USB Basics
By Steve Ford – WB8IMY

Transferring Data and Power

At a basic level, USB consists of two main components: the USB host and the USB device. The USB host is typically a computer that provides the power and/or controls the data transfer. It can also be something as simple as a power supply module, sometimes referred to a a wall wart.

The USB device, on the other hand, is an external device that is connected to the USB port. This can be a transceiver, smartphone, tablet, and so on.

When you connect a USB device to a USB port on a computer, several things happen:

Device recognition: The computer recognizes that a USB device has been connected and starts communicating with it.

Power delivery: The USB connection provides power to the connected device, allowing it to operate without requiring a separate power source. This is why you can charge your smartphone or other USB powered devices by connecting them to a computer or a USB charger,]. The same can be true of handheld transceivers.

Enumeration: The computer communicates with the connected USB device to determine its capabilities and functionalities. This process is call enumeration. During enumeration, the device and computer exchange information about the device's manufacture, model supported protocols, and other details.

Data transfer: Once the enumeration is complete, data transfer can take place between the computer and the USB device. The USB standard supports different transfer speeds, ranging from the original USB 1.o with a data rate of 1.5 Mbps (megabits per second) to the latest USB 3.2 with data rates of up to 20 Gbps (gigabits per second). The actual data transfer speed depends on the USB version supported by both the computer and the device.

In ham applications, you'll often find USB connections used to provide software control of transceivers. If you own logging software, for example, the software may be able to communicate with your radio via USB to automatically read your operating frequency, operating mode and much more. This makes it much easier to add the details of each contact to your log. This is especially valuable with digital modes, during over-the-air contests, so much so that virtually all contest software available today supports USB transceiver control.

Software used with digital modes, such as the popular WS/T-X software used for FT8 operating, rely on USB not only for radio control, but also to communicate with so-called interface devices that convert data from the computer into sound the radio can transmit (and vice versa). Some of these interfaces are available as separate boxes that may sit next to your radio, but many transceivers now have interfaces built in.

If you own a modern handheld transceiver, chances are it uses USB to allow your computer to program its memory channels, charge its internal batteries, and other functions.

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USB Cables and Connectors

There are many distinct types of USB cables, but most have the traditional rectangular connector used on most computers and other devices such as chargers (see Figure 1).

At the other ends of the cables, you'll find a variety of connectors. The most common ones found in amateur radio stations are…

USB-B: This sizeable connector usually plugs into printers as well as some amateur ratio HF transceivers (see Figure 2).

USB-C: This is a reversible, compact connector with fast data transfer and power delivery capabilities. It has become more prevalent in devices such aa smartphones and tablets, but it has yet to become widespread in ham gear (see Figure 3).

Micro USB:B: This small connector (see Figure 4) sees considerable use, especially in handheld transceivers)

Mini USB: Another small connector (see Figure 5) that can be easily mistaken for a Micro USB. It has become less common in recent years.

Proprietary Connectors

Some handheld transceivers use custom proprietary connectors rather than the ones mentioned previously. An example is shown in Figure 6. This USB cable is used with a handheld transceiver that communicates to computer through its microphone/speaker jack.

You may also encounter special cables that include the USB communication device as part of the cable itself (see Figure 7). Some of these will only function with certain types of software, so you must have the correct software installed before you can use them.

Cable Lengths

It is important to note that USB cables have limited usable lengths because of changes the cables can cause to the data signals. USB 1.0 and 2.0 cables can stretch to about 15 feet before problems begin to arise. Newer, faster versions of USB 3.0 are limited to only 6 feet. When in doubt, always choose the shortest possible cable for you application.

USB Cables and Interference

USB cables can act like antennas and pick up the radio frequency (RF) energy generated by your transceiver. This will interfere with the data signals within the cables and can even cause a computer to suddenly stop communicating with the device. For example, if you are using contest logging software you may discover that your software crashes every time you transmit on a certain frequency band.

Not only that, USB cables can radiate signals generated by computers. These signals will show up as interference in your receiver.

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You can purchase USB cables that come equipped with chokes that block RF. In stubborn cases, however, you may find that you must wrap several turns of the cable through a ferrite core (see Figure 8). These cores are available from several outlets including Amazon. For ham radio use, try an FT31 core for HF signals or an FT42 core for VHF signals.

Figure 1: There are many types of USB cable, but all of them are traditional rectangular connectors that plug into your computer of power supply.

Figure 2: The square USB-B connector is often found in modern HF transceivers.

Figure 3B: The USB-C connector is becoming increasingly popular.

Figure 4: The Micro USB is a small connector you'll often find in handheld transceivers.

Figure 5: The Mini USB is a small connector that has become less common in recent years.

Figure 6: This specialized USB cable is used with a handheld transceiver that communicates to computers through its microphone/speaker jack, which is, why it has a dual-conductor plug.

Figure 7: Some special USB cables include the USB communication device as part of the cable itself.

Figure 8: You can make a choke to suppress interference by wrapping several turns of the USB cable through a ferrite core, as shown here.

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