THE ROUND TABLE
Monthly Newsletter Of The Denver Radio Club
Since 1917 February 2025

President's Message

By Gerry Villhauer, W0GV

Hello DRC Members,

I hope this finds all of you well and ready for spring. I certainly am.

Those of you who use the 449.350 repeater and/or the Echolink, we have an intermittent receive sensitivity problem. There is not much we can do about trouble shooting it until better weather comes in the spring. Most of you have never been to the Squaw Mountain site. It has become a difficult journey in the summer because the road has deteriorated, making it a difficult extreme four wheel drive trip. Access in the winter time is snowshoeing or a track vehicle. I don't see any snowshoeing in my future.

Our program for the February 16th regular meeting will be presented by Greg Mihran, KJ6ER. (http://www.qrz.com/db/KJ6ER) Greg is an avid POTA operator and has designed and built several antennas for portable use. He will be talking about some of his POTA adventures and more detail on the antennas he has designed and built. Mark your calendars for a very interesting program…February 19th.

I have had a good response from members in regard to a possible ham radio class being conducted in the near future. It appears that the most requested is Extra class. I hope to get more information to the folks interested, in the very near future. Thanks to all who took time to respond.

Thanks to all of our new members who have recently joined the DRC. Your support is very much appreciated. Please come to meetings and events and stay active. Your name and call will be posted in this edition of the Round Table.

73 for now,
Gerry, W0GV
President

Who's New In The DRC?

Provided by Kelly Sobanski, KB8OGP

The DRC is a very active club in the Denver metro area and we'd like to have all of our members listen for these new calls and welcome them to the club and repeaters. Welcome to our newest members:

Jacob Schroeder - KE0KCE	Brad Greenwood - K0WET	Robert Smith - N0OM
James McNamee - KE0NRE	Andrew Slater	Christopher White - AD0XW
	Christopher Lavery - W0MOS	

We have a number of activities throughout the year and we'd like very much for you to participate in serving your community. If you have questions please feel free to ask on any of the repeaters or see the contact information on the last page of this publication.

Also, please join us once a month at the regular club meeting on the 3rd Wednesday at 7:00 p.m. For new hams we have the Elmer session which starts at 6:00 p.m. before the regular meeting.

Question of the Month

By Bill Rinker, W6OAV

Does bending dipole or beam elements 90° impact performance when space is limited?

The answer can be found on page 17 of the October 2017 issue of the Roundtable: https://w0tx.org/RoundtableArchive/2017-RoundTables/RT201710(OCT).pdf#page=17

The G5RV vs the ZS6BKW

By Bill Rinker, W6OAV

The G5RV multiband antenna is popular among hams. (Figure 1). However, many hams are switching from the G5RV to the relatively unknown ZS6BKW antenna due to the latter's improved performance, convenience and smaller size. (Figure 2). The ZS6BKW was designed by Brian Austin G0GSF (formerly ZS6BKW) in the early 1980s as an optimized variant of the G5RV antenna.

The ZS6BKW antenna offers a marked improvement over the G5RV. It provides efficient multiband operation across 40, 20, 17, 12, 10, and 6 meters without needing an antenna tuner on these bands. In contrast, the G5RV requires a tuner for all bands. The ZS6BKW's optimized

design ensures better impedance matching and low SWR on its resonant bands, enabling seamless band switching without any tuner adjustments. This makes the ZS6BKW a user-friendly choice for both fixed and portable installations.

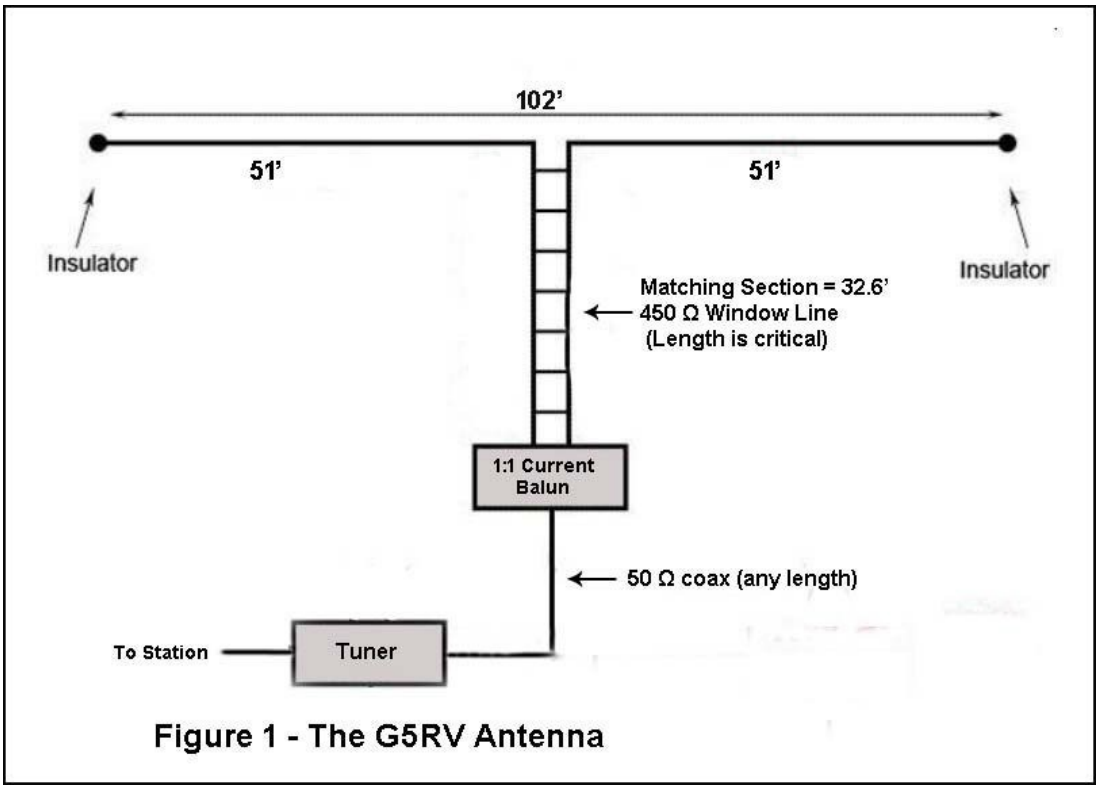


Figure 1 - The G5RV Antenna

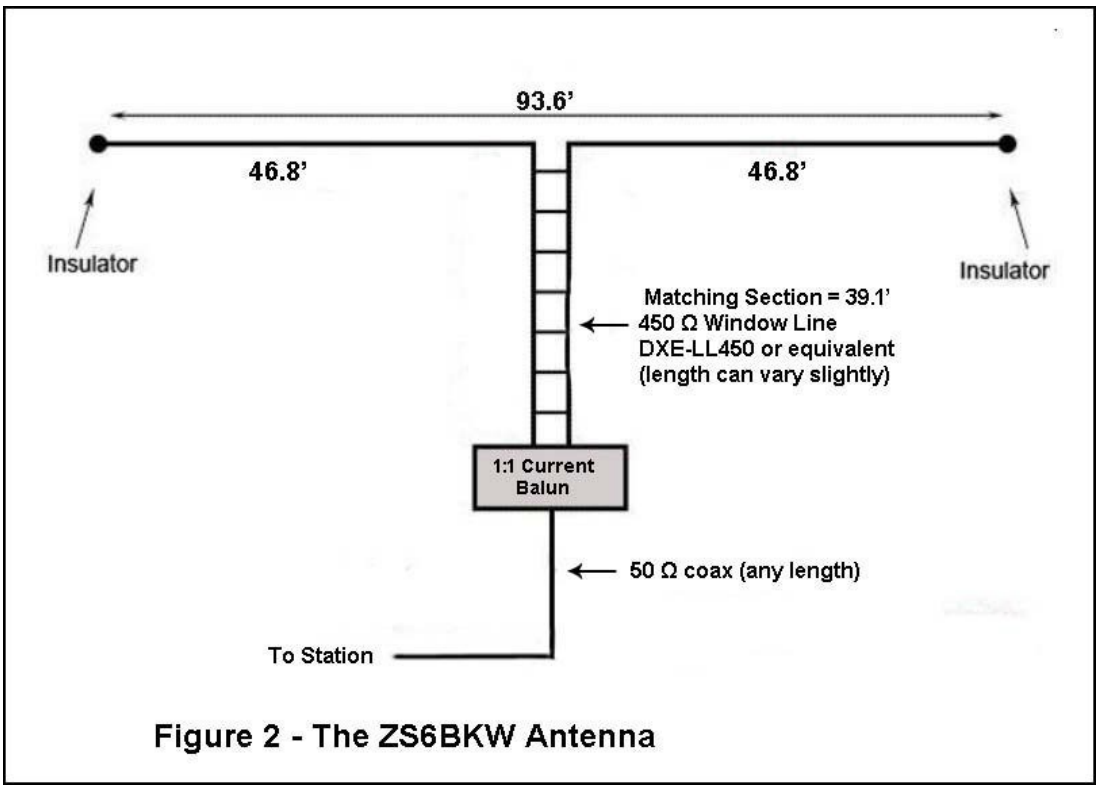


Figure 2 - The ZS6BKW Antenna

The ZS6BKW is a center fed antenna that uses a 450-ohm ladder line (also called window line) as an automatic impedance transformer, achieving a near 50-ohm impedance at the balun resulting in low SWR across the six bands listed above. Although it shares a similar impedance matching concept with the G5RV, the ZS6BKW offers greater performance and flexibility. Unlike the G5RV, which is highly sensitive to precise dimensions, especially the ladder line length, the ZS6BKW is more tolerant. However, adhering to the suggested lengths in Figure 2 is still recommended for optimal performance. This design is what enables efficient operation on six bands without requiring an antenna tuner.

Figure 3 displays the EZNEC theoretical 20 meter elevation radiation patterns of both the ZS6BKW and G5RV antennas at ½λ above ground. Note that the ZS6BKW has about 2 db of gain over the G5RV. This gain is basically due to no tuner loss and better impedance matching within the antenna system. Charts 1 and 2 show the EZNEC SWR plots of both antennas.

Although the ZS6BKW performs well on the six previously mentioned bands, it has limitations. It requires an antenna tuner for optimal performance on 80 and 15 meters and is generally less effective on 30 and 60 meters. Nevertheless, it provides a practical solution for amateur radio operators seeking a single, efficient antenna for multiple frequency bands.

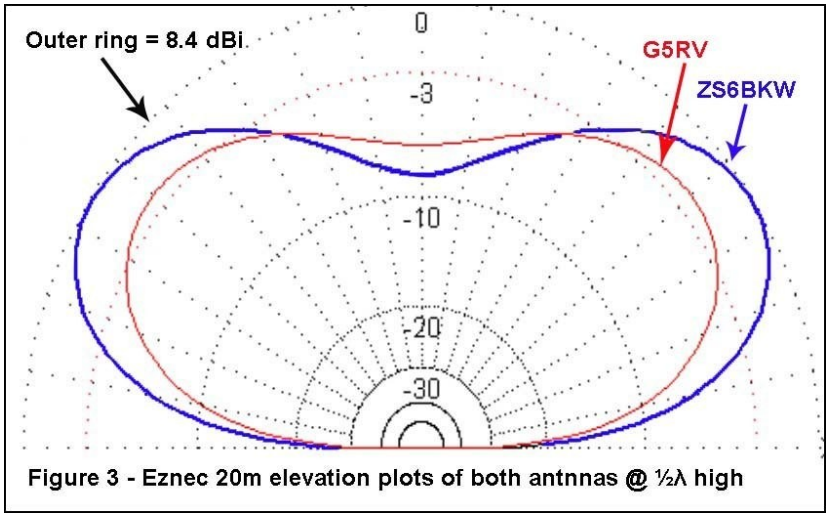


Figure 3 - Eznec 20m elevation plots of both antnnas @ ½λ high

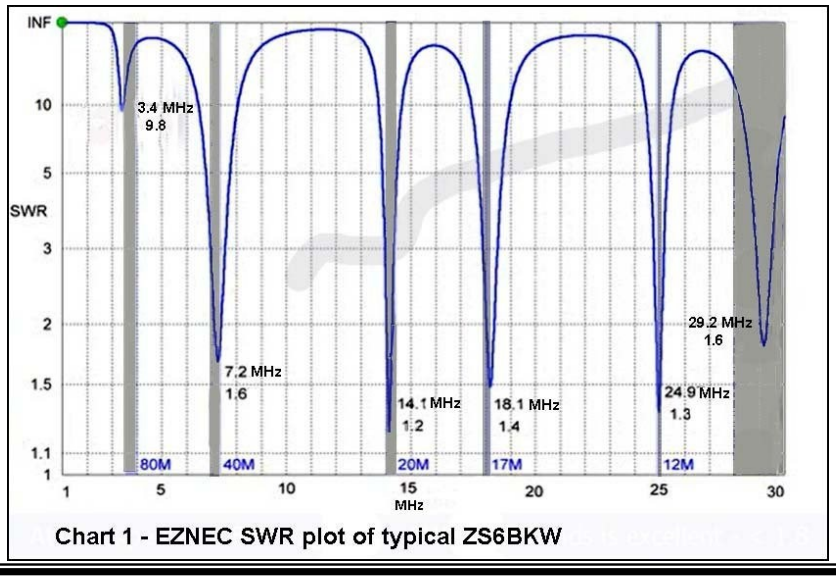


Chart 1 - EZNEC SWR plot of typical ZS6BKW

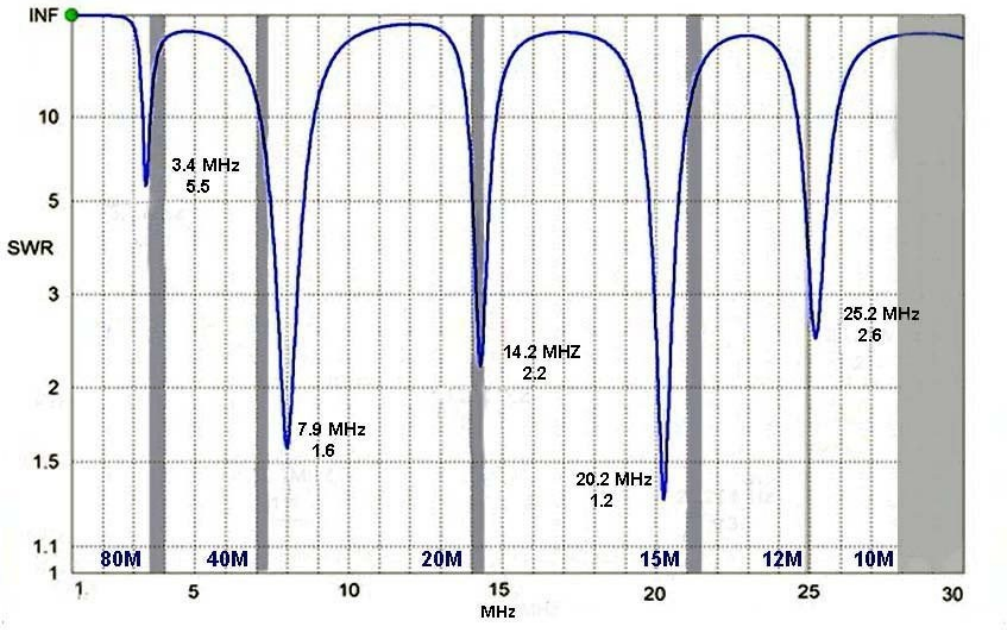


Chart 2 - EZNEC SWR plot of typical G5RV

In summary, the ZS6BKW is particularly well-suited for several types of amateur radio operators:

- **Space constrained operators**: Its relatively compact 93.6' length makes the ZS6BKW suitable for installations with limited space. It can be installed horizontally or as an inverted V. Also, it can be bent. (Refer to the last reference listed below).
- **Portable operators**: The antenna's lightweight design and tuner less operation simplify portability and setup making it ideal for SOTA and POTA deployments.
- **Multi band enthusiasts**: Efficient operation on 40, 20, 17, 12, 10, and 6 meters without a tuner appeals to operators seeking convenient multi-band operation.
- **Budget conscious operators**: As a relatively inexpensive yet effective multi-band antenna, it offers good performance at a reasonable cost. Prices for 450 ohm ladder line vary, typically ranging from about $0.70 to $1.35 per foot, depending on the specific type and vendor.
- **Beginners:** Its ease of use and simplicity makes it a good choice for new hams getting started on HF bands.

References:

"G5RV … on Steroids" *(Slide show comparing G5RV to the ZS6BKW*):
https://www.rochesterham.org/meetings/2020-05-06%20G5RV%20Presentation.pdf

The Almost-No-ATU ZS6BKW, (*A must read by L. B. Cebik, W4RNL*):
https://www.antenna2.net/cebik/content/wire/g5rv3.html

How to Build a ZS6BKW Antenna (optimized G5RV Antenna):
https://vk2kmi.wordpress.com/2013/09/02/how-to-build-a-zs6bkw-antenna-optimised-g5rv-antenna/

Revisiting the GR5V and ZS6BKW Multi-band Antennas:
https://squashpractice.com/2019/04/09/revisiting-the-gr5v-multi-band-antenna-2/

Say Goodbye to that G5RV! Look at the ZS6BKW:
https://www.youtube.com/watch?v=MbXmAcf9MmI

Multi-band, Low-loss, works without ATU. ZS6BKW: is it my new POTA antenna?
https://www.youtube.com/watch?v=CgvBH9iADMg

ZS6BKW Antenna Review: My Review After 1000 QSOs:
https://www.youtube.com/watch?v=Emivfhf0Sdw&t=789s

2024 Winter Field Day - Icom IC-7100 + ZS6BKW Antenna:
https://www.youtube.com/watch?v=CytWimoUPfQ

Don't Load It, Bend It!:
https://w0tx.org/RoundtableArchive/2017-RoundTables/RT201710(OCT).pdf#page=17

I Can't Get the SWR Down to 1:1

By Bill Rinker, W6OAV

How often have you heard someone say "No matter what I do, I cannot get the SWR of my dipole down to 1:1". Well, the response to that statement would be "If the dipole SWR is very close to a perfect 1:1 then there is extra loss somewhere in that antenna system". This article assumes that there is no transmatch at either end of the coax feed line. The effect of transmatches is explained below [1].

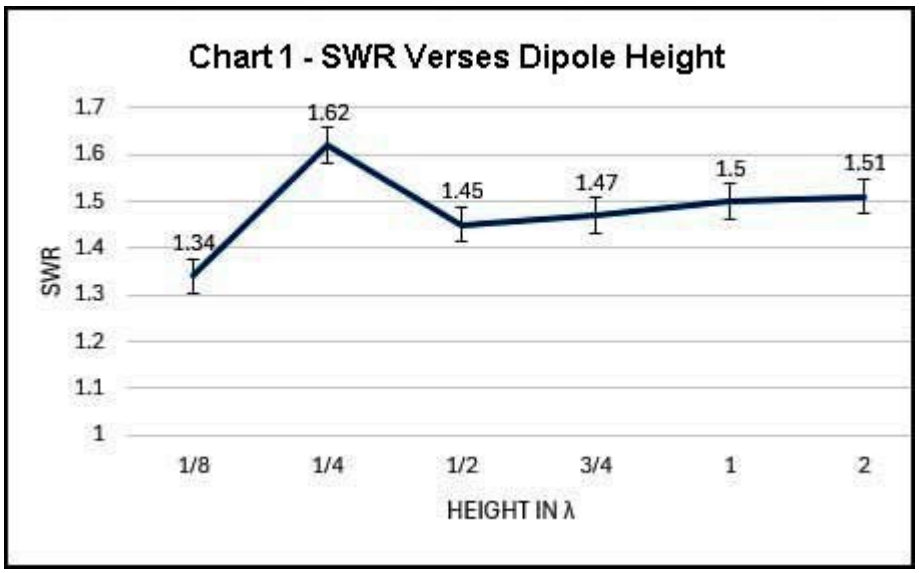
Antenna SWR With 50 Ohm Source

A common misconception among some hams is that a perfect 1:1 SWR automatically indicates an optimal antenna system. In reality, SWR is merely a measurement of impedance matching between the transmitter and antenna. A dummy load, for instance, can show a 1:1 SWR but would be useless as an actual antenna. The goal when constructing an antenna should be to obtain overall system efficiency rather than a perfect SWR number.

A 1/2 λ dipole antenna in free space exhibits a natural feed point impedance of 73 ohms. When connected to a 50 ohm zero loss source, this dipole would have a SWR of approximately 1.51:1. However, real world antennas are subject to various external influences that affect their feed point impedance. The most significant factor is the antenna's proximity to the ground. As a dipole is raised above ground and retuned to resonance, its SWR changes, but never reaches a perfect 1:1 ratio when using a 50 ohm source. Chart 1 illustrates these SWR variations as a dipole's height above ground increases. If a dipole's SWR measurements align closely with the values shown in Chart 1, it suggests that the antenna is performing as expected.

Note: Vertical antennas exhibit similar characteristics to dipoles in terms of how their imped-

ance and SWR are affected by environmental factors.



Based on Chart 1, attempting to reach an exact 1:1 SWR is impossible on a system with good coax. (Lossy coax can make the antenna's SWR value look better at the transmitter, perhaps close to 1:1). Maxwell, W2DU (SK), known for his expertise in antennas and transmission lines, stated in his book **REFLECTIONS III** *" Any effort to reduce an SWR of 2:1 on any coaxial line is completely wasted from the standpoint of any significant increase in power transfer*" [4]. This statement emphasizes the diminishing returns of pursuing an idealized SWR. Most modern transceivers perform excellently with SWR values up to 2:1 and many can handle ratios up to 2:5 without significant performance degradation.

Why Not Worry About SWR Value

Chart 2 shows the minimal RF power loss due to the dipole's SWR when fed with good 50 ohm RG 213 coax.

Chart 2 – Total RG213 Losses at Various SWRs @ 28 MHz

SWR	SWR Loss	+	Matched RG213 Loss	=	Total Loss	SWR Power Loss *
1.2:1	0.014 dB	+	1.065 dB	=	1.080 dB	0.32 w
1.5:1	0.070 dB	+	1.065 dB	=	1.135 dB	1.60 w
2.0:1	0.206 dB	+	1.065 dB	=	1.271 dB	4.64 w
2.5:1	0.363 dB	+	1.065 dB	=	1.492 dB	8.11 w
3.0:1	0.528 dB	+	1.065 dB	=	1.593 dB	11.3w

Note: The values in the first three columns above were determined from various online calculators [3].

* This column shows the minimal power lost due to a dipole's various SWRs when 100 watts is

applied to the dipole. The chart does not show the ≈ 21.83 watts lost due to the RG 213 coax loss (1.065 dB). The example below shows the method used for calculating the antenna's various antenna SWR power losses above. This example is for a 2:1 SWR:

- Convert the dB loss (0.206) to a power ratio:
  - Power ratio = 10^(-0.206/10) = 0.9536
- Calculate the remaining power:
  - Remaining power = 100 watts × 0.9536 = 95.36 watts
- Determine the power lost:
  - Power lost = Initial power - Remaining power
  - Power lost = 100 watts - 95.36 watts = 4.64 watts

Chart 3, which has appeared for many years in QST's antenna books, is a graphical version of information contained in Chart 2. Chart 3 allows determining the extra, but minimal, loss caused by an antenna's SWR.

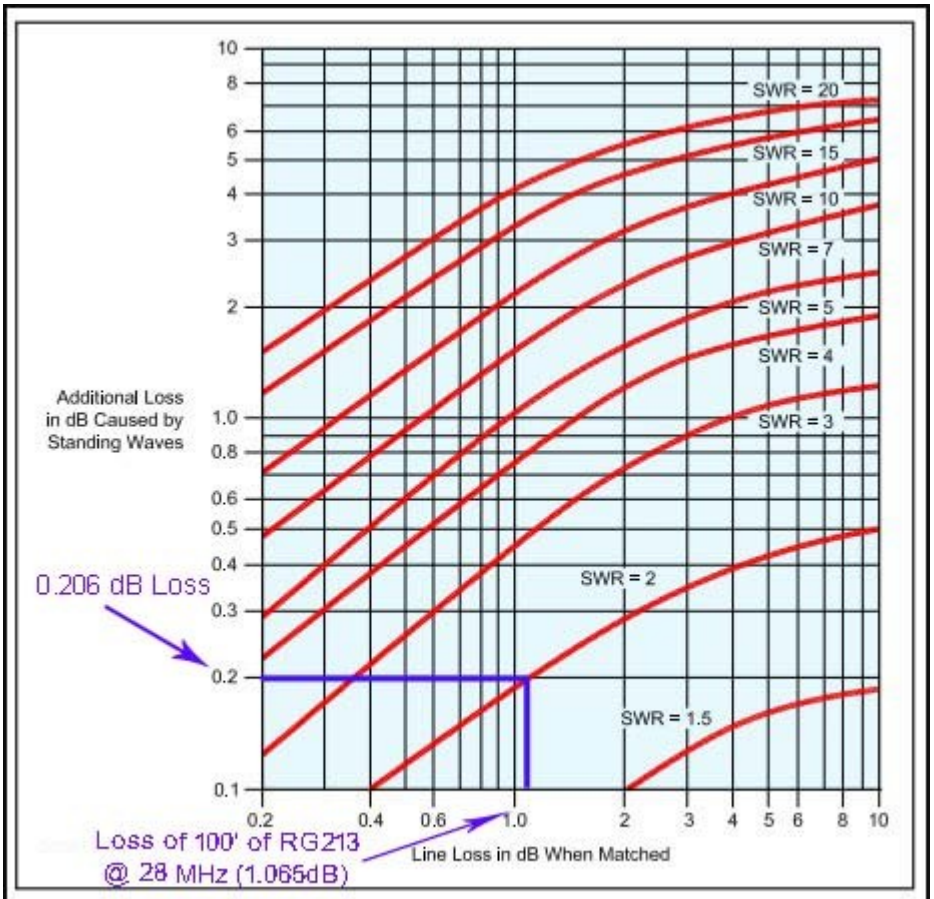


Chart 3 - Additional loss caused by an SWR of 2:1

The following procedure illustrates using Chart 3 to determine the extra loss caused by an antenna's SWR:

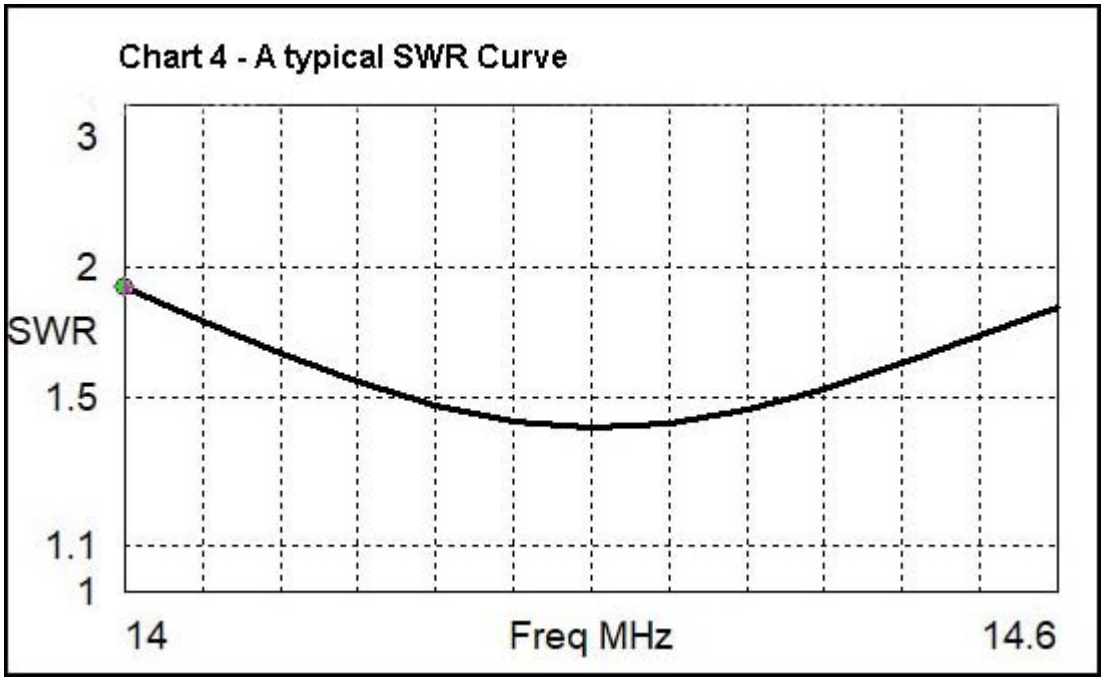
- Determine the dB loss for the particular type of coax, length, and frequency, assuming that the line is perfectly matched. (100' of RG213 @ 28 MHz = 1.065 dB).

- Locate this point on the horizontal axis and move up to the curve corresponding to the actual load. (SWR = 2).
- Moving to the left, the value on the vertical axis gives the additional loss in decibel caused by the standing wave. (Extra loss =0.206 dB).
- Add the two dB values for total system loss. (1.065 + 0.206 = 1.271 dB).

Chart 3 illustrates an important relationship between coaxial cable loss and SWR. As the coax loss increases along the horizontal axis, there is only a minimal corresponding increase in overall loss on the vertical axis. Also, if one were to extend the vertical line representing RG 213 from the 2.0 SWR up to the 3.0 SWR line, the *increase* in loss from before on the vertical axis would still be relatively small (0.322 dB). These observations illustrate a crucial principle in antenna systems: the characteristics of the coaxial cable itself have a more significant impact on overall system performance than the antenna's SWR values.

Important Practices When Tuning an Antenna

When tuning a dipole antenna, understanding the expected SWR (Chart 1) is important for identifying potential issues in the antenna system. As discussed earlier, knowing the typical SWR values helps to determine if the antenna is functioning properly. Additionally, it's important to measure the SWR across the entire frequency band of interest. The SWR should vary across the band typically showing a U shaped or V shaped curve with a minimum at the resonant frequency. See Chart 4. If the SWR remains relatively flat across the entire band, it may indicate excessive loss in the system. This could be due to issues such as faulty or lossy coax , poor connections or corroded components.



In Summary

When it comes to antenna systems, there are two important factors: SWR and coaxial cable matched loss. While both are significant, coax matched loss should be the primary concern.

Coax matched loss directly impacts the strength of the signal that reaches the antenna. This loss is inherent in the transmission line, occurring even when the system is perfectly matched. It increases with both frequency and cable length, meaning that longer runs of coax or operation at higher frequencies will result in greater signal attenuation and a better reading SWR value. This loss is always present and can significantly reduce the power available to the antenna.

SWR, while important, typically has a less dramatic impact on overall system performance, especially for moderate mismatches. For SWR values up to 2:1, which are common in many practical setups, the additional loss, as shown above, is often negligible.

So, select the highest quality low loss coaxial cable available. Carefully adjust the antenna to achieve the lowest possible SWR. Verify that the SWR is close to expected value and that the SWR curve exhibits the correct profile across the frequency range. Then, work the world!

References:

[1]. Don't Worry About High SWR!
https://w0tx.org/RoundtableArchive/2016-RoundTables/RT201602(FEB).pdf#page=8
[2]. Understanding SWR by Example
https://www.arrl.org/files/file/Technology/tis/info/pdf/q1106037.pdf
[3]. Coax Loss Calculator
https://kv5r.com/ham-radio/coax-loss-calculator/
[4]. REFLECTIONS III - By: M. Walter Maxwell, W2DU/W8HKK
https://www.w4wb.com/Reflections_III.pdf

Digital Radio Library

By Kevin Schmidt, K0KPS

Have you ever remembered an article published in one of the amateur radio publications, some time ago, and wanted to go back and review it? Have you wanted to look up an old callsign, but don't where to look? Have you long since cleaned out the shack clutter and disposed of those precious magazines or callbooks that had that information?

You may be in luck. The Digital Library of Amateur Radio and Communication (DLARC) site may be the source for you. This digital library site hosts collections of historical amateur radio magazines, documents and other ham rated information. Some items of the exhaustive collection include the 73 magazine, old Radio Shack catalogs, some podcasts, Call Books, etc. And yes, some of the old Round Table editions from the Denver Radio Club have been submitted for inclusion into the collection. The site is searchable and free to explore and can be found at https://archive.org/details/dlarc.

A YouTube video, https://www.youtube.com/watch?v=egjdrt-ye1E&t=1660s, can be watched to gain more information. Happy searching.

HamCon Colorado is Coming!

From John Maxwell, W0VG

The Rocky Mountain Division Convention is coming back to Colorado after nearly 9 years! We're going to have a great convention with some fantastic speakers and forums on every topic imaginable. We look forward to seeing you all October 23-26, 2025 in Grand Junction.

Thank you for your interest in HamCon Colorado. If you would like more information, go to hamconcolorado.com.

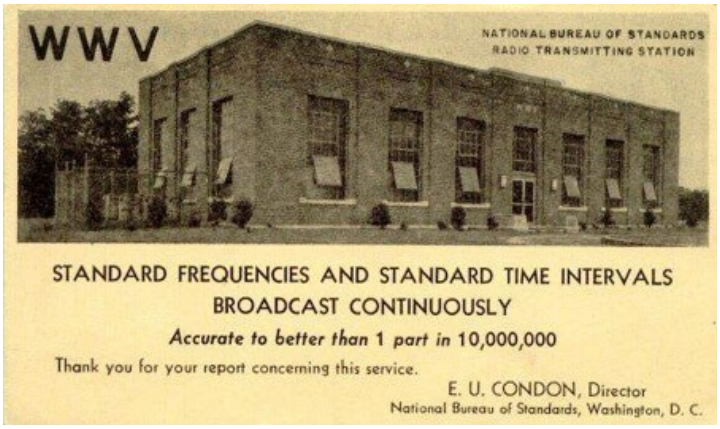
The DRC needs you!

The DRC is looking for Net Control operators for the Sunday night nets. A script, that will guide you through the process, will be provided. It is great practice for running a net and gaining additional experience. If you're interested, please email net@w0tx.org.

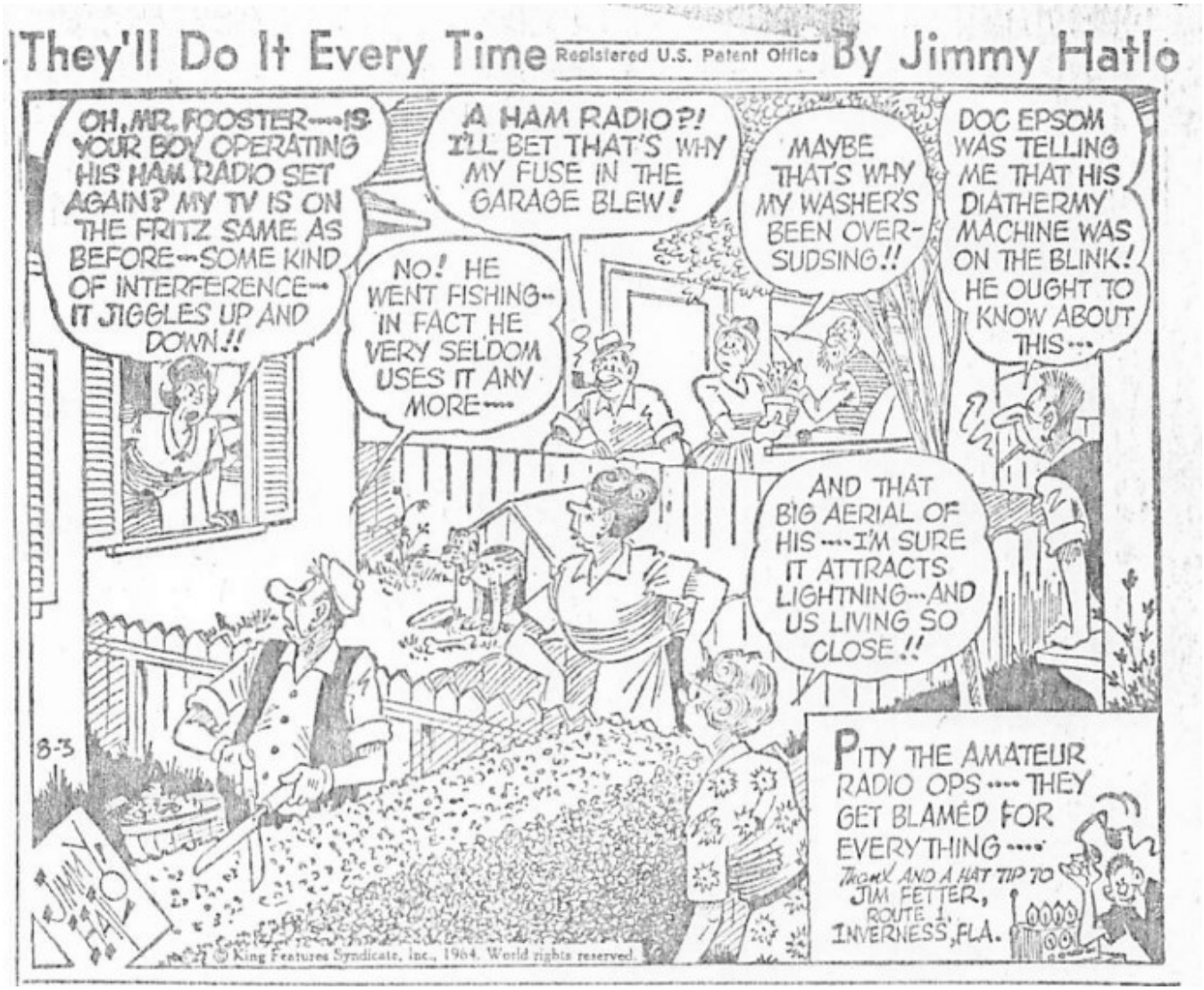
WWV & WWVH by Telephone

By Bill Rinker, W6OAV

Need an accurate time check but not near an HF radio? The audio portions of the WWV and WWVH broadcasts can be heard by telephone. To hear these broadcasts, dial (303) 499-7111 for WWV (Colorado), and (808) 335-4363 for WWVH (Hawaii). Callers are disconnected after 2 minutes. These are not toll-free numbers; callers outside the local calling area may be charged for the call at regular long distance rates.



FROM THE ARCHIVES



DRC's Emergency Response Info

In the event of a disaster in the metro area, please monitor our repeaters on 145.490/448.625 (primary) and 449.350 (secondary).

The emergency Net Control Operator will provide information and/or requests to members for assistance.

W0TX Repeater Directory

Kings Soopers Reward Program - Help the DRC.

kingsoopers.com/i/community/community-rewards

citymarket.com/i/community/community-rewards

Random Site Of The Month

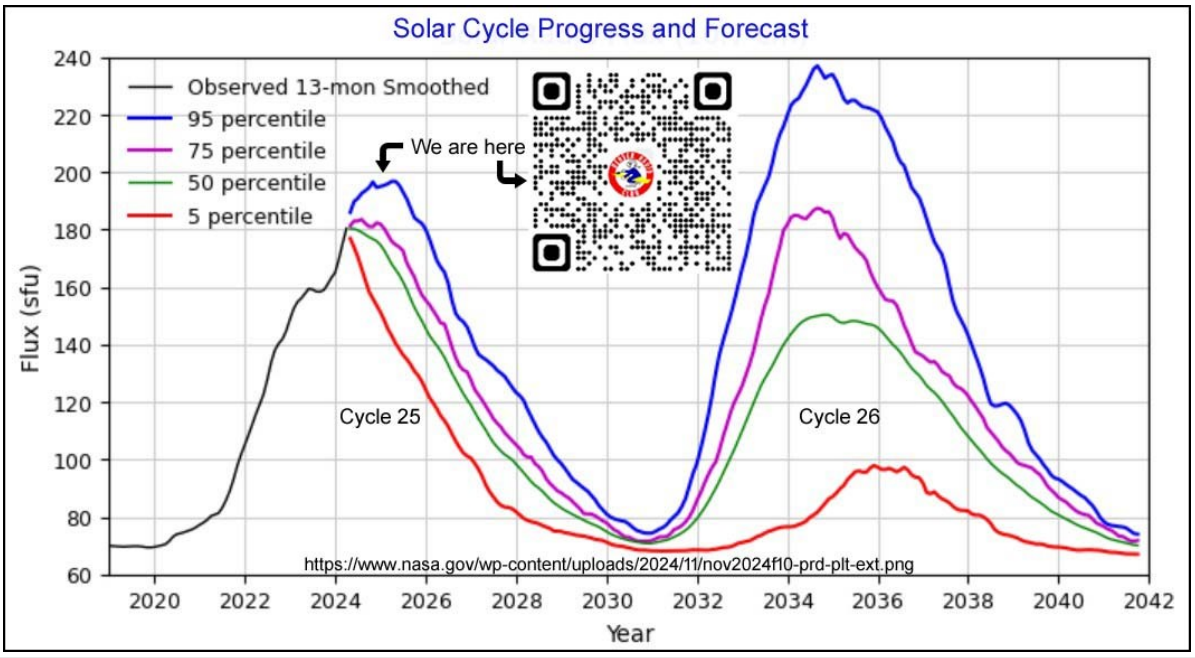
Amateur Radio Association of Lanka

The Round Table Archive and Article Index

w0tx.org/roundtable

Propagation Forecast

By Bill Rinker, W6OAV



Upcoming Events

Hamfests & Conventions

Event	Date	Location	Sponsor Website
The Swapfest	2/16/25	Adams County Fairgrounds	ARRL page
LARCfest 2025	04/05/25	Longmont	W0ENO page

Upcoming QSO Parties

The following are the Contests not sponsored by the ARRL. Please submit additions for future issues.

State/Province	Start Date	End Date	Sponsor Website	Notes
British Columbia	02/01/2025	02/02/2025	Orca DX and Contest Club	
Minnesota	02/01/2025	02/01/2025	Minnesota Wireless Association	
Vermont	02/01/2025	02/02/2025	Radio Amateurs of Northern Vermont	
South Carolina	02/22/2025	02/23/2025	SC QSO Party	
North Carolina	02/23/2025	02/24/2025	North Carolina QSO Party	
Idaho	03/08/2025	03/09/2025	Idaho QSO Party	
Oklahoma	03/08/2025	03/09/2025	Oklahoma QSO Party	
Wisconsin	03/09/2025	03/10/2025	West Allis Radio Amateur Club	
Virginia	03/15/2025	03/16/2025	Virginia QSO Party	
Louisiana	04/05/2025	04/06/2025	Louisiana Contest Club	

Source: qsoparty.eqth.net/index.html See contestcalendar.com/contestcal.html for a larger QSO parties list.

Attention

The DRC Board of Directors meetings are held on the 4th Wednesday of each month via Google Meet and are open to any member. If you wish to attend, please contact a board member prior to the meeting night for specific information.

DRC Repeaters

BAND	Freq / Shift / PL Tone	Additional Information
6m	53.090MHz (-1MHz) 107.2Hz PL	
Packet	145.05MHz	**Metro Denver Area Coverage**
2m	145.490MHz (-) 100Hz PL	**Linked to 70cm / 448.625MHz. Primary frequency during emergency net.**
2m	147.330MHz (+) 100Hz PL	**Local area. Has voting receivers. Does not TX a PL.**
1.25m	224.380MHz (-) 100Hz PL	
70cm	447.825MHz (-) DCS~073; NB 12.5; +/- 2.5	**Saint Anthony's. Note: This is a narrow band repeater requiring DCS.**
70cm	448.625MHz (-) 100Hz PL	**Linked to 2m / 145.490MHz. 1° disaster net freq.**
70cm	449.350MHz (-) 100Hz PL	**Wide area coverage with Echolink, node # 4140. Secondary frequency during emergency net.**
70cm	449.775 MHz (-)	**Yaesu digital, C4FM, Wires-X, DN, VW & Data. No analog FM. W0TX Room 40931.**
70cm	446.7875MHz (-)	**BrandMeister Repeater: Slot 1 – Wide Area Traffic, Slot 2 – Local Talk Group 310804**

DRC's Trading Post

Don't forget you can find locally-sourced, ham-grown merchandise at: w0tx.org/trade

FEBRUARY 2025

DRC Net Sundays at 8:30 p.m. on 145.490 / 448.625 (no PL)

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1
2 	3	4	5 **Learning Net** 7:30 p.m. 145.490 / 448.625 (No PL) First Quarter	6	7	8
9 **RMHAM Swapfest** **0900 - 1300** **rmham.org**	10 School Club Roundup ->	11	12 **Learning Net** 7:30 p.m. 145.490 / 448.625 (No PL) Full Moon	13	14 End School Club Roundup 	15 Int'l DX - CW
16 Int'l DX - CW	17	18	19 **DRC Lunch** 11:30 @ Valley Inn Restaurant, Lakewood **DRC Meeting** Elmer 6 p.m. General 7 p.m.	20 Last Quarter	21	22
23	24	25	26 **Learning Net** 7:30 p.m. 145.490 / 448.625 (No PL)	27 New Moon	28	

See arrl.org/contest-calendar for additional details about contests.

DRC Board of Directors

President	W0GV	Gerry Villhauer	303-467-0223	president@w0tx.org
Vice-President	K0KPS	Kevin Schmidt	303-475-9234	k0kps@arrl.net
Secretary	WW0LF	Orlen Wolf	303-279-6264	secretary@w0tx.org
Treasurer	N0CRZ	Cathy Villhauer	303-467-0223	treasurer@w0tx.org
Board Member	N0XRX	Mark Thomas	720-438-0848	n0xrx@w0tx.org
Board Member	K1DBC	Doron Ben Chaim	720-254-1561	k1dbc@w0tx.org
Board Member	WG0N	Dave Baysinger	303-987-0246	wg0n@arrl.net
Board Member	KB0CHT	Jeff Irvin	Check Roster	Check Roster

DRC Staff and Volunteers

Benevolent		Carolyn Wolf	303-279-1328	benevolent@w0tx.org
Club Librarian	WG0N	Dave Baysinger	303-987-0246	wg0n@arrl.net
Digital Committee	W6OAV	Bill Rinker	Check Roster	digital@w0tx.org
Education Coordinator	Open			elmer@w0tx.org
EmComm Coordinator	KE0HFH	Michael Vespoli	303-215-8862	emcomm@w0tx.org
Field Day Chairman	N6WHV	Dick Nelson		fieldday@w0tx.org
Membership	KB8OGP	Kelly Sobanski		membership@w0tx.org
Net Control	KS0E	Alex Acerra	Check Roster	net@w0tx.org
Public Relations	K0AXP	Dave Verlinde	248-515-2371	publicrelations@w0tx.org
RT Managing Editor	AD0UZ	Brennan Pate	Check Roster	roundtable@w0tx.org
RT Associate Editor	W6OAV	Bill Rinker	Check Roster	Check Roster
Hamfest Manager	KE0YKV	Bill Worthington	720-626-5485	drcfest@w0tx.org
Tech. Committee Chair	Open			tech@w0tx.org
Trustee	WW0LF	Orlen Wolf	303-279-6264	trustee@w0tx.org
VE Team	K0RAP	Robert Pickett	720-336-0114	k0rap@w0tx.org
Website & YouTube	K1DBC	Doron Ben Chaim	720-254-1561	websiteadmin@w0tx.org

Please Let Us Know

Over the years we occasionally hear from hams who have read the Round Table in other states and countries around the world. We appreciate the comments and we would like to know where you are located. So if you live outside the Front Range or Denver Metro Area and read the newsletter either online, email or hard copy please send a short note via email with your *City, State* or *City, Country*.
We will publish it at a later date in our new regular feature called Round Table Round World.
To respond to this request send your information to roundtable@w0tx.org.

Subject: I'm located in…

Editor's Note

DRC members - this is your newsletter. Please email your club or amateur radio related suggestions to the editor. Members are the heart of The Denver Radio Club, so if you have an expertise or an interest in a particular segment of ham radio that you'd like to write about, you may email your submissions to roundtable@w0tx.org. The submission deadline is the 25th of the Month. ~ Editor