



# RF



ORANGE COUNTY AMATEUR RADIO CLUB, INC.

VOL. LXII NO. 02

P.O. BOX 3454, TUSTIN, CA 92781

February 2021

## The Prez Sez...

By Nicholas AF6CF



Greetings to all! A month into 2021 we can already tell that this is going to be another great year for the Club. In spite of the lockdowns, stay at home, etc ... our membership is growing. We have big hopes for the rest of the year with plans and activities. Of course, Field Day is always front and center and we are starting conversations about it, although this time around it will be different because of the uncertainty of the current situation. We'll see what the ARRL has to say about this year's rules. The Board is working on electing the Chairpersons to give it an early start. I can only promise that I will delegate most if not all activities to others, so we will have qualified people doing the job at hand.

Unfortunately, because of COVID-19 many activities have been cancelled such as the Baker-to-Vegas race,

antennas at the park (or beach), open houses, parties and picnics until which time it's safer to proceed. Know that the Board of Directors are working to find engaging and fun activities. Our Nets (see page 2) are growing and many outside repeater nets are also buzzing with activity, as more operators are finding HAM radio a wonderful means of socializing with one other.

Last month we had a great turnout for our Zoom General Meeting, with an unusual twist, as it became necessary to stop it and restart it due to unexpected interference. It was too late in the evening for our speaker to rejoin because he was located in the East Coast. We are fortunate that he rescheduled with our club for this month. At any rate, the meeting was nonetheless very interesting, with members sharing their stories and an excellent "Q&A" about different radio related topics. So much so, that we may have a "speaker-less" meeting in the future. In the meantime our VP has secured several outstanding presenters for the next few months. I know that you will not be disappointed.

Happy Valentine's Day to everyone. Hope to see you all at the next OCARC (Zoom) meeting.  
73

Nicholas, AF6CF  
President OCARC 2021

## NEXT MEETING

February 19, 2021

Join us Via ZOOM at 7:00PM!  
Current OCARC members  
will receive an EMAIL with  
instructions. Early check-in  
available 6:10PM(+)

Will Jourdan AA4JW

Sales Rep. from

ICOM AMERICA

on the NEW

IC-705 HYBRID RADIO

## SPECIAL NOTICE:

During the COVID-19  
pandemic ALL OCARC Nets  
will Remain Active!  
See page 2.

## In This Issue

The Prez Sez.....	1
Club Information .....	2
OCARC Results for CA QSO Party ...	3-4
RadioActivity Contests .....	5
Radio Nets.....	6
2021 Field Day In the News .....	6
OCARC Board Mtg. Minutes .....	7-9
OCARC General Mtg. Minutes .....	9-12
Heathkit Model SQ-1 Generator.....	13-22
OCARC 2020 Audit Report .....	23
Ad for MiniTiouner-Express DATV .....	24

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**Monthly Events:****General Meeting time & location:****REGULAR MEETINGS\***

**\*See ZOOM announcement pg.1**

Normally Held third Friday of the month at 7PM, located at:  
The American Red Cross  
600 Parkcenter Drive  
Santa Ana, CA

**Club Breakfast (Board Mtg) info:**

First Saturday\*\* each month 8 AM  
Marie Callender's Restaurant  
307 E. Katella Ave  
Orange, CA 92867

**\*\* Board will handle Club business by ZOOM at this time**

**Club Nets (Listen for W6ZE):**

**10M: 28.375 ± MHz SSB**

Wed- 7:30 PM - 8:30 PM  
Net Control: Corey, KE6YHX

**2M: 146.55 MHz Simplex FM**

Mon, Wed, Fri 8:30 PM - 9:00 PM  
Net Control: Corey, KE6YHX

**75M 3.883 MHz LSB**

Wed @ 9:15 PM  
Follows right after end of 2M Net  
Net Control: Corey, KE6YHX



Wellness & Support Net

**Outside Nets: CARA REPEATER**

**147.090 MHz (+0.600 MHz) No PL**

Monday - Friday  
9:00AM and 9:00PM

NCO & Prg. Director. Tom W6ETC  
NCO: Jeff: KK6TRC, Don W6ZZW,  
Chris KF6LEX

**OCARC 2021 DUES**

**Membership period is:  
1 January to 31 December**

Individual New or Renewal:	\$30.
Family New or Renewal:	\$45.
Teen New or Renewal:	\$15.

**New Member Dues are prorated quarterly and includes a badge:**  
Additional Badges: • \$ 3.  
Use one of our interactive online forms to calculate current prices, join the club and/or order badges:

**Online Forms / Dues & Badges**

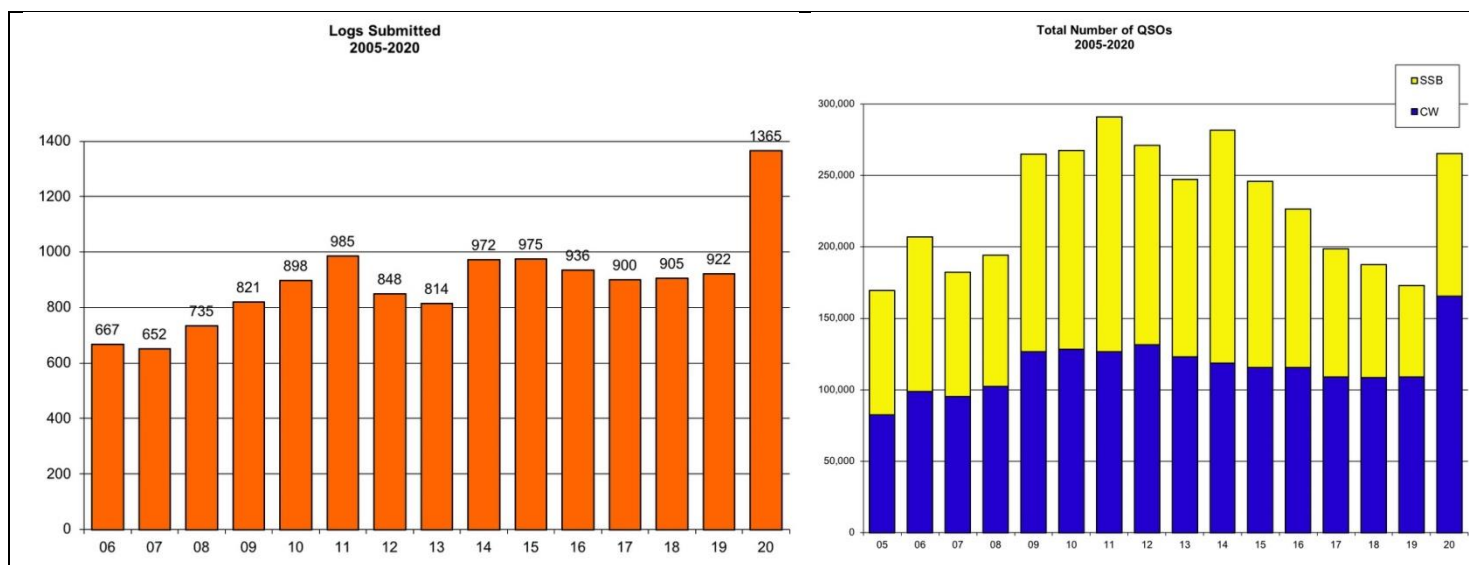
• \$3. plus mailing costs if applicable  
*Dues are subject to change without notice*



# OCARC Results in the California QSO Party 2020

By Tim Goeppinger N6GP

The NCCC has just published results from The California QSO Party (CQP) that was held on October 3 & 4<sup>th</sup>. For a more detailed article on our participation in it, please see the November 2020 RF, pages 5-7. This will be just a brief reporting of the official scores. All data & charts courtesy of the NCCC (Northern California Contest Club), and can be viewed at their site: <http://www.cqp.org/Results.html>. Personal achievement certificates are available there to all participants.



As you can see in the charts above, there were a record number of logs submitted, plus a record number of CW QSOs. Years closer to the solar sunspot peaks still hold the record for highest QSO counts.

We entered the Small Club Category, with our top 10 logs counting toward the overall score. We had a fantastic score of 918,688, but unfortunately we ended up in 4<sup>th</sup> place, behind 3 northern cal clubs. (West Valley ARS is in Santa Clara Valley).

## Small California Clubs

REDWOOD EMPIRE DX ASSOCIATION

PIZZA LOVERS 259

WEST VALLEY AMATEUR RADIO ASSOCIATION

ORANGE COUNTY AMATEUR RADIO CLUB

PASO ROBLES ARC

Num Logs	Score <sup>3</sup>
17	1,468,342
9	1,341,162
12	948,949
11	918,688
6	264,821



Orange	CW	PH	Total	Mult	Score	Type
<b>K6E<sup>17</sup> (N6MJ op)</b>	<b>1,520</b>	<b>1,100</b>	<b>2,620</b>	<b>58</b>	<b>392,080</b>	<b>SO</b>
N6HC	770	596	1,366	57	199,614	SO
<b>K7JA/6<sup>18</sup></b>	<b>974</b>	<b>277</b>	<b>1,251</b>	<b>57</b>	<b>198,132</b>	<b>SOA L</b>
AA6PW	773	303	1,076	58	169,650	SO
N6GP	821	88	909	56	147,784	SO
W6ZL	692	1	693	56	116,368	SOA L
<b>KI6X</b>	<b>513</b>	<b>217</b>	<b>730</b>	<b>56</b>	<b>110,488</b>	<b>SO L</b>
NE6DX (NT6X op)	376	178	554	53	78,652	SO
N6MU	336	13	349	50	51,700	SO L
<b>K6PB</b>	<b>294</b>	<b>16</b>	<b>310</b>	<b>49</b>	<b>44,786</b>	<b>SOA L</b>
N6OKU	0	339	339	51	34,578	SO L
<b>W6LEN</b>	<b>129</b>	<b>0</b>	<b>129</b>	<b>38</b>	<b>14,706</b>	<b>SO L</b>
K6PGH	12	105	117	45	11,070	SO L
<b>AF6N</b>	<b>94</b>	<b>0</b>	<b>94</b>	<b>29</b>	<b>8,178</b>	<b>SOA L</b>
WI6X	0	67	67	31	4,154	SO
KB6A	0	62	62	26	3,224	SO L
K6FTL	0	50	50	28	2,800	SO L
W6KSR	20	0	20	14	840	SO L
<b>W6ATB</b>	<b>0</b>	<b>12</b>	<b>12</b>	<b>13</b>	<b>312</b>	<b>SO L</b>
N6HCN	15	0	15	5	225	SO L
KF6I	22	0	22	3	198	SOA
AI6OU	0	4	4	4	32	SO L

### Orange County Results with OCARC members OUTLINED in RED.

Both Arnie N6HC and Chip K7JA were within 2000 points of winning a bottle of California wine. Maybe next year! Chip is the new record holder in the Single Operator Assisted Low Power category for Orange County! He also had the most QSOs with the SEQUOIA 1X1 stations in his category, and has received a nice 2021 National Parks Calendar!

We won't forget Ron W6WG, who operated his Kern County station remotely, and had a very nice score of 14,280. This sets the record for Single Operator Assisted Low Power in Kern County! Way to go Ron!

Mark your calendars for this year's CQP on Oct 2-3. Maybe we can get into that elusive 3<sup>rd</sup> place for a club score, and maybe some of our members can win bottles of wine. In any case, it is the most fun for Californians to get on the air!



*Field Day Memories ~ Back in the day!!!*



## UPCOMING ACTIVITIES

### February Events:

- **10-10 Winter Contest, SSB:** 0001 UTC Feb.6 through 2359 UTC Sunday Feb. 7
- **\*CQ WW WPX / RTTY** 0000 UTC Saturday Feb. 13 through 2359 UTC Sunday Feb. 14
- **\*ARRL International DX Contest: CW:** 0000 UTC Sat. Feb. 20 through 2400 UTC Sunday February 21
- **\*CQ WW 160 Meter SSB:** 2200 UTC Friday Feb. 26 through 2200 UTC Sunday February 28
- **North American QSO Party / RTTY:** 1800 UTC Feb. 27 through 0559 UTC Sunday February 28

*\* Indicates club entries are accepted    \*\* Indicates team entries are accepted*

**Important Note:** When submitting logs for ARRL Contests please **indicate** your **club affiliation** as:  
**“Orange County ARC”**

### State QSO Parties:

#### New State QSO Party Challenge for 2021!

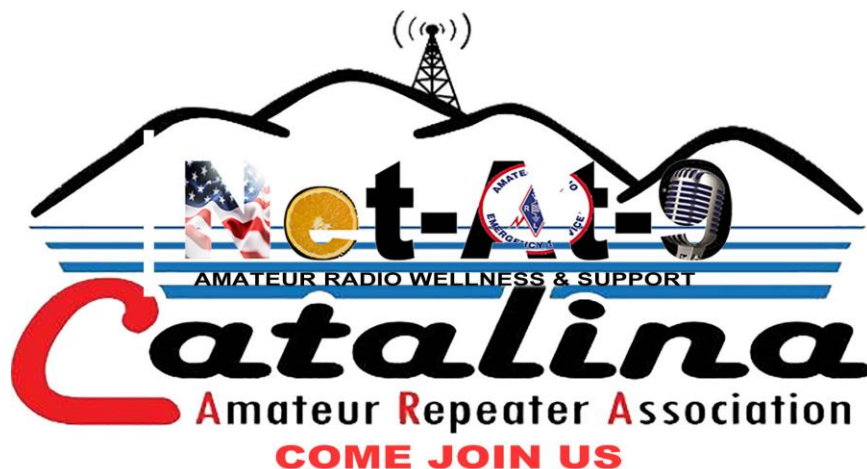
Also a new “Worked All QSO Party (WAQP)” Award . See details at <http://stateqsoparty.com/>

- **Vermont QSO Party:** 0000 UTC Saturday February 6 through 2359 UTC Sunday Feb. 7
- **British Columbia QSO Party:** 2 segments February 6 & 7 see [https://www.orcadxcc.org/bcqp\\_rules.html](https://www.orcadxcc.org/bcqp_rules.html)
- **Minnesota QSO Party:** 1400 through 2359 UTC Saturday February 6
- **South Carolina QSO Party:** 1500 UTC Saturday February 27 through 0159 UTC Sunday Feb. 28
- **North Carolina QSO Party:** 1500 UTC Saturday February 27 through 0100 UTC Monday March 1

### Repeating Activities:

- **Net-At-9 Wellness and Support Net** (2m & 1.25m) Monday - Friday 9am and 9pm
- **Phone Fry** Every Tuesday night at 0230 UTC to 0300 UTC
- **SKCC Weekend Sprintathon** (Straight Key CW) on the first weekend of the month after the 6<sup>TH</sup> of the month. 1200 UTC Sat. to 2359 UTC Sunday.
- **SKCC Sprint** (Straight Key CW) 0000 UTC to 0200 UTC on the 4<sup>th</sup> Tuesday night (USA) of the month.
- **CWops** Every Wednesday 1300 UTC to 1400 UTC 1900 UTC to 2000 UTC and Thursday 0300 UTC to 0400 UTC
- **K1USN Slow Speed Test:** (CW, 20WPM Max.)  
 Every Friday afternoon 2000 UTC to 2100 UTC  
 Every Sunday night at 0000 UTC to 0100 UTC Monday

Send an email to Ron W6WG, [w6wg@w6ze.org](mailto:w6wg@w6ze.org) to have your favorite activity or your recent RadioActivity listed in next month's column.



9 AM & 9 PM Monday – Friday on CARA Repeaters:  
 2M: 147.090 MHz (+0.600 MHz) No PL and  
 1.25M: 224.420 MHz (-1.600 MHz) PL 110.9 repeaters.  
 Also available on EchoLink node \*CATALINA\*

Tom W6ETC Program Director & Net Control

Additional Net Control Operators include: Jeff KK6TRC; Don W6ZZW and Chris KF6LEX

### Club Nets (Listen for W6ZE)



**2M: 146.55 MHz Simplex FM**

Mon, Wed, Fri 8:30 PM - 9:00 PM

Net Control: Corey, KE6YHX

### Other W6ZE Nets

**75M 3.883 MHz LSB**

Wed @ 9:15 PM

Follows right after end of 2M Net

Net Control: Corey, KE6YHX

**10M: 28.375 ± MHz SSB**

Wed- 7:30 PM - 8:30 PM

Net Control: Corey, KE6YHX

## IN THE NEWS

### ARRL to Extend Field Day Rule Waivers from 2020, Add Class D and E Power Limit

The COVID-19 pandemic-modified **ARRL Field Day** rules from 2020 will continue this June (2021) with the addition of a power limit imposed on Class D (Home Stations) and Class E (Home Stations-Emergency Power) participants.

For more information go to the following link.

<http://www.arrl.org/news/arrl-to-extend-field-day-rule-waivers-from-2020-add-class-d-and-e-power-limit>



## OCARC BOARD MEETING MINUTES 2021-02-06

Due to the COVID-19 restrictions on physical gatherings, the February Board Meeting was via Zoom on Saturday, February 6, 2021. The meeting was called to order by our president Nicholas AF6CF at 8:14 AM PST. Eight (8) directors were present for a quorum. Additionally, Tim G. N6GP showed up at 9:14 AM PST. Tom W6ETC was absent, and there were no visitors. There were nineteen (19) topics brought to the Board this morning, and one (1) motion carried, adjournment.



### Director Reports

- The vice president reports the speakers for the first-half of the year are scheduled:

### General Meeting Programs

February: Will Jourdain AA4WJ from Icom America "The new IC-705 HF rig"

March: Scott MacGillivray KM6RTE on "Introduction to Winlink"

April: Lance Collister W7GJ on "DXpeditioning with 6 Meter EME"

May: Marty Woll N6VI on "DXpedition to Mauritius Island 3B8"

- The Secretary reports on some upcoming holidays in April that may be in conflict with the Board meeting. After some discussion, the Board agrees unanimously to keep the schedule the same.

- The Treasurer hopes to get the books from Greg W6ATB as soon as the audit is complete. Ken W6HHC brings up the ways of sending owed monies from the OCARC. An easy way has presented itself, to send via PayPal. However, sending through PayPal incurs a fee to the payee, and does not leave a good paper trail. Whereas, writing a check (the current treasurer procedure), would be more work, but would leave a better paper trail. Bob suggests a separate ledger for PayPal, with their payments and fees, but Nicholas says it would be more difficult for the treasurer. Ken and Nicholas redirect the topic off the Board Meeting.

•The membership chairman reports there are 122 members, of those, 51 are new or have renewed, and 4 are honorary members. Dan reminds us to send a renewal notice in the February RF Newsletter. The renewal grace period continues until the end of March.

### Old Business

•The first topic under Old Business was a review of the Financial Audit Committee Report. Ken W6HHC reports Greg W6ATB has been working on getting his records set-up. Greg is cleaning up and reviewing his financial report. There were a few extra membership payments that were unclassified, but the records are in good shape, says Ken. Tim M. N6TMT is ready for a meeting Wednesday evening, pending Greg's schedule. The assets according to the draft of the report have increased by about \$200 from the year before. Ken summarizes the items on the Financial Audit Report. The Financial Audit Committee is Tim M. N6TMT, Ken W6HHC, and Greg W6ATB.

### Newsletter Editors

February: Tom W6ETC  
March: Tim M. N6TMT

April: Steve N1BKB  
May: —open to volunteers—

•The next topic under Old Business are Hybrid Meetings. We discuss the need to maintain a relationship with the American Red Cross. We may need to reintroduce ourselves to a new ARC contact. It makes sense for us to meet there after the gathering restrictions are lifted, since we have members from various served agencies, as well as the ARC.

•Another topic is Winter Field Day 2021. Ron reports Tim G. gathers the scores together. Ron tells us we did really well, but it would be inappropriate to release names or scores ahead of Tim G. Bob has his paper logs, but needs a file with location and call category information, and Dan can provide that. Dan needs Tim G. to compile and post the information he sent for OCARC email distribution. Ron explains the difficulty in gathering information, since the logs are sent directly to the Winter Field Day organization. Ron heard no one from our remote site.

•Next on the agenda is ARRL Field Day 2021. Nicholas says we need Field Day chairmen. He proposes two candidates, and Ron W6WG and Tim G. N6GP are asked if they will be FD chair.

•The bank signature cards are the next topic. Ken W6HHC reports everything is in place. Ken received a notice from Wells Fargo yesterday that Tim M. N6TMT had been added to the signature list. Ken called Wells Fargo and they told him that it was a mistake. The current president, vice president, and treasurer are now on the signature list. The issue is settled, says Ken, and the California Secretary of State did not charge us for the statement of information with the new club officers, and returned payment for this.

### New Business

•Tim M. N6TMT reports the solutions to last month's technical difficulties are in-place.

•Opportunity drawings are proposed for the Zoom meetings. We have some remaining prizes from the end of last year. During Zoom meetings, there is no way of collecting money for the drawing. Bob suggests a "white elephant prize," where the winner must provide the next prize.

•The next item of new business are "show and tell" ideas for the Zoom General Meetings. Nicholas AF6CF suggests stations, projects they are working on, radios, or something of general interest to the members and other attendees. For example, Nicholas AF6CF has a collection of Ham-logo baseball caps he can show, and Ron W6WG has a project he can show. A video can be made ahead of time, or it can be still-shots.



- As another topic, we can regularly have “member stories.” It worked well at the last meeting, and it can be provided in addition to “Ask the Elmer.” The Board members discuss memories of after-meeting activities.
- The “1-and-1” web service recently send a message that it is updating the PHP version used by our web site. PHP is used heavily for our online renewal forms. This is the third time it has occurred, usually during the renewal period. The first time it required substantial reprogramming. The plan is to see if switching breaks our online forms and if so pay the March monthly \$8.71 fee to get us past the signup period. Then fix the problem.
- For the future agenda, Bob AF6C brings up the need to check and update the various web pages on our site. Some people need to be assigned a page or two to look over and send corrections, etc. to the web masters, based on the topic of the page, such as Emergency Communications.
- Lastly, new photos for the home page need to be sent to Ken and Bob every month. Videos are possible as well, says Bob.

### **Good of the Club**

Many Board members got their COVID-19 vaccine. They are scheduled online, and some are given at Disneyland. It is less than a half-hour wait say Ron and Dan. The Othena web site at [www.othena.com](http://www.othena.com) is first-come first-served, except for an age consideration, 65 and over, says Nicholas

### **Adjournment**

A motion to adjourn was made, seconded, and carried at 9:23 AM PST.  
Respectfully submitted by Corey KE6YHX, OCARC Secretary.

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## **OCARC GENERAL MEETING MINUTES 2021-01-15**

Due to the restrictions on social gatherings with the pandemic, the first General Meeting of the year was via Zoom on January 15, 2021, at 7:00 PM PST. There were twenty-five (25) members, guests and visitors present, including our speaker.

The Zoom session was interrupted due to technical difficulties, so we restarted Zoom with our business meeting. The secretary apologized to our speaker, Mr. William Jourdain Jr. AA4WJ, via email on behalf of the Board and offered an invitation to return. He accepted and the February General Meeting is reserved for him.

### **Business Meeting**

Our business meeting was called to order by our president Nicholas AF6CF at 7:38 PM PST. There were eight (8) directors present at roll-call for a quorum, and fifteen (15) members and visitors. Ron W6WG joined at 8:29 PM, and Ken W6HHC was absent. Vijay Anand KM6IZO has a new vanity call sign, “NA6VJ”



## Director Reports

### -Secretary Report:

Meeting Holiday Conflicts:

Saturday, April 3: Holy Saturday/Easter Weekend

Saturday, July 3: Independence Day Weekend

Saturday, September 4: Labor Day Weekend

The secretary recommends that we “play it by ear,” as holiday calendars are continually updated throughout the year.

### -Activities Report:

Tom W6ETC, Tim G. N6GP, and the Board discuss upcoming activities/contests.

-January ARRL VHF Contest, January 16, 11:00 AM-January 17, 8:00 PM: Frequencies: 50.125-50.135 MHz, 146.520 MHz, 146.550 MHz, 146.580 MHz, 223.5 MHz, and 446.0 MHz

Tim G. will start either in the hills above Newport Beach, or on Signal Hill. The exchange is just your grid square, available on qrz.com. Rovers can be contacted every time they change grids. The bulk of the activity is in the first few hours of the contest, and repeaters are not allowed. Further information is on the ARRL web site. Questions can be sent to: [timgep@yahoo.com](mailto:timgep@yahoo.com)

-**Winter Field Day**, January 30, 11:00 AM PST-January 31, 11:00 AM PST:

The Clubs will be recognized the same way as last year's ARRL Field Day. If you operate as an individual at your QTH, and you claim OCARC as your club, we need to make sure the right club gets the credit, “Orange County ARC-CA” as there is an OCARC in Florida. Ron W6WG says everyone is needed for Winter Field Day, and it is in two weeks. Ron asks Vijay NA6VJ if he needs the radio and power supply for Winter Field Day, and Vijay says yes.

### -Weekday Activities:

Net-at-Nine, Monday-Friday 9 AM and 9 PM, on the CARA Repeater  
Coronavirus Net

### -Weekend Activities:

A good source for a variety of weekend activities is: [www.contestcalendar.com](http://www.contestcalendar.com)

**-Membership Chairman Report:**

Bob AF6C reports there are a total of 120 members, including four (4) honorary members, and two (2) new members both named "Jeff."

**-Member-at-Large Report:**

Dan KI6X reports on details of the technical difficulties.

**•Visitor Stories**

-Bill KM6ZHO is new and is learning and watching. He asks if anyone in the Club has a house backed by the Santa Ana creek-bed. He goes for his walk by there towards Hart Park from Tustin. The Directors tell Bill that Wayne Spring W6IRD and XYL K6IRD live there. Wayne repairs Collins equipment.

-Allen KN6GXB, is also a new member, has been collecting radios this past year. He has a Yaesu FT-857D, and is getting a Baofeng HT. Nicholas extolls the virtues and notes the disadvantages of the more inexpensive brands. Tom W6ETC asks Allen if he would please introduce his companion. Allen says he is his son, Paul. Paul waves hello.

-Edward KM6FPA has been licensed four years, and radio is a medium for his engineering background. He has many projects, and is now getting active in Ham Radio. He has a Baofeng and one other radio. There is a Ham down the street in Huntington Beach he says he might get acquainted with. He is happy to join the Club, and is excited to get involved. Nicholas and other members offer words of encouragement.

**•Chat and Discussion**

Edward KM6FPA asks about etiquette and repeaters, and where to start. Nicholas says he is on the right path. Joining a club is the way to go. Vijay NA6VJ, Tom W6ETC, and Corey KE6YHX mention the Net-at-Nine, and five other Club nets. Tom refers Edward to the RF Newsletter and [www.w6ze.org](http://www.w6ze.org) for the Net info.

Tom also Zoom-texts the times and frequencies of the Net-at-Nine. Edward asks about repeater protocols and etiquette.

The other members explain the simplicity of accessing a repeater. The Catalina repeater and some others are open repeaters says Tim M. N6TMT.

Allen KN6GXB and Clay N6CDB tell Edward about the WIN System.

Nicholas explains the convenience and functionality of a J-Pole antenna, and refers to the online RepeaterBook.

Tim G. N6GP and Dan KI6X tell Edward the magazines with his ARRL membership are excellent reading. Bob AF6C offers his backlog of QSTs to Edward.

Edward recounts of the copper-pipe antenna from one of his sources. Nicholas has one, a J-Pole, on his chimney for VHF/UHF. Edward is interested in assembly and testing for an antenna, and Nicholas explains the measurements are the most important, and an antenna analyzer is helpful. Steve recalls an OP back east he talked to loaded up a storm screen on his window as an antenna.

Corey KE6YHX asks Clay N6CDB about the 6m antenna he is building. Corey's antenna analyzer requires internal batteries for a balanced feed line, but Clay's antenna has an unbalanced feed line. Corey needs an external battery, so Dan offers his antenna analyzer to Clay, and Clay accepts.

Tim M. N6TMT got his XYL interested and active in Ham Radio with image transmissions from the International Space Station on the Christmas holiday. They used a Yaesu FT-60 HT and a log-periodic antenna. He also successfully tried a tape measure antenna. Edward asks if a computer is needed, and Tim M. explains it is done through the audio output of the radio to a cellphone or by recording and playing it back to a translation program on a computer. The images are sent on 2m.

Edward appreciates the involvement and thanks us for the discussion and much and varied information.

•**Adjournment**

The business meeting adjourns at 8:53 PM PST.

Respectfully submitted by Corey KE6YHX, OCARC Secretary.





## Heathkit of the Month #104: by Bob Eckweiler, AF6C

# Heathkit

## ELECTRONIC TEST EQUIPMENT

### Heathkit SQ-1 Square Wave Generator

#### Introduction:

In its September 1951 flyer Heathkit introduced six new test equipment products for 1952. The kits are listed in **Table I**. Among them was the SQ-1, Square Wave Generator. Prior to the release of the SQ-1, Heathkit had manufactured two audio generators that had both sine and square wave outputs – the G-2 (circa March 1948 - late 1950) and the AG-7 (circa February 1951 - late 1952). During the lifetime of the SQ-1 two additional sine / square wave generators were sold – the AO-1 (circa March 1952 - mid 1957) and the AG-10 (circa late 1957 - late 1962). The SQ-1 kit sold for \$29.50 throughout its lifetime. It remained in production into 1959.

#### New Heathkits for 1952

As listed in the September 1951 Flyer

Model	Name	HotM
O-7	Oscilloscope	#087
V-5	Vacuum Tube Voltmeter	#019
SQ-1	Square Wave Generator	#104
AV-1	AC VTVM	#047
IM-1	Intermodulation Analyzer	–
AF-1	Audio Frequency Meter	–

**Table I**

1. Notes appear on page 20

Here is a link to the index of Heathkit of the Month (HotM) articles:

[http://www.w6ze.org/Heathkit/Heathkit\\_Index.html](http://www.w6ze.org/Heathkit/Heathkit_Index.html)



**Figure 1:** Heathkit SQ-1 Square Wave Generator

The SQ-1 was a successful attempt to design a square wave generator that offered a large frequency range and a fast rise-time square wave. It covers 20 cps to 100 kc while the other Heath generators went only to 20 kc.

Even before the digital era, where pulse and square wave generators are used to generate clock pulses, square waves were used to test amplifiers for frequency response and ringing. In the post-war fifties Hi-Fi was becoming common in the average middle-class household. With its popularity, many small TV repair shops found themselves also servicing Hi-Fi equipment and needed test equipment to do the task – equipment that was better than the current square wave generators Heathkit was selling. Heathkit's responded with the SQ-1.

#### Why Square Waves?:

It can be mathematically shown that a square wave is composed of an infinite series of ODD harmonics of a sine wave<sup>1</sup>, the first harmonic<sup>2</sup> being the fundamental frequency of the square wave. Thus a 100 Hz square wave with an amplitude of A is composed of:

1. 100 Hz sine wave of amplitude  $(4/\pi)(A/1)$
2. 300 Hz sine wave of amplitude  $(4/\pi)(A/3)$
3. 500 Hz sine wave of amplitude  $(4/\pi)(A/5)$
4. 700 Hz sine wave of amplitude  $(4/\pi)(A/7)$
5. 900 Hz sine wave of amplitude  $(4/\pi)(A/9)$
6. 1100 Hz sine wave of amplitude  $(4/\pi)(A/11)$

7. 1300 Hz sine wave of amplitude  $(4/\pi)(A/13)$ .
8. 1500 Hz sine wave of amplitude  $(4/\pi)(A/15)$ .
9. 1700 Hz sine wave of amplitude  $(4/\pi)(A/17)$ .
10. 1900 Hz sine wave of amplitude  $(4/\pi)(A/19)$ .
11. ... to infinity.

See sidebar on page 22 for further discussion.

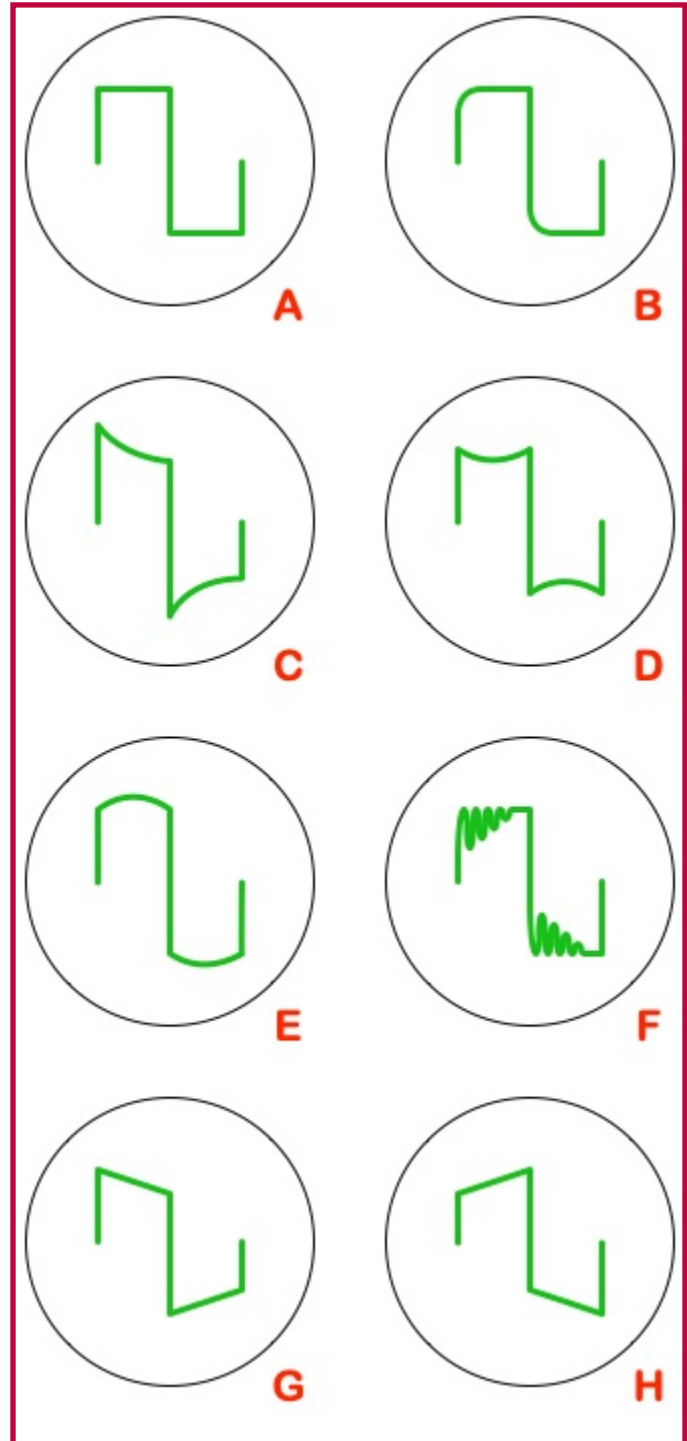
Thus, if a square wave (**Fig. 2A**) is fed into an audio amplifier, and the properly loaded amplifier output is displayed on a wide-band oscilloscope, distortion of the square wave gives an indication of the performance of the amplifier. The shape of the distortion to the square wave is an indication of what the deficiencies are. The Heathkit manual shows seven drawings of distorted waveforms: **Fig. 2B** represents a lack of high frequency response **Fig. 2C** boosted high frequency response, **Fig. 2D** a lack of low frequency response, **Fig. 2E** boosted low frequency response, **Fig. 2F** ringing / damped oscillation (and a clue to the oscillation frequency), **Fig. 2G** leading phase-shift in the amplifier and **Fig. 2H** lagging phase-shift in the amplifier.

It is interesting to note that the indications of the square wave distortion generally are useable from its fundamental frequency through its 10th harmonic. Thus, the testing of an SSB transmitter mike amplifier with a bandwidth of 100 Hz to 3,500 Hz should be tested first at 100 Hz and again at 350 Hz. If both of these show a good square waveform the amplifier has good bandwidth. To be sure the amplifier doesn't have excessive bandwidth it can be checked with square waves below 100 Hz which should begin to show a loss of low frequencies, and above 350 Hz which should begin to show a loss of high frequencies above ten times the square wave frequency.

Phase shift (Figs. 2G & 2H) is not a problem of concern for audio amplifiers; however it is a concern for other types of amplifiers such as those used in an oscilloscope.

### The SQ-1 Specifications:

The SQ-1 specifications are shown in **Table II**. It is surprising that no specifications are given in the manual (dated 9/8/52) for the square wave rise-time. Also surprising is



**Figure 2:** Various diagnostic wave-shapes.  
(See Text)

there are no specifications for output voltage, output impedance, sync input level or sync input impedance. However the output voltage is given in ad copy. **Table III** shows the four vacuum tube lineup used in the SQ-1.

### SQ-1 Square Wave Generator Specifications

Frequency Ranges:	10	–	100	cps
	100	–	1000	cps
	1	–	10	kc
	10	–	100	kc
Rise-Time:	<not given>			
Output Voltage:	0 – 20 V Referenced to Ground (Found in ad copy, not in specs.)			
External Sync:	Front Panel Terminals			
Power Requirements:	105 – 125 VAC, 50 – 60 cps 10 W			
Size:	12½ W x 7" H x 7½" D			
Net Weight:	11 lbs.			
Shipping Weight:	12 lbs.			

**Table II**

### The SQ-1 Controls and Connections:

The front panel layout of the SQ-1 (**Figure 3**) is uncluttered and straight forward. Centered horizontally and slightly above center vertically sits the main dial with a non-linear 100 - 1000 scale. A total of seven controls, indicator and terminals are arranged horizontally along the lower fourth of the panel. **Table IV** lists them. Note that in the table front panel wording is shown in bold.

### SQ-1 Square Wave Generator Tube Layout

6X5	Dual Diode	Full Wave CT Rectifier
6SL7	Dual Triode	Multivibrator
6AC7	Pentode	Amplifier-Limiter
6V6	Beam Power Tetrode	Cathode Follower Output

**Table III**



**Figure 3:** Larger view of Fig. 1 showing front panel controls. Photo courtesy of Keith Greenhalgh.



### SQ-1 Square Wave Generator Front Panel Layout

Single control centered horizontally, 45% vertically from top:

**Frequency** Dual 100KΩ potentiometer w/ scale:  
15 tics at: Full CCW, **100, 110, 125,**  
**150, 200, 300, 400, 500, 600, 700,**  
**800, 900, 1000,** Full CW (not linear)

Seven items equally spaced along the bottom (L to R):

**SYNC. INPUT** Dual Binding Posts lower post Gnd.

**SYNC. LEVEL** Potentiometer - 50KΩ w/ 300° two  
headed arrow circling control

**RANGE** Four-position rotary switch marked:  
**10 | 100 | 1K | 10K | 100K**

**Pilot Lamp Ass'y** Red Jeweled #47 lamp.

**POWER** Two-position rotary switch: **OFF ON**

**OUTPUT** Potentiometer - 2KΩ w/ 300° two  
headed arrow circling control

**OUTPUT** Dual Binding Posts lower post Gnd.

Other Lettering:

Top Center: *Heathkit* **SQUARE WAVE** Generator

Left 45% from top: **THE HEATH COMPANY** (small font)

Right 45% from top: **BENTON HARBOR, MICH.** (small font)

Under Pilot: **MODEL SQ-1** (small font)

**Table IV**

There are no controls on the rear skirt, just the power cord exiting via a 3/8" rubber grommet. Internally there are two potentiometers. These are neither labeled nor named. The 5K pot (located closer to the front panel) adjusts the frequency calibration. The 10K pot adjusts the wave-form.

### SQ-1 Assembly and Wiring:

In HotM #102 (The QM-1 'Q' Meter) it was noted that the QM-1 manuals lack step-by-step instructions, though other manuals in the same period used the full step-by-step format. There was no mention in the QM-1 manual of why this was done. QM-1 assembly was briefly summed up in a section called

"Notes on Construction". The SQ-1 manual is similar, with the addition of this explanation:

*Because the SQ-1 is a laboratory type instrument, it is assumed that the builder will have some experience in the construction of technical equipment. With this thought in mind, the usual very detailed "step-by-step construction" found in most Heathkit manuals has been replaced by a section entitled "Notes on Construction." This more generalized construction procedure will be found more interesting and less tedious by the experienced builder.*

The whole "Notes on Construction" text for the SQ-1 is reproduced in **Figure 4**. The text is supported with four detail drawings showing the mounting of the terminal assemblies, pilot light assembly, can capacitor mounting and controls and switches, along with a brief drawing of the parts location that mount to the top of the chassis and a large detailed drawing showing the under-chassis wiring. These drawings are in the manual in a small size and are also reproduced on a single separate 21" W x 16" H pictorial sheet. A small version of this sheet is shown in **Figure 5**. Do not accept a manual without the separate large pictorial; in the opinion of this author, it would be difficult to wire the kit using the manual's smaller under-chassis wiring drawing. The manual also has a page with an under-chassis photo print of an assembled SQ-1.

### SQ-1 Square Wave Generator Circuit:

The SQ-1 circuit may be divided into four sections: the power supply; the multivibrator; the limiter and the output cathode follower. **Figure 6** on page 21 shows the schematic.

### The Power Supply Circuit:

The power supply is a bit unusual for a Heathkit. It is a standard full-wave rectifier using an octal dual-diode 6X5 rectifier tube.



### NOTES ON CONSTRUCTION

When building the SQ-1, follow the pictorials and photoprint very closely. Deviating from the design shown may produce unwarranted operating difficulties.

Begin construction by mounting on the chassis those parts shown in the chassis layout pictorial. Watch carefully to get the tube socket keyways in the right direction and the electrolytic condenser in the proper position.

Next the pilot light and binding post assemblies may be mounted on the panel. Also mount the dual control. The detailed drawings illustrate the assembly of the pilot light and binding posts.

The panel is attached to the chassis at the same time the controls and switches across the front are mounted. Here again, see the detail for attaching these parts. Check the position of the terminals on controls and switches before tightening the nuts.

With the larger parts mounted, the actual wiring can begin. Many manufacturers supply parts with leads much longer than necessary. The leads on each part should be trimmed to fit the particular location as the part is wired in. This will produce a neater looking unit and also reduce stray coupling between circuits.

First wire in the transformer leads and the filament wiring. Next put in all the plain wire leads. Do not overlook the short ground connections needed on many of the tube sockets.

Next the resistors should be wired into place. Follow the pictorial and photoprint closely when wiring-in small parts. The color code chart on the inside cover will help in identifying resistors.

Use spaghetti on all leads where there is a possibility of shorting.

After the resistors are mounted, the condensers can be wired in. Use care to get the condensers in the correct locations.

The last step is connecting in the line cord. The pictorial illustrates how a knot is used to provide strain relief.

This completes the wiring. A careful check should now take place to be certain no connections have been missed. Tracing each lead in colored pencil on the pictorial as it is checked in the instrument will prevent overlooking some leads.

With the wiring known to be correct, the control and switch knobs can be mounted. Turn each shaft to the extreme counter-clockwise position and lock the pointer knob so that it is indicating the proper end marking.

Plug the tubes into their respective sockets and the instrument is ready for test and adjustment.

**Figure 4:** Text from SQ-1 manual showing the complete text of the assembly portion of the manual. This manual does not use step-by-step instructions. It, along with the pictorial sheet shown on the next page (Figure 5) and a photo print of the underside of the completed chassis are all that's given for assembly instructions. The original pictorial (shown in Figure 5) measures 21" W x 16" H and gives good detail. However, the COMPLETE WIRING PICTORIAL drawing in the manual is even smaller than shown in Figure 5 and would be hard to use for accurate construction.



This is followed by rather high quality filtering consisting of a two section LC filter, each filter utilizing a 4.5 Henry choke; the first section employs a 10  $\mu\text{f}$  capacitor and the second section an 80  $\mu\text{f}$  capacitor. This two-stage choke input filter is required to present a very low ripple to the remaining circuits to prevent waveform distortion. The power transformer is rated at 464 VCT @ 60 mA and 6.3 VAC @ 2.8 A. B+ voltage at the output of the second filter with a nominal line voltage is 185 VDC.

### **The Multivibrator Circuit:**

The multivibrator uses a 6SL7 dual triode vacuum tube. The triodes are coupled through a common cathode resistor, and an RC circuit determines the frequency of oscillation. One of four timing capacitors is switched in by the range switch. Each capacitor is a decade apart from the previous one. (0.1  $\mu\text{f}$ , 0.01  $\mu\text{f}$ , 1000 pf and 100 pf). The R part of the frequency determining circuit is split between two 100 K $\Omega$  potentiometers that are ganged to a single shaft. One of the ganged potentiometers has a second low value potentiometer in series that allows calibrating the oscillator frequency. The cathode resistor is also a potentiometer; it is an internal control that adjusts the waveform.

An external signal can be applied to the SYNC INPUT terminals on the front panel. This signal is AC coupled to the 50 K $\Omega$  SYNC LEVEL control. The wiper of the control is connected to the grid of the first section of the multivibrator. If the free-running multivibrator is operating near the sync signal frequency (or a multiple of it) the multivibrator will sync with a harmonic of the sync frequency.

### **The Limiter Circuit:**

The limiter is a 6AC7 high gain pentode amplifier that is driven into saturation to pro-

vide a well shaped waveform. The multivibrator output is AC coupled to the limiter.

### **The Output Cathode Follower Circuit:**

The high impedance output of the limiter is fed to a 6V6 beam power tetrode. (It is interesting to note that the schematic shows the tube drawn as a pentode.) The tetrode is wired as a cathode follower with a low impedance version of the input signal appearing across the cathode resistor. This resistor is a potentiometer and the tap is directly coupled to the output terminals producing a fast rise-time square wave adjustable to over 20 volts peak into a high impedance load.

### **Calibrating the Heath SQ-1:**

Proper calibration of the SQ-1 requires an oscilloscope. Prior to calibration the square wave should be set at about 400 cps (uncalibrated) as viewed on the scope to make sure it is functioning. You may need to adjust the two internal potentiometers to get a signal.

To proceed requires a direct connection to the vertical deflection plates of the CRT so the vertical amplifier, which does not have the needed bandwidth, is bypassed. At the time only the O3 and O4 featured a way to bypass the vertical amplifier and it is not a direct connection. Thus, in the manual there are instructions on how to connect the SQ-1 output directly to the vertical plates of the scope. The vertical amplifier response on many of today's scopes are flat out to more than 2 MHz, so no direct connection will be required. Needless to say, this section includes a lot of high voltage warnings.

Once the connection is made, the RANGE switch and frequency dial are set to 60 cps and a 60 cps signal is applied to the horizontal amplifier. With the SYNC LEVEL at minimum and the OUTPUT LEVEL at maximum, the 5 K $\Omega$  pot (marked **FREQ. ADJ** on the at-

tached schematic) is adjusted *until a stationary square pattern is viewed on the scope*.<sup>3</sup>

Next, the waveform is adjusted, first at 10 kc and then touched up at 50 kc. This is done by first using the scope's internal sweep oscillator so a couple of cycles of the square wave are synced on the screen. Then the 10 K $\Omega$  pot (marked **WAVE SHAPE** on the attached schematic) is adjusted *until the best proportioned square wave is obtained*.<sup>4</sup> Heath recommends you do the procedure twice, as there is some control interaction.

With these steps completed the instrument may be mounted in the cabinet, ready for use.

### Conclusion:

If you are an audiophile, having a square wave generator and scope, can help you be sure your equipment is working properly. With today's digital ICs and multivibrators the SQ-1 probably has little use in the solid-state world other than testing amplifiers for bandwidth.

### Comments:

I had hoped to have this article ready for the January issue of the OCARC RF newsletter but am still rather busy.

### QM-1 Update (HotM #102)

The restoration of my QM-1 Q-Meter has been completed except for seeing if I can remove some of the white paint that was splattered on the top and side of the cabinet and even a little on the face. I'm hoping it is a different type of paint and I can find something that removes it but not the base coat put on by Heathkit. I assume it is house paint and maybe latex based?

Electrically the unit operates fine and calibrated easily. The 12AT7 signal generator tube was soft and gave reduced output at the

higher end of the top band, but a replacement brought everything up to snuff. The generator tracks the scale on the front within Heathkit specs of less than 3%. Most of that error is at the top and bottom ends of the scale on each range.

I was able to get both of the variable capacitors with a vernier drive freed up. Luckily, the way the capacitors mount in the chassis it was easy to get to them for the fix. Unfortunately, in most other equipment the capacitor will need to be removed prior to freeing up and re-lubricating of the vernier drive.

April is fast approaching, so I'm asking for suggestions for an unusual Heathkit to tie in with April 1<sup>st</sup>.

73, from AF6C



### Notes:

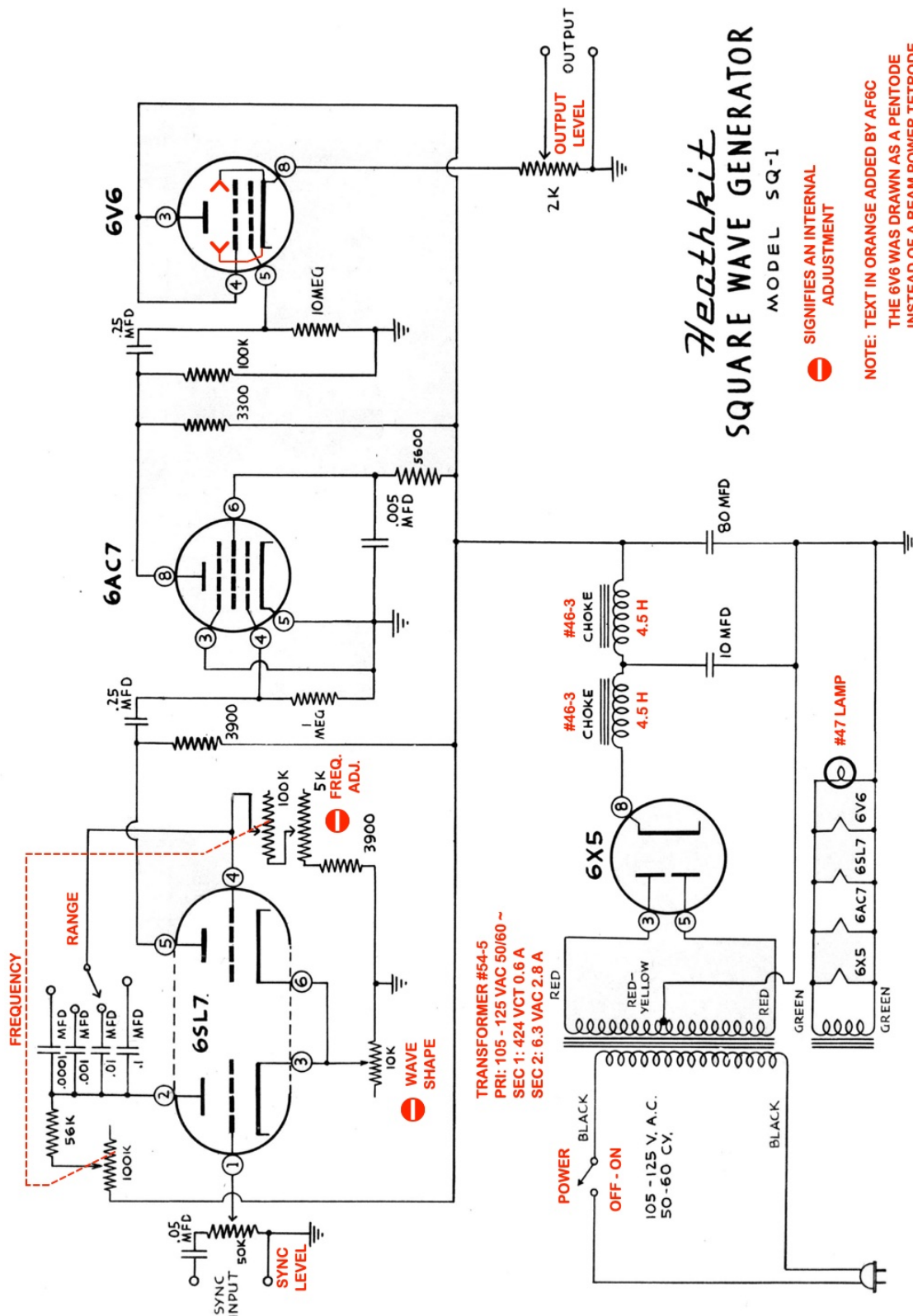
1. The mathematics behind this involves the Fourier Series and Fourier Analysis. See the Fourier Series Sidebar for further information.
2. The first harmonic of a sine wave is the fundamental frequency. It is the second harmonic that is twice the fundamental frequency.
3. The italicized text is a note from the manual.
4. See Note 3.
5. (Sidebar) - Definition is from the Merriam-Webster online Dictionary:  
<https://www.merriam-webster.com>

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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*





**Figure 6: Annotated Heathkit SQ-1 Schematic**

## Fourier Series...

**This series**, named for Jean-Baptiste Joseph Fourier (1768-1830), is an infinite series in which the terms are constants multiplied by sine or cosine functions of integer multiples of the variable and which is used in the analysis of periodic functions.<sup>5</sup>

In other words, any periodic function can be replicated by summing infinite harmonic sine or cosine waves of varying amplitudes. Today, Fourier analysis is taught in electrical engineering school and is used in the study of periodic waves. Fourier Transforms allow one to study a periodic function (or wave) in the frequency domain instead of the time domain. (i.e. the X-axis of a graph is in frequency instead of time).

Mathematically, the amplitude of a **square wave** with respect to time can be shown to be equal to:

$$x_t = \frac{4}{\pi} A \sum_{n=1,3,5,\dots}^{\infty} \frac{1}{n} \sin(n\omega t) \quad (\text{Eq 1})$$

where:

$X_t$  is the amplitude of the square wave at time  $t$ .

$\pi$  (pi) = 3.1415926...

$A$  is the amplitude of the square wave.

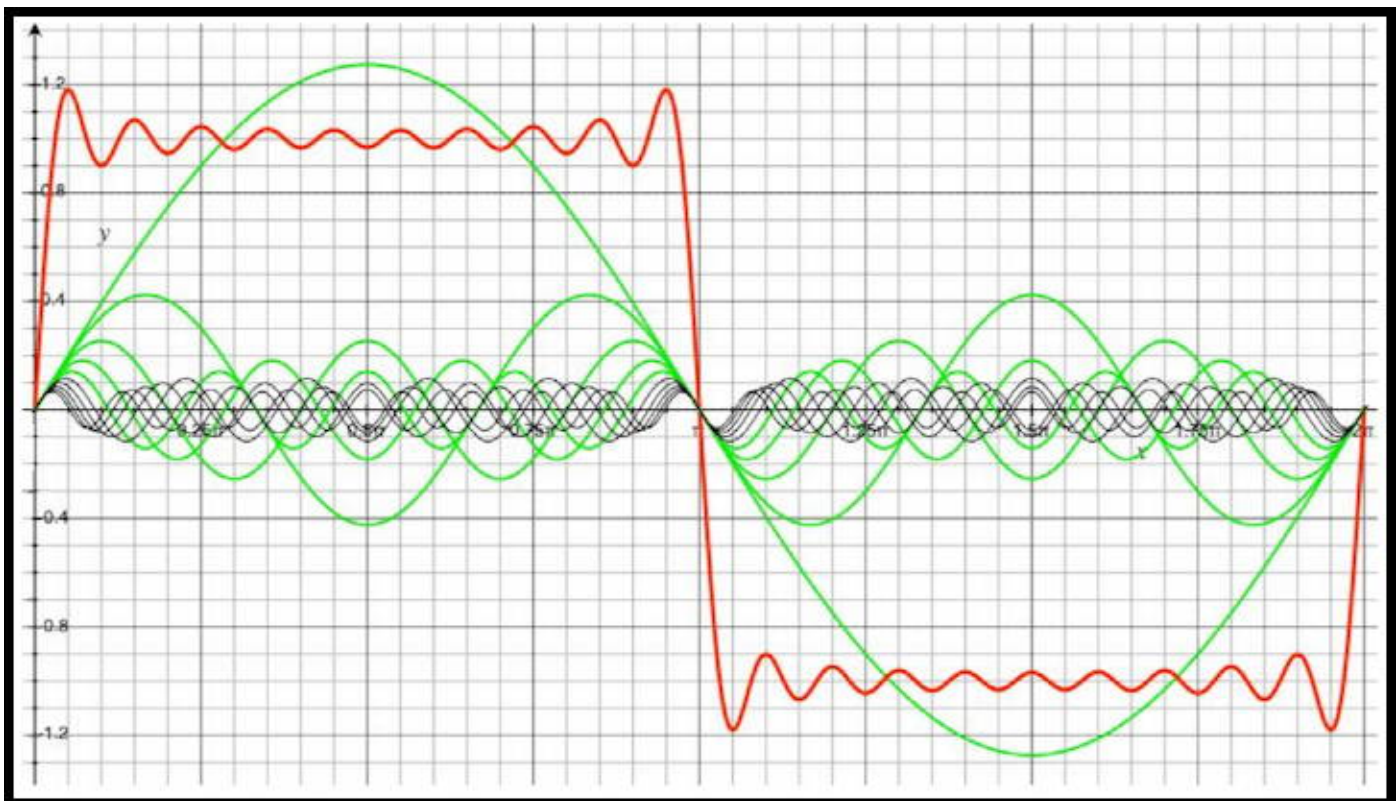
$n$  is a series of odd numbers starting at one and continuing to infinity.

$\omega = 2\pi f$  (where  $f$  is frequency).

$\sum_{n=1,3,5,\dots}^{\infty}$  is the sum of all the values of the equation to the right for each value of  $n$ .

**Figure A** shows a graph of each solution for odd values of  $n = 1$  through  $n = 19$ . The first five values are shown in green and the second five are shown in black. The sum of all these waves is shown in red. Notice that it is already beginning to take the shape of a square wave.

5. See Notes on page 20.



**Figure A:** Solutions for equation 1 for the first ten values of  $n$  ( $n = 1, 3, 5, \dots, 19$ ). The first five are shown in green ( $n = 1, 3, 5, 7, 9$ ), and the second five are shown in black ( $n = 11, 13, 15, 17, 19$ ). The red line is the sum of the ten traces. Notice after only ten sums the wave is taking on the appearance of a square wave.





# MiniTiouner-Express

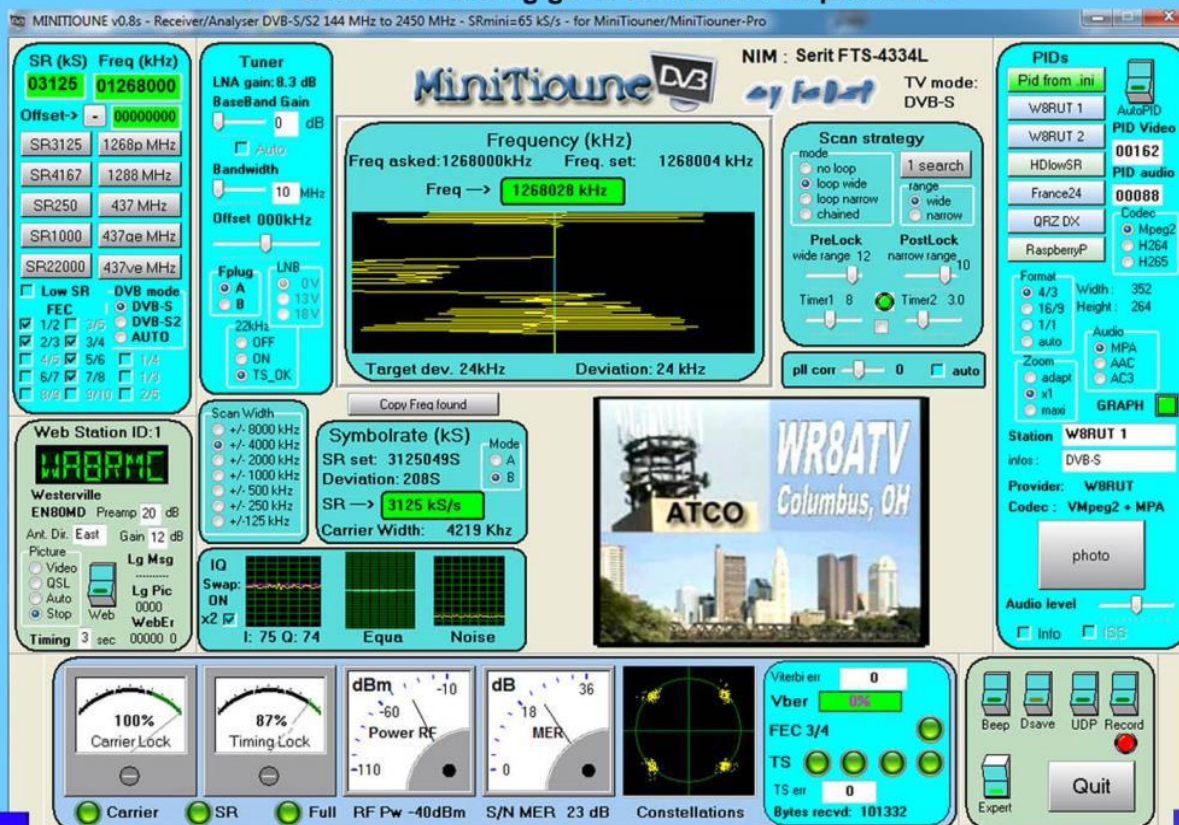
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(MiniTioune display above is the ATCO 1268MHz DVB-S repeater signal at WA8RMC QTH 15 miles away).