

All Things Digital

Amateur Radio for the 21st Century
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Happy New Year and welcome to my very first TCA column article! As you can see by my picture, I have the face for radio; a middle-aged, spectacled, greying, balding male, carrying a few extra pounds—the typical Ham Radio Operator of the 21st century. Many thanks to Bill Unger, VE3XT, (Ontario Northeast RAC Regional Director) for convincing Alan Griffin (TCA editor) to allow me to write for TCA (or at least try), and you’ve probably guessed it’s not about talking! Sure, I like to rag-chew with the best of them (ask anyone who knows me), but for emergency communications (EmComm) and passing lengthy formal messages, emails, images, or data files, voice just can’t compare to digital, IMHO. Even Morse code is still very handy, especially with language barriers.

ABOUT ME

I’ve always had a passion for radio and electronics, but never had much ability in either. The Canadian Air Cadet program provided my basic electronics training at CFB Trenton and after high school Transport Canada hired and trained me as a Radio Operator. I learned Morse code, typing, weather observing, electronic navigation aids, air and marine radio procedures, etc., at the Transport Canada Training Institute, Ottawa. Graduating from RO class (19)76-7 and near the bottom, my course instructor told me while I wasn’t a “natural”, if I worked hard at it I’d do “okay”. Well, after thirty-five years and near the end of my professional RO career, I guess that he was right—I did do “okay”.

MY GENERATION

Before I get to the specific topic, here’s what I have to say about we “Baby Boomers”. Attempts are always being made to target a younger generation and expose them to Amateur Radio in order to keep the hobby growing; well, I say that that’s probably the wrong approach! My eyes were opened after being involved with the restoration and rebuilding of the NWO Senior ARC (VE3SAO) located at the 55+ Centre, Thunder Bay. Every day, hundreds of seniors who use the Centre’s facilities walk past the Ham Radio room and they often stop, look, and listen.

Many are taking various computer and digital photography courses and expanding their interests because they now have the extra time and money. According to the ARRL, most new Hams are coming from among retirees and various groups interested in emergency communications.

Boomers grew up before computers, Internet, iPhones, Wi-Fi, et al. My generation remembers the “magic” of radio with glowing tubes, and listening to shortwave radio stations late at night. Many lost interest when they started careers and families, and put radio on the back burner, but they only need a little spark to fire things up again! Having an active Amateur Radio station (and club) at the 55+ Centre certainly makes easier to target this fastest growing segment of the population, and a federal New Horizons grant made it possible for a very dedicated group of 55+ Hams to resurrect the station after it had been QRT for over 10 years!

LET’S TALK DIGITAL

I suspect that many readers are already working the digital modes, so I may be “preaching to the choir” when I start to talk about how to get started. I’m not an expert by any means, and with my grade 12 diploma (barely), I’m probably not at the higher educational level of many of you.

This column is aimed at exposing the new or veteran Ham Radio operator who has heard strange beeps, burps, and musical tones when tuning across the dial; they often know these have something to do with digital modes, but aren’t quite certain on how to go about getting into this fascinating and very useful aspect of our hobby. So, I’m hoping my column will appeal to you, the digital newcomer.

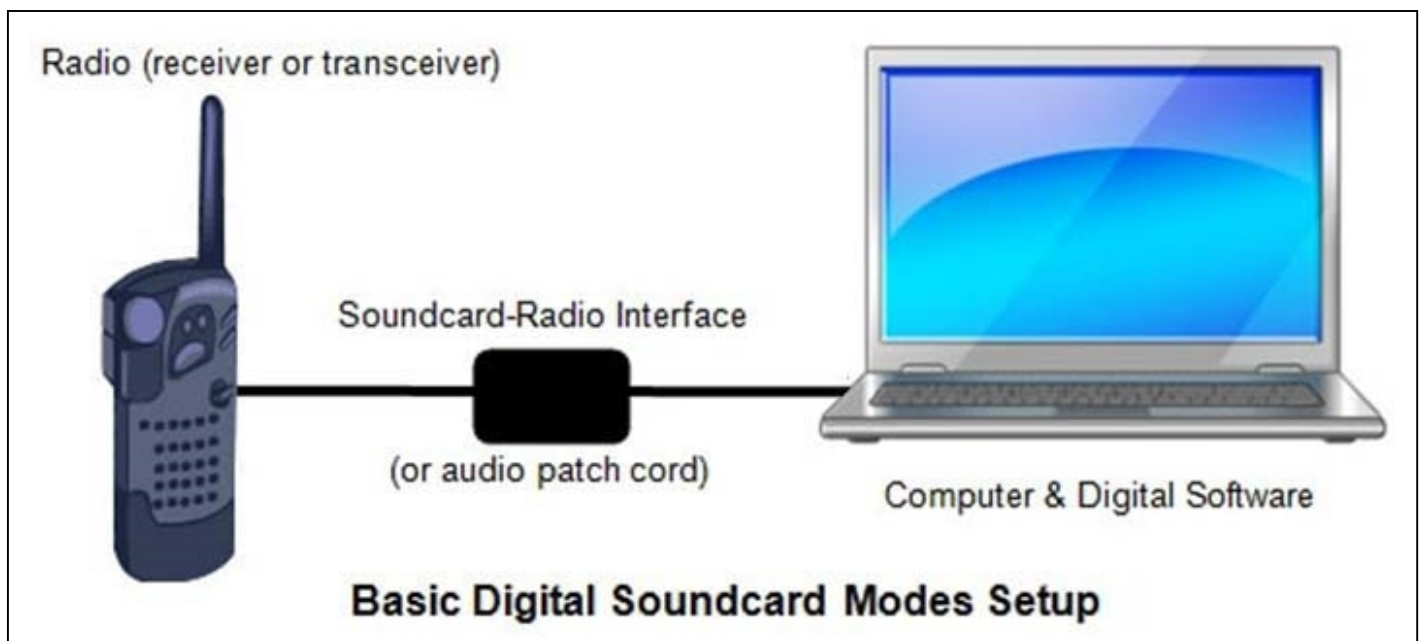
Using digital modes you can send and receive radio emails, position report beacons, pictures, data files, etc., all from the middle of nowhere! You don’t need Wi-Fi, Internet, landlines or anything else except your Ham Radio gear and a computer. As a Boomer, I’m constantly learning about new things and this column won’t be limited to just digital modes; there’ll be articles on computer programming, special use antennas, electronic circuits, kits, how-to tips and techniques, and whatever else seems to be related to the topic even if a bit off tangent—just no voice stuff.

WHAT DO I NEED?

Four things are required: a computer (desktop, netbook, laptop, or tablet) with a soundcard; a radio (transceiver, scanner, shortwave, HT, etc.); the appropriate digital mode software (often free), and a soundcard-radio interface. Most Hams already have the first two, and I’ll provide the links to the software. Almost any computer running Windows, (Linux or Apple operating systems can be used for the digital radio modes, but the radios must be solid-state and have good frequency stability.

This leaves the soundcard-radio interface and we have a few options depending on if you just want to decoded signals (to see if you are interested), or if you want to jump right in and transceive. From my own experience, I suggest you begin with the first option because your start-up costs are low, and if the digital modes don't interest you, no big loss. All you need is an audio patch cord (stereo or mono) with the proper type and size of plugs at each end, or you can make (not hard) or buy a more sophisticated transceive interface.

Most digital modes use software with a visual display of the signal (called a waterfall) and the decoded data (images or text), so good hearing isn't required, and you don't have to talk—just be able to two-finger type. The basic equipment and operating techniques always remain the same no matter what digital mode you choose; master any one and you've mastered them all!



APRS (PACKET RADIO)

Tune a VHF FM receiver to 144.390 MHz; this is the common North American simplex frequency for APRS (Automated Packet [or Position] Reporting System). Listen and see if you can hear some distinctive audio tone bursts, or point your browser to <http://aprs.fi>, enter your callsign, and the site will generate a graphical map of any APRS stations in your area. Unless you are in an isolated location, you should have some VHF APRS (or packet radio) activity. If not, there are several world-wide HF frequencies: 14103 kHz (LSB, see <http://net14.org.uk>) or 10147.60 kHz (USB).

What is APRS or packet radio, you ask? Well, it's a radio transmission mode using binary packets (bundles) of data, and dates back to the 1970's when Canadian Hams (in BC, then Quebec) created the world's first Amateur Radio packet radio network. On VHF, packet radio uses AX.25 protocol and transmits binary data (1's and 0's) via AFSK (audio frequency shift keying using two audio tones (1200 and 2200 Hz)).

The old teletype terms mark (1) and space (0) are commonly used, with the low tone for the mark and the high tone for the space. The VHF data rate is a blazing 1200 Baud (roughly 1000 words per minute), but don't laugh because it's fast enough to send text-based emails and small files.

Packet radio provides 100% error free copy, so you'll know if the other side has got the message or not. Hams used packet radio years before the modern Internet to move text-based electronic messages and data around the world, and had direct (keyboarding) chats between stations. Today, packet radio is very alive and kicking (cellular phone systems use packet radio), including the super variant called APRS.

Created in the late 1980's by packet radio pioneer Bob Bruninga, WB4APR, APRS combined the then new GPS technology with packet radio plus a geographical information system (GIS) mixing graphics and maps. APRS gives you the ability track and be tracked by others, use maps combined with graphics, send short text emails or SMS (short message service) cellular messages, transmit/receive weather information, and on and on, via radio alone or in combination with the Internet, or a cellular phone service (if available). APRS is used for search and rescue, onboard the ISS (International Space Station), for EmComm, and public service events. APRS was essential at the Atlanta summer Olympics (1996) to track ground events and align airborne (helicopter) cameras recording the events. Bob is a senior research engineer at the U.S. Naval Academy, Norfolk. He's taught many midshipmen engineering students about APRS, and according to legend, the very first thing APRS tracked was the Navy goat mascot! See <http://www.aprs.org>.

DECODING SOFTWARE (UZ7HO SCM & AGW PE)

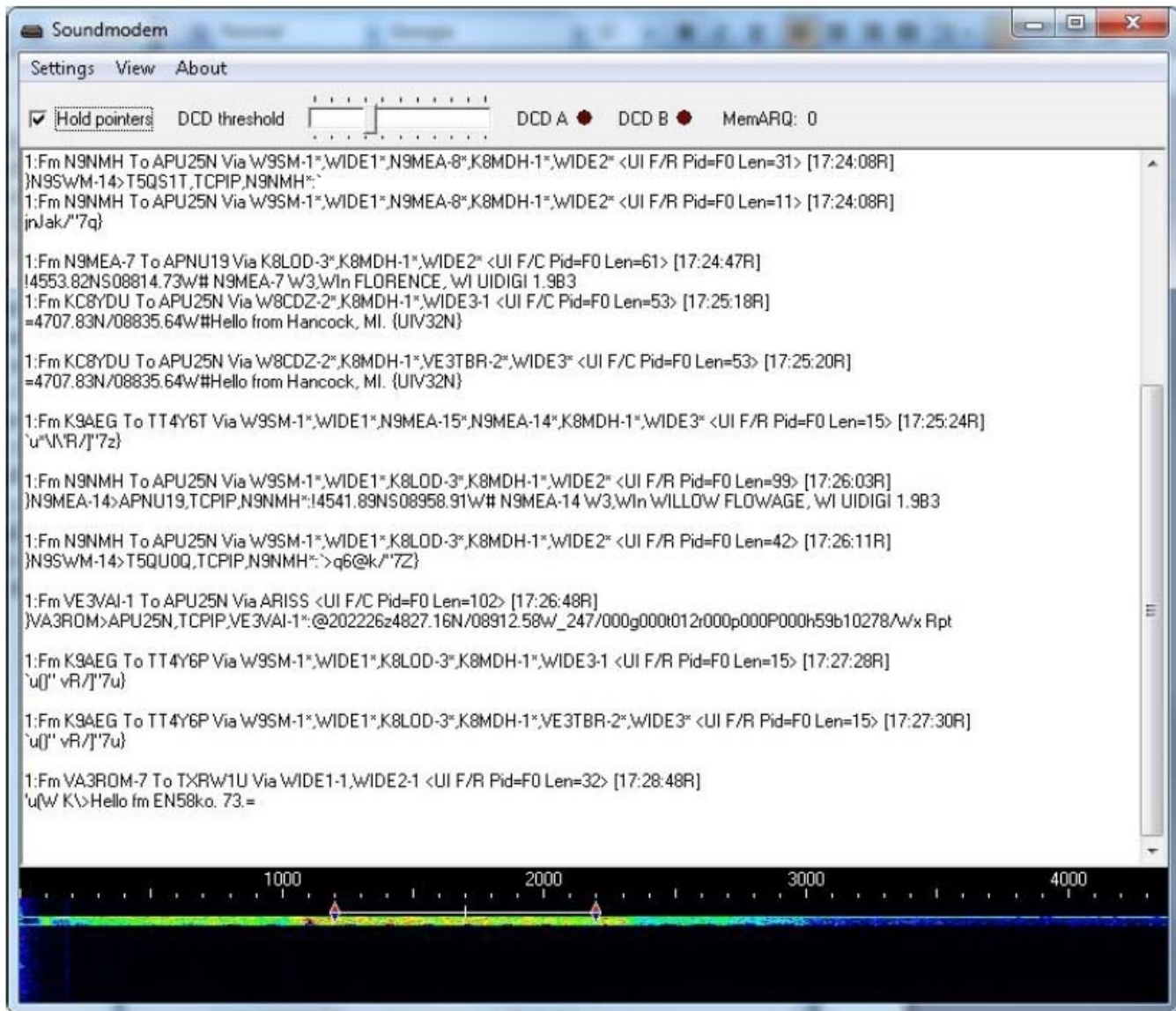
Free APRS and packet radio (VHF/HF) decoding software called UZ7HO SCM (soundcard MODEM) is available from Andrei Kopanchuk, UZ7HO (<http://uz7.ho.ua/packetradio.htm>). Your Internet DSL box is an example of a MODEM (MODulator-DEModulator) because it converts information into a binary data transmission stream and converts a received binary data stream back to information for communications between you and the Internet. Andrei wrote SCM as a compatible replacement for the older (and limited) AGW PE (packet engine) written by George Rossopoylos, SV2AGW (<http://www.soundcardpacket.org/2agwget.htm>). SCM is easier to setup and use, and has nice waterfall and text displays lacking in PE. SCM is especially useful when operating HF APRS because the HF tone pairs were never standardized as they are for VHF, so there's much confusion about how to set the correct HF dial frequency.

LET'S DECODE SOMETHING!

Download, install, and run the UZ7HO SCM program. There's an included PDF help file explaining how to configure the program so I'll only give you the quick start version.

1. Tune your VHF FM radio to 144.390 MHz; adjust the squelch and volume as you would for voice monitoring.
2. Plug one end of an audio patch cord (stereo or mono) into the radio's speaker or AF out (tape or fixed level audio) jack, and plug the other end into your computer's line in (for desktops), or microphone in (for laptops/netbooks/tablets).
3. Run the UZ7HO SCM program.
4. If you have more than one soundcard, use the **Settings|Devices** menu to select the soundcard you've connected to your audio patch cord. Leave the other settings at their defaults. Click the **Okay** button.
5. Use the **Settings|Modems** menu and set **Channel A** to 1200 Baud with the drop down data box. You should see the waterfall pointers move and sit on 1200 and 2200 Hz (1000 Hz shift); the standard VHF packet tones.
6. For HF packet, you select 300 Baud and the pointers will move and sit on 1600 and 1800 Hz (200 Hz shift). These are the standard Kantronics (Kam) TNC tones, but there are many other tones depending on the TNC manufacturer! Other pairs used are: PK-232 (2110/2310 Hz), TM-1 (1100/1300 Hz), and AGW PE (2100/2300 Hz). These tones require you to add or subtract from the listed dial frequency (USB or LSB) to correctly centre the mark/space signals. See http://wa8lmf.net/aprs/HF_APRS_Notes.htm.
7. Click on the **Hold Pointers** checkbox so you don't accidentally move off frequency.
8. From the **View** menu you can uncheck the **Second Waterfall** menu option to unclutter the display since we are only monitoring one channel source.

Depending on the soundcard input used, adjust the levels so that you aren't over-driving the audio. If the level is too high, the waterfall signal traces will be bright red. If you've done everything right and have VHF APRS local activity, you should see decoded radio packets appear in the text window. Congratulations, you're now decoding APRS!



UH7HO SC MODEM Display

If you can't decode any signals (providing you do have VHF APRS activity), check for a bad audio patch cord (use an ohmmeter); ensure that you're plugged into the proper soundcard input, and have selected it as the default device via the Windows soundcard control panel; turn up the radio's volume control, check the squelch level, and see if this helps. For those who don't have any local activity, if you have an HF transceiver (or shortwave radio with sideband), try decoding APRS on one of the HF frequencies.

My FINAL

To transmit digital signals, you'll need to make or buy a soundcard-radio interface (there is an acoustic coupling method but it's used when other options aren't available). I'll cover the interfaces and much more in my next column. Please email any questions, comments, critiques, or suggestions to va3rom@gmail.com. —73