VINTAGE RADIO

By JOHN HILL

Repairing an old Heathkit radio frequency generator

A radio frequency (RF) generator is an invaluable test instrument when it comes to aligning and adjusting old radio receivers. But why buy new when you can often refurbish an old unit for just a few dollars?

In the early days of my vintage radio activities, a receiver tune-up was a bit of a hit and miss affair. If an adjustment screw was turned and there was an improvement, well and good. If nothing much happened, then it was best left alone. Everyone has to start somewhere and I started at the bottom of the ladder knowing very little.

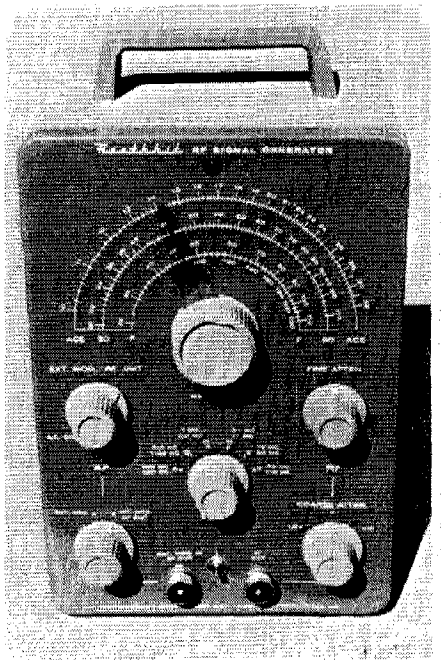
Naturally, I never had any alignment instruments in those days (apart from a screwdriver) and lacked such niceties as a radio frequency (RF) generator and output meter. These tools of trade make alignment quicker, easier and far more accurate.

I am not saying that a reasonable alignment job cannot be done without these instruments but, from my point of view, I would much sooner use them than not use them. If a receiver is badly out of alignment, the right equipment makes a big difference to the successful outcome of the job.

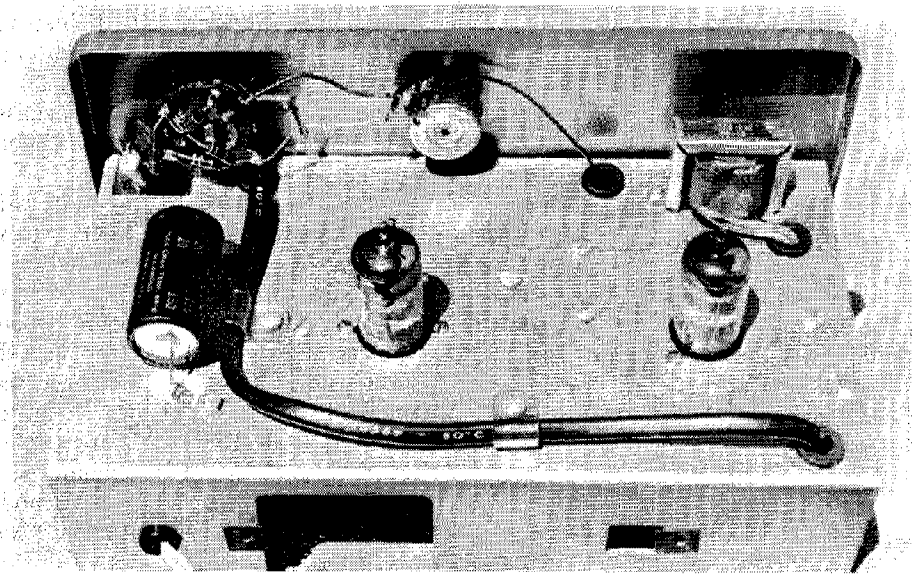
My first radio frequency generator was bought new from one of our local electronics retailers. But although it looked pretty on the outside, this "hi-tech" Taiwanese instrument was not all that good on the inside, and exhibited a very strange fault.

If a frequency of 600kHz was fed into a radio receiver, there were two adjacent resonance points, one nominally on 600kHz and another a little lower on the dial. When tuning the radio dial, the effect was to tune onto the signal, off the signal, then back onto it again. Which was the right signal was a bit hard to judge.

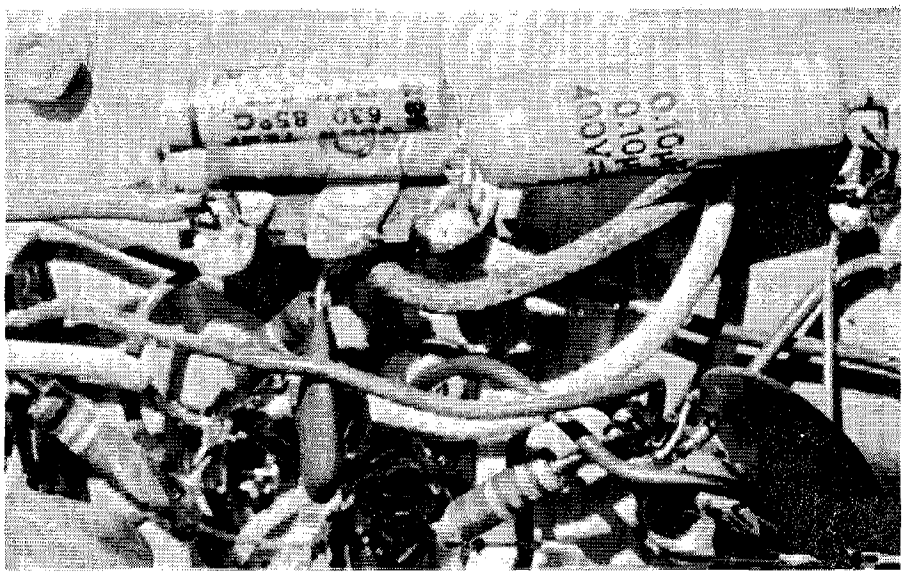
When a second generator of the same make exhibited similar characteristics, it seemed like the right time to ask for a refund – and I did! Per-



This radio frequency generator was restored to "as new" condition. It is a Heathkit RF-1 of 1960s vintage and was originally marketed in kit form.



The top of the chassis is neatly laid out and carries the two valves. The Heathkit RF-1 operates from a 110V supply (note the small power transformer) and must be used in conjunction with a 240-110V step-down transformer.



The under-chassis wiring is not so neat and is a typical rat's nest of point-to-point wiring. The two capacitors at top are polyester replacements for the troublesome paper types originally used.

The RF-1 uses two valves: a 6AN8 and a 12AT7. Although the originals tested OK, they were replaced as part of the restoration procedure.

haps it was a bad batch? Maybe it was only a simple adjustment? All I know is that I was relieved to have my money back.

Heathkit generator

One week later, I had the opportunity to buy a Heathkit RF-1. Normally supplied as a do-it-yourself kit, this particular unit had been put together some time in the 1960s and was still working quite well.

The Heathkit RF-1 is a valve type generator, not solid state. The valves used are the 6AN8 and 12AT7, both relatively modern types and still readily available.

There was no double spotting with this unit; the RF-1 worked perfectly. It has a frequency range from 100kHz to 110MHz (220MHz in harmonic mode), which makes it a little more versatile than some earlier generators. The good bit, however, was the price. At just $10.00, I felt as though I had stolen it!

TABLE 1	
Band	**Frequency Range**
A	100 - 320kHz
B	310 - 1100kHz
C	1 - 3.2MHz
D	3.1 - 11MHz
E	10 - 32MHz
F	32 - 110MHz
Band F is also calibrated for 2nd harmonics up to 220MHz	

Using a radio frequency generator and an output meter makes receiver alignment a breeze but, just recently, the old RF-1 developed an annoying fault. Often, usually in the middle of a tune-up, the output would dip to quite a low level. Such a malfunction is disconcerting to say the least, because one is never sure whether it is the generator or the receiver that is at fault.

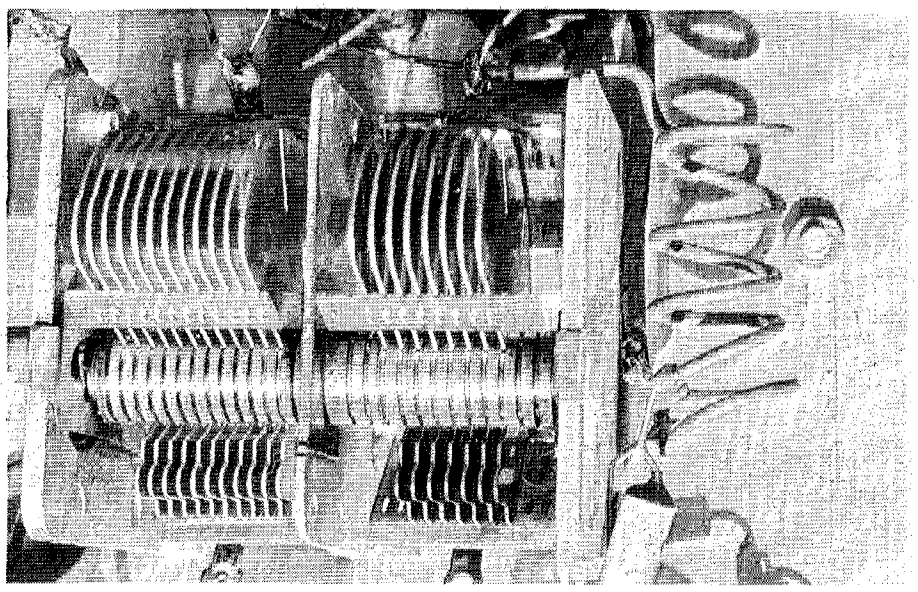
An "out of sight out of mind" attitude prevailed for quite some time. I only ever thought about the problem when it played up while I was using it. Suddenly, I made up my mind to do something about it and within minutes the generator was in pieces on the workbench.

Everything looked OK, although there were a few old-style paper capacitors in the circuit that I considered suspect. If these can give trouble in a radio, then why shouldn't they also cause problems in an RF generator? There were four paper capacitors and they were replaced with high voltage polyester types of the same value.

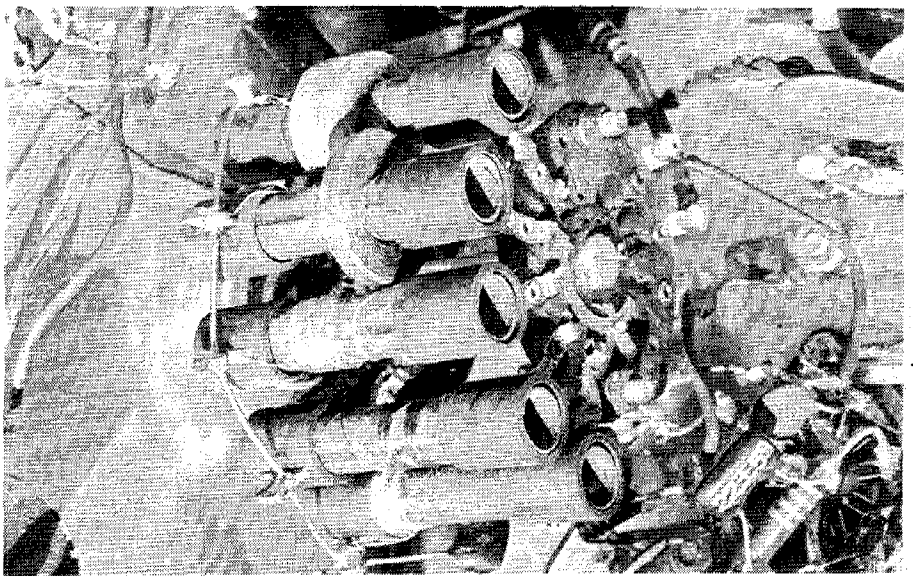
Next on the list were the switches. The old Heathkit generator has several multi-pole switches and these were sprayed with electrical contact cleaner, and the contacts checked for adequate tension. It requires only one faulty switch contact for all manner of problems to arise.

The switch check was followed by an examination of every solder joint in the circuit. One has to remember that, in this instance, the generator was a home assembly job and although it was put together by a competent technician, we are all capable of a crook solder joint now and then.

Checking the joints with a magnifying glass revealed that there were a few suspect ones and three joints were



This 2-gang tuning capacitor is connected to the dial on the front panel. Note the 5-turn airwound coil attached to the rear end of gang. This is the "band F" coil mentioned in the story.



This view shows the band selector switch and the various oscillator coils. The inductance of each coil can be varied by adjusting the iron slug inside the coil former.

resoldered just in case. This was probably unnecessary but the generator did have a problem and I was determined to eliminate it.

Valve checks

An instrument such as a radio frequency generator does not get a great deal of use and is not the sort of thing that is hard on valves. Even though the valves tested OK, both were replaced as the necessary types were conveniently on hand. If the generator was going to be properly repaired, then two new valves would not go astray.

Finally, a nuts and bolts check, and it was this operation that located the probable cause of the trouble. One of the tag strips bolted to the chassis was quite loose. It had been only finger tight ever since the kit was first put together. The centre tag that bolts to the chassis is also a chassis connection for three other components. It was tightened accordingly and other chassis connections also checked.

It appeared as though I had carried out the repair in the wrong order. If I had started with the nuts and bolts check it may have saved some time. However, considering that the generator is approximately 30 years old, the new values and capacitors must make the unit more reliable. It will probably still be working long after I have departed this planet.

Calibration woes

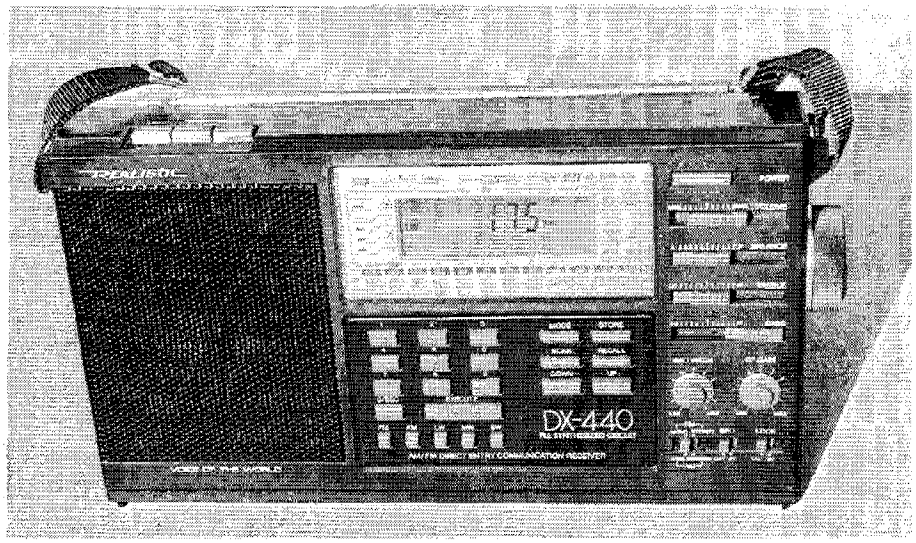
Replacing the valves and capacitors is one thing: their effect on the frequencies produced could be another matter. The final stage of this RF generator repair was to calibrate each band so that the generator would produce the frequencies indicated by the dial.

One might expect that such as task can only be performed with the aid of some expensive laboratory equipment but this is not the case. The alignment can be checked simply by using a radio receiver. Because the calibration involves LW, MW, SW and FM bands, I found it necessary to use three different receivers.

Table 1 shows the frequency ranges of the RF-1's six bands. Most of these bands can be checked in several positions simply by comparing the reading of the generator dial with a radio station of known frequency. In the case of shortwave stations, this may be easier said than done if one is not familiar with their callsigns and frequencies. The generator does not have to be connected to the receiver; simply placing the output leads in close proximity to the set provides sufficient signal coupling.

Tuning slugs are provided in the oscillator coils which, traditionally, are adjusted near the low frequency end of each band. However, the instruction manual implies that this should not be necessary as the coil assembly is pre-tuned at the factory. Alternatively, it should only be undertaken if adequate equipment and experience is available.

Adjustment at the high frequency end is normally by means of trimmer capacitors, one for each band. In this case, with the coil and switch assembly pre-tuned, the makers have seen fit to reduce this to a single trimmer. This is connected to the grid of the oscillator valve, making it common to all bands, and is probably provided to take care of the external distributed capacitance (eg, the capacitance of the wiring, and the internal capacitance of the oscillator valve). Significantly, the instructions say that this trimmer should be adjusted at the high



This nifty little radio receiver with its digital dial solved all of the problems associated with the realignment of the generator.

frequency end of one of the bands.

Initially, band A on the Heathkit RF-1 was checked on the long-wave band (150-350kHz) and this revealed considerable discrepancies between the readout on the generator's dial and the dial setting on the receiver. Unfortunately, nothing much could be done regarding the alignment of this band until the frequencies of some LW transmissions were known.

Band B was checked on the AM broadcast band using a station of known frequency below 1100kHz. I used 3AR on 621kHz as a reference. Band C was also checked using the AM broadcast band and a station of known frequency above 1MHz. In this case, I used 3XY on 1422kHz.

Bands D and E can be checked using shortwave stations if one is sure of the station frequency. But because I don't know the frequency of even one shortwave station, I found myself facing the same problem as with band A. As before, comparing the generator's dial with receiver dial calibrations showed considerable discrepancies.

It is also interesting to note that although the receivers were modern transistor types that had not been tampered with, their shortwave dial calibrations were only approximate.

Band F was easy to check. By using a local FM station, 3CCC on 103.9 MHz, the generator was found to be not quite on frequency and a small adjustment was required to correct the error. The band F coil has no coil slug adjustment. Adjustment is by simply squeezing or stretching the coil in or out.

After all this checking, the alignment process had been only partly successful; there were still three bands that required checking and possible adjustment. One colleague suggested using harmonics from the generator as a calibration aid. For example, assuming that bands B and C had been adequately calibrated against broadcast stations, a signal generated on band A would produce second and third harmonics which would land in one of these two bands.

Similarly, signals generated on the broadcast band would produce harmonics in the shortwave bands.

However, at this stage, I received help from an unexpected quarter. David, a young vintage radio collector friend, lent me a radio that solved all my problems. David's receiver is one of those new-fangled types that has a digital frequency display. Almost any mongrel frequency can be keyed in and that is precisely what you get.

Wow! Did this little receiver make bands A, D and E easy to adjust. It's marvellous what the right equipment can do!

When finally aligned, the RF-1's accuracy was well within its specified ±2%. It would be most interesting to compare this old valve type generator with a modern solid state unit. I am quite sure that it could hold its own in any company.

My repairs to the old Heathkit signal generator proved to be completely satisfactory and there were no more malfunctions. The generator is perfectly stable, remarkably free from harmonics, and completely accurate at the frequencies at which it is used.

However, the new valves and capacitors have pushed the price up to around $20.00. Shame about that! **SC**

Table 2

Station	Location	Freq. (MHz)
VNG	Australia	5, 8.638, 12.984, 16
WWVH	Hawaii	5, 10, 15
WWV	USA	5, 10, 15, 20
CHU	Canada	3.330, 7.335, 14.670
JJY	Japan	5, 8, 10, 15
RWN	Russia	4.996, 9.996, 14.996
RID	Russia	5.004, 10.004, 15.004

These standard time & frequency stations provide useful reference points for signal generator calibrations. Note that some Russian signals are in CW only & need a BFO to be resolved.