



# The RELAY)))

MARCH  
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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## AMATEUR RADIO EMERGENCY COMMUNICATION: Mesh Network Tools for Optimal Readiness

In last month's *Relay*, we told the story of how ham radio was first recognized as an important emergency communication tool in disasters as a result of the tragic 1912 sinking of the luxury ocean liner **Titanic**. Over 100 years ago a 25 year-old Welsh engineer named Artie Moore sat in the tower of his family's watermill listening to radio waves on his hand-made ham radio set. In the wee hours of the night, he received Titanic's distress signals from an astounding 3000 miles away. Hearing about Moore several days later, Guglielmo Marconi, inventor of the Marconi telegraph that was state-of-the-art equipment on Titanic and other ships, rushed to meet with Artie and hired him. News of Artie Moore's heroic attempt to alert South Wales constables in rescuing Titanic reached around the globe. As a direct result, ham radio was catapulted into the world spotlight and the **American Radio Relay League (ARRL)** was formed that same year. Ham radio operators were no longer viewed as mere hobbyists who tinkered with "radio-wave equipment". It was established that they could play a crucial role to perform life-saving communications during emergencies.

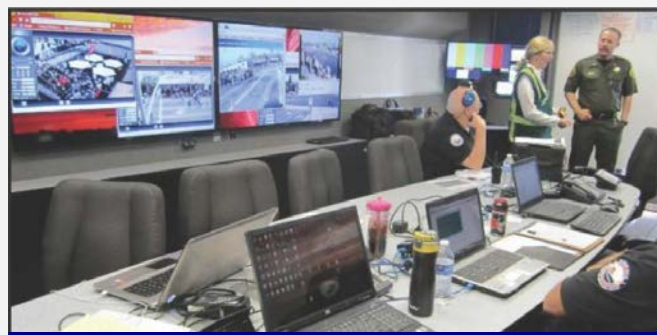
A lot has happened in the past 111 years to evolve amateur radio Emergency Communication into an efficient, coordinated "machine", fully trained and prepared to assist authorities in a variety of disasters. In 1914, ARES, the emergency communications and disaster preparedness arm of the **ARRL** was created. Today ARES works hand-in-hand with RACES, the emergency communications and disaster preparedness arm of the U.S. Government.

In many regions, amateur radio operators are members of both ARES and RACES and their leadership conducts official meetings and training that is coordinated with each other. This makes for a robust state of readiness and heightened operational efficiency during disasters or public safety events.

In review, **EmComm**-Emergency Communication - is the amateur radio practice of providing communication services in an emergency, especially when traditional communication modes are intermittent or completely unavailable.

In their article **EmComm 101, Denver ARES** describes ham radio operators' EmComm role well:

"We are communicators, not first responders. We do not provide first aid, transport victims, provide traffic control or any other function normally provided by public service agencies, nor are we running the show. We DO provide communication when public service systems are overloaded. We do not "self deploy." We deploy when a partner agency requests our services. The goal is to provide trained operators that have learned to communicate



Orange County, CA impressive Mobile Command Center in a tractor-trailer. RACES uses their mesh network to send real-time public safety info to patch panels for video, data, and radio in the MCC

Continued on Page 14



# 2023



Join us on  
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# ARAC Board Meeting - February 7, 2023

## PRESIDENT



**NØVRM**  
Gene Ellefsen  
3710 Chambersburg Ave  
Duluth, MN 55811  
218-390-3272  
lspitech@mail.com

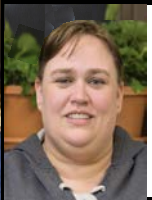
## VICE PRESIDENT



**KØDJP**  
David Pyrlík

david.pyrlík@gmail.com

## SECRETARY



**KFØGJW**  
Melinda Nelson

## TREASURER



**KEØYTM**  
Sam Frey

ke0ytm@gmail.com

## 3RD YEAR BOARD



**AAØAC**  
Dave Davis

218-348-6649  
aaøac@outlook.com

## 2ND YEAR BOARD



**AAØAW**  
Doug Nelson

aaøaw@arrl.net

## 1ST YEAR BOARD



**WØDIO**  
Denny Anderson

## Present:

### Board Members

Gene Ellefsen – NØVRM, Dave Pyrlík – KØDJP, Sam Frey – KEØYTM, Melinda Nelson – KFØGJW, Dave Davis – AAØAC, Doug Nelson - AAØAW

### Board Advisors (Non-Board Members)

Randy Wabik –KRØB

Guest: Elmer Berg – KCØNGY

Meeting called to order by President Gene – NØVRM at 18:30 (6:30 pm)

## Minutes:

Minutes were sent via email. Motion to approve Sam Frey – KEØYTM. Seconded by Doug Nelson – AAØAW, motion passed.

## Treasurer's Report:

Checking: \$1,909.08

Savings: \$1,775.19

Repeater: \$3,867.78

**Subtotal Cash \$7,552.05**

Winter CD: \$1,736.49

Summer CD: \$0.00

**Subtotal CD: \$1,730.42**

**Assets Subtotal: \$9,288.54**

**Grand Total \$9,288.54**

Motion to approve by Melinda Nelson – KFØGJW, seconded by Dave Davis – AAØAC, motion passed.

## Testing:

We had people test and pass. We had a new person test Tuesday night and had his call Thursday morning. John Snyder KFØLJC The new General Testing Pool is out and will go into effect on July 1<sup>st</sup>. As always if you are looking to test or upgrade, or know of anyone that is interested in testing please contact Doug Nelson at [AAØAW@arrl.net](mailto:AAØAW@arrl.net)

Continued on Page 3

# ARAC Board Meeting continued

## Repeater:

Dave Pyrlik – K0DJP asked work what it would cost for a commercial repeater put in. It would cost about \$3,100.00. Motorola SLR 5700.

Randy Wabik – KR0B question was asked if we had all the equipment for Mahtowa repeater? Yes, we have it all. Just waiting for the snow to start melting to get the new equipment installed.

## New Business:

HamFest – May 6<sup>th</sup>. \$10.00 entry fee. Looking for donations for drawings.

Upcoming HamFest

St. Cloud – February 18<sup>th</sup>

Midwinter Madness – March 18<sup>th</sup>

Brainard – April 15<sup>th</sup>

Motion to adjourn by Doug Nelson – AA0AW, seconded by Sam Frey – KE0YTM, motion passed at 19:10 (7:10 pm)



## IN MEMORIAM

### Ted Windus – KDØDZY

July 7, 1939 - February 20, 2023

Theodore J. “Ted” Windus Sr., 83, of Duluth passed away on Monday February 20, 2023, in St. Luke’s Hospital. He was born in Duluth, Minnesota on July 7, 1939 to Harry and Rose Windus. Ted graduated from Duluth Cathedral High School. He was employed by the 148<sup>th</sup> Minnesota Air National Guard, Duluth. Ted married Evelyn A. Bie-niek on August 30, 1958, in Duluth. He was a member of St. Mary Star of the Sea Catholic Church, The Knights of Columbus, and was a Deacon at Church. Ted enjoyed camping, fishing, and hunting.

He was preceded in death by his parents and a sister Mary Lou Gardepy. He is survived by his wife Evelyn, children Mike (Brenda) Windus, Steve (Lynn) Windus, Teresa (Peter) Bruno, Ted (Janet) Windus Jr., Doreen An-der-son, Joe (Jen) Windus, and Beth Windus, 14 grand-children, 13 great-grandchildren and a sister Corrine Howard.

Rest in peace, dear Friend.



# ARAC Club Meeting Minutes

February 9, 2023

## Present:

President: Gene Ellefsen – N0VRM  
Vice President: Dave Pyrlik – K0DJP  
Treasurer/Membership: Sam Frey – KE0YTM  
Secretary: Melinda Nelson – KF0GJW  
Second Year Board: Doug Nelson – AA0AW  
Third Year Board: Dave Davis – AA0AC  
Special Events: Open/Gene Ellefsen – N0VRM (acting)  
Parliamentarian: Grant Forsyth – KC0WUP  
Repeater: Dave Pyrlik – K0DJP  
Testing: Doug Nelson – AA0AW  
Repeater: Randy Wabik – KR0B  
Property/Picnic: Scott Ahlgren – N0VYU  
HamFest/Education: Bob Schulz – KC0NFB

## Absent:

First Year Board: Dennis Anderson – W0DIO  
Chaplin:  
Web Site: Thomas Dorr – KE0RHA  
Newsletter/Historian: Kim Waller – KE0NQS  
Newsletter/Historian: Steve Waller – KE0NQT

Meeting called to order at 19:00 (7:00 PM) by President Gene Ellefsen – N0VRM. Thirty-nine (39) members in attendance.

## Minutes:

Minutes are posted on the website and in the newsletter. Motion to approve by Dave Davis – AA0AC, seconded by Jon Nelson – N0UOZ. Motion Passed.

## Treasurer's Report:

Checking:	\$1,909.08
Savings:	\$1,775.19
Repeater:	\$3,867.78
<b>Subtotal Cash</b>	<b>\$7,552.05</b>
Winter CD:	\$1,736.49
Summer CD:	\$0.00
<b>Subtotal CD:</b>	<b>\$1,730.42</b>
<b>Assets Subtotal:</b>	<b>\$9,288.54</b>
<b>Grand Total</b>	<b>\$9,288.54</b>

Motion to accept as presented by Doug Nelson – AA0AW, seconded by Justin Cheever – KD9VKI, motion passed.

*Continued on Page 5*



# ARAC Club Meeting Minutes, continued

## Education:

Nothing until after HamFest. HamFest will be May 6, 2023. Entry Fee will be \$10.00. Looking for donations for the raffle drawings.

## HamFest:

HamFest will be May 6, 2023. Entry Fee will be \$10.00. Looking for donations for the hourly drawings. Will be having the \$500.00 door prize. Looking for people to come and help set up.

## Testing:

Doug Nelson – AA0AW Next scheduled one will be May 6<sup>th</sup> during the HamFest. If anyone needs testing contact Doug Nelson at [AA0AW@ARRL.net](mailto: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](http://FCC.gov/uls) and register. You will also need an email address going forward.

## Repeater:

Dave Pyrlík – K0DJP, we have all equipment for the Mahtowa repeater, just waiting for a warm day to get up there and remove the old equipment and replace it with the new equipment.

## New Business:

April meeting will be our annual Skywarn meeting. There will be chairs set up towards the front of the room. Please sit towards the rear of the room as this meeting will be open to the public. Grandma's Marathon password this year is Ham23.

## New HAMS/Upgrades:

John Snyder KF0LJC

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

Ted Windus – KD0DZY February 20, 2023

Door Prize was won by Edwin Murray – W1ELM. We had a 2<sup>nd</sup> drawing for a \$10.00 gift card that was donated and Paul Dallavia – KC0WDQ won this drawing.

Motion to adjourn by Bob Schulz – KC0NFB, seconded by Bill Fleischman – KC0ZZL, motion passed at 19:20 (7:20 PM). Program on SURVEY123 – disaster response tool that St Louis, Carlton, Douglas, and Lake county EM's will be using to track damages from an incident.



**CONGRATULATIONS**  
to Newly Licensed Technician Class Operator  
**John Snyder KF0LJC**  
of Makinen, MN



## Prez Sez ...

Hello Everyone,

Ice Station ZZL 2023 is in the books.

It is hard to believe that we started this event 10 years ago, when the WolfTrack Classic Sled Dog Race was cancelled due to a lack of snow. We provided Health and Welfare Communication for the Mushers, and since we had already scheduled the day for the race we decided to do something else.

Someone came up with the idea of going out on the ice and the rest is history. About eight courageous Souls braved the elements to have some fun. Bill Turk KFØILA made his first HF contact QRP with a Buddystick antenna.

Looking forward to next year !!!

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	

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



## US Amateur Radio Bands

### US AMATEUR POWER LIMITS

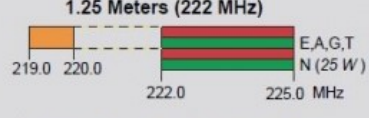
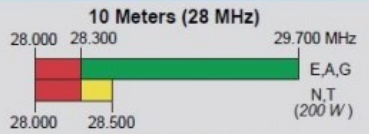
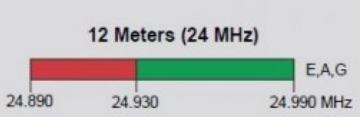
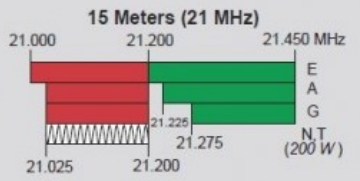
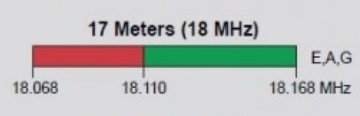
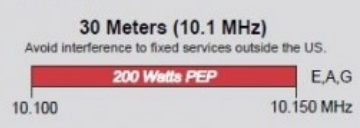
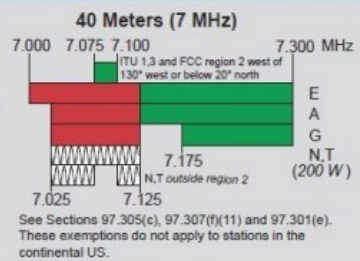
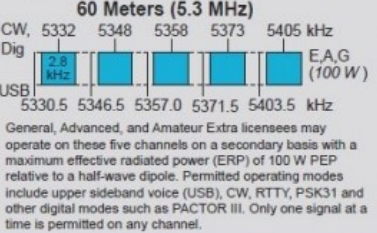
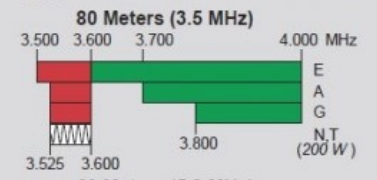
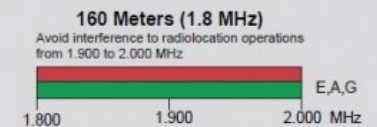
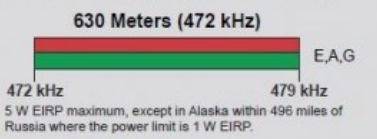
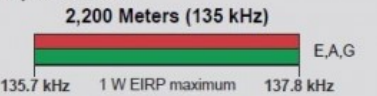
FCC 97.313 An amateur station must use the minimum transmitter power necessary to carry out the desired communications. (b) No station may transmit with a transmitter power exceeding 1.5 kW PEP.

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

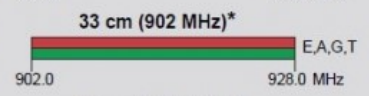
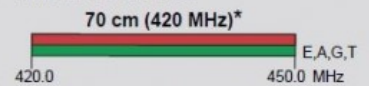


ARRL The national association for AMATEUR RADIO®

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.



\*Geographical and power restrictions may apply to all bands above 420 MHz. See The ARRL Operating Manual for information about your area.



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

**ARRL**  
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email: [nowham@arrl.org](mailto:nowham@arrl.org)

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

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# NETS

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...

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

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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



**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

# MARCH

## CLUB EVENTS

**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
			1	2	3	4
5  CW 1930 AA0AW USB 2000 KB9WLB ES 2100 KD9VKI	6  WX 2000 KC0MKS	7 <b>ARAC BOARD MEETING</b> Sammy's Pizza 6:30 pm  DC Net 2000 CC Net 2030	8 <b>Lake County ARES/RACES Meeting 1800</b>  Lake County Net 1900 2100 - BWAR	 9 <b>ARAC Club Meeting</b>  Coppertop Church <b>7:00 PM</b>	10	11
12  CW 1930 N0PDG USB 2000 K9KDK ES 2100 KC0WDQ	13 <b>DC ARES/RACES Mtg 1900 DC EOC</b>  WX 2000 KC0MKS	14  DC Net 2000 CC Net 2030	15 <b>St Louis County ARES/RACES Meeting 1800</b>  2100 - BWAR	16	17  <b>HAPPY SAINT PATRICK'S DAY!</b>	18
19  CW 1930 AA0AW USB 2000 N0VRM ES 2100 W0NWO	20  WX 2000 KC0MKS	21  DC Net 2000 CC Net 2030	22  Lake County Net 1900 2100 - BWAR	23  Carlton County ARES/RACES Meeting 1900 CC EOC	24	25 <b>ARAC Club Breakfast</b> The Chalet 4833 Miller Trunk Hwy Hermantown, MN <b>8 AM</b>
26  CW 1930 N0PDG USB 2000 N0PDG ES 2100 N0VRM	27  WX 2000 KC0MKS	28  DC Net 2000 CC Net 2030	29	30	31	

Get this newsletter *faster*  
via email!

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

Next Club Meeting:  
Thursday,  
*March 9th, 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).

accurately, clearly, and concisely in a timely fashion regardless of the obstacles in the event.

“A modern emergency response is a complex machine designed to save lives and protect property. Like any well-oiled machine, the parts that make it work need to be able to work together, to speak the same language, and to have the same ‘situational awareness.’ And that takes study and training to learn the drill and it takes practice to make sure the knowledge can be put to use. Regardless of how well-intentioned [hams] are, regardless of how much they want to help, they need the skills and training and equipment to work as part of the emergency response team.”

Go to <http://denverares.org/emcomm-101-what-is-emcomm> for further reading on EmComm training and implementation, as well as great suggestions in assembling a “12 Hour Deployment Kit” for hams.

Unlike the early days in Amateur Radio Emergency Communications, modern EmComm teams use mesh networks. Pima County, Arizona has a nice overview of mesh network basics, posted by their Emergency Management Communications team (who are, of course, hams) for the public. Here it is:

## What is a HAM Mesh Network – A Primer

Simply, it's hams using our radio privileges to operate a private, self-contained wireless computer network. Anything that can be done on a regular network/internet can be done on this private Wi-Fi network. The HAM Mesh Network uses off-the-shelf Wi-Fi equipment that has been modified to permit equipment to be used on HAM frequencies under Part 97 rules. This means much higher power can be used, where needed, to establish links between wireless routers (Nodes in HAM Mesh lingo). Links between nodes can be achieved for miles and miles limited by line-of-site.

### A Few Examples of Possible Uses of a HAM Mesh Network:

Success!	Application
✓	Field Day Logging (e.g., N1MM)
✓	Video (e.g., webcams)
✓	Phone (VoIP)
✓	File transfer (FTP)
✓	Chat
✓	Email
✓	Screen mirroring
✓	Web server (e.g., WX station)
✓	Map server

### How does this technology benefit Amateur Radio?

The biggest benefit is to our Emergency Communications operations. During a large emergency or disaster there is always the risk that the normal infrastructure, electrical power, telephone service, cell service, internet, etc. will fail. Traditionally, this is where Amateur Radio is strong in being able to provide needed communications during these times of need.

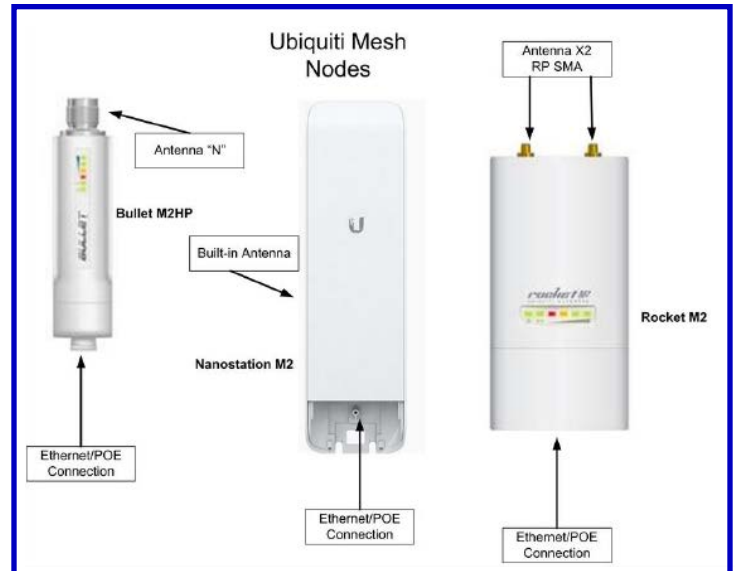
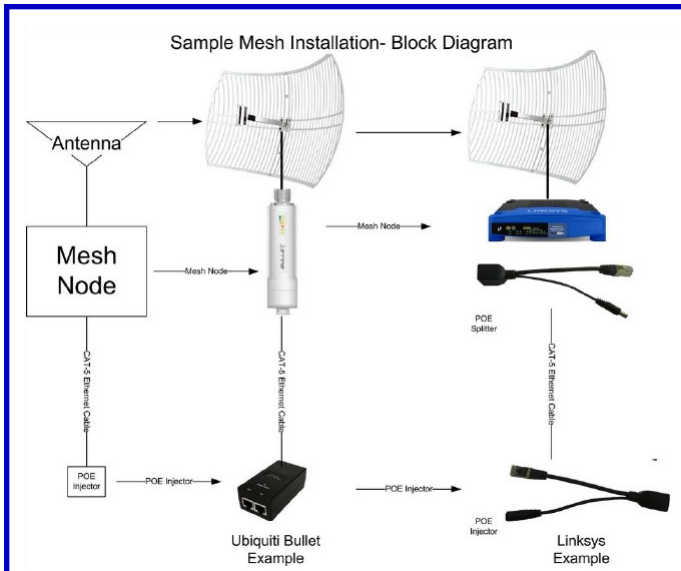
By adding this suite of computing power to the mix, computer operations can also be established for the use of responders when the internet and cell networks are down. All the data can be processed locally then transferred when things return to normal.

Pima County also shares a couple of simple diagrams and a good guide to mesh networking lingo for those

*Continued on Page 15*

# Amateur Radio EmComm, continued from page 14

new to amateur radio mesh networks:



## Mesh Networking Lingo

### Access Point (AP)

A device that acts as the bridge between wireless clients and the wired network. Often abbreviated as AP.

### Ad Hoc Mode

A peer to peer mode of networking using Wi-Fi networking but no access point. Ad Hoc networks can include more than two devices.

### Beacon

A beacon is transmitted by an AP ten times per second, and advertises the existence of the AP on a particular channel or channels. It includes information needed by clients to associate and may include the ESSID, the supported channels and data rates, and whether it is open or requires authentication. In HAM Radio mesh networking, the owners ham radio callsign is also broadcast.

### Channel

A channel is the network path for wireless transmissions. Each Wi-Fi standard has numerous channels, each of which is a center frequency. There are 11 channels in 802.11b and g networks in the United States and Canada; 14 in most other countries. Channels have a bandwidth-the greater the bandwidth, the greater the potential throughput. Ham Mesh bandwidth can be set to 5 MHz, 10 MHz, and 20 MHz.

### Diversity

Using multiple antennae to reduce interference and improve both transmission and reception of signals. LinkSys nodes and some Ubiquiti nodes use two antennae in diversity mode for better link quality. This is also referred to MIMO.

### MIMO

Multiple Input/Multiple Output signaling that uses several transceivers and antennae to improve throughput and range of the wireless network. APs with more than one antenna uses MIMO.

### Node

A node is a device that was originally a wireless router that has been converted to transfer data between other nodes in the mesh network. Nodes are **self discovering, self configuring, self advertising and fault tolerant**.

### Peer to peer

In mesh networking, nodes are peer to peer devices. That is, if a node is within radio range of another node and they broadcast the same SSID, they will connect to each other.

### SSID

The Service Set Identifier (SSID) is the name of the wireless network. It is contained in the beacons sent out by the nodes.

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Next, we'll turn our attention to an organization with a passion for providing effective mesh network tools to the amateur radio community for EmComm. This is merely one organization, but they are an excellent EmComm resource for hams to consider. **AREDN** (Amateur Radio Emergency Data Network) is a nonprofit 501(c)3 whose stated mission is:

***“To provide the Amateur Radio Community with software, education, and support to enable them to aid public safety, emergency response and disaster relief agencies with high-speed multimedia data networks.”***

Formed in 2015, the **AREDN** project has been a strictly volunteer effort with all expenses having been covered by its core team members, but of course, they accept public donations in any amount to support their mission. Many of the volunteers were formerly part of the **BBHN Development Team**. **BBHN** is an old project that has been sunsetted from a software developer standpoint, but was important in the history of EmComm, so here's a sidebar about **BBHN**:



**BroadBand HamNet (BBHN)** is a self-configuring mesh network that operates using standard off-the-shelf WiFi devices that have been loaded with custom firmware. Due to higher power output, these devices are operated in Amateur Radio Bands (typically Channel 1 of the 2.4 GHz Band). BBHN could run for days from a fully charged car battery, or indefinitely with the addition of a modest solar array or other supplemental power source.

Developers have moved on from supporting BBHN for the past 5+ years, as the older BBHN components (namely, Linksys WRT54G) have distinct limitations compared to newer technology. A few examples from elmer **Orville Beach W6BI** of Simi Valley, CA:

1. Not enough memory with a simple hardware crystal on Linksys WRT54G routers
2. Linksys WRT54G output is 60 mW, where most of the modern gear puts out around 600 mW
3. Linksys WRT54G is not MIMO (Multiple Input Multiple Output; all the modern gear has two digital transceivers
4. In modern gear with 2 digital transceivers the same SNR (signal to noise ratio), can transmit data twice as fast as a Linksys WRT54G. Or, with a 3 dB weaker signal, the same amount of data.
5. Modern gear also has built-in gain antennas

**AREDN** Team Member **Darryl Quinn K5DLQ** of Magnolia TX says:

“I think if all you want to do is a relatively NEAR-field (i.e. think feet, not miles) mesh implementation that is temporary and tactical, then you can certainly use the BBHN legacy technology with WRT54Gs. If you are thinking more strategic and wider use of an EMCOMM mesh, then, the experience that you will get with the BBHN+WRT54G hardware will not impress you, primarily due to the lack of clear channel space in Part 97, extra power, etc. (those things already mentioned above). As far as source code for BBHN, I haven't seen an active SVN repo [a Subversion Repository database of code files and the history of all changes] for that project in years, since we moved over to start AREDN. AREDN does maintain an archive of all the firmware files (bin files) for AREDN and BBHN, just in case people may still need it and the BBHN website goes away.”

For archive files go to: <http://downloads.arednmesh.org/firmware/ubnt/archive/>

Since the sunseting of BBHN, **AREDN** continues its focus on the importance of EmComm mesh networks use of easily-obtained and affordable components. The **AREDN** team strives to create free high-quality software releases for use with commercial-off-the-shelf (COTS) devices, with a primary objective of meeting the needs of emergency communications data networks.

Continued on Page 17



# Amateur Radio EmComm, continued from page 16

To that end, **AREDN's** objective is to enable hams to:

- ◆ Stand up a working mesh node with minimal expertise and effort
- ◆ Configure the mesh network automatically so that advanced network knowledge is not needed
- ◆ Use low-cost, reliable commercial equipment
- ◆ Define standards for inter-network integration
- ◆ Support those in the process of designing and implementing EmComm networks
- ◆ Refine the software to make implementation easier, more reliable, and more manageable.

**AREDN Project has designed, built and tested low-cost EmComm solutions, dedicated to continued software refinement & support**



**AE6XE Orange County, California 3 node installation Photo Credit: AREDN**

OK. Let's drill down a little into the specifics of AREDN's features and benefits. When they designed and implemented an EmComm mesh network in Orange County, CA, the AREDN team noted:

"Getting out of the WiFi band and onto ham-only channels on 2.4 and 3.4 GHz SIGNIFICANTLY improved the performance of our local network, and the tools and metrics in the latest release give us a much better understanding of our link performance."

See the chart below the development team created to explain the advantages of their system:

The AREDN team has successfully created a system that can be designed and set up even by someone who is new to ham radio EmComm. The AREDN website is a very impressive source of powerful tools to guide newbies and experts alike through the entire process of setting up an EmComm mesh network.

Their website has tabs that are full of expert content that is clearly explained in detailed sections.

The "Docs" tab alone is loaded with information broken down into every aspect of a mesh network project you can imagine. They provide a detailed spreadsheet called Device Selection Chart with notes and data necessary to begin your project.

Also under "Docs", the How-To Guides are packed with important info to answer any question you may have in the process, as well as remind you of questions to consider that you may not thought of yet.

<b>Exclusive Part 97 Channels</b>	AREDN offers two channels on 2.4 GHz, 24 channels on 3.4 GHz and 7 non-shared channels on 5.8 GHz that are not shared with Part 15 users.
<b>Over-the-Air firmware upgrades</b>	Changes to firmware can be done over an RF link without physical access to the node
<b>Maximum data rate of 130 Mbps</b>	802.11n has been added to the RF protocol. This improves the maximum data rate capability from 54 Mbps to 130 Mbps and allows AREDN nodes to take advantage of the Ubiquiti MIMO (concurrent data channels in both the vertical and horizontal polarization domains), although proportional data rate increases can also be achieved on non-MIMO devices.
<b>Low investment entry</b>	Portable nodes with cable and network switch can be established inexpensively; backbone nodes with multiple transceivers and cable are affordable.
<b>Rapid deployment and implementation</b>	Portable nodes can be set up in a few minutes
<b>Multiple antenna choices</b>	There are many choices for sector (60-,90-, and 120-degree) antennas and highly directional (Yagi and dish) antennas.
<b>Interfaces easily with other internet capable devices</b>	An AREDN network enables emergency responders to use familiar devices such as smart phones, tablets and laptop computers.

Once you have designed, configured and downloaded firmware for your mesh network, you have AREDN as a technical

*Continued on Page 18*

# Amateur Radio EmComm, continued from page 17

resource to ask questions, report issues, chat with other **AREDN** users on their forum, and of course, obtain free downloads for firmware updates to your system. Here's a snapshot of the Supported Platform Matrix on **AREDN's** website to easily review your existing equipment or assess new components you are considering. This at-a-glance matrix is updated whenever new equipment needs to be added or **AREDN's** software support status changes:

Simple color codes on this matrix indicate as follows:

## Green

Fully tested and supported commercial-off-the-shelf products that are compatible with **AREDN** firmware

## Orange

Products that are sunsetted for no more firmware updates

## Light Green

"Maybe" and is not a recommended product to choose for new deployment

## Yellow

Product is being researched and tested, and may or may not be supported

## Red

Item is absolutely not compatible with **AREDN** firmware

As you can see, four companies are featured for compatibility and reliability of their off-the-shelf products. They are MikroTik, Ubiquiti, TP-Link, and GL.iNet.

Because I've had discussions with hams recently about country of origin with regard to components of every kind, here's where each of these 4 companies are located, meaning their design team and headquarters:

**MikroTik** - Founded and still located in Riga, Latvia

**Ubiquiti** - Founded in San Jose, CA and now located in New York

**TP-Link** - Founded in China, now located in China and Hong Kong. Also created a branch in the U.S. in 2008 called TP-Link USA.

**GL.iNet** - Founded and still located in Hong Kong.

https://www.arednmesh.org/content/supported-platform-matrix

### Supported Platform Matrix

The supported platform matrix identifies the make and models of hardware which may be used with AREDN firmware in the various frequency bands. The equipment marked with a **green** background is fully supported and tested. Models with a **red** background are NOT supported nor are they compatible with AREDN firmware. The **orange** background indicates equipment that will be sunsetted in a future firmware release (meaning no more new firmware builds for these devices). Equipment with a **yellow** background is in the research stage and may or may not achieve fully-supported status depending on test results.

In the table below, if the model is a link (**BOLD TEXT**), we've linked those to Amazon for your convenience. As an Amazon Associate AREDN, Inc. earns from qualifying purchases.

Current As of AREDN™ 3.22.12.0 (updated on 12/19/2022)

Manufacturer/Model	Band			
	900Mhz	2.4Ghz	3Ghz (5)	5.8Ghz
<b>Mikrotik</b> ( <a href="http://www.mikrotik.com">www.mikrotik.com</a> )				
LHG (Lite Head Grid)		<b>RBLHG-2nD</b>		<b>RBLHG-5nD</b>
LHG HPXL		<b>RBLHG-2nD-XL</b>		<b>RBLHG-5HPnD-XL</b>
LHG HP				<b>RBLHG-5HPnD</b>
Basebox		<b>RB912UAG-2HPnD</b>		<b>RB912UAG-5HPnD</b>
hAP AC Lite (and TC)		<b>RB952Ui-5ac2nD</b>		<b>RB952Ui-5ac2nD</b> (AP only, no mesh)
LDF (Lite Dish Feed)		<b>RBLDF-2nD</b>		<b>RBLDF-5nD</b>
QRT				<b>RB911G-5HPnD-QRT</b>
SXT		<b>SXTsq-2nD</b>		<b>SXTsq-5nD</b>
mANTBox		<b>RB911G-2HPnD</b>		<b>RB911G-5HPnD</b>
<b>Ubiquiti Networks</b> ( <a href="http://www.ubnt.com">www.ubnt.com</a> )				
AirGrid (XM revision/old)		<b>M2</b>		<b>M5</b>
AirGrid (XW)				<b>AG-HP-5030</b>
AirRouter		<b>M2</b>		
AirRouter HP		<b>M2</b>		
Bullet		<b>M2</b>		<b>M5</b>
Bullet Titanium		<b>M2</b>		<b>M5</b>
Bullet (XW)		<b>M2</b>		
LiteBeam				<b>M5</b>
NanoBeam (XW)		<b>MBE-M2-13</b>		<b>MBE-505-18Y10</b>
NanoBridge	<b>M5</b>	<b>MB10</b>	<b>M3</b>	<b>MB2055G5</b>
NanoStation Loce (XM)	<b>M5</b>	<b>M2</b>		<b>M5</b>
NanoStation Loce (XW)		<b>M2</b>		<b>M5</b>
NanoStation (XM) Airmax		<b>M2</b>	<b>M3</b>	<b>M5</b>
NanoStation (XW) Airmax		<b>M2</b>		<b>M5</b>
PicoStation		<b>M2</b>		
PowerBeam (2)		<b>PBE-M2-400</b>		<b>PBE-M5-300 400 400H50</b>
PowerBeam				<b>PBE-M5-620</b>
PowerBridge				<b>M5</b>
Rocket (XM)	<b>M300</b>	<b>M2</b>	<b>M3 (5)</b>	<b>M5</b>
Rocket (XW)		<b>M2</b>		<b>M5</b>
Rocket Titanium (TI)		<b>M2</b>		<b>M5</b>
Rocket Titanium (XW) (4)				<b>M5</b>
<b>TP-Link</b> ( <a href="http://www.tp-link.com">www.tp-link.com</a> )				
CPE (v1.0)		<b>CPE210</b>		<b>CPE510/CPE520</b>
CPE (v1.1)		<b>CPE210</b>		<b>CPE510</b>
CPE (v2.0)		<b>CPE210</b>		<b>CPE510</b>
CPE210 (v3.0)		<b>CPE210</b>		
CPE220 (v2.0 and v3.0)		<b>CPE220</b>		
CPE610				<b>CPE610</b>
WBS210 (v1.0)		<b>WBS210</b>		
WBS510 (v2)				<b>WBS510</b>
<b>GL.iNET</b> ( <a href="http://www.gl-inet.com">www.gl-inet.com</a> )				
AR150		<b>AR150</b>		
AR300M16		<b>AR300M16</b>		
AR750 (Creta)		<b>AR750</b>		<b>AR750</b> (AP only, no mesh)
USB150		<b>USB150</b>		
<b>Meraki</b>				
MR16		<b>MR16**</b>		
-				
<b>GREEN</b> = "GO"	AREDN Stable			
<b>GREEN</b> = "MAYBE"	AREDN Stable, but, NOT recommended for new deployments. (Low memory or non-MIMO device)			
<b>PINK</b> ="COMMUNITY"	Supported by the community only (not the AREDN project), in the AREDN forums.			
<b>ORANGE</b> ="SUNSETTING"	Support for these device will be removed in a future release.			
<b>YELLOW</b> ="RESEARCHING"	Under research/testing			
**	Release candidate (or Nightly build) firmware available			

All components color coded **Green** on this matrix are considered reasonably priced and widely available, but it's always good to compare pricing and shipping times across the internet of course. Sale

Continued on Page 19

# Amateur Radio EmComm, continued from page 18

prices are great when you can find them, and don't forget gently used or new old stock at hamfests or ebay. Sometimes items that are not even very old can be snapped up if someone changes their mind or is liquidating an estate.



Moving on to the image (Left) of the dropdown under AREDN's software tab, you'll see **Supported Platform Matrix**, which we just reviewed, then **Download page** (which has obviously been selected, as seen behind the dropdown), **Nightly Build**, **Installation**, **Network Switch Configs**, **Netgear Switches**, **Ubiquiti Switches**, **Edgerouter X**, and **Cisco Switch**.

Go to their website to view the content at: <https://www.arednmesh.org/content/current-software>

The team is working on firmware every day, so check back to see updates and additions.

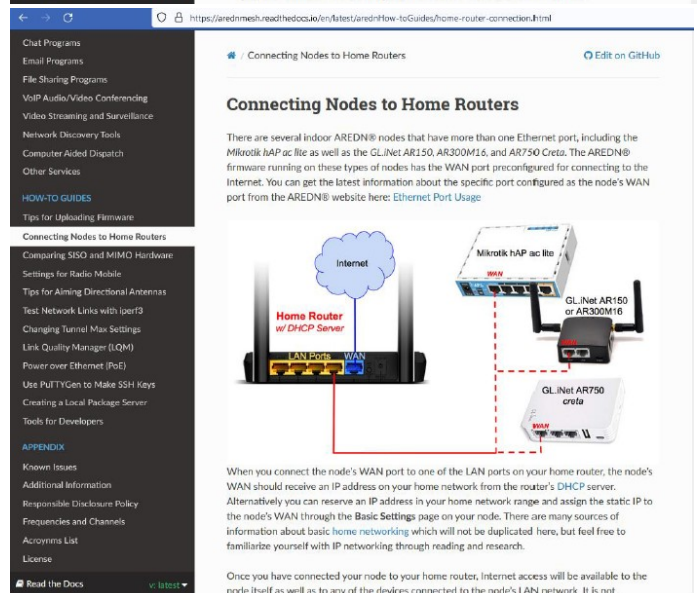
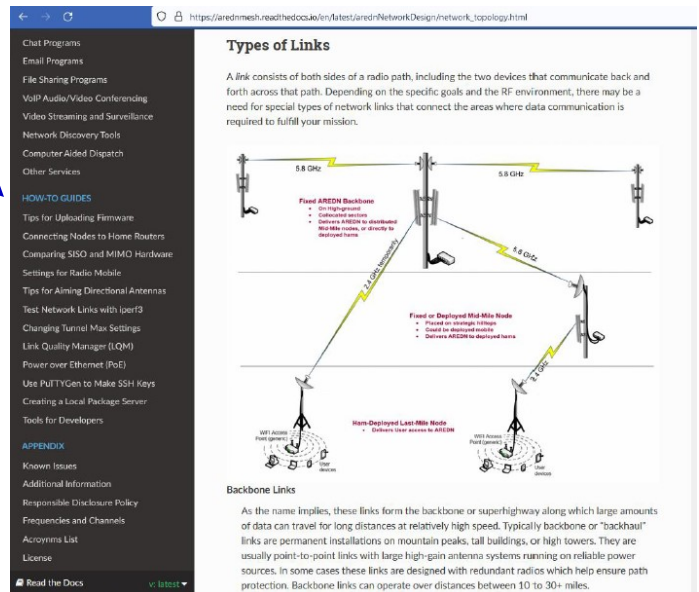
These images (Right) depict a couple of sections under the "Docs" tab. There is a **massive** amount of detailed data in each of these documents, and midway down on the navigation bar the How-To Guides are a gold mine. I've had to stop myself from going into each document listed to read as sheer enjoyment and curiosity, since I don't have the available time. 😊

If you're an elmer in mesh networks, though you may not find this as fascinating as I, these docs are still very helpful.

**Type of Links** under **Network Typologies** is shown here (top right), with radio path link information on **Backbone Links**, **Relay Links** and **Endpoint Links**. This is discussed as a drill down under **Types of Topologies** (*Point-to-Point*, *Hub-and-Spoke*, *Tree*). Simple, yet detailed diagrams and descriptions.

Another essential topic, **Connecting Nodes to Home Routers** is depicted (lower right) simply and effectively, with discussion on connecting a node's WAN port to your router's LAN port along with consideration of your IP network settings.

Finally, if you'd like to know more about AREDN mesh networks, be sure to start by visiting their website at <https://www.arednmesh.org>. Also consider viewing a YouTube video about using AREDN posted by other hams. Josh KI6NAZ has one called "What is AREDN" on his **Ham Radio Crash Course** YouTube channel. Note: Fast Forward to 5:29 in the video where he starts talking about AREDN. As always, let us know your thoughts on mesh networks, especially what you encountered along the way while building or using one. We'd love to publish your story in a future edition of the **Relay**. ★





# FOR SALE

## Estate Sale!

**Ameritron AL-1200** amplifier 1500w+ 10-160 3CX1200A7 (current price new \$5999.00) **\$2495.00** QSK-5 pin diode T/R switching is installed **\$379.95** option

**Icom IC-7800** 200w 10-160+6 meters. Original box and all accessories (\$14000 when new) Item is Mint condition, **\$2475.00**

**Icom SP-20** Speaker **\$160.00**

**Kenwood TS-590S** 10-160+6 meters Original box and all accessories **\$795.00**

**Kenwood TS-520S** 10-80 **\$250.00**

**Yaesu FT-897D** 10-160+6+2m+440, with box, mic, power cord **\$575.00**

Call **Gary K0GX 763-561-2836** or contact via email at **k0gx@comcast.net**

**ARAC CLUB REPEATER**

**WØGKP**

146.94 (-)  
CTCSS TONE  
103.5



# Contest Calendar - March 2023

<a href="#"><u>+ QRP Fox Hunt</u></a>	0200Z-0330Z, Mar 1
<a href="#"><u>+ Phone Weekly Test</u></a>	0230Z-0300Z, Mar 1
<a href="#"><u>+ A1Club AWT</u></a>	1200Z-1300Z, Mar 1
<a href="#"><u>+ CWops Test</u></a>	1300Z-1400Z, Mar 1
<a href="#"><u>+ Mini-Test 40</u></a>	1700Z-1759Z, Mar 1
<a href="#"><u>+ VHF-UHF FT8 Activity Contest</u></a>	1700Z-2100Z, Mar 1
<a href="#"><u>+ Mini-Test 80</u></a>	1800Z-1859Z, Mar 1
<a href="#"><u>+ CWops Test</u></a>	1900Z-2000Z, Mar 1
<a href="#"><u>+ UKEICC 80m Contest</u></a>	2000Z-2100Z, Mar 1
<a href="#"><u>+ AWA John Rollins Memorial DX Contest</u></a>	2300Z, Mar 1 to 2300Z, Mar 2 and 2300Z, Mar 4 to 2300Z, Mar 5
<a href="#"><u>+ Walk for the Bacon QRP Contest</u></a>	0000Z-0100Z, Mar 2 and 0200Z-0300Z, Mar 3
<a href="#"><u>+ CWops Test</u></a>	0300Z-0400Z, Mar 2
<a href="#"><u>+ CWops Test</u></a>	0700Z-0800Z, Mar 2
	1800Z-1900Z, Mar 2 (CW) and 1900Z-2000Z, Mar 2 (SSB) and 2000Z-2100Z, Mar 2 (FM) and 2100Z-2200Z, Mar 2 (Dig)
<a href="#"><u>+ NRAU 10m Activity Contest</u></a>	2000Z-2200Z, Mar 2
<a href="#"><u>+ SKCC Sprint Europe</u></a>	0145Z-0215Z, Mar 3
<a href="#"><u>+ NCCC RTTY Sprint</u></a>	0200Z-0330Z, Mar 3
<a href="#"><u>+ QRP Fox Hunt</u></a>	0230Z-0300Z, Mar 3
<a href="#"><u>+ NCCC Sprint Ladder</u></a>	2000Z-2100Z, Mar 3
<a href="#"><u>+ K1USN Slow Speed Test</u></a>	0000Z, Mar 4 to 2359Z, Mar 12
<a href="#"><u>+ Novice Rig Roundup</u></a>	0000Z, Mar 4 to 2400Z, Mar 5
<a href="#"><u>+ ARRL Inter. DX Contest, SSB</u></a>	0600Z-0629Z, Mar 4 and 0630Z-0659Z, Mar 4 and 0700Z-0729Z, Mar 4 and 0730Z-0800Z, Mar 4
<a href="#"><u>+ Wake-Up! QRP Sprint</u></a>	

*Continued on Page 22*



# Contest Calendar - March 2023

<a href="#"><u>+ Open Ukraine RTTY Championship</u></a>	1800Z, Mar 4 to 1359Z, Mar 5
<a href="#"><u>+ UBA Spring Contest, CW</u></a>	0700Z-1100Z, Mar 5
<a href="#"><u>+ NSARA Contest</u></a>	1200Z-1600Z, Mar 5 and 1800Z-2200Z, Mar 5
<a href="#"><u>+ SARL Hamnet 40m Simulated Emerg Contest</u></a>	1200Z-1400Z, Mar 5
<a href="#"><u>+ Classic Exchange, CW</u></a>	1400Z, Mar 5 to 0800Z, Mar 6 and 1400Z, Mar 7 to 0800Z, Mar 8
<a href="#"><u>+ WAB 3.5 MHz Phone</u></a>	1800Z-2200Z, Mar 5
<a href="#"><u>+ K1USN Slow Speed Test</u></a>	0000Z-0100Z, Mar 6
<a href="#"><u>+ ICWC Medium Speed Test</u></a>	1300Z-1400Z, Mar 6
<a href="#"><u>+ OK1WC Memorial</u></a>	1630Z-1729Z, Mar 6
<a href="#"><u>+ ICWC Medium Speed Test</u></a>	1900Z-2000Z, Mar 6
<a href="#"><u>+ RSGB 80m Club Championship, Data</u></a>	2000Z-2130Z, Mar 6
<a href="#"><u>+ Worldwide Sideband Activity Contest</u></a>	0100Z-0159Z, Mar 7
<a href="#"><u>+ ARS Spartan Sprint</u></a>	0200Z-0400Z, Mar 7
<a href="#"><u>+ ICWC Medium Speed Test</u></a>	0300Z-0400Z, Mar 7
<a href="#"><u>+ AGCW YL-CW Party</u></a>	1900Z-2100Z, Mar 7
<a href="#"><u>+ QRP Fox Hunt</u></a>	0200Z-0330Z, Mar 8
<a href="#"><u>+ Phone Weekly Test</u></a>	0230Z-0300Z, Mar 8
<a href="#"><u>+ A1Club AWT</u></a>	1200Z-1300Z, Mar 8
<a href="#"><u>+ CWops Test</u></a>	1300Z-1400Z, Mar 8
<a href="#"><u>+ Mini-Test 40</u></a>	1700Z-1759Z, Mar 8
<a href="#"><u>+ VHF-UHF FT8 Activity Contest</u></a>	1700Z-2100Z, Mar 8
<a href="#"><u>+ Mini-Test 80</u></a>	1800Z-1859Z, Mar 8
<a href="#"><u>+ CWops Test</u></a>	1900Z-2000Z, Mar 8
<a href="#"><u>+ CWops Test</u></a>	0300Z-0400Z, Mar 9
<a href="#"><u>+ CWops Test</u></a>	0700Z-0800Z, Mar 9

*Continued on Page 23*



# Contest Calendar - March 2023

<a href="#"><u>+ EACW Meeting</u></a>	1900Z-2000Z, Mar 9
<a href="#"><u>+ NCCC RTTY Sprint</u></a>	0145Z-0215Z, Mar 10
<a href="#"><u>+ QRP Fox Hunt</u></a>	0200Z-0330Z, Mar 10
<a href="#"><u>+ NCCC Sprint Ladder</u></a>	0230Z-0300Z, Mar 10
<a href="#"><u>+ K1USN Slow Speed Test</u></a>	2000Z-2100Z, Mar 10
<a href="#"><u>+ YB DX RTTY Contest</u></a>	0000Z-2359Z, Mar 11
<a href="#"><u>+ SARL Field Day Contest</u></a>	0800Z, Mar 11 to 1000Z, Mar 12
<a href="#"><u>+ RSGB Commonwealth</u></a>	1000Z, Mar 11 to 1000Z, Mar 12 1200Z-1700Z, Mar 11 (20m-10m) and 0700Z-0900Z, Mar 12 (80m) and 0900Z-1100Z, Mar 12 (40m)
<a href="#"><u>+ DIG QSO Party, SSB</u></a>	1200Z, Mar 11 to 1200Z, Mar 12
<a href="#"><u>+ EA PSK63 Contest</u></a>	1200Z, Mar 11 to 1200Z, Mar 12
<a href="#"><u>+ South America 10 Meter Contest</u></a>	1200Z, Mar 11 to 2400Z, Mar 12
<a href="#"><u>+ SKCC Weekend Sprintathon</u></a>	1400Z-2000Z, Mar 11
<a href="#"><u>+ AGCW QRP Contest</u></a>	1500Z, Mar 11 to 1500Z, Mar 12
<a href="#"><u>+ Stew Perry Topband Challenge</u></a>	1500Z, Mar 11 to 0200Z, Mar 12 and 1500Z-2100Z, Mar 12
<a href="#"><u>+ Oklahoma QSO Party</u></a>	1800Z, Mar 11 to 0559Z, Mar 12
<a href="#"><u>+ TESLA Memorial HF CW Contest</u></a>	1900Z, Mar 11 to 1900Z, Mar 12
<a href="#"><u>+ Idaho QSO Party</u></a>	0000Z-0359Z, Mar 12
<a href="#"><u>+ North American Sprint, RTTY</u></a>	0700Z to 1700Z, Mar 12
<a href="#"><u>+ FIRAC HF Contest</u></a>	0700Z-1100Z, Mar 12
<a href="#"><u>+ UBA Spring Contest, 2m</u></a>	1800Z, Mar 12 to 0100Z, Mar 13
<a href="#"><u>+ Wisconsin QSO Party</u></a>	0000Z-0200Z, Mar 13
<a href="#"><u>+ 4 States QRP Group Second Sunday Sprint</u></a>	0000Z-0100Z, Mar 13
<a href="#"><u>+ K1USN Slow Speed Test</u></a>	1300Z-1400Z, Mar 13
<a href="#"><u>+ ICWC Medium Speed Test</u></a>	

*Continued on Page 24*



# Contest Calendar - March 2023

<a href="#"><u>+ OK1WC Memorial</u></a>	1630Z-1729Z, Mar 13
<a href="#"><u>+ ICWC Medium Speed Test</u></a>	1900Z-2000Z, Mar 13
<a href="#"><u>+ Worldwide Sideband Activity Contest</u></a>	0100Z-0159Z, Mar 14
<a href="#"><u>+ ICWC Medium Speed Test</u></a>	0300Z-0400Z, Mar 14
<a href="#"><u>+ QRP Fox Hunt</u></a>	0100Z-0230Z, Mar 15
<a href="#"><u>+ Phone Weekly Test</u></a>	0230Z-0300Z, Mar 15
<a href="#"><u>+ A1Club AWT</u></a>	1200Z-1300Z, Mar 15
<a href="#"><u>+ CWops Test</u></a>	1300Z-1400Z, Mar 15
<a href="#"><u>+ VHF-UHF FT8 Activity Contest</u></a>	1700Z-2100Z, Mar 15
<a href="#"><u>+ Mini-Test 40</u></a>	1700Z-1759Z, Mar 15
<a href="#"><u>+ Mini-Test 80</u></a>	1800Z-1859Z, Mar 15
<a href="#"><u>+ CWops Test</u></a>	1900Z-2000Z, Mar 15
<a href="#"><u>+ RSGB 80m Club Championship, CW</u></a>	2000Z-2130Z, Mar 15
<a href="#"><u>+ Walk for the Bacon QRP Contest</u></a>	0000Z-0100Z, Mar 16 and 0200Z-0300Z, Mar 17
<a href="#"><u>+ NAQCC CW Sprint</u></a>	0030Z-0230Z, Mar 16
<a href="#"><u>+ CWops Test</u></a>	0300Z-0400Z, Mar 16
<a href="#"><u>+ CWops Test</u></a>	0700Z-0800Z, Mar 16
<a href="#"><u>+ BCC QSO Party</u></a>	1900Z-2059Z, Mar 16
<a href="#"><u>+ NTC QSO Party</u></a>	1900Z-2000Z, Mar 16
<a href="#"><u>+ QRP Fox Hunt</u></a>	0100Z-0230Z, Mar 17
<a href="#"><u>+ NCCC RTTY Sprint</u></a>	0145Z-0215Z, Mar 17
<a href="#"><u>+ NCCC Sprint</u></a>	0230Z-0300Z, Mar 17
<a href="#"><u>+ K1USN Slow Speed Test</u></a>	2000Z-2100Z, Mar 17
<a href="#"><u>+ Maidenhead Mayhem Sprint</u></a>	0000Z, Mar 18 to 2359Z, Mar 19
<a href="#"><u>+ BARTG HF RTTY Contest</u></a>	0200Z, Mar 18 to 0159Z, Mar 20

*Continued on Page 25*





# Contest Calendar - March 2023

[+ SARL VHF/UHF Analogue Contest](#)

[+ Russian DX Contest](#)

[+ All Africa International DX Contest](#)

[+ F9AA Cup, SSB](#)

[+ AGCW VHF/UHF Contest](#)

[+ Virginia QSO Party](#)

[+ Feld Hell Sprint](#)

[+ UBA Spring Contest, SSB](#)

[+ Classic Exchange, Phone](#)

[+ Run for the Bacon QRP Contest](#)

[+ K1USN Slow Speed Test](#)

[+ ICWC Medium Speed Test](#)

[+ OK1WC Memorial](#)

[+ Bucharest Digital Contest](#)

[+ ICWC Medium Speed Test](#)

[+ Worldwide Sideband Activity Contest](#)

[+ ICWC Medium Speed Test](#)

[+ CLARA Chatter Party](#)

[+ SKCC Sprint](#)

0300Z-0500Z, Mar 18 (6m) and  
0501Z-0700Z, Mar 18 (2m) and  
0701Z-0900Z, Mar 18 (70cm) and  
0300Z-0500Z, Mar 19 (6m) and  
0501Z-0700Z, Mar 19 (2m) and  
0701Z-0900Z, Mar 19 (70cm)  
1200Z, Mar 18 to 1200Z, Mar 19  
1200Z, Mar 18 to 1200Z, Mar 19  
1200Z, Mar 18 to 1200Z, Mar 19  
1400Z-1700Z, Mar 18 (144) and  
1700Z-1800Z, Mar 18 (432)  
1400Z, Mar 18 to 0400Z, Mar 19 and  
1200Z-2400Z, Mar 19  
2000Z-2159Z, Mar 18  
0700Z-1100Z, Mar 19  
1400Z, Mar 19 to 0800Z, Mar 20 and  
1400Z, Mar 21 to 0800Z, Mar 22  
2300Z, Mar 19 to 0100Z, Mar 20  
0000Z-0100Z, Mar 20  
1300Z-1400Z, Mar 20  
1630Z-1729Z, Mar 20  
1800Z-2059Z, Mar 20  
1900Z-2000Z, Mar 20  
0100Z-0159Z, Mar 21  
0300Z-0400Z, Mar 21  
Cancelled for 2023  
0000Z-0200Z, Mar 22

*Continued on Page 26*



# Contest Calendar - March 2023

<a href="#"><u>+ QRP Fox Hunt</u></a>	0100Z-0230Z, Mar 22
<a href="#"><u>+ Phone Weekly Test</u></a>	0230Z-0300Z, Mar 22
<a href="#"><u>+ A1Club AWT</u></a>	1200Z-1300Z, Mar 22
<a href="#"><u>+ CWops Test</u></a>	1300Z-1400Z, Mar 22
<a href="#"><u>+ Mini-Test 40</u></a>	1700Z-1759Z, Mar 22
<a href="#"><u>+ Mini-Test 80</u></a>	1800Z-1859Z, Mar 22
<a href="#"><u>+ CWops Test</u></a>	1900Z-2000Z, Mar 22
<a href="#"><u>+ CWops Test</u></a>	0300Z-0400Z, Mar 23
<a href="#"><u>+ CWops Test</u></a>	0700Z-0800Z, Mar 23
<a href="#"><u>+ RSGB 80m Club Championship, SSB</u></a>	2000Z-2130Z, Mar 23
<a href="#"><u>+ QRP Fox Hunt</u></a>	0100Z-0230Z, Mar 24
<a href="#"><u>+ NCCC RTTY Sprint</u></a>	0145Z-0215Z, Mar 24
<a href="#"><u>+ NCCC Sprint</u></a>	0230Z-0300Z, Mar 24
<a href="#"><u>+ K1USN Slow Speed Test</u></a>	2000Z-2100Z, Mar 24
<a href="#"><u>+ FOC QSO Party</u></a>	0000Z-2359Z, Mar 25
<a href="#"><u>+ CQ WW WPX Contest, SSB</u></a>	0000Z, Mar 25 to 2359Z, Mar 26
<a href="#"><u>+ UBA Spring Contest, 6m</u></a>	0600Z-1000Z, Mar 26
<a href="#"><u>+ K1USN Slow Speed Test</u></a>	0000Z-0100Z, Mar 27
<a href="#"><u>+ QCX Challenge</u></a>	1300Z-1400Z, Mar 27
<a href="#"><u>+ ICWC Medium Speed Test</u></a>	1300Z-1400Z, Mar 27
<a href="#"><u>+ OK1WC Memorial</u></a>	1630Z-1729Z, Mar 27
<a href="#"><u>+ ICWC Medium Speed Test</u></a>	1900Z-2000Z, Mar 27
<a href="#"><u>+ QCX Challenge</u></a>	1900Z-2000Z, Mar 27
<a href="#"><u>+ RSGB FT4 Contest</u></a>	2000Z-2130Z, Mar 27
<a href="#"><u>+ Worldwide Sideband Activity Contest</u></a>	0100Z-0159Z, Mar 28
<a href="#"><u>+ QCX Challenge</u></a>	0300Z-0400Z, Mar 28

*Continued on Page 27*

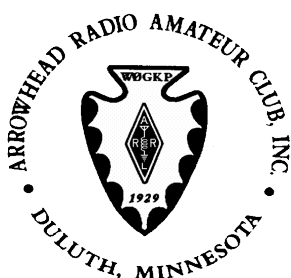


# Contest Calendar - March 2023

<a href="#"><u>+ ICWC Medium Speed Test</u></a>	0300Z-0400Z, Mar 28
<a href="#"><u>+ QRP Fox Hunt</u></a>	0100Z-0230Z, Mar 29
<a href="#"><u>+ Phone Weekly Test</u></a>	0230Z-0300Z, Mar 29
<a href="#"><u>+ A1Club AWT</u></a>	1200Z-1300Z, Mar 29
<a href="#"><u>+ CWops Test</u></a>	1300Z-1400Z, Mar 29
<a href="#"><u>+ Mini-Test 40</u></a>	1700Z-1759Z, Mar 29
<a href="#"><u>+ Mini-Test 80</u></a>	1800Z-1859Z, Mar 29
<a href="#"><u>+ CWops Test</u></a>	1900Z-2000Z, Mar 29
<a href="#"><u>+ UKEICC 80m Contest</u></a>	2000Z-2100Z, Mar 29
<a href="#"><u>+ CWops Test</u></a>	0300Z-0400Z, Mar 30
<a href="#"><u>+ CWops Test</u></a>	0700Z-0800Z, Mar 30
<a href="#"><u>+ QRP Fox Hunt</u></a>	0100Z-0230Z, Mar 31
<a href="#"><u>+ NCCC RTTY Sprint</u></a>	0145Z-0215Z, Mar 31
<a href="#"><u>+ NCCC Sprint</u></a>	0230Z-0300Z, Mar 31
<a href="#"><u>+ Sasquatch Stomp</u></a>	1900Z, Mar 31 to 0300Z, Apr 1
<a href="#"><u>+ K1USN Slow Speed Test</u></a>	2000Z-2100Z, Mar 31

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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