Vintage Radio

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More Philips Twins – the Dutch 209U and the Australian 112A

Continuing on with our series of Philips twins, this month we take a look at the Dutch Philips 209U multi-band receiver and its Australian "twin", the model 112A. Under the skin though, these are two very different receivers.

LIKE OTHER Dutch/Australian Philips twins, the 209U and 112A receivers look the same at first glance but on closer inspection, are as different as chalk and cheese. In this case though, there is a slight difference in cabinet size, so the Dutch parent company obviously produced more than one variant of this particular cabinet style with only minor differences between them.

As before, the cabinet moulds for the Australian-built receiver were obtained from the parent company, probably after the parent company had finished with them. The Dutch 209U receiver was manufactured from 1946-1947 while its Australian look-alike was produced somewhat later, from 1948-1949.

Model 112A circuit details

Fig.1 shows the circuit details of the Australian Model 112A. It's a fairly conventional 4-valve superhet receiver with 455kHz IF stages.

As shown, the antenna signal is fed to a tuned circuit consisting of L1 and C1 and resonates at a frequency just below the broadcast band. This boosts the sensitivity of the receiver at the low-frequency end of the band, while trimmer capacitor C2 boosts the performance at the high-frequency end by feeding signal into coil L2. The signal in L1 also inductively couples into L2.

Basically, the tuned antenna circuits in sets of this era and later were designed to extract the maximum amount of signal from relatively short antennas. In effect, this was done by partially tuning the antenna using fixed value components. This technique significantly improved receiver performance compared to sets using the antenna-tuned circuits of the 1920s.

As an aside, to get the best performance from crystal sets, additional tuned circuits for the antenna are used. These must be capable of tuning the antenna right across the band, as in the crystal set described in the April 2007 issue. In addition, high-frequency 2-way radios must also

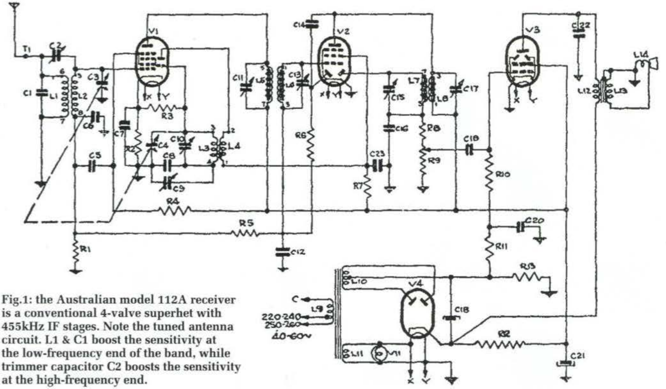


Fig.1: the Australian model 112A receiver is a conventional 4-valve superhet with 455kHz IF stages. Note the tuned antenna circuit. L1 & C1 boost the sensitivity at the low-frequency end of the band, while trimmer capacitor C2 boosts the sensitivity at the high-frequency end.

have fully tunable antenna circuits (ie, the antenna must be tuned to the operating frequency) if they are to work efficiently.

Getting back to Fig.1, the RF signal from the antenna circuit is tuned using C3 (one section of the dual tuning gang). The resulting signal, in the range from 530-1620kHz, is then applied to the signal grid of V1, an ECH35 converter.

Note that no provision has been made to adjust the inductance of L2, so it cannot be peaked at the low-frequency end of the tuning range. However, by adjusting the position of the dial pointer and adjusting the oscillator padder capacitors to suit, some peaking the set's low-frequency performance is possible. It's a fiddly process though and doesn't always achieve perfect results (the article on alignment in the February 2003 issue described the techniques necessary for good results).

At the other end of the band, C2 is adjusted to peak the performance at around 1500kHz.

The view inside the model 112A receiver. The chassis is well laid out and all parts are readily accessible.

Local oscillator

The local oscillator is based around V1, coils L3 and L4, the other section of the tuning gang (C4) and their associated components. The values of padder capacitors C8 and C9 are adjusted so that stations appear at the correct position of the dial at the low-frequency end of the tuning range, while C10 is used to do the same thing at the high-frequency end.

V1's output appears at its plate and this is coupled to a double-tuned 455kHz IF (intermediate frequency) transformer. The resulting 455kHz IF signal is fed to V2, an EBF35, where it is further amplified and then applied to another double-tuned 455kHz IF transformer. Its output is in turn fed to a detector diode in V2.

The resulting audio signal from the detector appears across R8 and volume control potentiometer R9. From

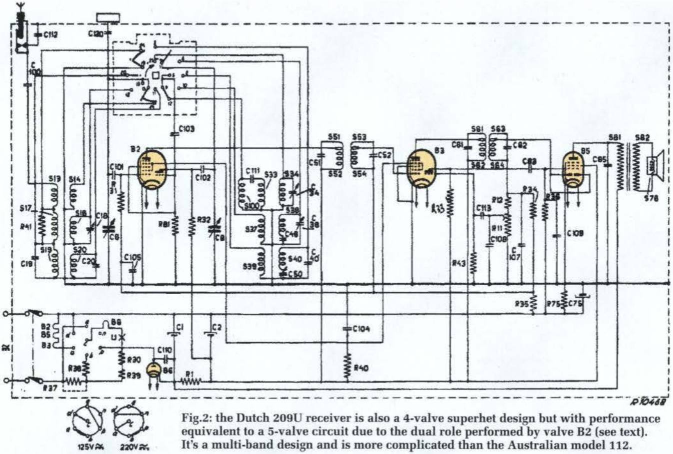


Fig.2: the Dutch 209U receiver is also a 4-valve superhet design but with performance equivalent to a 5-valve circuit due to the dual role performed by valve B2 (see text). It's a multi-band design and is more complicated than the Australian model 112.

there, the signal is fed via C19 to the grid of V3, a 6V6GT audio amplifier stage. This stage in turn drives the loudspeaker via an output transformer (L12/L13). No negative feedback is used in the audio amplifier.

Simple AGC

The IF signal level at V2's plate is greater than it is at the detector diode and this signal is also applied to the AGC diode via C14. This set has simple AGC and as soon as there is any signal (including any interference or other noise), a small AGC bias appears on the AGC diode. This is a good design feature as V2 has no standing bias and the set will normally be tuned to a station. However, it would not be considered good design practice in a communications receiver.

By contrast, the converter stage (V2) does have standing bias due to the voltage across R2. Note that the converter receives just 20% of the AGC voltage applied to the IF valve due to the voltage divider formed by resistors R1 and R5.

The power supply is designed to operate off voltages from 220-260VAC at 40-60Hz. Australia now has 50Hz mains but 40Hz was used in Western Australia for some time and 60Hz is used in the USA (although it's doubtful that Philips exported this set to the USA). However, it was a good selling point and it's possible that some of the home-lighting plants of the era ran at 60Hz.

Power transformer

The power transformer has two secondaries: (1) 6.3V for the valve heaters and dial lamps and (2) a 376V centre-tapped secondary for the HT (high tension). Note resistor R13 (250Ω) between the centre tap and the chassis. The voltage developed across this is fed to V3's grid via R10 and R11 and provides a bias of -9V for this stage.

Finally, resistor R12 decouples the HT supply at V3's plate from the HT line fed to other sections of the receiver. This is good design practice as it minimises IF and audio feedback between the stages.

The Dutch 209U circuit

Now let's take a look at the circuit for the Dutch 209U receiver – see Fig.2. This is a very different circuit to the one used in the 112A. It's also a 4-valve superhet receiver but in this case, the first stage uses a UCH21 triode heptode (B2). This valve can be used as a separate pentode and triode and/or as a converter. In this receiver, it is used as both and so it has the performance of a 5-valve set.

Unlike the 112A, which tunes the broadcast band only, the 209U is a multi-band receiver. The tuning ranges cover three bands: 157-400kHz long wave, 530-1600kHz medium wave (broadcast band) and 5.88-18.2MHz shortwave. In addition, this receiver is designed to work on both AC and DC mains and as such, can have a live or "hot" chassis.

Hot-chassis sets are considered by most vintage radio collectors to be dangerous to work on, as any carelessness can lead to a severe electric shock or even death. In fact, they are often shunned because of this and only those who know what they are doing and are aware of the dangers should work on them

That said, a receiver that uses a power transformer to isolate the mains from the chassis can be quite dangerous too, as these may have an HT rail voltage in excess of 500V DC (ie, across the main electrolytic filter capacitors) soon after switch-on. This HT rail is also capable of delivering a fatal electric shock and so all sets need to be treated with respect, not just the hot-chassis AC/DC types.

Valve heater voltages

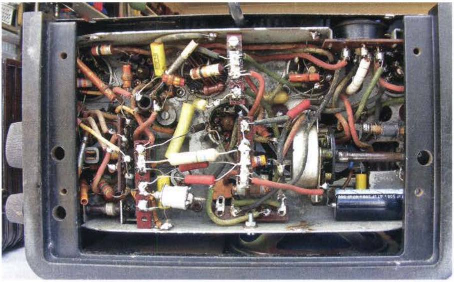
The valves used in the Dutch 209U receiver have 20V, 50V or 55V heaters, each rated at 100mA. As a result, when these are connected in series, a heater supply rail of 20 + 20 + 55 + 50 = 145V is required. Connecting a resistor or resistors in series with these heaters allows the set to be operated from 220V.

If the set is to operate from 125V, the heaters are instead switched into two strings with three heaters in series on one string and the rectifier heater on the other. Series resistors are then used to reduce the voltage drop across each string to the required 125V.

The necessary switching to do this is achieved via a plug-and-socket arrangement on the rear apron of the chassis. By changing the wiring to a couple of resistors in these strings, it's also possible to run the set on either 110V or 200V. The wiring is such that when used on AC, the HT voltage is of the order of 150V. When operated from 220V, the current drain is around 100mA for the heaters plus a further 70mA for the plate and screen loads of the valves.

Because this is an AC/DC receiver with a "hot" chassis, the antenna lead has a capacitor in series with it, so that no voltage appears on the antenna. There is no earth on this set; instead, it relies on the mains to effectively act as the earth.

This view of the model 112A shows just how few parts there are underneath the chassis. Note that this photo was taken before the power cord was rewired and properly clamped into position (the Earth connection was also later improved).



The Dutch 209U's chassis is more crowded than the model 112A's and is further complicated by the band-switching arrangement at lower left. As a result, it's the more difficult of the two sets to service.

Foil plate antenna

In addition to the external antenna, there is also a foil-plate antenna on the inside of the back panel of the receiver. This is also isolated by a capacitor to make sure no mains voltage appears on it. This antenna is shown at the top-left of the circuit diagram and is connected to the signal grid of the UCH21 triode-heptode converter valve (B2) via C120 and C101.

When aligning the receiver, this plate antenna must be attached and the back panel fitted in place as it affects the antenna input tuning adjustments at the high-frequency end of each tuning range.

As shown in Fig.2, all the antenna input coils are wired in series and various sections shorted to earth as required. At the same time, the secondaries are switched to valve B2's signal grid, depending on the selected frequency band. The oscillator circuits are also switched as required to the triode section of the B2 converter valve.

The mixed signals appear at the plate of B2 and are fed to a double-tuned 452kHz IF transformer (S51-S54). However, one version of the receiver has an IF of 468kHz.

Next, the resulting 452kHz IF signal is fed to the signal grid of the heptode section of valve B3 (UCH21). B3 amplifies this IF signal and it is then fed through a second double-tuned IF transformer. It then goes to the detector and AGC diodes in B5, a UBL21 duo-diode-power pentode valve.

The detected audio appears across resistor R12 and volume control potentiometer R11, with the signal at R11's wiper then fed to the grid of the triode section in valve B3. The amplified signal from B3 is then fed via C83 to the pentode section of audio output