A. Basics

1. What's a utility?

Usually "utilities" are defined as what they aren't. They are everything on short wave radio except for broadcasting, CB, and most routine amateur communication. The concept is one of "use" by a few people, rather than as a hobby or for the entertainment of many. Typical examples are weather reports, maritime safety information, ship and aircraft communications, and "numbers" broadcasts intended for spies. Since the information is not intended for the public at large, signals are weaker and/or transmitted in specialized modes. They require more skill in tuning, and often some detective work to find the right frequency and mode. But, for many, this is the challenge.

2. Do I need a special receiver for utilities?

Yes and no. The "yes" part is that utilities will usually be in upper sideband (USB), or any of a bewildering array of digital modes ranging clear from plain old Morse code to the latest computer miracles. For best results, a radio will therefore need a beat frequency oscillator (BFO). The existence of a "USB" button indicates that such an oscillator is present. Also desirable are good tuning stability, and at least one filter narrower than those used for broadcasting (3 kilohertz is good).

Up until only a few years ago, the most popular type of receiver was the free-standing "table top" radio. Typical were the Icom R-75, the Drake R-8, and various higher-priced receivers made by JRC. The Drake was discontinued some years ago, the JRC not long after, and recently the R-75 was dropped from Icom's line.

Today, the choices are between used radios, the receiver sections of the lower-priced ham radio transceivers, and the newer software-defined radios (SDRs).

Used radios are all over, many at relatively attractive prices for this kind of thing. As always, buyer beware. Beginners might want to have an old-timer look the box over before they shell out for it.

Ham transceivers are discussed in question #5.

SDRs are really the coming thing. They are perfect for utility. Prices range from low for tinkerer's experimental gadgets to thousands for high-end packages. These must be attached to computers, and run like any other program. Instead of a tuning knob, you have a waterfall like the ones on decode software, only usually bigger. There's a bit of a learning curve, but after that you'll wonder how you ever did it any other way. Most of these use software written for Windows, though Mac and Linux often have programs available too.

3. Do I need any other special equipment for utilities?

Since signals are weak, it's very desirable to use a better antenna than the whips or wires that come with some receivers. There is absolutely no agreement on what is the "best" antenna, and in fact this changes with where you live, who you live with, and what you want to hear.

A basic antenna often recommended for beginners is simply a wire run from the back of the receiver out a window, up the side of the wall, and then straight out to a convenient tree or building (but **NOT** a power pole!!!!!). Something like this can be constructed for less than ten US bucks. Safety requires that any outdoor antenna, and all feeders or supporting structures, be kept well away from power lines, so that they cannot fall on it, or it on them. It should also be completely disconnected at the first sign of a lightning storm. An arrestor connected to a good outside earth ground is worth considering as well.

As of late, noise generated by poorly shielded (if not illegal) consumer electronics is increasing dramatically. Wire antennas are prone to noise pickup if not connected and grounded properly. A lot of people are switching to small, active, loop antennas of a design which responds only to the magnetic field, while rejecting the electric one where most of this noise is. Wellbrook makes the industry standard, though it's a bit pricey. There are some others, which I know nothing about.

4. Do I need to use a computer?

It depends. USB and AM broadcast don't need them, but digital modes will require a computer for decoding. Standard personal computers work fine. Some modes push the limits of timing and latency on even a top-end PC, while others can actually be copied just fine on mobile phones. Yes, iOS and Android apps exist for this.

At one time, it was necessary to interface the computer through its serial port with a "rig blaster" or "hamcomm interface," but this is now only a factor when transmitting. The only interface needed is a simple audio cable from the radio to the computer's line input, as the sound card will do all the necessary signal processing.

SDRs will need some kind of "virtual audio cable." I have two of these, and they work quite nicely. Mobile phones usually use the built-in mike placed near a speaker, though I've gotten some of my apps to work straight off the incoming Internet connection.

Some non-SDR radios allow for computer control. This is usually a good thing. The exact cabling and interfacing necessary will vary greatly between different manufacturers, so read the manual. Most programs will control the radio via serial I/O on ports COM1 through COM4. Newer USB-based* computers may not have old-school RS232 serial ports, in which case a serial-to-USB adapter cable will often be needed. These cost about $40 US, and some work better with each specific radio than others. It's a good idea to ask around.

While SDRs don't have this problem, it's amazing how many can't be tuned from low-end hobby radio software. This is a factor on ALE, Automatic Link Establishment, where you really want to be able to scan many frequencies. The particular SDR I have is one of the best made, and works like a champ, but the author of the DLL for interfacing radios of this type to ham radio software never ported his code over to it. He just didn't feel like it. These things happen in hobbies.

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*The standard serial I/O bus, Universal Serial Bus, and the most common setting for utility reception, upper sideband, both have the acronym "USB." These things happen in electronics.

5. Can I use a ham transceiver for utilities?

Yes, as we've noted above. Just make sure that it has a general-coverage receiver. A few older ones have add-on converters or other ways of getting them out of band. The signal parameters of ham radio and utility are very similar in many cases, especially if the the radio has a CW filter to reduce QRM on narrow signals. The quality of ham radios varies all over the place, but typically you get what you pay for. The fancy ones are very nice equipment, and they cost like it. The lousy ones will make you wonder why you ever wanted to do this hobby in the first place.

Of course, you won't transmit on the typical broadband antenna used for utility monitoring, right? Good. Just don't. We so hate to see equipment get damaged.

6. What's all this I hear about Universal Time?

Coordinated Universal time, UTC, is the standard time scale for just about anything that uses HF radio. There's a good reason for this. The reason is that the Earth is round.

Now, it would be nice if time zones were the same as meridian lines, and we could just count them off on a map or globe, but this is not the case. In most cases, time zone lines are as much political as geographic. On top of that, the planet's full of half-hour offset zones. Then there's the whole thing with summer time ("daylight saving" in the US). Were it consistent worldwide, there'd be less of a problem, but it isn't. In fact, it's a mess, and really confusing.

And so, to keep everybody sane, nearly all schedules and logs are in UTC, Coordinated Universal Time. For our purposes, it's the same as the older Greenwich Mean Time (GMT), though I don't think anyone keeps that one any more. Mostly, it's the name for the non-summer time in the UK.

Just use UTC, OK? Set a clock on a computer, cell phone, or whatever, and log in it. Get used to tomorrow coming in the US afternoon.

7.Wait a minute. Why isn't Coordinated Universal Time "CUT?"

It's a Universal Time Scale. The others have numbers, like UT1 and UT2, etc. They use differing amounts of correction to the Earth's actual position in space. UTC differs from these in the manner in which it is corrected, which is coordinated by a world time organization in France. Thus Universal Time, Coordinated.

The common misconception is that UTC is "out of order" because the name comes from French. Well, no. The name in French is Temps Universel Coordonné, or TUC. It's UTC because that's what it's name is, and that's about as deep as it gets.

8. Why can't we use GMT?

Because we use UTC. Thing is, though, that it's the same time, for our purposes. So is Zulu (the time on the Zero Meridian). You can call it any of these, and although there are picky little differences, it's not a big deal for logging or scheduling HF transmissions.

Universal Time Scales replaced GMT some time back. GMT was and is Greenwich Mean Time, the mean solar time on the Zero Meridian, better known as the Prime Meridian or the Greenwich Meridian. It's a hallowed British institution. At the time, they had reasons why they should run the Prime Meridian, from which east and west are measured, right through the Greenwich district of London, where the Royal Observatory occupies a hill top. While this sounds awfully Eurocentric, that's actually a good place for it, because it puts the 180-degree date line out in the Pacific where it's easy to jog it around countries.

England did most of the early work on accurate timekeeping for navigation, and besides it had an empire and all that. The Royal Observatory is still there, as a museum, and I love the place. It's a good bucket-list item for radio freaks. There's a Time Building, with very geeky exhibits explaining the whole meridian concept. The science required was decidedly not simple.

Outside, they have the Prime Meridian marked off. Tourists line up to photograph each other "straddling the world." It looks really cool, but unfortunately most global surveying systems in use nowadays have moved the meridian a bit. It's either down the hill a few meters, or farther out in the park, depending on which datum is in use.

I've never been able to find out if the real, solar GMT is even kept any more. It isn't at the observatory, or anywhere in Greenwich. GMT seems to be mostly what the UK calls its standard time zone, when it isn't British Summer Time.

International conferences replaced GMT with "Universal Time Scales" for the world standard. The UTC second is derived from atomic vibrations, and periodically its time of day is synced to the other UT scales with the notorious Leap Seconds. There has been an awful fuss over these, but fortunately that's of interest only to time geeks like myself.

9. Why don't I ever hear anything?

Unlike broadcasters, who widely publish their times and frequencies, utility stations only transmit when they need to. Transmissions often consist of short messages, some lasting seconds. Therefore most utility frequencies are quiet most of the time.

A few stations can be tuned in any time. These include time stations, a handful of weather services, channel markers from surviving maritime coastal stations, and some propagation beacons. Others follow a set time/frequency schedule, such as aviation weather broadcasts, Coast Guard weather advisories, and many data links. Many "numbers" stations use a day/time/frequency schedule, in which the times and frequencies change for day of the week or month.

It's often said, "To catch a tiger, think like a tiger." This is certainly the way to maximize utility satisfaction and hear something besides noise on empty channels. After a while you get a sense of who is most active when, and what frequencies are working the best. This gives utility listening a lot of its challenge.

10. Why is it called "short wave," when it's just about the longest wavelength we listen to?

It's an old name. The wavelength was shorter than the one being used for "standard" AM broadcasting, and so it was the "short wave," even though by today's radio it's quite long.

Wavelength is related to frequency, by a formula where the wavelength in meters (usually symbolized with the Greek letter Lambda) = 300/frequency (f) in MHz. The 300 is the speed of light in a vacuum, 300,000,000 meters per second (actually 299,792,458, but 300 million gets you close enough for rock and roll).

Long wavelengths have low frequencies, short wavelengths have high frequencies. Radio started on very, very low frequencies with very, very long wavelengths sometimes measured in kilometers. It went steadily upward from there as circuitry improved.

Originally, the short waves were considered rather useless. Books have been written about "200 meters and down," the original ham radio band, with which early hams discovered the ionosphere.

Wavelength ultimately fell out of favor as a means of designating radio bands. This happened for a number of reasons, all relating to use of higher frequencies. When we got into microwaves, millimeter waves, and sub-millimeter waves, it got a little silly talking about the 0.0177-meter band.

The current designations for frequency ranges go something like this:

ELF	3-30 kHz
LF	30-300 kHz (longwave)
MF	300 kHz-3 MHz (mediumwave)
HF	3-30 MHz (shortwave)
VHF	30-300 MHz
UHF	300 MHz - 3 GHz
SHF	3-30 GHz
EHF	30-300 GHz

About the only times you hear about meter bands (and often wrong!) are in broadcasting and HF amateur radio. The name short wave is with us forever, though, and I like it. It still sounds kind of loopy and glamorous.

B. Stuff I get asked all the time

1. I just had a huge signal come on with a weird broad obviously from a computer making weird yakking in Spanish, followed by what sounds like computer data. WTF?

This FAQ is actually kind of old. By now, most people have heard of HM01, for "first hybrid mode station," which is what it is. The hybrid is of voice and data.

This is a Cuban "spy" numbers station. It has largely replaced the older Morse technique in which letters substituted for the digits 0 through 9, in order to improve transmission speed. Such techniques on Morse code are called "cut numbers," most common being "T" for "0," and, right behind that, "N" for "9."

The Cuban intelligence service, however, has never done anything the normal way on the radio yet, and we can't expect them to let us all down by starting now. They started off their entry into the Digital Age with simple ham modes such as PSK31, but now it's all in a complicated ham mode called RDFT for Redundant Digital File Transfer

This particular signal can attain some truly astonishing levels in the U.S., because the transmitters being used are most likely adapted from broadcast stations, with many times the effective radiated power of the typical utility. In fact they may well have been the first to use double-sideband AM to transmit these ham modes intended for upper sideband (USB/ J3E) emission.

They're not the last. At least three international broadcast stations have digital, usually MFSK32, for short periods on weekends (UTC).

2. Who is DESUO (or DEVO, or DESU, or Olivia Radio in voice, or some weird station in garbled Spanish)?

This is a Greek maritime station, SVO, Olympia Radio. It has a truly awesome facility well inland, though the control point remains at the older Athens Radio which it replaced. It's a relatively new station, as they go in this service, and doesn't always make it onto all the truly ancient lists circulating the Internet.

The actual Morse code transmission is "DE SVO," a channel marker. (DE is a Morse signal meaning "from.") Now, people know what the ionosphere does to CW signals, but computers don't, though they're getting better at it. Therefore the machine spits out all manner of weirdness on this one.

The voice is a different story, though the same principle. The identifier is on a voice loop (aka "voice mirror") which is distorted to start with, then it goes off into the ionosphere a few times, gets nicely phase distorted, fades up and down, and becomes misheard all kinds of creative ways. The loop alternates English and Greek, though the Greek is so distorted that indeed it sounds like Spanish on a noisy frequency. In this case, it's not all Greek to me.

3. I keep getting a noise that sounds like those old recordings of whale songs, or the 60s psychedelic rock. Is this my radio?

Nope. It's a set of funny noises known in the hobby as the Whale Sound Station or the Backwards Music Station. They tend to be associated with US and NATO military circuits using lots of gain compression. The exact mechanism of their generation remains unknown, though several theories exist. In all cases, the sound stops when someone talks or transmits data on or near the frequency, then fades gradually back up.

It's far from dead. In 2015, it was heard coming from the equipment used to broadcast Taskhent Volmet.

4. Those "numbers" stations sound really creepy. Are they really for spies?

In most cases, yes. Spies have been arrested with decoding pads and lists of frequencies. At least some of these transmissions are instructions or just a friendly "we're still here, carry on." They are not for the trench-coat movie-type spies, but more for the low-level deep-cover grunts recruited in-country by foreign agents. These spies live in the community, work at the target sites, or whatever. They would be in big trouble if seen with the fancier 007 type of gear, but a normal little broadcast receiver and possibly a laptop computer won't raise any suspicion. For this reason, "numbers" stations tend to use high power and AM or USB mode, and go out of their way to be found easily, by running open carriers, music, or odd noises.

In many cases, the messages are probably dummies, to defy traffic analysis, and in fact some have been heard being repeated for months. They are usually deeply encrypted with a system using random statistics from atomic disintegration counts, and decrypted with a one-time pad where every page is thrown away after use. As long as everyone follows instructions, this system is for all practical purposes unbreakable, even if pads fall into the wrong hands.

The Cubans tried to refine the system and make it more automatic. As a result it became far less secure. This was great for the US national security, but not so good for the various Cuban spies now doing Federal time.

5. I was listening to the radio and suddenly everything just stopped. I checked my antenna and it seemed ok, plus my radio still works on local stations and/or the power line noise is the same. Is something broken?

If it's daytime, most likely the ionosphere is broken. These shortwave fadeouts (SWFs) are caused by Sudden Ionospheric Disturbances (SIDs) which in turn are caused by large X-ray flares on the sun. X-rays of sufficient intensity can render the ionosphere unusable for up to an hour on the entire HF band. Since most static is ionospherically propagated lightning, it goes away too, and things get eerily quiet. Although the fadeout only takes seconds, the signals come back more slowly.

What's happening is that, as ionospheric opacity increases, the lowest usable frequency goes so high as to be out of the normal listening range, or clear out of HF altogether. Sometimes tuning higher in frequency can turn up unusual activity on normally dead bands such as 10 meters or even VHF. One especially violent such event made Australian TV picture carriers briefly audible on scanners in the US.

This effect is not associated with the Northern or Southern Lights, but the solar mass ejections that accompany many large flares can often increase aurora in 36-48 hours depending on their direction of ejection and the interplanetary magnetic field. Aurora will not cause sudden fadeouts, but it will decrease signal strengths and cause a fast fluttery effect sounding a bit like electronic music.

6. Do I need to learn Morse code?

No. Morse is still used on occasion, especially in the Russian military, but mostly it's useful for reading the identifiers in channel markers. These are short, and sent slowly, like the airplane navaids you might be used to from flying.

Most ham radio licenses have either dropped "code," or greatly lowered the speed of the test.

People hated the code because they were forced to learn it. Love it or hate it, it was compulsory, and that made it a burden for a lot of people, giving it a bad reputation. I suspect this will change, as only people who like the code will spend any time on it. There will be two kinds of people - those who don't have to think about the Morse code at all, and those who do it for fun. If you have the latter turn of mind, code IS fun. It's like making music, or meditation.

7. Is short wave dead/dying?

No. Only certain uses of it are dead/dying, and they keep inventing new ones. In fact there is a certain rediscovery of the ionosphere going on, as people realize the attractively cheap option of using "God-Furnished Equipment."

Even in the USA, there's a huge interest in HF backup networks as preparation for some future emergency in which all the more "modern" stuff goes away. They kind of learned this the hard way, mostly after hurricanes.

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