RF

ORANGE COUNTY AMATEUR RADIO CLUB, INC.

VOL. LI NO. 3 P.O. BOX 3454, TUSTIN, CA 92781-3454 March 2010

The Prez Sez.....

by Kristin K6PEQ

Prez Says:

We are heading into the time of conventions and field day! The sunspots are growing in number with more just around the corner!!!! What could be better!?!? We have co-chairs for field day and the planning is beginning. We will need band captains, setup and cleanup crews and someone to run the chuck wagon. If you are interested in helping out let Ken, W6HHC, know. We have been having terrific turnouts at the meetings and board meetings. I want to encourage all of you to keep inviting friends and fellow hams. We have many people becoming new hams or upgrading and this is a great chance to become an elmer. I know that when I first became a ham I definitely needed help in knowing the correct exchanges in contests, etc. on the air. Don't forget we are still doing show and tell. Have a cool QSL card or an invention you made? Well, bring it and share it! I hope you have a great month of March and I will see you at the meeting!

73,
Kristin, K6PEQ

THIS JUST IN: "NEW BOARD MEETING BREAKFAST DATE" PLOY STILL IN EFFECT!

The Breakfast board meeting date continues to be on the Second Saturday of every month, so the next Board meeting will be held on March 13th, 2010 in the Big Room.

--- OCARC---
March 19th General Meeting

The Speaker for the March 19th Meeting will be Carl Gardenias. He will speak on three different topics: 160 antenna setup, bringing youth into the hobby (update) and what is going on in our section.

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The next general meeting will be:

Friday, March 19th @ 7:00 PM

We will be meeting in Room 208
In the east Red Cross Building

ORANGE COUNTY AMATEUR RADIO CLUB
www.W6ZE.org

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Monthly Events:

General Meeting:
Third Friday of the month
at 7:00 PM
American Red Cross
601 N. Golden Circle Dr.
(Near Tustin Ave. & 4th St.)
Santa Ana, CA

Club Breakfast:
Second Saturday of every
month at 8:00 AM
Jagerhaus Restaurant
2525 E. Ball Road
(Ball exit off 57-Freeway)
Anaheim, CA

Club Nets (Listen for W6ZE):

28.375 ± MHz SSB
Wed- 7:30 PM - 8:30 PM
Bob AF6C, Net Control

146.55 MHz Simplex FM
Wed- 8:30 PM - 9:30 PM
Bob, WB6IXN, Net Control

145.400 MHz (-) PL 103.5 Hz
Thur – 8:00 PM – 9 PM
Nicholas AF6CF, Net Control

7.086 ± MHz CW **OCWN**
Sun- 9:00 AM – 10 AM
John WA6RND, Net Control

Club Dues:

Regular Members	...$20
Family Members*	...$10
Teenage Members	..$10
Club Badge**	…….$3

Dues run from Jan thru Dec and are prorated for new members.

*Additional members in the family of a regular member pay the family rate up to $30 per family.

**There is a $1.50 charge if you'd like to have your badge mailed to you.

VISIT OUR WEB SITE

http://www.w6ze.org

for up-to-the-minute club information, the latest membership rosters, special activities, back issues of RF, links to ham-related sites, vendors and manufacturers, pictures of club events and much much more.

TechTalk #83

DATV Testing Report - Part 3 (Bench Testing)

by Ken Konechy W6HHC
&
Robbie Robinson KB6CJZ

In TechTalk77, we provided a testing report (Part 1) of the Digital-ATV exciter and the SetTopBox (STB) DVB-S receiver for the first time. A lot of information has been learned about DATV since our first testing report. Now, a first-stage (driver) power amp and a second-stage 30W power amplifier have been added. This report will cover bench testing the new power amplifiers and discuss information on receiving signals with different video resolutions.

First-Stage Power Amp

If you look at the block diagram in **Fig 1**, you will see that the first-stage 1.2 GHz PA chosen was the Kuhne model MKU-P1301A unit. We knew we wanted to use the Down East unit for stage-two...and we knew that Down East specified that their PA needed no more than about 25 mW to drive to full linear output levels. But, the SR-Sys MiniMod-S exciter output was only around 1 mW. So the 1 W Kuhne MKU-P1301A PA turned out to be a good choice. A little expensive, this 1W PA costs more than the Down East 30W unit, but it is a well-engineered PA for our purposes.

Fig 2 shows a photo of the exciter connected to the first-stage Power Amp on our "bread board" set-up. Notice that the Kuhne 1 W PA (on the far-right) is mounted on a thick aluminum plate that serves as a heat-spreader (aka "heatsink"). The Kuhne PA contains two internal voltage regulators to provide correct voltage to the power amp circuitry from the big 12V external power supply. These internal regulators draw a standby power of about 6 W.

When tested with an HP Model 432A microwave power meter, the Kuhne delivered plenty of power for our needs. **Table 1** shows that we could get "measured average power" of over 300 mW output when driven hard by the exciter.

Figure 1 – Block Diagram Showing DATV Station being Tested

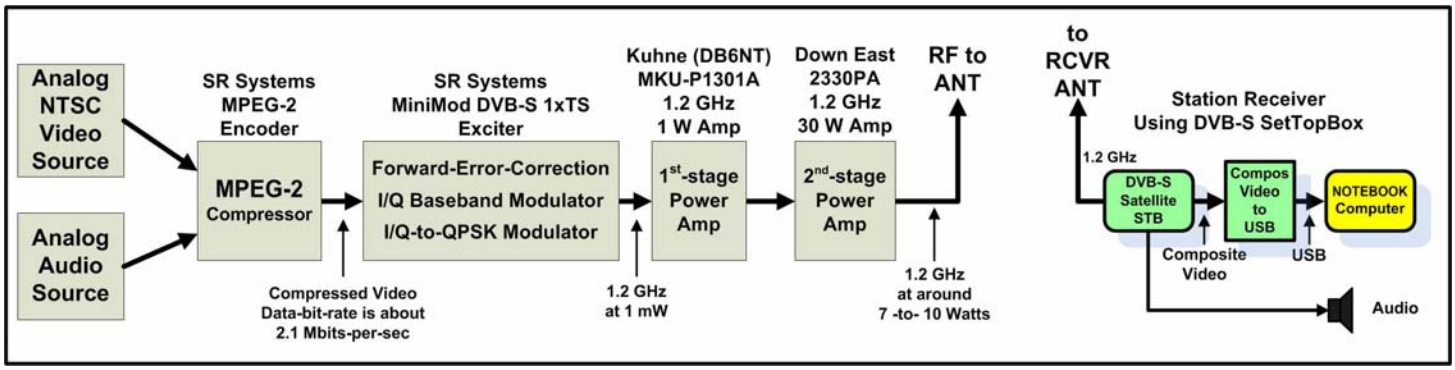


Figure 2 – Breadboard of MPEG-2 Board and MiniMod Exciter Board and Kuhne 1st-Stage PA

Table 1 – Power Measurements taken during the DVB-S Station Testing

MiniMod-S exciter menu power setting	Measured MiniMod Output mW	Measured Kuhne 1st-amp Output mW	Measured Down East 2nd-amp Output dBm	Measured Down East 2nd-amp Output W	"shoulder" below main carrier
1	0.0661 mw	N/A	N/A	N/A	N/A
2	0.158 mw	N/A	37.6 dBm	5.75 W	35 dB
3	0.302 mw	N/A	39.7 dBm	9.33 W	32 dB
4	0.490 mw	N/A	41.8 dBm	15.1 W	29 dB
(Note: the readings below are with 5 dB attenuator between the first-PA and the second-PA					
5	0.724 mw	N/A	38.0 dBm	6.31 W	34 dB
6	1.00 mw	N/A	39.3 dBm	8.51 W	32 dB
7	1.32 mw	N/A	40.3 dBm	10.7 W	31 dB
8	**1.74 mw**	**115 mW**	**41.1 dBm**	**12.9 W**	**28 dB**
9	2.24 mw	N/A	41.8 dBm	15.1 W	27 dB
10	2.63 mw	158 mW	42.3 dBm	17.0 W	25 dB

Fig 3 shows that the output signal of the Kuhne Power Amp was very clean (without spectral regrowth "shoulders") even when being driven to the maximum by the exciter RF output settings.

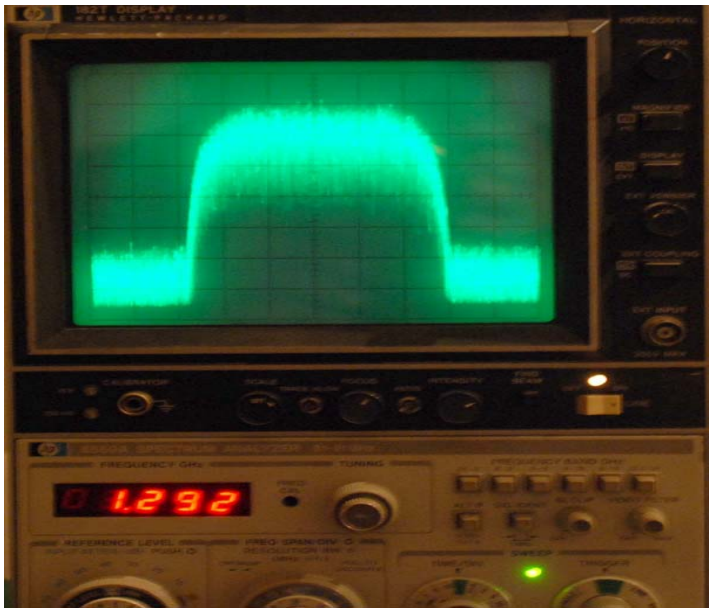


Figure 3 – HP Model 8559A Spectrum Analyzer looks at Kuhne first-stage PA output

Second-Stage Power Amp

The block diagram in **Fig 1** shows that the final-stage 1.2 GHz PA is a model 2330PA 30W unit from Down East Microwave (in Florida USA). **Fig 4** shows the

Some Discussion on Hand-soldering SMT Amplifier Kits

A funny thing happened while trying to select the first-stage PA for the W6HHC DATV station. The first choice was not the Kuhne. Our first-choice was a very low-cost kit for a 1 Watt 1.2 GHz model using an ATF50189 PHEMT from MiniKits in Australia. The kit was only about US$50, but offered a big challenge...it was a Surface Mount Technology (SMT) kit.

Now, Ken W6HHC has built more than his fair share of building the famous Heathkit ham gear. Including the really terrific SB-301/SB-401 SSB station. But, Ken was no match for hand-soldering SMT components.

The first trick learned for easy hand-soldering was to buy a tube of solder-paste (used by automated SMT soldering). This works very well. It is very easy to control the amount of solder. Normal solder-wire tended to melt too much solder on the board for Ken. Solder-paste also nicely keeps the part in position on the board while you get ready to use solder-iron.

The big SMT problem was losing parts while trying to get them onto the PCB. These SMT parts are small.

1) Tweezers could shoot an SMT part half-way across the lab. Sometimes Ken searched the lab floor on "all fours" for a half-hour without success.
2) Pressing an SMT part into the finger-tip and lifting it into position seemed to work better. But, parts still "disappeared" before they reached the magnifying glass view of the PCB.
3) Dipping a toothpick in solder rosin worked even better for picking up and placing SMT components.

Finally, purchasing an assembled-and-tested 1 Watt amplifier from Kuhne Electronics was the very best solution.

rugged well-cooled construction of the Down East Power Amp. **Fig 5** shows the HP Model 432A Power Meter (a bolometer type) that was used for power measurements. Note the stack of precision attenuators at the top of **Fig 5** that are used to drop the power down close to 0 dBm for meter readings.

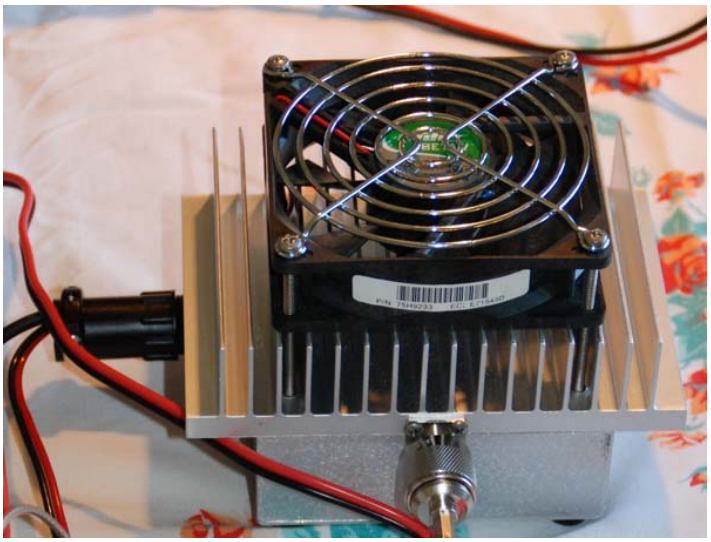


Figure 4 – Construction of Down East Model 2330PA Power Amplifier

Figure 5 – HP Model 432A Power Meter
Note attenuator-stack at the top of the photo

Fig 6 shows the quality of the Down East PA output signal at about 13 W. The spectral regrowth shoulders are down about 28 dB from the main carrier signals. Power measurements are shown in **Table 1**.

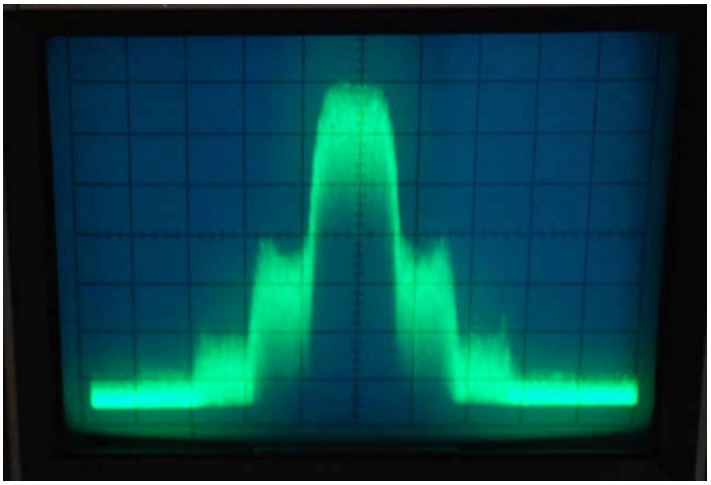


Figure 6 – HP Spectrum Analyzer looks at Down East output signal (shoulder about 28 dB down)

Choices of Video Resolution

The User Documentation manual (English) that we had found on the SR-Systems web site for the Mini-Mod-S exciter did not go into depth concerning the configurations for video resolution that can be selected. The manual clearly shows that there are three choices for the transmitted DATV video:

- D1
- HD1
- SIF

But, what do these choices really mean? It took some Google searches to begin sorting out the puzzle and then finally found a very good article by DJ1CU (called “The DVB-S 70 cm sender” in German) is up on the www.DATV.de web site (under Projekte). Let’s look at each of these three resolutions.

-- D1 Resolution --

D1 is the normal resolution that is shown on a normal Standard-Definition Digital television (DVD quality).

D1 = 720 x 576 Pixel for PAL
D1 = 720 x 480 Pixel for NTSC

-- HD1 Resolution --

The HD1 resolution does NOT mean “High Definition”. It turns out that HD1 really means “Half of D1”.

HD1 = 352 x 576 pixels for PAL
HD1 = 352 x 480 pixels for NTSC

Volker-DJ1CU states that in his opinion HD1 resolution is perfectly acceptable for DATV.

-- SIF Resolution --
SIF stands for "Standard Input Format". It is related closely to CIF ("Common Interchange Format")

SIF = 352 x 288 pixels for PAL
SIF = 352 x 240 pixels for NTSC
CIF = 352 x 288 pixels for PAL and for NTSC

DJ1CU states that in his opinion SIF is unacceptable for ordinary video transmission. Ken and Robbie used SIF for many tests. The main problem is observed while displaying full screen video. Since you only have one-fourth of the video pixels...the display graphics needs to generate three more "phantom" pixels for every "real" pixel. What we could see in a full-screen video were that some pixels in the background appeared to "flicker". The picture was clear...but the "phantom pixel flicker" was distracting.

Another impact of choosing the video resolution is that it determines the Net-Data-Bit-Rate (NDBR) coming out of the MPEG-2 encoder, and therefore affects the RF Bandwidth. A higher NDBR typically means a larger RF Bandwidth. DJ1CU reports:

Resolution	Video NDBR
D1	~2.0 Mbps
HD1	~1.1 Mbps
SIF	~0.5 Mbps

We are currently using the D1 video resolution for our DATV TechTalk83 testing.

Digital-ATV "Latency"

During our first table-top tests in TechTalk77, we described that we had seen latency (delay) of about 1 sec and that the video motion really got "jerky" (lost frames) if we displayed at full-screen on the notebook display. We needed to dig onto what were the causes.

We have determined that there are at least four primary potential-sources of latency involved with digital transmission/reception:

- **MPEG-2 Encoder**
- **SetTopBox Receiver**
- **USB2 Video-Capture Board**
- **Graphics Processing in Notebook Display**

After the TechTalk77 tests, Ken W6HHC was concerned that he was display-processing-limited with his 6-year-old entry-level Dell notebook. There were also concerns that the low-end video-capture USB adapter could also be the source of delays. So, it seemed like a good time to buy a new Dell notebook computer (Precision model M4400) configured with a good graphics-processor for the notebook display.

At the same time, Ken had read a DATV article that introduced him to new Hauppauge WinTV-HVR-1950 USB-based ATSC/NTSC/video-capture adapter. It had an external AC power adapter, so it had plenty of power for fast-processing. A series of tests were conducted to measure the DVB-S real-time delays from camera-to-display. The latency results are shown in **Table 2** on next page. Let's look at each of these four areas of potential delays.

-- MPEG-2 Encoder delays --
There is a lot of processing that goes on during the MPEG-2 encoding (compressing data) processing. While discussing latency with Stefan-DG8FAC of SR-Systems, Stefan explained that typically 90% of the latency that I was seeing going to an analog TV (Test #1 in **Table 2**) was occurring in the MPEG-2 board. Stefan stated "....The delays have nothing to do with the DVB-S Modulator/exciter, the delay is only generated by the MPEG-2 Chip on the Encoder board and the MPEG-2 Decoder that is in your SetTopBox...." We will see later when we discuss the SetTopBox, the SR-System MPEG-2 encoder board is generating about 1 second delay. Stefan explained that there is a "LowDelay Solution" for the encoder, but this encoder is very expensive, about 2500 Euro.

-- SetTopBox Receiver delays --
Each frame of video requires 33 msec in NTSC. A quality STB will lag by about four frames (0.13 seconds) for the MPEG-2 decoding. A lot of inexpensive STBs have a delay of around 5-8 frames. The ViewSat VS2000 Xtreme STB is reported to be an excellent STB and we are inclined to believe it fits into the group of BOXes with a four frame delay. That means that the MPEG-2 Encoder board in Test #1 (see **Table 2**) has about a delay of ~1 second.

-- USB2 Video-Capture delays --
The low-cost StarTech.com USB2 video-capture adapter steals its power from the USB port on the computer. So, we knew that StarTech does not have a lot of power for fast processing, a potential concern. But, **Table 2** clearly shows a measureable delay of about only 0.1 second being introduced by the StarTech.com USB2 unit. On the other hand, the newer Hauppauge WinTV-HVR-1950, with its external power source, introduced a delay of 1.37 second using Ver 6 of WinTV display software. With the newer (Win7 certified) Ver 7 WinTV display software and device driver, an internal delay of 1.7 seconds was measured....for a total latency of 2.8 seconds.

Table 2 – Measured DATV Latency Delays

Test	STB w/ NTSC Analog TV	STB w/ Dell Inspiron 1150 Notebook Intel 2.4 GHz CPU WinXP Pro	STB w/ Dell Precision M4400 Notebook Intel 3.1 GHz Core2 Win7 Pro	USB2 Video Capture board	NOTE
1	1.1 sec			(none used)	
2		1.2 sec	1.2 sec	Startech.com USB2	StarTech GrabBee lite display SW
3			2.47 sec	Hauppauge WinTV-HVR-1950	WinTV Ver 6 display software
4			2.8 sec	Hauppauge WinTV-HVR-1950	WinTV Ver 7 display software

This Hauppauge HVR product was quite a disappointment for a DATV application, but OK for recording off-the-air TV broadcasts.

-- Display Graphics Processing delays --

The old entry-level Dell notebook had simple graphics processing....just a "vanilla" Intel 82852/82855 Graphics Controller. The new Dell M4400 notebook has a powerful NVIDIA Quadro FX 370M6 Graphics Controller. The video "jerking" I had described on the older Dell, when displaying quarter-size SIF resolution to full-display-size, completely disappeared on the new faster Dell with the NVIDIA graphics.

First Cross-Town Tests

Bench testing is important. But we get excited about seeing "proof of concept". So, we tried to send a 1.2 GHz test signal from Ken's home (using a 3-ft vertical) to the roof of the Orange PD where Robbie KB6CJZ set up a 24-element loop-Yagi. The FEC was set to 1/2 and the RF bandwidth was 3 MHz. The distance is about 3 miles at roof-top heights, with plenty of tree-lined streets and back-yard trees, and through one elevated-freeway. The DATV pictures were perfect!

Figure 7 – Robbie KB6CJZ set up a 24-ele Loop-Yagi on the OPD roof and received perfect DATV pictures

Fig 8 – First cross-town DATV Transmission received at Orange Police Department building (3 miles)

The use of a 24-ele Yagi at the OPD was probably not required. The signal was clear whenever the antenna was pointed within about 30 degrees of Ken's QTH.

More field testing is planned.

Interesting DATV Links

- AGAF D-ATV components (Boards) – see **www.datv-agaf.de** and **www.AGAF.de**
- SR-Systems D-ATV components (Boards) – see **www.SR-systems.de** and **www.D-ATV.org**
- Down East Microwave RF amplifiers – see **www.DownEastMicrowave.com**
- Kuhne Electronics (DB6NT) RF Amplifiers – see **www.Kuhne-Electronic.de**
- MiniKits (SMT kits for RF amplifiers) – see **www.MiniKits.com.au**
- British ATV Club - Digital Forum – see **www.BATC.org.UK/forum/**
- British ATV Club – select from about 25 streaming repeaters – see **www.BATC.TV/**
- German ATV portal for streaming repeaters and forum – see **www.D-ATV.net/**
- Orange County ARC newsletter entire series of DATV articles – see **www.W6ZE.org/DATV/**
- TAPR Digital Communications Conference free proceedings papers – see **www.TAPR.org/pub_dcc.html**
- Volker Broszeit DJ1CU article for "The DVB-S 70 cm Sender" – see **www.DATV.de/Projekte/projekte.html**
- Darren-G7LWT site for "DATV Primer" – see **www.G7LWT.com/datv.html**
- Nick Sayer N6QQQ site for his future DATV repeater – see **www.N6QQQ.org**
- Rob-MØDTS D-ATV site including details of F4DAY-design – see **www.M0DTS.co.uk/datv.htm**
- Ultimate Resource for Digital Amateur Television – see **www.D-ATV.com**

Here is a follow-on article authored by well-experienced homebrew antenna creator and expert CW operator Arend Ubbink, PA2AWU. He is a valued and highly successful member of Contest Club PA6Z in eastern NL.

In the OCARC RF issue of September 2008, page 21, I ended my 2 meter Cubical Quad model article by saying: I cannot wait to start building the 40 meter Diamond Quad!

Well, I have built the antenna and now will give you some details:

The 40 meter Cubical Quad
a continuing story……

by Arend Ubbink PA2AWU

Our preparations for the Dutch PACC (13–14 February) started the previous weekend. This small contest only lasted 24 hours and probably most amateurs all over the world did not even know its name, but we participated with all of our ops and forces….

First, some information about the Quad, then some info abt our PACC station.

We bought eight 10 meter (abt 32.8 ft) length glass fiber angling (fishing) rods in England. Fortunately the thin 2 top sections are not used. The necessary length is abt 8 meters (abt 26.5 ft) I decided to use the + orientation of the quad arms, instead of the X orientation. The Internet gives reasonable arguments for both orientations, but in our situation, the + orientation had the best arguments. The best argument is that by having the Quad boom low above the ground, it's very convenient to position the four horizontal and two up-pointing elements, except for the two pointing down. The last two arms can be nested until the antenna is placed on top of the fully nested (six meter high) tower. After mounting the Quad boom on the tower, we dropped down the down-pointing fibre poles while cranking up /extending the (20 meter high) tower.

The Proud Owner and Creator, Arend PA2AWU

A two meter Cubical Quad can be positioned two meters above the ground and taking measurements are a piece of cake. A 40 meter Quad, 20 meters up in the air requires acrobatic positions to take the measurements. Most ops have no lack of acrophobia. As a 9-year-old child, I used to climb in the highest available trees, then yell to everybody standing on the ground : “See what I dare to do!”. (Many years later, my mother told me that she forced herself to look in another direction). Never having fallen down, I still trust the grip of my hands…(still) making intuitively the right decisions while climbing towers. ☺

The Quad’s impedance should be abt 110 Ohms. So I wound a PET bottle with ¼ lambda of 75 Ohm coax, transforming 110 Ohms -> 50 Ohms. The coil works as a symmetrical-to-asymmetrical balun (I hope ☺). Some construction details/views follow:

Cross detail 1

Cross detail 2

Without wire attached, the pole is bending down

Helping hands PD9DX

The sizes of the Cubical Quad: the following Friday we measured the resonance frequency. If too low, we shorten both elements a small percentage…….
Radiator: 4 X 10,535 = 42,140 meter = 138.26 feet
Reflector: 4 X 11,157 = 44,626 meter = 146.41 feet
Element distance: 5.8 meters = 19.03 feet Boom diameter: 50 cm = 19,69 inch
I used 1.5mm (#15 awg) diameter Cu wire (+ insulation: 2.25 mm diameter). (Larger diameter is heavier and weight counts).

Let's pause the "words" and show some pictures, to give you an impression of our PA6Z contest station. We build it up before a contest and afterwards put all down agn…. ☹

7 element 10 meter Yagi

5 element 15 meter Yagi to be mounted on 20 meter mast

[4 el 20 mtr on 20 mtr mast]

[40 mtr centre of 6 experimental 80 meter long Beverages]

Experimentally, we used the following for the PACC contest:

On 40 meters, 6 X 80 meter Beverages and on 160 meters we TXed on a top-loaded vertical and RXed on 6 X 320 meter Beverages, of which 2 were staggered. Those were also used for RX on 80 meters!

More pictures are available on: http://www.PA6Z.nl
73 es C U in future contests !!

Attention Members!!!

Do you know a fellow ham that would be interested in joining OCARC? Do you have a friend that is curious about ham radio and wants to learn more about our hobby? Why not invite him or her to one of our exciting monthly meetings?!?! The meetings are fun, informative and entertaining. And don't forget about the raffle prizes too. So bring a visitor to one of our meetings, and help **your** club expand!

Make sure to inform your friends of our club's website, which is always kept up to date. Information on club meetings, activities and our newsletter archive make it a worthwhile site to surf! http://www.w6ze.org

2010 ARRL CONTEST SCHEDULE

June	12 - 15	ARRL June VHF QSO Party
	19 – 20	ARRL Kids Day
	26 – 27	ARRL Field Day
July	10 - 12	IARU HF World Championships
August	7 - 9	ARRL UHF Contest
	21 - 23	ARRL 10 GHz and Up Contest
September	11 - 14	ARRL September VHF QSO Party
	18 - 20	ARRL 10 GHz and Up Contest
November	6 - 9	ARRL November Sweepstakes (CW)
	20 - 23	ARRL November Sweepstakes (Phone)
December	3 - 6	ARRL 160 Meter Contest
	11 - 13	ARRL 10 Meter Contest

Bob's TechTalk #40 (TechTalk #84)
by Bob Eckweiler - AF6C

The "L" Matching Network - Pt II

Last month the "L–Network" was introduced as a way to match two impedances at a particular frequency. Summarizing last month's article, a reactance is paralleled with the higher resistance impedance. The parallel circuit created has an equivalent series circuit. The parallel reactance is chosen so the resistance of the series circuit is the desired matching resistance. Finally a reactance of opposite magnitude is added in series to cancel the resulting series reactance. If that sounds confusing re-read part I.

There are two questions in last month's column that weren't addressed:

- ★ How are the component values chosen?
- ★ What are the pros and cons of the "L-Network"?

Calculating "L Network" Components:
Unlike last month, we'll have to break out the scratch paper, calculator and a sharp pencil! But the math is simple - I promise.

A term that was not mentioned last month is 'Q' or the 'quality factor' of the circuit. You can read more about 'Q' in the ARRL Handbook, but for us it is just an intermediate step for obtaining the needed component values.

Q for an "L-Network" is given by equation 1 *:

$$Q = \sqrt{\left(\frac{R_P}{R_S} - 1\right)} \qquad \text{eq. 1.}$$

Rp and Rs are the two desired resistances to be matched so Q is easily calculated. Note that Rp must be the larger of the two values. From the example last month:

$$R_P = 50\Omega, \quad R_S = 36\Omega \quad \text{so}$$

$$Q = \sqrt{\left(\frac{50}{36} - 1\right)} = \sqrt{1.389 - 1}$$

$$Q = \sqrt{0.389} \quad = 0.624$$

Use equation 2 to solve for Xp:

$$X_P = \frac{R_P}{Q} \qquad \text{eq. 2.}$$

$$X_P = \frac{50\Omega}{0.624}$$

$$X_P = 80.18\Omega$$

And use equation 3 to solve for Xs:

$$X_S = Q\ R_S \qquad \text{eq. 3.}$$

$$X_S = 0.624 * 36\Omega$$

$$X_S = 22.45\Omega$$

If you'd like to make the network act as a low-pass filter choose a capacitor for Xp; an inductor for Xp results in a high-pass filter. Remember a capacitor passes more RF and an inductor blocks more RF as the frequency increases. If Xp is a capacitor it shunts more of the higher frequencies to ground and Xs, then being an inductor, blocks more of the higher frequencies from continuing.

Up until now frequency hasn't entered into any of the calculations. The reactance values will work for all frequencies, though their as-

sociated component values might become unrealistic at extreme frequencies or for high Q values. For the example being used from last month the design frequency was 10.1 MHz.

For the low-pass "L-Network", choose Cp to be a capacitor with a reactance of Xp (80.18Ω) at 10.1 MHz. Using equation 4, the reactance formula for capacitors that you learned when you took your ham test:

$$C_P = \frac{1}{2\pi f X_P} \qquad \text{eq. 4.}$$

So:

$$C_P = \frac{1}{2\,(3.1416)(10.1)(80.18)}$$

$$C_P = \frac{1}{5088} = 0.000197\ \mu\text{F}$$

Since f is in MHz, Cp will be in μF. To convert to pF multiply by 1 million:

$$C_P = 197\ p\text{F}$$

The equivalent series circuit of 50Ω in parallel with Cp is a capacitive reactance Xs in series with 36Ω. We've already solved its value as 22.46Ω. To cancel out this capacitive series reactance an inductive series reactance of 22.46Ω is added in series. This is calculated using equation 5, the reactance formula for inductors that you also learned when you took your ham test:

$$L_S = \frac{X_S}{2\pi f} \qquad \text{eq. 5.}$$

$$L_S = \frac{22.45}{2(3.1416)(10.1)}$$

$$L_S = \frac{22.45}{63.46} = 0.354\ \mu\text{H}$$

The final schematic was shown in figure 1 last month and is redrawn here:

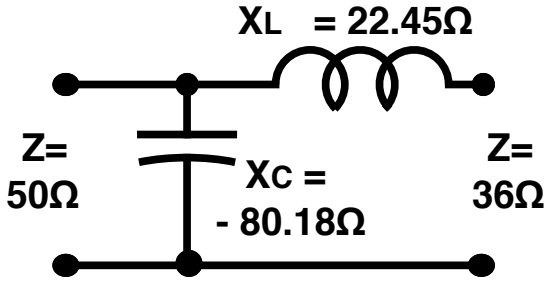


Fig. 1 "L-Network" to Match 50Ω and 36Ω. At 10.1 MHz: C = 197 pF & L = 0.354 μH

Matching Complex Impedances:

So far only purely resistive impedances have been matched. What if the vertical antenna is a little short and has an impedance with a reactive component, say 36 – j10Ω? (That's 36 ohms resistance in series with 10 ohms of capacitive reactance.) The answer is simple; since series reactance values add there is now –22.46Ω plus –10Ω or –32.46Ω of capacitive reactance and it must be nulled out with +32.46Ω of inductive reactance.

Likewise, if the vertical is long and has an impedance of 36 + j10Ω? (That's 36 ohms resistance in series with 10 ohms of inductive reactance) it's just as simple; the total reactance is –22.46Ω (capacitive) plus +10 ohms (inductive) so only –12.46Ω of capacitive reactance needs to be nulled out with +12.46Ω of inductive reactance.

And what if the antenna is so long that the inductive reactance is greater than the needed canceling reactance? Perhaps 36 + j30Ω? The total series reactance is now +30Ω –22.46Ω or +7.54Ω inductive. Cancel the series reactance with a 7.54Ω of capacitive reactance. Now the "L-Network" is composed of a shunt capacitor and a series capacitor!

The Hy-Gain *Beta Match*:

This leads to a clever way to match a beam antenna. The beam's driven element is normally in the range of 10 to 35 ohms depending on the beam configuration. By deliberately making the driven element short, the antenna looks to the feedline like a capacitive reactance in series with the antenna's resistance. This capacitive reactance can be set by adjusting the antenna length to be the value needed to be the series reactance Xs, eliminating a physical capacitor from the antenna design. An inductor is then used to shunt the 50Ω coax side of the antenna to complete what is a high-pass L-Matching network. Hy-Gain uses a length of shorted transmission line stub instead of an inductor and calls this matching design a *Beta Match*. An advantage of the shorted stub is that the center point of the short can be electrically grounded putting the driven elements at DC ground potential, preventing static buildup and providing some extra lightning protection. Designing this to work on a tri-band beam is a mathematical tribute to the engineers at Hy-Gain.

A Beta match for the vertical:

Figure 2 shows the high pass configuration matching 50Ω to a vertical mounted over perfect ground. The 10.1 MHz vertical is made of 279-9/16 of 1" dia. 6061-T6 aluminum, and has an feedline impedance of 36 + j0Ω. When the vertical is shortened its impedance changes; the resistive component goes down and the reactive component becomes capacitive negative). What if we shorten the antenna to the point where the capacitive reactance is the value of Xs needed to match 50Ω to the antenna's new resistive component? This eliminates the physical Xs capacitor and only a shunt inductor is required at the antenna feed-point! This matching technique is the well known Beta Match used by Hy-Gain in many of their antennas.

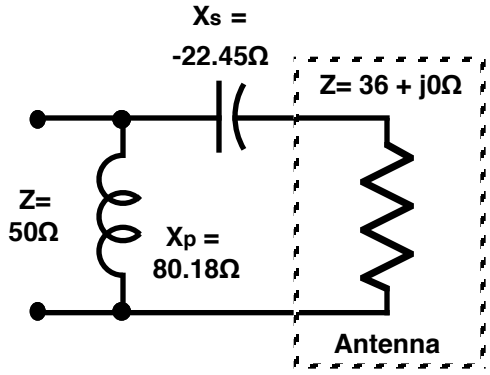


Fig. 2: High-pass "L-Network" matching a "perfect" vertical. At 10.1 MHz: *C* = 702 pF & L = 1.26 μH

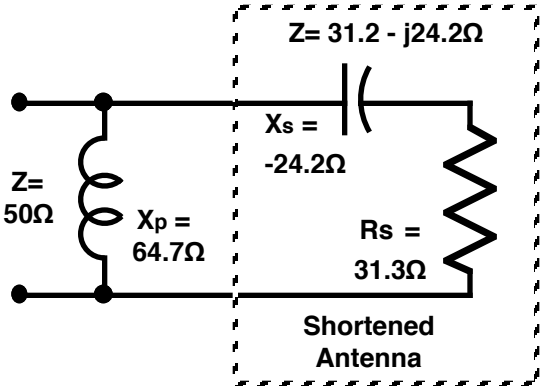


Fig. 3: Beta match of a shortened vertical. Xs is created by shortening the antenna . At 10.1 MHz: L = 1.02 μH

If the vertical is shortened to 266-5/8" the feed-point impedance changes to 31.3 –j24.2Ω. Calculating the needed components for an L-Network to match 50Ω (Rp) to 31.3Ω (Rs) are:

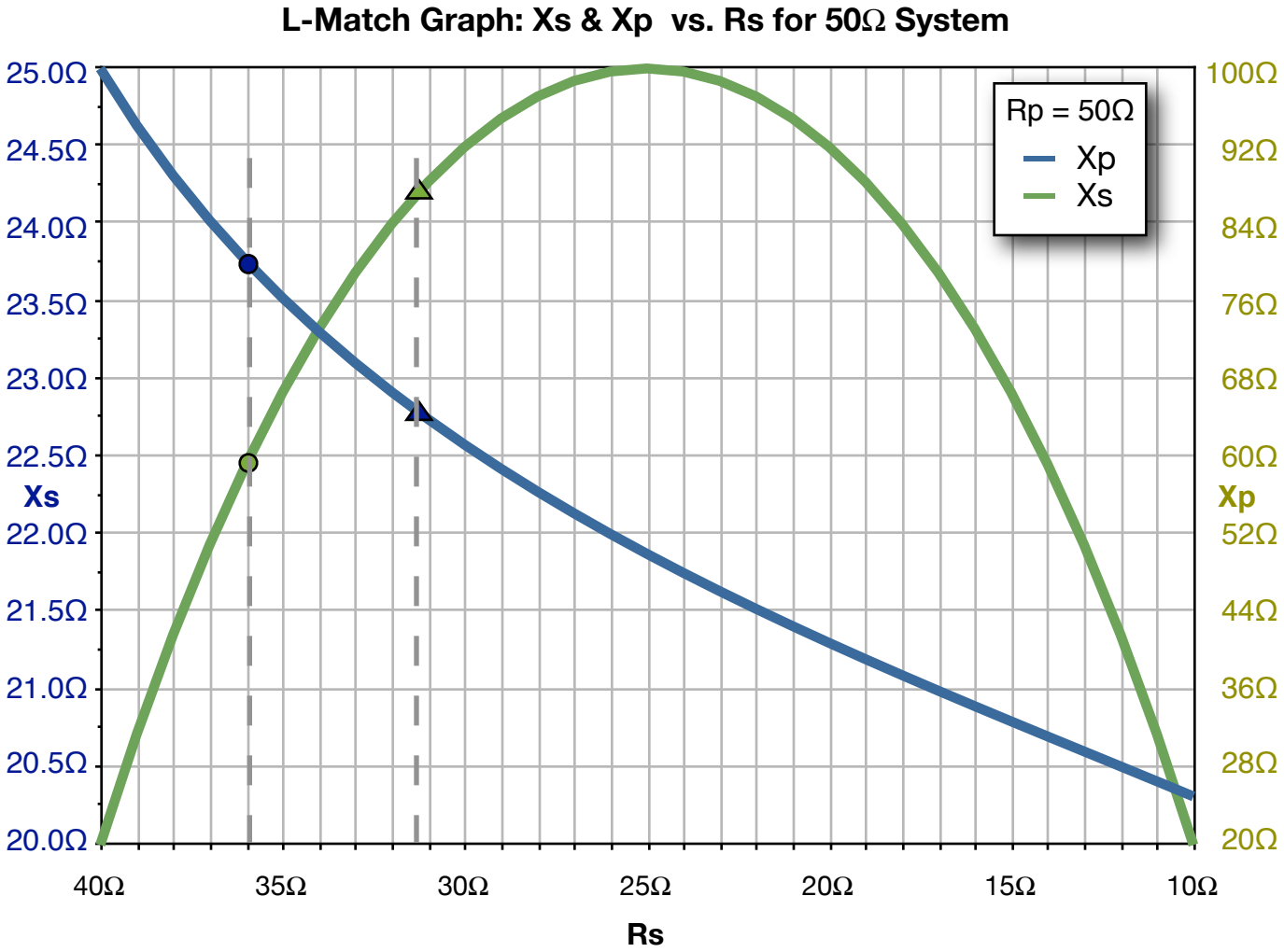
$$Q = 0.773 \quad X_S = -24.2\Omega$$
$$X_P = 64.7\Omega \quad L_P = 1.02\mu H$$

The finished antenna is shown in figure 3; it has a calculated SWR below 1.002:1. Just remember though, this is an antenna of 1" dia. aluminum tubing erected over a perfect ground (lots of radials) and clear of obstacles. Your mileage may vary!

A graph to get you close:
Let's face it, when building a homebrew antenna and winding a coil the coil is not going to be right on on the first try. Once the antenna is built, there will always be some trimming of elements and coils. What is needed is a good starting point. The 50Ω "L–Match" graph gives Xs and Xp for any resistive load between 40 and 10 ohms. The graph is set up for an Rp of 50 ohms and gives you a good starting point and a check for your calculations.

To use the graph, look at the original example – matching a 36Ω vertical to 50Ω feedline. On the horizontal (Rs) axis find 36 ohms. Draw a line vertically from that point. Where the vertical line intersects the green line, read Xs on the left-hand scale (22.4Ω); and where the vertical line intersects the blue line, read Xp on the right-hand scale (80Ω). These points are marked by a small circle.

Another example – matching the shortened antenna to 50Ω feedline – is marked with small triangles. As the antenna was shortened its resistance (Rs) decreased and its reactance (Xs) increased in a negative direction (capacitive). The trick is to find where Rs and and Xs fall on the same vertical line. This can be done by trial-and-error, by a lot of math, or by a computer program such as NEC-WIN PLUS, or EZNEC. The result turns out to be



31.3Ω for Rs and 24.2Ω for Xs for our example. Where the vertical line (extended if necessary) passes through the blue Xp line the correct value of Xp (64.7Ω) can be read on the right scale.

One last thing - The "L–Matching" network is based on the conversion between a parallel impedance and its equivalent series impedance. In the general form this can be done with the following equations:

For converting Parallel to Series *:

$$R_S = \frac{R_P X_P^2}{R_P^2 + X_P^2} \qquad \text{eq. 6a.}$$

$$X_S = \frac{R_P^2 X_P}{R_P^2 + X_P^2} \qquad \text{eq. 6b.}$$

For converting Series to Parallel *:

$$R_P = \frac{R_S^2 + X_S^2}{R_S} \qquad \text{eq. 7a.}$$

$$X_P = \frac{R_S^2 + X_S^2}{X_S} \qquad \text{eq. 7b.}$$

"L–Network" Pros an Cons:

The "L–Network works well when matching reasonable impedances. If Q becomes too large or too small then the component values can become unreasonable.

Under moderate to high power operation the voltages across the capacitor can become high. High-voltage and high-Q capacitors that can handle the expected current should be used. If you are unsure, calculate the expected voltage and current, and add a good safety margin. Similarly, coils should be low loss. If the coil's resistance is significant with respect to Rs and Rp then the Q becomes affected resulting in changes to the way the network matches.

If the component(s) of the matching network are out in the open then they need to be protected from the weather. HyGain uses a balance transmission line stub instead of a coil in its antenna designs. This not only allows DC grounding, it also makes for a weather resistant design.

Still, the "L–Network" provides a simple low-loss matching scheme that is easy to calculate and implement. It a method a builder should consider when looking for the best way to match two impedances.

In Conclusion:

If this article has whet your appetite for learning more about antennas, I must recommend that you look into the ARRL Antenna Modeling Course. This class is taught over the Internet. You will need to buy an antenna modeling program and there is a fee for the course. It is a worthwhile expense if you want to know more about antenna design, and how to model an antenna with a computers. You can find more about the course on the ARRL website. Look for ARRL course # EC-004:

http://www.arrl.org/cce/courses.html#EC004

*** Notes:** Derivations for equations 1, 6a, 6b, 7a and 7b may be found on our club website at:

http://www.w6ze.org/btt/btt040_notes.pdf

de Bob – AF6C

It is
Time to Organize
for
OCARC Field Day 2010

It is time to begin the planning for OCARC Field Day 2010. We need a few good hams to fill in some leadership positions.

1) FD Co-Chairmen

This year Ken W6HHC and Doug W6FKX have agreed to the roles of co-chairmen for FD

2) Band Captains confirmed

So far, the following people have volunteered as Band Captains

- 20M PH – Ken W6HHC
- 20M CW – Paul W6GMU
- 40M PH – (We think we have a 75% commitment for this band?)
- GOTA – Steve N1AB

3) Looking for Band Captains

It would be really great if someone would be willing to organize:

- 40M CW
- 2M (and VHF...maybe UHF, too?)
- Any other band is welcome (15M etc.)

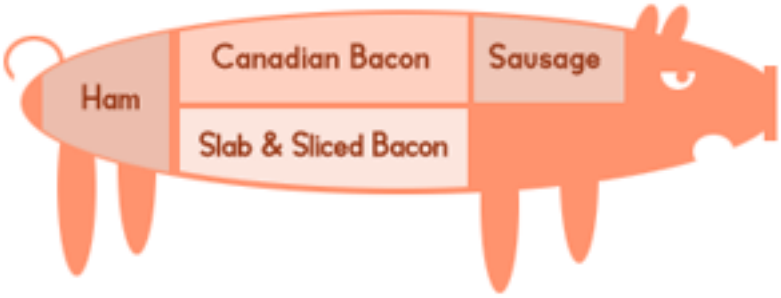
4) Organize Food

This year the number of operators may not be as large as last year. We are looking for one or two people to get together to help OCARC organize food. We have lot's of possibilities....cook, buy McDonalds or Pizza, use a caterer????? We just need a couple people to help organize.

5) Field Day Site

George N6VNI has turned in the application to request allowing OCARC to use Walter Knott Elementary School field in Buena Park for FD. We will keep you posted.

Let us know if you can help the OCARC Field Day planning efforts.....
...de Ken W6HHC **W6HHC@W6ZE.org**
...de Doug W6FKX **W6FKX@W6ZE.org**



Ham Cuisine

by Kristin, K6PEQ

Beef and Irish Stout Stew

In honor of St. Patrick's Day, we are bringing back the Irish stew. Enjoy!

Ingredients:

2 pounds lean beef stew meat
3 tablespoons vegetable oil, divided
2 tablespoons all-purpose flour
freshly ground black pepper to taste
1 pinch cayenne pepper
2 large onions, chopped
1 clove garlic, crushed
2 tablespoons tomato paste
1 1/2 cups Irish stout beer (e.g., Guinness)
2 cups chopped carrot
1 sprig fresh thyme
1 tablespoon chopped fresh parsley for garnish

Cooking Directions:

Toss the beef cubes with 1 tablespoon of vegetable oil. In a separate bowl, stir together the flour, salt, pepper, and cayenne pepper. Dredge the beef in this to coat.
Heat the remaining oil in a deep skillet or Dutch oven over medium-high heat. Add the beef, and brown on all sides. Add the onions, and garlic. Stir the tomato paste into a small amount of water to dilute; pour into the pan and stir to blend. Reduce the heat to medium, cover, and cook for 5 minutes.

Pour 1/2 cup of the beer into the pan, and as it begins to boil, scrape any bits of food from the bottom of the pan with a wooden spoon. This adds a lot of flavor to the broth. Pour in the rest of the beer, and add the carrots and thyme. Cover, reduce heat to low, and simmer for 2 to 3 hours, stirring occasionally. Taste and adjust seasoning before serving. Garnish with chopped parsley.

Serving Suggestions:

Drink with a Guinness!

OCARC

General Meeting Minutes

2-19-2010

OCARC General Meeting Minutes
February 19, 2010

The OCARC February General Meeting was held at the Red Cross complex in Santa Ana at 7:00 pm on Friday evening, February 19, 2010. There were a total of 33 members and visitors present. All of the club officers were present for a quorum.

Our guest speaker is a friend and avid DXer – Bob Grimmick N6OX. Bob's presentation on Tunisia TS7C was another one of his interesting DXpeditions. Bob has experienced some really great travels around the world but his trip and especially his Airbus flight to Tunisia could be categorized as that of a "Kid in a Candy Store". Bob was the envy of the entire DXpedition team (of course, they had no idea what he was doing up with the pilot). He got to spend nearly the entire flight in the cockpit with the pilot and his crew, firsthand experience!

Fig 01 – Bob N6OX presents a great DXpedition story about Tunisia-TS7C

Considering that once in Tunisia the team's radios were confiscated and held in customs, the team moved onto their site with the aid of the local Boy Scouts who sponsored the DXpedition as their guests. The average person could not have a radio station however the Boy Scouts are allowed to have a radio station which is sanctioned and licensed by the government. Gradually the radios through negotiations were returned to the team by the Boy Scouts.

All the six stations operating on the DXpedition were identical and used the WIN TEST logging system. Due to the diversity of the team both American and European keyboards were used with the computers. Spider Beam antennas were used with telescopic poles 40 & 60 feet – both antennas and poles were lightweight and easy for transporting.

Fig 02 – The QSL card from the TS7C DXpediton...Kerkennah Island off the coast of Tunisia.

Not only did everyone enjoy the presentation Bob gave a brief overview on a DXpedition with Arnie's N6HC input (another avid DXer). The best way to describe a DXpedition is to compare it to a Field Day experience with teamwork and cooperation from all participants. This helped many of our members and guests have a better understanding of the undertaking of a DXpedition. Bob … many thanks again. The best to you on your next DXpedition.

Field Day 2010 – June 25th-27th is just around the corner! The location will be Walter Knott School in Buena Park. Kristin asked for volunteers and her wish was granted - the Field Day Chairman will be co-chaired by Ken W6HHC and Doug W6FKK. George N6VNI and Paul W6GMU will work to secure the site. We now need Team Captains for each of the stations. Field Day meetings will be announced shortly so get ready to volunteer and help.

OCARC

General Meeting Minutes

2-19-2010

OCARC General Meeting Minutes
February 19, 2010 Cont'd

For our Show and Tell we had two members who brought items to share. Gary K6EKE shared several interesting items that he picked up. Gary is a new ham and from what he displayed is thoroughly enjoying the hobby and his new "Toys"… just remember the description of HAM – Had A lot of Money!

Fig 03 – "Show and Tell" by new-ham/new-member Gary K6EKE presented a T100 Antenna Analyzer for 144 MHz and 440 MHz

Ken W6HHC brought a Digital–ATV transmitter to share. It is one of his favorite aspect of the ham radio hobby and he and Robbie KB6CJZ are always experimenting with DATV. .

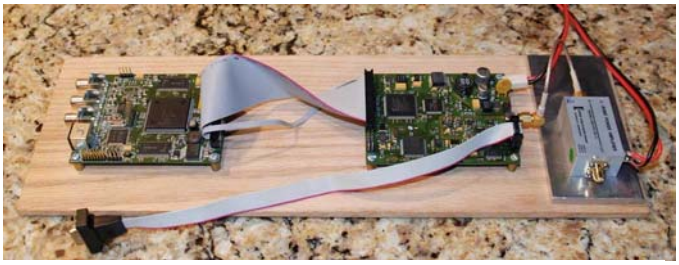


Fig 04 – "Show and Tell" by Ken W6HHC discussed a Digital-ATV transmitter for 1.2 GHz...set-up for 100 mW as seen.

Remember, if you have something for the Show and Tell bring it to the next meeting on March 19th, 2010.

Just a reminder that the ORARC Board Meetings will now be held on the second Saturday of each month at 8:15 AM at the Jagerhaus Restaurant, 2525 East Ball Road Anaheim. Visitors are welcome.

W6ZE will have an additional net on Thursday evenings on the WARA 2 meter repeater 145.400 at 8:00 PM; Nicolas AF6CF will be the net coordinator. Please check in and say hello.

Motion to adjourn at 9:00 pm by Paul W6GMU, seconded by Larry K6YUI. Followed by the raffle.

Submitted by:
Kristine Jacob KC6TOD
OCARC Secretary

OCARC

Board Meeting Minutes

2-13-2010

OCARC Board Meeting Minutes for February 13, 2010

The OCARC Board meeting was held at the JagerHaus Restaurant, 2525 East Ball Road, Anaheim, at 8:15AM Saturday, February 13, 2010. There were a total of 8 directors and 4 visitors – Danny KG6TII, Chuck AE6YJ, George N6VNI, and Steve N1AB. There was a quorum with all directors present.

DIRECTOR REPORTS:

- Vice President Paul W6GMU – with Kristin's assistance has speakers arranged most of the year – with the exception of July and November.
- Treasurer Ken W6HHC – Balance on hand is $3,944.76. The 2009 Audit has been completed and signed off. He reported the club grew financially in 2009.
- Secretary Kristine KC6TOD – shared that she is now the Vice Chairperson for OCCARO, if anyone had suggestions to please email them to her.
- Dan – N6PEQ - absent
- Loran AF6PS Membership - is preparing an update on the membership listing and would send to Ken W6HHC.
- Bob AF6C – absent
- Robbie KB6CJZ – handouts are now available and flyers are at HRO
- Nicholas AF6CF reported that the new net on WARA Thursday nights is doing well with 9 check-ins the first week. Good job!
- Larry K6YUI – Nope!

OLD BUSINESS:

- **RF Newsletter " Rotating" Editors**
  - March – Paul W6GMU
  - April – Doug Britton W6FKX
  - May – Kristine KC6TOD
  - June – Ken W6HHC
  - July - Paul W6GMU
  - August – Kristin K6PEQ
- **Guest Speakers –** Speakers confirmed for the year with the exception of July & November
- **Morse code Class:** on hold at this time
- **2010 Field Day Plans -** Walter Knott School will be the location, Paul and/or George to assist to go to school district to request Walter Knott School. Field Day Chairman position is still open and will be discussed at the General Meeting. For the benefit of our visitor Danny KG6TII, Kristine KC6TOD and the board gave a brief explanation of "What Is Field Day". We will contact CARA to see if they would like to participate as in previous years. Dino KX6D is not available for this year's Field Day.
- **Finances –** Kristin K6PEQ, Kristine KC6TOD, George N6VNI and Ken W6HHC completed the audit, bank cards and transition completed.
- **Red Cross Donation –** George N6VNI to get information as to proper procedure for OCARC's donation.

NEW Business

- **Eyeball Cards** – Business card for club – need to have format in Photo Shop or jpg file. Kristin K6PEQ has contact to produce the cards. Robbie KB6CJZ and Nicolas AF6CF to work on card.

GOOD OF THE CLUB – no input

Motion made to adjourn meeting by Nicolas AF6CF, seconded by Paul W6GMU.
Meeting adjourned 9:05 AM
Respectfully submitted:
Kristine Jacob KC6TOD, Secretary

You don't need to write like William "Bill" Shakespeare in order to write an article for the RF Newletter. In fact, we prefer articles without the words "Thy", "Whilst", "'Tis" and "Oft".

Do you have an idea for a newsletter article? Maybe you have acquired a new piece of equipment, designed or constructed a new antenna, took a trip focused around ham radio, want to share an amateur radio related experience or discuss a technical topic. Why not write an article for the monthly RF newsletter? The article can be short or long, simple or elaborate, and can even include pictures!

The RF newsletter relies on articles from our members. So why not give it try? Write an article and send it to the newsletter editor. It's fun, and at the same time, your contribution helps support our club and hobby!

If you want you can also try your hand as the newsletter editor. We have a rotating editor monthly and would love to have someone new give it a try. There is a template and it is easy and fun!!