Microvolt

Monthly newsletter of the Utah Amateur Radio Club

December 2024

POWER

Whether it's for a large base station or a small HT (handheld transceiver), you're likely going to need a way to supply electrical power to your device for it to operate. But there are different ways you can provide that power, so which is the best? Or can you use more than one source at a time? Let's explore different ways, both conventional and alternative, of feeding our hungry gear with the electrical power it needs to work properly.

Cover – Power

When we amateurs speak of ***power***, we're typically talking about ***energy*** instead. Power is technically the amount of energy generated or consumed per unit time. We're so accustomed to using *power* (measured in watts) in our conversations, we don't often realize that we really mean energy (measured in joules) more often than not, but most of us have a much better "feel" for watts than for joules.

For example, it's easy to visualize a bucket of water, which is a quantity, just like energy is a quantity. But when we start pouring the water out of the bucket, the water leaves the bucket at a certain rate, just like power is a rate of energy coming or going per second. Still, as long as we keep the details in mind, we can say that our solar panel can deliver 300 watts of power, which is 300 joules of energy per second.

While energy can be realized in many forms (kinetic, potential, heat, chemical, mechanical, nuclear, sound, etc.), we tend to focus on two, electrical and electromagnetic. Our amateur radio equipment consumes ***electrical energy*** (electricity), and some both consume and deliver ***electromagnetic energy*** (radio waves). Further concentrating on the electrical side, our equipment draws energy in two forms, AC (alternating current) and DC (direct current).

AC

Alternating current is most often delivered to us as commercial (house current or mains) power or by generator. We then convert the AC into DC by means of a power supply, since nearly all amateur equipment eventually relies on DC. The definition of AC includes the fact that current flows in one direction, then in the opposite direction, in a conductor.

DC

Direct current is most often made available to us by battery, solar, or converted AC, as previously mentioned. The definition of DC includes the fact that current flows in only one direction in a conductor. While DC power by solar can be abundant during daylight hours, battery power is often very temporary, requiring constant recharging.

PSU

To convert AC into DC, you'll need a PSU, or ***power supply unit***, which is typically available in one of two forms, linear and switching. Linear PSUs tend to be more expensive and weigh more (less portable) than switching PSUs, but often employ simpler circuitry and exhibit long-term reliability. Switching PSUs tend to be more efficient (require less energy) than linear PSUs, but can exhibit RF (radio frequency) noise on certain frequencies, a problem that has largely been addressed in the latest switching PSUs.

When selecting a PSU, one of the biggest considerations is its ability to serve your needs. For most amateur radio gear, your PSU should be able to present 12.0 volts to 14.0 volts, even if your rig specifies 13.8 volts. Another important property is its amperage, or current-handling ability. Some manufacturers advertise PSUs by their output wattage, but that can be misleading. What you really need to know is how many ***amps*** your equipment requires. Then, your PSU selection will be a more educated decision.

Microvolt editorial staff

Editorial – More power to you

The simple fact is that we amateurs want to be heard when we transmit. There are good ways to improve your transmission, such as raising your antenna, removing common-mode noise, and speaking clearly and closer to your microphone. Sometimes, we just want more available power. It's been said that *knowledge is power*, but understanding power and power sources can require a little knowledge too.

Calculations

Power can be calculated in several ways, depending on the physical device that's requiring or dissipating the energy. Probably the two most familiar to amateurs are the ones involving electrical components. Because P = I x E and E = I x R,

$$P = I^2R \text{ and } P = E^2/R$$

Whether you know the voltage or the current quantity, if you know the resistance, you can calculate the power dissipation of a component, whether the voltage and current are AC (alternating current) or DC (direct current).

Complex power

When the opposition to AC current flow is dependent on reactive (by inductors and/or capacitors) components, the power calculations can take on a different form. This is known as **complex power** and starts by replacing resistance R with **impedance** Z:

$$Z = R + jX$$

$$X = X_L - X_C$$

$$X_L = 2\pi fL \text{ and } X_C = 1/(2\pi fC)$$

Because of the dependency on f (frequency), L (inductance), and C (capacitance), the resulting power calculations can become a bit messy very quickly.

Amplifiers

There might be times when a little more transmit power is what you need, to get the attention of that elusive distant station. An **amplifier** can help tremendously by boosting your signal higher than the 100 watts your rig was born to deliver. But, be sure that you've done all you can to optimize your antenna before you start sinking good money into an amp.

Alternative power

It's assumed that most of your amateur station power needs are being met by either batteries or commercial (wall socket) power. Many modern hams are exploring **solar power**, which this issue discusses in the ***Strays*** column. But alternative means such as wind, hydro-electric, and even pedal (mechanical) power are possible. And if you have the inclination, you can explore how to combine different sources.

In the 1973 movie ***Soylent Green***, Edward G. Robinson plays a character in an apartment, for which he must daily pedal his generator-mounted bicycle. Not only does he recharge the batteries, but he also gets a little exercise in the process.

Finally

Keep in mind that more power is not always better, especially when boosting a distorted signal results in a stronger distorted signal. Also, if you're attempting to send your message over the horizon, you might be at the mercy of the current **band conditions**.

Anything to add? Email ***editor@utaharc.org***

Letters to the editor

Dear Editor:

Is it true that an N connector is better than a UHF connector?

Jordan in Sugarhouse

Dear Jordan:

The N connector is not "better" but it does have properties that differ from those of the PL/SO connector. It's just that the characteristics (impedance, noise, cost, ease-of-use) of the N connector really do not outweigh those of the PL/SO connectors below about 600 MHz. But because they start to outweigh them with increased frequency greater than about 600 MHz, purists insist on their general use, especially because of their presence in commercial and military applications. Yet, we amateurs confine most of our operations to below 500 MHz, so switching to the costlier N connector in most cases simply does not make sense.

Dear Editor:

I'm a new Tech, and I've heard about spectrum analyzers. What's their purpose, and do I need one?

Devon in Riverton

Dear Devon:

A spectrum analyzer is a device that displays the detected strength of received signals for a continuous range ("spectrum") of frequencies. This allows you to visualize 1) whether the radio is transmitting on the frequencies you expect, 2) how much signal power your radio is transmitting on any of the frequencies within that range, and 3) whether your radio is transmitting on frequencies outside the expected range.

Is a spectrum analyzer useful to you? Only if 1) you suspect problems with your transmitting equipment or 2) you intend to use one many times, like in helping others diagnose problems or in teaching classes.

Dear Editor:

Last month's cover story (***Doing it yourself***) mentioned putting together a kit as a club project. Is building a project from a kit truly "DIY"?

Jed in Salt Lake City

Dear Jed:

It seems that the true spirit of "DIY" is building or designing something yourself. Maybe the question is the distinction between building something yourself and *building something from scratch*. Either way, I suppose it depends on how far you want to take it. Is it still *DIY* if you didn't construct the resistors?

Dear Editor:

I have my General Class license, and I'd like to upgrade to Extra. But I'm afraid I've forgotten pretty much everything since I last studied for an exam. How well should I know and understand the material before attempting the Extra license?

Don in Salt Lake City

Dear Don:

You'll only need to absorb as much as needed to pass the Extra Class license exam, so ***knowing*** and ***understanding*** the material are quite optional and at your discretion. The real learning comes by experience after you pass the exam and getting involved with amateur radio in your own fashion. This way, you can select after passing the exam which facet(s) of the craft are relevant to your interests without wasting your time poring over details of little practical value to you before passing the exam.

Send your thoughts to ***editor@utaharc.org***

Club news

Gary Crum KK7DV was scheduled to present at the November 2024 club meeting on the HF remote stations. But, he fell ill, and James Bennett KK7AVS graciously picked up the task of running the presentation, and did a wonderful job.

James first paid tribute to Chris Price W7CHP, who recently became a silent key. He mentioned what a great mentor and encouraging friend Chris was, and what a loss to the amateur radio community. Next, James acknowledged the irritating presence of a jammer on the Intermountain Intertie and the '62 repeater. His counsel is to attempt to listen to the jammer on reverse, and report your finding, plus your antenna information, to the club leadership.

James turned the time to Clint Turner WA7OEI to share his knowledge about the club HF remote stations located in Leamington and Fairview. Clint explained how the stations can be remotely controlled, and why one would want to do such a thing.

James showed photos of several work parties out at the remote sites, where a lot of sweat was worked out of everybody who participated. Among the tasks

accomplished were the large antennas, guy wires, and battery installation.

You can see the video presentation here: ***https://www.youtube.com/live/Tkqooh9Xdxw****. Visit the club YouTube channel to view past club meeting presentations:* ***https://www/youtube.com/@UtahAmateurRadioClub***

(Photos courtesy James Bennett KK7AVS, et al)

UARC is now officially a 501(c)(3) non-profit

After long last, UARC has finally received the letter from the IRS in July 2024 indicating our club is officially designated as 501(c)(3) non-profit status, paving the way to a number of opportunities going forward.

End of the printed and mailed Microvolt

We're about to reach the end of a long era. Or rather, we're about to embark on a new era. Starting with the January 2025 issue, *Microvolt* will no longer be mailed out in printed form and will be available in digital form (online) only. This (December 2024) issue will be the final issue that we plan to print and mail to members. If you'd like a printed copy and don't have reasonable access to a color printer, please reach out to us at **uarc@xmission.com**

For your information

Microvolt has expanded!

Your club newsletter *Microvolt* is now longer than the 8 pages you're used to. See the rest of the story in the online version, located at

https://user.xmission.com/~uarc/Microvolt/2024/December2024.pdf

Winter Field Day 2025

UARC plans to participate in Winter Field Day for the first time in many years, possibly the first time ever. WFD takes place from noon Saturday January 25 through noon Sunday January 26. We're still trying to nail down the location, but meanwhile please feel free to contact James Bennett KK7AVS (kk7avs@gmail.com) with questions.

Field Day 2025

Saturday noon 28 June through Sunday noon 29 June **near Payson Lakes**. We plan to start setting up Thursday night about 6:00 pm.

License classes

Salt Lake:

General : Tuesdays 7:00 pm to 9:00 pm
147.160+ MHz (127.3 Hz tone)

Orem:

Technician : 4 Tuesdays, 6:30 to 8:30 pm
Jan 21, Jan 28, Feb 4, Feb 11
Visit **psclass.orem.org** to register ($10)
Orem Traffic Training Room, 95 E Center St
HamStudy.org account required
Email **nojiratz@hotmail.com** for info

Eagle Mountain:

Technician : 5 Thursdays, 7 to 9 pm
Feb 6, Feb 13, Feb 20, Feb 27, Mar 6
Email **ki6oss6365@gmail.com** to register (free)
Eagle Mountain City Hall, 1650 Stagecoach Run

Exam sessions

Salt Lake County:

- Email Garth Wiscombe W7PS **w7ps@arrl.net**
  May 20, Jun 24, Jul 29, Aug 25, Sep 30, Oct 28, Nov 25
- Email Rick Morrison W7RIK **w7rik@arrl.net**

Utah County:

- Wed 19 Jun 7:00 pm : **Provo** : **signup**
- Wed 17 Jun 7:00 pm : **Provo** : **signup**
- Sat 22 Jun 10:00 am : **Eagle Mtn** : **signup**

Club repeaters

Farnsworth Peak : 146.620– MHz (no tone)
Scott Hill : 146.620– MHz (no tone)
Lake Mountain : 146.760– MHz (no tone)

SDRs and beacons

Northern Utah WebSDR : **sdrutah.org**
KK7AVS SDR : **k7xrd.club**
N7RIX SDR : **https://sdr.n7rix.com**
K7JL beacon 28.2493 MHz

HF remote and club transceiver stations

If you'd like to learn how to get started using the remote stations, visit the **HF Remotes link** on **the club website**:
https://user.xmission.com/~uarc/HFRemote.html

How can I help?

Reach out to the club leadership by sending an email to **uarc@xmission.com**. Also, add to this page by emailing **editor@utaharc.org**

Spotlight – Noji Ratzlaff KNØJI

As a young lad, Noji Ratzlaff has always had a fascination with electronics, space, and science in general. His grandfather took him aside many times to tutor him in basic electricity and other sciences, especially astronomy. By age 13, Noji's grandfather helped him get his amateur radio Novice license. After a couple of years, however, his grandfather passed away and other interests arose, so amateur radio took a back seat.

Fast-forward many years, and after marriage, college, and kids, a fellow ward member challenged Noji and his wife to become licensed amateurs to help out with communications in an upcoming stake trek (re-enactment of the Mormon pioneer migration). After some study, Noji eventually became KNØJI and wife Lisa became KR5LYS.

Since those days, Noji has taught all three levels of amateur radio classes for years (including full courses at the UofU, UVU, BYU, and the MTC), promoted amateur radio on many platforms, and has held many seminars and presentations in LDS wards and stakes, plus at city centers, apartment complexes, preparedness fairs, hospitals, and the National Guard.

Asked what kinds of changes he's seen in ham radio through the years, Noji replied, *I believe the three largest milestones that have positively transformed amateur radio in the last twenty years have been the removal of the Morse code requirement, the introduction of the Baofeng HT (handheld transceiver), and the public posting of the amateur radio exam pools coupled with the completely renovated VE program. There have been other positive improvements, but these top the charts, in my opinion.* When asked for his thoughts on why he feels the way he does about the Baofeng radio, he said, *It's not the most technically superior transceiver on the market, but the price point and simple dual-band features of this little marvel have placed ham radio within the reach of many who previously could not have had the opportunity to participate.*

Above all, Noji loves his family, and his wife comes first in all things. He also enjoys meeting people, especially new hams, and sitting and talking with them about any aspect of amateur radio. He loves teaching courses, building projects, consulting, mentoring, contesting, but most of all, installing antennas. He has **a website** that posts many amateur radio topics, including **equipment links**, a **training page**, a **new ham page**, and the **ultimate ham radio glossary**.

His ham radio gear includes

Icom IC-7300	Hustler 5-BTV	Yaesu FT-8800R	Yaesu FT-4XR
Kenwood TS-450S	Diamond X510H	Yaesu FT-2900R	Yaesu FT-60R
Yaesu FT-857D	Diamond F23H	Kenwood TM-D700A	Yaesu FT-65R
Yaesu FT-100D	Diamond NR770H	TYT TH-7800	Yaesu VX-7R
Yaesu FT-840	Hustler SF-2	TYT TH-8600	Yaesu VX-8R
Icom IC-735	Comet SBB-25	BTech UV-2501	RigExpert AA-170
Icom IC-728	Pockrus J-pole	Icom IC-2720H	NanoVNA H4
Yaesu FT-757GX	Signal Stick	Baofeng UV-17 Pro	Kenwood SM-230
Icom IC-718	Smiley Half-wave	Baofeng UV-21R	Quansheng UV-K6

Noji and Lisa have four kids, three of whom are licensed amateurs, and over a dozen grandkids. He received a BSEE / BSMath (double-major) from BYU and MSEE from University of Arizona, and currently works as an engineer in the aerospace industry developing military drones for Lockheed Martin / Skunk Works. Today he is the UARC *Microvolt* Editor and the UVARC (Utah Valley Amateur Radio Club) President. He's also an ARRL Lifetime Member, amateur radio instructor, CERT instructor, VE (Volunteer Examiner), **karate instructor**, and the author of many **amateur radio-related articles**. Noji was even featured once in the **May 2021 issue of QST**.

– 73 and thanks for all you do, Noji!

Microvolt is the official publication of the Utah Amateur Radio Club, Inc. (UARC), 3815 S 1915 E, Salt Lake City, UT 84106, and is published monthly. Reprints are allowed with proper credits to *Microvolt*, UARC, and authors. Online versions located at **https://user.xmission.com/~uarc/Microvolt**

We encourage you to submit original pictures (highest resolution), articles, software and hardware descriptions, appropriate humor, and responses to editorials. Email the content, pictures attached, to the editor at **editor@utaharc.org** by the 24th just prior to the target month.

The **Utah Amateur Radio Club** was organized under its present name in 1927, although its beginnings may date back as early as 1909. In 1928, it became affiliated with the American Radio Relay League (club #1602) and is now a 501(c)(3) non-profit organization. It holds a club station license with the call sign W7SP, a memorial to Leonard "Zim" Zimmerman, amateur radio pioneer in the Salt Lake City area.

The club meets each month except July and August. The meetings are usually held on the second Thursday of the month at 7:30 PM in the University of Utah's Warnock Engineering Building, room 2230.

Club membership is open to anybody interested in amateur radio; a current license is not required. Dues are $20 per year, including a *Microvolt* subscription, which cannot be separated from membership. Those at the same address as a member who has paid the $20 can obtain a membership without a *Microvolt* subscription for $12. Send dues to club secretary James Bennett, 4960 W 5400 S, Kearns, Utah 84118. Email address changes to **kk7avs@gmail.com**

Tax-deductible monetary contributions are gladly accepted. Send directly to club treasurer Shawn Evans, 1338 S Foothill Dr, #265, Salt Lake City, Utah 84108-2321. For in-kind contributions, please contact **uarc@xmission.com** to make arrangements.

UARC maintains the 146.620– and 146.760– repeaters, which are administered by the UARC Repeater Committee. Direct comments and questions to any committee member. The 146.760– repeater is on IRLP node 3352.

Call the **UARC Ham Hotline** at **801-583-3002** for amateur radio information, including club, testing, meeting, and membership information. Leave a message, and we'll make an effort to return your call.

Microvolt (USPS 075-430) is printed monthly except August, by the Utah Amateur Radio Club. Periodicals postage paid at Salt Lake City, Utah.

POSTMASTER: Send address changes to *Microvolt*, c/o James Bennett, 4960 W 5400 S, Kearns, Utah 84118.

UARC 2024 Board

President: Marvin Match, KA7TPH
Exec. Vice President: Linda Reeder, N7HVF
Vice President: Bruce Fereday, KF7OZK
Secretary: James Bennett, KK7AVS
Treasurer: Shawn Evans, K9SLE
Microvolt Editor: Noji Ratzlaff, KNØJI
Asst. *Microvolt* Editor: Ricky Asper, AC7RA
Program Chair 1: Mike McAinsh, KI7MTI
Program Chair 2: Jeri Brummett, WJ3RI
Immediate Past President: Morris Farmer, AD7SR

For late breaking news listen to the UARC Information Net, Sundays at 8:30 pm on 146.620– or visit the announcement page.

We are grateful to the management of our internet service provider XMission, for the donation of our web service. For account information go to https://xmission.com/ or call 801-539-0852

EIN : **99-0407768**

Utah Business Registration : **575790-0140**

Tech corner – Dummy load

Seems like every once in awhile you need a ***dummy load***, something that doesn't require an antenna, but that you can connect to the output of your radio and make a test while transmitting without everybody hearing you. This inexpensive one will handle 100 watts from DC to 54 MHz.

When designing or building a dummy load, be careful to purchase resistors that present a constantly resistive impedance regardless of frequency.

Parts list

Four **50-ohm 100-watt resistors**

24 inches of **14 AWG stranded speaker wire**

Four **#6-32 screws**, **nuts**, **split washers**

Seven **16 AWG #4 stud ring terminals**

One **5″ x 7″ x ¼″ fiberboard sheet**

One **SO-239 bulkhead connector**

One **4″ x 10″ copper sheet**

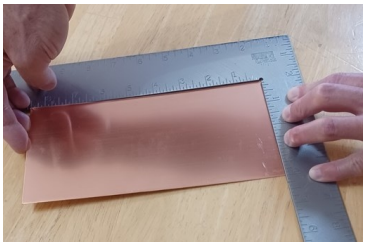
Four **adhesive LRFs (little rubber feet)**

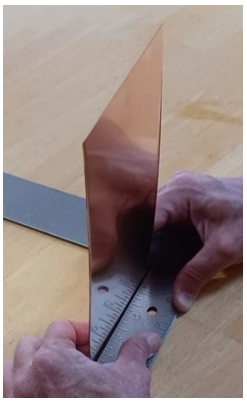
Four each **M3 screws**, **split washers**, **nuts**

Eight **#6 ½″ metal spacers** Eight **M3x25mm screws**

Body preparation

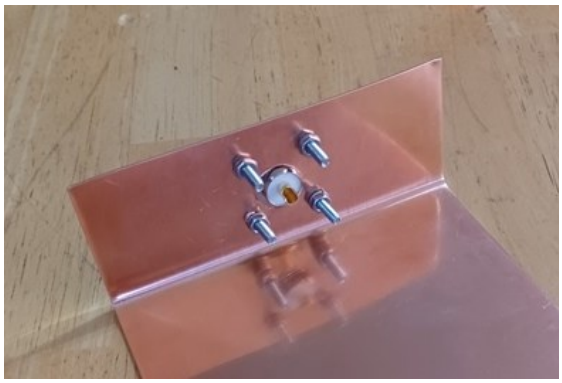
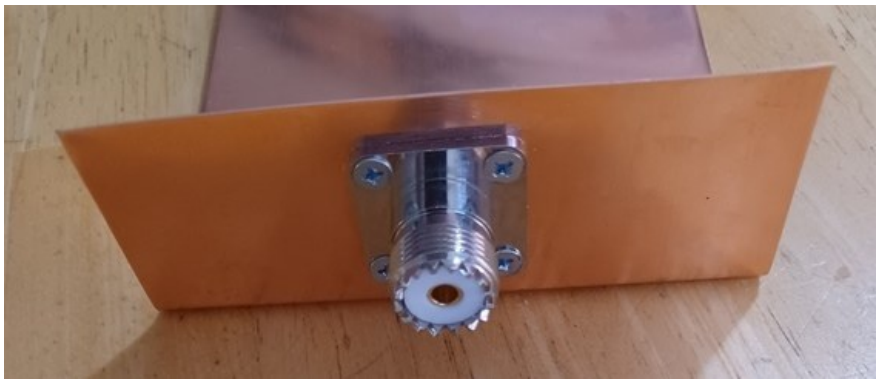
Bend 1½″ of one end of the copper sheet into a right angle. The bend tends to be a little more uniform and square if you use a carpenter's square, by lining up the long side against the square and pressing down on the square while bending the sheet upward.






Connector assembly

Drill a ½″ hole in the center of the 1½″ end that's bent upwards. Place the solder cup end of the SO-239 bulkhead into the ½″ hole on the outside of the enclosure, and using the four mounting holes of the bulkhead as a template, drill a 1/8″ hole for each mounting hole. Assemble the bulkhead onto the copper plate bend using the M3 smaller screws and hardware.

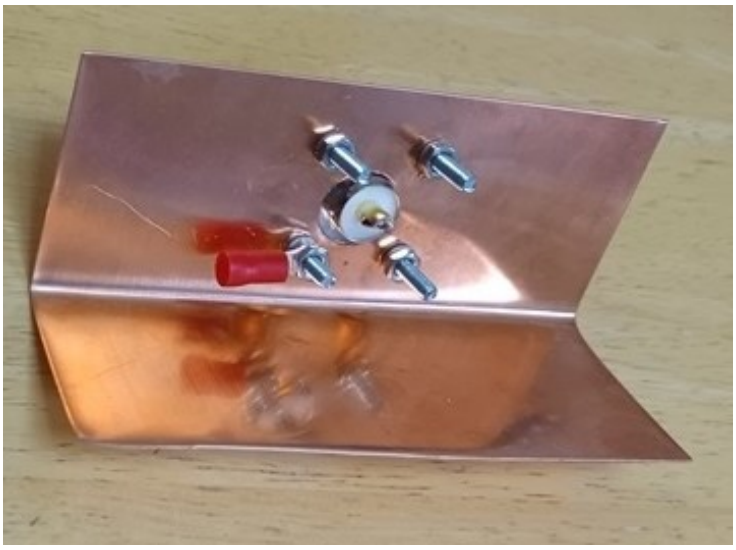



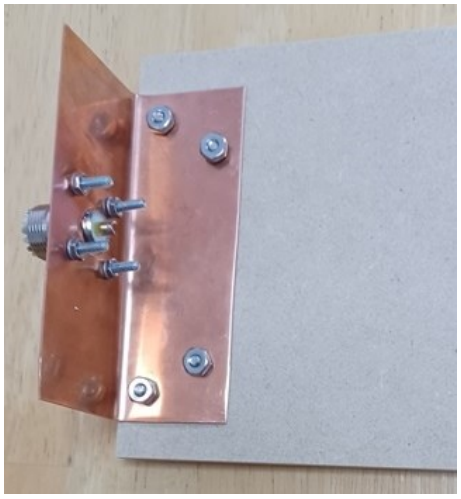
Cut off all but 1½″ of the copper sheet. I suppose I could have simply started with a 4″ x 3″ sheet, and then

Tech corner – Dummy load, cont'd

bend it in half, but I found it easier to bend the larger 4″ x 10″ sheet, then cut off the excess 7″. Line up the edge of the copper sheet bend with one of the 5″ ends of the fiberboard sheet, and drill four 9/64″ holes in both the copper sheet bottom and the fiberboard sheet. Install the four #6 hardware to secure the copper to the fiberboard base.

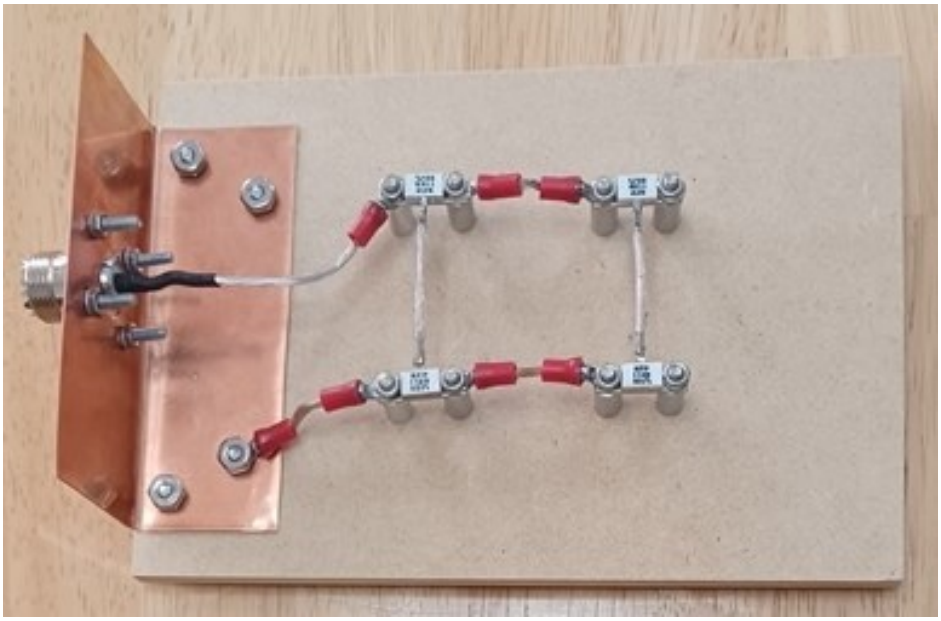
Resistor network assembly





Arrange the resistors on the fiberboard sheet, allowing for plenty of space on the sheet for ventilation, including the spacers. Drill 1/8″ mounting holes for each resistor, and mount the resistors to the sheet using the spacers and M3 25-mm hardware.

Separate the entire length of the speaker wire into its two conductors. Solder one of the speaker wires to the #4 ring terminal that's mounted to the copper sheet. Solder another to the center conductor of the bulkhead connector. (I added heat shrink to cover it.) Cut and strip the speaker wire to accommodate the wiring lengths needed for each connection, then solder the wires according to the photo on the right. *The little foil tabs of the resistors are very delicate; use extreme care when touching and soldering them.*



Solder one wire between the tabs of two of the resistors, and another wire between the tabs of the other two. Connect the wire of the bulkhead center conductor to a pair of the resistor bases, and the wire of the copper sheet to the other pair of resistor bases. Apply the LRFs.

Testing the dummy load

Tech corner – Dummy load, cont'd

Testing required three steps, first by an ohmmeter,

next by an analyzer, and finally by my Kenwood HF rig transmitting FM on 20 meters at maximum power (100 watts) with the Send (not PTT) button pressed.

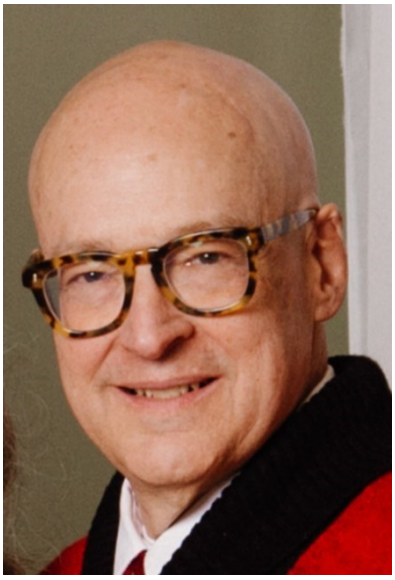
The ohmmeter showed 50.2 ohms, well within the 5% tolerance of the components. The analyzer showed good results for 80 meters, 40 meters, 20 meters, and 10 meters, but not that great for 2 meters. 6 meters was on the acceptable boundary, so it appears that this dummy load is not useful for frequencies higher than 54 MHz, in spite of the resistors' advertisement. In the end, this will probably make a good HF / 6-meter dummy load. Also, this dummy load does get hot at 100 watts, so I recommend that you only use it for about ten to twenty seconds at a time when dissipating high power, since it has no heat sink or fan. And if you want to add those, I leave it as an exercise for your own build.

Noji Ratzlaff KNØJI

Silent key– Chris Price W7CHP

On 08 November 2024 the amateur radio community lost a giant friend and elmer. James Bennett KK7AVS said, *He was a great friend and a real great mentor in the hobby, and I absolutely loved working with him. He was very involved with ARES as well as making sure we all stay connected in a disaster or whatever might come our way*.

Chris volunteered as a ride marshal with UtahSAG for numerous charity bike rides. This motivated him to obtained his Technician Class license in 2014, and he became KG7LRD. Chris then upgraded to General Class in April 2020, and finally to Extra Class in December 2020. In February 2021, he changed his call sign to W7CHP. Chris was a VE (volunteer examiner), an ARRL member, and participated in SLCOARES. He was last a member of **SDARC (Sinbad Desert Amateur Radio Club)** and the Utah VHF Society.



From the comfort of his Sandy home, Chris became the net control operator for the Thursday morning net of the **Sunshine Coast Amateur Radio Club VK4WIS**, located in Queensland, Australia. He was a regular check-in on the weekly Salt Lake 10-meter Net, and has joined several nets in the Salt Lake area. He became a contender for the **ORARI (Organizer Amateur Radio Indonesia) award** in July 2024 for his FT8 contacts on 20 meters.

A Pennsylvania native, Chris had a love of cars at an early age, and that love led him to a Mechanical Engineering degree from Lehigh University. He worked in his career as a mechanical engineer at companies such as ICI America, Ford Motor Company, Hercules, and retired as Vice President of Engineered Storage Products. He celebrated an "end of life crisis" by acquiring a red Shelby Cobra.

You can read more about Chris and his life on **his obituary** and on **his QRZ page**.

73, Chris. You'll be missed by many.

Strays – Solar power

Many modern amateurs look to the Sun as a seemingly free, renewable, and limitless energy source. Whether it's by solar panels on our roofs or through a tiny film sheet on a calculator, we're taking advantage of technology that converts ***radiant energy*** into ***electrical energy***. Because of today's availability and relatively low cost, coupled with an increasing energy demand, ***solar power*** is quickly turning from a fad into a necessity.

If you're thinking you might want to join the solar crowd and become one of the cool kids, there are several parts to a solar setup that you'll need to collect. They include, but are not limited to, a solar panel, a solar charge controller, a battery, and possibly an inverter.

Panels

The most obvious component of your solar setup is a solar panel, a device made of many solar cells that convert sunlight into DC (direct current) electricity. Each solar cell is made of tiny semiconductor diodes that generate electric current from absorbed light.

Today, many homes throughout the world have solar panels installed on their roofs, as a means of reducing both their power bills and reliance on an expensive infrastructure.

Charge controller

The sunlight striking the surface of a solar panel can be bright and direct or dim and at an angle, and the output electrical energy can vary by a large amount as a result. This wide range of voltages presented by your panels can fail to power your electrical system or burn it up if the panel output is not regulated. The purpose of a solar charge controller is to maintain as steady a voltage to your devices as possible. It's generally unwise to omit a charge controller from your solar setup.

Charge controllers come in two types, PWM (pulse-width modulation) and MPPT (maximum power point tracking), and each has its advantages. PWM controllers tend to be less expensive but also less efficient. MPPT controllers tend to be bulky and expensive, but are very efficient. For most portable radio and solar station cases, a PWM controller will do the trick. But for a permanent home solution, an MPPT controller is more often the better option.

Battery

As you likely know, batteries are available in numerous types, shapes, capacities, chemistries, and physical sizes. While you can run a solar setup without a battery, I recommend using one for energy storage, especially if you plan to operate your appliances at night. Also, a battery acts as a buffer between the solar panel and the load placed on it.

While most amateur radio equipment require 12 V to the power them, one type of battery might be better suited for your needs than others. For most ham radio setups, a $LiFePO_4$ (lithium-iron-phosphate) battery is highly recommended, because of its light weight and deep-cycle ability, but it is typically more expensive than a SLA (sealed lead-acid) battery.

Inverter

A power inverter is a device that converts DC into AC (alternating current) electricity, for appliances and equipment that need to plug into a wall outlet. This way, you can be far away from civilization and still make use of your laptop or toaster. Then again, if

Strays – Solar power, cont'd

you don't plan to use any such appliances in your solar station, you might not need an inverter.

Calculating your solar power needs

Let's take a look at how much power your amateur radio station might need in two separate examples, mobile VHF and portable HF.

Needs common to both

- Laptop (charger, and inverter = 6.6 A -» 6.6 Ah)
- Phone (12 V to USB charger = 3 A -» 3 Ah)
- Lighting (PWRbrite LED light strip = 0.2 A -» 0.2 Ah)

Common hourly energy draw = **9.8 Ah**

Mobile VHF solar solution

- Mobile radio (TYT TH-7800 = 9A, but at 50% duty cycle -» 4.5 Ah)

Total mobile VHF hourly draw = 9.8 Ah + 4.5 Ah = **14.3 Ah**

Portable HF solar solution

- Portable HF radio (Yaesu FT-891 = 23 A, but at 50% duty cycle -» 11.5 Ah)
- Tuner (LDG AT-100Pro II = 0.5 A -» 0.5 Ah)

Total portable HF hourly energy draw = 9.8 Ah + 11.5 Ah + 0.5 Ah = **21.8 Ah**

Therefore, 21.8 Ah x 12 V = 261.6 Wh is the amount of energy you'll need to run your portable HF station. Assuming an 80% efficient PWM charge controller, you'll need 261.6 Wh / 0.80 = 327 W of solar panels charging your battery for an hour, or a 100 W panel for about 3½ hours. A 100 Ah deep-cycle $LiFePO_4$ battery should easily take care of your needs. Keeping your radio transmissions short (say, 25% duty cycle) can help lower those amounts to 2½ hours with the same panel into a 50 Ah battery.

The discussion about solar power is not a trivial one, and involves some understanding of not only how to convert radiant energy into electrical energy, but also how to control it and store it. Similarly, figuring out just what it's going to take to supply your solar needs is also a little involved, but practical if you keep inefficiencies in mind. One final word about charge controllers and inverters: some of them tend to generate radio noise ("hash"), so you might want to keep that in mind too. Read the reviews and ask around, to be sure, or you might end up generating some expensive noise.