Vintage Radio

By Rodney Champness, VK3UG

The upmarket 1950 HMV R53A radiogram

For many well-off families, an expensive radiogram was the focal point of the family lounge room in the era from the late 1920s up until the late 1960s. It not only provided the entertainment but was also an impressive piece of furniture.

RADIOGRAMS were first developed in the late 1920s and were produced in various formats up until the 1960s when TV took over as the main source of family entertainment. During that time, they evolved from very basic units with a record player on top of the cabinet to units that had automatic record changers alongside the radio section.

Some of the very latest units also included a TV set and/or a tape recorder and some even had a cocktail section for good measure!

Of course, not all radiograms were created equal and the quality of the cabinets varied considerably. Some were impressive units made of solid high-quality timber, with timber veneers where necessary. These sets were quite imposing and were heavy but there were also many cabinets that were built to a price and were much lighter.

The radio chassis used also varied considerably in quality. Most units used a cheap and cheerful bog-standard 5-valve mantel receiver chassis driving a large speaker mounted on a baffle board. These sets often had a rather restricted audio frequency range, otherwise hum would have been quite obvious due to minimal high-tension supply ripple filtering and inadequate (or non-existent) shielding of sensitive audio leads.

By contrast, the more expensive top-of-the-line radiograms used a better-engineered chassis designed to give high-quality sound and capable of driving the speaker to high volume. These sets also generally had better RF sensitivity and stability than their cheaper counterparts.

This was achieved by increasing the filtering on the HT (high-tension) line, adequate shielding of critical leads and higher-quality audio output transformers. The audio amplifier was also beefed up, often by using a push-pull audio output stage.

Two Australian-made radiograms that were excellent performers were the STC A8551 from 1955 (featured in the January 2010 issue of SILICON CHIP) and the HMV R53A which came onto the market in 1950. The R53A described here had quite a few problems when it was obtained by its owner and was passed on to the author so that the chassis could be restored.

HMV R53A radiogram

Basically, the owner wanted to be sure that the chassis could be repaired before he undertook the cabinet restoration. As shown in the photos, the R53A is quite a large unit, with the radio chassis and the record changer

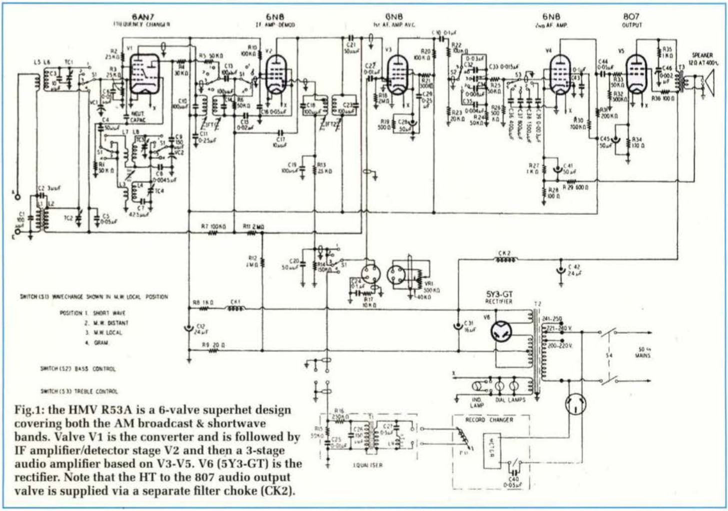


Fig.1: the HMV R53A is a 6-valve superhet design covering both the AM broadcast & shortwave bands. Valve V1 is the converter and is followed by IF amplifier/detector stage V2 and then a 3-stage audio amplifier based on V3-V5. V6 (5Y3-GT) is the rectifier. Note that the HT to the 807 audio output valve is supplied via a separate filter choke (CK2).

mounted side-by-side in separate compartments. These compartments are accessed by opening separate doors which hinge down.

It's interesting to note that the same chassis was also used in a variant which had a top-opening lid to gain access to the controls and the record changer. This was probably a down-market version as the cabinet is not as large and is somewhat lighter than the R53A's.

As it came to me, the R53A radiogram featured here was 64 years old. Its chassis was covered in dust and when I removed it, I could find only one resistor and one capacitor that had been previously replaced, along with a section of the dial cord. However, the original record changer had obviously proved to be less than reliable and had been replaced by a more modern BSR unit at some time in the past.

Circuit details

Fig.1 shows the circuit details of the HMV R53A. It's a 6-valve superhet design and covers the AM broadcast band (nominally 540-1600kHz) plus the shortwave band from 6-18MHz. The broadcast band tuning range specified is what was allocated in the 1940s and 1950s but in practice, the R53A tunes a slightly wider range of frequencies from 530-1660kHz.

As shown in Fig.1, the antenna coil's primary windings are in series with each other, with the shortwave coil acting as a low-value loading coil for the antenna.

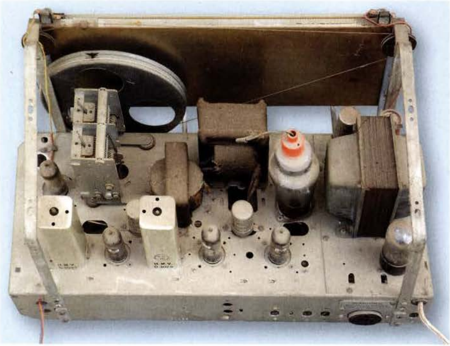
The broadcast coil primary winding resonates below the broadcast band due to the combination of L1 & C1. This gives improved performance at the low-frequency end of the band. The 3pF capacitor (C2) between the primary and secondary windings (L1 & L2) improves the performance at the high-frequency end of the broadcast band.

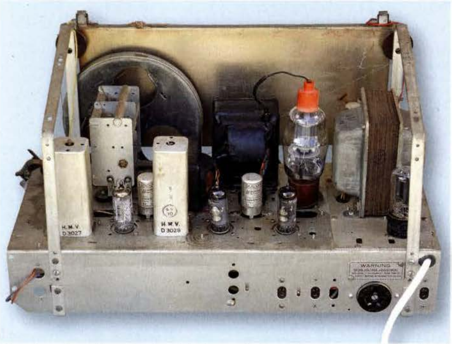
Unlike the broadcast-band coils, the shortwave coils (L5 & L6) do not use any elaborate coupling methods. That's because any antenna likely to be employed would have sufficient length to be resonant on some portion of the shortwave band. L5 is in series with L1 and although L1 will act as an RF choke on shortwave, C1 (100pF) acts as a low-impedance path to earth for the 'earthy' side of L5. This was a neat trick that was used by many manufacturers; it worked well and saved a switch section.

The antenna coils are switched as appropriate in the grid circuit of converter valve V1, depending on the band selected. Alternatively, V1's grid is shorted to chassis when the set is switched to 'Gram', to prevent RF signals breaking through.

R4 and C9 ensure that no high voltages are present in the oscillator's tuned circuits. This method was used by many manufacturers but others have the oscillator plate current flowing through the feedback winding. Either method works well but you do have to be aware that high voltages are present in the tuned circuits of some oscillator stages.

The converter stage is neutralised using a small 'gimmick' capacitor between the oscillator grid and the





These two views show the chassis before and after restoration. Note the insulated cap (red) on the top of the 807 output valve. This is the plate connection and must not be touched due to the shock hazard.

signal input grid. This 'gimmick' capacitor was made using about 20mm of insulated bell wire.

The 457.5kHz IF (intermediate frequency) appears at V1's plate and is fed to the primary winding of IF transformer IFT1. It also goes to a section of 4-position switch S1, which is the band change and 'Gram' selector switch.

In positions 1 & 2, the IF transformer is coupled in the conventional manner. However, when S1 is in position 3, resistor R10 is switched across IFT1's primary while R6 is switched across the secondary winding. Capacitor C13 is also connected between V1's plate and V2's grid.

These switched parts lower the Q of the tuned circuits and, along with the heavy top-coupling due to C13, give a wide frequency response with a dip in the middle. IFT2 (which follows V2) also has a wide response and this means that signals out to about 10kHz are amplified with little attenuation of the higher audio frequencies.

V2, a 6N8, amplifies the IF signal and, like the converter, this stage is also neutralised. This is done by C17 in conjunction with C15. The signal at the output of IFT2 is fed to the detector diode in V2. The resulting audio signal is then fed to another section of switch S1 which selects the audio signal from either the radio or the record changer and feeds it to a 4-pin socket. The volume control is wired to this socket and its output is then fed back via this socket to the input of V3, another 6N8.

It's difficult to understand why the volume control was attached via a plug and cable to the chassis and not mounted on the front of the chassis like the other controls. In this case, the volume control is mounted on a side panel of the radiogram, possibly so that it could be accessed with the door to the radio section closed.

V3 amplifies the volume control signal and in turn drives separate bass and treble control networks. The resulting signal then goes to V4, another 6N8, which further amplifies the signal before feeding it via C44 to the grid of an 807 output valve (V5).

V5 again amplifies the audio signal and then feeds it via a substantial audio transformer to a 12-inch (~30cm) loudspeaker. This circuit includes voice-coil negative feedback which is fed back to the cathode circuit of V4. Note that the 807 is not bypassed at the screen but via a 100Ω resistor (R36). Some valves, including the 807, can be unstable if they are not bypassed in this manner.

The power supply is based on full-wave rectifier V6 (5Y3-GT) and is quite conventional. The HT (high tension) line has two filter chokes (CK1 & CK2), with CK2 feeding just the 807 output valve (V5) and CK1 feeding HT to the remainder of the receiver. Note that back bias is applied from the top of resistor R9 to the AGC diode in V3 and to the grids of V1 & V2.

Conventional delayed AGC is used with -2V of delay. As a result, both V1 & V2 are biased at -2V, as is the AGC diode in V3. No additional bias is developed until the IF signal at the plate of the AGC diode exceeds 2V peak.

Restoring the chassis

Removing the R53A's chassis from

The two tone controls, the tuning control and the band-switch are mounted just below the dial, while the volume control is mounted on a side-panel of the cabinet.

The original record changer had obviously given trouble because it had been swapped out for this more-modern BSR unit. It sits on a shelf that slides out of the cabinet.

the cabinet is quite straightforward. First, the plywood sheet covering the back of the receiver is removed, then the knobs are removed by pulling them off their spindles. The volume control is then removed by unplugging its cable from the socket on the top of the chassis, then undoing the three screws which secure it to the side of the chassis.

Next, the four screws underneath the chassis shelf are removed and various leads at the back of the chassis disconnected (ie, antenna/earth leads, speaker lead, record changer leads, etc). The 'on' light lead to the bottom of the cabinet must also be disconnected. This entire procedure takes just few minutes.

Once it was out of the cabinet, the chassis was carefully dusted using a paintbrush and cleaned with a kerosene-soaked rag. This also worked wonders on the black sealing material used on the transformers. The cabinet was then brushed down and a damp sponge used to remove any ingrained dust from the woodwork.

There was no corrosion to any extent and the chassis looked quite presentable. This old HMV R53A has obviously been stored in a dry environment to still be in such condition.

As is my usual practice, my next step was to remove all the valves and wash them in warm soapy water. The miniature valves were simply dunked in the water and the glass envelopes rubbed clean. However, you have to be careful not to remove the type markings, as these can easily be rubbed off. These valves were then rinsed under clean water and allowed to dry.

Valves like the 5Y3GT and the 807 have Bakelite bases and have to be treated more carefully. For these types, the valves were simply turned upside-down and the envelopes carefully washed while taking not get any water into the bases. They were then rinsed with clean water and left to dry upside-down.

Replacing faulty parts

The next job was to replace all the electrolytic capacitors and any paper capacitors that were excessively leaky. The paper capacitors were tested for leakage using a high-voltage insulation tester. This tester was then set to its 1000V range and used to check the insulation of the power transformer. In this case, the resistance from the mains winding to earth was found to be in excess of 100MΩ, which is quite satisfactory.

In order to maintain the original appearance, the faulty electrolytic capacitors on the top of the chassis were left in place but were disconnected from the circuit. New capacitors were then fitted in place under the chassis. The most critical capacitor is the one connected to the 5Y3GT as this rectifier doesn't 'like' high surge currents flowing through it. In this case, C31 was initially replaced with a 10μF 525V capacitor (see below).

The two components (one resistor and one capacitor) that had been replaced earlier in the set's life had failed again and so new parts were substituted for these. A couple of other resistors were also found to be well out of tolerance and were also replaced.

That done, the dial mechanism and all the movable controls were lubricated using either light machine oil or Inox® lubricant. These controls then all worked smoothly and were free of mechanical noise. The original 2-core power lead was also replaced with a securely anchored 3-core lead so that the chassis could be safely earthed.

Getting it going

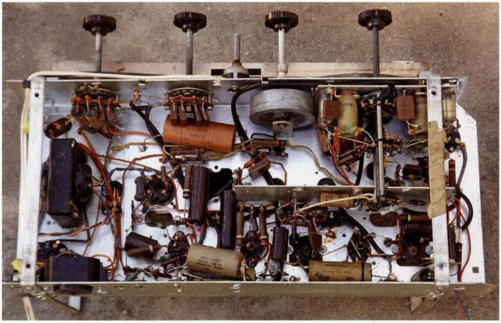
It was now time for a smoke test (well, actually I hoped that there wouldn't be any smoke).

First, the loudspeaker was removed from its baffle inside the cabinet and connected to the receiver, along with an antenna and earth. The HT line was then checked for any shorts to chassis, after which the set was connected to mains power and switched on with the multimeter now monitoring the HT voltage.

It was all something of an anti-climax because the HT voltage rose and settled down as expected. Because the 5Y3-GT heats up more quickly than the other valves in the set, the HT initially rises up to around 400V before settling down to about 290V out of the rectifier when the other valves warm up. As expected, the HT is somewhat lower when measured at the filter capacitors following the two filter chokes.

Once the valves had warmed up, the set then burst into operation and it sounded quite good except that hum was evident in the audio. The cause wasn't hard to find – I had replaced filter capacitor C31 with a 10μF unit which was inadequate for this set.

I tried replacing this capacitor with the only 16μF capacitor I had but the hum was still quite evident. I then



All the parts under the chassis of the HMV R53A are readily accessible. This view shows the chassis prior to restoration – some parts were replaced to get the set going, while the 2-core mains cable was later replaced with a 3-core cable so that the chassis could be earthed.

installed a 22µF capacitor across C12 but it was still not enough so I decided to try decoupling the plate and screen leads to V3. This involved installing a 4.7µF capacitor between the junction of R20 & R21 and chassis, plus a 10kΩ resistor from R20/R21 to C12.

That finally reduced the hum to quite a low level, such that it was just audible with my ear near the speaker cone and with the volume control turned right down.

The set goes dead

The hum problem had no sooner been solved when the set suddenly went dead. There was no audio so there was clearly something wrong with the audio amplifier stage.

A few quick checks showed that while there was plenty of voltage on the plate and screen of the 807 output valve, there was no voltage drop across its cathode resistor. Substituting another 807 cured the problem, so that problem was easily solved.

By the way, the 807 valve is a moderately-large 5-pin valve that was originally designed for use in medium-sized communications transmitters during the 1940s. And here a word of warning: if a set uses an 807 and there is no protective top cap cover on the connector, don't be tempted to put your finger on it while the set is operating (ie, while power is applied). This is the plate terminal, not the grid, and you will get a nasty high-voltage shock if you do.

Although the set was quite sensitive, further checks revealed that very little AGC voltage was being developed between the junction of R7 & R11 and the chassis. I had expected around 10V of AGC when the set was tuned to a local broadcast station but I was only getting about 2.5V.

I checked the voltages around valves V1 & V2 and they appeared normal so I tried substituting a new 6N8 for V2 and the performance improved quite noticeably. The AGC voltage also shot up to somewhere near the expected level. The chassis was then left on test for quite a few hours to make sure there were no further problems lurking in the background.

Checking the alignment

The next step was to check the alignment. First, I tried tweaking the antenna trimmers on both the broadcast and shortwave bands but couldn't improve the performance, so the original settings were retained. However, when I checked the IF amplifier, I found that the centre of the IF passband changed by about 4kHz when I switched S1 between the distant and local positions.

This shift in the passband centre is caused by the top coupling between the two tuned circuits in the first IF transformer. If the set had used bottom coupling instead, the frequency shift would have been in the opposite direction. This means that the best method of maintaining the same centre frequency is to have both top and bottom coupling between the two tuned circuits.

In the end, by carefully adjusting the IF alignment, I was able to minimise this effect and get close to a common passband frequency centre for the local and distance switch positions.

Record changer repairs

Observing the operation of a record changer mechanism isn't normally an easy job. However, back in the October 2000 issue of SILICON CHIP, I described a home-made servicing aid which allowed a changer to sit up on 300mm-high dowels, so that the mechanism could be observed during operation.

As shown in one of the photos, I also used this device when I overhauled the R53A's changer. As mentioned, the original changer had obviously given trouble because it had been replaced with a more-modern BSR unit.

The biggest problem with this changer turned out to be the pick-up cartridge – it simply had no output. Unfortunately, a direct replacement is now almost impossible to obtain and after looking through many catalogs, the only generic pick-up that was suitable was listed by WES Components of Ashfield in Sydney.

It wasn't a drop-in replacement, however, and the tone-arm mounting had to be carefully modified so that it could be installed properly. It wasn't a difficult job but it did take more time than expected.

Stylus pressure

One thing that's important with the pick-up is to correctly adjust the stylus pressure. Up-market hifi turntables may specify just 1.5g to 3g of stylus pressure, whereas most record changers intended for the broad consumer market have stylus pressures of 5-7g. If more than this is required to get the tone-arm to track the record properly, then the sliding surfaces in the mechanism probably need lubricating.

The downward stylus pressure is controlled by either a spring at the vertical pivot point of the tone-arm or, in some cases, the weight has to be adjusted at the head. In this case, the new pick-up was lighter than the original, so I had to add some weight

Now that the radio and record changer have been repaired, the next job is the cabinet restoration. One of the bottom doors is missing and will have to be made.

The record changer was serviced by sitting it on top of this homemade jig.

into the shell where the cartridge is located. Some shells already have weights installed but if not, metal washers can sometimes be used to increase the pressure on the stylus.

I didn't have a stylus pressure gauge, so I used our digital kitchen scales to get the weight correct. These scales can measure down to 1g, which is good enough for this job.

Having set the stylus pressure, I then cleaned any old congealed grease off various surfaces and applied fresh, light grease in its place. The motor bearing and various pulley bearings were then oiled. This was relatively straightforward although I did have to dismantle the motor to gain access to its bearings. In fact, this should be done every few years as these motors can seize up if they are not lubricated and this particular unit was very close to that point.

The various other adjustments on the changer were all spot on. The stylus drop-in point was correct, the speed change mechanism worked well and the record dropping and cut-out mechanisms all worked as they should. BSR record changers were relatively simple compared to some other brands and it is rare for them to have any major problems.

Summary

For its time (circa 1950), this is one of the best radiograms I have ever worked on. The receiver section is quite sensitive, the dual-bandwidth IF amplifier works well, the audio output is more than adequate and the audio bandwidth and clarity are excellent. And once the owner finishes the cabinet restoration, the old HMV R53A will look great too.

The chassis is also easy to work on and is well laid out, with most components easily accessible. HMV used lots of plastic-sheathed shielded audio and RF cables which were only earthed at one end to prevent induced hum from the heater circuits.

One very worthwhile feature is a 'rollover cage' over the top of the chassis. This makes it easy to tip the set over for servicing without risking damage to fragile parts such as valves.

The circuitry also shows considerable attention to detail and includes neutralised IF amplifier and converter stages to ensure stability. It certainly ticks most of the boxes for good design. The chassis was also obviously designed to accommodate a number of sets of the era as there is an extra cut-out for an additional IF transformer and the power transformer is mounted on a plate at one end of the chassis.

In fact, I have a HMV model 268 receiver which started life as a vibrator-powered set but was converted to 230VAC operation as described in May 2000. Its chassis layout is almost identical to the R53A's, so HMV had developed a layout that worked well for many quite different models.

If you have the room and want to enjoy the sound from one of the better early radiograms you couldn't go past the HMV R53A. And if it had been fitted with a dual-cone speaker it probably would have sounded even better than it already does. SC