By Maurie Findlay, MIE Aust, VK2PW

# Restoring The Hotpoint Bandmaster J35DE console radio; Pt.2

**Last month, we discussed the Hotpoint Bandmaster J35DE in general terms. This month, we describe how it was restored to its original performance. The only instrument required was an inexpensive digital multimeter and the same general ideas can be applied to most vintage sets.**

MANY OF THE ARTICLES on vintage radios in these columns give some of the details of restoration but rarely would a set which looks potentially good on initial inspection turn out to require so much work to restore it to its original standard of operation. And while some people might simply turn the set on and hope for the best, that is not likely to be successful in many cases.

The starting point with this set was the power cord. It was originally fitted with a twin-lead conductor power flex which is not deemed safe these days, especially when a 60-year old power transformer is being used. It might be OK for the present but that cannot be guaranteed.

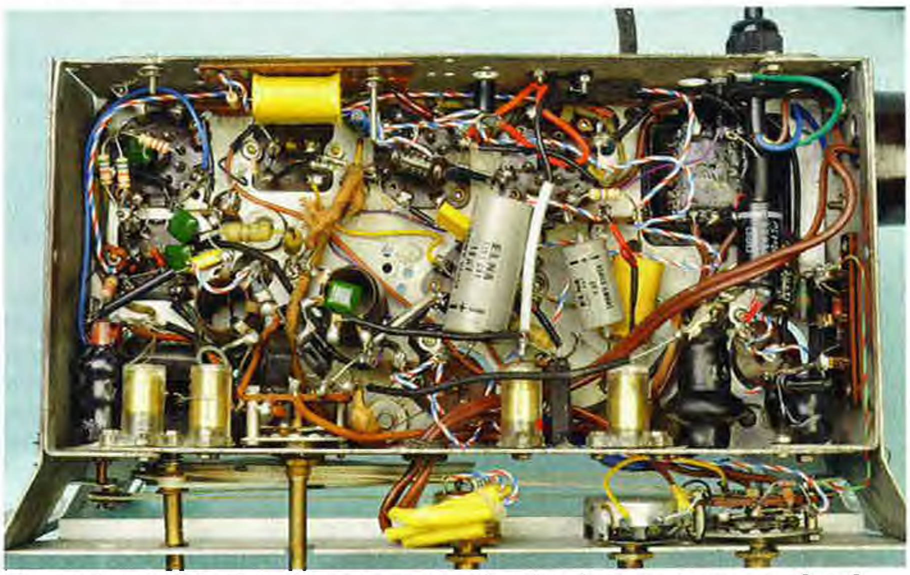
Accordingly, a 3-conductor flex was fitted, with the chassis correctly connected to mains earth for safety. The power cord was securely anchored with an IP68 cable gland and the green earth wire terminated to the chassis with crimped lug, screw, nut and lockwasher. This works well although using a cable gland may not be an approved method when it comes to anchoring mains cords.

The next step was a resistance measurement of the primary of the power transformer. Measured via the power plug pins it was about 50Ω and from the plug pins to the chassis it was a large number of megohms. So that was OK but the set has a double-pole rotary power switch operated by one of the front-panel knobs and it seemed very tired. Turning the switch backwards and forwards produced an occasional flicker on the meter but not the original 50Ω reading. So it had to be replaced but obtaining the same switch was impossible.

A used switch potentiometer with a double-pole switch rated at 240VAC 2A was found and fitted as a replacement but its shaft was too short. This was extended using a short section of shaft from another pot. They were joined using a threaded bush from yet another pot, the whole lot being glued together with JB Weld epoxy adhesive.

Terminating wires to the switch was yet another hurdle. The solder tags on

**These faulty parts all had to be replaced in the old Hotpoint Bandmaster radio. Most are capacitors but there are also quite a few resistors, a couple of dial lamps and the 6J8G mixer valve.**



**This under-chassis view shows the radio after the above parts were replaced. It's normally fitted with a perforated steel cover.**

the switch pot are of thin sheet metal and not designed to take the strain of stiff wires with mains insulation. For this reason, the mains wires were extended with flexible hook-up wire which was in turn covered with thick plastic tubing.

Fortunately, the original volume control, which is separate from the power switch, was quite usable.

Then we come to the valves. A natural tendency among these new to radio restoration is to pull out the valves and wipe away the dust and grime but this can be a real trap since it is so easy to clean off the label marking. Then how do you identify them? Four of the valves in this set are of similar size and have no connection to a top cap, so it would be easy to mix them up.

So before pulling any valves out of the chassis, do a quick diagram showing the location of each valve and its type. Then put a sticker on the base of each valve and label it as well.

Turning the chassis upside down is another hazard because it needs a rear support to stop it from resting on one of the IF transformers. A length of angle bracket bolted to the back of the chassis provided the necessary support.

Then we could have a detailed look at the components underneath. One manufacturer produced paper capacitors in a black plastic which melted at soldering temperature. Servicemen in the 1950s referred to them as the "black death". It was expected that most of these would be leaky. Surprisingly though, most of the capacitors were OK, both with regard to leakage and capacitance, except for a couple where the ends broke off when the multimeter was connected!

Ultimately though, most of the paper capacitors were replaced with modern metallised polyester types (greencaps etc) as the leads of the originals were so fragile.

The resistors were carbon composition, most about 35mm long and 6mm diameter, and were probably rated at 1W dissipation. Measurements showed that most of the resistors were high in value, some by a factor of two to one but the 325Ω V4 cathode resistor and the 50Ω resistor for the back bias circuit measured both very close to their marked values. They appeared to be wirewound types.

## Electrolytic capacitors

Electrolytic capacitors in old valve radios usually have a high leakage or if not, they have dried out and have low capacitance. Still, replacements are available from a number of suppliers.

In this particular case, the 4.7μF and 16μF capacitors were salvaged from a junk box and reformed using the electrolytic capacitor tester described in the August and September 2010 issues of SILICON CHIP.

Resistance checks of the power transformer high-tension secondary and heater windings and the two windings in each of the two IF transformers gave the expected readings, being 400Ω for the HT, a low value for the heater winding (since the valve heaters are all in parallel) and about 10Ω for the IFs.

The broadcast-band (BC) aerial coil primary checked out at about 30Ω and the secondary (tuned winding) at about 4Ω. The BC oscillator primary and secondary both measured about the same as the latter. Initially, the shortwave coils were not checked.

## Disintegrating wiring

A wire was removed from the 16μF filter capacitor just to check for shorts and its insulation disintegrated just as the wire was moved. Quite a number of other wires in the chassis looked as though they would do the same.

So, the big decision had to be made. Was it worth refurbishing the set to the point where it would be reliable and perform as it did originally? Having

**Some of the leads of the speaker transformer had broken off at the base. It was repaired by digging away some of the pitch-like sealant, joining new leads to the exposed wire ends and then resealing the unit.**

proceeded this far, there could still be other faults. For example, the tuning slugs in the IF transformers might not work, the rotary switch for BC/SW selection could be intermittent and so it goes on.

In all these cases the answer is as follows: if you are prepared to spend the money on components and hours of fairly skilled work with a soldering iron, a multimeter and long-nose pliers, and you regard the project as a hobby, then it is worthwhile.

Components improved greatly in the 1950s and many of the younger radios that come up for refurbishment would not have as many faults as this Hotpoint. Hopefully, your set would not require as much work.

A general tip: when working on a radio that requires many hours of concentration, don't continue for more than one or two hours without a rest. It is very easy to make a mistake which could be hard to find later.

In this set, many of the components were soldered directly to the chassis during manufacture. A large soldering iron would be required to undo the original connections. The way around this is to cut the wire close to the component after which a new component can be connected to the stub with a normal soldering iron.

Modern components are almost always smaller than vintage parts of the same voltage rating (in the case of capacitors) and power dissipation rating (in the case of resistors). So there is a temptation to terminate the leads in places different to the original. Don't do this. There are often cases where, for example, a different earth termination point could lead to instability. The original designer of the radio would no doubt have spent a lot of time determining the best component connecting points.

The damaged wiring loom presented real problems. There were cases where a wire with damaged insulation was bound up with other wires which appeared OK. In those cases, it was decided to leave the bad wire in place and just cut off the ends. Binding the new wire into the loom risked further disturbing the crumbling insulation so we tried to disturb it as little as possible.

## Keeping it original

Many restorers want to keep the radio looking as original as possible. In this case, we left the original electrolytic filter capacitors in place so that the top the chassis looked the same. However, it was just not practical to make the inside of the chassis look original since most of the components have to be replaced in a relatively small space.

No doubt the purists would be aghast but taking the purist approach would be far more time-consuming and all for a result that no-one will see. In particular, as shown on page 96 of last month's issue, the Hotpoint chassis has a screening panel underneath which prevents you seeing inside unless it is removed.

With the passage of 60 years, there are changes to the circuitry of the Hotpoint which could be made to improve performance. However, we have resisted these temptations for the moment and adhered to the original circuit except for some modifications to the output transformer connection (the original circuit allowed the high-tension to remain on the screen of the 6V6GT output valve when the speaker cable was unplugged – see last month's article).

Incidentally, one reader emailed to say that there wasn't any design fault since the circuit shown on page 94 clearly showed a plug with inbuilt HT link. What he hadn't realised was that I had redrawn the circuit (also mentioned in last month's article) to incorporate this modification. Perhaps I should have emphasised that point.

Having replaced all the doubtful parts there comes the critical time to apply mains power. Measure from the high-tension line to ground to make sure that there is high resistance and also from pin 3 to pin 4 of the 6V6GT, to make sure that the primary of the speaker transformer is intact. The latter should measure a few hundred ohms. Of, course the abovementioned speaker plug should be in place.

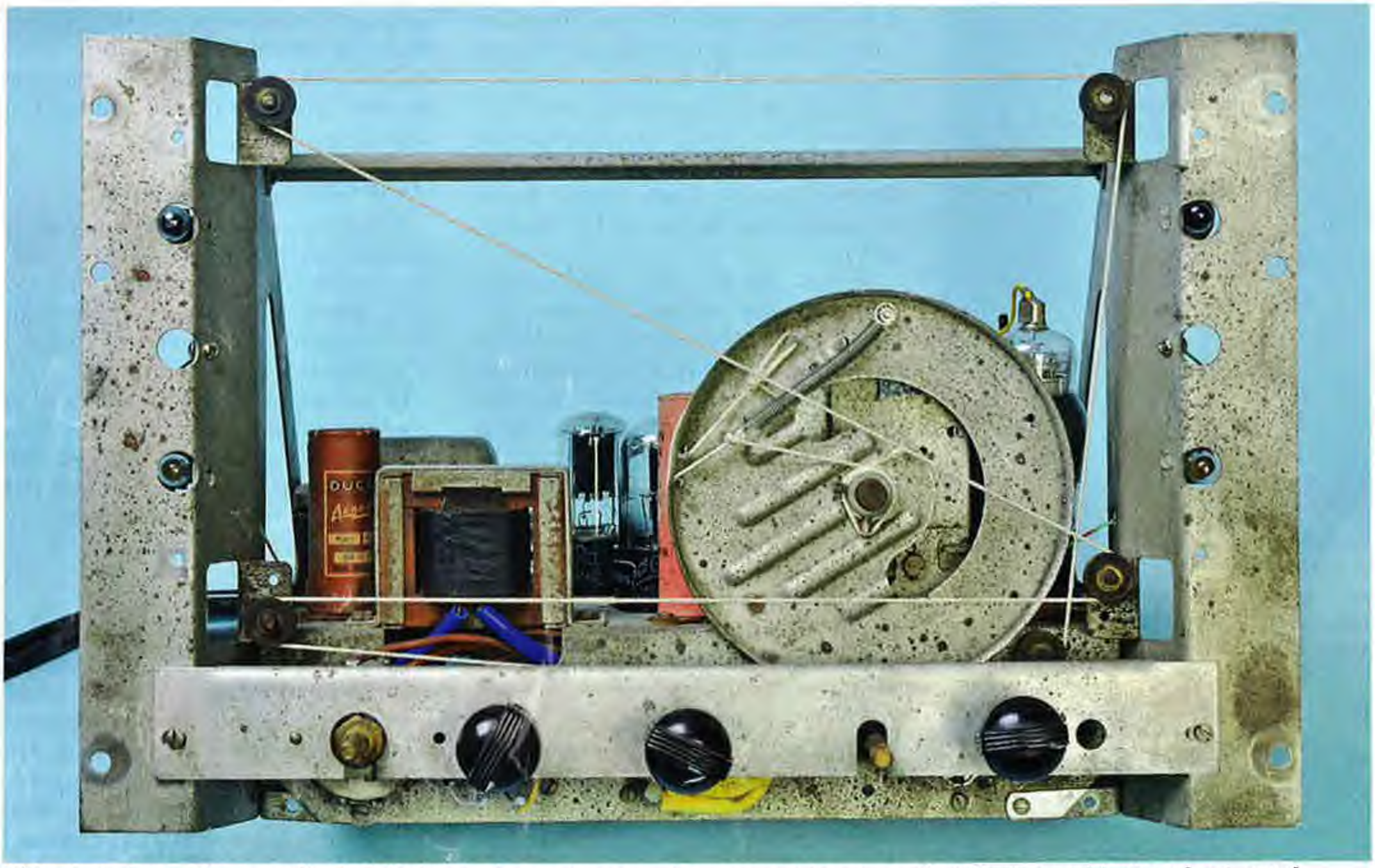
Place the chassis on the bench so that the valves can be viewed. Switch the power on but have your hand on the mains outlet switch in case anything shows distress. Check the valves. With most types the cathode will glow a dull red.

With the Hotpoint, there were no fireworks and the cathodes were all as expected. The heater element of the 6X6GT protruded out of the cylindrical cathode by about 8mm which isn't normal but the cathode was a normal dull red, so the valve still did its job.

With luck, there will be a gentle hiss from the set with the volume control fully advanced. And with an insulated wire connected to the aerial terminal, you should be able to hear some stations, even if weakly, as the tuning knob is rotated.

But the chances are that you may not be so lucky. In that case, a systematic search through the circuitry will be necessary. This is a good idea anyway because it will pick up any more faulty components, including valves.

Place the chassis so that you can get at the underneath connections and measure the high-tension (HT)



**This view shows the complicated dial stringing arrangement, necessary to ensure that the top and bottom horizontal sections both travel in the same direction to carry the long vertical pointer. About 2.4 metres of dial cord is required to complete the job.**

voltage across the 16µF filter capacitor. It should be about 250V DC. Then measure the voltage across the 325Ω resistor from the 6V6GT cathode to earth. It should be about 13V which means that the cathode current of the valve is 40mA. If it is much less, it is probable that the valve is low in emission and due for replacement.

To check that the valve is amplifying, switch the meter to the ohms scale, connect the red (normally positive) lead to earth and touch the black lead to the junction of the 47kΩ and 0.47MΩ (470kΩ) resistors. There should be a thump from the speaker. If not, there is most likely a problem in the speaker transformer, the speaker or the connections.

All OK with the output stage? Measure the voltage at the plate (pin 6) of the 6SQ7GT. It should measure about 90V and touching the probe on the pin should result in a click from the speaker. If the voltage is much higher than 90V, the valve is probably low in emission and should be replaced. (Note: this is a case where the cathode current is only about 0.5mA and a usable valve would be failed by an emission tester.) Again, use the ohms setting of the meter from grid (pin 2) to ground to confirm that the stage is amplifying.

Also, the volume control can be checked by using the meter on the ohms scale. Start with the knob turned fully clockwise and note that the sound in the speaker is reduced as the knob is turned anticlockwise.

The lefthand knob is marked "PHONO – RADIO" and has positions marked "TREB", "MED" and "BASS" for both the phono and radio functions – six positions altogether. The frequency response of the Hotpoint shown in Fig.1 is for the "TREB" position. The other two positions impose very severe high-frequency audio attenuation.

The plate current of the 6SK7GT can't easily be checked because its cathode is grounded. Measure the resistance of the IF transformer primary with the set switched off. Then, after making sure the screen voltage is about 80V, the plate voltage about 250V and the grid -3V, measure the voltage drop across the IF transformer winding. This voltage divided by the resistance and multiplied by 1000 will give the plate current (in milliamps). With a good valve, it should be about 5mA.

Now with the DMM on the ohms range, briefly touch the probe to the grid (pin 4) of the 6SK7GT. This should result in a slight click in the speaker if the valve is amplifying but not nearly as loud as with the audio stages,

Testing the 6J8G is a special problem in the Hotpoint chassis. The socket for the valve is hidden by the broadcast-band oscillator coil and the accompanying trimmer capacitor. It is just not practical to make contact with the two connections which are needed to determine if the valve is OK, ie, the cathode and the grid of the oscillator section.

As a result, the trimmer was removed and a 1MΩ resistor soldered to the oscillator grid connection on the valve socket (pin 5). The other end of the resistor was left to protrude between the two trimmers so that the meter connection could be made. The voltage reading will be only slightly reduced by the presence of the resistor (the capacitance of the meter leads would affect the oscillator frequency if

**A 2.2Ω resistor was wired in series with each dial lamp to improve its reliability. This gives only a slight reduction in brightness.**

**The shaft of the replacement switch pot was extended using a short section of shaft from another pot. The two were joined using a threaded bush from another pot, the lot held together with JB Weld epoxy adhesive.**

a direct connection were made).

In order to get at the 6J8G valve socket cathode connection, the side of the chassis which carries the support for the dial glass and dial lamps had to be removed. A length of hook-up wire was soldered to pin 8 of the socket. This pin is already bypassed to chassis so that the wire can be extended without affecting the performance. Altogether, this was a time-consuming job.

The cathode resistor and the oscillator grid-return resistor were both within 20% of their marked values and because of the difficulty of replacing them, they were left as is. The capacitors were difficult to undo and measure but their effect is easy to determine. If the 70pF capacitor is not about the correct value, the oscillator will not perform correctly across the band.

In addition, the gain of the valve will be low if the bypass capacitor across the 200Ω resistor is low in value. We checked this by connecting a 0.1µF capacitor from the extended wire to earth.

Ohm's law can be applied after measuring the voltage across the cathode resistor. The calculation should indicate about 6mA. It was much less than this with our set and so a new 6J8G was fitted. This fixed the problem of the set not receiving stations at the high-frequency end of the band.

The operating conditions for the 6J8G in the Hotpoint circuit are really not optimum for performance. The grid bias should be lower, giving a higher cathode current and thus increasing the gain and oscillator amplitude.

We did, however, decide to retain the original design where reasonable. Shorting out the 220Ω cathode resistor on the broadcast band is an easy way of proving the point. It improves the sensitivity on the broadcast band by about 6dB. However, to make the grounded cathode legitimate, negative bias has to be restored on shortwave.

The socket for the 6J8G in the Hotpoint chassis is shock-mounted from the chassis. We can only assume that early production versions of the valve tended to be microphonic and that this was done to prevent acoustic feedback from the 12-inch (30cm) speaker which was positioned close to the chassis.

## Stringing the dial cord

The dial cord had at some time been re-strung with ordinary string and it just wasn't working as it should. Ordinary string doesn't work as it is too slippery to provide enough friction around the pulley for the tuning knob. And it has to be tensioned properly.

In the case of the Hotpoint, the dial cord arrangement is quite complicated since it supports the long pointer at both the top and bottom of the dial. Cord sections going in the same direction at top and bottom are provided by the special stringing arrangement. In fact, it requires about 2.4m of dial cord.

You have several choices if you cannot obtain dial cord. One approach is to use the cord from slimline venetian blinds and another is to use the thin line used by bricklayers. A third possibility is to use dental floss. Fortunately, the Hotpoint chassis has a diagram for the dial stringing on the back of the dial-plate.

## Over-bright dial lamps

Dial lamps in typical vintage radios present a reliability problem if operated at the full heater voltage of 6.3V. They get very hot and they can even lead to cabinet discolouration in those with Bakelite cases.

In the case of the Hotpoint, I decided to wire a 2.2Ω resistor in series with each of the four lamps. This results in a slight reduction in brilliance but also reduces the amount of heat they produce.

## IF alignment

The next job was to align the tuned circuits and correct the dial station calibration positions. Bear in mind that the dial was originally designed when the stations were 10kHz apart in frequency; now AM broadcast frequencies have 9kHz spacing. Having said that, most of the major city stations are still close to their original frequencies.

Alignment of the 455kHz intermediate transformers can be undertaken using a local radio station and your digital multimeter (DMM). With care, the job can be done virtually as well as with a signal generator.

The positive lead of the DMM can be connected to chassis and the negative lead to a point on the AGC (automatic gain control) line which is bypassed. In the case of the Hotpoint, this could be across the .047µF capacitor at the bottom of the 1st IF transformer secondary. You may use the chosen point for the whole of the alignment procedure and it could be worthwhile arranging a "hands free" connection to the meter.

You will probably stand the chassis on end so that you can access all the adjustments. Tools such as small screwdrivers should be on hand and plastic alignment tools may be needed if some of the adjustments involve internal slugs.

An aerial wire, say five metres long, should be connected and when you tune accurately to a strong station the meter should indicate a positive value of a few volts. Carefully adjust the tuning capacitor for maximum reading. If there is a choice, use a station at the low-frequency end of the broadcast band.

Then, one by one, adjust the IF transformers for best meter reading. In most cases, the increase in reading will be small and accounted for by the aging of components. If one adjustment does not result in a peak meter reading then the IF transformer is faulty may need to be replaced. This doesn't happen with many sets.

Another possibility is that an adjustment screw or slug has jammed and can't be moved. A decision then has to be made. If, eventually, the set is sensitive enough to receive the stations needed, it could well be a reasonable decision to leave the component in place rather than face a difficult replacement.

The next job is to make the dial pointer agree with the station positions.

Tune to a known station at the high-frequency end of the band and then adjust the trimmer capacitor for the oscillator coil (25pF) so that the pointer indicates the station position correctly. That done, tune to a station at the low-frequency end of the band and adjust the core of the oscillator coil for the dial position.

When the set is tuned back to the high-frequency station, the dial position may have shifted slightly. Correct this again with the trimmer capacitor. It may be necessary to go backwards and forwards two or three times to complete the oscillator line up.

Signal frequency circuits are lined up for maximum sensitivity using the same general idea: adjusting trimmer capacitors towards the high-frequency end and inductors towards the low-frequency end. The tuning capacitor rotates through 180°. Try to make the adjustments near the 20° and 160° points.

Note: the shape of the tuning capacitor plates is the same for both the oscillator and signal-frequency tuned circuits, so tracking can only be perfect at three points on the dial: near the ends and towards the centre. The loss in sensitivity is not too serious, however. Some manufacturers in the late 1950s overcame this problem with tuning capacitors by having differently-shaped plates for the oscillator section.

If your radio has an RF amplifier stage, there will probably be two tuned circuits to adjust but the principle is the same: inductors towards the low-frequency end and trimmer capacitors towards the high-frequency end.

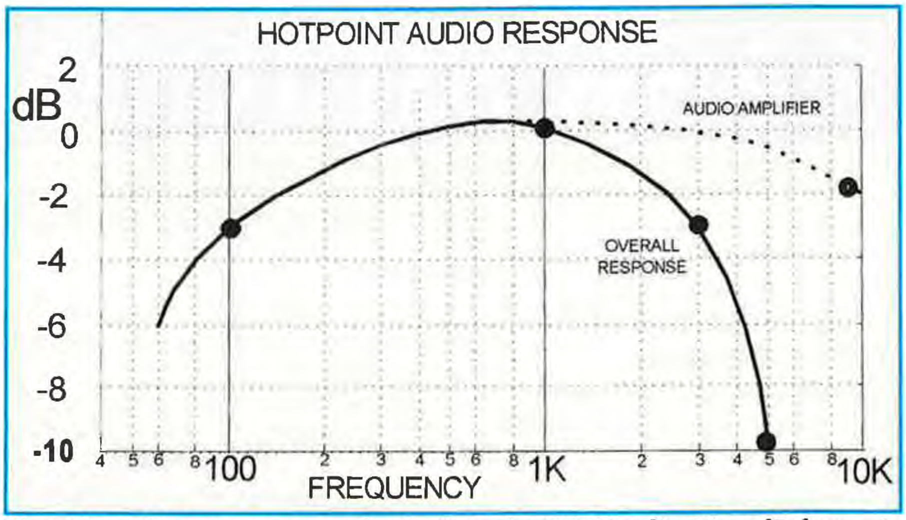



**Fig.1: the audio response curve for the Hotpoint J35DE radio. It's 10dB down at 5kHz but most people were happy with a "mellow" tone in the 1950s.**

## Measured Performance

| | |
|---|---|
| Audio Output | Max. 3W; undistorted 1W. |
| Frequency Response | -3dB @ 100Hz & 3kHz, -10dB @ 5kHz. |
| Receiver Sensitivity | 12µV @ 600kHz; 8µV @ 1500kHz; 20µV @ 10MHz |

(Signal level at receiver aerial terminal: AM signal 30% modulated @ 1 kHz for 50mW output)

Our Hotpoint presented another design problem: there is no means of adjusting the inductance of the aerial tuned circuits on either the broadcast or shortwave band. All we can do is adjust the trimmer capacitors.

Shortwave alignment without a signal generator does present a problem. The Hotpoint could never be considered as a set for the serious shortwave listener but something should be done so that strong stations can be heard. Simply turn the dial to the middle of the range and with the aerial connected, adjust the trimmer capacitor for maximum noise. This may be sufficient for some.

For those who wish to go further, use can be made of the American station WWV which transmits accurate frequency and time signals from both Hawaii and Colorado. The 10MHz signals can usually be heard at good strength in Australia in the early evening and are identified by a one-second pulse on the audio.

Simply adjust the shortwave oscillator trimmer so that WWV appears at the calibration point on the dial and then adjust the aerial trimmer for maximum volume

Once the dial calibration is correct at 10MHz, it will be easy to find the 25-metre (11.6-12.1MHz) and 31-metre (9.4-9.99MHz) bands. A long outside aerial will be desirable with sets like the Hotpoint because of limited sensitivity.

Shortwave propagation conditions around the world at the present time and probably for the next few years, tend to favour stations between about 4MHz and 12MHz so that it would be reasonable to adjust the aerial trimmer somewhere in the middle of that range.

How accurate is the alignment using the above methods?

We checked the Hotpoint with a laboratory signal generator, output test set and oscilloscope. The centre frequency of the intermediate stage was a few kHz away from the normal 455kHz but this really doesn't matter. We were unable to improve on any other adjustments.

The performance of the receiver is listed in the accompanying panel. The poor audio response is due to the narrow selectivity of the 455kHz IF stage attenuating the sidebands and is typical of AM receivers manufactured in the 1940s and 1950s, when people were happy with a "mellow" tone. The sensitivity, although not outstanding, is adequate for receiving local stations given about 5m of aerial wire extended away from shielding objects. **SC**