VSC-X: A Virtual Serial Cable to Remotely Program Your Mobile Radio

How long of a serial cable do you need? Transfer your data wirelessly!

With hundreds if not thousands of memories available, mobile radios have become increasingly capable and increasingly complex to program. This has naturally given rise to the development of computer software to allow users to manage memory contents and program the radios. Mobile radios, however, are most often located in cars and trucks where users generally don’t have computers. As a result, in order to program the radios it is necessary to either bring the radio inside to a computer or bring a computer to the radio.

This inconvenience means that many users make changes to their radios either infrequently, or never.

Every ham radio operator knows that the solution to transmitting data over a distance that is too long for a cable run is, of course, radio. Using radio to program your mobile radio, however, requires that you find something faster and more robust than the standard 1200 baud (or even 9600 baud) packet signals that most hams think of when they think about data transfer over radio. A lot of software for programming radios requires that the effective data throughput (not just the raw bit rate) be at least 9600 bits per second.

There are some higher speed digital radio links available, but for the most part they are very low power or very expensive. What we need is an inexpensive way to transmit data with at least a 9600 bit per second throughput that has a signal strong enough to provide reliable communications between a computer in the house and a mobile radio inside a car. It would also be nice if the resulting data link
could use a USB port on the computer rather than the rapidly vanishing serial port. Finally, it would be nice if this serial link could work for both radios that have conventional RS-232 serial ports (such as the Kenwood D700 and D710) and radios that have TTL level serial ports (such as most ICOM and Yaesu radios). The virtual serial cable (VSC-X) described in this article provides exactly this solution.

A company called Digi, Inc. manufactures a line of data transceivers called XBee modules. These modules provide a transparent data link that is capable of continuous throughput of at least 9600 bits per second. The modules come in two power levels. The XBee Pro module is most useful for this project, because the output power of the unit is 50 mW. This is substantially higher than the 1 to 2 mW that is available on most inexpensive RF data modules. The XBee Pro modules are available in three antenna configurations. You can get them with an on-board “chip” antenna, but somewhat better range can be had with what they call a “wire” antenna. This is essentially a tiny whip (see Figure 1). Alternatively, it is also possible to purchase these modules with a U.FL antenna connector in order to connect a range of other antennas. The radios operate in the popular 2.4 GHz frequency band. The price of the XBee Pro module is only about $32 each from Digi-Key, Mouser and other suppliers.

The XBee modules use the ZigBee protocol. Wikipedia describes ZigBee as a specification for a suite of high level communication protocols using small, low-power digital radios based on an IEEE 802.15.4 standard for personal area networks.

The data interface to the modules is asynchronous serial TTL level data. As a result, it
is relatively easy to interface them to either a
PC (assuming you provide a USB or RS232
interface) or to a radio (with no interface for
radios that support TTL level signals or with
an RS232 level converting interface for the
rest). In either case it’s not really necessary to
provide any “intelligence” in the circuit beyond
that which is supplied by the XBee module
itself. The XBee module also requires a 3.3 V
power supply of approximately 300 mA.

Casual experimentation showed that
the XBee-Pro modules could easily handle
9600 bps data over fairly decent distances. I
plugged one into the computer on the second
floor of my house and was able to walk 3
houses down the street with no loss of data. I
brought the unit back to my driveway, put it
in the trunk of my car and closed the trunk and
brought the unit back to my driveway, put it in
the floor of my car under the driver’s seat and
still had almost perfect copy. With the radio on
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floor of my house and was able to walk 3
plugs with that cable.)

The VSC-X serial adapter uses a female
DB-9 connector. Since radios that use RS-232
level signals (like the Kenwood D700) generally
have male DB-9 connectors, the adapter
will plug directly into the radio (no cable
required!). While the Kenwood D710 also uses
RS-232 level signals, it does not have a DB-9
connector. As a result, an adapter cable is nec-
essary to connect to the radio’s 8 pin mini-DIN
connector. You can either use the PG-5G cable
available from Kenwood, or you can construct
your own using the diagram in Figure 6. (The
PG-5G cable uses a female DB-9 connector;
so you will need a “gender changer” adapter
with that cable.)

If the radio you are using requires TTL
level signals rather than RS-232 level signals
(for example, the Yaesu FT-857 or most ICOM
radios), it is necessary to remove the ICL3232
from its socket and jumper the inputs and out-
puts of the chip’s socket. This is done by plac-
ing jumpers across pins 1 and 2 and across pins
3 and 4 of JP1.

Since virtually all radios that use TTL level
signals do not have a DB-9 connector, it will
be necessary to construct a cable that connects
the TXData, RXData and ground lines. For
example, on the 800 series Yaesu radios, the
connection to the computer is made through
an 8 pin mini-DIN connector, wired as shown
in Figure 7.

In order to connect VSC-X to an ICOM

I developed a second board to support the
serial port connection to the mobile radio. The
VSC-X serial adapter requires 5 to 15 V dc
at 300 mA. Typically this would be provided
either by the radio power supply or with a 9 V
battery. Be very careful if you power it from
the radio power supply, because if the ground
connection from the adapter to the power sup-
ply comes loose, the full 300 mA will flow
through the ground circuit on the radio’s com-
puter connector. See Figure 4. The VSC-X
adapter reduces the input voltage to 3.3 V to
power the XBee module. The XBee module
also uses 3.3 V signal levels. As a result, I used
the 3 V version of the usual MAX 232 chip
(ICL3232). The resulting circuit is shown
in Figure 5. Note: C4 must be at least 35 V.
(This may have more to do with the need for
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Figure 4 — The VSC-X serial adapter is shown in this photo. Part A is the top of the circuit board and Part B is the bottom of the board.

Figure 5 — VSC-X serial port adapter circuit.

Decimal values of capacitance are in microfarads (µF); others are in picofarads (pF); Resistances are in ohms; k=1,000, M=1,000,000.
radio with a CI-V interface (IC-706, IC-756, IC-703 and others), you will need an adapter using a ¼ inch phone plug using the wiring diagram shown in Figure 8.

Using the VSC-X modules is fairly straightforward. There is nothing that requires configuration; you just plug them in and they work. Configure your radio programming software to use the port where the USB module appears after driver installation, and set the data rate to 9600 baud and you should be ready to program your radio.

While the VSC-X was designed to allow remote reprogramming of mobile radios, it can be used for virtually any application where a serial port connection is needed and data flows at a rate of 9600 baud or less. Remote antenna tuners that are controlled by serial ports or weather stations that deliver data over a serial connection are two examples of other applications that have been suggested for VSC-X. You might have other ideas for ways to use your virtual serial cable. [How about a connection between two computers to transfer files? Your editor is considering a pair as a way to put his old West Mountain Radio RigBlaster back into service with a computer that lacks the required serial port. What other applications can you come up with?—Ed.]

Notes

A complete set of boards and all of the parts necessary to build a pair of VSC-X modules (except the XBee Radios) is available for $40 plus $5 shipping from John A. Hansen, 49 Maple Avenue, Fredonia, NY 14063. A complete set of parts to build a pair of VSC-X modules, including 2 XBee Pro modules with whip antennas are available for $110 plus $8 shipping. Pre-wired radio cables are also available. Because of export restrictions, the kit with XBee Pro modules is only available for shipment to addresses inside the US. See www.vsc-x.com for more details.