



RF



ORANGE COUNTY AMATEUR RADIO CLUB, INC.

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P.O. BOX 3454, TUSTIN, CA 92781-3454

June 2017

The Prez Sez.....

by Tim N6GP



The biggest day for hams in North America is almost here! By the time you read this, Field Day will be only 2 weeks away! This is the Big Kahuna! Last year over 1,500 clubs and over 36,000 hams participated. All the planning that we have done since the beginning of the year is coming into a great culmination on Friday June 23 to Sunday June 25. Everyone in our club can take part. From the new ham who has never operated before, to the most experienced contester. Even those who need to stay at home can participate. Those who are not able to make it to Walter Knott can give us some points on the air. If you are on the West end of Orange County, you WILL hear us. Even if you just

have a 2 meter hand-held, look for us around 146.40 to 146.60 MHz simplex (not 146.52). And while you are at it, give some points to other Field Days like N6HC, W6PA and K6SOA. They will appreciate it. We look forward to the Boy Scouts making some great food for us again this year, and meal tickets will be on sale at our meeting this month.

It was awesome to see Peter N16E's newsvan last month. We hope to have him bring it back after he has done some more customization to it. This month we will have Chip Margelli K7JA give us a pep talk on his favorite topic of Field Day. It is not an exaggeration that Chip is one of the World's most foremost speakers on the topic of Field Day. His tips and techniques for FD are pure magic. Don't miss it.

The conditions on 6 meters during the month of May were tremendous. June is off to a slow start, but is better today. I heard Canary Islands, and worked 2 Japanese stations. Let's hope it stays good for the June VHF Contest June 10-11.

73.

Tim Goeppinger N6GP
President

Next General Meeting

The next OCARC General meeting presenter will be Chip Margelli, K7JA offering his annual Field Day pep talk.

Continued of page 20

The next General Meeting will be on:

**Friday, June 16, 2017
@ 7:00 PM**

ENTER from the WEST SIDE entrance of the
Red Cross Building, Room 208
Take elevator to the 2nd Floor. See you there!

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editors@w6ze.org

Monthly Events:

General Meeting:

Third Friday of the month
at 7:00 PM held at:
American Red Cross
600 Parkcenter Drive
Santa Ana, CA
(Near Tustin Ave. & 4th St.)

Club Breakfast (Board Mtg):

Normally First Saturday of month at 8am
Marie Callender's Restaurant
1821 North Grand Ave
Santa Ana, CA
(Between 17th & Santa Clara)

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

7.086 ± MHz CW **OCWN**
Sun- 9:00 AM – 10 AM
Ann K6OIO, Net Control



Club Dues for 2017:

Regular/New Members* - - - - - \$30
Family renewal/Join** - - - - - \$45
New Member Join Apr-Jun*** - - \$23
Replacement Badge**** - - - - - \$ 3

* New members Jan-March, w/badge.

** Two members or more, w/badge.

*** New members April-June, w/badge.

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



Field Day Planning Meeting

Everyone is invited!
Tuesday June 13th 7PM

**At the home of
Tim Goeppinger, N6GP
18122 Estes Way
North Tustin 92705**

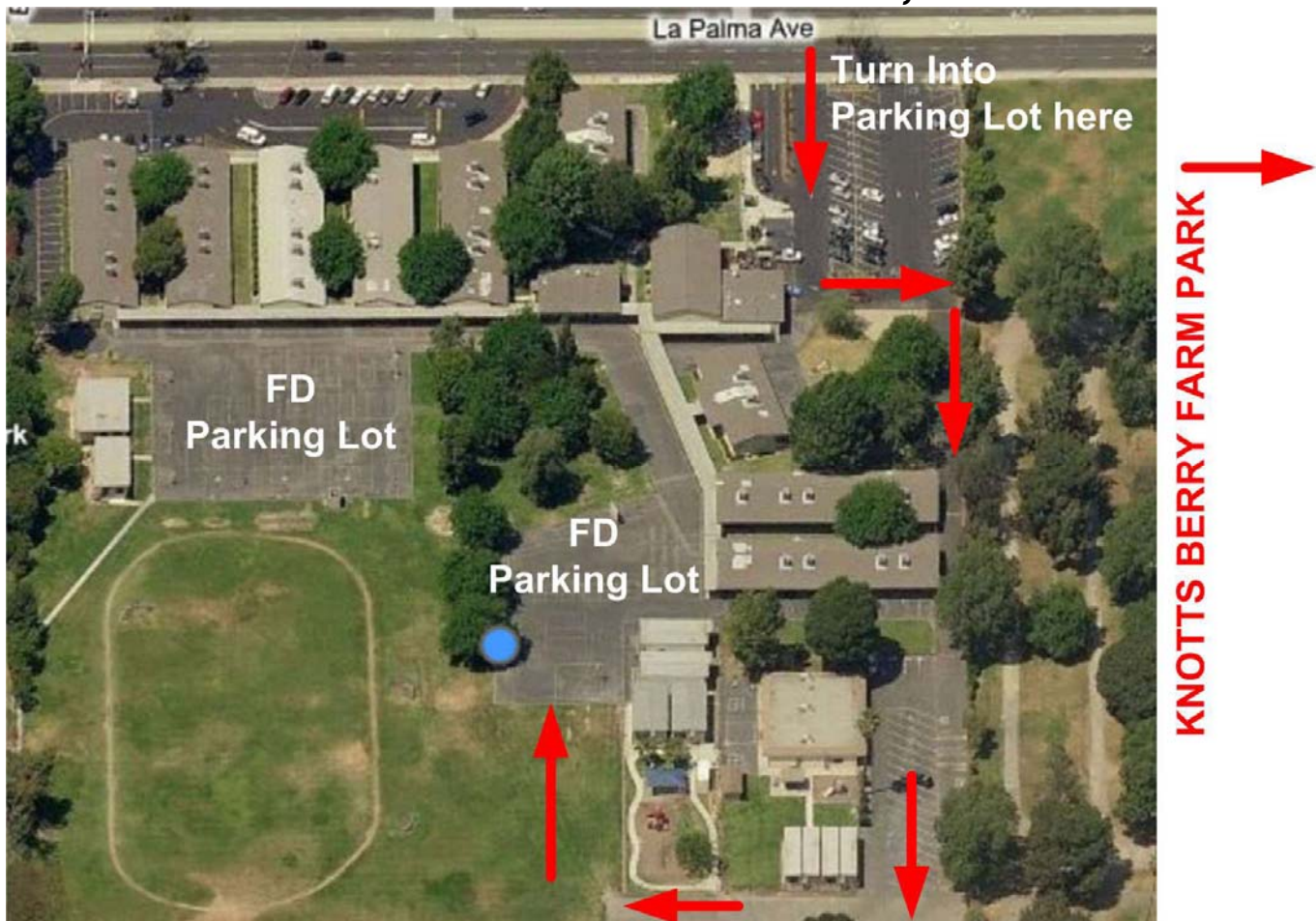
See you there!

OCARC Field Day Location Map

Field Day will be again at last year's site (Walter Knott Education Center); however this year the access to the field may be slightly different than some past years. You may have to drive on a grassy area to reach the Field Day parking lot.

See aerial picture below for more details.

7300 Palma Ave Buena Park, CA 90620



- Head for Knott's Berry Farm
- Take the Beach Blvd (south) exit from the 91 or the 5 FWY
- Turn right (west) on La Palma Ave, along the north edge of Knott's Berry Farm Park.
- Continue driving on La Palma, past the Knott's Berry Park to 7300 La Palma Ave.
- The school will be on your left on the south side of La Palma.
- Use the first entrance on the East side of the school building

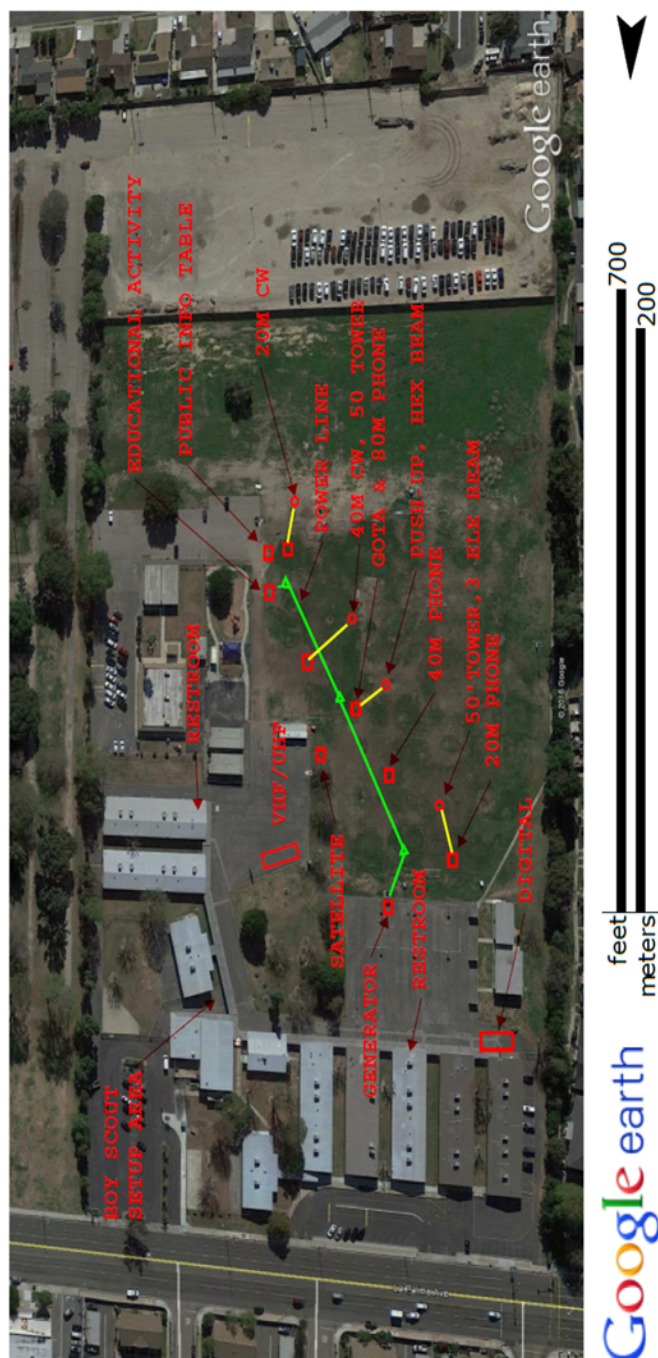
Revised 5/9/2017

BONUS POINTS 1450 MAX.

SUPPORT

OPERATORS

CW	PHONE	DIGITAL	VHF/UHF PHONE/SATELLITE	GOTA
TIM, N6GP 40m	BOB, AF5C, 20m	COREY, KE6VHX		TIM, N6TMT/VUAY, KM6IZO
JIM, AF6H 20m	KEN, W6HHK, 20m		TONY, N2VAI	
PAUL, W6GMU 20m	KEN, W6STJC 20m	PHIL, K5PAD?		
BOB, W6ZQ 40m/20m?	JEFF, KX6TRC vhf uhf?	DOA, N6XBP 15m/40m?		
John, KQ6EX, 40m/20m?	RON, W6EFS, 40m	JEFF, KX6TRC vhf uhf?	KEN, W6HHK - RACES - Part time Sat/Sun - Recruiting other RACES.	
	RODGER, K6WIZR, 40M PH	TONY, W6ETC?	PHIL, K5PAD? - Corey to call and confirm	
	STEVE, K6REB - 40PH	BILL, K5FRN?		
	DOUG, K6PGH - 40m	BILL, K6L15, 2500, or 40m?		
	BRYAN - K6AJY	JOEL, K0M6JNP, 4m?/at camper but contingent on changing trip date.		
	Nell - N6VHF, 40M PH			



Digital Station has been relocated from the northwest corner to the southeast corner of the site.

The map is subject to further change pending Fire Authority co-ordination.

When: Saturday 11:00 a.m. June 24 to Sunday 11:00 a.m. June 25, (Setup will start 8:30 am Friday, June 23. Teardown will start at 11:00 am Sunday)

Where: Walter Knott Educational Center, 7300 La Palma Avenue, Buena Park, California

Food: Meals will be provided by the Boy Scouts which can be purchased in advanced at the June General Meeting or at the Field Day site.

Operators: Contact one of the Band Captains listed below if you plan to operate on one or more of the stations. Advance notice will help the club to optimize our station setup and allocate our resources to the preferred bands and modes.

Support: Besides operators we will need additional manpower to setup and takedown antennas, towers, tents, generator and power lines.

BAND/MODE	BAND CAPTAIN	MODE	PHONE
40M/15M CW	Tim - N6GP	CW	(714) 730-0395
40M/15M PH	Ron - W6FPS	PH	(714) 840-3613
	Neil - N6VHF		N/A
Digital - 20M	Corey - KE6YHX	DIG	(714) 639-5475
	Phil - K6PAD		(657) 203-1223
20M - CW	Jim - AF6N	CW	(714) 544-5435
20M - PH	Ken - W6HHC	PH	(714) 348-1636
	Bob - AF6C		(714) 639-5074
VHF/UHF PH	Robbie KB6CJZ Don - K0VNI	PH	(714) 978-8049 (402) 310-1076
SATELLITE	Tony - N2VAJ	PH	(408) 500-9628
GOTA - 10/15/80 M	Tim - N6TMT Vijay - KM6IZO	PH	(714) 744--8909 N/A

Heathkit of the Month #75: by Bob Eckweiler, AF6C



ELECTRONIC TEST EQUIPMENT

Heathkit IT-121 FET/TRANSISTOR TESTER (Part I)

Introduction:

In the main 1959 Heathkit catalog I could only find one kit that used transistors - the 6-transistor DF-1 Radio Direction Finder. Just two years later, the 1961 catalog had more than a dozen kits that used transistors, including a new DF-3 Radio Direction Finder. Interestingly, none of these kits were in the audio - stereo area. With the growth of transistorized Heath - kits it didn't take Heathkit long to start manufacturing test equipment for testing transistors.

Between 1961 and the demise of Heathkit as we knew it, Heathkit offered four different transistor testers. All were sold under more than one model number as styling changed, but little, if any, changes were made to the circuits.

The first transistor tester - The IT-10 - was listed as "New through Heath research" in the May 1961 catalog. Later that year the IM-30, a much more advanced laboratory transistor tester, was offered. In 1968 the portable IT-18, with a capability between the IT-10 and the IM-30, and housed in a portable plastic case, was introduced. In 1972 the IT-121 began production. It replaced a later version of the IM-30, though the two sold concurrently for more than a year. The IT-121 (Figure 1) will be the focus instrument of this article. Table I shows some history for the four models and their successors.

IT-10, IT-27 and IT-3127 Testers:

These three units are simple and inexpensive; they perform only the rudimentary evaluation of forward conductance and reverse leakage of



**Figure 1: Heathkit IT-121
FET / Transistor Tester**

a diode, and collector to emitter leakage (I_{ceo}^1) and gain of a transistor. They also test for open and shorted diodes and transistors. Power is provided by two "C" batteries. The unit is 3-1/8" H x 3-1/8" W x 3-3/4" D and weighs 12 oz. The IT-10 is shown in figure 2; the IT-27 and IT-3127 appear physically and electrically identical with new color and styling. The three units are not designed for in-circuit testing.

The IT-10 (Figure 2) has three slide switches. The first selects NPN or PNP polarity and forward or reverse diode current measurement. This switch simply reverses the battery and meter polarity. The second switch selects high or low current. The low position is also used for diode testing. In the low position the meter reads 3 mA full scale and the transistor base current is set to about 30 μ A, while in the high position full scale current is around 200 mA and transistor base current is set to about 1.4 mA. The third switch selects testing for either leakage or gain. In the leakage position the transistor base is left unconnected, and in the gain position the selected current is applied to the transistor's base.

A transistor short is indicated by full scale meter deflection in the leakage position, and an

¹ Notes begin on page 14

MODEL	FIRST YEAR	LAST YEAR	INTRO PRICE	HIGH PRICE	POWER SOURCE	METER	COMMENTS
IT-10	1961	1967	\$6.95	\$6.95	2-C Batteries	0 - 3 MA	Simple transistor & diode tester
IT-27	1967	1978	\$6.95	\$11.95	2-C Batteries	0 - 3 MA	Restyled IT-10
IT-3127	1978	1981	\$12.95	\$12.95	2-C Batteries	0 - 3 MA	Restyled IT-27
IM-30	1961	1967	\$54.88	\$54.88	7-D Batteries	$\pm 10 \mu\text{A}$	Lab transistor & diode tester
IM-36	1967	1974	\$60.00	\$67.50	7-D Batteries	$\pm 10 \mu\text{A}$	Restyled IM-30
IT-18	1968	1979	\$24.95	\$32.95	1-D Battery	0 - 200 μA	Portable transistor & diode tester
IT-3118	1978	1979	\$34.95	\$34.95	1-D Battery	0 - 200 μA	Restyled IT-18, New blue molded case
IT-121	1972	1977	\$59.95	\$62.95	2-D Batteries	0 - 100 μA	Transistor, FET, UJT, SCR, Triac & diode tester
IT-3120	1977	1989	\$54.95	\$99.95	2-D Batteries	0 - 100 μA	Restyled IT-121
				TABLE I		Info from available factory catalogs	

open is indicated by no meter deflection in the gain position.

IT-18 and IT-3118 Testers:

The IT-18 is a less rudimentary transistor tester utilizing a calibrated meter and capable of making quantitative measurements. It also does rudimentary in-circuit testing of transistors and diodes. It is powered by a single "D" battery, measures 8-1/2" W x 4-1/8" H x 7-1/8" D, and weighs 2-1/4 pounds.

Out-of-circuit transistor measurements are I_{ceo} and I_{cbo}^2 leakage up to 5 mA, and DC β up to 3.

from 2 to 1,000 in two ranges: 2 to 100 and 20 to 1,000. Diode testing indicates the diode is open, shorted or good whether in or out of a circuit.

The IT-18 has a large 4-1/2" 100 μA meter that is easy to read. The 0 - 5 mA leakage scale is nonlinear and expanded at the low end so you can read leakage as small as 5 μA . 1 mA is at center scale with 5 mA full-scale.

The IT-18 has a meter and six controls on the front panel. The large meter takes up over half the area, and there are three rows of controls to

Heathkit® Test Instruments



new
through Heath research

Speed service operations with this handy
TRANSISTOR/DIODE CHECKER...only \$6.95

- Tests low and high power transistors
- Tests forward & reverse current of diodes
- Rugged self-protecting case design

SPECIFICATIONS—Transistor test: leakage, short, open and current gain. Diode test: forward and reverse current. Also serves as a continuity checker. **Switches:** Forward-Reverse (PNP/NPN, Diode/Hi-LO Leakage-Gain. **Power supply:** self-contained, two 1.5 volt size "C" flashlight cells. **Dimensions:** 3 3/4" H, x 3 1/4" W x 3 3/4" D.

The great variety of transistorized equipment now in use and the tremendous rate at which transistors are being used in the electronic industry calls for a reliable transistor checker to speed up service and eliminate guesswork. The IT-10 tests transistors, diodes, and also serves as a handy continuity checker . . . just the thing for carrying with you on service calls or for shop use. Easily fits into tool case, glove compartment, etc. Instrument is self-protecting with its extended-edge case. External, removable test leads are provided for checking transistors which do not fit tester socket. The versatile switching system in the IT-10 identifies transistors as to PNP or NPN type and eliminates need for transferring test leads for diode testing. Easily assembled. 2 lbs.

Kit IT-10.....\$6.95

Figure 2: Heathkit IT-10 Transistor Tester (From: May 1961 Heathkit Catalog)



Figure 3: Heathkit IT-18 Transistor Tester

its right. The top row (L to R) contains the **BETA CAL** pot and the **NPN - OFF - PNP** power and polarity switch. As with the IT-10 this switch reverses the power and meter polarity. In the OFF position it also shorts the meter to provide dynamic damping protection, important for portable instruments. The second row has the **BETA X1 - X10**, range switch, the **Icbo** -

BETA - **Icbo** function switch and a socket for the transistor under test. (Leads are also available for connection to a transistor in circuit or one that won't fit the socket). The final row contains the **CAL - TEST** rocker switch.

The IT-18 originally came in a black plastic case. The case was replaced with a brown molded case partway through its production. This is the same type brown molded case that deteriorated to plastic fragments on my ID-29 (see HOM #73). The later IT-3118 sports the newer blue inject molded case that seems to be less prone to disintegration over time. The IT-18 case measures 9-3/8"W x 5-3/8"H x 9"D (including handle) and weighs 2-1/4 lbs.

IM-30 and IM-36 Transistor Testers:

The IM-30 (Figure 4) and restyled IM-36 are more advanced laboratory style transistor testers than the units already discussed. They are designed for out-of-circuit transistor testing and may be set up for quick GO - NO GO testing, and matching, of batches of transistors once the desired parameters are set on the front panel. The IM-30 performs Base Current, Collector Current, Collector Voltage, Gain (both DC Beta and DC Alpha⁴), Leak Voltage, Transistor Leakage (both I_{cbo} and I_{cbo}) and Short tests. Diodes can be checked

for leakage and forward current characteristics. AC operating conditions can also be determined by testing at different bias points. The sensitive $\pm 10 \mu A$ meter allows accurate quantitative measurements that facilitate calculations of both AC and DC current gain, transconductance, base and collector resistance. The IM-30 is powered by seven (7) "D" batteries. A voltage



**Figure 4: Heathkit IM-30
Laboratory Transistor Tester**

up to 9V is available internally (in 1.5V steps) for collector voltage and leak voltage tests, or an external voltage source may be used for tests up to 50 and 150 volts respectively. The IM-30 measures 10-3/4W x 5-1/2"H x 10-1/4 D and weights 8 lbs.

To go into greater detail on this tester is beyond the scope of this article. Perhaps if there is interest the IM-30 and IM-36 may be given its own article in the future.

IT-121 & IT-3120 FET / Transistor Testers:

Between the IT-18 and the IM-30 capability sits the Heathkit IT-121 and it's restyled IT-3120. The IT-121 not only tests diodes and transistors, it incorporates the necessary circuitry to test FETs (Field Effect Transistors) SCRs (Silicon-Controlled Rectifiers), Triacs and UJTs (Unijunction Transistors). Let's delve more deeply into this handy piece of test equipment. The focus will be on the IT-121, everything also pertains to the IT-3120.

The IT-121 comes in a cabinet with a sloping front that measures 9-9/16 W x 5-1/4 H x 8-5/8 D. A large 4-1/2" meter reads Gm and beta directly, as well as leakage. It is powered by 2 internal "D" cell batteries. These batteries have to provide up to one amp of current during certain tests. The batteries remain serviceable down to a voltage of 0.9V while under load.

HEATHKIT IT-121 FET/TRANSISTOR TESTER

Top Panel (Left to Right):

FET Socket (Pins CW from top):

Source - **Gate1** - **Gate2** - **Drain**

Banana Jack (Green) - **Gate2**

Banana Jack (Red) - **Source**, **Emitter**, **Anode**

Banana Jack (White) - **Gate1**, **Base**

Banana Jack (Black) - **Drain**, **Collector**, **Cathode**

Transistor Socket (Pins CW from top):

Base - **Collector** - none - **Emitter**

Sloping Panel (Left to Right):

Row 1:

Meter (Five scales):

BETA: ∞ down to 1

BETA: **CAL x1**, **CAL x5**, **CAL x10**

FET Gm x1000: ∞ down to 0: **μ mhos x 1000**

LEAKAGE: 0 to 100

BAT. OK

Potentiometer (multi-turn):

SET Gm = 0 (top), **SET BETA = ∞** (bottom)

Potentiometer (single-turn) with pull switch:

BETA CAL

PULL TO EXTEND RANGE

Row 2:

Meter (continued)

RANGE: 5-Push button switch group (L to R):

(Interlocked - only one sw. is in a time)

100 μ A (remainder blank) - top

100 μ A, **1 mA**, **10 mA**, **100 ma**, **1 A** - bottom

Row 3:

FUNCTION: 6-Push button switch group (L to R):

(Interlocked - so only one may be activate a time)

Gm=0, **Gm**, **GATE 1**, **GATE 2**, **Igss**, **Idss** - top

BETA= ∞ , **BETA CAL**, **BETA**, **Icbo**, **Ices**, **Iceo** - bot.

MODE: 5-Push button switch group (L to R):

ON (IN), **OFF (OUT)** (independent).

BAT. TEST, **TRANSistor**, **FET**, (Interlocked)

P CHAN./PNP (in), **N CHAN./NPN** (out) (independent)

TABLE II - IT-121 Panel Controls

Fresh batteries will pin the meter when the battery test switch is pressed; this can be a bit disheartening, but it is mentioned in the manual which claims it will not damage the meter.

Table II shows lists the layout of the controls and switches for the IT-121. The switches are organized in three banks, the **RANGE** bank, **FUNCTION** bank and **MODE** bank. The RANGE and FUNCTION banks are each interlocked so only one switch may be in at a time as are the middle three MODE switches. The **ON - OFF** and **NPN - PNP** MODE switches operate independently.

IT-121 Tests:

The IT-121 tests can perform the following tests: For general germanium or silicon bipolar junction transistors, including power transistors, the IT-121 measures Beta, I_{ceo} , I_{ces}^5 and I_{cbo} . For FETs it measures G_m^6 , I_{gss}^7 and I_{dss}^8 . For UJT's three leakage tests may be performed, I_{eb2s}^9 , I_{b2b1s}^{10} and I_{b2es}^{11} . These tests are performed out-of-circuit only. SCRs and Triacs may be tested for function and operation both in and out-of-circuit.

Checking the IT-121 Batteries:

Prior to testing any device, the batteries should be checked. First, turn the IT-121 on by pressing the ON - OFF (MODE) switch. This switch alternates between ON (in) and OFF (out) with each press. Next, be sure the NPN - PNP switch is out (NPN), and press the BAT TEST (MODE) switch. The meter should read above the **BAT. OK** mark on the face of the meter (Figure 5). This tests one of the "D" batteries. To test the other battery, press in the NPN - PNP switch and again check the meter scale. Press the **TRANS** (MODE) switch to release the BAT. TEST switch. Do not leave the tester in the BAT. TEST any longer than necessary as it will shorten battery life. Turn the IT-121 off by releasing the ON - OFF switch and also return the NPN - PNP switch to the NPN position (out).

Testing a Typical Bipolar Transistor:

With the ON - OFF switch OFF (out), connect the three transistor leads to the red (**E**) white

(**B**) and black (**C**) banana jack leads, or insert the transistor in the right-hand socket. Be sure the leads are correct by checking the transistor data sheet or using the illustrations of standard lead positions in the Heathkit manual. If testing in-circuit, connect the test leads to convenient points on the circuit.

Now press in the **TRANS** (MODE) switch and the **BETA = ∞** (FUNCTION) switch. Select a collector current depending on the transistor type (See Table III) and press the appropriate current switch (RANGE).

CLASS	APPLICATION	CURRENT CAPABILITY
SIGNAL	AUDIO, RF, IF	1 mA - 10 mA
INTERMEDIATE POWER	AUDIO, SWITCHING	10 mA - 100 mA
POWER	AUDIO, REGULATOR, OUTPUT	100 mA - 1 A

TABLE III: From the Heathkit IT-121 Manual

Next press ON and using the **SET BETA = ∞** control adjust the meter needle until it aligns with the ∞ mark at the left of the **BETA** scale (top). If this step cannot be performed the transistor may be defective or improperly connected. Once set, check that the **BETA CAL** control is pushed in and turned fully counter-clockwise, then press the **BETA CAL** (FUNCTION) switch; this releases the **BETA = ∞** switch. Rotate the BETA CAL control to move the meter needle. If the meter goes off-scale or doesn't respond, it indicates either a bad transistor, improper connection, or the NPN - PNP switch may be improperly set. Move the control until the meter needle corresponds with one of the three CAL marks on the BETA meter scale (**CAL X10**, **CAL X5** or **CAL X1**). Generally use x10 first. If you are testing a power transistor and you cannot set the CAL, pull out on the BETA CAL control. This extends the control's range, but only for power transistors.

To measure beta, press the **BETA** (FUNCTION) switch and read the beta on the BETA scale on the meter. Multiply this number by 10, 5 or 1, depending on the calibration mark used.

Leakage testing requires the transistor be out-of-circuit. Generally germanium transistors will show significant leakage that increases with higher temperature. Low power silicon transistors will show no, or almost no, leakage and any significant leakage can be a sign the transistor is bad. To test for leakage Press the **l_{cbo}** (FUNCTION) switch, then set the RANGE to 100 μ A and read the leakage directly on the meter's 0 - 100 leakage scale (bottom). Likewise press the **l_{ces}** and **l_{ceo}** switches to measure their leakage. **l_{ceo}** should always be the largest leakage and **l_{cbo}** should always be the smallest leakage of the three measurements.

Testing an FET Transistor:

The IT-121 will test both junction FET and MOS-FET transistors. With the power switch OFF (out) Select **FET** (MODE), set the **N CHAN - P CHAN** switch to the proper type of FET and select the **G_m = 0** (FUNCTION) switch. Press the ON switch and use the **SET G_m = 0** control to set the meter needle over 0 (full-scale) on the **G_m** scale (red). Now press the G_m (FUNCTION) switch and read the G_m on the red scale. Remember to multiply the scale reading by 1000. If the meter reads 0 or ∞ the FET is bad. Now press the **GATE 1** switch (FUNCTION). The G_m should decrease. If it does not change, or if it increases, the FET is either bad, the connections are improper or the **N CHAN - P CHAN** switch is in the wrong position. If the FET being tested has two gates, press the



Figure 5: IT-121 Meter scales

GATE 2 switch. The G_m should again decrease. If this is not the case then the FET is bad.

To test the FET for leakage the FET must be out-of-circuit. To test for **I_{gss}** press the **I_{gss}** (FUNCTION) switch. The meter switch should be in the 100 μ A (RANGE) position. This leakage is in the nano ampere range so you should see no movement of the meter. To measure **I_{dss}** first set the meter switch to 10 mA (RANGE) position, then press the **I_{dss}** (FUNCTION) switch. You should see a reading of somewhere between 100 μ A and 10 mA depending on the FET. You can check that this reading is in the ballpark on the FET's data sheet.

Testing a Diode:

With the power off, connect the diode's cathode lead to the black (C) banana jack and the anode lead to the red (E) banana jack of the IT-121. Press the TRANS (MODE) switch, press the 100 μ A (RANGE) switch, Press the **I_{ceo}** (FUNCTION) switch, and put the NPN - PNP switch in the NPN position (out). Now press

the ON switch (in) and read the reverse diode leakage directly on the LEAKAGE scale.

To check the forward conduction of the diode move the NPN - PNP switch to the PNP position (in). Select a test current using the RANGE switch. Do not exceed the current rating of the diode. (Typically 1 mA or 10 mA for a signal diode and 100 mA or 1 A for a rectifier diode). If the diode has good forward conductance the meter should read above 80 on the LEAKAGE scale.

Testing a UJT Transistor:

The FET functions of the IT-121 are used to test unijunction transistors. A UJT typically has three leads, two are bases and one is the emitter, and must be tested out-of-circuit. With the power off, the UJT is connected as follows:

UJT Emitter to the G1 banana jack (white)

UJT Base 1 to the S banana jack (red)

UJT Base 2 to the D banana jack (black)

Press in the FET (MODE) switch, the I_{gss} (FUNCTION) switch and the 100 μA (RANGE) switch. Determine the polarity of the UJT under test from the data sheet (P-channel UJTs are rare) and set the N CHAN - P CHAN switch appropriately. Now press the ON switch and read I_{eb2s} leakage current which should be less than 1 μA .

Next press the 1 mA (RANGE) switch and the I_{dss} (FUNCTION) switch. The meter now reads the I_{b2b1s} current. It should be nominally between 150 μA and 400 μA . From this value you may calculate R_{bb} , the resistance between base 1 and base 2, knowing the battery voltage (1.5 V):

$$R_{bb} = 1.5V / I_{b2b1s}$$

Next, press the 100 mA (RANGE) switch and reverse the N CHAN - P CHAN switch. The meter reads the emitter current I_{b2es} on the leakage scale. It should be nominally between 15 and 50 mA.

Testing a Silicon Controlled Rectifier (SCR):

The transistor functions of the IT-121 are used to test SCRs. An SCR typically has three leads,

the anode, cathode and gate; and may be tested in-circuit or out-of-circuit. With the power off, the SCR is connected as follows:

SCR Cathode to the C banana jack (black)

SCR Anode to the E banana jack (red)

SCR Gate to the B banana jack (white)

Press in the TRANS (MODE) switch, the 1 A (RANGE) switch and the I_{ceo} (FUNCTION) switch. Set the NPN - PNP switch to PNP (in).

Next press the ON switch, press the I_{ces} switch (FUNCTION) and then press the I_{ceo} switch (FUNCTION). The SCR should now be turned on and the meter should read 50 or greater on the LEAKAGE scale. Momentarily disconnect the cathode lead from the black banana jack and then reconnect it. This should turn the SCR off. The meter should now read less than 5 on the LEAKAGE scale.

Testing a Triac:

The transistor functions of the IT-121 are used to test Triacs. A Triac is a dual polarity device, and typically has three connections, the anode (often referred to as "hot"), cathode (often referred to as "common") and gate; and may be tested in-circuit or out-of-circuit. With the power off, the Triac is connected as follows:

Triac Cathode to the C banana jack (black)

Triac Anode (hot) to the E banana jack (red)

Triac Gate to the B banana jack (white)

Press in the TRANS (MODE) switch, the 1 A (RANGE) switch and the I_{ceo} (FUNCTION) switch. Set the NPN - PNP switch to NPN (out).

Press the ON switch (in).

Press the I_{ces} switch (FUNCTION) and then press the I_{ceo} switch (FUNCTION). The Triac should now be turned on and the meter should read 50 or greater on the LEAKAGE scale. Momentarily disconnect the cathode lead from the black banana jack and then reconnect it. This should turn the Triac off. The meter should now read less than 5 on the LEAKAGE scale.

To test the other polarity of the Triac set the NPN - PNP switch to PNP (in), and then repeat the previous paragraph.

When finished testing be sure to remove the device from the tester and check that the ON - OFF switch is in the OFF position (out). This will insure long battery life.

What the IT-121 Cannot Test:

Probably the weakest feature of this instrument is the low test voltage it uses (± 1.5 VDC); this is also a safety feature as it prevents damage when doing in-circuit testing. Due to the low voltage, zener diodes can be checked for leakage but not for their regulating voltage; usually if a zener diode passes the leakage test it is operating properly. High-voltage diodes, SCRs and Triacs that have a forward voltage drop greater than 1.5 volts cannot be tested; neither can Darlington transistors that have a V_{be} drop greater than 1.5 volts. SCRs, Triacs and UJT's that require trigger voltages greater than 1.5 volts also cannot be tested. Generally these devices can be checked by measurement.

Next Article - In Part II...

...we will examine the circuitry used in each of the tests and perhaps briefly cover a little of the theory behind the semiconductors that can be tested.

73, from AF6C



Notes:

1. **I_{ceo}** is the current that flows between the collector and emitter with the base is open.
2. **I_{cbo}** is the current that flows between the collector and base with the emitter is open.
3. **DC Beta (β)** is the ratio of the collector current to an applied base current. It is the DC current gain.
4. **DC Alpha (α)** is the collector current divided by the emitter current. It is always less than one and is related to the DC beta by $\alpha = \beta/(\beta+1)$.
5. **I_{ces}** is the current that flows between the collector and emitter with the base is shorted to the emitter.
6. **G_m** (transconductance) is a measurement of how a change in FET gate voltage affects drain current. It is usually expressed in μmhos .

Notes continued:

7. **I_{gss}** is the FET current that flows between the gate and the source with the source shorted to the drain.
8. **I_{dss}** is the FET current that flows between the drain and the source with the gate shorted to the source.
9. **I_{eb2s}** is the leakage current between the emitter and base 2 with base 1 shorted to base 2 of a UJT.
10. **I_{b2b1s}** is the forward current through base 2 and base 1 with the emitter shorted to base 1 of a UJT.
11. **I_{b2es}** is the emitter current that flows between base 2 and the emitter with base 1 shorted to the emitter of a UJT.
12. A schematic of the IT-3120 (IT-121) may be found at: http://www.w6ze.org/Heathkit/Sch/IT3120_Sch.jpg

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

Thanks - AF6C

PUZZLER

For our CW ops out there, here is a simple Puzzler:

There is a common abbreviation used heavily by CW operators. The abbreviation is sent with all dits except for one dah. Interestingly, the unabbreviated words for the abbreviation can also be sent by CW using all dits except for one dah. Can you guess the abbreviation?

Send your solution to: puzzler@w6ze.org

The answer will appear in an upcoming RF Newsletter.

Give it a try!

73 from The Puzzler

PUZZLER

HAMCON 2017

ARRL Southwestern Division Convention

September 15-17, 2017
Torrance Marriott Redondo Beach Hotel
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For complete convention details, registration and hotel bookings log onto:

WWW.HAMCONINC.ORG

OCARC GENERAL MEETING MINUTES 2017-05-19

The OCARC General meeting was held at the Red Cross Complex in Santa Ana on May 19, 2017.

Club Officers: There was a quorum with all officer's present with the exception of Bob AF6C, Dan N6PEQ, Nicholas AF6CF and Greg W6ATB.

Attendance: There were a total of Thirty-four club members and guests, and the guest speaker (Peter Putnam NI6E) in attendance.

Meeting Started at 7:03 pm

Program:

Jim AF6N introduced this month's speaker Peter NI6E. Peter's presentation was about his trials and tribulation on acquiring a "TV Van" and converting it for use as a rover. After the introduction the meeting was moved to the parking so Peter's van could be viewed up close and Peter could answer questions. After the outside presentation, the meeting was continued upstairs with a power point presentation.

Intermission was taken from 8:26 pm to 8:41 pm

Announcements:

- Tim N6GP wanted to bring to the membership's attention that we are guest of the Red Cross and everyone should make an effort to leave the meeting room clean and as we found it prior to the meeting. Tim will bring the suggestion of a second net for a trial period.
- The club received the permit to use the Walter Knott school site for Field Day.
- The status of sharing the site with the Fire Department is still unresolved but no problems are anticipated.
- The GOTO station will use the newly acquired W6NGO callsign.
- The budget for Field Day will be published in the newsletter and voted on at the June General Meeting on June 16th.

Discussion:

- At the previous Board of Directors meeting Tim N6GP was asked to get input of from the membership regarding the use of the WD6AWP repeater on Santiago Peak.



Show and Tell:

- Tony N2VAJ demonstrated his collapsible 2 Meter 3 element beam.
- Lito KI9H demonstrated his All Star link node.

Ask the Elmers:

- Fran KJ6UJS is asking for help from anyone who has experience setting up GPS interface with a Kenwood TM-D700A.
- Tim N6GP had his question about resolving his wet balun problem answered by recent Santa Ana winds. Problem solved.

Good of the Club:

- Ned Sterns AA7A was elected ARRL South-western Division Vice-Director.

Meeting Adjourned at 9:05 pm

Submitted by *Ron Mudry W6FPS*
OCARC Secretary



The business end of the pneumatic lift of the 55-ft tower.



The operating position for future Ham Portable Contesting.

Peter N16E provided a tour of his conversion of a Commercial TV Van before the meeting.



Tim N6GP teaches Field Day University class



OCARC BOARD MEETING MINUTES 2017-06-03

The April OCARC Board meeting was held at the Marie Callender's Restaurant at 1821 N. Grand Ave in Santa Ana on June 3, 2017.

Meeting Called to Order: 8:07 am

Roll Call:

Pres.: Tim N6GP, Present	Vice Pres. Jim AF6N, Present
Sec.: Ron W6FPS, Present	Membership: Bob AF6C, Present
Tech.: Clem W0MEC, Present	Treasurer: Ken W6HHC, Present
Activities: Tim N6TMT, Present	Publicity, Dan N6PEQ, Absent
Directors at Large: Greg W6ATB, Absent	Nicholas AF6CF, Present

Members Present: Rodger Kerr AI6WV, Corey KE6YHX

DIRECTOR REPORTS:

- ☐ **Vice President** – Jim AF6N reported that the June speaker will be Chip K7JA and he will be giving his Field Day preparation talk. July's speaker will be Wayne W6IRD, Boat Anchor Restoration and Don Hill KE6BXT, Mesh Network/AREDN.
- ☐ **Secretary** – Ron W6FPS had no report.
- ☐ **Membership** – Bob AF6C reported the current membership is now 76 members and the online roster is up to date.
- ☐ **Technical** – Clem reported that the Wednesday night 10 meter net was a little noisy, but 2 meters was fine. Clem asked Bob AF6C to update Bob and Lee Evens email addresses in the roster.
- ☐ **Treasurers Report** – Ken W6HHC provided a current Cash Flow Report. Ken renewed the OCARC mailbox after having to update the information that the post office had on file. After Field Day, the treasure will look in to the advantage of transferring the clubs checking and savings accounts to a bank that will not charge monthly service charges.
- ☐ **Activities** – Tim N6TMT had no report.
- ☐ **Publicity** – No report.
- ☐ **Directors at Large** – Nicholas AF6CF & Greg W6ATB experienced an airline SNAFU while trying to go to the Hamvention at Xenia Ohio. Thus, their trip had to be cancelled.

OLD BUSINESS:

- ☐ **Newsletter Editors**
June-Tim N6TMT, July-Tom W6ETC, August-Kristin K6PEQ, September-Pending
- ☐ **Club Historian Report** – Corey KE6YHX provided a copy of his report on his work with Santa Ana Library.
- ☐ **New 2 Meter Repeater**-Bob will check if the repeater will be available for club use on Thursday nights at 7:00 pm. Corey KE6YHX will be the net controller.
- ☐ **June 2017 Field Day** – The next Field Day planning meeting will be at 7:00 pm on Tuesday June 13 at Tim's N6GP home. Neil N6VHF has arranged for press releases and a site visit by the mayor of Buena Park. Corey reserved a tent for Field Day. Tim N6GP will provide a 6 meter moxon antenna for use by Robbie's KB6CJZ VHF station. Help is needed for setup of the publicity table and a site visit by a representative of a qualifying agency. Bob AF6C will service the generator. The Field Day budget will be presented and voted on at the June General Meeting. The boy scouts will collect meal ticket money at the General Meeting.

- **Club Kilowatt Bioenne Battery** – The battery will be tested by Tim N6GP in the upcoming June VHF contest and recharged by solar power for use at Field Day.

NEW BUSINESS:

- **Net Control Guidelines** – Corey KE6YHX made a motion to except a set of “Net Control Guidelines”. Nicholas seconded to motion and Tim N6GP called for discussion. The motion was tabled and will be discussed at the July Board Meeting.

GOOD of the CLUB:

- **Tents** – Nicholas donated a tent and easy-up to the club.
 - Jim AF6N will investigate why WPX log submittals will not accept “Orange County ARC” as a club submittal.
- Meeting Adjourned 9:52 am

Submitted by *Ron Mudry W6FPS, Secretary*
OCARC Secretary

OCARC Cash Flow - Year To Date

1/1/2017 through 6/4/2017

Category	1/1/2017- 6/4/2017
INFLOWS	
ARRL Membership Income	95.00
Badge Income	5.00
Dues, Family	90.00
Dues, Family (PayPal)	206.03
Dues, Future (PayPal)	28.83
Dues, Membership	630.00
Dues, Membership (PayPal)	706.21
Refreshments Income	39.00
Sale Of Equipment	845.00
TOTAL INFLOWS	2,645.07
OUTFLOWS	
ARRL Membership Expense	93.00
Bank Svc Chg	25.00
OCARC Historian	27.45
PO Box Rental	64.00
Refreshments Expense	95.82
Storage Locker	380.00
Supplies	46.62
Trifold Brochure Printing	231.12
Web Site Hosting	89.94
TOTAL OUTFLOWS	1,052.95
OVERALL TOTAL	1,592.12

BIOGRAPHICAL INFORMATION

**Charles H. "Chip" Margelli,
K7JA**

**6652 Cerulean Avenue
Garden Grove, CA 92845**

Chip Margelli, K7JA, has been licensed since 1963, and an Extra Class licensee since 1968. Chip and his wife Janet, KL7MF live in Garden Grove, California. Chip is a Life Member of ARRL, AMSAT, Honorary Member of OCARC, and Quarter Century Wireless Association, and he works for Ham Radio Outlet as an I.T. Specialist.

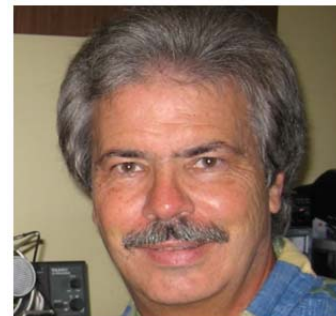
For over fifty years, Chip has been active in DXing and, especially, international radiosport competition. Among his accomplishments are twelve First-Place finishes nationally in the ARRL November Sweepstakes, and a number of world-high or national wins in the CQ World-Wide DX Contest, ARRL DX Contest, and CQ WPX Contest.

Chip's DXpedition activities include operations from St. Lucia, Dominica, Antigua, the U.S. Virgin Islands, Puerto Rico, Saipan, Micronesia, Aruba, Bonaire, Curaçao, Martinique, and Barbados. In 1984, Chip and Janet were invited by the Chinese Radio Sport Association to travel to Beijing for operation from BY1PK and help train the new Chinese operators during the early phases of the rebirth of Amateur Radio in China.

In 1989, Chip was honored by being selected to be the American representative in the first-ever Finnish-Soviet-American DXpedition to Malyj-Vysotskij Island as 4J1FS. The following year, Chip and his teammate Mike Wetzel, W9RE, won a Silver Medal at the World Radiosport Team Championship held in conjunction with the Goodwill Games in Seattle, an

elite competition featuring twenty-three teams from fifteen countries around the world.

And in the Fall of 1991, Chip was a member of the Instructor/Operator team in the IARU Albania Project (ZA1A), led by Martti Laine, OH2BH, which brought about the rebirth of Amateur Radio in Albania after many decades of radio silence.



In 1994, Chip and Janet accepted commissions by two magazines to visit the Havana area to document the participation by members of the *Federación de Radioaficionados de Cuba* in the ARRL June VHF QSO Party, which included operation as COØFRC, CO2/K7JA, and CO2/WA7WMB. Theirs was the first group of American radio amateurs to be so honored. Feature articles by Chip and Janet appeared in *The QCWA Journal* and *QST* in late 1994. In 2003, Chip and Janet and four other members of the Piña Colada Contest Club (KP2AA) joined forces with the FRC in the first-ever joint Cuba-U.S. Field Day operation as COØUS. This operation marks the first occasion where a Treasury Department Specific License was granted for a public Amateur Radio demonstration involving U.S. Amateurs.

In May of 2005, Chip and partner Ken Miller, K6CTW, made an appearance on *The Tonight Show with Jay Leno* on NBC, competing with (and defeating) the U.S. champion cell-phone text messenger in a message-completion speed contest.

Articles by Chip have been published in *QST*, *CQ VHF*, *Popular Communications*, and *CQ* magazines, and in several books. Outside of Amateur Radio, Chip enjoys photography, astronomy, and is a marathon runner.

In May of 2008, Chip was inducted into *CQ Magazine's Amateur Radio Hall of Fame*.

Our 6th Annual HRO Ham Jam is coming up!

Saturday, July 8, 2017 is the date, store hours are 10AM-5:30PM, and once again we will be hosting our local clubs and communications specialists in the store parking lot for another educational and fun event.

Come see local communications vehicles, learn about Hospital Disaster Services, and see how many of the local clubs make various activities available to local hams. We look forward to hearing from any local group who would like to reserve space for this event.

The Eagle Scouts will be providing a hotdog lunch again this year, and Mr. Gordon West and many manufacturer representatives will be available for questions. Seminars will be scheduled on various subjects, including D-Star, C4FM System Fusion, and other hot topics.

License testing will also be available most of the day; if interested in testing, please call Janet at the store at [714-533-7373](tel:7145337373) with name and contact information so that we may plan for appropriate seating.

Two prize drawings will be held during the day at 12 noon and 3PM. Winners will need to be present to win goodies from many of our suppliers who have donated some really great stuff!

Come join us for a fun-filled Saturday of ham radio; make it your goal to leave having learned at least one new thing and/or shared your own knowledge with at least one new ham.

Kind 73,
Janet Margelli, KL7MF
Manager
Ham Radio Outlet
933 N. Euclid St.
Anaheim, CA 92801
[\(714\)533-7373](tel:7145337373) Tel
[\(800\)854-6046](tel:8008546046) Tel
[\(714\)533-9485](tel:7145339485) Fax
anaheim@hamradio.com

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ters)
DX Doubler
Elecraft K2
Elecraft KAT 100 antenna tuner
Elecraft KAT 500 antenna tuner

Elecraft KPA 500 solid state amplifier
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LDG AT-100 Pro antenna tuner
LDG RBA 1:1 balun
Radioworks Line Isolator T-4
NorCal 40A QRP transceiver
Workman CX-3 coaxial antenna switch
Bencher Low Pass Filter YA-1
Rig Runner 4008 interface
Winkeyer USB
Pyramid SWR 14 meter
Palomar Preamplifier P-410X
Multimeter
Fiberglass antenna poles (12)

Field Day Meals and Food: The Boy Scout troop will be providing meals at a fixed cost. This is a convenience to the club and a fund raiser for the Boy Scouts. There are two discount meal plans offer for FD participants who purchase food in advance. Please get your order in prior by June 19th OCARC Membership meeting.

Plan 1, four meals for \$25 includes the meals as follows: (Great Bargain) • Saturday break-
fast - 8:00 to 9:30 AM • Saturday lunch - 12:00 to 1:30 PM • Saturday dinner - 6:00 to 7:30
PM • Sunday breakfast - 8:00 to 9:30 AM

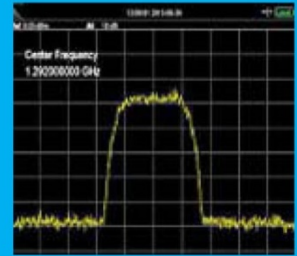
Plan 2, for \$30 includes the four meals indicated in Plan 1 plus a Friday evening meal as in-
dicated below: (Best Bargain) • Friday dinner - 7:00 to 8:30 PM

A Limited amount of Individual meals may be available for purchased at \$7.50



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