RF

VOL. LIV NO. 8 P.O. BOX 3454, TUSTIN, CA 92781-3454 AUGUST 2013

THE PREZ SEZ:

August is here, and this means that there is less than a year to the next ARRL Field Day. We hope that next year will be as spectacular and this one was. In the meantime, we have big plans for the rest of the year with the upcoming anniversary party in September, the Club Auction in October and a couple of excellent speakers for this month and November meetings. Last month's speaker could not make it, so John N6QQ had to "fill in" on a short notice with an outstanding collection of videos that highlighted the best of our hobby. Thank you John and our apologies to those that were hoping to watch the Arduino and Picaxe presentation. We will try to schedule that one as soon as the Club calendar allows it, maybe early next year. Thanks to the generosity of its members, the Club did not lose money on the Field Day activity as expected, so the Board has decided to have a special drawing for an FT-817 radio at the reunion party in September, along with other "door prizes" like gift certificates for HRO, etc. As usual. I look forward to an eyeball contact with you all at the next General Meeting.

73,

Nicholas, AF6CF

Visit our Webpage:
Scan this QR code with your smartphone or tablet.

http://www.w6ze.org

AUGUST MEETING

At the August meeting Ken W6HHC will provide a presentation on digital-ATV called "DATV-Express Project - a Testing Report" with a demo.

Guest History Minute: Arnie - N6HC will present the NG84O amateur radio operation from the 1984 Olympic Village.

FRIDAY, AUGUST 16th @ 7:00 PM

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Click on a line to go to that page. Click on "*RF*" at the top of any page to go to page 1. (Works in most PDF viewers.)

The Next OCARC Breakfast & open club Board Meeting is on Sat. September 14th.

THE ORANGE COUNTY AMATEUR RADIO CLUB, INC.
P.O. Box 3454, Tustin, CA 92781

SPECIAL SERVICE CLUB

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Feedback & Corrections:
rf_feedback@w6ze.org

Submit Articles:
editors@w6ze.org

Monthly Events:

General Meeting:
Third Friday of the Month
At 7:00 PM except Dec.
American Red Cross
600 N. Parkcenter Dr.
(near Tustin Ave. & 4th St)
Santa Ana, CA

Club Breakfast (Board Mtg.):
Second Saturday of the month at 8:00 AM at the Jägerhaus Restaurant
2525 E. Ball Rd.
Anaheim, CA
(Ball exit west off 57-Fwy)

Club Nets (Listen for W6ZE):
28.375 MHz SSB ± QRM
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

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

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.

Club Dues:

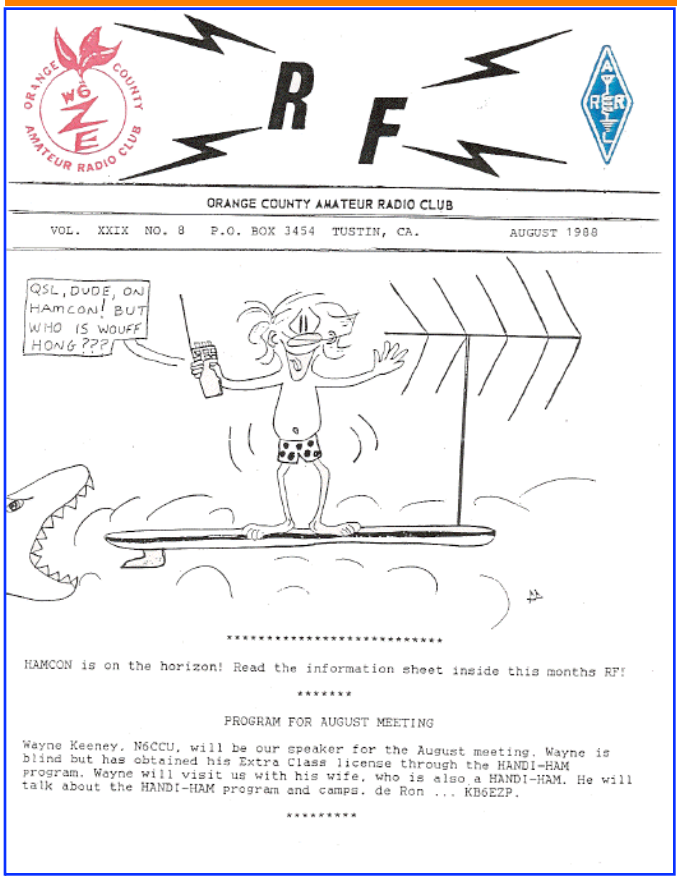
Regular Members	$20
Family Members*	$10
Teenage Members	$10
Club Badge**	$3

Dues run from January thru December & 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. We prefer you pickup your badge at a meeting.

New members joining after midyear may choose to pay for the remainder of the year and the next year at a savings of $5.

August 1988: 25 Years Ago in RF Newsletter:



ORANGE COUNTY AMATEUR RADIO CLUB

VOL. XXIX NO. 8 P.O. BOX 3454 TUSTIN, CA. AUGUST 1988

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HAMCON is on the horizon! Read the information sheet inside this months RF!

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PROGRAM FOR AUGUST MEETING

Wayne Keeney, N6CCU, will be our speaker for the August meeting. Wayne is blind but has obtained his Extra Class license through the HANDI-HAM program. Wayne will visit us with his wife, who is also a HANDI-HAM. He will talk about the HANDI-HAM program and camps. de Ron ... KB6EZP.

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With the club celebrating its 80th anniversary, it might be fun to look back and see what the club was doing 25 years ago (1988). Here is a quick rundown thanks to the preservation of our RF Newsletters by our historian Bob - WB6IXN. August 1988 was a large issue, 16 pages; that's almost twice the size of typical RF newsletters of the time. In 1988, the RF editor was being rotated among different members (as it is now!). August was edited by Mark Stanford - KJ6JC (Now W6MCS).

The two major topics discussed in the August 1988 (XXIX No. 8) issue of RF were the upcoming ARRL convention, and the possible loss of the top two MHz of the 220 MHz band. Wayne Keeney - N6CCU was the scheduled speaker talking on the HANDI-HAM program and camps.

The ARRL National Convention was being held at the Disneyland Hotel September 2, 3 & 4. The OCARC was in charge of security, with Ken - W6HHC the security chairman. Admission cost $12. The banquet, with Dave Bell - W6AQ the banquet speaker and Johnny Grant WB6MJV the MC, was another $25. Among the convention speakers were Fried - WA6WZO (ARRL Forum) and Gordon - WB6NOA (Tropo Ducting…).

There was much discussion on a recent FCC vote to take the 220 - 222 MHz band segment away from radio hams and give it to the land mobile business. Karl Pagel N6BVU provided a petition that hams could use to petition the FCC to stop the action.

In other news items: Frank - WA6VKZ reported on the centennial bike ride - it was Orange County's 100th anniversary; Alex - W6RE was missing a chair from FD; and Ted - K6LJA was offering to a good home a complete set of QST from the 30's to present.

Bob - WB6IXN published the Net News; Club nets were held on 15M CW (Thu), and 2 and 15M SSB (Wed).

The club was holding its monthly meetings on the third Friday at Mercury Savings and Loan, 1095 Irvine Blvd. near 17th St. (Now a St. Joseph Heritage Medical Group office.) The club was holding its breakfasts at Le Grand Cafe at 2525 N. Grand Ave. Suite A, just south of the 22 Fwy.

We hope to have the 1988 RF Newsletters scanned and up on the club website soon. ***Any volunteers want to help?*** The August 1988 issue of RF will be up on our website shortly after this RF issue is published.

de Bob – AF6C

Let the Club Handle Your ARRL Renewal

Over the past few years very few members have taken advantage of joining or renewing their A.R.R.L. membership through the club. The club benefits by receiving a commission when a member joins or renews through the club. If you wish to join the ARRL, see the club Treasurer for a form. You pay the Treasurer directly and he will submit your form. If it is time to renew, bring your renewal notice to the Treasurer along with your renewal check made out to the OCARC and he will handle the submission. (you can renew early, even before you receive your renewal notice. Just see the Treasurer.)

ARRL 2013 S.W.D Ham Convention

The 2013 Southwestern Division ham convention, sponsored by the Santa Barbara Amateur Radio Club, will be held on the weekend of September 7 and 8 in Buelton (Solvang), CA. For more information visit their website at:

http://www.swhamcon.com/

No fliers were available on their website at press time to add to the newsletter.

Scan the QR code to the right with your smart phone or tablet to visit the SWHAMCON site

? ? PUZZLER ? ?

It's been awhile since the newsletter carried a puzzler. Here is one to keep you busy should a solar storm quash the band propagation.

Three hams from a rival radio club, Tom, Dick and Harry, find an unbuilt Heathkit DX-100B at the local swap meet. Quickly picking up the gem at a bargain price, they proceed over to Harry's shack. Mulling over how to assemble the kit, they decide that it could at most be a two man job. While two of them built the kit, the third would video tape the work for YouTube. But who would do what?

Doing a little math, they determined that Tom and Harry, working together, could build the kit in 20 hours. Doug and Tom could do it in 60 hours and Harry and Doug could to it in 30 hours.

How long would it take each ham to built the kit if they worked alone? Which one would end up taking the video?

DX-100B

? ? PUZZLER ? ?

Heathkit of the Month:
by Bob Eckweiler, AF6C

Heathkit IG-4505 Oscilloscope Calibrator

Introduction:

Heathkit has manufactured numerous oscilloscope kits over the years. Early scopes have variable vertical amplifiers (usually AC coupled) and sweep generators. Measuring actual voltage or frequency (period of a wave) requires some form of external signal to compare to the signal being measured. Newer oscilloscopes have calibrated vertical and horizontal amplifiers, and time bases. The amplifiers (most DC coupled) have a switched gain control marked in Volts-per-Division. The time-base is also switch selected, marked in Seconds-per-Division. A typical Heathkit oscilloscope of the 1980's, such as the IO-4235, has a voltage range of 2mV. to 10 V/Div. in a 1-2-5 sequence, and a time-base range of 0.05 µSec. to 0.20 Sec/Div. The vertical input is often used with a scope probe that has a 10X attenuation. And many time-bases have a X5 switch.

These newer scopes allow you to easily get a good approximation of the frequency and voltage when looking at a waveform. However, to initially calibrate such a scope requires a calibrator, such as the Heathkit IG-4505 (Figure 1), with accurate voltage and frequency outputs. Newer scopes generally have a higher frequency vertical amplifier response (35 MHz in the case of the IO-4235). In order to get good response, the front end attenuators must also be calibrated. This requires a square wave with a very fast and clean rise time.

Figure 1: Heathkit IG-4505 Deluxe Oscilloscope Calibrator

Heathkit Scope Calibrators:

Over the years, Heathkit produced six models of oscilloscope calibrators that I am aware of. In 1952 Heathkit introduced the VC-1 voltage calibrator ($9.50), followed a year later by the VC-2 ($11.50) (Figure 2). In 1956 the VC-2 was replaced by the VC-3 ($12.50) that was sold through 1962. These three units output a calibrated AC voltage. The VC-1 and VC-2 have peak-to-peak 60 Hz. outputs of 0.1 V, 1 V, 10 V and 100 V. A variable potenti-

Figure 2: VC-2 Scope Voltage Calibrator

Figure 3: Heathkit IOA-4510-1 Low Cost Scope Calibrator

ometer marked 0 - 10 allows you to scale the voltage in each range. The VC-3 is a bit more accurate with 1 KHz fixed peak-to-peak output voltages from 0.03 V to 100 V in a 1-3 sequence. These three calibrators also have a **SIGNAL** input that can be switched to the output so you don't have to change leads to switch between the signal and the the calibrator. The three newer units are for actually calibrating the fixed gain and time-base of an advanced oscilloscope.

The IOA-4510-1 Low-Cost Calibrator:

The IOA-4510-1 calibrator (Figure 3) was originally designed for the IO-4510 10 MHz scope. Produced from 1974 through 1981, it sold for $14.95 in 1977 and for $17.95 in 1981. This calibrator is just a circuit board with square-wave outputs from 1 KHz to 1 MHz. The 1 KHz is adjustable from 0 to 4.7 V peak-to-peak. Power is derived from the oscilloscope under test. Signal selection is through a shielded clip-lead provided with the kit.

The Heathkit IG-4244 Precision Calibrator:

The IG-4244 is the last of the calibrators manufactured by Heathkit. It was "new" in the Christmas 1983 catalog, (see Figure 4) and sold for $149.95. An assembled and tested model, the SG-4244, was available for $249.95. The kit continued to be available into 1992 selling for $199.95. The calibrator is able to calibrate scopes above 100 MHz. It has two crystal oscillators and covers a voltage range of 1 mV to 100 V in 1-2-5 sequence at an accuracy of 1% and a rise time of <5 uSec.. The time-base range is 10 nSec. to 0.5 Sec in a 1-2-5 sequence with an accuracy of 0.015% and a rise time of <1nSec. when properly terminated. There is also a sine-wave output for calibrating triggering circuits. This is a complex calibrator, as indicated by its price. Perhaps some day the IG-4244 will be featured in this column?

The Heathkit IG-4505 Deluxe Calibrator:

The IG4505 was in production from late 1975 until 1990. Until the IG-4244 was introduced it was named the "Deluxe" scope calibrator. Afterwards the name changed to the "Economical" scope calibrator. The IG-4505 originally sold for $44.95. In the fall of 1989 the price had risen to $69.95.

On September 19th, 1979 I walked into the local Heathkit store, located on Ball Road in Anaheim, and purchased an IG-4505 to calibrate the new IO-4235 delayed sweep, dual channel, 35 MHz oscilloscope I had just completed. Prices at Heathkit's retail outlets were commonly higher than the factory prices, so the bill came to $49.95 (plus $3.00 for the then 6% CA tax).

The IG-4505 was introduced shortly before the IO-4235, likely for calibrating it and other new scopes Heathkit had in their plans.

Heathkit IG-4505 Specifications:

The IG-4505 has two outputs, a voltage output and a time-base output. The peak square wave voltage output has six decade steps from 1 mV to 100 V. A seventh position grounds the output lead. The voltage accuracy is 2% with a rise time of 2 µSec. The voltage output frequency can be selected from 2 Hz up to 10 KHz in a 1-2-5 sequence. DC output can also be selected on the voltage switch. The voltage output is available via a pair of red-black binding posts on the front panel.

The Time-base output is a nominal 200 mV peak square wave. The frequency range is 1 uSec to 0.5 Sec in a 1-2-5 progression with an accuracy of 0.01% and a rise time of <4 nSec. The time-base output is a coax cable a few feet long terminated with a BNC connector and a built-in 51Ω terminating resistor.

Overall, the IG-4505 weighs 2-1/4 lbs. and measures 2-3/4" H x 9-1/8" W x 4-1/4" D. Power requirements are 120 VAC or 240 VAC at 13 watts.

The front panel of the Heathkit IG-4505 has two rows of controls and outputs. These are shown in table one. The rear panel of the IG-4505 sports only the three-wire power cord and the Blue-White ID label.

Kit Assembly:

Most of the components mount on a single circuit board which is "stuffed" first (components soldered on). The board contains 5 transistors, 10 diodes and seven integrated circuits plus numerous resistors and capacitors. Two rotary switches mount to the board, but the connections are by wire, not PC terminals. A three position slide switch is mounted similarly. Also on the board is the voltage calibration potentiometer.

Front Panel Top Row (L to R)

Switch - 2 pos. Slide: **POWER**
OFF - ON

Lamp - Pilot (Neon): **POWER**

Switch - 7 pos. Rotary: **VOLTS OUT**
(**100V, 10V, 1V, 100mV, 10mV, 1mV, GND**)

Switch - 7 pos. Rotary: **TIME OUT**
(**DC, .1S, 10mS, 1mS, .1mS, 10µs, 1µs**)

Switch - 3 pos. Slide: **TIME OUT**
(**X1, X2, X5**)

Front Panel Bottom Row (L to R)

Binding Post - dual (red, blk): **VOLTS OUT**
Cable - 30", BNC male, 50Ω terminated

RG-58 coaxial. **TIME OUT**

Table I: IG-4505 Front Panel Controls, Etc.

Most of the remaining components, not directly mounted to the chassis, mount on two large terminal strips. Cleverly, Heathkit has you mount these terminal strips to the outside back of the chassis temporarily while you wire them up due to limited space inside the chassis. These terminal strips hold the power supply filter capacitors and the voltage regulator components.

Next the chassis components are mounted. The OFF-ON switch, two binding posts, a rubber grommet for the time-base output cable, some solder lugs, and the power transformer with another terminal strip mounted to one of its fasteners. This terminal strip, with part of one of the others, is used to wire the unit for 120 or 240 VAC.

Chassis wiring is then started; the power cord is prepared and mounted using a strain relief. The terminal strips, prepared earlier, are mounted inside the chassis and final chassis wiring is conducted. The circuit board is then installed and the three switches prewired to the circuit board are fastened to the front panel. Finally the time-base cable is prepared and installed as are the knobs.

A tradition, born in the late sixties, is then performed: The Heathkit "Blue and White" identification label is attached to the rear of the chassis. This label shows the model and serial number of the equipment.

After checkout and calibration, final assembly consists only of installing the chassis cover.

Testing and Calibration:
Testing involves powering up the unit, checking for smoke and looking at the waveforms on your oscilloscope. Should you experience a problem, the manual comes with an extensive section, including three pages of flowcharts, covering troubleshooting.

Calibration is straight forward with only one adjustment. The time base accuracy is set by the crystal. The voltage adjustment can be done either with an accurate DVM or using a built-in reference and an analog voltmeter.

Operation:
Using the IG-4505 oscilloscope calibrator is simple. Getting to the adjustments in your scope might not be as easy. Heathkit scopes, though, usually have good access to their adjustments.

Time-base calibration is done by connecting the time base output cable to [one of] your scope's vertical channel input[s]. The scope's time-base range to be calibrated is then set and a time-base signal from the calibrator is selected that gives a square-wave that covers numerous divisions. The scope time-base is then adjusted so the waveform covers the correct number of divisions. For instance, say you are calibrating the 10 mSec/Div. time base. Assuming the scope has ten horizontal divisions select 50 mSec on the calibrator. then adjust the scope's time-base so one

Figure 4: Ad in 1983 Catalog #863 Introducing the "New" IG-4244 Calibrator

full cycle of the square wave displayed is five divisions wide.

Voltage calibrations are done using the voltage output. It is connected to the scope's input amplifier with its range set to the desired voltage to be calibrated. The calibrator is then set to a voltage that makes the square wave fill most of the vertical divisions. Then the scope's vertical calibration control is adjusted to it fills the correct number of divisions on the scope.

Another important scope adjustment is the vertical amplifier compensation. In this case use the 1 µSec time-base output and adjust the vertical compensation capacitor(s) for the best square wave without overshoot.

The IG-4505 oscilloscope calibrator can also be used measure the bandwidth of an oscilloscope's amplifiers.

IG-4505 Circuit:

The circuit of the IG-4505 is quite straight forward. See Figure 5 for a schematic of the Heathkit IG-4505. There are two power supplies. a regulated five volt supply for most of the ICs and miscellaneous circuits and a zener regulated 110 volt power supply, for the voltage calibrator.

The time-base is a 4 MHz oscillator which is divided to 2 MHz followed by a 7490 IC dividing the 2 MHz by two and by five. The three resulting signals, 2 MHz, 1 MHz and 400KHz are then selected by the **TIME OUT X1 X2 X5** switch and then divided by two again. The resulting 1 µSec., 2 µSec. and 5 µSec. square wave time-base signals are then fed into a string of five divide-by-ten ICs. One of those outputs is selected by the decade **TIME OUT** switch and sent to a pair of emitter coupled fast, non saturating, switching transistors driving the fast rise-time **TIME OUT** cable.

The output from the timeout circuit, before the final driver transistors, also goes to the voltage circuit. Here it drives two high voltage transistors connected in series. When the bottom transistor is conducting, driven by the time-base signal, it drops the voltage on the emitter of the upper transistor to cutoff. When the time base signal goes low the lower transistor cuts off causing the upper transistor to conduct. Thus the collector of the lower transistor switches from between about 108 volts and ground. This voltage is fed through a calibration pot to a precision voltage divider where decade voltages between 100 V and 1 mV are tapped off by the VOLTS OUT switch and sent to the front panel VOLTS OUT binding posts.

Conclusion:

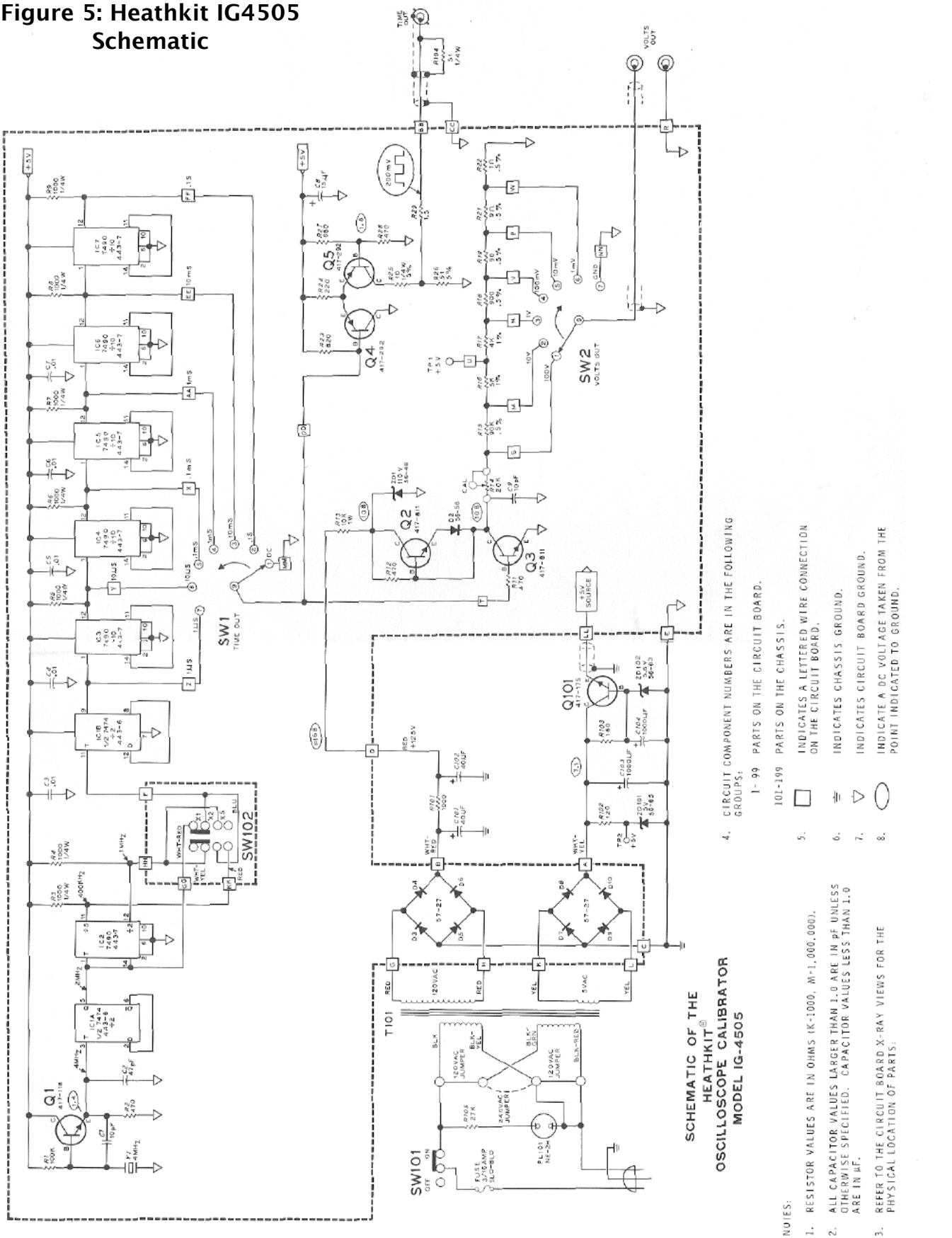
The IG-4505 Oscilloscope Calibrator is one of those tools that you don't need often, but when you do it earns its cost. Occasionally it gets used as a signal generator. Other than an out-of tolerance resistor that sometimes caused the crystal oscillator not to start, it has worked well.

73, from AF6C

Remember, if you are getting rid of any old Heathkit Manuals or Catalogs, please pass them along to me for my research.

Thanks - AF6C

Figure 5: Heathkit IG4505 Schematic



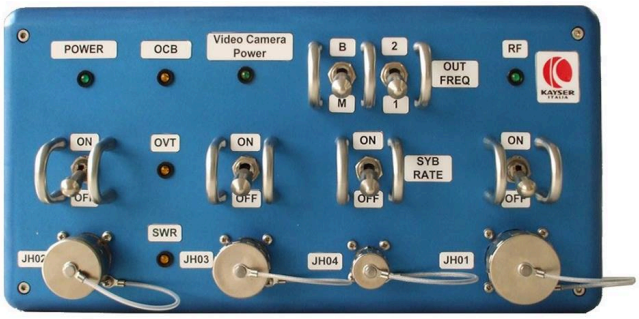
Ham Digital TV transmitter launched to ISS

posted on internet by

Trevor M5AKA of AMSAT-UK

http://ukamsat.files.wordpress.com/2013/08/issdatvgastonbertelson4wf.pdf

On Saturday, August 3 at 1948 UT the Japanese HTV4 cargo vessel was successfully launched to the International Space Station (ISS). Onboard was the HamTV [DATV] transmitter and a number of CubeSats carrying amateur radio payloads.

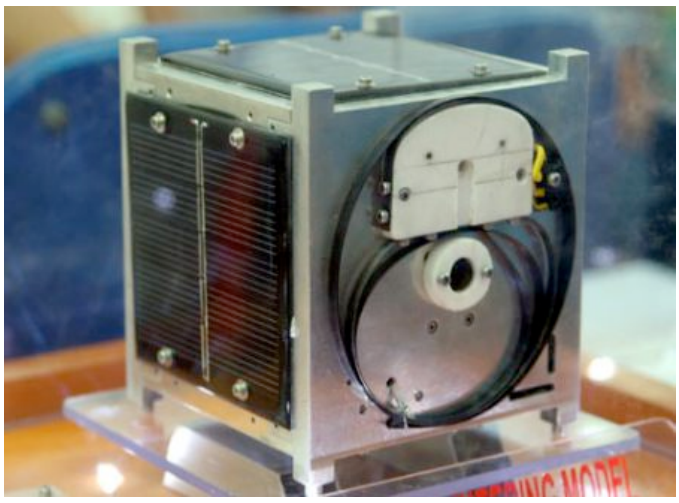


Front panel of the HamTV transmitter

The Japanese space agency JAXA has announced details of four CubeSats on the launch. They will be deployed from the ISS by the JEM Small Satellite Orbital Deployer (JSSOD) between October 2013 and March 2014.

The four CubeSats are:

- **PicoDragon** - a 1U CubeSat developed by Vietnam National Satellite Center(VNSC), University of Tokyo, IHI aerospace. CW beacon on 437.250 MHz and 1k2 AFSK AX.25 telemetry on 437.365 MHz

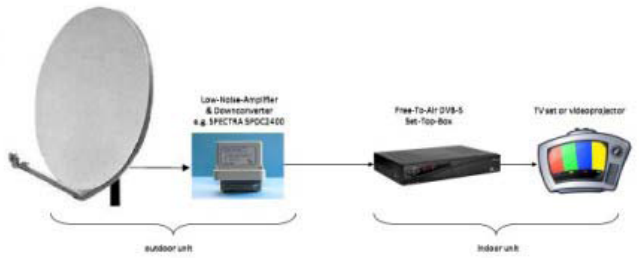


PicoDragon CubeSat – (Image credit VNSC)

- **ArduSat1 and ArduSatX** - 1U CubeSats developed by Nanorack, NanoSatisfi. ArduSat1 437.325 MHz 9k6 MSK CCSDS downlink. ArduSatX 437.345MHz 9k6 MSK CCSDS downlink.
- **TechEdSat3** - a 3U CubeSat developed by NASA Ames Research Center

The company NanoRack has announced it is sending 36 Units of CubeSats to the ISS (believed to be 26 separate CubeSats, some 2U or 3U in size). At the time of writing it is believed they will be going on a later cargo vessel.

The main mission of HamTV is to perform contacts between the astronauts on the ISS and school students, not only by voice, but also by unidirectional video from the ISS to ground within the ARISS.



A basic amateur radio station that should be able to receive HamTV from ISS – (Image AMSAT-Italia)

The ESA Columbus module on the ISS will host the 2.4 GHz video transmitting station in addition to the existing 144 MHz FM amateur radio station. This new equipment can broadcast images from the ISS during the school contacts or other prerecorded video images up to 24 hours a day to allow ground stations tuning.

It is planned to transmit DVB-S [protocol DATV] signals on 2.4 GHz at either 1.3MSps or 2.3MSps with 10 watts of RF. The IARU Amateur Satellite Frequency Coordination Panel announced frequencies of 2422.0 MHz and 2437.0 MHz. HamVideo is the name of the onboard DATV Sband transmitter. HamTV is the name of the complete system, comprising DATV downlink and VHF voice uplink. Kaiser Italia SRL was the prime contractor for the design and development of the flight and ground segment.

Orange County Amateur Radio Club
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Style	Color	XS	S	M	L	XL	XXL	3XL	4XL
L420	White								
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Personalization - Name
Personalization - Call Sign
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Total

OCARC Board Meeting Minutes for July 13, 2013

The OCARC Board meeting was held at the JagerHaus Restaurant, 2525 East Ball Road, Anaheim, and called to order by President Nicholas Haban AF6CF on Saturday, July 13, 2013. Called to order at 8:15 am.

Roll call:
President- Nicholas AF6CF
Vice President – Tim N6GF
Treasurer – Ken W6HHC
Publicity – Kris KC6TOD
Technical – Bob AF6C
Directors – Robbie KB6CJZ & Paul W6GMU

Absent:
Secretary – Tim KJ6NGF
(Kris KC6TOD to take minutes)
Activities – Doug W6FKX
Membership - Jay – KI6WZU

Visitors:
George Jacob N6VNI
Jim Brackett KE6FVN
David Brackett KE6OPK

BOARD MEMBER REPORTS:

President – Nicholas AF6CF will discuss points later in the meeting.

Vice President – Tim N6GF, no report, but has info for discussion later in the meeting.

Treasurer – Ken W6HHC – Club is in the black, Field Day was a financial success. Ken mentioned having a discussion on the "Opportunity Drawing" prizes changing the assortment, using a little more imagination.

Publicity – Kris KC6TOD discussed the success of Field Day 2013 and the great visits from government agencies.

Technical – Bob AF6C, New members need recognition as in a blanket email, thanking them for joining the club – this needs to come from the Membership chair. Nicholas said that he would handle the recent new members

Director – Robbie KB6CJZ Nothing to report

Director – Paul W6GMU Nothing to report

Old Business:

- Newsletters are covered through the end of the year – August AF6C, September N6GP, October KC6TOD, November W6GMU, December KC6TOD
- July meeting speaker to be Bill K6ACJ on Raspberry Pi
- Field Day 2013
  - George N6VNI shared the tremendous success of the VE Testing at Field Day – six (6) new and upgraded HAMS – four (4) Technicians and two (2) Generals.
  - Ken W6HHC reported that Bob Harrington AA6PW made mention the 15 meter balun needed repair, Bob AF6C to make new 15 meter balun.
  - Pins for towers need to be tapered [chamfered? - ed] – research being done
  - Element for 15 meter beam is damaged, Bob Harrington AA6PW to order replacement part.
  - Tim N6GP praised the great teamwork and that OCARC has a chance at second place especially on 20 meter SSB (we beat W3AO by far).
  - Paul W6GMU commented it was the best Field Day by far, great experience
  - Nicholas AF6CF shared that PSK31 station lost contact, more planning needs to be done on that particular station.
  - Field Day scores will be in newsletter

- Bonus points will not be available until 7/25 **[18,708 QSO points., 2,550 Bonus points. 21,258, Total points. - Ed.]**
- Overall views were shared again as a great Field Day with much success thanks to everyone working as a team.

New Business:

- Logo items for 80th Anniversary meeting
  - Paul W6GMU to order mugs for club
    - Logo needs to be in a tif or gif file
    - Mugs to be sold for $10.00
    - Orders can be placed at the July and August club meeting, members can order with name and call sign.
    - No minimums making the order much easier
  - George N6VNI will contact Terri at Embroidery in Motion for quote on 80th Anniversary, Bob AF6C to send jpg file to George. He will have information to provide at the July 19th meeting
- September 80th Anniversary meeting
  - Food will be handled by Tim N6GP and Doug W6FKX
  - Short tribute to former member and Silent Key W6NGO
  - Contact old members by emails, letters, calling
  - Dan N6PEQ has time capsule from the 75th Anniversary meeting in his garage
  - George N6VNI had a suggestion to have a special drawing for a Yaesu 817 All Band Radio
    - $5.00 a square (discussion on number of squares and decision was made for a board with 100 squares)
    - Unanimous decision from all in attendance
    - Club will pick up the difference for the cost of the radio
    - All in favor – George N6VNI will proceed with obtaining the information for the special drawing. Kris KC6TOD to create the board with 100 squares
  - Discussion on expanding the prizes to include door prizes
    - Prizes to be $25.00 gift certificates to HRO (four total)
- Bob AF6C to bring Field Day sign-up sheets to the next meeting to gather any members/visitors that neglected to sign-in at Field Day.
- Need to recognize new members and visitors at each meeting, make everyone feel welcome
- Invite Gordon West WB6NOA to become an Honorary Member, this will be done at the September 80th Anniversary meeting. George N6VNI and Kris KC6TOD to visit Gordon and follow through with the invitation.

Good of the Club – Awards of Appreciation to all coordinators of "Field Day 2013"

Meeting adjourned at 10:00 AM

Respectfully submitted by:
Kris Jacob KC6TOD

An ***ARRL*** Special Service Club

OCARC GENERAL MEETING MINUTES for July 19th, 2013

The OCARC General Meeting was held at the Red Cross Complex on July 19th 2013. The meeting was called to order at 7:02 PM. There were 36 members and 2 visitors in attendance. At least two of those members were newly paid as of that evening.

The meeting started off with a quick introduction of those in attendance and also an announcement that because there was about a $200 surplus from the field day funds there will be an opportunity drawing for a Yaesu FT-817. The membership would have the opportunity to buy squares on a board containing one hundred positions. At the September meeting a winner will be drawn.

The main speaker for the evening was John Schroeder – N6QQ. John served as a last minute fill in when the previously scheduled speaker had a family emergency. John is a highly accomplished DX'er who wowed us with another of his passions youtube video's centered on Ham Radio. The video's ranged from the bizarre melodic signing on an antenna about "Join Us on the Air Waves" to science related videos regarding lightning and also solar activity.

Just prior to the break several announcements were made. This included information on purchasing coffee mugs with the Club 80th anniversary logo or T-shirts similarly arrayed. Several certificates were awarded to members who had leadership roles in our Field Day event. **[Also, before the break, a check was presented to the club for $231.30 for the balance of the FD generator cost from the Kei Yamachika - W6NGO Trust fund - Ed.]**. At about 8:25 PM a break was called.

The meeting resumed at 8:45 PM. A quorum was in attendance with only the Treasurer – Ken W6HHC and Membership Chair – Jay KI6WZU not present.

Our Club President reported that Field Day went very well. A proclamation from California Assemblyman Alan Mansoor was read. It congratulated the club on its 80th anniversary and Field Day event.

Technical Chair – mentioned that FCC District Director from the Enforcement Bureau visited our Field Day site and remarked that we had a very impressive setup. [In a followup email he wrote:

It was a good visit to witness all the radios and operators working outdoors using generators in a simulated emergency environment. I hope it will never be necessary to utilize these capabilities, but it is comforting to know the resources are available if needed. - Ed.]

Various upcoming events include MS walk and MS bike ride where members can offer assistance through the use of their radio skills and vehicles. if interested contact Ken Simpson - w6kos@earthlink.net.

OC Races is looking for new members. See:

http://www.ocraces.org/cntct2.html

Meeting adjourned at 9:00 PM.

Respectfully submitted by:
Tim Millard, KJ6NGF,
Secretary 2013.

An ***ARRL*** Special Service Club

Bob's TechTalk

Number 46
(TechTalk 112)
by Bob Eckweiler, AF6C

Understanding the HF Reflectometer

Introduction:

For many years the reflectometer (AKA as the SWR bridge) was a staple in most every ham shack. This device measures relative power traveling in a transmission line in both the forward and reflected directions. It is a frequency dependent device, becoming more sensitive as frequency is increased in the HF bands. The meter scale is often calibrated in SWR and % reflected power. Since these are related to the ratio of forward to reflected power, the meter is first switched to forward power and adjusted to a specific reading (usually full scale) using a sensitivity control. Next the reflectometer is switched to read reflected relative power. The meter then reads in SWR and % reflected power. A reading of zero represents an SWR of 1.0:1; a reading of half-scale represents an SWR of 3.0:1 and a reading of full scale represents infinite SWR. This type of SWR bridge is based on *The Monimatch Mark II* article by Lew McCoy (QST February 1957 p 39). Lew developed it from an article in Naval Research Labs (See Lew's earlier article *The Monimatch* - QST October 1956 p 11).

Newer bridge designs are often frequency independent to a large extent, and can read out both forward and reflected power directly in watts as well as the SWR.

In 1959 I built the Heathkit AM-2 reflectometer as a budding Novice. For years it mystified me as to how it worked. In college, with a little mentoring from a professor-ham, I worked out the principle. Perhaps others are curious? We'll be doing math, but you can also follow along without working the the math.

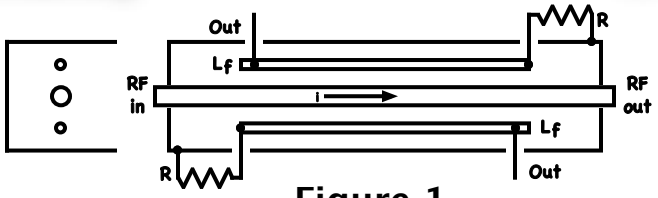


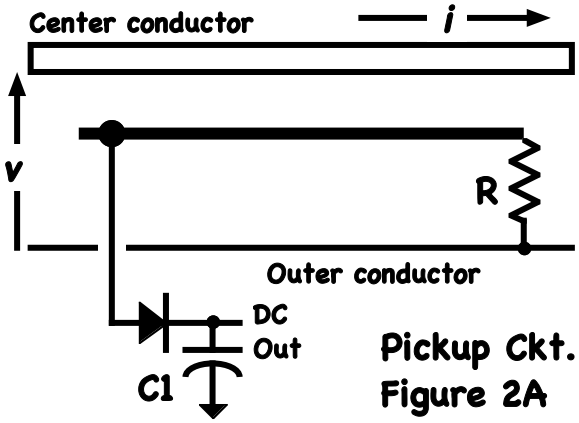
Figure 1

The Reflectometer:

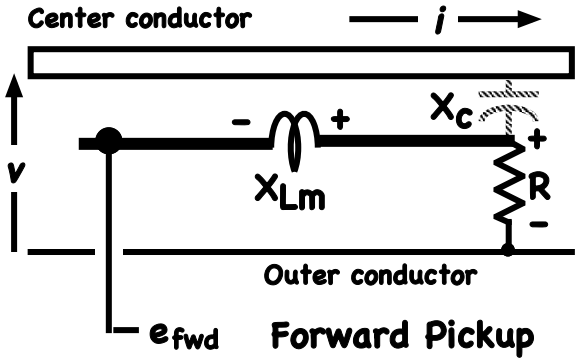
Figure 1 depicts the inside of a typical reflectometer. The input and output are connected directly together through a transmission line section that approximates the nominal impedance of 50 - 75Ω. In the AM-2 this is done using a tube for the center conductor and a U-shaped trough for the outer conductor. Two separate pickup circuits are used; usually they are identical except one's orientation is reversed from the other. The original Monimatch had the two pickup wires located serially along the center conductor; this made the instrument almost a foot long, an inconvenient size. Later instruments located the pickups in parallel on either side of the center conductor, similar to figure 1. Key to the operation of the reflectometer is that the pickup wire is not only coupled inductively to the center conductor, it is also coupled capacitively; This is something I didn't consider in my younger days, but is important to the working of the bridge.

Figure 2A shows typical pickup circuitry. Figure 2B is the same circuit showing a phantom capacitive coupling with a reactance (X_C) and inductive mutual coupling with a reactance (X_{Lm}) between the pickup

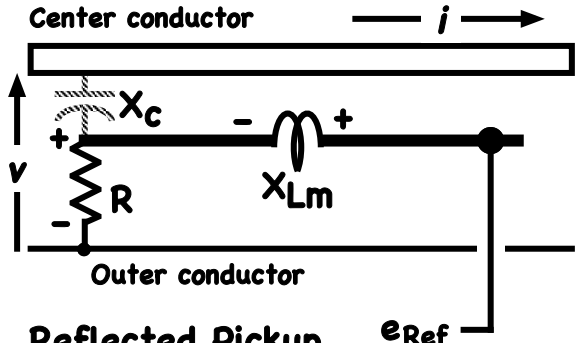
wire and the center conductor. Note that since the coupling is small, X_C is quite large and X_{Lm} is quite small. One end of each pickup is terminated by a fixed non-inductive resistor. A lead, exiting perpendicular to the transmission line to beyond the outer conductor, brings the RF voltage to a crystal diode where it is rectified and filtered by C_1. The resulting DC voltage is then routed to a metering circuit which will be discuss later. In the following steps we'll be looking at the RF output voltage of each pickup before the diode. These voltages are designated e_{Fwd} and e_{Ref}.



Pickup Ckt.
Figure 2A



Forward Pickup
Figure 2B



Reflected Pickup
Figure 2C

In Figure 2A: ***v*** and ***i*** are the RF voltage and current in the transmission line. If the transmission line is terminated in its nominal impedance Z_0 then ***v*** and ***i*** are simply related by Ohm's law:

$$v = iZ_0 \qquad (1)$$

The large center conductor has a small inductance as does the thinner pickup wire. Since they are in proximity and parallel, a mutual inductance L_m with an inductive reactance X_{Lm} exists in the pickup. A voltage is thus developed across L_m. The length of the pickup wire must be small in relation to the signal's wavelength to assume that the voltage ***v*** is constant over the length of the pickup. This is reasonable for a pickup 3" to 4" long to beyond 50 MHz.

The voltages e_{Fwd} and e_{Ref} are the sum of $\boldsymbol{v}_R$ (the voltage across R) and $\boldsymbol{v}_{Lm}$ (the voltage across L_m).

$$e_{Fwd} = v_R + V_{Lm} \qquad (2)$$

Solving for the Resistor Voltage:

The voltage at the top end of R in figure 2B (and 2C as well), can be calculated by a simple voltage divider with R and X_c the two elements:

$$v_R = \left(\frac{R}{R - jX_C}\right)v \qquad (3)$$

R turns out to be small, on the order of a few hundred ohms at most, and is much smaller than Xc across the HF band. Thus we can ignore R in the denominator and eq. 3 approximates to:

$$v_R = \left(\frac{R}{-jX_C}\right)v$$

but: $X_C = \frac{1}{\omega C}$ where: $\omega = 2\pi f$

The result, remembering that $\frac{1}{-j} = j$, is:

$$v_R = j\omega RCv \qquad (4)$$

Solving for the Inductor Voltage:

v_{Lm} is the voltage induced by the current in the center conductor, and is:

$$v_{Lm} = jX_{Lm}i$$

but: $X_{Lm} = j\omega L_m$

so: $$v_{Lm} = j\omega L_m i \qquad (5)$$

Solving for the Output Voltages:

Substituting eqs. 4 and 5 into eq. 2 yields:

$$e_{Fwd} = j\omega RCv + j\omega L_m i \qquad (6)$$

If you look at figure 2C for the reflected pickup everything is the same except that the polarity of the voltage from the mutual inductance is reversed, hence:

$$e_{Ref} = j\omega RCv - j\omega L_m i \qquad (7)$$

Balancing the Bridge:

To balance the circuit, the output from the reflective pickup should be zero when the bridge output is terminated in Z_0 (SWR = 1:1). What we want from our reflectometer is to have e_{Ref} be zero when terminated by Z_0. From Eq. 7, this can only be true when:

$$j\omega RCv = j\omega L_m i$$

or: $$\frac{v}{i} = \frac{L_m}{RC}$$

Inserting eq. 1 and solving for R gives us:

$$R = \left(\frac{L_m}{CZ_0}\right) \qquad (8)$$

The value for R that results in balance can most easily be found by trial and error. L_m and C are hard to determine accurately but can be calculated roughly and a starting value for R installed. The bridge output is then terminated with a good dummy load of Z_0. RF is applied to the bridge input and e_{Ref} measured. This is repeated until a resistor is found that results in the closest null (5% resistors are adequate). While C is fixed by the geometry, L_m can be adjusted slightly by moving the location of the lead going to the diode. This final adjustment should result in a nearly perfect null.

Once R is determined and the bridge is balanced in the reverse direction, the forward pickup can be nulled simply by reversing the input and output so that the forward pickup in the circuit is now the reflected pickup, and vice versa. If the geometry is same for both pickups, R will be identical so only the lead adjustment need be done.

Solving R for another Z_0:

Looking at equation 8, note also that as Z_0 gets larger, R gets smaller. Thus the terminating resistor R for a 75Ω bridge will be smaller than for 50Ω bridge. Once R is determined <u>for a given geometry</u> it can be calculated for another close by Z_0. For instance say R=100Ω for a Z_0 = 50Ω bridge; then the correct R for a Z_0 = 75Ω bridge is:

$$R_{75} = \left(\frac{Z_{50}}{Z_{75}}\right)R_{50}$$

$$R_{75} = \left(\frac{50}{75}\right)100 \approx 68\Omega$$

While the bridge geometry (inner and outer conductors) are designed to represent a transmission line near Z_0 it is not

critical enough to prevent a slight change in bridge Z_0. Thus many bridge designs work on both 50 and 75 ohms with just a change in the resistor values.

Balanced Pickup Output:

Using eq. 8 to substitute for RC, eqs. 6 and 7 may be simplified to:

$$e_{Fwd} = j\omega L_m\left(\frac{v}{Z_0} + i\right) \qquad (10)$$

$$e_{Ref} = j\omega L_m\left(\frac{v}{Z_0} - i\right) \qquad (11)$$

When the bridge is balanced these equations simplify, by substituting in eq. 1, to get:

$$\begin{bmatrix} e_{Fwd} = 2v\left(\frac{j\omega L_m}{Z_0}\right) \\ e_{Ref} = 0 \end{bmatrix} \text{ Balanced}$$

Unbalanced Pickup Output:

When the bridge termination is different than Z_0, there is reflective energy traveling against the forward energy. The two voltages add, but the two currents oppose and subtract.

$$v = v_F + v_R$$
$$i = i_F - i_R$$

also: $$i_F = \frac{v_F}{Z_0} \text{ and } i_R = \frac{v_R}{Z_0}$$

Substituting first for ***i*** in eqs. 10 and 11 we get:

$$e_{Fwd} = j\omega L_m\left(\frac{v}{Z_0} + \left[\left(\frac{v_F}{Z_0}\right) - \left(\frac{v_R}{Z_0}\right)\right]\right)$$

$$e_{Ref} = j\omega L_m\left(\frac{v}{Z_0} - \left[\left(\frac{v_F}{Z_0}\right) - \left(\frac{v_R}{Z_0}\right)\right]\right)$$

And then substituting for ***v*** we get:

$$e_{Fwd} = \left(\frac{j\omega L_m}{Z_0}\right)\left(v_F + v_R + \left[v_F - v_R\right]\right)$$

$$e_{Ref} = \left(\frac{j\omega L_m}{Z_0}\right)\left(v_F + v_R - \left[v_F - v_R\right]\right)$$

For the forward voltage, the v_R terms cancel; and for the reverse voltage, the v_F terms cancel. Thus :

$$e_{Fwd} = 2\left(\frac{j\omega L_m}{Z_0}\right)v_F = 2\left(\frac{X_{Lm}}{Z_0}\right)v_F \qquad (12)$$

$$e_{Ref} = 2\left(\frac{j\omega L_m}{Z_0}\right)v_R = 2\left(\frac{X_{Lm}}{Z_0}\right)v_R \qquad (13)$$

Equations 12 and 13 give the voltage output to the diode. The X_{Lm} term in the numerator of the two formulas means the voltage is frequency sensitive, increasing with frequency, since the reactance of an inductor increases with frequency.

Meter Circuit and Scaling:

The forward and reflected voltages are each converted to DC by a diode and filtered by a small capacitor (typically 1,000 to 5,000 pF). A switch selects either of the two voltages and directs it to the meter through a potentiometer that adjusts the sensitivity. The voltages are small and a fairly sensitive meter is required to give full scale deflection. Meters on the order of 100 µA to 200 µA are typical for HF bridges. One milliamp meters may be used for bridges at higher frequencies.

Figure 3 shows the meter face of the Heathkit AM-2. Note the SET mark at full scale. The percent reflected power is:

$$\%\text{ Reflected Power} = \frac{P_R}{P_F} = \left(\frac{v_R}{v_F}\right)^2 \qquad (14)$$

Fig 3: Heathkit AM-2 SWR Meter scales

and the SWR is calculated as:

$$SWR = \frac{(v_F + v_R)}{(v_F - v_R)} \qquad (15)$$

or solving eq. 15 for v_R:

$$v_R = \frac{(SWR - 1)}{(SWR + 1)} v_F \qquad (16)$$

From equations 12 and 13 we know that the voltages on the center conductor v_F and v_R are proportional to the meter voltages e_{Fwd} and e_{Ref}. Also when the meter is properly set, v_F is represented by full scale meter movement. Thus the percent of full scale (%FS) the meter moves represents the percentage of forward voltage reflected. From this we can easily calculate the reflected power from eq. 14, and the SWR from eq. 15. Eq. 16 can be used to calculate the reflected voltage for a given SWR.

Table I shows the calculated values for every 5% of meter scale for the first 50%. When v_F is set to 100, representing a full scale of 100%, v_R is then represented by the % of full scale of the meter.

v_R (%FS)	%Ref Power	SWR
0	0.000	1.000
5	0.250	1.105
10	1.000	1.222
15	2.250	1.353
20	4.000	1.500
25	6.250	1.667
30	9.000	1.857
35	12.250	2.077
40	16.000	2.333
45	20.250	2.636
50	25.000	3.000

Table I:

Table II is similar to table I. It shows the % of full scale for various values of SWR.

SWR	v_R (%FS)	%Ref Power
1.10	4.762	0.227
1.20	9.091	0.826
1.30	13.043	1.701
1.40	16.667	2.778
1.50	20.000	4.000
1.60	23.077	5.325
1.70	25.926	6.722
1.80	28.571	8.163
1.90	31.034	9.631
2.00	33.333	11.111
2.20	37.500	14.063
2.50	42.857	18.367

Table II:

I hope this has taken some of the mystery out of the SWR bridge (Reflectometer)!

73, from AF6C

OCARC's 80th Anniversary Special Opportunity Drawing

The special drawing is for a **Yaesu 817 All Band Radio**…

The cost is $5.00 a square and the drawing will be held on Friday, September 20th – Our 80th Anniversary Celebration!

The raffle board has 100 squares and is already half full…

FT-817 The Ultimate Backpacker!
Multi-mode Portable Transceiver

The world's first self-contained, battery-powered, Multi-mode Portable Transceiver covering the HF, VHF, and UHF bands!

For more than four decades, Yaesu has been a world leader in the design and manufacture of high-performance multi-mode base station and mobile transceivers, as well as FM handhelds.Yaesu broke new ground with the introduction of the FT-817: the world's first HF/VHF/UHF self-contained battery-powered Multi-mode Portable Transceiver. Providing up to five watts of power output, the FT-817 is designed for operation on the 160-10 meter HF bands, plus the 6 meter, 2 meter, and 70 cm bands. Whether your preferred operating mode is SSB, CW, AM, FM, Packet, or SSB-based Digital modes like PSK31, the FT-817 is ready to join you on your next hiking, camping, or search-and-rescue adventure!

See Kris Jacob – KC6TOD at the meeting on Friday, August 16 to purchase your square!

WWII and OCARC Field Days – A Shared History – Part 2

Centennial Park, Santa Ana

by Tim Goeppinger N6GP

Second half of expanded coverage from the "History Minute" at the June OCARC Meeting:

In researching this "History Minute", I had gathered plenty of information on our local WW II military bases that later served as our Field Day sites. I was looking over our list of FD sites, and I thought, "I wonder what went on at what is now Centennial Park in western Santa Ana during WW II?" One Google search and holy smokes, what a find! That location was an important FCC Primary Monitoring Station that collected radio intelligence during the war. We had Field Days on this historic site in 1982, 1985, 1987, 1988 and 1989.

Centennial Park as it looks today, along with Godinez Fundamental High School. Edinger at Fairview is upper right-hand corner.

Background:

Even in 1939 before the war, there was a realization in the U.S. State Department that their radio intelligence capabilities were lacking. They were missing much of the radio traffic between Germany and their spies in South America. They approached the FCC to monitor these transmissions. The FCC at that time was primarily doing enforcement activities from their field offices, much like it is done in current times. Congress funded the FCC in 1940 to form a National Defense Operations (NDO) division, which later became the Radio Intelligence Division (RID).

The number of Primary Monitoring Stations was increased from 8 to 12, and the Santa Ana Primary Monitoring was one of the 4 new ones added. In addition, the FCC RID had 60 secondary stations and 90 mobile units before the end of the war.

The Santa Ana FCC Primary Monitoring Station in an 1959 aerial photo

Santa Ana Primary Monitoring Station:

In June of 1941, 110 acres of land in western Santa Ana was purchased by the federal government for this facility. An old dilapidated farm house was in the northeast corner of this parcel, and would be home to the communications equipment.

The construction of this monitoring station must have been rapid. By the time a reporter from the Milwaukee Journal visited the site to write an article published in October 13, 1941, it sounded like the station was fully outfitted with antennas, radios, teletypes, and staffed 24/7 by 15 technicians. Assigned to this station were 8 secondary monitoring stations around the west coast, each equipped with a mobile unit.

Staffing:

Statistically, about 70 to 90 percent of the staff at the FCC RID monitoring stations were hams, and I am sure that the Santa Ana station was no exception. One of the operators was John Kemper W6SCO (later W6SN), who started working there in May 1942 at the age of 17. We don't have any proof that an OCARC member worked at this station, but I bet one did. In August 1954 RF, OCARC member W6PM is listed as leaving the area to work for the FCC in Laurel MD. Who knows where he was in WW II?

Several of these Hallicrafters SX-28s were installed at each of the FCC Monitoring Stations

An Adcock direction finding antenna at Allegan, Mich.

Workstations at the FCC Monitoring station in Allegan, Mich.

Equipment:

Each of the monitoring stations was brimming with radio and electronic equipment. The 1944 QST article called the Allegan, Mich monitoring station a "ham's paradise". Remember – hams were ordered off the air on Dec 8th 1941, so being able to work at a monitoring station must have been like being in heaven.

Standard equipment included Hallicrafters SX-28 and SX-27 receivers. Recording devices were available to record signals onto plastic disks, or wax cylinders, and these were air mailed back to the FCC RID HQ in Washington DC. For antennas, rhombics and dipoles on wooden poles were implemented. Accurate direction finding was done with Adcock direction finding stations with their H style antennas.

A nationwide network of radioteletype (RTTY) printers were set up so that something typed in at one of the stations could instantly be seen at all of the other stations. A large generator was available to provide back up power during blackouts.

Each station had a Hudson sedan that was equipped with radios and DF equipment.

Duquesne Spy Ring:

The Minnesota Journal article made a claim that the Santa Ana station was involved in intercepting a signal from Hamburg Germany that was used in rolling up the Duquesne Spy Ring, which was a ring of 33 German spies operating in the US. I had mentioned this in my presentation, but now I think the article was incorrect. The spy ring members were arrested in June 1941, which was the same time the land for the Santa Ana site was being purchased. Seems to be a time-line problem here. This is not to minimize the significant contributions that this site made to the war effort.

The Cold War and the closing:

During the 1950's and 60's this station was used to monitor transmissions from communist countries. I

imagine normal FCC activities continued at this site as well. The monitoring station was closed down in 1967, and the land given to the City of Santa Ana. This parcel is now home to Centennial Park, Godinez Fundamental High School, and the Heritage Museum.

1985 Field Day Group Photo
from Centennial Park

1988 FD, L to R: Jack N6UC, Bob WB6IXN,
Bob AF6C and Kei W6NGO

Bibliography:

October 13, 1941. Milwaukee Journal, "California Station Put Finger on Gestapo's Hamburg Radio"
http://news.google.com/newspapers?id=FKZQAAAAIBAJ&sjid=ziIEAAAAIBAJ&pg=2583%2C5725080

Note: *To access the following two QST articles you must search for QST date and author or author's call at the given link after you sign in as an ARRL member.*

October 1944 QST "Hams in the RID" by Oliver Read, W9ETI

January 2007 QST "How the FCC Helped to End World War II" by Walter Maxwell, W2DU

http://www.arrl.org/arrl-periodicals-archive-search

Obituary, John Kemper W6JN ex-W6SCO http://www.qrz.com/db/W6JN

OC History Roundup Blog http://ochistorical.blogspot.com/2010/10/spies-in-centennial-park.html
http://ochistorical.blogspot.com/2010/10/spies-in-centennial-park-part-ii.html

History of Original W3DF – FCC RID http://users.isp.com/danflan/sterling/dfh1.html

The challenge has been answered! Every year for the past 3 Aprils, after writing on the Heath Log-Splitter, I've challenged the readers to come up with another Heathkit that runs on gasoline or other fuel. No one in the club gave a R.A. to even try to guess an answer. The response was zilch, which I found depressing. It took an email from Australia to get an answer! Here is that email and my reply:

Hi Bob,

Can't believe no one suggested the boonie bike. They are still popular!

Thanks for the articles – I enjoy reading them.

If looking for ideas, maybe you could do one on Nixie display kits, or Panaplex. Heath made clocks, DMMs, counters – of which I have a few.

Justin VK2CU

Hi Justin,

Yes, that is the Heathkit I had in mind, the GT-18 Boonie-Bike. Later, they made a second mini-bike, the GT-101 "Hilltopper". Heath also made a gasoline powered AC generator, the GU-1820, and, if you include other fuels, a lot of R/C gas powered vehicles!

Thanks for your reply. You are the first to even attempt to answer my query. Our club members don't show much interest in my Heathkit articles, and I may be moving them to a different venue.

73, Bob - AF6C

In other Heathkit news, Heathkit may be once again trying to arise like a Phoenix! Checkout:

http://www.heathkit.com

and look for the hidden Easter egg. Go from there!

73, from AF6C

The Next RF DEADLINE is: September 7th; EVIDENTLY a useless bit of trivia!

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