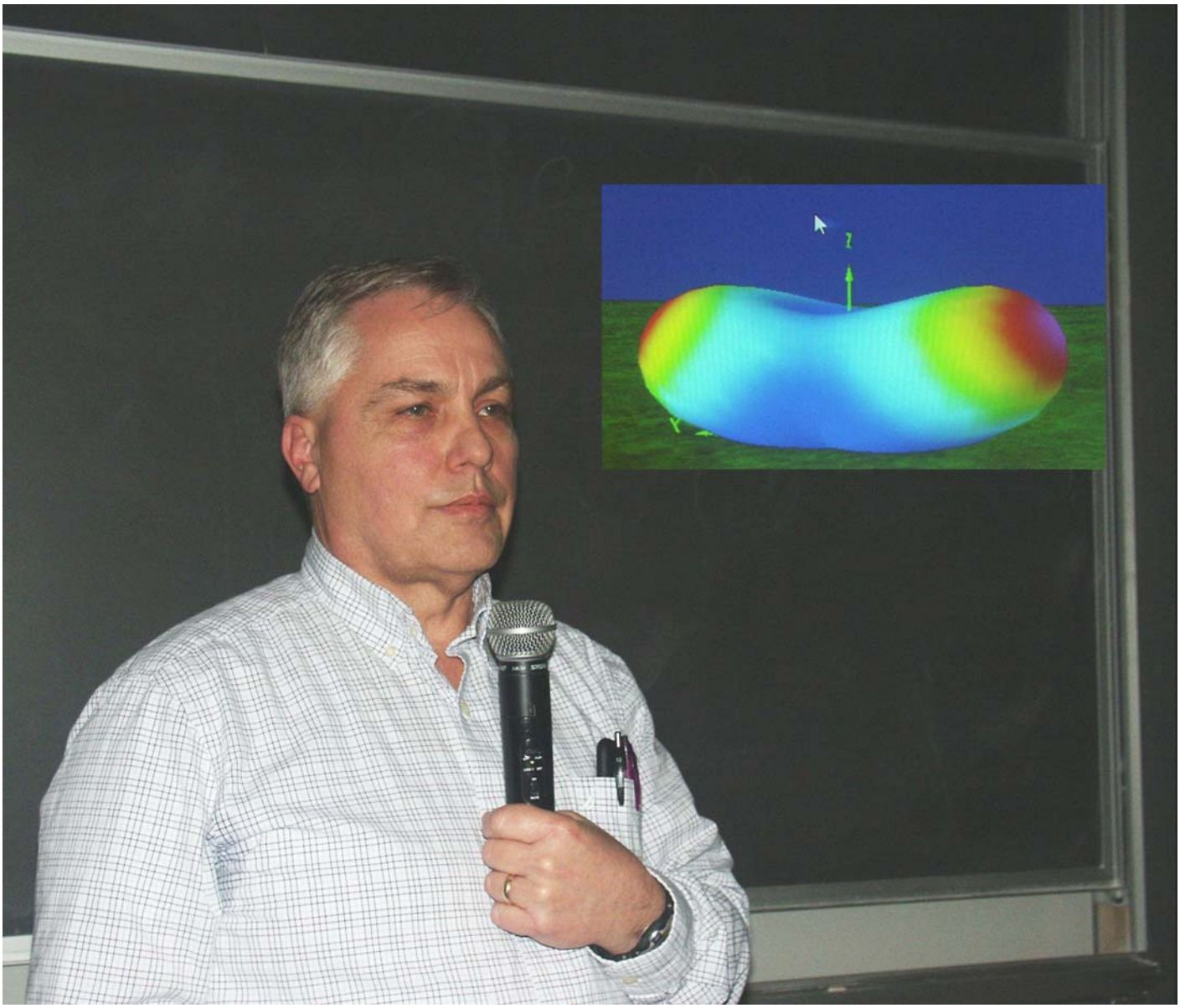
The *Microvolt*

March, 2018



Prologue

Publication: *The Microvolt* (USPS 075-430) is the official publication of the Utah Amateur Radio Club, Incorporated, 699 E. South Temple Ste 100, Salt Lake City, UT 84102-1282. It is published monthly except August. Subscription is included with club membership at $20 per year. Single copy price is $1.50. Periodicals postage paid at Salt Lake City, Utah. Postmaster: send address corrections to *The Microvolt*, c/o Tom Kamlowsky, 4137 Clover Lane, Salt Lake City, UT, 84124-2711.

Deadline for submissions is the 24th of each month prior to publication. Submissions by email are preferred (k7hfv@arrl.net), but other means including diskettes and typewritten submissions can be mailed directly to: Gordon Smith, 632 University St., Salt Lake City, UT 84102-3213. Reprints are allowed with proper credits to *The Microvolt*, UARC, and authors. Changes in mailing address should be communicated to the Club Secretary: Tom Kamlowsky, 4137 Clover Lane, Salt Lake City, UT, 84124-2711.

Club: 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 a non-profit organization under the laws of Utah. It holds a club station license with the call W7SP, a memorial call for Leonard (Zim) Zimmerman, an amateur radio pioneer in the Salt Lake City area.

Meetings: The club meets each month except July and August. The meetings are held on the second Thursday of the month at 7:30 PM in the University of Utah's Warnock Engineering Building, generally in room 1230 or 2230, sometimes in 2250 or 105.

Membership: Club membership is open to anyone interested in amateur radio; a current license is not required. Dues are $20 per year, including a *Microvolt* subscription. *The Microvolt* and membership cannot be separated. Those living at the same address as a member who has paid $20 may obtain a membership without a *Microvolt* subscription for $12. Send dues to the Club Secretary: Ton Kamlowsky, WA7ZRG, 4137 Clover Lane, Salt Lake City, UT 84124-2711.

Contributions: Monetary contributions are gladly accepted. Send directly to the Club Treasurer: Chuck Johnson, 1612 W. 4915 S. Taylorsville, UT 84123-4244. For in-kind contributions, please contact any board member to make appropriate arrangements.

Repeaters: UARC maintains the 146.62- and 146.76- repeaters. The repeaters are administered by the UARC Repeater Committee. Comments and questions may be directed to any Committee member. The Lake Mountain repeater (146.76-) is IRLP node 3352. Instructions for IRLP use are on the club website.

Ham Hot-Line: The Utah Amateur Radio Club (UARC) has a Ham Hotline, 583-3002. Information regarding Amateur Radio can be obtained, including club, testing, meeting, and membership information. If no one answers leave your name, telephone number and a short message on the answering machine, and your call will be returned.

UARC 2018 Board

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Committee Chairpersons and Members

"Book Lady": Rick Gregory, KG7GOW	801 582-7783
Historian: Ron Speirs, K7RLS	801 904-3587
Field Day Chair: (To be determined)	
License Trustee: Brett Sutherland, N7KG	801 298-5399
Repeater Engineer: Randy Finch, K7SL	801 556-7565
ATV Engineer: Clint Turner, KA7OEI	801 566-4497
Autopatch Engineer: Gordon Smith, K7HFV	801 582-2438

Contents

IRLP Information

For information on using the club's IRLP node on the 146.76 repeater, check http://www.utaharc.org/irlp.

For late breaking news listen to the UARC Information Net Sundays at 21:00 on 146.62 or set your browser to: http://user.xmission.com/~uarc/announce.html

We are grateful to the management of XMission, our Internet Service Provider (ISP), for the donation of this Web-Page service.

For account information go to:
http://www.xmission.com/ Or call 801 539-0852

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March Meeting:
Restoring and Using Teletype Machines

Teletype machines have a long history in amateur radio allowing anyone to exchange text messages at 60 words per minute using the mode called "Radio Teletype" (RTTY), our first mechanically decoded digital mode. The use started back in the 1940's and continued for decades afterward.

Teletype printers have changed a great deal since then. At our next UARC meeting on Thursday, March 8, John Whitney, AF7ZU, will be telling us about the Teletype company, the machines, how to restore them, and how they can be connected to Internet. After the presentation there will be a hands-on session where attendees can try out these working machines to punch paper tape, get news and weather from the Internet, send and receive email, etc.

The restored machines at the meeting will be one Teletype Model 33ASR Data Terminal and one table top Model 35KSR Data Terminal. Mr. Whitney will also cover the design and development of the TTYLink data converter that he built (using KiCad and Seeed Studio) to allow these machines to communicate with a Linux desktop over a 300 to 9600 Baud serial port.

Two additional UARC members will be helping during the presentation: Brian Whitney, AF7ZT, in tenth grade; and Steven Whitney, AF7ZV, in seventh grade. There won't be refreshments, but there will be awards for the best answers and questions asked.

The meeting will take place at 7:30 P.M. on Thursday, March 8, in room 2250 (the "Robison" classroom) of the Warnock Engineering Building on the University of Utah campus.

UARC meetings are held on the second Thursday of each month at 7:30 P.M., in the Warnock Engineering Building on the University of Utah campus. The meetings during the University's spring semester of 2017 will be in room 2250 on the second floor.

See http://user.xmission.com/~uarc/meetmap.html for a map and information on finding the building. The room number varies depending on availability.

Of course, the meeting will include the "standard" meeting features:

- Availability of ARRL books from Rick, the "book lady"
- An opportunity to join UARC or renew your membership
- An opportunity to join ARRL or renew your membership
- The chance to meet face-to-face the people you talk to on the air
- The "Meeting after the meeting": A chance to enjoy pizza or other gastronomic delights with other hams. It happens at Litza's Pizza, 716 E. 400 South.

- The "Meeting *before* the meeting": A similar get-together for those who can leave work early enough to get there by 5:15 P.M. It is held at "The Village Inn," 910 E. 400 South in Salt Lake City.

Latest News

Our Cover

Our cover this month is from our February meeting where Jed Petrovich, KD7KM, demonstrated features of the 4NEC2 antenna modeling program. Shown with Jed is a 3-D model of an antenna's vertical and horizontal patterns with different colors showing different gains in different directions.

Thanks to our Historian, Ron Speirs, K7RLS, for the photos.

Welcome, Rick

John Brewer, N7MFQ, who has been our "book lady," in recent months has recently had to step down due to too many work conflicts with UARC meetings. Roderick ("Rick") Gregory has generously volunteered to take over and will be ready to offer books and kits at our meetings.

Rick is hoping we can find a better title than "Book Lady," the one we have been using since the late Susan Boman, AA7HD, had the position quite a number of years ago. Any suggestions?

Field Day Help (*Still*) Needed

The annual national Field Day "non-contest" is coming up on the weekend of June 23 and 24. UARC is planning to enter from our traditional site near Payson Lakes. This is a great event for anyone who likes to ham and also to camp out. It is a chance to see how many stations we can work in a 24-hour period from a portable station set up in an empty field.

Field Day is the most popular operating event in the U.S. and Canada. In 2017 we had the highest score in Utah, so we are expecting plenty of competition. Making it all work takes a fair amount of preparation, work, and planning. It would be great if we could find volunteers to make sure various aspects of the event come together properly. These include things like antennas, computers, rigs, tents, transportaion, tables and chairs, permits, toilet facilities, publicity, safety, educational events, tower setup, and generator maintenance. It would be great, also, if we could find a Chair Person we could blame… uh 'er, rather, to keep watch over planning the whole enterprise. If you would like to help and to get in early on the planning, let one of the officers know.

Above all, make sure you've carved out the weekend of June 23 and 24, and perhaps a little more. Setup activity will begin as early as Thursday evening, June 21.

Second Annual Digital Conference

March 24 is the date of the "Second Annual Amateur Utah Digital Communications Conference" or SAAUTCC for short. The event will be a full day of conferences and hands-on workshops about digital text modes and digital voice modes, as well as information about home construction and software.

Location is the same as last year: the conference center at the Miller campus of Salt Lake Community College. Registration fee is $15 prior to the event or $20 at the door. Proceeds go toward the cost of the facility.

The organizers are seeking presenters for seminars and workshops. Let them know if you are prepared to present or know of someone you can recomment.

For more information go to:
http://www.utah-dcc.org/.

License Examination Schedule

Opportunities to test for new or upgraded amateur licenses

Date	Day	City	Contact Person	Phone
03/03/18	(Sat.)	Logan	Richard E. Elwood, KE7GYD	(435) 770-7050
03/17/18	(Sat.)	South Jordan[6]	Lance Q. Homer, K7LQH	(801) 742-5382
03/21/18	(Wed.)	Provo	Steve Whitehead, NV7V	(801) 465-3983
03/21/18	(Wed.)	St. George[2]	Gary O. Zabriskie, N7ARE	N/A
03/26/18	(Mon.)	Taylorsville[3]	Garth Wiscombe, W7PS	(801) 558-5936
04/07/18	(Sat.)	Salt Lake City[1,4]	Gordon Smith, K7HFV	(801) 582-2438
04/14/18	(Sat.)	Hurricane[2]	Gary O. Zabriskie, N7ARE	N/A
04/18/18	(Wed.)	Provo[5]	Steve Whitehead, NV7V	(801) 465-3983
04/18/18	(Wed.)	St. George[2]	Gary O. Zabriskie, N7ARE	N/A
04/30/18	(Mon.)	Taylorsville[5]	Garth Wiscombe, W7PS	(801) 558-5936

[1]Preregistration required. Check with the contact person before the test session.
[2]More information at http://www.dixieham.org/meetings.html
[3]New location is the Taylorsville City Hall, 2600 Taylorsville Blvd, Room 110
[4]More information at http://www.utaharc.org/Exams/
[5]Preregister by going to http://www.hamstudy.org/sessions/ and finding the session date.
[6]Only Technician exams given at this session.
More details at http://user.xmission.com/~uarc/testinfo.htm

Getting On 630 Meters

Part 2: Preparing to transmit

By Clint Turner, KA7OEI

Transmit antennas

Last time we discussed what it would take to receive on the 630-meter amateur band — using either available wire antennas or small active antennas. In short, how well one receives at these frequencies is mostly dependent on how much local noise there is rather than the size of the antenna itself. But for transmitting, the challenge is greater. If one happens to have the real estate, one might be tempted to erect a full-size *(985 foot!)* dipole for 630 meters, but this would probably not work well at all as it would probably not be possible to get it the hundreds of feet into the air that would be required for it to be a usable fraction of wavelength off the ground — plus, the propagation modes at these frequencies favor verticals, anyway.

Fortunately we can electrically shorten a vertical, but that comes at a cost. While the impedance of the ideal ¼-wave vertical over perfect ground would be in the 36-ohm range, the resistive part of a vertical goes lower as the antenna is shortened along with an ever-increasing need for a higher inductance coil in series to match it. As this antenna gets smaller, the resistive losses — both in the coil and in the ground system — become an increasingly large percentage of the losses overall causing the antenna system efficiency to drop. It's not so much that a small antenna *can't* work

efficiently, but rather that it's really difficult to get them to! One thing that can help tremendously is to put a metal top hat on the vertical: This increases the capacitance of the antenna overall and can dramatically increase its "effective height" and both of these factors work to improve overall efficiency, both by increasing its feedpoint resistance a bit and also to allow us to reduce the size of our lossy coil — both of which go toward improving overall efficiency.

At 160 meters, only the most ardent hams with enough land and money can erect a 130-foot vertical — but very few do. Instead they usually "load" much shorter antennas with coils and/or tophats. Practically speaking, most of us with reasonable-sized yards must be content with something in the range of 30-60 feet in height — but it is still practical to construct a 630-meter antenna of this size that has an efficiency of several percent, and with the 500-watt maximum transmitter power limit it is quite practical to reach the 5-watt *radiated* power limit.

Using an HF antenna for transmitting on 630 meters

It may be possible to transmit on 630 meters using an available HF antenna — if it is used differently. Taking a dipole as an example, let us connect the ends of the feedline at the bottom of the antenna together and feed our RF at this point, against the ground. When we do this we have created a "flat-top" vertical antenna with the vertical feedline being the portion that radiates and the wire comprising the dipole elements on top making a capacity hat. As with any vertical, one cannot escape the need for the best-possible ground — and operation on these bands is no exception!

In a suburban lot one may be able to bury some radials in the lawn, but it may be possible to implement a ground system in other ways, such as using fences by using the bonded-together ridge poles of a chain link property fence and/or running wires along other types of fences. On this band — arguably more than others — you can't have too many radials, but extending them much past 1-2 antenna heights beyond the extent of the top hat puts one well into the point of diminishing returns. As with HF, ground rods are *not* a substitute for radials: While useful for lightning and electrical safety, the conductivity of typical soil simply does not permit their useful contribution as part of a ground plane more than a few feet radius from each rod.

Matching the transmit antenna

For matching a typical top-hatted vertical wire antenna — including the typical HF dipole — one uses a series coil with a typical inductance range of 150-400 micro-Henrys, depending on antenna capacitance *(i.e. how much wire is in the air)* but this coil must be physically large *(several inches in diameter and length at a minimum)* and use relatively heavy wire *(22 gauge at a minimum, 10-12 gauge works well)* and have little or no ferrite: Anything smaller than this will be extremely lossy, producing more heat than RF. Because an electrically small antenna is capacitive, inductance is required to cancel out that capacitance, ideally leaving the resistive portion of the feedpoint impedance of the antenna which, for 30-60 foot tophatted vertical on 630 meters, is only a few *tenths* of an ohm. This is why we must keep our coil and ground losses as low as possible. In a typical "back yard" 630-meter installation, the vast majority of the *feed point* resistance will be ground loss, on the order of 10-50 ohms — the lower the better — but this is why the autotransformer is needed to convert from the 50-ohm output of the transmitter to the resistance seen at the loading coil. A sobering fact is that on a reasonably *good* 630-meter antenna with 20 ohms of feedpoint resistance, perhaps 0.25 ohms of that will be the actual antenna, explaining why single-digit antenna efficiencies are normal. The most common type of coil used at these frequencies is the variometer, a large coil with a smaller coil inside which may be slid in and out or rotated to adjust the inductance. These can be easily constructed using wire, plastic pipe and wooden dowels from home improvement stores

and following construction articles easily found on the web.

At these frequencies normal HF-band VSWR/power meters *do not work*, giving misleading/erroneous readings. Some antenna analyzers work at these frequencies, but as is true when used with HF antennas, one must be wary about RF energy from AM broadcast stations entering their detectors and causing them to display confusing and useless readings. As with antenna tuners, it is likely that one would have to modify/construct a VSWR/wattmeter specifically for these frequencies — at least until such devices, designed for these frequencies, are available from the various manufacturers. The most useful devices for tuning these antennas include easily-built RF ammeters to monitor for peak antenna current as one adjusts the variometer. Another, similar system is the so-called "Scope match" which monitors both the voltage and current and their relative phases.

Practical safety concerns

If you plan on using your HF antenna as a 630-meter transmit antenna by tying the ends of the feedline together, remember that this feedline — which is the vertical portion of a top-hatted vertical — is what radiates most the signal, and because of the need to "tune out" the antenna capacitance, everything on the *antenna* side of the loading coil can have *several thousand volts* of peak RF. What this means is that *everything* on the "loading coil" side of the antenna *must* be kept free and clear of other objects and conductors — not only to keep the radiated energy from this wire from being coupled into everything in sight and causing RF problems within the shack, but also because this high RF voltage can cause dielectric heating and eventual breakdown. In the best case this will considerably reduce the overall antenna system efficiency, but in the worst case *it can be a significant safety and fire hazard!* In other words, *it is best to locate the feedpoint and matching network for a 630 antenna system outside*, sheltered from the weather. and treat all wires on the "antenna" side of the loading coil as if they are always carrying high voltage. Because of this, it gets a bit awkward to switch a typical antenna between MF and HF use, a task usually done with a large knife switch, high-voltage vacuum relays or simply moving wires between the "HF" to the "MF" sides — often using insulated banana plugs.

The diagram shows a typical "small urban lot" 630- meter transmit system consisting of an HF antenna
being used as a top-hatted vertical working against a ground plane, and using a variometer and autotransformer to match the transmitter. An additional piece depicted is a relay that disconnects the matching network from the antenna when receiving. If this is not done the transmit antenna, matched at frequency, will "suck out" a significant amount of the signal intercepted by the receive antenna and it also tends to radiate a bit of "house noise" — from electrical devices in the house — potentially increasing the receiver system's noise floor. Also shown on the diagram is a "static bleed resistor" on the low impedance side of the loading coils — typically 100k or so — that, when in receive mode, will bleed off accumulated wind static to ground through the autotransformer.

630 meter transmitting equipment

At the time of this writing, *there are no commercially-available amateur HF transceivers that produce useful output power on 630 or 2200 meter*s. A few radios — such as some Flex models and the Elecraft K3S — can produce a low-level signal on their transverter ports, but they will still need external amplification and filtering. Some radios like the Icom '735 and '7300, can be modified to tune to 630 meters and may *appear* to be producing RF, but most of this energy is really in the form of harmonics with amplifier circuitry being electrically and thermally stressed from high losses. Most stations active on 630 meters use

either homebrew transmitters or transmit converters to convert the output of an HF rig and amplify it. At my station I use the Yaesu FT-817 QRP all-mode transceiver with a homebrew transmit converter to transmit on both 630 and 2200 meters. There are a few commercially-made 630- and 2200-meter transverters available already built and as kits, but it will still be up to the user to put together the matching network.

The limited radiated power and small size of the 630-meter band *(it's only 7 kHz wide!)* means that voice modes are rarely used. Most activity is on CW, WSPR, and JT-9 because of their ability to work when signals are weak. Because these modes are "carrier only", it is possible to use non-linear transmitter stages which means that it is relatively easy to construct high power, high efficiency amplifiers at these frequencies using inexpensive components.

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For more information about 630-meter operation and links to other web pages on the subject go to WB5NJD's site: http://njdtechnologies.net/