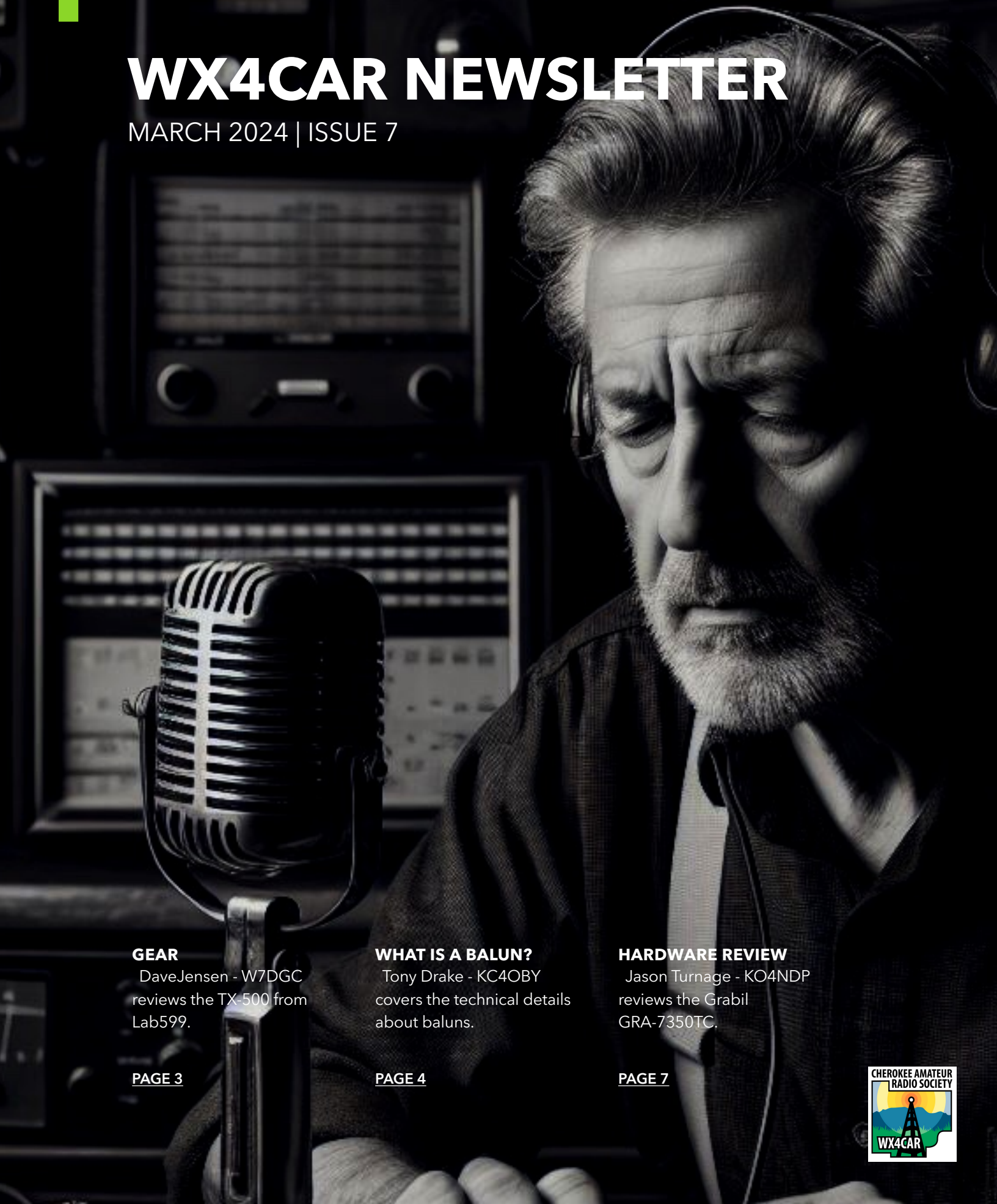
CHEROKEE AMATEUR RADIO SOCIETY

WX4CAR NEWSLETTER

MARCH 2024 | ISSUE 7



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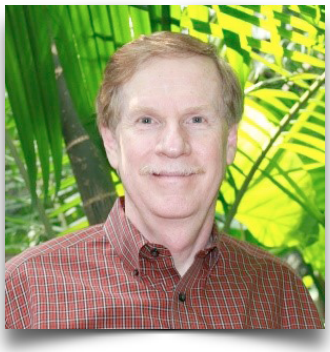
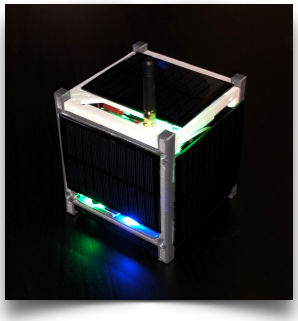


Mart Buehring – KB4MG

Spring is in the air and so are outdoor activities. It's a great time to try POTA or hang that antenna you have wanted to put up all winter long. The club too will have a great activity to celebrate Spring as we have our Spring Picnic and POTA event at Red Top Mountain on April 6th. Read more about it in the Events Column.

The past month has been busy for the club. Thanks to help from Jay Street (K4QEX) and Jason Turnage (KO4NDP), we were able to support two events at the Mountain View Elementary school. If you recall, this is where we will be hosting the ARISS event in April. Leading up to the ARISS event, Cassie Zielinski (KQ4JVI) has been preparing the students by helping them to understand more things about outer space, satellites, Morse code, and much more. As a club we have committed to assist her with these activities.

On February 12th Jay and Marty (KB4MG) had the opportunity to show off the AMSAT CubeSat Simulator (cubesatsim.org), which is a model of a 1U size cube satellite just like ones launched by various organizations and universities. It contains a CPU and payload consisting of various sensors, as well as a radio that sends telemetry on 449.10 MHz to a ground station. It is powered by batteries and charged by solar panels on all six sides of the cube. We were able to show this to almost 900 students that day. What a great thing for CARS to be a part of!



On February 16th Jason Turnage was able to demonstrate Morse code to groups of second graders. Marty told the students about the invention of Morse code and how it came about. Many of the students knew a little bit about the topic, and some knew a relative who learned it for the military and used it then. It was a great way to relate what ham radio operators use Morse code for and the tie to history.

ARISS UPDATE

In March I am excited to have Daryl Young (K4RGK) be our main presenter. Daryl has been past president of the North Fulton Amateur Radio League (NFARL.org) and is the ARISS representative assigned to help us with the ISS contact in April. He works a lot with satellites and is the main support for ARISS in Georgia. You will not want to miss this presentation. If you are even curious about working satellites, Daryl will help you understand what is needed. Come with your questions and curiosity.

We are beginning to plan for Field Day 2024. How do you want to be involved? There are going to be multiple opportunities to serve on one of the teams that put this event on. You will hear a lot more about this at the March meeting. We are really excited to see what happens this year, especially with so many new members. We will have workshops again this year and give you a chance to gain some new skills, or be the one that shares your skills with others. That is what Field Day is all about.

Lastly, we had a very successful New Hams Luncheon following the February meeting. There were some great questions and admonitions to us about making sure we explain things in a way that new hams can understand. We use a lot of three- and four-letter acronyms in this hobby. If you are speaking to a new ham, don't always assume they know what these acronyms mean. Take the time to be a Mentor (Elmer) and explain things in terms that they will understand. In this newsletter edition, Tony Drake (KC4OBY) explains what is meant by a BALUN, and tells us why they are needed. This question was asked and debated by us at the luncheon and is worthy of more explanation.

Enjoy the newsletter!

GEAR - DAVE JENSEN - W7DGJ

Dave Jensen - W7DGJ

Dave was first licensed in 1966 as WN7VDY (and later WA7VDY). Dave loved radio so much he went off to study broadcasting and came out with a BS in Communications from Ohio University. After working his way through the microphone business of Audio-Technica, he moved to Arizona and was later re-licensed as W7DGJ (Scottsdale). His column, Tooling Up, ran for more than 20 years in the website of the leading scientific journal, SCIENCE, and his column Trials and Errors: Ham Life with an Amateur continues to be a popular read each month on QRZ.com. Read Dave's column at https://www.qrz.com/trials-and-errors

I recently replaced my go-to POTA/SOTA radio, a Xiegu G90, with a new TX-500 from Lab599. I'm sure you've seen this odd-appearing little block of solid aluminum, as it doesn't resemble any other radio on the market. While I had no serious issues with the Xiegu, its "usability" factor had deteriorated for me. My eyesight has declined with age, resulting in frustration with the G90's microscopic controls and non-intuitive user interface. Would I still recommend it? Of course, but only for those with great eyes and limitless patience. It's generally priced right when you consider it's in the $450 range.

But wow, what a difference the TX-500 made in my outdoor radio play! The intuitive nature of the menu system and the ample controls improved the usability factor a great deal. I attached a Chameleon QRP antenna and a

small Bioenno 3-amp hour battery (10 volts) and got on the air quickly with impressive results. The receive quality was excellent, and the filtering system was impressive in comparison to my experience with other QRP

"I LOVE THE FORM FACTOR ON THIS RADIO. IT'S FLAT, RECTANGULAR AND EVERY CONTROL IS EASY TO REACH."

radios. While the TX-500 is twice as expensive as the Xiegu G90, within the first few minutes I knew it was worth the extra cost just for the receive quality.

I heard a station north of Vancouver in British Columbia (1400 miles) calling CQ and he picked me up immediately despite only 5W output on my new radio running at 50% power. A few more QSOs and I then connected to my friend Robert, out of Chicago (N9NUQ) another decent haul at 1500 miles. Robert had 100% readability on my little signal, a 54, and I passed along a 57 when he swung his beam around to the Southwest.

I love the form factor on this radio. It's flat, rectangular and every control is easy to reach. The spectrum display is so much more useable than the microscopic one on the Xiegu. On the negative side, it has a few elements requiring adaptors or special accessories, and I generally dislike anything that is aviation or commercial (and harder to find) on a ham radio product. Luckily, the package includes cables for work-arounds. The speaker is in the Mic (which I objected to at first) but soon I found that it was easy to use.

The Lab599 TX-500 radio is one that has earned a place not only in my go-box, but as a backup radio for my shack as it offers reception and a big feature set much like the ICOM IC-7300 sitting next to it.

73, Dave - W7DGJ

WHAT IS A BALUN?

Tony Drake - KC4OBY

Baluns, UnUns, and chokes are three of the most commonly misunderstood and misapplied concepts in amateur radio antenna theory. The word "balun" is a combination of BALanced and UNbalanced. A quick search for "balun" in the "QST" archives brings up 105 articles, columns, and comments dating back 70 years. Some of the more current designs that are still in use come from articles in the 1970's and 1980's. According to an article in the now out-of-print "Ham Radio" magazine, the first instance of a balun made from transmission line in the literature was in 1944. In an article from February, 1980, John J. Nagle presents an improved version of the "W1JR Balun", which was originally presented in "Ham Radio" in September, 1978. In March, 1983, Walt Maxwell presented the design and theory behind the W2DU balun. The difference between them is that the W1JR and K4KJ baluns use circular toroid cores, while the W2DU balun design uses ferrite beads.

Both the W1JR and W2DU baluns are widely available today. The end fed half-wave antennas that were built as a club project for use on Field Day use a W1JR style balun.

If you would like to read more of the theory and construction details, there are links in the footnotes to several excellent online articles. The "Ham Radio" articles are available to non-ARRL members, but the "QST" article requires an ARRL login. For most of us, the somewhat complex theory can be distilled to a few key points that can address when to use a balun, and why.

ARRL EFHW Balun [8]

3KW W2DU Style Balun from difona.de [9]

THE CONCEPT OF A CURRENT BALUN AND CURRENT CHOKE

At their core, all baluns have one primary purpose: to connect an unbalanced feedline to a balanced antenna and ensure that the antenna behaves as it should. This is why you can and in many cases should have a 1:1 balun. These baluns and common mode chokes are, for most amateur radio purposes, similar

enough to be considered the same thing. The purpose is to prevent currents from coming down the coax and into the shack. You can also put a choke between the antenna and radio to reduce radio frequency interference (RFI) from currents induced into the coax from sources near the coax. The reason we need to prevent currents in coax has to do with the difference between a balanced and unbalanced feedline.

In ham radio terms, balanced feedlines come in three flavors. The first is twinlead. If you ever had "rabbit ears" on an old picture tube-style television, you had two screws on the back of the set. These were connected to a parallel wire feedline with an impedance of 300 ohms. These were common and could be bought at almost any hardware or electronics store.

The second and third types are what are known as open wire feedlines. They were generally custom made by amateur radio operators by taking two equal lengths of bare copper wire separated with insulators to keep the wires spaced at an appropriate distance from each other. The spacing determines the impedance of the wire, either 450 or 600 ohms in most typical installations. Fortunately, we no longer need to go through this meticulous work. We can now order insulated wire that is less susceptible to degradation, corrosion, and other environmental factors.

These three types of feedlines are balanced. The current in one side is equal and opposite the current in the other. Thus, the magnetic field in one wire cancels the field in the other. The wire is thus balanced, neutral and does not radiate.

For an antenna to be balanced, it needs to have two halves. A center fed dipole is the classic example. The current in one half of the dipole is equal and opposite the current in the other half.

UNBALANCED FEEDLINES

Coax cable is the most common unbalanced feedline. The reason that coax is called unbalanced is because there are three currents in the coax. The first is in the center conductor. The second is on the inside of the shield. There is a third current path due to the skin effect. The current in the shield does not go through the center of the conductor material that makes up the shield. It splits at the edge of the material and travels on both the inside and outside of the shield as though there are two wires.

The skin effect describes the physical phenomenon in which the depth of the material through which current travels decreases with increasing frequency. In layman's terms, if you have a solid conductor that you connect to a direct current (DC), the current will travel down the center of the conductor. When you increase the frequency from DC to alternating current (AC) to radio frequency (RF), the current travels down the outside of the conductor at a shallower and shallower depth. The reference in footnote four has more details about the physics involved. In the reference in footnote five, you can see that for 14-gauge wire, the frequency at which the entire conductor is used is 6700 Hz. For 20-gauge wire, the frequency is 27 kHz. At any frequency higher than these, the current occupies a shallower and shallower depth of the conductor. This is why at RF you can use thin wall aluminum or copper pipe, or copper tape to build antennas.

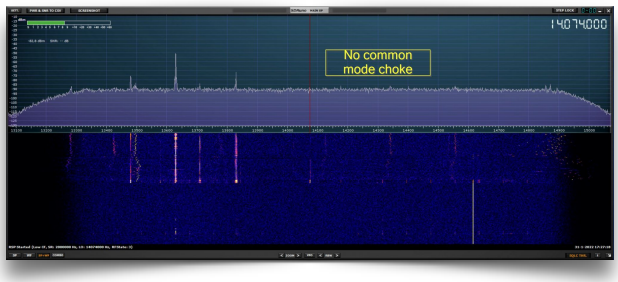
In order to feed a balanced antenna (e.g. a center fed dipole), with an unbalanced feedline, you need to do something to deal with the unbalanced currents. The solution is a balun. If the impedance of the feedline closely matches the impedance of the antenna, then a 1:1 balun is appropriate. This type of balun is also called a common mode choke, or choke balun. If the impedance of the antenna is not closely matched, then the balun can take on a second function, impedance transformation. Typically, 50-ohm coax is used with 1:1, 1.5:1, 4:1 and 9:1 baluns to match common antenna impedances. In these cases, the balun functions both as an impedance transformer and as a common mode choke.

WHY DO I CARE ABOUT CURRENT MISMATCH?

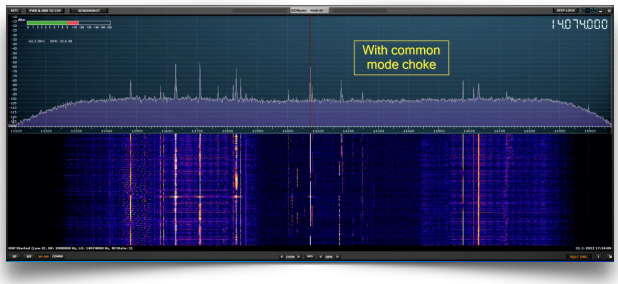
The short answer is that when an unbalanced feedline is connected to a balanced antenna, stray currents travel on the shield of the coax. The currents that come down the outside of the coax make the coax "hot." If you grab it while transmitting, you can get an RF burn. This will also impact the functioning of the antenna, and the radiation pattern. In footnote six, PA9X demonstrates the impact that stray currents have on signals in a receiver using a waterfall with and without a common mode choke, which is equivalent to a 1:1 balun.

An UnUn is an application of a common mode choke (or 1:1 balun) used to connect an unbalanced feedline (coax) to an unbalanced antenna (quarter-wave vertical or end fed half-wave, for example). In

this application the UnUn serves to ensure that stray currents do not travel on the coax into the shack. It functions as a common mode choke to remove the current from the shield of the coax, and, in the case of an end fed half-wave antenna, as an impedance transformer.



Waterfall of receive without common mode choke, count the number of vertical lines indicating signals [6]



Waterfall of receive with common mode choke, count the number of vertical lines indicating signals [6]

SUMMING IT ALL UP

The primary purpose of a balun is to prevent current from traveling down the shield of the coax into the shack, causing RFI, increasing the risk of RF burns, and adversely impacting the performance of the antenna itself. There are two main types of baluns, W2DU which uses ferrite beads on coax, and W1JR, which uses a ferrite toroid with wires wrapped around it. Either type can function as a common mode choke if the ratio is 1:1, or as an impedance transformer and common mode choke if the ratio is larger than 1:1. One-to-one baluns can also be placed at the receiver to remove currents that may be induced into the coax between the antenna and the receiver by other devices or equipment. In this application the balun is referred to as a common mode choke.

[[Footnote 1]] (https://www.worldradiohistory.com/Archive-DX/Ham%20Radio/80s/Ham-Radio-198002.pdf retrieved 2/14/2024) "High Performance Broadband Balun" by By John J. Nagle, K4KJ February, 1980]]

[[Footnote 2]] (https://www.worldradiohistory.com/Archive-DX/Ham%20Radio/70s/Ham-Radio-197809.pdf) retrieved 2/14/2024 Joe Reisert, W1JR.

[[Footnote 3]] (https://webpubs.arrl.org/pubs_archive/76227) Some aspects of the Balun Problem, Walt Maxwell, W2DU QST March 1983 retrieved 2/14/2024)

[[Footnote 4]] (https://www.allaboutcircuits.com/textbook/alternating-current/chpt-3/more-on-the-skin-effect/ retrieved 2/14/2024)

[[Footnote 5]] (https://www.powerstream.com/Wire_Size.htm retrieved 2/14/2024)

[[Footnote 6]] (https://www.pa9x.com/the-broadband-common-mode-choke/ retrieved 2/14/2024)

[[Footnote 7]] (https://www.pa9x.com/the-difference-between-a-balun-unun-common-mode-choke-line-isolator-and-impedance-transformer/ retrieved 2/15/2024)

[[Footnote 8]] (image retrieved from https://home.arrl.org/action/Store/Product-Details/productId/133267 2/15/2024)

[[Footnote 9]] (image retrieved from https://difona.de/en/ham-radio/antenna-accessories/baluns/1746/3kw-balun 2/15/2024)

GABIL LASER ENGRAVED GRA-7350TC

Jason Turnage - KO4NDP

INITIAL THOUGHTS

It's basically a multi-banded hamstick, but a few times more expensive than one. I've seen it successfully used on antenna tripods, but requires radials when used that way and I feel like a Buddistick or Wolf River Coil may be better choices in that setup. I was looking for a mobile option that I could use for in-the-truck POTA, as some parks can be inconvenient or difficult to set up any other type of antenna.

TESTING, AND MY OWN USAGE

I tested and currently use this antenna with a Tram 240-B CB Mag Mount (https://www.amazon.com/gp/product/B013HHINDS, $31 on Amazon) which has 17' of non-detachable RG-58 coax with PL-259 connector.

On the roof of my Ram truck, my findings are slightly different from the spec sheet included with instructions. However, with a solid mag-mount connection I found this antenna resulted in SWR < 1.6 on all bands. On the lower bands, the bandwidth gets narrower and doesn't cover the entire band, but the lowest dips were excellent. The worst result in my initial test was 40m (1.6:1) but SWR can vary by location and even slight changes in mounting. I've used the antenna several times on 40m since this initial test and have seen SWR at 1.5 or lower. All other bands are near 1.2 lowest.

The 80m results are the most impressive. SWR of 1.2 with a 25KHz 1.5:1 range and almost 50KHz 2.0:1 range is amazing. My guess at 80m being better SWR-wise than 40m is the amount of grounding roof metal that happens to be better tuned for the band. A different vehicle will likely have much different results But for me, it can easily be

used for 80m CW contacts (and has been). The range is big enough to call CQ in SSB as well, probably best with a tuner. But it's not an antenna you'd want to search-and-pounce with on 80m in any mode.

With an analyzer (such as my nanoVNA) I've found I only need the line chart from my initial test as a guide. Every setup is slightly different due to surroundings and other environmental factors. I start with that number and then adjust to find the best match and it's never the same twice.

You'll note I did most of the testing in the CW/Digital portion of the bands, but they should be close to the same SWR and ranges when moved up into the Voice portions.

OPERATING

- 6m is used with the extendable coil completely collapsed, and whip retracted to 42.9"
- 10-40m is used with the extendable laser-marked coil extended to length needed to tune the band with the whip fully extended. Adjustment is performed by loosening the locking nut, moving the sleeve housing up or down to the desired position, and tightening the nut. You only want this hand tight, and it doesn't even need much force to be effective, just a light tighten so it doesn't move.
- 80m is used with the extendable coil (almost) fully extended + 80m extension coil, whip fully extended

In general, when carefully calibrated, a tuner is not needed for this antenna. This antenna is a superb performer and I highly recommend it, especially when used mobile with a mag mount.

SPECS

Max power rating: 130W SSB

3/8"-24 thread

Includes soft bag for storage

Dimensions

Primary coil 11-½" - 18-½"

80m extension coil 6-¾"

Whip extended - 85-½" (7' 1-½")

Whip collapsed 9-½"

Gabil Laser Engraved GRA-7350TC

https://www.amazon.com/gp/product/B0C81DJQYJ

	Mark	SWR (min)	SWR (max)
6 Meter	Coil fully collapsed, whip 42.9" (per specs)	Untested	Untested
10 Meter	¾, on line	1.24 @28.3MHz	1.27 range 28.0 - 28.6MHz
12 Meter	1-¼ on line	1.08	1.08 across band
15 Meter	1-⅞, just below line	1.04 @21.194MHz	1.18 range 21.0 - 21.4MHz
17 Meter	2.5	1	1.0 across band
20 Meter	4, just above line	1.11 @14.072	1.5 range 13.928 - 14.368 1.5 range: 440KHz
30 Meter	6-⅜	1.12 @10.125	<= 1.17, 10.100 - 10.150
40 Meter	13-¾	1.61 @7.158	2.0 range 7.083-7.225 2.0 range: 142KHz
80 Meter	17, just below line (plus 80m coil)	1.23 @3.530	1.5 range 3.516 - 3.541 MHz 1.5 range: 25KHz 2.0 range 3.505 - 3.553 MHz 2.0 range: 48KHz

CONTESTING

CONTEST CORNER

MARCH 2024

ARRL INTER. DX CONTEST, SSB
0000Z, Mar 2nd to 2400Z, Mar 3rd

SOUTH AMERICAN 10M CONTEST
1200Z, Mar 9th to 1200Z, Mar 10th

OKLAHOMA QSO PARTY
1500Z, Mar 9th to 2100Z, Mar 10th

IDAHO QSO PARTY
1900Z, Mar 9th to 1900Z, Mar 10th

AFRICA ALL MODE INTER. DX CONTEST
1200Z, Mar 16th to 1200Z, Mar 17th

DXPEDITION NEWS

4S7KKG Sri Lanka - March 2024

VK0DS Davis Station Antarctica - March 2024

XU7GNY Cambodia - Thru March 15th

LICENSE NEWS

CONGRATULATIONS TO THE FOLLOWING HAMS WHO TESTED FOR NEW OR UPGRADED LICENSES IN FEBRUARY

Ronald Young	KQ4OVA	Technician
Charles Underwood	KQ4OZI	Technician
Peter Jones	KQ4OXN	Technician
Craig Hacker	KQ4OXB	Technician
Virginia Harris	KD9ZUQ	Technician
Donald Bachand	KO4RKF	General

ROBERT CLARK ALLPHIN – K4UEE

JUNE 28, 1944 – FEBRUARY 10, 2024

Robert (Bob) Clark Allphin, Jr., 79 (K4UEE), passed away on February 10, 2024.

Bob was born in Planview, TX on June 28, 1944, to the late Robert Clark Allphin and Patricia Geyer Allphin. As part of an Air Force family, Bob's childhood included many moves, leading him to complete high school in Okinawa, Japan. From there he attended Auburn University where he was a member of Lambda Chi Alpha Fraternity. In 1963, while at Auburn, Bob met and fell in love with Mary Russell. Bob graduated from Auburn in 1966 with a Bachelor's in Industrial Management and then was commissioned into the Air Force as an officer. After being married in July 1967, Bob and Mary lived in Sacramento, CA, where Bob was stationed at Mather Air Force Base for six years.

While in the Air Force he earned his Master's in Business Administration from Golden Gate University. In 1972, they moved to Atlanta, GA for Bob to begin his career in the financial services industry. After starting out as a stockbroker, Bob went on to have a successful career with Wood Logan Associates as a Regional Sales Director, retiring in 1999.

Bob was a renowned Amateur Radio operator setting many radio contest world records and traveling to some of the most remote places in the world on DXpeditions. After completing the very successful K1N DXpedition to Navassa Island, K4UEE has reached a milestone in his ham radio "career". He has now participated in, led, or co-led DXpeditions to ELEVEN of the DXCC "top 10 most wanted". They are Baker/Howland (#8), Heard Island (#4), Bhutan (#3), South Sandwich Islands (#6), South Georgia Island (#10), Peter I Island (#4), Lakshadweep (#2), Desecheo Island (#6), Saba/St. Eustatius (all-time new one), Amsterdam/St. Paul (# 4) and now Navassa Island (#1). In 2012, the HKØNA Malpelo Island DXpedition ranked #12 "most wanted", set a new World Record for QSOs for non-hotel, non-fly-in DXpeditions.

Bob and Mary were married for 56 years during which they enjoyed sailing, traveling, being with their children and grandchildren and serving their community and Mt. Bethel Church.

A Celebration of Life Service occurred Thursday, February 15, 2024, at 1:00 pm at Mt. Bethel Church on Lower Roswell Road in Marietta, GA. The family received guests at 12:00 pm. A reception with refreshments will follow the service.

In lieu of flowers, donations can be made in Bob's name to Mt. Bethel Missions at https://mtbethel.org/give (choose Fund = Missions and enter "In Memory of Bob Allphin" in the Note field) or to the International DX Association by PayPal at treasurer@indexa.org or by check at 2309 Lincoln Avenue, St Albans, WV 25177.

RESOURCE LINKS

Website - https://www.wx4car.org

Contact Us - https://www.wx4car.org/contact-us.html

Membership - https://www.wx4car.org/membership-form.html

CARS Club Technical Programs - https://www.wx4car.org/technical-monthly-programs.html

Club Activities - https://www.wx4car.org/club-activities.html

POTA Corner - https://www.wx4car.org/pota-corner.html

ARRL FIELD DAY - https://www.wx4car.org/field-day.html

Ham Fests - https://www.wx4car.org/amateur-radio-events.html

CARS Groups.io - https://groups.io/groups

ARRL Testing Info - https://www.wx4car.org/testing2023.html

New Ham Kit - https://www.wx4car.org/uploads/8/3/7/7/83773582/wx4cars_intro_to_new_hams-7apr2021.pdf

Ham License Upgrading - https://www.wx4car.org/obtaining-a-license.html

Technician Ham Cram Study Guide - https://www.wx4car.org/uploads/8/3/7/7/83773582/2022-2026_technician_pool_study_guide.pdf

Club Apparel - https://www.hamthreads.com

CARS Club Badges - https://www.thesignman.com/clubs/carsga.html

POTA Supplies - https://www.clubgearonline.com

CONTESTING LINKS

ARRL Contest Calendar - http://www.arrl.org/contest-calendar

Contesting Calendar - http://www.contesting.com/

CQ Contest Calendar - http://cq-amateur-radio.com/cq_contests/cq_annual_contest_calendar/cq_annual_contest_calendar.html

SolarHam Site - http://www.solarham.net/index.htm

Space Weather - http://www.spaceweatherwoman.com/

Contest Calendar - https://www.contestcalendar.com

OTHER LINKS

ARRL - http://www.arrl.org

Sky Warn - http://skywarn.org

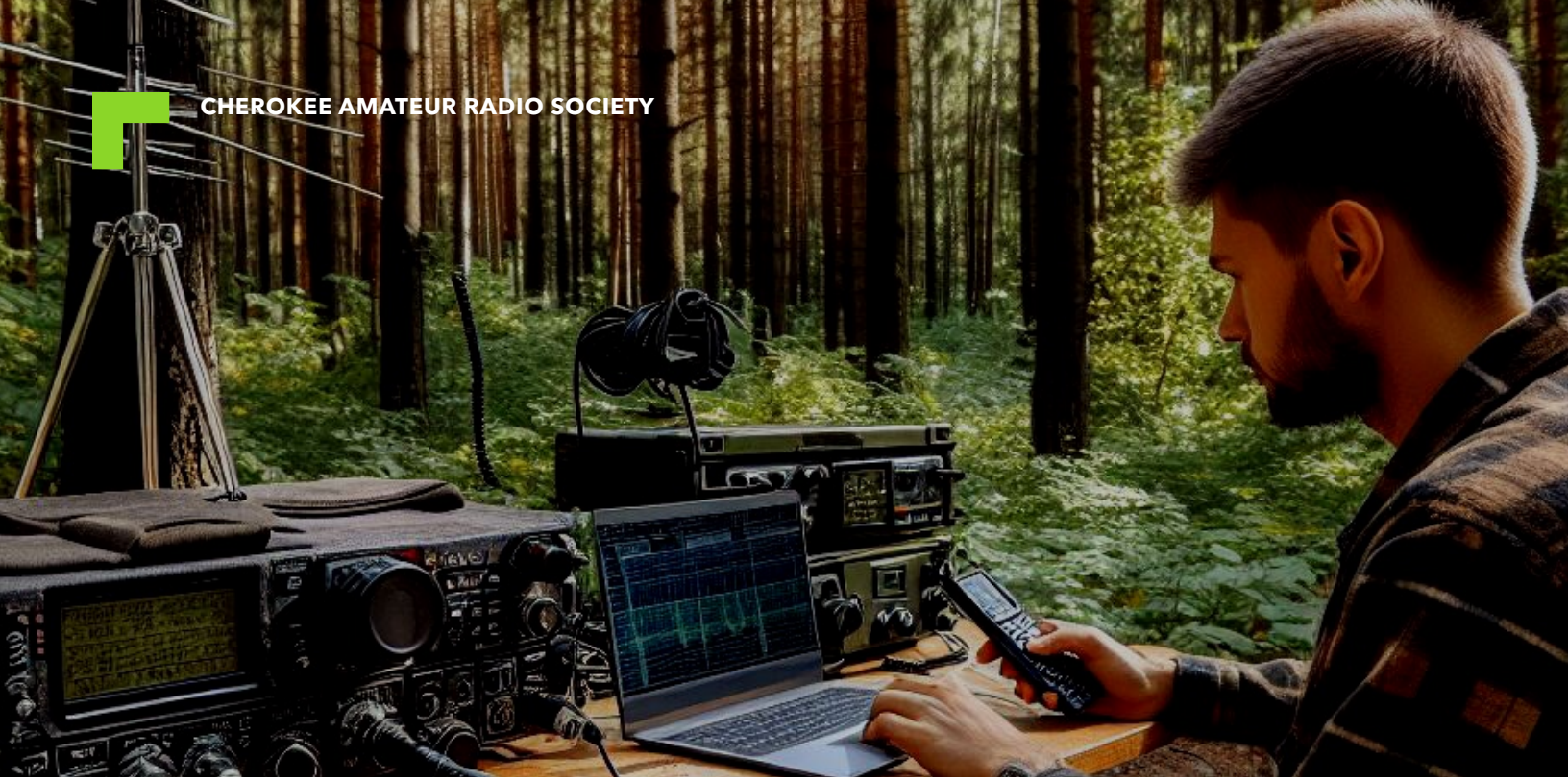
QSO Today - http://qsotoday.com

Cherokee EMA - http://cherokeega-ema.org

Georgia ARES - https://www.gaares.org

Ham Radio Work Bench - http://hamradioworkbench.com

On All Bands - https://www.onallbands.com



MISSION STATEMENT

The mission of the Cherokee Amateur Radio Society is to promote the hobby of amateur radio to the Cherokee County residents and surrounding communities. It primarily serves to provide education, FCC testing, public service, and fellowship to people with the common interest of amateur radio.

Cherokee Amateur Radio Society is an organization of FCC licensed amateur radio operators (also called Hams) that meet and share the hobby, educate people about amateur radio, as well as support our local community in times of disaster. We are located in Cherokee County, Georgia and have club call sign WX4CAR. We are an ARRL Affiliated Club.

The club also participates with ARES, and the Cherokee County EOC when severe weather gets close to the area, and we help with local public service projects. The members of the club also dedicate some of their time to promote and help new hams to develop their skills and knowledge on Amateur communications modes and to be better operators. We are a very active club and participate in ARRL Field Day every year. If you are located in Cherokee County or the surrounding area, we would like to invite you to participate.

CARS OFFICERS FOR 2024:

President: Martin Buehring – KB4MG
Vice President: Chad Cone – KY4KP
Secretary: Mark Schulze – KO4IFY
Treasurer: James James – KE4HMS
Cherokee County Emergency Coordinator:
Rob Bruderer – W1JKU

Email: club.wx4car@gmail.com

Time & Location of Meetings:
Meetings are the second Saturday of each month at 10:00 am Eastern Time.

William G. Long Senior Center
223 Arnold Mill Road
Woodstock, Georgia 30188

Our meetings are open to all visitors. You do not need to be a member or have a license to attend.Come for the fellowship and technical programs. We also have a combined ARES meeting at the same time. ARRL FCC Testing is at 1:00PM following the meeting.

Newsletter Team:

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