

2011 Radio Buyer's Guide

A special supplement to Monitoring Times



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Latest in Amateur Radio Transceivers and SDRs



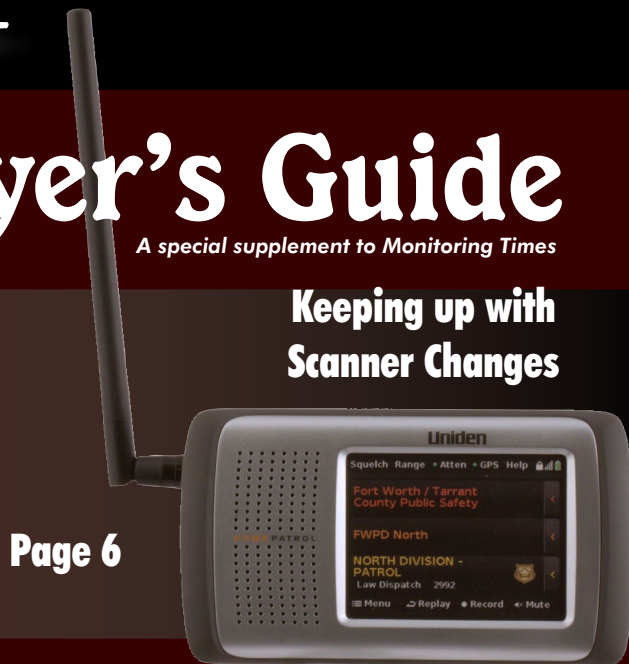
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Icom Bases - Receive at home or on the job!



IC-R75

Low Noise Floor, Medium Size, and High Value!

Discriminating shortwavers and other listening enthusiasts love Icom's R75. It's a great way to enjoy the hobby without breaking the bank. The R75 is compact enough for a small tabletop. Yet it's big enough to offer a well laid out front panel, a direct frequency entry keypad, and plenty of easy to use controls. User-friendly menu system and memory channel management, too. For great selectivity, great size, and a great price, get your R75 today!

- 0.03 - 60 MHz*
- USB, LSB, CW, RTTY, AM, FM
- 99 memory channels
- Optional DSP
- Dual passband tuning
- Automatic notch filter
- Noise blanker with dual preamps
- Built-in attenuator and RF gain control
- Internal clock with ON/OFF, sleep timer

IC-R8500

Professional Grade. Export or Government Approved Users Only



The R8500 is a handsome DC-to-daylight receiver, offering a superb design, remarkable performance, and first-rate build quality.

- 0.01 - 2000 MHz*
- SSB (USB, LSB),
AM (wide, normal, narrow),
FM (normal, narrow), WFM.
Optional CW (normal, narrow)
- 1000 memory channels
- 10Hz resolution
- Built-in high quality crystal
- IF shift
- Audio peak filter
- S-meter squelch
- RS-232C interface
- 3 Antenna connectors

*Frequency coverage may vary. Refer to owner's manual for exact frequency specs.
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MT's Guide to Buying a Transceiver

By Kirk A. Kleinschmidt, NTOZ

Despite the friendly notions of those with a hankering for an earlier age, when it comes to the basic technology that underlies our hobby and the widespread availability and affordability of that technology, there's no doubt that the Golden Age of Radio is right now!

Every HF transceiver from every mainstream maker offers a certain minimum level of performance, flexibility and value that has never been available before. Every rig in this year's roundup benefits from certain standards of modern design, technology and manufacturing. Among these standards are stable and agile digital frequency synthesizers; digital signal processing (DSP); dual Variable Frequency Oscillators (VFO); detailed digital displays; all-band and all-mode coverage; computer interfaces; Receiver Incremental Tuning (RIT); noise blankers; QSK full-break-in CW operating; built-in keys; selectable filters; multiple memories; adjustable power outputs; versatile, built-in metering; flexible accessory and I/O connections, and more.

Size Does Matter

Modern radios are more compact than previous offerings. They are truly modern marvels that pack an amazing range of function in small packages that can easily be used in mobile, portable or base station applications. This flexibility often exacts a toll in operating, however, and can lead to "menu madness."

With only a small amount of front and rear panel space available, small radios are forced to rely on potentially confusing menus and ever-smaller buttons and controls that can have two or more functions. Selections and settings that are easy to make on a big-box radio (typically one knob, one function) can be frustrating and confusing on a tiny radio, especially when multiple "nested menus" are required.



In addition to being easier to use in typical shack environments, physically bigger radios usually offer better RF performance and increased expandability and I/O options. On the simplest level, big radios have space for more circuitry and larger components, so in terms of ultimate performance, bigger is better.

Mid-size rigs define the battle between flexibility and performance, and it's here that the overall market tends to see the most competition and innovation.

They have more controls, fewer menus and better ergonomics than the smallest rigs, but can come very close (or even exceed) the performance of the largest and most expensive big box radios (although they often lack a few luxuries such as second receivers, high RF power outputs, internal transverters, etc).



Basic Radio Performance

Basic radio, which isn't shorthand for a cheaply-made radio with few features, encompasses the fundamentals involved in receiving and transmitting radio signals at the circuit, or "physics," levels. Here are the critical fundamentals.

Sensitivity measures a receiver's ability to detect weak signals. The old adage, "you can't work 'em if you can't hear 'em" is as true today as it was in Marconi's day.

Selectivity measures a receiver's ability to receive desired signals

while excluding unwanted signals.

Dynamic range measures a receiver's ability to receive and cleanly demodulate weak, desired signals in the presence of nearby strong, undesired signals.

Synthesizer noise performance is a way to characterize the quality of a radio's frequency synthesizer (or oscillator on old-school rigs). Modern radios use direct digital synthesis (DDS) to generate most or all of their RF signals. But, real-world synthesizers output waveforms with varying levels of noise and other unwanted "garbage," which affects all aspects of received- and transmitted-signal performance. Achieving the highest levels of radio performance – receive and transmit – requires the best possible DDS performance.

Intermodulation distortion (IMD) measures a transmitter's ability to transmit clean, low-distortion AM/SSB signals. Mixer components/designs and synthesizer performance affect a transmitter's IMD. Better IMD performance improves voice/signal quality and minimizes distortion, splatter and harmonics.

Sideband suppression measures a transmitter's ability to cleanly output the desired sideband (SSB) and suppress the unwanted sideband (minimum performance levels mandated by the FCC).

Harmonic suppression measures a transmitter's ability to transmit its intended signal while suppressing harmonics of that signal (minimum performance levels mandated by the FCC).

Trends in HF Transceivers

VHF/UHF Coverage

Not too many years ago, HF transceivers topped out at 30 MHz, and many didn't even cover 160 meters. Thankfully, that's not the case today. 160-meter coverage is standard, and 6-meter coverage isn't far behind. Many models also include coverage of 2 meters and 70 cm, leading to record-high activity on these bands on SSB, CW and digital modes.



Transverters and Transverter I/O

Still not well-represented on entry-level radios, many mid- and high-end rigs have optional internal VHF/UHF transverters or well-integrated support for external transverters, making the previously arduous task of connecting and managing a stack of external boxes relatively straightforward.

USB Connectivity

The long reign of more primitive serial/RS-232/TTL external control interfaces has started to give way to USB, which is much faster, more convenient and more flexible.

Digi-Mode Interfaces

HF digital modes are more popular than ever before, and manufacturers have responded by adding internal USB or analog connectivity (or internal digi-mode systems) for easy interfacing with PC-based digi-mode hardware and software.

Roofing Filters

At the simplest level, a roofing filter is a narrow filter (usually a crystal filter) in a receiver's first IF through which all signals must pass before they can get to downstream mixers, filters, amplifiers, etc. By greatly reducing the number and intensity of unwanted signals that can be applied to a receiver's later stages, including IF amplifiers and the detector, receiver performance can be greatly improved. Designs centered around the performance boosts provided by modern roofing designs are replacing poorer-performing designs of years past.

Panoramic Displays

Panoramic or “band scope” displays are a central part of software-defined radios, but the technology is seeing greater use in mid- and high-end HF transceivers of more conventional design. By adding an external hardware or software band scope to a radio’s IF output port, operators have conventional “knob and switch” rig interfaces with the ability to graphically “see” signals on adjacent frequencies.

Dual Receivers

Many mid- and high-end radios intended for use in serious contesting and DXing have built-in (or optional) sub receivers, second receivers or dual receivers. Dual receivers offer exceptional flexibility for split-frequency or multi-frequency operation and can give a radio true diversity reception capability. By listening to the same signal on two receivers and two antennas (usually of different polarization), distant, normally unreadable signals affected by harsh propagation effects or atmospheric noise, can be successfully received.

Software-Defined Radios (SDR)

Pioneered by high-performance shortwave receivers, the number of “software-defined transceivers” is on the rise in 2011. After a more conventional RF front end and first mixer, an SDR replaces typical downstream hardware (mixers, amplifiers, filters, AGC and detectors, etc) with digital signal processing (DSP) hardware and PC (or embedded) software. Pure SDRs are “black box” radios without front-panel controls that rely on computerized displays and controls. Unlike conventional radios, SDRs can evolve, improve and add features by simply upgrading the software and/or firmware used to “define” them.

Hybrid Radios

A “hybrid radio” typically uses a high-performance RF front end (with roofing filters, etc) to get things started, but switches to a DSP-based SDR for the rest of the hardware. This is aimed at providing the best of both worlds: A conventional user interface (knobs and switches on a front panel) with the performance, flexibility and upgradeability of a DSP-based radio. Arguably, the best-performing radios available today are hybrids. Once exclusively found in high-end boxes, hybrid designs are becoming more affordable (a trend that is expected to continue).

High Power Output

Typical ham transceivers have maximum outputs of about 100 W, but a few mid- and high-end rigs have power outputs of 200 or even 400 W. On the air, the difference in received signal strength would be difficult to notice, but the extra power may come in handy if you need to drive an external amplifier that requires more than 100 W to reach full power.

Tips for Making the Decision

Finding unbiased and relevant information about the basic radio performance of the latest and greatest HF radios isn’t easy or straightforward. Manufacturers tout features and performance specifications that place their products in the best possible light, while downplaying or not mentioning weaker points at all. As long as a manufacturer isn’t lying outright, that’s allowed. It’s called marketing.

When researching rigs in person or online, be on the lookout for “brand evangelists” and “price justifiers.” A brand evangelist insists that a particular brand or model of radio is superior regardless of any evidence to the contrary. A price justifier, having just spent many thousands of dollars on a particular radio, feels compelled to ignore or dismiss its weak points or become a full-fledged evangelist, again, despite any evidence to the contrary.

When it comes to detailed technical and operational reviews with extensive test data and actual measurements, the Product Review section of *QST* is still the best. It’s the *Consumer Reports* of amateur radio evaluation. A complete list of *QST* product reviews can be found at www.arrl.org/reviews-listed-by-issue. Only ARRL members can download write-ups from past and present issues from the web site. If you’re serious about finding the right radio, the \$39 annual membership fee via www.arrl.org might be a bargain.

The internet is a powerful tool for finding information and opinions about your soon-to-be favorite radio. In addition to manufacturers’ web sites, the ‘net has a lot of nooks and crannies full of rig specs, user reviews, modifications, workarounds, service info and photos.

Google away, but be sure to point your browser to www.eham.net, which, among other resources, has hundreds of equipment reviews submitted by users.

Sherwood Engineering, of Denver, Colorado, hosts a variety of white papers and independent RF performance tests and comparisons featuring many of the best HF transceivers available. The receiver performance chart at www.sherweng.com/table.html is sorted by close-in (2-kHz spacing) dynamic range (which squashes many “high-performance” radios, as only the “highest-performance” receivers can compete in that rarefied category).

Another helpful receiver performance comparison can be found at www.elecraft.com. Click on the “Rig Comparisons” item on the left-hand menu. This chart uses data compiled from ARRL and Sherwood Engineering tests, and is probably a bit easier to understand.

Warranties and Customer Service

Because modern HF rigs are complex and difficult or impossible for the average user to repair in any significant way, you might expect that warranties would be a major factor influencing specific buying decisions. According to several prominent vendors I spoke with, they’re really not!

That may be because almost every new HF transceiver has essentially the same warranty – one year parts and labor, with the manufacturer usually paying for shipping costs from the repair depot to your door (leaving you or your dealer to pay for the first leg of the trip). A select few rigs, usually high-end models, have two-year warranties. These include the ICOM IC-7800 and the Flex-Radio 3000 and 5000 models.

It’s surprising that dealers don’t offer extended warranties, although one long-time vendor I talked to, who used to offer them, is considering offering them again.

Although there isn’t a scientific study of the topic that includes all ham transceiver manufacturers, it’s safe to say that Ten-Tec and Elecraft are universally known for their customer service and willingness to “go the extra mile” for hams who own their respective gear and both companies are “made in the USA.”

Direct Sales

Ten-Tec, Elecraft and Flex-Radio Systems sell their products directly to customers and have no domestic dealer networks. This makes it a bit more difficult to stop by your local ham store to twiddle the knobs and check out a particular radio “in the flesh.”

To overcome this potential sticking point, these manufacturers offer 30-day return (evaluation) periods so buyers can thoroughly put their new radios to the test. If returned, the radios must be in “as new” condition and complete with all factory-packed accessories, manuals and goodies, with some models being subject to restocking fees.

MT PICKS

The Best of Amateur Transceivers

Entry-Level HF Transceivers

Making a versatile, good-looking low-cost rig is the easiest part. Wringing every last drop of RF performance out of a rig’s available price class is the tricky part (without making the rig so good that it diminishes sales of the company’s higher-priced, higher-margin models!). It’s a real tightrope. Street prices in this category range from \$600 to \$1100.

This category is dominated by mobile radios, but if you don’t specifically need to mount your radio in a vehicle or toss it into a backpack, the performance and usability of compact “base station” radios – which are readily portable – is usually better. Additionally, mobiles that don’t at least cover 6 meters are probably missing the biggest part of the market.

Yaesu FT-857D:

\$800. HF + 6, 2, and 70cm. SSB, CW, AM, FM, DIGITAL. Power: 5 to 100 W

Plus: The smallest “dc to daylight” mini mobile rig with DSP and other “big radio” features. It’s almost as small as the micro-size





GRECOM

MULTI-TRUNKING SCANNERS

Featuring GRE's Intuitive "Object Oriented" User Interface

The PSR-310 and PSR-410 are a new generation of scanners designed for ease of use, yet are powerful enough to satisfy the most sophisticated experts. With GRE's intuitive Object Oriented User Interface, common data entry, browsing and control methods are used for non-trunked conventional channels, trunking talkgroups, search configurations and Spectrum Sweeper setups. This radio grows with you - start out with a small, easy to manage configuration, then expand it whenever you need to!

◀ PSR-310 Handheld Analog Trunking Scanner

- ▶ New Object Oriented User Interface
- ▶ Wide Band Reception
- ▶ Multi-System Analog Trunking
- ▶ Exclusive Multi-Color Alert LED
- ▶ Subaudible Squelch Decoder
- ▶ Full dot matrix bitmap LCD Display with white LED backlight
- ▶ SAME Weather Alerting
- ▶ High Speed PC Interface
- ▶ User Upgradable CPU Firmware

PSR-410 Desktop/Mobile Analog Trunking Scanner ▶



Available Oct. 2010



Available Dec. 2010



GRE AMERICA INC.
425 Harbor Blvd, Belmont, CA 94002

Available at ...



www.greamerica.com

FT-817ND (but has a lot more power), and is much smaller and more portable than the FT-897D, which doesn't offer much more radio overall.

Minus: No QSK CW. "Small radio" ergonomics. Not as expandable as larger radios.

FlexRadio Flex-1500:

\$650. HF + 6 m. SSB CW AM DSB Synchronous-AM (RX only) FM DIGITAL DRM. Power: 1 mW to 5 W. The Flex-1500 is a DSP-based, black-box, software-defined radio (SDR). A full-featured HF+6 QRP transceiver, the '1500 excels as an IF deck for external VHF/UHF/microwave transverters.

Plus: The most affordable way to get your feet wet with an SDR. Panoramic band scope display with point-and-click tuning. Sophisticated DSP filters, noise-reduction and AGC. Very high RF performance for its price. Ability to add features and improve performance via software updates.



Recommended only for experienced PC users. Emerging technologies have glitches and issues.

Minus: Requires an external PC running Windows XP or Windows 7. Using an SDR – especially with logging, rig-control and digital-mode software – can take some getting used to and isn't for everyone. Recommended only for experienced PC users. Emerging technologies have glitches and issues.

Icom IC-7200:

\$1,069. HF + 6. SSB, CW, FSK, AM. Power: 2 to 100 W. Facing strong competition from the Yaesu FT-450 (which has an auto-tuner option, a much lower price, and targets a similar audience), the rugged and water-resistant '7200 was a slow starter but is now heralded as a "sleeper" and the "unsung hero" of its class.

Plus: A powerful IF DSP system that rivals the performance of pricier rigs. Outperforms many top-flight radios that are only several years old. A built-in USB rig-control and digital-mode interface that provides a handy "one cable" solution without requiring any additional hardware.



Minus: No FM. No internal auto-tuner option. Most expensive radio in its price class.

Mid-Level HF Transceivers

Mid-Level transceivers slug it out in a crowded, testosterone-fueled arena. The best are a big step up from entry-level rigs, with added features (some that are not available on any entry-level radio), improved RF performance, RF or IF DSP instead of (or in addition to) audio DSP, and expanded I/O connectivity for external accessories such as amplifiers, transverters, separate receive antennas, etc. Contesters, DXers and "radio specialists" of every type rely on these workhorse rigs to take their on-air activities to new levels. With street prices ranging from \$1100 to \$4000, mid-level HF transceivers are definitely not casual purchases

Elecraft K3

(factory assembled, basic feature set):

\$2200. HF + 6. SSB, CW, FSK, AM, Synchronous-AM (RX only) FM, DATA. Power: 200 mW to 100 W. Available factory-assembled or as a kit, Elecraft's K3 is completely modular, allowing owners to start with a basic setup and add options and capabilities (from conventional to exotic) as desired. The 10-W K3 costs as little as \$1400. Considering that it offers



what many independent labs and testers consider to be the best RF performance available at any price, at only \$300 above entry-level it's nothing short of spectacular.

Plus: State-of-the-art "switch-mode" mixer. Dual 32-bit DSP. Flexibility and modularity that allows you to build exactly the radio you want (leaving out the features you don't), saving thousands of dollars in the process. It's like buying a Ferrari for the price of a Fiat.

Minus: Too small for ops who prefer a big-radio feel. Some ops find ergonomics odd and perplexing. Choosing from multiple optional add-ons can be confusing. Emerging/evolving complex technology that can require mods and firmware updates.

Icom IC-7600:

\$3900. HF + 6. SSB, CW, FSK, AM, FM Digital. Power: 2 to 100 W. Icom's mainstream DXpedition and contest machine has a lot in common with the IC-7700 and IC-7800 at a much lower cost.

Plus: Easy to use for a sophisticated, feature-rich radio. Feels well-rounded and complete. Big, beautiful, informative main display.

Minus: Pricy. Virtual S-meter is uncalibrated. No internal power supply. Spectrum scope can't compete with those on pricier radios or SDRs.



High-End HF Transceivers

High-end transceivers are aimed at producing the best possible RF performance in a package that oozes high-tech style and luxury. Mostly "big box" radios, features can include dual receivers, increased power output, exotic displays, integrated transverters – you name it. In many ways, high-end transceivers conform to the law of diminishing returns: you have to spend "thousands extra" to get minimal (if any) RF performance gains compared to already-superb, much more affordable radios. If you need or want special features that are only available in this price class, you have no choice. As with exotic sports cars, when prices range between \$4000 and \$12000, many ops buy these radios for personal reasons that aren't always based on cold, hard numbers.

Yaesu FT-DX5000:

\$5400. HF + 6. SSB, CW, FSK, AM, FM DIGITAL. Power: 10 to 200 W. With a price tag of more than \$5000, the FT-DX5000D is still half the price of its big brother, the FT-DX9000D. This radio is a big-box, "launch control center" style radio that will not get lost on your desktop!

Plus: Switches, knobs and buttons for every possible feature – perfect for "control freaks." Dual, independent receivers. 200 W output. Rear-panel IF output. Internal power supply. Silky-smooth "feel" with luxurious ergonomics.

Minus: Pricy. Heavy (weighs nearly 50 pounds). May require expensive accessories for enhanced features. Requires initial setup and tweaking to accommodate personal preferences.



Elecraft K3 (factory assembled, deluxe feature set):

\$4600. HF + 6. SSB, CW, FSK, AM, Synchronous-AM (RX only) FM, DATA. Power: 200 mW to 100 W. A loaded K3 offers the same

chart-topping RF performance as the standard rig, but adds features and functionality demanded by high-end users.



Plus: Second internal receiver is identical to the main receiver (not reduced in performance, as is typical). External matching band-scope display with “select and click” tuning rivals SDR functionality. Internal and external VHF/UHF transverters.

Minus: Tiny and cramped for ops seeking “big box” majesty. Potentially quirky ergonomics. Emerging/evolving complex technology that can require mods and firmware updates.

Ten-Tec Orion II:

\$4600. HF only. SSB, CW, AM, FM, DIGITAL. Power: 5 to 100 W. Ten-Tec’s flagship radio is HF-only, a design choice aimed at providing the highest possible “ham-only” RF performance. The Orion II has the same

“down-converting + DSP” design philosophy as the Elecraft K3, but in a big-box radio.

Plus: Easy to use, especially for its class. Big-radio ergonomics. Dual receivers. Top-flight RF performance. Fast, wide-range internal auto-tuner.

Minus: Complaints about mechanical design and build quality. Only second RX is general-coverage (not a minus for every user). Spectrum scope isn’t “SDR performance.”



Buying Radios for Amateur Satellites

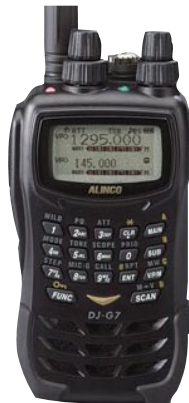
By Keith Baker, KB1SF/VA3KSF

When shopping for a satellite-capable radio, it is important to remember that most of our amateur satellites operate in what’s called true duplex or full duplex mode, meaning that the uplink receivers and downlink transmitters are both operating at the same time.

By operating full duplex, you’ll learn immediately that the satellite hears you, because you will actually hear your own uplink signal coming back to you through the satellite. Unfortunately, fewer newly manufactured amateur radios these days have the capability to operate in full duplex mode. Fortunately, there are still a few of them on the market...with more to follow.

The Alinco DJ-G7T/E

Priced at about \$300, the new Alinco DJ-G7T/E is one such radio suitable for hand-held satellite operation on our FM birds in full duplex mode on the 144 MHz, 430 MHz and 1200 MHz bands. It has a 5W transmitter, 50 pair of programmable scan memories and a host of other features.



Kenwood’s TS-2000

As of this writing, the only base station on the new radio market that enables full duplex satellite work is the Kenwood TS-2000. Lately, thanks to Kenwood incentives, the radio can be purchased for \$150 less than its current suggested retail price of \$1700.

Offering the beginning satellite user a superb value in a “do every-



thing” rig, this HF/VHF/UHF all-mode radio has a 100W transmitter for HF through 2m, 50W on 70cm, dual channel receive, digital signal processing (DSP), superb frequency stability, as well as a built-in auto antenna tuner for 160 through 6 meters.

For satellite work, the ‘2000 uses 10 dedicated memory channels with the ability to synchronize the transceiver between normal or reverse tracking of uplinks (transmitting) and downlink (receiving) frequencies. I personally own a TS-2000 and have found it to be an absolutely superb radio for satellite work.

ICOM’s new IC-9100

ICOM has been another strong supporter of the amateur satellite community over the years. Lately, they, too, have been filling a high end niche with some outstanding satellite equipment. The bad news is that they recently discontinued sale of their very popular IC-910H VHF/UHF all mode radio.

The good news is that they are now in the process of replacing the ‘910 with what promises to be an even more robust satellite radio, the IC-9100. It’s slated to provide 100W on all bands and all modes HF through 2m, and 75W on UHF. It will simultaneously receive on two different bands and work as if there are two different receivers in one radio. The 9100 will also have a 32 bit DSP and ICOM’s increasingly popular D-Star, digital communications capability.



In satellite mode, the ‘9100 will synchronize uplink and downlink frequencies via 20 satellite memory channels that let you store operating modes and tone settings as well as other satellite-unique parameters. As of this writing, sale of the IC-9100 in the United States is still awaiting FCC approval. Retail price, when it finally hits dealer shelves, is expected to be around \$4000.

SATellites

MT's Guide to Buying a Scanner

By Larry Van Horn, N5FPW

Buying a scanner can be confusing and frustrating for the newcomer to the radio hobby. The question I'm asked most is, "What scanner do you think should I buy?" But, there is no quick and easy answer to this question, so I usually answer back by asking two other questions: "What do you want to hear, and where do you live?" Once you answer those questions and figure in the amount of money you want to spend, a recommendation can be made.

For instance, if you are interested in monitoring public safety services, (police, fire, and EMS), you can narrow your purchase options to a couple of considerations – analog vs. digital and conventional vs. trunk systems.

I recommend that the first thing you do is conduct a survey of the agencies you are interested in monitoring in your local area. You can do that on an Internet website such as RadioReference.com (www.radioreference.com/).

Based on what you find during your survey, you can narrow your choice of general scanner types to analog, analog/trunking, and analog-digital/trunking. If you are interested in monitoring conventional frequencies (non-trunked) and analog (non-digital) you have a whole host of scanners you can buy in handheld, mobile and desktop configurations. These scanners can range in price from just less than \$100 to wideband professional models that sell for five figures and more. Note that prices given are typical of those found at various MT advertisers.

Conventional Analog Scanners

Best

Handhelds **Alinco DJ-X11 (\$330), Icom R20 (\$510)**
Desktops **AR-5001D (\$3,900)**

Better

Handhelds **Alinco DX-X30, AOR AR-Mini (\$280), Icom IC-RX7 (\$200), Yaesu VR-500 (\$270)**
Desktops **Yaesu VR-5000 (\$640)**

Good

Handhelds **Alinco DJ-X3 (\$180)/DJ-X7 (\$180), GRE PSR-100 (\$90), Icom R6 (\$190), Radio Shack Pro-444 Race Scanner (\$100), Uniden BC-72XLT (\$100), BC-95XLT (\$105)**
Desktops **GRE PSR-200U (\$90), Uniden BC-340CRS (\$100) 355C (\$105), 370CRS (\$120)**

Some of the higher end models in the analog-only category of scanning radios are manufactured by AOR, Icom, and WinRADiO and are usually computer-controlled or software-defined radios that cover wide frequency ranges but cannot trunk or decode digital P25 signals. WinRADiO does have an optional software package to decode P25 digital transmissions for some of their models. They also have an optional software package to track analog Motorola, EDACS and MPT-1327 trunk radio systems available for selected units. AOR has an optional P25 hardware decoder, but it can only decode conventional P25 digital signals and will not work with any radio that handles trunk radio signals.

Analog/Trunking Scanners

When you do your survey and find there are analog trunk radio systems in your area, you'll have to step up to the next level of scanners that enable efficient reception of those transmissions. Yes, you can hear radio communications from an analog trunk radio system on a conventional scanner, but you won't be able to follow specific communications on the system or be able to positively identify who you are hearing.

Typically, the scanners listed below will not only follow Motorola analog trunk systems, but they can handle the various EDACS and LTR analog trunk systems as well.

Best

Handhelds **GRE PSR-310 (\$200), Radio Shack Pro-107 iScan (\$230), GRE PSR-700 EZ Scan SD (\$200)**

Desktops **Uniden BCT-15X (\$220)**

Better

Handhelds **GRE PSR-300 (\$170), Radio Shack Pro-164 (\$200)**
Desktops **GRE PSR-400 (\$170), Radio Shack Pro-163 (\$200), Uniden BCT-8 (\$163)**

Good

Handhelds **Uniden BC-346XT (\$220)**



The new Radio Shack Pro-107 and GRE PSR-700 scanners are easy to use and program. These units have a built-in SD card pre-programmed with a full database of all the known analog public-service trunked systems, as well as many conventional frequencies. If easy operation is important to you, one of these two scanners is your best bet in this scanner category.

There is one important caveat: Some of these will no longer correctly track Motorola systems after 800 MHz rebanding takes place, and they cannot be updated. If you need to follow an EDACS or LTR trunk system, the scanners in the next category will work well when the new rebanded 800 MHz frequencies are programmed. I have covered the topic extensively on my personal *BTown Monitoring Post* blog at monitor-post.blogspot.com/2006/06/800-mhz-rebanding-and-uniden-scanners.html

Analog-Digital/Trunking Scanners

If you need to monitor any of the increasing number of digital public safety trunk systems in the country or any of the new 380-400 MHz Department of Defense P25 trunk radio systems, you will need to step up in price again with a digital scanner. Here is a list of scanners you should consider.

Best

Handhelds **Uniden BCD-396XT (\$500)**
Desktops **Uniden BCD-996XT (\$495)**

Better

Handhelds **GRE PSR-500 (\$510), Radio Shack Pro-106 (\$400)**
Desktops **GRE PSR-600 (\$410), Radio Shack Pro-197 (\$400)**

Good

Handhelds **Uniden BCD-396XT (\$500)**
Desktops **Uniden BCD-996XT (\$495)**



Finally, in a class by itself is the new Uniden HomePatrol scanner (\$500). You can read an in-depth review of this unit in the October issue of *Monitoring Times*. Bottom line: this scanner is the easiest scanner on the market to program at any price. It is the top dog in this category of scanner, since it can also handle all scanner conventions previously discussed.

Monitoring Other Services

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

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

If you are an air show buff, the analog scanner playing field changes just a bit. While an analog scanner will let you hear most of the action, some scanners currently being marketed (and most older scanners on the used market) are *not* suited for air show monitoring. You can get more details on the units I recommend for air show monitoring in the March issue of *Monitoring Times* or check out page 6 of last year's annual air show guide at http://monitoringtimes.com/MT_Air_Show_Guide_2009.pdf

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AR2300 "Black Box" Professional Grade Communications Receiver

First in a new generation of software-controlled black box receivers, the AR2300 covers 40kHz to 3.15 GHz* and monitors up to 3 channels simultaneously. Remote control functions. Internal SD audio recorder allows for unattended long term monitoring. Spectrum recording with optional AR-IQ software can be used for laboratory signal analysis. Using FFT, the unit scans large frequency segments quickly and accurately. Optional IP control port.

AR5001D Professional Grade Wide Coverage Communications Receiver

With amazing performance in terms of accuracy, sensitivity and speed, the AR5001D features ultra-wide frequency coverage from 40kHz to 3.15GHz* in 1 Hz steps with 1ppm accuracy and no interruptions. Large easy-to-read digital spectrum display and popular analog signal meter. The AR5001D makes it easy to monitor up to 3 channels simultaneously. Can also be controlled through a PC running Windows XP or higher. Great as a mobile or desktop receiver.



AR-Alpha with I/Q Control Software

Welcome to a new class of professional monitoring receivers. The AR-Alpha can perform unattended datalogging for extended periods and covers 10kHz to 3.3GHz* continuous, with no interruptions. It boasts a 6-inch color TFT monitor that displays spectrum bandwidth, a switchable time-lapse "waterfall" display or live video in NTSC or PAL. Five VFOs, 2000 alphanumeric memories that can be computer programmed as 40 banks of 50 channels, 40 search banks, a "select memory" bank of 100 frequencies and a priority channel. Also includes APCO-25 digital capability and can record up to 52 minutes of audio.

AR-One Communications Receiver

Enjoy total command of frequencies, modes and tuning steps with this versatile performer that allows you to control up to 99 units with a single PC. Covers 10 kHz to 3.3 GHz and delivers excellent sensitivity, ultra-stable reference frequency oscillator, high intercept, adjustable BFO and multi-IF signal output (10.7 MHz or 455kHz) plus 1000 memory channels and 10 VFOs.



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AR200 Mark III World Class Portable Receiver

With 1,000 alphanumeric memories and a TCXO that delivers solid frequency stability and performance not found in most desktop units, the AR200 Mark III covers 500 kHz to 3GHz* and can be used with optional internal slot cards that expand its capabilities. It features true carrier reinsertion in USB and LSB modes and includes a 3kHz SSB filter. The data port can be used for computer control, memory configuration and transfer, cloning or tape recording output. A special government version, AR2000Mark III IR, features user-selectable infra-red illumination of the display and operating keys.

AR600 Mark II Wide-Range Desktop Receiver

With an optional P25 (APCO25) decoder module, improved front end and receive audio response, display illumination control, ultra-stable TCXO and up to four optional cards that can enhance certain functions, the AR600Mark II covers 100kHz to 3GHz* with 1000 alphanumeric memories and free downloadable control software. Receives WFM, NFM, Super-narrow FM, Wide and Narrow AM, USB, LSB and CW.

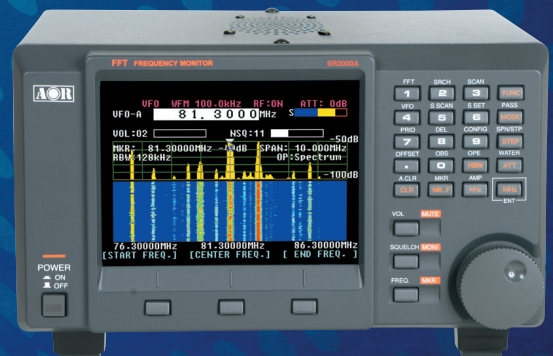


AR-STV Handheld Video Receiver

See who is watching you on wireless video surveillance cameras. The AR-STV handheld receiver detects hidden NTSC or PAL analog video signals in real time. A valuable addition to any security operation, the AR-STV features a large 2.5 inch color LCD display and a USB connector that makes it easy to download stored images into a computer. With optional 4GB SD memory card, up to nearly 2000 images can be stored for later analysis.

SR2000A Spectrum Display Monitor

Ultra sensitive, incredibly fast, yet easy to use, the SR2000A lets you SEE received signals in FULL color. Using the power of FFT, it covers 25 MHz to 3GHz* and features a color monitor that displays spectrum bandwidth, a switchable time-lapse "waterfall" display or live video in NTSC or PAL. High quality internal speaker delivers crisp, clean audio signals. Scans 10 MHz in as little as 0.2 seconds. Instantly detects, captures and displays transmitted signals. PC control through RS232C serial port or USB interface. With 12 VDC input, it's perfect for base, mobile or field use.



Whatever the monitoring need, AOR products deliver exceptional performance for use by federal, state and local law enforcement agencies, the military, emergency managers, diplomatic service, news-gathering operations, and home monitoring enthusiasts.

What to Look for in Portable Shortwave Receivers

By Ken Reitz KS4ZR

Tens of thousands of portable shortwave radios are sold every year. They're available in big discount department stores such as Target and mall favorites such as Ritz Camera as well as long-time specialty mail order firms such as Grove Enterprises and Universal Radio. Prices range from \$39 to \$450.

Doing Your Homework

There's a big difference in what's available now and what was offered even ten years ago. For starters, these radios are typically smaller and better performers. Today, even some of the cheapest radios come with standard features such as Phase Lock Loop (PLL) tuning, direct frequency entry, expanded LCD displays, and sideband capability that had been available only on more expensive sets. Most have large memory storage for hundreds of frequencies, clock, multiple timers, and improved reception. The best part is that prices have remained stable over the years while the feature count has risen. But, before you start looking seriously for one to buy, you need to do a little homework.

If you intend to actually carry your portable shortwave radio with you, look to the specs on each unit and compare size and weight. Just because it has a handle doesn't mean it's portable.

If you plan to use your portable inside the house with an outside antenna, make sure it has an external antenna connector.

If you plan to use your portable shortwave radio on commercial power, make sure it comes with a wall transformer (it's an option on some models). If you plan to use it more as a portable, make sure it includes rechargeable Ni-MH batteries and has a charging circuit built-in.

If you plan to trade-up in the future to a better radio, make sure the company you buy it from has a trade-in program. The big box stores don't, but both Grove Enterprises and Universal Electronics do.

Use available resources to see how the product you want to buy stacks up with the pros and with regular users. *Monitoring Times* offers hundreds of reviews online at www.monitoringtimes.com/html/mt_reviews.html. An extensive list of portable shortwave sets, reviewed by avid radio hobbyists, may be found at www.eham.net/reviews/products/8.

Get a Deal!

Don't be afraid to buy closeout models. These radios still carry full factory warranties but are often deeply discounted. You'll have to act quickly, though; once the supply of close-out models is exhausted, the deal's over! Both Grove and Universal Radio have special pages on their web sites just for closeouts. Check them out often because these items change all the time.

The same is true for factory refurbished models. A few companies offer them (Universal Radio is one) at big discounts. If they're factory refurbished, they will still come with a warranty. But, supplies of reconditioned units are usually even more limited.

Often radio manufacturers will offer instant coupons, T-shirts, baseball caps, travel mugs, radio-related books, or software as purchase incentives for certain products. If the item you were going to buy anyway offers such a deal, go for it. Just don't be dazzled into making a purchase based on such an offer.

And, don't forget to look at "catalog returns, scratch 'n' dent, orphans" or any other used product offer from reputable dealers. The catalog company C. Crane, for example, has many such items on their web site under the "orphans" category, some at substantially reduced prices, with the same 30 day money back guarantee they offer on their new products.

New in Portable Shortwave Radios

There are two new portable shortwave radios that are being introduced this year. Unfortunately, they are so new that demonstration units were not available as this is written.

Grundig S450DLX

Dubbed a "Field Radio," the S450DLX has some very interesting features, not the least of which is the projected \$100 price tag. Bands

include AM/FM and continuous shortwave tuning from 1.7 through 30 MHz. The audio quality is promising, thanks to an oversized 12.2" x 8.5" x 3.8" cabinet. Most interesting will be the AM IF output jack which might be used for a future add-on DRM converter, for digital shortwave reception, or Single Side Band (SSB) adapter.



Sangean ATS-909X

The next model to pick up where the soon-to-be-discontinued ATS-909 leaves off, the ATS-909X becomes Sangean's new flagship shortwave portable. Little is known about the new model at press time other than the re-styled front, though we do know the MSRP will be \$450, but discounted to \$260 at Universal Radio. Tuning coverage will be continuous from 153 kHz to 29.999 MHz.



MT PICKS

Premium Grundig 750

This is a tough category because several radios that might have automatically qualified for this slot – Eton's E1 (\$400) for example – are no longer made, and replacements, such as the aforementioned Sangean ATS-909X, haven't been tested. And, that price point is near enough to highly rated desk-top shortwave radios that you'd have to wonder why you wouldn't opt for one of those instead.

There's only one company still cranking out pricey but reputable portables: Grundig. So, I give the nod to the latest in heavyweight, but still competent, portables, the Grundig 750.

Plus: Great audio; Air Band; Rotatable AM antenna.

Minus: Heaviest portable made (7 pounds); uses 4 "D" alkaline batteries.

List Price: \$400. Typical Discount Price: \$300. One year limited parts and labor warranty.



Mid-Range Sony ICF-SW7600GR

There is no way to know how many tens of thousands of these units have been sold over the years, many of which are still going strong. Its reputation continues to hold up and anyway, can a hundred thousand satisfied shortwave listeners be wrong?

Plus: Non-volatile memory, sophisticated clock-based timers.

Minus: Poorly designed optional power adapter, but Universal sells a special, filtered wall supply specifically for this model (\$20).

List Price: Sony doesn't like retailers to advertise the retail price. Typical price range: \$140-\$160. Ninety day limited warranty.



Economy Kaito KA1103

Until someone else makes a portable shortwave radio this good with this many features, this cheaply, the KA1103 will stay the top-rated economy portable shortwave set on the market. Despite some quirks, it's a great performer.

Plus: Built-in NiMH battery/charger.

Minus: Awkward front panel buttons, unusual analog-looking LCD tuning dial.

List price: \$110. Typical Discount Price: \$80. One year limited warranty.



Personal Radios: CB, FRS/GMRS

By Ken Reitz KS4ZR

The FCC lumps all of these radio services, Citizens Band (CB), Family Radio Service (FRS) and General Mobile Radio Service (GMRS), into what it calls collectively the Personal Radio Service (PRS). PRS could also stand for Poorly Radiated Signals. If the original intention was to create a number of radio services using different bands and transmission modes, none of which can be heard outside a three mile radius, then PRS is a whopping success.

CB Radio: 50+ Years without Respect

The Commission has also been toying with the idea of making various changes to the rules of some of these services, notably CB, including reducing the power output of CB sets in order to prevent CBers from working skip during what may be one of the weakest solar cycles in a century. At the same time they're trying to figure out how to get CBers to stop using linear amplifiers. There wouldn't be a more surefire way to get CBers to *add* a linear than by reducing the barefoot power.

There is also some concern about tweaking the time limit restrictions for transmissions, as if they were ever observed, and possibly allowing a certain amount of sound effects, music, and whistling, as if every trucker in the country had been holding back for an invitation.

Still, the few remaining manufacturers of legitimate CB sets continue to design within the closet they've been given and new products actually emerge.

Cobra marks the 50th anniversary of the CB service two years late, with a commemorative model which should be on truck stop shelves by the time you read this. Called the 29LXLE, it's still 4 watts out and 40 channels, but offers a more modern LCD display panel in three back-lit colors (choose from amber, blue or green). Priced at \$150, it's good to see that CB prices have kept pace with the price of gas.

Cobra offers 10 sets (nine mobile rigs and one hand-held unit). Cobra's Classic 29 LTD (\$120) now has a red warning LED, should your antenna become disconnected and you can't figure out why channel 19 is dead. It also comes with a 9 foot mic cord, a real plus for backseat drivers. Cobra's 148GTL offers upper and lower sideband channels for \$190, the only model so equipped.

Midland has pared down its model list to five (three mobile and two hand-held units), including their lowest priced model, the 1001z (\$45) and the inexpensive, but limited, hand-held, the 75-785 (\$50). Midland's newest offering, their new 1001LWX, is an affordable \$70 and comes with a scan feature that looks for the strongest NOAA Weather Radio signal, a big help when on the road.

Uniden offers nine CB models ranging from a compact mobile unit, the Pro 510XL (\$45) to their PC78 Elite (\$150). All Uniden models are sold at Radio Shack. The Shack also carries a private labeled Uniden product, the TRC-503 (\$60) which, at just under 4" wide, is the most compact mobile CB set available.

Available from Radio Shack with a three year warranty.

Economy

Uniden PRO510XL (\$45)

Plus: Well established model with a good track record at a good price.

Minus: No Weather Radio. Available from Radio Shack online only with a two year warranty.



FRS/GMRS

The Family Radio Service (FRS) uses small, license-free, hand-held, two-way FM radios with a 1/2 watt output that operate simplex on seven UHF channels in the 467 MHz range and seven channels in the 462 MHz range that it shares with the General Mobile Radio Service (GMRS). GMRS is a licensed service with 5 watts output that also has eight of its own simplex channels in the 462 MHz range and eight repeater channels in the 467 MHz range.

Confused? Most people are. That's why only a small fraction of the millions of people who have bought these sets have applied for the license. Proposed rules changes for the FRS/GMRS radio service are also under consideration by the FCC, but it's unclear what the effect will be. With tens of millions of sets in circulation, it's hard to believe any major changes, if made, could be enforced.

All sets are seemingly identical and consumers may be tempted to make purchases based on distance claims made by manufacturers. All such claims given for the range of any FRS/GMRS radio on the market should be ignored. While technically correct, few will be able to duplicate the results. Your mileage will *not* compare.

While all FRS/GMRS sets come in pairs, here are the main features to look for: rechargeable battery packs with charging cradles, extensive privacy features; hands-free VOX operation with boom mics; NOAA Weather Radio with S.A.M.E. Alert; and variable output power (for battery conservation).

MT PICKS

Premium

Cobra MicroTalk® CXR925 (\$90)

Plus: Lithium Ion batteries with recharging cradle; high/low power output in GMRS mode; NOAA Weather Radio/Alert function, VOX; silent alert for incoming calls, 3,124 channel combinations; 10 call tones to recognize up to 10 different callers.

Minus: Boom mic optional (\$20). Available from Radio Shack with a one year warranty.



Mid-Range

Midland LXT490VP3 (\$60)

Plus: Rechargeable NiMH batteries with recharging cradle; high/low power setting; Weather Scan NOAA Weather Radio/Alert; VOX; 2,676 channel options; channel scan looks for on-air activity.

Minus: Boom mic optional (\$20).

Available directly from www.midlandradio.com and carries a three year warranty.



Economy

Motorola FV750R (\$35)

Plus: This was the cheapest FRS/GMRS unit that featured rechargeable batteries, a charging cradle, VOX and NOAA Weather.

Minus: Power on the GMRS side is only 2 watts. Available at B&H Photo Video (www.bhphotovideo.com) and carries a one year warranty.



MT PICKS

Premium

Cobra 29 WXNWB (\$210)

Plus: Bluetooth technology allows hands free cell phone connection through the radio; NOAA Weather Radio with S.A.M.E. Alert mode; enough knobs, switches and LEDs to make any trucker happy.

Minus: Expensive and large (13.25" W 12" D x 3" H). Available at Radio Shack with a two year warranty.



Mid-Range

Midland 75-822 (\$85)

Plus: Convertible radio goes mobile or hand-held; has Weather Radio; adjustable power to 1 watt output for battery conservation.

Minus: rubber duck antenna won't work inside vehicle; use a mag-mount antenna when mobile.



MT's Antenna Roundup

By Bob Grove W8JHD



Next to receivers and transceivers, no topic is talked about more in the radio hobby than antennas, and no topic suffers from more misinformation. But, armed with facts, you can make the right choices. Many products mentioned here have been reviewed in past issues of *Monitoring Times* and can be found in the index on MT's home page.

Antennas for Listening

SWL Antenna Options

Multiband portable radios are easily overloaded by large antennas, but benefit from their outdoor location. A simple preselector like the MFJ 1045C (\$83) can boost weak signals as well as pick them out of overload interference.

The popular 45' PAR Endfedz wire antenna (\$75) is equipped with a standard SO-239 coax connector. If you have a tree nearby, try dangling the Grove HVU FlexTenna (\$15) from a branch. A similar Hidden FlexTenna can be strung through your attic trusses (\$20).

If you don't have space for a wire antenna, try the LF Engineering H-800 Skymatch active antenna (\$149); it's just over two feet in height and comes with a power supply and 50 feet of coax, but you'll probably need an adaptor to fit its RCA phono connector. For severe weather protection, even a marine environment, there's the WINRADIO AX-81S active antenna (\$190).

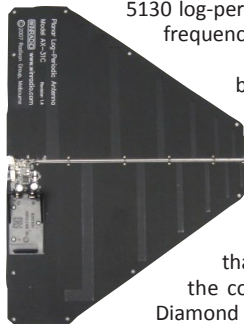
If an indoor antenna is a must, then consider the MFJ 1020C tuned active antenna (\$90) or, if you have a wide-frequency-coverage receiver, the AOR LA-390 loop antenna (\$380) lets you select ranges from 150 kHz to 500 MHz and rotate the loop for best reception.



Scanning VHF/UHF Antennas

Although your scanner came with an attachable whip, it's only satisfactory for local reception. To get distance, just as with shortwave, an outdoor antenna is required. Discone antennas are very popular; they have wide frequency coverage and hear from all directions. The long-standard Diamond D130J covers 25-1000 MHz (\$100). Consider as well the WINRADIO AX-71C (\$90) which receives 25-3500 MHz, or the Scantenna vertical dipole (\$50) for 25-1300 MHz reception.

Looking for maximum range? You may need a directional beam like the Grove Scanner Beam (\$70) for uncompromised 30-1000 MHz reception. For rugged installations including transmitting, the Create 5130 log-periodic dipole array (\$300-\$410 depending on frequency range) is a great choice.



Compact UHF beams etched on a circuit board are available from cutting-edge technology companies like WINRADIO. Their AX31C covers at least 290-2200 MHz and has a built-in preamplifier (\$139.95); their AX37A goes to 3000 MHz (\$390).

If you aren't satisfied with your hand-held performance, you might want to change that whip. No rubber duckie substitute has beat the compact, 11" Condor (\$35) or the thin, 16" Diamond RH77A (\$25).

Mobile scanning is enhanced by a good, mag-mount antenna such as the AOR MA500 (\$100), the unobtrusive Pro-Comm CD144MBN (\$20) for local VHF/UHF scanning, or MP's Super-M Ultra with uncompromised 25-6000 MHz reception and 120-6000 MHz transmitting (\$125).

Selecting the right coax

The higher the frequency, the more critical the choice of transmission line. CB-style cables like RG-58/U become quite lossy at VHF and especially UHF and should be avoided. Thick RG-8/U works well, but it's expensive and hard to manage.

TV cable like RG-59/U and especially RG-6/U work very well up through at least 1000 MHz; it's inexpensive and low loss. Many dealers stock it in 25, 50 and 100 foot lengths (\$15-\$25) with F connectors on both ends. Adapters are available for nearly any application, including PL-259/UHF, N, BNC, and SMA (\$4).

Antennas for Transmitting

Transmitting antennas for High Frequency (HF) also make great receiving antennas, but require more attention to details so that all the power generated by the transmitter gets radiated and in the right direction. The size of a transmitting antenna doesn't really matter in terms of its radiation efficiency; proper impedance matching, however, is important.

HF Stationary Antennas

Horizontal wire antennas for are very popular, radiating their energy outward from the sides. A north/south oriented wire radiates east and west. Models like the G5RV (\$50) and Carolina Windom (\$150) require an external tuner (transmatch) for multiband operation, while the Alpha Delta DX-CC (\$160) has built-in trap coils to electrically isolate and select the antenna elements according to frequency. Of course, at lower frequencies, horizontal wire antennas can be quite long, must be mounted high for best performance, and require supports at both ends.

Vertical antennas may be mounted at or near ground level so long as they clear nearby obstacles. Compact, self-supporting (no radials or wire supports necessary), multiband models like the Cushcraft R-8 (\$540), Hy-Gain AV-18AVQII (\$240) and Patriot (\$400), and Gap Titan (\$400) are popular for their less obtrusive appearance.

Beam Antennas

Since maximum distance is always a goal for transmitting, antenna gain is critical, and nothing provides more gain more easily than a Yagi beam. Some Yagis are single-band and unidirectional, although they can be combined or stacked into an array for even more gain or for multiple bands.

Beams are available from shortwave through microwave, but remember, their design and custom construction makes them expensive; the lower the frequency (longer elements), the higher the price.

Popular HF beams include tri-band beams for 10, 15, and 20 meters. Cushcraft's three-element A3S (\$600) and four-element A4S (\$700); Hy-Gain's seven-element TH-7DX (\$870) and three-element TH-3JRS (\$360) are great examples. Single-band Yagis (known as monobanders) are widely available from these same manufacturers, and priced much lower (\$150-\$300).

But not all beams are Yagis; some are Log-Periodic Dipole Arrays (LPDA) which not only have good gain, but wide bandwidth which is not possible in a Yagi. Hy-gain's LP-1009A (\$1430) covers the continuous 13-30 MHz spectrum.

Supports and Rotators

Heavyweight beams need towers for support; they can be self-supporting (sunk into a concrete footing) with telescoping sections, or raised into place with a hand crank or a motor. The Rohn 25G 40' tower (\$700) is that company's shortest, but keep in mind that shipping could cost several hundred dollars!

Lighter VHF/UHF beams can be supported by telescoping tubular masts, with or without guy wires. Lightweight sectional masts are available from Radio Shack and TV antenna suppliers. A heavier telescoping mast may be ordered from Hy-Gain (\$200),

Hy-Gain also has half a dozen rotators including their AR-35X light duty rotator for VHF/UHF antennas (\$120), medium duty HAM-IV (\$650), and digitally-controlled T-2XD (\$1230).



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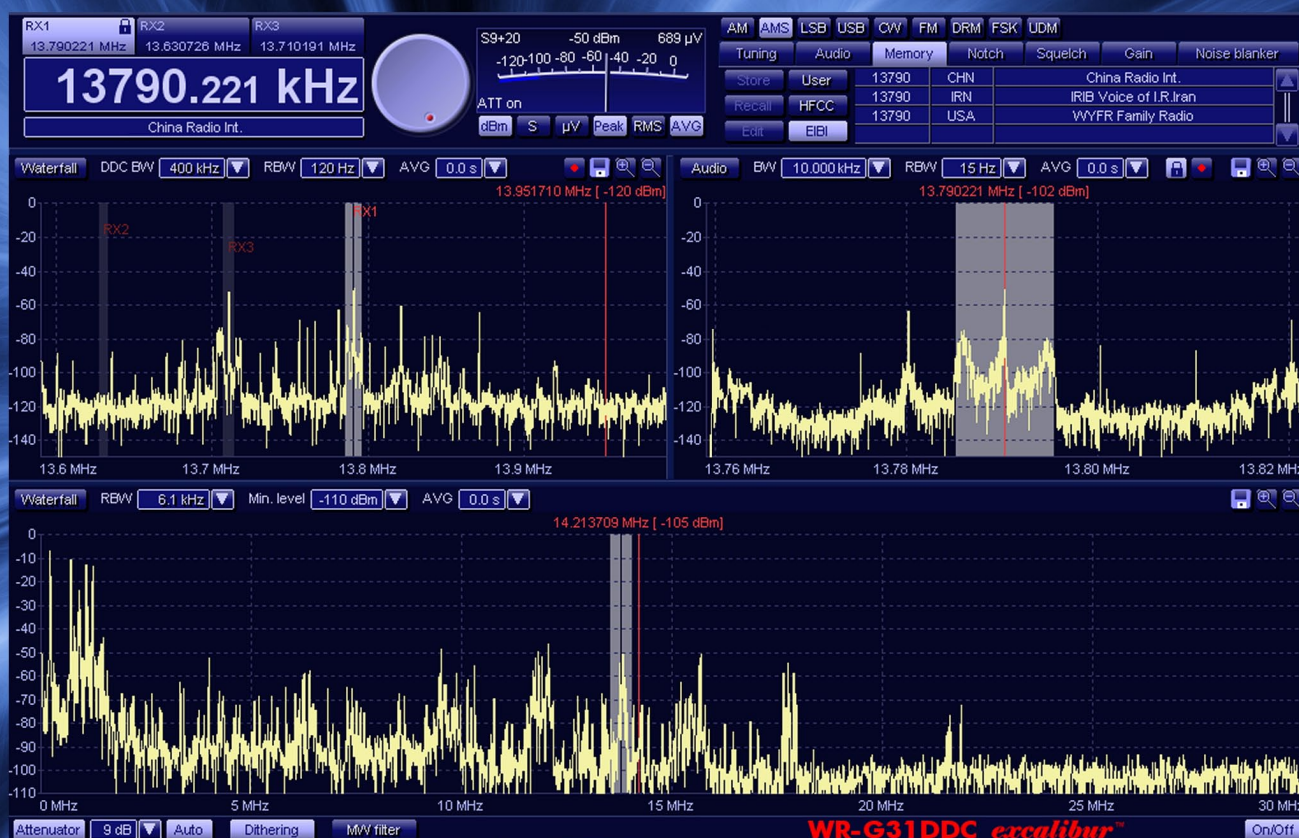


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- Excellent dynamic range (107 dB)
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- Very affordable

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