



# The RELAY

September 2023

The Official Publication of the Arrowhead Radio Amateur Club

A.R.A.C. Inc.

P.O. Box 7164 Duluth MN 55807-7164

<http://www.thearac.org>

Dues: Member \$20/Family \$25

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## DXing the Gray Line

### Optimizing Long Distance Communications

For many Hams, DXing is an exciting part of the hobby. DXing is the receiving and identifying distant **radio** or television signals, or making two-way **radio** contact with distant stations. "DX" is telegraphic shorthand for "distance" or "distant".

One intriguing aspect of DXing is "working the gray line". The "gray line" is a band around the Earth that separates daylight from darkness. Propagation along the gray line is very efficient. One major reason for this is that the D layer, which absorbs HF signals, disappears rapidly on the sunset side of the gray line, and it has not yet built upon the sunrise side. Ham radio operators and shortwave listeners can optimize long distance communications to various areas of the world by monitoring this band as it moves around the globe.

*Continued on Page 14*

The Relay Co-Editors:  
Kim & Steve Waller

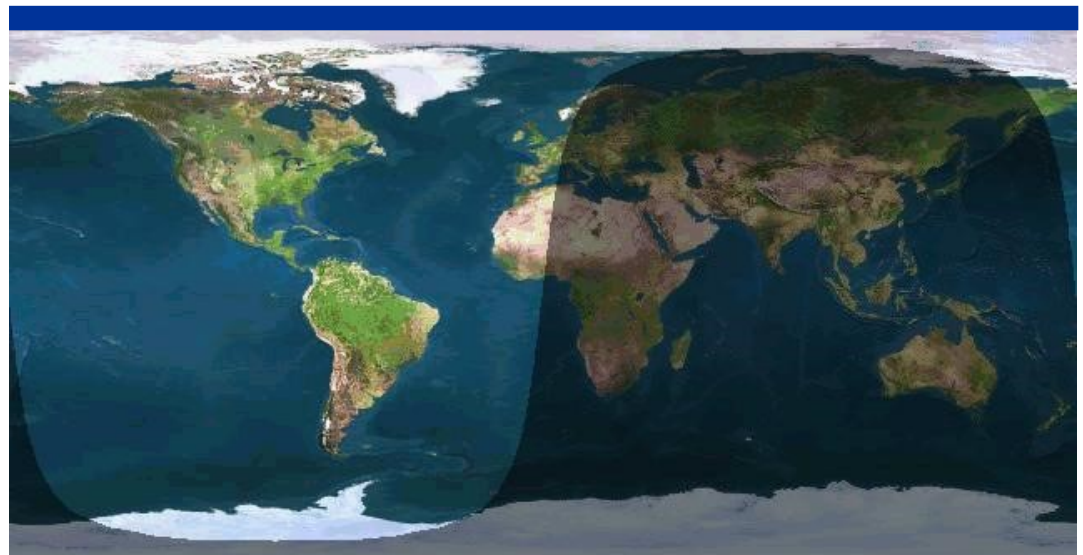
Kim - KE0NQS      Steve - KE0NQT  
[KE0NQS.mn@gmail.com](mailto:KE0NQS.mn@gmail.com)    [KE0NQT@gmail.com](mailto:KE0NQT@gmail.com)



## Last Days of Summer 2023



Join us on Facebook!



Snapshot of DX.QSL.NET's dynamic gray line map, early September, 2023. This site updates the map every 5 minutes.

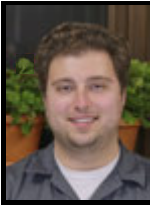
# ARAC Board of Directors

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3710 Chambersburg Ave  
Duluth, MN 55811  
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lspitech@mail.com

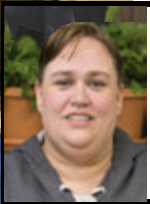
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David Pyrlík

david.pyrlík@gmail.com

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Melinda Nelson

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Sam Frey

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Dave Davis

218-348-6649  
aa0ac@outlook.com

## 2ND YEAR BOARD



**AAØAW**  
Doug Nelson

aa0aw@arrl.net

## 1ST YEAR BOARD



**WØDIO**  
Denny Anderson

No Minutes for the August 1st  
**ARAC Board of Directors Meeting,**  
as we did not have a quorum.

Latest Treasurer's Report, as also published in August  
10th Club Meeting Minutes on page 4 of this issue:

### Treasurer's Report:

Checking:	\$2,416.09
Savings:	\$3,575.93
Repeater:	\$3,319.30
<b>Subtotal Cash</b>	<b>\$9,311.32</b>

Winter CD:	\$1,736.49
Summer CD:	\$ 0.00
<b>Subtotal CD:</b>	<b>\$1,736.49</b>

Assets Subtotal: \$11,047.81

*Our Thanks to*  
**ARAC Treasurer Sam Frey KEØYTM**





# ARAC Club Meeting Minutes

## ARAC Club Meeting

August 10, 2023

### Present:

President: Gene Ellefsen – N0VRM  
Treasurer/Membership: Sam Frey – KE0YTM  
Secretary: Melinda Nelson – KF0GJW  
Second Year Board: Doug Nelson – AA0AW  
Special Events: Open/Gene Ellefsen – N0VRM (acting)  
Parliamentarian: Grant Forsyth – KC0WUP  
Testing: Doug Nelson – AA0AW  
Repeater: Randy Wabik – KR0B  
Property/Picnic: Scott Ahlgren – N0VYU  
HamFest/Education: Bob Schulz – KC0NFB

### Absent:

Vice President: Dave Pyrlik – K0DJP  
First Year Board: Dennis Anderson – W0DIO  
Third Year Board: Dave Davis – AA0AC  
Repeater: Dave Pyrlik – K0DJP  
Chaplin:  
Web Site: Thomas Dorr – KE0RHA  
Newsletter/Historian: Kim Waller – KE0NQS  
Newsletter/Historian: Steve Waller – KE0NQT

Meeting called to order at 19:05 (7:05 PM) by President Gene Ellefsen – N0VRM.  
Thirty-eight (38) members were in attendance.

### Minutes:

Minutes are posted on the website and in the newsletter. Motion to accept by Grant Forsyth – KC0WUP. Motion Passed.

*Continued on Page 4*



# ARAC Club Meeting Minutes, cont.

## **Treasurer's Report:**

Checking: \$2,416.09

Savings: \$3,575.93

Repeater: \$3,319.30

**Subtotal Cash \$9,311.32**

Winter CD: \$1,736.49

Summer CD: \$0.00

**Subtotal CD: \$1,736.49**

**Assets Subtotal: \$11,047.81**

Motion to accept as presented by Jeff Nast – KC0MKS, seconded by Paul Gilsdorf – KF0GEX, motion passed.

## **Education**

Bob Schulz – KC0NFB Class will be starting up September 26<sup>th</sup>. Already have inquiries in and this class in nationwide.

## **Testing:**

Doug Nelson – AA0AW. If anyone needs testing contact Doug Nelson at AA0AW@ARRL.net and they will test individually. Do not forget to get your FRN number prior to testing. You can go to FCC.gov/uls and register. You will also need an email address going forward.

## **Repeater:**

Dave Pyrlik – K0DJP Nothing new currently.

## **New Business:**

WDSE – Donation of \$1,200.00 for the space of the repeater, and the antenna.

Fall Fest September 30<sup>th</sup> at 9:00 AM. If you are interested, please contact John Cavanaugh – KC0AFE

## **Silent Key: (Please keep their family in your thoughts)**

Elmer Berg – KC0NGY passed on 8/1/2023.

Door Prize was won by Scott Ahlgren – N0VYU, who donated it back to the club.

Motion to adjourn by Paul Gilsdorf – KF0GEX, seconded by Mike Lovold – N0PDG, motion passed at 19:17 (7:17 PM).

**CLUB REPEATER**

**WØGKP**

**146.94 (-)**

**CTCSS TONE**

**103.5**



## Prez Sez ...

Hi Everyone,

I wish to thank all those that helped out at the picnic this year!

Jeff KDØDHF and Al K9KDK were the grill masters cooking up the Brats, and Bruce KNØNUL took over the Corn Roasting this year. To those who shucked the corn and cleaned the tables: Thank You!!! We had a lot of people attend and there was plenty of good food—nobody went away hungry!!! There was a Fox Hunt that proved to be very popular. Thanks Doug AAØAW for providing the "Fox" and Antennas.

Saturday, September 30th will be the day for the **Carlton Fallfest** at the Four Seasons Building under the Water Tower in Carlton. 9:00 am to 1:00 pm & admission is \$3.00, and there will be free coffee. For table reservations, contact John Cavanaugh KCØAFE at 218-879-6295 and leave a message.

Hope to see a lot of you there this is a fun event!

**Gene Ellefsen NØVRM**



**LOOKING for an Amateur Radio License TESTING SESSION?**

***Schedule your own Testing Session TODAY!***

**Contact Doug Nelson-AA0AW at [aa0aw@arrl.net](mailto:aa0aw@arrl.net) or 218-391-5874**

All Exam Candidates are REQUIRED to have an FCC Registration Number (FRN) before exam day, which will require your email address.

Not Currently Licensed? For New License Candidate FRN registration, go to: [www.fcc.gov/new-users-guide-getting-started-universal-licensing-system-uls](http://www.fcc.gov/new-users-guide-getting-started-universal-licensing-system-uls)

Upgrading to General or Expert Class & not sure you have an FRN number?  
go to

<https://wireless2.fcc.gov/UlsApp/UlsSearch/searchLicense.jsp>


**UPGRADE CANDIDATES:**

***Please bring a copy of your current license to the exam session.***

# CW Abbreviations

AR End of Message	AS Pse QRX	BK Back to You	SK End of Contact
TU Thank You	PSE Please	K Invite to Transmit	
QST Calling all Amateurs	QRL Are You Busy?	QRU Have anything for me	
QRV Are You Ready?	QRX Standby	QRS Transit Slower	

<b>A</b> ●—	<b>M</b> —●—	<b>Y</b> —●●—
<b>B</b> —●●●	<b>N</b> —●●	<b>Z</b> —●●●
<b>C</b> —●●●●	<b>O</b> —●—●—	<b>1</b> ●—●—●—
<b>D</b> —●●●	<b>P</b> —●—●●	<b>2</b> ●●—●—●—
<b>E</b> ●	<b>Q</b> —●—●—●—	<b>3</b> ●●●—●—
<b>F</b> ●●—●●	<b>R</b> —●—●●	<b>4</b> ●●●●—
<b>G</b> —●—●●	<b>S</b> ●●●	<b>5</b> ●●●●●
<b>H</b> ●●●●	<b>T</b> —●—	<b>6</b> —●—●●●
<b>I</b> ●●	<b>U</b> ●●—	<b>7</b> —●—●●●●
<b>J</b> —●—●—●—	<b>V</b> ●●●—	<b>8</b> —●—●—●—●
<b>K</b> —●—●—	<b>W</b> —●—●—●	<b>9</b> —●—●—●—●●
<b>L</b> —●—●●●	<b>X</b> —●—●—●●	<b>0</b> —●—●—●—●—



## US Amateur Radio Bands

### US AMATEUR POWER LIMITS

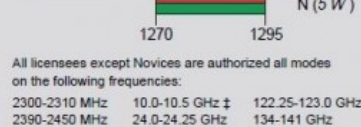
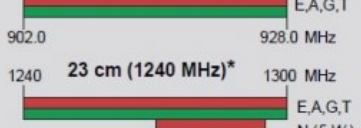
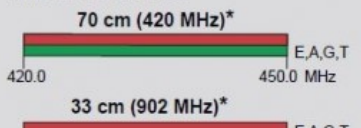
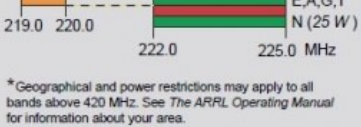
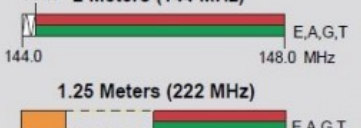
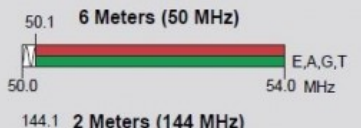
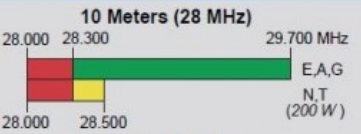
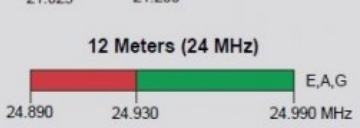
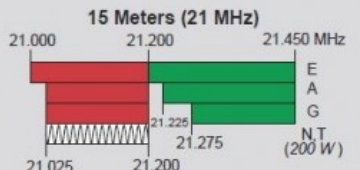
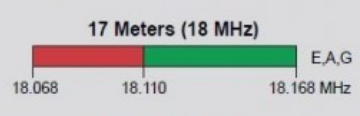
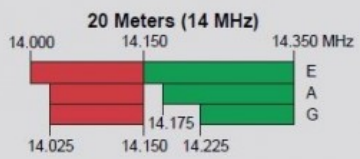
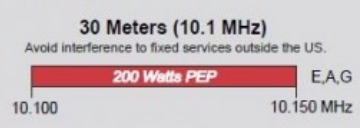
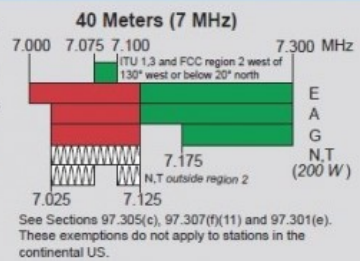
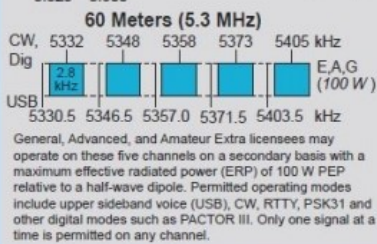
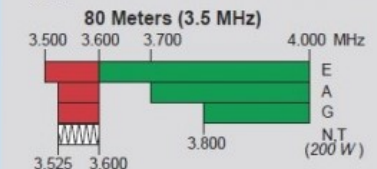
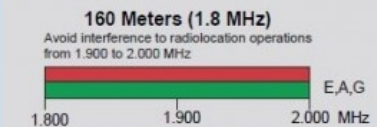
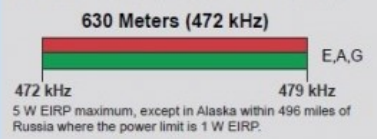
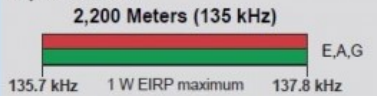
FCC 97.313 An amateur station must use the minimum transmitter power necessary to carry out the desired communications. (b) No station may transmit with a transmitter power exceeding 1.5 kW PEP.

Effective Date for  
2,200 and 630 Meters  
to be announced



The national association for  
**ARRL AMATEUR RADIO**

On March 28, 2017, the Federal Communications Commission adopted rules that will allow Amateur Radio access to 472-479 kHz (630 meters) and to 135.7-137.8 kHz (2,200 meters). However, amateurs cannot use these frequencies until 30 days after the Report and Order is published in the Federal Register and the final procedures for registering stations with the Utilities Telecom Council (UTC) have been approved and announced. At the time this chart was created, the Report and Order had not been published and the UTC online registration site is not yet available. Follow ARRL news for further information. New charts will be published at [www.arrl.org/graphical-frequency-allocations](http://www.arrl.org/graphical-frequency-allocations) when the bands are fully available for use.



All licensees except Novices are authorized all modes on the following frequencies:

2300-2310 MHz	10.0-10.5 GHz ‡	122.25-123.0 GHz
2390-2450 MHz	24.0-24.25 GHz	134-141 GHz
3300-3500 MHz	47.0-47.2 GHz	241-250 GHz
5650-5925 MHz	76.0-81.0 GHz	All above 275 GHz

‡ No pulse emissions

**KEY**

**Note:**  
CW operation is permitted throughout all amateur bands.  
MCW is authorized above 50.1 MHz, except for 144.0-144.1 and 219-220 MHz.  
Test transmissions are authorized above 51 MHz, except for 219-220 MHz

- = RTTY and data
- = phone and image
- = CW only
- = SSB phone
- = USB phone, CW, RTTY, and data
- = Fixed digital message forwarding systems only

E = Amateur Extra  
A = Advanced  
G = General  
T = Technician  
N = Novice

See [ARRLWeb](http://ARRLWeb) at [www.arrl.org](http://www.arrl.org) for detailed band plans.

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email: [news@arrl.org](mailto:news@arrl.org)

Exams: 860-594-0300 email: [vec@arrl.org](mailto:vec@arrl.org)



Have a favorite HF/6m/2m/1.25m/70cm net that you check into or listen in on? Also, please send corrections and we will add it to the list below - Kim KEØNQS at my email KEØNQS.mn@gmail.com.

- **Northland Weather Group Net:** Mondays 2000 on the ARAC repeater (146.940 MHz with a tone of 103.5 and standard offset).
- **Minnesota D-Star Net:** Sundays at 19:30 on Reflector 53A
- **Minnesota Section Net** 1200 and 1730 on 3.860 [Net Manager: NØYR] [http://www.mn-section.org/dept\\_stm.html](http://www.mn-section.org/dept_stm.html)
- The non-non-net: Evenings 2000 144.200 USB except for Sunday evenings.
- Badger WX Net: 0500-0715 on 3.985. Give 24 hour high/low/current temperature, precipitation and snowfall.
- **PICONET:** 3.925 from 0900-1100 CT Mon-Sat and 1600-1700 CT Mon-Fri. Info at: <http://www.piconet3925.com>
- Michigan Upper Peninsula Net: 1600 (CST) on 3.921 MHz Sun-Sat and 1200 Sun. Info: <http://www.michupnet.com>
- Great Lakes Marine/Maritime Mobile Net: Morning 07:30 - 3.932; 08:15 - 7.261 MHz and evening 18:30 - 3.1730927; 19:15 - 7.268 MHz. Weekend extra net: 10:00 - 7.261/7.268 MHz. All CST, LSB and +/- QRM. See: <http://www.sailblogs.com/member/glimmnet/>
- MIDCARS: 07:30-13:00 - 7.258 MHz. See: <http://www.midcars.net>
- Iowa snowbird net on 14.257MHz, M-W-F at 10:00 am Local Time. This is an open net.
- Spider Web Net (Marco Island FL) on 14.347 every morning at 0730 CST/CDT: <http://www.spiderwebnet.net>
- Maritime Mobile Service Network: Daily at 1100—2100 Central on 14.300. <http://mmsn.org> and <http://www.14300.net>
- RV Radio Network: Every day at 1900 Central on 7.265 MHz. Web site: <http://www.rvradionetwork.com>
- Upper Midwest Ten Meter Net: Every Thursday Evening @ 8 PM – 28.480 MHz USB
- Wisconsin Sideband Net: Daily @ 5:15 PM – 3985 [or 3982.5] KHz LSB
- Hobby Helpers Net - Tuesday @ 8 PM – 28.330 MHz USB (Isanti MN) LSB [Net Manager: WOØA].
- Northstar Trader Net: 3.908 +/- at 0830 CST Sundays
- WARFA: 3.908 +/- Sun/Tue/Thu nights at 2200 CST, <http://warfa.org/>
- Youth Net: 14.320-14330 Sundays 1800-1900 UTC, Net Control: AC8PI
- YACHT: Saturdays 1900 CST on EchoLink #481872, <http://yachthams.webstarts.com>
- Northwestern Ontario ARES Net: Evenings at 20:15 (Central) on +/- 3.750Mhz
- The Iron Range Net: Saturdays at 0800 Central time on or near 3.919 Mhz. Look them up on Facebook!
- FORX Net: Mondays at 1900 Central at 3.941 Mhz +/- QRM. WAØJXT — Grand Forks, North Dakota
- HF CW: Fridays 08:00 CST, 7.112 MHz. Informal slow speed CW Net. W8IRT NCS. Email: [w8irt@aol.com](mailto:w8irt@aol.com)
- Minnesota ARES Digital Net: Thursdays at 2000 CST, 3.5835 MHz USB +/- QRM, Mode: Olivia 8/500.
- SARA Digital Net: Sundays at 1900 Local, 3.582.150 MHz USB +/- QRM, Mode: BPSK31/BPSK63
- Spider Web Net (Marco Island FL): 14.347 every morning at 0730 CST/CDT: <http://www.spiderwebnet.net>
- Broadcaster Net: 7.231 or 3.855 M/W/F @ 1500 UTC. 14.255 M-F @ 2130 UTC. <http://www.cbsretirees.com/ham.htm>
- Old Military Radio Net: 7.268 +/- nightly at 0200z. Other times/Frequencies too. See: <http://www.mrca.ar88.net/>
- Rag Chew Crew/Tailgaters/Freewheelers Nets: 3.916 +/- nightly at 1900 CST, <http://www.tailgatersnet.com>
- North South Net: 7.214.6 +/- at 0700 CST, Monday-Saturday



# DULUTH AREA REPEATERS

## ARAC System WØGKP

Frequency	Offset	Tone	Location
146.940	minus	103.5	Duluth
146.940	minus	107.2	Lakeside (recv)
146.940	minus	151.4	Two Harbors (recv)
146.940	minus	100.0	Gary-New Duluth (recv)
146.940	minus	110.9	Cloquet (recv)
147.000	minus	103.5	Mahtowa
444.100	plus 103.5		Duluth UHF Link

## N9MMU/N9QWH System (WI)

145.310	minus	110.9	Duluth
145.490	minus	110.9	Solon Springs
147.255	plus 110.9		Hayward
145.110	minus	110.9	Rice Lake
147.345	minus	136.5	Holcombe
145.230	minus	110.9	Eau Claire

## WECOMM – WI Statewide Linked System WE9COM

147.075	plus 110.9		Meteor Hill (closest repeater to Duluth)
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## LSAC System # 1

147.330	plus 151.4		Proctor
147.330	plus 103.5		Duluth (recv for Proctor)
147.270	plus 114.8		Two Harbors
147.270	plus 103.5		Wales
147.090	plus 114.8		Silver Bay
145.410	minus	114.8	Finland
147.300	plus 114.8		Isabella
145.150	minus	103.5	Washburn, WI
146.700	minus	103.5	Bayfield, WI
443.850	+5.00	none	Bayfield, WI
147.165	plus 110.9		Hurley, WI
146.640	minus	151.4	Ely
443.500	+5.00	141.3	Gilbert
147.060	plus 103.5		Virginia
147.360	plus 162.2		Cook
147.165	plus 114.8		Coleraine
443.925	+5.00	110.9	Brainerd
443.200	+5.00	114.8	Tamarack
147.360	plus 203.5		Aitkin
146.865	minus	146.2	Giese
147.570	simplex	146.2	Hinckley
444.575	+5.00	146.2	Hinckley
443.325	+5.00	146.2	Isanti





# DULUTH AREA REPEATERS, continued

## NARC System NAØRC

147.135 plus 103.5 Knife River  
 145.450 minus 114.8 Park Point (rcv)  
 147.135 plus 114.8 Knife River - Park Point (rcv)

## Stand Alone Repeaters

145.210 minus 110.9 Clam Lake, WI  
 146.880 minus 123.0 Grand Rapids, MN  
 146.910 minus 146.2 Duxbury, MN  
 146.955 minus 146.2 Askov, MN  
 147.105 plus 110.9 Chaffey, WI  
 444.850 +5.00 141.3 Cloquet, MN

## Fusion

Fusion (Analog has tone and C4FM digital with no tone)

147.150 plus 151.4 NTØB Gilbert, MN Fusion Repeater  
 145.170 minus 110.9 WA9KLM Superior, WI – Douglas County RACES/ARES Fusion Repeater (Digital only) Fusion Room 28373

145.250 minus 103.5 KBØYHX Cloquet, MN – Carlton County RACES/ARES Fusion Repeater

444.300 +5.00 103.5 NØEO Duluth, MN – Spirit Valley Amateurs Fusion Repeater WIRES-X NØEO (Analog only) Fusion Room 40494

444.400 +5.00 103.5 NAØRC Knife River, MN – Wires X Connected to NØEO Room 40494  
 444.500 +5.00 103.5 NØLCR Two Harbors, MN – Wires X Connected to NØEO Room 40494  
 444.600 +5.00 103.5 NØLCR Silver Bay, MN – Wires X Connected to NØEO Room 40494  
 444.800 +5.00 103.5 NØLCR Grand Marais, MN – Wires X Connected to NØEO Room 40494

## D-Star

147.375 plus NØEO D Star  
 442.200 plus NØEO D Star

Rev. KCØWDQ as of 10/1/22 For ARAC Newsletter

# Elmers

## El-mer / el-mər/ [el-mer]

1. a male given name: from Old English words meaning "noble" and "famous."
2. an adhesive used to bond like or unlike materials
3. An experienced ham radio operator who mentors new and prospective hams.

Name	Call Sign	Expertise
Jeff Nast	KCØMKS	APRS, EchoLink, WinLink, Fusion, Contesting
Bob Schulz	KCØNFB	Contesting
Jim Anderson	NØJWA	QsoNet
Doug Nelson	AAØAW	HF, VHF/UHF, Contesting, Packet, APRS, Morse Code, VE testing, Echolink, Allstar, EmCom...



## UPCOMING EVENTS

### Next ARAC Board Meeting

Tuesday, September 5, 2023 @ 6:30 p.m. - Sammy's Spirit Valley

### NEXT ARAC CLUB MEETING

Thursday, September 14, 2023 @ 7:00 p.m. - Coppertop Church

## CARLTON COUNTY ARES/RACES

# Fallfest 2023

**Saturday, September 30<sup>th</sup>, 2023 9am to Noon**

4 Seasons Sports Facility on Highway 210 in Carlton

Fest is located on Highway 210, 2 miles East of I35 going towards Carlton. Under the water tower!

**Admission: \$3 (12 and under FREE!) Free parking. Bring your RV!**

Used radios, electronic equipment, supplies, and other Ham Radio gear

**FREE Coffee**  
**Door Prizes**

**\$100 GRAND PRIZE!**

**Attention Dealers, Vendors and Hams with good stuff!**

**Tables available - Reserve yours today**

4' table: \$2

8' table: \$4

Vendor Setup: 7AM Saturday

### Table Reservations

John Cavanaugh KC0AFE

[johnxcavanaugh@yahoo.com](mailto:johnxcavanaugh@yahoo.com)

Cliff Tanner AC0FO

[cliff.tanner@gmail.com](mailto:cliff.tanner@gmail.com)

Talk-in on: W0GKP repeater  
146.940 (-) [103.5] Duluth

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Members, please check your name and email address for accuracy. If you are not on this list and want to be on the list, contact us with your info. If you need to make a change, please let us know at KEØNQS.mn@gmail.com OR KEØNQT@gmail.com



Contact Kim or Steve Waller to include your name in this listing!

# SEPTEMBER

## CLUB EVENTS

**SUNDAY NIGHT NETS**  
 1930 - CW - 28.125 MHz USB-CW  
 2000 - USB 28.450 MHz  
 2100 - Southern St. Louis County  
 Emergency Services Net  
**MONDAY NIGHT NETS**  
 2000 - Northland WX Net - ARAC Repeater

**TUESDAY NIGHT NETS**  
 2000 - Douglas Cty 145.490 MHz  
 2030 - Central Carlton County  
**WEDNESDAY NIGHT NETS**  
 1900 - Lake County - LSAC1  
 2nd & 4th Wednesdays  
 2100 - BWAR

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			2	3	1	2
3  CW 1930 AA0AW USB 2000 W0NW0 ES 2100 K9KDK	4  <b>HAPPY LABOR DAY!</b>  WX 2000 KC0MKS	5  <b>ARAC BOARD MEETING</b> Sammy's Pizza 6:30 pm  DC Net 2000 CC Net 2030	6  2100 - BWAR	7	8	9
10  CW 1930 N0PDG USB 2000 N0VRM ES 2100 N0VRM	11  <b>DC ARES/RACES Mtg 1900 DC EOC</b>  WX 2000 KC0MKS	12  DC Net 2000 CC Net 2030	13  <b>Lake County ARES/RACES Meeting 1800</b> Lake County Net 1900 2100 - BWAR	14  <b>ARAC Club Meeting</b> Coppertop Church 7:00 PM	15	16
17  CW 1930 AA0AW USB 2000 N0PDG ES 2100 KE0YTM	18  WX 2000 KC0MKS	19  DC Net 2000 CC Net 2030	20  <b>St Louis County ARES/RACES Meeting 1800</b> 2100 - BWAR	21	22	23
24  CW 1930 N0PDG USB 2000 AA0AW ES 2100 AA0AW	25  WX 2000 KC0MKS	26  DC Net 2000 CC Net 2030	27  Lake County Net 1900 2100 - BWAR	28  <b>Carlton County ARES/RACES Meeting 1900 CC EOC</b>	29	30  <b>ARAC Club Breakfast</b> The Chalet 8 am <b>Fall Fest</b> 9 am

Get this newsletter *faster*  
via email!

Email Doug AAØAW at  
[aa0aw@arrl.net](mailto:aa0aw@arrl.net)

Next Club Meeting:  
Thursday,  
September 14th, 2023 - 7 pm  
at the Coppertop Church!

## ARAC Committee Chairs



**Club License Trustee:**

Ray Barnes KEØZN

**Control Operators:**

AAØAW - NØKXT - KCØNFB

**Newsletter/Historian:**

Kim KEØNQS & Steve KEØNQT  
Waller

**Education Chair:**

Bob Schulz KCØNFB

**Hamfest Chair:**

Bob Schulz KCØNFB

**Chaplain:**

Rollie Bockbader KBØCK

**Visiting Chaplain:**

**Parliamentarian:**

Grant Forsyth KCØWUP

**Website:**

Thomas Dorr KEØRHA

**Membership:**

Sam Frey KEØYTM

**Property Chair:**

Scott Ahlgren NØVYU

**Testing:**

Doug Nelson AAØAW

**Field Day:**

**Picnic Chair:**

Scott Ahlgren, NØVYU

**Repeater Chairs:**

Randy Haglin NØBZZ  
Randy Wabik KAØJZV

**Contest Calendar** at [www.contestcalendar.com](http://www.contestcalendar.com)

**National Contest Journal** at [www.ncjweb.com](http://www.ncjweb.com)

**QSO Party Note:** State/Province/National QSO Parties are abbreviated with the 2 or 3 letter abbreviation for the state/province/national designation followed by QP for QSO Party:

Examples: Minnesota QSO Party is MNQP  
British Columbia QSO Party = BCQP

**QRZ** web site at [www.qrz.com](http://www.qrz.com)

**VHF Propagation** site at [www.aprs.mountainlake.k12.mn.us](http://www.aprs.mountainlake.k12.mn.us)

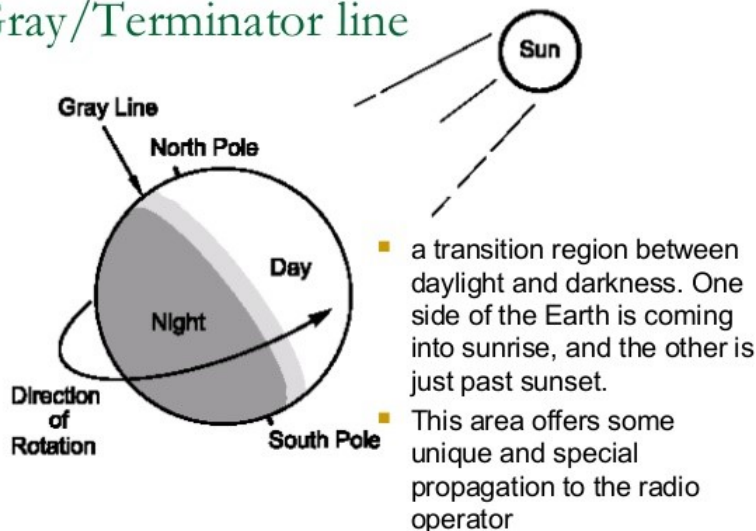
**Reminder:** The Contest Corral monthly listing of contests can be found in each issue of QST. ARRL sponsored contests can be found in Contest Corral, highlighted, or on the ARRL's web site at [arrl.org](http://arrl.org).

**Paul Harden NA5N** from the National Radio Astronomy Observatory in Socorro, New Mexico posted an interesting in-depth explanation for those new to the subject. Here it is:

“During the day, solar radiation collides with the molecules in our ionosphere, ripping off electrons. These electrons are called "free electrons" because they are not attached to an atom or molecule. All of these free electrons cause the density of the ionosphere to increase. The more dense the ionosphere, the higher the frequency that is reflected back to earth. Our electron density is what determines the maximum usable frequency (MUF), and the action of solar radiation separating electrons from the molecules is called *ionization*.

“In the daytime, solar radiation causes ionization to stratify, that is, to form distinct layers. The layer closest to the earth is called the D-Layer. It does not reflect signals generally, but does absorb some of the energy, and hence the D-Layer is often called the "absorption layer." Higher up in our ionosphere, we find the E- and F-Layers. These layers *do* reflect the signals back to earth if they are below the MUF, and is exactly what causes "skip propagation." So during the day, the sun is ionizing the D, E and F layers (there are actually two F layers, called F1 and F2). Your 10m signal must travel through the D-Layer, getting attenuated, then bounces back from the E or F layer to some exotic DX spot, passing through the D-Layer for more absorption again. But since solar radiation has to travel the farthest to get the D-Layer, absorption is usually fairly minimal. So far, during the middle of the day, we have moderate absorption, and good skip propagation.

### Gray/Terminator line



VE6TN - Working DX!

28

Image Courtesy VE6TN, shown in his guide called "Working DX!"

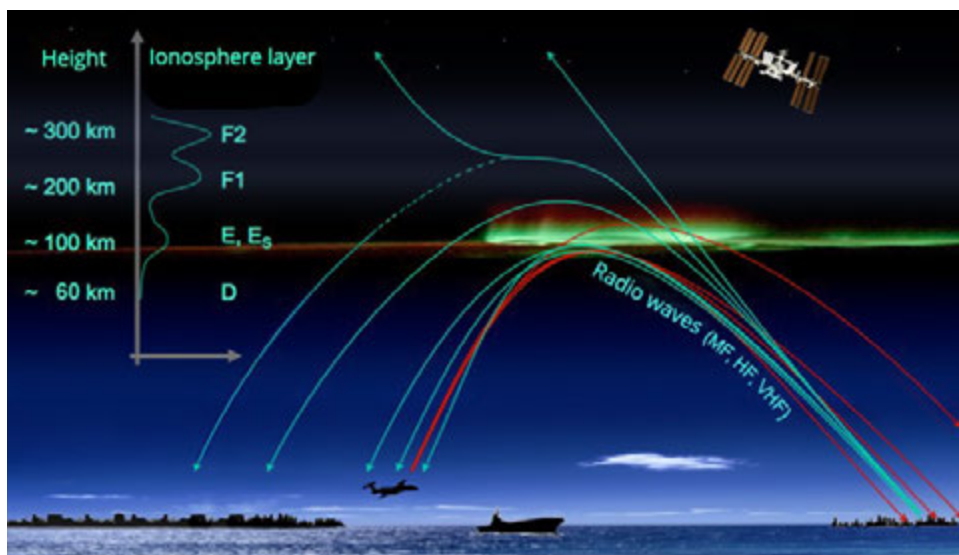
“AT SUNDOWN ... solar radiation no longer strikes our ionosphere right above our heads, and ionization stops. This means there is no solar radiation to form free electrons. In fact, without this solar radiation, these free electrons tend to get attracted back to recombine with their host molecules. This is called "recombination" (gee, how original!). Recombination, when it starts to get dark, causes the electron density to go down, forcing the MUF to go down as well, which is

Continued on Page 15

why by total darkness, 10m (and a bit later 15m) are completely dead. The MUF is far below 28 MHz.

“BUT DURING TWILIGHT ... OR IN THE "GRAY LINE" ... the D-Layer suddenly causes little absorption to signals passing through it, while the E and F layers are still being ionized by sunlight. This makes for about 45-60 minutes of interesting operating, *especially for QRPers* (low power operators). There is almost no signal attenuation, but the MUF is still very high, so long-distance skip is still possible. However, when the sun quits illuminating the E and F layers, the MUF can drop dramatically ... sometimes with only a few minutes of warning, sometimes between heartbeats. So when you establish a contact, get the QSL info fast!

“One other advantage of gray-line DX is that your signals tend to reflect off the edge of the ionized portion of the upper layers. This means propagation will often be in a southerly direction, bouncing along the shadow, or terminator, between sunlight and darkness. This is good for working into South America and the South Pacific. Your signals can also bounce northward along the terminator, bending around the pole, and down the *morning terminator* across eastern Europe, the Middle East, and into Africa (depending on the time of year). So gray-line DX also affords an opportunity to work portions of the world not usually accessible during the day, where propagation tends to be more east-west circuits.



The different layers of the ionosphere as a function of altitude. Image credit U.S. Navy

“The same principles apply at sunrise. The upper ionosphere begins to become ionized, while the D-Layer is still dark and offers low absorption, although, the MUF in the morning generally does not support propagation on 10m, so most people enjoy gray-line work on 20m or 15m (if open). Morning gray line can even be eventful on 80m and 40m, due to the low absorption before the sun starts heating the D-Layer.

“And remember, 10m and 15m (and often down to 30m) are *not* generally bothered by a geomagnetic storm. So even during major geomagnetic storms, the higher bands may be open and fairly quiet. And even if a bit noisy, the short period of gray-line operating can still produce a couple of good QSO's. Hope this helps to explain the "gray line" phenomenon, and hope it helps you snag a few new ones.”

Thanks, to Paul Harden NA5N for sharing his expertise on the subject!

Do you have a story to share about DXing or another favorite aspect of the hobby? Submit an article or an idea for an upcoming newsletter topic by emailing us at [KE0NQS.mn@gmail.com](mailto:KE0NQS.mn@gmail.com) We'd love to hear from you! ★

# ESTATE SALE

## Contact:

**Gary K0GX 763-561-2836**

**k0gx@comcast.net**

RF-KIT RF2K 1500w Solid state amplifier	\$3495.00
Ameritron AL-1200 amplifier 1500w+ 10-160 3CX1200A7 current price 5999.00	\$2495.00
Heathkit SB-200 Amplifier	\$495.00
Heathkit SB-220 Amplifier	\$995.00
Hy-Gain TH-11DX 5 Band H.F. antenna 10-12-15-17-20meters	\$795.00
Drake R-4C Receiver	\$249.00
DrakeMS-4 speaker	\$95.00
Kenwood TS-590S 10-160+6 meters Original box and all accs	\$795.00
Icom IC-706MK2 10-160 + 2m	\$525.00
Yaesu FT450D H.F. transceiver	\$550.00
Radio Shack DX-394 General coverage receiver	\$125.00
Daiwa CN-101L 1.8-150Mhz power/swr meter	\$125.00
MFJ-1762 6 meter 3 element beam antenna	\$150.00
MFJ 989D Legal limit tuner	\$195.00
MFJ 989C 3000watt tuner	\$275.00
MFJ-1025 noise cancelling	\$125.00
OJE PS32wi 23 amp switching power supply	\$75.00
Astron 35M 35amp with meters	\$175.00
Samlex 1235M 35amp power supply	\$125.00
Icom RC-28 remote encoder	\$175.00
Ameritron RCS-8V 5 port remote ant switch	\$160.00
Ameritron RCS-4 4 port remote antenna switch	\$160.00
Astron RS-35M	\$175.00
Alinco 110 2 meter radio	\$110.00
Logikey memory keyer	\$60.00
ICE-421 low pass filter	\$45.00
ICE-420 low pass filter	\$30.00
Heil HS-2 ptt switch	\$22.00
Heil foot switch	\$12.00





# Contest Calendar - September 2023

<a href="#"><u>+ NCCC FT4 Sprint</u></a>	0100Z-0130Z, Sep 1
<a href="#"><u>+ QRP Fox Hunt</u></a>	0100Z-0230Z, Sep 1
<a href="#"><u>+ NCCC RTTY Sprint</u></a>	0145Z-0215Z, Sep 1
<a href="#"><u>+ NCCC Sprint Ladder</u></a>	0230Z-0300Z, Sep 1
<a href="#"><u>+ K1USN Slow Speed Test</u></a>	2000Z-2100Z, Sep 1
<a href="#"><u>+ CWOps CW Open</u></a>	0000Z-0359Z, Sep 2
<a href="#"><u>+ INDEXA Worldwide QSO Party</u></a>	0000Z, Sep 2 to 2400Z, Sep 10
<a href="#"><u>+ Russian RTTY WW Contest</u></a>	0000Z-2359Z, Sep 2
<a href="#"><u>+ All Asian DX Contest, Phone</u></a>	0000Z, Sep 2 to 2400Z, Sep 3
	0600Z-0629Z, Sep 2 and
	0630Z-0659Z, Sep 2 and
<a href="#"><u>+ Wake-Up! QRP Sprint</u></a>	0700Z-0729Z, Sep 2 and
	0730Z-0800Z, Sep 2
<a href="#"><u>+ SARL Field Day Contest</u></a>	0800Z, Sep 2 to 1000Z, Sep 3
<a href="#"><u>+ CWOps CW Open</u></a>	1200Z-1559Z, Sep 2
<a href="#"><u>+ Colorado QSO Party</u></a>	1300Z, Sep 2 to 0400Z, Sep 3
<a href="#"><u>+ RSGB SSB Field Day</u></a>	1300Z, Sep 2 to 1300Z, Sep 3
<a href="#"><u>+ IARU Region 1 Field Day, SSB</u></a>	1300Z, Sep 2 to 1259Z, Sep 3
<a href="#"><u>+ IARU Region 1 145 MHz Contest</u></a>	1400Z, Sep 2 to 1400Z, Sep 3
<a href="#"><u>+ AGCW Straight Key Party</u></a>	1600Z-1900Z, Sep 2
<a href="#"><u>+ CWOps CW Open</u></a>	2000Z-2359Z, Sep 2
<a href="#"><u>+ PODXS 070 Club Jay Hudak Memorial 80m</u></a>	2000Z, Sep 2 to 2000Z, Sep 3
<a href="#"><u>+ WAB 144 MHz QRO Phone</u></a>	1000Z-1400Z, Sep 3
<a href="#"><u>+ Tennessee QSO Party</u></a>	1800Z, Sep 3 to 0300Z, Sep 4
<a href="#"><u>+ K1USN Slow Speed Test</u></a>	0000Z-0100Z, Sep 4
<a href="#"><u>+ ICWC Medium Speed Test</u></a>	1300Z-1400Z, Sep 4
<a href="#"><u>+ OK1WC Memorial</u></a>	1630Z-1729Z, Sep 4
<a href="#"><u>+ ICWC Medium Speed Test</u></a>	1900Z-2000Z, Sep 4
<a href="#"><u>+ RSGB 80m Autumn Series, SSB</u></a>	1900Z-2030Z, Sep 4

*Continued on Page 18*



# Contest Calendar - September 2023

<a href="#"><u>+ MI QRP Labor Day CW Sprint</u></a>	2300Z, Sep 4 to 0300Z, Sep 5
<a href="#"><u>+ Worldwide Sideband Activity Contest</u></a>	0100Z-0159Z, Sep 5
<a href="#"><u>+ ARS Spartan Sprint</u></a>	0100Z-0300Z, Sep 5
<a href="#"><u>+ ICWC Medium Speed Test</u></a>	0300Z-0400Z, Sep 5
<a href="#"><u>+ Phone Weekly Test</u></a>	0230Z-0300Z, Sep 6
<a href="#"><u>+ A1Club AWT</u></a>	1200Z-1300Z, Sep 6
<a href="#"><u>+ CWops Test</u></a>	1300Z-1400Z, Sep 6
<a href="#"><u>+ VHF-UHF FT8 Activity Contest</u></a>	1700Z-2100Z, Sep 6
<a href="#"><u>+ Mini-Test 40</u></a>	1700Z-1759Z, Sep 6
<a href="#"><u>+ Mini-Test 80</u></a>	1800Z-1859Z, Sep 6
<a href="#"><u>+ CWops Test</u></a>	1900Z-2000Z, Sep 6
<a href="#"><u>+ UKEICC 80m Contest</u></a>	2000Z-2100Z, Sep 6
<a href="#"><u>+ Walk for the Bacon QRP Contest</u></a>	0000Z-0100Z, Sep 7 and 0200Z-0300Z, Sep 8
<a href="#"><u>+ CWops Test</u></a>	0300Z-0400Z, Sep 7
<a href="#"><u>+ CWops Test</u></a>	0700Z-0800Z, Sep 7
<a href="#"><u>+ NRAU 10m Activity Contest</u></a>	1700Z-1800Z, Sep 7 (CW) and 1800Z-1900Z, Sep 7 (SSB) and 1900Z-2000Z, Sep 7 (FM) and 2000Z-2100Z, Sep 7 (Dig)
<a href="#"><u>+ SKCC Sprint Europe</u></a>	1900Z-2100Z, Sep 7
<a href="#"><u>+ NCCC FT4 Sprint</u></a>	0100Z-0130Z, Sep 8
<a href="#"><u>+ NCCC RTTY Sprint</u></a>	0145Z-0215Z, Sep 8
<a href="#"><u>+ NCCC Sprint Ladder</u></a>	0230Z-0300Z, Sep 8
<a href="#"><u>+ K1USN Slow Speed Test</u></a>	2000Z-2100Z, Sep 8
<a href="#"><u>+ YB7-DX Contest</u></a>	0000Z, Sep 9 to 2359Z, Sep 10
<a href="#"><u>+ FOC QSO Party</u></a>	0000Z-2359Z, Sep 9
<a href="#"><u>+ WAE DX Contest, SSB</u></a>	0000Z, Sep 9 to 2359Z, Sep 10
<a href="#"><u>+ ARRL EME Contest</u></a>	0000Z, Sep 9 to 2359Z, Sep 10

*Continued on Page 19*



# Contest Calendar - September 2023

<a href="#"><u>+ SKCC Weekend Sprintathon</u></a>	1200Z, Sep 9 to 2400Z, Sep 10
<a href="#"><u>+ Ohio State Parks on the Air</u></a>	1400Z-2200Z, Sep 9
<a href="#"><u>+ Russian Cup Digital Contest</u></a>	1500Z-1859Z, Sep 9 and 0600Z-0959Z, Sep 10
<a href="#"><u>+ Alabama QSO Party</u></a>	1500Z, Sep 9 to 0300Z, Sep 10
<a href="#"><u>+ ARRL September VHF Contest</u></a>	1800Z, Sep 9 to 0300Z, Sep 11
<a href="#"><u>+ North American Sprint, CW</u></a>	0000Z-0400Z, Sep 10
<a href="#"><u>+ 4 States QRP Group Second Sunday Sprint</u></a>	0000Z-0200Z, Sep 11
<a href="#"><u>+ K1USN Slow Speed Test</u></a>	0000Z-0100Z, Sep 11
<a href="#"><u>+ ICWC Medium Speed Test</u></a>	1300Z-1400Z, Sep 11
<a href="#"><u>+ OK1WC Memorial</u></a>	1630Z-1729Z, Sep 11
<a href="#"><u>+ ICWC Medium Speed Test</u></a>	1900Z-2000Z, Sep 11
<a href="#"><u>+ Worldwide Sideband Activity Contest</u></a>	0100Z-0159Z, Sep 12
<a href="#"><u>+ ICWC Medium Speed Test</u></a>	0300Z-0400Z, Sep 12
<a href="#"><u>+ Phone Weekly Test</u></a>	0230Z-0300Z, Sep 13
<a href="#"><u>+ A1Club AWT</u></a>	1200Z-1300Z, Sep 13
<a href="#"><u>+ CWops Test</u></a>	1300Z-1400Z, Sep 13
<a href="#"><u>+ VHF-UHF FT8 Activity Contest</u></a>	1700Z-2100Z, Sep 13
<a href="#"><u>+ Mini-Test 40</u></a>	1700Z-1759Z, Sep 13
<a href="#"><u>+ Mini-Test 80</u></a>	1800Z-1859Z, Sep 13
<a href="#"><u>+ CWops Test</u></a>	1900Z-2000Z, Sep 13
<a href="#"><u>+ RSGB 80m Autumn Series, CW</u></a>	1900Z-2030Z, Sep 13
<a href="#"><u>+ CWops Test</u></a>	0300Z-0400Z, Sep 14
<a href="#"><u>+ CWops Test</u></a>	0700Z-0800Z, Sep 14
<a href="#"><u>+ BCC QSO Party</u></a>	1800Z-1959Z, Sep 14
<a href="#"><u>+ EACW Meeting</u></a>	1900Z-2000Z, Sep 14
<a href="#"><u>+ NCCC FT4 Sprint</u></a>	0100Z-0130Z, Sep 15
<a href="#"><u>+ NCCC RTTY Sprint</u></a>	0145Z-0215Z, Sep 15
<a href="#"><u>+ NCCC Sprint Ladder</u></a>	0230Z-0300Z, Sep 15

*Continued on Page 20*



# Contest Calendar - September 2023

+ AGB NEMIGA Contest

+ K1USN Slow Speed Test

+ SARL VHF/UHF Digital Contest

+ ARRL 10 GHz and Up Contest

+ Scandinavian Activity Contest, CW

+ Iowa QSO Party

+ Texas QSO Party

+ QRP Afield

+ Wisconsin Parks on the Air

+ Washington State Salmon Run

+ New Hampshire QSO Party

+ New Jersey QSO Party

+ Feld Hell Sprint

+ North American Sprint, RTTY

+ BARTG Sprint PSK63 Contest

+ Run for the Bacon QRP Contest

+ K1USN Slow Speed Test

+ ICWC Medium Speed Test

+ OK1WC Memorial

+ RSGB FT4 Contest

+ ICWC Medium Speed Test

1600Z-1700Z, Sep 15

2000Z-2100Z, Sep 15

0300Z-0500Z, Sep 16 (6m) and

0500Z-0700Z, Sep 16 (2m) and

0700Z-0900Z, Sep 16 (70cm) and

0300Z-0500Z, Sep 17 (2m) and

0500Z-0700Z, Sep 17 (6m) and

0700Z-0900Z, Sep 17 (70cm)

0600 local, Sep 16 to 2400 local, Sep 17

1200Z, Sep 16 to 1200Z, Sep 17

1400Z, Sep 16 to 0200Z, Sep 17

1400Z, Sep 16 to 0200Z, Sep 17 and

1400Z-2000Z, Sep 17

1500Z-2100Z, Sep 16

1600Z-2300Z, Sep 16

1600Z, Sep 16 to 0700Z, Sep 17 and

1600Z-2400Z, Sep 17

1600Z-2200Z, Sep 16 and

1600Z-2200Z, Sep 17

1600Z, Sep 16 to 0359Z, Sep 17

1800Z-1959Z, Sep 16

0000Z-0400Z, Sep 17

1700Z-2059Z, Sep 17

2300Z, Sep 17 to 0100Z, Sep 18

0000Z-0100Z, Sep 18

1300Z-1400Z, Sep 18

1630Z-1729Z, Sep 18

1900Z-2030Z, Sep 18

1900Z-2000Z, Sep 18

*Continued on Page 21*



# Contest Calendar - September 2023

<a href="#"><u>+ 144 MHz Fall Sprint</u></a>	1900 local - 2300 local, Sep 18
<a href="#"><u>+ Worldwide Sideband Activity Contest</u></a>	0100Z-0159Z, Sep 19
<a href="#"><u>+ ICWC Medium Speed Test</u></a>	0300Z-0400Z, Sep 19
<a href="#"><u>+ Phone Weekly Test</u></a>	0230Z-0300Z, Sep 20
<a href="#"><u>+ A1Club AWT</u></a>	1200Z-1300Z, Sep 20
<a href="#"><u>+ CWops Test</u></a>	1300Z-1400Z, Sep 20
<a href="#"><u>+ VHF-UHF FT8 Activity Contest</u></a>	1700Z-2100Z, Sep 20
<a href="#"><u>+ Mini-Test 40</u></a>	1700Z-1759Z, Sep 20
<a href="#"><u>+ Mini-Test 80</u></a>	1800Z-1859Z, Sep 20
<a href="#"><u>+ CWops Test</u></a>	1900Z-2000Z, Sep 20
<a href="#"><u>+ Walk for the Bacon QRP Contest</u></a>	0000Z-0100Z, Sep 21 and 0200Z-0300Z, Sep 22
<a href="#"><u>+ NAQCC CW Sprint</u></a>	0030Z-0230Z, Sep 21
<a href="#"><u>+ CWops Test</u></a>	0300Z-0400Z, Sep 21
<a href="#"><u>+ CWops Test</u></a>	0700Z-0800Z, Sep 21
<a href="#"><u>+ NTC QSO Party</u></a>	1900Z-2000Z, Sep 21
<a href="#"><u>+ NCCC FT4 Sprint</u></a>	0100Z-0130Z, Sep 22
<a href="#"><u>+ NCCC RTTY Sprint</u></a>	0145Z-0215Z, Sep 22
<a href="#"><u>+ NCCC Sprint Ladder</u></a>	0230Z-0300Z, Sep 22
<a href="#"><u>+ K1USN Slow Speed Test</u></a>	2000Z-2100Z, Sep 22
<a href="#"><u>+ CQ Worldwide DX Contest, RTTY</u></a>	0000Z, Sep 23 to 2400Z, Sep 24
<a href="#"><u>+ Maine QSO Party</u></a>	1200Z, Sep 23 to 1200Z, Sep 24
<a href="#"><u>+ Masonic Lodges on the Air</u></a>	1400Z-2200Z, Sep 23
<a href="#"><u>+ AGCW VHF/UHF Contest</u></a>	1400Z-1700Z, Sep 23 (144) and 1700Z-1800Z, Sep 23 (432)
<a href="#"><u>+ UBA ON Contest, 6m</u></a>	0700Z-1000Z, Sep 24
<a href="#"><u>+ K1USN Slow Speed Test</u></a>	0000Z-0100Z, Sep 25
<a href="#"><u>+ QCX Challenge</u></a>	1300Z-1400Z, Sep 25

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# Contest Calendar - September 2023

<a href="#"><u>+ ICWC Medium Speed Test</u></a>	1300Z-1400Z, Sep 25
<a href="#"><u>+ OK1WC Memorial</u></a>	1630Z-1729Z, Sep 25
<a href="#"><u>+ ICWC Medium Speed Test</u></a>	1900Z-2000Z, Sep 25
<a href="#"><u>+ QCX Challenge</u></a>	1900Z-2000Z, Sep 25
<a href="#"><u>+ Worldwide Sideband Activity Contest</u></a>	0100Z-0159Z, Sep 26
<a href="#"><u>+ ICWC Medium Speed Test</u></a>	0300Z-0400Z, Sep 26
<a href="#"><u>+ QCX Challenge</u></a>	0300Z-0400Z, Sep 26
<a href="#"><u>+ 222 MHz Fall Sprint</u></a>	1900 local - 2300 local, Sep 26
<a href="#"><u>+ SKCC Sprint</u></a>	0000Z-0200Z, Sep 27
<a href="#"><u>+ Phone Weekly Test</u></a>	0230Z-0300Z, Sep 27
<a href="#"><u>+ A1Club AWT</u></a>	1200Z-1300Z, Sep 27
<a href="#"><u>+ CWops Test</u></a>	1300Z-1400Z, Sep 27
<a href="#"><u>+ Mini-Test 40</u></a>	1700Z-1759Z, Sep 27
<a href="#"><u>+ Mini-Test 80</u></a>	1800Z-1859Z, Sep 27
<a href="#"><u>+ CWops Test</u></a>	1900Z-2000Z, Sep 27
<a href="#"><u>+ UKEICC 80m Contest</u></a>	2000Z-2100Z, Sep 27
<a href="#"><u>+ CWops Test</u></a>	0300Z-0400Z, Sep 28
<a href="#"><u>+ CWops Test</u></a>	0700Z-0800Z, Sep 28
<a href="#"><u>+ RSGB 80m Autumn Series, Data</u></a>	1900Z-2030Z, Sep 28
<a href="#"><u>+ NCCC FT4 Sprint</u></a>	0100Z-0130Z, Sep 29
<a href="#"><u>+ NCCC RTTY Sprint</u></a>	0145Z-0215Z, Sep 29
<a href="#"><u>+ NCCC Sprint Ladder</u></a>	0230Z-0300Z, Sep 29
<a href="#"><u>+ K1USN Slow Speed Test</u></a>	2000Z-2100Z, Sep 29
<a href="#"><u>+ Feld Hell Sprint</u></a>	0000Z-2359Z, Sep 30
<a href="#"><u>+ Worked All Provinces of China DX Contest</u></a>	0600Z, Sep 30 to 0559Z, Oct 1
<a href="#"><u>+ Russian WW MultiMode Contest</u></a>	1200Z, Sep 30 to 1159Z, Oct 1
<a href="#"><u>+ UK/EI DX Contest, SSB</u></a>	1200Z, Sep 30 to 1200Z, Oct 1
<a href="#"><u>+ AWA Amplitude Modulation QSO Party</u></a>	2200Z, Sep 30 to 2200Z, Oct 1

Our thanks to Bruce Horn, WA7BNM for use of this calendar!  
Visit Bruce at [www.contestcalendar.com/contestcal.html](http://www.contestcalendar.com/contestcal.html)

## The ARAC RELAY



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