



# RF



ORANGE COUNTY AMATEUR RADIO CLUB, INC.

VOL. LXI NO. 02

P.O. BOX 3454, TUSTIN, CA 92781

February 2020

## The Prez Sez.....

By Dan KI6X



Now that Winter Field Day (WFD) is wrapped up it is time to start on the bigger effort of THE Field Day (FD) end of June. We did wonders in WFD with higher mults and beating our World Record score of last year. Ron, W6WG, did a yeomen's effort getting it organized with many others helping in specific areas to keep the machine running. It was also great fun with less pressure which can equal great enjoyment.

But, planning needs to begin now for June FD. Tim, N6GP, headed up an excellent FD last year but needs to step back some this year. We therefore need a FD Chairman. They get the station captains assigned (who then run all aspects of their station) and oversee the planning (planning meetings, emails, help assign club equipment as needed). Tim will help and will work securing the location but we need someone to step up as Lead.

You will hear more about summer FD at the meeting but please consider or bring a friend and co-lead.

Please read through the whole "RF"s you receive since we try to put a lot into it to let you know what is going on and to educate. For example, Bob, AF6C, has authored dozens of Heathkit articles you see in the "RF" and they are all available on the website. These are a treasure-trove of information. We also encourage articles from the members. Technical, items of interest, etc. are welcome and can be sent at any time to me, any Officer, or to "editor@w6ze.org".

I know we have many new members in the club in the last year so if you want to know more about me I wrote that in the Feb 2019 Prez Sez. And ALL previous "RF"s are available on the website. That reminds me of a couple more stalwarts of the club that have been our web masters since the web started, Bob AF6C and Ken W6HHC. We have others working behind the scenes on many aspects for the club and more examples are: auction helpers, inventory of club equipment, insurance, and much more. Help is always needed and encouraged.

**Dan, KI6X, President**

## NEXT MEETING

**Friday, Feb 21, 2020, 7:00 PM**

**@ Red Cross, Santa Ana  
600 Parkcenter Drive,  
Santa Ana, CA**

**Speaker: Arnie - N6HC  
Topic: DX-pedition to  
Pitcairn Island.**

Arnie - N6HC, club member and one of the VP6R operators will present us with slides and discussion on the Pitcairn DXpedition.

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**Monthly Events:****General Meeting time & location:**

Held third Friday of the month  
This month: DX : Pitcarin  
Begins at 7:00 PM located at:  
*The American Red Cross*  
**600 Parkcenter Drive**  
**Santa Ana, CA**  
(Near Tustin Ave. & 4th St.)  
For more information see below.

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

Held the First Saturday\*  
of the month at 8am  
Marie Callender's Restaurant  
307 E. Katella Ave  
Orange, CA 92867  
\*Unless otherwise advised

**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**  
Wed- 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,  
Follows right after end of 2M Net  
Corey, KE6YHX, Net Control

**OCARC 2020 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

# RadioActivity

## February 2020

### Upcoming Activities:

### FEBRUARY

- **\*CQ WW WPX / RTTY** 0000 UTC Saturday Feb. 8 through 2359 UTC Sunday Feb. 9
- **Fists Winter Unlimited Sprint:** CW: 1700 UTC Sat. Feb 9 through 2100 UTC Sat. Feb 8
- **\*ARRL International DX Contest:** CW: 0000 UTC Sat. Feb 15 through 2400 UTC Sunday Feb. 16
- **\*CQ WW 160 Meter SSB:** 2200 UTC Friday Feb. 21 through 2200 UTC Sunday February 23
- **North American QSO Party/RTTY:** 1800 UTC Sat. Feb 22 through 0559 UTC Sunday Feb. 23

### MARCH

- **\*ARRL International DX Phone Contest:** 0000 UTC Saturday March 7 through 2359 UTC Sunday March 8.
- **\*\*North American Sprint / RTTY:** 0000 UTC through 0400 UTC Sunday March 15
- **\*CQ WW WPX / SSB:** 0000 UTC Saturday March 28 through 2400 UTC Sunday March 29

\* Indicates club entries are accepted

\*\* Indicates team entries are accepted

Note: When submitting logs for ARRL Contests indicate your club affiliation as "Orange County ARC"

### State QSO Parties

- **Vermont QSO Party:** 0400 UTC Saturday February 1 through 2400 UTC Sunday Feb. 2
- **Minnesota QSO Party:** 1400 through 2400 UTC Saturday February 1
- **South Carolina QSO Party:** 1500 UTC Saturday February 29 through 0159 UTC Sunday Mar.1
- **North Carolina QSO Party:** 1500 UTC Sunday March 1 through 0059 UTC Monday Mar. 2

- **Oklahoma QSO Party:** 1500 UTC Saturday March 14 to 0200 UTC Sunday March 15 and 1400 UTC to 2100 UTC Sunday March 15
- **Idaho QSO Party:** 1900 UTC Saturday March 14 to 1900 UTC Sunday March 15
- **Wisconsin QSO Party:** 1800 UTC Sunday March 15 to 0100 UTC Monday March 16

### Ongoing Activities:

- **Super QP Challenge:** Year Long Event 0000 UTC Jan. 1 to 2400 UTC Dec. 31



### Repeating Activities:

- **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 2400 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

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.



**OCARC  
BOARD MEETING MINUTES  
2020-02-01**

The OCARC Board meeting was held at the Marie Calendar's Restaurant at 307 E Katella Ave. in Orange on Saturday Feb 01, 2020 at the 8:00 AM. In attendance were 7 members. All of the directors, except Bob AF6C, Jim AF6N and Corey KE6YHX, were present for a Board quorum.

**Director Reports:**

- **Secretary** – Ken W6HHC explained that he had to leave the board meeting early, and that Ron W6WG would fill in after he left.
- **Treasury** - Greg W6ATB reported that the club had a net income of \$285 during the month of January. This includes a net profit of \$337 from the clubs Radio Auction that was held in January. See Newsletter Page **22** for a cash flow of the club's finances.

**Old Business:****• Newspaper Editors**

**Feb** – Vijay KM6IZO

**Mar** – Tim N6GP

**Apr** – Nicholas AF6CF

**May** – Jim AF6N

**June** – Greg W6ATB

**General Meeting Programs**

**Feb** – Pitcairn DXpedition by Arnie N6HC

**Mar** – Tim N6TMT Said he has the February and March programs booked and he is working on April. The June meeting subject will be Field Day, but the speaker is yet to be selected. Tim is also working on getting a presentation on End Fed antennas for possibly the July meeting.

**• By-Laws Update Committee**

The board members discussed a few tweaks (in the section on Election of Directors) to Tim N6GP's latest revised set of by-laws were sent out to the board for review. The current plan is to hold a first reading of the updated Bylaws for the club membership at the March 2020 general meeting.

**• Financial Audit Committee**

The OCARC treasurer, Greg W6ATB, scheduled the audit of 2019 finances for February 13.

**• Update to OCARC Trifold Brochure**

Dan KI6X pointed out that many items were out of date in the current brochure. Dan asked that the board members should review the brochure. Vijay KM6IZO will consultate the comments and report back to the board.

**• Donation to Red Cross**

In recognition of providing the OCARC with a great meeting place, Dan KI6X will make up a certificate that will be presented to the Red Cross along with a check for \$250.00 to show the club's appreciation for the use of their facilities.

**New Business:****• WFD Report**

Ron W6WG reported that the event went well with no difficulties. Tim N6GP is compiling our final score and it appears that we did very well. Tim also suggested that we ask for contributions to offset the \$130 cost of the tent/tables/chairs. A donation can will be brought to the next General Meeting for that purpose.

**• Storage Locker expenses**

Club treasurer Greg W6ATB pointed out that the rent for the club's 'Storage Closet' in Placentia is now running \$1193 per year (up 18% from 2018). This makes the storage expense the highest "net cost" item in our budget. The board members discuss a number of possible solutions to reduce this expense, that will be explored.

**• Next Auction Date**

The date on the next auction was discussed. The question was should the auction be held in October or next January. The question will be in the "Old Business" portion on the March Board Meeting.

**• Summer Field Day preparations**

The club membership will be asked of a volunteer to act as the Field Day Chairman.

Tim N6GP will coordinate the acquisition of the Field Day site with the school district.

**Good of the Club:**

- **CQP** - Tim N6GP will print out our certificate for our participation in the California QSO Party (CQP) to put into the February newsletter.

**Winter FD Flag** - Does anyone know where the Winter Field Day flag went to?

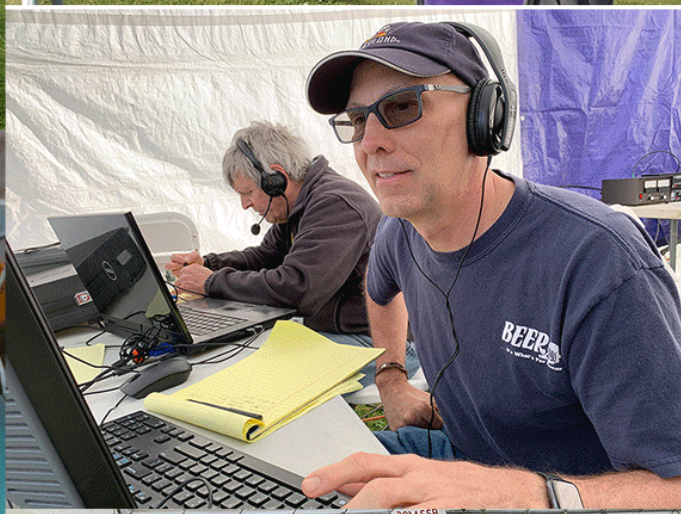
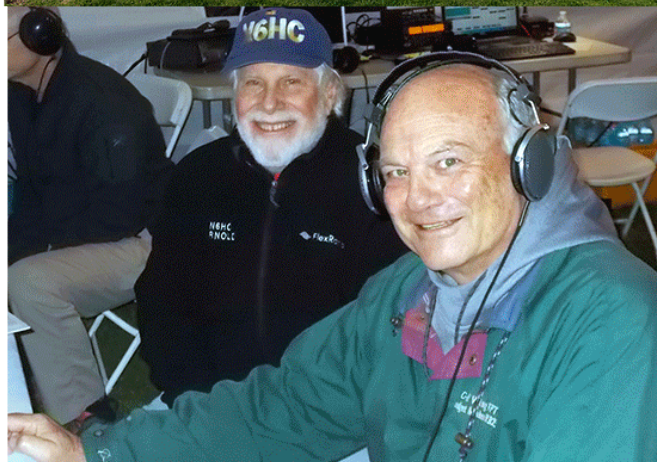
- **BSA Guidelines** - Tim N6TMT(?) spoke about the power of guidelines as demonstrated by the boy scouts.

Submitted by Ken W6HHC, OCARC Secretary and Acting-Secretary Ron W6WG













## 2020 WINTER FIELD DAY WRAP-UP

**OCARC** has participated in the past five WFD events. Each year more and more operators across the US and Canada have braved the elements to put their stations on the air. Our efforts started out with a couple of guys, a rig and a couple of modest antennas.

After two years at the camping ground at Prado Dam we decided to move the operation closer in order to encourage more club members to become involved. For the past three years the club has operated from Huntington Beach. To someone who wasn't there, the new site may not sound much like "roughing it" or needing to "brave the elements", but let me tell you, having your tent flipped over by the Santa Ana winds or having the lawn sprinkler system come on in your tent at 11:00 at night is enough "outdoors" for this California boy. Despite the conditions our clubs participation has grown each year. The last two years we have been able to enter our logs as "Six Oscar", that's six transmitters operating outdoors. We have been fortunate to have a group of enthusiastic and capable club members.

When planning the upcoming event, you are never sure of what the turn out will be. Are we being over optimistic thinking we can man six stations, or will six stations be enough to handle the crowd? After the first hour it was rewarding to see all the positions occupied and everyone enjoying the moment. The event lasts from 11:00 am Saturday to 11:00 am Sunday, plenty of time for everyone to operate. There was a stretch of

time in the wee hours of the morning when we had only two operators awake, Jim AF6N and Corey KE6YHX, good work guys. We were lucky to have Chip K7JA and Bob AA6PW cranking out contacts on 20 SSB and 20 CW respectively. Doug K6PGH made a run on 40 SSB, by the way he also makes good coffee. Jim AF6N and Tom KA9FRH anchored 40 CW. Arnie N6HC and Dan KI6X were busy at several positions, CW, SSB, doing whatever it takes.

Two new club members Mike KX6A and Bill KM6ZHO made impressive efforts for their first contests and Vijay KM6IZO and Corey KE6YHX gave us a very respectable digital score. Bob AF6C, Tom W6ETC and his brother Jeff KK6TRC put in their shifts on 40 SSB. Tom was also responsible for supplying power via his 3kW generator and Nicholas AF6CF stopped by on Sunday to provide support.



Janet KL7MF, Clem W0MEC and Bryan K6AJY helped with setup and teardown. And "Hats Off" to Mr. Multiplier, Tim N6GP, with his quest to add as

many multipliers as he did, we have most likely clinched first place.

At midnight Tim along with Doug K6PGH and myself strung up a 160M dipole for one more CW multiplier. Think about it, 12:00 at night putting up another antenna for just one contact, that's crazy, that's teamwork.

Like the original Field Day, WFD isn't a contest, or is it? Most people like to make the simplest things into a competition. Golf, for an example. Well the primeval drive to be the alpha male is not lost on the amateur radio community. Last year your OCARC was the top dog and it appears we may have done it again.

A few quotes from some of the op's (operators): *AA6PW Bob*, "I participated in my second WFD with OCARC. The camaraderie and teamwork were phenomenal. It was another great opportunity for older and newer hams to learn something more about this great hobby we all share together. I especially like the more casual



atmosphere of WFD compared to summer FD. Less stress, seemingly less work and the weather in California has been pleasant the last two years. WFD is a great event and I can see it growing more popular in the years to come."

*AF6N Jim*, "The teamwork was exceptional. I enjoyed talking with a couple of new members who stopped by to get a feel for Winter Field Day activity. Their questions were really impressive. Hope my answers were somewhat helpful. Special kudos to Michael KX6A, new to field day activity but not to ham radio. He did a great job on 40 CW."

*K6PGH Doug*, "Winter Field Day was a fun learning experience. It provided an opportunity to operate using various radios, modes and antennas while also spending time with friends. For those with limited stations and compromised antennas it allowed us to operate a "big gun" station and despite poor propagation we were able to work most of the states and provinces. I was able to see different configurations of radios which will benefit me in improving my station. Overall it was a great time getting on the air and socializing with fellow radio enthusiasts."

*K7JA Chip*, "Conditions were really horrible on 20 meters, and I am very disappointed that my station did not contribute more. But the warm bodies that were there to help, especially with setup and teardown, made for a very efficient operation. I think we made some real strides in the digital station and our effort (especially Tim N6GP) in getting the UHF+ multipliers really made a huge difference. A special thanks to all who went the extra mile to take some of the lifting and twisting off my new bionic knee. Way to go, W6ZE!"

*KX6A Mike*, "Winter Field Day brought out the best in the Club. Not only is it a fun event to operate in, but for the new member it was a perfect opportunity to learn. I can't tell you how valuable it was to sit side by side with experienced CW operators as we worked the bands."

*N6HC Arnie*, "Tim, Thanks for taking on the responsibility of tabulating the tremendous score to which so many club members contributed. Nice bit of team work guys. Let's give each other high fives at the next meeting!"

Thank you and congratulations to all. 73,

Ron, W6WG

## W6ZE California QSO Party Results



With only about 3 hours of operating time, our Club posted a good score in the California QSO Party. The number 9 ranking statewide does not sound great, but we are compared to Multi – Multi stations that are operating from someone's house. With logs from Tim N6GP, Doug K6PGH plus our W6ZE log, we finished 9<sup>th</sup> out of 24 in the California Small Club category. With more logs this year, just think what we can achieve. The next CQP is Oct 3 & 4<sup>th</sup>, and maybe we will have a few sunspots going by then.

## Quiz: Match Country with Callsign

HU1DL	Greece
4E3X	United States of America
4U1WB	El Salvador
4A5E	Mexico
J42L	Philippines



**Heathkit of the Month #98:***by Bob Eckweiler, AF6C*

# Heathkit

**MISCELLANEOUS:****Heathkit RC-1****Radiation Counter****Introduction:**

In October of 1962 the world worried; the Cuban missile crisis was in progress, a nuclear stand-off between the Soviet Union and the US over Soviet nuclear missiles in Cuba. I was living on the east coast at the time, attending high school on Long Island; there was serious concern, and I remember riding on a school bus, as part of our high school soccer team, to an away game. The crisis was near its peak, so it was the topic of discussion among many team members, some talked bravely, but fear was in the back of our minds. Someone mentioned that we all needed to have a Geiger counter, just in case....

I remembered seeing a "Radiation Counter" kit in an older (at the time) Heathkit catalog, and after getting home I looked through the current catalog. The kit had been discontinued. It was shown in an earlier catalog, but at \$80 it was beyond my budget. Luckily, the crisis ebbed and the discussions on the bus rides went back to sports and girls. But since then, the thought of owning a geiger counter seemed a good idea even in times of peace. Heath offered the GDP-341 Family Radiation Measurement Set in the then current catalog, but it was a big step down from a Geiger counter.

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:** The Heathkit RC-1 Radiation Counter (Geiger Counter) less probe. Photo courtesy of Chuck Penson - WA7ZZE.

**The RC-1 Radiation Counter:**

This month's article looks back at that Heathkit Radiation Counter kit, the RC-1 (**Figure 1**).

The RC-1 was introduced in the Summer 1956 Heathkit flyer, and it actually got top billing on the front cover (**Figure 2**). Heathkit called it a "professional radiation counter" kit,



**Figure 2:** The Heathkit RC-1 as shown on the cover of the 1956 Summer Flyer.

and the cover illustration shows a family picnicking, while in the foreground the husband prospects with his RC-1. Uranium prospecting was popular around the time Heath's Geiger counter was introduced. The kit remained in production until sometime in 1961; it didn't make the main 1961 US catalog, but did appear in the Italian 1961 Heathkit catalog.

The RC-1 Radiation Counter, often called a Geiger counter, weighs 6½ lbs. It runs on three batteries, A 67½ volt 'B' battery and two 1½ volt 'A' batteries (standard 'D' cells). The 'B' battery is good for about 200 hours of operation and the 'A' batteries, which power the tube filaments, are good for about 20 hours of operation. The end-of-life voltage for the batteries are 40-volts and 1-volt respectively. Specifications for the RC-1 are shown in **Table I**.

Time Constant:	0.5, 1, 5, 10 seconds.
Ranges:	0 – 100, 600, 6,000, 60,000 CPM.* 0 – 0.02, 0.1, 1, 10 mR/Hr.**
Meter:	Calibrated 4½" scale; 200 µa movement.
Probe:	Satin aluminum and chrome-plated probe case. 6306 bismuth Geiger tube.
Speaker:	2-1/2" square (no impedance specified)
Calibration:	Calibration control on front panel. Radio-active calibration sample furnished.
Batteries	2 each 1.5 volt carbon-zinc "D" battery 1 each 67½ volt 'B' Battery NEDA 200 (2-13/16" W x 1⅜" D x 3-45/64" H): Burgess XX45, V45 Eveready 467, 468 Mallory M200 Ray-O-Vac 200 RCA VS016, VS125.
Size:	9½" high x 6½" wide x 5" deep.
Weight:	6½ lbs.
Shipping weight:	8 lbs.
* Counts per minute. ** milliroentgens per hour	

**Heathkit RC-1 Radiation Counter Specifications**  
**Table I**

#### Vacuum Tubes:

V1	1U5	Amplifier
V2	1U4	Amplifier
V3	1U5	½ Monostable multivibrator
V4	3V4	½ Monostable multivibrator
V5	5841	Corona Voltage Regulator (900 V)

#### Geiger Müller Tube:

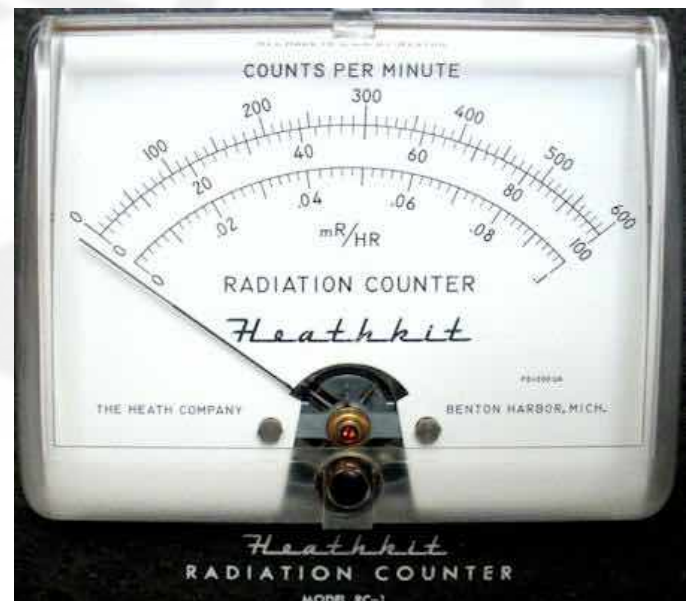
V6	6306	Counter tube (bismuth-argon)
----	------	------------------------------

#### Semiconductor:

2N109 GePNP –25 Vceo 165 mW

**RC-1 Tube and Transistor Lineup**  
**Table II**

The RC-1 uses six tubes<sup>1</sup>. Four of these are vacuum tubes designed for portable operation, three with 1.5 volt filaments and one with dual 1.5 volt filaments that may be run in series or parallel (these tube's filaments are also their cathode). The fifth tube is a five lead subminiature gas-corona voltage regulator tube, and the sixth is the Geiger-Müller detector tube which mounts in a probe assembly and is connected to the chassis via a shielded coil-cord. **Table II** lists the tubes and the one transistor.



**Figure 3:** Heathkit RC-1 Radiation Counter meter scales.



### Heathkit RC-1 Controls:

The panel of the RC-1 has a large 4½" 200 µA meter, a carry handle, two rotary switches: **RANGE** and **TIME CONST.** and a tone **PITCH** control. It also has a **CALIBRATE** control with a protective cover, a speaker, a phone jack for an **EXT. METER** and a connector for the **PROBE**. The panel layout is described in detail in **Table III** and the meter face is shown in **Figure 3**.

### Heathkit RC-1 Operation:

Operating the RC-1 is not difficult. There are only two switches you need to set and a control you can use to make your listening more comfortable. The first switch is **RANGE**. It is set so the meter is on scale and indicating a reading. The second is **TIME CONST.** This is the time over which the meter reading is averaged. At the shortest time constant the meter may jump quickly responding to changes in radioactive levels. At the higher time constants the level will change more slowly averaging the levels. The manual states:

***"The choice of time constant has been made available so that you may use a time constant appropriate to your speed in covering the area in which you are prospecting. The shorter time constants are advantageous when covering ground rapidly, as when in a vehicle or mounted on a horse or burro. The long time constants enable a more accurate reading to be made when checking ore samples or when grid prospecting a suspected anomaly. When prospecting, a time constant sufficiently short to enable the instrument to indicate any change in the normal background count is normally used."***

No, the burro is not part of the kit, nor is the horse or vehicle!

The only other control you might use in the field is the **PITCH** control. Heathkit, instead

#### Top Row:

##### Meter 4½-inch, 200 µA full-scale

Top Scale: **0 – 600 COUNTS PER MINUTE**

at 10 counts per small division (60 div. total)

Middle Scale: **0 – 100 COUNTS PER MINUTE**

at 2 counts per small division (50 div. total)

Bottom Scale: **0 - 0.1 mR/HR**

at 0.002 mR/HR per small division (50 div. total)

#### Second Row (L to R):

**RANGE mR/HR-CPM** 5 position rotary switch -:

Power OFF

mRX100 / 60K CPM

mRX10 / 6K CPM

mRX1 / 600 CPM

mRX.2 / 100 CPM

Plastic Handle - Extends downward to bottom of panel.

**TIME CONST. SECONDS** 4 position rotary switch:

10, 5, 1, .5

#### Third Row (L to R)

**CALIBRATE** 100 KΩ Potentiometer

No scale markings, Plastic shaft lock/protector

Speaker X" dia. Square frame

**PITCH** 2 KΩ Potentiometer

CCW circular arrow, **OFF** at full CCW position.

#### Bottom Row (L to R):

**EXT.[ernal] METER** ¼" 3 circuit (TRS). phone Jack

Bottom of handle (from second row)

**PROBE** SO-239 UHF connector

**Table III: Panel Layout**

of sending clicks to the speaker, turns each click into a short burst of tone, making it easier on your ears, as well as easier to distinguish in a noisy environment (also distinguishing it from the clicks created by the internal HV power supply assembly).

### Heathkit RC-1 Calibration:

So how does the typical layperson calibrate a radiation counter? With each kit Heath sent a 'safe' radioactive sample<sup>2</sup> to use for calibration (See **Figure 4**). New, the sample has a radiation level of 1 mR/Hr and is used to calibrate the mR/Hr X10 position, adjusting the **CALIBRATE** control to 1 mR/HR on the meter



**Figure 4:** Heathkit PN 419-1 Radioactive Sample used for calibration. It produces 1 mR/hr. Photo courtesy of Chuck Penson - WA7ZZE

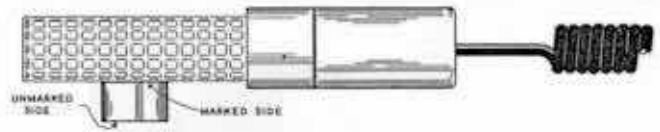
scale with the marked side of the sample placed against the middle of the probe body along its circumference (**Figure 5**). Due to the use of precision capacitors, the other ranges should follow this one calibration point.

Assuming the calibration sample is radium, whose half life is 1,600 years, the calibration sample after 60 years will have decayed by just over 2.5%<sup>3</sup>. For it to decay by 10% of its original radioactivity would take over 244 years.

### The Heathkit RC-1 Circuit:

A schematic for the RC-1 can be found at the end of this article (**Figure 15**). The output of the Geiger-Müller tube is negative pulses. These pulses are amplified by V1 and further by V2, which also acts as a limiter at about a quarter volt to insure the pulses properly trigger V3. Since each of these two stages inverts the pulse, the pulses coupled to the grid of V3 are also negative going.

V3 and V4 are connected as a “one-shot” monostable multivibrator. In the stable position V3 is conducting lightly and V4 is cut-off. V3 is conducting due to the positive bias on its grid from the 2.2 MΩ and 1 MΩ volt-



**Figure 5:** Calibration showing proper placement of sample and probe. (Heath Manual - Figure 12)

age divider. V3 and V4 share the same 15 KΩ cathode resistor and the voltage drop across that resistor makes the cathode of V4 positive with respect to the grid which is returned to common through a 1 MΩ resistor, holding V4 cut-off.

When a negative pulse is applied to the grid of V3, the tube turns off. This raises the V3 plate voltage which is coupled to the grid of V4 through one of the four RANGE capacitors turning V4 on. V4 draws significantly more current when on than V3, hence the voltage drop across the common 15 KΩ cathode resistor keeps V3 cut-off. After a period of time, determined by the value of the RANGE capacitor, the voltage across the capacitor reaches equilibrium cutting off V4 and returning the circuit to its V3 on stable state.

The more counting pulses that occur per minute the longer V4 is on over that minute and the higher the average plate current. The plate current is set by the 47 KΩ fixed resistor and the 100 KΩ calibration control. Since the range capacitors are precision, the calibration holds for the other ranges.

The TIME CONSTANT switch selects one of four large-value capacitors that are across the meter circuit. This capacitance averages out the meter reading over a given period of time depending on the capacitor selected. The purpose of the TIME CONSTANT function was described earlier in the operation section.

Instead of the speaker receiving the pulses (or clicks) directly, Heath built in a small os-



cillator using a single transistor, an output transformer and a couple of resistors. Each pulse draws current through the 2 K $\Omega$  PITCH control and a fixed 18 K $\Omega$  resistor. This voltage drop powers the transistor and it oscillates, producing a short burst of tone in the speaker instead of a click. Heath claims this makes it easier to hear in a noisy environment, as well as being easier on the ears. When the PITCH control is turned fully counterclockwise the tone oscillator is biased off.

When in the power OFF position the RANGE switch disconnects the B+ battery and each of the two 1.5 V 'D' cells from the circuit. It also shorts the meter circuit to prevent damage during transport. Two separate filament batteries are required since the filament is also the cathode. One 'D' cell powers the multivibrator circuit tube filament (V3 and V4) since they require a common cathode resistor, and the other 'D' cell powers V1 and V2 which share the same cathode bias source. Note that the V1 and V2 filaments draw 100 mA total while the V3 and V4 filaments draw 150 mA total. Thus, one 'D' battery will require changing more often.



**Figure 6:** The Victoreen #667 HV unit, with the cover unsoldered, used in the Heathkit RC-1. Note the inductor/transformer, the relay, the foam mounted tube (type unknown), one tubular capacitor and some disc ceramic bypass capacitors.

### The RC-1 HV Power Supply Sub\_Assembly:

The 6306 counter tube requires a high voltage of 850 to 950 VDC at a very low current to operate. The kit is supplied with a pre-built and solder sealed HV power supply assembly. This Victoreen #667 may have been made specifically for Heath? Little can be found in the manual or on the Internet. It is a three terminal device with a +67.5 volt input, a +1,200 VDC output and ground. **Figure 6** is a photo of the inside of the #667 regulator that was found<sup>4</sup>. It reveals many of the components inside. These include a relay, an inductor or transformer, some capacitors and an electron tube mounted in foam by a spring band. The tube type is unknown. The **Test and Calibration** section of the manual starting on page 20 states: *"A rapid, uniform clicking will be heard coming from the power supply unit. This is normal and indicates the power supply is working."* The relay is causing this clicking, and evidently it is breaking the current through the inductor, producing the high voltage, which possibly is isolated by the tube and filtered by some of the capacitors. Since no filament voltage is supplied to the tube it is probably some sort of gas rectifier? The operation of the #667 HVPS mentioned here is an educated guess.

The output voltage is regulated at 900 volts by V5, a 5B41 voltage regulator, also manufactured by Victoreen. This tube is a corona discharge type regulator tube; a lot of discussion is included in the RC-1 manual on how it operates and is worth reading if you are interested further. Suffice to say it regulates  $\pm 1.5\%$  at 900 volts from 5 to 50  $\mu\text{A}$ .

### The RC-1 Probe and Geiger tube:

The probe containing the Geiger Müller tube has its own assembly section in the manual titled: **"CONSTRUCTION OF THE GEIGER**

**COUNTER PROBE MODEL GC-1”** <sup>5</sup>. The 6306 tube itself is very fragile due to its thin walls and mounts a thin plastic collar which, in-turn, mounts inside the mesh probe barrel. The probe handle, which screws into the probe barrel, contains a socket and is wired to a shielded coiled cable. A PL-259 UHF connector mounts on the other end of the coiled cable and mates with the SO-239 connector on the front panel of the RC-1.

The 6306 counter tube (See **Figure 7**) is a thin walled tube filled with argon gas along with an unspecified organic quench gas. It is designed for detecting gamma rays. Inside the outer thin aluminum cover is a plating of bismuth. Inside that a lining of copper screen is added for mechanical strength. The tube itself measures 4½” L x 51/64” D. Its active length is 2¾”. The tube is sensitive to high energy beta rays above 160 K eV (Kilo electron Volts). and gamma rays from below 25 K eV to above 800 K eV.

#### **The 6306 Geiger Müller (G-M) Tube Operation:**

It is surprising that Heathkit gave a very small description of the 6306 tube; especially after their long description of the 5B41 corona regulator tube. The 6306 description in



**Figure 7:** 6306 Geiger Müller tube manufactured by the Victoreen Instrument Company,

the manual just states: ***“A thyrode counter tube is a gas diode designed to produce an electrical pulse when its sensitive volume is penetrated by an ionizing particle.”***

Victoreen appears to have coined the name “Thyrode” for their series of Geiger Müller tubes. The tube consists of a sealed cylinder with a thin conductive wall that makes up the cathode. The anode is a wire running along much of the cylinder’s axis. The cylinder is filled at a low pressure with a halogen gas (argon for the 6306) and an organic quenching gas. A high voltage, on the order of 900 volts, is applied between the anode and cathode.

When a high-energy beta ray or a gamma ray strikes the tube it ionizes some of the gas within the tube. It may also knock some electrons loose from the tube wall. When a gas molecule ionizes it creates an ion and a free electron.

The electrons are attracted to the anode, and as they get close they accelerate, colliding with and ionizing more gas molecules. UV photons are also created, and these particles are not affected by the anode charge. Many travel parallel with the axis of the tube causing more ionization along the length of the tube. Overall a large avalanche is created causing current to flow in the anode. This current creates a negative voltage drop across the 1 MΩ anode series resistor.



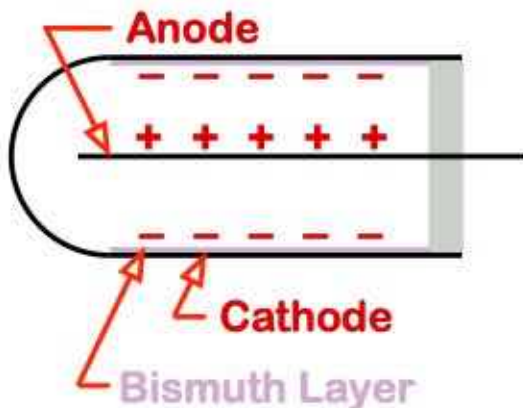
**Figure 8:** Probe (Heath designation GC-1) that is assembled as part of the RC-1 kit.



As the avalanche continues, many ions are created around the anode. these ions move much slower than the electrons and build a space charge around the anode that reaches a level where it stops the avalanche. As the ions move back to the cathode, they pick up an electron and return to their neutral state, and the anode current ceases.

Unfortunately, when a gas ion reaches the cathode and recombines with an electron it can cause the release a photon, often resulting in spurious secondary discharging. The quench gas is chosen to absorb these photons and help the tube to return back to its normal state. While the tube is avalanching it will not respond to a new event so it is important that the tube recover quickly. The 6306 dead time is specified at 100  $\mu$ S. The 6306 quench gas is specified only as “organic”, however methane is a gas that was commonly used at the time.

High energy gamma rays can travel so fast that they can often pass through the tube without striking an atom in either the aluminum casing or the internal gas, reducing the tube's sensitivity to this type of radiation. To counter this a layer of bismuth is added to the inside of the cathode. Bismuth is a heavy metal and its density is such that



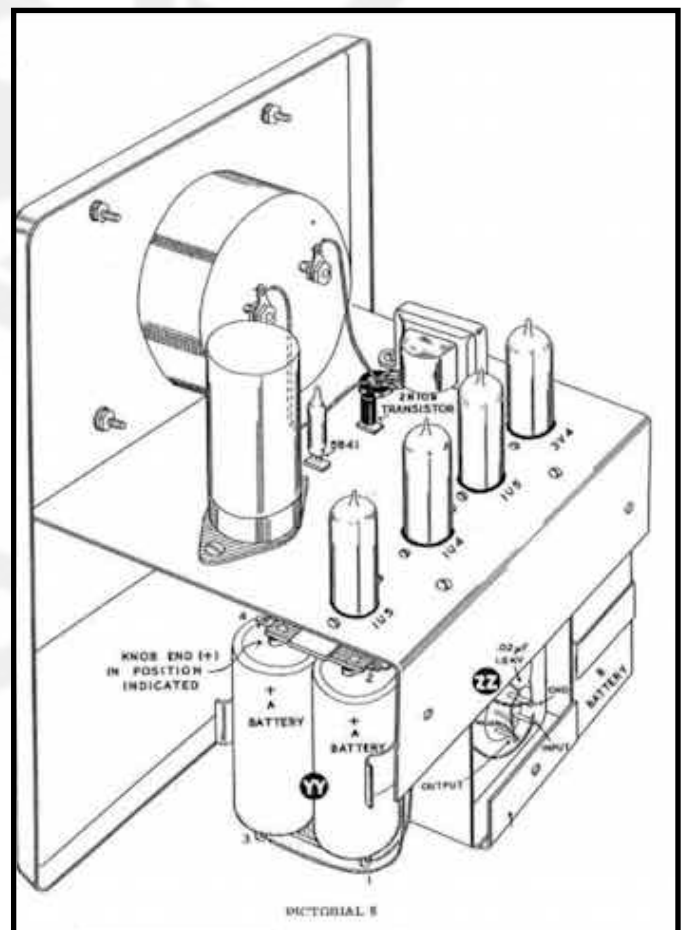
**Figure 9:** 6306 Geiger Müller tube layout.

the chance of a gamma ray hitting it is significantly improved. The difference in sensitivity for 200 K eV gamma rays between the Victoreen 6306 and its identical, less the bismuth, 1B85 tube is 10 fold.

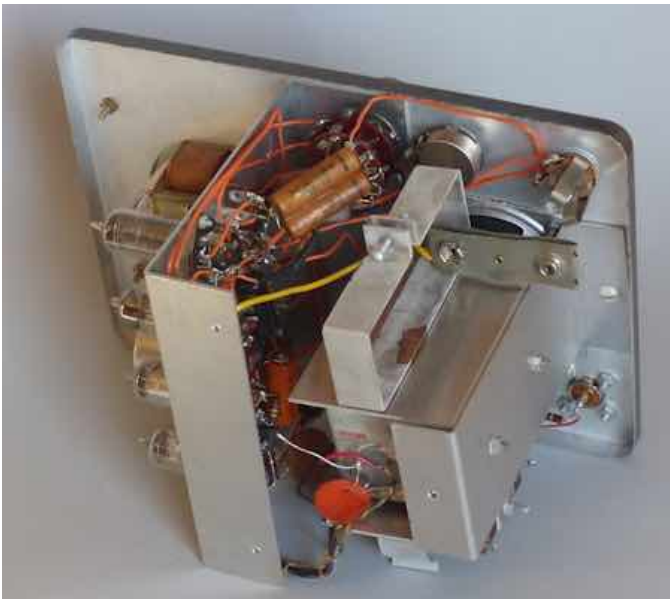
## Heathkit RC-1 Assembly:

No assembly time is given, but the RC-1 is not a difficult kit to assemble. It could probably be considered a two or three evening kit. The manual is straight forward with seven, mostly full page, pictorials and ten figures showing assembly and wiring details. **Figure 10** shows one of the pictorials in the manual. The whole assembly and calibration section of the manual is just over 14 pages.

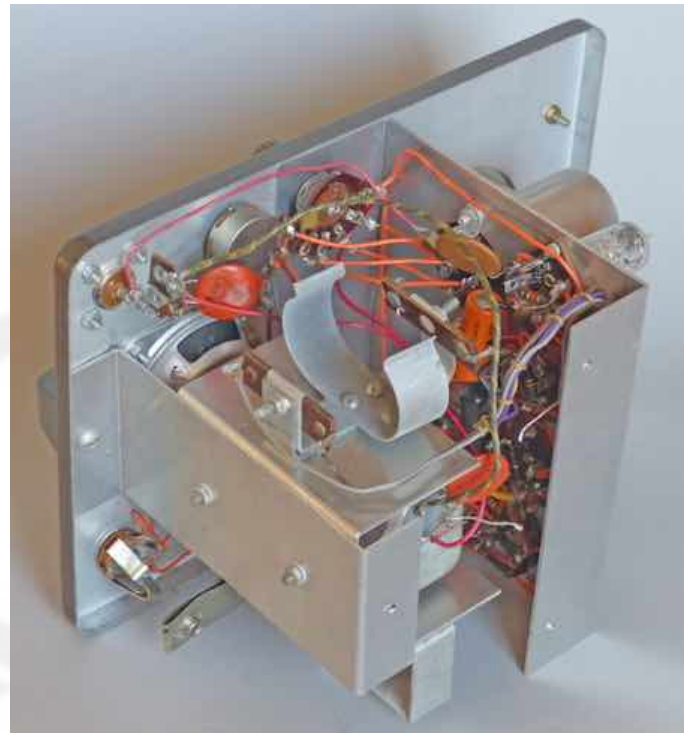
**Figure 11** is a photo of the B-battery side of the RC-1 with the B battery and case re-



**Figure 10:** Typical manual pictorial drawing.



**Figure 11:** The B-battery, when installed, is held by the bracket, and mates with the snap connector. HV power unit can be seen below the bracket.



**Figure 12:** Two 'D' Cells mount in the battery clip to power the tube filaments.

**Pocket size radiation monitor**

SKILL LEVEL 3 This Heathkit Geiger counter uses the sensitive, industry-standard Geiger-Mueller tube to detect and warn of low levels of radiation – even “harmless” levels. The monitor can be calibrated to a standard traceable to the NBS Cesium 137 Gamma source as an option. A beeper indicates detected radiation and a meter shows measured levels on three selectable ranges. Includes carrying case with strap. Requires a 9-volt battery (not included). 5¾" H x 2⅞" W x 1½" D.

**Kit RM-4 (2 lbs.) ..... \$129.95**

**Figure 13:** Heathkit RM-4 Pocket Geiger counter as shown in the Spring 1989 (#216) Catalog. It is light, small and uses one standard 9V battery.

moved. The battery connector is clearly visible. The orange disk capacitor (bottom center) is soldered to a terminal of the sealed HV power unit. **Figure 12** shows the D-cells battery side and some of the point-to-point wiring. No printed circuit boards are used.

#### Comments:

While this was an important kit in its day, newer solid-state radiation counters are available on today's market. They are smaller, lighter more sensitive and use readily available batteries. Heathkit did not produce another Geiger counter kit until the late eighties when they released their RM-4 (shown in **Figure 13**). This unit meets all the requirements mentioned above. When the RC-1 was discontinued Heath sold the GDP-341 Family Radiation Measurement Set. (**Figure 14**) for a short time.

The biggest drawback to using the RC-1 today is the cost of the B battery. In the 1970



Allied Radio catalog it sold for \$2.07 (\$13.64 in today's dollars<sup>6</sup>). However today's battery price is over \$50 when you can find one.

### Acknowledgements:

I'd like to take this opportunity to thank Chuck Penson - WA7ZZE, and from across the Atlantic, Gerhard Wagner - DF1DA for providing photos, comments and a PDF manual. Gerhard mentioned the RC-1 in an email and got me interested in writing about it. Credit also should go to whoever is responsible for the PDF manual; it is in searchable/selectable PDF format. Also credit should go to the person who put the video on YouTube that briefly shows the insides of the sealed HV power supply. I was unable to contact him for more information.

### Notes:

1. A seventh tube is internal to the closed HV power supply assembly. Type is unknown though it is probably a gas type since it uses no filament voltage. It is a 7 or 9-pin miniature tube and has a plate cap.
2. The calibration sample is not specified; it believed to be radium with a half-life of 1,600 years.
3. The formula for life remaining is:  $L_R = e^{-KT}$  where  $L$  is life remaining,  $K$  is a constant 0.0004332 calculated from the half-life, and  $T$  is time in years.
4. A video of the RC-1 briefly showing inside the HVPS: <https://www.youtube.com/watch?v=DMdB7IPycwg> I was unable to contact the uploader for more info.
5. GC-1 is also the model number of the Heathkit **Mohican** shortwave receiver.
6. The current (2019) price was calculated using: <https://www.usinflationcalculator.com>

73, from AF6C



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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*


## Family Radiation Measurement Set

measure fallout radiation and survive

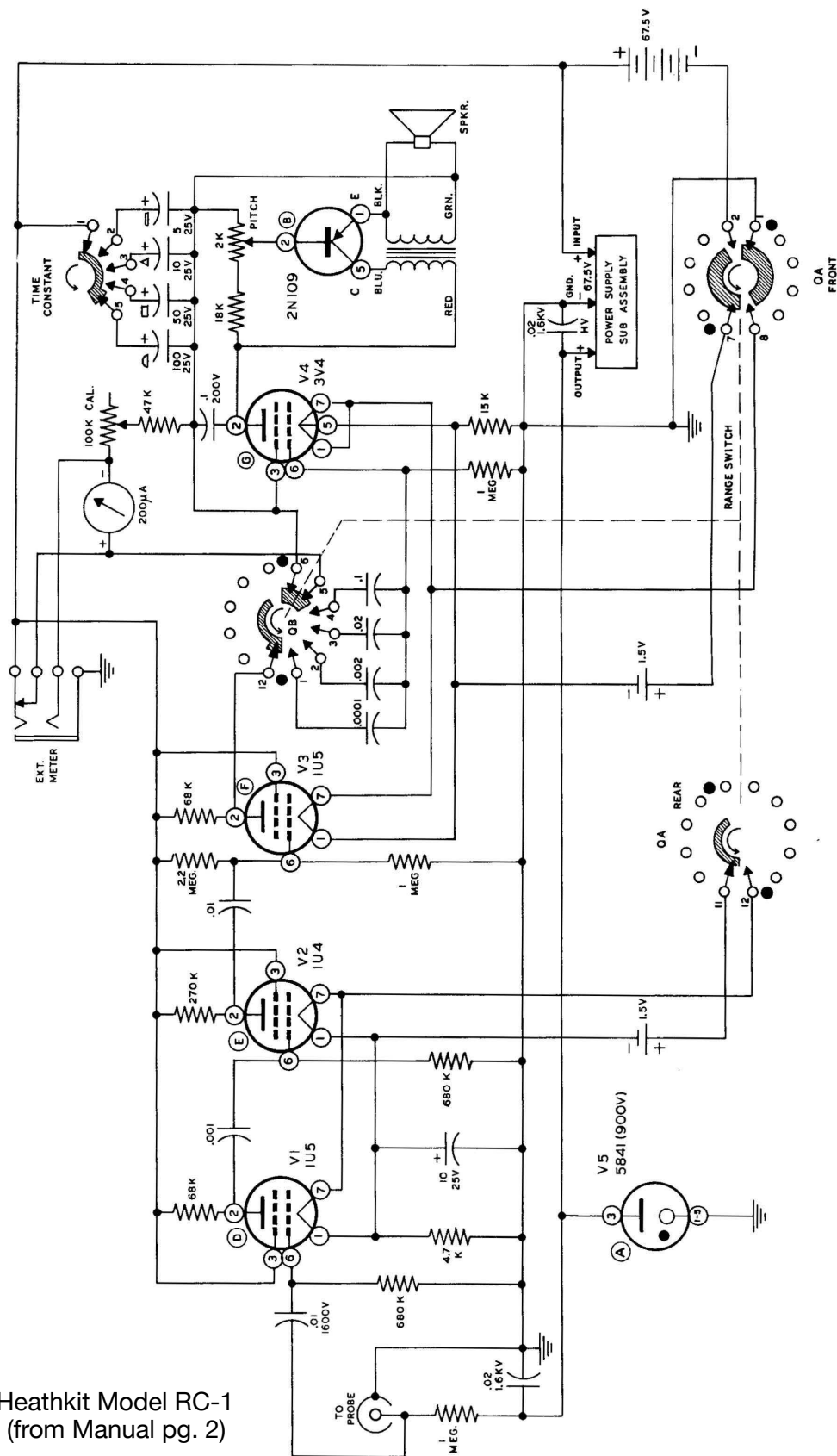
• simple to use • direct reading • rugged and reliable • pocket size • low in cost

In the event of enemy attack, the safety of your family could depend upon accurate information about fallout radiation . . . a silent threat that cannot be measured by any of the five human senses. A family radiation measurement set can give you that vital sixth sense. It can help you to determine when to seek shelter, the safest area for shelter, how long to stay in shelter. This family radiation measurement set, certified by Bendix, its manufacturer, to meet or exceed the Office of Civil Defense Mobilization specifications, consists of a Ratemeter (measures dose rate), a Dosimeter (measures accumulated radiation), a Charger (resets the instruments), and an instruction manual. As part of personal preparedness, order your sets today.

**GDP-341 . . . 3 lbs. . . no money dn., \$5 mo. . . . . \$24.95**



**Figure 14:** Heathkit GDP-341 Family Radiation Measurement Set. Not a kit but made by Bendix. If you were ever with the Civil Defense in the 60's or 70's you may be familiar with these. This ad appeared in the Heathkit Gift Supplement (80/01) for Christmas 1961.



HEATHKIT MODEL RC-1  
RADIATION COUNTER

Figure 15: Heathkit Model RC-1  
Schematic (from Manual pg. 2)





**OCARC Cash Flow - Year To Date**

1/1/2020 through 1/31/2020

Category	1/1/2020- 1/31/2020
<b>INFLOWS</b>	
Auction In, Jan 2020	1,696.25
Dues, Membership (PayPal) 2020	230.64
Dues, Membership 2020	120.00
<b>TOTAL INFLOWS</b>	<b>2,046.89</b>
<b>OUTFLOWS</b>	
Auction Payout, Jan 2020	1,359.23
Storage Locker	285.00
Supplies	15.85
Web Site Hosting	101.94
<b>TOTAL OUTFLOWS</b>	<b>1,762.02</b>
<b>OVERALL TOTAL</b>	<b>284.87</b>



# 2020 OCARC DUES ARE NOW DUE





# MiniTiouner-Express

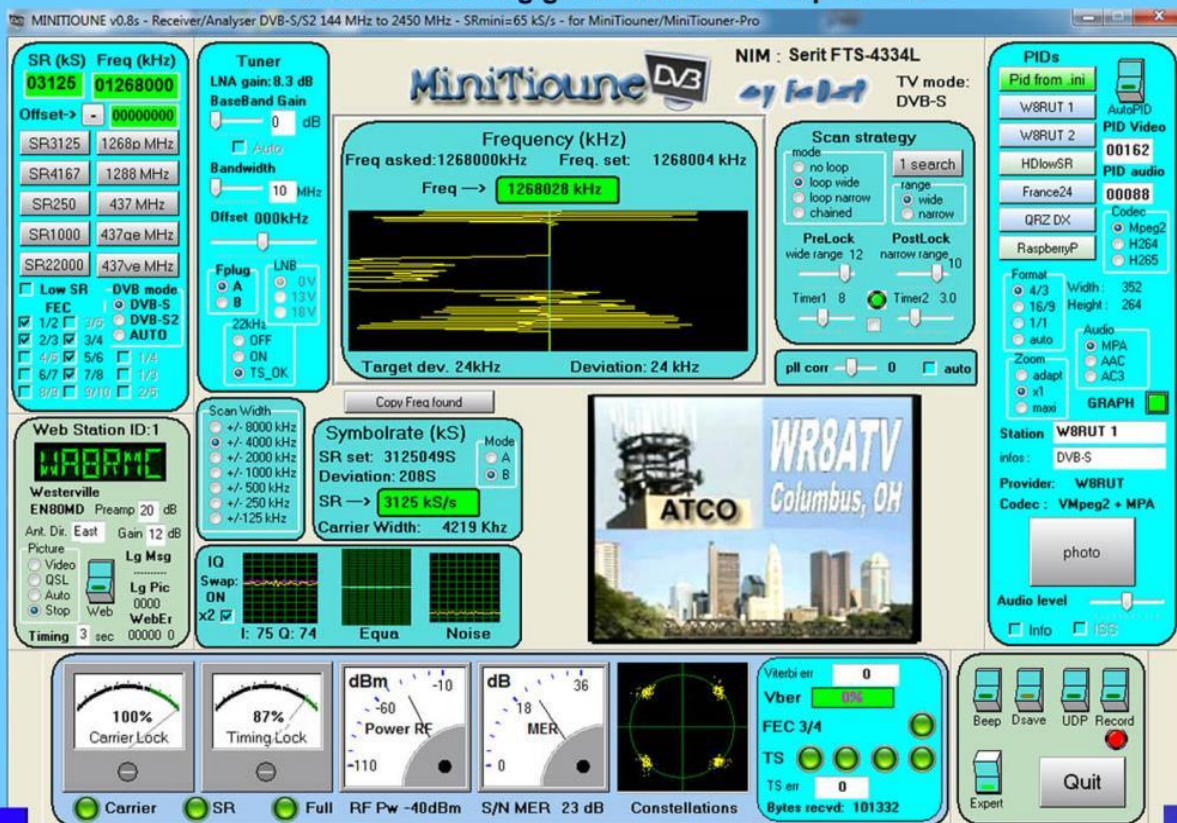
## Digital Amateur Television DVB-S/S2 Receiver / Analyzer



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- Operates with Windows PC using free MiniTioune software from Jean-Pierre F6DZP
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- High sensitivity -100dBm @1288MHz – at 1/2 FEC
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(MiniTioune display above is the ATCO 1268MHz DVB-S repeater signal at WA8RMC QTH 15 miles away).