

Aksarben Amateur Radio Club (AARC) – July 10, 2026

Alternative Radio Firmwares

Extending Budget Amateur Transceivers

by Aaron Grothe / KC0WIH

Welcome & Opening Remarks

INTRO

Interactive Session

Welcome to the presentation! This session is designed to be fully interactive. Please feel free to raise your hand, ask questions, or share your own radio-modding experiences at any moment.

Ask Anytime

There is absolutely no need to wait until the end of the talk! Let's keep this open, conversational, and collaborative.

Presenter Caveat

NOTE

“I'm still figuring this stuff out and might not know all the answers!”

– Aaron Grothe / KCOWIH

100%

Bricking Risk Warning

Caution Required

If you try to change the firmware on your radio, you can **BRICK YOUR RADIO!**

This process replaces critical software. Procedural errors or faulty programming setups can render your hardware completely unresponsive.

Safe Flashing Rule

SAFEGUARD

01. Read the Documentation

Always read the project documentation thoroughly before you even begin downloading binary files or hooking up cables.

02. Read It Again

Once you're done reading, read it again to ensure you fully comprehend the risks, specific key sequences, and safety guidelines.

Quick Audience Poll

SURVEY



Hardware Owners

How many own a Quangsheng, Baofeng DM-series, or a TIDradio device?



Active Modders

How many here are currently running alternative firmware on their radio?



Terminology

How many actually know what alternative firmware is and what it does?

Evolution of Alternative Firmwares

From simple hex hacks to fully modular custom operating systems

Historical Milestones

TIMELINE



01. Patching

Early patching binary edits, extending range margins, and setting screen text.



02. Open-Source

Reverse engineering microcontrollers to achieve real spectrum sweeps and custom DSP controls.



03. Major Projects

Arrival of polished, easy-to-flash software bundles (Egzumer, OpenGD77) designed for newbies.

Which Radios are Supported?

COMPATIBILITY

Confirmed Models

- Quansheng: UV-K5, UV-K1, and similar variants
- BaoFeng DMR: DM-1801, DM-1801A, DM-1701
- TIDradio: TD-H3 platform

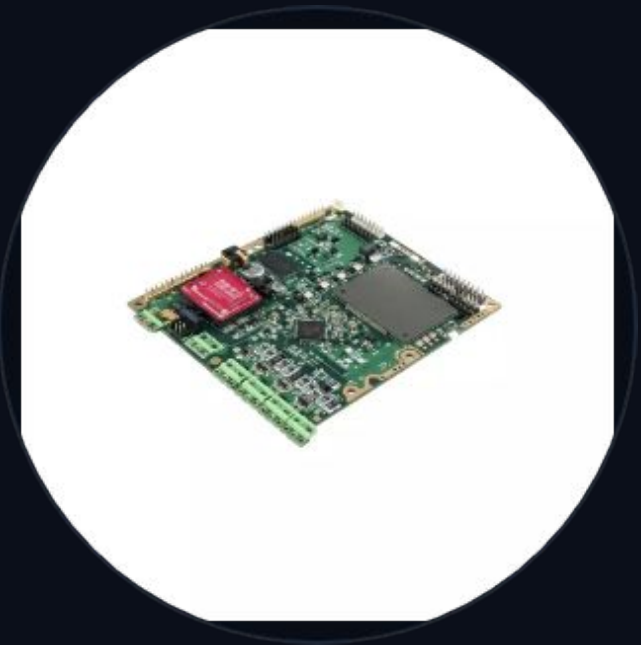
Research First

Many other modern transceivers support similar alternative firmware initiatives.

"Always check development directories and forums before making a purchase!"

Locked Hardware!

WARNING



Write-Protected Devices

Not all radios allow writing custom code. Some budget models are completely locked down by the factory.

- Quangsheng UV-R5 uses a locked, write-protected firmware chip (Boo!!!).
- Older traditional analog Baofeng devices (like the classic UV-5R) are hardcoded at the assembly line.

Extended Frequencies & Modes

BENEFITS





Extended Frequencies

Unlock wideband VFO receive capabilities well outside standard operating ranges. This allows tuning into experimental frequencies with the help of hardware-level filtration.

Experimental Modes

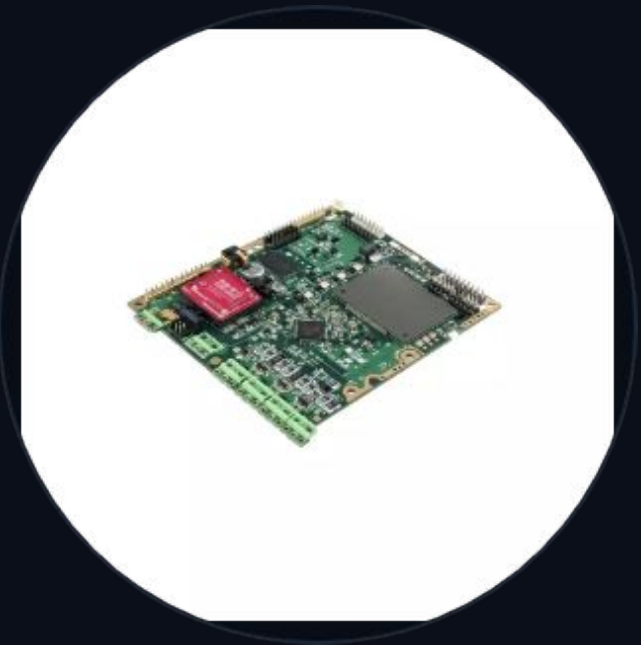
Equip analog transceivers to support customized demodulation and transmission methods, including Single Sideband (SSB), AM Airband, and Morse Code (CW).

Advanced Features Unlocked

-  **Active Spectrum Sweeps:** View live graphical RF activity directly on the low-resolution screen.
-  **Ultra-Fast Scanning:** Heavily optimized channel-hopping algorithms for finding active channels in seconds.
-  **Improved Accessibility:** Font resizing options and fully voiced menus (OpenGD77 is exceptionally good at this).
-  **Diagnostics:** Precise real-time battery voltage metrics, raw signal values, and debug status monitors.

Microcontroller Constrained

HARDWARE



Highly Optimized Code

The microcontroller running radios like the Quangsheng UV-K5 is extremely limited compared to standard computing platforms powered by a 32-bit ARM Cortex-M0 processor core.

- Requires developers to write ultra-lean C and specialized assembly.
- Squeezing complex operations into standard chips is absolute art.

64KB

Available Flash Space

Every Byte Counts

The majority of budget transceivers have only 64 kilobytes of total storage space for the operating program.

Adding visual menus, multi-mode digital interfaces, or DSP tweaks requires extreme cleverness and code-space conservation.

Major Radio Platforms

A closer look at supported hardware options and custom operating systems

Radio Platform Options

HARDWARE



Quangsheng

The UV-K5 and UV-K1 series representing the absolute hub of software customization.



BaoFeng DMR

Advanced digital transceivers supporting full OS replacement projects.







TidRadio

The compact TD-H3 running modern graphical interface overhauls.

Quangsheng UV-K5 Ecosystem

ECOSYSTEM

-  **Ezgummer:** Recognized globally as the ultimate everyday daily driver.
-  **F4HWN (Fusion):** Incredible visual spectrum options tailored for new hardware.
-  **IJV:** Stripped-down optimization prioritized for hardcore DX operators.
-  **QuangshengDock:** Specialized custom ROM to control your unit remotely over serial.

EzGummer: The Granddaddy

Daily
Driver

The Gold Standard for UV-K5

EzGummer is widely loved as the most stable, robust daily-driver firmware for general-use Quangsheng platforms.

- Integrated support for clean AM and SSB reception on a budget.
- Highly configurable custom actions for sidebar hardware keys.



F4HWN (Fusion) Features

MODERN EDGE

Tailored for New Hardware

Specifically compiled and tuned to extract peak performance out of newer UV-K5 (V3) and UV-K1 board designs.

- Highly stable operating performance
- Optimized for upgraded internal filters

Advanced UI & Audio

Brings a state-of-the-art interface with real-time spectrum scanning and custom acoustic profiles.

- Live visual spectrum sweeping
- Custom EQ receiver audio profiles
- Standard broadcast FM radio support

Stripped-Down Interface




IJV is a heavily customized firmware option designed exclusively for weak-signal operations and experienced amateur operators who prefer functionality over visual fluff.

Weak Signal Mastery

Features custom AM Airband receive optimizations, highly responsive controls, and dedicated single sideband (SSB) demodulators designed to pull faint signals out of the noise floor.

QuangshengDock: Remote ROM

REMOTE CONTROL

-  **Remote Controller Engine:** Converts your tiny, affordable handheld into a remotely operated radio node.
-  **Impressive Optimization:** Fitting full serial control protocols into standard 64KB is an absolute programming miracle.
-  **Perfect Companions:** Highly recommended to pair with an AIOC (All-In-One Cable) for plug-and-play operation.

Baofeng DMR Alternatives

DIGITAL OPTIONS

Classic Analog Limitations

Traditional analog Baofeng units like the UV-5R or BF-F8HP use locked, write-protected internal microchips that prevent flash overhauls.

DMR Platform Potential

Modern DMR variants (DM-1801, DM-1801A, DM-1701) feature powerful architectures that completely support alternative firmware platforms.

OpenGD77: DMR's Best Friend Gold Standard

Total Operating System Rebuild

OpenGD77 completely overhauls how modern DMR radios operate.

- Integrated spoken accessibility menus and high-contrast screens.
- Direct computer CSV codeplug imports, bypassing complex tools.
- Real-time orbital tracking support for amateur satellites.



OpenRTX: Elegant Design

OPEN STANDARDS

Well-Documented Code

OpenRTX is an ultra-clean, highly structured, and documented developer project that strictly champions fully open-source digital standards.

M17 Digital Protocol

Fully optimized to provide modern open-source digital voice protocols (M17 mode) on select compatible handheld models.

NicSure (nicFW) Platform

The premium community firmware option for the compact TD-H3. It unlocks gorgeous graphical S-meters, responsive real-time spectrum charting, and custom memory management on standard screens.

TID Station Integration

Fully harnesses the radio's onboard wireless and Bluetooth hardware, enabling quick modifications and remote terminal interface capabilities.

Other Firmware Options

Historical Foundations

Many alternatives exist because developers adapt codebases. For example, OpenGD77 originally supported the Radioddity GD-77 before expanding extensively.

Open Sourced Forks



Numerous community-led forks branch off primary configurations, allowing rapid deployment of experimental fixes across similar microchips.

“Google is a great tool. I recently bought a new Baofeng DMR. It isn't supported yet, but I do regular searches to see if projects have added it.”

– Aaron Grothe / KCOWIH

Demo 1: uv-kx-tools & K5Viewer

WEB TOOLS

-  **uv-kx-tools:** Outstanding management dashboard to configure channels and radio operational behaviors dynamically.
github.com/joaquimorg/uv-kx-tools
-  **K5Viewer:** Intuitive visual terminal meant to read back-up logs and check transceiver system configurations.
armel.github.io/k5viewer/

Demo 2: UV-Mod Flasher

ON-THE-FLY

Binary Patching Made Easy

UV-Mod is an outstanding web-based GUI that patches original factory firmware binaries on-the-fly, giving users access to custom modifications without compiling code themselves.

- No local development compilers needed
- Highly visual click-and-patch toggles
- Instant customization of radio parameters

Access the Tool

Connect your radio, select your desired mods, and flash directly from your web browser using modern WebSerial APIs.

whosmatt.github.io/uvmod/

Flashing: Four Steps

HOW-TO



01. Connect

Plug your standard 2-pin programming cable into your PC USB port and radio side jack.



02. Boot

Hold down the PTT sidebar key while switching the power knob to boot into bootloader mode.



03. Web Tool

Open a modern browser flasher interface utilizing Google Chrome's WebSerial APIs.



04. Launch

Restart your radio automatically, loading up your newly tailored operating system!





Things I Wish I Knew

TIPS & TRICKS

- ✈️ **AIOC Cable:** The All-In-One Cable integrates a sound card and a serial interface over a single premium USB-C plug.
- ➔ **Browser Selection:** Use Chrome or Chromium. Firefox does not natively support the WebSerial API needed for flashing.
- 📦 **Buying Options:** Quangsheng transceivers are incredibly affordable—you can easily buy them in multipacks!
- 🔒 **Save Factory Configs:** Always download and secure your factory EEPROM calibrations before flashing anything.

Safety Guide: Avoid Bricking

PREVENTATIVE

-  **Charge Fully:** Ensure your handheld has a freshly charged battery before writing firmware blocks.
-  **Secure Power:** Use a laptop with a functional battery or a computer backed by an active UPS.
-  **Double Backups:** Secure your original factory calibrations and dump factory software twice.
-  **Avoid Late Night:** Start at least two hours before bedtime in case the process runs long.

A large, bold, green graphic of the text '\$0' is centered on the slide. The dollar sign and the zero are both in a sans-serif font and are the same size.

Massive Enhancements

An Unmatched Value

For me, absolutely YES! At zero cost, your budget handheld gains massive features and usability enhancements.

While the bricking hazard is always present, modern browser-based flashing tools make recovery and restoration easier than ever.

Xiegu G90 HF Modding

BEYOND CHEAP RADIOS



Advanced Transceiver Potential

Custom firmware modification is not strictly limited to ultra-cheap transceivers.

- The Xiegu G90 HF radio has a highly dedicated developer base.
- Actively analyzing, decrypting, and improving its core files.
- Shows broad interest in open-source SDR optimizations.

Conclusion: Ham Spirit

ETHOS



Education

Experimenting with alternative radio firmware is hardware hacking at its finest, driving deeper mastery of RF electronics.



Collaboration

Global open-source projects connect hams across international borders to collaborate on software designed for the common good.



Potential

Inexpensive radios with customized software are unlocked to punch far above their weight, challenging high-tier units.

Awesome Hamradio

An incredible directory containing community-led firmwares, hardware modifications, SDR projects, and software integrations.

github.com/DD5HT/awesome-hamradio

Why Use Indexes?

Because alternative firmwares branch out and change rapidly. Following curated repository indexes helps you discover active forks and verified builds safely.

Questions & Answers

Thanks & 73!

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Slides are available at: www.grothe.us