OUR 26TH YEAR!

EPARA BEACON

VOL. 6, NUMBER 11 THE OFFICIAL NEWSLETTER OF THE EASTERN PENNSYLVANIA AMATEUR RADIO ASSOCIATION NOVEMBER 2022

NEXT CLUB MEETING: NOVEMBER 10TH

Monroe County Public Safety Center, 100 Gypsum Rd Stroudsburg, PA 18360

Welcome to the EPARA Beacon! This newsletter is published monthly and is the official newsletter of the Eastern Pennsylvania Amateur Radio Association. EPARA has served the amateur radio community in the Pocono Mountains for over 25 years. We have been an ARRL affiliated club since 1995. We offer opportunities for learning and the advancement of skills in the radio art for hams and non-hams alike. EPARA supports Monroe County ARES/RACES in their mission of providing emergency communications for served agencies in Monroe County. Feel free to join us at one of our meetings or operating events during the year. The club meets on the second Thursday of every month, at the Monroe County 911 Emergency Control Center. The business meeting starts at 7:30 P.M. Anyone interested is invited to participate in our meetings and activities.

ZOOM Meeting Info: Meetings begin at 7:30PM!

https://us02web.zoom.us/j/85463346031?pwd=bU1KcVZoaVZiVEUvdjRsUXlNNHZkZz09

Meeting ID: 854 6334 6031 Password: 244632

From The President

I can't believe its November already, our VE sessions are completed for the year and this month's meeting is our last business meeting for 2022. Its time to get ready for the holidays with our families. For me its time to start getting ready for the winter contests, January and February bring my favorite RTTY contest. There is so much more to amateur radio than weekly nets or Field Day, I encourage you to find something you like and dive in.

Speaking of nets, our SSTV net is up and running. We hold it on 80 meters (3.845MHz) on the 1st and 3rd Thursdays of the month. It's fun and I hope many of you will join us as we expand our nets to the HF bands. I've always preferred HF to FM repeaters and maybe soon we will start a SSB net on 80 or maybe 160 meters.

Finally, I received word from Donald Darcy WK2RP. As many of you know Don moved to South Dakota, I hate to report Don has been diagnosed with Leukemia and is currently in the hospital receiving chemotherapy. He is optimistic that it was caught early, and he will beat this. As you know this is a serious form of cancer and Don has a tough battle ahead. Don will need all our thoughts and prayers. Well wishes and words of support can be sent to wk2rp@aol.com

That's all for now, see you at our meeting on November 10th.
73 Chris AJ3C

CONTACT INFORMATION

President Chris Saunders AJ3C: aj3c@gmx.com	Vice President Bob Matychak W3BMM: w3bmmqth@gmail.com
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What's INSIDE this ISSUE

EPARA Net list

Monroe county ARES-RACES – Sunday's 8:30 PM, 146.865 MHz, PL -100 Hz

The Monday Night Pimple Hill repeater 8:30 PM (Repeater freq = 447.275 with a - 5MHz offset) DMR TECH Net on TG314273* Time Slot 2

SPARK Information/Swap Net – Tuesday's 8:30 PM, 147.045 MHz, PL 131.8 Hz

The Wednesday Night EPARA Hot Spot DMR Rag Chew net at 8:30 PM, TG 3149822* Time Slot 2 (N3IS Talk Group)

EPARA Tech Net – Friday's 8:30 PM, 147.045 MHz, PL +131.8 Hz

*TG = Talk Group

President
Chris Saunders AJ3C

Vice President
Bob Matychak W3BMM

Secretary
Kevin Forest W3KCF

Treasurer
Scott Phelan KC3IAO

Member at Large
Eric Weis N3SWR

****

ARES EC
Charles Borger KB3JUF

Assistant EC
Chris Saunders AJ3C
Len Lavenda KC3OND

Field Day Coordinator
Chris Saunders AJ3

Quartermaster
TBD

Membership Coordinator
Al Brizzi KB3OVB

Newsletter Editor
Eric Weis N3SWR

Photographer
Eric Weis N3SWR

Public Information
TBD

Social Media
Chris Saunders AJ3C
Eric Weis N3SWR

Hamfest Coordinator
Bill Connely W3MJ
Walter Koras W3FNZ

Technical Program Coordinator
Bill Carpenter AB3ME

Lead VE
Chris Saunders AJ3C

Webmaster
Chris Saunders AJ3C

Announcements

AND UPCOMING EVENTS

EPARA Club Dues

For those that missed the chance to stay current, there are two (2) methods available to pay to help make this easy for all. Contact Scott KC3IAO via his email: KC3IAO@hobbyguild.com and you can send him a check or pay via PayPal.

ARES/RACES

There is an official S.E.T planned for Sunday, October 2nd. Contact Charlie KB3JUF for further info if needed.

Veteran's Day Parade

EPARA is looking to participate in the parade on November 6th. For those that are interested, please contact Chris AJ3C or Ruth Anne W9FBO for more information.

Christmas Dinner:

This years Christmas dinner will be held on November 10th at the Chestnuthill Dinner once again. We will meet between 7:00 and 7:30pm.

Santa Net:

We are happy to announce that the Santa Net will be in full swing on Christmas Eve. Anyone wishing to help Santa and Mrs Claus please get in contact with Chris AJ3C.

Ham TV to Return to the ISS

During the AMSAT-UK Space Colloquium on October 8th, AMSAT announced the Ham TV unit for the ISS is repaired and on the way to Houston for testing. The flight date dependent on testing.

Ham TV has been inoperative since April 2018. It had been active since April 2014, having been launched to the ISS in 2013. It was returned to earth for diagnosis and repair in late 2018.

The ARISS Ham TV transmitter is capable of downlinking DVB-S digital video of ARISS contacts and other activities on board the ISS to amateur ground stations in the 2.3 GHz amateur band. More information can be found at https://www.ariss.org/hamtv-on-the-iss.html

Rule #1 of Amateur Radio, it is a hobby, unless you figured out a way to fashion a living out of it.
Rule #2 of Amateur Radio, life is not a hobby and typically carries heavy responsibilities of everything that is not a hobby.
Rule #3 of Amateur Radio, never give up a LIFE event for a Ham event. You may make some great memories at the Ham event, but the guilt you may carry missing a LIFE event can be a terribly heavy millstone.
Rule #4 of Amateur Radio, as technology moves forward, so does Ham Radio - do what makes you happiest, experiment with other elements of Ham Radio as LIFE allows.
Rule #5 of Amateur Radio, it is only Ham Radio, when confused always refer to Rule #1 through #4.

EPARA GENERAL MEMBERSHIP MEETING AGENDA

EPARA Membership Meeting Minutes
October 13th *2022*

General Membership Meeting 7:30Pm

Open meeting:

Meeting called to order at 7:34 pm on October 13th 2022 by Chris AJ3C
Declaration of Quorum.
Total attending **18**. Present at 911 Center **11** Present on Zoom **7**. Visitors present **0**

Pledge of Allegiance / Moment of silence:

Membership Meeting – Minutes Sep 8th, 2022
Secretary - Kevin W3KCF:

Meeting minutes for Sep 8th 2022 were posted on the EPARA website. Chris – AJ3C asked members if they had seen and read the minutes from our previous meeting. He then asked if there were any questions or objections to the minutes as they were presented. With no objections, Chris asked for a motion to accept the minutes as presented:

Motion to accept minutes as read: By Martin KC3TOE 2nd by Julia – KC3TOF Motion Passed

Treasurers report:

Treasurers report: For October 2022 EPARA Club Meeting.
Read by Chris – AJ3C

Bank Account Statement Opening Balance 9/30/22 statement.): $3,693.98

Income:

$40.00 Dues – Jeff Bunting (KC3OYI) and Scott Gentles – No call sign
$70.00 - 50/50
$1996.00 – Hamfest deposit (Gross)
$0.15 – Bank interest

Expenses:

$560.30 Various items (see below) #165

$35.56 - Red Cross – Coax cables
$172.54 - Antenna weekend supplies
$172.23 - Field day expenses
$42.00 - Stamps for Hamfest mailing
$24.37 - Padlock to replace cut lock at 911Center
$116.60 – Hamfest Tickets Printing

$51.57 – Hamfest Mailer - Printing costs #166
$600.00 – Withdrawal for Hamfest change #167

Closing Balance $4585.26

Our PayPal Account 9/30/22 $447.58 (No change from last month)

Hamfest Cost Breakdown:

Income $1996 (Gate - $1506, Food - $217, 50/50 - $133, Club table $110)

Motion to accept by AL -KB3OVB 2nd by Eric – N3SWR Motion Passed

Correspondence:
None

Reports of officers and committee's:

Bill AB3ME – Program Committee

Bill was not present when the committee report was given and Chris filled in. He told us there would be a presentation given tonight by Alex - KD2FTA on slow scan TV.

Chris -AJ3C then stated that those interested in giving a presentation, please contact him or Bill – AB3ME.

Charlie KB3JUF – ARES/RACES:

Charlie spoke about how well he thought the MCARES staged emergency On October 2nd went. He said we'd go over the details at our next ARES meeting on the 28th of October.

Charlie then reiterated that all involved in ARES need to be motivated. Make sure you attend our meetings on the 4th Friday of the month and keep your Task Books up to date. Complete any and all training required and stay enthused. Charlie also stated, please check in on the Sunday Night ARES Net.

Ruth Ann, W9FBO – PIO:

Grant Request:

Deadline for grant request is October 1st 2022. Ruth Ann has been working with Chris on the grant submission to fund a new emergency communications trailer. Everything is going well.

Ruth Ann then asked if everything was still a go with the Veteran's Day Parade being held on the 6th of November at 1300. Chris said the club would participate.

Chris AJ3C -- Instruction and Training:

Nothing to report. Chris thought classes would begin after the new year.

Chris AJ3C – Website:

Will be doing a revamp of the website in the near future.

EPARA GENERAL MEMBERSHIP MEETING AGENDA

Bob W3BMM – Social Media:

Bob said, "**please like the site**". Chris said, as always, share material with Bob for the club's various social media accounts.

He mentioned that the ARRL has very good material on their Facebook account.

Many very good channels for every kind of radio interest -- DMR, Wingroup, EME, etc.

Al, KB3OVB: Membership:

Al said we are currently at 71 members

Eric N3SWR – Newsletter:

Eric said all's well with the newsletter. Keep sharing content with him. Next months newsletter will have audio clips embedded.

Sat-Com / EME Group:

Bob – W3BMM: Satellite communication works very well during weekdays even without Arrow antenna. Best in the very early hours and very late at night. Weekends have too much traffic. Chris said we'd like to try another attempt at EME in November. The antenna and all the equipment is coming together.

Old business:

PAQSO Party (Recap)

Bill said they had a good time and had 125 contacts. Bob – W3BMM has audio and video clips of their encounters. Once again, Bill hosted the event at his home. Those present were Bob - W3BMM, RuthAnn-W9FBO, Martin - KC3TOE, Julia - KC3TOF, Len - KC3OND, Dan –

Hamfest 2022 (Recap)

Walt said everything went well. Turnout was good and the club made money. See treasurer's report for breakdown of income and expenses.

Any other old business:
None

EPARA 2023 Budget:

Chris – AJ3c presented the 2023 budget to the club. He mentioned that for 2023 we would have a special purchase buy for a new radio to place in the radio room at the 911 Center. The club has allocated $1500 for this purchase, but we hope to find one cheaper.

We are expecting dues of $800 for 2023 and our budget total of $2100 will be $760 less than shown due to the special radio purchase.

Motion to accept minutes as read: By Eric -N3SWR 2nd by Charlie – KB3JUF Motion Passed

EPARA GENERAL MEMBERSHIP MEETING AGENDA

New business:

Christmas Party 2022

Our annual Christmas Party will be held on the 2nd Thursday of December. Remember the date, December 8th at 1930. It will be held at the Chestnut Hill Diner. See you there.

Any Other New Business:

Christmas Eve Net – Once again, Alex – KD2FTA will be net control. We are hoping Ruth Anne – W9FBO will play Mrs. Claus.

Votes / New members: **0**

Announcements: None

Any Additional Announcements

Tonight's 50/50 Raffle: $40.00. Won by Eric – N3SWR (Donated back to club)

Adjournment…

Meeting was adjourned at 2018:

Motion to close by Ed-KB3OLB 2nd by Martin -KC3TOE Motion Passed.

Secretary
Kevin Forrest
W3KCF

EPARA MEETING

TEST YOUR KNOWLEDGE!

How are analog SSTV images typically transmitted on the HF bands?

A. Video is converted to equivalent Baudot representation
B. Video is converted to equivalent ASCII representation
C. Varying tone frequencies representing the video are transmitted using PSK
D. Varying tone frequencies representing the video are transmitted using single sideband

Last month's answer was, B A Pi-network with an additional series inductor on the output. One issues with transmitting into a multi-band antenna system is the creation of harmonic distortion,using a filter can suppress harmonics. The Pi-L network is one of the most effective methods to suppress the harmonics

What is Digital Mobile Radio (DMR)?

- A European Telecommunications Standards Institute (ETSI) standard first ratified in 2005 and is the standard for "professional mobile radio" (PMR) users. Motorola designed their MotoTrbo line of radios based upon the DMR standards
- Meets 12.5kHz channel spacing and 6.25kHz regulatory equivalency standards
- Two slot Time Division Multiple Access (TDMA)
- 4 level FSK modulation
- Cutting edge Forward Error Correction (FEC)
- Commercial ETSI/TIA specs mean rugged performance and excellent service in RF congested urban environments (no intermod and other RF "hash")
- Equipment interoperability is certified by the DMR Association

DMR
DIGITAL MOBILE RADIO

The EPARA HOT SPOT Wednesday night DMR rag chew is here!

Wednesday evenings at 8:30 PM local, 0:30 UTC!

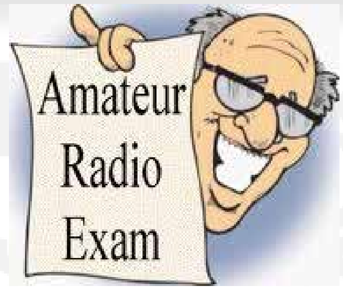
Tune your DMR radios to Talk Group 3149822 TS2 to join the

N3IS EPARA Hot Spot rag chew DMR net.

Listen to the Tech Net Friday nights on the 147.045 repeater to learn more about joining this net and for upcoming ZOOM meetings announcements to learn more about programing your radios and hot spots!

VE Testing & Classes

Anyone looking to take an exam is encouraged to contact Chris AJ3C to preregister at least one (1) week in advance of the test date. If you have any questions or to register, Chris can be reached via email AJ3C@GMX.COM. VE sessions are being held the 4th Friday of each month at 6pm at the Monroe County 911 training center. Seating is limited for the time being so we can follow the health guidelines set forth by the county and state.



VE sessions are back - contact Chris AJ3C for further information!

AMATEUR RADIO CLASSES

ARES/RACES meetings are now being held on the fourth Friday of each month at 7PM. The meetings are once again being held at the 911 call center. These meetings will serve as training sessions covering several aspects of amateur radio emergency communications. We will start with traffic handling and the use of Radiograms and the ICS 213 general message form. Future sessions will cover the use of several ICS forms and the setup and use of digital communication modes including Winlink, Packet Radio, APRS, and the FLDIGI software program. Meeting are open to all, you do not need to be an ARES/RACES team member to attend.

Want to Put Your Ham Radio Skills to Good Use? Get Involved in EmComm!

One of the missions of the Amateur Radio Service is for amateur radio operators to provide public service and emergency communications (EmComm) when needed. We act as a voluntary noncommercial communication service and pitch in to help our communities and first responders.

So, what organizations are out there for community-minded amateur radio operators and what can we do to help?

Join In

One good entry point into public service and emergency communications is to join SkyWarn, a volunteer program run by the National Weather Service (NWS) with more than 290,000 trained severe weather spotters. These volunteers help keep their local communities safe by providing timely and accurate reports of severe weather to the NWS.

Not all of these weather spotters are amateur radio operators, but many are. Amateur radio communications can report severe weather in real time. When severe weather is imminent, SkyWarn spotters are deployed to the areas where severe weather is expected. A net is activated on a local repeater and SkyWarn spotters who are Hams check into that net. The net control advises the spotters when they might expect to see severe weather, and the spotters report conditions such as horizontal winds, large hail, rotating clouds, and even tornadoes.

To become a SkyWarn spotter, you must attend a class that teaches you the basics of severe weather, how to identify potentially severe weather features, and how to report them. The classes are free and typically last about two hours. Check your local NWS website for class schedules.

ARES/RACES/CERT

Another way Hams can become involved in public service and emergency communication is to join an ARES or RACES group. Technically, these are two separate services—the Amateur Radio Emergency Service (ARES) is run by the ARRL, while the Radio Amateur Civil Emergency Service (RACES) is a function of the Federal Emergency Management Agency (FEMA). Amateur radio operators who typically take part in one also take part in the other.

To participate in RACES, you'll need to take some self-study FEMA courses in emergency preparedness and emergency-response protocols. Classes may or may not be required to participate in ARES. These requirements are set by each individual ARES group. To get involved with either ARES or RACES, ask your local club members when they meet. You can also contact the Section Manager or Emergency Coordinator for your ARRL section. To contact them, click here and find the section that you live in.

Amateur radio operators belonging to ARES (and its predecessor, the Amateur Radio Emergency Corps) have responded to local and regional disasters since the 1930s, including the 9/11 attacks, and Hurricane Katrina and Hurricane Michael, among others.

The Community Emergency Response Team (CERT) program trains volunteers—both Hams and non-hams—how to be prepared for disasters that may impact their area. They provide basic disaster response skills, such as fire safety, light search and rescue, team organization, and disaster medical operations. CERT offers a nationwide approach to volunteer training and organization that first responders can rely on during disaster situations, allowing them to focus on more complex tasks.

What Gear Do You Need?

For most local needs, a 5-watt VHF/UHF handheld transceiver is sufficient for utilizing local repeaters to relay messages and report on conditions as they exist. Replacing the radio's stock antenna with a higher gain antenna or connecting it to a magnetic mount on a vehicle will increase range significantly.

Even better is a VHF/UHF mobile radio installed in your vehicle with 25 or more watts output and a good mobile antenna. In the event the repeater loses power, you can talk over a considerably larger area in simplex mode with the extra power and a good mobile antenna.

If you work with an ARES or RACES group, you may be asked to act as a county control station. In this capacity, you'd need both HF and VHF transceivers in a fixed location, such as your house, with a good antenna system and emergency power capabilities like a generator or batteries. This allows you to make contacts within your state and throughout the U.S.

Helping Hams

Ham radio can play a key role in emergency situations. Here are a few examples:

- Ham radio connected firefighters and police departments, Red Cross workers, and other emergency personnel during the 2003 blackout that affected the northeast United States.
- In 2017, fifty amateur radio operators were dispatched to Puerto Rico to provide communications services in the wake of Hurricane Maria.
- Amateur radio operators provided communications in the aftermath of the Boston Marathon bombing when cellphone systems became overloaded.

- During Hurricane Katrina, more than one thousand ARES volunteers assisted in the aftermath and provided communications for the American Red Cross.
- During the devastating Oklahoma tornado outbreak that began in May 1999, amateur radio operators—giving timely ground-truth reports of severe weather—played a critical role in the warning and decision-making processes at the NWS Weather Forecast Office in Norman, Oklahoma.

Credit: https://www.onallbands.com/want-to-put-your-ham-radio-skills-to-good-use-get-involved-in-emcomm/

From the Editor

Eric, N3SWR

With the cold weather months and the holidays approaching, it occurred to me that it's probably a good time to start to include some additional reading material. I'm going to toss in a bunch of technical skills related material and whatever else that seems appropriate for the hobby. The electronics skills and theory from years ago has not changed. Only the package that it's presented in has.

SSTV has become a personal favorite of mine lately. I've struggled to get WSJT-X and MMSSTV software packages to cooperate with each other finally. And the result has been some interesting contacts from around the country on 20 meters. You should try this mode as it can be fun!

Cheers for now! Eric
N3SWR

"Before you criticize someone, you should walk a mile in their shoes. That way when you criticize them, you are a mile away from them and you have their shoes."
—Jack Handey

Topics of Interest

Have an idea you would like to share with your fellow hams? Interested in one of the new exotic digital modes and would like to get others interested in it too? Found a blog somewhere that you think others would find interesting? Members are encouraged to submit items of interest for publication. Submitted articles (are suggested) to be no more than a page or two in length and may be edited for content and grammar. The EPARA officers and newsletter editor reserve the right to determine which items will be included in The Beacon. The deadline for publication is the 15th of the month. The publication date will be at the end of each month. Copyrights are the property of their respective owners and their use is strictly non-profit/educational and intended to foster the spirit of amateur radio.

If you've taken pictures at an event and would like to submit them for possible inclusion in the newsletter, forward them to the newsletter editor. Please send action shots, if possible. Faces are often preferable over the backs of heads. Many hams may be way too overweight, so please consider using a wide-angled lens.

Disclaimer

The Beacon is not representative of the views or opinions of the whole organization, and such views and opinions expressed herein are of the individual author(s).

Contest Corral November 2022

Check for updates and a downloadable PDF version online at **www.arrl.org/contest-calendar**.
Refer to the contest websites for full rules, scoring information, operating periods or time limits, and log submission information.

Start Date	Start Time	Finish Date	Finish Time	Bands	Contest Name	Mode	Exchange	Sponsor's Website
1	0100	1	0159	1.8-28,50	Worldwide Sideband Activity Contest	Ph	RS, age group (OM, YL, youth YL, or youth)	wwsac.com
1	0300	1	0400	1.8-28	QCX Challenge	CW	RST, name, SPC, rig	www.qrp-labs.com
1	0600	1	0859	3.5,7	Silent Key Memorial Contest	CW	RST, SK call sign you wish to recognize	www.skmc.hu/en/rules.html
2	1700	2	2100	144	VHF-UHF FT8 Activity Contest	FT8	4-char grid square	www.ft8activity.eu/index.php/en
2	2000	2	2100	3.5	UKEICC 80-Meter Contest	Ph	6-char grid square	www.ukeicc.com
3	0000	4	0300	7	Walk for the Bacon QRP Contest	CW	13 WPM max; RST, SPC, name, mbr/power	qrpcontest.com
3	1800	3	2200	28	NRAU 10-Meter Activity Contest	CW,Ph,Dig	RS(T), 6-char grid square	nrrlcontest.no
3	2000	3	2200	1.8-28,50	SKCC Sprint Europe	CW	RST, SPC, name, mbr or "none"	www.skccgroup.com
5	0600	5	1800	3.5-28	IPARC Contest, CW	CW	RST, serial, IPA, US state (if USA)	www.iparc.de
5	2100	7	0300	1.8-28	ARRL Sweepstakes Contest, CW	CW	Serial, precedence, your call, check, ARRL/RAC Section	www.arrl.org/sweepstakes
6	0600	6	1800	3.5-28	IPARC Contest, SSB	Ph	RST, serial, IPA, US state (if USA)	www.iparc.de
6	1400	6	1700	3.5-28	High Speed Club CW Contest	CW	RST, mbr or "NM"	www.highspeedclub.org
7	2000	7	2130	3.5	RSGB 80-Meter Autumn Series, Data	Dig	RST, serial	www.rsgbcc.org
8	0100	8	0159	1.8-28,50	Worldwide Sideband Activity Contest	Ph	RS, age group (OM, YL, youth YL or youth)	wwsac.com/rules.html
8	0200	8	0400	3.5-28	ARS Spartan Sprint	CW	RST, SPC, power	arsqrp.blogspot.com
9	1700	9	2100	432	VHF-UHF FT8 Activity Contest	FT8	4-char grid square	www.ft8activity.eu/index.php/en
10	1900	10	2000	3.5,7	EACW Meeting	CW	RST, mbr, nickname, EA province or DXCC prefix	www.eacwspain.es/eacwmeeting
12	0000	13	2359	50-1296	ARRL EME Contest	CW,Ph,Dig	Signal report	www.arrl.org/eme-contest
12	0000	13	2359	3.5-28	WAE DX Contest, RTTY	Dig	RS, serial	www.darc.de
12	0000	14	2359	1.8-7	PODXS 070 Club Triple Play Low Band Sprint	Dig	RST, SPC	www.podxs070.com
12	0001	13	2359	28	10-10 International Fall Contest, Digital	Dig	Name, mbr or "0," SPC	www.ten-ten.org
12	0300	13	0900	50,70,144, 432,1296	SARL VHF/UHF Analogue Contest	CW,SSB, AM,FM	RS(T), 6-char grid square	www.sarl.org.za
12	0700	13	1300	1.8-28	JIDX Phone Contest	Ph	RST, JA prefecture number or CQ zone	jidx.org
12	1200	13	1200	1.8-28	OK/OM DX Contest, CW	CW	RST, 3-letter OK/OM district code or serial	okomdx.crk.cz
12	1200	13	2359	1.8-28,50	SKCC Weekend Sprintathon	CW	RST, SPC, name, mbr or "none"	www.skccgroup.com
12	1600	12	1800	3.5-28	FISTS Saturday Sprint	CW	RST, name, mbr or "0," SPC	fistsna.org
12	1900	14	0500	1.8-28, 50,144,432	CQ-WE Contest	CW,Ph,Dig	Name, location code, years of service	cqwe.cboh.org
12	2300	21	0300	1.8-14	AWA Bruce Kelley 1929 QSO Party	CW	RST, name, QTH, equipment year/type/power	antiquewireless.org
13	0700	13	1700	3.5-28	FIRAC HF Contest	Ph	RS(T), serial	www.firac.de/FIRAC_HF_ CONTEST_E.pdf
13	1400	16	0800	1.8-28, 50,144	Classic Exchange, Phone	Ph	Name, RS, SPC, rig make/model	www.classicexchange.org
14	0100	14	0300	1.8-28	4 States QRP Group Second Sunday Sprint	CW,Ph	RS(T), SPC, mbr or power	www.4sqrp.com
15	0100	15	0159	1.8-28,50	Worldwide Sideband Activity Contest	Ph	RS, age group (OM, YL, youth YL, or youth)	wwsac.com
16	1700	16	2100	1.2G	VHF-UHF FT8 Activity Contest	FT8	4-char grid square	www.ft8activity.eu/index.php/en
16	2000	16	2130	3.5	RSGB 80-Meter Autumn Series, SSB	Ph	RS, serial	www.rsgbcc.org
17	0000	18	0300	14	Walk for the Bacon QRP Contest	CW	13 WPM max; RST, SPC, name, mbr/power	qrpcontest.com
17	0130	17	0330	3.5-14	NAQCC CW Sprint	CW	RST, SPC, mbr or power	naqcc.info
17	1900	17	2000	3.5-14	NTC QSO Party	CW	25 WPM max; RST, mbr or "NM"	qsl.net/ntc/party.html
19	1200	20	1200	3.5-28	LZ DX Contest	CW,Ph	RS(T), 2-letter LZ district or ITU zone	lzdx.bfra.org/rulesen.html
19	1600	19	2359	1.8	All Austrian 160-Meter Contest	CW	RST, serial, OE district code (if OE)	www.oevsv.at
19	1700	20	0100	1.8	REF 160-Meter Contest	CW	RST, serial, department code	concours.r-e-f.org
19	1900	19	2059	1.8-7,21, 28,50	Feld Hell Sprint	Dig	RST, mbr, SPC, grid	sites.google.com/site/feldhellclub
19	1900	19	2300	1.8	RSGB 1.8 MHz Contest	CW	RST, serial, UK district code (if UK)	www.rsgbcc.org
19	2100	21	0300	1.8-28	ARRL Sweepstakes Contest, SSB	Ph	Serial, precedence, your call, check, ARRL/RAC Section	www.arrl.org/sweepstakes
20	1300	20	1700	3.5,7	Homebrew and Oldtime Equipment Party	CW	RST, serial, class	www.qrpcc.de
20	2100	20	2300	3.5-28	FISTS Sunday Sprint	CW	RST, SPC, name, mbr or "0"	fistsna.org
20	2300	21	0100	1.8-28	Run for the Bacon QRP Contest	CW	RST, SPC, mbr or power	qrpcontest.com
22	0100	22	0159	1.8-28,50	Worldwide Sideband Activity Contest	Ph	RS, age group (OM, YL, youth YL, or youth)	wwsac.com
23	0000	23	0200	1.8-28,50	SKCC Sprint	CW	RST, SPC, name, mbr or "none"	www.skccgroup.com
24	2000	24	2130	3.5	RSGB 80-Meter Autumn Series, CW	CW	RST, serial	www.rsgbcc.org
26	0000	27	2359	1.8-28	CQ Worldwide DX Contest, CW	CW	RST, CQ zone	www.cqww.com
28	2000	28	2130	3.5-14	RSGB FT4 Contest	FT4	4-char grid square	www.rsgbcc.org
29	0100	29	0159	1.8-28,50	Worldwide Sideband Activity Contest	Ph	RS, age group (OM, YL, youth YL, or youth)	wwsac.com
30	2000	30	2100	3.5	UKEICC 80-Meter Contest	CW	6-char grid square	www.ukeicc.com

There are a number of weekly contests not included in the table above. For more info, visit: **www.qrpfoxhunt.org**, **www.ncccsprint.com**, and **www.cwops.org**. All dates and times refer to UTC and may be different from calendar dates in North America. Contests are not conducted on the 60-, 30-, 17-, or 12-meter bands. Mbr = Membership number. Serial = Sequential number of the contact. SPC = State, Province, DXCC Entity. XE = Mexican state. Listings in blue indicate contests sponsored by ARRL or *NCJ*. The latest time to make a valid contest QSO is the minute listed in the "Finish Time" column. *Data for Contest Corral is maintained on the WA7BNM Contest Calendar at* **www.contestcalendar.com** *and is extracted for publication in* QST *2 months prior to the month of the contest. ARRL gratefully acknowledges the support of Bruce Horn, WA7BNM, in providing this service.*

Amateur Radio Special Event Stations!

10/29/2022 | Spruce Goose 75th Anniversary of Flight

Oct 29-Nov 6, 1700Z-2359Z, W6HA/W6HA/7, Torrance, CA. Hughes and McMinnville Amateur Radio Clubs. SSB: 3.833 7.233 14.233 21.333 28.333; CW: 3.533 7.033 14.033 21.033 28.033; 445.620 PL 127.3; 146.52 on 146.550. QSL. Brian Johnson, AB6UI, 5207 Lillian St, Torrance, CA 90503. Wednesday, November 2, 2022 is the 75th Anniversary of the Flight of the Hughes Aircraft Company's Hercules H-4 Flying Boat aka The Spruce Goose. W6HA stations will be near Culver City and/or Long Beach Harbor where the craft was built, assembled and flown. W6HA/7 stations will be near McMinnville, Oregon were the aircraft is now displayed in the Evergreen Aviation and Aerospace Museum. W6HA near Culver City/Long Beach, CA; W6HA/7 near McMinnville, OR. www.w6ha.org

10/30/2022 | 47th Anniversary, Sinking of the Edmund Fitzgerald

Oct 30-Nov 13, 0000Z-2359Z, W8F, Livonia, MI. Livonia Amateur Radio Club. 14.260 14.040 7.260 7.040. Certificate. Mike Rudzki N8MR, 14071 Fairway St., Livonia, MI 48154. Sat. Nov. 5, 1600-2030 UTC, W8F will operate from Dossin Great Lakes Museum, Detroit MI, and POTA K-1487. https://livoniaarc.com

10/31/2022 | Boo To You

Oct 31-Nov 1, 0000Z-0400Z, KC5BOO, Cleburne, TX. Club KC5NX. 14.278 14.074. QSL. Judy Cox, 3701 Park Rd 21, Cleburne, TX 76033. On Halloween come say boo to me and I'll say boo to you! https://kc5nx.com

10/31/2022 | WØO Halloween FunXpedition

Oct 31-Nov 1, 1900Z-0300Z, W0O, Frankenstein, MO. Mid-MO Amateur Radio Club. 3.538 3.980 14.038 14.340. QSL. See QRZ, for QSL, , information. Operating from Frankenstein, MO, the only known Frankenstein in the USA. QSL information via QRZ.COM. www.qrz.com/db/w0o

11/03/2022 | Godzilla 68th anniversary of coming to the big screen

Nov 3-Nov 13, 0000Z-2359Z, W9G, Indianapolis, IN. Indiana Elmer Network. 14.074 144.174 7.074 14.060. QSL. W9G C/O Wayne Michael, 1255 Weston Drive, Indianapolis, IN 46234. November 3rd is the 68th anniversary of Godzilla coming to the big screen in the original Japanese film classic. Some QRPer's from Central Indiana are going to be operating Special Event Station W9G from November 3rd to November 13th, along with other operators in the 7th region. Modes to be used will be CW, SSB, and a few digital modes like PSK, RTTY and FT8. This special event is being sponsored by the Indiana Elmer Network. QSL cards will be sent via EMAIL. indianaelmernetwork.us

11/04/2022 | Vigil at the Ottawa IL War Memorial

Nov 4-Nov 5, 2300Z-2200Z, W9TAL, Ottawa, IL. The American Legion Post 33 ARC Ottawa, IL. 7.06 7.2 3.55 3.9. QSL. Joe Tokarz TALARC Post 33, 901 LaSalle St., Ottawa, IL 61350-2017. For the 14th year, 96 military veterans, family and friends will stand guard for 15 minute segments during this period at the Ottawa IL War Memorial. kb9ezz@yahoo.com. www.ottawaalpost33.com

11/05/2022 | 2022 Remembering the Edmund Fitzgerald

Nov 5-Nov 6, 1500Z-2355Z, W0JH/W0F, Stillwater, MN. Stillwater, MN Amateur Radio Association (SARA). 3.860 7.260 14.260 21.360. Certificate. W0JH, 1618 Pine St W, Stillwater, MN 55082. QSL certificates may only be requested and sent via email address: W0JH22Fitz@outlook.com. W0JH (Phone & Digital at Split Rock only) and WØF (Phone & Digital at Club Member QTHs in the Minneapolis/St. Paul area). There will be multiple stations simultaneously using these call signs, on different bands. IMPORTANT: ONLY W0JH contacts qualify for POTA K-2524, K-8095, ARLHS USA 783 validations and submission to LOTW. This is the 18th consecutive year, the club has conducted this Special Event. Visit www.radioham.org and QRZ.com (W0JH) for more details. This year marks the 47th year since the famous iron-ore carrier was

Amateur Radio Special Event Stations!

caught in a fierce fall storm on Lake Superior. www.radioham.org

11/05/2022 | Carrollton Festival at the Switchyard

Nov 5, 1500Z-2359Z, KB5A, Carrollton, TX. Metrocrest Amateur Radio Society. 14.235 Voice/14.070 Digital 7.155 Voice/7.070 digital 21.305 Voice. QSL. See website, for QSL, information, TX. https://www.kb5a.org

11/06/2022 | Mill Mountain Star

Nov 6, 1400Z-2000Z, W4CA, Roanoke, VA. Roanoke Valley Amateur Radio Club. 14.265 7.265. QSL. Roanoke Valley ARC, P.O. Box 2002, Roanoke, VA 24009. Commemorating the Roanoke Star on Mill Mountain. Shining its light on the city below since November 1949 and giving the nickname "Star City of the South" to Roanoke, Virginia. Send SASE for QSL card. w4ca.com/special-events

11/10/2022 | Stuart Air Show

Nov 10-Nov 13, 1400Z-2200Z, N4A, Stuart, FL. Martin County ARES. 14.280 21.280. QSL. MC ARES, P.O. Box 2769, Stuart, FL 34995. www.mcaraweb.com

11/11/2022 | Activation from the Strategic Air Command and Aerospace Museum

Nov 11, 1500Z-2200Z, K0AIR/K0GRL, Bellevue, NE. Strategic Air Command Memorial Amateur Radio Club. CW: 7.112; SSB: 7.275 14.275; RTTY 14.085. QSL. SACMARC K0AIR/K0GRL, 1413 Saint Joachin Ct., Bellevue, NE 68005-4937. www.sacmarc.org

11/11/2022 | Burlington Amateur Radio Club 50th Anniversary

Nov 11-Nov 12, 1400Z-2300Z, VC3CJ50, Burlington, ON. Burlington Amateur Radio Club. 14.320. Certificate. Leo Guidolin, 704 Rambo Crescent, Burlington, ON L7R 2L3, CANADA. eCertificate will be emailed to email address indicated on QRZ.com barc.ca

11/11/2022 | Celebrating Veterans Day 2022

Nov 11, 1800Z-2300Z, W6VET, Redding, CA. Redding Veterans Amateur Radio Club. 14.320 21.383 146.550. QSL. Redding Veterans Amateur Radio Club, c/o Michael Vancleemput K6WK, 3400 Knighton Road, Redding, CA 96002. QSL cards appreciated, no SASE required. https://www.qrz.com/db/w6vet

11/11/2022 | Iron Mission Days

Nov 11-Nov 12, 1601Z-1601Z, N7U, Cedar City, UT. Rainbow Canyons ARC. 14.260 7.040. Certificate. Richard Parker, 4410 Apple Blossom Ln., Cedar City, UT 84721. Celebrating 171st anniversary of the first iron works in the Rocky Mountains. In conjunction with Frontier Homestead State Park & Museum. rrparker@netutah.com or www.rcarc.info

11/11/2022 | Salute To Service

Nov 11, 0000Z-2300Z, K0RWB, Bates City, MO. K0RWB. 14.250 14.260 14.270. QSL. Randy Booth, 7562 Copenhaver Rd, Bates City, MO 64011-8250. rwb22311@outlook.com

11/11/2022 | Veterans Day Commemoration

Nov 11, 1600Z-2130Z, W5KID, Baton Rouge, LA. Baton Rouge Amateur Radio Club. 7.040 7.250 14.040 14.250. QSL. USS KIDD Amateur Radio Club, 305 S. River Road, Baton Rouge, LA 70802. Operation aboard the USS KIDD (DD-661). WW II Fletcher class destroyer. www.qrz.com/db/w5kid

11/12/2022 | Franklin Amateur Radio Club 50th Anniversary

Nov 12-Nov 26, 0500Z-2359Z, KF4RC, Franklin, NC. Franklin Amateur Radio Club, Inc.. 14.275. QSL. Howard Estes, 505 North Sugar Creek Rd., Franklin, NC 28734. FARC will celebrate its 50th anniversary of being an ARRL affiliated club on November 18th with club members operating KF4RC from the 12th through the 26th. A special QSL card will be sent, SASE please. www.qrz.com/db/kf4rc

11/12/2022 | USS Cobia WWII Submarine

Amateur Radio Special Event Stations!

Celebrating Veterans Day

Nov 12-Nov 13, 1400Z-2100Z, NB9QV, Manitowoc, WI. USS Cobia Amateur Radio Club. 7.240 +/- 14.240 +/-. QSL. Fred Neuenfeldt, W6BSF, 4932 S. 10th St., Manitowoc, WI 54220-9121. SASE #10 for QSL card www.qrz.com/db/nb9qv

11/12/2022 | Veterans Day (11/11/19) and USMC Birthday (11/10/1775) Commemoration

Nov 12, 1700Z-2359Z, NI6IW, San Diego, CA. USS Midway (CV-41) Museum Ship. 14.320 7.250 14.070 PSK31 DSTAR on PAPA repeaters. QSL. USS Midway Museum COMEDTRA, 910 N Harbor Drive, San Diego, CA 92101. www.qrz.com/db/ni6iw

11/17/2022 | 2022 Hammarlund Radio Hullabaloo

Nov 17-Nov 18, 1200Z-2359Z, W4H, Mars Hill, NC. High Appalachian Mountain Amateur Radio Society. 14.050 14.240 7.050 7.210. QSL. HAMARS, P.O. Box 366, Mars Hill, NC 28754. Celebrating the Hammarlund Radio factory that was located in Mars Hill, NC, in the 1950s and 60s. hamars.club

11/17/2022 | NRA's 151st Birthday Party

Nov 17, 1500Z-2359Z, K7GST, Prescott, AZ. Yavapai Amateur Radio Club. 21.335 14.040 14.250 7.250. Certificate. Go to, http://w4gkf.com/k7gst/qso.htm, for certificate. See website for details. www.w7yrc.org/nrabirthday

11/19/2022 | November Bug Roundup

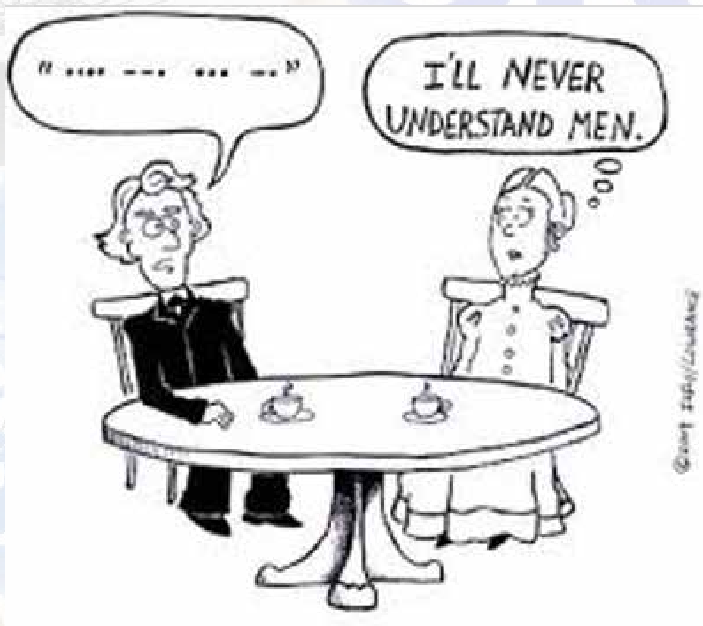
Nov 19-Nov 21, 0000Z-0000Z, W6SFM, Sacramento, CA. Samuel F. Morse Amateur Radio Club. 14.045 MHz. QSL. Bob Kehr, 13989 Sutter Highlands Dr, Sutter Creek, CA 95685. W6SFM – The Samuel F. Morse Amateur Radio Club, a Sacramento, California based CW enthusiast club wanted a special time to bring bug operators together on the air. In the same spirit as ARRL's Straight Key Night, participants are encouraged to make simple, conversational, "chewing-the-fat" QSOs using their bug type key. This is an opportunity to exercise, share and exhibit your personalized fist. This is NOT a contest. Call "CQ BR" so folks know you are a Bug Roundup Participant. Grab that bug, clean those contacts, and let'er fly! Let's hear that "Banana Boat / Lake Erie Swing" or that commercial KPH/WCC quality fist. Switch off that keyer! Fill the ionosphere with home grown digital music, and have some Fun! https://w6sfm.com/bug-roundup

11/19/2022 | Western Mass Council BSA WHOA Saturday

Nov 19, 1400Z-2000Z, W1M, Russell, MA. Western Mass Council Scouts BSA. 7.190 10.115 14.060 14.290. QSL. Tom Barker, 329 Faraway Road, Whitefield, NH 03598. QSL available for a SASE.

11/26/2022 | The First Pilgrim Landing at Plymouth

Nov 26-Nov 27, 1300Z-1900Z, NI1X, Plymouth, MA. Whitman Amateur Radio Club. 3.860 7.260 14.260 18.160 EchoLink: WA1NPO-R, IRLP:8691 . Certificate. Whitman ARC, P.O. Box 48, Whitman, MA 02382. Times Are Daily www.wa1npo.org



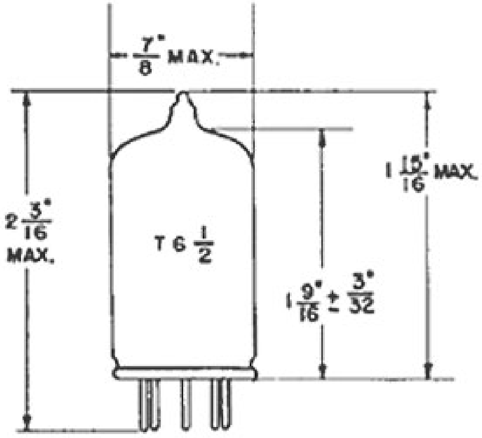
SAMUEL MORSE GOES ON A DATE.


SPIRIT
HAM
RADIO
GUY
Includes:
High-Vis Vest
Baofeng HT
Cargo Shorts
ARES ID Lanyard
Does Not Include:
Training Manual
ICS Certifications
Bald Cap
ADULT
Size Costume
ONE SIZE FITS MOST

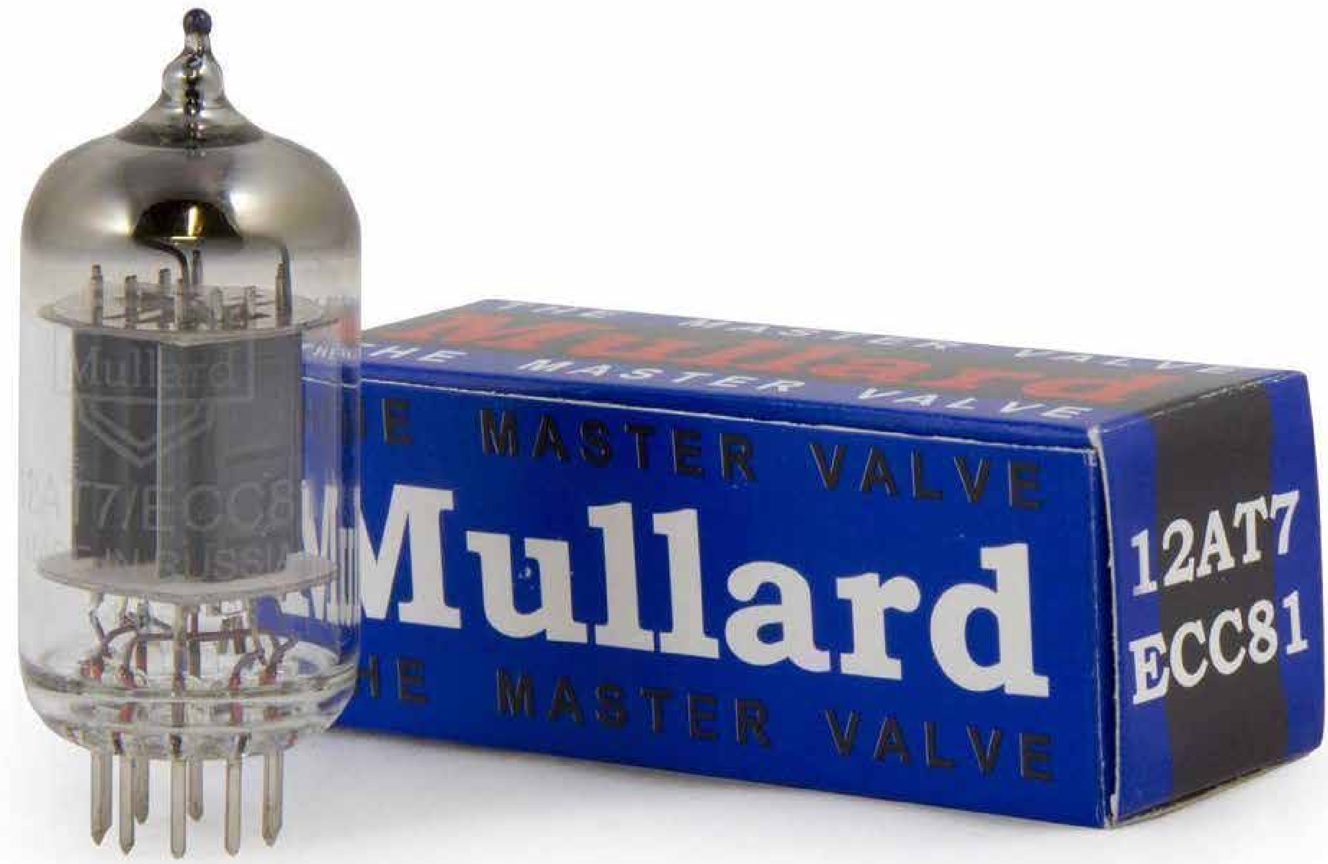
12AT7 Dual Triode

The '12AT7' Tube

The 12AT7 is a miniature, high-mu twin triode designed for use as a grounded-grid radio-frequency amplifier or as a combined oscillator and mixer at frequencies below approx 300MHz. This tube has a mu factor of 60, as compared to the higher gain 12AX7 with a factor of 100, and the 12AU7, with a mu of only 20. The 12AT7 is found in many high fidelity applications, as each triode section in normal use operates as a class A amplifier. They also turn up in line and microphone preamplifiers, musical instrument amps, and vacuum tube equipped recording equipment. By their design, they are inherently low noise, making them a good choice for these applications. The tube requires a noval nine-contact socket and may be mounted in any position.

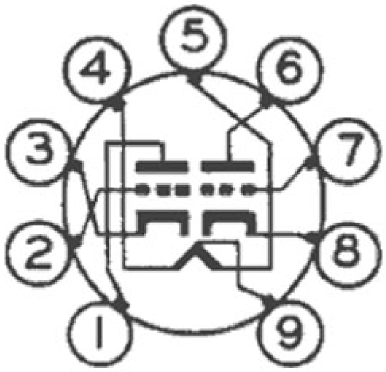


Physical dimensions



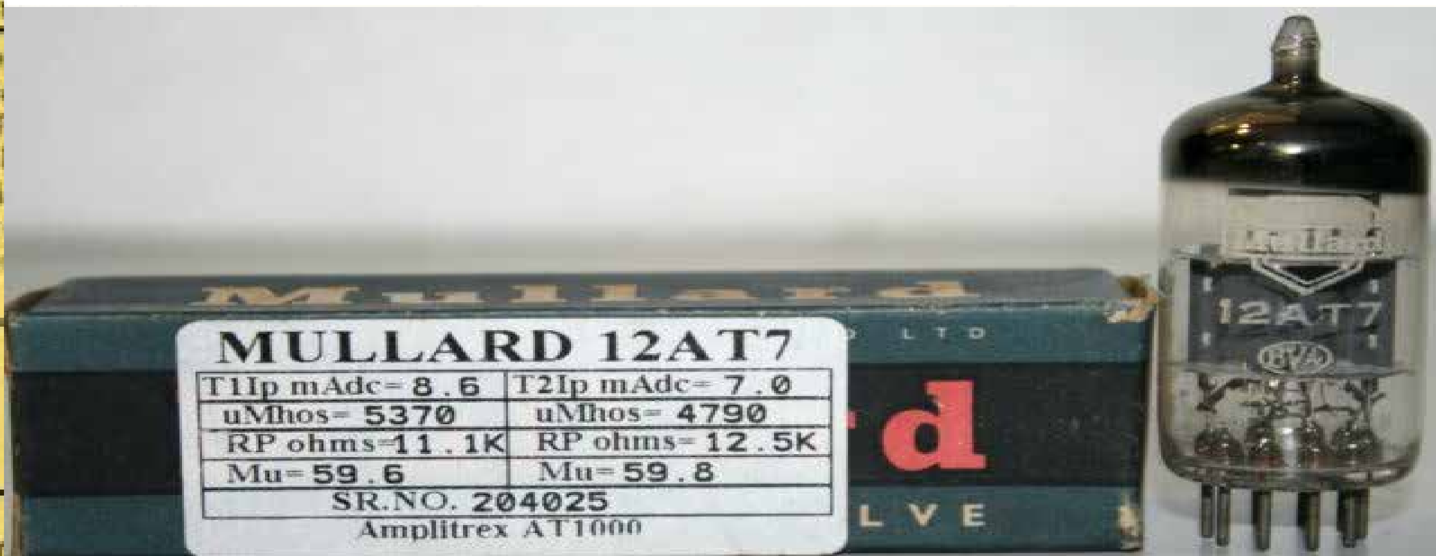
TUBE OF THE MONTH

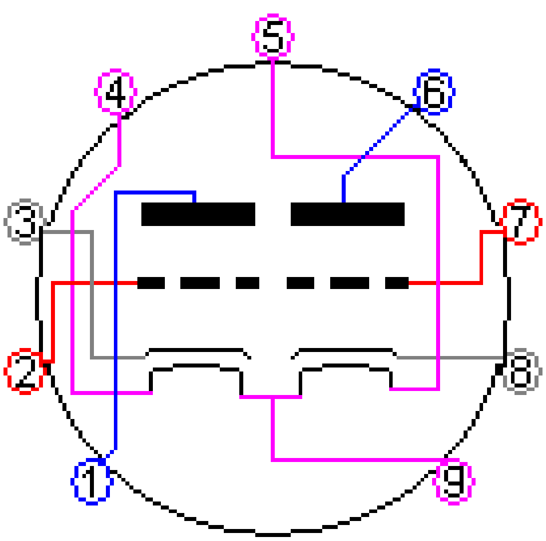
DOUBLE TRIODE (separate cathodes)



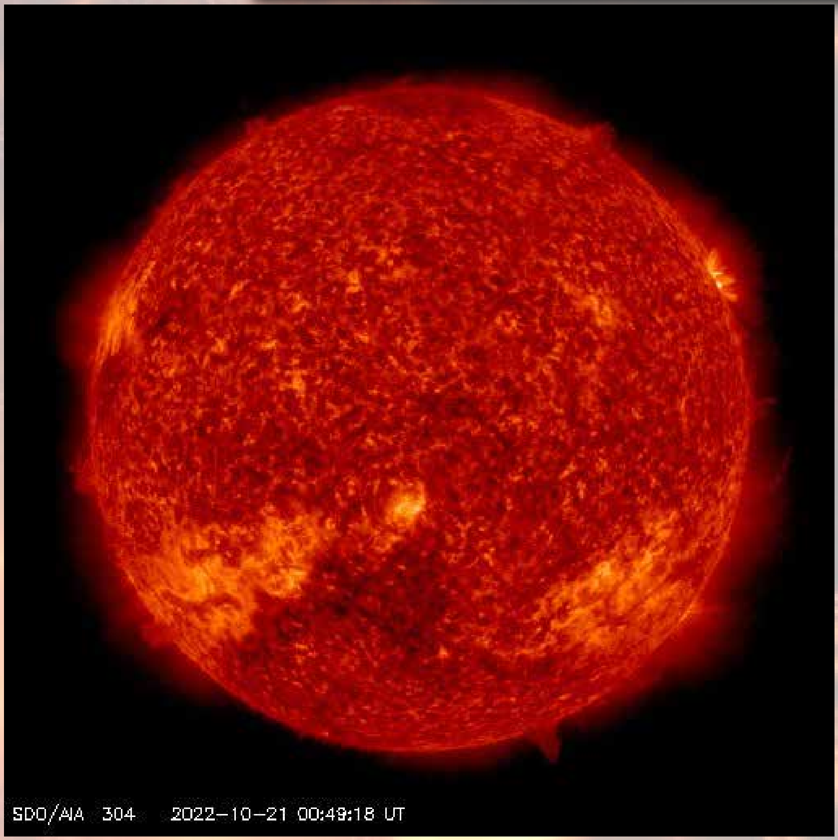
B9A base pinout

Heater Voltage	6.3-12	V
Heater Current	300-150	mA
Plate Voltage	250	V
Plate Current	10	mA
Plate Resistance	10,900	Ω
Amplification Factor (μ)	60	
Plate Dissipation (*max*)	2.5	W





1. Anode Triode Number 2
2. Grid Triode Number 2
3. Cathode Triode Number 2
4. Heater (Triode 2)
5. Heater (Triode 1)
6. Anode Triode Number 1
7. Grid Triode Number 1
8. Cathode Triode Number 1
9. Heater Center tap



Average daily sunspot numbers and solar flux increased this week, with sunspot numbers going from 111.4 to 114.9, and flux values from 149.2 to 155.3.

A feel-good exercise is to compare these numbers with a year ago, when the sunspot reading in 2021 Propagation Forecast Bulletin ARLP041 was only 30.7 and flux was 86.9. Solar Cycle 25 progression is better than predicted.

October 9 saw a planetary A index reading of 25. On that day Spaceweather.com warned that sunspot AR3112 had a delta-class magnetic field with energy for strong solar flares.

The next day they posted movies of two flares, seen here, https://bit.ly/3T82fQS and here, https://bit.ly/3evItjp .

Predicted solar flux from USAF and NOAA shows values peaking during the first week in November at 160.

The forecast shows flux values of 130, 120, 115 and 117 on October 14-17, 120 on October 18-20, 130 and 138 on October 21-22, 140 on October 23-25, then 145, 145 and 150 on October 26-28, then 155, 155 and 152 on October 29-31, 160 on November 1-8, then 150, 140 and 135 on November 9-11, 130 on November 12-13, 135 on November 14, 138 on November 15-17, and 140 on November 18-21.

Predicted planetary A index is 5 on October 14, 8 on October 15-16, 5 on October 17-19, 12 on October 20-21, 5 on October 22-26, then 12, 15, 12 and 20 on October 27-30, 15 on October 31 through November 1, then 18, 15 and 12 on November 2-4, 20 on November 5-6, then 8 and 12 on November 7-8, then 5, 5, 12 and 10 on November 9-12, then 5 on November 13-15, 12 on November 16-17, and 5 on November 18-22.

With increased solar activity and the progression into the Fall season, I am seeing improved conditions on 10 meters, including more beacon reports for my K7RA/B CW beacon on 28.2833 MHz.

Designing Colpitts oscillators

The Colpitts oscillator is one of the classic RF oscillators used widely to generate stable signals for either a fixed frequency application or a variable frequency application. There have been several variations on the basic theme over the years, including the Vackar oscillator, but they all use the same basic concept.

The Colpitts oscillator was invented in the heydays of vacuum tubes and later semiconductor versions used the same basic principles. Unlike types such as the Hartley oscillator the Colpitts is simpler to analyse and design as the feedback mechanism is performed by a capacitor tapped network. In the Hartley and similar designs the feedback is by varying the turns ratio between two series connected inductors and varying the feedback ratio is more difficult and less easy to analyse before the construction begins.

RF oscillators are characterised by several parameters that are important to the application. These include frequency stability, output level, frequency and tuning range and close in phase noise. Not all of these can be optimised together unless great care is taken to attain the best compromise and usually some trade-offs need to be made.

Where the greatest frequency stability and lowest close in phase noise is essential then the classic LC oscillator is not as good as a crystal controlled type, as crystals can offer loaded Q values well in excess of the best LC oscillators. The highest Q a practical inductor can have is around 600 whereas a crystal Q figure is normally at least 10,000. However, crystal oscillators are essentially "*fixed frequency*" types as the average crystal is made for a specific frequency and it cannot be varied more than a very small amount.

A schematic of a typical Colpitts oscillator is shown in Figure 1 where the basic components are shown. One of the additional parts is the biasing that is often omitted for clarity.

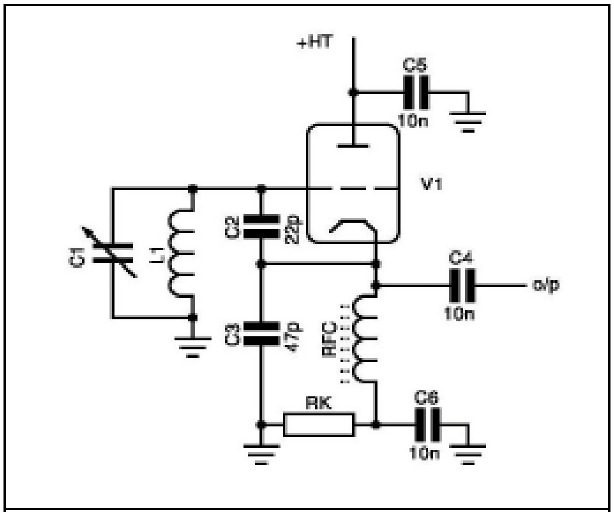


Figure 1 Typical Colpitts oscillator using a vacuum tube

The basic Colpitts oscillator uses two series connected tapped capacitors to produce the feedback signal between the cathode and the control grid. Figure 1 shows a simple triode circuit but it can also use a tetrode or pentode. In these types an additional supply is required for the screen grid pin (g2). The basic building block for the Colpitts circuit is the classic *Cathode Follower*. This is shown in Figure 2.

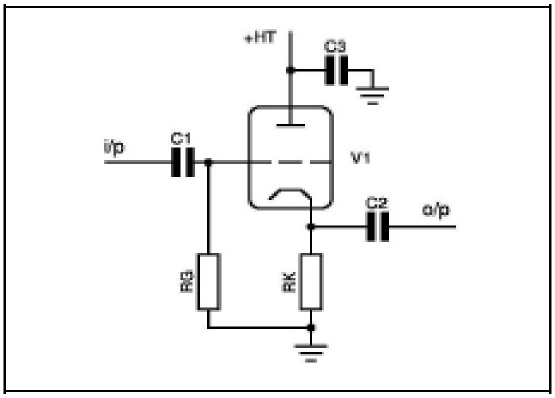


Figure 2 Cathode Follower

The cathode follower is a simple amplifier which has zero phase shift between the input and output. The input resistance is very high but the output resistance is low. This makes it the ideal "*buffer amplifier*" where low impedance loads need to be driven from a high impedance source. The voltage gain of a cathode follower is slightly less than 1. In practice it is between 0.95 to 0.99 depending on the frequency of operation. By selection of a suitable tube the gain is almost 1 and the small difference can be ignored in most applications.

Although the voltage gain is only 1 it has a high current gain and it can produce considerable "*power gain*" allowing it to drive low impedance loads with fairly high current.

The classic tubes used for RF oscillators are the 6C4 and the 12AT7. The 6C4 is a single triode and the 12AT7 is a dual triode. Both have an acceptable "*amplification factor*" commonly known as the mu (μ). The 6C4 is typically 20 and the 12AT7 is 60, so it is a better choice. Either one will oscillate up to several hundred MHz in a suitable circuit and draw little current, providing a few volts rms output. There are many other suitable tubes that can be used.

In all oscillators a small portion of the output power generated is used to drive the input terminal and if the "*loop gain*" is high enough it is self sustaining once it begins to oscillate. The initial signal is produced from the inherent noise present and this is fed back to the input amplifying the noise. Very quickly the amplitude builds up to a maximum level. The oscillator is inherently "*self limiting*" above a certain output level as the gain falls as the input level is increased. This limiting action in a tube oscillator is caused by the grid current flowing developing a negative bias on the control grid. As the control grid is driven more negative the anode current begins to fall, so lowering the gain of the tube. It settles into a steady state after a few cycles and thereafter it can only change if the external load is varied or the supply voltage changes.

Hence, all oscillators need to drive a fairly constant load to ensure a constant output voltage is attained and a well regulated anode supply voltage if good frequency stability is essential.

The frequency the oscillator will run at is determined by the LC "*tank circuit*" connected in the feedback path. If the tank circuit presents a pure resistance to the input of the oscillator then the phase shift across the feedback path is 0°. Since the cathode follower also has a 0° phase shift from its input to output the tank circuit required is a parallel resonant LC network. This is shown in Figure 3.

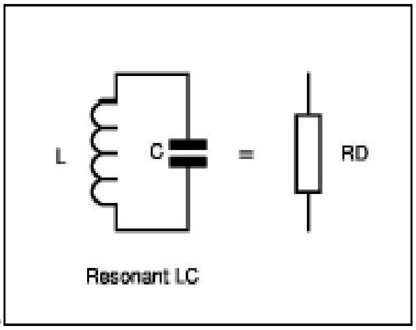


Figure 3 Parallel resonant network and its equivalent circuit

The criteria for oscillation is that the feedback signal through the resonant network must be in-phase and greater than a gain of 1 in voltage terms. A parallel resonant LC network can fulfil both these criteria as long as it has low loss.

At resonance a parallel resonant network appears as a pure resistance of a high value, commonly known as the "*Dynamic Resistance*" or RD. The value of RD can be several tens of thousand ohms with good Q components. If the network is resonant then the voltage and current are in-phase and complies with the needed 0° phase criteria at that particular frequency. If the network is tuned to a different resonant frequency then the oscillator will run at the new frequency.

The resonant frequency is determined by the reactance values of L and C. To be truly resonant they must be the same value. Changing the frequency can be achieved by altering either the L or C value to select the required frequency. It is normally easier to change the value of C rather than L, but some oscillators use either or both to get the correct frequency. Variable tuning capacitors are a simple method of varying the resonant frequency, but some oscillators use variable inductors, known as "*Permeability Tuning*" with fixed value capacitors.

Feedback network

The Colpitts oscillator uses two series connected capacitors between the cathode (output) and the grid (input) as a *constant ratio divider* network. This is shown in Figure 4. Effectively it is a fixed ratio "*step-up*" network. Electrically it behaves the same as a tapped inductance where the drive input is fed in low down on the "*auto-transformer*" winding.

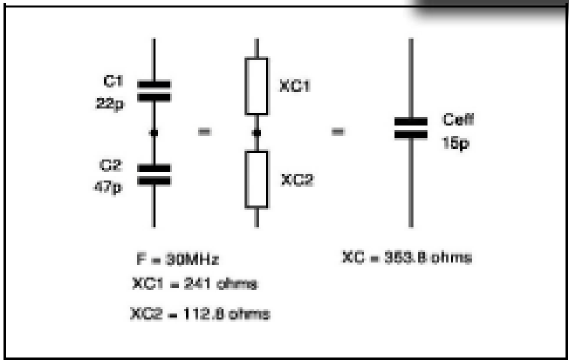


Figure 4 Tapped capacitor voltage divider network

Each capacitor exhibits a reactance determined by its value and the frequency. The ratio between the two reactance's is constant no matter what the frequency is. In some versions of the Colpitts oscillator the two divider capacitors are the same value giving a 2:1 ratio, but in high input resistance amplifiers such as tubes or FETs, it is usually a larger value at the bottom and a smaller value at the top, giving a higher step-up ratio. High value capacitors have a lower reactance than low value capacitors.

For the example oscillator we have selected a frequency range of 30MHz to 50MHz. Capacitors in series have a total capacitance less than the smallest value. They behave the same way as resistors in parallel. In this example the values are 22pF and 47pF and the reactance in circuit across the inductor is the sum of the two in series. Effectively the 22pF and 47pF connected in series add ≈15pF across the inductor.

Resonance Criteria

To attain a particular frequency of oscillation the reactance of the inductor X_L and the total capacitive reactance X_C across the inductor have to be numerically equal. Inductive reactance rises with increasing frequency whereas capacitive reactance decreases with increasing frequency. The formula for each are:

$$X_L = \omega L \quad \text{and} \quad X_C = 1 / \omega C$$

Where $\omega = 2\pi f$

A 100pF capacitor at 1MHz has a reactance of 1951Ω. The corresponding inductor to resonate at 1MHz is 253µH.

At 2MHz a 100pF capacitor has X_C = 795.5Ω and the inductor requires a reactance of the same value and it is 1/4 of the value at 1MHz, being 63.25µH.

The choice of main tuning capacitor is often limited to standard air variable capacitors available. In this example we have selected an air variable with a minimum value of 20pF and a maximum of 100pF, a swing of 80pF nominal.

In addition to the tapped capacitor network and the tuning capacitor we have to take into consideration any other capacitance effectively across the inductor. One of these is the grid-cathode capacitance of the tube chosen. In most cases with small tubes it is a fairly low value of 4pF typically.

Hence the total capacitance across the inductor is (15 + 100 + 4) = 119pF when the capacitor is at maximum, with fully meshed plates. At fully unmeshed condition the total capacitance across the inductor is (15 + 20 + 4) = 39pF. These two values determine the minimum and maximum frequency possible with a particular inductor value, and hence the tuning range possible.

We will choose to cover 30MHz to 50MHz and calculate the inductor value required. At the highest frequency the inductor reactance must be the same as the 39pF condition and since we want 50MHz the reactance required is 81.6Ω. This is an inductance of 0.259µH nominal.

To check that the frequency coverage is correct we now calculate what the reactance of a 0.259µH inductor is at 30MHz. It is 48.82Ω and this corresponds to a capacitance of 108.6pF. This is less than the maximum effective capacitance of 119pF so the capacitor will be slightly less than fully meshed. The effective values for L and C are shown in Figure 5.

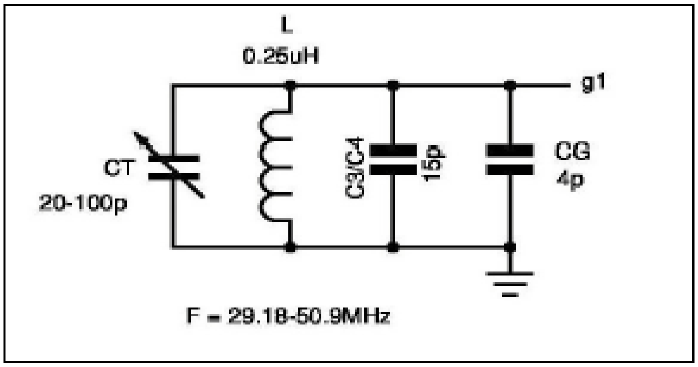


Figure 5 Circuit constants

These calculations confirm the oscillator should cover the frequency range required. If there is a small stray capacitance we haven't taken into account then a small reduction in the inductor value will cater for this. Alternatively we can add a variable "*padding capacitor*" of a small value across the network for fine tuning, taking into account the effect this has on the total capacitance across the inductor. A 20pF maximum air variable trimmer would be a good choice. This means we need to reduce the inductor value by a small amount to compensate for this capacitor when set to about mid value, say 10pF effective.

In variable LC oscillators that have to cover a wide range then the inductor is adjusted at the lowest frequency with the tuning capacitor fully meshed and the padding capacitor at the highest frequency. By alternating between the two ends of the range the tuning can be correctly adjusted to cover the minimum and maximum frequency correctly.

Temperature stability

All practical components exhibit a change in value as their temperature varies. As the components get warm in use, either due to the heat from the tube or the current flowing in them, then they will change in value by some amount. The ambient temperature at switch on is normally low but as the oscillator runs the temperature rises slowly and some warm up drift is likely to occur.

The inductors used generally have a strong positive temperature coefficient. As the temperature rises the inductance will increase in value due to the metal used expanding slightly. This causes the reactance to also rise and the result is the frequency drifts lower as the temperature increases, if the capacitor reactance and hence the value remains constant.

To counter this drift the capacitors are usually chosen to have an equal and opposite temperature coefficient. This means they need to have the correct negative temperature coefficient. These capacitors are chosen from standard values with a N150, N220 or higher temperature coefficient. If the two temperature coefficients are the same then drift from cold to full operating temperature is virtually eliminated. The number in N150 is the "*parts per million*" they change per degree Celsius rise in temperature.

The capacitors used also have to be a low loss type of a suitable construction, voltage and current rating for the application frequency required. Normally mica, ceramic or polystyrene types are chosen for the parameters. Polystyrene types are not suitable for very high frequency applications (above about 10MHz). Often a mixture of mica or ceramic types are used with different temperature coefficients to combat the thermal changes over the envisaged operating temperature range.

Air variable capacitors have a strong to medium negative temperature coefficient as they also suffer from some mechanical expansion as they warm up. In some cases the negative temperature coefficient is greater than the inductor positive coefficient so some of the capacitors may need to be positive types, for example P100, to keep the net temperature coefficient close to zero.

There are special positive-negative temperature coefficient air variable trimmer capacitors that can be adjusted to have a constant capacitance value but a temperature coefficient that can be changed from positive to negative coefficient by adjusting the trimmer. Oxley made "*Tempa-Trimmers*" for this application.

In oscillators that do not require a wide variation in frequency then often a suitable air variable capacitor is not available. A simple way to reduce the effective tuning range is to connect a capacitor in series with the tuning capacitor to reduce its swing.

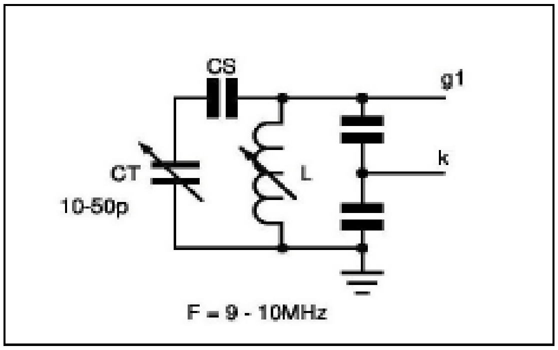


Figure 6 Reducing the tuning range with series capacitor

Additional circuitry

If we look at Figure 1 again we can see what some of the other components are used for. The quiescent biasing is determined by the grid 1 to cathode voltage and this is determined by the value of the cathode resistor RK. For a grid bias voltage of, say, -3V to set the correct bias conditions the voltage drop across the cathode resistance is the same value so the cathode sits at +3V above ground. This value can be determined by perusing the anode current versus grid 1 bias voltage for the tube in use at the chosen anode voltage. The resistor value at the required anode current is then calculated using Ohms Law. For the non-oscillating state the bias is set to be in the Class A range with a medium level of anode current flowing. When the oscillator starts the anode current is driven up to a higher value, but it must remain within the safe operating conditions for the tube chosen.

The RF choke in series with the cathode and its decoupling capacitor to ground serves to stop the RF being shunted to ground. The reactance value of the RF choke is normally selected to be at least ten-times higher than the output Z of the stage. Since this is relatively low almost any practical RF choke has enough reactance. In some low frequency oscillators a cathode resistor is not required as the RFC if it is a fairly high value has significant resistance, sufficient to provide the correct voltage drop to suit the tube used.

The anode of the tube must be held at close to zero RF potential to ensure correct operation. The value of decoupling capacitors are normally quite tolerant as long as they are large enough in value for the lowest frequency of operation. In this case a 10nF capacitor will serve for frequencies as little as 5MHz and above to about 100MHz. (A 10nF capacitor at 5MHz has a reactance of 3Ω and is close to being a short circuit to RF signals). Above this frequency a smaller capacitor will suffice, such as 4.7nF or 1nF.

The output can be taken from the cathode via a suitable dc blocking coupling capacitor. For best frequency stability the oscillator should feed a high impedance device such as another cathode follower with a small value coupling capacitor. For 30MHz a 1nF capacitor is more than big enough feeding a cathode follower stage and often as little as 10pF will suffice. By selecting the coupling capacitor value with the cathode follower grid resistance the level into the buffer amplifier stage can be set to the required value. It forms an attenuator network or voltage divider.

A small coupling winding on the main tank coil can transfer the signal to a high Z amplifier stage. Alternatively a second inductor with a resonating capacitor can be positioned close to the main inductor to form an air cored transformer with loose coupling. This method is show in Figure 7.

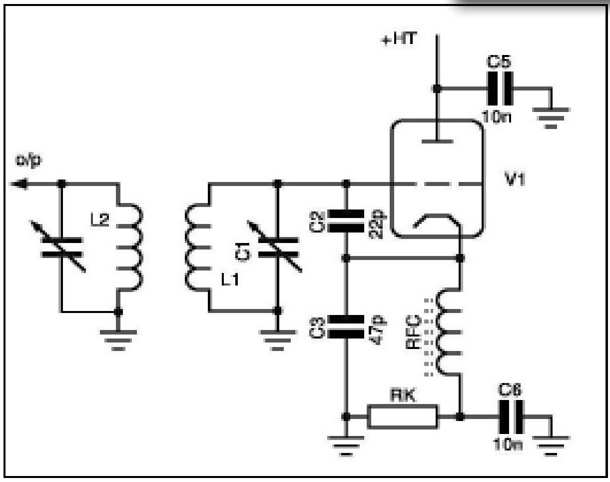


Figure 7 Transformer coupling for the output

Harmonic output

One of the characteristics of limiting oscillator stages is the purity of the sine wave output. Since the oscillator is basically running in Class C it is a non-linear amplifier and has harmonics present in the output. If a 'scope is used to look at the output waveform it is normally distorted because of the harmonics present. The signal at the grid is however more like a pure sine wave as the tank circuit acts as a high Q filter. The amount of signal you can extract from this point is much less than from the cathode as any significant loading will reduce the feedback signal and it can cause the oscillator not to run if too much coupling is attempted.

The unloaded Q of the inductor should be as high as possible by the winding method and gauge of wire. For best frequency stability the loaded Q needs to be fairly high and this means thick wire and rigid construction are essential where high stability is the main criteria.

Freedom from "*microphonics*" is also a problem if the construction is less than rigid. Vibration and tapping on the enclosure containing the oscillator will cause jumps in frequency if the inductance is subject to vibration.

Another factor is the regulation of the anode supply voltage. For maximum frequency stability this should be regulated as tightly as possible. A variation in the anode voltage causes a change in frequency, so a well regulated supply is normally necessary to counter any variation in the raw dc supply voltage due to variations in the mains voltage. Any significant ripple on the anode voltage supply will causes residual FM which causes modulation in frequency and phase of the carrier.

Variations on the Colpitts oscillator

In some applications the oscillator frequency needs to be multiplied to a higher frequency. Generally, where a higher frequency is required it is often better to use a low frequency oscillator and then to multiply up to the final frequency than try to construct an oscillator at the higher frequency. Higher frequency oscillators tend to drift more than a low frequency oscillator that is multiplied up.

One of the methods to incorporate the multiplier as part of the oscillator is to add a parallel tuned tank circuit to the anode of the oscillator stage. This however is not the correct way to solve the problem.

The Colpitts oscillator relies on the anode being firmly grounded to RF. If the grounding is removed its operation is upset. Placing a parallel resonant tank circuit at two-times or higher the oscillator fundamental frequency effectively removes the ground potential. This causes a loss of gain and an uncertainty of the degree of feedback.

The normal premise for choosing this method is that the Colpitts, like most self-limiting oscillators, has a high harmonic content as it is run hard into Class C. Why not utilise this effect and pick off the harmonic of interest? Although to some extent it can be made to work with a narrow tuning range the derivation of the tapped capacitor values is a bit hit and miss and entails lots of empirical work. It may not work for a variety of tubes of varying emission and is best rejected as a method to use.

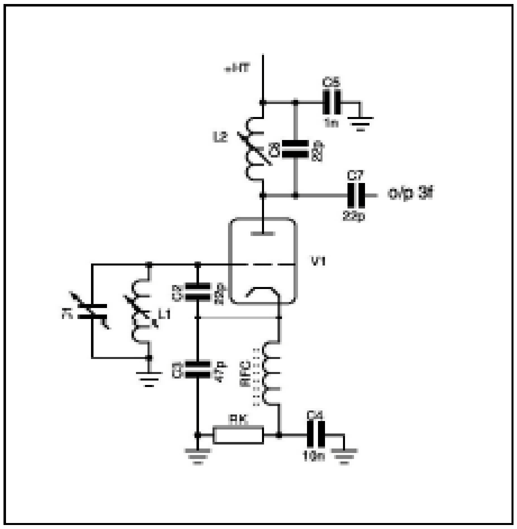


Figure 8 Frequency multiplier tank circuit in anode

If this method is used then the oscillator output at the multiplied frequency is much lower in amplitude and if the tuning range is fairly wide it is common to find the oscillator ceases to run over the whole tuning range, as the feedback ratio has been upset by the modified circuit.

It is far better to use a separate stage as the harmonic multiplier. If one of the common dual triodes is used, (the 12AT7 is good for at least 100MHz as an oscillator or multiplier stage), the second half can be configured as the multiplier stage and the multiplier tank circuit is placed in the anode of this stage. This provides the necessary isolation and a high load impedance for the oscillator stage to work into. The level into the multiplier can be adjusted by the value of coupling capacitor used to optimise the multiplier efficiency. Alternatively a tube such as the 6U8/ECF82 is a triode-pentode combination and is also a suitable choice. The oscillator uses the triode and the multiplier stage the pentode section.

Band switching methods

When several ranges are required, for example in a home constructed RF signal generator, there are several methods used to change the resonating components. In professional signal generators the coils and padding capacitors are normally mounted in a type of turret mechanism that rotates and connects the required components into circuit. This is a complicated method and where the highest performance isn't necessary then simpler methods can be used with normal multi section wafer switches.

One of the simplest methods is to use several inductors that can be connected in parallel with the main inductor. Inductors in parallel act in the same way as resistors in parallel. If the main inductor is chosen to be, say, 10µH and the tuning capacitor is a dual gang type with two equal sections then with one additional inductor up to three ranges can be arranged.

For the lowest frequency range both gangs of the tuning capacitor are paralleled and a single 10µH inductor. If the tuning capacitor is a 365pF per section then when fully meshed it will be 730pF and this with the inductor and capacitor divider will tune to some low frequency, typically about 1.9MHz. For the next range only one section of the tuning capacitor is used. The lowest frequency will be approximately twice the first range and highest also twice the first range. It is possible to cover, say, 2MHz to 5MHz for the first range and 4MHz to 10MHz for the next range with a useful amount of overlap.

For the third range an additional inductor is added in parallel to produce an effective inductance of 2.5µH. This range has only one tuning capacitor section used and it will cover from 6MHz to 16MHz approximately. The basic circuit is shown in Figure 9.

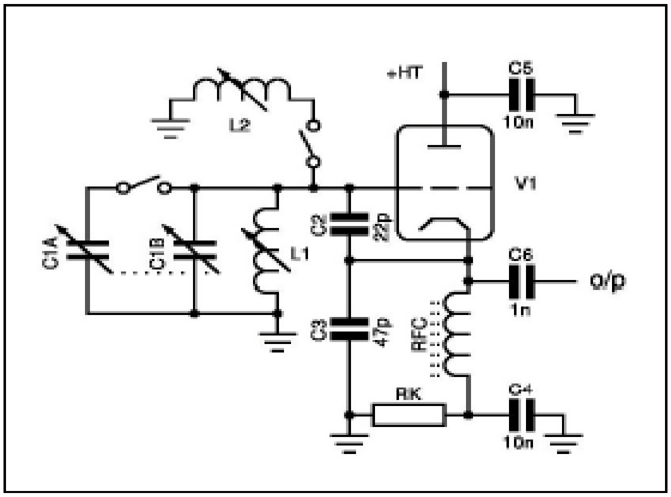


Figure 9 Band switching with shunt inductor

This method may also require the capacitor divider values to be changed at some point in the various ranges. Again this can be by having several identical capacitors in parallel for both of the divider capacitors, so the ratio is constant. It may need 2 x 220pF for the bottom capacitor and 2x 100pF for the top capacitor for the lowest frequency range. For the highest range only one of each value is required and the others are switched out of circuit These effective values need to be included in the inductor calculation to obtain the required lowest frequency and frequency swing with the tuning capacitor and the padding capacitors for each range.

This method is attractive as the switching is simplified and the inductor values are sensible and requires less inductors than the other methods employed, although the calculations are more involved to arrive at a workable solution.

Crystal oscillators

Where a very high stability oscillator is required for a fixed frequency then the Colpitts oscillator using a crystal is simple to arrange. The crystal replaces the normal LC resonant network. This means it is best with a "*fundamental crystal*" that mimics a parallel resonant network.

A quartz crystal can oscillate in two different modes, these are the series resonant mode and the so-called "*parallel resonant*" mode. In actual fact a quartz crystal does not have a true parallel resonant mode. What is commonly referred to is a series mode crystal that has been pulled slightly lower in frequency so it appears to be inductive. To make it into a "*parallel resonant*" crystal requires a specific value of shunt capacitance so it can behave as a very high dynamic resistance.

The frequency difference between the series and parallel mode is about 0.0001% in frequency terms. A nominal 10MHz series resonant crystal when pulled with the correct shunt capacitance will oscillate at about 9.9999MHz.

The so-called "*fundamental*" or "*parallel resonant*" crystals are series mode crystal ground very slightly higher in frequency so that when pulled lower it is on the required frequency. The danger is that if the feedback network is incorrect it can jump from one mode to the other and generate spurious signals in the output or it may not oscillate at all.

> For series mode oscillators, it is imperative to have some means of suppressing the "*parallel mode*" should the oscillator tuning be incorrectly aligned. A simple way is to shunt the crystal with a low value resistor of about ten-times the ESR of the crystal. Most fundamental series mode crystal have an ESR of not more than 68Ω and a 680Ω 1/4W resistor is normally sufficient to prevent "*parallel moding*".

For a fundamental crystal operated as a parallel resonant network then the capacitor value appearing across the crystal has to be a specific value, which the manufacturers will specify. Common values are 20pF to about 60pF.

The oscillator therefore needs to present to the crystal the correct "*operating capacitance*". The fine adjustment of the frequency is performed by a variable capacitor to bring the shunt capacitance to the correct value. Normally this is determined during alignment by measuring the frequency of oscillation whilst adjusting the crystal trimmer capacitor.

Since the shunt capacitance required is quite a low value then the oscillator connection point to the crystal has to take into account the tapped capacitor values as these appear across the crystal terminals. However, in some cases the effective value of the tapped capacitor plus the grid-cathode capacitance is often more than the crystal needs to have to oscillate on the correct frequency. This can be alleviated by placing a series capacitor between the grid of the tube and the crystal, its value chosen to give the correct shunt value. The crystal trimmer also appears across the crystal so this value also has to be considered.

A typical Colpitts crystal oscillator is shown in Figure 10. This uses a 30pF load crystal.

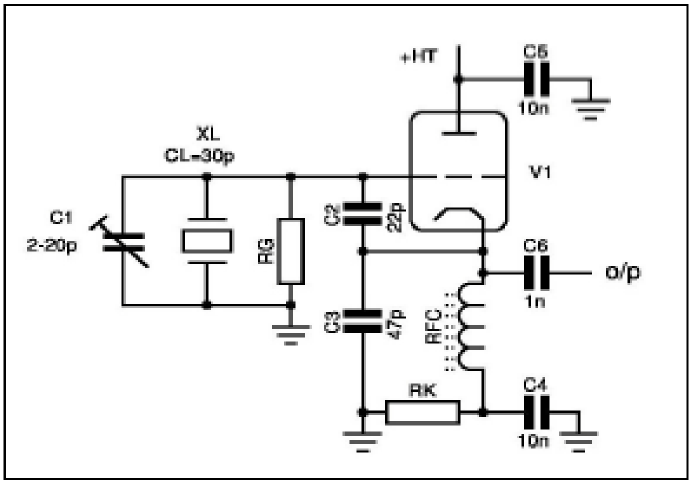


Figure 10 Crystal controlled Colpitts oscillator

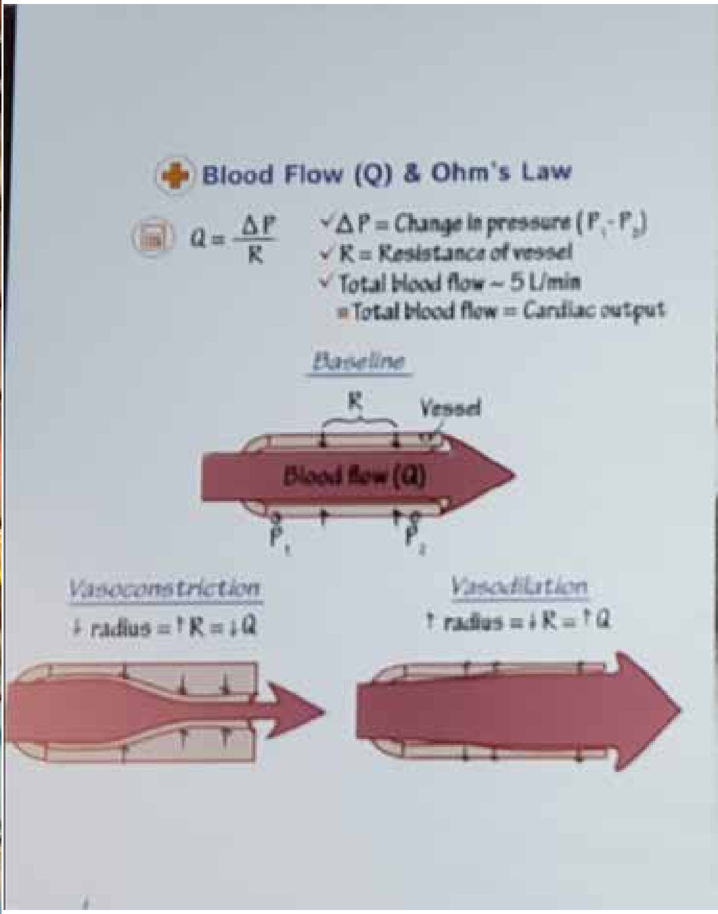
The crystal requires a shunt capacitance of ≈30pF to resonate on the correct frequency. The capacitance appearing across the grid terminal to ground is the tapped capacitors in series of an effective value of ≈15pF plus the grid-cathode capacitance of 4pF. This is a total of 19pF plus any stray capacitance that may exist. Since this is likely to be about 2pF then the effective capacitance appearing across the crystal is ≈21pF.

The crystal needs 30pF to run on its correct frequency, so an additional ≈9pF needs to be provided by the trimmer capacitor C1. This is a 20pF maximum trimmer so it will be approximately midway at the correct setting.

In this case no series capacitor is needed to reduce the grid capacitance as it is already less than the 30pF required. If the tapped capacitors are larger, say a 100pF and a 220pF in series this gives a shunt capacitance of about 90pF plus the grid-cathode capacitance of 4pF. In this case a suitable series capacitor between the grid and the crystal of about 22pF would lower the total to less than 30pF and the rest is provided by the 20pF trimmer.

The other component required is a resistor between the grid and ground to complete the dc path for the grid current. In the previous oscillators shown this dc path was provided by the inductor so no resistor was needed. This resistor can be a fairly high value, a value of 47kΩ to about 330kΩ will generally be correct. The higher the value of grid resistor the more negative bias will be generated to turn off the tube at full drive level. This resistor cannot be too low in value as it will cause some damping of the voltage across the crystal if it is too low a value. The RD of a typical parallel mode crystal of 10MHz is about 100kΩ to several MΩ.

In some schematics the grid resistor is replaced with a high value RF choke. The danger is that this can also resonate at some other frequency with the associated circuit capacitance and the oscillator can attempt to run on two different frequencies, which will produce high spurious signal levels because the oscillator running in Class C also makes an efficient mixer. If a RF choke is used then it must be shunted by a resistor to damp out any spurious oscillation tendencies. This rather precludes the use of a RF choke as a resistor is normally reasonably non-inductive and has no significant spurious resonant modes.



How to Build Aluminum Antennas

Posted by Ward Silver, N0AX on October 14, 2022 at 7:55 pm

Next to wires, antennas made of aluminum tubing and rod are the most common type of amateur radio antenna construction. There is a wide range of high-quality aluminum alloy available, especially the popular T6061 material, that is just right for antenna building. Sooner or later, you will get to build one yourself, so why not learn some helpful tips to get started? While there is no substitute for a seasoned mentor to help you with your first project or two, don't be too shy about giving it a try. We'll assume you're building from scratch and include tips for assembling commercial antennas along the way.

Homebrew antennas, homebrew antennas
Ain't nothing in the world like homebrew antennas
Just two things that money can't buy
That's free junk and homebrew antennas
(With apologies to Guy Clark and "Homegrown Tomatoes")

Building from Scratch

Perhaps you have downloaded a design or have the plans from a book or website. You can buy aluminum from a local metals dealer or a company like DX Engineering. Also check with local hams to see if they have what you need in their "bone yards" of old antenna parts. Many a VHF or high-band HF Yagi has been constructed from parts from a defunct HF beam or vertical!

Inspect the pieces carefully. While a minor bend or nick is not usually a problem, you don't want pieces that are dimpled, crimped, or cracked. Be wary of tubing with swaged ends narrower than the main diameter since that will reduce the size of tubing that can be inserted into the tube. It may be best to cut off swaged sections entirely. Clean the materials using a non-abrasive plastic cleaning pad. Steel wool will leave small bits of steel in the surface of aluminum to rust or pit. Blow or wash out any "stuff" in hollow tubing.

Measure Twice, Cut Once

The best advice ever! Aluminum is expensive! Once you have your stock in hand, carefully check the diameter and wall thickness to be sure you have the right stuff. After verifying that you actually have the material you need, measure and cut a test length for one section. Then check to see what length it *actually* turns out to be. If there is a meaningful difference between the length you wanted and the length you wound up with, now is the time to figure out why. Maybe your measuring device isn't accurate? Tape measures are notorious for the end hook being loose and moving on the tape. Whatever the cause, either obtain a more accurate measuring device or take the error into account on all future measurements.

Don't Get the Bends

Whatever you use to hold, drill, or cut tubing, don't deform it so it becomes out of round. If that happens, it won't telescope with round tubing or rod. Rod that gets bent is very hard to straighten out such that it will still slide into a straight tube. Store and handle the materials carefully.

Cutting and Sawing

There are lots of ways to cut tubing or rod: by hand with a hacksaw or tubing cutter, metal-cutoff wheel in a handheld drill, band saw, metal-cutting blade in a table saw, and so on. Just search for "how to cut aluminum" on the internet and you'll find plenty of advice and videos. The most important tips are:

- Use a clamp or jig to hold what you're cutting so it can't move
- Set up the cutting tool to cut the material square across its diameter
- Don't force the cutting tool. Take your time and cut at the right rate for the saw blade

Drilling Tubing

When drilling round tubing, make the hole directly across the tubing diameter. That can be very hard to do consistently using a hand drill without using some kind of jig or clamp for both the tubing and the drill. If you like building antennas, you should really invest in or borrow a small drill press and a couple of machine vises that can be clamped to the press table. Even for a few holes, using a drill press makes the process easy and clean. **Here's a good introduction to the process**.

For the drill bits, make sure they are sharp and have a variety of sizes. (Don't you have a birthday coming up?) Use the right size specified for the screws or other hardware being used. A hole that is too large will elongate as the antenna flexes in the wind—this can lead to failure, particularly on big antennas. A too-small hole will be hard to thread or might damage screw threads. Use and follow a table of drill sizes for the hardware used.

When you are drilling small tubing or rod, the drill bit can "walk" because of the slope of the tubing or from a small misalignment with the tube's center. Use a center punch and put a small pit in the tubing exactly where you want the hole. Then, use a small bit with light pressure to get the hole started. If you are drilling heavier material like a boom-to-mast plate, drill a small pilot hole to guide the larger bit through the material and prevent an off-center hole.

How hard should you press? Aluminum is a soft metal, so you won't have to put a lot of pressure on the bit. Let the bit cut its way through the material, don't push it through. If the bit is generating chips, the drill is turning too fast and will "chatter," which creates an out-of-round hole. Turning a large bit too slowly can allow the bit to "grab" and twist, even bend, the material. Experiment with some scrap and find a speed and pressure that generate curls instead of chips.

Burrs and Deburring

No matter what type of drill you use, you're probably going to have some burrs around the hole on both surfaces. You have to remove the burrs if the tubing is expected to telescope with a larger or smaller tube or rod.

Getting the burrs off the outside surface or at the end of a tube or rod is fairly easy since you can use a common **deburring tool**, a countersink or drill bit several times the hole diameter, or a round file. That will clean up the hole and does not require a power tool. Twisting a countersink or drill bit by hand keeps them from biting into the hole.

Clearing the burrs from the inside of a hole in tubing is a different story. Cogsdill, Noga, and other specialty deburring tools will do the job on both surfaces but can be expensive if you need different sizes.

If you have a drill bit that is the same size as the tubing going into the inside of the tubing, you can run it into the tube and knock off the burrs. You might need to deburr both inside and outside a couple of times if the burrs bend back into the hole. Deburring holes in larger tubing can be done with a half-round file. *Editor's Note: The* ***DX Engineering Tube Deburring Tool Kit*** *comes with a small hand-deburring tool, half-round file, and two reamers for deburring tubing sizes from 3/8" to 2-1/8" O.D. and 1-7/8" to 3-1/2" O.D.*

Warning—do not force metal tubes together if there are burrs or chips present. The mating surfaces of the tubes or rod must be clean and free of metal bits or they will jam between the surfaces. This makes the joint very difficult to disassemble! The tubing or rod should slide in and out without binding.

Slotted Tubing and Hose Clamps

Many antennas use stainless-steel hose clamps to clamp nested tubing together. **Slotted tubing** has one or two narrow slots cut into the end of the outer tubing, about 1.5 to 2 tubing diameters long.

With the inner tubing inserted, the hose clamp compresses the outer tube against inner tube. This technique is simple, inexpensive, and can be pretty reliable with the following caveats:

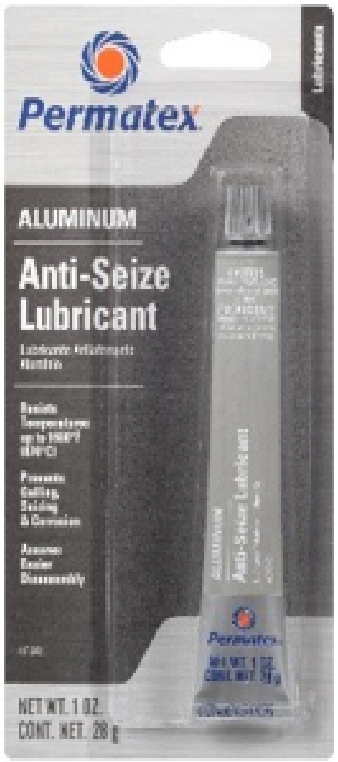
- Clean the slot of burrs inside and out to ensure maximum clamping area
- Use a hose clamp in the middle of its size range so the free end does not stick out
- Orient the hose clamp so that the screw is at halfway between the slots
- Let the clamps sit overnight and then retighten before installing the antenna

Some recommend wrapping the hose clamp with electrical tape to control the free end and help prevent the clamp from snagging on ropes or wires.

Screws and Locknuts

Although it is more expensive, stainless-steel hardware should be used to prevent corrosion. Plated hardware will rust quickly and may be quite difficult to get apart.

On larger sizes of stainless-steel screws (like U-bolts), use an **anti-seize compound** such as Permatex 80078 or 81313 to keep the threads from galling (a type of surface-to-surface adhesion). A small tube will suffice for a few antennas.



On small tubes and rods, a sheet metal screw may be sufficient to hold tubing or rod together. Machine screws, going all the way through the tube, are better on larger tubing sizes. A pair of machine screws at right angles is a very robust connection.

How tight is tight? The goal is to tighten the threads until they begin to deform. (Not so much that the tubing deforms or the threads strip!) That creates enough tension to keep the hardware from loosening. A lockwasher adds to and maintains the tension as a kind of spring. For medium and small aluminum pieces, an external-tooth lockwasher is recommended to maintain mechanical and electrical connections. The common split-O lockwasher loses most of its spring force when completely compressed. Another common technique is to use a pair of nuts (double-nutting) on larger tubing to prevent loosening.

Nylon-insert Nyloc nuts are another common solution. If you are concerned about the nylon degrading from being exposed to sunlight, install the nuts where they will face the ground. Or apply a thin coat of liquid electrical tape after the nut is seated—it will peel off if the nut has to be removed. These nuts are only supposed to be used once for the plastic to provide the full holding ability. Use new ones on all construction and rebuilding.

Finally, a thread locking compound will hold a nut or screw in place against vibration or thermal cycling. Both Locktite and Permatex make several varieties. The "medium" grade compounds are recommended and still allow the hardware to be removed.

Rivets

Another popular method of holding tubes and sheets together is pop-riveting. The rivet is aluminum with a steel mandrel in the middle. The rivet is placed in a hole through the pieces to be joined with the outer flange against the workpiece. The **riveting tool**—about the size of a large pair of pliers—pulls the mandrel into the rivet, spreading it out and compressing it against the back surface until the mandrel snaps off at the proper force for the rivet.

The pop-riveting process is illustrated **here**.

You have to use the right rivet depth and diameter for the job. Your hardware store or supplier should have the necessary information for you to make a selection. Most amateur antennas use 1/8" or 3/16" rivets. Don't scrimp on the rivet gun, either. Even a modest antenna will require dozens of rivets, and a cheap gun will make the job harder and your hands sore! For larger rivets, use a large, two-handled tool about the size of a hedge clipper because a hand-squeezed tool won't supply the necessary force to do the job right.

Assembling the Pieces

Once you have all the pieces and hardware, the process of assembly is about the same for commercial and homemade antennas:

- Lay out the pieces and verify you have all of them and they are all the expected sizes
- Keep track of the various small hardware in pans, cups, or bags
- Use a thin coating of anti-corrosion/anti-oxidation compound on all tubing joints and between dissimilar metals
- After assembly, let the antenna day/night cycle outside, then retighten all hardware

You might want to assemble the antenna on sawhorses or a work support. Working on the ground gets old fast—your knees and back will get sore—so elevate the antenna to where it's comfortable. Work over a hard, clean surface, not grass or rugs, so that when (not if) you drop a small part, you won't have to hunt for it. (Hint—a magnet will find ferrous hardware otherwise lost in grass or shaggy carpet.)

One of the best ways to build a Yagi is to secure a piece of mast material in a vertical position, then mount the boom on it at a convenient height and add the elements. The antenna will probably be very unbalanced for part of the process, so make sure the mast can't tip over. If the mast can swivel, you can turn the antenna and work on different parts without having to walk around it. If you're going to build a lot of antennas, burying a sleeve in the ground to seat the mast simplifies setup considerably.

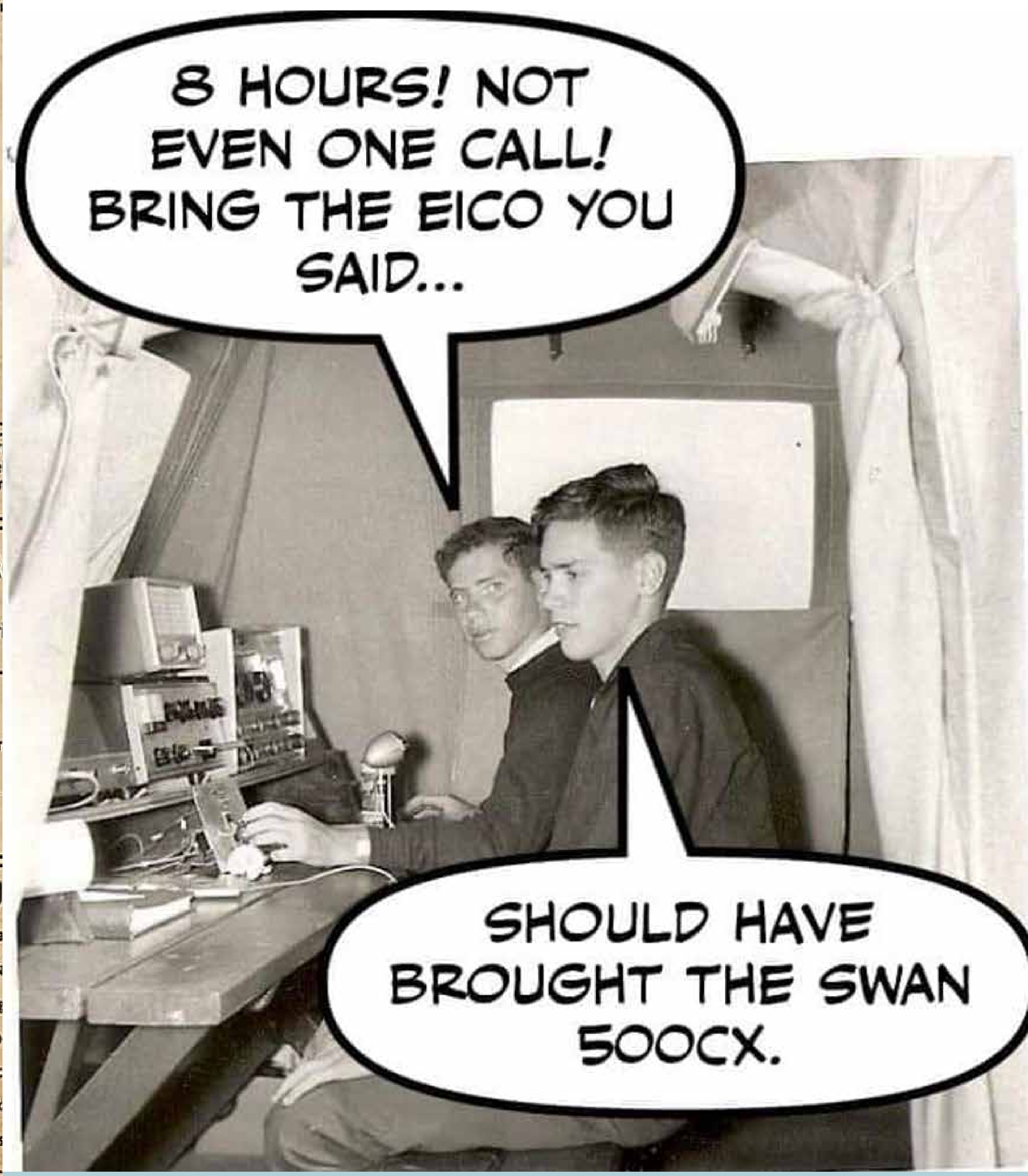
Before inserting a piece of tubing into a telescoping joint, give it a *thin* coating of anti-oxidation compound like SS-30 or Penetrox on the nested length. You don't need a lot. With the tubing inserted, you should see a small bead of compound formed at the junction of the tubes. Wipe off any excess with a rag. Almost any anti-oxidation or anti-corrosion compound will do. It prevents the formation of oxide between the tubes that can create an insulating layer and make it almost impossible to get the sections apart.

Tuning a VHF or UHF antenna can be done a few feet above the ground. Larger HF antennas need to be away from the ground during tuning but doing it on top of the tower can be difficult. One way to get around this problem is to orient the antenna vertically, pointing up with the rear element 6 to 10 feet above the ground to reduce the detuning effect of ground. Another way is to suspend the antenna from a rope between two supports so that the antenna is 10 or 20 feet above the ground. Make it easy to lower the antenna for adjustments.

Finally, water…it ***will*** get into the tubing, no matter how you try to seal it up. If you install plastic caps on the element or boom tubes, they will capture the water that gets in or condenses inside the tube. Slowly the water fills the tubes, which causes its own problem. It's best to leave tubing open. If you are concerned about noise from wind blowing across the open end or insects getting in, put stainless-steel wool or a scrubbing pad in the tubing. It will allow drainage while keeping all but the littlest stuff out.

At Last

Finally, you've built your own antenna, tuned it up, and are making QSOs with it—congratulations! Antenna design and building are two of ham radio's great features. Only a few other FCC-licensed services allow its licensees to do this. It's a great way to gain "radio know-how," and its part of what makes ham radio so valuable.



By Wes Hayward, W7ZOI, and Bob Larkin, W7PUA

Simple RF-Power Measurement

Making power measurements from *nanowatts* to 100 watts is easy with these simple homebrewed instruments!

PHOTOS BY JOE BOTTIGLIERI, AA1GW

Measuring RF power is central to almost everything that we do as radio amateurs and experimenters. Those applications range from simply measuring the power output of our transmitters to our workbench experimentations that call for measuring the LO power applied to the mixers within our receivers. Even our receiver S meters are power indicators.

The power-measuring system described here is based on a recently introduced IC from Analog Devices: the AD8307. The core of this system is a battery operated instrument that allows us to directly measure signals of over 20 mW (+13 dBm) to less than 0.1 nW (–70 dBm). A tap circuit supplements the power meter, extending the upper limit by 40 dB, allowing measurement of up to 100 W (+50 dBm).

The Power Meter

The cornerstone of the power-meter circuit shown in Figure 1 is an Analog Devices AD8307AN logarithmic amplifier IC, U1. Although you might consider the

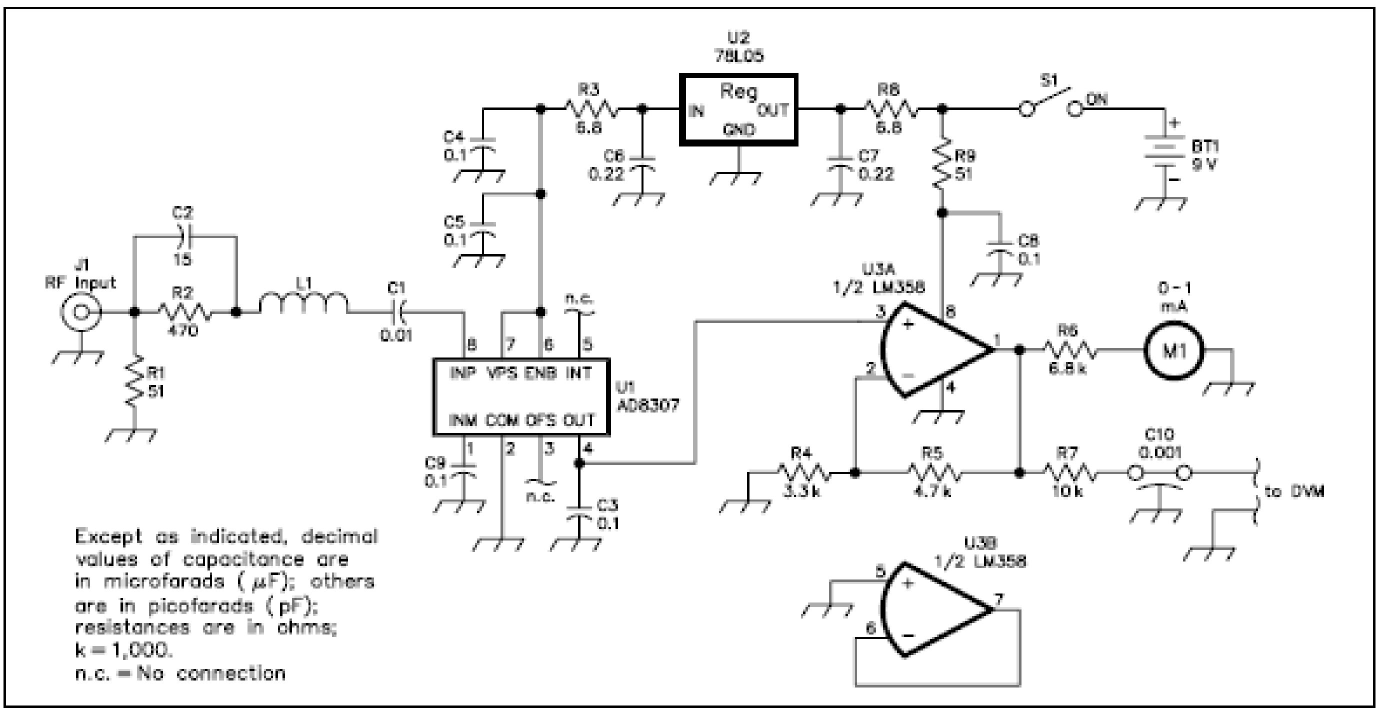


Figure 1—Schematic of the 1- to 500-MHz wattmeter. Unless otherwise specified, resistors are 1/4-W 5%-tolerance carbon-composition or metal-film units. Equivalent parts can be substituted; n.c. indicates no connection. Most parts are available from Kanga US; see Note 2.

J1—N or BNC connector
L1—1 turn of a C1 lead, 3/16-inch ID; see text.
M1—0-15 V dc (RadioShack 22-410); see text.

S1—SPST toggle
U1—AD8307; see Note 1.
U2—78L05
U3—LM358

Misc: See Note 2; copper-clad board, enclosure (Hammond 1590BB, RadioShack 270-238), hardware.

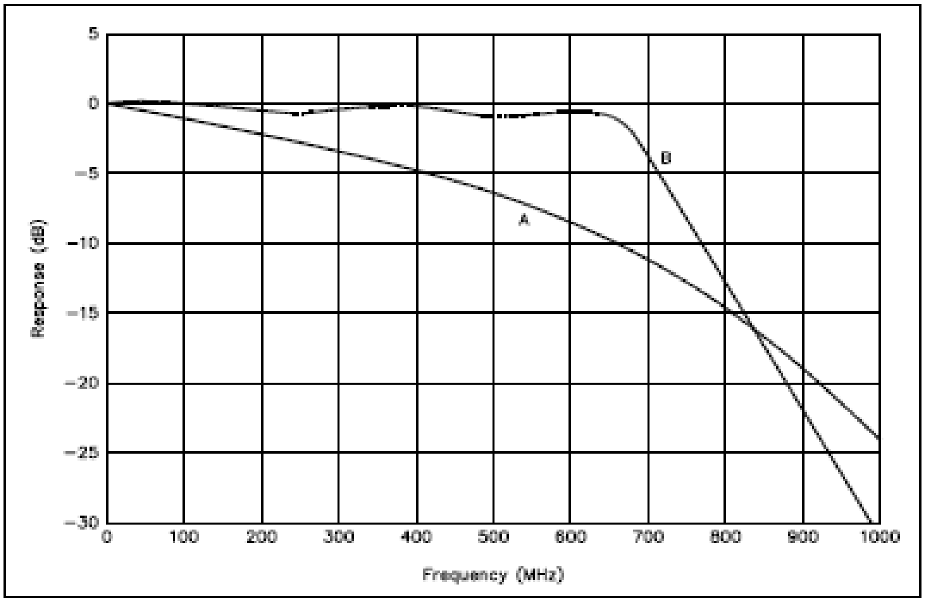


Figure 2—Response curves for the power meter before (A) and after (B) addition of R2, C2 and L1.

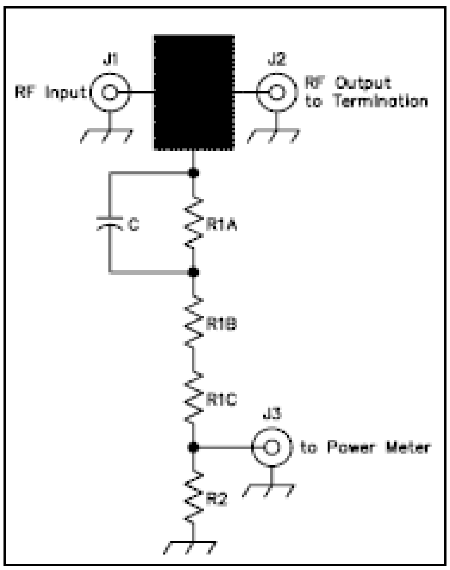


Figure 3—A tap that attenuates a high-power signal for use with the power meter. See the text and Figure 4 for discussion of the capacitor, C.

J1, J2—N connectors; see text.
J3—BNC connector
L1—1×1½-inch piece of sheet brass; see text.
R1A-R1C—Three series-connected, 820-Ω, ½-W carbon film
R2—51-Ω, ¼-W carbon film

IC as slightly expensive at about $10 in single quantities, its cost is justified by the wide dynamic range and outstanding accuracy offered. You can order the part directly from the Analog Devices Web site, which also offers a device data sheet.[1,2]

[1]Notes appear on page 43.

U1's power supply can range from 2.7 to 5.5 V. A 5-V regulator, U2, provides stable power for U1. U3, an op amp serving as a meter driver completes the circuit. U1's dc output (pin 4) changes by 25 mV for each decibel change in input signal. The dc output is filtered by a 0.1 µF capacitor and applied to the noninverting input of U3, which is set for a voltage gain of 2.4. The resulting signal with a 60 mV/dB slope is then applied to a 1-mA meter movement through a 6.8-kΩ multiplier resistor. When the circuit is driven at the 10-mW level, U3's output is about 6 V. U3's gain-setting resistors are chosen to protect the meter against possible damage from excessive drive.

U1 has a low-frequency input resistance of 1.1 kΩ. This combines with the resistances of R1 and R2 to generate a 50-Ω input for the overall circuit. R2 in parallel with C2 form a high-pass network that flattens the response through 200 MHz. L1, a small loop of wire made from a lead of C1, modifies the low-pass filtering related to the IC input capacitance, extending the response to over 500 MHz.

M1 is a RadioShack dc voltmeter. Although sold as a *voltmeter*, it actually is a 0-1 mA meter movement supplied with an external 15-kΩ multiplier resistor. The 0 to 15 V scale is used with a calibration curve that is taped to the back of the instrument to provide output readings in dBm. The dBm units can be converted to milliwatts by using a simple formula, although dBm readout is generally more useful and convenient.[3]

An auxiliary output from C10, a feedthrough capacitor, is provided for use with an external digital voltmeter or an oscilloscope for swept measurements.[4] We use the DVM when resolution is important. The analog movement can be read to about 1 dB, which is useful when adjusting or tuning a circuit. Enterprising builders might program a PIC processor to drive a digital display with a direct reading in dBm.

The first power meter we built did not include R2, C2 and L1. That instrument was accurate in the HF spectrum and useful beyond. Adding the compensation components produced an almost flat response extending beyond 500 MHz with an error of only 0.5 dB. The compensation network reduces the sensitivity by about 3 dB at HF, but boosts it at UHF. If your only interest is in the HF and low-VHF spectrum through 50 MHz, you can simplify the input circuit by omitting R2, C2 and L1. The responses before and after compensation are shown in Figure 2.

The power meter is constructed "dead-bug" fashion without need of a PC board. It is breadboarded on a strip of copper clad PC-board material held in place by the BNC input connector. R1 is soldered between the center pin and ground with short leads. U1 is placed about ¾ inch from the input in dead-bug fashion (leads up) with pins 1 and 8 oriented toward J1. The IC is held to the ground foil by grounded pin 2 and bypass capacitors C3, C4 and C5. R2 and C2 are connected to the J1 center pin with short leads. L1 is formed by bending the lead of C1 in a full loop. Use a ³⁄₁₆-inch-diameter drill bit as a winding form. None of the remaining circuitry is critical. It is important to mount the power meter components in a shielded box. We used a Hammond 1590BB enclosure for one meter and a RadioShack box for the other, with good shielding afforded by both. *Don't use a plastic enclosure for an instrument of this sensitivity*.

Higher Power

Transmitter powers are rarely as low as the maximum that can be measured with this power meter. Several circuits can be used to extend the range including the familiar attenuator. Perhaps the simplest is a resistive tap, shown in Figure 3. This circuit consists of a flat piece of metal, L1, soldered between coaxial connectors J1 and J2, allowing a transmitter to drive a 50-Ω termination. A resistor, R1, taps the path to route a sample of the signal to J3, which connects to the power meter. R2 shunts J3, guaranteeing a 50-Ω output impedance. Selecting the values that comprise R1 establishes the attenuation level.

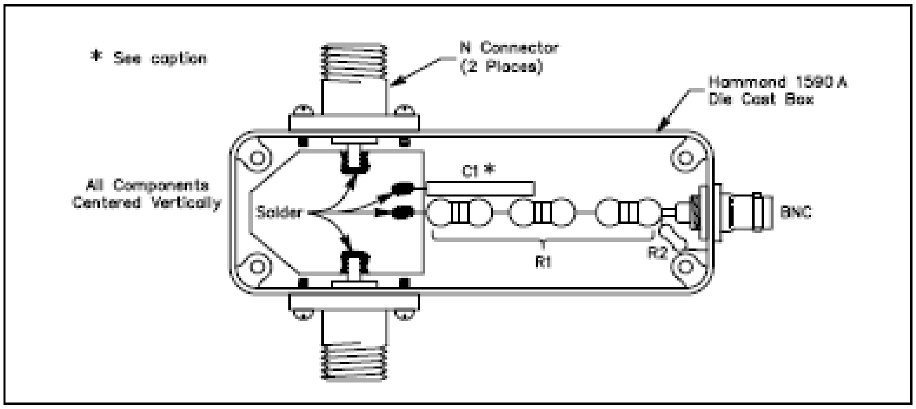


Figure 4—Drawing of the 40-dB power tap assembly shown schematically in Figure 3. The center conductors of the two N connectors (RF INPUT and RF OUTPUT) are connected by a 1×1½-inch piece of sheet brass with its corners removed to clear the pillars in the Hammond 1590A die-cast aluminum enclosure. C1 is made from a piece of #22 AWG insulated hook-up wire; it extends 0.6 inch beyond the edge of the tinned metal piece and almost rests against the two resistor bodies.

The tap extends the nominal +10 dBm power meter maximum level to +50 dBm, or 100 W. Power dissipation becomes an issue at this level, so R1 is built from three series-connected half-watt, carbon-film resistors.

The tap is built with the J1 to J2 connection configured as a 50-Ω transmission line as shown in Figure 4 and the accompanying photographs. Adjustments were performed with an HP-8714B network analyzer. The analyzer was used to adjust the value of C for an attenuated path to J3 that is flat within 0.1 dB up to 500 MHz. The tap can then be used with a spectrum analyzer or laboratory grade power meter.

It is not realistic to achieve 0.1-dB accuracy through UHF without a network analyzer for adjustment. However, if the tap is duplicated using the mechanical arrangement of Figure 4, you can expect the tap to be flat within about 1 dB through 500 MHz. The low-frequency attenuation is determined merely by the resistors, so can be guaranteed with DVM measurements. If the primary interest is in measurements below 150 MHz, you can replace the N connectors with BNC connectors. The tap is housed in a Hammond 1590A box.

Calibration

We read and use our meters in one of two ways. The DVM output is recorded and used with an equation that provides power in dBm. Alternatively, we read the panel meter and look at a chart taped to the back of the instrument. In both cases, we need a known source of RF power to calibrate the tool.

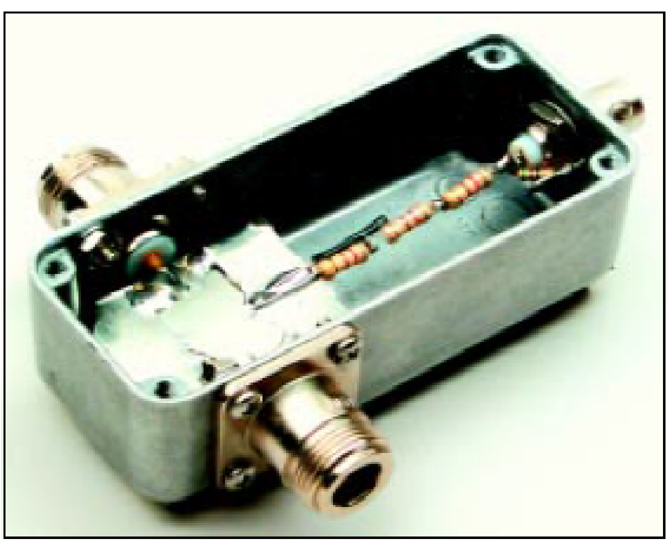
The easiest way to calibrate this instrument is with a calibrated signal generator. Set the generator for a well-defined output and apply it to the power meter. We did our calibration work at 10 MHz and levels of –20 and –30 dBm. The two levels provide a 10-dB difference that establishes the slope in decibels per DVM millivolt. One of the two values then provides the needed constant for an equation. The signal generator can be stepped through the amplitude range in 5- or 10-dB steps to generate data for the meter plot. Figure 5 shows a plot of DVM output Vs power meter reading. The meter plot is similar.

If you don't have access to a quality signal generator, you can calibrate the power meter using a low-power transmitter. A power level of 1 to 2 W at 7 MHz is fine. Attach the transmitter through the tap to a dummy load where the output voltage can be read directly using a diode detector and DVM as shown in Figure 6. If the power output is 1 W, the peak RF voltage will be 10 V. The detector output will then be about 9.5 V and the signal to the power meter is –10 dBm. Adding a 10-dB pad, as shown in Figure 6, at the meter input drops the power to –20 dBm for the second calibration point.

Applications

There are dozens of applications for this little power meter, a few of which are shown in the accompanying figures. Some applications are obvious and practical while others are more elaborate and instructive. Most of these measurements are *substitutional*, where the power meter is substituted for a load in a circuit. In contrast, most measurements with an oscilloscope are *in situ*, performed *in place* within a working circuit.

Figure 7A shows power measurement for early stages of a transmitter, very low power transmitters, or signals from other



An inside view of the simple attenuator shown in Figure 3.

The calibration curve taped to the back of the instrument provides output readings in dBm relative to the meter's 0 to 15 V scale.

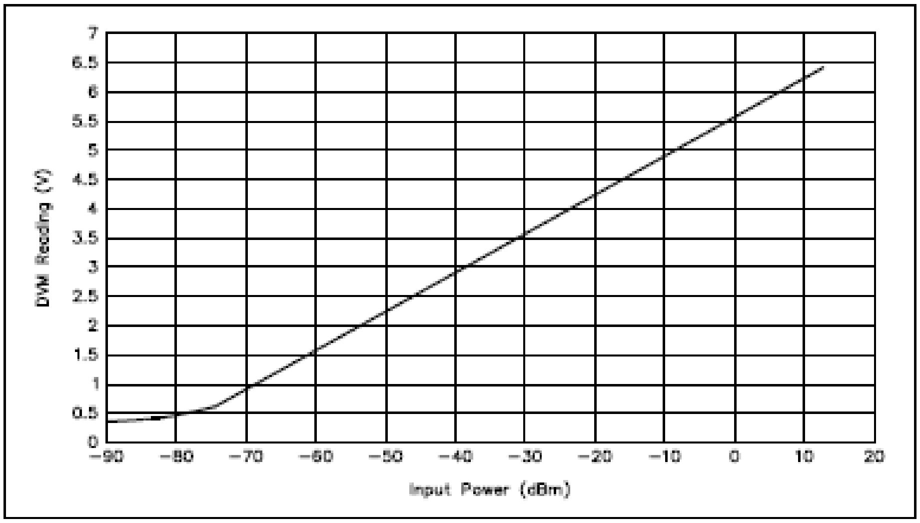


Figure 5—Plot of the DVM output versus generator power.

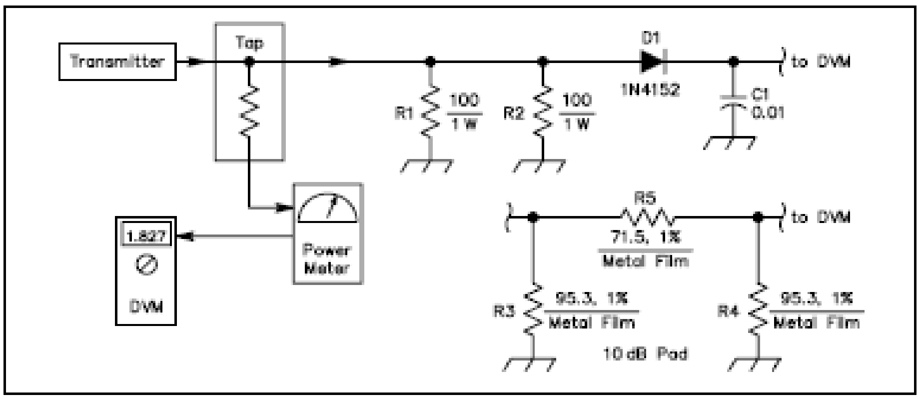


Figure 6—If a signal generator is not available, calibration can be done using a low-power transmitter. Resistor values for a 10-dB pad are shown.
C1—0.01 µF disc ceramic
D1—1N4152
R1, R2—100 Ω, 1 W
R3, R4—95.3 Ω, 1% metal film
R5—71.5 Ω, 1% metal film

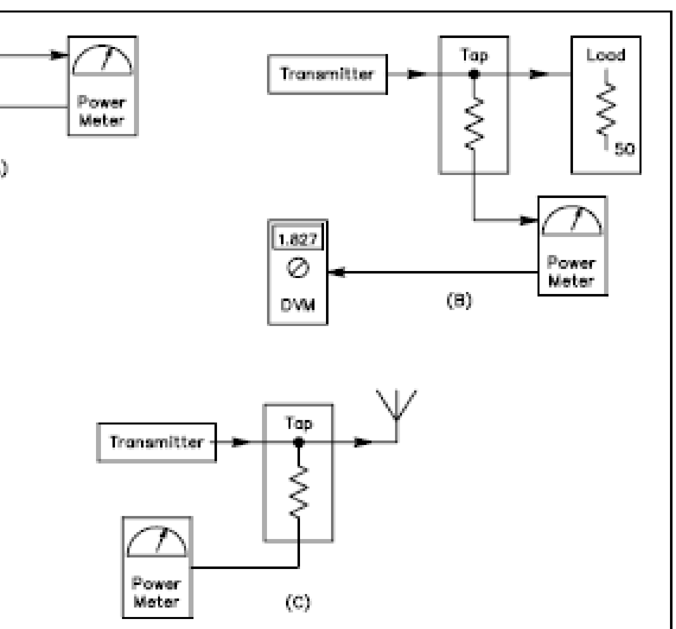


Figure 7—Power measurement schemes for various situations; see the text for an explanation.

sources. Among the most common is measurement of the power available from a LO system that will then drive a diode-ring mixer. The nominal maximum power for the meter is +13 to +16 dBm. We were able to perform measurements nearly up to +18 dBm at HF, but this is not maintained at the VHF. Careful calibration at HF was made by comparing our meters' outputs to those of an HP435A.

The tap of Figure 3 extends transmitter testing with the setup of Figure 7B. A good dummy load (termination) is placed on the tap output with the transmitter attached to the input. The power in dBm is now that read on the meter in dBm plus the tap attenuation in decibels.

We sometimes wish to measure power during an operating session. This can be done with the setup of Figure 7C. A typical application might be a QRP station where the operator experiments with significantly reduced, but variable power.

The power meter is useful for a variety of applications with bridge circuits. Figure 8 shows the meter as the detector for a return loss bridge (RLB) driven by a signal generator.[5] In this example, we use the system to adjust an antenna tuner. Because of the excellent sensitivity of the power meter, the generator need not have high output power. For example, we often make these measurements with a homebrew generator delivering +3 to +10 dBm.

The use of such low power can complicate the measurements, as we discovered when we tried the experiment of Figure 8. The exercise began without either of the filters shown. When the generator was turned on, the power meter indicated –4 dBm from the RLB. We tuned the matching circuit, but could only achieve –25 dBm, indicating 21-dB return loss.[6] No further improvement could be observed. This was the result of local VHF TV and FM broadcast interference. A bandpass or low-pass filter in the power-meter input eliminated the residual response, allowing us to achieve a 45-dB return loss with further tuning. But this was also a limit where no further improvement seemed possible. Adding a low-pass filter to the signal generator output reduced the harmonics there, allowing further improvement. We were eventually able to tune the system for an absurd 60-dB return loss (SWR = 1.002), generally impossible to measure with normal bridges using diode detectors.

The power meter is ideal for experiments with various RF filters as shown in Figure 9. A signal generator is attached to the filter input with the power meter terminating the output. The filter may then be tuned or swept. Temporarily re-

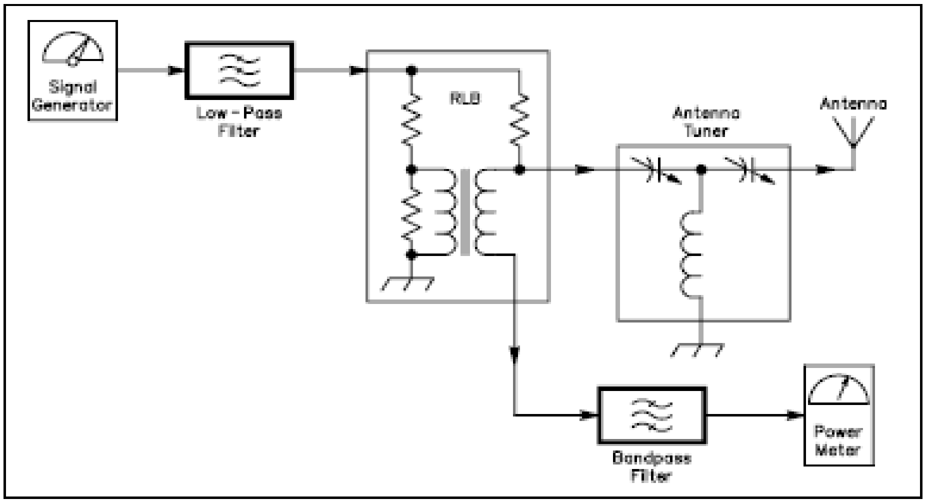


Figure 8—Using the power meter for bridge measurements.

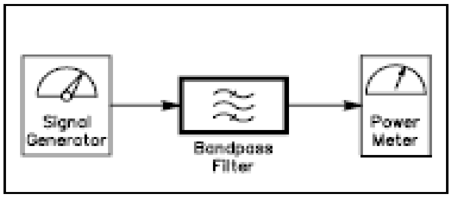


Figure 9—Filter measurements with the power meter.

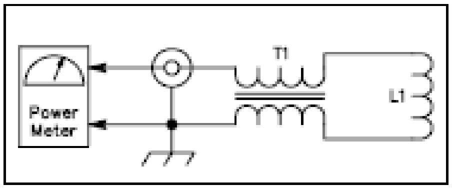


Figure 11—An RF sniffer probe that allows observation of relative RF levels. This probe allows you to see self-oscillation in amplifiers, or proportional responses in a receiver or transmitter.

L1—Two turns of insulated wire, ¼-inch ID.

T1—Several ferrite beads on a length of coaxial cable; see text.

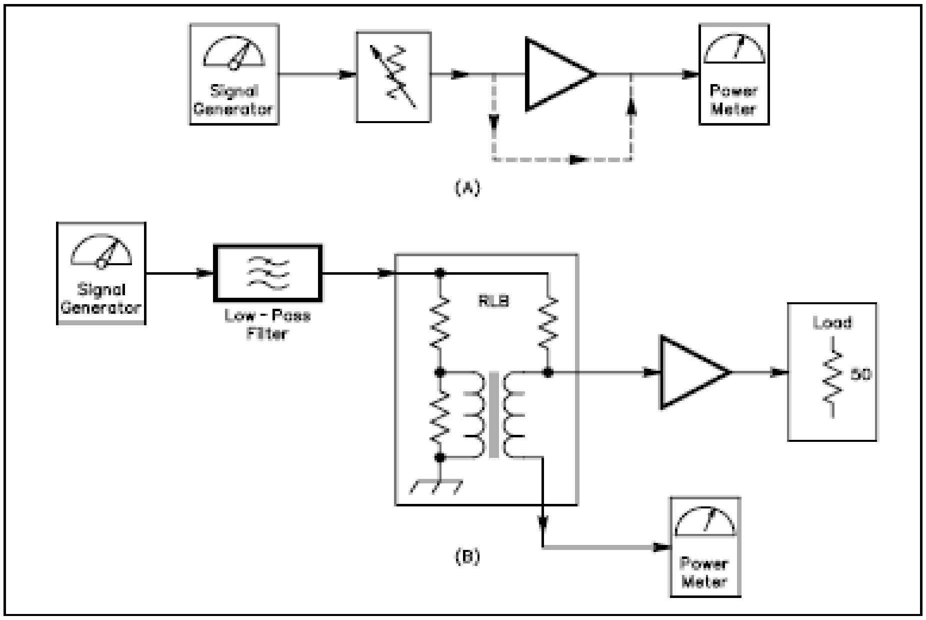


Figure 10—Amplifier measurements with the power meter. At A, making gain measurements. At B, a method to determine the input-impedance match. Reversing the amplifier terminals allows investigating reverse gain and output match.

placing the filter with a coaxial through connection allows you to evaluate filter insertion loss. Both the power meter and the signal generator are 50-Ω instruments, so the filter will need matching networks if it is not a 50-Ω design.

As with the previous example, measurement anomalies can be observed when investigating filters. For example, after using the power meter to adjust a 7-MHz bandpass filter we were able to easily measure the second-harmonic content of the signal generator when tuned to 3.5 MHz.

Figure 10A shows the power meter used with a signal generator to study amplifier circuits. A step attenuator is shown with the generator, allowing the power level to be reduced while preserving a 50-Ω environment. Generally, a drive level of –30 dBm is low enough with typical circuits. The system is initially set up with a through connection, indicated by the dotted line. Then the amplifier is inserted and the output power is measured. The difference between the two responses, each in dBm, is the gain in decibels. An interesting and easily performed related measurement is that of amplifier reverse gain. Merely swap the amplifier terminals, attaching the generator to the *output* and the power meter to the *input*. The measured *gain* will now be a negative decibel number.

Amplifier investigation continues with the setup of Figure 10B where we use an RLB to measure the input impedance match. Although a simple bridge will not provide the actual input impedance, it will tell you how close the circuit is to a perfect match. Adjustments can be done to achieve a match. Again, reversing the amplifier allows examining the output. We included a low-pass filter in the generator output, a precaution that may also be useful with the gain-determination setup. The measurements of Figure 10 provide the information normally provided by a scalar network analyzer.

The power meter can serve as the detector for a number of simple instruments. Figure 11 shows a simple RF sniffer probe, handy for examining circuit operation. The probe consists of a small inductor attached to the end of a piece of coaxial cable (RG-58, RG-174, or similar). A few ferrite beads of about any type are placed over the outside of the cable near the coil. The probe can be placed close to an operating circuit to look for RF. The smaller the link diameter, the greater the spatial resolution can be. This is a scheme that actually lets you see self-oscillation in an amplifier, much more useful than a speculation that a circuit "might be oscillating."

The power meter can be used with other probes. One might be a simple antenna that would allow field-strength determinations. Another is a resonance-indicating probe that would provide traditional dip meter-like measurements, but with improved ac-

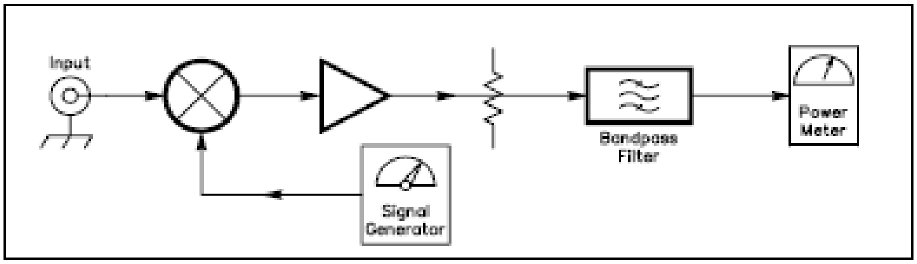
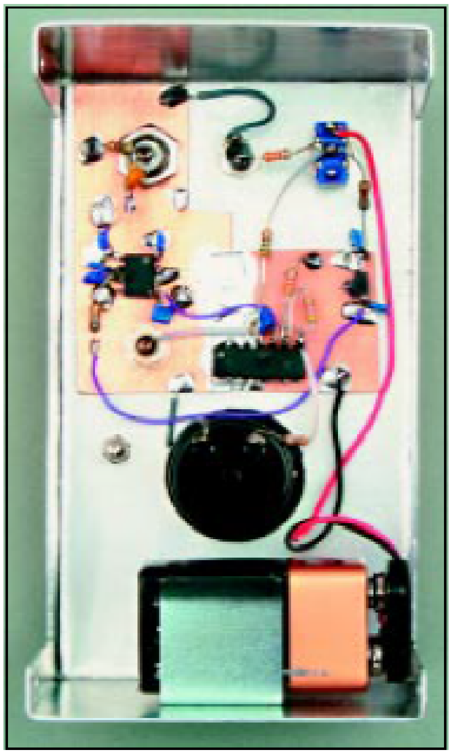


Figure 12—Adding a few components to a signal generator and the power meter creates a measurement receiver. The kinds of measurements possible depend on the filter used. See the text for some possibilities.



An inside view of the wattmeter showing its "dead-bug" construction and simplicity.

This version of the power meter is built in an inexpensive RadioShack utility box.

curacy and sensitivity.[7]

A recent *QST* project developed by Rick Littlefield, K1BQT, uses an AD8307 as a relative RF indicator.[8] That instrument, with the probe described in the sidebar by Ed Hare, W1RFI, is aimed at examining conducted electromagnetic interference (EMI). Our power meter should function well with that probe. There is great potential for small portable instruments for the study of both conducted and radiated EMI.

Figure 12 shows an example of some simple instruments that can be built using the power meter as a foundation. Here, the signal generator becomes the LO for a mixer such as the popular diode ring. This drives an optional amplifier and attenuator, followed by a bandpass filter. The power meter measures the filter output. The result is a custom measurement receiver.

We have built two variations of this project. The first uses a three-resonator LC bandpass filter tuned to 110 MHz, while the signal generator tunes from 50 to 250 MHz.[9] A Mini-Circuits MAV-11 is used for the amplifier. The resulting receiver can then be used to measure signals over the entire spectrum up to 360 MHz with sufficient resolution to examine transmitter spurious responses.

The second measurement receiver uses a homebrew 5-MHz crystal filter with a 250-Hz bandwidth. The signal generator is a homebrew unit with extreme tuning resolution, or bandspread. This instrument was used to measure SSB-transmitter carrier and sideband suppression and IMD, and for examining spurious output of experimental frequency synthesizers.

Concluding Thoughts

The traditional view of a power meter is as an instrument that examines transmitter output. But it can be much more than that. The AD8307 allows you to build a power meter that turns a common Amateur Radio station into the beginnings of a RF measurement lab.

Our thanks to Barrie Gilbert of Analog Devices Northwest Labs for providing the AD3807 IC samples.

Notes

[1]**www.analog.com**. The data sheet includes an extensive discussion of the theory of operation of the logarithmic detector and applications beyond the scope of this article.

[2]Kanga US offers a collection of most of the parts for this project, excluding the meter, copper-clad board and enclosure. For specifics, contact KANGA US, Bill Kelsey, N8ET, 3521 Spring Lake Dr, Findlay, OH 45840; tel 419-423-4604; **kanga@bright.net**; **www.bright.net/~kanga/**.

[3]$P_{mW} = 10^{dBm/10}$

[4]Feedthrough capacitors are available from Down East Microwave Inc, 954 Rt 519, Frenchtown, NJ 08825; tel 908-996-3584, fax 908-996-3702; **www.downeastmicrowave.com/**.

[5]See Wes Hayward, W7ZOI, and Doug DeMaw, W1FB, "Solid-State Design for the Radio Amateur," p 154, ARRL, 1977. Directional couplers are also useful in this application, such as that used in the classic W7EL power meter, Roy Lewallen, W7EL, "A Simple and Accurate QRP Directional Wattmeter," *QST*, Feb 1990, pp 19-23 and 36.

[6]A return loss of 21 dB corresponds to a SWR of 1.196, already a great match for most practical antenna situations.

[7]See Wes Hayward, W7ZOI, "Beyond the Dipper," *QST*, May, 1986, pp 14-20. Also, the signal-generating portion of that instrument is useful as a simple, general-purpose RF source.

[8]Rick Littlefield, K1BQT, "A Wide-Range RF-Survey Meter," *QST*, Aug 2000, pp 42-44; see also Feedback, Oct 2000, p 53.

[9]Wes Hayward, W7ZOI, "Extending the Double-Tuned Circuit to Three Resonators," *QEX*, Mar/Apr 1998, pp 41-46. The band-pass filter was then used in the instrument described in Wes Hayward, W7ZOI, and Terry White, K7TAU, "A Spectrum Analyzer for the Radio Amateur," *QST*, Aug 1998, pp 35-43; —Part 2, Sep 1998, pp 37-40.

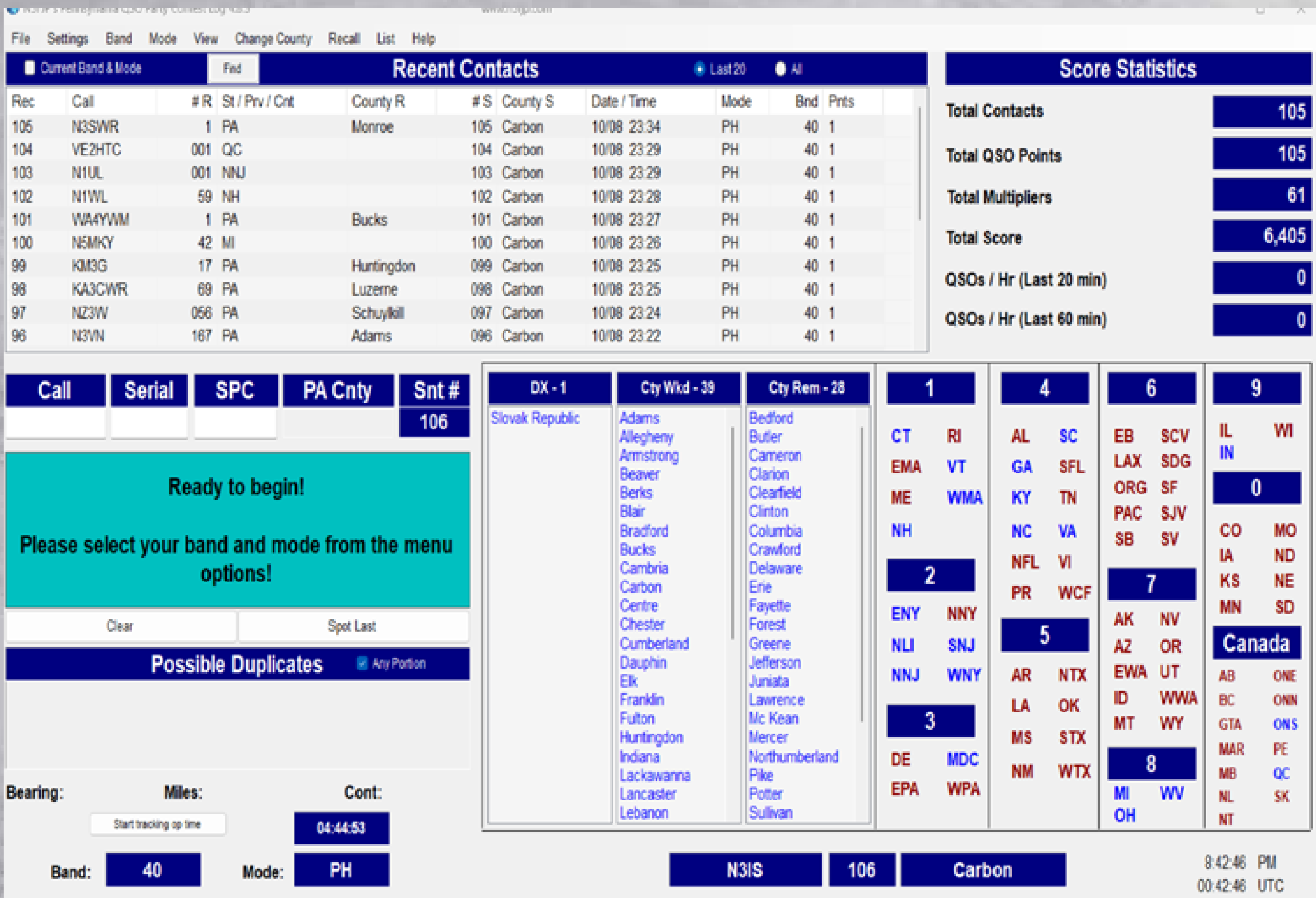
Over the years, Wes Hayward, W7ZOI, has provided readers of QST, The ARRL Handbook and other ARRL publications with a wealth of projects and technological know-how. His most recent article, The Micromountaineer Revisited (which he wrote with K7TAU), appeared in July 2000 QST. You can contact Wes at 7700 SW Danielle Ave, Beaverton, OR 97008; **w7zoi@easystreet.com**.

Bob Larkin, W7PUA, is a consulting engineer for communication companies. His last article, "An 8-Watt, 2-Meter 'Brickette'" appeared in June 2000 QST. You can contact Bob at 2982 NW Acacia Pl, Corvallis, OR 97330; **boblark@proaxis.com**.

Ruth Ann W9FBO calling during the QSO party

N3IS is number 1 in North Jersey!

N3IS connects with Slovakia!



Community, Camaraderie and Communication!
Another successful Pennsylvania QSO Party on the books!

Sure, this is a nationwide QSO Party but, here in the north east, we're fortunate to have a lot of counties participating, and the contacts we got just from our club alone, speaks to the dedication of keeping the Ham Radio institution alive!

So, kudos to all that came out, and those that participated from their base stations. We'd like to especially thank the Rover Stations for those really hard to get counties! There's nothing like hearing it all unfold in real time on the air and how the contacts are immediately tracked and shared on social media.

If you have not yet participated in any of our QSO Parties – put it on the books for next year! For anyone new to this, during the QSO Party, contacts are expected to carry out on the typical bands: 80M, 40M, 20M, 10M, 6M, 2M, & 70CM. If you're operating from a limited station you're still encouraged to make contacts as they are abundant throughout these bands!

The best way to get started and ensure success is to read the PA QSO Party rules prior to participating so you can best prepare to operate on as many bands as possible! And, of course, the best way to fully immerse yourself is joining a contest station in person like N3IS! Each year a club member hosts and we do a pot luck and a great time is had by all.

Thanks to Bill AB3ME once again for opening his QTH to the club and all those that prepared delicious food & drink that sustained us throughout the day!

Below are the statistics from this year's QSO party. Please note that we only operated for about 6 hours on Saturday only this year. No one showed up for the Sunday event this year due to other commitments. Last year we operated both days and made about double the contacts.

2022 October 8th & 9th,

N3IS's Contest Summary Report for PAQP
Created by N3FJP's Pennsylvania QSO Party Contest Log
Version 4.8.3 www.n3fjp.com

Total Contacts = 105
Total Points = 6,405

Operating Period: 2022/10/08 19:24 - 2022/10/08 23:34

Total op time (breaks > 30 min deducted): 3:30:33
Total op time (breaks > 60 min deducted): 4:09:40

Avg Qs/Hr (breaks > 30 min deducted): 29.9

Total Contacts by Band and Mode:

Band	CW	Phone	Dig	Total	%
40	0	105	0	105	100
Total	0	105	0	105	100

Total Contacts by State \ Prov:

State	Total	%
PA	63	60
NJ	6	6
CT	4	4
MI	4	4
VA	4	4
NY	3	3
OH	3	3
ON	3	3

MA 2 2
NH 2 2
WV 2 2
1 1
GA 1 1
IN 1 1
KY 1 1
MD 1 1
NC 1 1
QC 1 1
SC 1 1
VT 1 1

Total = 19

Total Contacts by Country:

Country Total %
------- ----- ---
USA 100 95
Canada 4 4
Slovak Republic 1 1

Total = 3

Total DX Miles (QSOs in USA not counted) = 5,779
Average miles per DX QSO = 1,156

Average bearing to the entities worked in each continent.
QSOs in USA not counted.

EU = 47
NA = 19

Total Contacts by Continent:

Continent Total %
--------- ----- ---
NA 104 99

EU 1 1

Total = 2

Total Contacts by CQ Zone:

CQ Zone Total %
------- ----- ---
05 87 83
04 16 15
03 1 1
15 1 1

Total = 4

Total Contacts by County:

County Total %
--------- ----- ---
PA Montgomery 5 5
PA Beaver 4 4
PA Monroe 4 4
PA Carbon 3 3
PA Franklin 3 3
PA Luzerne 3 3
PA Westmoreland 3 3
PA Allegheny 2 2
PA Chester 2 2
PA Cumberland 2 2
PA Lehigh 2 2
PA Lycoming 2 2
PA Northampton 2 2
PA Adams 1 1
PA Armstrong 1 1
PA Berks 1 1
PA Blair 1 1
PA Bradford 1 1
PA Bucks 1 1
PA Cambria 1 1
PA Centre 1 1
PA Dauphin 1 1

PA Elk 1 1
PA Fulton 1 1
PA Huntingdon 1 1
PA Indiana 1 1
PA Lackawanna 1 1
PA Lancaster 1 1
PA Lebanon 1 1
PA Mifflin 1 1
PA Montour 1 1
PA Perry 1 1
PA Philadelphia 1 1
PA Schuylkill 1 1
PA Snyder 1 1
PA Somerset 1 1
PA Tioga 1 1
PA Venango 1 1
PA Wyoming 1 1

Total = 39

Total Contacts by Initials:

Initials Total %
-------- ----- ---
RAR/BC 78 74
LEN 8 8
LL/BC 7 7
MG/JG 5 5
RAR 4 4
MG 2 2
BC 1 1

Total = 7

Total Contacts by Operator:

Operator Total %
-------- ----- ---
W9FBO 82 78
KC3OND 15 14
KC3TOE 4 4

W3BMM 3 3
AB3ME 1 1

Total = 5

Some high-points of the day were #1. a contact with KB3JUF and KD2FTA as well as a gentleman in Slovakia! Bob was able to get these qso's recorded....too bad they could not be played in the newsletter. I will try to remember to play them in our next membership meeting for all to hear!

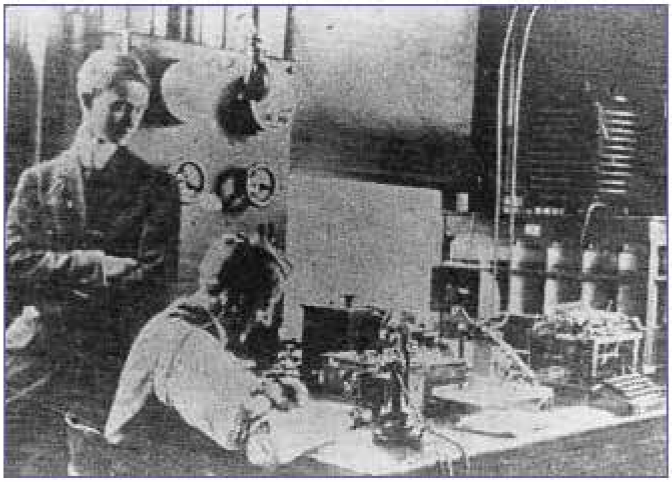
Bill...AB3ME


80M SSTV Net
3.847 MHz
7:30pm check-in on the 147.045 repeater.
Thursday
October
20th
EPARA
N3IS
Be sure to download MMSSTV software
to receive and transmit images.
KB9LVR de KD2FTA
73
WB2TQE
575
N9LV
595
KD2FTA
KD2FTA 575
595
KD2FTA
AJ3C
WD9IDV
CQSSTV
W4NCH/AG
2022-MAY-07
KD2FTA
555
W4NCH/AG
73
KD2FTA de WD9IDV
WD9IDV Robert Grayslake, IL USA
KD2FTA
N3MLB
595 R5
WD9IDV

From Whence Came Ham
November 1976 QST Article

The mystery of the origin of the term "ham" for amateur radio operators never has, after more than a century, been absolutely settled. Be thankful, though, for being this day referred to as a "ham" and not a "plug." Waaay back in 1976, the year I graduated from high school (wow), Mr. Bill Johnston wrote this article for QST magazine which presented his research into the etymology of "ham." According to his information, both "ham" and "plug" were terms applied to fledgling wireless operators on trains and ships. "Plug" is a term often applied to a worn out horse or defective item, so it was an appropriate enough derogatory word for a newbie. The author claims that as of 1976, some dictionaries list as an alternate definition of plug, "an inexperienced telegrapher." I just checked my c1976 Webster's New Collegiate Dictionary and it does not include that definition. None of the most prominent online dictionaries give that definition, either. Mr. Johnston also points out the origin of "73," meaning "best regards," coming from Western Unions "92 Code" list.

By Bill Johnston,* WB5CBC



Hams could well be Plugs, now. Both were popular terms applied by seasoned railroad telegraphers to green operators.

Gather a few hams together and you're sure to hear some reminiscing about the past - what great fun the old days were with primitive, homebrewed equipment and friends made around the world. But one issue there's never been much agreement on is the origin of the word ham itself. You would think, though, that with so many old-timers around, someone would remember. On the other hand, perhaps that's the trouble. Countless tales have been woven over the years - romantic yarns having only in common that they have nothing in common. Perhaps it's because we all remember how it was, that none of us really are certain any longer. Most amateurs now are resigned to the belief that we will never know.

Now that we are in our bicentennial year, and amateur radio has been with us for three-quarters of a century, it seems fitting that we should put this puzzle into historical perspective. While I cannot trace the origin of the word, I can tell you the origin of its use in amateur radio.

On the American railroads during the 1800s, ham was a slang word for a new or inexperienced telegraph operator and was used interchangeably in this context with the word plug. Such jargon was used not only along the railroads, but in the commercial telegraph and cable companies as well. These terms continued among wireless telegraph operators as this new field began to open up about 1900, and amateur radio operators adopted the nickname for obvious reasons. Actually, the word plug was the more commonly used term of, the two. Why radio amateurs chose to be hams instead of plugs, or for that matter, why one name didn't survive is not clear, I have been unable to determine how the words came to be used on the railroads, but plug has several connotations which have the general meaning of "green" or "second best," as in a reference to a horse. So it is easy to see why experienced operators might refer to a beginner as a plug. To this day, many dictionaries include a definition for a plug as "an inexperienced telegrapher" (though I have seen some fairly recent ones which define it incorrectly as "an incompetent telegrapher").

"73," One of Many

Our nickname wasn't the only thing copied from nineteenth century railway telegraphy. The salutation 73 was just one of a long list of "Numerical Wire Signals" in use at the time, and meant then, as it does now, best regards.

The abbreviation "es" for the word "and" comes from the American Morse character for &. (American Morse was used on domestic telegraph lines. International Morse, also called continental Morse, has always been used for radio communication.) Some American Morse characters have spaces within the character itself. The ampersand (&) is one of these, but when viewing the separate elements as distinct characters themselves, it is equivalent to the letters "es."

Nineteenth century telegraphers spoke of duplex, quadruplex, bugs-in-the-wire, and knocking off - all of which had the same meaning as they do today. Traffic handlers and brass pounders will be interested to know of another expression, getting old, which referred to telegrams that were being delayed. A telegram was considered to be old if it was delayed for longer than fifteen minutes. Incidentally, standard time signals were received from various observatories and transmitted daily to all points on the line.

Almost all the special telegraphic signals commonly used today (AR, AS, SK, K, CQ, DE) were in use since the very earliest days of commercial wireless. I have seen no evidence that they were used by the railroads, but the possibility cannot be ruled out.

Libraries, a Good Source

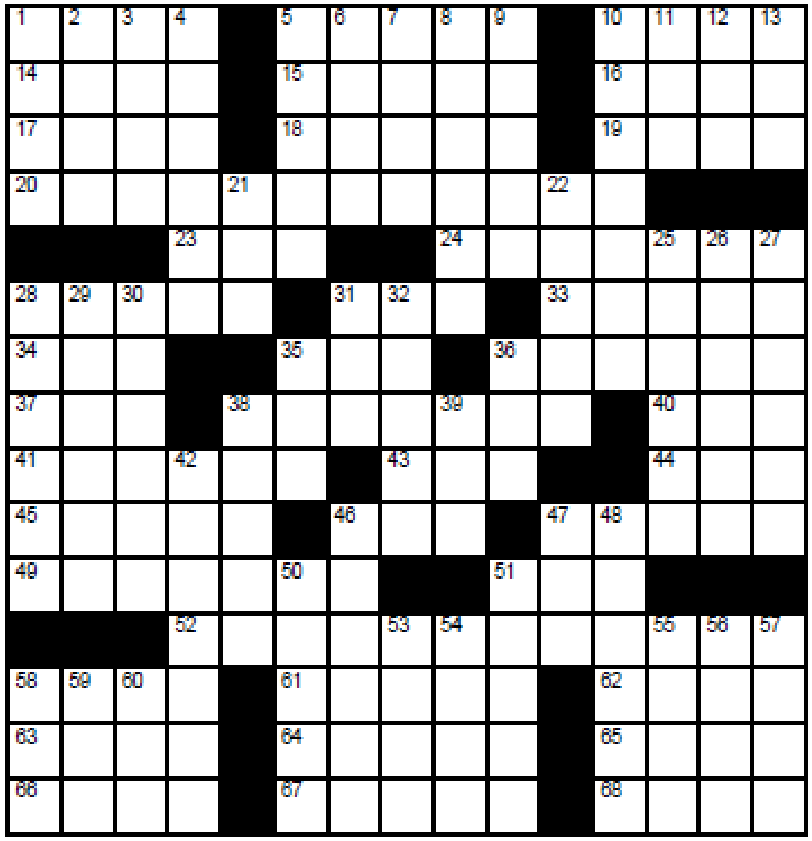
Much interesting history stands behind our hobby, and its real beginning starts even before Marconi; a slow evolution which began on the singing wires of the American railroads. For historically oriented radio buffs, I recommend a visit to the local library in search of old books on telegraphy, railroad operations and wireless. The most informative ones, it seems, were published between 1880 and 1920.

One book you might enjoy is The Telegraph Instructor by G. M. Dodge. This charming volume delves into considerable detail on telegraph and railroad operations. First published in 1898, several editions followed later. From it, you can learn meanings of slang words then in vogue, how to set up and care for a gravity battery, and a host of other things. Incidentally, for many years Dodge ran a school in Valparaiso, Indiana, called Dodge's Telegraph and Railway Accounting Institute, starting about 1891. In later years a wireless department, complete with a 2-kW Marconi Marien set, was added, and the name of the school was modified to reflect this. Apparently, he was also president of the Northwestern Indiana Telegraph Company.

There may still exist in some obscure location, historical records of these and similar institutions. Perhaps somewhere out there lies the answer as to why, by some stroke of luck, we are called hams, rather than plug radio operators.

by Chris Codella, W2PA 7/15/2009

Ham Humor, Part 1



Across

1. Four after A
5. High frequency prefix
10. Two is one
14. Dubai designator
15. Best condition for contesting, or tower climbing, say
16. ZS neighbor's prefix
17. AI language
18. Diminish
19. FET type
20. With 41 and 52 across, society highlighted in 36 across and founded by 31 down
23. VE2 way
24. They make some displays play
28. Skedaddles
31. Buzzer (non-RF)
33. 5N dough
34. Mint alt., on eBay, e.g.
35. "Excuse me", low in the band
36. QST department
37. React. plus res.
38. Hams love them
40. Bird word
41. See 20 across
43. Owns
44. Coffee maker
45. "Sesame Street" regular
46. Cut 100
47. Salad green
49. Kane's word
51. "QRZ?"
52. See 20 across
58. N.Y.C. part
61. 4W, was CR8 during the time of 31 down writing 36 across
62. Tuvalu
63. Houston university
64. 31 down's prefix
65. She sheep
66. Rotating rings for towers
67. "Yes, Sen. Kennedy", familiarly
68. Zero

Down

1. Unadorned
2. Nassau prefix
3. EME antenna
4. IC-7800, say, in JA
5. Grammar topic
6. Radiation pattern feature
7. Ski lift
8. Respond again, on RTTY, say
9. "He's ___ nowhere man"
10. Tool for reducing spectrum width?
11. 20's dispenser
12. JA transceiver maker middle
13. Don'ts partner
21. Famous DXpedioner, when 31 down wrote 36 across, familiarly
22. Trillions of zeptos
25. Goof
26. Passions
27. 5th century G-land settlers
28. Last second on-line bidder
29. D6 place
30. Poplars, in W0, say
31. Callsign suffix of one time 36 across writer and creator of 20 across.
32. Zero zulu in two-land June
35. Articulate
36. Very popular examples of 38 across
38. Early radio maker
39. Fast no more
42. Decorates 60's-style
46. "...like taking ______ from a fire hose." (information overload)
47. Half a Latin dance
48. T.O.M.'s series of articles
50. Where the DX might be listening
51. Kit alternative
53. Radiate
54. UHF antenna type, with dis-
55. Prefix in Lombardia
56. First astronaut ham, familiarly
57. Well known DXer KH6IJ when 31 down ran 36 across
58. Disp. device before LCD, LED
59. Early first century year
60. Inter-area NTS org

B	C	D	E		U	L	T	R	A		B	A	N	D
A	S	I	X		S	O	B	E	R		A	T	W	O
L	I	S	P		A	B	A	T	E		N	M	O	S
D	X	H	O	G	G	E	R	Y	A	N	D			
			R	U	E			P	L	A	S	M	A	S
S	C	A	T	S		B	E	E		N	A	I	R	A
N	O	S			S	R	I		H	O	W	S	D	X
I	M	P		G	A	D	G	E	T	S		C	O	O
P	O	E	T	R	Y		H	A	S			U	R	N
E	R	N	I	E		A	T	T		C	R	E	S	S
R	O	S	E	B	U	D			W	H	O			
			D	E	P	R	E	C	I	A	T	I	O	N
C	I	T	Y		T	I	M	O	R		T	T	W	O
R	I	C	E		W	N	I	N	E		E	W	E	S
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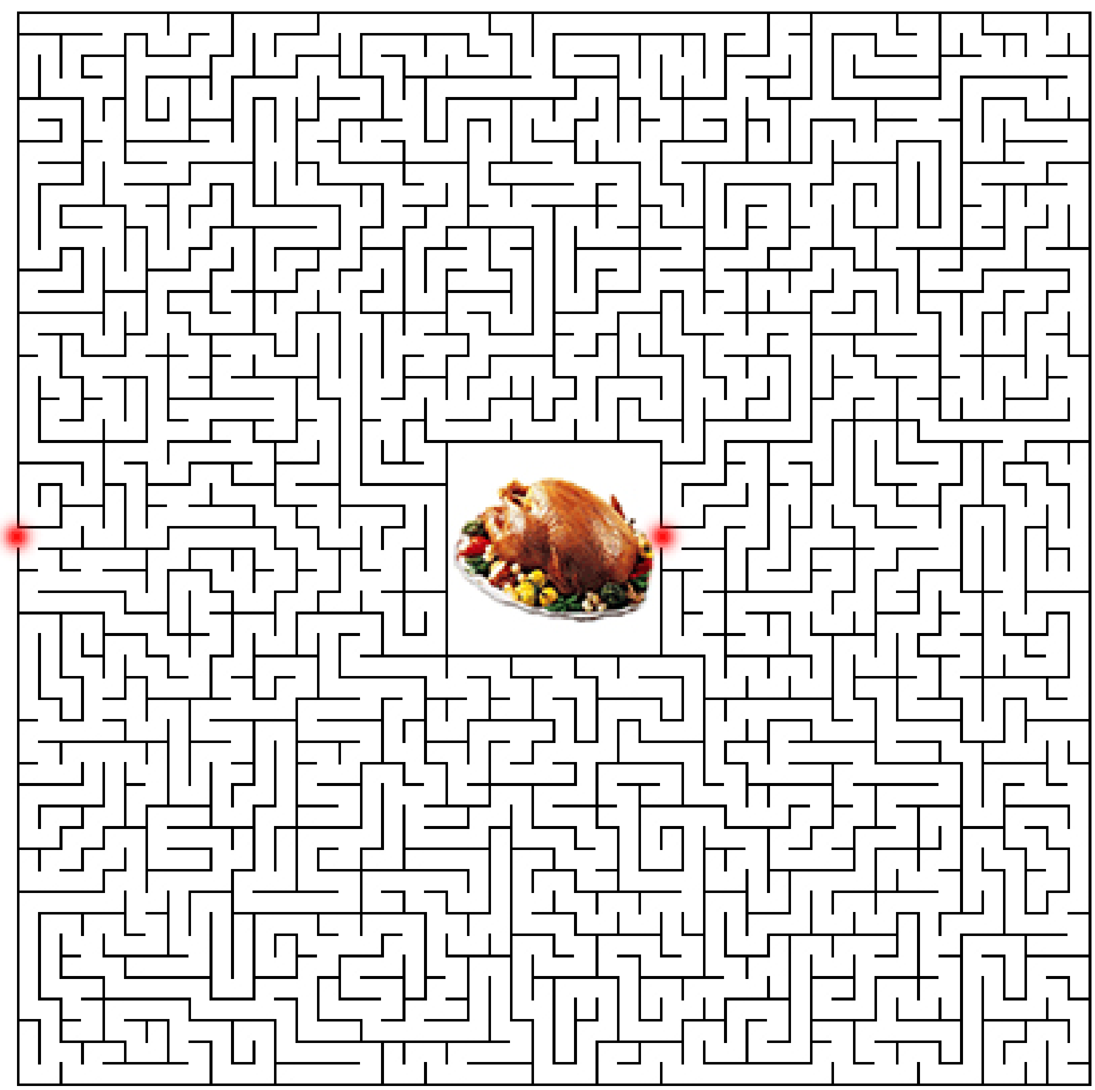


Basic J-Pole Antenna for the 220mHz Band (1.25 Meter band)

The 220mHz ham band is the least popular ham band in the VHF/UHF portion of the ham bands. It is not used nearly as much as the 2 meter or the 440 ham bands in the U.S.

According to Repeaterbook.com, there are 81 220mHz repeaters compared to 608 2 meter repeaters in Texas as of this article date, 02-2014.

But if you have "220" repeaters near you and wish to try your skill at building an antenna and operating on this fun band...read on!

The J-pole antenna is an end-fed omnidirectional dipole antenna that is matched to the feedline by a quarter wave transmission line stub. Matching to the feed-line is achieved by sliding the connection of the feedline back and forth along the stub until a VSWR as close as possible to 1:1 is obtained. Because this is a half-wave antenna, it will exhibit gain over a quarter-wave ground-plane antenna. This article will get you started in building the J Pole antenna for the 220 ham band, also called the 1.25 meter band. The specific lengths, etc in this article are for the center of the FM repeater input frequency of the band.

The J-pole antenna is somewhat sensitive to surrounding metal objects, and should have at least a quarter wavelength of free space around it. The J-Pole is very sensitive to conductive support structures and will achieve best performance with no electrical bonding between antenna conductors and the mounting structure. (This last sentence is debatable and ignored by many builders). Most builders use an air wound choke made from 50 ohm coax at the bottom of the antenna. About 4 to 6 coils of coax formed into a circle usually does the job.

In this article you will find a basic drawing of a J Pole antenna below and the lengths, spacings, and other details to build one for the 200 mHz ham band. More specifically, the article details lengths and spacings for the center of the FM repeater input section of the band.

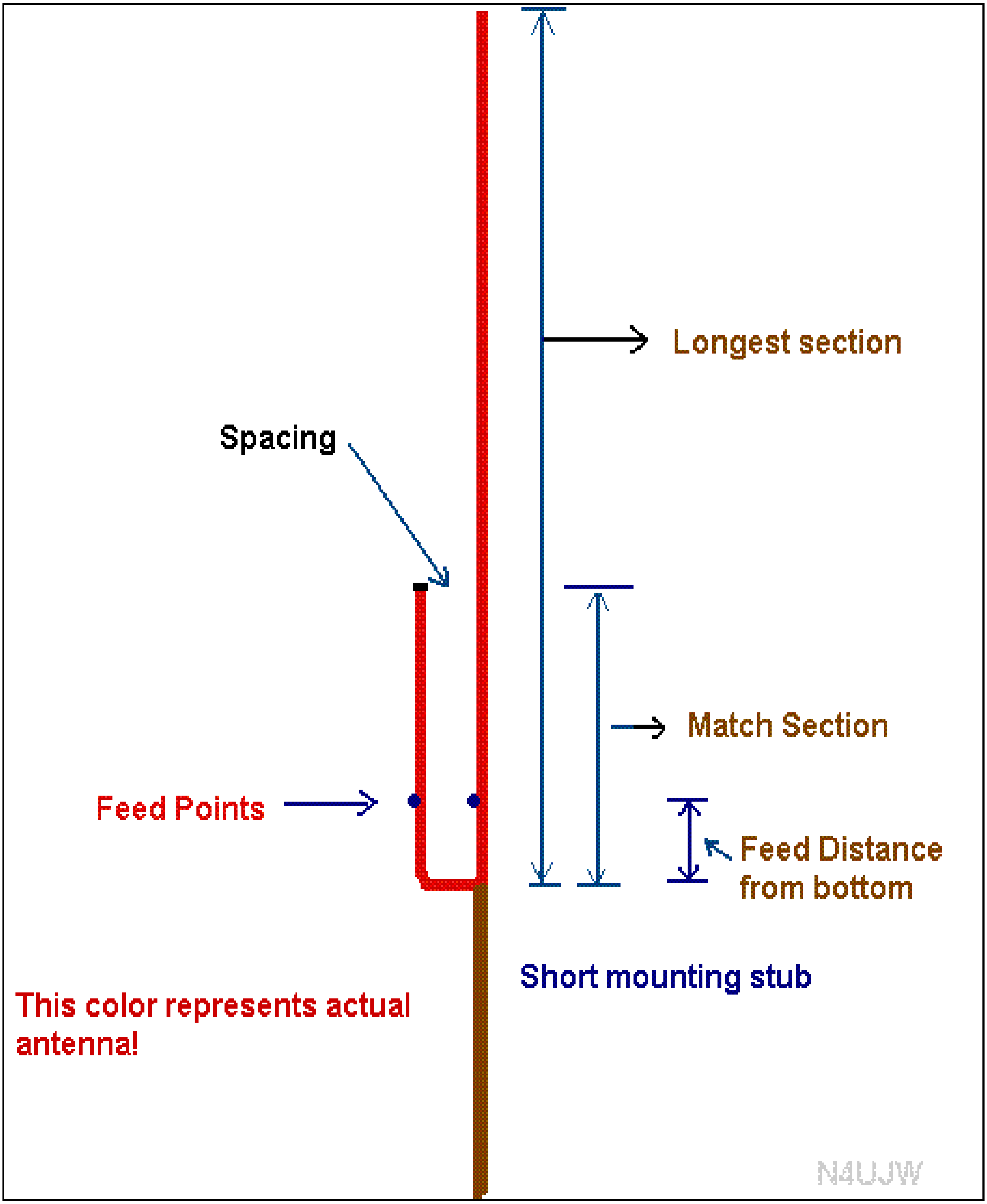
The 220 band frequency range in the U.S. is between 219mHz and 225mHz so we looked at the ARRL suggested band plan and used 222.8mHz as the design frequency for this project. It is in the center of the repeater portion of the band plan. You may want to consider another frequency if needed and adjust the lengths and feed point connections as needed.

Note in the drawing above the wording, "This color represents the actual antenna!", refers to the red/orange color, not the brown color to the right of the wording. That is the support for the J pole.

MARCH 1976
$1.50

73 ANTENNA ARCHIVES #52

AMATEUR RADIO



In the drawing above, you will see one long vertical element "spaced" a short distance from a shorter vertical element and connected at the bottom. This is called the "spacing" as you will see later in the lengths section of this article below. The feed points, noted by the dots in the drawing near the bottom, are actually connected to a part of the lower matching section that consists of a 1/4 wave section. These feed points are the connection points for the coax feed line. The shield of the coax connects to the SHORTEST ELEMENT. The center conductor connects to the longest element. You will want to make these connections temporary at first for swr tuning.

They are adjusted up or down equally from the bottom "U" spacer for best swr after the antenna is built and installed.

Most builders use small copper tubing and 90 degree copper elbows for the construction. However there are other methods of building the J pole antenna. Copper tubing is used for its' strength.

Also most builders use one single very long length of copper tubing for the entire longest vertical section by using a "T" copper fitting at the junction (where the color turns from brown to the different color in the drawing at the bottom of the matching section.)

Below are the lengths for a J pole designed for a center frequency of 222.8 mHz.

37.92 inches   Longest element (not including) the support below it.

12.6 inches   Short element

1.2 inches   Spacing from longest element to shortest (metal to metal, not center to center)

1.2 inches   Starting point up from the bottom for matching (adjust as needed for lowest swr)
When you achieve your lowest swr, then attach the feed connections securly.
(These lengths and measurements were taken from the J pole antenna calculator on this page.)
Note that if your swr is at or very near 1:5 to 1 using the starting point of 1.2 inches, you need not try to be a perfectionist unless you are!

The formulas used for designing a J Pole antenna are as follows:

Total length (1/2 wave element)	705 / frequency of use = feet
Short length (1/4 wave element)	234 / frequency of use = feet
Feed Tap Point up from bottom)	23 / frequency of use = feet
Spacing between long and short sections	22 / frequency of use = feet

Multiply feet X 12 to convert to inches.

A J pole antenna will get VERY tall for lower frequency bands. One designed for the low end of the 80 meter band would be over 200 feet tall! Now try that on your pickup. Just kidding.

73 N4UJW   Credit: http://www.hamuniverse.com/220fmrepeaterjpole.html

MEMBERSHIP APPLICATION

EPARA

Eastern Pennsylvania Amateur Radio Association

Address: PO Box 521, Sciota, PA 18354

Email: N3IS@qsl.net

Website: www.qsl.net/n3is

Date: ________________________

Name: ____ **Callsign** _________________

License: Novice Technician General Advanced Extra

Address: ____

City: ______________________________________ **State:** _____ **Zip:** _________

Home Phone: _____________________________________

Cell Phone: _______________________________________

Email: ____

* **Note**: We do not publicize your phone or email information.

ARRL Member: _____ **Skywarn Spotter:** _____ **ARES/RACES Member:** _____ **VE:** _____

Interests:

DX _____ Contest _____ CW _____ QRP _____ Digital Modes_____ Antique Radio Equipment _____

Building Antennas _____ Electronic Repairs _____ Elmering _____ Kit Building _____ EmComm: ____

Others: ____

How did you get interested in Ham Radio?

____

Please list any relevant qualifications or assets you have or are willing to share/contribute to the club.

Use reverse side if needed:

____

____

____

Sponsored or Reviewed by: ___________________________ **Callsign:** ________________

Membership Rates,

Membership: **$20.00** per year Spouse: **$10.00** per year

Full time Student: **$15.00** per year Senior:(Over 62 years of Age): **$15.00** per year