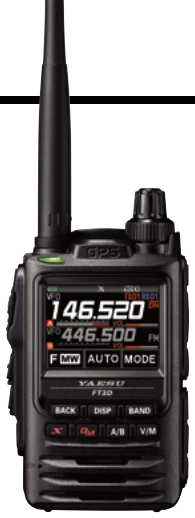
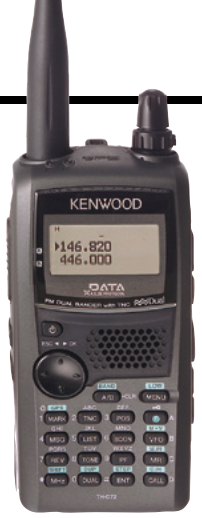
Buying a Handheld Radio

The ICOM ID-31A is a dual-band D-STAR handheld that also receives and transmits analog FM.



The Yaesu FT-3DR is a System Fusion handheld that operates analog FM as well.



The Kenwood TH-D72 is an example of a feature-rich analog-only transceiver.

Why Handhelds Are Called HTs

Many people think handheld transceivers are known as "HTs" because "HT" stands for "Handheld Transceiver," but that's actually not the case.

"HT" is an abbreviation referring to Motorola's "Handie Talkie" radios, which had their roots in Motorola's "Walkie Talkies," military transceivers that debuted in 1940 at the beginning of World War II.

Motorola trademarked "Handie Talkie"—along with the abbreviation "HT"— in 1951 and has guarded it jealously ever since, which is why amateur radio publications often refer to handheld radios as "handheld transceivers."

Check the Reviews

For in-depth information about specific models of handheld transceivers, check the *QST* Product Review archive at arrl.org/product-review.

Most amateurs own more than one handheld transceiver. Different radios can have different uses — public service, AM/shortwave, digital protocols, and so on. Plunging prices make it easier to have a handheld for each of your radio interests. Today you can buy a single-band handheld for less than $40, and a dual-band for less than $100. Not all handhelds are created equal, though. Here are several key aspects to consider before making a purchase.

Single Band or Multiband

This seems like a no-brainer. Who wouldn't want a handheld that can be used on more than one band? But multiband capability also means a more expensive radio, so unless money is no object, you need to ask yourself if you really need those extra bands.

The most common multiband combinations are:

- 2 meters and 70 centimeters (146 and 440 MHz)
- 6 meters, 2 meters, and 70 centimeters (52, 146 and 440 MHz)
- 2 meters, 1.25 meters, and 70 centimeters (146, 222 and 440 MHz)

In terms of activity, the most active bands, listed here from most to least active, are:

2 meters 70 centimeters 1.25 meters 6 meters

You'll get plenty of use out of 2 meters, less on 70 centimeters, and much less on 1.25 and 6 meters. With that in mind, it's easy to understand why 2 meters/70 centimeters is the most popular multiband handheld configuration.

The sticking point with 1.25 meters is that it's not a worldwide amateur radio allocation. Only amateurs in the US and a few other countries have access to the band. As a result, transceiver manufacturers are understandably reluctant to make equipment for this limited market. This factor has suppressed activity on 1.25 meters since the beginning.

As for 6 meters, this band is occasionally available (or *open*, in ham radio-speak) for direct communication over hundreds and even thousands of miles — a feat that led to its nickname, "the Magic Band." However, FM on 6 meters just never caught on and manufacturers have had little incentive to market FM products for this band.

This doesn't mean that you should avoid multiband handhelds that offer 6 or 1.25 meters. Just keep your budget and your local resources in mind. Get a copy of the *ARRL Repeater Directory* or download the RFinder smartphone app to see how many 6- or 1.25-meter repeater systems are available in your area — and then check with local hams to determine whether those systems are active. Being listed in the *Repeater Directory* doesn't guarantee that a repeater system is consistently active.

How Much Output Power

The maximum RF output power you're likely to find in a handheld FM transceiver is 5 watts (W). Many radios offer the ability to adjust the output power, typically from 1 to 5 W in steps. At the opposite extreme, you'll find handhelds with a maximum output of only a few hundred milliwatts (mW).

When it comes to effectiveness, you can rarely go wrong buying as much RF output as you can afford. This is especially true for handhelds, because you're often limited to using the so-called rubber duck antennas that are included with the radio.

There are a few downsides to buying maximum RF output, however:

- More power means more money. A 5-watt radio is more expensive than, say, a 1-watt radio.
- Higher output power drains batteries faster.
- Higher output power requires more components inside the radio, so the radio will be physically larger.
- Higher output power often results in more heat being generated during long transmissions. Some 5-watt handhelds can become uncomfortably warm.

Milliwatt output handhelds are inexpensive, but at that level of RF output you need to have a sensitive repeater close by to relay your signal. Without that, these otherwise fine radios can be disappointing.

So long as the transceiver offers the ability to select different RF output levels, the battery drain issue isn't a serious consideration. In most instances, cost is the main factor.

Expanded Reception

This popular handheld feature often adds to the cost of the radio. A bargain handheld may only allow you to receive signals that fall within the transmitting spectrum of the radio. On 2 meters, for instance, that means 144 to 148 MHz in models intended for the US market.

As price increases, reception range begins to expand. It's common to see 2-meter handhelds offering expanded reception above 148 MHz, often as high as 170 MHz. That may give you access to a fair amount of public service and commercial radio activity, including NOAA Weather Radio between 162.400 and 162.550 MHz — a must-have feature for amateurs interested in public service work.

Many police and fire departments have yet to make the jump to digital communications and you're likely to run into their transmissions above 148 MHz, along with a host of other transmissions from railroads to tow truck operators.

Above the high end of the amateur 70-centimeter band (450 MHz), you'll hear more commercial and public service activity, including the Family Radio Service.

All these transmissions use FM modulation. Climb the price ladder higher still and you'll find radios that offer expanded reception on other frequencies as well as other modulation methods. Some handhelds allow you to eavesdrop on AM transmissions from aircraft at 108 to 137 MHz. You'd be astonished at how much aircraft chatter you may hear, regardless of your location.

Some handhelds offer *Wide FM* reception (WFM), which allows you to listen to broadcast stations from 88 to 108 MHz, although not all handhelds include the ability to receive in stereo.

At the very top tier are handhelds that include general-coverage MF/HF receivers. You can use these radios to listen to AM broadcasts, shortwave transmissions, and even HF amateur activity—in addition to expanded VHF/UHF coverage.

The ability to listen to shortwave sounds like a fine feature to have, and it is, but be sure to calibrate your expectations. Performance on the AM broadcast and shortwave bands is often adequate at best. With the small antennas that accompany these radios, you'll only be able to hear big powerhouse stations. Attaching a longer antenna may improve reception, but keep in mind that these receivers are designed to be used with the small antennas that are sold with them. The receiver can easily overload if you couple it to a longer antenna.

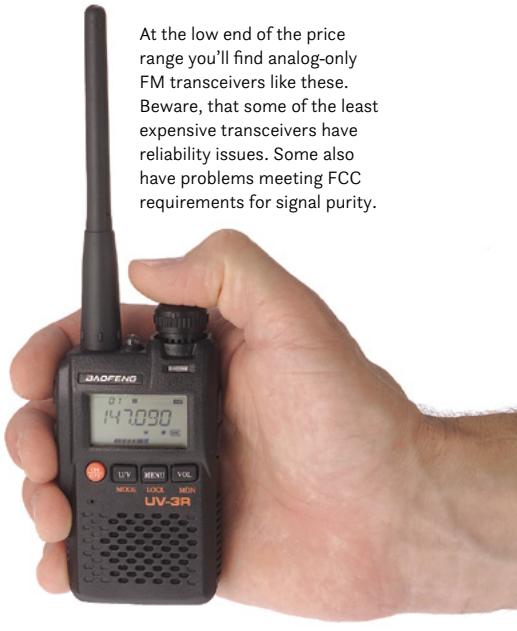
The Best of Both Worlds

Analog Advantages

- Less expensive than comparable digital transceivers.
- Features and functions are easier to learn.
- Analog repeater systems are much more common. In fact, of the roughly 23,000 repeaters in existence today, only about 18% are digital.
- Will still provide audio—albeit noisy—even as the signal weakens beyond the point where a digital transceiver could decode it. (A digital radio will just fall silent —a phenomenon known as the *digital cliff*.)

Digital Advantages

- Send text and other information, in addition to your voice.
- Display the call signs of those you are communicating with and use this information for selective calling features.
- Greater audio clarity — 100% noise free.
- Flexible group calling capability.
- Automatic routing through repeater networks and the internet. (With D-STAR networks, for example, a person with a 2-meter handheld transceiver in Orlando, Florida can communicate with a 70-centimeter handheld operated by a person in Olympia, Washington.)



At the low end of the price range you'll find analog-only FM transceivers like these. Beware, that some of the least expensive transceivers have reliability issues. Some also have problems meeting FCC requirements for signal purity.

Analog or Digital

Until relatively recently, all amateur FM transceivers were analog. You pressed the push-to-talk button, began speaking, and your speech was converted to electrical signals and used to shift the transmitting frequency of the radio. When you received, the process occurred in reverse.

But the early 2000s saw the birth of *D-STAR*, a digital communications protocol developed by the Japan Amateur Radio League (JARL). A D-STAR radio transforms the sound of your voice into bits of data, which are then transmitted and decoded on the receiving end.

A D-STAR transceiver can communicate more than just your voice. The data stream transporting your voice is also carrying your call sign, which appears on the display of the receiving radio, along with the call sign of the D-STAR repeater you may be using. There's a second data stream that can carry more information such as your location (as latitude and longitude coordinates supplied by an attached GPS receiver). Most commonly used D-STAR transceivers are designed for operation on the 2-meter or 70-centimeter bands, and are made by Icom or Kenwood.

Another contender in the digital arena is Yaesu with their *System Fusion* transceivers, which use an entirely different approach to digital communication, and are not compatible with D-STAR.

Another popular digital transceiver is *DMR* — Digital Mobile Radio. DMR began as a system for commercial use, but amateurs adapted it to their purposes and it's now the second-most-popular amateur digital communications mode, behind D-STAR. However, DMR is incompatible with both D-STAR and System Fusion.

Despite the gradually increasing popularity of digital transceivers, analog-only FM radios still comprise the vast majority of amateur radio FM transceivers. Digital radios tend to be more complex than analog transceivers, and each digital system has its own peculiarities. The functional differences between analog and digital hardware are so great, books have been written for the owners of digital transceivers. In the ARRL online store (arrl.org/shop), for example, you'll find books such as the *Nifty E-Z Guide to D-STAR Operation*.

It's worth noting that some digital transceivers are capable of operating as analog FM rigs as well, so you get two modes of communication in the same package.

Happy Shopping

These guidelines can help you set your priorities and standards as you start shopping around. There's a handheld to fit every amateur radio pursuit. Before long, you may find yourself with a collection!

FM Handheld Transceiver Features

Feature	Must Have	Good to Have	Limited Use
5 Watts Output	X		
CTCSS	X		
DTMF Keypad		X	
Illuminated Keypad		X	
Extended Receive Frequencies			X
Wide/Narrow FM		X	
GPS/APRS			X
Time-Out Timer			X
Tone Burst		X	
Switchable Attenuator		X	