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SIGNALS

Rockwell Collins

Monthly Newsletter of the

Amateur Radio Club

Volume 36 Issue 12 **Web Site** http://www.w5rok.us **September 2015**

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RCARC
Membership Meeting

Tuesday 22 September 2015
1700 Social 1730 Meeting
1800 Program

Methodist Richardson Medical Center
At Bush/Renner/Shiloh Intersection
Second Floor Conference Room 200

Subject:
Upcoming Amateur Radio Satellites
by Jonathan Brandenburg KF5IDY

Local Club News

Meeting Notice

We have a great program this month! Jonathan will begin by describing the many exciting launch opportunities AMSAT is pursuing to put even more amateur radio payloads into orbit, including opportunities for low earth orbit, high earth orbit, geosynchronous orbit, and even a competition for a trans-lunar orbit. He'll continue with a detailed description of the Fox-1 series of satellites scheduled for launch before the end of this year and then close with a call to action!

By day, Jonathan is an Enterprise Software Architect developing business software for Gimmal (http://www.gimmal.com). By night (and weekends), Jonathan is an avid Maker. In particular, he has volunteered for AMSAT for over five years and develops the control and experiment interface software for AMSAT's Fox-1 series of satellites. Jonathan also leads the Dallas Raspberry Pi User Group and experiments with digital communication technologies.

RCARC Community Service Activities

Siren Testing Dennis Cobb WA8ZBT, Chris Havenridge KF5GUN, John McFadden K5TIP and Jim Skinner WB0UNI participated in the Richardson emergency siren testing on 2 September 2015. All sirens tested operated normally, with one siren unreported due to lack of an observer. The siren testing is performed on the first Wednesday of each month. The sirens are monitored by amateur radio operators and reports made using the Richardson Wireless Klub (RWK) repeater at 147.120 MHz.

Crime Watch Patrol Jim Skinner WB0UNI participated in Richardson Duck Creek Crime Watch Patrol (CWP). CWP members, after successful completion of Richardson Police Department Training, patrol their neighborhoods and report all suspicious activities to the Police Department.

Officer Elections

RCARC officers for FY2016 will be elected at this month's meeting. It is critical that our members be at the meeting to vote. And, BTW, how about running for an office? See you at the polls!

Welcome Back Gene Duprey K1GD

Gene Duprey, K1GD, has returned to Texas. He and his family moved from the soon-to-be frozen north of Cedar Rapids to enjoy the last unbearable days of summer in Texas. We are all looking forward to seeing Gene at the meeting on Tuesday.

Ohio QSO Party and Route 66 Operation

Dennis Cobb, WA8ZBT, operated recently in the Ohio QSO Party. Dennis also worked two stations on 40 CW for the Route 66 special event. The purpose of this event is to offer amateur radio operators a fun way to 'Relive the Ride' of their own memories of Route 66, and to celebrate the highway's 82nd anniversary. The U.S. Highway 66 established in 1926, was the first major improved highway to link the west coast with the nations heartland. The highway came to symbolize the spirit of the freedom of the open road, inspiring many to see America.

RCARC OFFICERS

PRESIDENT
Mike Schmit WA9WCC
214.862.4249
wa9wcc@arrl.net

VICE-PRESIDENT
OPEN

SECRETARY
Jim Brown AF5MA
972.495.2209
jhksbrown@verizon.net

TREASURER
Mike Montgomery WD5TX
972.705.1498
dmmontgo@rockwellcollins.com

ACTIVITIES
OPEN

WEBSITE MANAGER
Mike Hollingsworth W5QH
972.571.6060
w5qh@arrl.net

STATION TRUSTEE
Steve Phillips K6JT
972.517.3332
k6jt@arrl.net

NEWSLETTER EDITOR
Jim Skinner WB0UNI
214.535.5264
wb0uni@arrl.net

MEMBERSHIP
Joe Wolf N5UIC
214.202.2757
n5uic@arrl.net

W5ROK CLUB STATION
972.705.1349
461-290

VE SESSIONS

Dallas tests are held on the fourth Saturday of each month at 1000 hrs. 13350 Floyd Rd. (Old Credit Union) Contact Bob West, WA8YCD 972.917.6362

Irving tests are held on the third Saturday of each month at 0900. Fifth and Main St. Contact Bill Revis, KF5BL 252-8015

McKinney VE test sessions are held at the Heard Museum the first Sunday of the month. The address is 1 Nature Place, McKinney TX. The time of the testing is 1430, ending no later than 1645. ***Note: no tests given on holiday weekends.***

Garland testing is held on the fourth Thursday of each month, excluding November, and begins at 1930 sharp. Location is Freeman Heights Baptist. Church, 1120 N Garland Ave, Garland (between W Walnut and Buckingham Rd). Enter via the north driveway. A HUGE parking lot is located behind the church. Both the parking lot and the Fellowship Hall are located on the east side of the church building, with big signs by the entrance door. Contact Janet Crenshaw, WB9ZPH at 972.302.9992.

Plano testing is on the third Saturday of each month, 1300 hrs at Williams High School, 1717 17th St. East Plano. Check Repeater 147.180+ for announcements.

Greenville testing is on the Saturday after the third Thursday, 1000 hrs at site TBA, contact N5KA, 903.364.5306. Sponsor is Sabine Valley ARA. Repeater 146.780(-) with 118.8 tone.

Richardson The Richardson Wireless Klub (RWK) VE team hold license testing on the third Thursday of each month at St. Barnabas Presbyterian Church, 1220 West Beltline Rd. Testing begins at 1900 hrs in room 12. Enter through the Northern most door on the east side of the church building. For further information contact Dave Russell W2DMR, at 972.690.9894 or E-mail warhog4@tx,rr.com.

President's Message

THIS SPACE RESERVED FOR PRESIDENT'S AND/OR VICE-PRESIDENT'S MESSAGE

Secretary's Report

25 August 2015

The meeting was called to order by President Mike Schmit WA9WCC at 1739.

The following were present at the meeting:

Jim Brown	AF5MA
Dennis Cobb	WA8ZBT
Kathy Cobb	Guest
Chris Havenridge	KF5GUN
John McFadden	K5TIP
Steve Phillips	K6JT
Mike Schmit	WA9WCC
Jim Skinner	WB0UNI
Richard Strnad	AA6DV

Officers and Committee Reports:
President's Report: There was no formal President's Report.

Vice-President's Report: There was no formal Vice President's Report.

Secretary's Report: The Secretary's Report is in this newsletter.

Treasurer's Report: There was no formal Treasurer's Report.

Website Manager's Report: There was no Website Manager's Report.

Station Trustee's Report: There was no Station Trustee's Report.

Database Manager's Report: There was no Database Manager's Report.

Old Business:
The report from the committee appointed to investigate proposed equipment purchases was delayed to the next meeting.

New Business:
Mike Schmit WA9WCC announced that the annual election of RCARC officers will be held at the September 2015 meeting.

The remainder of the meeting consisted of general discussions on the following topics:

Member radio contacts, equipment performance and general communications environment for the past month

General approach to officer elections scheduled for next month

Approach to handling of club mailing list, including a reliable update process and availability of the list to all members while preserving member data privacy

Adjournment:
The meeting was adjourned at 1829

Understanding Antennas For The Non-Technical Ham - Part 13

*Each month for the next year or so, we are including in **SIGNALS** excerpts of a book by Jim Abercrombie – N4JA (SK) on antenna design. This book is available online for free and can be located at http:// www.hamuniverse.com/basicantennas.pdf. Now, part 13...*

Understanding Antennas for the Non-Technical Ham

A Book By Jim Abercrombie, N4JA (SK)

Illustrations by Frank Wamsley, K4EFW

Edited by Judy Haynes, KC4NOR

Edited for the web , N4UJW

XV. DIRECTIONAL BEAM ANTENNAS

1. The Monoband Yagi
Between 1926 to 1929, Shintaro Uda and Hidetsugu Yagi developed a beam antenna that had sharp directivity and high gain. Later, work was done primarily by Mr. Yagi and yagi was the name given to the antenna until finally recognition was given to Mr. Uda. Its proper name is the Yagi-Uda Array. Most hams call it a beam.

A monoband yagi is the name given to a yagi for a single band. The performance of any commercially made monoband yagi is touted to have its dimensions tuned for maximum performance. As you will see later, this is not always the case. Monoband yagis being sold today are much improved over older designs because of computer modeling programs available.

The yagi is made of two or more aluminum elements mounted on and perpendicular to a boom. Hams use antenna rotors to turn the antenna in the direction of the station they want to work. However, there are wire beams, fixed in one direction, mainly on 80 meters, suspended between trees or other supports. Most high frequency beam antennas used by hams are in the horizontally polarized configuration, which means the elements are parallel to the ground. CB beam antennas and some two-meter beams are vertically polarized with the elements at right angles to the ground (See Section III).

A 2-element yagi has a gain around 3 to 4 dBd. A two-element yagi will have a driven element with either a reflector or a director. The driven element is the only element receiving power directly from the transmitter. The reflector and directors are called parasitic elements because they receive power from the driven element by inductive coupling.

The 3-element yagi will have a gain of approximately 5 to 7 dBd or 7 to 9 dBi depending on its boom length. A three-element yagi has one reflector, one driven element, and one director. Because the yagi has a low radiation resistance, a matching system is located at the driven element feed-point. The ratio of the radiation off the front compared to the radiation off the back is called front-to-back ratio. Front-toback ratio and forward gain are factors to be considered in choosing a yagi design. Both measurements are given in dB. All yagis have a good front-to-side ratio, with the signal off the side being 50 dB below the front.

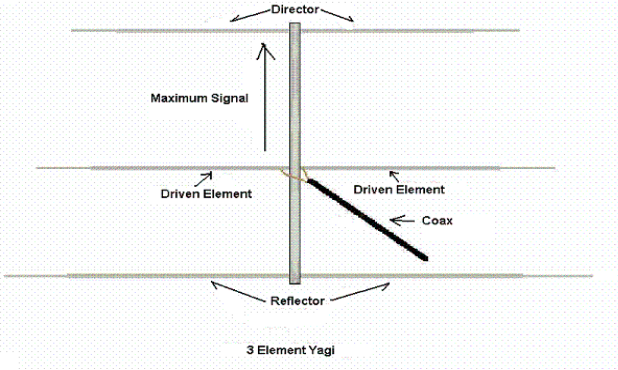

Figure 33. Three-Element Yagi

The reflector of a yagi is about 5% longer than the driven element. The reflector, being longer, will have inductive reactance. The inductive reactance shifts the phase of the re-radiated wave, which radiates and combines with the driven elements wave and reinforces it in the direction away from the reflector toward the driven element. A director is about 5% shorter than the driven element. The director, being shorter, has capacitive reactance, and this changes the phase of the reradiated wave to reinforce the wave away from the driven element opposite the reflector.

The gain of a yagi is derived from radiation being concentrated in one direction at the expense of the other directions. One hundred watts fed into a yagi with a gain of 6 dBd will have an apparent power of 400 Watts in the main lobe. Because one hundred watts put into a yagi radiates only one hundred Watts, and because that one hundred Watts of power is concentrated in the main lobe, it is equal to the power from a dipole being fed with 400 Watts. This is referred to as effective radiated power or ERP, but a yagi is not any more efficient than other antennas. Because of the Principal of Reciprocity, an antenna having a 6 dBd gain on transmitting will also have a 6 dBd gain on receiving.

Adding more directors and increasing the boom length will increase the gain of a yagi. The front-to-back ratio ranges from 18 dB for a 2-element yagi to over 25 dB for a multi-element yagi, provided the parasitic elements are carefully tuned. The gain of a yagi is generally proportional to the boom length and not necessarily the number of elements. Doubling the boom length, while keeping the proper number of elements for that boom length, will add about three more dB of gain.

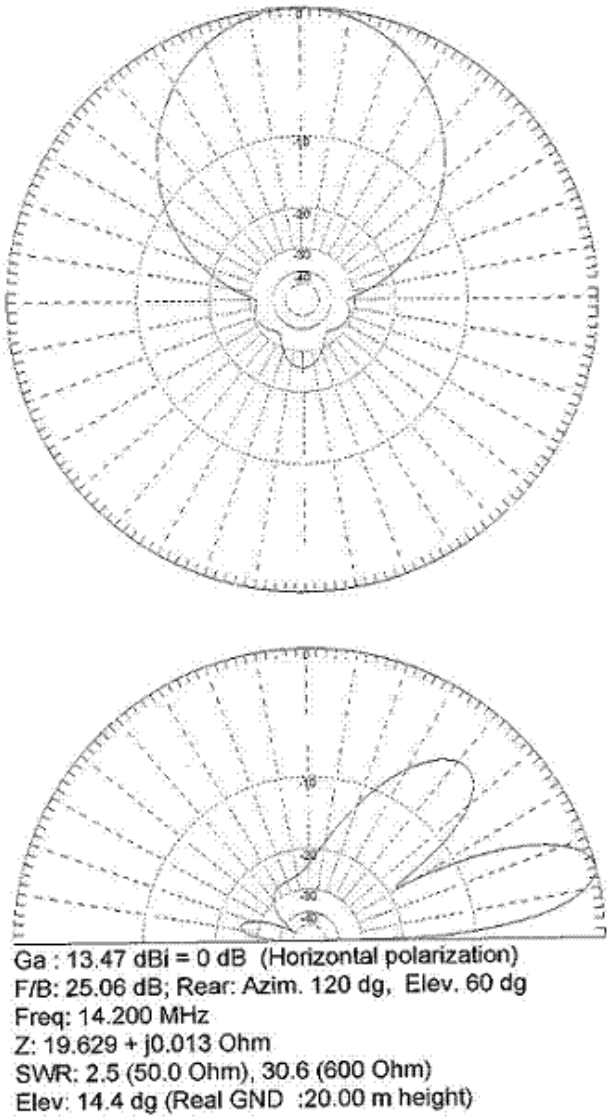

Figure 34. 3-Element Yagi Radiation Pattern

Tuning the yagi for maximum gain makes the bandwidth very narrow, and it will have a poor front-toback ratio. For these reasons, we dont recommend tuning a yagi for maximum gain, because you will only increase the gain by a fraction of a dB at the expense of front-to-back and feed-point impedance. Tuning the yagi for maximum front-to-back will help eliminate interference coming from the rear of the antenna. The building of any yagi involves compromise spacing and element tuning.

As you make the yagi larger by adding directors, the main radiation lobe becomes narrower increasing the gain and ERP. The gain of a yagi with four elements is about 7 to 8 dBd. You used to see 3 or 4 element yagis advertised claiming a gain of more than 10 dB, but they never said if that gain was referenced to an isotropic or a dipole. That gain also involves the gain derived from signals reflected from the ground adding to the direct wave. A more realistic gain figure is the "free space gain." Some companies, who

sell monoband yagis, inflate their gain figures. Beware! Increased spacing of the elements will increase the gain of a yagi up to a point. Increasing the spacing past that point will reduce the gain. The spacing of a reflector or director needs to be in a range of 0.1 to 0.3 wavelengths. With a 3-element yagi maximum gain occurs with both parasitic elements spaced at about a quarter wavelength. Second and third directors can have wider spacing.

Most hams do not build yagis but buy them from the many companies who sell them. Ham catalogs are full of pre-cut and tuned yagis that come in boxes ready to be assembled in the back yard. Many of these are very good. However, there is a lot of satisfaction to be gained from building your own.

In 1971, we purchased, a 15-meter monobander being sold by a reputable company. Its performance was disappointing. It had only a 10-dB front-to-back ratio. That design is no longer being sold. After reading some books, we readjusted the antenna elements to some new dimensions and it performed much better. This was the beginning of our yagi building.

During the last nearly 50 years, we built many yagis. During the period of 1979 until 1986, many multielement yagis were constructed, gain measured, formulas derived for spacing and element length, and the radiation patterns plotted on graphs. In 1986, a computer program titled "Yagi" by Dean Straw, N6BV, was bought. From that point on, that program was used to design and set the element lengths to their proper values. Not much difference in performance of the new designs was seen over what was previously used, but tuning parasitic elements and running back and forth to the field strength meter was eliminated. There are many better computer programs available today for designing yagis and other antennas.

The largest yagis we built were a 4 element 20-meter yagi on a 38-foot boom, a 5 element 15 meter one on a 27-foot boom, and a 5 element 10 meter beam on a 24-foot boom. These are modest designs compared to some of the big antennas used by contest stations. All these yagis were stacked one above the other on a 20-foot mast coming out of the top of the tower. The 20 meter one was on the bottom, next came the 15 meter, and the 10-meter yagi was on top. This method of stacking yagis for different bands one above the other makes what is called a "Christmas tree array." These antennas worked well. Since retiring and moving back home, we use pre-tuned directional antennas because of the lack of a good place for an antenna range. Climbing is not now an option because of age and infirmity.

If you make the reflector 5% longer than the driven element and the director 5% shorter than the driven element, you will be pretty much in the ballpark. The beautiful part about a yagi is it will work reasonably well with the element lengths only in the ballpark. By carefully tuning, you will get a fraction of a dB more gain or a few more dB front-to-back, because the spacing and diameter of parasitic elements affect the length required for those elements. A yagi can be tuned for maximum forward gain, maximum front-to-back ratio, or best impedance, but you can achieve only one of these conditions at a time. Element tuning, at best, is a compromise.

Most hams who are yagi builders do not tune their antennas at all, but use published dimensions for building them. Yagi builders who do tune, tune for either gain or front-to-back and then match the driven element with a gamma match, hairpin match, a series-resonant coax matching section, or a step down balun. The feed-point of a properly tuned yagi is close to 25 ohms.

Formulas for calculating yagi element lengths will not be given in this book. Because yagi elements are made from telescoping aluminum tubing, the elements will be tapered. The diameter of the elements and the taper determine the lengths required for tuning of the elements. A tapered element will resonate higher in frequency than one not tapered. The formula to calculate the length of the tapered elements is complicated, but there are computer programs to do that.

2. Trapped Multi-band Yagis

Some yagis have traps in the elements to make them into a multi-band beam. Many of these commercially made antennas are available at ham radio stores or directly from the manufacturers. In a 3-element, 3-band design, the spacing on the booms is a compromise. A 3-band beam is known as a "tribander." The spacing is close on 20 meters, optimum on 15 meters, and wide on 10 meters. You cannot tune the trapped elements for maximum performance on three bands simultaneously and have a good match on all those bands. Since a good match is important to most hams, gain and front-to-back ratio are sacrificed for a good match on triband beams

The inductors in the traps load the elements in triband beams. Therefore, the elements are shorter than the elements of a 20-meter monobander. Regardless of the compromised design, a triband-trapped beam is much better for working DX than a dipole. Many hams have achieved working over 300 entities with tribanders having short booms.

The radiation pattern from a yagi is at a lower angle than a dipole. This gives the impression a yagi has much more gain than it does. A dipole has unity gain, but that gain will be at a higher angle. The dipole puts out a weaker signal at the low angles needed to work DX, and a yagi puts a strong signal at low angles. In comparing a dipole to a yagi, the yagi may only have a 4 dBd gain in its major lobe. The gain of the yagi at a low angle may be 10 dB or so better than a dipole at that same lower angle. The gain of any antenna is always measured in its major lobe, irrespective of where the angle ar which the maximum radiation lobe occurs.

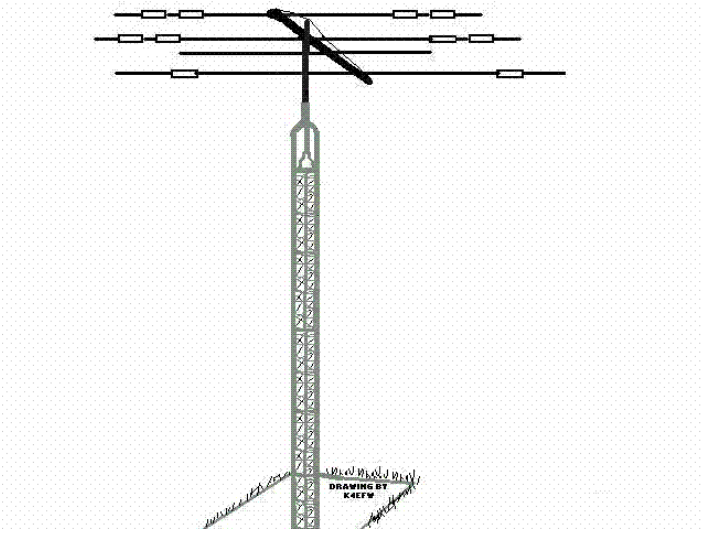

Figure 35. Trapped 3-element Yagi

The above picture shows two sets of traps in two of the elements and one set in the rear element. The front element is the director with traps for 10, 15, and 20 meters (it takes two sets of traps to make the elements work three bands). Directly behind it is the driven element with traps also for 10, 15, and 20 meters. The rear element is trapped for 15 and 20 meters (a single set of traps makes it work two bands). The entire lengths of the three longest elements are resonant on 20 meters. The short element is a reflector for 10 meters. Only the part of the antenna between the 10-meter reflector and the front director is used on 10 meters. The maximum signal is radiated in a direction coming out of the page toward you. Mosely builds trapped antennas that have two traps in one enclosure and you can not determine the bands from the traps as you can on Hy-Gain and Cushcraft beams.

Some triband beam models as the one above are built with longer booms so they would have more gain on 20 meters, a good match on all bands, and optimum 3-band performance. They achieve this by interlacing extra monoband reflectors and directors on the boom placed between the 20-meter elements as is done with the antenna in figure 34. The extra elements have no effect on 20 meters or any band for which they are not resonant. Some amateurs mistakenly think the extra elements work on all bands, but they dont. The Cushcraft A-4 shown above is not a beam with four working elements on any band. The old Hy-Gain TH6DXX and Mosley Classic 36 had six elements on the boom. They both had three trapped elements and three monoband elements. They had three working elements on 20 meters, three on 15 meters, and four elements on 10 meters. The trapped reflector worked on 15 and 20-meters. The trapped driven element worked on all three bands. The trapped director worked on 10 and 20 meters. On the boom was a resonant reflector for 10 meters and one each resonant directors for 10 and 15 meters. When using one of them, we have often heard amateurs saying they were using a six-element beam. This gave the other station the mistaken idea they were working someone with an antenna with six working elements. Other beam antennas interlace additional elements of different lengths to make the tribander into a 5-bander covering 20, 17, 15, 12, and 10 meters. Hy-Gain makes a 5-band yagi for 20 through 10 meters that has 11 trapped and monoband elements. It is the Hy-Gain TH-11. Mosely makes a 6-bander that includes two elements for 40 meters. It is the Pro-67.

In order to achieve better SWR curves over a wide bandwidth, some triband yagis have two driven elements spaced 3 to 5 feet apart. The front driven element is shorter than the rear driven element. Both driven elements are trapped. This double driven element scheme is called a log-cell. A log cell, by itself, has a small gain and may slightly increase the overall gain of the tribander. The KLM KT-34 and the HY-Gain TH-7 are examples of this kind of antenna.

Is a monobander better than a tribander? We dont know if our tests can be duplicated and no one else has ever said he has actually compared the two antennas. It is "common knowledge" that traps have loss. Therefore, the ham fraternity believes a monobander has to be better. From the tests we performed here, we believe it is a myth a monobander is significantly better than a tribander having an equal boomlength. We believe the traps do not have enough loss to make enough difference to matter. However, monobanders having very long booms and many directors will outperform any tribander.

Having two towers, both having the same height and being 100 feet apart, made it possible for us to do the experiment described here. The result is useful information because it was made in a real world situation that would be comparable to the average hams location. Both antenna element lengths were set to Hy- Gain specifications. The constants were terrain, antenna height, antenna boom length, frequency, coax length, and power level. The only variable in the tests was the two antennas being tested. The test was performed to see how much loss antenna traps have. Had there been more than one variable, the tests would not have been valid, because in any scientific experiment, the test is valid only when one variable is being tested. In addition, more than one test has to be made in order to average out the collected data errors. In this case, many tests were made.

On one tower was a 20-meter four-element Hy-Gain 204-BA monobander with a boom-length of 26 feet. This antenna is arguably not one of the best monobanders made, but it is what we had and it was about the same size as our tribander. On the other tower was a trapped 6-element Hy-Gain TH-6 DXX tribander having a 24-foot boom. The entire tribander boom-length was used on 20 meters, so both boom-lengths were comparable.

The transmitted signal strength of the two antennas was compared on 20-meters. This test involved many DX stations and one local amateur 5 miles away. With both an-

tennas pointing toward the receiving station, a carrier power of 10 watts was fed from the transmitter, and held constant while the antennas were "hot" switched several times. (The power level was unimportant as long as it was held constant on both antennas). None of the many DX stations involved in this test could see any difference in either antenna, and, yes, their analog meters could discern a difference of one dB. These tests by themselves were not conclusive because of the possibility of fading signals (QSB). A second series of tests was performed with a local ham when 20 meters was dead. Testing with him was done to eliminate QSB from spoiling the results. He could also measure no difference on his S-meter. He could also see a one-dB difference on his analog S-meter. As a third series of tests, the antennas were switched while we looked at the signals on the S-meter from distant stations and the local station. No differences in received signals were noted. Maybe the difference was a monobander has only a few tenths of a dB less loss, such a small amount of difference no one was able to see it on receiver S-meters. Certainly, the difference in the two antennas was less than one dB.

Conclusion: The Hy Gain TH6DXX and the 204-BA antennas perform equally well on 20 meters at a height of 56 feet.

TO BE CONTINUED

Specialized Cable Source

Frank Krizan, K5HS, obtained the following information from the Sept. 6, 2015 Austin SwapNet newsletter. This information is not only news for Elecraft owners, but, for anyone needing specialized cables.

> I wanted a Mike extension cable for my new RadioSport headset, which they do not make yet (they say they will have them available before the end of this year) so I called Elecraft to see if they sold them. Answer was no, but they referred me to Phil Parish, W4AIN, www.myhamcables.com and I ordered the cable.
>
> I called him, and he immediately called me back, took care of my order, and the cable will be on the way by the end of the week.
>
> I checked out his ratings on eHam.net and they were all 5:5.
>
> He can make any cable for any purpose or for any radio. If Elecraft believes in him, and recommends him, so do I.
>
> I have no interest in his business and paid regular price for my cables." [From Donald L Schliesser, K6RV]

(*Contributed by Frank K5HS, ex KR1ZAN*)

Upcoming Events

OCTOBER

19-23	**SCHOOL CLUB ROUNDUP** The objective is to exchange QSO information with club stations that are part of an elementary, middle, high school or college. Non-school clubs and individuals are encouraged to participate. The 5-day event runs Monday through Friday from 1300 UTC Monday through 2359 UTC Friday. A station may operate no more than 6 hours in a 24-hour period, and a maximum of 24 hours of the 107 hour event. More info at http://www.arrl.org/school-club-roundup.
31-Nov 1	**EME 50-1296 MHz** The objective is to work as many amateur stations as possible via the earth-moon-earth path on any authorized amateur frequency above 50 MHz. 48-hour periods (0000 UTC on Saturday through 2359 UTC Sunday). More info at http://www.arrl.org/eme-contest.

NOVEMBER

7-9	**NOVEMBER SWEEPSTAKES—CW** The objective is for stations in the United States and Canada (including territories and possessions) to exchange QSO information with as many other US and Canadian stations as possible on 160, 80, 40, 20, 15 and 10 meter bands. Contest Period: Begins 2100 UTC Saturday and runs through 0259 UTC Monday. More info at http://www.arrl.org/sweepstakes.
21-23	**NOVEMBER SWEEPSTAKES—PHONE** The objective is for stations in the United States and Canada (including territories and possessions) to exchange QSO information with as many other US and Canadian stations as possible on 160, 80, 40, 20, 15 and 10 meter bands. Contest Period: Begins 2100 UTC Saturday and runs through 0259 UTC Monday. More info at http://www.arrl.org/sweepstakes.
28-29	**EME 50-1296 MHz** The objective is to work as many amateur stations as possible via the earth-moon-earth path on any authorized amateur frequency above 50 MHz. 48-hour periods (0000 UTC on Saturday through 2359 UTC Sunday). More info at http://www.arrl.org/eme-contest.

REGULAR ACTIVITIES

Daily	DFW Early Traffic Net (NTS) at 6:30pm 146.88 – PL 110.9Hz
Daily	DFW Late Traffic Net (NTS) at 10:30pm 146.72 – PL 110.9Hz
Daily	Texas CW Traffic Net (NTS) at 7:00pm on 7053 KHz and at 10pm on 3541 KHz www.k6jt.com
1st Wednesday	Richardson Emergency Siren Test. At noon using the Richardson Wireless Klub (RWK) repeater at 147.120 MHz.
2nd Wednesday	ARES North Texas HF Net Every month—3860 KHz at 8:30 pm—9:30pm

Rockwell-Collins

Amateur Radio Club

Mail Station 461-290

P.O. Box 833807

Richardson, TX 75083-3807

TO:

CLUB STATIONS
(972) 705-1349

W5ROK REPEATER
441.875 MHz +5 MHz Input
131.8 Hz PL - RX and TX

W5ROK-1 PACKET BBS ROK Node
145.05 MHz

W5ROK-N1, W5ROK-N2 & W5ROK-N3 HSMM-MESHNET Nodes 2.4 GHz

Tuesday 22 September 2015

1700 Social **1730 Meeting**

Methodist Richardson Medical Ctr
At Bush/Renner/Shiloh Intersection

Second Floor Conference Room 200

NEXT SIGNALS INPUTS DEADLINE:
➔➔➔ 16 October 2015 ➔➔➔