Vintage Radio

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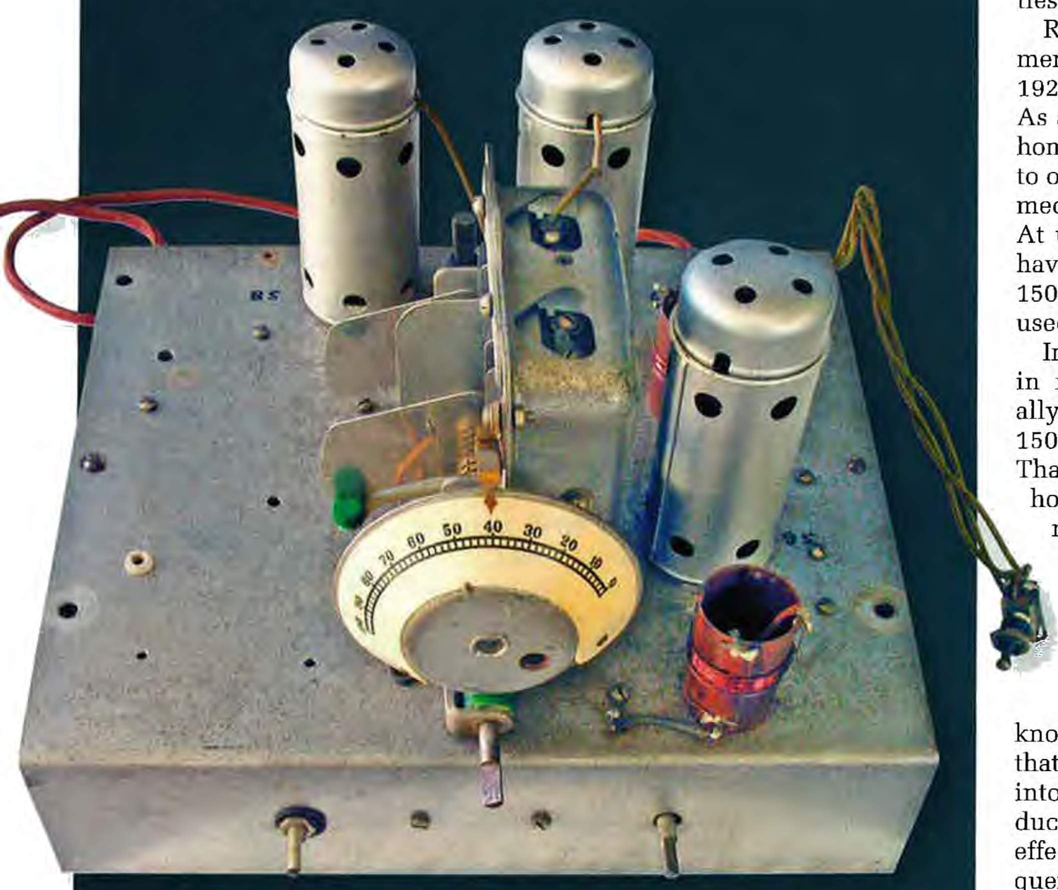
Shortwave converters from the 1930s

Shortwave converters were popular for a brief period in the 1930s and 1950s. In an era when money was tight, they provided a low-cost means of converting a standard broadcast-band receiver to shortwave reception.



This view of the AWA C103/43 converter shows the layout on the top of the chassis. All parts are readily accessible, making it easy to service.

INITIALLY, radio transmissions were broadcast on frequencies ranging from 100kHz to 1500kHz (ie, on wavelengths from 3000 metres to 200 metres, respectively). However, there were some high-power transmissions below 100kHz.

Basically, all "important" transmissions were licensed or permitted to operate in this general frequency range. By contrast, those "pesky" experimenters and amateurs were permitted to use any of the so-called "useless" frequencies above 1500kHz. Because of this frequency allocation, they were not expected to be able to contact each other over long distances but they quickly proved the authorities wrong!

Radio transmissions for entertainment commenced during the early 1920s and quickly became popular. As a result, radio manufacturers and home constructors developed receivers to operate on both the long-wave and medium-wave bands (100-1500kHz). At the time, there was no reason to have radios capable of tuning above 1500kHz, since those frequencies were used only by the experimenters.

In any case, the components used in radios at the time were generally unsuitable for frequencies above 1500kHz, as was the layout of the sets. That didn't deter the experimenters, however. They immediately set about making the most of the frequencies that they were permitted to use and began by experimenting with ways to improve both the stability and the performance of their receivers and transmitters.

In some cases, they were even known to remove the valve bases so that the valves could be wired directly into the circuit. This was done to reduce the inductance and capacitance effects that limited a valve's high-frequency response.

By the end of the 1920s, experimenters had convincingly proved that the frequencies above 1500kHz were not useless. In fact, they permitted worldwide communications under the right circumstances.

The governments of the day soon realised that these shortwave transmissions could be used for inter-continental communications to suit their own needs. They could also be used to broadcast "propaganda" thinly disguised as entertainment to people overseas. As a result, shortwave stations were set up and because components, circuit design and layout had greatly improved over the decade, both the receivers and the transmitters worked quite effectively on the shortwave bands.

Shortwave converters

The introduction of shortwave transmissions was naturally accompanied by a corresponding demand for new receivers capable of receiving the new frequencies. However, not everyone had the money for this and instead wanted to "modify" their existing receiver.

The answer was to fit what was called a "shortwave converter" ahead of a conventional broadcast-band (medium-wave) receiver. A converter stage was, in fact, nothing more than the front-end of a superheterodyne receiver and effectively converted stations on shortwave to the broadcast band (ie, the IF output of the converter was in the broadcast band).

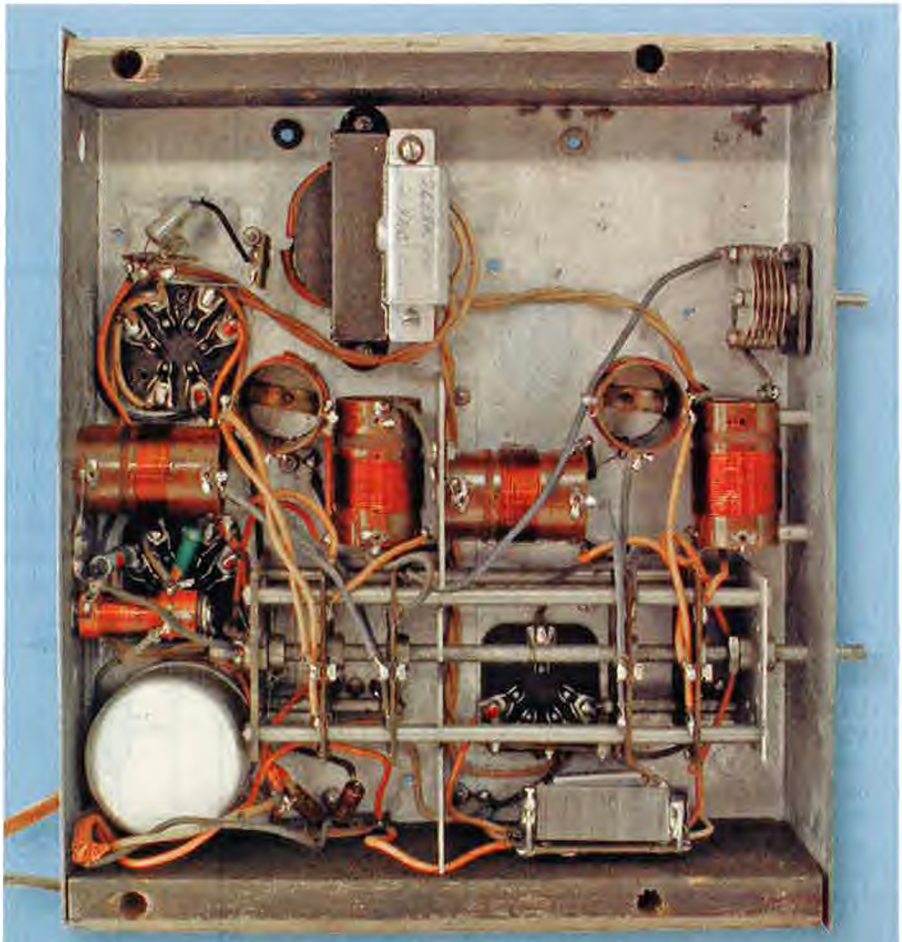
In practice, this meant that a tuned radio frequency (TRF) receiver became a superhet receiver when a converter was connected to it, while a normal superhet receiver became a double-conversion superhet.

AWA C103/43 converter

I recently had a chance to examine two such shortwave converters, one an Australian design and the other an American design. Both are circa 1930/3 and neither has been restored at this stage.

The AWA C103/43 converter is set up in the following manner. First, the antenna lead is removed from the broadcast receiver and attached instead to the antenna terminal of the converter. The yellow wire coming out of the converter is then connected to the antenna terminal of the broadcast receiver – this is the converter's RF (radio frequency) output lead.

Next, the earth wire to the receiver remains in place and the black wire



This is the under-chassis view of the AWA C103/43 shortwave converter. Despite its age, it is still in remarkably good condition and requires little in the way of restoration.

The AWA C103/43 shortwave converter is housed in a wooden cabinet. This is also in good condition and will be easy to restore.

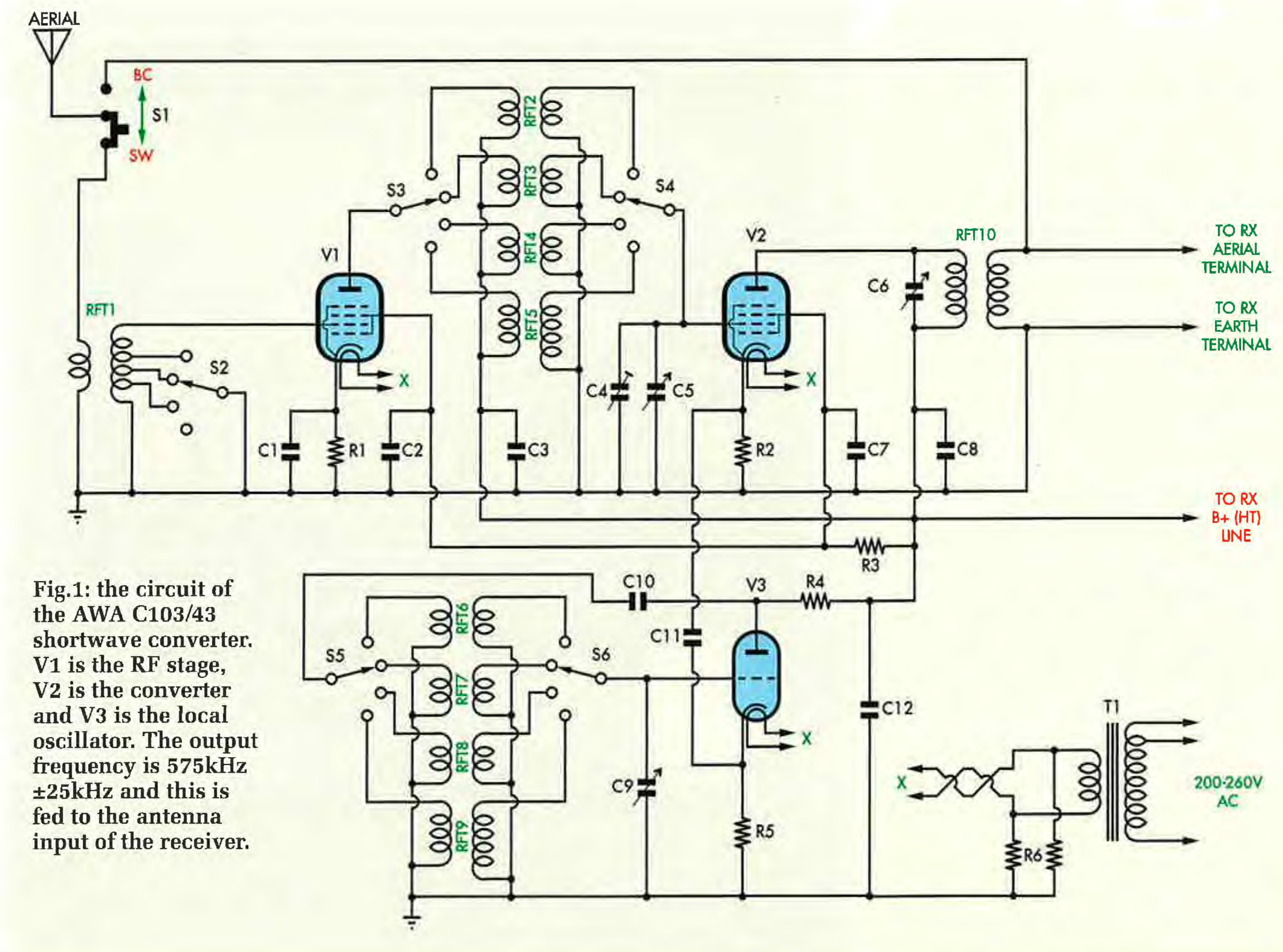
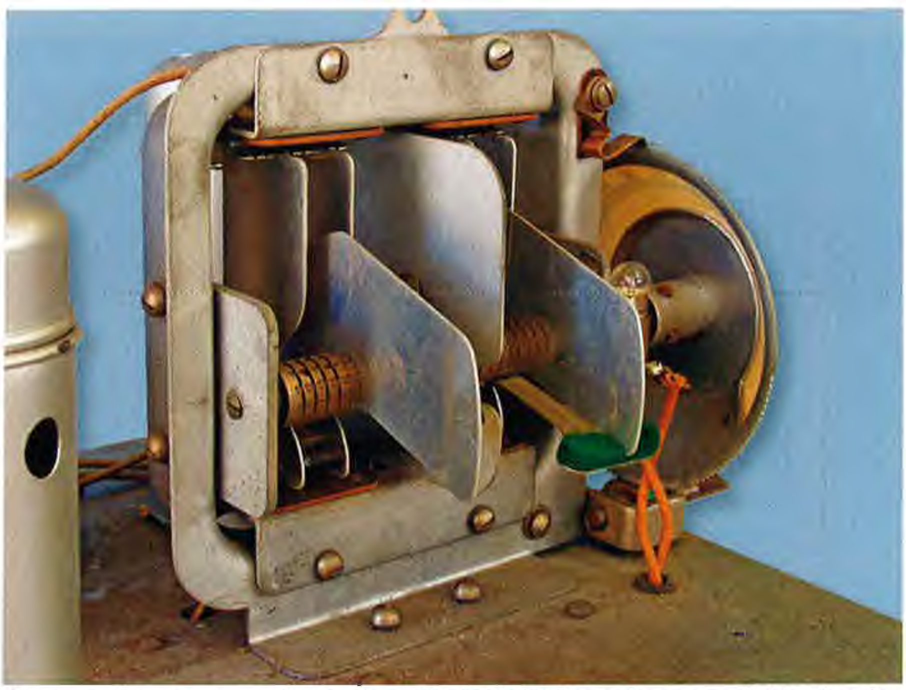


Fig.1: the circuit of the AWA C103/43 shortwave converter. V1 is the RF stage, V2 is the converter and V3 is the local oscillator. The output frequency is 575kHz ±25kHz and this is fed to the antenna input of the receiver.



The ganged tuning capacitor in the AWA C103/43 has only one variable plate in each section. This means that the converter tunes over a fairly limited range on each of its four bands, rather than tuning across the entire shortwave band (ie, it was designed to tune the four international shortwave bands only).

from the converter is attached to the same terminal. Also in this batch of cables is another wire coloured red. This red lead has a 4-pin plug attached to its end. The 80 rectifier in the receiver is removed and this 4-pin adaptor is then plugged into the rectifier's socket. The 80 rectifier is then plugged back into the receiver via the 4-pin adaptor.

Why is this done? Simple – the red wire is connected to the HT high-tension output of the 80 and thus supplies the necessary HT to the converter. How's that for cutting costs in the converter unit?

By contrast, the heater supply for the converter's valves is obtained from an internal 240V to 2.5V filament/heater transformer.

The final connection simply involves plugging the 240V lead into the mains. There is no on-off power switch on the converter and in most cases there was no on-off switch on the radios of the era either. So to turn the system off completely, it was necessary to turn two power points off (one for the converter and one for the receiver), unless a double adaptor was in use.

The controls

The cabinet of the AWA C103/43 was rather tall and chunky for the time and has quite a dark colour. The unit I have is in quite good condition and requires little in the way of restoration.

The front panel carries three controls and a "peephole" type dial. The lefthand knob controls a trimmer capacitor to peak up the performance on the selected band and this trimmer is C4 in the circuit diagram (Fig.1). The centre knob is the tuning control, while the righthand control is the 4-position wave-change switch. A broadcast/shortwave toggle switch is also located on the side of the cabinet.

In practice, the front-panel controls are well spaced and easy to use. However, it's a mystery why the broadcast/shortwave switch was not placed on the front panel as well.

In summary, the unit is quite neatly made both above and below the chassis and would not be difficult to work on if required.

Circuit details

Fig.1 shows the circuit of the AWA C103/43. The ganged tuning capacitor is interesting in that each gang has only one variable plate in each section. This means that the converter was designed to tune over a fairly limited range on each band selected.

The RF stage is broadly resonant on the shortwave band selected and has no variable tuning capacitor. This stage uses a 58 valve (V1), the output of which is coupled via band-switching to converter stage V2 (a 57 valve). The LC circuits between these two stages are tuned by one section of the tuning gang.

To enhance frequency stability and general performance, a separate oscillator valve (V3) is employed. This uses a 56 valve and its cathode output is fed to the cathode of the converter stage (V2) via capacitor C11.

The output from the converter stage is applied to a single IF (intermediate frequency) transformer, tuned to 575kHz ± 25kHz. Its output is in turn fed to the antenna terminal of the receiver via an unshielded yellow wire.

It's open to conjecture as to just how stable this would be and whether stations close to 575kHz would be picked up by this unshielded antenna wire. It was undoubtedly necessary to tune the IF transformer away from any radio stations in the 550-600kHz range to alleviate this problem.

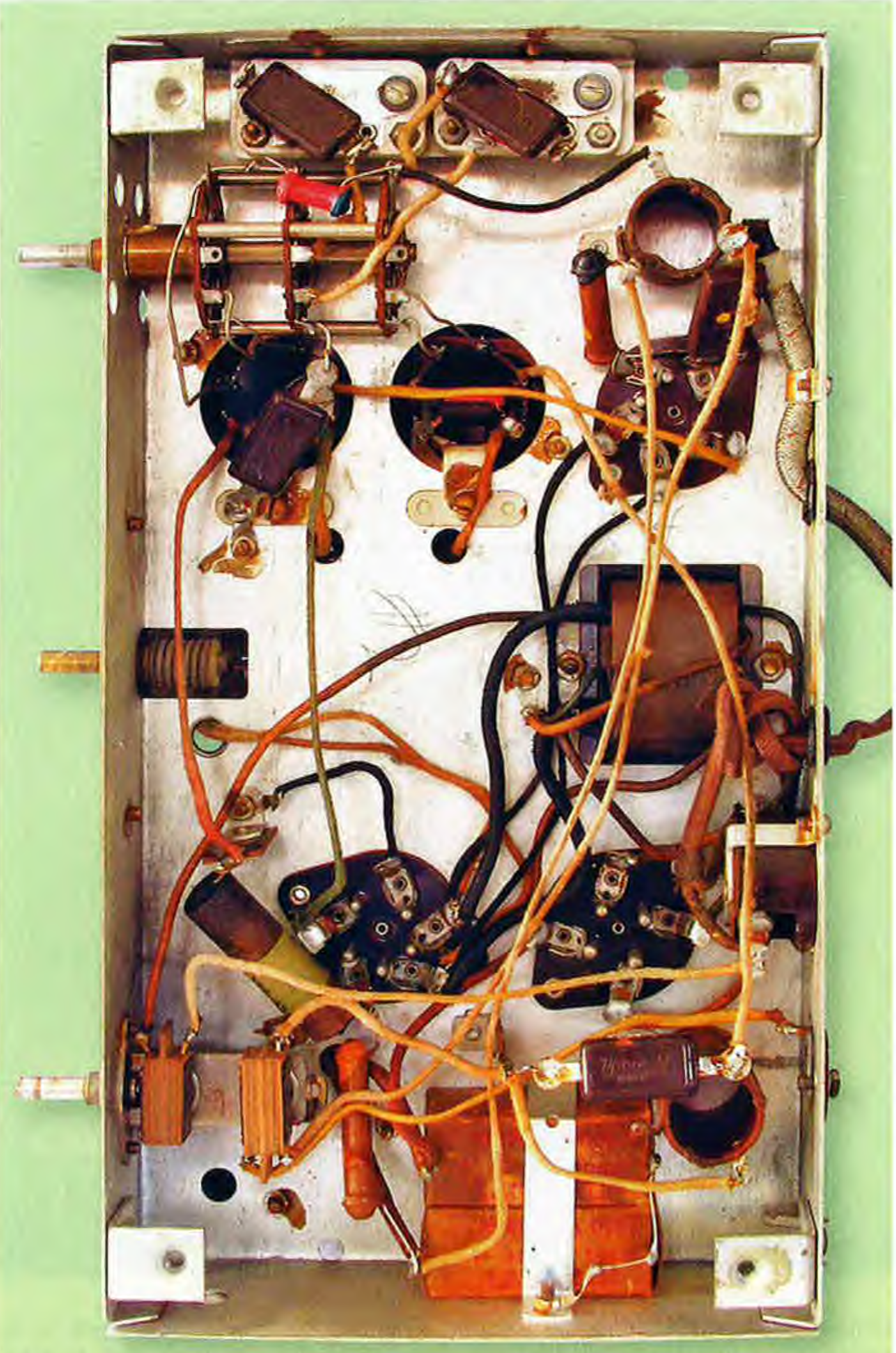
As with the AWA unit, the US-made Apex converter is fitted into a wooden cabinet but has an easier-to-read dial. Note that someone has placed the wave-change knob on the wrong shaft in the top photo.

By the way, there is some doubt as to which valves were actually used in the converter, as the diagrams, the circuit and the manual don't match in several areas. There was obviously not much care taken when it came to proof-reading and checking the manual.

The bands tuned by the converter are the 49, 31, 25 & 19-metre international broadcasting bands, which equate roughly to 6, 9, 12 & 15MHz. Providing the RF and oscillator coils are correctly aligned, the converter should be as easy to tune as the broadcast receiver to which it is connected. Mechanical band-spreading is achieved by the single plate gang sections with their restricted tuning range.

Apex converter (USA 110V)

The American Apex converter dates from around 1930 and is different in several ways to the Australian unit. It's attached to the receiver by first removing the antenna lead from the set and attaching it to the antenna terminal of the Apex. The output from the Apex is fed out via a shielded cable and this goes to the antenna and earth terminals of the receiver.



The Apex converter is a snack to service, with all parts under the chassis easy to access. At top right is the above-chassis view.

Unlike the AWA unit, the Apex converter relies solely on its own power supply and is designed to plug into a 110V AC mains outlet. That means that it is a little easier to connect than the AWA unit.

The controls

The Apex converter is housed in an attractive wooden cabinet. As shown in the photo, the controls and tuning escutcheon are arranged in an easy-to-use layout on the front panel. The knobs are somewhat unusual, being made of wood with a metal insert.

The lefthand control is used to switch the unit from the broadcast band to shortwave. It does this using a pair of toggle switches which are ganged together. In the broadcast position, all power is removed from the converter.

The central control is the tuning control and the dial in this unit is larger and easier to read than the dial on the AWA converter.

Finally, the righthand control is a 3-position wave-change switch and the knob is labelled "H", "M" & "L". I am unsure of the tuning range on this converter, but suspect that it tunes from about 2-22MHz as it has three bands and a full-size 2-section tuning gang.

This converter also has three valves: a 24 converter stage, a 27 (or 56) which is used as a local oscillator and an 80 rectifier in the power supply. The valve types are marked on the sockets themselves, so only a very careless person would get the valves mixed up.

The Apex converter has no RF stage, so it will not be as sensitive as the AWA unit. Its image ratio may not be as good as the AWA unit either. However, if the output frequency of the converter is close to 1500kHz, instead of 575kHz as in the AWA unit, the image ratio will be quite satisfactory.

Another difference between the two units is that the output frequency of the Apex converter isn't directly adjustable. However, if break-through from a strong local broadcast station did occur, the output frequency could easily be altered by changing the value of the fixed capacitor on the output coil.

Unlike the AWA converter, this unit tunes over quite a wide frequency range on each band selected. This in turn means that the tuning would be quite critical. However, fine tuning of any station can be achieved by

altering the tuning of the broadcast receiver that it is connected to by a few kilohertz.

Performance

Although I haven't used the AWA converter (as it has not yet been restored), I believe that it would acquit itself quite well. The bandspread tuning (over four bands) is certainly a plus for the unit, as it makes tuning so much easier compared to sets that tune over one sweep of the dial.

By contrast, the Apex converter covers three bands and as previously stated, is probably a general-coverage unit that tunes up to around 22MHz. This means that the two units are designed for slightly different markets. The AWA unit was designed specifically for tuning four international broadcast bands whilst the Apex converter would have been more suited to the amateurs and experimenters of the day who wanted to tune as much of the shortwave spectrum as possible.

Both units would be relatively stable, as each uses a separate oscillator to feed the converter valve. However, I am not convinced that the unshielded output lead on the AWA unit was a good idea. That said, there weren't as many broadcast stations around in 1933 as there are now, so break-through may not really have been a significant problem.

One problem that was not alluded to in the manual was the possibility of supplying excessive HT voltage to the AWA converter. The unit is designed for a HT voltage ranging from 200-220V and this is derived from the 80 rectifier output of the host receiver. As a result, the voltage applied to the converter could be as high as 400-500V but no mention is made in the manual as to how this voltage should be adjusted, a rather serious oversight in my opinion.

The Apex converter would have worked well in the USA where stations are either closer together geographically or are stronger than in Australia. Its shielded output lead would have largely eliminated any break-through of signals from nearby stations in the broadcast band. However, an ability to readily adjust the output frequency would have been a good idea to completely eliminate this possible problem.

In summary, converters from the early 30s are rarely seen and are from an interesting phase of the development of radio. They are well worth having in a collection of vintage radios.

Finally, my thanks to Brian Lackie for the opportunity to look at these two units. It will be interesting to hear them in action once they have been restored. **SC**

Photo Gallery: Mullard 68 (1940-1)

MADE BY AIRZONE FOR MULLARD IN 1940-41, the 68 was a portable 5-valve superhet receiver with the following valve line-up: 1A7G converter, 1N5G first IF, 1N5G second IF, 1H5G first audio and 1Q5G audio output. The radio pictured here was recently judged as the best portable at an HRSA competition, pulling in stations better than the other brands. Photo supplied by the Historical Radio Society of Australia Inc (HRSA), PO Box 2283, Mt Waverley, Vic 3149. www.hrsa.net.au