

Contesting

Outside the UK there are a number of significant contest stations that regularly appear in our contest logs – many are in the USA. *RadCom* talked to Tim Duffy, K3LR about the ‘Superstation’ he has built in West Middlesex, Pennsylvania.

The K3LR team is one of the most celebrated and technically advanced collective efforts in the world of amateur radio contesting.

The station is primarily designed for competitive entries in the Multi-Multi (M/M) category, where a team of operators will make QSOs on six bands simultaneously. This requires a massive logistical effort and a cohesive group of competent operators (all on site) to maintain peak performance over 48-hour contest periods.

From back garden ham to ‘International Superstation’

Tim’s adventure in amateur radio started in 1972 at the age of 12 (then WN3SZX to WA3SZX). His interest was sparked by assembling a Quaker Oats crystal set and he operated a simple station with wires and a small tri-bander at his parents’ house.

When he was 16, Tim built a station with his friend AF3P. They had three towers with mono-banders. And that put K3LR on the map.

His early fascination with radio quickly evolved into a lifelong passion for competitive radio contesting. He gained the call K3LR in 1977 while he was a junior in high school. Still at first high school, then college, Tim became chief engineer of a local AM/FM broadcast radio station. His education and enthusiasm led to a career in cellular telephony and wireless, then later to a commercial role associated with amateur radio.

Tim cut his teeth contesting at famous Multi-Multi stations like W3AU, W2PV and K2GL (N2AA). The idea that Tim’s K3LR station might be engineered for Multi-Multi grew from a suggestion by his lifelong friend, Scott Jones, N3RA.

“Scott suggested that we go ‘big’ at K3LR. Don’t build a multi-single station – go for the biggest class and build a massive station for Multi Multi,” Tim recalls.

In 1986, aged 27, Tim bought his current home. Remembering Scott’s words of encouragement and based on his earlier experiences, Tim transformed his hilltop property into what is today a ‘mega station’ currently featuring 14 towers and 11 to 12 operating positions.

As well as building and operating, Tim is a central figure in the contesting community. He is the Chairman of Contest University (CTU) [1] and the World Wide Radio Operators Foundation (WWROF) [2], organisations dedicated to training new operators and supporting the infrastructure of major contests.

As the CEO of DX Engineering [3], Tim bridges the gap between commercial radio technology and amateur radio sport, ensuring the K3LR station remains at the cutting edge of performance. His extensive experience with executive roles in the wireless technology sector has made him ideally qualified to lead and inspire.

Tim is a member of the CQ Contest Hall of Fame and the Amateur Radio Hall of Fame. He was named the 2015 Amateur of the Year by the Dayton Hamvention and is an accomplished single operator who has competed five times as part of a World Radiosport Team Championship (WRTC) team.

He is a member of the First-Class Operator’s Club (FOC) and has been an RSGB member for 25 years. He is also a member of ARRL and DARC.



PHOTO 1: K3LR aerials for CQWW CW, November 2025.

The K3LR station

The K3LR facility is engineered for maximum performance, utilising a 16-acre antenna farm designed to make the most of every decibel of the received and transmitted signals.

The station currently includes 14 towers supporting over 50 different antenna systems (Photo 1).

The 20, 15 and 10m towers feature four full-sized, custom-built OWA Yagis spaced one wavelength apart, allowing operators to select various phased combinations to target Europe or Asia with precision. There is also a three-high stack on 40m, with the top antenna at 80m high.

The Yagis are Optimised Wideband Arrays (OWA). The OWA was developed by Jim, WA3FET and this technology was first applied to Yagi antennas at K3LR around 1990.

For the 160m band, Tim designed a massive vertical Yagi with four switchable vertical ‘T’ wires acting as reflectors and directors to steer the beam in four directions. For 80m there is a Large Phased Two Four Square eight vertical array.

The station uses innovative HI-Z 8-circle and HI-Z 4-square receiving arrays, loops, low dipoles and the DX Engineering NCC-2 to optimise weak signals from atmospheric noise.

If mains power to the site is interrupted, K3LR has a 50kW on-site generator that comes on line automatically, seven seconds after a power outage.

Hardware and software

The radio shack is equipped with outstanding technology, engineered for high reliability and – most importantly – to handle the extreme RF environment of a multi-multi operation. The station uses Icom IC-7851 transceivers, chosen for their superior receiver performance and outstanding reliability in multi-user settings. With 13 IC-7851s at K3LR – there has not been a failure to date.

Each band is powered by a K3LR custom-built, single-band amplifier using single 8877 tubes, capable of running ‘full legal power’ (1500W) with

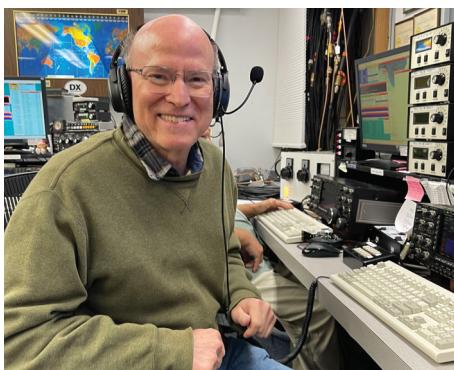


PHOTO 2: Bob, N6TV at the 15m operating position for CQWW CW 2025.

high reliability and a 100% duty cycle.

In 2025 the team started using HAMSET headsets from Italy, a custom combination of Bose noise cancelling headphones with an adjustable microphone.

Green Heron RT-21 rotator controllers and custom RF switching systems allow for rapid reconfiguration of the antenna arrays. K3LR uses DX Engineering rotators and K7NV prop pitches. Every antenna can be rotated for best performance. Six independent receivers from Italy are always on, sharing the K3LR antennas with the world using the CW Skimmer software and links to the Reverse Beacon Network.

Team composition and the Multi-Multi environment

The K3LR Multi-Multi effort is not just about having the best radios and antennas. Success is also dependent on the competence and team ethos of the operators. For major competitions, the station hosts around 12 operators. Over 200 different operators have been a part of the K3LR team over the years and the K3LR station has hosted operating events using other callsigns such as the ARRL call W1AW.

How does the K3LR station operate in practice?

In the Multi-Multi category, the station operates up to six stations on the air simultaneously using the following approach:

Each amateur band (160, 80, 40, 20, 15 and 10m) is activated by a two-person team. While one operator 'runs' (calls CQ and manages the pile-up), the second operator listens for new multipliers or 'search and pounce' opportunities.

To comply with contest rules and prevent interference, the transmitters are electronically interlocked so they cannot transmit at the same time on the same band, requiring precise timing and coordination.

The team is built on a foundation of long-term loyalty. Operators such as George Gross, N3GJ and Phil Koch, K3UA, have been part of the K3LR

backbone for 30 years and over 100 contest weekends.

K3LR strategy

Success at K3LR is the result of intentional planning and a strategy that includes:

- **Operator scouting:** Carefully selecting and recruiting top radio contesting talent from around the world. Each operator at K3LR has a strong contesting resume and a track record of working well in a team environment.
- **Proof of performance:** The K3LR team conduct a systematic test procedure to ensure every piece of hardware is functioning perfectly before a contest begins. Everything is logged into the K3LR station notebook to keep track of parameters that may aid in performance improvements in the future.
- **Post-contest analysis:** This means studying logs and propagation data to optimise performance for future years. Tim meets with the operators frequently to understand their input - to suggest changes and improvements – to always make the station better.
- **International operators:** A typical example being Sandy Raeker, DL1QQ from Germany. She is an operator with extensive experience and is able to work at a rapid rate with high accuracy speaking both English and German languages.
- **Great food and accommodation:** The K3LR campus has four locations for housing operators and frequently has Sal, WM2H from Houston, Texas to handle the catering.

What has the K3LR contest station achieved?

The K3LR team is a dominant force in the four major annual contests - CQ Worldwide Phone & CW and the ARRL International DX Phone & CW but also other contests are entered regularly. The team has won more USA Multi-Multi #1's than any other team or station (in the USA) as of 1 January 2026. If you participate in any of the major international contests you will be familiar with K3LR (if you don't find them, they will find you!).

The K3LR team holds the USA records in CQWW Phone & CW, ARRL DX CW and CQ WW WPX Phone & CW contests (Photo 2). K3LR has completed over one million QSOs in 33 years of Multi-Multi team operations. All QSOs are loaded on ARRL LoTW, Club Log and QRZ.com. K3LR also sends and receives paper QSL cards on request.

The Western Pennsylvania K3LR team's competitive spirit is fuelled by rivalries with other Multi-Multi teams, such as with W3LPL in

Maryland, K1LZ in Maine and KC1XX in New Hampshire. In 2025, a friendly 'rivalry match' against the ND7K team in Arizona saw both stations break previous WPX records, highlighting the current high level of attainment.

Mentoring the next generation

A core part of the K3LR philosophy and mission is 'passing the torch' to younger amateurs. Tim has hosted all-youth teams, such as Team Exuberance in the 2019 CQ WW WPX SSB contest at the K3LR station. These teams, comprised entirely of operators under age 21, are mentored by the veteran K3LR crew but the youth are responsible for making every contact themselves.

In 2025, young operators like Katie Campbell, KE8LQR, participated in multi-op efforts at K3LR, gaining experience in propagation analysis and high-speed rate radio operating.

Through a combination of world-class engineering, a 'Formula One' approach to operation and a deep commitment to community and youth, the K3LR team continues to set a standard for what is possible in amateur radio contesting.

HamSCI activities at K3LR

Not just a contest station, K3LR engages with HamSCI (Ham Radio Science Citizen Investigation) [4], a program which links amateur radio with scientific education and investigation. The recent installation of a magnetometer and SDR for HamSCI at K3LR demonstrates that the station engineering is appropriate for research, not just contesting.

The station design, therefore, is dual-purpose: HamSCI carried out a *field exercise* at K3LR in August 2025, installing a Personal Space Weather Station (PSWS) including a ground magnetometer and a wideband SDR, and laying cables. This also provided insight into the topography's role (how the land around the station influences HF propagation) as part of K3LR's engineering rationale.

HamSCI determined that the RF environment at K3LR is very 'clean', likely due to the careful engineering and maintenance of the K3LR installations. HamSCI will return to K3LR in August 2026 to continue its research.

References

- [1] Contest University: contestuniversity.com
- [2] World Wide Radio Operators Foundation: wwrof.org
- [3] DX Engineering: dxengineering.com
- [4] Ham Radio Science Citizen Investigation: hamscl.org
- [5] K3LR website: k3lr.com

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