, RCI Montreal: Spectrum.
0222 Argentina, RAE: Music.
0230 Germany, Deutsche Welle: Living in Germany.
0230 Hungary, Radio Budapest: News.
0235 Taiwan, Radio Taipei Intl: Hot Spots.
0239 Argentina, RAE: DX'ers Special.
0245 Hungary, Radio Budapest: Radio Budapest DX Blockbuster.
0250 Vatican State, Vatican Radio: The Pope and the People.
0254 Vatican State, Vatican Radio: Pilgrim City.

Fridays

0200 Canada, RCI Montreal: CBC Radio News.
0200 Finland, Radio: News/Weather.
0200 Germany, Deutsche Welle: News.
0200 Australia, Radio: RA News.
0200 Taiwan, Radio Taipei Intl: News.
0206 Germany, Deutsche Welle: NewsLink.
0210 Finland, Radio: Reports and Features on Life in Finland.
0211 Canada, RCI Montreal: Spectrum.
0215 Bulgaria, Radio: Events and Development.
0215 Taiwan, Radio Taipei Intl: Taipei Magazine.
0224 Finland, Radio: Finnish Press Review.
0230 Bulgaria, Radio: Business and Finance.
0230 Ecuador, HCJB Quito (am): Inspirational Classics.
0230 Taiwan, Radio Taipei Intl: Life on the Outside.
0250 Vatican State, Vatican Radio: Then and Now.

Saturdays

0200 Croatia, Croatian Radio: News.
0200 Finland, Radio: News/Weather.
0200 Argentina, RAE: News.
0200 Australia, Radio: RA News.
0200 Ecuador, HCJB Quito (am): Inside HCJB.
0200 Taiwan, Radio Taipei Intl: News.
0205 Finland, Radio: Feature Stories from Last Week.
0205 Australia, Radio: Ockham's Razor.
0211 Canada, RCI Montreal: Spectrum.
0215 Finland, Radio: Starting Finnish.
0215 Bulgaria, Radio: Events and Development.
0217 South Korea, Radio Korea Intl: Sites and Sounds.
0223 Finland, Radio: Finnish Press Review.
0230 Bulgaria, Radio: The Way We Live.
0230 Taiwan, Radio Taipei Intl: Reflections.
0236 South Korea, Radio Korea Intl: Globalizing Korea.
0238 Netherlands, Radio: Newsline.
0250 Vatican State, Vatican Radio: Echoes of an Era.

www.americanradiohistory.com

Frequencies

0300-0400	Anguilla,Caribbean Beacon	6090am			
0300-0400	Australia, Radio	9660pa	12080as	15240pa	15415as
		15510pa	17715pa	17750as	21725pa
0300-0400 vl	Australia, VL8K Katherine	5025do			
0300-0400 vl	Australia, VL8T Tent Crk	4910do			
0300-0400	Australia,DefenseForces R	14790as			
0300-0400 vl	Canada, CBC N Quebec Svc	9625do			
0300-0400	Canada, CFRX Toronto	6070do			
0300-0400	Canada, CFVP Calgary	6030do			
0300-0400	Canada, CHNX Halifax	6130do			
0300-0400	Canada, CKZN St John's	6160do			
0300-0400	Canada, CKZU Vancouver	6160do			
0300-0400	China, China Radio Intl	9690na			
0300-0400	Costa Rica,RF Peace Intl	6975am	15050am		
0300-0305	Croatia, Croatian Radio	9925na			
0300-0400	Cuba, Radio Havana	6000na	9820na	13605na	
0300-0327	Czech Rep, Radio Prague	7345na	9435na		
0300-0400	Ecuador, HCJB	9745am	12015na	21455am	
0300-0330	Egypt, Radio Cairo	9475am			
0300-0350	Germany, Deutsche Welle	6085na	6145na	6185na	9535na
		9640na			
0300-0400	Germany,Overcomer Ministr	3975eu	9500as		
0300-0400	Guatemala.TGNA/R Cultural	3300do			
0300-0400 irreg	Iraq, Radio Iraq Intl	11785eu			
0300-0400	Ireland, Unt Christian BC	6200do			
0300-0400 as/vl	Italy, IRRS	7120va			
0300-0400	Japan, R Japan/NHK World	17685pa	17825ca	17855as	
0300-0400	Kenya, Kenya Broadc Corp	4885do	4935do		
0300-0400 vl	Lesotho, Radio Lesotho	4800do			
0300-0400	Malaysia, Radio	7295do			
0300-0330 mtwhfa	Mexico, Radio Mexico Intl	5985na	9705na		
0300-0325	Moldova, R Moldova Intl	7520na	9665na		
0300-0400 vl	Namibia, NBC	3270af	3289af		
0300-0325	Netherlands, Radio	9855as	11655as		
0300-0400	New Zealand, R NZ Intl	17675pa			
0300-0400 vl	Papua New Guinea, NBC	9675do			
0300-0330 vl	Philippines, R Pilipinas	11885as	15120as	15270as	
0300-0400	Russia,Voice of Russia WS	7125na	7180na	9825na	12000na
		12050na	13640na	13790na	15425na
		15455na	15595na		
0300-0330	S Africa, Channel Africa	5955af			
0300-0400	Singapore,RCorp Singapore	6150do			
0300-0400	Sri Lanka, Sri Lanka BC	9730as	15425as		
0300-0400	Taiwan, Radio Taipei Intl	5950na	9680na	11745as	11825as
		15345as			
0300-0400 vl	Tanzania, Radio	5050do			
0300-0330	Thailand, Radio	9655am	11905am	15395na	
0300-0400	Turkey, Voice of	7270as	9655va	17705as	
0300-0315 mtwhf	Uganda, Radio	4976do			
0300-0400	UK, BBC African Service	3255af	6005af	6190af	9600af
		11730af			
0300-0400	UK, BBC Asian Service	9605as	15310as	15360as	17790as
		21660as			
0300-0330	UK, BBC World Service	5970sa	5975am	6175na	6195eu
		9410eu	9895am	9915sa	11760me
		12095me			
0300-0400	Ukraine, R Ukraine Intl	6020eu	6080eu	7410eu	9550na
		12040na	13590na		
0300-0400	USA, KAIJ Dallas TX	5810am			
0300-0400	USA, KTBN Salt Lk City UT	7510am			
0300-0400	USA, KVOH Los Angeles CA	9975am			
0300-0400	USA, KWHR Naalehu HI	17510as			
0300-0400	USA, Voice of America	6080af	6115af	7105af	7275af
		7290af	7340af	9575af	9885af
		11695af			
0300-0330 smtwh	USA, Voice of America	4960af			
0300-0400	USA, WEWN Birmingham AL	5825eu			
0300-0400 twhfa	USA, WGTG McCaysville GA	5085am			
0300-0400	USA, WHRA Greenbush ME	9400me			
0300-0400	USA, WHRI Noblesville IN	5745am	7315am		
0300-0400	USA, WINB Red Lion PA	11950am			
0300-0400	USA, WJCR Upton KY	7490na	13595na		
0300-0400	USA, WMLK Bethel PA	9465am			
0300-0400 m	USA, WRMI/R Miami Intl	9955ca			
0300-0400 twhfas	USA, WSHB Cypress Crk SC	5850na			
0300-0400 irreg	USA, WWBS Macon GA	11905na			
0300-0400	USA, WWCR Nashville TN	3215am	5070am	5935am	7435am
0300-0400	USA, WYFR Okeechobee FL	6065na	9505na		
0300-0310	Vatican State, Vatican R	7305ca	9605am		
0300-0400	Zambia, Natl BC Corp	6165do	6265do		
0300-0400 vl	Zimbabwe, Zimbabwe BC	3306do	4828do		
0310-0340	Vatican State, Vatican R	7360af	9660af		
0330-0357	Czech Rep, Radio Prague	9480va	11600as		
0330-0400 vl	Philippines, R Pilipinas	13770as	15330as	17730as	
0330-0400	Sweden, Radio	9475am	11665am		
0330-0355	UAE, Radio Dubai	12005na	13675na	15400na	
0330-0400	UK, BBC African Service	9610af			
0330-0400	UK, BBC Asian Service	11955as	15280as	15310as	
0330-0400	UK, BBC World Service	5975am	6175na	9895am	11760me
		12095me			
0330-0400 s	UK, BBC World Service	6180eu	6195eu	9410eu	
0330-0400	Vietnam, Voice of	5905am	7260am		
0340-0350	Greece, Voice of	7450na	9375na	9420na	11645na
0345-0400	Burundi, Radio Nationale	6140do			
0345-0400	Tajikistan, R Dushanbe	7245as	9905as	11620as	
0345-0400 as	Uganda, Radio	4976do			
0356-0400	Zambia, Christian Voice	3330af	6065af		

Selected Programs

Sundays

0300 Turkey, Voice of: News.
0300 Australia, Radio: RA News.
0300 Guatemala, TGNA: Back to the Bible.
0305 Australia, Radio: Feedback.
0306 Germany, Deutsche Welle: Weekend Review.
0311 Turkey, Voice of: Review of the Day's Turkish Press.
0314 Germany, Deutsche Welle: Spectrum.
0314 Turkey, Voice of: Outlook.
0319 Turkey, Voice of: Musical Interlude.
0323 Turkey, Voice of: VOT DX Corner (biweekly).
0330 Australia, Radio: Correspondents' Report.
0333 Vatican State, Vatican Radio: News of the Church.
0338 Turkey, Voice of: Turkish Songs.
0343 Vatican State, Vatican Radio: African News Panorama

Mondays

0300 Germany, Deutsche Welle: News.
0300 Turkey, Voice of: News.
0300 Australia, Radio: RA News.
0304 Turkey, Voice of: Review of the Day's Turkish Press.
0305 Croatia, Croatian Radio: News.
0306 Germany, Deutsche Welle: Religion and Society.
0308 Turkey, Voice of: Turkish Customs and Traditions.
0310 Australia, Radio: The World Today (Part 2).
0315 Germany, Deutsche Welle: Arts on the Air.
0318 Turkey, Voice of: Turkish Songs.
0320 Vatican State, Vatican Radio: News from the African Church.
0330 Vatican State, Vatican Radio: African News Panorama.
0331 Turkey, Voice of: As the World Turns.
0340 Greece, Voice of: News.

Tuesdays

0300 Turkey, Voice of: News.
0300 New Zealand, Radio NZ Intl: RNZ News.
0300 Taiwan, Radio Taipei Intl: News.
0305 Vatican State, Vatican Radio: Postcards from Rome.
0305 Croatia, Croatian Radio: News.
0306 Germany, Deutsche Welle: NewsLink.
0307 Czech Rep, Radio Prague: Press Review.
0309 Czech Rep, Radio Prague: Magazine '98.
0311 Turkey, Voice of: Review of the Day's Turkish Press.
0315 Turkey, Voice of: Last Week.
0315 Taiwan, Radio Taipei Intl: Jade Bells and Bamboo Pipes.
0320 Vatican State, Vatican Radio: News.
0322 Turkey, Voice of: Turkish Songs.
0329 Turkey, Voice of: Science in Turkey.
0330 Germany, Deutsche Welle: Man and Environment.
0338 Turkey, Voice of: Turkish Portraits.
0342 Sweden, Radio: SportScan.

Wednesdays

0300 Australia, Radio: RA News.
0300 USA, KWHR Naalehu HI: UPI News.
0300 USA, Voice of America: Daybreak Africa.
0306 Vatican State, Vatican Radio: What Can I Do?
0306 Germany, Deutsche Welle: NewsLink.
0309 Turkey, Voice of: Review of the Day's Turkish Press.
0310 Australia, Radio: The World Today (Part 2).
0314 Turkey, Voice of: Prominent Turks in History.
0315 USA, KVOH Los Angeles CA: Strength for the Day.
0324 Turkey, Voice of: That Magnificient Sultan Sulleyman.
0330 Germany, Deutsche Welle: Insight.
0334 Turkey, Voice of: In the Wake of an Essay Writing Contest.
0336 USA, Voice of America: Dateline.
0340 Greece, Voice of: News.
0342 Turkey, Voice of: Turkish Songs.

Thursdays

0300 Turkey, Voice of: News.
0300 Australia, Radio: RA News.
0300 Taiwan, Radio Taipei Intl: News.
0305 Vatican State, Vatican Radio: Postcards from Rome.
0305 Croatia, Croatian Radio: News.
0306 Germany, Deutsche Welle: NewsLink.
0307 Czech Rep, Radio Prague: Press Review.
0310 Czech Rep, Radio Prague: From the Archives.
0310 Turkey, Voice of: A Review of the Foreign Media.
0310 Australia, Radio: The World Today (Part 2).
0315 Taiwan, Radio Taipei Intl: Taiway Today.
0317 Czech Rep, Radio Prague: The Arts.
0319 Turkey, Voice of: Letter Box.
0330 Germany, Deutsche Welle: Living in Germany.
0330 Taiwan, Radio Taipei Intl: Miss Mook's Big Countdown.
0338 Turkey, Voice of: Turkish Decorative Arts.
0340 Czech Rep, Radio Prague: From the Archives.

Fridays

0300 Australia, Radio: RA News.
0300 Taiwan, Radio Taipei Intl: News.
0305 Vatican State, Vatican Radio: Think of It this Way.
0305 Croatia, Croatian Radio: News.
0306 Germany, Deutsche Welle: NewsLink.
0308 Turkey, Voice of: Review of the Day's Turkish Press.
0310 Australia, Radio: The World Today (Part 2).
0314 Turkey, Voice of: I Am Antolia.
0315 Taiwan, Radio Taipei Intl: Jade Bells and Bamboo Pipes.
0322 Turkey, Voice of: Impressions of Turkey.
0330 Germany, Deutsche Welle: Spotlight on Sport.
0332 Turkey, Voice of: Elements of Anatolian Culture.
0337 Turkey, Voice of: Turkish Songs.

Saturdays

0300 South Africa, Channel Africa: Network Africa.
0300 Turkey, Voice of: News.
0305 Vatican State, Vatican Radio: Ask the Abbot.
0305 Australia, Radio: Book Reading.
0306 Germany, Deutsche Welle: NewsLink.
0307 Turkey, Voice of: Review of the Day's Turkish Press.
0311 Turkey, Voice of: Turkish Album.
0315 Taiwan, Radio Taipei Intl: Taipei Magazine.
0328 Turkey, Voice of: Sacred Sites of Turkey.
0335 Taiwan, Radio Taipei Intl: Life on the Outside.
0336 USA, Voice of America: Communications World (B).
0338 Turkey, Voice of: Cross Sections of Turkey's Recent History (biweekly).

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Frequencies

0400-0500	Anguilla,Caribbean Beacon	6090am			
0400-0500	Australia, Radio	9660pa	12080as	15240pa	15415as
		15510pa	17715pa	17750as	21725pa
0400-0500 vl	Australia, VL8K Katherine	5025do			
0400-0500 vl	Australia, VL8T Tent Crk	4910do			
0400-0500	Australia,DefenseForces R	14790as			
0400-0500	Canada, CBC N Quebec Svc	9625do			
0400-0500	Canada, CFRX Toronto	6070do			
0400-0500	Canada, CFVP Calgary	6030do			
0400-0500	Canada, CHNX Halifax	6130do			
0400-0500	Canada, CKZN St John's	6160do			
0400-0500	Canada, CKZU Vancouver	6160do			
0400-0429	Canada, R Canada Intl	9715me	11835me	11975me	
0400-0500	China, China Radio Intl	9560na	9730am		
0400-0500	Costa Rica,RF Peace Intl	6975am	15050am		
0400-0405	Croatia, Croatian Radio	5945eu			
0400-0500	Cuba, Radio Havana	6000na	9820na	13605na	
0400-0500	Ecuador, HCJB	9745na	12015am	21455am	
0400-0450	Germany, Deutsche Welle	5990af	6015af	7225af	9565af
		11765af			
0400-0500	Germany,Overcomer Ministr	3975eu	11910as		
0400-0500 vl	Guatemala,TGNA/R Cultural	3300do			
0400-0500	Ireland, Unt Christian BC	6200do			
0400-0415	Israel, Kol Israel	9435eu	11605eu	17535na	
0400-0500 as/vl	Italy, IRRS	7120va			
0400-0500	Kenya, Kenya Broadc Corp	4885do	4935do		
0400-0410 vl/m-f	Malawi, MBC	5993do			
0400-0500	Malaysia, Radio	7295do			
0400-0500 vl	Malaysia, RTM Kuching	7160do			
0400-0430 mwhf	Mexico, Radio Mexico Intl	5985na	9705na		
0400-0425	Moldova, R Moldova Intl	7520na			
0400-0458	New Zealand, R NZ Intl	17675pa			
0400-0430 m	Norway, Radio Norway Intl	9445na			
0400-0500 vl	Papua New Guinea, NBC	9675do			
0400-0500	Romania, R Romania Intl	9570na	11940na	15325as	17720as
0400-0500	Russia,Voice of Russia WS	7180na	9825na	12000na	12050na
		13645na	13790na	15425na	15495na
		15595na			
0400-0430	S Africa, Channel Africa	5955af			
0400-0500	Singapore,RCorp Singapore	6150do			
0400-0430	Sri Lanka, Sri Lanka BC	9730as	15425as		
0400-0430	Switzerland, Swiss R Intl	5840eu	6165eu	9885am	9905am
0400-0500 vl	Tanzania, Radio	5050do			
0400-0415	Uganda, Radio	4976do			
0400-0500	UK, BBC African Service	3255af	6005af	6190af	7160af
		9600af	15420af		
0400-0500	UK, BBC Asian Service	9605as	11955as	15280as	15310as
		17790as	21660as		
0400-0430	UK, BBC World Service	3955eu	5975am	6175na	6180eu
		6195eu	9410eu	9895am	11760me
		12095eu	15575as	17640eu	
0400-0500	USA, KAIJ Dallas TX	5810am			
0400-0500	USA, KTBN Salt Lk City UT	7510am			
0400-0500	USA, KVOH Los Angeles CA	9975am			
0400-0500	USA, KWHR Naalehu HI	17780as			
0400-0500	USA, Voice of America	6080af	7170af	7265af	7275af
		7290af	9575af	9885af	11965me
		15205va			
0400-0500	USA, WEWN Birmingham AL	5825eu			
0400-0500 twhfa	USA, WGTG McCaysville GA	5085am			
0400-0500	USA, WHRA Greenbush ME	9400me			
0400-0500	USA, WHRI Noblesville IN	5745am	7315am		
0400-0500	USA, WINB Red Lion PA	11950am			
0400-0500	USA, WJCR Upton KY	7490na	13595na		
0400-0500	USA, WMLK Bethel PA	9465am			
0400-0500 mtwhfa	USA, WRMI/R Miami Intl	9955ca			
0400-0500 w	USA, WSHB Cypress Crk SC	9840af			
0400-0500	USA, WWCR Nashville TN	3210am	5070am	5935na	7435am
0400-0500	USA, WYFR Okeechobee FL	6065na	9505na	9985va	
0400-0500	Zambia, Christian Voice	3330af	6065af		
0400-0500	Zambia, Natl BC Corp	6165do	6265do		
0400-0500 vl	Zimbabwe, Zimbabwe BC	3306do	4828do		
0425-0440 vl	Italy, RAI Intl	5975af	7270af		
0425-0500	Nigeria, FRCN/Radio	3326do	4770do	4990do	6025do
0430-0500	Austria, R Austria Intl	6155eu	13730eu		
0430-0500 a	Kyrgyzstan, Kyrgyz Radio	4010do			
0430-0500 vl	Lesotho, Radio Lesotho	4800do			
0430-0500	Netherlands, Radio	6165na	9590na		
0430-0500	Serbia, Radio Yugoslavia	9580na	11870na		
0430-0500	Swaziland, Trans World R	3200af	4775af		
0430-0500	Switzerland, Swiss R Intl	9885na	9905na		
0430-0500	UK, BBC World Service	5975am	6175am	11760me	15575as
		17640me			
0430-0500 as	UK, BBC World Service	3955eu	6180eu	6195eu	9410eu
		12095eu			
0455-0500	Nigeria, Voice of	7255af	15120af		
0459-0500	New Zealand, R NZ Intl	11905pa			

Selected Programs

Sundays

0400 Australia, Radio: RA News.
0400 Ecuador, HCJB Quito (am): Latin and International News.
0400 Switzerland, Swiss Radio Intl: News.
0405 Australia, Radio: Pacific Focus #4.
0405 Switzerland, Swiss Radio Intl: Newsnet.
0406 Germany, Deutsche Welle: Weekend Review.
0409 Ecuador, HCJB Quito (am): HCJB DX Partyline.
0414 Germany, Deutsche Welle: Inside Europe.
0415 Switzerland, Swiss Radio Intl: Capital Letters (2/4).
0415 Switzerland, Swiss Radio Intl: Sounds Good (3/5).
0438 Netherlands, Radio (am): Newsline.
0454 Netherlands, Radio (am): Weekend.

Mondays

0400 Australia, Radio: RA News.
0400 Ecuador, HCJB Quito (am): Latin and International News.
0405 Switzerland, Swiss Radio Intl: Newsnet.
0430 Switzerland, Swiss Radio Intl: Rendez-vous with Switzerland.
0430 Swaziland, Trans World Radio: Bible College.
0436 Serbia, RYugoslavia: Commentary.
0436 Netherlands, Radio (am): Sincerely Yours.
0439 Serbia, RYugoslavia: Cultural Panorama.
0445 Serbia, RYugoslavia: Weekly Concert.
0446 Switzerland, Swiss Radio Intl: Capital Letters (2/4).

Tuesdays

0400 Australia, Radio: RA News.
0400 Ecuador, HCJB Quito (am): News.
0400 Switzerland, Swiss Radio Intl: News.
0400 USA, WEWN Birmingham AL: The Sacraments.
0400 Zimbabwe, Zimbabwe BC: News.
0405 Switzerland, Swiss Radio Intl: Newsnet.
0406 Germany, Deutsche Welle: NewsLink.
0410 Australia, Radio: The World Today (Part 3).
0410 Ecuador, HCJB Quito (am): Studio 9.
0411 Zimbabwe, Zimbabwe BC: Radio Three.
0430 Germany, Deutsche Welle: Good Morning Africa.
0430 Ecuador, HCJB Quito (am): You Should Know.
0430 USA, KTBN Salt Lk City UT: Doctor to Doctor.
0430 Switzerland, Swiss Radio Intl: Rendez-vous with Switzerland.
0438 Netherlands, Radio (am): Newsline.

Wednesdays

0400 Guatemala, TGNA: Insight for Living.
0400 Australia, Radio: RA News.
0400 Ecuador, HCJB Quito (am): News.
0405 Switzerland, Swiss Radio Intl: Newsnet.
0406 Germany, Deutsche Welle: NewsLink.
0410 Ecuador, HCJB Quito (am): Studio 9.
0430 Germany, Deutsche Welle: Good Morning Africa.
0430 Ecuador, HCJB Quito (am): El Mundo Futuro.
0430 Switzerland, Swiss Radio Intl: Rendez-vous with Switzerland.
0430 Serbia, RYugoslavia: News.
0438 Netherlands, Radio (am): Newsline.
0440 Serbia, RYugoslavia: Press Review.
0444 Serbia, RYugoslavia: Economic Review.
0448 Serbia, RYugoslavia: Yugoslav Musical Heritage.

Thursdays

0400 Guatemala, TGNA: Insight for Living.
0400 Ecuador, HCJB Quito (am): News.
0400 USA, KAIJ Dallas TX: World University Network.
0400 USA, KVOH Los Angeles CA: Joni and Friends.
0400 Switzerland, Swiss Radio Intl: News.
0405 Switzerland, Swiss Radio Intl: Newsnet.
0406 Germany, Deutsche Welle: NewsLink.
0410 Ecuador, HCJB Quito (am): Studio 9.
0411 Israel, Kol Israel: Review of the Paper Press.
0430 Germany, Deutsche Welle: Good Morning Africa.
0430 Ecuador, HCJB Quito (am): Ham Radio Today.
0430 Switzerland, Swiss Radio Intl: Rendez-vous with Switzerland.
0430 Serbia, RYugoslavia: News.
0438 Netherlands, Radio (am): Newsline.
0453 Netherlands, Radio (am): Documentary.

Fridays

0400 Israel, Kol Israel: News.
0400 Guatemala, TGNA: Insight for Living.
0400 Australia, Radio: RA News.
0400 Ecuador, HCJB Quito (am): News.
0400 Zimbabwe, Zimbabwe BC: News.
0405 Switzerland, Swiss Radio Intl: Newsnet.
0406 Germany, Deutsche Welle: NewsLink.
0410 Ecuador, HCJB Quito (am): Studio 9.
0411 Israel, Kol Israel: Review of the Paper Press.
0411 Zimbabwe, Zimbabwe BC: Radio Three.
0415 USA, WRMI/R Miami Intl: Words of the Spirit.
0430 Germany, Deutsche Welle: Good Morning Africa.
0430 Ecuador, HCJB Quito (am): Woman to Woman.
0430 Switzerland, Swiss Radio Intl: Rendez-vous with Switzerland.
0438 Netherlands, Radio (am): Newsline.
0453 Netherlands, Radio (am): Media Network.

Saturdays

0400 Israel, Kol Israel: News.
0400 Australia, Radio: RA News.
0400 Costa Rica, R for Peace Intl: World of Radio.
0400 Ecuador, HCJB Quito (am): News.
0400 Germany, Deutsche Telekom: The Overcomer Broadcast.
0405 Switzerland, Swiss Radio Intl: Newsnet.
0406 Germany, Deutsche Welle: NewsLink.
0410 Ecuador, HCJB Quito (am): Studio 9.
0411 Russia, Voice of: Science and Engineering in the CIS.
0415 USA, KVOH Los Angeles CA: What's New.
0425 Cuba, Radio Havana Cuba: Music.
0430 Germany, Deutsche Welle: German by Radio.
0430 Ecuador, HCJB Quito (am): Musica del Ecuador.
0430 Switzerland, Swiss Radio Intl: Rendez-vous with Switzerland.
0438 Netherlands, Radio (am): Newsline.
0453 Netherlands, Radio (am): A Good Life.

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Frequencies

0500-0600	Anguilla,Caribbean Beacon	6090am			
0500-0600	Australia, Radio	9660pa	12080as	15240pa	15510pa
		17715pa	21820pa		
0500-0600 vl	Australia, VL8K Katherine	5025do			
0500-0600 vl	Australia, VL8T Tent Crk	4910do			
0500-0600 vl	Cameroon, Radio Cameroon	4850do			
0500-0600	Canada, CBC N Quebec Svc	9625do			
0500-0600	Canada, CFRX Toronto	6070do			
0500-0600	Canada, CFVP Calgary	6030do			
0500-0600	Canada, CHNX Halifax	6130do			
0500-0600	Canada, CKZU Vancouver	6160do			
0500-0529 mtwhf	Canada, R Canada Intl	7295eu	9595eu	11835af	15430af
0500-0600	Costa Rica,RF Peace Intl	6975am	15050am		
0500-0505	Croatia, Croatian Radio	5945eu	9830eu	13830au	
0500-0600	Cuba, Radio Havana	9550na	9820na	9830na	
0500-0600	Ecuador, HCJB	9745na	12015na	21455am	
0500-0550	Germany, Deutsche Welle	6045na	6185na	9615am	11810na
0500-0600	Germany,Overcomer Ministr	3975eu	11910as		
0500-0600	Ireland, Unt Christian BC	6200do			
0500-0600 vl	Italy, IRRS	3985va			
0500-0600	Japan, R Japan/NHK World	6110na	7230eu	9835na	11715as
		11760as	11840as	11850pa	15230pa
		17810as			
0500-0600	Kenya, Kenya Broadc Corp	4885do	4935do		
0500-0530 vl	Lesotho, Radio Lesotho	4800do			
0500-0600	Liberia, Star Radio	3400do			
0500-0600	Liberia,LCN/R Liberia Int	5100do			
0500-0510 vl/m-f	Malawi, MBC	5993do			
0500-0600	Malaysia, Radio	7295do			
0500-0600 vl	Malaysia, RTM Kuching	4895do	7160do		
0500-0600 vl	Namibia, NBC	3270af	3289af		
0500-0525	Netherlands, Radio	6165na	9590na		
0500-0600	New Zealand, R NZ Intl	11905pa			
0500-0505	Nigeria, FRCN/Radio	3326do	4770do	4990do	
0500-0600	Nigeria, Voice of	7255af	15120af		
0500-0557	North Korea, R Pyongyang	3560eu	11710eu	13790eu	
0500-0600 vl	Papua New Guinea, NBC	9675do			
0500-0600	Russia,Voice of Russia WS	9450au	17495au	17665au	21760au
		21790au			
0500-0530	S Africa, AWR Africa	6000af	6100af		
0500-0530	S Africa, Channel Africa	9525af			
0500-0600	Singapore,RCorp Singapore	6150do			
0500-0600	Spain, R Exterior Espana	6055am			
0500-0600 vl	Tanzania, Radio	5050do			
0500-0515	Uganda, Radio	4976do			
0500-0600	UK, BBC African Service	3255af	6005af	6190af	7160af
		9600af	15420af	17885af	
0500-0600	UK, BBC Asian Service	9740as	11955as	15280as	15310as
		15360as	17760as	17790as	21660as
0500-0600	UK, BBC World Service	3955eu	5975am	6175am	6180eu
		6195eu	9410eu	11760me	12095eu
		15575eu	17640me		
0500-0600	USA, KAIJ Dallas TX	5810am			
0500-0600	USA, KTBN Salt Lk City UT	7510am			
0500-0600	USA, KVOH Los Angeles CA	9975ca			
0500-0600	USA, KWHR Naalehu HI	17780as			
0500-0600	USA, Voice of America	5970af	6035af	6080af	7170eu
		7195af	9630af	11965me	12080af
		15205eu			
0500-0600	USA, WHRA Greenbush ME	11565af			
0500-0600	USA, WHRI Noblesville IN	5745am	7315am		
0500-0600	USA, WINB Red Lion PA	11950am			
0500-0600	USA, WJCR Upton KY	7490na	13595na		
0500-0600	USA, WMLK Bethel PA	9465am			
0500-0600 mtwhf	USA, WRMI/R Miami Intl	9955ca			
0500-0600 w	USA, WSHB Cypress Crk SC	7535eu	9835af		
0500-0600	USA, WWCR Nashville TN	2390am	3210am	5070am	5935am
0500-0600	USA, WYFR Okeechobee FL	5985na	9985eu	11580af	
0500-0530	Vatican State, Vatican R	4005eu	5883eu	7250eu	9660af
		11625af	15570af		
0500-0600	Zambia, Christian Voice	3330af	6065af		
0500-0600	Zambia, Natl BC Corp	6165do	6265do		
0500-0530 vl	Zimbabwe, Zimbabwe BC	3306do	4828do		
0505-0600	Swaziland, Trans World R	3200af	4775af	9500af	
0520-0530	Vatican State, Vatican R	9660af	11625af	15570af	
0525-0600	Ghana, Ghana Broadc Corp	3366do	4915do		
0530-0600	Austria, R Austria Intl	6015na			
0530-0600	Switzerland, Swiss R Intl	5840eu	6165eu		
0530-0600	Thailand, Radio	9655eu	11905eu	15445eu	
0530-0600	UAE, Radio Dubai	17830eu	21605eu		
0530-0600 vl	Zimbabwe, Zimbabwe BC	4828do	5012do		
0555-0600	Malaysia, Voice of	6175as	9750as	15295au	

Selected Programs

Sundays

0500 Vatican State, Vatican Radio: With Heart and Mind.
0500 South Africa, Channel Africa: News.
0500 Australia, Radio: RA News.
0500 Ecuador, HCJB Quito (am): Musical Mailbag.
0500 USA, KWHR Naalehu HI: Breakthrough.
0505 Australia, Radio: Oz Sounds #1.
0506 Germany, Deutsche Welle: Weekend Review.
0508 Vatican State, Vatican Radio: On-the-Air.
0510 Spain, R Exterior de Espana: Window on Spain.
0515 Germany, Deutsche Welle: Marks and Markets.
0523 Spain, R Exterior de Espana: Distance Unknown.
0530 Australia, Radio: Media Report.
0530 USA, WWCR #1 Nashville TN: The Lutheran Reformation Hour.
0533 Spain, R Exterior de Espana: Spanish Poparama.

Mondays

0500 Vatican State, Vatican Radio: To the Ends of the Earth.
0500 Vatican State, Vatican Radio: News from the African Church.
0500 Australia, Radio: RA News.
0500 Ecuador, HCJB Quito (am): Radio Reading Room.
0500 USA, WWCR #1 Nashville TN: Rock the Universe.
0506 Germany, Deutsche Welle: Mailbag.
0511 Spain, R Exterior de Espana: Visitors Book.
0515 Germany, Deutsche Welle: COOL.
0515 USA, WWCR #3 Nashville TN: The Old Time Religior Hour.
0530 Ecuador, HCJB Quito (am): The Sower.
0530 Nigeria, Voice of: VONSCOPE.
0530 USA, WWCR #3 Nashville TN: The Hour of Courage.
0538 Spain, R Exterior de Espana: Radio Club.

Tuesdays

0500 Vatican State, Vatican Radio: A Room with a View of the Vatican.
0500 USA, KTBN Salt Lk City UT: Jack Van Impe Presents
0506 Germany, Deutsche Welle: NewsLink.
0515 Vatican State, Vatican Radio: Ask the Abbot.
0515 USA, WWCR #3 Nashville TN: The Old Time Religior Hour.
0521 Vatican State, Vatican Radio: African News Panorama.
0530 Spain, R Exterior de Espana: Press Review.
0530 Ecuador, HCJB Quito (am): Let My People Think.
0530 USA, KTBN Salt Lk City UT: This is Your Day!
0530 USA, WWCR #3 Nashville TN: The Hour of Courage.
0533 Spain, R Exterior de Espana: Entertainment in Spain.
0545 Spain, R Exterior de Espana: Spanish Course by Radio.

Wednesdays

0500 Vatican State, Vatican Radio: The Rome Report.
0500 Vatican State, Vatican Radio: The Environment.
0500 Australia, Radio: RA News.
0506 Germany, Deutsche Welle: NewsLink.
0510 Vatican State, Vatican Radio: News from the African Church.
0515 USA, WWCR #3 Nashville TN: The Old Time Religion Hour.
0516 Vatican State, Vatican Radio: What Can I Do?
0530 Ecuador, HCJB Quito (am): Unshackled.
0530 USA, KTBN Salt Lk City UT: This is Your Day!
0530 USA, WWCR #3 Nashville TN: The Hour of Courage.

Thursdays

0500 Vatican State, Vatican Radio: The Pope and the People.
0500 South Africa, Channel Africa: News.
0500 Vatican State, Vatican Radio: News of the Church.
0500 Australia, Radio: RA News.
0505 Vatican State, Vatican Radio: Pilgrim City.
0505 South Africa, Channel Africa: Dateline Africa.
0506 Germany, Deutsche Welle: NewsLink.
0510 Australia, Radio: Pacific Beat (Afternoon Edition) (Part 1).
0512 Vatican State, Vatican Radio: African News Panorama.
0514 Vatican State, Vatican Radio: Postcards from Rome.
0515 USA, WWCR #3 Nashville TN: The Old Time Religion Hour.
0517 Vatican State, Vatican Radio: Health and Healing.
0523 Vatican State, Vatican Radio: Communication Update.
0530 Germany, Deutsche Welle: Living in Germany.
0530 Australia, Radio: Sport.
0530 USA, WWCR #3 Nashville TN: The Hour of Courage.

Fridays

0500 Vatican State, Vatican Radio: Then and Now.
0500 Australia, Radio: RA News.
0506 Germany, Deutsche Welle: NewsLink.
0515 USA, WWCR #3 Nashville TN: The Old Time Religion Hour.
0530 Germany, Deutsche Welle: Spotlight on Sport.
0530 USA, WWCR #3 Nashville TN: The Hour of Courage.

Saturdays

0500 Vatican State, Vatican Radio: By the Way....
0500 Vatican State, Vatican Radio: News.
0500 Spain, R Exterior de Espana: The News from Spain.
0500 Australia, Radio: RA News.
0500 Germany, Deutsche Telekom: The Overcomer Broadcast.
0505 Australia, Radio: Oz Sounds #2.
0506 Vatican State, Vatican Radio: Roundtable Discussion.
0506 Germany, Deutsche Welle: Newslink.
0526 Spain, R Exterior de Espana: Press Review.
0530 Germany, Deutsche Welle: German by Radio.
0530 Australia, Radio: The Sports Factor.
0530 USA, KTBN Salt Lk City UT: This is Your Day!
0532 Spain, R Exterior de Espana: Arts Review.
0550 Spain, R Exterior de Espana: A Spanish Course by Radio.

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0600 UTC SHORTWAVE GUIDE 2:00 AM EDT 11:00 PM PDT

Frequencies

0600-0700	Anguilla,Caribbean Beacon	6090am			
0600-0700	Australia, Radio	9660pa	12080as	15240pa	15415as
		15510pa	17715pa	17750as	21725pa
0600-0700 vl	Australia, VL8K Katherine	5025do			
0600-0700 vl	Australia, VL8T Tent Crk	4910do			
0600-0700 vl	Canada, CBC N Quebec Svc	9625do			
0600-0700	Canada, CFRX Toronto	6070do			
0600-0700	Canada, CFVP Calgary	6030do			
0600-0700	Canada, CHNX Halifax	6130do			
0600-0700	Canada, CKZU Vancouver	6160do			
0600-0700	Costa Rica,RF Peace Intl	6975am	15050am		
0600-0610 mtwhfa	Croatia, Croatian Radio	5945eu	9830eu	13820au	
0600-0700	Cuba, Radio Havana	9550na	9820na	9830na	
0600-0700	Ecuador, HCJB	9745na	12015na	21455am	
0600-0650	Germany, Deutsche Welle	11915af	13790af	15185af	17820as
		17860af	21680me		
0600-0700 vl	Germany, Sunrise Radio	5850va			
0600-0700	Germany,Overcomer Ministr	3975eu	13810au	15755as	
0600-0615	Ghana, Ghana Broadc Corp	3366do	4915do		
0600-0700	Ireland, Unt Christian BC	6200do			
0600-0630 vl	Italy, IRRS	3985va			
0600-0700	Japan, R Japan/NHK World	5975eu	7230eu	9835na	11740as
		11840as	11850pa	17810as	
0600-0700	Kenya, Kenya Broadc Corp	4885do	4935do		
0600-0700	Liberia, Radio Veritas	5470do			
0600-0700	Liberia, Star Radio	3400do			
0600-0700	Liberia,LCN/R Liberia Int	5100do			
0600-0700	Malaysia, Radio	7295do			
0600-0700 vl	Malaysia, RTM Kuching	4895do	7160do		
0600-0625	Malaysia, Voice of	6175as	9750as	15295au	
0600-0700 vl	Namibia, NBC	3270af	3289af		
0600-0700	New Zealand, R NZ Intl	11905pa			
0600-0630	Nigeria, FRCN/Radio	3326do	4770do	4990do	
0600-0700	Nigeria, Voice of	7255af	15120af		
0600-0630 m	Norway, Radio Norway Intl	7180eu	9590eu		
0600-0700 vl	Papua New Guinea, NBC	9675do			
0600-0700	Romania, R Romania Intl	9510na	11940na		
0600-0700	Russia,Voice of Russia WS	9450au	15490au	17495au	17665au
		21760au	21790au		
0600-0630	S Africa, Channel Africa	11900af			
0600-0630	S Africa, Trans World R	11735af			
0600-0610	Sierra Leone, SLBS	3316do			
0600-0700	Singapore,RCorp Singapore	6150do			
0600-0700 vl	Solomon Islands, SIBC	5020do			
0600-0605	Swaziland, Trans World R	4775af	9500af		
0600-0700 vl	Tanzania, Radio	5050do			
0600-0700	UK, BBC African Service	6005af	6190af	7160af	9600af
		11835af	11940af	15420af	17885af
0600-0700	UK, BBC Asian Service	7145pa	9740as	11955pa	15310as
		15360as	17760as	17790as	21660as
0600-0700	UK, BBC World Service	5975am	6175am	6180eu	6195eu
		7325eu	9410eu	11760me	12095eu
		15565eu	15575eu	17640me	
0600-0700	USA, KAIJ Dallas TX	5810am			
0600-0700	USA, KTBN Salt Lk City UT	7510am			
0600-0700	USA, KWHR Naalehu HI	17780as			
0600-0630	USA, Voice of America	5970af	6035af	6080af	7170eu
		7195af	9630af	9680af	11805af
		11965me	11995af	12080af	15205va
0600-0700	USA, WEWN Birmingham AL	5825eu			
0600-0700	USA, WHRA Greenbush ME	11565af			
0600-0700	USA, WHRI Noblesville IN	5745am	7315am		
0600-0700	USA, WJCR Upton KY	7490na	13595na		
0600-0700	USA, WMLK Bethel PA	9465am			
0600-0700 mtwhf	USA, WRMI/R Miami Intl	9955ca			
0600-0700 tf	USA, WSHB Cypress Crk SC	7535eu			
0600-0700	USA, WWCR Nashville TN	2390am	3210am	5070am	5935am
0600-0700	USA, WYFR Okeechobee FL	5985am	7355va		
0600-0700	Yemen, Radio Aden	9780do			
0600-0700	Zambia, Christian Voice	3330af	6065af		
0600-0700	Zambia, Natl BC Corp	6165do	6265do		
0600-0700 vl	Zimbabwe, Zimbabwe BC	4828do	5012do		
0605-0700	Swaziland, Trans World R	4775af	6100af	9500af	
0630-0700	Finland, YLE/R Finland	11945as	17830au		
0630-0700 smtwha	Malta, VO Mediterranean	9600eu			
0630-0700	USA, Voice of America	7170eu	11805af	11965me	15205eu
0630-0700 as	USA, Voice of America	5970af	6035af	6080af	7195af
		9630af	11995af	12080af	
0630-0645	Vatican State, Vatican R	11625af	13765af	15570af	
0630-0645 mtwhfa	Vatican State, Vatican R	4005eu	5883eu	7250eu	9645eu
		11740eu	15595eu		
0641-0656	Romania, R Romania Intl	9550eu	9625eu	9665eu	11885eu
0645-0655 s	Albania, TWR Tirana	9685eu			
0645-0655 as	Monaco, Trans World Radio	9755eu			
0645-0700	Vatican State, Vatican R	11625af	13765af	15570af	
0655-0700	Albania, TWR Tirana	9685eu			
0655-0700 mtwhf	Monaco, Trans World Radio	9755eu			

Selected Programs

Sundays

0600 UK, BBC London (af/as pac/south as): World News.
0600 UK, BBC London (am/eu): Newsday.
0615 UK, BBC London (af): Development '97. Aid and development issues.
0615 UK, BBC London (as pac): Letter from America.
0615 UK, BBC London (south as): Letter from America.
0630 UK, BBC London (am): Play of the Week. A different radio drama program each week.
0630 UK, BBC London (af): African News.
0630 UK, BBC London (as pac/south as): Meridian. One of the topical programs weekly about the world of the arts.
0630 UK, BBC London (eu): Jazz for the Asking. Record requests with Malcolm Laylock.
0631 UK, BBC London (af): African Perspective. A considered view of life and issues facing the African continent.

Mondays

0600 Ecuador, HCJB Quito (am): Mountain Meditations.
0600 USA, WWCR #1 Nashville TN: USA Radio News.
0605 USA, WWCR #1 Nashville TN: The Hour of Courage.
0615 Nigeria, Voice of: Nigeria and Politics.
0630 Nigeria, Voice of: World News.
0630 Ecuador, HCJB Quito (am): Musica del Ecuador.

Tuesdays

0600 Germany, Deutsche Telekom: The Overcomer Broadcast.
0630 Nigeria, Voice of: World News.
0630 Ecuador, HCJB Quito (am): Nightsounds.
0640 Nigeria, Voice of: Commentary.
0645 Nigeria, Voice of: News about Nigeria.
0652 Vatican State, Vatican Radio: African News Panorama.
0655 Nigeria, Voice of: Program Announcements.

Wednesdays

0630 Nigeria, Voice of: World News.
0630 Ecuador, HCJB Quito (am): Nightsounds.
0630 Vatican State, Vatican Radio: Update.
0640 Nigeria, Voice of: Commentary.
0645 Nigeria, Voice of: News about Nigeria.
0655 Nigeria, Voice of: Program Announcements.

Thursdays

0600 Nigeria, Voice of: West African Scene.
0630 Nigeria, Voice of: World News.
0630 Ecuador, HCJB Quito (am): Nightsounds.
0630 Vatican State, Vatican Radio: News.
0640 Nigeria, Voice of: Commentary.
0644 Vatican State, Vatican Radio: Health and Healing.
0645 Nigeria, Voice of: News about Nigeria.
0652 Vatican State, Vatican Radio: African News Panorama.
0655 Nigeria, Voice of: Program Announcements.

Fridays

0630 Nigeria, Voice of: World News.
0630 Ecuador, HCJB Quito (am): Nightsounds.
0640 Nigeria, Voice of: Commentary.
0645 Nigeria, Voice of: News about Nigeria.
0652 Vatican State, Vatican Radio: African News Panorama.
0655 Nigeria, Voice of: Program Announcements.

Saturdays

0600 Germany, Deutsche Welle: News.
0600 Anguilla, Caribbean Beacon: World University Network.
0600 Australia, Radio: RA News.
0600 Germany, Deutsche Telekom: The Overcomer Broadcast.
0600 USA, KAIJ Dallas TX: World University Network.
0600 USA, WWCR #3 Nashville TN: World of Radio.
0605 Australia, Radio: Feedback.
0608 Germany, Deutsche Welle: NewsLink.
0630 Ecuador, HCJB Quito (am): Nightsounds.
0630 Vatican State, Vatican Radio: The Gospel.
0635 Vatican State, Vatican Radio: Reflection.
0641 Vatican State, Vatican Radio: Justics and Peace.
0650 Vatican State, Vatican Radio: News of the Church.
0654 Vatican State, Vatican Radio: African News Panorama.

Thank You...

Additional contributors to this month's Shortwave Guide:

Joe Brashier/WHRI; Bob Fraser, Cohasset, MA; Harold Frodge, Midland, MI; Glenn Hauser, Enid, OK/*World of Radio & DX Report*; Al Quaglieri, Albany, NY; Adrian Sainsbury, RNZ Intl; Harold Sellers, Canada/*HCDX*; Lee Silvi, Mentor, OH: Jeff White/WRMI; BBCMS/*World Media*; *Cumbre DX*; *NASWA Journal*/LN; LUsenet newsgroups.

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FREQUENCIES

0700-0800	Anguilla,Caribbean Beacon	6090am			
0700-0800	Australia, Radio	9660pa	12080as	15240pa	15415as
		15510pa	17715pa	17750as	21725pa
0700-0800 vl	Australia, VL8K Katherine	5025do			
0700-0800 vl	Australia, VL8T Tent Crk	4910do			
0700-0800	Canada, CFRX Toronto	6070do			
0700-0800	Canada, CFVP Calgary	6030do			
0700-0800	Canada, CHNX Halifax	6130do			
0700-0800	Canada, CKZU Vancouver	6160do			
0700-0800	Costa Rica,RF Peace Intl	6975am			
0700-0727	Czech Rep, Radio Prague	7345eu	9505eu		
0700-0800	Ecuador, HCJB	9640pa	11960eu	21455am	
0700-0800 as	Eqt Guinea, R East Africa	15186af			
0700-0800 mtwhf	Eqt Guinea, Radio Africa	15186af			
0700-0800 vl	Germany, Sunrise Radio	5850va			
0700-0800	Germany,Overcomer Ministr	13810au	15755as		
0700-0715	Ghana, Ghana Broadc Corp	3366do	4915do		
0700-0800	Guyana, GBC/Voice of	3290do	5950do		
0700-0800	Ireland, Unt Christian BC	6200do			
0700-0800	Kenya, Kenya Broadc Corp	4885do	4935do		
0700-0800	Liberia, Radio Veritas	5470do			
0700-0800	Liberia, Star Radio	3400do			
0700-0715	Liberia,LCN/R Liberia Int	5100do			
0700-0800	Malaysia, Radio	7295do			
0700-0800	Monaco, Trans World Radio	9755eu			
0700-0800	Myanmar, Radio	9730do			
0700-0715 vl	Namibia, NBC	3270af	3289af		
0700-0705	New Zealand, R NZ Intl	11905pa			
0700-0730 s	Norway, Radio Norway Intl	13800eu	15640eu		
0700-0800 vl	Papua New Guinea, NBC	9675do			
0700-0800	Romania, R Romania Intl	17735af	21480af		
0700-0800	Russia,Voice of Russia WS	9450au	17495au	17665au	21760au
		21790au			
0700-0710	Sierra Leone, SLBS	3316do			
0700-0800	Singapore,RCorp Singapore	6150do			
0700-0730	Slovakia, R Slovakia Intl	9440eu	15460au	17550au	
0700-0800 vl	Solomon Islands, SIBC	5020do			
0700-0735	Swaziland, Trans World R	4775af	6100af	9500af	
0700-0800	Taiwan, Radio Taipei Intl	5950na			
0700-0800 vl	Tanzania, Radio	5050do			
0700-0730	UK, BBC African Service	6005af	6190af	9600af	11835af
		11940af	17830af		
0700-0800 as	UK, BBC African Service	17885af			
0700-0800	UK, BBC Asian Service	7145pa	9740as	11955pa	15310as
		15360as	17760as	17790as	21660as
0700-0800	UK, BBC World Service	5975am	6175am	6195eu	7325eu
		9410eu	11760me	12095eu	15485eu
		15565eu	15575eu	17640me	
0700-0800	USA, KAIJ Dallas TX	5810am			
0700-0800	USA, KTBN Salt Lk City UT	7510am			
0700-0800	USA, KWHR Naalehu HI	17780as			
0700-0800	USA, WEWN Birmingham AL	5825eu			
0700-0800	USA, WHRA Greenbush ME	11565af			
0700-0800	USA, WHRI Noblesville IN	5745am			
0700-0800	USA, WJCR Upton KY	7490na	13595na		
0700-0800	USA, WMLK Bethel PA	9465am			
0700-0800 mtwhf	USA, WRMI/R Miami Intl	9955ca			
0700-0800	USA, WWCR Nashville TN	2390am	3210am	5070am	5935am
0700-0800	USA, WYFR Okeechobee FL	7355eu	9985af	13695va	
0700-0715 vl	Vanuatu, Radio	3945do	4960do		
0700-0800	Zambia, Christian Voice	6065af			
0700-0800	Zambia, Natl BC Corp	6165do	6265do		
0700-0800 vl	Zimbabwe, Zimbabwe BC	4828do	5012do		
0705-0710 s	Croatia, Croatian Radio	5945eu	9830eu	13820au	
0706-0800	New Zealand, R NZ Intl	9700pa			
0715-0730 s	Greece, Voice of	9375eu	9425au	9755au	11645eu
		15650au			
0715-0800 vl	Namibia, NBC	4930af	4965af		
0730-0800	Austria, R Austria Intl	6155eu	13730eu	15410me	17870me
0730-0755	Belgium, R Vlaanderen Int	7290eu	9940au		
0730-0740 s	Greece, Voice of	9375eu	9425eu	9755au	11645eu
		15650au			
0730-0800	Netherlands, Radio	9720pa	9820pa		
0730-0800	Switzerland, Swiss R Intl	9885af	11860af	13635af	
0730-0800	UK, BBC African Service	6190af	9600af	11940af	15400af
		17830af			
0730-0800 as	UK, BBC World Service	15575eu			
0735-0800 as	Swaziland, Trans World R	4775af	6100af	9500af	
0740-0800	Guam, TWR/KTWR	15200as			
0745-0800 s	Ghana, Ghana Broadc Corp	3366do	4915do		
0800-0820	Albania, TWR Tirana	9685eu			
0800-0900	Anguilla,Caribbean Beacon	6090am			
0800-0900	Australia, Radio	5995pa	9580pa	9580pa	9710pa
		12080as	15415as	15510pa	17715pa
		17750as	21725pa		
0800-0830 vl	Australia, VL8K Katherine	5025do			
0800-0830 vl	Australia, VL8T Tent Crk	4910do			
0800-0900 vl	Canada, CBC N Quebec Svc	9625do			
0800-0900	Canada, CFRX Toronto	6070do			
0800-0900	Canada, CFVP Calgary	6030do			
0800-0900	Canada, CHNX Halifax	6130do			
0800-0900	Canada, CKZU Vancouver	6160do			
0800-0900	Costa Rica,RF Peace Intl	6975am			
0800-0810 mtwhfa	Croatia, Croatian Radio	7185eu	9830eu	13820au	
0800-0900	Ecuador, HCJB	9640pa	11960eu	21455am	
0800-0900 as	Eqt Guinea, R East Africa	15186af			
0800-0900 mtwhf	Eqt Guinea, Radio Africa	15186af			
0800-0900 vl	Germany, Sunrise Radio	5850va			
0800-0830 s	Germany, Universal Life	17780as			
0800-0900	Germany,Overcomer Ministr	13810au	15755as		
0800-0805 s	Ghana, Ghana Broadc Corp	3366do			
0800-0900	Guam, TWR/KTWR	15200as			
0800-0900	Guyana, GBC/Voice of	3290do	5950do		
0800-0900	Indonesia, Voice of	9525as	11765as	15510as	
0800-0900	Ireland, Unt Christian BC	6200do			
0800-0900	Kenya, Kenya Broadc Corp	4885do	4935do		
0800-0900	Liberia, Radio Veritas	5470do			
0800-0900	Liberia,LCN/R Liberia Int	5100do			
0800-0900	Malaysia, Radio	7295do			
0800-0900 s	Malta, VO Mediterranean	9600eu			
0800-0835 a	Monaco, Trans World Radio	9755eu			
0800-0820 as	Monaco, Trans World Radio	9755eu			
0800-0830	Myanmar, Radio	9730do			
0800-0900 vl	Namibia, NBC	4930af	4965af		
0800-0900	Netherlands, Radio	9720pa	9820pa		
0800-0900	New Zealand, R NZ Intl	9700pa			
0800-0900 as	Palau, KHBN/Voice of Hope	9985as			
0800-0900 vl	Papua New Guinea, NBC	9675do			
0800-0900	Russia,Voice of Russia WS	9450au	17495au	17665au	21760au
		21790au			
0800-0810	Sierra Leone, SLBS	3316do			
0800-0900	Singapore,RCorp Singapore	6150do			
0800-0900 vl	Solomon Islands, SIBC	5020do			
0800-0900	South Korea, R Korea Intl	9570au	13670eu		
0800-0805 as	Swaziland, Trans World R	4775af	6100af	9500af	
0800-0900 vl	Tanzania, Radio	5050do			
0800-0900	UK, BBC African Service	6190af	11940af	15400af	17830af
0800-0900 as	UK, BBC African Service	17885af			
0800-0900	UK, BBC Asian Service	7145pa	9740as	11955pa	15310as
		15360as	17760as	17790as	21660as
0800-0900	UK, BBC World Service	7325eu	9410eu	12095eu	15485eu
		15565eu	17640eu		
0800-0900 as	UK, BBC World Service	15575as			
0800-0900	USA, KAIJ Dallas TX	5810am			
0800-0900	USA, KNLS Anchor Point AK	9615as			
0800-0900	USA, KTBN Salt Lk City UT	7510am			
0800-0900	USA, KWHR Naalehu HI	11565pa	17780as		
0800-0900	USA, WEWN Birmingham AL	5825eu			
0800-0900	USA, WHRI Noblesville IN	5745am	7315am		
0800-0900	USA, WJCR Upton KY	7490na	13595na		
0800-0900 mtwhf	USA, WRMI/R Miami Intl	9955ca			
0800-0900 as	USA, WSHB Cypress Crk SC	9835eu			
0800-0900 twhas	USA, WSHB Cypress Crk SC	9845pa			
0800-0900	USA, WWCR Nashville TN	2390am	3210am	5070am	5935am
0800-0815 vl	Vanuatu, Radio	3945do	4960do		
0800-0900	Zambia, Christian Voice	6065af			
0800-0900	Zambia, Natl BC Corp	6165do	6265do		
0800-0900 vl	Zimbabwe, Zimbabwe BC	4828do	5012do		
0805-0810	Pakistan, Radio	15530eu	17835eu		
0815-0900 mtwtf	Nigeria, FRCN/Radio	3326do	4770do	4990do	
0815-0900 f	Seychelles, FEBA Radio	15540as			
0820-0835 as	Albania, TWR Tirana	9685eu			
0820-0830 t	Kyrgyzstan, Kyrgyz Radio	4010do	4050do		
0830-0900 vl	Australia, VL8A Alice Spg	2310do			
0830-0900 vl	Australia, VL8K Katherine	2485do			
0830-0900 vl	Australia, VL8T Tent Crk	2325do			
0830-0900	Georgia, Radio	11910eu			
0830-0900	Switzerland, Swiss R Intl	9885au	13685au		
0835-0850 s	Albania, TWR Tirana	9685eu			
0835-0850 s	Monaco, Trans World Radio	9755eu			
0855-0900	Guam, TWR/KTWR	15330pa			

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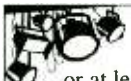
FREQUENCIES

0900-1000	Anguilla,Caribbean Beacon	6090am			
0900-1000	Australia, Radio	6080as	9580pa	11880as	17750as
0900-1000 vl	Australia, VL8A Alice Spg	2310do			
0900-1000 vl	Australia, VL8K Katherine	2485do			
0900-1000 vl	Australia, VL8T Tent Crk	2325do			
0900-1000	Canada, CFRX Toronto	6070do			
0900-1000	Canada, CFVP Calgary	6030do			
0900-1000	Canada, CHNX Halifax	6130do			
0900-1000	Canada, CKZU Vancouver	6160do			
0900-1000	China, China Radio Intl	9785pa	9890pa	11755pa	
0900-1000	Costa Rica,RF Peace Intl	6975am			
0900-0927	Czech Rep, Radio Prague	17485af	21745as		
0900-1000	Ecuador, HCJB	9640pa	21455am		
0900-1000 as	Eqt Guinea, R East Africa	15186af			
0900-1000 mtwhf	Eqt Guinea, Radio Africa	15186af			
0900-0950	Germany, Deutsche Welle	6160pa	9565af	12055as	15205af
		15410af	17715as	17800af	21600af
		21680as			
0900-1000	Germany, Sunrise Radio	5850va			
0900-1000	Germany,Overcomer Ministr	13810au	15735as		
0900-0915 mtwtf	Ghana, Ghana Broadc Corp	3366do	4915do		
0900-0915	Guam, TWR/KTWR	15200as			
0900-0930	Guyana, GBC/Voice of	3290do	5950do		
0900-1000	Ireland, Unt Christian BC	6200do			
0900-1000	Kenya, Kenya Broadc Corp	4935do			
0900-1000	Liberia, Radio Veritas	5470do			
0900-0915	Liberia,LCN/R Liberia Int	5100do			
0900-1000	Malaysia, Radio	7295do			
0900-1000 vl	Malaysia, RTM Kuching	4895do	7160do		
0900-0930 s	Malta, VO Mediterranean	9600eu			
0900-1000 vl	Namibia, NBC	4930af	4965af		
0900-0925	Netherlands, Radio	9720pa	9820pa		
0900-1000	New Zealand, R NZ Intl	9700pa			
0900-0930 s	Norway, Radio Norway Intl	18950au			
0900-1000 vl	Papua New Guinea, NBC	4890do			
0900-1000	Singapore,RCorp Singapore	6150do			
0900-1000 vl	Solomon Islands, SIBC	5020do			
0900-1000 vl	Tanzania, Radio	5050do			
0900-1000	UK, BBC African Service	6190af	11940af	15400af	17830af
		17885af			
0900-0915	UK, BBC Asian Service	6065as	6195as	9580as	9740as
		11765as	11955as	15310as	15360as
		17760as	17790as	21660as	
0900-1000	UK, BBC World Service	9410eu	11760me	12095eu	15190sa
		15485eu	15565eu	15575eu	17640eu
		17705eu			
0900-1000	USA, KAIJ Dallas TX	5810am			
0900-1000 twhfas	USA, KHBI N Mariana Is	15665as			
0900-1000	USA, KTBN Salt Lk City UT	7510am			
0900-1000	USA, KWHR Naalehu HI	11565pa	17780as		
0900-1000	USA, WEWN Birmingham AL	5825eu			
0900-1000	USA, WHRI Noblesville IN	5745am	7315am		
0900-1000	USA, WJCR Upton KY	7490na	13595na		
0900-1000 mtwhf	USA, WRMI/R Miami Intl	9955ca			
0900-1000 th	USA, WSHB Cypress Crk SC	9835eu			
0900-1000	USA, WWCR Nashville TN	2390am	3210am	5070am	5935am
0900-1000	Zambia, Christian Voice	6065af			
0900-1000	Zambia, Natl BC Corp	6165do	6265do		
0900-1000 vl	Zimbabwe, Zimbabwe BC	4828do	5012do		
0905-0910 s	Croatia, Croatian Radio	7185eu	9830eu		
0915-1000	Ghana, Ghana Broadc Corp	6130do	7295do		
0915-0945	UK, BBC Asian Service	15310as	17790as		
0915-0945 as	UK, BBC Asian Service	6195as	9740as	11765as	15360as
		21660as			
0930-1000 mtwhfa	Austria, R Austria Intl	15455as	17870au		
0930-1000	Canada, CKZN St John's	6160do			
0930-1000	Georgia, Radio	11910eu			
0930-1000	Guam, TWR/KTWR	9865as			
0930-1000	Italy, AWR Europe	7230eu			
0930-1000	Lithuania, Radio Vilnius	9710eu			
0930-1000	Netherlands, Radio	12065as	13710as		
0945-1000	UK, BBC Asian Service	6195as	9740as	11765as	15360as
		17760as	17790as	21660as	
0945-1000 a	UK, BBC Asian Service	6065as	9580as	11945as	11955as
		15280as			
0945-1000 smtwhf	UK, BBC Slow Speed News	6065as	9580as	11945as	11955as
		15280as			

1000 UTC

1000-1100	Anguilla,Caribbean Beacon	6090am			
1000-1100	Australia, Radio	6080as	9580pa	11880as	17750as
1000-1100 vl	Australia, VL8A Alice Spg	2310do			
1000-1100 vl	Australia, VL8K Katherine	2485do			
1000-1100 vl	Australia, VL8T Tent Crk	2325do			
1000-1100 vl	Canada, CBC N Quebec Svc	9625do			
1000-1100	Canada, CFRX Toronto	6070do			
1000-1100	Canada, CFVP Calgary	6030do			
1000-1100	Canada, CHNX Halifax	6130do			
1000-1100	Canada, CKZN St John's	6160do			
1000-1100	Canada, CKZU Vancouver	6160do			
1000-1100	China, China Radio Intl	9785pa	9890pa	11755pa	
1000-1100	Costa Rica,RF Peace Intl	6975am			
1000-1100	Ecuador, HCJB	9640pa	21455am		
1000-1100 as	Eqt Guinea, R East Africa	15186af			
1000-1100 mtwhf	Eqt Guinea, Radio Africa	15186af			
1000-1100	Germany, Sunrise Radio	5850va			
1000-1100	Germany,Overcomer Ministr	15715au	15755as	17505pa	
1000-1100 as	Germany,Overcomer Ministr	5900eu			
1000-1030	Guam, AWR/KSDA	11790as			
1000-1100	Guam, TWR/KTWR	9865as			
1000-1100	India, All India Radio	11585au	11735au	13700au	15050au
		17387au	17840as		
1000-1100	Ireland, Unt Christian BC	6200do			
1000-1100	Japan, R Japan/NHK World	9695as	11730as	11850pa	
1000-1100	Jordan, Radio	11690eu			
1000-1100	Kenya, Kenya Broadc Corp	4935do			
1000-1010 fa	Kyrgyzstan, Kyrgyz Radio	4010do			
1000-1100	Malaysia, Radio	7295do			
1000-1100 irreg	Malaysia,RTM KotaKinabalu	5980do			
1000-1100 vl	Namibia, NBC	4930af	4965af		
1000-1030	Netherlands, Radio	12065as	13710as		
1000-1015	New Zealand, R NZ Intl	9700pa			
1000-1100	Nigeria, Voice of	7255af	15120af		
1000-1100 vl	Papua New Guinea, NBC	4890do			
1000-1100	Philippines, FEBC/R Intl	11635as			
1000-1100	Philippines, FEBC/R Intl	11635as			
1000-1030	Singapore, RTE Radio	11740as			
1000-1100	Singapore,RCorp Singapore	6150do			
1000-1100 vl	Solomon Islands, SIBC	5020do			
1000-1030	Switzerland, Swiss R Intl	6165eu	9535eu		
1000-1100 vl	Tanzania, Radio	5050do			
1000-1100	UK, BBC African Service	6190af	11940af	17885af	
1000-1100 as	UK, BBC African Service	15400af	17830af		
1000-1030	UK, BBC Asian Service	6195as	9740as	11765as	15310as
		15360as	17790as	21660as	
1000-1100	UK, BBC World Service	6195am	9410eu	11760me	12095eu
		15485eu	15565eu	15575eu	17640eu
		17705eu			
1000-1100 as	UK, BBC World Service	15190sa			
1000-1100	USA, KAIJ Dallas TX	5810am			
1000-1100 twhfas	USA, KHBI N Mariana Is	11660pa	15665as		
1000-1100	USA, KTBN Salt Lk City UT	7510am			
1000-1100	USA, KWHR Naalehu HI	9930as	11565pa		
1000-1100	USA, Voice of America	5985pa	6165ca	7405ca	9590ca
		11720as	15425as		
1000-1100	USA, WEWN Birmingham AL	9465na	15745eu		
1000-1100 mtwhfa	USA, WGTG McCaysville GA	9400am			
1000-1100	USA, WHRI Noblesville IN	6[illegible]am	9495am		
1000-1100	USA, WJCR Upton KY	7490na	13595na		
1000-1100 mtwhfa	USA, WRMI/R Miami Intl	9955ca			
1000-1100 wh	USA, WSHB Cypress Crk SC	6095na			
1000-1100 a	USA, WSHB Cypress Crk SC	9455sa			
1000-1100	USA, WWCR Nashville TN	2390am	5070am	5935am	
1000-1100 mtwhf	USA, WWCR Nashville TN	3210am			
1000-1100 as	USA, WWCR Nashville TN	15685am			
1000-1100 mtwhfa	USA, WYFR Okeechobee FL	5950na			
1000-1030	Vietnam, Voice of	9840as	12020as	15010as	
1000-1100	Zambia, Christian Voice	6065af			
1000-1100	Zambia, Natl BC Corp	6165do	6265do		
1000-1100 vl	Zimbabwe, Zimbabwe BC	4828do	5012do		
1030-1100 s	Austria, R Austria Intl	15455as	17870au		
1030-1055	Belgium, R Vlaanderen Int	9925eu	15595eu		
1030-1057	Czech Rep, Radio Prague	7345eu	11640eu		
1030-1100	Guam, AWR/KSDA	11790as	15170as		
1030-1035	Israel, Kol Israel	15640eu	15650na		
1030-1100	Netherlands, Radio	6045eu	9860eu	12065as	13710as
1030-1100	South Korea, R Korea Intl	11715am			
1030-1100	Sri Lanka, Sri Lanka BC	11835as	15120as	17850as	
1030-1100	UAE, Radio Dubai	13675eu	15370eu	15395eu	21605eu
1030-1100	UK, BBC Asian Service	6195as	9740as	11765pa	15310as
		17790as			
1030-1045	Vatican State, Vatican R	5883eu	9645eu	11740eu	15595va



Your Name in Lights!

... or at least in ink within the *Monitoring Times* Shortwave Guide. Please send us your "best catches" on the worldwide shortwave bands — QSLs, that is — and we will try to use them in future issues of *MT*. Your QSLs will be returned.

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Frequencies

1100-1200	Anguilla,Caribbean Beacon	11775am			
1100-1200	Australia, Radio	6080as	9580pa		
1100-1200 vl	Australia, VL8A Alice Spg	2310do			
1100-1200 vl	Australia, VL8K Katherine	2485do			
1100-1200 vl	Australia, VL8T Tent Crk	2325do			
1100-1200	Bulgaria, Radio	15175eu	17585eu		
1100-1200 vl	Canada, CBC N Quebec Svc	9625do			
1100-1200	Canada, CFRX Toronto	6070do			
1100-1200	Canada, CFVP Calgary	6030do			
1100-1200	Canada, CHNX Halifax	6130do			
1100-1200	Canada, CKZN St John's	6160do			
1100-1200	Canada, CKZU Vancouver	6160do			
1100-1200	Costa Rica,RF Peace Intl	6975am			
1100-1200	Ecuador, HCJB	12005ca	15115am	21455am	
1100-1200 as	Eqt Guinea, R East Africa	15186af			
1100-1200	Eqt Guinea, Radio Africa	9530as			
1100-1150	Germany, Deutsche Welle	15370af	15410af	17765af	17800af
1100-1200	Germany, Sunrise Radio	5850va			
1100-1200 as	Germany,Overcomer Ministr	5900eu			
1100-1200	Germany,Overcomer Ministr	15375as	15715au	17505pa	
1100-1200	Iran, VOIRI	11830as	11875as	13605me	15260as
1100-1200	Ireland, Unt Christian BC	6200do			
1100-1200	Japan, R Japan/NHK World	6120na	9695as	11730as	
1100-1200	Jordan, Radio	11690eu			
1100-1120 fa	Kazakhstan, R Almaty Intl	9505eu	9620eu	11720as	
1100-1200	Kenya, Kenya Broadc Corp	4935do			
1100-1130 mtwhf	Kyrgyzstan, Kyrgyz Radio	4010do	4050do		
1100-1110	Liberia,LCN/R Liberia Int	5100do			
1100-1200	Malaysia, Radio	7295do			
1100-1200 irreg	Malaysia,RTM KotaKinabalu	5980do			
1100-1200 vl	Namibia, NBC	4930af	4965af		
1100-1125	Netherlands, Radio	6045eu	9860eu	12065as	13710as
1100-1157	North Korea, R Pyongyang	3560as	9640af	9975me	11335va
		15230va			
1100-1130 as	Palau, KHBN/Voice of Hope	9965as			
1100-1200 vl	Papua New Guinea, NBC	4890do			
1100-1200	Singapore,R Singapore Int	6015as	6150as		
1100-1130 vl	Solomon Islands, SIBC	5020do			
1100-1200	South Korea, R Korea Intl	7275as			
1100-1130	Sri Lanka, Sri Lanka BC	11835as	15120as	17850as	
1100-1200	Switzerland, Swiss R Intl	9810as	17515as		
1100-1200	Taiwan, Voice of Asia	7445as			
1100-1200 vl	Tanzania, Radio	5050do			
1100-1200	UK, BBC African Service	6190af	11940af	15400af	17830af
		17885af	21660af		
1100-1200	UK, BBC Asian Service	6195as	9580as	9740as	11955as
		15280as	15310as	17785as	
1100-1130 mtwhf	UK, BBC Caribbean Report	6195ca	15220ca		
1100-1130	UK, BBC World Service	5965na	9410eu	11760me	12095eu
		15485eu	15565eu	15575eu	17640eu
		17705eu	17790sa		
1100-1130 as	UK, BBC World Service	6195am	15190sa	15220am	
1100-1200	USA, KAIJ Dallas TX	5810am			
1100-1200 twhfas	USA, KHBI N Mariana Is	9355as			
1100-1200	USA, KTBN Salt Lk City UT	7510am			
1100-1200	USA, KWHR Naalehu HI	9930as	11565pa		
1100-1200	USA, Voice of America	5985pa	6160as	9645as	9760as
		11720as	15160as	15425as	
1100-1200	USA, WEWN Birmingham AL	7425na	9465na	15745eu	
1100-1200 mtwhfa	USA, WGTG McCaysville GA	9400am			
1100-1200	USA, WHRI Noblesville IN	6040am	9495am		
1100-1200	USA, WJCR Upton KY	7490na	13595na		
1100-1200	USA, WRMI/R Miami Intl	9955ca			
1100-1200 tfas	USA, WSHB Cypress Crk SC	6095na			
1100-1200 wf	USA, WSHB Cypress Crk SC	9455ca			
1100-1200	USA, WWCR Nashville TN	5070am	5935am	7435am	15685am
1100-1200 mtwhfa	USA, WYFR Okeechobee FL	5950na			
1100-1200	USA, WYFR Okeechobee FL	5850na			
1100-1130	Vietnam, Voice of	7285as	9730as		
1100-1200	Zambia, Christian Voice	6065af			
1100-1200	Zambia, Natl BC Corp	6165do	6265do		
1100-1200 vl	Zimbabwe, Zimbabwe BC	4828do	5012do		
1105-1120	Pakistan, Radio	15530eu	17835eu		
1120-1140 w	Kazakhstan, R Almaty Intl	9505eu	9620eu	11720as	
1125-1200	Netherlands, Radio	6045eu	9860eu		
1130-1200	Sweden, Radio	15235am	15240am	17870am	
1130-1200 as	UK, BBC Asian Service	15310as	17785as		
1130-1200	UK, BBC World Service	6195am	15220am		
1130-1200	USA, Voice of America	11680eu			
1130-1200 f	Vatican State, Vatican R	15595va	17550va		
1140-1200 t	Kazakhstan, R Almaty Intl	9505eu	9620eu	11720as	

Selected Programs

Sundays

1100 Canada, N Quebec Svc: News.
1100 USA, KAIJ Dallas TX: World University Network.
1100 USA, KTBN Salt Lk City UT: Breakthrough.
1105 Australia, Radio: Jazz Notes.
1130 Ecuador, HCJB Quito (am): The Christian's Hour.
1130 Sweden, Radio: Sounds Nordic (2/4).

Mondays

1100 Australia, Radio: RA News.
1100 Ecuador, HCJB Quito (am): Insight for Living.
1100 Singapore, R Singapore Intl: News.
1105 Switzerland, Swiss Radio Intl: Newsnet.
1109 Singapore, R Singapore Intl: Business and Market Report.
1130 North Korea, R Pyongyang: Music of the Korean People's Army.
1130 Australia, Radio: Sport.
1130 Singapore, R Singapore Intl: News.
1130 Switzerland, Swiss Radio Intl: Rendezvous with Switzerland.
1131 Ecuador, HCJB Quito (am): Latin American News.
1131 Sweden, Radio: News.
1133 North Korea, R Pyongyang: The Spirit of Socialist Korea.
1135 Australia, Radio: Countrywide.
1138 Netherlands, Radio: Newsline.
1142 Sweden, Radio: SportScan.

Tuesdays

1100 Germany, Deutsche Welle: News.
1100 Australia, Radio: RA News.
1100 Costa Rica, R for Peace Intl: Alternative Radio.
1100 Japan, Radio: News.
1105 Switzerland, Swiss Radio Intl: Newsnet.
1115 Bulgaria, Radio: Events and Developments.
1115 Japan, Radio: Top News Asia.
1130 Australia, Radio: Sport.
1130 Bulgaria, Radio: Magazine Economy.
1130 Singapore, R Singapore Intl: News.
1130 Switzerland, Swiss Radio Intl: Rendezvous with Switzerland.
1131 Ecuador, HCJB Quito (am): Latin American News.
1135 Australia, Radio: Countrywide.
1138 Netherlands, Radio: Newsline.
1145 Bulgaria, Radio: Folk Studio.
1146 Sweden, Radio: MediaScan (1/3).

Wednesdays

1100 Germany, Deutsche Welle: News.
1100 Australia, Radio: RA News.
1100 Costa Rica, R for Peace Intl: My Green Earth.
1100 Japan, Radio: News.
1100 Papua New Guinea, NBC: News.
1100 Singapore, R Singapore Intl: News.
1106 Germany, Deutsche Welle: NewsLink.
1109 Singapore, R Singapore Intl: Business and Market Report.
1115 Bulgaria, Radio: Events and Developments.
1115 Japan, Radio: Top News Asia.
1115 Singapore, R Singapore Intl: Star Trax.
1125 Japan, Radio: Music Reflections.
1130 Australia, Radio: Sport.
1130 Bulgaria, Radio: Cultural Review.
1130 Singapore, R Singapore Intl: News.
1130 Switzerland, Swiss Radio Intl: Rendezvous with Switzerland.
1131 Ecuador, HCJB Quito (am): Latin American News.
1135 Australia, Radio: Countrywide.

Thursdays

1100 Australia, Radio: RA News.
1100 Papua New Guinea, NBC: News.
1100 Singapore, R Singapore Intl: Newsday.
1103 North Korea, R Pyongyang: News.
1110 Singapore, R Singapore Intl: Business and Market Report.
1115 Bulgaria, Radio: Events and Developments.
1115 Singapore, R Singapore Intl: Living.
1122 North Korea, R Pyongyang: Words of the Great Leader.
1130 Bulgaria, Radio: Timeout for Music.
1130 Switzerland, Swiss Radio Intl: Rendezvous with Switzerland.
1131 Ecuador, HCJB Quito (am): Latin American News.
1131 Sweden, Radio: News.
1135 Australia, Radio: Countrywide.
1140 Singapore, R Singapore Intl: Afterthought.

Fridays

1100 Australia, Radio: RA News.
1100 Bulgaria, Radio: News.
1100 Costa Rica, R for Peace Intl: Voices of Our World.
1100 Japan, Radio: News.
1100 Switzerland, Swiss Radio Intl: News.
1103 North Korea, R Pyongyang: News.
1105 Switzerland, Swiss Radio Intl: Newsnet.
1115 Bulgaria, Radio: Events and Development.
1115 Japan, Radio: Top News Asia.
1125 Japan, Radio: Music Beat.
1130 Bulgaria, Radio: The Way We Live.
1130 Costa Rica, R for Peace Intl: WINGS.
1130 Ecuador, HCJB Quito (am): Morning in the Mountains.
1130 Switzerland, Swiss Radio Intl: Rendezvous with Switzerland.
1131 Ecuador, HCJB Quito (am): Latin American News.
1135 Australia, Radio: Countrywide.

Saturdays

1100 Australia, Radio: RA News.
1100 Germany, Deutsche Telekom: The Overcomer Broadcast.
1100 Japan, Radio: News.
1100 Papua New Guinea, NBC: News.
1103 North Korea, R Pyongyang: News.
1105 Australia, Radio: Fine Music Australia.
1105 Papua New Guinea, NBC: Top of the Pops.
1105 Switzerland, Swiss Radio Intl: Newsnet.
1110 Japan, Radio: Asia Weekly.
1113 North Korea, R Pyongyang: Music/Commentary.
1115 Switzerland, Swiss Radio Intl: The Name Game (1).
1130 North Korea, R Pyongyang: All People Free.
1130 Singapore, R Singapore Intl: News.
1135 North Korea, R Pyongyang: Music.
1138 Netherlands, Radio: Newsline.

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1200 UTC SHORTWAVE GUIDE 8:00 AM EDT 5:00 AM PDT

Frequencies

1200-1300	Anguilla,Caribbean Beacon	11775am			
1200-1300	Australia, Radio	6020pa	6080as	9580pa	9660pa
		9770as			
1200-1300 vl	Australia, VL8A Alice Spg	2310do			
1200-1300 vl	Australia, VL8K Katherine	2485do			
1200-1300 vl	Australia, VL8T Tent Crk	2325do			
1200-1300	Brazil, Radio Bras	15445am			
1200-1215	Cambodia, Natl Radio Of	11940as			
1200-1300 vl	Canada, CBC N Quebec Svc	9625do			
1200-1300	Canada, CFRX Toronto	6070do			
1200-1300	Canada, CFVP Calgary	6030do			
1200-1300	Canada, CHNX Halifax	6130do			
1200-1300	Canada, CKZN St John's	6160do			
1200-1300	Canada, CKZU Vancouver	6160do			
1200-1229	Canada, R Canada Intl	9640am	9660as	11855am	13650am
		15195as			
1200-1300	China, China Radio Intl	6950pa	7385pa	9715as	9945as
		11660as	11675as	11980as	
1200-1300	Costa Rica,RF Peace Intl	6975am			
1200-1300	Ecuador, HCJB	12005ca	15115am	21455am	
1200-1300 as	Eqt Guinea, R East Africa	15186af			
1200-1300	Eqt Guinea, Radio Africa	9530as			
1200-1300	France, Radio France Intl	9805eu	11600as	15155eu	15195eu
		15530am	15540af	17575am	
1200-1300	Germany, Sunrise Radio	5850va			
1200-1230 s	Germany, Universal Life	9710as			
1200-1300	Germany,Overcomer Ministr	15715au	15735as	17505pa	
1200-1300	Ireland, Unt Christian BC	6200do			
1200-1300	Jordan, Radio	11690eu			
1200-1300	Kenya, Kenya Broadc Corp	4935do			
1200-1300	Malaysia, Radio	7295do			
1200-1300 irreg	Malaysia,RTM KotaKinabalu	5980do			
1200-1300 vl	Namibia, NBC	4930af	4965af		
1200-1225	Netherlands, Radio	6045eu	9860eu		
1200-1230 s	Norway, Radio Norway Intl	17535as			
1200-1300	Palau, KHBN/Voice of Hope	9965as			
1200-1300 vl	Papua New Guinea, NBC	4890do			
1200-1255	Poland, Polish R Warsaw	6095eu	7270eu	9525eu	11820eu
1200-1300	Singapore,R Singapore Int	6015as	6150as		
1200-1300	South Korea, R Korea Intl	7285as			
1200-1230	Switzerland, Swiss R Intl	6165eu	9535eu		
1200-1300	Taiwan, Radio Taipei Intl	7130as	9610au		
1200-1300 vl	Tanzania, Radio	5050do			
1200-1300	UK, BBC African Service	6190af	11940af	17830af	17885af
		21660af			
1200-1300	UK, BBC Asian Service	6195as	9580as	9740as	11955as
		15280as	15310as	17785as	
1200-1300	UK, BBC World Service	5965na	6195am	9410eu	9515na
		11760me	12095eu	15220am	15485eu
		15565eu	15575as	17640eu	17705eu
1200-1300	USA, KAIJ Dallas TX	5810am			
1200-1300 twhfas	USA, KHBI N Mariana Is	9355as			
1200-1300	USA, KTBN Salt Lk City UT	7510am			
1200-1300	USA, KWHR Naalehu HI	9930as	11565pa		
1200-1300	USA, Voice of America	6160as	9645as	9760as	11715as
		15160as	15425as		
1200-1300	USA, WEWN Birmingham AL	7425na	9465na	15745eu	
1200-1300 mtwhfa	USA, WGTG McCaysville GA	9400am			
1200-1300	USA, WHRI Noblesville IN	6040am	9495am		
1200-1300	USA, WJCR Upton KY	7490na	13595na		
1200-1300	USA, WRMI/R Miami Intl	9955ca			
1200-1300 mwh	USA, WSHB Cypress Crk SC	6095na			
1200-1300 a	USA, WSHB Cypress Crk SC	11660am			
1200-1300	USA, WWCR Nashville TN	5070am	7435am	13845am	15685am
1200-1300 mtwhfa	USA, WYFR Okeechobee FL	5950na			
1200-1300	USA, WYFR Okeechobee FL	5850na	6015na	17750na	
1200-1228	Uzbekistan, R Tashkent	7285as	9715as	15295as	17775as
1200-1300	Zambia, Christian Voice	6065af			
1200-1300	Zambia, Natl BC Corp	6165do	6265do		
1200-1300 vl	Zimbabwe, Zimbabwe BC	4828do	5012do		
1205-1210	Croatia, Croatian Radio	7125eu	9830eu		
1206-1300 occsnal	New Zealand, R NZ Intl	6100pa			
1209-1215 mtwhf	UK, BBC Caribbean Report	6195ca	15220ca		
1209-1215 as	UK, BBC World Service	6195am	15220am		
1210-1240	Mongolia, Voice of	12085au			
1215-1300	Egypt, Radio Cairo	17595as			
1229-1259	Canada, R Canada Intl	9640am	11855am	13650am	
1230-1300	Austria, R Austria Intl	6155eu	13730na		
1230-1300	Bangladesh, Bangla Betar	7185as	9550as		
1230-1255	Belgium, R Vlaanderen Int	15545na			
1230-1300	Guam, AWR/KSDA	13720as			
1230-1300	Italy, AWR Europe	7230as			
1230-1300	South Korea, R Korea Intl	6055as	9570as	9640am	13670as
1230-1300	Sri Lanka, Sri Lanka BC	9730as	15425as		
1230-1300	Sweden, Radio	13740as	15240au		
1230-1300	Thailand, Radio	9655as	9885as	11905as	
1230-1300	Turkey, Voice of	15185as	17830as	17830eu	
1230-1300 a	USA, Voice of America	7768eu			
1230-1300	Vietnam, Voice of	9840as	12020as	15010as	
1240-1250	Greece, Voice of	17525af			
1240-1255 smtwh	UK, BBC Slow Speed News	7140me	11820me	13660af	15180af
		15555me	17585af		

Selected Programs

Sundays

1200 France, Radio France Intl: News.
1200 Poland, Polish Radio Warsaw: News.
1200 USA, KAIJ Dallas TX: World University Network.
1204 Poland, Polish Radio Warsaw: Weekend Commentary.
1205 Australia, Radio: Country Club (Part 1).
1208 Poland, Polish Radio Warsaw: Panorama.
1219 France, Radio France Intl: Asia File.
1230 Singapore, R Singapore Intl: News.
1230 Austria, R Austria Intl: The Week in Review.
1230 South Korea, Radio Korea Intl: News.
1233 France, Radio France Intl: Club 9516.
1238 South Korea, Radio Korea Intl: Multiwave Feedback.

Mondays

1200 France, Radio France Intl: News.
1200 Australia, Radio: RA News.
1200 Canada, RCI Montreal: CBC Radio News.
1200 Brazil, Radiobras: Brazilian Panorama.
1205 Australia, Radio: Late Night Live.
1213 Canada, RCI Montreal: This Morning.
1225 France, Radio France Intl: Review of the French Newspapers.
1230 South Korea, Radio Korea Intl: News.
1230 Thailand, Radio: National News.
1232 France, Radio France Intl: RFI Europe.
1243 South Korea, Radio Korea Intl: Globalizing Korea.
1245 France, Radio France Intl: Arts in France.
1250 France, Radio France Intl: Insight.
1252 Turkey, Voice of: Science in Turkey.

Tuesdays

1200 Canada, RCI Montreal: RCI News.
1200 Australia, Radio: RA News.
1200 Canada, RCI Montreal: CBC Radio News.
1213 Canada, RCI Montreal: This Morning.
1215 Taiwan, Radio Taipei Intl: Taiwan Today.
1220 Singapore, R Singapore Intl: Business and Market Report.
1226 France, Radio France Intl: Review of the French Newspapers.
1230 Singapore, R Singapore Intl: News.
1230 South Korea, Radio Korea Intl: News.
1230 Thailand, Radio: National News.
1232 France, Radio France Intl: Books.
1237 France, Radio France Intl: Discovery.
1244 South Korea, Radio Korea Intl: Cultural Promenade.
1246 France, Radio France Intl: Land of France.
1251 France, Radio France Intl: Echoes from Africa (biweekly).

Wednesdays

1200 Canada, RCI Montreal: RCI News.
1200 France, Radio France Intl: News.
1200 Brazil, Radiobras: Brazilian Panorama.
1211 Canada, RCI Montreal: Spectrum.
1213 Canada, RCI Montreal: This Morning.
1226 France, Radio France Intl: Review of the French Newspapers.
1230 Belgium, R Vlaanderen Intl: Brussels Calling.
1232 France, Radio France Intl: France Today.
1234 France, Radio France Intl: Power and Policy.
1239 France, Radio France Intl: RFI Europe.
1239 Belgium, R Vlaanderen Intl: Belgium Today.
1244 Belgium, R Vlaanderen Intl: Green Society.
1247 France, Radio France Intl: Letter from a Listener.
1250 France, Radio France Intl: Land of France.
1250 Belgium, R Vlaanderen Intl: Living in Belgium.

Thursdays

1200 Canada, RCI Montreal: RCI News.
1200 France, Radio France Intl: News.
1200 Australia, Radio: RA News.
1200 Taiwan, Radio Taipei Intl: News.
1200 Brazil, Radiobras: Brazilian Panorama.
1213 Canada, RCI Montreal: This Morning.
1215 Taiwan, Radio Taipei Intl: Tragedies of the Orient.
1226 France, Radio France Intl: Review of the French Newspapers.
1230 Taiwan, Radio Taipei Intl: Hot Spots.
1230 South Korea, Radio Korea Intl: News.
1233 France, Radio France Intl: The Bottom Line.
1239 France, Radio France Intl: Planet Earth (biweekly).
1246 Sweden, Radio: Horizon (4/5).
1247 France, Radio France Intl: Letter from a Listener.
1250 France, Radio France Intl: North/South (biweekly).

Fridays

1200 Canada, RCI Montreal: RCI News.
1200 France, Radio France Intl: News.
1200 Australia, Radio: RA News.
1200 Canada, RCI Montreal: CBC Radio News.
1200 Singapore, R Singapore Intl: Newsday.
1200 Taiwan, Radio Taipei Intl: News.
1200 Brazil, Radiobras: Brazilian Panorama.
1205 Australia, Radio: Late Night Live.
1211 Canada, RCI Montreal: Spectrum.
1215 Canada, RCI Montreal: As It Happens.
1215 Taiwan, Radio Taipei Intl: Taipei Magazine.
1230 Taiwan, Radio Taipei Intl: Life on the Outside.
1230 South Korea, Radio Korea Intl: News.
1234 France, Radio France Intl: Weekend.
1243 South Korea, Radio Korea Intl: Notes of Nostalgia.

Saturdays

1200 France, Radio France Intl: News.
1200 Australia, Radio: RA News.
1200 Taiwan, Radio Taipei Intl: News.
1200 Brazil, Radiobras: The Best of Brazilian Popular Music.
1211 Canada, N Quebec Svc: As It Happens.
1215 Taiwan, Radio Taipei Intl: Kaleidoscope.
1223 France, Radio France Intl: Focus on France.
1230 Taiwan, Radio Taipei Intl: Reflections.
1231 France, Radio France Intl: Spotlight on Africa.
1237 Turkey, Voice of: Review of the Day's Turkish Press.
1238 South Korea, Radio Korea Intl: From Us to You.
1240 Belgium, R Vlaanderen Intl: Music from Flanders.
1240 Turkey, Voice of: Outlook.
1245 Turkey, Voice of: VOT DX Corner (biweekly).
1251 France, Radio France Intl: Letter from a Listener.
1257 Turkey, Voice of: Blue Voyage.

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Frequencies

1300-1400	Anguilla,Caribbean Beacon	11775am			
1300-1330	Australia, Radio	9770as			
1300-1400	Australia, Radio	5995pa	6020pa	6080as	9580pa
		9660pa			
1300-1400 vl	Australia, VL8A Alice Spg	2310do			
1300-1400 vl	Australia, VL8K Katherine	2485do			
1300-1400 vl	Australia, VL8T Tent Crk	2325do			
1300-1320	Brazil, Radio Bras	15445am			
1300-1400 vl	Canada, CBC N Quebec Svc	9625dc			
1300-1400	Canada, CFRX Toronto	6070dc			
1300-1400	Canada, CFVP Calgary	6030dc			
1300-1400	Canada, CHNX Halifax	6130dc			
1300-1400	Canada, CKZN St John's	6160dc			
1300-1400	Canada, CKZU Vancouver	6160dc			
1300-1400 smtwhf	Canada, R Canada Intl	11855am	13650am		
1300-1400 mtwhf	Canada, R Canada Intl	9640am			
1300-1400	China, China Radio Intl	7385pa	7405na	9945pa	11660as
		11675pa	11980as	15180as	
1300-1400	Costa Rica,RF Peace Intl	6975am			
1300-1330	Czech Rep, Radio Prague	13580as	21745af		
1300-1400	Ecuador, HCJB	12005ca	15115am	21455am	
1300-1330	Egypt, Radio Cairo	17595as			
1300-1400	Eqt Guinea, R East Africa	15186af			
1300-1400	Eqt Guinea, Radio Africa	9530as			
1300-1400	Germany, Sunrise Radio	5850va			
1300-1330 s	Germany, Universal Life	12025as			
1300-1400	Germany,Overcomer Ministr	15625pa	15735as		
1300-1400	Ireland, Unt Christian BC	6200do			
1300-1400	Jordan, Radio	11690eu			
1300-1400	Kenya, Kenya Broadc Corp	4935do			
1300-1310	Liberia,LCN/R Liberia Int	5100do			
1300-1400	Malaysia, Radio	7295do			
1300-1400 irreg	Malaysia,RTM KotaKinabalu	5980do			
1300-1400 vl	Namibia, NBC	4930af	4965af		
1300-1400 occsnal	New Zealand, R NZ Intl	6100pa			
1300-1330 s	Norway, Radio Norway Intl	9590eu	15640na	15650as	
1300-1400	Palau, KHBN/Voice of Hope	9985as			
1300-1400 vl	Papua New Guinea, NBC	4890do			
1300-1400	Philippines, FEBC/R Intl	11995as			
1300-1400	Romania, R Romania Intl	15250na	15390eu	17770eu	17790na
1300-1400	Russia,Voice of Russia WS	11655as	15510as	17570as	21760as
1300-1400 as	S Africa, Channel Africa	9445af	17675af	17870af	
1300-1400	Singapore,R Singapore Int	6015as	6150as		
1300-1400	Sri Lanka, Sri Lanka BC	9730as	15425as		
1300-1400	Switzerland, Swiss R Intl	7230as	7480as		
1300-1400 vl	Tanzania, Radio	5050do			
1300-1330	Turkey, Voice of	11995eu	15185as	17830eu	
1300-1400	UK, BBC African Service	6190af	11940af	15420af	17830af
		17885af	21660af		
1300-1400	UK, BBC Asian Service	5990as	6195as	9740as	11750as
		15310as			
1300-1400	UK, BBC World Service	5965na	6195am	9410eu	9515na
		11760me	11865na	12095eu	15220am
		15485eu	15565eu	15575eu	17640eu
		17705eu			
1300-1400	USA, KAIJ Dallas TX	5810am			
1300-1400 twhfas	USA, KHBI N Mariana Is	9355as			
1300-1400	USA, KJES Mesquite NM	11715am			
1300-1400	USA, KNLS Anchor Point AK	7365as			
1300-1400	USA, KTBN Salt Lk City UT	7510am			
1300-1400	USA, KWHR Naalehu HI	9930as	11565pa		
1300-1400	USA, Voice of America	6160as	9645as	9760as	11715as
		15160as	15425as		
1300-1400	USA, WEWN Birmingham AL	7425na	9465na	15745eu	
1300-1400 mtwhfa	USA, WGTG McCaysville GA	9400am			
1300-1400	USA, WHRI Noblesville IN	6040am	15105am		
1300-1400	USA, WJCR Upton KY	7490na	13595na		
1300-1330 a	USA, WRMI/R Miami Intl	9955ca			
1300-1400 mtwhas	USA, WSHB Cypress Crk SC	9410na			
1300-1400 tf	USA, WSHB Cypress Crk SC	11660am			
1300-1400	USA, WWCR Nashville TN	9475am	12160am	13845am	15685am
1300-1400	USA, WYFR Okeechobee FL	11830na	11970na	13695na	17750na
1300-1400	Zambia, Christian Voice	6065af			
1300-1400	Zambia, Natl BC Corp	6165do	6265do		
1300-1400 vl	Zimbabwe, Zimbabwe BC	4828do	5012do		
1302-1400	USA, WYFR Okeechobee FL	11550as			
1315-1400 mtwhfa	Bhutan, Bhutan BC Service	5030do			
1330-1359	Canada, R Canada Intl	9535as	11795as	11935eu	15325eu
1330-1359 mtwhfa	Canada, R Canada Intl	17820va			
1330-1400	China, Heilongjiang PBS	4840do			
1330-1400	Guam, AWR/KSDA	9650as			
1330-1400	India, All India Radio	9545as	11620as	13710as	
1330-1400	Netherlands, Radio	9890as	15585as		
1330-1400	Sweden, Radio	13740as	15240am	17515au	
1330-1400	UAE, Radio Dubai	13630eu	13675eu	15395eu	21635eu
1330-1400 as	USA, WRMI/R Miami Intl	9955ca			
1330-1400	Uzbekistan, R Tashkent	7285as	9715as	15295as	17775as
1330-1400	Vietnam, Voice of	9840eu	12020as	15010as	
1335-1345	Greece, Voice of	9395eu	11730na	15175eu	15630eu
1345-1400	Vatican State, Vatican R	13765au	15540au		

Selected Programs

Sundays

1300 Czech Rep, Radio Prague: News.
1300 USA, KJES Mesquite NM: Religious Chanting.
1300 USA, KNLS Anchor Point AK: Music/News/Commentary.
1300 Singapore, R Singapore Intl: News.
1305 Czech Rep, Radio Prague: The Week in Politics.
1305 Australia, Radio: Country Club (Part 2).
1305 Switzerland, Swiss Radio Intl: Newsnet.
1312 Czech Rep, Radio Prague: From the Weeklies.
1318 Czech Rep, Radio Prague: Media Check.
1330 Ecuador, HCJB Quito (am): Mountain Meditations.
1330 Sweden, Radio: Sounds Nordic (2/4).
1330 UAE, Radio Dubai: News.
1330 Netherlands, Radio: News.
1337 Netherlands, Radio: Sincerely Yours.
1345 China, China Radio Intl: Voices from Other Lands.
1354 Vatican State, Vatican Radio: On-the-Air.
1355 Netherlands, Radio: Sounds Interesting.

Mondays

1300 Romania, Radio Romania Intl: Radio Newsreel.
1300 Canada, RCI Montreal: CBC Radio News.
1300 Philippines, FEBC : News Insight.
1306 Canada, RCI Montreal: This Morning.
1308 Turkey, Voice of: Treasured Portraits.
1310 Brazil, Radiobras: Brazilian Reporter.
1311 Czech Rep, Radio Prague: Magazine '98.
1315 Romania, Radio Romania Intl: Pro Memoria.
1315 Australia, Radio: The Planet (Part 1).
1330 Canada, RCI Montreal: RCI News.
1330 Netherlands, Radio: News.
1332 Russia, Voice of: Audio Book Club.
1338 Netherlands, Radio: Newsline.
1339 Canada, RCI Montreal: Spectrum.
1340 Romania, Radio Romania Intl: Romanian Itineraries.
1340 Philippines, FEBC : Computer Corner.
1353 Netherlands, Radio: Research File.

Tuesdays

1300 Romania, Radio Romania Intl: Radio Newsreel.
1300 Australia, Radio: RA News.
1300 Germany, Deutsche Telekom: The Overcomer Broadcast.
1300 Philippines, FEBC : News Insight.
1310 Brazil, Radiobras: Brazilian Reporter.
1315 Romania, Radio Romania Intl: Business Club.
1315 Australia, Radio: The Planet (Part 1).
1325 Romania, Radio Romania Intl: Inside Romania.
1331 Romania, Radio Romania Intl: Romanian Literature.
1338 Netherlands Radio: Newsline.
1341 Romania, Radio Romania Intl: Romanian Hits.

Wednesdays

1300 Czech Rep, Radio Prague: News.
1300 Romania, Radio Romania Intl: Radio Newsreel.
1300 Australia, Radio: RA News.
1305 Switzerland, Swiss Radio Intl: Newsnet.
1310 Brazil, Radiobras: Brazilian Reporter.
1312 Czech Rep, Radio Prague: From the Archives.
1315 Romania, Radio Romania Intl: Society.
1315 Philippines, FEBC : FEBC DX Dial.
1330 Singapore, R Singapore Intl: News.
1330 Canada, RCI Montreal: RCI News.
1338 Netherlands, Radio: Newsline.
1340 Philippines, FEBC : Computer Corner.
1346 Sweden, Radio: Money Matters.

Thursdays

1300 Romania, Radio Romania Intl: Radio Newsreel.
1300 Australia, Radio: RA News.
1305 Singapore, R Singapore Intl: Singa-Pop.
1305 Switzerland Swiss Radio Intl: Newsnet.
1306 Canada, RCI Montreal: This Morning.
1310 Brazil, Radiobras: Brazilian Reporter.
1315 Romania, Radio Romania Intl: Citizens of the Same Country.
1315 Australia, Radio: The Planet (Part 1).
1325 Romania, Radio Romania Intl: Romanian Musicians.
1335 Romania, Radio Romania Intl: Partners in a Changing World.
1335 Singapore, R Singapore Intl: E-Z Beat.
1338 Netherlands, Radio: Newsline.
1339 Canada, RCI Montreal: Spectrum.
1352 Netherlands, Radio: Media Network.

Fridays

1300 Romania, Radio Romania Intl: Radio Newsreel.
1300 Australia, Radio: RA News.
1306 Canada, RCI Montreal: This Morning.
1310 Brazil, Radiobras: Brazilian Reporter.
1315 Romania, Radio Romania Intl: A Time for the Future.
1315 Australia, Radio: The Planet (Part 1).
1325 Romania, Radio Romania Intl: The Skylark.
1325 Russia, Voice of: News and Views.
1330 Singapore, R Singapore Intl: News.
1335 Romania, Radio Romania Intl: Listeners' Letterbox.
1335 Singapore, R Singapore Intl: E-Z Beat.
1338 Netherlands, Radio: Newsline.
1352 Romania, Radio Romania Intl: The Listeners Club.

Saturdays

1300 Czech Rep, Radio Prague: News.
1300 Romania, Radio Romania Intl: Radio Newsreel.
1300 Russia, Voice of: News.
1304 Czech Rep, Radio Prague: Let's Go.
1305 Singapore, R Singapore Intl: Chartbeat.
1305 Switzerland, Swiss Radio Intl: Newsnet.
1315 Romania, Radio Romania Intl: World of Culture.
1320 China, China Radio Intl: Chinese Folktales.
1325 China, China Radio Intl: The Cooking Show.
1330 China, China Radio Intl: China Scrapbook.
1332 Russia, Voice of: A Christian Message from Moscow.
1337 Romania, Radio Romania Intl: Inside Romania.
1340 Philippines, FEBC : Computer Corner.
1348 Romania, Radio Romania Intl: Bucharest along the Centuries.
1355 Netherlands, Radio: Weekend.

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FREQUENCIES

1400-1500	Anguilla,Caribbean Beacon	11775am			
1400-1500	Australia, Radio	5995pa	6020pa	6080as	9580pa
		9660pa			
1400-1500 vl	Australia, VL8A Alice Spg	2310do			
1400-1500 vl	Australia, VL8K Katherine	2485do			
1400-1500 vl	Australia, VL8T Tent Crk	2325do			
1400-1500 vl	Canada, CBC N Quebec Svc	9625do			
1400-1500	Canada, CFRX Toronto	6070do			
1400-1500	Canada, CFVP Calgary	6030do			
1400-1500	Canada, CHNX Halifax	6130do			
1400-1500	Canada, CKZN St John's	6160do			
1400-1500	Canada, CKZU Vancouver	6160do			
1400-1500 s	Canada, R Canada Intl	11855am	13650am		
1400-1500	China, China Radio Intl	7260as	7405na	9535as	9700as
		9870af	11825as	15125af	
1400-1500	Costa Rica,RF Peace Intl	6975am			
1400-1500	Ecuador, HCJB	12005ca	15115am	21455am	
1400-1500 as	Eqt Guinea, R East Africa	15186af			
1400-1500	France, Radio France Intl	11910as	15405as	17560af	
1400-1500	Germany, Sunrise Radio	5850va			
1400-1430 s	Germany, Universal Life	9955na			
1400-1500	Germany,Overcomer Ministr	13810me	15625pa		
1400-1500	India, All India Radio	9545as	11620as	13710as	
1400-1500	Ireland, Unt Christian BC	6200do			
1400-1430	Israel, Kol Israel	12535eu	15640na		
1400-1500	Japan, R Japan/NHK World	9505na	11730as	11880af	
1400-1500	Jordan, Radio	11690eu			
1400-1500	Kenya, Kenya Broadc Corp	4935do			
1400-1500	Malaysia, Radio	7295do			
1400-1500 vl	Malaysia, RTM Kuching	4895do	7160do		
1400-1500 irreg	Malaysia,RTM KotaKinabalu	5980do			
1400-1430	Mexico, Radio Mexico Intl	5985na	9705na		
1400-1500 vl	Namibia, NBC	4930af	4965af		
1400-1500	Netherlands, Radio	9890as	15585as		
1400-1500 occsnal	New Zealand, R NZ Intl	6100pa			
1400-1410	Pakistan, Radio	9650as	11570me	15170af	
1400-1500 as	Palau, KHBN/Voice of Hope	9985as			
1400-1500 vl	Papua New Guinea, NBC	4890do			

1400-1500	Philippines, FEBC/R Intl	11995as			
1400-1500	Russia,Voice of Russia WS	4730as	4940as	4975as	7510as
		11655as	12025as	15510as	17570as
1400-1455 as	S Africa, Channel Africa	9445af	17675af	17870af	
1400-1500	Singapore,RCorp Singapore	6150do			
1400-1500	Sri Lanka, Sri Lanka BC	9730as	15425as		
1400-1500	Switzerland, Swiss R Intl	9575as	15265as		
1400-1500 vl	Tanzania, Radio	5050do			
1400-1430	Thailand, Radio	9655as	9830as	11905as	
1400-1500	UK, BBC African Service	6190af	11940af	17830af	21490af
		21660af			
1400-1500	UK, BBC Asian Service	5990as	6195as	9740as	11750as
		15310as			
1400-1500	UK, BBC World Service	9410eu	9515na	11865na	12095eu
		15220na	15485eu	15565eu	15575eu
		17640eu	17705eu	17840am	
1400-1500	USA, KAIJ Dallas TX	13815am			
1400-1500	USA, KJES Mesquite NM	11715am			
1400-1500	USA, KTBN Salt Lk City UT	7510am			
1400-1500	USA, KWHR Naalehu HI	9930as	11565pa		
1400-1500	USA, Voice of America	6160as	7125as	7215as	9645as
		9760as	15160as	15255va	15395as
		15425as			
1400-1500	USA, WEWN Birmingham AL	9455na	11875na	15745eu	
1400-1500 mtwhfa	USA, WGTG McCaysville GA	9400am			
1400-1500	USA, WHRI Noblesville IN	6040am	15105am		
1400-1500	USA, WJCR Upton KY	7490na	13595na		
1400-1500 as	USA, WRMI/R Miami Intl	9955ca			
1400-1500	USA, WWCR Nashville TN	9475am	12160am	13845am	15685am
1400-1500	USA, WYFR Okeechobee FL	11502as	11830na	11970na	17750na
1400-1405	Vatican State, Vatican R	13765au	15540au		
1400-1500	Zambia, Christian Voice	6065af			
1400-1500	Zambia, Natl BC Corp	6165do	6265do		
1400-1500 vl	Zimbabwe, Zimbabwe BC	4828do	5012do		
1415-1425	Nepal, Radio	5005do	7165do		
1430-1500	Australia, Radio	9500as	11660as		
1430-1500	Guam, AWR/KSDA	9385as			
1430-1500	Mongolia, Voice of	9720as	12085as		
1430-1500	Myanmar, Radio	5986do			

SELECTED PROGRAMS

Sundays

1400 Israel, Kol Israel: News.
1400 France, Radio France Intl: News.
1400 Australia, Radio: RA News.
1400 Canada, RCI Montreal: CBC Radio News.
1400 Ecuador, HCJB Quito (am): The Urban Alternative.
1400 Jordan, Radio: Listeners' Choice.
1405 Australia, Radio: Other Worlds (Part 1).
1405 Canada, N Quebec Svc: Sunday Morning (2nd hour).
1405 Switzerland, Swiss Radio Intl: Newsnet.
1415 Thailand, Radio: Travel Thailand.
1415 Switzerland, Swiss Radio Intl: Sounds Good (3/5).
1419 France, Radio France Intl: Asia File.
1430 Switzerland, Swiss Radio Intl: Rendez-vous with Switzerland.
1433 France, Radio France Intl: Club 9516.
1439 Netherlands, Radio: Wide Angle.
1445 Philippines, FEBC : Sound Words.
1454 Netherlands, Radio: Siren Song.

Mondays

1400 Mexico, R Mexico Intl: Antenna Radio Summary.
1400 France, Radio France Intl: News.
1400 Australia, Radio: RA News.
1405 Australia, Radio: The Planet (Part 2).
1405 Switzerland, Swiss Radio Intl: Newsnet.
1415 Thailand, Radio: Travel Thailand.
1420 India, All India Radio: Press Review.
1425 India, All India Radio: DX-ers Corner (2/4).
1430 Netherlands, Radio: News.
1432 France, Radio France Intl: RFI Europe.
1434 China, China Radio Intl: Changzhou Reports.
1438 Netherlands, Radio: Newsline.
1445 France, Radio France Intl: Arts in France.
1445 China, China Radio Intl: Idioms and Their Stories.
1450 France, Radio France Intl: Insight.

Tuesdays

1400 Israel, Kol Israel: News.
1400 Mexico, R Mexico Intl: Antenna Radio Summary.
1400 Thailand, Radio: Thai Culture.
1400 Anguilla, Caribbean Beacon: World University Network.
1400 Australia, Radio: RA News.
1400 Switzerland, Swiss Radio Intl: News.
1405 Australia, Radio: The Planet (Part 2).
1405 Switzerland, Swiss Radio Intl: Newsnet.
1415 Thailand, Radio: Travel Thailand.
1426 France, Radio France Intl: Review of the French Newspapers.
1430 Switzerland, Swiss Radio Intl: Rendez-vous with Switzerland.
1437 France, Radio France Intl: Discovery.
1438 Netherlands, Radio: Newsline.
1446 France, Radio France Intl: Land of France.

Wednesdays

1400 Vatican State, Vatican Radio: What Can I Do?
1400 France, Radio France Intl: News.
1400 Australia, Radio: RA News.
1400 India, All India Radio: Radio Newsreel.
1400 Japan, Radio: News.
1405 Switzerland, Swiss Radio Intl: Newsnet.
1415 Japan, Radio: 44 Minutes.
1426 France, Radio France Intl: Review of the French Newspapers.
1430 Switzerland, Swiss Radio Intl: Rendez-vous with Switzerland.
1432 France, Radio France Intl: France Today.
1434 France, Radio France Intl: Power and Policy.
1438 Netherlands, Radio: Newsline.
1439 France, Radio France Intl: RFI Europe.
1452 Japan, Radio: Tumbling Dice.
1454 Netherlands, Radio: Sounds Interesting.

Thursdays

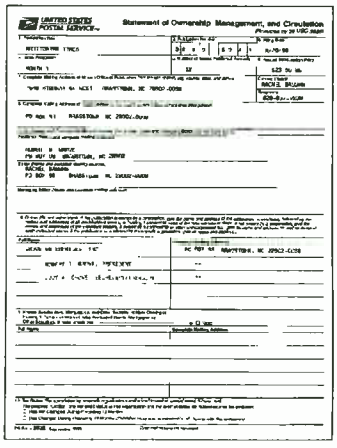
1400 Vatican State, Vatican Radio: Postcards from Rome.
1400 Mexico, R Mexico Intl: Antenna Radio Summary.
1400 France, Radio France Intl: News.
1400 Australia, Radio: RA News.
1405 Australia, Radio: The Planet (Part 2).
1405 Switzerland, Swiss Radio Intl: Newsnet.
1426 France, Radio France Intl: Review of the French Newspapers.
1433 France, Radio France Intl: The Bottom Line.
1438 Netherlands, Radio: Newsline.
1439 France, Radio France Intl: Planet Earth (biweekly).
1447 France, Radio France Intl: Letter from a Listener.
1450 France, Radio France Intl: North/South (biweekly).
1453 Netherlands, Radio: Research File.

Fridays

1400 Israel, Kol Israel: News.
1400 Mexico, R Mexico Intl: Antenna Radio Summary.
1400 Thailand, Radio: Bangkok Vibrations.
1400 France, Radio France Intl: News.
1400 Australia, Radio: Radio National News.
1405 Australia, Radio: The Planet (Part 2).
1405 Switzerland, Swiss Radio Intl: Newsnet.
1413 Israel, Kol Israel: Current Cultural Events in Israel.
1415 Thailand, Radio: Travel Thailand.
1426 France, Radio France Intl: Review of the French Newspapers.
1434 France, Radio France Intl: Weekend.
1438 Netherlands, Radio: Newsline.
1454 Netherlands, Radio: Documentary.

Saturdays

1400 Israel, Kol Israel: News.
1400 Thailand, Radio: Thai Culture.
1400 France, Radio France Intl: News.
1400 Australia, Radio: Radio National News.
1405 Canada, N Quebec Svc: Basic Black.
1405 Switzerland, Swiss Radio Intl: Newsnet.
1410 Israel, Kol Israel: The Week in Review.
1420 South Africa, Channel Africa: This is Your World.
1423 France, Radio France Intl: Focus on France.
1430 Switzerland, Swiss Radio Intl: Rendez-vous with Switzerland.
1431 France, Radio France Intl: Spotlight on Africa.
1438 Netherlands, Radio: Newsline.
1440 Philippines, FEBC : Mailbag.
1454 Netherlands, Radio: Roughly Speaking.
1455 Philippines, FEBC : FEBC DX Dial.



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Frequencies

1500-1600	Anguilla,Caribbean Beacon	11775am			
1500-1600	Australia, Radio	5995pa	6020pa	6080as	9500as
		9580pa	9660pa	11660as	
1500-1600 vl	Australia, VL8A Alice Spg	2310do			
1500-1600 vl	Australia, VL8K Katherine	2485do			
1500-1600 vl	Australia, VL8T Tent Crk	2325do			
1500-1600 vl	Canada, CBC N Quebec Svc	9625do			
1500-1600	Canada, CFRX Toronto	6070do			
1500-1600	Canada, CFVP Calgary	6030do			
1500-1600	Canada, CHNX Halifax	6130do			
1500-1600	Canada, CKZN St John's	6160do			
1500-1600	Canada, CKZU Vancouver	6160do			
1500-1559 s	Canada, R Canada Intl	11855am	13650am		
1500-1600	China, China Radio Intl	7160as	9785as	9870af	15125af
1500-1600	Costa Rica,RF Peace Intl	6975am	15050am		
1500-1600	Ecuador, HCJB	12005ca	15115am	21455am	
1500-1600 as	Eqt Guinea, R East Africa	15186af			
1500-1600	Germany, Sunrise Radio	5850va			
1500-1600	Germany,Overcomer Ministr	13810me	15625na		
1500-1600	Guam, TWR/KTWR	15330as			
1500-1600	Ireland, Unt Christian BC	6200do			
1500-1600	Japan, R Japan/NHK World	7200as	9505na	9750as	11730as
1500-1600	Jordan, Radio	11690eu			
1500-1600	Kenya, Kenya Broadc Corp	4935do			
1500-1510	Liberia,LCN/R Liberia Int	5100do			
1500-1600	Malaysia, Radio	7295do			
1500-1600 irreg	Malaysia,RTM KotaKinabalu	5980do			
1500-1530 smtwfa	Mexico, Radio Mexico Intl	5985na	9705na		
1500-1600	Myanmar, Radio	5986do			
1500-1600 vl	Namibia, NBC	4930af	4965af		
1500-1525	Netherlands, Radio	9890as	15585as		
1500-1600 occsnal	New Zealand, R NZ Intl	6100pa			
1500-1600	Nigeria, Voice of	7255af	15120af		
1500-1557	North Korea, R Pyongyang	3560ca	9640af	9975me	11735sa
		13650va			
1500-1530 s	Norway, Radio Norway Intl	13800va			
1500-1530 as	Palau, KHBN/Voice of Hope	9985as			
1500-1600 vl	Papua New Guinea, NBC	4890do			
1500-1600	Philippines, FEBC	11995as			

1500-1600	Russia,Voice of Russia WS	4730me	4940me	4975me	7130me
		7325me	9975me	11500as	11775me
		15470me	15540me	17580me	
1500-1530	S Africa, Channel Africa	9445af			
1500-1530 twhfa	Seychelles, FEBA Radio	11600as			
1500-1545 sm	Seychelles, FEBA Radio	11600as			
1500-1600	Singapore,RCorp Singapore	6150do			
1500-1600	Sri Lanka, Sri Lanka BC	9730as	15425as		
1500-1600	Taiwan, Voice of Asia	7445as			
1500-1600 vl	Tanzania, Radio	5050do			
1500-1600	UK, BBC African Service	6190af	11860af	11940af	15400af
		15420af	17830af	21470af	21490af
		21660af			
1500-1600	UK, BBC Asian Service	5975as	5990as	6195as	7135as
		9740as	11750as	15310as	
1500-1600	UK, BBC World Service	9410eu	9515na	11865na	12040eu
		12095eu	15220na	15485eu	15575eu
		17705eu	17840am		
1500-1600	USA, KAIJ Dallas TX	13815am			
1500-1600	USA, KTBN Salt Lk City UT	15590am			
1500-1600	USA, KWHR Naalehu HI	9930as	11565pa		
1500-1600	USA, Voice of America	6110as	6160as	7125as	7215as
		9645as	9700me	9760as	15205va
		15255va	15395as		
1500-1600	USA, WEWN Birmingham AL	9455na	11875na	15745eu	
1500-1600 mtwhfa	USA, WGTG McCaysville GA	9400am			
1500-1600	USA, WHRI Noblesville IN	13760am	15105am		
1500-1600	USA, WJCR Upton KY	7490na	13595na		
1500-1600 as	USA, WRMI/R Miami Intl	9955ca			
1500-1600	USA, WWCR Nashville TN	9475am	12160am	13845am	15685am
1500-1600	USA, WYFR Okeechobee FL	11830na	17750na		
1500-1502	USA, WYFR Okeechobee FL	11550as			
1500-1600 vl	Vatican State, Vatican R	13765va	15500va		
1500-1600	Zambia, Christian Voice	6065af			
1500-1600	Zambia, Natl BC Corp	6165do	6265do		
1500-1600 vl	Zimbabwe, Zimbabwe BC	4828do	5012do		
1530-1600	Guam, AWR/KSDA	11980as			
1530-1600	Iran, VOIRI	7215as	11775as	13605me	
1545-1600	Albania, R Tirana Intl	11734eu	12084eu		
1545-1600	Israel, Kol Israel	11605eu	15650na	17515na	

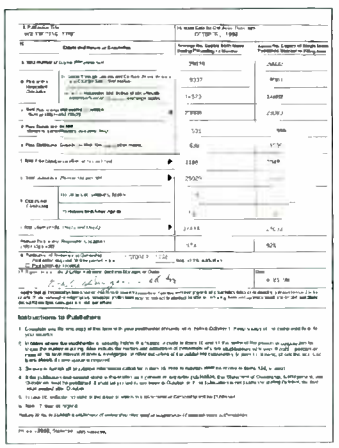
Selected Programs

Sundays

1500 Australia, Radio: RA News.
1500 Ecuador, HCJB Quito (am): Encounter.
1503 Jordan, Radio: Listeners' Choice.
1505 Australia, Radio: Other Worlds (Part 2).
1520 China, China Radio Intl: China Snapshots.
1525 China, China Radio Intl: Report on Developing Countries.
1530 Philippines, FEBC : Guidelines.
1535 China, China Radio Intl: Song of the Week.
1545 China, China Radio Intl: Voices from Other Lands.
1545 Israel, Kol Israel: News.
1550 Vatican State, Vatican Radio: Focus on the Church.

Mondays

1500 Australia, Radio: RA News.
1500 Jordan, Radio: News Summary.



1500 USA, WWCR #3 Nashville TN: USA Radio News.
1505 Australia, Radio: Asia Pacific.
1520 China, China Radio Intl: Current Affairs.
1525 China, China Radio Intl: Press Clippings.
1530 China, China Radio Intl: China's Open Windows.
1530 Australia, Radio: The Health Report.
1530 Philippines, FEBC : World News Update.
1534 China, China Radio Intl: Changzhou Reports.
1545 China, China Radio Intl: Idioms and Their Stories.

Tuesdays

1500 Australia, Radio: RA News.
1500 Japan, Radio: News.
1500 USA, Voice of America: News.
1511 China, China Radio Intl: News about China.
1515 Japan, Radio: Top News Asia.
1520 China, China Radio Intl: Current Affairs.
1525 Japan, Radio: Let's Learn Japanese.
1530 Philippines, FEBC : World News Update.
1530 USA, Voice of America: News (Special English).
1534 China, China Radio Intl: Press Clippings.
1539 China, China Radio Intl: Orient Arena.
1545 China, China Radio Intl: Voices from Other Lands.
1545 USA, WWCR #1 Nashville TN: Wisdom from the Word.
1545 Israel, Kol Israel: News.

Wednesdays

1500 USA, WWCR #3 Nashville TN: USA Radio News.
1504 Jordan, Radio: The Mix.
1506 USA, WWCR #3 Nashville TN: Freedom's Call (live).
1511 China, China Radio Intl: News about China.
1520 China, China Radio Intl: Current Affairs.
1530 Australia, Radio: The Religion Report.
1530 Philippines, FEBC : World News Update.
1535 Philippines, FEBC : The Way to Life.
1550 Vatican State, Vatican Radio: News of the Church.
1555 Vatican State, Vatican Radio: Mailbox.

Thursdays

1500 Japan, Radio News.
1500 Jordan, Radio: News Summary.
1500 USA, WWCR #3 Nashville TN: USA Radio News.
1503 Jordan, Radio: Country Music.
1506 USA, WWCR #3 Nashville TN: Freedom's Call (live).
1515 Japan, Radio: Top News Asia.
1525 Ecuador, HCJB Quito (am): Joni and Friends.
1530 Philippines, FEBC : World News Update.
1550 Vatican State, Vatican Radio: United Nations Radio.

Fridays

1500 Mexico, R Mexico Intl: Universal Forum.
1500 Japan, Radio: News.
1500 Jordan, Radio: News Summary.
1500 Guam, TWR/KTWR: Words of Hope.
1500 USA, WWCR #3 Nashville TN: USA Radio News.
1504 Jordan, Radio: Country Music.
1511 China, China Radio Intl: News about China.
1515 Japan, Radio: Top News Asia.
1520 China, China Radio Intl: Current Affairs.
1530 Philippines, FEBC : World News Update.
1533 China, China Radio Intl: Press Clippings.
1535 Philippines, FEBC : The Way to Life.
1537 China, China Radio Intl: Life in China.
1544 China, China Radio Intl: Global Review.
1550 Vatican State, Vatican Radio: News from the African Church.

Saturdays

1500 Canada, N Quebec Svc: CBC Radio News.
1500 Ecuador, HCJB Quito (am): Words of Hope.
1500 Germany, Deutsche Telekom: The Overcomer Broadcast.
1500 Jordan, Radio: News Bulletin.
1505 Canada, N Quebec Svc: Basic Black.
1506 USA, Voice of America: All About English.
1520 China, China Radio Intl: Chinese Folktales.
1530 China, China Radio Intl: China Scrapbook.
1530 Canada, N Quebec Svc: The Great Northern.
1530 Philippines, FEBC : World News Update.
1530 USA, Voice of America: News (Special English).
1535 China, China Radio Intl: Music from China.
1545 USA, WWCR #1 Nashville TN: Words of Hope.
1549 Jordan, Radio: Music.
1550 Vatican State, Vatican Radio: Mass in English.

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Frequencies

1600-1700	Algeria, R Algiers Intl	11715af	15160me		
1600-1700	Anguilla,Caribbean Beacon	11775am			
1600-1700	Australia, Radio	5995pa	6020pa	6080as	9500as
		9580pa	9660pa	11660as	
1600-1700 vl	Australia, VL8A Alice Spg	2310do			
1600-1700 vl	Australia, VL8K Katherine	2485do			
1600-1700 vl	Australia, VL8T Tent Crk	2325do			
1600-1700 vl	Canada, CBC N Quebec Svc	9625do			
1600-1700	Canada, CFRX Toronto	6070do			
1600-1700	Canada, CFVP Calgary	6030do			
1600-1700	Canada, CHNX Halifax	6130do			
1600-1700	Canada, CKZN St John's	6160do			
1600-1700	Canada, CKZU Vancouver	6160do			
1600-1700	China, China Radio Intl	9560af	9620af		
1600-1700 as	Costa Rica, Adv World R	9725na			
1600-1627	Czech Rep, Radio Prague	5930eu	17485af		
1600-1700	Ethiopia, Radio	7165af			
1600-1700	France, Radio France Intl	11615af	11705af	12015af	15210af
		15640af	17850af		
1600-1650	Germany, Deutsche Welle	6170as	7130af	7225as	9735af
		9875as	11810af	15145as	21695af
1600-1700	Germany, Sunrise Radio	5850va			
1600-1700	Germany,Overcomer Ministr	6130eu	13810me	15625na	
1600-1700	Guam, AWR/KSDA	11980as			
1600-1630	Guam, TWR/KTWR	15330as			
1600-1630	Iran, VOIRI	7215as	11775as	13605me	
1600-1700	Ireland, Unt Christian BC	6200do			
1600-1630	Jordan, Radio	11690eu			
1600-1700	Kenya, Kenya Broadc Corp	4935do			
1600-1700	Lebanon, Voice of Hope	9960me			
1600-1700	Malaysia, Radio	7295do			
1600-1700 vl	Namibia, NBC	4930af	4965af		
1600-1650 occsnal	New Zealand, R NZ Intl	6100pa			
1600-1700	Nigeria, Voice of	7255af	15120af		
1600-1630 s	Norway, Radio Norway Intl	13800va	15340na	18950va	
1600-1630	Pakistan, Radio	9650as	11570me	15170af	17720af
1600-1700 vl	Papua New Guinea, NBC	4890do			
1600-1700	Russia,Voice of Russia WS	9675me	11775me	11850me	12065me
		15540me			
1600-1625	S Africa, Channel Africa	6000af			
1600-1700	South Korea, R Korea Intl	5975as	9515va	9870as	
1600-1700 as	Sri Lanka, Sri Lanka BC	9730as	15425as		
1600-1700	Swaziland, Trans World R	9500af			
1600-1615	Switzerland, Swiss R Intl	9575as	15265as		
1600-1700 vl	Tanzania, Radio	5050do			
1600-1645	UAE, Radio Dubai	13630eu	13675eu	15395eu	21605eu
1600-1700	UK, BBC African Service	3255af	6190af	15400af	17705af
		17830af	21470af	21660af	
1600-1606	UK, BBC Asian Service	3915as	5975as	5990as	6195as
		7160as	9740as	11750as	15310as
1600-1700	UK, BBC World Service	9410eu	9515na	12095eu	15485eu
		15575eu	17840am		
1600-1700	USA, KAIJ Dallas TX	13815am			
1600-1700	USA, KTBN Salt Lk City UT	15590am			
1600-1700	USA, KWHR Naalehu HI	9930as			
1600-1700	USA, Voice of America	6035af	6110as	6160as	7125as
		7215as	9645as	9700me	9760as
		13600af	13710af	15205va	15225af
		15255va	15395as	15410af	15445af
		17895af			
1600-1700	USA, WEWN Birmingham AL	11875na	13615na		
1600-1700 mtwhfa	USA, WGTG McCaysville GA	9400am			
1600-1700	USA, WHRI Noblesville IN	13760am	15105am		
1600-1700	USA, WJCR Upton KY	7490na	13595na		
1600-1700	USA, WMLK Bethel PA	9465am			
1600-1700 mtwhf	USA, WRNO New Orleans LA	15420am			
1600-1700 a	USA, WSHB Cypress Crk SC	18930af			
1600-1700	USA, WWCR Nashville TN	9475am	12160am	13845am	15685am
1600-1700	USA, WYFR Okeechobee FL	11705na	11830na	15695va	17555va
		17750na	21525va		
1600-1610 a	Vatican State, Vatican R	13765va	15500va		
1600-1630	Vietnam, Voice of	9840eu	12010eu	15010eu	
1600-1700	Zambia, Christian Voice	3330af	4965af		
1600-1700	Zambia, Natl BC Corp	6165do	6265do		
1600-1630 vl	Zimbabwe, Zimbabwe BC	4828do	5012do		
1606-1615	UK, BBC Asian Service	3915as	5975as	7160as	9740as
		11750as			
1606-1615 mtwhf	UK, BBC Asian Service	5990as	6195as	15310as	
1615-1645 as	UK, BBC African Service	11860af			
1615-1645	UK, BBC African Service	15420af			
1615-1700	UK, BBC Asian Service	3915as	5975as	7160as	9510as
		9740as	11750as		
1615-1700 as	UK, BBC World Service	9515na			
1615-1630	Vatican State, Vatican R	4005eu	5883eu	7250eu	9645eu
		11810eu			
1630-1700	Austria, R Austria Intl	6155eu	11855me	13710as	13730va
1630-1655	Belgium, R Vlaanderen Int	5910eu	7290eu		
1630-1657	Canada, R Canada Intl	6140as	7150as		
1630-1700	Egypt, Radio Cairo	15255af			
1630-1700 a	Germany, Universal Life	12015af			
1630-1700	Slovakia, R Slovakia Intl	5920eu	6055eu	7345eu	
1630-1700 vl	Zimbabwe, Zimbabwe BC	3306do	4828do		
1645-1700	Tajikistan, R Dushanbe	7245as			
1645-1700	UK, BBC African Service	11860af	15420af		
1650-1700	Eqt Guinea, Radio Africa	15186af			
1650-1700 mtwhf	New Zealand, R NZ Intl	6145pa			

Selected Programs

Sundays

1600 Vatican State, Vatican Radio: The Backgrounder.
1600 Australia, Radio: RA News.
1600 France, Radio France Intl: News.
1605 Switzerland, Swiss Radio Intl: Newsnet.
1605 Australia, Radio: The National Interest.
1606 Germany, Deutsche Welle: Religion and Society.
1610 Costa Rica, AWR: Science News.
1616 Germany, Deutsche Welle: Arts on the Air.
1619 France, Radio France Intl: Asia File.
1630 Costa Rica, AWR: The Quiet Hour.
1630 France, Radio France Intl: News Headlines.
1630 USA, Voice of America: News (Special English).
1633 France, Radio France Intl: Club 9516.
1640 USA, Voice of America: Words and their Stories (Special English).
1645 USA, Voice of America: People in America (Special English).

Mondays

1600 Australia, Radio: RA News.
1600 France, Radio France Intl: News.
1602 Vatican State, Vatican Radio: News.
1605 Switzerland, Swiss Radio Intl: Newsnet.
1605 Australia, Radio: Music Deli.
1606 USA, Voice of America: All About English.
1625 France, Radio France Intl: Review of the French Newspapers.
1630 France, Radio France Intl: News Headlines.
1631 France, Radio France Intl: Sports Magazine.
1632 France, Radio France Intl: RFI Europe.
1641 France, Radio France Intl: News Summary.
1645 France, Radio France Intl: Arts in France.
1650 France, Radio France Intl: Insight.

Tuesdays

1600 Australia, Radio: RA News.
1600 France, Radio France Intl: News.
1600 USA, KTBN Salt Lk City UT: The Music of Praise.
1602 Vatican State, Vatican Radio: News.
1605 Switzerland, Swiss Radio Intl: Newsnet.
1610 Jordan, Radio: Classical Gems.
1615 UAE, Radio Dubai: Music.
1615 Vatican State, Vatican Radio: News.
1626 France, Radio France Intl: Review of the French Newspapers.
1631 France, Radio France Intl: Books.
1636 France, Radio France Intl: Land of France.
1641 France, Radio France Intl: News Headlines.
1645 France, Radio France Intl: Letter from a Listener.
1648 France, Radio France Intl: Drumbeat.

Wednesdays

1600 France, Radio France Intl: News.
1602 Vatican State, Vatican Radio: News.
1605 Switzerland, Swiss Radio Intl: Newsnet.
1606 Germany, Deutsche Welle: NewsLink.
1626 France, Radio France Intl: Review of the French Newspapers.
1630 France, Radio France Intl: News Headlines.
1632 France, Radio France Intl: France Today.
1634 France, Radio France Intl: Power and Policy.
1639 France, Radio France Intl: RFI Europe.
1644 France, Radio France Intl: News Summary.
1645 USA, WWCR #1 Nashville TN: The Living Word Broadcast .
1647 France, Radio France Intl: Letter from a Listener.
1650 France, Radio France Intl: Land of France.

Thursdays

1600 France, Radio France Intl: News.
1600 USA, KTBN Salt Lk City UT: The Music of Praise.
1605 Switzerland, Swiss Radio Intl: Newsnet.
1605 Australia, Radio: Hindsight.
1610 USA, WWCR #1 Nashville TN: Outdoor Tips.
1626 France, Radio France Intl: Review of the French Newspapers.
1630 France, Radio France Intl: Sports Magazine.
1632 France, Radio France Intl: Reach Out.
1639 France, Radio France Intl: News Headlines.
1642 France, Radio France Intl: Echoes from Africa.
1648 France, Radio France Intl: Discovery.

Fridays

1600 Vatican State, Vatican Radio: Mass in English.
1600 Jordan, Radio: News Bulletin.
1600 France, Radio France Intl: News.
1600 USA, KTBN Salt Lk City UT: The Music of Praise.
1600 USA, WYFR Okeechobee FL (Satellite Net): UNI News.
1602 Vatican State, Vatican Radio: News.
1605 Switzerland, Swiss Radio Intl: Newsnet.
1626 France, Radio France Intl: Review of the French Newspapers.
1631 France, Radio France Intl: Film Reel.
1637 France, Radio France Intl: Drumbeat.
1642 France, Radio France Intl: News Headlines.
1645 France, Radio France Intl: Letter from a Listener.

Saturdays

1600 Jordan, Radio: News Bulletin.
1600 Canada, N Quebec Svc: CBC Radio News.
1600 Costa Rica, AWR: Sing for Joy.
1600 France, Radio France Intl: News.
1604 USA, KWHR Naalehu HI: Turn Your Radio On.
1605 Switzerland, Swiss Radio Intl: Newsnet.
1606 Germany, Deutsche Welle: Talking Point.
1606 USA, Voice of America: All About English.
1609 Canada, N Quebec Svc: Quirks and Quarks.
1615 Germany, Deutsche Welle: Spectrum.
1623 France, Radio France Intl: Focus on France.
1626 France, Radio France Intl: Review of the French Newspapers.
1630 USA, Voice of America: News (Special English).
1631 France, Radio France Intl: Spotlight on Africa.
1631, Belgium, R Vlaanderen Intl: News.
1635 Belgium, R Vlaanderen Intl: Press Review.
1639 Belgium, R Vlaanderen Intl: Music from Flanders.
1645 France, Radio France Intl: News Update.
1645 USA, Voice of America: American Stories (Special English).
1648 France, Radio France Intl: French Lesson.

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FREQUENCIES

1700-1800	Anguilla,Caribbean Beacon	11775am			
1700-1800	Australia, Radio	5995pa	6080as	9500as	9580pa
		11880pa			
1700-1800 vl	Australia, VL8A Alice Spg	2310do			
1700-1800 vl	Australia, VL8K Katherine	2485do			
1700-1800 vl	Australia, VL8T Tent Crk	2325do			
1700-1800 vl	Canada, CBC N Quebec Svc	9625do			
1700-1800	Canada, CFRX Toronto	6070do			
1700-1800	Canada, CFVP Calgary	6030do			
1700-1800	Canada, CHNX Halifax	6130do			
1700-1800	Canada, CKZN St John's	6160do			
1700-1800	Canada, CKZU Vancouver	6160do			
1700-1800	China, China Radio Intl	7405af	9570af	9745af	11910af
1700-1800	Costa Rica,RF Peace Intl	7385am	15050am		
1700-1727	Czech Rep, Radio Prague	5930eu	17485af		
1700-1800	Egypt, Radio Cairo	15255af			
1700-1800	Eqt Guinea, Radio Africa	15186af			
1700-1730	France, Radio France Intl	11615af	15210af	15460af	
1700-1800	Germany, Sunrise Radio	5850va			
1700-1800	Germany,Overcomer Ministr	6130eu	13810me		
1700-1800	Ireland, Unt Christian BC	6200do			
1700-1800	Japan, R Japan/NHK World	6090as	7110eu	9535na	9825as
		15355af			
1700-1800	Kenya, Kenya Broadc Corp	4935do			
1700-1800	Lebanon, Voice of Hope	9960me			
1700-1800	Liberia, Star Radio	5880do			
1700-1800	Malaysia, Radio	7295do			
1700-1751 mtwhf	New Zealand, R NZ Intl	6145pa			
1700-1715 vl	Palau, KHBN/Voice of Hope	9965as			
1700-1800 vl	Papua New Guinea, NBC	4890do			
1700-1755	Poland, Polish R Warsaw	6095eu	7285eu		
1700-1800	Romania, R Romania Intl	9510eu	11940eu	15250eu	
1700-1800	Russia,Voice of Russia WS	7445af	9740eu	9765eu	9775eu
		11695eu	15540af		
1700-1730	S Africa, Channel Africa	15240af			
1700-1800 a	Swaziland, Commercial R	6155do			
1700-1715 mtwh	Swaziland, Trans World R	3200af			
1700-1800	Swaziland, Trans World R	9500af			
1700-1800 vl	Tanzania, Radio	5050do			
1700-1800	UK, BBC African Service	3255af	6005af	6190af	9630af
		11860af	15400af	17830af	
1700-1745	UK, BBC Asian Service	3915as	5975as	7160as	9510as
		9740as			
1700-1800	UK, BBC World Service	6095me	6180eu	6195eu	9410eu
		12095eu	15485eu	15575eu	17840na
1700-1800 w	UK, Merlin Network One	15200eu			
1700-1800	USA, KAIJ Dallas TX	13815am			
1700-1800	USA, KTBN Salt Lk City UT	15590am			
1700-1800	USA, KWHR Naalehu HI	9930as			
1700-1800	USA, Voice of America	6110as	6160as	7125as	7215as
		9645as	9700me	9760af	15135eu
		15255va	15395as	15410af	15445af
		17895af			
1700-1800 mtwhf	USA, Voice of America	5990as	6045as	7150as	9550as
		9770as	11870as	12005as	12050as
		15255as			
1700-1800	USA, WEWN Birmingham AL	11875na	13615na	15745eu	
1700-1800 mtwhfa	USA, WGTG McCaysville GA	9400am			
1700-1800	USA, WHRI Noblesville IN	9495am	13760am		
1700-1800	USA, WJCR Upton KY	7490na	13595na		
1700-1800	USA, WMLK Bethel PA	9465am			
1700-1800 mtwhf	USA, WRNO New Orleans LA	15420am			
1700-1800 tha	USA, WSHB Cypress Crk SC	18930af			
1700-1800	USA, WWCR Nashville TN	9475am	12160am	13845am	15685am
1700-1800	USA, WYFR Okeechobee FL	15695eu	17555af		
1700-1800	Zambia, Christian Voice	3330af	4965af		
1700-1800	Zambia, Natl BC Corp	6165do	6265do		
1700-1800 vl	Zimbabwe, Zimbabwe BC	3306do	4828do		
1715-1745 vl	Palau, KHBN/Voice of Hope	9965as			
1715-1800	Swaziland, Trans World R	3200af	9500af		
1730-1800	Ascension Is, RTE Radio	17885af			
1730-1755	Belgium, R Vlaanderen Int	11810me	17655af		
1730-1800	Guam, AWR/KSDA	9355as	13660me		
1730-1800	Netherlands, Radio	6020af	7120af	11655af	
1730-1800	Philippines, R Pilipinas	11720as	11890as	15190as	
1730-1800	S Africa, AWR Africa	12130af			
1730-1800 s	Sweden, Radio	13855va	15735va		
1730-1800 mtwhfa	Sweden, Radio	6065va	15735va		
1730-1800 s	UK, BBC Asian Service	9750as	12045as	15565as	
1730-1800	Vatican State, Vatican R	13765af	15570af	17550af	
1745-1800	Bangladesh, Bangla Betar	7185eu	9550eu		
1745-1800	India, All India Radio	7410eu	9650af	9950eu	11620eu
		11935af	13780af	15075af	
1745-1800 vl	Palau, KHBN/Voice of Hope	9965as			
1745-1800	UK, BBC Asian Service	5975as	9510as	9740as	
1752-1800 smtwh	New Zealand, R NZ Intl	11675pa			
1800-1900	Anguilla,Caribbean Beacon	11775am			
1800-1900 mtwhf	Argentina, RAE	15345eu			
1800-1900	Australia, Radio	6080as	7240pa	9500as	9580pa
		9660as	11880pa		
1800-1900 vl	Australia, VL8A Alice Spg	2310do			
1800-1900 vl	Australia, VL8K Katherine	2485do			
1800-1900 vl	Australia, VL8T Tent Crk	2325do			
1800-1900	Bangladesh, Bangla Betar	7185eu	9550eu		
1800-1900	Brazil, Radio Bras	15265va			
1800-1900	Canada, CFRX Toronto	6070do			
1800-1900	Canada, CFVP Calgary	6030do			
1800-1900	Canada, CHNX Halifax	6130do			
1800-1900	Canada, CKZN St John's	6160do			
1800-1900	Canada, CKZU Vancouver	6160do			
1800-1900	Costa Rica,RF Peace Intl	15050am			
1800-1830	Egypt, Radio Cairo	15255af			
1800-1900	Eqt Guinea, Radio Africa	15186af			
1800-1900	Germany, Sunrise Radio	5850va			
1800-1830 s	Germany, Universal Life	11785af			
1800-1900	Germany, Voice of Hope	6015eu			
1800-1900	Germany,Overcomer Ministr	3975eu	9800af	12055me	
1800-1815	Greece, Voice of	7450eu	9425eu	17705sa	17765na
1800-1900	India, All India Radio	7410eu	9650af	9950eu	11620eu
		11935af	13770af	15075af	
1800-1900	Ireland, Unt Christian BC	6200do			
1800-1900	Kenya, Kenya Broadc Corp	4935do			
1800-1900	Kuwait, Radio	11990na			
1800-1900	Lebanon, Voice of Hope	9960me			
1800-1900	Liberia, Radio Veritas	3450do			
1800-1900	Liberia, Star Radio	5880do			
1800-1815	Liberia,LCN/R Liberia Int	5100do			
1800-1900	Malaysia, Radio	7295do			
1800-1900 s	Morocco, RTVM Marocaine	17815af			
1800-1830	Netherlands, Radio	6020af	7120af	11655af	
1800-1900 smtwh	New Zealand, R NZ Intl	11675pa			
1800-1857	North Korea, R Pyongyang	4405eu	6575eu	9335eu	11700na
		13760na			
1800-1830 s	Norway, Radio Norway Intl	7485eu	15705na	15735va	18950af
1800-1900 vl	Papua New Guinea, NBC	4890do			
1800-1900	Philippines, R Pilipinas	11720as	11890as	15190as	
1800-1900	Russia,Voice of Russia WS	7290eu	7350eu	7445af	9740eu
		9765eu	9775eu	9820eu	9895af
		11695af	11985af		
1800-1830	S Africa, AWR Africa	3345af	3390af		
1800-1830	S Africa, Channel Africa	15240af			
1800-1900 irreg	Sudan, Radio Omdurman	7200af	9200af		
1800-1900 a	Swaziland, Commercial R	6155do			
1800-1830	Swaziland, Trans World R	3200af	9500af		
1800-1900 vl	Tanzania, Radio	5050do			
1800-1900	UK, BBC African Service	3255af	6190af	11860af	15400af
		17830af			
1800-1830	UK, BBC Asian Service	5975as	9510as	9740as	
1800-1900	UK, BBC World Service	6095me	6180eu	6195eu	9410eu
		12095eu	15485eu	15575eu	
1800-1900 w	UK, Merlin Network One	15200eu			
1800-1900	USA, KAIJ Dallas TX	13815am			
1800-1900 mtwhfa	USA, KHBI N Mariana Is	13820as			
1800-1900	USA, KJES Mesquite NM	15385am			
1800-1900	USA, KTBN Salt Lk City UT	15590am			
1800-1900	USA, KWHR Naalehu HI	13625as			
1800-1900	USA, Voice of America	6035af	7415af	9760af	11975af
		15410af	15580af	17895af	
1800-1900	USA, WEWN Birmingham AL	11875na	13615na	15745eu	
1800-1900 mtwhfa	USA, WGTG McCaysville GA	9400am			
1800-1900	USA, WHRA Greenbush ME	17655af			
1800-1900	USA, WHRI Noblesville IN	9495am	13760am		
1800-1900	USA, WJCR Upton KY	7490na	13595na		
1800-1900	USA, WMLK Bethel PA	9465am			
1800-1900 mtwhf	USA, WRNO New Orleans LA	15420am			
1800-1900	USA, WWCR Nashville TN	9475am	12160am	13845am	15685am
1800-1900	USA, WYFR Okeechobee FL	15695va			
1800-1830	Vietnam, Voice of	7440eu	9840eu	12020eu	15010eu
1800-1900	Yemen, Radio Aden	9780do			
1800-1900	Zambia, Christian Voice	3330af	4965af		
1800-1900	Zambia, Natl BC Corp	6165do	6265do		
1800-1900 vl	Zimbabwe, Zimbabwe BC	3306do	4828do		
1805-1810	Croatia, Croatian Radio	5900eu			
1830-1900	Georgia, Radio	6230eu			
1830-1900 s	Germany, Universal Life	9490af			
1830-1900	Mongolia, Voice of	9720eu	12085eu		
1830-1900	Netherlands, Radio	6020af	7120af	9895af	11655af
		15315af	17605af		
1830-1900	Serbia, Radio Yugoslavia	6100eu	9720af		
1830-1900	Slovakia, R Slovakia Intl	5920eu	6055eu	7345eu	
1830-1900	Swaziland, Trans World R	3200af			
1830-1900	Turkey, Voice of	9445eu	11765na		
1830-1900	UK, BBC African Service	6005af	9630af		
1830-1900	UK, BBC Asian Service	9740pa			
1830-1900 w	USA, FEBC N Mariana Is	9465as			
1830-1900 as	USA, Voice of America	7170af	7330af	9860af	
1840-1850	Greece, Voice of	11645af	15150af		

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FREQUENCIES

1900-2000	Anguilla,Caribbean Beacon	11775am			
1900-2000	Australia, Radio	6080as	7240pa	9500as	9580pa
		9660as	11880pa		
1900-2000 vl	Australia, VL8A Alice Spg	2310do			
1900-2000 vl	Australia, VL8K Katherine	2485do			
1900-2000 vl	Australia, VL8T Tent Crk	2325do			
1900-1920	Brazil, Radio Bras	15265va			
1900-2000	Bulgaria, Radio	9700eu	11720eu		
1900-2000	Canada, CFRX Toronto	6070do			
1900-2000	Canada, CFVP Calgary	6030do			
1900-2000	Canada, CHNX Halifax	6130do			
1900-2000	Canada, CKZN St John's	6160do			
1900-2000	Canada, CKZU Vancouver	6160do			
1900-2000	China, China Radio Intl	9440af	9600af	11515af	11840af
1900-2000	Costa Rica,RF Peace Intl	15050am			
1900-2000	Ecuador, HCJB	17735eu	21455am		
1900-2000	Eqt Guinea, Radio Africa	15186af			
1900-1950	Germany, Deutsche Welle	9640af	9670af	11785af	11810af
		13790af	15245af	15390af	
1900-2000	Germany, Sunrise Radio	5850va			
1900-2000	Germany, Voice of Hope	6015eu			
1900-2000	Germany,Overcomer Ministr	3975eu	9800af	12055me	15625ne
1900-1910	Greece, Voice of	7515eu	9375eu		
1900-2000	Guatemala, Adv World R	5980am			
1900-1930	Hungary, Radio Budapest	3975eu	7170eu		
1900-1945	India, All India Radio	7410eu	9650af	9950eu	11620eu
		11935af	13780af	15075af	
1900-2000	Ireland, Unt Christian BC	6200do			
1900-1925	Israel, Kol Israel	9435eu	11605na	15640na	15650eu
1900-2000	Kenya, Kenya Broadc Corp	4885do	4935do		
1900-2000	Kuwait, Radio	11990na			
1900-1930 a	Latvia, Radio Latvia Intl	5935eu			
1900-2000	Lebanon, Voice of Hope	9960me			
1900-2000	Liberia, Radio Veritas	3450do			
1900-2000	Liberia, Star Radio	5880do			
1900-1915	Liberia,LCN/R Liberia Int	5100do			
1900-2000	Malaysia, Radio	7295do			
1900-2000 s	Malta, VO Mediterranean	12060eu			
1900-1930	Mexico, Radio Mexico Intl	5985na	9705na		
1900-2000	Netherlands, Radio	6020af	7120af	9895af	11655af
		15315af	17605af		
1900-1958	New Zealand, R NZ Intl	11675pa			
1900-2000	Nigeria, Voice of	7255af	15120af		
1900-1957	North Korea, R Pyongyang	6520af	9600af	9975me	
1900-2000 vl	Papua New Guinea, NBC	4890do			
1900-1930	Philippines, R Pilipinas	11720me	11890as	15190as	
1900-2000	Russia,Voice of Russia WS	7290eu	7350eu	7440eu	7445af
	9440af	9740eu	9765eu	9775eu	9820eu
	9865eu	9895af	11695af	11850af	11985af
1900-1930	Serbia, Radio Yugoslavia	7230au			
1900-2000	South Korea, R Korea Intl	5975as	7275as		
1900-2000 a	Sri Lanka, Sri Lanka BC	5975eu			
1900-2000	Swaziland, Trans World R	3200af			
1900-1930	Switzerland, Swiss R Intl	6165eu	9885eu		
1900-2000 vl	Tanzania, Radio	5050do			
1900-2000	Thailand, Radio	7210eu	9655eu	11905eu	
1900-1930	Turkey, Voice of	9445eu	11765na		
1900-2000	UK, BBC African Service	3255af	6005af	6190af	9630af
		11835af	15400af	17830af	
1900-1930	UK, BBC Asian Service	5975as	9740pa		
1900-2000	Uk, BBC World Service	6180eu	6195eu	9410eu	12095eu
		15485eu			
1900-2000 w	UK, Merlin Network One	13690eu	15565na		
1900-2000	USA, KAIJ Dallas TX	13815am			
1900-2000	USA, KTBN Salt Lk City UT	15590am			
1900-2000	USA, KWHR Naalehu HI	13625as			
1900-2000	USA, Voice of America	6035af	7375af	7415af	9525pa
		9760af	11870pa	11975af	15180pa
		15410af	15445af	15580af	
1900-2000 s	USA, Voice of America	4950af			
1900-2000	USA, WEWN Birmingham AL	11875na	13615na	15745eu	
1900-2000 mtwhfa	USA, WGTG McCaysville GA	9400am			
1900-2000	USA, WHRA Greenbush ME	17655af			
1900-2000	USA, WHRI Noblesville IN	9495am	13760am		
1900-2000	USA, WJCR Upton KY	7490na	13595na		
1900-2000	USA, WMLK Bethel PA	9465am			
1900-2000 a	USA, WRMI/R Miami Intl	9955ca			
1900-2000 mtwhf	USA, WRNO New Orleans LA	15420am			
1900-2000 tf	USA, WSHB Cypress Crk SC	15665eu			
1900-2000	USA, WWCR Nashville TN	9475am	12160am	13845am	15685am
1900-2000	USA, WYFR Okeechobee FL	15695eu			
1900-1930	Vietnam, Voice of	9840eu	12020eu	15010eu	
1900-2000	Zambia, Christian Voice	3330af	4965af		
1900-2000	Zambia, Natl BC Corp	6165do	6265do		
1900-2000 vl	Zimbabwe, Zimbabwe BC	3306do	4828do		
1930-2000 th	Belarus, R Belarus Intl	7210eu	11960eu		
1930-2000	Georgia, Radio	6230eu			
1930-2000	Iran, VOIRI	7160eu	7260eu	9022eu	
1930-2000	Poland, Polish R Warsaw	6035eu	6095eu	7285eu	9525eu
1930-2000 mtwfha	Sweden, Radio	6065eu			
1930-2000	Uganda, Radio	4976af			
1930-2000	UK, BBC Asian Service	9740pa			
1930-2000 mtwhfa	UK, BBC World Service	5975me			
1935-1955	Italy, RAI Intl	5970eu	7145eu	9760eu	
1945-2000 smthf	Germany, Universal Life	5890eu			
1950-2000	Vatican State, Vatican R	4005eu	5883eu	7250eu	9645eu
1956-2000	S Africa, Voice of Hope	6290af			

2000 UTC

2000-2100	Algeria, R Algiers Intl	11715af	11750af		
2000-2100	Anguilla,Caribbean Beacon	11775am			
2000-2100	Australia, Radio	7240pa	9500as	9580pa	9660as
		11880pa	12080as		
2000-2100 vl	Australia, VL8A Alice Spg	2310do			
2000-2100 vl	Australia, VL8K Katherine	2485do			
2000-2100 vl	Australia, VL8T Tent Crk	2325do			
2000-2100	Canada, CFRX Toronto	6070do	Canada, CFVP Calgary		6030do
2000-2100	Canada, CHNX Halifax	6130do	Canada, CKZN St John's		6160do
2000-2100	Canada, CKZU Vancouver	6160do			
2000-2059	Canada, R Canada Intl	5995va	7235va	11690va	13650va
	13670va	15150va	15325va	17820va	17870va
2000-2100	China, China Radio Intl	6950eu	7170af	9440af	9920eu
		11840af	11975af		
2000-2100	Costa Rica,RF Peace Intl	15050am			
2000-2027	Czech Rep, Radio Prague	5930eu	11600as		
2000-2100	Ecuador, HCJB	17735eu	21455am		
2000-2100	Eqt Guinea, Radio Africa	15186af			
2000-2030	Finland, YLE/R Finland	6135va			
2000-2050	Germany, Deutsche Welle	9615eu			
2000-2100	Germany, R Voice ofCanada	15245am			
2000-2015 smthf	Germany, Universal Life	5890eu			
2000-2100	Germany, Voice of Hope	6015eu			
2000-2100	Germany,Overcomer Ministr	3975eu	12055me	15625na	
2000-2030	Ghana, Ghana Broadc Corp	3366do	4915do		
2000-2100	Guatemala, Adv World R	5980am			
2000-2100	Indonesia, Voice of	9525as	11765as	15510as	
2000-2100	Ireland, Unt Christian BC	6200do			
2000-2100 fas/vl	Italy, IRRS	3955va			
2000-2100	Kenya, Kenya Broadc Corp	4885do	4935do		
2000-2100	Kuwait, Radio	11990eu			
2000-2100	Lebanon, Voice of Hope	9960me			
2000-2100	Liberia, Radio Veritas	3450do			
2000-2015	Liberia,LCN/R Liberia Int	5100do			
2000-2100	Malaysia, Radio	7295do			
2000-2030 smthf	Mexico, Radio Mexico Intl	5985na	9705na		
2000-2100 vl	Namibia, NBC	3270af	3289af		
2000-2025	Netherlands, Radio	6020af	7120af	9895af	11655af
		15315af	17605af		
2000-2100	New Zealand, R NZ Intl	17675pa			
2000-2015 vl	Niger, Voice du Sahel	5019do			
2000-2005	Nigeria, FRCN/Radio	3326do	4770do	4990do	
2000-2100	Nigeria, Voice of	7255af	15120af		
2000-2030 s	Norway, Radio Norway Intl	15220au			
2000-2100 vl	Papua New Guinea, NBC	4890do			
2000-2025	Poland, Polish R Warsaw	6035eu	6095eu	7285eu	9525eu
2000-2100	Russia,Voice of Russia WS	6000af	7350eu	9440af	9710eu
		9765eu	9775eu	9820eu	11675eu
		11850af	11930eu	11980eu	
2000-2005	S Africa, Voice of Hope	6290af			
2000-2015	Sierra Leone, SLBS	3316do			
2000-2100 mtwhf	Spain, R Exterior Espana	9855eu	11830af		
2000-2015	Swaziland, Trans World R	3200af			
2000-2030	Switzerland, Swiss R Intl	9840af	9885af	9905af	11725af
2000-2100 vl	Tanzania, Radio	5050do			
2000-2015	Uganda, Radio	4976do			
2000-2100	UK, BBC African Service	3255af	6005af	6190af	9630af
		11835af	15400af	17830af	
2000-2100	UK, BBC Asian Service	5975pa	9740pa		
2000-2100	UK, BBC World Service	6180eu	6195eu	7325eu	9410eu
		12095sa			
2000-2100 w	UK, Merlin Network One	13690eu	15565na		
2000-2100	USA, KAIJ Dallas TX	13815am			
2000-2100	USA, KJES Mesquite NM	15385am			
2000-2100	USA, KTBN Salt Lk City UT	15590am			
2000-2100	USA, KWHR Naalehu HI	15405as			
2000-2100	USA, Voice of America	6035af	6095me	7375af	7415af
		9760af	9770af	11975af	15410af
		15445af	15580af	17725af	17755af
2000-2030	USA, Voice of America	4950af	11855af		
2000-2100	USA, WEWN Birmingham AL	11875na	13615na	15745eu	
2000-2100 mtwhfa	USA, WGTG McCaysville GA	9400am			
2000-2100	USA, WHRA Greenbush ME	15460af			
2000-2100 mtwhf	USA, WHRI Noblesville IN	5745am			
2000-2100	USA, WHRI Noblesville IN	9495am			
2000-2100	USA, WINB Red Lion PA	13790am			
2000-2100	USA, WJCR Upton KY	7490na	13595na		
2000-2100	USA, WMLK Bethel PA	9465am			
2000-2100 s	USA, WRMI/R Miami Intl	9955ca			
2000-2100	USA, WRNO New Orleans LA	15420am			
2000-2100 w	USA, WSHB Cypress Crk SC	13770eu			
2000-2100	USA, WWCR Nashville TN	9475am	12160am	13845am	15685am
2000-2100	USA, WYFR Okeechobee FL	11855na	15695eu	17555va	17845va
2000-2010	Vatican State, Vatican R	4005eu	5883eu	7250eu	9645eu
2000-2100	Zambia, Christian Voice	3330af	4965af		
2000-2100	Zambia, Natl BC Corp	6165do	6265do		
2000-2100 vl	Zimbabwe, Zimbabwe BC	3306do	4828do		
2005-2100	Syria, Radio Damascus	12085eu	13610na		
2010-2030	Vatican State, Vatican R	9660af	11625af	13765af	
2015-2045 mtwhfa	Armenia, Voice of	4810eu	9965eu		
2025-2045	Italy, RAI Intl	7170af	9710af	11800af	
2030-2100 th	Belarus, R Belarus Intl	7210eu	11960eu		
2030-2100	Cuba, Radio Havana	13720eu	13750eu		
2030-2100	Egypt, Radio Cairo	15375af			
2030-2100	Germany, AWR Europe	9835af			
2030-2100 irreg	Iraq, Radio Iraq Intl	11785eu			
2030-2035 mtwhf	Latvia, Radio Latvia Intl	5935eu			
2030-2055	Moldova, R Moldova Intl	7520eu			
2030-2100	S Africa, AWR Africa	9745af			
2030-2100 as	Sweden, Radio	6065eu	13830af		
2030-2045	Thailand, Radio	9655eu	9680eu	11905eu	
2030-2100	Turkey, Voice of	7210as			
2030-2100 as	USA, Voice of America	4950af			
2030-2100	Uzbekistan, R Tashkent	9540eu	9545eu		
2030-2100	Vietnam, Voice of	9840eu	12020eu	15010eu	
2045-2100	India, All India Radio	7150au	7410eu	9910au	9950eu
		11620eu	11715au		

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FREQUENCIES

2100-2200	Anguilla,Caribbean Beacon	11775am			
2100-2200	Australia, Radio	7240as	9660pa	11880pa	12080as
		17715pa	21740pa		
2100-2130	Australia, Radio	9500as			
2100-2130 vl	Australia, VL8A Alice Spg	2310do			
2100-2130 vl	Australia, VL8K Katherine	2485do			
2100-2200 vl	Australia, VL8K Katherine	5025do			
2100-2130 vl	Australia, VL8T Tent Crk	2325do			
2100-2200 vl	Australia, VL8T Tent Crk	4910do			
2100-2200	Bulgaria, Radio	9700eu	11720eu		
2100-2115 vl	Cameroon, Radio Cameroon	4850do			
2100-2200 vl	Canada, CBC N Quebec Svc	9625do			
2100-2200	Canada, CFRX Toronto	6070do			
2100-2200	Canada, CFVP Calgary	6030do			
2100-2200	Canada, CHNX Halifax	6130do			
2100-2200	Canada, CKZN St John's	6160do			
2100-2200	Canada, CKZU Vancouver	6160do			
2100-2129	Canada, R Canada Intl	7235va	11690va	11890va	13650va
		13670va	15150va	15325va	17820va
2100-2130	China, China Radio Intl	3985eu	6590eu	7170af	7405af
		9535af	9920eu		
2100-2200	Costa Rica,RF Peace Intl	15050am			
2100-2130	Cuba, Radio Havana	13720eu	13750eu		
2100-2200	Ecuador, HCJB	17735eu	21455am		
2100-2200	Egypt, Radio Cairo	15375af			
2100-2200	Eqt Guinea, Radio Africa	15186af			
2100-2150	Germany, Deutsche Welle	7115as	9670as	9735af	9765as
		11785as	11865af	15135va	
2100-2200	Germany, R Voice ofCanada	15245am			
2100-2200	Germany, Voice of Hope	6015eu			
2100-2200	Germany,Overcomer Ministr	3975eu	9510as	11625sa	12050sa
2100-2130	Hungary, Radio Budapest	3975eu	11700eu		
2100-2200	India, All India Radio	7150au	7410eu	9910au	9950eu
		11620eu	11715au		
2100-2200 irreg	Iraq, Radio Iraq Intl	11785eu			
2100-2200	Ireland, Unt Christian BC	6200do			
2100-2200 fas/vl	Italy, IRRS	3955va			
2100-2200	Japan, R Japan/NHK World	6035pa	9725eu	11850pa	13630na
2100-2200	Liberia, Radio Veritas	3450do			
2100-2115	Liberia,LCN/R Liberia Int	5100do			
2100-2200	Malaysia, Radio	7295do			
2100-2200 vl	Namibia, NBC	3270af	3289af		
2100-2200	New Zealand, R NZ Intl	17675pa			
2100-2200	Nigeria, FRCN/Radio	3326do	4770do	4990do	
2100-2157	North Korea, R Pyongyang	4405eu	6575eu	9335eu	11700na
		13760na			
2100-2200 vl	Papua New Guinea, NBC	4890do			
2100-2200	Romania, R Romania Intl	7105eu	9550eu	9690eu	
2100-2130	Serbia, Radio Yugoslavia	6100eu	6185eu		
2100-2130	South Korea, R Korea Intl	3970eu	6480eu		
2100-2200	South Korea, R Korea Intl	15575eu			
2100-2200 as	Spain, R Exterior Espana	9855eu	11830af		
2100-2135	Sri Lanka, Sri Lanka BC	15245as			
2100-2130	Switzerland, Swiss R Intl	3985eu			
2100-2200	Syria, Radio Damascus	12085na	13610na		
2100-2200 vl	Tanzania, Radio	5050do			
2100-2130	Turkey, Voice of	7210as			
2100-2110	Uganda, Radio	4976do			
2100-2200	UK, BBC African Service	3255af	6005af	6190af	11835af
2100-2200	UK, BBC Asian Service	3915as	5965as	5975pa	6195as
		9740pa	11945as		
2100-2200	UK, BBC World Service	5975am	6180eu	6195eu	7325eu
		9410eu	12095sa		
2100-2200 w	UK, Merlin Network One	11915eu	11985eu	13690va	
2100-2200	Ukraine, R Ukraine Intl	5905eu	6020eu	6080eu	7180eu
		7240eu	7380eu	7410eu	9550na
		9560eu	12040na	13590eu	
2100-2200	USA, KAIJ Dallas TX	13815am			
2100-2200	USA, KTBN Salt Lk City UT	15590am			
2100-2200	USA, KWHR Naalehu HI	15405as			
2100-2200	USA, Voice of America	6035af	6095me	7375af	7415af
		9535af	9760eu	11870pa	11975af
		15185as	15410af	15445af	15580af
		17725af	17735as		
2100-2200	USA, WEWN Birmingham AL	5825na	13615na	15745eu	
2100-2200 mtwhfa	USA, WGTG McCaysville GA	9400am			
2100-2200	USA, WHRA Greenbush ME	15460af			
2100-2200	USA, WHRI Noblesville IN	9495am	13760am		
2100-2200	USA, WINB Red Lion PA	13790am			
2100-2200	USA, WJCR Upton KY	7490na	13595na		
2100-2200 as	USA, WRMI/R Miami Intl	9955ca			
2100-2200	USA, WRNO New Orleans LA	15240am			
2100-2200 mwa	USA, WSHB Cypress Crk SC	11550eu			
2100-2200	USA, WWCR Nashville TN	9475am	12160am	13845am	15685am
2100-2200	USA, WYFR Okeechobee FL	11855na	15215va	15695va	17845va
2100-2200	Zambia, Christian Voice	3330af	4965af		
2100-2200	Zambia, Natl BC Corp	6165do	6265do		
2100-2200 vl	Zimbabwe, Zimbabwe BC	3306do	4828do		
2115-2200	Egypt, Radio Cairo	9900eu			
2115-2130	Iran, VOIRI	6175au	9685ca		
2115-2130 mtwhf	UK, BBC Caribbean Report	5975ca	15390ca	17715ca	
2115-2130 as	UK, BBC World Service	5975am			
2130-2200	Albania, R Tirana Intl	6025eu	7165eu		
2130-2200	Austria, R Austria Intl	5945eu	6155eu	13730va	
2130-2200	China, China Radio Intl	6950eu	9920eu		
2130-2157	Czech Rep, Radio Prague	11600va			
2130-2200	Ghana, Ghana Broadc Corp	3366do			
2130-2200	Guam, AWR/KSDA	15310as			
2130-2155	Moldova, R Moldova Intl	7520eu			
2130-2200 as	Sweden, Radio	6065eu	9430af		
2130-2145 t f	UK, BBC Calling Falklands	11680sa			
2130-2200	USA, Voice of America	6040me	6095me	9535af	9760eu
		11870pa	15185as	17735as	
2130-2200 smtwhf	USA, Voice of America	6035af	7375af	7415af	11975af
		15410af	15445af	15580af	17725af
2130-2200	Uzbekistan, R Tashkent	9540eu	9545eu		

2200 UTC

2200-2300	Anguilla,Caribbean Beacon	11775am			
2200-2300	Australia, Radio	12080as	17715pa	17795pa	21740pa
2200-2300 vl	Australia, VL8K Katherine	5025do			
2200-2300 vl	Australia, VL8T Tent Crk	4910do			
2200-2300	Canada, CBC N Quebec Svc	9625do			
2200-2300	Canada, CFRX Toronto	6070do			
2200-2300	Canada, CFVP Calgary	6030do			
2200-2300	Canada, CHNX Halifax	6130do			
2200-2300	Canada, CKZN St John's	6160do			
2200-2300	Canada, CKZU Vancouver	6160do			
2200-2229	Canada, R Canada Intl	5960am	9755am	11705as	13670am
		15305am			
2200-2300	China, China Radio Intl	9880eu			
2200-2300	Costa Rica,RF Peace Intl	15050am			
2200-2245	Egypt, Radio Cairo	9900eu			
2200-2300	Eqt Guinea, Radio Africa	15186af			
2200-2300	Germany,Overcomer Ministr	3975eu	9510as	11625sa	11925sa
		12050sa			
2200-2215	Ghana, Ghana Broadc Corp	4915do			
2200-2230	India, All India Radio	7150au	7410eu	9910au	9950eu
		11620eu	11715au		
2200-2230	Iran, VOIRI	6025au	6175au		
2200-2300 irreg	Iraq, Radio Iraq Intl	11785eu			
2200-2300	Ireland, Unt Christian BC	6200do			
2200-2225	Italy, RAI Intl	6150pa	9675pa	11900as	
2200-2215	Liberia,LCN/R Liberia Int	5100do			
2200-2300	Malaysia, Radio	7295do			
2200-2300 vl	Namibia, NBC	3270af	3289af		
2200-2300 smtwh	New Zealand, R NZ Intl	17675pa			
2200-2215	Nigeria, FRCN/Radio	3326do	4770do	4990do	
2200-2230 s	Norway, Radio Norway Intl	11635au			
2200-2300 vl	Papua New Guinea, NBC	9675do			
2200-2215	Sierra Leone, SLBS	3316do			
2200-2205	Syria, Radio Damascus	12085na	13610na		
2200-2300	Taiwan, Radio Taipei Intl	15600eu	17750eu		
2200-2300	Turkey, Voice of	7190eu	9655na		
2200-2300	UK, BBC African Service	11835af	15400af		
2200-2300	UK, BBC Asian Service	5965as	6195as	7110as	9660as
		9890as	11955as	12080ps	
2200-2300	UK, BBC World Service	5975am	6175na	6195na	7325eu
		9410eu	9590am	9915sa	12095sa
2200-2300 w	UK, Merlin Network One	9645eu	9780na	11915eu	11985na
		13690na			
2200-2300	USA, KAIJ Dallas TX	13815am			
2200-2300	USA, KTBN Salt Lk City UT	15590am			
2200-2300	USA, KWHR Naalehu HI	17510as			
2200-2300	USA, Voice of America	7215as	9705as	9770as	11760as
		15185as	15290as	15305as	17735as
		17820as			
2200-2230 mtwhf	USA, Voice of America	6035af	7340af	7375af	7415af
		11975af			
2200-2300	USA, WEWN Birmingham AL	5825na	9975eu	13615na	
2200-2300 mtwhfa	USA, WGTG McCaysville GA	9400am			
2200-2300	USA, WHRA Greenbush ME	15460af			
2200-2300	USA, WHRI Noblesville IN	5745am	9495am		
2200-2300	USA, WINB Red Lion PA	13790am			
2200-2300	USA, WJCR Upton KY	7490na	13595na		
2200-2300	USA, WRMI/R Miami Intl	9955ca			
2200-2300 h	USA, WSHB Cypress Crk SC	11550eu			
2200-2300 w	USA, WSHB Cypress Crk SC	15285sa			
2200-2300	USA, WWCR Nashville TN	5070am	7435am	9475am	13845am
2200-2300	USA, WYFR Okeechobee FL	11855na	15215va	17845va	
2200-2210	Zambia, Natl BC Corp	6165do	6265do		
2230-2300	Canada, R Canada Intl	5960am	9755am	13670am	
2230-2300	Cuba, Radio Havana	9550am			
2230-2257	Czech Rep, Radio Prague	9435na	11600na		
2230-2300	UK, BBC World Service	5975am	6175na	9590na	9915sa
		12095sa			
2240-2250	Greece, Voice of	9420au	11645au		
2245-2300	Ghana, Ghana Broadc Corp	3366do	4915do		
2245-2300	India, All India Radio	7410as	9705as	9950as	11620as
2245-2300	Vatican State, Vatican R	7305au	9600au	11830au	

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Frequencies

2300-0000	Anguilla,Caribbean Beacon	6090am			
2300-0000	Australia, Radio 21740pa	9660pa	12080as	17715pa	17795pa
2300-0000 vl	Australia, VL8K Katherine	5025do			
2300-0000 vl	Australia, VL8T Tent Crk	4910do			
2300-0000	Bulgaria, Radio	9485na	11720na		
2300-0000	Canada, CBC N Quebec Svc	9625do			
2300-0000	Canada, CFRX Toronto	6070do			
2300-0000	Canada, CFVP Calgary	6030do			
2300-0000	Canada, CHNX Halifax	6130do			
2300-0000	Canada, CKZN St John's	6160do			
2300-0000	Canada, CKZU Vancouver	6160do			
2300-2329	Canada, R Canada Intl 15305am	5960am	9755am	11895am	13670am
2300-0000	Costa Rica,RF Peace Intl	15050am			
2300-2330	Cuba, Radio Havana	9550am			
2300-0000	Egypt, Radio Cairo	9900am			
2300-2350	Germany, Deutsche Welle	5975as	6090as	7235as	9690as
2300-0000	Germany,Overcomer Ministr	3975eu	9510as	11625sa	12050sa
2300-2330 as	Guam, AWR/KSDA	11775as			
2300-0000 mtwhf	Guam, AWR/KSDA	11775as			
2300-0000	India, All India Radio	7410as	9705as	9950as	11620as
2300-0000	Ireland, Unt Christian BC	6200do			
2300-2315	Liberia,LCN/R Liberia Int	5100do			
2300-0000	Malaysia, Radio	7295do			
2300-0000 vl	Namibia, NBC	3270af	3289af		
2300-0000 smtwh	New Zealand, R NZ Intl	17675pa			
2300-2315	Nigeria, FRCN/Radio	3326do	4770do	4990do	
2300-2357	North Korea, R Pyongyang	11335na	11700na	13760na	15130na
2300-2330 s	Norway, Radio Norway Intl	9935as	11640as	11735sa	13805am
2300-0000 vl	Papua New Guinea, NBC	9675do			
2300-0000	Romania, R Romania Intl	6130eu	7195eu	9570na	11830na
2300-0000	Singapore,RCorp Singapore	6150do			
2300-0000	UK, BBC Asian Service	3915as	5965as	6035as	6195as
		7110as	11945as	11955as	17790as
2300-0000	UK, BBC World Service 12095sa	5975am	6175na	9590na	9915sa
2300-0000 w	UK, Merlin Network One	3955eu	7170na	9645eu	9780na
		11985na	13690na		
2300-0000	USA, KAIJ Dallas TX	13815am			
2300-0000	USA, KTBN Salt Lk City UT	15590am			
2300-0000	USA, Voice of America	7215as	9705as	9770as	11760as
		15185as	15290as	15305as	17735as
		17820as			
2300-0000	USA, WEWN Birmingham AL	5825na	9975eu	13615na	
2300-0000 mtwhfa	USA, WGTG McCaysville GA	5085am			
2300-0000	USA, WHRA Greenbush ME	15460af			
2300-0000	USA, WHRI Noblesville IN	13760am			
2300-0000	USA, WINB Red Lion PA	13790am			
2300-0000	USA, WJCR Upton KY	7490na	13595na		
2300-0000 s	USA, WRMI/R Miami Intl	9955ca			
2300-0000 s	USA, WRNO New Orleans LA	7355am			
2300-0000 w	USA, WSHB Cypress Crk SC	11550af			
2300-0000 m	USA, WSHB Cypress Crk SC	15285sa			
2300-0000 irreg	USA, WWBS Macon GA	11910na			
2300-0000	USA, WWCR Nashville TN	5070am	7435am	9475am	13845am
2300-0000	USA, WYFR Okeechobee FL	11855na			
2300-2315	Vatican State, Vatican R	7305au	9600au	11830au	
2310-2320	Kyrgyzstan, Kyrgyz Radio	4010do	4050do		
2329-2359 as	Canada, R Canada Intl	11895am	15305am		
2329-2359	Canada, R Canada Intl	5960am	9755am	13670am	
2330-0000 vl	Ghana, Ghana Broadc Corp	4915af			
2330-0000	Netherlands, Radio	6020na	6165na	9845na	
2330-0000	Vietnam, Voice of	9840eu	12020eu	15010eu	
2335-2345	Greece, Voice of	9395sa	9425sa	11595sa	11645sa
2335-2345	Sierra Leone, SLBS	3316do			
2345-0000 mtwhf	UK, BBC Asian Service	3915as			

Selected Programs

Sundays

2300 Guam, AWR/KSDA: Wavescan.
2300 Norway, Radio Norway Intl: Norway Now.
2300 Bulgaria, Radio: News.
2300 USA, WWCR #3 Nashville TN: Talk USA.
2301 Norway, Radio Norway Intl: News.
2302 Egypt, Radio Cairo: The Holy Koran and Its Meanings.
2310 Bulgaria, Radio: Topics of the Week.
2315 Norway, Radio Norway Intl: Listeners' Corner.
2315 Bulgaria, Radio: News Behind the News.
2315 Bulgaria, Radio: Weekly Spotlight.
2320 Guam, AWR/KSDA: Pacific Island Journal.
2330 Australia, Radio: Media Report.
2330 Bulgaria, Radio: History Club.
2330 Bulgaria, Radio: Spectrum (biweekly).
2330 Netherlands, Radio (am): News.
2338 Netherlands, Radio (am): Wide Angle.
2344 Bulgaria, Radio: Answering Your Letters.
2354 Netherlands, Radio (am): Siren Song.

Mondays

2300 Vatican State, Vatican Radio: Ask the Abbot.
2300 Australia, Radio: RA News.
2300 Bulgaria, Radio: News.
2300 Canada, N Quebec Svc: As It Happens.
2306 Germany, Deutsche Welle: NewsLink.
2310 Australia, Radio: Asia Pacific.
2315 Bulgaria, Radio: Events and Development.
2315 Egypt, Radio Cairo: News.
2330 Australia, Radio: The Sports Factor.
2330 Bulgaria, Radio: Magazine Economy.
2330 USA, KTBN Salt Lk City UT: Get Ready.
2344 Bulgaria, Radio: Folk Studio.

Tuesdays

2300 Cuba, Radio Havana Cuba: News Supplement.
2300 Australia, Radio: RA News.
2300 Canada, N Quebec Svc: As It Happens.
2300 Egypt, Radio Cairo: Program Preview.
2300 USA, WRNO New Orleans LA: The Overcomer Broadcast (live).
2307 Cuba, Radio Havana Cuba: Timeout.
2311 Cuba, Radio Havana Cuba: DXers Unlimited.
2315 Bulgaria, Radio: Events and Development.
2315 Egypt, Radio Cairo: News.
2330 Australia, Radio: The Health Report.
2335 Greece, Voice of: News.
2338 Netherlands, Radio (am): Newsline.
2345 Bulgaria, Radio: Cultural Review.

Wednesdays

2300 Vatican State, Vatican Radio: Would You Believe It?
2300 Australia, Radio: RA News.
2300 Canada, N Quebec Svc: As It Happens.
2300 Egypt, Radio Cairo: Program Preview.
2300 Guam, AWR/KSDA: Sounds of Inspiration.
2300 UK, Merlin Network One: News.
2303 UK, Merlin Network One: Rock Radio Network.
2315 Bulgaria, Radio: Events and Development.
2315 Egypt, Radio Cairo: News.
2330 Australia, Radio: Law Report.
2330 Bulgaria, Radio: Business and Finance.
2330 USA, WINB Red Lion PA: Music.
2335 Greece, Voice of: News.
2344 Bulgaria, Radio: Midweek Mailbag.

Thursdays

2300 Vatican State, Vatican Radio: Ask the Abbot.
2300 Australia, Radio: RA News.
2300 Canada, N Quebec Svc: As It Happens.
2300 Guam, AWR/KSDA: Sounds of Inspiration.
2315 Bulgaria, Radio: Events and Development.
2315 Egypt, Radio Cairo: News.
2330 Australia, Radio: The Religion Report.
2330 Bulgaria, Radio: The Way We Live.
2330 Egypt, Radio Cairo: Arabic Music.
2335 Greece, Voice of: News.
2338 Netherlands, Radio (am): Newsline.

Fridays

2300 Canada, N Quebec Svc: As It Happens.
2300 Egypt, Radio Cairo: Program Preview.
2300 Germany, Deutsche Telekom: The Overcomer Broadcast.
2300 Guam, AWR/KSDA: Sounds of Inspiration.
2305 Egypt, Radio Cairo: The Holy Koran and It's Meanings.
2306 Germany, Deutsche Welle: NewsLink.
2315 Bulgaria, Radio: Events and Development.
2315 Egypt, Radio Cairo: News.
2330 Germany, Deutsche Welle: Spotlight on Sport.
2330 Bulgaria, Radio: Straight from the Horse's Mouth.
2330 Egypt, Radio Cairo: Arabic Music.
2335 Greece, Voice of: News.
2338 Netherlands, Radio (am): Newsline.
2344 Bulgaria, Radio: Radio Bulgaria Calling.
2353 Netherlands, Radio (am): Documentary.

Saturdays

2300 Cuba, Radio Havana Cuba: Top News Stories.
2300 Vatican State, Vatican Radio: On-the-Air.
2300 Guam, AWR/KSDA: Wavescan.
2300 Australia, Radio: RA News.
2300 Germany, Deutsche Telekom: The Overcomer Broadcast.
2300 USA, WINB Red Lion PA: Music.
2306 Cuba, Radio Havana Cuba: DXers Unlimited.
2310 Australia, Radio: Australia All Over.
2315 Guam, AWR/KSDA: Pacific Island Journal.
2315 Bulgaria, Radio: Weekly Spotlight.
2315 Egypt, Radio Cairo: News.
2323 Cuba, Radio Havana Cuba: Music.
2330 Bulgaria, Radio: Spectrum (biweekly).
2335 Egypt, Radio Cairo: The Civilization of Islam.
2335 Greece, Voice of: News.
2338 Netherlands, Radio (am): Newsline.
2356 Egypt, Radio Cairo: Egyptian Songs.

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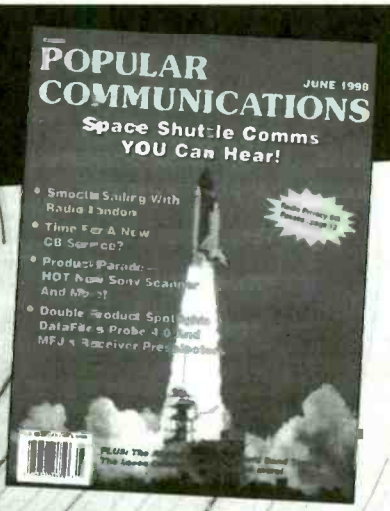

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Jacques d'Avignon
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Ionospheric Modification

In the last few years we have heard and read a lot about HAARP (High frequency Active Auroral Project) and the installation of the necessary equipment in a remote region of Alaska (see Oct 97 *MT*). It might surprise many readers that ionospheric modification, as will be attempted by this project, is nothing new! The first report of possible ionospheric modification by radio wave was reported in 1933 by Tellegen (1). At that time it was not yet fully understood, but it already had a fancy name: "The Luxembourg Effect." Why this name? And what was this effect?

In the early 1930's, a very powerful low frequency (LF) radio transmitter was installed in Luxembourg; the programs transmitted by this installation began to be heard in another part of Europe mixed with a program transmitted by another site. It was postulated in 1934 by Bailey and Martin (2) that the transmissions from the Luxembourg transmitter were actually modulating the ionosphere and interacting with the other transmissions in Europe.

It should be noted that in Europe and in North Africa, LF transmitters operating in ITU (International Telecommunication Union) Region 1 utilize very high power. It is not unusual to see some of the LF stations list their power as 1000 or 2000 kW and even higher.

(I am assuming that this is the power at the antenna. If this assumption is correct and the efficiency of the transmitters is about 25%, we are looking at transmitters consuming between 4000 and 8000 kW of power. That is the equivalent of 80,000 regular home lightbulbs or 40,000 PC's operating at the same time. I am glad I do not have to pay the electricity bill!)

The Luxembourg effect phenomenon was described by Frederick Terman in the 1943 edition of his *Radio Engineers Handbook,* but from reading the short paragraph describing the Luxembourg effect, it would appear that Terman was not fully convinced of the reality of this phenomenon.

For a while, the phenomenon was forgotten. It was observed again in the 1960s when the modulation of the transmitter from the Voice of America, operating on 173 kHz and located in Germany, was being heard on many other transmissions in Eastern Europe. It was reported that at the same time the LF transmitter of Radio France International was also causing similar effects on signals being transmitted from other sites in Western Europe.

Is this phenomenon strictly confined to the LF part of the spectrum? Apparently not: it appears that it can be found also in the medium wave (MW) part of the spectrum. A few years ago some discussions of this topic on the 'Net revealed that the Luxembourg Effect was showing up in Iran. In the 1970s new radio networks were set up across that country and high power transmitters were installed in many cities and towns. The Luxembourg effect appeared on the transmissions of various transmitters across the country.

What is interesting in the examples cited above is that in all cases the transmitter power was very high (equivalent to about 80,000 lightbulbs!), and the transmitted frequencies were in the LF or MW part of the spectrum.

Will project HAARP shed some light on the Luxembourg Effect and what causes it? I really do not know, as HAARP and other similar projects around the world are operating on frequencies above 2 MHz. Only time will tell what these projects will be able to answer in relation to this peculiar Luxembourg Effect.

(1) Telegen, B. D. H., Interaction between radio waves? , Nature, 6, 369, 1933

(2) Bailey, V.A. and D.F. Martyn, Influence of electric waves on the ionosphere, Phil. Mag., 23, 369,1934

OPTIMUM WORKING FREQUENCIES (MHz)

For the Period 15 October to 14 November 1998 Flux=148 SSN=100

Predictions prepared using ASAPS for Windows®

UTC	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
TO/FROM US WEST COAST																								
SOUTH AMERICA	27	25	20	17	16	15	14	13	13	12	11	11	10	13	21	28	30	30	30	29	29	28	29	28
WESTERN EUROPE	12	11	11	11	10	10	10	10	10	10	10	*	*	*	14	20	24	25	23	20	17	15	13	12
EASTERN EUROPE (P)	10	10	10	10	10	12	11	11	10	10	*	*	*	10	12	17	20	16	14	12	*	*	*	10
MEDITERRANEAN	16	16	15	15	14	14	13	12	12	*	*	*	*	16	*	26	27	23	20	19	18	17	16	
MIDDLE EAST (P)	12	12	12	17	15	13	*	*	*	*	*	*	10	11	16	18	15	14	13	13	13	12	12	
CENTRAL AFRICA	23	22	20	16	15	13	13	12	*	*	*	*	*	20	27	27	26	24	22	23	25	26	25	
SOUTH AFRICA	21	19	17	15	13	13	13	12	*	*	*	*	*	23	27	27	28	27	26	24	23	22	22	
SOUTH EAST ASIA (P)	29	29	26	22	18	15	*	*	*	*	10	10	10	10	10	12	18	21	20	17	15	13	13	17
FAR EAST	28	27	25	20	17	14	12	11	11	10	10	10	10	10	10	11	11	11	11	11	13	21	27	28
AUSTRALIA	25	26	26	26	21	18	17	16	15	14	13	12	11	11	11	14	17	16	16	17	21	23	24	25
TO/FROM US MIDWEST																								
SOUTH AMERICA	24	20	16	15	14	13	13	12	12	11	10	10	11	18	25	27	28	28	27	26	26	26	26	25
WESTERN EUROPE	13	13	13	12	12	11	11	11	12	12	11	11	13	18	24	27	28	28	27	24	21	18	15	14
EASTERN EUROPE	9	9	9	9	10	11	12	12	11	11	11	*	11	14	19	23	21	17	15	13	*	*	10	10
MEDITERRANEAN	16	15	15	15	14	13	13	13	12	*	*	*	*	18	24	27	29	28	24	20	19	18	17	16
MIDDLE EAST (P)	12	12	12	15	14	13	12	*	*	*	*	*	11	13	18	21	18	16	14	13	13	13	13	13
CENTRAL AFRICA	23	20	17	15	14	14	13	13	*	*	*	*	*	21	27	28	27	27	25	23	24	26	27	26
SOUTH AFRICA	21	19	17	15	13	13	13	13	*	*	*	*	*	23	28	27	27	28	27	26	24	24	23	22
SOUTH EAST ASIA (P)	27	25	21	18	15	*	*	*	*	10	10	10	10	10	13	18	20	19	18	16	14	13	12	16
FAR EAST	28	26	22	18	15	13	12	11	11	10	10	10	10	10	12	12	12	12	12	*	14	22	28	29
AUSTRALIA	25	26	24	20	17	15	14	13	13	13	12	11	11	11	14	18	17	16	16	17	21	23	24	24
TO/FROM US EAST COAST																								
SOUTH AMERICA	17	15	14	13	12	12	11	11	10	9	8	11	19	24	26	26	25	25	25	24	24	24	23	21
WESTERN EUROPE	12	12	11	11	10	10	10	10	11	11	11	14	21	25	27	27	27	26	25	22	19	16	14	13
EASTERN EUROPE	10	9	9	9	9	11	12	11	11	11	10	12	18	23	25	23	20	18	15	12	11	10	10	10
MEDITERRANEAN	16	15	15	14	12	12	13	12	12	*	*	16	23	27	29	30	29	27	23	20	19	18	17	16
MIDDLE EAST (P)	13	13	13	14	14	14	13	12	*	*	*	14	20	25	27	23	20	18	16	14	14	14	14	13
CENTRAL AFRICA	19	17	16	16	15	15	14	13	*	*	*	22	27	28	28	28	28	27	25	23	24	26	26	22
SOUTH AFRICA	19	17	16	15	13	14	14	13	*	*	*	20	28	28	28	27	27	28	27	26	25	24	23	22
SOUTH EAST ASIA (P)	21	18	16	15	14	*	*	*	*	*	11	12	14	19	23	22	19	17	16	15	14	13	12	14
FAR EAST	25	21	18	16	14	14	13	13	12	12	11	11	12	13	13	13	13	12	12	12	14	20	28	28
AUSTRALIA	24	22	18	15	*	*	13	12	12	12	12	11	12	17	19	18	16	16	15	17	21	22	23	24

Unfavorable conditions: Search around the last listed frequency for activity.

www.americanradiohistory.com

PROGRAMMING SPOTLIGHT

John Figliozzi
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Shortwave as a Learning Experience

As I write this column, I am less than 24 hours away from the trip of a lifetime—a two week visit to Australia. In the broadest sense of the word "education," shortwave radio has taught me things about this continent and nation that I am convinced I never could have learned, or learned so well, from any other source. I've been a listener to Radio Australia since I was thirteen years old. Almost imperceptibly over the decades, I've gained a deepening appreciation and understanding for this place halfway around the world.

That's one part of the magic of the shortwave medium: the fact that one can learn—steadily, progressively, painlessly—using an inexpensive portable device that provides a unique and instant connection to the world.

Distance Learning

Where I work a concept called "distance learning" is all the rage. Much effort is going into devising schemes to use cable, microwave, the Internet and satellites to bring teachers together with students over distances, an effort that otherwise would be cost-prohibitive. This is a fine concept and its further development and fuller utilization are to be enthusiastically encouraged. But "distance learning" is not a new concept. An early manifestation of this idea took place in (you guessed it) Australia, using (guessed it again) shortwave radio.

As long ago as the 1930s, students scattered throughout the massive Australian outback received their lessons, asked questions of, and recited their homework to their teachers via two-way amateur radio. This tradition continues on international shortwave radio today with programs about teaching and education, various lecture series and language lessons. (Times are in UTC. Refer to *MT*'s "Shortwave Guide" for frequencies and abbreviations for days of the week; * denotes program will shift one hour later UTC beginning the last Sunday in October. Programs broadcast to Asia or Africa are often heard well in North America.)

Educational Programs on Shortwave

The BBC, with its "Open University," was perhaps the first broadcaster to recognize the worth of radio as a means of bringing education to the masses. In recent years, World Service has rededicated itself to this spirit with a concerted effort to develop and broadcast a diverse series of learning programs on various subjects designed for students learning English. *The Learning Zone* is the result. (Africa stream M-F1530; Asia/Pacific stream M-F 0915 to South Asia, 1130 to East Asia)

The BBC also has an excellent program about what it means to teach. *The Learning World* focuses on practical advice for teachers by looking at new developments in teaching and hearing from teachers in different countries about their working lives. (Americas/Europe stream H0545, 1130, F0915; Africa stream S1515, W0730; Asia/Pacific stream T0030, H0730, 2115, F0345)

The BBC also has an interesting program for its African listeners entitled *Postmark Africa* which promises expert answers to any question! This encyclopedia of the air is broadcast in the Africa stream Sundays at 0330, 0530 and 1901.

Radio for Peace International (RFPI) broadcasts a series of lectures that reflect the station's broad mission to promote peace and international understanding (F0000). Also in this regard, RFPI broadcasts credit-bearing courses in peace studies in conjunction with the University for Peace. RFPI's *University of the Air* goes out Tuesday through Friday at 2230 and Wednesday through Saturday at 0630.

Radio Australia relays a Radio National (one of the Australian Broadcasting Corporation's main domestic networks) program that also offers university courses by radio. *Open Learning* airs Saturdays at 1805.

The Voice of America (VOA), in its Special English programs, brings informative programs to learners of English by using a simplified vocabulary of about 1500 words. One of these, *Words and Their Stories* can be readily recommended even to those who feel they already are sophisticated users of the language. The program is actually an exercise in etymology and airs Sundays at 0040 to Asia and the Pacific, 1540 to Asia, 1640 to Africa and 2140 to the Middle East.

A small, but growing minority of parents are opting for home schooling for their children in lieu of classroom education. *Home Education Network* is a magazine-style programming profiling the home schooling movement and offering advice and assistance to those pursuing it. It airs on World Harvest Radio (WHRI and KWHR) and World Wide Christian Radio (WWCR) as follows:

A0100 on KWHR on 17510 kHz. to Asia and the Pacific
A1405* on WHRI on 15105 kHz. to the Americas
M0700* on WWCR on 3210 kHz. to the Americas and Europe

Language Lessons

Table 1 is a listing of various foreign language courses on offer from shortwave broadcasters. When you tune in, listen for how to obtain books and other materials to assist you in your studies. Until November, good listening!

TABLE 1: LANGUAGE COURSES BY SW

Arabic by Radio	R. Cairo	A 0000
Enjoy Japanese	R. Japan	T 0325, 0625, 1125, 1525, 2125
French Lesson	R. France Internationale	A 1245, 1445, 1645
German by Radio	Deutsche Welle	A 0130, 0230, 0330, 0430, 0530, 0630, 2030
Greek Lesson	Voice of Greece	S 0325, 0715; F 0115; A 2145
Learn to Speak Chinese	China R. International	M/W 1240, 1340, 1440, 1540, 1640, 1740, 1940, 2040, 2140, 2240; T/H 0340, 0440, 0540, 0940, 1040
Let's Learn Chinese	R. Taipei International	Daily 0245, 0345, 0745, 1245, 2245
Let's Learn Korean	R. Korea International	M-H 1140, 1240, 1940, 2140; M-F 1640; T-F 0240, 0840; F 1115, 1215, 1615, 1915, 2115; A 0215, 0815
Romanian by Radio	R. Romania International	S 0745, 1345, 1745, 2145, 2345; M 0245, 0445, 0645
Russian by Radio	Voice of Russia*	S 0632, 1532; M 0632; W 0532, 1332; F 0232, 1932; A 2032
Slovak Lesson	R. Slovakia International	H 0720, 1650*, 1850*; F 0120
Spanish Course	R. Exterior de Espana	M-F 2047; T-A 0047, 0147, 0547
Starting Finnish	YLE R. Finland	A 0214, 0644

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"Spooky" Radio Listening

With a tip of the hat to Halloween, this issue is devoted to the more "spooky" frequencies that can be found out there in radio land. I have to admit that I've always enjoyed listening to such signals more than most other things on the bands.

Folks trying to push the idea that radio is "dead" could never prove it by the number of unusual signals to be found. Those who by choice or necessity do a certain amount of their business "in the shadows" still use radio as a major means of communication.

So in the spirit of "spooky" radio, let's do a bit of a band sweep and see what's out there to listen to that isn't on somebody's broadcast schedule. Some things will be relatively benign, but sleuthing around some of these signals will rank you right up there with James Bond.

■ Very Low Frequency (VLF): 10-30 kHz

If you had a receiver capable of going down into this neck of the radio frequency spectrum you would be able to hear the coded transmissions of submarines and some other military applications. The U.S. and the former Soviet Union used this portion of the radio frequency spectrum to play the kinds of spooky activities that have been popularized in books such as Tom Clancy's *The Hunt for Red October*. These frequencies are used because they are very effective in penetrating through sea water, allowing for continuous submerged submarine operations.

This portion of the radio spectrum is more or less off limits to the typical radio monitor for two reasons. First, receiving equipment that covers this portion of the spectrum is harder to come by. Most entry-level hobby communications receivers do not tune down this far into radio's basement. Second, just about anything going on down here is seriously coded.

By the way, the land-based transmitting stations that send signals out to the submarines have antenna installations that can cover several miles.

■ Low Frequency (LF): 30-300 kHz

At least a portion of the low frequency band is easily reached by the hobbyist. This is because many modern hobby-level, communications receivers begin their frequency coverage at 150 kHz. The lower end of the LF bands can be a bit "spooky" as it is populated by a host of military operations. Above 100 kHz you will find military stations, including systems that send weather charts by way of fax, very similar to the fax machines you might have in your office only utilizing radio signals instead of signals that come over the telephone.

Orson Wells, the Father of Spooky Radio

As we round the corner into the 150 kHz range where hobby receivers begin to earn their keep, we run into a lady named *GWEN*. From 150 through 175 kHz the *Ground Wave Emergency Network* (GWEN) is a nationwide system established by the United States Air Force to provide for a "survivable" communications system. GWEN is there to keep things running if "The Big One" ever drops. Spooky indeed. Again, as with so many military operations, you can listen but you won't hear very much. The signals are encrypted.

■ Medium Frequency (MF): 300-3000 kHz

Now we are getting closer to radio as you probably envisioned it before your eyes were opened to the full extent of the radio world. Still, there are a few matters to get excited about before we run up against the standard AM broadcast band. From 415 through 515 kHz you will find maritime communications frequencies. This chunk of the band is currently in a state of flux, as almost all communications done here were previously carried out by International Morse Code, including the maritime distress frequency on 500 kHz. The trend is to move away from Morse code as a primary means of maritime communications, so you can look for changes in this area. The possibility of monitoring distress traffic from ships that haven't upgraded does carry a certain amount of adventure.

From 530 kHz through 1610 kHz we find familiar ground. This is the good old **standard AM broadcast band**. A recent development in the medium-frequency band is the Federal Communications Commission's (FCC) expansion of the AM broadcast band all the way out to 1710 kHz. Several stations have already begun broadcasting in this new band segment.

Other than the fact that these new stations are on the cutting edge, how can you expect to find anything spooky in the middle of the most common form of radio broadcasting know in the United States? Well, from 1610 through 1710 kHz you may still hear a few **pirate broadcasters**. These are folks that choose to broadcast without the benefit of applying for FCC licensing. Information about these types of broadcasters is often found in George Zeller's "Outer Limits" column.

From 1710 kHz through 1800 kHz is a segment of frequencies that were at one time fairly well populated by cordless telephones. These frequencies have fallen out of use somewhat, and current government regulations make monitoring of cordless-telephone frequencies illegal anyway—attracting spooks for an entirely different reason.

From 2000 kHz through 3000 kHz you will primarily find **maritime communications**. Not too spooky, but you can always keep one ear on 2182 kHz. This frequency is universally recognized for emergency distress calling and safety communications.

From 2300 kHz through 2495 kHz is also recognized as the first of the **international broadcasting bands** known as the 120 Meter Band, also known as the **tropical** bands. In the part of the world we live in, we are used to the standard AM and FM radio bands as the primary sources of radio. But, in many other parts of the world, especially those grouped toward the equatorial regions of our planet, the tropical bands are used for domestic broadcasting. Some of the most challenging and rewarding long-distance listening (DXing) can be done on the tropical bands.

Because of the volatile nature of some of the parts of the world in the so-called tropical regions, the opportunity to listen in on any number of "clandestine stations" also begins in this broadcast band. These are stations that

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are set up to broadcast programming, usually against the government controlled broadcasting in various countries. As areas of the world heat up, so do clandestine broadcasts.

■ High Frequency (HF): 3000-30,000 kHz

Between the more familiar AM and FM standard broadcast bands is the **high-frequency** portion of the radio spectrum, most commonly known as the **shortwave** band. Among all the international and domestic radio broadcasts on shortwave you do have the opportunity to hear quite a few spooky signals. You will hear military and government services. You will hear unlicensed clandestine and pirate radio stations and even drug running. These broadcasters "on the edge" often make use of amateur radio transmitters, so checking through those frequencies slightly above and below the various amateur radio segments can yield some spooky listening indeed.

This is also the part of the spectrum where "spy" numbers stations appear. These are strange signals that just seem to be a voice or Morse code transmission of a brief series of numbers repeated for a period of time. They can also appear in any one of several languages. They represent some form of code, and their meaning and station locations have been subjects of controversy for as long as I have been a radio hobbyist. Tuning around the shortwave bands will turn up a few of these stations. Now you can join in the conjecture about their meaning.

It may seem like I am saying very little about the biggest section of the radio monitoring spectrum, but that is only because the best way to find the spooky stuff on shortwave is to spin the dials and look in the cracks between the "known" broadcasts. There is always something new and often spooky to listen to.

■ Very High Frequency (VHF): 30-300 MHz

From 30 to 50 MHz you will find many different signals from the government and business worlds. The tendency in recent years has been for operations to move up higher into the upper end of the VHF and on into the UHF regions. Still, no frequency goes unused in a world that runs on radio. I have often heard allegedly "unused" VHF channels used for undercover work such as interstate drug interdiction. Spooky stuff to be sure.

From 72 to 76 MHz is an interesting corner of the bands. Among the many paging transmitters in this segment, these frequencies are popular with surveillance and eavesdropping equipment users, such as law enforcement agencies and private investigators. More good spooky stuff.

From 88 to 108 MHz we return to a more familiar world, the **standard FM broadcast band**, or so you may think. Many FM stations also broadcast **subsidiary carrier authorization** (SCA) signals underneath the programming you normally hear. You could have listened to radio all your life and never have known these signals were there. This SCA music, programming and data, by law, can only be monitored by people who have the transmitting station's permission to do so. However, equipment to receive these signals is within the budget and expertise of even beginning radio monitors. It's spooky only in so far as it's not for common consumption.

Monitoring 136-138 MHz allows you to become a "Spooky Space Cadet." These frequencies are used by many weather satellites. Hobbyists who become interested in satellite transmission can purchase demodulator equipment that allows the signals received to be translated into weather facsimile (**WEFAX**) pictures. You can "spy" on the earth's weather from satellite and have a spooky old time.

From 148-150.8 MHz will bring in a few more government/military signals that have spooky potential. The frequencies from 225 through 300 kHz and beyond to 400 MHz round out the VHF band and move into UHF with more military aviation frequencies.

■ Ultra High Frequency (UHF): 300-3000 MHz

Military aircraft usage extends through to 400 MHz as you gracefully enter the land of UHF. From 406 through 420 MHz is another chunk of Federal Government frequencies. In this area you may hear communications from Air Force One if the President of the United States is visiting near you. Now there's a signal with spooky potential!

From 825 through 849 MHz and 869 through 894 MHz you will find **cellular telephone frequencies**. Monitoring of these signals is illegal, except for spooks with court-ordered permission.

Above 894 MHz is a relatively new range of frequencies being used for many of the applications stated for the VHF band. These frequencies up through 1300 MHz represent the new "high frontier" for the radio monitor. Many newer hobby-level receivers are designed to let you listen in on the excitement as this new world opens up. No doubt some of the future uses of these newer segments will have spooky potential.

And finally, let's not forget that this year is the 60th anniversary of Orson Wells' broadcast of "The War of the Worlds," the spookiest radio signal ever broadcast. Happy Halloween and have fun!

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ASK BOB

ANSWERS TO YOUR RADIO QUESTIONS

Bob Grove, W8JHD
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CALCULATOR VS. TELEPHONE KEYPAD: WHY THE DIFFERENCE? PART 2!

In our August column, we discussed the difference between the order of numerals on the telephone and calculator keypads. Jim Thornton wrote in with a plausible explanation, noting that the difference was deliberate.

According to Jim, AT&T Bell Labs designers feared that a proficient calculator user would enter sequences too fast for the 1950s-era mechanical switching networks to handle, so the deliberate slow-down would prevent misdialings. Jim continues:

"By reversing the sequence, sufficient time was provided between the dialed numbers for the equipment to detect and convert the multi-frequency tones into standard equipment control signals. Before the pushbutton telephones were introduced, numerous tests were conducted with experienced ten-key operators using the reversed keypads to ensure that the chance of misdialed numbers would be minimized."

Makes good sense. Thanks, Jim.

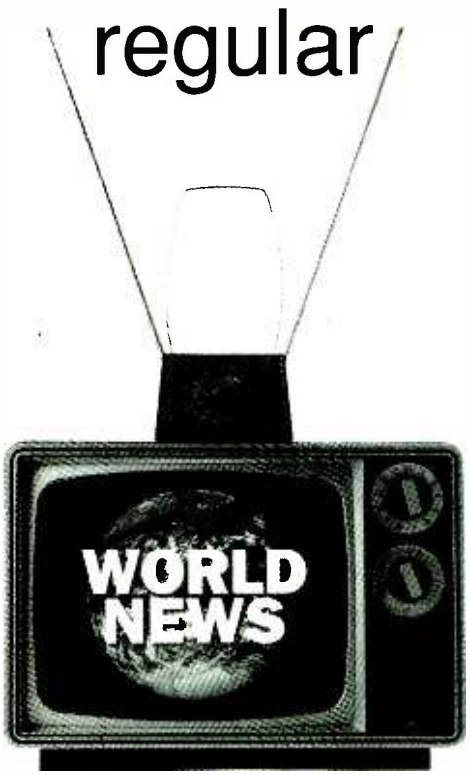
***Q.** I recently placed a maritime call via INMARSAT and heard a distinct echo of my voice in the background, yet when I placed a call to another country from the ship, the echo was not as pronounced. How come? (Ulrich van Rakel, Köln, Germany)*

A. Radio waves travel at the speed of light, roughly 186,000 miles per second. The geostationary satellite belt which holds the INMARSAT is nearly 22,300 miles high, so the signal had to reach it, return to earth for processing, then bounce back over the same path, nearly 100,000 miles, resulting in a half-second delay.

Using the ship's two-way radio, however, the path is much shorter, a maximum of about 12,000 miles for the greatest separation between you and a distant point on the globe, corresponding to a delay of less than one-tenth of a second.

***Q.** Does Motorola still manufacture AM/FM consumer radios as well as commercial communications equipment? (Robert Brock, Phoenix, AZ)*

A. No. They closed the consumer electronics division years ago, but many of their former products are on exhibit in their museum at corporate headquarters in Schaumburg, Illinois.



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Q. Bob, I just picked up a CB Radio from a yard sale. Can I power it from the same 13.8 volt power supply I use for my Icom 735 transceiver? Can I run both rigs at the same time?

A. Absolutely; the only limiting factor is the total amperage drawn from the power supply. The CB only draws about one amp during transmit—no consequence to your power supply which is designed to provide a good 20 amps to the ham rig. And it's unlikely that you will be transmitting simultaneously with both of them!

Q. My ham radio is on the second floor. What can I do for a ground system?

A. An old ham trick to get an RF ground for HF (shortwave frequencies, 1.8-30 MHz) from a distant location is to use a length of 50 ohm coaxial cable. Connect a capacitor (approximately 0.01 microfarad, 600 volt or more) across the coax—one at each end. This coax ground lead should be connected to an eight-foot ground rod.

Another trick is to use two lengths of heavy wire in parallel, one twice as long as the other, as your ground wire.

A third trick is to use one quarter wavelength wire, led conveniently out of the way in the dwelling, as a counterpoise (substitute for actual ground) for each frequency band. You can also use the same wire on odd harmonics of its quarter-wave-resonant frequency.

And finally, try an "artificial ground" like the unit manufacture by MFJ; it tunes any random length of wire into an RF counterpoise for any band (typically 1.8-30 MHz).

Bob's Tip of the Month

Listen To and *See* Your Infrared Remote Control Signals!

A couple of months back, we suggested a method of building an optical interface coupled to an amplifier to hear the signals from an infrared remote control. Greg Feis of Potomac, Maryland, suggests a much easier way: "Just hold the remote next to any cheap old AM radio tuned off-frequency, and you will hear the pulses as you push each button." I tried it on an AM/FM portable here at the office; it works!

And how about *seeing* the signal? Lynn Gilliland of King George, Virginia, says that if you have a camcorder with a CCD (charged-coupled device) viewer, all you need to do is look through the viewfinder at the "business end" of the remote while the buttons are being pushed; you will see the flashes of light!

Both eloquent examples of the "K.I.S.S. principle" (keep it simple, stupid!). Thanks, Greg and Lynn.

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Better Beginnings

Even though we're headed for the end of the year, it seems to me that fall is a great time for beginnings. I'm sure this comes from many years of heading off to school with new clothes, new books, and a new attitude. Fall is also the perfect time to get started in longwave monitoring. Receiving conditions are good now (low static), and should only improve as we head into winter.

If you've never explored the signals below the AM broadcast band, why not give it a try this season? This month's column will show a simple way to get on the band and discusses ways of identifying the signals you hear.

■ Getting on the Band

Most receivers of recent manufacture include longwave coverage down to at least 150 kHz. There are many older rigs, however, that provide only limited coverage, or omit the band entirely. This includes ham transceivers from the 1970s. Except for longwave coverage, most of these older units are well suited for DX reception.

To add LF capability, or to extend the range of a radio with limited coverage, you'll need a converter. These outboard units connect to your receiver's external antenna jack, and require no equipment modifications at all. The only critical point to installing a converter is to use shielded cable between it and the companion receiver. This prevents bleedthrough of unwanted (non-LF) signals.

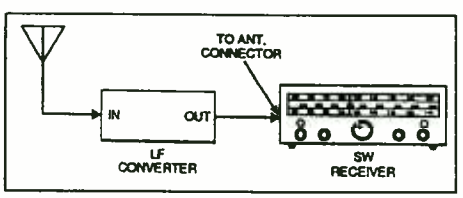

FIGURE 1. *Hookup of an LF Converter*

A converter works by taking a slice of the longwave spectrum, typically 5 to 500 kHz, and electronically "moving" it to a frequency range that your receiver can tune—say 3,500 to 4,000 kHz (the 80 meter ham band). The move is made possible by mixing the original signal with a fixed crystal oscillator running inside the converter. A natural result of mixing is the sum of the two signals. The sum is fed to the external antenna jack of the receiver.

■ Tuning In

Determining the LF frequency you're tuned to might seem like a complicated process when using a converter. It is actually very simple. You need only subtract the frequency of the converter's oscillator from the receiver dial setting. For instance, suppose you were using a converter with a 3,500 kHz oscillator inside (a commonly used frequency). With your receiver tuned to a signal at 3,600 kHz, you would subtract 3,500 from the reading for an actual frequency of 100 kHz. With the receiver tuned to 3,700 kHz the actual frequency would be 200 kHz, at 3,800 kHz it would be 300 kHz, and so on. This is much easier than it sounds, and quickly becomes second nature.

I am a big proponent of converters for two main reasons. The first is cost. A good converter can be obtained for a fraction of the price of a new receiver. (Have you ever checked the price of a receiver that goes down to 5 kHz?) Some very good converters sell for $75 or less.

The second reason is that you retain all of the features built into your HF receiver when you tune LF signals. Helpful features such as an S-meter, notch filter, and digital frequency readout are all active and can be directly applied to the LF signals you hear.

If you're considering adding a converter to your station, check the listings in recent issues of *Monitoring Times* and other radio magazines. Two established firms carrying converters are: Palomar Engineers, Box 462222, Escondido, CA 92046 and LF Engineering Co., 17 Jeffry Rd. East Haven, CT 06512.

■ First Steps

Perhaps you already have equipment for tuning the longwaves and want more information on the signals you've been hearing. The first ones heard by most newcomers are from navigation beacons. These are typically low power (less than 50 watt) unmanned stations, which send their ID in slow speed Morse Code. They are often located near airports or along approach routes.

Navigators use beacons to home in on their destinations or to determine their current position in relation to the beacon. At one time beacons were primary navigation tools, but today they serve as backups to more advanced systems.

For many listeners, "beacon chasing" is a major part of the radio hobby. They attempt to log as many beacons as possible, just as hams participate in contests to work as many states or countries as they can. The low power of beacons adds a challenging dimension to the game.

Frequently, the Morse ID of a beacon gives a clue as to its location. For example "ALP" could indicate "Alpine" and LGA might denote "Laguna Beach." If you hear a strong signal, it may be possible to corrolate the ID with a town near your location. Another way to identify some beacons is to check back issues of "Below 500 kHz."

In time, you'll probably want a more definitive guide to the stations you hear. For this, you will need a beacon guide. I've recently compiled an inexpensive booklet for the longwave listener that lists the frequency, ID and location for the majority of North American beacons, plus commonly logged beacons outside of North America. Copies of the guide are available for $9.95 (U.S. funds) postpaid in North America. Orders may be sent to Kevin Carey, P.O. Box 56, West Bloomfield, NY 14585.

European DXers may be interested in the guide titled *Non-Directional Beacons of Europe* by Robert A. Connolly. It lists over 2800 aero and marine beacons from the Arctic to North Africa. The basic price for the guide is £5.50 in the U.K. and US$12 elsewhere. For further information, or to place an order, write to: R.A. Connolly (GI7IVX) 21, Eleastan Park, Kilkeel, Co. Down, Northern Ireland, UK BT34 4DA.

To get you started, the table below lists some commonly logged beacons in North America. Be sure to send your loggings to: Below 500 kHz, P.O. Box 98, Brasstown, NC 28902.

SELECTED BEACON LOGGINGS

Freq.	ID	Location
194	TUK	Nantucket, MA
198	DIW	Dixon, NC
206	GLS	Galveston, TX
209	AEC	Warm Springs, NV
216	CLB	Wilmington, NC
220	RBJ	Tucson, AZ
224	SDL	Scottsdale, AZ
227	GDX	Upperville, VA
230	SH	Shreveport, LA
233	LG	Long Beach, CA
236	GNI	Grand Isle, LA
245	YZE	Gore Bay, ONT
246	OFI	Defiance, OH
260	AP	Denver, CO
266	FA	Fresno, CA
266	VR	Vancouver, BC
281	SGK	Knoxville, TN
302	PU	Pueblo, CO
305	RO	Roswell, NM
332	HK	Hickory Hills, IL
344	AVN	Avon, NY
346	YXL	Sioux Lookout, ONT
350	RG	Oklahoma City, OK
362	LYL	Lima, OH
365	CZM	Cozumel, MEX
413	YHD	Dryden, ONT
423	CKP	Cherokee, IA
429	IKY	Springfield, KY
432	IZN	Lincolnton, NC
518	GCT	Guthrie Center, IA
524	UOC	Iowa City, IA

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The Expanded-Band Times

These days, *The Expanded-Band Times* might be a better title for this column! The world above 1600 kHz is where the activity is these days, and we have a couple of new stations to talk about this month.

My home state of Wisconsin has become considerably easier to DX with two new expanded-band stations appearing in late June and early July. WTDY-1670 in Madison appeared first, with a news-talk format parallel to their old station on 1480. 1670 operated briefly as WAWY, before taking over the calls formerly used by the 1480 kHz outlet; 1480 then became WTDA (but still uses WTDY except for the on-the-hour ID). The expanded-band operation should be quite useful in this case (provided there are enough listeners with radios that tune to 1700 kHz!), as the 1480 facility has a very deep null across the heavily populated west side of the city.

In early July, another Wisconsin station appeared on the expanded band. WKSH-1640 is in Sussex, a Milwaukee suburb. This is a religious station. Most expanded-band stations have kept their old frequencies on the air; the FCC is providing a five-year phase-in period. But WKSH has already removed their old 1370 kHz transmitter from service, and I've seen it listed for sale (along with the antennas and other equipment) in trade magazines.

In Maryland, WMDM-1690 Lexington Park (about 40 miles southeast of Washington, DC) has appeared on the band. Their regular-band station is WPTX-920, but the two do *not* simulcast. The format for this station is news/talk. Finally, there has been one report in the National Radio Club's *DX News* of KSOX-1660 Brigham City, Utah. I have no further details on this station.

THE EXPANDED BAND LIST

Here's a list of stations currently operating in the 1610-1700 kHz band:

Freq.	Call	City	Programming
1620	WPHG	Atmore, Alabama	religious
1620	KYIZ	Renton, Washington	religious
1640	WKSH	Sussex, Wisconsin	religious
1640	KDIA	Vallejo, California	black oldies
1640	KKJY	Lake Oswego, Oregon	religious
1650	KKTR	Costa Mesa, California	traffic reports
1660	WBAH	Elizabeth, New Jersey	Portuguese ethnic
1660	KXOL	Brigham City, Utah	testing only
1670	WNML	Warner-Robins, Georgia	sports
1670	WTDY	Madison, Wisconsin	news/talk
1690	WMDM	Lexington Park, Maryland	talk
1690	KAYK	Arvada, Colorado	children's
1700	KTBK	Denison-Sherman, Texas	testing only
1700	WCMQ	Miami Springs, Florida	Cuban ethnic

You wouldn't have seen logos like these last year! WNML and WTDY, both on 1670, are just two of the 14 stations operating on the expanded AM band as I write this month's column. There will almost certainly be more by the time you read it...

The first of the expanded-band stations has changed format — twice. It's also been assigned a new callsign. As WJDM-1660, this station near New York City was widely heard both with its original format of music and talk for pre-teen children, and with an interim format of dance music provided by a former pirate station operator in Minneapolis.

In June and July, the callsign was reported changed to WBAH, and the station switched to Spanish-language broadcasting from the "Radio Unica" network. Just a few hours after the last report of the station as "Radio Unica," Bill Harms in Maryland reported hearing programming in Portuguese and an ID as "Radio Portugal."

Reader Bob Combs of New Mexico wrote with details of two of his expanded-band loggings. As reported earlier, KGXL-1650 near Los Angeles has become KKTR "K-Traffic," broadcasting only traffic reports. Bob says KKTR's signal is quite good in New Mexico, disappearing only for a few hours between noon and 4pm. (And he was listening in June, right at the solstice.)

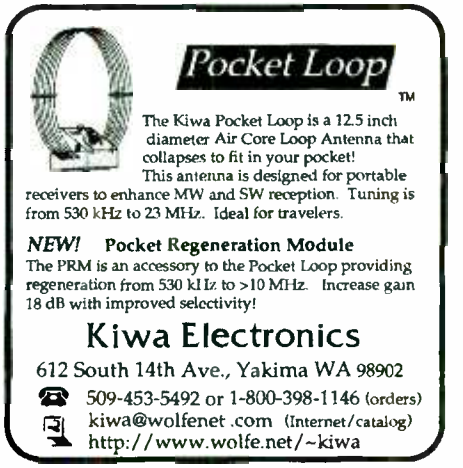
Also reaching Bob's receiver is KAYK-1690 in suburban Denver. This station is now carrying the "Radio Disney" children's format. (Similar to what WJDM-1660 used to air.) KAYK reaches New Mexico 24 hours a day.

Bits and Pieces

- Interested in what other countries are doing with their AM (or FM/TV) bands? Two more countries have put their broadcasting databases online for Internet access. The Australian Register of Radiocommunication Licenses can be searched at **http://www.sma.gov.au/database/radcomm/freq.htm**, and the U.K.'s Radio Authority is at **http://www.radioauthority.org.uk/Licensees/index.html**. The latter address lists only private stations; the BBC's homepage is at **www.bbc.co.uk** though I've not been able to find a transmitter list on that site!
- Another Internet site readers might want to visit is the "AM Stereo Page" at **www3.ns.sympatico.ca/lettuce/home.htm**. It'll take awhile to load, but anything you ever wanted to know about this seemingly lost technology can be found here.
- Patrick Griffith reports on news in the Denver area. Major construction on the KOA-850 transmitter site might have meant Colorado DXers might have found some silent time in KOA's schedule. Unfortunately, it will probably have already happened by the time you read this. Still, you should always check! You never know when your powerful locals may temporarily disappear... (Yet another good reason to join a DX club and the *amfmtvdx@qth.net* mailing list.)

His second item involves the 1190 kHz station at Boulder. This was the AM side of KBCO-97.3 for many years; it also operated for awhile as "KHOW2," carrying some programs provided by the 630 kHz station in Denver. 1190 has been off the air for awhile and was donated to the University of Colorado early this year. University officials told Patrick they expect the station back on the air sometime this month. It will replace an existing station (presumably run by students?) which operates on "carrier-current" (closed-circuit) AM and cable FM.

The days are getting shorter, and the DX is getting better. What are you hearing? Write me at Box 98, Brasstown NC 28902-0098, or by email at *w9wi@bellsouth.net*.



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George Zeller
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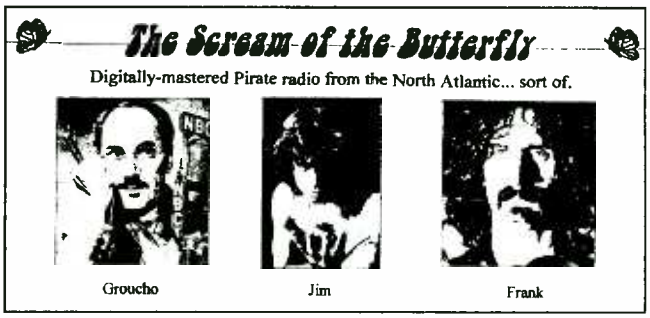
WREC Retires from Pirate Broadcasting

P. J. Sparx, probably the most active shortwave pirate station in recent years, has announced his retirement as a broadcaster. His station, **WREC,** has been heard on a worldwide basis with its entertaining format of rock music, comedy, and novelty parodies of rock songs. In addition, P. J. actively relayed numerous European pirates that otherwise were extremely tough DX catches on our side of the Atlantic.



WREC no longer relays the Scream of the Butterfly

In a release to *Monitoring Times*, P. J. indicated that he enjoyed his six year stint on the pirate bands. He indicates that he has accomplished what he set out to do, so he is retiring while on top of his game. P. J. thanks listeners for their support, and promises that outstanding reception reports will be verified via the Belfast maildrop. Multiple pirates that used WREC as their relay transmitter will now be looking for a new home.

■ Millennium Radio

The name of *Cumbre DX* maven Hans Johnson is well known in DX circles. His interesting articles have appeared in *Monitoring Times* on several occasions. Hans announces that **Millennium Radio,** a new internet radio station, can be tuned in at **http://www.gelat.com/radio/** on the web. The station plans a variety of programming formats, including relays of historic pirate broadcasts that you may have missed. Hans can be reached at **73042.36442@compuserve.com** if you'd like additional information on this new service.

■ Pirate CD

Veteran pirate DXer Kirk Trummel, who with John Cruzan has done a fantastic job maintaining the outstanding *Free Radio Network* internet web site, has prepared a lengthy CD containing audio clips from dozens of North American pirates. Additional information on this CD, which costs $20 US, is available from Kirk at **kirk@mail.frn.net** via e-mail.

■ Free Radio Survey

Steven Dick and Walter McDowell of the Department of Radio-TV at Southern Illinois University are conducting a survey of free radio stations. If you'd like to help out with their research, **http://members.aol.com/siubarn/freeradio/** contains additional information and a copy of their questionnaire. You can write to them at Mailstop 6609, Southern Illinois University at Carbondale, IL 62901. Tell them that *MT* sent you!

■ Shortwave Pirate Activity

North American shortwave pirate reception traditionally improves during the fall as static levels diminish. Pirates heard by our readers last month all used frequencies within 500 kHz of 6955 kHz on your dial, normally from two hours before sunset to at least 0500 UTC. Programming formats and contact maildrops (when known) are listed here.

AFRTS- In addition to AFN's return to the air via their Key West transmitters on 4278.5, 6458, and 12689.5 kHz, pirate Armed Forces Radio relays have been appearing on 6955 kHz. (None)
Betty Boop Radio- Rollo Verndeigh programs nostalgia music from pre-World War II cartoons. (Providence)
Black Radio- This new one has been testing so far; stay tuned. (Announced (888) 959-8177 phone number)
Deliverance Radio- They feature dueling banjos and squealing pigs. (None)
Echo Alpha- A new one, with plugs for their fictional organization. (None)
Free Dylan Experience- Soul, rap, rock and diverse music is heard here, with Bob Dylan on a secondary basis. (None)
Free Hope Experience- Major Spook programs pirate advocacy and rock tunes. (Blue Ridge Summit)
Jerry Rigged Radio- Recently they aired a Big Band music format. (Providence)
Lounge Lizard Radio- If you like *Volare*, you'll like this station. (Providence)
Mystery Radio- The Shadow's instrumental music is a distinctive format. (Stoneham)
Radio Clandestine- R. F. Burns, a long-standing pioneer in pirate radio, has returned with relays of classic programs. (None)
Radio Free Euphoria- Related to the Maharishi; they also plug marijuana consumption. (Belfast)
Radio Free Vinyl- Their rock and comedy is a traditional pirate format. (Providence)
Radio Metallica Worldwide- Dr. Tornado, Señor El Niño, and Jade still use a powerful 10 kW transmitter for their rock music. (Blue Ridge Summit)
Radio Nonsense- Veteran pirate Joe Mama is noted for well produced pirate entertainment. (Belfast)
Radio Pipsqueak- This new one features Christian rock songs. (Blue Ridge Summit)
Radio Two- Their rock oldies are mixed with friendly banter. (Providence)
Reefer Madness Radio- The radio version of serious anti-pot programming that's a parody of itself. (Belfast)
Ricochet Radio- Radio Animal gave Rick O'Shea some airtime, so this rocker and talker emerged. (Blue Ridge Summit)
Scream of the Butterfly- As we see here, their new QSL features deceased artists. (Providence)
SWRS- Currently the best heard Europirate in North America; try 11470 kHz near sunset. (Wuppertal)
Up Against the Wall Radio- An entertaining example of 1960's nostalgia. (Providence)
Voice of the Runaway Maharishi- Maharishi Ali Ganja promotes the marijuana industry. (Belfast)
Voice of Pancho Villa- The traditional low power Kulpsville Winterfest station was heard in Alberta by Ed Kusalik! (Blue Ridge Summit)
WACK- Here's a rocker that takes instant requests via phone. (Use announced toll free telephone number)
WHYP- Relays of this small town licensed station from the eastern Lake Erie shoreline have been widely heard. (Try **whyp1530@yahoo.com**)
WKND- This is Radio Animal's pirate, not the licensed MW station in Windsor, CT. (Blue Ridge Summit)
WMPR- Their techno dance music is normally heard with solid signals. (Still None)
WPUP- The doggies at this one are sending out QSL's. (Belfast)

Reception reports to pirate stations require three first class stamps for USA maildrops or $2 US to addresses outside the USA. Send your letters to PO Box 1, Belfast, NY 14711, PO Box 28413, Providence, RI 02908; PO Box 109, Blue Ridge Summit, PA 17214; PO Box 146, Stoneham, MA 02180; and PO Box 220342, Wuppertal, Germany.

■ Thanks!

Your input is always welcome via PO Box 98, Brasstown, NC 28902, or via the e-mail address atop the column. We appreciate material sent in this month from the following: John T. Arthur, Belfast, NY; Richard Ashley, Houston, TX; Shawn Axelrod, Winnipeg, Manitoba; Ranier Brandt, Hoefer, Germany; Joe Filipkowski, Providence, RI; Harold Frodge, Midland, MI; Nick Grace, Washington, DC; Paul Griffin, San Francisco, CA; Hans Johnson, Houston, TX; Ed Kusalik, Edmonton, Alberta; Zacharias Liangas, Italy; Chris Lobdell, Stoneham, MA; Greg Majewski, Oakdale, CT; Bill McClintock, Minneapolis, MN; Bob Mills, San Diego, CA; Michael Prindle, New Suffolk, NY; Al Quaglieri, Albany, NY; Robert Ross, London, Ontario; Martin Schoech, Merseburg, Germany; Ed Schwartz, Chicago, IL; Lee Silvi, Mentor, OH; Walter Szczepaniak, Philadelphia, PA; Kirk Trummell, Montreal, Quebec; Niel Wolfish, Toronto, Ontario; Andrew Yoder, Blue Ridge Summit; PA, and David Zartow, Janesville, WI.

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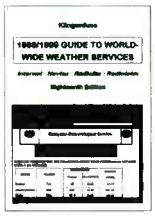

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Ike Kerschner, N3IK

The Kenwood VC-H1

The April issue of *QST* magazine carried a full page advertisement from Kenwood for their VC-H1 portable slow scan TV (SSTV) unit. After reading the ad and looking at the photos, I thought perhaps this was someone's idea of an April fool joke. But I figured someone like Kenwood would not do that and began a search for more information on the unit.

During my annual visit to the Rochester, New York, hamfest I looked up the Kenwood folks to see what they could tell me. Guess what: they were showing the VC-H1! No larger than many VHF hand held transceivers, this fantastic piece of equipment floored me.

The Old Days

I had built an SSTV unit back in the mid 50s when the idea of SSTV was first conceived. That original system required two tables to hold all of the gear. I used a flying spot scanner to send my pictures, which meant the best I could do for my first picture was to write my call, name and location (QTH) on a piece of cellophane. Eventually I managed to have a friend make a 5 x 7 inch transparency of a photo of me in my shack. During the years I had this set-up I managed no more than a dozen two-way SSTV conversations (QSOs). But, the idea of sending photos had bitten hard, and I continued to run SSTV and updated the rig every few years.

Used to be Expensive

The major drawback to SSTV has been the cost. Until the advent of SSTV software for the home computer, the average set-up cost about a kilobuck plus, if you were going to have a decent one. And for the most part, it was a bit complicated getting good photos to send as most cameras were not easily portable, and storing photos was time consuming. While using the home computer is definitely easier, there is still the problem of getting the image into the computer for transmission.

Kenwood has sure changed all this with the VC-H1. This portable SSTV unit operates off four AA batteries or an AC power pack. The VC-H1 has a self-contained, detachable, CCD camera (which stands for charge coupled device), and a 1.8 inch thin film transistor (TFT) display which produces a really sharp image.

VC-H1 Features

You can view incoming pictures and transmit images in all popular SSTV formats and the new fast FM mode. In addition, the VC-H1 has a video input terminal so you can use images from a digital camera or 8mm videotape recorder (VTR); a built-in memory allows storage of ten photos. It also functions as a speaker mike to make operation very easy.

The VC-H1 connects to your computer via the RS-232 port allowing you to store images and modify them using standard cut and paste software and even superimpose text on your photos. Using just the VC-H1 it is possible to superimpose your call sign.

Connecting the VC-H1 to your rig is quite simple. Of course Kenwood has available connectors for attaching the unit to any of their rigs. Hooking up to other rigs will require making your own connector; however, Kenwood provides complete information so the job is fairly easy.

Kenwood, as usual, provides a complete and easy to understand operating manual with the VC-H1 with clear, easy to follow instructions, drawings and photos.

The most exciting thing about Kenwood's SSTV unit is the price; list price is just under $600 but the unit is going for well under $500. In fact, The Ham Station of 220 N. Fulton Ave, Evansville, Indiana 47710 was selling the VC-H1 for $479.00 at the Rochester hamfest; their order line is 1-800-729-4373 if you would like to order one or get more information.

An Exciting Future for SSTV

The VC-H1 is going to make the field of Slow Scan TV a lot easier to get into for everyone. I expect to see SSTV activity expanding from the present handful of frequencies on HF to include all bands. No reason why novice and tech operators shouldn't have a ball with this unit on VHF/UHF, too. This unit will add a new dimension to the hobby for all hams.

Can you imagine connecting the VC-H1 to your handheld and sending photos of interesting subjects while on your daily walk, jog or bicycle ride? Or take a shot of the new baby, puppy, toy or whatever to show to friends across town or the world. Public service events will benefit from SSTV, too. (One picture is worth a thousand words.)

In case you were wondering, I love the VC-H1 and hope all of you will, too. Soon we can add a whole new meaning to the phrase, "BCNU." Great job, Kenwood.

Conditions

I have been told there were some very good six meter openings this past summer; however, I did not manage to hit any myself. I did catch some excellent two meter openings during July and worked stations all up and down the East Coast as well as some 8 and 9 land QSOs.

This time of year the HF bands are beginning to produce a lot of good DX. Look for VK (Australia) and ZL (New Zealand) on 160, 80 and 40 from and hour or so before sunset to about an hour after; and again from an hour before sunrise to an hour after.

20 meters and up has been very hot all summer long and a lot of DX has been worked on 15 and 10, it can only improve with the increase in sunspot numbers.

Till Next month, 73 es DX de N3IK

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Jock Elliott, KB2GOM
lightkeeper@sprintmail.com

Kenwood's Easy-to-Use FreeTalk

Kenwood's FreeTalk radio is one of the most appealing Family Radio Service (FRS) units I have tested. Small (just over 2"W x 3.9" H x 1"D) and with a high level of fit and finish, the FreeTalk's minimum number of controls makes it very approachable.

The FreeTalk makes easy for the first time user to get started with FRS. Available in black and yellow colors, it clearly came from the same design philosophy as the Icom IC-4008A, with the same fold-down and antenna and same unusual thumbwheel arrangement for attaching the belt clip on the back. There are just four buttons on the face of the unit (Power, Up, Down, and Mode), plus a speaker/microphone and a backlit LCD. On top of the radio is a volume control and rubber flap that can be lifted to reveal plug-ins for a speaker/mic and other accessories.

On the left side of the FreeTalk is the push-to-talk switch and below it, a wedge-shape rubber protrusion that helps to locate your finger or thumb over the push-to-talk button. On the back, there is a removable belt clip and a hatch for installing three AA batteries, for which Kenwood claims 38 hours of operating time. That's eight hours longer than the Icom FRS radio, which also uses three AA batteries. We'll get to the reason why in just a bit.

For basic operations, the FreeTalk is extremely easy to operate. Press the Power button, and the radio turns on with the volume set where you left it. To select from any of the 14 FRS channels, press the Up or Down buttons.

To block unwanted transmissions from other FRS users, you and the members of your group can select a CTCSS (Continuous Tone Coded Squelch System) tone from the 38 programmed into the FreeTalk. To activate a CTCSS tone, tap the Mode button once and then use the Up and Down buttons to select the tone of choice. Once you have selected a CTCSS tone for use, it is applied to all channels on the radio. Unlike some competing units, you cannot select a tone for one channel, but none for another or different tones for different channels. Once a tone has been selected, the display shows both the channel and the tone number.

The Kenwood also offers a feature I've not seen on other FRS radios, a simple form of speech scrambling called PrivacyTalk. To activate this feature, press the Mode button twice (after you have selected a CTCSS tone) and use the Up or Down button to turn it on. There is, as nearly as I can tell, no way to activate scrambling without first activating a CTCSS tone. When scrambling is activated, an icon appears on the LCD and only another FreeTalk on the same channel with the same tone and scrambling can understand your transmissions and talk back to you. Unfortunately, the same tone and scrambling combination applies to every channel, so if you want to talk privately on one channel and then talk "in the clear" on another channel, you can't do so without some extra button pushing.

The Kenwood FreeTalk offers ease of use, speech scrambling, and only about 2/3 the range of top performing FRS radios.

The FreeTalk also offers a number of other interesting features such as four different call tones that make the radio ring like a telephone. By appropriately programming the radios in your group, you can tell who is calling you by the unique ring tone. With the optional SMC-34 speaker microphone, you can scan to find a busy channel or scan to find one that matches the CTCSS tone you have selected. Nine different functions, including locking the transceiver, require powering On the radio while pushing different combinations of buttons.

In most respects, the performance of the FreeTalk is exemplary. Receive and transmit audio quality are loud and clear, and the receiver performance is right where it should be. Unfortunately, the range of the FreeTalk is only about 2/3 that of other top-of-the-line FRS radios. The reason: the FreeTalk puts out only 330 milliwatts on transmit, compared to a full half watt for the other top performers. That's where the extra eight hours of operating time comes from: reduced transmitter power.

The Kenwood FreeTalk is an excellent FRS radio that is exceptionally easy to use for first timers. If you don't need maximum range from your FRS units, the FreeTalk definitely deserves consideration. Suggested retail price of the FreeTalk is $159 per radio. For additional information, call 1-800-950-5005.

FAMILY RADIO SERVICE

Channel	MHz
1	462.5625
2	462.5875
3	462.6125
4	462.6375
5	462.6625
6	462.6875
7	462.7125
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9	467.5875
10	467.6125
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Clem Small, KR6A

Some Hard-to-Spy Antennas

Hidden in a deserted farmhouse located deep in enemy territory, headphones clamped tight to your ears, you are risking your life or even worse, using your tiny shortwave station to send back vital information about enemy troop movements. As you tap out your message in Morse code there is a loud banging at your door. Your heart stops — then races wildly. Quickly you stuff your miniature station into its secret hiding place. And no one will guess that that old telephone line which runs only between the house and barn was just now serving as your antenna. Trying to look like some down-on-your-luck drifter who just came in from the cold, you cautiously open the door...

Luckily we're just pretending here, but there *are* real-life situations where we may want to have antennas which are not visibly obvious; antennas that the gestapo, KGB, or even your neighbors or landlord won't see. Or maybe you would like to have the view in your own yard free of any visible wires and towers.

On the other hand, who knows? Your expertise in radio operation *could* lead to a spy assignment someday when your country needs you. We hope that isn't too likely, but just the same let's take a look at some antennas that could come in handy for a variety of reasons.

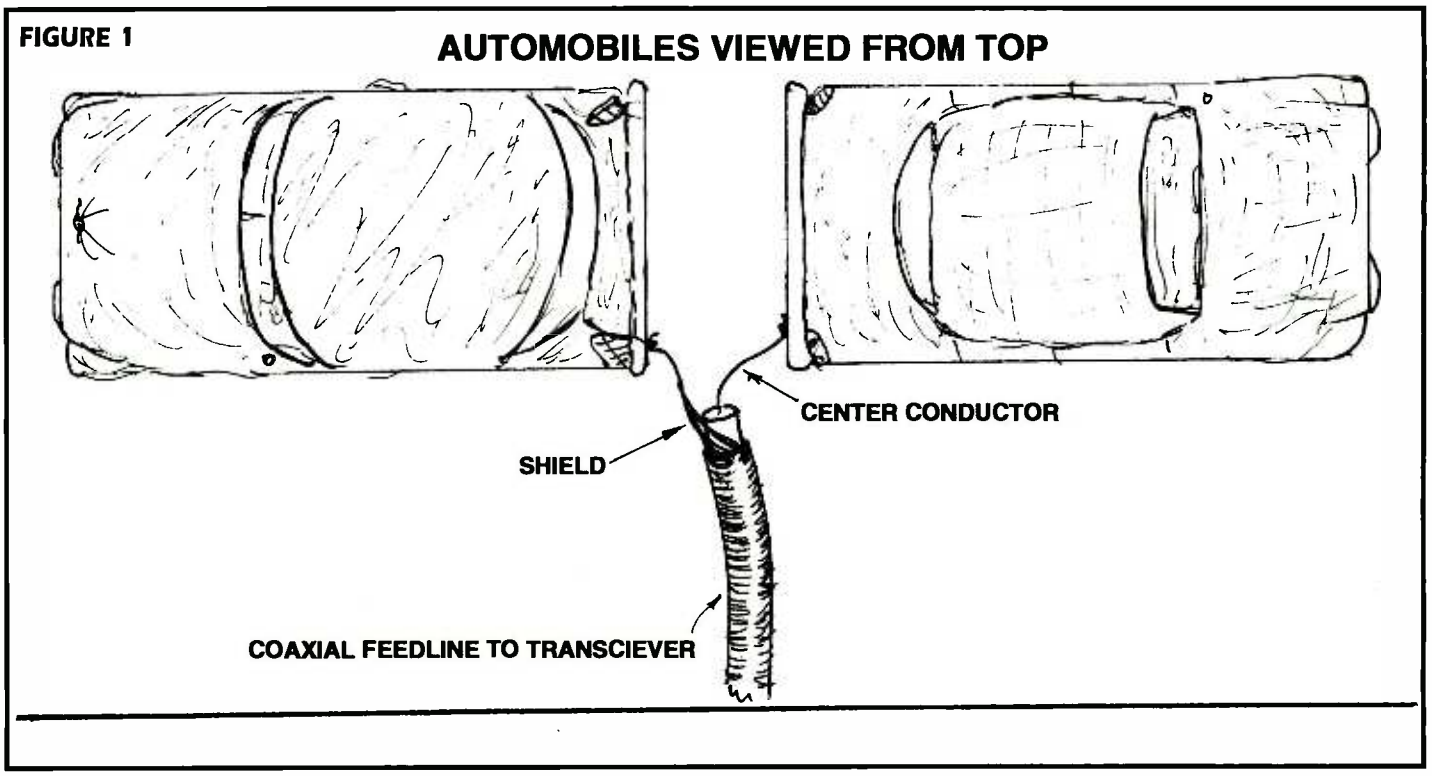
■ Ordinary antennas in non-ordinary places

Some types of wire antennas will fit full-sized into the attic of a home, the crawl space above the ceiling of a room, or even in an unused chimney. Sometimes they must be bent a bit to fit, but they still work. Halfwave dipoles shortened by as much as half their length still work surprisingly well. Some people have had success putting wire antennas under rugs, around the baseboard of a room, or under the eves of their roof. Unused chimneys can house base-fed vertical antennas, although putting radials out for them can be a problem. In some cases a couple of radials run out to each side of the antenna during operation (and rolled up and kept in the chimney when not using the antenna) can give good results. Or a center-fed dipole might fit your chimney if fed through a flue on your second story.

■ Non-obvious antennas just waiting for you

Obviously we should mention antennas like telescoping whips, active antennas and desk-top loops as among those with a low visible impact on the environment, but there are many even less-obvious antennas which operators have found useful in the past. These include metal window frames, metal porch awnings, lawn chairs, grocery carts, rabbit cages, clothes lines, dog-run cables, bedsprings, flagpoles, aluminum ladders, metal gutters, wire fences, and even automobile bodies (fig. 1). As a matter of fact the *human*

FIGURE 1



A center-fed dipole antenna utilizing the metal bodies of two parked automobiles as its elements. Good two-way communication was reported using this antenna.

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body makes a fair antenna at times! Items such as lawn chairs or ladders must be insulated from the ground. Setting them on a piece of dry wood is one way. The grocery cart and automobile are automatically insulated from ground by their rubber tires.

Unused electric appliances often work well as antennas. Be sure they are not plugged into the power mains! Actually the appliance's unplugged power cord can be used as the feedline when using the antenna for reception. To utilize these various objects as antennas you simply run a short wire from the center connection of the antenna input socket on your receiver, and connect it to the metal case of the object.

Believe it or not trees make decent antennas. Connect your coax feedline center-connector to a nail driven into the tree a few inches above the ground, and the coax shield to a rod in the ground below. Speaking of the ground, insulated wires laid on the ground, or just under the ground, can be used as antennas when received-signal strength is strong.

Although it is important to avoid utilizing for an antenna any appliance that is plugged into the electric power lines, you can utilize your entire house wiring as a receiving antenna! Do not, I repeat, *do not* connect any antenna directly to the household power lines, and never use this antenna for transmitting. To couple to the wiring wrap a few feet of insulated wire tightly along the length of an extension cord. *Do not* connect this wire to the wires of the extension cord. It doesn't matter if there is something plugged into the extension cord or not, but the extension cord must be plugged into an outlet. The free end of the insulated wire runs to your receiver's antenna terminal.

Transmitting, too!

Non-obvious antennas which are insulated from everything but your antenna lead-in wire should be OK for transmitting as well as for receiving. You need to use common sense, however (i.e., no one should be sitting in the lawn chair when it's being used to transmit, forget using the human body as a transmitting antenna, etc!). Don't use an appliance's power cord as a feedline when transmitting. As a matter of safety there should be no one near an antenna when it's transmitting. Very low power should be used for in-house antennas unless the antenna is well away from any other objects. Never use a transmitting antenna near a fuel storage tank.

For transmitting you're almost sure to need an antenna tuner to get any worthwhile radiation from the antenna. Non-obvious antennas used for reception usually do not have a high level of output, and in some cases an antenna tuner may be useful in bringing the received-signal level up.

And so.....

In case you think that the antennas described here are suggested only in jest, let me say that I have received reports from readers and friends who have enjoyed themselves with one or more of these antennas. The infamous Kurt N. Sturba frequently writes about his exploits using only a lawn chair, or some such unusual item, as an antenna. He makes many DX contacts with such a setup. Perhaps the most impressive small-antenna stunt that's come to my attention is that of a reader who reported that he had made a contact several states away using only a straightened paper clip as an antenna on the 10-meter amateur band!

It is usually true that putting a half wavelength receiving antenna outside, in the clear, and as high as practical gives better reception than is obtained from the antennas we've discussed here. But not everyone has the space, time, finances or desire to put up a more ideal antenna. The antennas described here have brought many listeners a lot of pleasure over the years. They are not difficult to try, and you can have yourself some fun in the process.

RADIO RIDDLES

Last Month:

I asked: "What was the first antenna?" The answer to this question depends on how you interpret the question. Hertz, who discovered electromagnetic waves about 1888, utilized loops, dipoles, parabolic reflector antennas, and dielectric antennas in his laboratory research. Marconi utilized a horizontal dipole in his early wireless work around 1896. But before these pioneers there were pre-pioneers like Henry, 1842; S. Thompson, 1876; Hughes, 1879; and Dolbear, 1882, who utilized various antennas in successfully sending and/or receiving wireless signals. E. Thomson (1871) even utilized a metal table top and a tin still as antennas. And he wasn't even a spy.

This Month:

Where did we get the name "antenna?"

You'll find an answer for this month's riddle, and much more, in next month's issue of *Monitoring Times*. Til then Peace, DX, 73

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Bill Cheek
email: bcheek@san.rr.com

Automatic NiCd Cell Discharger

I recently encountered another amazing lady technologist, not only a computer expert, but also a dedicated scannist! Judy May, *tandembike@worldnet.att.net*, works as a UNIX systems administrator with database and shell programming.

Mrs. May relates, "I am comfortable tweaking the registry of Windows 95, and like to dabble with VBA programming in MS Access. At home my biggest interests are tandem bicycling with my husband (over 1500 miles every year) and visual satellite observing. I use software to make satellite predictions, including the relatively new Iridium Flare phenomenon that produces spectacularly bright displays in the night sky."

She listens to shortwave broadcasts with a modest portable and all the local action with a BC9000XLT scanner. In addition to administering UNIX computer systems, May "dabbles" with repairing VCRs, camcorders, automobile and motorcycle electrical systems. She even designed and installed her home burglar alarm circuit. Her next challenge is "to bring myself up to speed on projects involving IC chips."

■ NiCd Cell Memory Effect?

I "met" Judy over e-mail when she asked about a circuit to safely discharge NiCd and NiMH cells to prevent the alleged "memory" effect and stop the discharge when the cell reaches full discharge.

At first, I scoffed. Fifteen or so years ago, NASA published the results of independent studies by the Gates and General Electric companies that debunked the myth of NiCd "memory." For more information, see: **http://www2.bath.ac.uk/~bspahh/bikelights/node12.html**

Judy's question sparked me to some research that suggests a periodic, full discharge of NiCd and NiMH cells can correct for the effects of past abuses of overcharge and undercharge, but only under the right conditions.

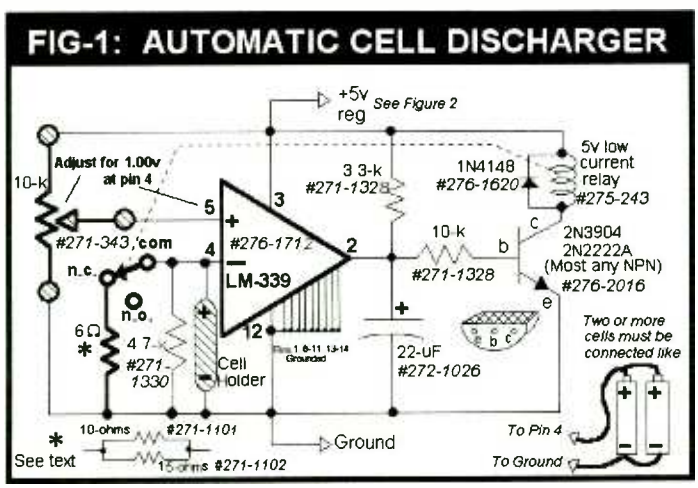
■ NiCd/NiMH Cell Details

The facts: NiCd and NiMH rechargeable cells are fully charged when their open-circuit terminal voltage reaches about 1.44 volts (V). Full discharge is considered to be when the cell drops to 1.0 V. The halfway point is considered to be the nominal cell voltage: 1.20 - 1.25 volts. Frequent discharges below 1.0 and recharges above 1.44 V are considered destructive.

I found that normal use of rechargeable cells does properly discharge them; at least in radios that are designed for rechargeable batteries. Most such radios have a "low battery" flag or an automatic shutoff circuit. These are designed for 1.0 V per cell as the bottom level of discharge. But for those of you who have trouble with rechargeable cells, here is a project.

Figure 1 shows the simple circuit, the heart of which is an LM-339, an op-amp called a "voltage comparator." As seen in Figure 1, a trimmer potentiometer is tweaked to set a reference voltage on the non-inverting (+) input. Since 1.0 V is the point at which the cell must stop discharging, the pot should be adjusted for exactly 1.00 V at Pin 5 of the LM-339.

When a cell is connected between ground and Pin 4, it continues to discharge a miniscule amount through the 4.7-k Ω resistor, but much more so via the relay contacts (com-to-n.c.) through the 6-ohm resistor. The 4.7-k Ω resistor ties Pin 4 low to ensure stability when a cell isn't connected. As long as a connected cell's terminal voltage is above 1.0 V, the output of the LM-339 is low (0 volts). This low is coupled via the 10-k Ω resistor to the base of the switching transistor, which can't conduct when low. Thus, the relay is de-energized, with its contacts in the normally connected position (n.c.)



As soon as the cell discharges to 1.0-V to match the reference voltage, the output of the LM-339 shifts to high (5 V). This turns on the switching transistor and, in turn, energizes the relay, the contacts of which shift to the normally open (n.o.) position. This stops further discharge of the cell. The 4.7-k Ω resistor continues to discharge the cell, but at 200-mA or less, this is insignificant so long as the cell is removed within a few days.

If for any reason the cell's voltage should climb back over 1.0 V, the LM-336 will trigger the switching transistor to switch the relay back to the n.c. position. The cell then discharges at the much higher rate until it drops to 1.0 V again. Operation is automatic all the way, and hands-off is the keyword here. But there are caveats.

■ Caveats and Precautions

The 6-ohm resistor is really a nominal value chosen for moderate-duty "AA" NiCd cells (600-mA/h). The maximum recommended charge and discharge rates for NiCd and NiMH cells are one third the mA/h rating. If we figure a cell's starting discharge voltage is the nominal 1.2v, and if we don't want to exceed 200-mA (600-mA/h divided by 3), then using Ohm's Law (I = E/R), R = 1.2/.200 = 6-ohms.

Therefore, you need to know your cells. Heavy duty NiMH cells rated at 1000-mA/h require 1.2/.333; or 4-ohms for the quickest, but safest discharge.

Low value resistors aren't available from Radio Shack, but you can make your own with a little ingenuity and basic math. The lower left corner of Figure 1 shows a 10-ohm resistor in parallel with a 15-ohm resistor, the effect of which is 6-ohms.

The calculation for two resistors in parallel is: (R1*R2)/(R1+R2) or (10*15)/(10+15) = (150)/(25) = 6. You can concoct a wide range of values this way. This combination of two for 6-ohms, when paralleled with another 15-ohm resistor, yields 4.3-ohms; or with a 10-ohm resistor, yields 3.75 ohms. Four 15-ohm resistors in parallel yield an effective 3.75-ohms, etc.

You also have to note the wattage rating of the discharge resistor. Ohm's Law for power says: P = E*I; or 1.2 * .200 (or, .333) equals 0.24-watt (or, 0.4 watt); therefore, the minimum wattage rating of the discharge resistor should be 0.5-watt.

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You can use this circuit to discharge more than one cell at a time, but it will take longer unless you reduce the value of the discharge resistor. Use the same formulas above, except take the additional cells into account. For instance, two 600-mA/h cells connected in parallel as in Figure 1 are considered as one 1200-mA/h cell that can be discharged at 400-mA. The resistor should be about 1.2/0.4 or 3 ohms. Likewise, a 6-cell pack in parallel is considered as one 3600-mA/h cell: 1.2/3.600, or 0.33 ohms. You can make a 0.33-ohm resistor by wiring three 1-ohm resistors in parallel.

Power for the circuit should be 5 volts regulated. Figure 2 shows a cheap and easy regulated +5 V supply.

It is not wise to discharge more than one cell at a time from the series-connected pack that runs the radio. Rechargeable cells connected in series typically do not discharge equally. That is, a fully discharged NiCd pack of six cells might show individual voltages of 0.94v, 1.07v, 1.03v, .89v, 1.10v, and 1.00v.

It is ideal to discharge each individual cell to the same level, and as you see, that can be done only with the cells connected in parallel, or discharged individually, one at a time.

If you insist on trying the automatic discharger with a series pack, you will have to use a higher supply voltage, equal to or a few volts above the maximum terminal voltage of the pack. For example, a six-cell NiCd pack can measure as high as 8.7v, so the regulated power supply should be 9v or higher. A four-cell pack can measure as high as 6v. The LM-339 chip can take power supplies up to 18v, though 13.8v is about the practical maximum.

The reference voltage for a series-connected pack should be calculated at 1.0v multiplied by the number of cells. The discharge resistor is calculated based on the nominal 1.2v per cell. Example: a six-cell pack needs a reference of 6.0v . The resistor should be calculated for 1.2 x 6 = 7.2v. So, for a 600-mA/h pack, the resistor would be: 7.2/0.200 = 36 ohms. The discharge resistor for a six-cell, 1000-mA/h pack would be 7.2/1.000 = 7.2 ohms (7 ohms would be fine.)

Unused pins of the LM-339 Quad Comparator must be grounded. See Figures 1 and 3. You might devise temporary grounds so that other sections can be used for future projects as needed.

FIG-3: LM-339 PINOUT

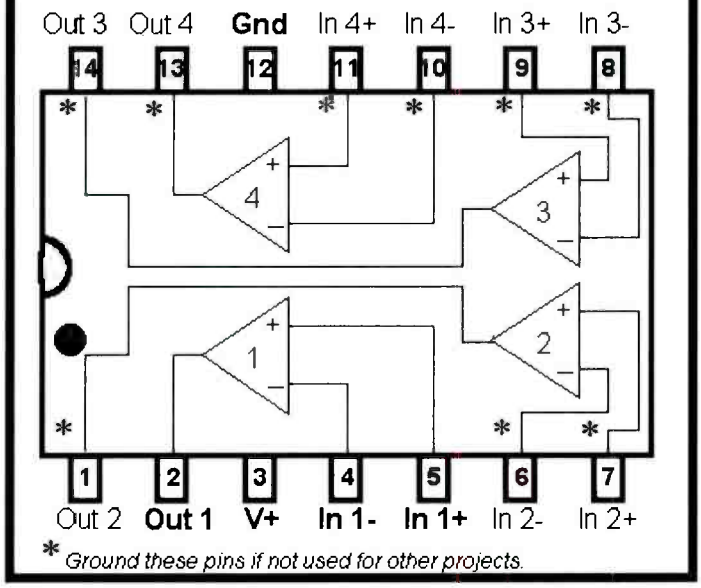
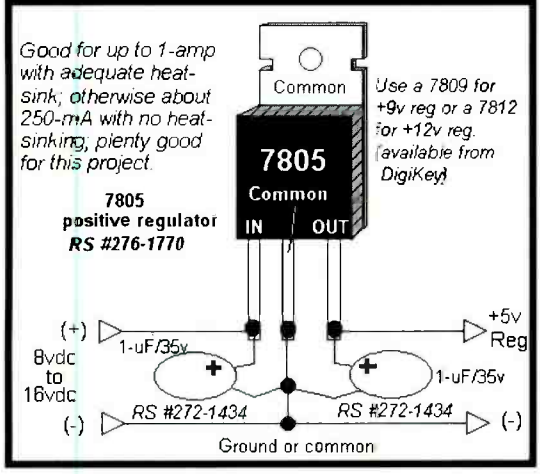


FIG-2: EASY +5v SUPPLY



The Rest of the Story

The rest of the circuit isn't critical, but use good layout and perfboard techniques, keeping the Pin 2 (output) side of the circuit apart from the Pins 4-5 (input) side. Your first version of the circuit should be for a single cell. Test it and make sure there are no problems. After it works, you can experiment with discharging multiple cells (in parallel, of course.)

You can also experiment with different values of discharge resistors, too. Remember, I used a value based on the one-third of the cell's mA/h rating at 1.2v. You can speed up the discharge rate by decreasing the value of the resistor. If the initial current drain exceeds the 1/3 rating for a short time, there is little or no risk of permanent damage, and once the cell starts discharging, the open circuit terminal voltage drops off rapidly, to well under my conservative spec of 1.2v. As the terminal voltage drops, current drain falls proportionally.

This drop-off is not linear; more like logarithmic, meaning the terminal voltage drops quickly at first under discharge, and then tends to stabilize at a less rapid rate. You can experiment with this by using lower values for the discharge resistor with voltmeters and milliammeters connected to show what's happening.

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Dan Veeneman
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Cellular Cryptography and GSM

Digital cellular systems are on a growth curve to overtake analog systems in just a few years. More than five and a half million digital handsets were sold in 1997, up from less than one and a half million in 1996.

One of three digital technologies competing for customers in the United States is the Global System for Mobiles (GSM) standard. Originating in Europe in the early 1980s, GSM is now serving more than 100 million customers around the world, and more than two million subscribers in the United States.

Rather than holding customer information in the phone itself, each GSM telephone uses a removable, personalized smartcard called a Subscriber Identity Module (SIM). The SIM is actually a tiny computer, complete with memory storage and a low power microprocessor. Besides holding subscriber information, it also performs security functions to protect the customer and the network.

Probably the two most common areas of vulnerability in a cellular telephone network are fraudulent use of service and interception of call contents. The GSM SIM makes use of cryptography to reduce fraud and provide some measure of confidentiality.

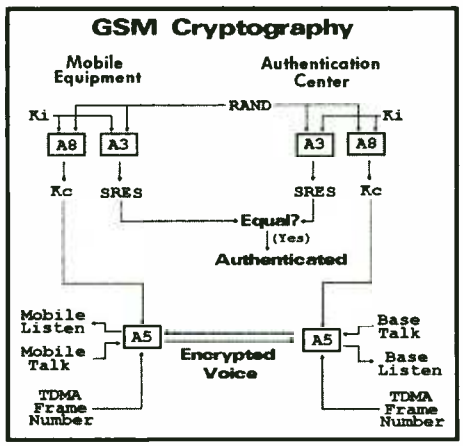
Before a SIM is released to a customer it is programmed with a unique, secret 128-bit long key called Ki. Once programmed, Ki is supposed to remain hidden and invisible, available only to special computer algorithms that run internally on the SIM. A copy of this secret key is also kept by the network operator in an Authentication Center (AuC).

The SIM also contains two cryptographic algorithms referred to as A3 and A8, which are used for authentication and confidentiality.

■ Authentication

One of the primary security functions of the SIM is to *authenticate* the subscriber to the network. A GSM network verifies the identity of a subscriber through a *challenge-response* process. When a mobile subscriber requests service, the network sends a mathematical challenge to the phone, which it must answer correctly before being granted access.

The challenge sent by the network to the phone consists of a 128-bit number called RAND. When the phone receives the RAND challenge it passes it into the SIM for processing. The SIM card sends RAND and the secret 128-bit key Ki through the A3 algorithm to produce a 32-bit "signed response" (SRES). This number is transferred out of the SIM into the phone, where it is then transmitted to the network. This is the phone's response to the network's challenge.



Meanwhile the network has performed the same set of operations. Using the same value of RAND and an identical copy of Ki, the network has computed its own value for SRES.

The network compares the SRES received from the phone to its own SRES: If the two values are the same, it assumes the phone is legitimate and allows service to proceed. If the two values are not the same, the network assumes the SIM does not have the proper secret key Ki and therefore denies service to the phone.

Since the RAND value changes with every access attempt, an eavesdropper recording the SRES response will not be able to successfully reuse it later. Even if by chance a particular RAND challenge happened to be reused, a GSM network has the flexibility to authenticate the phone as often as it wishes, perhaps several times throughout the duration of a call. A legitimate phone can easily return the correct answer each time, whereas a cloned phone using a single successful SRES will be thwarted.

■ Confidentiality

The SIM also provides information needed to encrypt the radio connection between the phone and the base station. In order to understand how the encryption works, a little background is necessary.

GSM uses a technique called *time division* to share the radio channel with up to seven other users. Each user takes turns using the common radio channel, sending and receiving information only during one of the eight available time slots. Each time slot is very short, lasting only about 4.6 milliseconds, and is identified by a *frame number*. A GSM conversation uses two frames, one going from the base station to the phone (called the *forward* direction) and another going from the phone back to the base station (called the *reverse* direction). Each of these frames contains 114 bits of user information, which is almost always digitized and compressed speech.

So, every 4.6 milliseconds the phone receives 114 bits of information from the base station and transmits another 114 bits to the base station. It is these 228 bits that require encryption to protect them from eavesdroppers.

Using the RAND challenge and the secret key Ki, the SIM runs the A8 algorithm to produce a 64-bit long cipher key called Kc. Kc is transferred out of the SIM and into the phone, where it is used by a third algorithm called A5.

A5 uses Kc and the current frame number to produce a key stream of 228 bits, half of which decode the incoming forward channel and the other half encode the outgoing reverse channel. A5 resides in hardware in the phone, not in the SIM, and must operate quickly and continuously to generate a fresh set of 228 bits every 4.6 milliseconds. Also, because GSM handsets are designed to operate in different networks, the A5 algorithm must be common to all GSM networks.

There are presently at least two different implementations of A5. The first, called A5/1, provides the strongest level of encryption across the air link. Although purportedly using 64 bit keys, in actual practice the keys are no more than 54 bits long. The second, A5/2, uses a 16-bit key and is designed for export to non-Western countries.

Since encryption requires additional hardware in each base station, raising the cost and complexity of the network, a third option is to employ what's euphemistically called A5/0 — that is, no encryption at all.

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■ Weaknesses

GSM security is based on keeping Ki a secret. If Ki could somehow be extracted from a SIM, the holder would be able to create a duplicate SIM. As demonstrated in April of this year, there is a weakness in most GSM networks that allows Ki to be determined.

The A3 and A8 algorithms are really interface specifications, not the actual routines themselves. A3 and A8 define the inputs (RAND and Ki) and the outputs (SRES and Kc) of each algorithm, but don't specify exactly how each will produce their result. Each GSM network operator can basically implement whatever security routines they wish as long as the inputs and outputs match the definitions for A3 and A8. In addition, since A3 and A8 take the same inputs, a combined algorithm called A38 is also defined.

GSM specifications provide a "reference implementation" for A38, spelling out the details of an example computer program that will produce SRES and Kc. It turns out that almost all network operators have implemented this example, referred to as COMP128.

COMP128 was designed in secret and released only to a limited number of groups under strict non-disclosure agreements. Its strength was based on what cryptographers call *security through obscurity*, relying on that fact that since so few people knew the details no one would find any weaknesses and the algorithm would remain unbroken.

As usually happens with this type of "security," the details of COMP128 were eventually pieced together from leaked documents and other data. A group of researchers in California assembled the algorithm and soon found that it had a serious flaw.

COMP128 is what's known as a *hash function*. To generate an answer to a network challenge it takes a total of 256 bits of information (RAND and Ki) and produces a 32-bit answer (SRES). Because there are so many possible values of RAND as compared to possible SRES values, it is likely that more than one value of RAND will produce the same SRES. This is known as a *collision*, and in the case of COMP128 it turns out that such collisions "leak" information about Ki.

By selecting the proper values of RAND, an attacker can eventually determine the value of Ki by examining the SRES collisions. Using a smart card reader and some custom software, in April of this year the researchers demonstrated this attack by extracting the secret key from a Pacific Bell SIM in about eight hours. Their software repeatedly requested that the SIM execute the COMP128 authentication algorithm and examined the results, slowly piecing together the value of Ki. Once they had the secret key they copied it into another SIM card and effectively cloned a GSM phone.

The researchers also discovered an interesting fact about Kc, the cipher key used to encrypt the contents of a GSM call. Although Kc is a 64-bit key, the COMP128 algorithm forces the last 10 bits to all zeros, effectively reducing it to a 54-bit key. It appears that the original designers, probably under pressure from intelligence and law enforcement agencies, deliberately weakened the protection that A5 provides.

The law in the United States requires a court order before a law enforcement agency is allowed to wiretap a telephone, cellular or otherwise. Legal wiretaps are almost invariably performed at the mobile switching center, where the mobile network joins with the rest of the public telephone network. The call at that point is carried over wires that can easily be tapped, making eavesdropping relatively easy. Very few legal wiretaps are done by intercepting the radio portion of the call, since it's much easier, safer, and more reliable to do so at the switch. Why then would law enforcement agencies be interested in weak radio encryption, if not to perform illegal wiretaps?

■ Wireless Surveillance

Things are still boiling on the legislative front regarding wiretapping. If you recall, in 1994 Congress passed the Communications Assistance for Law Enforcement Act (CALEA), which requires telecommunications equipment and service providers to make the nation's wired and wireless telephones "wiretap friendly." Providers and equipment manufacturers are facing an October deadline to meet a set of compliance requirements that haven't yet been approved by all sides.

The telecommunications industry, as required by CALEA, has developed a set of technical standards to implement the law. The FBI, representing the nation's law enforcement agencies, has blocked implementation of the standards, arguing that they don't go far enough in providing surveillance capabilities. The FBI has a "punch list" of requirements that the telecommunications industry and privacy advocates say goes far beyond what Congress intended and what CALEA allows.

This spring the deadlock ended up in the hands of the Federal Communications Commission (FCC), who will study the issue, take public comments, and eventually issue a ruling to arbitrate the dispute.

More information on GSM, CALEA, and other wireless topics is available on my website at **www.decode.com**, and in my book *Inside Mobile Telephone Systems* from Index Publishing. I am also reachable via electronic mail at *dan@decode.com*. Until next time, happy monitoring!

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FBI to Obtain New Radio System

It seems that the Federal Bureau of Investigation (FBI) is concerned with the unauthorized eavesdropping of its communications. I do not know how it is in your area, but here in South Florida, there are *NO* clear voice transmissions on any of the FBI frequencies.

According to an article in the August 1998 issue of *Popular Mechanics*, the FBI is going to a new type of mobile/portable radio. It is a Motorola Astro Seneca digital radio and the Bureau will begin replacing 12,000 of their current radios with these new units in the next two years.

The radios are jointly built by Motorola and Harris Corp. Motorola will provide the radio and Harris will provide the Seneca processor with "Type 1 encryption." This will allow transmission of communications up to the level of Top Secret.

In addition to providing secure voice communications, the radios will provide the FBI agents with the ability to exchange computer files and digital fingerprints with other federal and state agencies, as well as national police in other countries.

The radios will not come cheap to the taxpayers. The first 500 of the units will cost the taxpayers over $8000 apiece. The only saving grace about this is that the old radios (the ones they are using now) will show up at government auctions and hamfests. On the other hand, one has to be careful about jumping to conclusions based on the information you may find left in those radios, as you will see in the following story.

■ Department of Justice

I want to thank my anonymous friend "Abe" who constantly keeps providing me with new federal frequency information. The latest info comes from two radios he bought at the Dayton Hamfest. These radios were Motorola MX-300S units. One had DES encryption capability still in it and had a subaudible tone of 167.9 Hz. This obviously is FBI. The frequencies were neatly taped to the back.

DEPARTMENT OF JUSTICE (FBI?)

Zone A

Ch	Transmit	Receive
01	167.2125	167.2125
02	167.2375	167.2375
03	167.2625	167.2625
04	167.5625	167.5625
05	167.6375	163.9325
06	167.5375	163.4625
07	167.6125	167.6125
08	167.6125	162.7375

Zone B

Ch	Transmit	Receive
01	167.2875	167.2875
02	167.3125	167.3125
03	167.4125	163.9125
04	167.4125	163.8375
05	167.4375	163.9625
06	163.4375	162.6375
07	167.4375	163.8875
08	167.4375	163.9125

Zone C

Ch	Transmit	Receive
01	167.5875	163.9125
02	167.5875	163.8875
03	167.5875	163.9625
04	167.5875	162.7375
05	167.5875	162.6375
06	167.4875	162.6375
07	167.4875	163.9125
08	167.4875	163.8375

Zone D

Ch	Transmit	Receive
01	167.3375	167.3375
02	167.3625	167.3625
03	167.4625	162.7625
04	167.5125	163.9875
05	167.5000	167.5000
06	167.5000	163.9625
07	167.6875	167.6875
08	167.2250	167.2250

The 162/163 MHz frequencies *used to be* repeater outputs with the inputs in the 167 MHz range as indicated in this older radio. This has since changed in the last five years, and the 167 MHz range has now become the FBI repeater outputs and simplex channels, while 162/163 MHz is the location of repeater inputs nationwide.

■ FBI Miscellany

• While on the topic of the FBI, Dana Stein wrote into the Fedcom list with a question about a frequency that has been monitored in the New York City (NYC) area. The frequency is 172.475 MHz. The frequency is used by units with a Cobra callsign and it seems they are running some type of surveillance, mostly using encrypted comms.

Rickey Stein, the Scan-L International Editor, came back with the reply that these units are probably FBI and have been heard in the NYC area for some years. Seems the repeater output listed above is located in Queens. Thanks Rickey.

• At the last radio club meeting one of the club members came to me with a question. This person has collected a large number of federal frequencies for both Drug Enforcement Administration (DEA), FBI, and other federal agencies and has plugged them into his scanner. Problem is, he does not really know what frequencies go with each agency. Steven Scott of Deer Park, Washington, was kind enough to answer his question on the Fedcom mailer. Here is a fairly complete list of FBI and DEA frequencies used throughout the United States. The original list contained some old material which has been passed from hand-to-hand for years, but we've cleaned it up a great deal.

■ FBI Nationwide Plan

This is the D bank of channels found in nearly every FBI radio in the country. The A, B, and C banks will contain the local discrete channels and the interagency/county/state and other coordination frequencies.

Ch	Freq MHz	Use
D1	164.550	Repeater out
D2	164.550	Simplex
D3	166.4625	common
D4	167.5625	FBI nationwide
D5	167.5375	Special ops simplex
D6	167.5375	Special ops repeater out
D7	163.1000	Federal ops joint strike force
D8	155.475	National law enforcement coordination

OTHER FREQUENCIES USED BY THE FBI

163.9375	C2 Repeater input--unknown output
163.9625	E5 Repeater input--unknown output
165.2375	Coordination with Customs
172.4750	Cobra units in New York City--B3 Channel

FBI FREQUENCIES WITH NO KNOWN DESIGNATORS

167.2625 167.2875 167.3625 167.3875 167.4125
167.4625 167.4875 167.5125 167.5875 167.6375
167.6500 167.6625 167.6875 167.7625 167.7725

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167.7875 168.3500 169.5000 170.6250 170.6750
170.9000 173.1750 414.2000 414.4250

These are by no means all of the FBI frequencies. Keep a check on the Fedcom mailer (*majordomo@qth.net*) and this column for new ones as they are available. Also, doing a search from 163-165 and 167-168 MHz will often produce new unknown channels.

The FBI has a nationwide shortwave network which is tested every Monday at 0900 hours Eastern. The stations are located in major field offices and run 1000 watts. They are made by Harris and have, obviously, heavy encryption capabilities. Their frequencies are (kHz):

5058.5 7903.5 9311.5 10498.5 12138.5 14493.5
15953.5 16376.0 17403.5 18666.0 20348.0

■ DEA has a Plan

The Drug Enforcement Administration has a nationwide band plan also. We are lucky in that there are not as many frequencies in use as the FBI utilizes.

DEA STRIKE FORCE

Ch	Freqs MHz	Use
01	418.625	Repeater out
02	418.900	Repeater out
03	418.750	Simplex
04	418.675	Simplex
05	418.825	Repeater out
06	418.950	Repeater out
07	418.975	Repeater out
08	?	
09	419.250	(this is FBI)
10	418.050	Interagency coordination
11	419.300	(this is FBI)
12	419.375	(this is FBI)

HIGH DENSITY DRUG TRAFFICKING AREA FREQUENCIES*

01	414.550Repeater out (CA)
02	414.500Repeater out (CA)
03	414.025Simplex (FBI/INS)
04	414.050Simplex (NY)
05	414.150Simplex (NY)
06	412.000Repeater out (CA)
07	414.350Repeater out (CA)
08	414.450Repeater out (CA/MA)
09	414.475Repeater out (CA/ FL/MA)
10	412.125Joint task force repeater out (CA)

DEA AIRCRAFT FREQUENCIES (AM)*

01	282.425	Blue 1
02	260.800	Blue 2
03	303.825	Blue 2
04	336.600	Blue 3
05	353.900	Blue 3
06	254.200	Blue 4
07	243.600	Blue 5
08	381.800	Blue 6
09	283.400	Blue 7
09	361.800	Blue 9
10	281.400	Blue 10
11	355.900	Unknown
12	350.450	Unknown
13	418.500	Air Surveillance FM Mode
14	120.375	Air
15	120.775	Air
16	132.950	Air Tactical 1
17	139.700	Air Tactical 2

*We cannot verify these lists

DEA SHORTWAVE COUNTERNARCOTICS FREQUENCIES

Freq	Channel ID
5277	Alpha
5841	Bravo
7300	Charlie
9497	Delta
7657	Foxtrot
11076	Echo
14686	Papa
14690	Golf
18171	Designation Unknown
18666	Hotel

■ T for TVA

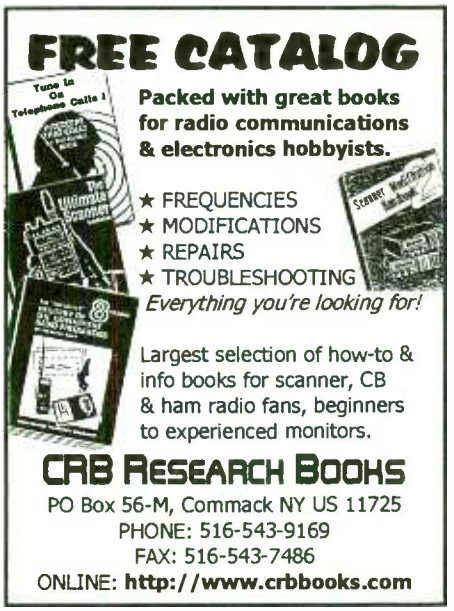
A reader sent me some e-mail asking about the frequencies used by the Tennessee Valley Authority. In the past, the TVA has used both low band and UHF frequencies. It seems they have done away with their 38 MHz frequency and have moved up to the VHF band.

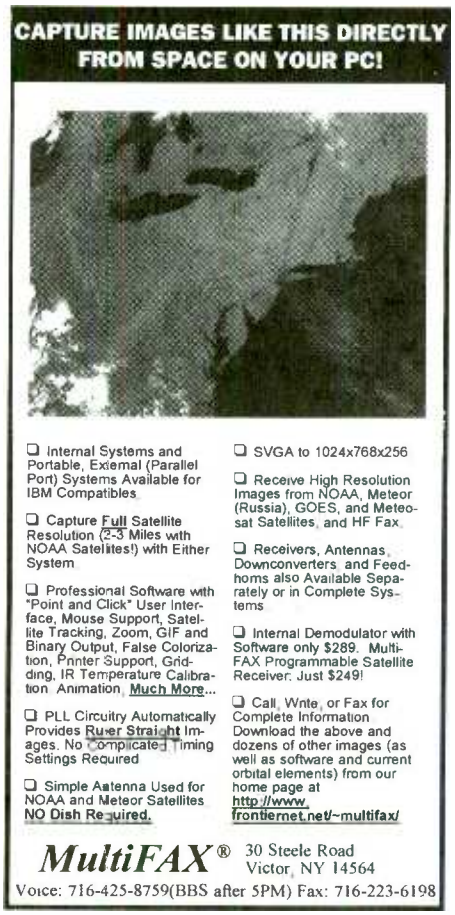
In southeast Tennessee, the TVA people have been seen carrying Motorola Saber portables. The low band traffic has been moved to a repeater with its output on 172.625 MHz in Chattanooga. The TVA police are using 168.225 and 171.150 MHz, almost always encrypted. They did go in the clear for radio testing and it was confirmed they were the channel occupants.

In the area known as "Land Between the Lakes" the new radios have not arrived yet, for the TVA police are still using 166.325 MHz for their base repeater at Golden Pond Station.

As a final note, a reader in Washington State has noticed the Secret Service with 800 MHz antennas on their cars along with the 165 MHz antennas. It seems a little birdie at the radio shop let it slip that the Secret Service is using a talk group on the Washington State Trunked System. Look for more of this in the future.

As a closing note, President Clinton was down in my area visiting Sly Stallone in Miami Beach. There were *NO* 415.7 MHz transmissions from Air Force 1. The action was found at 345.5 MHz on the wideband multiplexed (mux) transmitter talking down to an unknown base station here in Florida.





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Jean Baker, KIN9DD

Coming to Terms with Radar

Welcome aboard, everyone. As aviation band monitors, we quite often hear the word radar ("radio detecting and ranging") used in many of the transmissions between pilots and air traffic controllers at both terminal and enroute air traffic control facilities. Today we will begin a look at the various components which make up today's modern radar system, along with its associated terminology.

The **National Airspace System** (NAS) comprises the common network of U.S. airspace: air navigation facilities, equipment, services, airports and landing areas. It provides support for these areas of responsibility by aeronautical charts, information and services, rules and regulations, procedures, technical information, manpower and material. Included are system components shared jointly with the military.

The **National Beacon Code Allocation Plan** (NBCAP) is an associated system whose airspace includes the United States territory located within the North American continent between Canada and Mexico, including adjacent territorial waters outward to the boundaries of the oceanic control areas.

Primary Radar - A radar system in which a minute portion of a radio pulse transmitted from a site is reflected by an object and then received back at that site for processing and display at an air traffic control facility.

Secondary (Surveillance) Radar - This is also referred to as the Air Traffic Control Radar Beacon System, or the ATCRBS. In this radar system the object to be detected is fitted with cooperative equipment in the form of a radio receiver/transmitter (transponder).

The Interrogator, which is the ground-based radar beacon transmitter-receiver, scans in sync with the primary radar and transmits discrete radio signals which repetitiously requests all transponders in the mode being used to reply. The replies received are then mixed with the primary radar returns and both are displayed on the same radarscope.

The airborne radar beacon transmitter-receiver or transponder automatically receives the signals from the interrogator and selectively replies with a specific pulse group (code) only to those interrogations being received on the mode to which it is set. These replies are independent of, and much *stronger* than a primary radar return.

Photo Credit: FAA

A mode is the letter or number assigned to a specific pulse spacing of radio signals transmitted or received by ground interrogator airborne transponder components of the ATCRBS. Mode A (military Mode 3) and Mode C (altitude reporting) are used in air traffic control.

■ More about the ATCRBS

An integral part of the ATCRBS ground equipment is the decoder. This equipment enables the controller to assign discrete transponder codes to each aircraft under his control. Assignments are made by the Air Route Traffic Control Center (ARTCC) computer on the basis of the National Beacon Code Allocation Plan. There are 4096 aircraft transponder codes which can be assigned. An aircraft must be equipped with civilian Mode A or Military Mode 3 capabilities to be assigned a transponder code.

The decoder is also designed to receive Mode C altitude information from aircraft so equipped. This system converts aircraft altitude in 100-foot increments to coded digital information which is transmitted together with Mode C framing pulses to the interrogating ground radar facility. When you hear an air traffic controller tell a pilot whose flight he's working to "squawk ident," this means that the pilot should activate the identify feature of the transponder, which causes the assigned code number to appear on the controller's radarscope.

The radarscope used by air traffic controllers displays returns from both the primary radar system and the ATCRBS. These returns, called targets, are what the controller uses to control and separate traffic. If an aircraft has the necessary airborne equipment, the ATCRBS data is displayed on the radarscope in alpha/numeric blocks that show the flight number, altitude, ground speed, climb or descent, emergency, hand-off, loss of radar contact, and other information pertinent to the aircraft.

Radar utilized by air traffic control facilities is divided into two broad general categories: **Airport Surveillance Radar** (ASR) and **Air Route Surveillance Radar** (ARSR) — the enroute or ARTCC function. Both types can scan through 360 degrees of azimuth and present target information on a radar display located in a control tower and approach/departure facility, as well as in an ARTCC. This information is used independently or in conjunction with other navigational aids in the control of air traffic. In normal air traffic control (ATC) operations, ASR and ASRS is combined with the ATCRBS (secondary surveillance radar), although ATCRBS can be used by itself.

Next month we shall feature part two of our look at ATC radar.

■ More Airline Callsigns

IRANAIR - Iran National Airlines Corp.
IRAQI - Iraqi Airways
JAGUAR - Belize Trans Air
JAPAN CHARTER - Japan Air Charter Co. Ltd.
JETSET - Air 2000
JORDANIAN - Royal Jordanian Airlines
JOHN DEERE - Deere & Co.
JULIETT MIKE - Air Jamaica
KIWI - Royal New Zealand Air Force
KUWAITI - Kuwait Airways Corp.
LATE NIGHT - Midnite Express, Inc.
LOCKHEED - Lockheed Aircraft Corp.
MALEV - Hungarian Airlines
MAROCAIR - Royal Air Maroc
MEDIVAC - General Callsign Worldwide for Medical Evac Aircraft
MERIDIAN - Meridian Air Cargo, Inc.
MEXICANA - Conpania Mexicana de Aviacion S.A.
MID PAC - Mid Pacific Airlines, Inc.
METMAN - Meteorological Research Flights
MIDEX - Mid-West Express
MIKE ROMEO - Air Mauritanie
MOBIL - Mobil Oil, Ltd.
MOTOR CITY - Falcon Air, Inc.
NASA - National Aeronautics And Space Administration
NEW ZEALAND - Air New Zealand, Ltd.
NORWEGIAN - Royal Norwegian Air Force

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NEW

WiNRADiO®

From the Pioneers of Computer Controlled Radio now comes a whole new range.

Internal Model (WR-1500i)

The popular WiNRADiO WR1000i is the world's first commercially available PC-controlled scanning receiver. No wonder it has received the coveted Most Innovative Receiver Award for the Year 1998, by WRTH.

However, this fine receiver has now finally encountered serious competition:

Our own.

WiNRADiO Communications now proudly introduce a new series of radio-controlled PC-based receivers, in both internal and external versions:

- WR1000i ... 100% internal 1300MHz scanning receiver
- WR1000e ... 100% external 1300MHz scanning receiver with standard RS-232 control and optional PCMCIA (PC-card) interface
- WR1500i ... 100% internal 1500MHz scanning receiver
- WR1500e ... 100% external 1500MHz scanning receiver with standard RS-232 control and optional PCMCIA (PC-card) interface

External Model (WR-1500e)
(computer not included)

The 1000/1500 series products offer cost-effective solutions for a wide variety of applications. The products come in two forms: internal ISA-bus cards, and compact external units with an RS-232 interface (PCMCIA interface optional).

The WiNRADiO Virtual Control Panel

The advantages of an internal card model are in its neatness – there are no external cables required, no external interface ports are occupied, no external power supplies or extra desk space are needed. And if you wish, nobody needs to know that you have a scanning receiver hidden inside your PC!

Multi-channel operation is simple to achieve, as up to eight WiNRADiO internal receivers can be used simultaneously in one PC.

Spectrum Scope

The advantage of an external model is in its portability – the optional plug-and-play PC card interface (PCMCIA) allows a very fast and simple installation for any portable PC. Serial RS-232 interface is also available as standard.

Both models are very well shielded from PC interference. We use specially developed shielding materials and innovative design methods to prevent any interference directly entering the receiver.

Software options:

- WiNRADiO Digital Suite software for decoding of WEFAX, HF fax, packet, ACARS, DTMF, CTCSS; for signal classification, audio spectrum analysis, squelch-controlled playback and recording.
- WiNRADiO Database Manager

Hardware options (for external models):

- WiNRADiO Portable Power Source for a truly portable computer-controlled radio system, containing nickel-metal-hydride batteries and an intelligent battery charging facility with battery charge indication.
- WiNRADiO PC Card Adaptor allows the use of PCMCIA card interfaces commonly used with laptop computers.

WiNRADiO receivers are available from selected radio dealers in North America.
See our Web site **www.winradio.com** for more details or email enquiries to info@winradio.com.

Technical Specifications are subject to change without notice.
WiNRADiO, WiNRADiO Digital Suite and VISITUNE are trademarks of WiNRADiO Communications.
Availability subject to FCC certification (application pending at time of printing). Contact us for details.

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WHAT'S NEW?

TELL THEM YOU SAW IT IN MONITORING TIMES

Serious Surveillance!

Grove Enterprises carries a number of products that are for government use or export only. Among the most exciting are several receivers based on WiNRADiO's wideband, digital signal processing WR-3000i-DSP receiver. The impressive signal surveillance specs of the computer-hosted WR-3000i include continuous 150 kHz-1500 MHz reception, 65 dB image and spurious signal rejection, and 85 dB dynamic range.

This plug-in receiver ISA card can memorize thousands of channels and scan them at speeds up to 50 per second! It will even log intercepts unattended, storing them into virtually unlimited memory for later recall. Up to eight independent receivers can be controlled at one time.

The Visitune spectrum display spans up to 100 MHz at a time, with storage and recall of multiple scans. And you can access any signal immediately by pointing and clicking your mouse, or even rapidly tune through the spectrum by simply dragging the mouse. Double-clicking on a spike provides accurate center-frequency readout of AM and FM signals.

The basic WR-3000i-DSP receiver is available from Grove for $1,995.

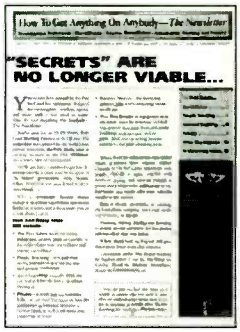
However, for rapid deployment and compact applications in which you can't drag the computer around with you, consider the MS8002 ($9,950), MS8003 ($11,945) and MS8006 ($19,950) computerized receivers. These

portables have all the advanced specifications of the WR-3000i, but are self-contained — built around two, three, or six receivers respectively. The models are equipped for remote networking, are internally Pentium hosted, offer a brilliant thin-film-transister (TFT) LCD display, and can digitally record up to 30 days of audio!

For more information on these surveillance receivers for government use, see Grove's web page at **www.grove-ent.com** or call 800-438-8155.

Get Anything on Anybody

Lee Lapin, author of Vol 1 and 2 of *How to Get Anything on Anybody* and *The Whole Spy Catalog*, has come out with "How to Get Anything on Anybody," the newsletter. Vol. 1 No. 1 com-



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With Scancat Gold for Windows "SE," your spectrum never looked so good! Load virtually "any" database and Scancat "SE" will examine your database, plot each and every frequency, no matter what the range...and "paint" the entire analysis on your screen.

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- By Number of hits per frequency in a "histograph".
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- Unlike "single radio" adapters, can be used with ANY radio supported, simply change the adapter, then "Plug and Play."
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prised 11 pages packed with tips and tricks for researchers, investigators, spies, and "generally nosy people."

$89 gets you 10 issues, or you can send $10 per issue (no mention of a sample!). Send to Intelligence Incorporated, 2228 S. El Camino Real #349, San Mateo, CA 94403.

Hitler's Airwaves

Joseph Goebbels, propaganda minister of the Third Reich, was a firm believer in the power of radio — or what he termed "mind-bombing." The first target was the German people themselves, bombarded with the message of anti-communism and anti-semitism.

Then announcers like "Axis Sally" worked to undermine the morale of the Allied forces. Clandestine stations directed against listeners on the home front might rebroadcast actual BBC programs mixed with propaganda to English audiences, or claim to be broadcasting from Iowa in the U.S. with intent to confuse or discourage. "Propaganda swing"and jazz parodies coaxed homesick soldiers to listen.

The 350-page *Hitler's Airwaves*, co-authored by Horst Bergmeier and Rainer Lotz and published by Yale University Press, is an objective accounting of the Nazis' radio strategy. The book is accompanied by a compact disk with both news and musical programs from the era.

Hitler's Airwaves is available from Yale University Press in Connecticut at 800-987-7323, or it's $40 from the internet's Amazon Bookstore (**www.amazon.com**).

GPS Color TRAK Satellite Navigator

Magellan has just released its new GPS ColorTRAK Satellite Navigator— the first hand-held GPS unit with a color display. The screen is ultra sharp — 25% larger than other handheld units — and it lets you color code critical symbols and markers for instant recognition and unmatched visibility.

The powerful 12-channel receiver plus the detachable quadrifilar antenna combine to guarantee outstanding tracking in any environment. The keypad is backlit for easy viewing. Wrap-around rubber grip and water-sealed battery compartment withstand rugged outdoor use.

The GPS ColorTRAK can store up to 500 user-entered locations and 20 reversible routes with up to 30 legs to show you where you are, take you there, and bring you back again. It even includes a built-in thermometer and altimeter!

The ColorTRAK boasts 30 hours of continuous battery life

with a 10-year internal lithium battery backup. Accessories include wrist strap, nylon carrying case, four AA batteries, and manual.

The user-friendly Magellan GPS ColorTRAK Satellite Navigator is available from Grove Enterprises for $289.95 plus shipping. So don't get lost: get GPS. Call 800-438-8155 or go to **www.grove-ent.com** to order.

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- Plus, with the listed radios below, you can have a complete computerized control of receive frequency, direct frequency readout, and a spectrum bandwidth (variable from 500KHz to 10 MHz).
- Just use your mouse to "arm chair" the controls. Never touch the radio once the software is running.

Supports
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- R7000, R7100 ICOM
- Most ICOMs with 10.7MHz IF.

Features *indicates for above listed radios only.
- Variable bandwidth, up to 10.7 MHz.*
- Instant Readout of Frequency any place on the PC's Display.
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Minimum Requirements • IBM PC 8 meg ram. • Windows 3.1 or later. • 8 meg Hard Drive

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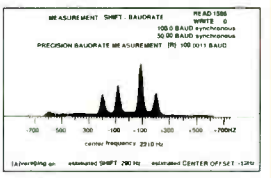
Many radio amateurs and SWLs are puzzled! Just what are all those strange signals you can hear but not identify on the Short Wave Bands? A few of them such as CW, RTTY, Packet and Amtor you'll know - but what about the many other signals?



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There are some well known CW/RTTY Decoders but then there is CODE-3. It's up to you to make the choice, but it will be easy once you see CODE-3. CODE-3 has an exclusive auto-classification module that tells YOU what you're listening to AND automatically sets you up to start decoding. No other decoder can do this on ALL the modes listed below - and most more expensive decoders have no means of identifying ANY received signals! Why spend more money for other decoders with FEWER features? CODE-3 works on any IBM-compatible computer with MS-DOS with at least 640kb of RAM, and a CGA monitor. CODE-3 includes software, a complete audio to digital FSK converter with built-in 115V ac power supply, and a RS-232 cable, ready to use.

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- Twinplex
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- SI-ARQ/ARQ-S
- SWED-ARQ-ARQ-SWE
- ARQ-E/ARQ1000 Duplex
- ARQ-N-ARQ1000 Duplex Variant
- ARQ-E3-CCIR519 Variant
- POL-ARQ 100 Baud Duplex ARQ
- TDM242/ARQ-M2/4-242
- TDM342/ARQ-M2/4
- FEC-A FEC100A/FEC101
- FEC-S • FEC1000 Simplex
- Sports info 300 baud ASCII
- Hellschreiber-Synch/Asynch ★
- Sitor • RAW (Normal Sitor but without Synch.
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Jane's Military Communications

The ultimate directory, *Jane's Military Communications* describes in-depth more than 4,000 communications systems currently being manufactured or under development. Descriptions include full specifications, frequencies, transmission rates, manufacturer information and much more.

Sixteen main sections cover topics such as tactical communications, naval and air force systems, satellite systems, encryption and security, surveillance and signal analysis, direction-finding, and jamming systems. A glossary and explanation of acronyms and code names are among the helpful resources provided in the book.

Jane's Military Communications is now available on CD-ROM ($1,075) or in yearbook format ($350). For more information on this and other titles or to order, call 800-824-0768 or visit Jane's website at **www.janes.com.**

America's Garage Sale

Occasionally "Fed File" editor John Fulford mentions hobbyists picking up ex-government radios at hamfests or government auctions. But where does old military equipment go? Often it goes to auction, too, via the Defense Reutilization and Marketing Service (DRMS) based in Battle Creek, Michigan. To find out what's available in your area, go to their web site at **www.drms.dla.mil.** Note, though: you won't find items for sale that are inappropriate for civilian use—no old Jeeps, tanks or warplanes. Sorry.

Encryption for the Consumer

A reasonably-priced encryption program called Cyberlock is available from Design Automation. Cyberlock will protect your data files or can add additional layers to your existing encryption program.

In addition to ensuring that only those possessing the passphrase may read the file, the program has a self-extraction feature that enables a user to send a specific message or file to someone who does not own the program. See the August 98 "Computers & Radio" column for John Catalano's review. Visit **www.DA.com** or call 713-972-7912 for more information or to order the $49.95 program.

RaceTrac Headphones

The RaceTrac headphones are favorites among racetrack regulars for their comfort and for their quieting. These same features make them ideal for anyone engaged in a lengthy monitoring (or surveillance) session, especially if external noise is a problem.

The $88.95 RaceTrac Classic has a fully adjustable headband, right angle 1/8-inch (3.5 mm) plug, and a 25 dB noise reduction rating; the $59.95 RaceTrac Platinum has a detachable cord with 1/8-inch plug, comfortable cloth ear covers, comfort fit headband, and a 24 dB noise reduction rating. Both are available from Grove Enterprises by calling 800-438-8155 or by e-mail at *order@grove.net.*

Trunked Radio Systems (California)

This handy guide to scanners in California lists 800 MHz public safety trunking systems for county, state, federal, and industrial users throughout the state, identifying frequencies and talk groups, as well as system manufacturers.

Trunked Radio Systems by Robert Kelty is available for $18 postpaid from Mobile Radio Resources, 1224 Madrona Avenue, San Jose, CA 95125-3547.

The ARRL Repeater Directory (1998-1999 Edition)

Each year, the American Radio Relay League (ARRL) publishes an updated pocket book of VHF/UHF amateur repeaters across North and South America as well as other countries worldwide. Callsigns, input/output pairs, sponsoring organizations, and technical notes are included.

An excellent listing of bandplans is included for 28-29.7, 50-54, 144-148, 222-225, 420-450, 902-928, 1240-1300, and 2300-2310/2390-2450 MHz. Text notes inform readers of repeater protocol, CTCSS (subaudible) tones, and names and addresses of repeater coordinators.

To order the *ARRL Repeater Directory* (1998-1999 Edition) call Grove Enterprises at 800-438-8155 and ask for BOK-103, only $8 plus shipping.

Passport to Web Radio

With 1,550 AM, FM, and shortwave stations now using the Internet to simultaneously relay their radio broadcasts via the Web, it is no wonder that this second edition of the *Passport to Web Radio* directory stands out as the single source for these audio broadcasts.

One chapter profiles the leading Web radio stations — music, ethnic, talk, religious, news, sports, children's programming, and more. Another chapter allows the browser to tune in on the country of his choice — in the language of his choice.

Excellent insights into Web broadcasting, along with an interesting history of its inception and evolution, are included.

Passport to Web Radio is available for $19.95 plus shipping from International Broadcasting Services, Box 300, Penn's Park, PA 18943; call (215) 794-3410, fax (215) 794-3396, or email *mwk@passport.com.*

Books and equipment for announcement or review should be sent to "What's New?" c/o Monitoring Times, P.O. Box 98, 7540 Hwy 64 West, Brasstown, NC 28902 Press releases may be faxed to 704-837-2216 or e-mailed to mteditor@grove.net.

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Radio Max by Future Scanning Systems

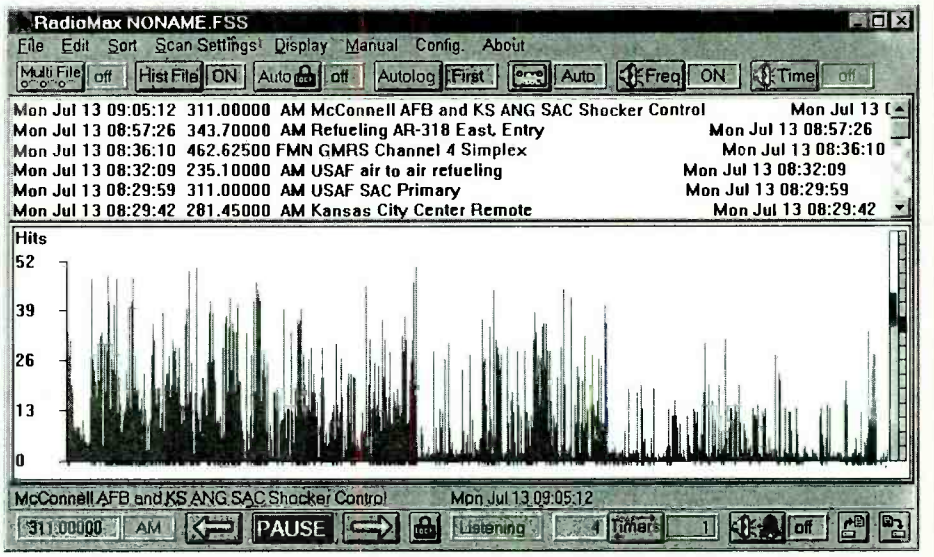
By Steve Donnell WA1YKL

The Radio Max software package is a versatile and easy to use program to interface your scanner with a personal computer running Windows 3.1 or Win 95. Radio Max supports interfacing to a number of HF and VHF/UHF receivers including the latest from Uniden: the BC-895.

During our tests, we used Radio Max on several different scanners: a PRO-2035/with an Opto OS535 interface installed, an AOR AR8000, and an Icom IC-R7000, the latter two using an Optolynx as the PC interface. In all cases, configuring Radio Max to operate with each of these was very easy: All that was required was to select the name of the manufacturer, then click on the model number. Of course we also needed to select the type of radio-to-PC squelch that we wanted, as this can vary among different radios and interfaces that can be used.

Besides being easy to install and set up, the main display "page" for the Radio Max has a very distinct "Windows" look and feel to it by having a tool bar along the very top edge and two easily accessible control bars for the most commonly needed controls along both the top and bottom edges. The upper portion of the page is taken up by the History file list — a simple listing of all signal hits the program finds. Below that is a graphical representation of a given range of frequencies the program is searching or scanning through. Left to right is the span of frequencies, and vertical increments represent the accumulation of "hits" for a given frequency.

I was a bit disappointed initially to find that Radio Max could not store or display the relative signal strength of any signals that it logged. However, I reconsidered this in light of the fact that only a few scanners, like the older Radio Shack models (with an Optoelectronics interface) and a couple of others, were ever capable



of this. Radio Max does include a graphic display to signal hits, which is much more important and useful.

The graph also has a number of well thought out features. Besides showing previously logged frequencies, red marks below the base line indicate locked out frequencies. A sliding cursor shows the relative progression through a given frequency file. You can also use the Windows arrow to click on a given frequency to lock it out from being scanned or to instantly move the received frequency to any other frequency within the range or file being scanned.

The lower control bar provides most instantaneous scanning commands and status readouts, such as received frequency, operating mode, scan Stop/Start and Pause Timer selection. The upper task bar selects most of the scanning frequency files and different logging options. When Radio Max is used on a PC with an appropriate sound card, one useful logging function that's available is to add a synthesized voice output that can speak the received frequency and the time/date of the event. If you're recording, this will give you a log of the signal reception.

One minor weakness I noted with both of the task bars is that the frequency display in the lower left corner needs to be more prominent, with larger digits. As it is, it can be difficult to see exactly what frequency the scanner is on unless you are right in front of the PC monitor.

Otherwise, Radio Max is a visually easy program to operate. It has the ability to import large volumes of frequency data such as from the FCC database on CD ROM, or frequencies on a floppy disk. Note, however, that our tests discovered that some CD ROMs more than a couple years old may not be able to do this.

Overall, I have found the Radio Max program to be easy to set up and operate. It operates very smoothly on my old Pentium 90 PC and I can easily swap it between my AR8000 and an IC-R7000 receiver. I also have experienced the program to be very reliable: In using it to scan a very active portion of the 800 MHz band, running continuously for several weeks in an old "memory starved" 486 PC, never once did it crash.

For more information,contact Future Scanning Systems at: 918-335-3318 or on the Web at: **www.futurescanning.com**

www.americanradiohistory.com

Bob Parnass, AJ9S

AOR AR8200 Scanner

The AOR AR8200 is a portable, high end "super" scanner which affords frequency coverage from 0.1 - 2040 MHz. It delivers what the earlier AR8000 model provided and more, packaged in a smaller, more finely crafted housing.

The AR8200 is not a scanner for beginners. It has more features than we've seen in any other model, and even advanced hobbyists may find it difficult to use. Many of the settings are made through the use of menus, navigated by a rotary thumbwheel switch and a four-key cluster located on the side of the case (Fig. 2). The 140 page operating manual is very thorough, except for the specifications section, which does not describe the intermediate frequency (IF) arrangement or dynamic range.

Our AR8200, S/N 550004, is an early evaluation unit and is supplied with only a manual, steel belt clip, plug-in AM antenna, and wall wart power supply. Production units may be furnished with those plus four NiCd AA batteries, fused cigarette lighter power cord, and hand carrying strap.

This scanner has lots of memory: 1,000 conventional channels, 10 temporary channels, and a single priority channel. The 1,000 conventional channels are initially divided into 20 banks of 50 channels each, but here's where it gets complicated. Banks are identified by upper and lower case letters A-J and a-j. Banks are paired, e.g. banks "A" and "a," "B" and "b," etc. The 100 channels per bank pair can be reapportioned as 60/40, 70/30, etc.

Each memory channel may be programmed with frequency, mode, step, step-adjust, offset, attenuator enable, noise limiter, automatic frequency control (AFC), and write protect. If you have the patience, you can program each memory with an alphanumeric label of up to 12 characters, using a procedure in which a slowly blinking cursor blocks your view of the current character. AOR claims the flash memory requires no battery or capacitor for backup.

Banks may be linked together into a "scan group" for multi-bank scanning and you can define up to nine such scan groups. Despite the complex memory organization, the AR8200 provides only one priority channel, which can be polled at intervals of 1 - 99 seconds. You can enable a 0 - 9 second rescan delay with each scan group, but not per channel.

You can program up to 40 pairs of search limits. Each search bank can be configured with a reception mode, noise limiter enable, CTCSS tone (with CT8200 option), text label, step and offset, and write protect parameter.

The AR8200's offset capability is great. You can associate a frequency offset with each memory channel and monitor a repeater's input by pressing two keys. By listening on the repeater input, you can tell if the transmitting mobile station is nearby. It is also handy for monitoring both sides of a conversation in a two frequency simplex system, like 152/157 MHz taxi cab base/mobile and VHF-low band state police networks. A similar feature is found in modern VHF/UHF ham radio equipment.

Large characters and excellent contrast help make the liquid crystal display (LCD) display easy to read. The display and keypad are backlit using green light emitting diodes (LEDs).

The band scope portrays a graphical representation of spectrum activity in an adjustable 100 kHz - 10 MHz wide span, but wider spans take longer to sweep. The AR8200 searches silently while drawing the scope display.

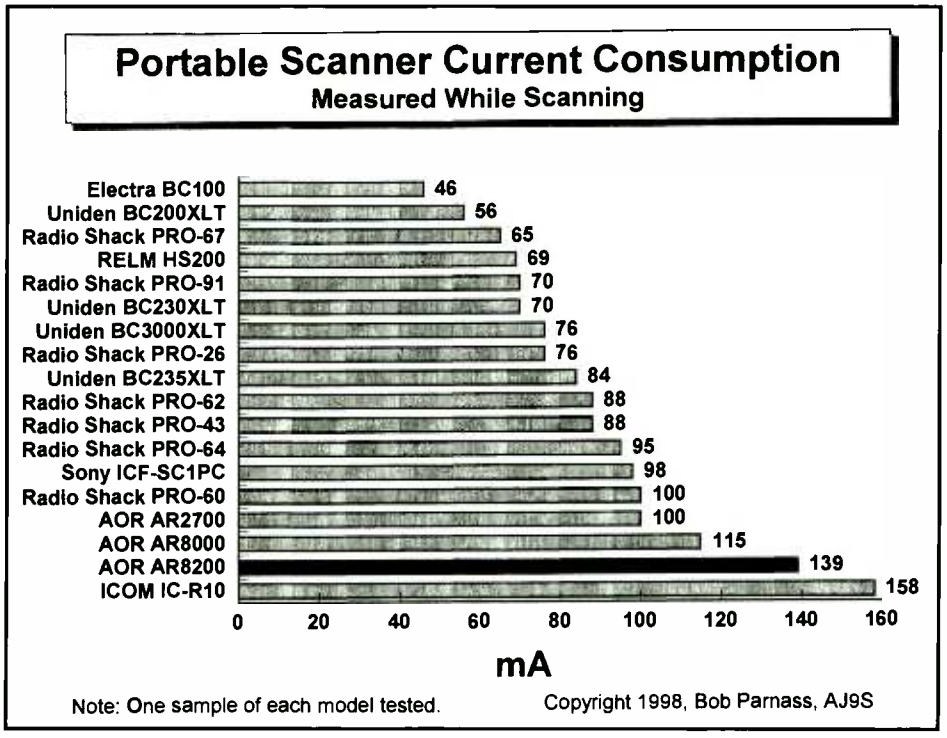
The band scope is more detailed than the DJ-X10T band scope. The AR8200 offers a peak hold capability in which the band is searched repeatedly without erasing the previous screen. The resulting screen shows accumulated band activity over a long time interval. A peak search command lets you hop among the strongest signals on the band scope screen.

Performance

Good shortwave reception requires finding the right antenna and we recommend you start by using a 20 foot length of wire. Our AR8200 is virtually stone deaf on shortwave when fitted with the supplied antenna or a 19" whip. Like our Alinco DJ-X10T, it is seriously overloaded by a 132 foot long dipole unless we use the built-in attenuator.

The supplied "dorsal fin" antenna, which plugs into a multi-pin connector atop the radio, provides adequate AM broadcast band reception.

Compared with simpler radios, our AR8200



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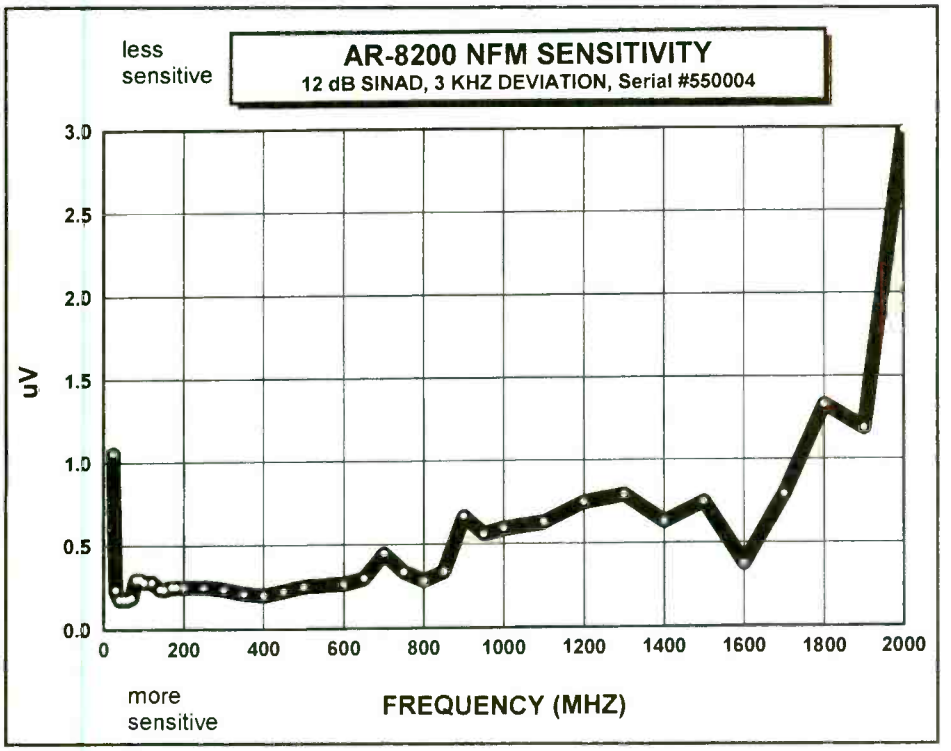

scans slowly (14 channels/sec) and requires more current (see comparison bar graph). Audio quality is slightly above other portable scanners, though not as room filling as the RELM HS-200.

Options

The IF (intermediate frequency) scheme is not specified in the manual and we didn't deduce it using test equipment. If you want to connect your AR8200 to a personal computer serial port, you must first purchase a CC8200 cable and obtain the necessary software. Contrast this to the SONY SC1PC scanner which is supplied with both cable and software (see August *MT*). Documentation describing the computer interface commands are not furnished with either scanner.

AOR will be offering several optional cards which plug into a slot on the bottom of the AR8200, though we were given none to test. Too bad there is room for only one card at a time. Among the cards listed in the operating manual are:

1. VI8200 157 frequency voice inversion descrambler.
2. CT8200 CTCSS tone search and tone search. Individual tones can be programmed into memory channels and search banks.
3. TE8200 256 frequency tone eliminator.
4. RU8200 voice recorder and playback, records up to 20 seconds. It can set to start recording when the squelch opens but must be manually stopped unless it times out.
5. EM8200 extended memory, which can back up four sets of data from the search banks and 1,000 memory channels but cannot be searched or scanned. The manual states that transferring data between the scanner's memory and the EM8200 takes 20 seconds to complete.

Extreme Scanning

Our AR8200 is insensitive on shortwave. It performs well on VHF and UHF, but so do many less expensive models. The difference is in flexibility, operational complexity, and richness of features. If you like being able to control just about every aspect of a scanner, you'll like the AR8200.

MEASUREMENTS
AOR AR8200 PORTABLE SCANNER S/N 550004

Frequency coverage (MHz):
0.1 - 824.009, 849.001 - 869.009, 894.001 - 2040
NFM Sensitivity: see graphs
AM Sensitivity (10 dB S/N):
2.24 µV @ 5 MHz
1.99 µV @ 15 MHz
2.51 µV @ 25 MHz
0.40 µV @ 30 MHz
MDS (minimum discernible signal):
0.75 - 0.84 µV @ 5 - 25 MHz
FM modulation acceptance: 9.7 kHz
Selectivity (not measured):
SSB/NAM: 3 kHz @ 6 dB, 9 kHz @ 60 dB
AM/NFM: 9 kHz @ 6 dB, 20 kHz @ 40 dB
WAM/NFM: 12 kHz @ 6 dB, 25 kHz @ 40 dB
WFM:150 kHz @ 3 dB, 380 kHz @ 20 dB
Practical memory scan speed:
14 channels/sec.
Search speed: 21 steps/sec.
Current consumption at 6 VDC:
off - 0.4 mA
manual - 135 mA
scan - 139 mA
full volume - 196 mA
lamp - 25 mA additional
Battery saver: after adjustable delay in Manual mode
Low battery warning at 4.71 VDC or less
Shutdown at 3.85 VDC or less

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Lawrence Magne
Editor-in-Chief, Passport to World Band Radio

Sangean ATS 404 Economy Portable

Nothing is quite so telling as imitation. When Fiat comes up with a new car, few competitors pay attention. But when Mercedes Benz comes up with a new design for its cars, soon half the cars on the road look like Mercedes.

Last year, Grundig came up with a nifty trick to energize its sales of world band radios. They employed the F.A. Porsche Design Group—yes, from the same family that designs those V-2s on wheels—to come up with an innovative design for one of Grundig's compact radios. The result was a silver beauty, and it reportedly has been a great success.

Now, Taiwan's Sangean has done something similar with its new ATS 404. Although it lacks the Grundig's styling panache, it is about the same size and shape as the Grundig, with the same ersatz-aluminum "tech" finish. And although the country of origin is nowhere to be found on the '404 or its box, it is clearly, like the Grundig, made in China.

■ A lot of radio for $99.95

The '404 has only recently gone on sale, but already the street price is just under $100. And for this economy price it has much more to offer than we normally expect to find.

To begin with, the '404, powered by four "AA" batteries, is digital. Its liquid crystal display (LCD) "information central" has large digits to show frequency, as well as 24-hour time in two zones (although, as with many other Chinese radios, the leading time zero is inappropriately suppressed, so 01:25 displays as 1:25). Incidentally, although the time won't show while the frequency is being displayed, when the time is visible it displays exact seconds numerically—unusual at this price. There are also alarm and snooze-timer facilities.

Tuning is by keypad in the customary telephone format, as well as up/down slewing, "signal-seek" scanning, shortwave band selector and 45 presets—but no tuning knob. There is an "APS" preset scheme for the AM and FM bands that we found to be of little practical use. There is a brief silent pause when slew tuning from one channel to another, but it is not so long or annoying as on

certain other models.

The '404 tunes AM from 520-1710 kHz in user-selectable 9 or 10 kHz increments, FM from 87.5-108 MHz in 0.1 MHz increments, and world band from 2300-26100 kHz in 5 kHz increments. Longwave is not covered. On our unit, purchased in the United States, the AM channel setting was incorrectly placed at 9 kHz; it is easily reset.

Handy user features include an illuminated LCD, a power lock, a flip-out elevation panel to cock the radio at a handy listening angle and a soft-plastic protective travel case. However, like many other Chinese radios the power lock does not keep the LCD illumination from accidentally coming on. As has been the custom with recent Sangean radios, there is no carrying strap or handle, and as you would expect at this price range there is no single-sideband demodulation.

■ Above-average performance for price

Performance is slightly above average for an economy model. Sensitivity to weak shortwave signals is superior, to the point where we encountered occasional overloading. This is easily dealt with by gradually shortening the telescopic antenna until things sound normal, and especially for Midwesterners and west coast dwellers is a preferable situation to having inadequate sensitivity.

On AM, if you don't collapse the telescopic antenna you may find the band awash in overloading. But, for those in the bush, extending the antenna might be a way of bringing in faint distant AM signals.

Diminishing the usefulness of all that weak-signal sensitivity is that the radio tends to pick up some digital hash from its own circuitry, at least in the AM band and lower shortwave bands. Sometimes you hear it, sometimes you don't, but it suggests that better shielding is in order.

Selectivity is decent, nothing more. On our unit, the filter was skewed to the high side, so that, say, 5975 kHz would be audible on 5975 and 5980 kHz, but not 5970 kHz.

Image rejection is mediocre, as befits the radio's pedestrian single-conversion design that is the norm for radios in this price class. Indeed, among digital receivers selling for under $100, only the Sony ICF-SW30 has double-conversion circuitry to ensure good image rejection. It is the '404's only significant drawback, and is most noticeable within the upper reaches of the 60 meter tropical band, where 49 meter signals "ghost" through to make listening all but impossible.

Audio quality is reasonable for the radio's size, with a three-level treble-cut control and limited low-frequency reproduction.

The quality of Sangean's Taiwan-made models has always been superior. On the other hand, all makes of world band radios from China, although much improved in recent years, still tend to have a shorter life than most others. Bottom line is that given Sangean's long track record of attention to manufacturing detail, the '404 will probably hold up well.

Although the Sony ICF-SW30 remains our favorite under-$100 performer, it is seriously flawed when it comes to ease of tuning. Although the performance of Sangean's new ATS 404's is a notch under the Sony's, it is much more flexible to tune and has a nicer roster of features; it makes a welcome substitute for the recently discontinued Grundig Yacht Boy 305. For many the '404 will prove to be the better choice.

UPDATE:
Version 3 of Japan Radio NRD-545

Although Japan Radio originally informed us that they were done with making improvements to the new NRD-545 DSP receiver, within weeks JRC in Tokyo air shipped us a

The new Sangean ATS 404 is available from Grove Enterprises (800-438-8155) for $99.95.

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pair of upgraded ROMs to enhance reception quality. This is a good sign, as it suggests the manufacturer is determined to get it right with this important model. We installed these on our unit, and although we found little change—indeed, one chip bears the same number as the prior version—in one important respect it was positive.

One of our main criticisms was of disappointing ultimate selectivity. Japan Radio's engineer pointed out that the receiver would have better ultimate selectivity if we changed our measurement technique slightly by altering the measurement point, which is true but leads to the testing equivalent of "grade inflation." Nevertheless, we checked out the new version our usual way, plus their preferred way and points between.

Because of subjectivity introduced by the dozens of spurious tones that appear when trying to measure this receiver in the lab, regardless of how the measurement is performed it is not possible to give the usual objective figure for ultimate selectivity. However, it has definitely been improved over the original 45 dB, and is now anywhere from a conservative 50 dB to an optimistic 65 dB, depending on how you factor in the spurious responses and where the measurement reference point is set. While this is still a mediocre showing for a model in this price class, the benefit of this improvement is real.

Among other things, the improved ultimate selectivity has allowed us to more closely determine the shape factors of the various bandwidths at -6 dB/-60 dB. On the '545, these improve—get smaller—as bandwidth increases, so for example the 6 kHz bandwidth has a cliff-steep shape factor of 1:1.06, whereas the 0.5 kHz CW bandwidth weighs in at 1:1.61. All voice bandwidths have shape factors of 1:1.14 or better, a magnificent showing.

On our unit with the v3 chip set, the "ECSS" feature (Exalted Carrier Selectable Sideband) made no audible difference in adjacent-channel interference rejection between lower and upper sideband settings. This almost certainly is a one-off anomaly, as the first two ROM packages provided acceptable "ECSS" sideband selectivity, so this oddity shouldn't show up in regular production.

More important than the numbers themselves is that Japan Radio has demonstrated a tangible interest in making improvements to this model. This is, after all, their first DSP unit, and DSP technology is tricky even for manufacturers who have been at it since the outset.

The question is whether the receiver, which uses only one microprocessor, has enough horsepower to overcome its existing limitations, regardless of the manufacturer's good intentions. A spokesman for the chip's manufacturer, Analog Devices (**www.analog.com**), cites some impressive numbers that would suggest that much better performance can be obtained from the '545 using its existing SHARC DSP. The rub is that in a DSP receiver the microprocessor has to serve many functions, each of which robs it of performance for the remaining operations. Whether the '545's is already stretched to the limit remains to be seen.

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Image captured with Apt. Dwellers System

Our Web Site is: http://www.swagur.com • Our E-Mail Address is: swagur@execpc.com

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John Catalano, PhD
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First Look at WinRadio's WR1500E

Stop the presses! I know I promised you some topics at the end of last month's column with the best of intentions. But when the good people at WinRadio asked if I would like to be the first reviewer of their newly announced, PC based, wide band communications receiver, I replied, "You bet!" Our editor and I both agreed: *MT* readers would want the latest and greatest information available on new products. So, here's a story that you may not read in other magazines for many months.

FIGURE 1

What's a WR1500e?

Although we covered PC based radios a few years ago, it's worth repeating some basics to refresh our memory and for newcomers to the column.

PC based receivers have no physical controls. Instead, these receivers connect to serial ports of a PC and are controlled via software displayed on the computer's screen. So what about the WR1500e? The "e" indicates that this radio is housed in a box *external* to the computer. The size of this very sturdy, attractive, grey metal box is 4.8 x 8.5 x 1.8 inches — about the size of two thick paperback books, laid end to end.

This differs from WinRadio products ending in an "i," meaning the radio is on a PC expansion card mounted on the motherboard inside the desktop computer's case. The strong point of the "e" products is their portability. Since they connect to external ports they can be used with desktops and mobile laptops.

We were among the first to look at the WR1000i two years ago. Well, since then, the 1500 series has added a wider frequency range (up to 1500 MHz), smaller tuning steps, increased sensitivity and better selectivity than its older 1000 brother. The reception modulation modes, AM, FM narrow, FM wide and CW, now include separate sideband choices of USB (upper side band) and LSB (lower sideband). In CW, USB and LSB, the user can choose to tune the radio in 1 Hz steps (that's not a typographical error).

An IF shift control allows the user to move the center frequency of the intermediate frequency (IF) tuned circuit by +/- 2 kHz. This is a very useful feature which worked quite well when using the 1500e in crowded band conditions.

Making the Connection

All connections are made at one end of the 1500e case. This includes power, serial port, PCMCIA, speaker output and discriminator output used for data converters. The other end of the case has an On-Off switch and a power-on LED. The WR1500e gets power from a small boxed 12 volt power supply.

Since the cable going from the box to the wall outlet (mains) is a world-standard removable cable; no outlet type will be a problem. The power supply circuit automatically adapts to the correct voltage. The WR1500e can be connected to any computer's serial (com) port via the included 9 pin DIN cable.

On newer laptop computers another connection method is the PCMCIA card. These ultra-thin, 1 x 2 inch metal encased cards slide into slots on laptops and are usually used to increase memory or add external devices such as CD ROMs. Using the PCMCIA requires an optional accessory, WR-PCA, which comes from WinRadio with the card adapter and cable.

This method is very convenient for laptops without an easily accessible serial port. My IBM Thinkpad 701C fits that description perfectly. To make connection to the IBM's the serial port requires attachment to a docking station. Using the PCMCIA option eliminates this cumbersome necessity. Although a speaker output is provided, an internal speaker, which fires upward, is mounted on the top of the case.

A partially shielded 20 foot wire antenna is supplied with the 1500e, but is dismissed as an "indoor test antenna" by the WinRadio manual.

The Software - Deja Vu All Over Again

WinRadio uses the same software for both the 1000 and 1500 series receivers. The only difference I noticed was the small "WR1500" at the lower right of the on-screen receiver. Installation of the provided, single disk software, version 2.51 was quick and easy. Connecting the WR1500e to the serial port, I loaded the software on my IBM without a problem. The now familiar image of the WinRadio receiver appeared. See Figure 1.

The setup asked which computer serial port the 1500e was connected to. If you guess wrong — no problem. The program just informs you it cannot find the radio and to try again. The setup could not be easier. If you have an older version of the WinRadio program, it detects that and appears to even save your old frequency files. Very slick.

We also tried the optional PCMCIA interface. Due to my older version of Windows 95 it would not allow a connection, indicating that Windows 95 could not "find" a required ".inf" file. The solution was to manually direct Windows 95 to a subdirectory in Windows where WinRadio's installation program deposited the required winrad.inf file. After this procedure the PCMCIA interface worked great.

The latest version of WinRadio software is so user friendly you can be up and monitoring within minutes. A 27 page comprehensive manual is nicely supplemented by on-line detailed instructions of most functions. A detailed instruction screen is just a mouse click away at any time.

A Good Gooey (GUI)

So how does a user control WR1500e? Pointing to the desired function on the screen — for example, the volume control on the right side — and clicking the left mouse button gives you control of that function. It's a very simple graphical user interface (GUI). All major func-

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tions can also be accessed via keyboard stokes which are listed in a pulldown menu at the top of the screen.

There are a number of methods of setting the frequency. The simplest is to just to type it in the large box at the top. For those of you who want the feel of an "in the flesh" radio, moving the screen cursor to the large round tuning knob below the display and then pushing the left mouse button tunes the radio higher in frequency. Clicking the right button tunes the radio lower in frequency.

The tuning step is determined either by the number you input in the box to the right of the display or via another pulldown menu. This step can be as small as 1 Hz in the sideband mode and 100 Hz in the other modes. As if that were not enough, clicking on the vertical arrows on the right side of the display will tune slew the frequency. The keyboard tuning is also convenient using the page up/down and arrow keys.

The very useful Duplex function is still a part of the software. This allows the user to quickly switch between two frequencies with a fixed frequency separation.

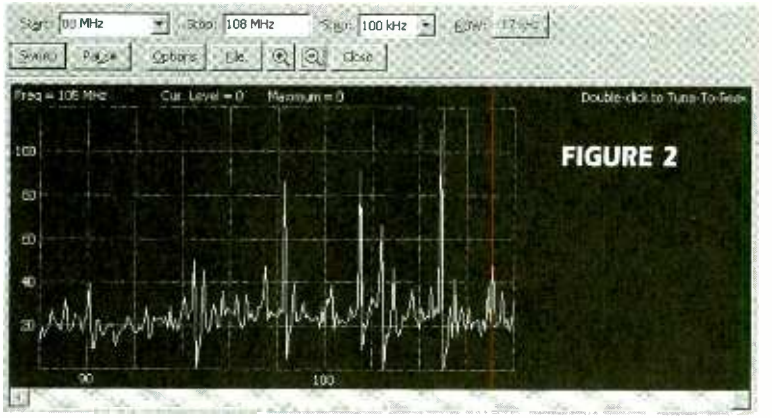

FIGURE 2

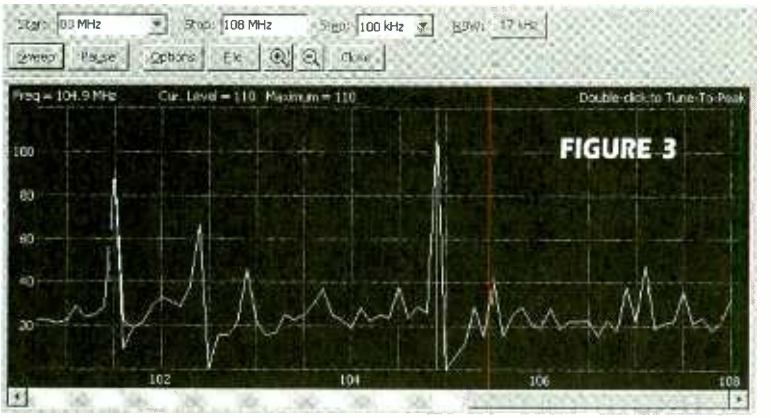

FIGURE 3

■ Saving and Scanning

The only functions which take a few seconds of reading are the memory functions. Due to their built-in flexibility the memory and scanning functions can be used in a number of ways.

Frequency ranges, discrete frequencies, or blocks of frequencies are just some of the scanning methods that the 1500e user can choose. The type you choose will depend on the purpose of your monitoring; for example, whether you are searching for new active frequencies, monitoring previously stored frequencies or listening in on a given service. Further scan conditions can also be set, such as picking which signal modes should be scanned.

Another useful feature is the alphanumeric frequency identifier which you can assign to a stored frequency. The identifier is displayed below the tuned frequency. In Figure 1 we have stored Radio Austria and the time it was heard in English. Editing of all data fields is a very simple one-step process.

The receiver's "resume scanning" can be set to one of four methods: when signal disappears, after a user-defined delay time, if the signal disappears during the delay time, or only if no signal appears during the delay time.

■ Seeing is Hearing

The jewel in the crown of the WinRadio is its spectrum scope as seen in Figure 2. Now you can "see" active frequencies in a user-defined range of frequencies. In this case we are looking at the FM broadcast band. The tall peaks are FM stations.

Since our first review of WinRadio products VisiTune has been added. This lets you tune to any frequency just by placing the screen cursor on that frequency of the spectrum scope chart. For example, in Figure 2, you can see from the number in the top left corner that we are scanning between 88 and 108 MHz. We have placed the cursor at 105 MHz and clicked the left mouse button. This immediately tunes the receiver to 105 MHz and displays the "cursor" frequency in the top left of the screen.

The software can magnify and display a selected part of the spectrum, as shown in Figure 3. All are very, very useful for signal hunting expeditions. The scan rate is user set, having a maximum rate of 50 steps per second.

Next time we'll operate the WR1500. Meanwhile, for any budding software developers among you, check out WinRadio's website at **www.winradio.com**. There you'll be able to download WinRadio's control modules in a number of development languages including Visual Basic, C and others. If anyone has the talent, time and ambition to develop something for the WR1500e, or the WR1000i, E-mail me with the details. Till next time.

The WR1500e is available from Grove. See ad on p. 11.

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LETTERS TO THE EDITOR

NEWS AND VIEWS FROM OUR READERS — Rachel Baughn, Editor

Don't Get Spooked!

This somewhat esoteric edition of *MT* is our "spooky" October issue — next month we will return your magazine to more traditional radio topics. But we know many of you admit to being fascinated by shortwave's weirder signals.

Take Edward Defreitas of Farmington, Connecticut, for instance. Ed came across a Morse code numbers station last summer around 0223 UTC on 10119 kHz and couldn't resist trying to analyze it:

It sent "DADUD UGGNT WGIGD TATRD MDUNN MGWUI ... and more for quite a while. Then it sent AR AR AR ATMDU ATMDU ATMDU ATMDU ATMDU BT BT BT, followed by what appeared to be a second message that ended differently.

"After I copied its message on two sides of a sheet of paper and realized this cipher needed a key, I started scanning for a clue or two. Only one struck me as unusual: In all that I copied, no 5-letter group contained any of the following letters of the alphabet: E, Z, Q, S, B, C, H, J, K, L, F, or P. Several 5-letter groups contained a sequence of three letters, such as UUURA.

"I then turned my attention to David Kahn's great book *The Code Breakers* and began on a different line of thought ... Let's say the first two letters represent the vertical part and the last three letters represent the horizontal component. Then, wherever these intersect could represent a phrase of some sort. This is the barest formula that can be applied. But when they're only using half the alphabet it certainly limits one's choices.

"If this helps sort out a mystery ... GOOD!"

Almost in Hot Water

"While living in Detroit in the early 1970s," says Robert Lindsay, "I happened to hear and thus record an aerial hijacking of a DC-9 owned by Southern Airlines. I called the *Detroit News* with the scoop and negotiated a fee for exclusive rights to the tape and any info I could add to the story. To make a long story short, within 12 hours the FBI was involved, and I thought I was headed to San Quentin.

"What I heard and recorded over the airwaves was certainly not illegal. But in a time when Viet Nam was very much a part of our lives and metal detectors were just popping up at our neighborhood airports, hijackings then (and now) are serious business.

"My tape was confiscated and never returned. I don't feel I was treated wrongly, but the sensitive nature of my story cast an 'act now and ask questions later' element to it."

Robert, who was not implicated, has a message for government agencies: "Don't kill the messenger!"

A license to talk?

Al Ortiz has an idea related to this month's "Closing Comments." But he wonders if it has a chance, given that Congress relies on special interests to fund their campaigns.

"It is time that we stop bending to every whim and ouch that people have. We simply cannot afford to make everyone's interest a matter of Congress. Rather than make laws against scanners (democracy), regulating VFOs, etc., perhaps we should make cellular users have a license and a test that, by signature, releases liability to those that 'overhear' their public speeches. That doesn't mean there can't be laws against those that would record and use this information against a cellular user."

Affordable DVD

"I found the February COMDEX article very interesting with special regards to the Philips' TV-PC-CD-DVD (digital video disc) combination system. I was shocked at the approximate price of $5000, and I have found a better alternative (i.e., some real competition).

"Tiger Direct (1-800-888-4437) offers two systems, known as PC CINEMA, with a price tag of $999.99 and $1399.99. Both are DVD systems with a built-in IBM-compatible computer, and can also do two functions at the same time (i.e. finish a spread sheet while watching a movie).

"Both systems hook up to your TV, come with a wireless keyboard and universal remote, and have resolution of up to 1600 x 1200! (plus, like other computers, they are expandable)

"It's like getting a computer for $500, since most DVDs cost $500 or more. So far, though, their website doesn't show it (**www.tigerdirect.com**), so you have to call for your free catalog (1-800-888-4437)

Paul Midlick, Girard, OH

Great Stuff!

"I cannot tell you how much I enjoyed 'Monitoring the Federal Government During Emergencies.' It was full of really useful information and plenty of new frequencies to diddle with.

"With the onset of the hurricane season I was also very interested in the hurricane frequencies by Hugh Stegman in which he listed frequencies for hurricane aircraft. The daily flight schedules for these aircraft are made public on the NOAA website at **www.nhc.noaa.gov**. Each day they list their flight schedule for that and the next day. You can also find satellite and radar images for those of us who cannot afford a utility receiver yet. For those who do, NOAA lists their TCP radio FAX schedule at **www.nhc.noaa.gov/aboutradiofax.html**."

Chris Stroup, Norman, OK

"I just read your online statement regarding the end of one of my two favorite magazines. (*MT* being the other) I'm stunned. Each copy of *Satellite Times* has brought me more information, facts, tips, hints, ideas and excitement than any other satellite monitoring source. Each copy was an encyclopedia. It has given me many hours of everything from remembering the thrill of the early days of space exploration, to plans and dreams of expanding my own personal adventure, listening around the solar system.

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Ray Stickney, via email

We welcome letters from our readers at Letters to the Editor, PO Box 98, Brasstown, NC 28902 or email to Rachel Baughn, *mteditor@grove.net*.

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CLOSING COMMENTS

By Bob Grove, Publisher

Legislators above the law?

U.S. District Judge Thomas Hogan dismissed a lawsuit against Rep. Jim McDermott who gave tape recordings of a notorious cellular telephone intercept of Newt Gingrich to the news media. While Hogan was sharply critical of McDermott, he said that the Congressman's Constitutional right to free speech outweighed the right to privacy under the Electronic Communications Privacy Act (ECPA). An interesting — and far-reaching — decision.

According to Hogan, while the ECPA makes it illegal to divulge the contents of an illegally recorded cellular telephone call, it is not illegal to be the recipient of such a tape. The individuals who recorded the intercept were fined $500 each, but McDermott was not under any legal restriction about divulging the contents of the tape he was given. An appeal is expected.

The decision stands in marked contrast to 47 USC s 605 (Section 705 of the Communications Act), which specifically forbids such a disclosure:

> No person having received any intercepted radio communication or having become acquainted with the contents...of such communication knowing that such communication was intercepted, shall divulge or publish the existence, contents, substance, purport, effect, or meaning of such communication for his own benefit or for the benefit of another not entitled thereto.

As outrageous as that decision may seem, it isn't alone. Consider, for example, a new book from Incommunicado Press published by Gary Hustwit entitled, *The Spacewürm...I Listen*, subtitled, "A Document of Digital Voyeurism."

According to a *New York Times* article, the anonymous author known as "V" has been illegally monitoring and recording cellular telephone conversations off the air for the past five years, initially working them into his performance of technomusic. Now, the most salacious and graphic examples have been selected to produce a book. Legal experts, familiar with listening laws, should have a field day with this one, right? Wrong!

According to Marc Rotenberg, director of the Electronic Privacy Information Center in Washington, DC, and reported by *The New York Times*, "...people think they're sending sealed envelopes (by cell phone, when in fact) they're sending the electronic equivalent of open postcards."

As in the Hogan/McDermott issue, Rotenberg compares the interception with the constitutionality of publishing the contents of the intercepts. He feels that the publisher "has the right to publish, but whoever intercepted the conversations could be prosecuted for violating wiretap laws."

Both of these opinions from legal "experts" seem to protect any individual who reveals the contents of an intercepted private communication provided he wasn't the one who did the intercept! While such a landmark decision would let many hobbyists, news media, and radio publications off the hook for reporting the contents of intercepts, think of the more serious ramifications of such a precedent.

Voyeurs could now anonymously hand over tapes of cellular calls, cordless phone calls, or even physical wiretaps to newspapers, TV and radio broadcasters, political rivals, business competitors, or anyone else who could use the contents to suit their own purposes. While the interceptor is theoretically liable for his (probably unprovable) action, the recipient, who could do the most damage, is not.

The Communications Act is very explicit and clearly forbids such revelations. It is our opinion that if the courts were more informed and consistent in their reading and enforcement of these age-old laws, such misguided legislation as was proposed in the past year by Representatives Markey and Tauzin might never have been initiated. What the courts ultimately decide to do (or not to do) about these and similar cases could have considerable impact on the radio monitoring hobby.

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