Zero Retries 0118 - by Steve Stroh N8GNJ

zeroretries.org/p/zero-retries-0118

Steve Stroh N8GNJ

Zero Retries is an independent newsletter promoting technological innovation in Amateur Radio, and Amateur Radio as (literally) a license to experiment with and learn about radio technology. Now in its third year of publication.

About Zero Retries

Steve Stroh N8GNJ, Editor

Jack Stroh, Late Night Assistant Editor Emeritus

In this issue:

Web version of this issue - https://www.zeroretries.org/p/zero-retries-0118

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Editorial by Steve Stroh N8GNJ

New Founding Member and New Paid Subscriber

My thanks to Merik Karman VK2MKZ who is now Founding Member 0007, and Prefers to Remain Anonymous 12 who is now a Paid Subscriber for their financial support of Zero Retries. Financial support is a real vote of confidence for continuing to publish Zero Retries.

Standards? Amateur Radio Don't Need No Steenkin' Standards!

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In the article **News from Packet Radio User's Group**, in this issue, I'm struck once again by the… *experimental…* mindset of many differing developers, groups, manufacturers to develop, adapt, and "fork" various data communications standards in Amateur Radio. Many only have loose… or sometimes no compatibility with other systems despite trying to accomplish a similar goal.

One example is that there are now two implementations of Forward Error Correction in Amateur Radio Packet Radio - FX.25 and IL2P. Both have advantages and disadvantages, and both have now been implemented successfully in various systems. Unfortunately, they're not interoperable with each other - an FX.25 transmission cannot be recognized by a unit using IL2P, and vice versa. This isn't necessarily a bad thing as such "divergence" can indicate a vibrant "marketplace of ideas". Because Amateur Radio really doesn't operate as a commercial marketplace, which usually forces a unified standard, multiple standards can coexist. Indeed that's the case with digital voice in Amateur Radio - System Fusion, DMR, D-Star, NXDN, P25, FreeDV, M17 are all in use, and we're even inventing new ones like Opulent Voice.

Fortunately, multiple standards in Amateur Radio likely won't be a major problem much longer as Software Defined Radio technology will soon (enough) be the dominant technology in Amateur Radio. In Zero Retries 0117 I mentioned Multicarrier base station transceiver for DMR, YSF, M17 etc. with MMDVM and LimeSDR hardware. *Inevitably, that type of radio system will become the norm* as fixed-function radios inevitably give way to Software Defined Radios. Eventually the DACs, ADCs, DSPs, and FPGAs

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will be so inexpensive that it's less expensive to build a generic radio out of those components and add value entirely in software. We've seen something like this beginning to occur with the too-numerous-to-mention projects based on the ADALM-Pluto such as the Pluto SDR Plus and the Charly 25 line of HF radios based on the Red Pitaya.

Many of us have witnessed similar transitions as fixed function computer systems (example - dedicated word processors) couldn't compete with more flexible and less expensive general purpose personal computers *running software*.

In seeing the successful implementations of both FX.25 and IL2P, I'm also struck by the prescience

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of Brian Hoyer K7UDR and Kenny Richards KU7M in imagining the need for the Amateur Radio Engineering Task Force (ARETF). I was involved briefly in that website prior to launching Zero Retries, but ultimately decided I needed to focus my time and energies on Zero Retries. I believe there is a role for something like ARETF, but it's a bigger task than K7UDR, KU7M, or I could tackle on our own. Such a task is sustainable only for a larger organization. In Zero Retries 0079, I imagined a dedicated organization for such a role - the Amateur Radio Standards Organization (ARSO).
But, in 2023, there don't seem to be any organizations in Amateur Radio that are willing to take on coordinating, or even inventorying various standards used in Amateur Radio for easy reference, compatibility, and interoperability.

Zero Retries YouTube Edition - Revisited

For Zero Retries 0093, I tried a too-ambitious experiment, three separate issues of Zero Retries. One of those was Zero Retries 0093 YouTube Edition. It was a one-off experiment, but I think it had value because there's no "guide" to YouTube channels / videos that are Zero Retries Interesting… *except Zero Retries*. Thus, I've concluded that devoting one issue of Zero Retries per month to Zero Retries Interesting YouTube videos has merit. The things I find Zero Retries Interesting on YouTube (generally) aren't topical, and thus will retain their value despite being reported on as much as a month after they are published. Tentatively, I will attempt this with the first issue of each month, thus look for Zero Retries 0119 - YouTube Edition next week.

Pacificon - *No* 😐

This week there was a change of plans (good news) within my family that makes it infeasible for me to attend Pacificon 2023 in San Ramon, California 2023-10-20 thru 22. *Bummer!* I was looking forward to the road trip and the event, but it's not to be this year. Thanks to those of you who reached out for a meetup there - next time! Unfortunately my (local) fallback event for that same weekend - LinuxFest Northwest here in Bellingham, Washington, USA was postponed. More time for N8GNJ Labs!

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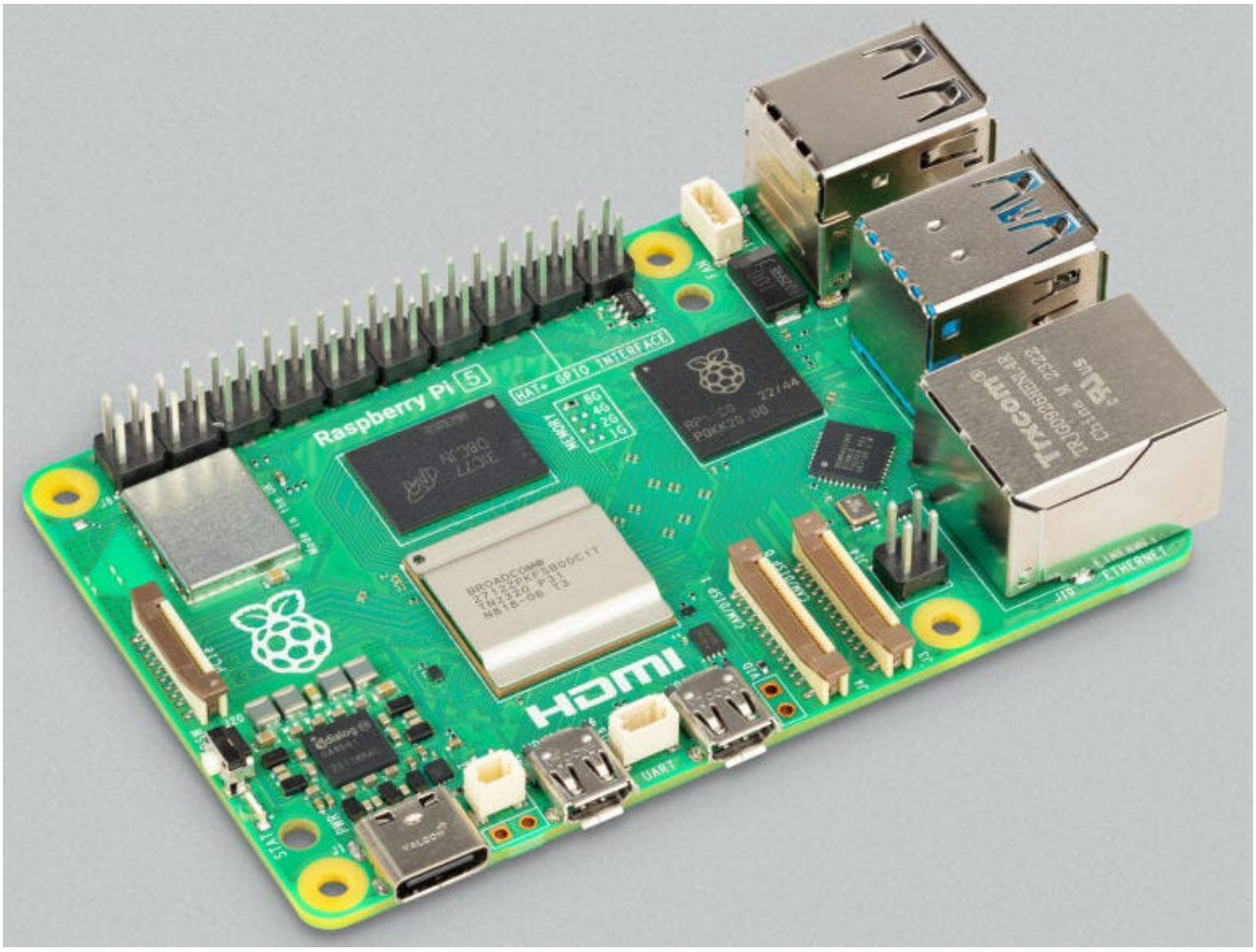
Breaking News - Raspberry Pi *5* Announced

By Steve Stroh N8GNJ

*I couldn't in good conscience call Zero Retries a **news**letter if I didn't cover this significant development that affects Amateur Radio, even though this issue was already full.*



Raspberry Pi 5 - Image courtesy of Raspberry Pi

I'll leave most of the breathless prose about how this is the *best Raspberry Pi ever* and the attendant compu-lust to others such as Jeff Geerling KF0MYB. In this article, I'll focus on features of the Raspberry Pi 5 (RPi 5) that I think will matter most for using it in Amateur Radio.

Besides the Raspberry Pi 5 becoming available in (late) 2023 instead of 2024 as was forecast, a pleasant surprise about the Raspberry Pi 5 was this quote from Ars Technica's article:

> Perhaps most importantly, the 5 is being prioritized for individual buyers rather than commercial partners.
>
> "We're incredibly grateful to the community of makers and hackers who make Raspberry Pi what it is; you've been extraordinarily patient throughout the supply chain issues that have made our work so challenging over the last couple of years," writes Raspberry Pi founder and CEO Eben Upton. "We'd like to thank you: we're going to ringfence all of the Raspberry Pi 5s we sell until at least the end of the year for single-unit sales to individuals, so you get the first bite of the cherry."

Thus… the RPi 5 *may* be actually available for purchase at reasonable prices - initially $60 for a 4 GB RAM unit and $80 for a 8 GB RAM unit.

Here are my top “Amateur Radio” features of the Raspberry Pi 5:

- Per Raspberry Pi, the big news of the RPi 5 that the **overall processing power of the RPi5 is double *to triple* the processing power of the RPi 4**. That improvement bodes well for two emerging compute-intensive applications in Amateur Radio that we like to devote embedded systems to - Software Defined Radio and independent (not online) Artificial Intelligence. I predict that we will see a *lot* of AI applications for Amateur Radio in 2024 such as automatic mode identification (and selection), and AI-assisted data decoding (digging even more signals out of the noise). Such applications were “leaning” towards using X86 processors, but I suspect the momentum of “which platform?” will now tip back towards using RPi 5.

- ***Standard* Power button** - there is *finally* a Power button *onboard* to start up and shut down the RPi 5 cleanly (minimizing corruption of the file system when power is abruptly removed). A Power button means you don’t need to use the menu or keyboard or a third party solution to shut down a RPi 5 cleanly. As seen in a demo, the RPi 5 *will start up* when power is applied - pressing the Power button is not required.

- ***Standard* Real Time Clock** - An RTC was crammed into the silicon of the custom RP1 chip, and RPi offers a *$5 Panasonic lithium manganese rechargeable coin cell, with a pre-fitted two-pin JST plug and an adhesive mounting pad* to keep the RTC alive when the RPI5 is powered off.

- Both the Power button and the RTC are *big improvements* because these features are *standard* on the RPi 5, thus no need to patch the OS to add a Power button or RTC in varying ways using varying I/O ports. They’re going to work the same way *every time* because they’re *standard features*.

- Another subtle improvement is that RPi now recommends a **5V *5A* power supply** to provide *ample* power via the USB C power input port to the entire system and peripherals. RPi even developed a custom power management chip for the RPi 5 to insure that all the components get all the power they need to run at peak performance. You *can* use a 5V 3A power supply, but if you do so, the RPi 5 will throttle power to peripherals if it doesn’t detect the (Official Raspberry Pi?) 5V 5A USB C AC power supply. It may take some work to fully power the RPi 5 from 12V power

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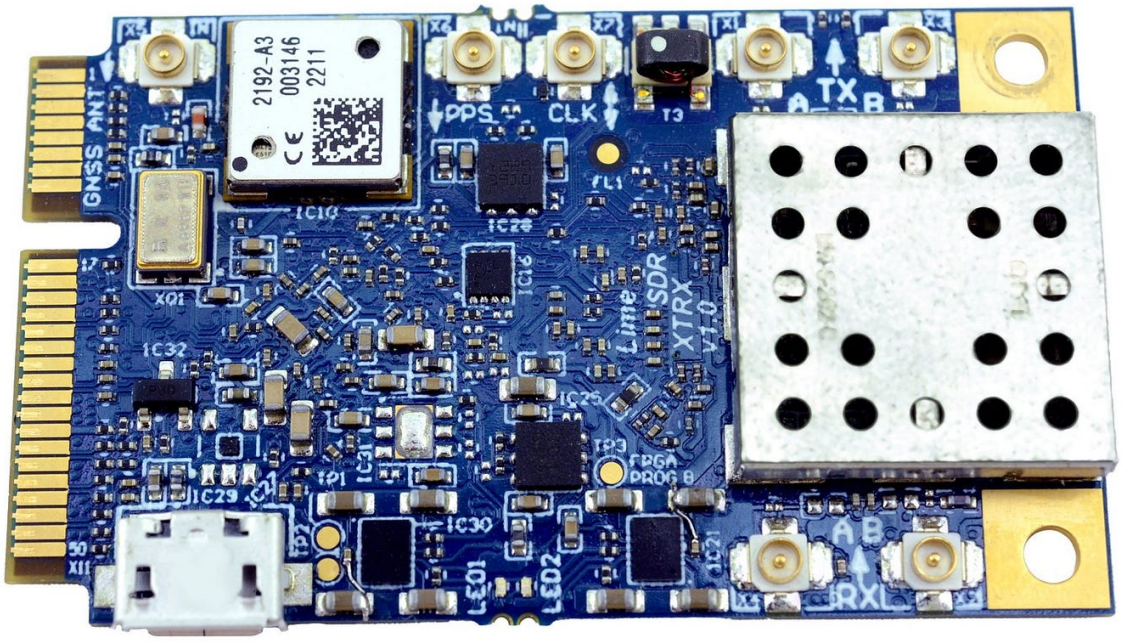
  . I rate this as an improvement because the recommended additional power will provide ample power margin for intensive processing and interesting peripherals (see below).

- **Big heat sink with quiet fan** - RPi finally abandoned the ambiguity of whether a heat sink or fan was needed by offering an official heat sink with a fan. Notably they did the RPi 5 fan *right* by including a tachometer input to monitor for a failed fan, and making the fan controllable via Pulse Width Modulation (PWM) so that fan speed can be throttled up and down in proportion to how much heat dissipation is required. Mercifully, reviewers indicate the fan is reasonably quiet.

- There will be an official **Power Over Ethernet (POE)** option with the RPi 5, available sometime in 2024. This will be, I think, RPi's third version of a POE adapter so *this* one will probably work *well*. I think POE may well be a bigger deal with the RPi for Amateur Radio applications than the previous RPi units (see below).

- It's a minor feature for Amateur Radio, but because the RPi 5 offloads all I/O to a dedicated R1 chip, **all of the I/O now runs at full speed for each port**. For example, Ethernet bandwidth isn't shared with USB. *Each* USB port (2x USB 3, 2x USB 2) has dedicated, full-bandwidth I/O. And, the R1 enables a PCI Express (PCIe) 2.0 port. Even the Micro SD card slot (yep, it's still there) got a dedicated I/O channel and now is compatible with the SDR104 standard for faster "disk" I/O.

- A standard PCIe 2.0 port on the RPi 5 is a big deal for Amateur Radio because we're seeing **Software Defined Transceivers (SDTs) emerging with PCIe ports**, and even in the "Mini PCIe" form factor that's compatible with being onboard a RPi 5.



LimeSDR XTRX - image courtesy of Lime Microsystems / Crowd Supply

One example of a PCIe SDT is the LimeSDR XTRX, shown above. It's not much of a stretch to imagine a remote mounted radio with a RPi5 as a host for a LimeSDR XTRX. Yes, the native transmit power output of the XTRX is miniscule, but POE capability means that the unit can be mounted remotely (on a tower / roof / pole) with very little (lossy) feedline between the XTRX and antennas. RPi has said that they will offer adapter boards from the RPi 5 PCIe 2.0 port to the standard form factor for PCIe 2.0 boards (M.2?). What's unclear is if the heat sink / fan, and POE board, and PCI 2.0 board are compatible enough to be used together.

Or maybe the PCIe port might be used for something a bit more mundane like RS-232 ports.

Ultimately, I think that the RPi 5 with an SDT connected via the RPi 5's PCIe bus will be the basis of a new wave of bleeding-edge Amateur Radio units. ***Someone** is going to figure out the incredible bang-per-buck of this combination and make some real money selling such systems* into Amateur Radio and related applications, such as satellite receive-only stations, spectrum monitoring stations, maybe even universal broadcast receivers that convert Over The Air broadcasts to streaming.

The RPi 5 is differentiated enough that it will require a new Raspberry Pi OS - "Bookworm" (based on Debian Bookworm)

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. It's purely a guess on my part that given the powerful compute power of the RPi 5, RPi OS "Bookworm" will be a 64-bit OS, and thus RPi 5 will be even more powerful with a native 64-bit OS.
I was going to bemoan that in all the new features of the RPi 5, they didn't add a hardware watchdog timer. But, I decided to be prudent and do a quick check on that statement, and I found an article that claims that the RPi 3 (and hopefully the 4 and 5) have a built-in hardware watchdog timer:

> One of their underdocumented features is a builtin hardware watchdog. This little hardware service will *once enabled* watch the system activity and automatically power cycle the Raspberry Pi once it gets stuck.

✔️ Watchdog timer

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When I Get Something Wrong - New Packet Radio Data Rate and Channel Size

By Steve Stroh N8GNJ

I strive for accuracy in Zero Retries, but sometimes I get something wrong. "Big" publications employ professional editors, fact-checkers, and proofreaders to attempt to not publish incorrect information. But Zero Retries is just me, doing my best. Fortunately, with Zero Retries nearing 1000 subscribers, there's a good chance that when I do get something wrong, it will be noticed. Thus I am very grateful to John Kreno N3XKD for spotting the following major error on my part, and commenting on that error.

Background - see My Letter to ARRL Regarding Elimination of Symbol Rate from US Amateur Radio Regulations in Zero Retries 0117 (incorrect info has been removed).

In the Zero Retries 0117 comments, John Kreno N3XKD wrote:

> The information in your article concerning the limitations of NPR due to symbol restraints is incorrect, in order to achieve full speed (470kbps) with NPR, you need to consume an entire 1Mhz of spectral width, not 100khz, at 100khz NPR is restricted to 68kbps @ 50kSps. My source is this document https://cdn.hackaday.io/files/1640927020512128/NPR70_introduction_EN_v3.6.pdf (Just for the sake of accuracy).

I was a bit gobsmacked that I may have gotten this basic technical fact of operation of New Packet Radio (NPR) *so completely wrong*. In the article N3XKD references, I wrote (which, again, has been removed from the online article):

> There is an easy illustration of the importance of this issue - see **New Packet Radio** - https://elekitsorparts.com/product/npr-70-modem-by-f4hdk-new-packet-radio-over-70cm-band-amateur-radio-packet-radio/
>
> **Note for USA :** Due to CFR 47 Part 97.3 FCC regulations, for the 70cm amateur radio band (restriction to 100kHz and 56kBaud), only the setting “modulation 20” of NPR-70 seems to be legal in USA. Please always check your local amateur-radio regulation before buying and using NPR70.
> Modulation 20: Symbol Rate 50kS/s, bandwidth 100kHz, raw datarate 100kb/s raw, usable datarate 65kb/s.
>
> When this unit is used *anywhere other than USA*, this unit can operate at a data rate of **500 kbps**.
>
> But when this unit is used in the USA, per §97.307 (f) (6), this unit can (legally) only operate at a data rate of **50 kbps** - *only 10% of its actual capability*.
>
> The same unit, the same software, same technical parameters - just a different mode setting.
>
> Note that in both the “USA mode” (50 kbps) and the “Anywhere other than USA mode” (500 kbps), *use of a 100 kHz channel is required*. Thus there is no “saving of bandwidth” by “going slower” to comply with §97.307 (f) (6).
>
> New Packet Radio is just one example of this issue for data communications experimentation in Amateur Radio VHF and UHF bands. Data communications experimentation using techniques such as Software Defined Radio, the GNU Radio software toolkit for radio technology experimentation, and numerous other advanced systems are important for attracting technologists into Amateur Radio.

The detail N3XKD mentions is on Slide 19 of NPR70_introduction_EN_v3.6.pdf:

NPR – Quick Start Guide
5 modulations

- Meaning of 2 digits
  - 1ier digit: 2GFSK or 4GFSK
  - 2ième digit: Symbol Rate

	Modulation name 2nd digit	x0	x1	x2	x3	x4	
	Symbol Rate	50	100	180	300	500	kS/s
	Radio bandwidth	100	200	360	600	1000	kHz
2GFSK (1st digit of name : 1x)	Modulation name		11 (*)	12 (*)	13	14	
	Raw data rate		100	180	300	500	kbps
	Usable data rate		71	120	190	300	kbps
4GFSK (1st digit of name : 2x)	Modulation name	20 (*)	21 (*)	22	23	24	
	Raw data rate	100	200	360	600	1000	kbps
	Usable data rate	68	130	220	330	470	kbps

(*) Available for firmware ≥ 2019_06_08

Image courtesy of F4HDK / New Packet Radio

The line **Radio bandwidth** tells the tale. Restating the same information to highlight the details most relevant to me as an Amateur Radio Operator in the US, subject to FCC regulations:

- **Modulation 20:** 100 kbps

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  raw data rate requires a 100 kHz channel.
- **Modulation 11:** 100 kbps raw data rate requires a 200 kHz channel.
- **Modulation 12:** 180 kbps raw data rate requires a 360 kHz channel.
- **Modulation 21:** 200 kbps raw data rate requires a 200 kHz channel.
- **Modulation 13:** 300 kbps raw data rate requires a 600 kHz channel.
- **Modulation 22:** 360 kbps raw data rate requires a 360 kHz channel.
- **Modulation 14:** 500 kbps raw data rate requires a 1000 kHz (1 MHz) channel.

- **Modulation 23:** 600 kbps raw data rate requires a 600 kHz channel.
- **Modulation 24:** 1000 kbps raw data rate requires a 1000 kHz (1 MHz) channel.

Thus, the statement by ELEKITSORPARTS that *only* Modulation 20 seems legal for use in the US seems to hang on the symbol rate not exceeding 56,000 *and* channel size for data communications not exceeding 100 kHz in the 420-450 MHz band.

A separate discussion is justified - *should data communications be limited* to a maximum channel size of 100 kHz in the 420 - 450 MHz band (70cm) band in the US? Notably, a channel size of *6 MHz* is permitted for image communications (television). Such a discussion is especially appropriate for the US since most of the US has access to 420 - 450 MHz (30 MHz), of which only 440-450 MHz is heavily used for voice repeater operations. But that's a discussion for another time, perhaps after the inane symbol rate limitations are removed from US Amateur Radio regulations.

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News from Packet Radio User's Group

By Steve Stroh N8GNJ

Image courtesy of Packet Radio User's Group

I've known of the Packet Radio User's Group (PRUG) of Tokyo, Japan for decades since I was active in producing the Digital Communications Conference (DCC) and PRUG members were regular attendees to the DCC. Since beginning Zero Retries, I've been curious what PRUG has been doing of late. PRUG's FX.25 TNC is a Zero Retries Interesting project mentioned on the PRUG website, but the information there was years old. I had been periodically reaching out to PRUG via email and am now working with PRUG member Ryuji Suzuki AB1WX who attends PRUG meetings virtually from Boston, Massachusetts USA and can converse and write in excellent English.

In advance, I apologize for any errors in fact or omission in this article. The information I was provided from PRUG describes several projects that are obviously in active development.

But, much of the information I was provided could not be machine-translated from Japanese into English. Thus, it's possible that some details I will relate in this article are incorrect, and I apologize in advance for that.

Basics of the PRUG FX.25 TNC

Early version of the PRUG FX.25 TNC, using a TCM3105 modem chip. Image courtesy of Packet Radio User's Group

AB1WX confirmed that the PRUG FX.25 TNC is an active, evolving project. The basic details are:

- It's a KISS TNC, requiring a host computer for Amateur Radio Packet Radio functions beyond the Physical Layer (modem)
- As the name implies, it incorporates the FX.25 optional Forward Error Correction (FEC) protocol so that it can communicate with other FX.25 systems using FEC, but also can communicate with conventional AX.25 systems (no FEC).
- The host computer interface is serial (via USB) or TCP/IP (via Wi-Fi)
- Power is via USB (5V @ 0.5A)
- ESP-WROOM-32 processor

- It can be used to monitor various sensors - the BME280 humidity sensor was specifically mentioned in a diagram.

Current Hardware Development

- *Early* versions of the PRUG FX.25 TNC used a TCM3105 for 1200 bps Audio Frequency Shift Keying (AFSK). *Current* versions of the PRUG FX.25 TNC use a "software modem"

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  instead of the TCM3105 modem chip. The data rates of the "software modem" were not stated.
- There are two radios in development by Hidekazu "Ina" Inaba JK1MLY. Both radios are based on the BK4802 transceiver chip, and operate on 29 MHz (10m), 51 MHz (6m), 145 MHz (2m), and 433 MHz (70cm). One version is FM only, and the other version incorporates a PRUG FX.25 TNC.

Availability of PRUG FX.25 TNC Boards

Per AB1WX:

> PRUG is distributing fabricated boards and some components so that people can build their own FX.25 TNCs. They just sold a bunch at the Ham Fair in Tokyo. PRUG currently distributes boards within Japan, partly because it did not make any effort to disseminate information or establish logistics.

PRUG's Proposed Extension to FX.25 Protocol

The information provided to me by PRUG makes reference to a paper presented at DCC 2020 about a proposed extension to FX.25. However, the version available on the TAPR website:
Current Status Report of FX.25 KISS TNC Development by Kazuhisa Yokota JN1DFF, Masaaki Yonezawa JE1WAZ and Aki Yonex
… seems incomplete - only five pages, and there are no references to an extension to FX.25.

But the information provided to me by PRUG included a link to a different paper:
FX.25 KISS TNC development and Proposed extensions to the standard by Kazuhisa Yokota JN1DFF, Masaaki Yonezawa JE1WAZ, and Norito Nemoto JH1FBM - Packet Radio Users' Group, Sept.03, 2020, includes *considerable* detail about the extension to FX.25. Summary slides (14 and 19):

> **Add a function to FX.25**
>
> - One large FX.25 frame by combining multiple blocks.
> - Long packet can be sent in a single frame of FX.25 without splitting it up.
> - Any higher level protocols can use the FEC with relative ease.
> - More resistant to further burst errors.
> - Compatibility with the existing AX.25 facilities is maintained.

> **Solution: One large FX.25 frame by combining multiple blocks**
>
> - It enables FX.25 to send long messages.
> - You don't need to split the frame.
> - The problems presented in the previous section will be solved.

This proposal seems to me quite sound - the small data blocks inherent in AX.25 are a legacy of the simple processors, frequent collisions and retransmissions, and the use of native AX.25 implemented in (limited) firmware. With built-in FEC such as FX.25 and faster, more capable processors with larger memory and more capable, modern software, reliable transmission and reception of larger data blocks is more feasible.

I hope to be able to report more about PRUG's various projects in future issues of Zero Retries. Again, I am grateful to Ryuji Suzuki AB1WX for his help in learning more about PRUG's activities in 2023 and the PRUG FX.25 TNC project.

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ZR > BEACON

By Steve Stroh N8GNJ

ARDC Releases Grant Details for 2023 "Q2 and Q3"

Details of the second and third groups of grants from ARDC have begun to emerge on ARDC's Grants page.

TechStuff Goes Transmitter Hunting (Podcast)

Part 1 (39:08) and Part 2 (49:53)

It's always interesting to hear radio technology described by those with little direct experience with it, *for* an audience with little direct experience with it. These two episodes were from 2017, and I found it interesting that they had enough to talk about to make it into two episodes.

Decoding the TM-V71A Display Protocol

Nino Carillo KK4HEJ describes a brief experiment to decode the data protocol between the radio body and the detachable control / display head on the Kenwood TM-V71A. This is notable because of the widespread use of the Kenwood TM-V71A for data communications in Amateur Radio.

> On a whim, I decided poke around with the display interface on my Kenwood TM-V71A 2M/440 dual band ham transceiver. The display/control panel is removable, and connected to the transceiver by an RJ-11 port. So I cobbled together a jig to poke at the 4 copper wires that connect the display to the base unit. Using a couple of homebrew usb-to-serial interfaces along with my laptop, I was able to learn a fair bit about the interface.
>
> The display and unit communicate via a duplex asynchronous serial protocol, timed at 57,600 baud and using a standard 8n1 serial data format.

Interesting Shack PC With Eight USB Ports

Image courtesy of CNX SOFTWARE — EMBEDDED SYSTEMS NEWS

When I read the referenced article about the HUNSN BM34 mini PC, I was startled that it mentally “ticked all my boxes” for a “Shack Computer” that could run Windows. I was startled because I had been *unconsciously* “benchmarking” PCs (which I define as having an x86 processor that is capable of running Windows) mentioned on CNX SOFTWARE – EMBEDDED SYSTEMS NEWS. My benchmark criteria for a “Shack PC”:

- Low profile enclosure (not a typical PC case).
- No fan (passive cooling only).
- Power input is 12 volts DC with just a cable (no voltage adapter needed).
- At least six USB ports (in my experience, USB port expanders can be unreliable).
- Maximum price of $300 (or less).

The HUNSN BM34 mini PC meets all of the above criteria, with a price (reportedly) of ~$200 and *eight* USB ports. Other features include Wi-Fi, Bluetooth, dual Ethernet, speaker output, microphone input, and triple video output. Generic memory modules up to 16 GB, and generic solid-state storage options up to 512 GB can be used with this unit.

Join the *Fun* on Amateur Radio

If you're not yet licensed as an Amateur Radio Operator, and would like to join the fun by *literally having a license to experiment with radio technology*, check out **Join the Fun on Amateur Radio** for some pointers.

Zero Retries Frequently Asked Questions (FAQs) — In development 2023-02.

Closing the Channel

In its mission to highlight technological innovation in Amateur Radio, promote Amateur Radio to techies as a literal license to experiment with radio technology, and make Amateur Radio more relevant to society in the 2020s and beyond, Zero Retries is published via email and web, and is available to everyone at no cost. Zero Retries is proud *not to participate* in the Amateur Radio Publishing Industrial Complex, which hides Amateur Radio content behind paywalls.

My ongoing ***Thanks*** to:

> Tina Stroh KD7WSF for, well, *everything!*
>
> ***Founding Members* who generously support Zero Retries financially:**
> Founding Member 0000 - Steven Davidson K3FZT
> Founding Member 0001 - Prefers to Remain Anonymous 01
>
> Founding Member 0002 - Chris Osburn KD7DVD
> Founding Member 0003 - Don Rotolo N2IRZ
> Founding Member 0004 - William Arcand W1WRA
> Founding Member 0005 - Ben Kuhn KU0HN
> Founding Member 0006 - Todd Willey KQ4FID
> Founding Member 0007 - Merik Karman VK2MKZ
>
> Numerous Annual and Monthly subscribers who also generously support Zero Retries financially!

Want to Support Zero Retries?

- The *most* effective way to support Zero Retries is to simply mention Zero Retries to your co-conspirators that are also interested in knowing more about technological innovation that is occurring in Amateur Radio and encourage them to become a fellow subscriber.
- One particularly effective method of promoting Zero Retries is to add a mention of Zero Retries to your QRZ page (or other web presence) and include a link:

  https://www.zeroretries.org

If you'd like to financially support Zero Retries, becoming a paid subscriber is *greatly* appreciated and helps offset expenses incurred in publishing Zero Retries. Paid subscriptions for Zero Retries are *entirely optional*, as explained in this special issue of ZR:
Zero Retries Administrivia - Activating Payment Options.

These blogs and newsletters regularly feature Zero Retries Interesting content:

- Dan Romanchik KB6NU mentions "Zero Retries Interesting" topics so regularly on his blog (that I otherwise wouldn't know about) that I've bestowed on him the honorific of Pseudostaffer.
- Jeff Davis KE9V also mentions "Zero Retries Interesting" topics so regularly on his blog (that I otherwise wouldn't know about) that I've bestowed on him the honorific of Pseudostaffer.
- Amateur Radio Weekly by Cale Mooth K4HCK is a weekly anthology of links to interesting Amateur Radio stories.
- Experimental Radio News by Bennet Z. Kobb AK4AV discusses (in detail) Experimental (Part 5) licenses issued by the US FCC. It's a *must-read-now* for me!
- RTL-SDR Blog - *Excellent* coverage of Software Defined Radio units.
- TAPR Packet Status Register has been published continuously since 1982.
- Other Substack Amateur Radio newsletters recommended by Zero Retries.

These YouTube channels regularly feature Zero Retries Interesting content:

- HB9BLA Wireless by Andreas Spiess HB9BLA
- KM6LYW Radio by Craig Lamparter KM6LYW (home of the DigiPi project)
- Modern Ham by Billy Penley KN4MKB
- Tech Minds by Matthew Miller M0DQW

The Substack email publishing platform makes Zero Retries possible. I recommend it for publishing newsletters.

If you're reading this issue on the web and you'd like to see Zero Retries in your email Inbox every Friday afternoon, just click below to join ~~100~~ ~~200~~ ~~300~~ ~~400~~ *500* ~~600~~ ~~700~~ ~~800~~ *900*+ other readers:

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Zero Retries (N8GNJ) is on Mastodon — n8gnj@mastodon.radio — just click:

Zero Retries / N8GNJ on Mastodon

Email issues of Zero Retries are "instrumented" by Substack to gather basic statistics about opens, clicking links, etc.

More bits from Steve Stroh N8GNJ:

- SuperPacket blog — *Discussing new generations of Amateur Radio Data Communications — beyond Packet Radio (a precursor to Zero Retries)*
- N8GNJ blog — *Amateur Radio Station N8GNJ and the mad science experiments at N8GNJ Labs — Bellingham, Washington, USA*

Thanks for reading!
Steve Stroh N8GNJ / WRPS598 (He / Him / His)
These bits were handcrafted (by a mere human, not an Artificial Intelligence bot) in beautiful Bellingham (The City of Subdued Excitement), Washington, USA.

2023-09-29

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Blanket permission granted for TAPR to use any Steve Stroh content for the TAPR Packet Status Register (PSR) newsletter (I *owe* them from *way* back).

1
Apologies for the clickbait headline - it just seemed humorous. See https://www.thisdayinquotes.com/2010/01/we-don-need-no-stinking-badges-misquote.html for the inspiration for this clickbait headline.

2

Digital to Analog Coverter, Analog to Digital Converter, Digital Signal Processor, and Field Programmable Gate Array.

3
The creation of ARETF, at least in concept, was in preparation for the “any mode, it’s just software” promise of the now-canceled NW Digital Radio UDRX-440.

4
At the moment, 12 Volts to USB C Power Delivery (PD) providing 5A seems rare; I wasn’t able to find one - only 3A units.

5
Yes, as with previous Debian major versions, the name comes from a character in the Toy Story series.

6
kbps - kilo (1000) bits per second

7
Most of the info I was provided by PRUG included references about using a TCM3105 modem chip. When I provided a draft of this article for comment, there was strong pushback that the current versions of the PRUG FX.25 TNC use a “software modem”. In the information I was provided, I was unable to find any technical details of the “software modem".