Heathkit of the Month:
by Bob Eckweiler, AF6C

The CA-1
Conelrad Monitor.

Introduction:
This month's Heathkit is a product of the Cold War. It was manufactured from 1957 through 1960, and made the task of adhering to the FCC Part 12 rules of the time automatic. But before we learn more about this kit, perhaps a discussion of the Conelrad system is in order for our younger hams.

CONELRAD:
Conelrad stands for **CON**trol of **EL**ectromagnetic **RAD**iation. In the fifties and early sixties the United States was at war with the Soviet Union. It was not a shooting war, but one of technology and nuclear threats. In order to prevent Soviet bombers from homing in on US cities President Harry Truman established the Conelrad system in 1951. In the event of an attack, or pending attack, the Conelrad system would be put into effect. All normal radio and TV transmissions would broadcast a special short message and then go off the air. Only two frequencies would remain on the air - 640 KHz and 1240 KHz. The stations transmitting on these frequencies would operate only in short increments and then switch to a different station in a different location. This, of course, was to confuse any bomber navigation using radio direction-finding. The two Conelrad frequencies, by law, had to be marked on the dial of all radios sold between 1953 and 1963. The mark was the Civil Defense symbol – the letters CD inside a triangle inside a circle. You would find them at 640 and 1240 'KC' on the dial of radios of that era.

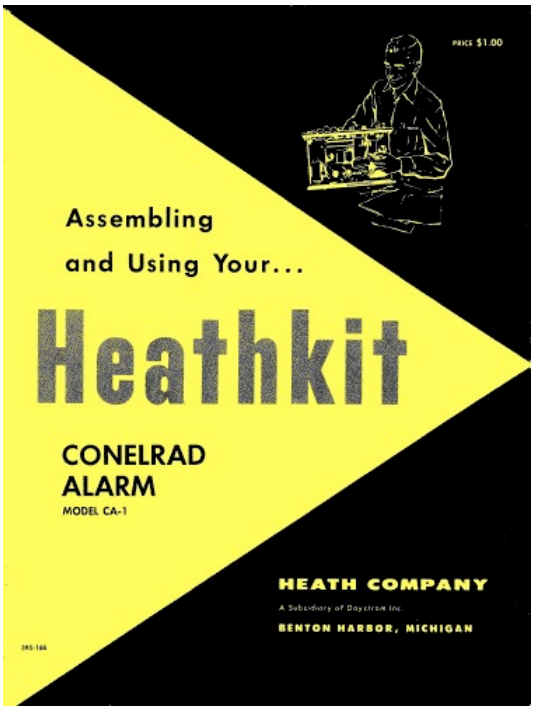
Originally only broadcast stations were required to comply with Conelrad monitoring; hams weren't required to comply until Jan 2, 1957. Many hams did this by having an AM broadcast radio running in the background that they could monitor to be sure the station was on the air. Of course one wouldn't monitor a station that was broadcasting on either of the Conelrad frequencies.

Since notifying all the radio stations would be too time-consuming, the FCC designated certain broadcast stations as ***key stations***. Other stations were required to monitor these key stations. Should an alert occur the broadcast station was to drop its carrier twice at five-second intervals and then transmit a 1 KHz tone for fifteen seconds and then either leave the air or switch to one of the Conelrad frequencies. Three 'key stations' in the Los Angeles area were KNX - 1070 kc, KFI - 640 kc and KMPC - 710 kc. KMPC has since moved frequency and gone to Korean language broadcasting.

The Heath CA-1:

To automate monitoring for a Conelrad alert Heathkit produced the CA-1 Conelrad Monitor. It was a simple device and fit into the popular small accessory cabinet (7-3/8 W x 4-11/16 H x 4-1/8 D) that Heathkit used for numerous other products including the AM-1 SWR bridge and the QF-1 "Q" Multiplier.

The CA-1 first appeared in the March 1958 catalog and was produced through 1960. The CA-1 was self-powered using a transformer and selenium rectifier. The circuit had a single 2D21 Thyratron tube. The signal input for the CA-1 came from the AVC (Automatic Volume Control) circuit of a standard AC/DC AM radio of the time. Since AC/DC radios ran directly off the 120-volt AC line without a transformer, there was always a 50-50 chance the chassis was hot (connected to the hot AC line). That was why the AC/DC radios chassis were insulated to the outside. Heathkit used a large resistor (220K ohms) in the ground lead from the broadcast radio to prevent shock from touching the CA-1 metal cabinet. Still, it was a good idea to "polarize" the plug to the AC/DC radio to make prevent the hot side of the power from being on the radio chassis.



The 2D21 thyratron tube is a gas-filled tetrode (four elements – excluding the filament). Like a standard vacuum tube, the grid voltage controls the plate current, but only to a certain extent. Once the grid loses control, the gas 'fires' and the tube turns on. The tube continues to conduct until the plate voltage is lowered below the firing point of the tube's gas.

In the CA-1 the AVC from an external radio was DC coupled to the grid of the 2D21 tube. The cathode of the tube was biased positive by the sensitivity adjustment to allow for different ranges of AVC. As long as the key radio station was on the air, the negative AVC voltage kept the tube cutoff. If the broadcast station went off the air the thyratron tube would fire, operating a relay. The relay lit a large three-watt pilot lamp on the CA-1 and also removed power from an auxiliary AC power socket on the front panel. If your transmitter was plugged in it would unceremoniously take you off the air. Once the thyratron tube fired it would continue to conduct until the plate voltage was momentarily removed. This was done via a reset button on the unit. The CA-1 also had a neon pilot light on the front panel to show the unit was powered.

False Alarms:

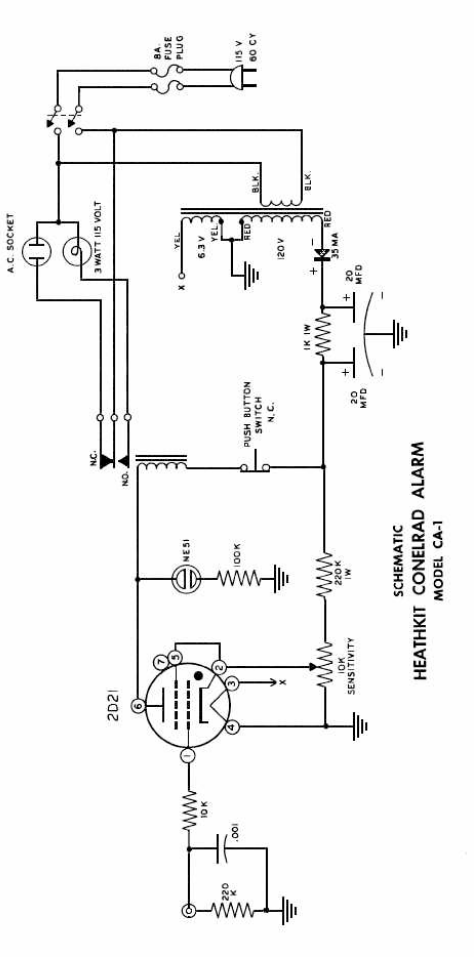
The CA-1 was prone to false alarms. A false alarm would occur if the AM station being monitored went off the air momentarily – and they did frequently – or if the station was distant and prone to fading. With the transmitter connected the AC outlet on the CA-1 your QSO would be interrupted. Many hams modified their CA-1 as suggested in the manual to instead turn on a bright warning light or sound a buzzer or bell when the Conelrad Monitor was triggered. This modification involved a simple rewiring of the relay contacts and the addition of an indicator device.

CA-1 Specifications:

(From the Heathkit CA-1 Manual)

Tube Complement:	2D21 thyraton.
AVC Sensitivity:	–2 volts to –20 volts
Operating Power:	115 VAC, 60 cycles 7 watts.
Cabinet Size:	7 3/8" wide x 4 11/16" high x 4 1/8" deep.
Net Weight:	3 lbs.
Shipping Weight:	4 lbs.

In August of 1963, with intercontinental ballistic missiles becoming more of a threat than bombers, Conelrad was replaced by the ***Emergency Broadcast System***, which was itself replaced in 1997 with the ***Emergency Alert System***.



73, from AF6C

Remember if you come across any old Heathkit Manuals or Catalogs that you do not need, please pass them along to me.
Thanks - AF6C

This article originally appeared in the May 2008 issue of RF, the newsletter of the Orange County Amateur Radio Club - W6ZE.