NUE-PSK Digital Modem

Operating Manual

(For software version 3)

The **NUE-PSK Digital Modem** is a standalone, battery-operated digital modem using Microchip dsPIC technology. Weighing about 12 ounces and requiring only 60ma at 12V DC, the modem is easily taken to the field. For easy visibility in high or low ambient light, the NUE-PSK modem's backlit graphic LCD displays transmit and receive text data, as well as band spectrum and tuning indicator. When coupled with a standard PS2 or USB keyboard and an SSB-capable transceiver, you can have an effective portable PSK31 station. Optional internal USB card provides for saving QSO text files, easy software updates, and real time clock.

CONTENTS

VERSION HISTORY

The version number of this manual corresponds to the software version running in the modem, which is displayed in the display's "splash screen" when the modem is initially turned on. (The small letter after the version number in the splash screen differentiates minor fixes for the specific version.)

ver 1.15 – Initial production release.

ver 1.20 – Improved speed tuning, F10 for Tx mode, Ctrl-S char, backspace and CWID fixes, and improved displaying/saving/loading of configurable modem settings.

ver 1.30 – Initial support for the optional USB add-on hardware and improved text entry keyboard sequences and commands.

ver 1.33 – Full USB support adds PC Bootload and Flash Bootload capabilities.

ver 1.34 – Beacon Mode added.

ver 2.10 – RTTY Mode added.

ver 2.33 – Added: Upload / Download Config, spectral display improvements, Beacon Counter.

ver 3.00 – Added: Real Time Clock Calendar feature (RTCC).

1) Introduction

PSK31 is one of the latest communications modes to capture the interest of hams worldwide. Its inherent ability to dig out weak, nearly-inaudible signals is ideally suited for low power QRP enthusiasts. The PSK31 digital modem engine, however, requires intense DSP processing that is only commonly available in PC sound card. Thus the PSK operator desiring portability for field operation is locked into using a laptop computer as a controller, which results in a cumbersome station. But there's hope!

The NUE-PSK Digital Modem offers a unique way for hams to get on the air using the digital modes. No PC is required, thus enabling one to communicate using PSK31. This self-contained, hand-held modem connects to your SSB transceiver and allows you send and receive text data using the PSK31 digital mode.

PSK31 is actually one of many modulation techniques within the "phase shift keying" family of communication. PSK31 operates at 31.25 bits/second, while other speeds may be achieved using variations to the software algorithm. PSK is perhaps more accurately termed BPSK, for bi-phase shift keying, whereby two distinct phase states separated by 180 degrees are used to convey the information. Four states may also be encoded/decoded, as is done with QPSK (quad-phase shift keying), in order to provide higher speeds with greater error correction ability.

The NUE-PSK digital modem can currently support the digital modes of BPSK and QPSK, and now also support RTTY. The modem may soon support other modes such as MSFK and even CW. In fact, the field updating capability – that is, the ability to download new/improved programs from the Internet and simply program them into the modem –allows users to stay current with new features and modes for years to come!

2) Connections

Ideally, you just need to use two cables:

a) Connect the modem's "radio" cable to the "data" jack on the back of your SSB transceiver. Most radio manufacturers today provide this way for getting audio modulated tones to/from the rig.

b) Connect a standard PS2 keyboard, or a PS2/USB combination keyboard, to the "Kbd" jack on the modem.
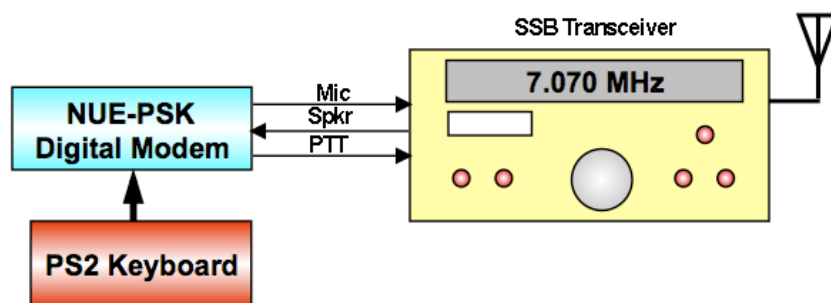
You are now ready to rock 'n roll using the digital modes … read on and enjoy!

3) Specifications

> Standalone, half-duplex modulator/demodulator for amateur radio digital mode communications

> Handheld unit ... no PC required

> Menus select operating modes, Squelch Thresh, PGA Gain, CW ID, Beacon, more

> 128 x 64 pixel graphic LCD displays audio signal spectrum 500 Hz to 2.5 kHz (with backlight)

> Tx and Rx buffers and menu system displayed in lower half of LCD using four 20-character lines of text

> "Tune" dial controls modem position along audio spectrum

> Modes currently supported: BPSK31, QPSK, QPSK reversed, and RTTY

> External keyboard jack: 6-pin mini-DIN, PS2-compatible

> Standard PS2-style or dual-mode USB/PS2 keyboard (user-supplied) provides text input for Tx entry, command/mode selection and modem frequency adjustment

> Connection to SSB transceiver: 8-pin mini-DIN (audio in, audio out, PTT, power)

> Powered by two internal 9V batteries (not included) or an externally-applied supply via 2.1mm coaxial jack

> Power requirements: 9-18V DC. Current at 12V is 60 ma without backlight, 80 mA with backlight. The current decreases as input supply voltage is increased.

> Field reprogrammability of internal microcontroller allows software updating in the field by the owner

> Aluminum enclosure provides for rugged portable use while shielding transceiver from digital EMI

> Enclosure dimensions: 7" x 4" x 1"

> Single 3.75" x 5.25" pc board contains all components and connectors

> Lightweight: < 1 lb with batteries.

> "Tx Audio" **c**ontrol for precise audio level control to transceiver

> Cable assembly provided (plug and shielded cable) for connection to the SSB transceiver

> Optional USB plug-in card provides ability to Record QSO text and save to USB flash memory device. The USB port also can be used for easy software upgrades. The USB option includes an independently powered Real Time Clock Calendar.

> Beacon Mode provides auto-repeating message buffer for far-signal measurement experiments.

4) Power

Install two standard 9V alkaline batteries in the battery compartment, or connect an external 9-to-18 volt supply to the coaxial power connector (2.1mm) on the right end of the modem. The two 9V alkaline batteries nestle tightly against the pc board in the compartment. One battery lies flat and over to one side in the compartment, with the other battery sitting up at an angle with its connector overlapped with that of the first. The screw-on cover holds them firmly in place.
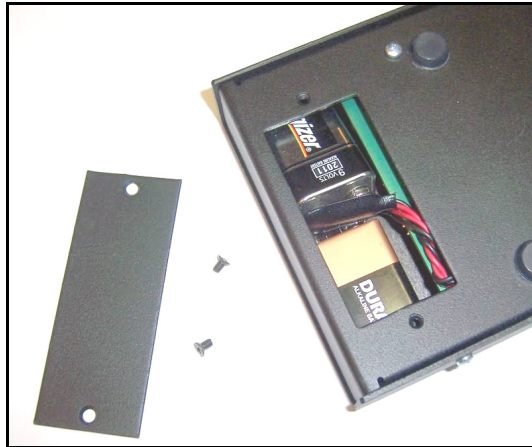
Use of internal batteries is not possible when optional USB card is in place.

5) Signal Connections

Install a connector(s) to the unterminated end of the cable provided with the modem. Most modern HF rigs have a mini-DIN Data or AUX connector which provides for PTT, fixed level audio from the receiver (independent of the volume control on the rig), and a line-level (approx 100mv rms) audio input to the transmitter. On the Yaesu FT-817/857/897 this connector is a 6-pin mini-DIN. On many Kenwood HF rigs there are 6-pin and 13 pin mini-DIN connectors that may be used. See Appendix A for wiring details. See the website Ordering page for a list of pre-assembled modem cables accommodating over 50 different rigs.

6) Keyboard

The modem requires an AT/PS2 style keyboard for character entry. The keyboard also provides for entry and playback of macros. Connect the keyboard to the 6-pin mini-DIN connector on the right-hand side of the modem. A USB keyboard may be used if it has built-in PS2 support. Most USB keyboards that are sold with a USB-to-PS2 adapter will work using this adapter.

7) Operation

Once you have the cable between the modem and the rig connected, keyboard attached, and power available, you are ready to operate. But first, some additional setup may also be desired, as described next.

Turn on the modem. If the cabling between the rig and modem is wired correctly, you should see evidence of signals and/or noise on the top half of the display (the spectrum area). Tune your rig to one of the PSK sub-bands. These are typically 70-to-74 kHz above the lower band edge on 40 and 20 meters. If there is digital activity on the band, you should see peaks on the graphic display. The horizontal location of the peaks corresponds to the audio frequency of each signal relative to the tuned frequency of the rig. For example, if the rig is tuned to 14070 kHz, the display shows audio frequencies from 500 Hz to 2500 Hz, or actual RF frequencies from 14070.5-to-14072.5 kHz.

Now for the fun ... **tuning**! Turn the "Tune" dial clockwise, or counterclockwise, to move the cursor to a higher or lower frequency. The cursor is the small triangular icon just below the spectrum display. The audio frequency is displayed when turning the dial. Try to align the cursor with one of the peaks on the display. Don't worry if it is not exactly aligned. Once close to the peak, stop turning the encoder. The modem now attempts to "lock" onto the signal and fine-tune the frequency if needed. If the modem is able to lock onto a PSK signal, it will very shortly begin decoding the signal, and then display characters on the screen. The time it takes for decoded characters to appear depends on the ability of the modem to estimate the center frequency of the incoming signal and the signal to noise ratio. Tuning can also be done by using the arrow keys on the keyboard. The right and left arrow keys provide finer tuning, while the up and down arrow keys provide faster tuning. The tuning rate of the encoder on the modem can also be selected from a menu setting. Note: When tuning in receive mode, the spectral display is frozen - this is intentional.

Now on to **setup for transmission**. If you have a dummy load for your rig, connect it now.

Since PSK signals generated by the modem contain simultaneous multiple frequencies (over a very narrow bandwidth), it is imperative that the audio output from the modem not overdrive the input to the rig; otherwise very poor signal quality will result. To facilitate setting the audio drive to the rig, a potentiometer on the modem may be used to adjust the level. In addition, the modem includes provision for "measuring" the position of the potentiometer so that it can be easily reset to the same setting in the future. More on this later.

We have found that the best way to set up for PSK operation is to initially set up the transceiver for normal SSB operation, including whatever power setting you usually employ. For example, if you have a 100 watt PEP rig, set it up for 100 watts on SSB.

Switch to Digital mode if your rig provides that option; otherwise retain the SSB mode.

Then press F8 on the keyboard. This places the modem in the TUNE state, which is denoted by "TUNE" at the top left of the display. The modem is now generating a continuous single tone, which is fed to the audio input of the rig. The PTT signal from the modem should also cause the transceiver to switch to Transmit. At this point, the

"Tx Audio" control on the modem just to the right of the display can be adjusted to set the power level of the transceiver. A transmit power of 15%-to-40% of the rig's rated power is recommended. (That is, 15-to-40 Watts with a 100 Watt rig). Keeping the power at this level does two things. First, it minimizes distortion due to clipping. Second, it avoids excessive heating in the rig finals since PSK is a 100% duty cycle mode. A power meter is very handy for making this setting. Once the Tx Audio control has been set, press F8 again to return to RECEIVE mode.

You should now be ready for transmitting PSK.

Pressing F10 will place the modem in TRANSMIT mode, but with a PSK idle tone being generated, unlike the single tone used in TUNE. If you are ready to give it a try, Press F10. At this point anything that you type on the keyboard will be converted into Varicode characters and transmitted using PSK modulation. Pressing F10 again, will toggle back to RECEIVE. When in TRANSMIT mode, "TX" will appear at the top left of the display.

8) RTTY Operating Details

Starting with software version 2.10, the NUE-PSK Digital Modem is now able support full RTTY transmit and receive. Use of the modem for this older-yet-still-popular digital mode is very similar to the other modes we support (PSK, QPSK), and is great for long ragchews, sending "brag files" describing equipment, and contesting. Decoding sensitivity is a bit less than with PSK31 (a mode that has been optimized for low power operation), but tuning in someone calling CQ is a bit easier and some people say there are more RTTY-capable hams around for potential contact, continuing the age-old enjoyment of the hobby.

We are initially supporting 45 baud operation with 170 Hz shift between mark and space frequencies, which classically tends to characterize the majority of RTTY use over the years – especially with the older and original TTY equipment. We also simplify the upper/lower sideband confusion that can exist these days by allowing the user to flip the order of the mark and space frequencies, thus accommodating a variety of users over all the bands.

RTTY Specs:

➢ 45 Baud, 170 Hz shift. (Other speeds and shifts may be supported later.)

➢ Normal operating convention is to use USB for RTTY. In the event that the station that you are attempting to connect with is instead using LSB, you may "reverse" the Mark and Space frequencies to allow this "cross-mode" connection.

➢ Normal mode, with the lower Mark frequency, is indicated by an N in the upper right corner of the LCD.

➢ Reverse mode, with the higher Mark frequency, is indicated by an R in the upper right corner of the LCD.

- Normal and Reverse may be toggled by typing Ctrl-R while the modem is in Receive mode. Typical usage of this toggling is to help the modem decode when the transmitter is on a different sideband.

- Generally, Normal mode is used when both transmitting and receiving stations are on the same sideband. (USB-USB or LSB-LSB.) When the stations are on different sidebands (USB-LSB or LSB-USB), type Ctrl-R to toggle to Reverse mode in order to enable proper transmit and receive.

- An L or F is also displayed in the upper right portion of the LCD, corresponding to LTRS or FIGS being received by the modem. The L and F may be toggled by typing Ctrl-C, which is useful if the corresponding LTRS or FIGS character is missing from the incoming data stream. Thus the user can correct such an error condition.

Setting the Modem for RTTY Operation:

- Select the Mode item in the Config menu. (Press the Select pushbutton for about 2 seconds, release and rotate the Tune encoder one position clockwise.)

- Rotate the Tune dial until the RTTY menu item is shown. Press the Select pushbutton to change to that mode. The press the pushbutton again to exit back to normal modem operation.

- Notice that the spectral display now shows two cursors. These cursors are used when tuning to a RTTY signal that has two characteristic spectral peaks separated by 170 Hz. When the frequency is properly adjusted, each cursor will point to a spectral peak.

- Two techniques may be used for adjusting the frequency to place the cursors beneath the two spectral peaks of the desired incoming signal. The modem's Tune dial may be used in the conventional manner to slide over to the received signal. Otherwise, the receiver's frequency dial may be adjust to move the spectral peaks of the desired signal such that they are positioned over the two cursors.

- If the modem does not immediately start properly decoding the incoming data stream, try pressing Ctrl-R to reverse the mark-space frequencies as described above. The sending operator might be on an opposite sideband from what you are using, and the mark-space frequencies would need to be the same for proper decoding.

RTTY Operating Tips:

- When using RTTY with your transceiver set to USB, the actual RF frequency is simply the addition of the transceiver setting plus the display frequency on the NUE-PSK modem. Further, most Digital modes (with the exception of RTTY) are usually run in USB.

➢ It should be noted that RTTY will not decode weak signals as well as PSK31. This is because the filters for RTTY are not as narrow. The modem will decode a PSK signal that is about one S-unit lower than what —can be decoded with RTTY

➢ Macros work just fine in RTTY mode – same as in other modes, and is quite convenient for the "brag files" that are commonly used in RTTY.

➢ Beacon Mode works well with RTTY as well.

➢ If you wish to use RTTY mode exclusively for a while, it may be convenient to select Save Config from the Configure menu, thus saving your current mode (RTTY) so it comes up by default when you next turn on the modem.

➢ Some typed characters do not appear on the LCD. The older, 5-bit "Baudot code" used in RTTY communications is limited in the number of characters that are supported. Thus, only capital letters are able to be transmitted, and the only supported "FIGS" include: -, ?, :, &, !, &, #, ', (,), /, ", comma, semicolon and period. *(Characters **not** transmitted or displayed on the modem LCD include: %, @, ^, *, {, }, [,], |, \, +, =, ~, `, _, -, <, and >.)* So be careful not to use these characters when doing RTTY communications … otherwise your messages may be received in an unusual manner. (For example: "My email is george verizon.net", "It costs 23.44", "The Dow is up 2.1", "John I went home", etc.)

➢ We have implemented the US version of Baudot character representation. For example, someone on a mechanical TTY keyboard (such as the Teletype Model 19) who types a FIGS key followed by the H key, a pound sign (#) will be sent and displayed on the NUE-PSK display. Correspondingly from the NUE-PSK modem keyboard, pressing the # key will transmit the FIGS code followed by the H code (or just the H code if the FIGS code was previously sent) and the # character will be printed on the receive side.

9) Using the "Download Config" and "Upload Config" Features

This new feature pair, accessed from the modem's CONFIG menu (beneath the Select pushbutton), allows the operator to send (Upload) the modem's current "configuration settings" (user settings and macro strings) to a text file on the USB Flash Drive; edit this text file on a PC; and then load (Download) that modified text file into the modem. This is a great way to create macro strings offline and save them for later reminder or modification.   This is a very convenient way to ...

- Send the modem's current configuration parameter settings and the current macro strings (found under the Function keys F1-thru-F7) as a text file to the USB thumb drive;

- Edit all of the above on the PC by plugging the USB thumb drive into the PC; and

- Load the modified text settings back to the modem by plugging the USB flash drive into the modem and "Downloading" the config.txt file.

The best way to use the new Download/Upload capabilities ...

1) Download the blank template to your PC from http://www.nue-psk.com/software/CONFIG.TXT (right-click the link and save file to a known location on your computer. The file is also shown at the end of this section.)

2) Open the **config.txt** file on your PC using the WordPad text editor. WordPad can be found in the Start->Programs->Accessories location on your computer. (The Microsoft NotePad text editor produces unexpected formatting problems for us.)

3) Edit the **config.txt** template to reflect your preferences for the modem. You can change the text lines in the template to reflect your favorite mode, your callsign, and other settings that you would like the modem to have when you turn power on each time. Additionally, and most powerfully, you can edit and manage the text strings used as the F1-through-F7 macros on the modem. For example, changing one word in Macro 5 (F5) is much easier to do by editing here on the PC than by re-entering the entire string anew with the modem's keyboard.

Editing Config.txt

It is very important to keep several in mind when editing the **config.txt** file ... The Instructions written out at the top of the file, briefly describing how to successfully edit the various lines. Read these instructions carefully. In short ...

1) You can ONLY edit the text on each of the 15 lines **after the colon <u>and</u> the space**;

2) The ONLY <u>allowable text</u> after the colon+space on lines 1-thru-8 are shown in the parentheses for that line. You must enter the desired option exactly as shown, or the selected edit will not be put in place when the file is later Downloaded to the modem.

3) You MUST be sure to retain the line termination character "|" at the end of each macro string (lines 9-thru-15). This is the "pipe" character typically located on the right side of one's keyboard as a shift character for the backslash key. Failure to retain the this special character at the end of the macro string will case a run-on (merge) of the two adjacent macro strings when loaded back into the modem;

After edits have been made, save the file to your computer using the same filename (i.e., you must keep the same filename **config.txt**), and copy that **config.txt** to your USB thumb drive.

4) Load the **config.txt** file into your modem -- Plug your thumb drive into your modem's USB port and in the CONFIG menu, dial up the **<u>Download</u> Config** menu item and select Start Download. See the modem port LED blink for perhaps about 3 seconds. The modem will then automatically reset and re-power up with the new (edited) configuration parameters and/or macro strings in place. They are automatically "saved to EEPROM" such that each time the modem is started up in the future, the new settings will be in effect.

Upload Config

The Upload **Config** feature is a lesser-needed capability that copies the modems config settings and macro text strings to the USB thumb drive. One could use this as a starting point for making text edits as described above, instead of using the blank template to start with. However an updated "C02" firmware file needs to be loaded into the USB chip, and a hardware modification is needed on the modem pcb for this feature to work for modems purchased prior to Feb 1, 2010. See the web page **Using the USB** Card (http://www.nue-psk.com/usb/using.html) and follow the steps described in the section **Installing the USB Card** for the hardware mod, and the section **Programming the USB Card** for installing the C02 firmware on the USB chip.

Note that the **Upload Config** command **is completely optional** and the modem will work just fine even if you don't make the hardware modification. Of course you won't have the ability to send the modem's config and macro strings to the thumb drive, but most people (including modem designers Milt and George) only use the **Download Config** feature to get the edited **config.txt** file from the PC into the modem. This is the most common and most useful aspect of the feature-pair.

All new modems going out the door here with USB cards, and those that have the Full Factory Upgrade made, will indeed have the extra signal wire and the updated "C02" USB chip firmware. This will enable those new modem users to use the **Upload Config** feature as well as future features coming downstream.

However, if you chose to make the optional hardware modification, you will be able to use the **Upload Config** feature, and at least one other feature coming soon -- support for a USB printer. So perhaps making the simple modification when convenient, or perhaps sending it back to us to do the low-cost mod, would be a good thing to plan on doing. Once the hardware modification is done to support **Upload Config**, you will be able to send the config and macro text to the USB thumb drive ...

1) Place the thumb drive in the modem's USB port.

2) Selecting **Upload Config** from the CONFIG menu. (Press-and-hold the Select pushbutton for a couple seconds, release and turn dial to Config Upload, and tap the Select pushbutton to initiate the feature.)

3) See the USB port LED blink rapidly for about 15 seconds while the modem's parameters and macro strings are written to the **config.txt** text file on the USB thumb drive.

4) When the blinking has stopped and control is returned to the modem's LCD screen, remove the USB thumb drive and place into the USB port of your PC. You can save this file away for safe keeping or use it (instead of the Template) as a starting point for making some edits.

Default Template for Config.txt File

```
--------------------------------------------------------------------

NUE-PSK CONFIG
--------------------------------------------------------------------

Configuration file for the NUE-PSK Digital Modem for device settings and macro strings.

DESCRIPTION ... This file is generated by the 'Upload Config' selection in the
modem's CONFIGURE menu, and is written to a USB flash drive inserted into the modem.

CONFIG.TXT ... This file reflects all the current settings of the modem, and may be
modified as desired on a PC by using a simple text editor like Microsoft WordPad.

EDITING ... Editing this text file must be done very carefully by changing characters after
the colon and space. The options available for each field are listed in parentheses
for each field and must be entered exactly as shown. Special control characters are
entered into macro strings as <TXON>, <TXOFF>, <MYCALL> and <THEIRCALL>. For example ...
<TXON>Thanks <THEIRCALL>. QTH HERE IS BALTIMORE, de <MYCALL><TXOFF>
Be sure to leave the special termination character '|' in as the last string character.

LOADING INTO MODEM ... The settings and strings contained in the CONFIG.TXT file may loaded
into the modem by placing the file onto the flash drive, inserting it into the modem,
and then selecting 'Download Config' in the modem's CONFIGURE menu.

RESULTS ... If the modem is able to successfully read and transfer all settings to the modem,
'Exit' will be displayed and pressing the Select pushbutton will bring you back to the
normal operating mode of the mode with the new settings in effect. Otherwise, the modem
will beep will beep and the Download Config operation will terminate.
--------------------------------------------------------------------

1) My Call: N2APB

2) Log Fname: NUE-PSK.txt

3) PGA (x1,x5,x16,x32): x16

4) Mode (BPSK,QPSK,QPSK/R,RTTY): BPSK

5) BackLight (ON,OFF): ON

6) SQLCH (25, 50): 25

7) AFC (ON,OFF): ON

8) CWID (ON,OFF): OFF

9) Macro 1: <TXON>CQ CQ CQ CQ CQ de <MYCALL> <MYCALL> <MYCALL> PSE K <TXOFF> |

10) Macro 2: My Macro 2 |

11) Macro 3: My Macro 3 |

12) Macro 4: My Macro 4 |

13) Macro 5: My Macro 5 |

14) Macro 6: My Macro 6 |

15) Macro 7: My Beacon Macro |
```

10) Real Time Clock Calendar (RTCC)

In receive and transmit modes, the date and time are displayed on the top line of the 128 x 64 graphical display. In other modes, the entire screen is used so the date and time are not displayed; however, the date and time are maintained so they will be current when next displayed. When first powered up, the time is initialized as "00:00:00" and the date is not displayed until the date is input to the modem either by the operator (see Configuration Menu) or by the optional USB option card (automatic, if installed). If the time is not updated, it can serve as a running time meter showing how long the modem has been turned on. The operator may also choose to turn the date and time displays off.

The date display is located in the upper left corner as an eight-character string formatted as: "MM/DD/YYYY. The time display is located in the upper right corner as an eight-character string formatted as: "hh:mm:ss" in a 24-hour format. To conserve display space, both are displayed using a special 3 x 5 font with no space between characters instead of the standard screen font which is a 5 x 7 font with one column of pixels between characters (6 x 7 pixels used per character).

The time is updated every second either by the Real Time Clock Calendar (RTCC) circuits on the USB option card or, when the USB option card is not installed, by a one-second timer in the modem. The main differences between these two approaches are accuracy and persistence. The RTCC on the USB option card uses the same type of crystal used in quartz watches to generate a very accurate time base. The modem time base is derived from the main system clock and is less accurate. The RTCC is powered by its own separate battery so it will maintain accurate time even when the modem power is turned off. Each time the modem is turned on, it verifies that the RTCC is present and automatically sets its copy of the date and time from the current RTCC settings. When the RTCC is not detected, the user must manually enter the date and time each time the modem is powered up.

When the USB option card is first installed, the date and time settings will not be accurate. The operator must enter them once. From then on, the RTCC will maintain them whether or not the modem is powered on. The RTCC knows nothing about time zones and daylight savings time. The operator can choose to use either local time or Universal Time and must change the time ahead or back one hour to account for daylight savings time, if desired. The RTCC programming is aware of leap years so it is not necessary for the operator to make leap year adjustments in the date. Of course, the operator will have to reenter the date and time after replacing the RTCC battery. (Note: Whenever a battery is installed onto the USB card, pin 4 of PIC controller U3 should be grounded quickly once with a touch of a clip lead in order to properly reset the PIC and start the clock programming.)

12) Macros

a) General Macro Usage

Macros are pre-recorded strings of characters for subsequent convenient playback. If you wish to use macros, now is a good time to do it.

For those already familiar with PSK operations, macro setup is similar to many of the popular PSK programs.

Macro recording is initiated by pressing the Ctrl key plus the function key that you want to be associated with your macro. Let's go through an example of entering your callsign into EEPROM memory and setting up a CQ calling sequence, as shown below. I'll use my callsign in this example, but of course you should use your own.

a) Record your callsign into EEPROM …

      Ctrl-M   n2apb   Ctrl-Z

b) Record the CQ calling sequence into the F1 macro ….

      Ctrl-F1   Ctrl-S   cq cq cq de Alt-M   k Ctrl-Q Ctrl-Z

   Now play the macro by pressing F1 and see …

 Tx comes on, "cq cq cq de n2apb k", Tx turns off

You can also record the other station's call sign "TheirCall" in RAM (not in nonvolatile EEPROM) by pressing Ctrl+T, TheirCall and Ctrl-Z to end the entry. To insert the other station's call sign into a macro, simply use Alt+T in the macro. Then, when you play the macro the other station's call sign will be inserted into the macro. In this way whenever you enter a new call sign using Ctrl+T, you do not need to re-record the macro to use the new call sign.

b) Special macro usage: Beacon Mode

- Using this feature, the user is able to specify a text string up to 256 characters in length into macro buffer F7 and then turn on Beacon Mode by pressing Shift-F9.

- The F7 macro should contain the Tx-ON control character Ctrl-S at the start of the string and the Tx-OFF control character Ctrl-Q at the end. The beacon transmission will then start and stop automatically with nothing being transmitted during the pauses.

- Once in Beacon mode, the reverse-video characters "BCN" are displayed at the right edge of the display and the F7 buffer begins transmitting as the text is displayed on the LCD.

- Since the Tx-OFF control character Ctrl-Q is the last character in the string, the modem drops out of Tx mode and the modem stays in Rx mode until the Beacon Interval timer expires.

- When the Beacon Interval time expires (which must be greater than the time required to transmit the F7 buffer), the F7 buffer transmit cycle begins again.

- This "beacon cycle" continues as long as the modem is powered (i.e., transmit F7 buffer, wait for Beacon Interval to timeout, transmit F7 buffer, ...)

- Beacon mode may be turned off at any time by pressing Alt-F9.

- The Beacon Interval is able to be set within the modem's Configure menus ... press-hold the Select pushbutton, dial two positions counter-clockwise and select Beacon Interval. Adjust the dial to select time in seconds for the start of every F7

buffer transmit cycle. It is important that the time be greater than the time required for F7 buffer to transmit. A good guideline is to first program the F7 buffer with the desired string and play the F7 buffer once by pressing F7 while in Tx mode. Time the transmission and add the number of seconds desired before the next transmission. That combined time will be the Beacon Interval.

- The user-set Beacon Interval time in the Config menus is retained only as long as modem power is applied. You will need to re-enter the time each time you power up the modem. The default Beacon Interval is 60 seconds.

- Usage Example: A beacon is desired for sending "v v v v N2APB 10mW PSK Beacon"

> a) Enter string to F7:
> "Ctrl-F7, Ctrl-S v v v v N2APB 10mw PSK Beacon Ctrl-Q, Ctrl-Z"
> b) Send F7 buffer to determine length: F7 (Takes about 6 seconds)
> c) Set Beacon Interval to 15 seconds:
> > - press-hold Select, dial to Beacon Interval and select it;
> > - dial to 15 seconds;
> > - tap Select twice to exit back to normal modem display.
> d) Turn on Beacon Mode: press Shft-F9
> > ... see modem transmit F7 buffer on 15 second intervals
> e) Turn off Beacon Mode: press Alt-F9

13) Configuration Menu

Configuration of the modem is accomplished by using a menu system. For example, you can select among the available modes PSK, RTTY, QPSK, and QPSK reversed. You can also change the software squelch setting, the gain of the programmable gain amplifier (PGA), turn CW Identification on or off, turn the display backlight on or off, change the tuning "increment", monitor battery voltage, or monitor the setting of the TX audio potentiometer. Other items may be added to the menu at a later time.

The method of menu access is through the "Select" button on the menu and the Tune dial. Pressing and holding the Select button for more than ½ second will activate the menu system. When initially activated, the display will show "Configure" on one line, followed by "Exit" on the line below. If you wish to abort configuration, simply tap the Select button at this time. If, on the other hand, you wish to configure one of the modem settings, simply rotate the dial clockwise or counter clockwise to cycle through the top level menu selection. Once you see an item that you wish to change, tap the Select button again. This will then allow you to cycle through a list of choices, again by rotating the Tune dial. When the choice you wish to make appears on the display, tap the Select button again. This will record your choice, and the menu will revert to the top level, showing "Exit" as the default choice. You can now make additional changes or tap the Select button again to exit the Configuration menu.

The current menu choice is the item initially displayed when a given menu is selected. For example, if you dial up Squelch Threshold menu item and change it to show "25", the next time you access this menu item it will still show as "25", thus allowing you to always see the current setting before (possibly) changing it.

Another way to see a full "status display" of current settings is to press the F12 key. This function shows the current value for each of the changeable settings: Mode, Squelch, CwID, Backlight and PGA. This is a convenient way to determine at a glance how your modem is currently configured.

Once a change is made in Config mode, the display shows "Exit" as a prompt for you to tap the Select button to get out of Config mode; and once you exit that change will be effect as long as the modem has power applied. However, you have an opportunity to save any changed Configuration settings to nonvolatile memory such that those new settings will be in effect the next time you power up the modem. Just turn the Tune dial one position counterclockwise and see the option for "Save Config". Tapping Select at this point will save the current settings to EEPROM and they will be loaded and put into effect when you next turn on the modem.

See a useful list of available menus and hot key assignments on the next page, along with a sample usage scenario for saving data to the USB device.

Hot Keys

F1 to F7 Play Macros
Ctrl-Fn Record Macros-- Enter keystrokes.
 Ctrl-Z to conclude entry.
Alt-Fn Delete Macro associated with Fn.
F8 Toggle TUNE mode on/off. Accessible only in RX
 or TX. (Not in Setup, or Macro Recording.)
Shft-F9 Turn on Beacon Mode. 'BCN' displayed.
Alt-F9 Turn off Beacon Mode.
F10 Toggle between RX and TX (but not in Setup,
 or Macro Recording)
F11 Display "MyCall" EEPROM.
F12 Toggle on/off a display of modem's current settings.
Ctrl-M Record "MyCall" into EEPROM.
 Ctrl-Z to conclude entry.
Ctrl-T Record "TheirCall" into RAM.
 Ctrl-Z to conclude entry.
Alt-M Insert "MyCall" into a Macro.
Alt-T Insert "TheirCall" into a Macro.
Ctrl-F Save the current frequency into EEPROM
 so that it can be restored at the next power-up.
Alt-F Retrieve the saved frequency and makes
 it the current frequency.
Ctrl-Tab Displays the current frequency (audio)
Ctrl-A Enable AFC (Automatic Frequency Control)
Alt-A Disable AFC
PgUp Increase input gain.
PgDn Decrease input gain.
Ctrl-L Clear the text area of the LCD
Ctrl-K Clear the keyboard buffer. (While receiving, keystrokes are not displayed—this allows clearing
 the buffer, so that callsigns may be entered, or re-entered in case you think that you have
 entered the wrong callsign)
Ctrl-B Clear the internal buffers
Ctrl-Q Inserts a TX-OFF control character in the TX buffer or Macro. (Toggles back to Rx mode when
 encountered in the string being transmitted.)
Ctrl-S Inserts a TX-ON control character in the Tx buffer or macro.
Ctrl-O Toggles the display backlight on and off.
Ctrl-R Reverse the order of MARK and SPACE frequencies in RTTY mode. Useful for copying sender
 Transmitting on opposite sideband
Ctrl-D Enter Date.
Alt-D Enter Time (Ctrl-Z ends entry)

Example Usage of Recording to USB Device

1) Power up modem (flash mem device *not* inserted)
2) Enter filename for file to be recorded ...
   Ctrl-N FieldDay.txt Ctrl-Z
3) Turn on REC mode to begin recording
   Ctrl-U
   and see the USB LED blink fast.
4) Insert block of free form text to Flash filename ...
   Ctrl-I Field Day 2008 QSO recordings Ctrl-Z
5) Tune around and find a station to call
6) Enter Tx mode per usual (F10) to call. Entered text is
   recorded to USB filename.
7) Enter Rx mode per usual (F10) to receive. Receive
   text is recorded to USB filename.
8) Insert free form text to USB file ...
   Ctrl-I Time ending QSO is 2130 hrs. Ctrl-Z
9) Close USB file recording session ...
   Ctrl-U
   and see the USB LED stop blinking and go solid on.
10) Remove Flash memory device for remote viewing,
    archival or printing.

Spectrum Cursor Tuning Rates

Left: <u>1x</u>: Left Arrow   <u>2x</u>: Down Arrow   <u>5x</u>: ALT+Left Arrow   <u>10x</u>: ALT+Down Arrow
Right: <u>1x</u>: Right Arrow   <u>2x</u>: Up Arrow   <u>5x</u>: ALT+Right Arrow   <u>10x</u>: ALT+Up Arrow

USB-Related Hot Keys

Ctrl-U: Toggle REC mode on/off. REC displayed on right edge of display. Mode aborted if no flash
device present in connector. If USB card not detected within 5 seconds, piezo beeped mode aborted.

Ctrl-N: Enter name for USB file to be recorded. Ctrl-Z concludes entry. Standard 8.3 file names accepted.
(E.g., "FD2008-2.txt")

Ctrl-I: Insert text into recording file. Ctrl-Z to conclude entry. The USB file must already be open (Ctrl-U)
for this to work. The recording file remains open for additional Rx or Tx text, until Ctrl-U pressed again to
close the recording file.

14) Updating Modem Software

Increasingly today, microcontrolled devices have an ability to be "field updated" with new features and software updates made available by the designers. So instead of needing to send your modem back for re-programming to get these new capabilities and bug fixes, you can simply download the latest-and-greatest software from the Internet and send it to the modem and the hardware automatically updates its internal memory with the new program. What a great way to keep your project completely up to date with the latest features!

Three methods are available to perform this field updating of the software:

a) **External Serial Adapter between Modem and PC** – With this method you just need to connect your PC serial port to the modem using a simple adapter, and send it the new software obtained from the NUE-PSK website whenever new capabilities are made available. We designed a TTL serial port into the modem, accessible via a 4-pin connector P4 located inside the battery compartment. Just connect your computer's USB port to an inexpensive USB-to-TTL adapter such as the CP2102 from SparkFun[9], and plug the adapter into P4. When you select the PC Bootload option in the Config menu and run the 'prog' loader program on your PC, the new software will be transferred to the modem. Once you power-cycle the modem, the modem will be running the latest software release containing, for example, a new digital mode, some new I/O capabilities, and so on. This is really quite a convenient and powerful capability for the project.

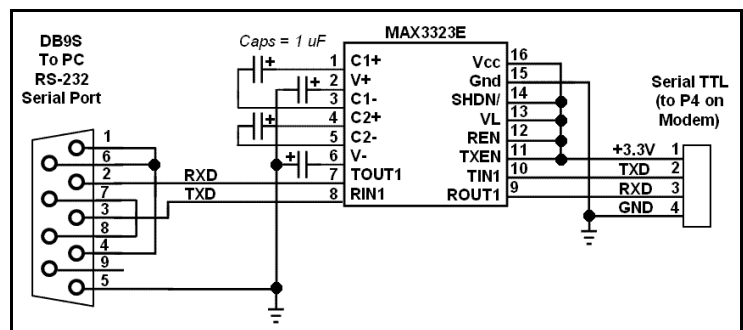Photo 10: CP2102 USB-to-TTL interface from SparkFun

Figure 5: Schematic of an easy RS-232 interface to the NUE-PSK Digital Modem

b) **PC Bootload using optional internal USB Card –** Connect the modem to a USB port on the PC using an A/B USB cable and upgrade the modem software from the PC in the same manner as with the external serial adapter. Just dial up the PC Bootload function in the Select menu, activate the same "prog" program on your PC as before, and watch your modem software get upgraded.

c) **Flash Bootload using optional internal USB card –** Use a USB flash "thumb drive" to load new software into the modem, thus eliminating any need for cable connection to the PC. See the USB section for details.

Loading New Software using an <u>External Serial Adapter</u>

In general, the process is simply to select PC Bootload item in the modem's Config menu, connect the serial adapter, and run a program called **prog** on your PC.

***Important** ... If you haven't yet proved out your serial adapter connection between your PC and modem, you should first follow the steps outlined on the web page Serial Interface Checkout (**http://www.nue-psk.com/serial_interface**). If you cannot do the operation specified there, you will not be successful trying to load new software into the modem.*

First, you'll need to "get ready" by first doing a couple of things ...

1) Determine the COM port number of your USB or RS-232 serial port -- You can find this out by clicking START and then right-clicking My Computer. Select Properties and then the Hardware tab. Click Device Manager and find the Ports line item in the list. Expand that line item and see that the Communications Port will have a COM number shown. That is the serial COM port number that you'll use.

2) Get the PROG program onto your local computer -- You can download prog from **http://www.nue-psk.com/serial_interface/prog.exe**. Save the file in a convenient place, like at the root of your C drive. (When your computer prompts for the save location, enter C:\ )

3) Download the latest modem software to your computer -- Download the software file **modem2_10h.zip** from the Software section on the website **www.nue-psk.com**, and place it in the same location as you did the prog program above.

Next, perform the following steps to connect the PC to your modem using your serial port ...

4) Connect the serial adapter between the modem and the PC -- You will either (a) connect a serial adapter to a serial port cable that is plugged into your computer, and then connect the adapter to the 4-position "Field Programming" pinheader (P4) located on the bottom side of the modem pc board, as accessed form the battery compartment; or (b) connect an A/B USB cable between the PC and the USB card's square connector on the side of your modem.

5) Open a Command Window on the PC -- You can bring up this window by clicking in START, Run ... and enter Command. Navigate to where you saved the prog.exe program. If this was at the root of the C drive, just enter CD \ .

6) Enter command to run the "prog" program -- From the prompt inside the Command Prompt window, type the following command line **... but do not yet press <Enter>**. For example, on my system that uses the COM1 serial port, I would type ....

<p align="center">**prog -i com1 modem3_0(modem+lowboot).hex**</p>

7) Start the PC Bootload process – Select the PC Bootload function in the modem's Config menu, and then select Start Download. Next press the "Enter" key on the PC keyboard to execute the command you previously entered.

8) See the PC screen start displaying the downloading indicators -- See the PC screen show a series of "periods" as the software gets downloaded to the modem and burned into flash. You will see about 3 rows of the periods and then it will stop. At that point the modem will automatically restart and you'll see the splash screen display the new version number "2.10h".

```
[Command Prompt - prog -i com1 modem1_20FPE.hex]
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\Owner>cd\

C:\>prog -i com1 modem1_20FPE.hex

Reading Target Device ID...   Found dsPIC33FJ128MC706 (ID: 0x00a9)

Reading HexFile.
Reading Target

Programming Device .......................................................
.........................................................................
.......................................
```

(NOTE: This screenshot shows the command line for loading version 1.20 software. The sequence is the same for all version numbers, but instead using the filename of the latest software version.)

15) Capabilities and usage of the optional internal USB Card

Three major features are enabled by having the USB card installed: **REC mode**, **Flash Bootload**, and **PC Bootload**. These features are very powerful and will greatly enhance your digital modem experience.

Software v1.34 (or later) must be loaded for these features to work as described ... **and** you must have firmware "C01" loaded on your USB card. See the USB web page for instructions on loading C01 firmware if you constructed the USB card from a kit.

= =
REC MODE -- Recording QSOs to a USB flash memory device

Insert a USB flash memory device into the modem connector. The LED on the side of the modem will come on.

Type **Ctrl-U** on the modem keyboard to place the modem into RECORD mode. You will see "REC" displayed on the right side of the modem display and the LED on the USB port will start blinking rapidly, indicating that it is ready to receive any text that you may type in Tx mode or any text that is coming across the LCD in Rx mode. (Note: If the USB card is not in place, or not working, the REC will be shown briefly on the display and a beep will be sounded by the modem to indicate that an error condition is present.)

Assuming things are working (no beep and the LED blinking rapidly), place the modem into **Tx mode** (press **F10**) and start typing some text. You do not need to be connected to your transceiver to try this out. You will see the text displayed on the modem LCD of course, but it is also being simultaneously written to your USB flash device.

Type **Ctrl-U** again to stop the REC mode and you will see the USB port LED stop blinking and remain on continuously.

Remove the USB device and plug it into your computer. You will notice a new file on the stick called **NUE-PSK.TXT**. If you open this file you will see the text that you typed while in Tx mode, and any other text that might have been displayed while in Rx mode.

As summarized on the Command Reference sheet, two other USB-related features are available to you. One is that you may specify **your own unique filename** for the data being recorded to the USB device while plugged into the modem. Before turning on REC mode (**CTRL-U**), you may type **CTRL-N** and you will be prompted at the top of the modem display to enter a filename. Give it any standard 8.3 format filename that is useful to you. (8.3 is 8 characters followed by a period and 3 more characters as an extension, like "Test1234.txt".) Don't forget to use **CTRL-Z** key to end this entry.)

The other USB-related feature is that you may **Insert** your own text into the data stream being recorded to your USB flash device. For example, after getting into REC mode (**CTRL-U**) but before starting up a QSO, you might wish to enter the current date, time or operator name in order to have a better record of the QSO downstream. To do this, type **CTRL-I** and you will prompted at the top of the screen to enter this "offline" text. Don't forget to end your entry with a **CTRL-Z** in order to return back to Tx or Rx mode. Remember, what you enter in this Insert mode is **not** transmitted, but it is only text that is inserted into the stream of data going to your USB flash memory device.

The QSO recording format

The QSO recording format for flash drives is enhanced with additional information including date and time. At the start of each recording session (initiated by a **CTRL-U**) the following text block is written to the file:

```
*****************************************
* START RECORDING  <MM/DD/YY hh:mm:ss>  *
*****************************************
```

This text block is always followed by a blank line. At the end of the recording session (terminated by another **CTRL-U**), the following text block is written to the file:

```
*****************************************
* STOP RECORDING  <MM/DD/YY hh:mm:ss>  *
*****************************************
```

This text block is always preceded by a blank line.

The start of each recorded receive session contains the following preamble text:

```
* * * RECEIVING:     <hh:mm:ss>
```

This text is followed by a single space character and then the received text as received, no formatting.

The start of each recorded transmit session contains the following preamble text:

```
* * * TRANSMITTING:  <hh:mm:ss>
```

This text is followed by a single space character and then the transmitted text as transmitted, no additional formatting.

When the operator inserts text in the recording (**CTRL-I**), the following text is inserted in the file:

```
* * * INSERTING:     <hh:mm:ss>
```

This text is followed by a single space character and then the operator-keyed text, no additional formatting. When the operator ends the insert operation with **CTRL-Z**, the modem resumes recording the interrupted mode with the appropriate RECEIVING or TRANSMITTING preamble.

= =
FLASH BOOTLOAD -- Loads new modem software from a flash device

This feature allows you to upgrade your modem software from a file placed onto a USB thumb drive. Just place the latest version of the modem software (in a special format, named mem.dat) onto your USB drive, as downloaded from the NUE-PSK website. This file is then automatically loaded into your modem. Thus, you no longer need to use a serial adapter to upgrade your modem software!

1) Download the modem software **mem.dat** to your computer from the Latest Software section of the modem web page, and then copy the file to your thumb drive.

2) Insert the USB drive into the modem and select the Flash Bootload function in the modem menu within the Select pushbutton items list. (Hold the Select pushbutton down for more than 1/2 second and turn the dial counterclockwise until Flash Bootload is displayed, and tap Select again to select this menu item.)

3) Turn the dial until "Start Bootload" is showing then tap the Select pushbutton. You will note some blinking of the LED on the USB drive itself (if it has an LED), and in about 15 seconds the modem will reboot and start up the software version just loaded.

= =
PC BOOTLOAD -- Loads new modem software from your PC

This feature allows you to load a new version of a software hex file onto your modem from your PC, much in the same way as you did previously when using a serial adapter.

1) Download from the modem website the software you wish to load into your modem, for example **modem2_10h(modem+lowboot).hex**, and then connect your modem to the USB port on your PC. You will use a suitable cable that plugs into the square USB jack on the modem and into the rectangular USB jack on the PC. When you plug in both ends of the cable, the computer will recognize the USB port.

2) Ready your PC in the same fashion as done previously when using the separate serial adapter. Bringing up a Command Prompt window on the PC, navigating to the location where the PROG program and your modem software hex file reside (the root of the C: drive is convenient) and type: **prog -i com5 modem2_10h(modem+lowboot).hex** where the COM port number is

that used by your PC for the USB ports. Do not hit <Enter> yet until you have readied the modem side of the connection.

3) Select the PC Bootload function in the modem menu underneath the Select pushbutton. (Hold the Select pushbutton down for more than 1/2 second and turn the dial counterclockwise until Flash Bootload is displayed.)

4) Press the Select pushbutton and turn the dial one notch to see "Start Bootload" displayed.

5) Tap the Select pushbutton to select the Start Bootload item on the modem, and then press the <Enter> key on the PC keyboard to run the PROG program. You will see the standard series of about 100 dots appear on the PC screen to signify the program download process. When the dots stop appearing, the modem will reset and the new software will be running.

NOTE 1: You will need to have the FTDI USB driver installed on your PC before attempting to use this PC Bootload feature. To install the driver, download the driver installation zip file from:
    www.nue-psk.com/software/CDM%202.04.06%20WHQL%20Certified.zip
and expand it onto a temporary file on your PC, and then plug in the cable from your modem. With the modem power turned on, the PC will recognize that a new USB device is plugged in and Device Found Wizard will pop to lead you through the process of installing the new driver. At the appropriate point indicate that you wish to specify that that PC searches for the driver at the location you have the temporary folder. When the PC indicates that the device is successfully installed, you can use the PC Bootload feature. NOTE: If you need help with this process, you can download and study the FDTI application note called "AN232R-03 Driver Pre-Installation Document", located at:
    http://www.nue-psk.com/usb/AN232R-03_DriverPreInstallation.pdf

 16) Tips & Techniques, and "Things to Watch Out For"

Here is a useful section that will undoubtedly grow in length over time. Please be sure to often check the NUE-PSK website for the latest online information.

  a) **Signal Level** – Setting the right drive level to your SSB rig is essential to success when operating the PSK31 mode. Please be sure to read the corresponding section on the NUE-PSK website containing lots of tips on this topic.

  b) **Inserting Plugs to the Modem** – You will want to be sure that you fuly insert the Radio and Keyboard plugs into the connectors on the modem. Failure to do so could well result in unusual, intermittent or "noisy signal" symptoms during usage. When inserting, be sure to press firmly in the direction of insertion – do not "wiggle the plug while inserting. Same for unplugging – just pull it back firmly. (Care in this area will save the life of the connectors on the modem.)

  c) **Tap-Hold to Select Config** – As described elsewhere in this manual, you can get into the Configuration menu in order to make various settings in your modem. Config is entered by a press-and-hold of the Select pushbutton … just press the pushbutton for about one second (say "one one thousand") and release it to see

the options that you can further select by rotating the Tune control. You can select any other operation or menu selection merely with a quick tap of Select.

d) **Tx Audio Level Setting** – This menu selection in Config will show you the relative position of the mini-pot used for the control on the top of the modem. The control currently ranges from 0%-to-26%, or -60%, -125% or even -160%, etc.   Don't worry about the specific number at this time; we will make the readings more consistent from unit-to-unit in a future software release.

e) **Spectrum Artifacts** – When viewing a moderately-strong signal at the midscale point on the modem's LCD spectrum (which corresponds to 1500 Hz), "noise" will also be seen on the far right and far left ends of the spectrum display. This is common and is an artifact of the DSP process of the signal, and it will occur even when viewing received signals a bit below or above the spectrum midpoint.

f) **How We Tested the Modem (in part)** – Some might find this info helpful in testing their own modems. We had direct audio connections to a laptop running Digipan, with the audio in/out cables connected to the soundcard headphone/mic connectors, respectively. We then commanded the modem to transmit at 1500 Hz and viewed the classic two-tone "railroad track" signal on the Digipan waterfall display.   Ensuring that the Digipan frequency (i.e., the red diamond) was centered on the tracks to ensure we were tuned to the modem's signal, we adjusted the Tx Audio level control fully counterclockwise to generate no signal, then increased it slowly in a clockwise direction while viewing the IMD reading on the Digipan window. We stopped turning the control when the IMD reading got to a -54 dB level, after which turning it further has no more effect. We found this level to be an ideal setting of the Tx Audio level delivered by the modem. Characters typed on the modem keyboard could then be seen on the Digipan receive window. We then turned the channel around (i.e., set Digipan to Tx and the modem to Rx), and saw n the modem display the characters typed into Digipan. [Note, you should follow the adjustment procedure elsewhere in this manual when connected to a radio.]

17) Technical Support

In case of questions or problems, feel free to send an email with your comments to us at **support@nue-psk.com**.

Be sure to also check the NUE-PSK website at **www.nue-psk.com** for the latest information, software availability and tips & techniques to make your digital mode operating experience enjoyable. This printed manual will be updated frequently with corrections and new capabilities presented in the current software, so be sure to always check out the website.

Another great source of information and camaraderie with fellow owners of the digital modem is the **NUE-PSK email reflector** on Yahoo Groups. If not already signed up for this great communication forum, go to **www.yahoogroups.com** and search for the group called NUE-PSK. You can view all the messages posted there, and if you join (for free!), you will be able to post questions and comments yourself, as well as access the files in the group.

Appendix A: The Radio Cable

This diagram represents what is shipped with your NUE-PSK modem. Since the modem can interface with literally hundreds of different SSB transceivers, it will be necessary for you to connect the "unfinished end" of the Radio cable to properly interface with your specific radio. Once you have the proper connector in hand for your radio, the task is simple – just use the signal names and wire colors here as a guide to get the PTT signal and audio tones to your rig.

The cable supplied with the modem has color-coded wires on one end, either as shown in Figure A or in Figure B below. You will need to determine which type you have before attaching the connector required for the data connection to your specific radio.

You can easily determine which cable type you have by using a VOM to check for continuity from pin 8 on the molded Radio plug to the blue wire on the other end of the cable. If there is continuity, you have Cable Type A. Otherwise, with pin 8 continuity to the black wire, you have Cable Type B

OR …
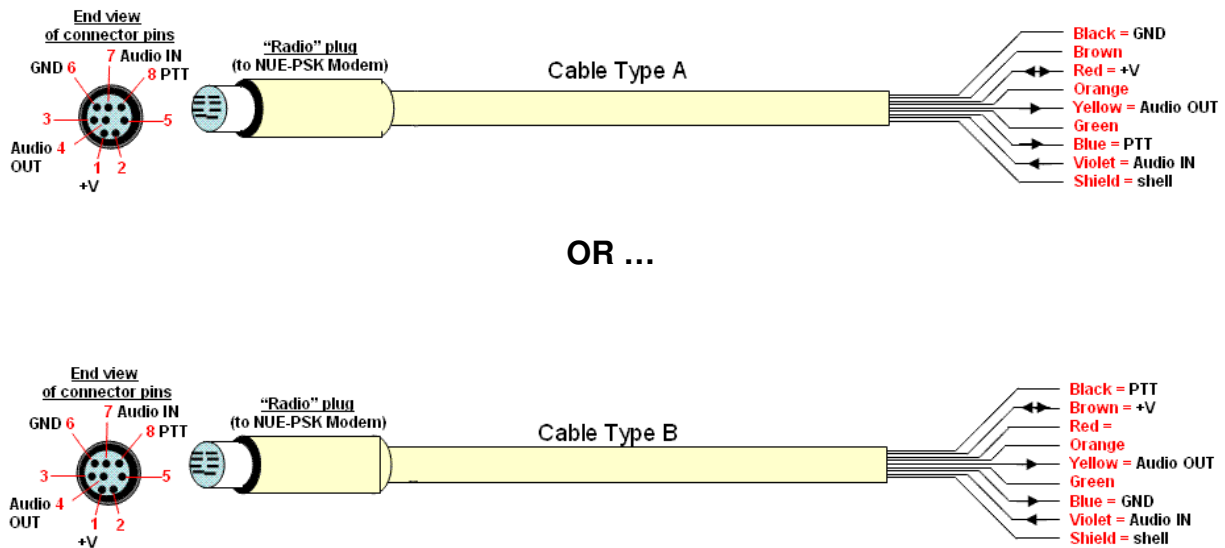
To help owners get on the air as quickly as possible with their new modems, we have pre-fab cables, supporting over 50 popular transceiver models, available for purchase from the NUE-PSK website. See **www.nue-psk.com** for details.

Appendix B: Modem Schematic

Appendix C: Optional USB+RTCC Card Schematic (rev B1)

Appendix D: Optional USB+RTCC Card Schematic (rev A, A3 and A4)