Vintage Radio

By Ian Batty

The Kriesler 41-47 can be easily carried in one hand, with both the tuning and volume controls operated by the thumb. Power comes from three 1.5V cells.

Too Cool for School: Kriesler 41-47 "Mini" transistor radio

Manufactured in Australia during the mid-1960s, the Kriesler 41-47 is a pocket-size 6-transistor radio with some rather interesting features. It not only looks "cool" but was also a good performer, despite its relatively simple circuit design.

IMAGINE THIS: a kid in the mid-1960s takes his new "trannie" to school and is showing it off during class. One of the teachers confiscates it, handing it back at the end of the day with instructions to never bring it in again.

I can well imagine the kid not really understanding the reasons for this but concluding that this marvellous piece of technology was just "too cool" for his fuddy-duddy teacher to "get".

If looks are important, then the Kriesler 41-47 "Mini" pretty much beats the competition hands down (as did another Mini of the decade). Its sleek looks are just, well, "cool". It features a black case with two large silver speaker grilles, a large side dial, thumbwheel controls and a carry strap. The case is a single moulding with a plastic hinge joining the two "clam-shells" and even rival engineers of the day reckoned that it was an outstanding piece of design.

And so they should have – the Kriesler Mini was designed by Harry Widmer, the design director at the Kriesler Radio Company of Sydney (the company was then owned by Philips). In 1966, he won the prestigious F. H. Edwards Laurel award for designing the set's polypropylene plastic case, the judges noting that this was the first such application of this material in a portable radio worldwide.

Of course, size was another important ingredient in the design of the 41-47. It's easily carried in one hand and can be operated using the thumb.

The 41-47: first look

The Kriesler 41-47's circuit is similar to the Bush TR82C described in the September issue, although the presentation and method of assembly is quite different. For example, unlike the TR82C, the 41-47 uses a printed circuit board (PCB) to accommodate most of the parts (the TR82C used point-to-point wiring and a metal chassis).

Despite its obvious advantages, PCB construction can restrict access to the circuit for servicing. That's because most sets mount the board "component side" up, leaving the copper tracks on the "inside" of the case. In addition, the transistors are often mounted close down on the PCB on short lead lengths, making it difficult to connect a test probe to make measurements or for signal injection.

Some early transistor set manufacturers mounted the resistors flat against the board, making it easy to measure voltages at each end. Others, to save space, stood them upright, with one end right down against the board. This meant that access could only be gained at one end without lifting or removing the PCB.

As a result, AC and RF measurements, and especially signal injection, can be more difficult. Regency's TR-1, for example, used neutralisation components in its IF section and these could be tapped onto fairly easily for signal injection. By contrast, sets such as the Kriesler 41-47 do not offer such connections, so any detailed analysis must be done with the PCB either completely removed or swung out from the case.

Circuit description

Like the TR82C, the 41-47 uses a

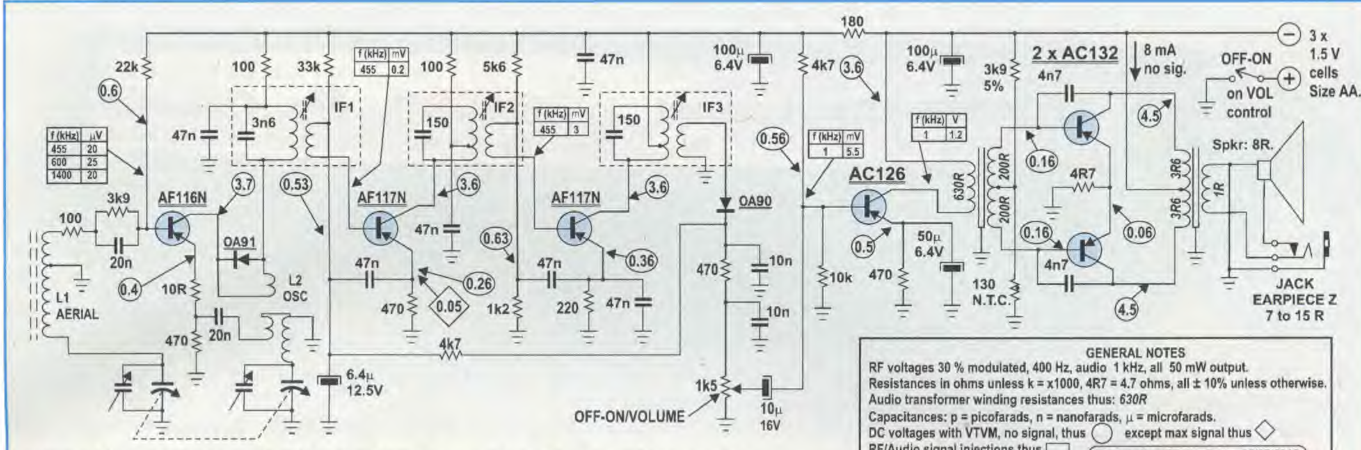


Fig.1: the circuit is a fairly standard superhet design with a self-oscillating mixer, two IF stages and a 3-transistor audio amplifier.

fairly standard circuit and as mentioned, the two are similar. Fig.1 shows the details. It employs a self-oscillating mixer, two IF stages, a diode detector (OA90) and an audio driver feeding a push-pull transformer-coupled output stage.

In all, the 41-47 uses a total of six transistors (the TR82C has seven) These are all Philips/Mullard series germanium PNP types – alloy-diffused in the RF/IF section (AF116N & AF117N) and alloy-junction in the audio stages (AC126 & AC132).

Like most "broadcast-band-only" transistor sets, the 41-47 uses a "cut" tuning gang, with dissimilar aerial and oscillator sections, This removes the need for a padder and allows better aerial-oscillator tracking.

The mixer stage is based on an AF116N and uses collector-emitter feedback, thereby reducing the amount of local oscillator radiation back into the antenna rod. As in the TR82C, this mixer lacks the damping diode included in the original Mullard circuit design to give extended AGC action. Diode D1 (OA91) in the feedback circuit is presumably there to stabilise the oscillator's operation as the receiver is tuned across the broadcast band.

IF stages

The mixer's output feeds the untapped tuned primary of the first IF transformer (IF1). This has a low-impedance untapped secondary to match into the low base impedance of the first IF amplifier stage. The tuning capacitor, by the way, is labelled as "3600" and I suspect that this value (some 20 times higher than normal) is a misprint.

The two following IF transformers (IF2 & IF3) both use tapped, tuned primaries and untapped low-impedance secondaries, with the two AF117N transistors operating as IF amplifier stages. The first stage is biased to operate with a collector current of about 0.5mA. On strong signals, the AGC circuit acts to reduce this bias to reduce the gain.

The second IF operates, as usual, with fixed bias. Note that both stages are biased using a voltage divider and an emitter resistor, to give a predictable operating point and to ensure stability against temperature changes. The emitter resistors are bypassed at the intermediate frequency to prevent degenerative feedback and loss of gain.

This is the view inside the Kriesler 41-47, with the major circuit sections labelled. A large ferrite rod antenna ensures good signal pick-up, while power is supplied by three 1.5V AA cells.

The dial and the thumbwheel-operated tuning and volume controls are all laid out on a panel along one side of the case. This panel also carries a small jack socket for an earphone.

As previously stated, the RF & IF transistors are AF116/117 diffused-junction types. Their feedback capacitance is so low that no neutralisation is needed at 455kHz.

The demodulator is a conventional diode (OA90) at the output of IF3 and the detected audio is fed to the volume control via a 470Ω resistor. In addition, it is filtered using a 4.7kΩ resistor and 6.4μF capacitor to provide the AGC voltage for the first IF stage. The diode's output is positive-going, so it "bucks" the negative bias applied to the first IF base, thereby reducing the transistor's collector current and its gain.

As with all AGC systems, the higher the signal voltage, the greater the gain reduction. The net effect is to keep the audio volume constant so that it is independent of the RF signal strength from different stations.

The audio driver stage (AC126) is biased in much the same way as the IF amplifier stages. However, it uses a much larger emitter bypass capacitor which is effective at audio frequencies.

Output stage

The AC126 drives the primary of a transformer which acts as a phase splitter. Its centre-tapped secondary in turn drives a class-B push-pull output stage based on two AC132 transistors. These then drive the centre-tapped primary winding of the speaker transformer, with the secondary then driving an 8-ohm loudspeaker.

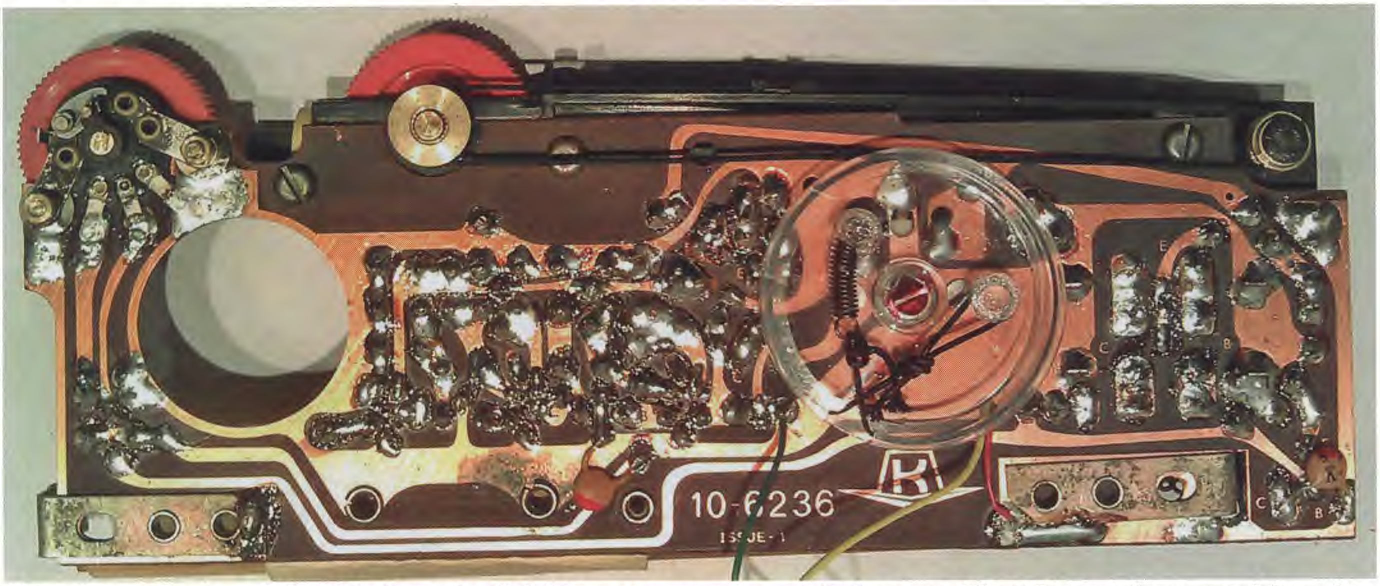
A headphone socket is also wired in parallel with the speaker and automatically switches the speaker out of circuit when a set of headphones is plugged in. Note the 4.7nF capacitors between the collectors and bases of the output transistors. These provide negative feedback at high frequencies, to reduce distortion in the output stage.

A voltage divider consisting of a 3.9kΩ resistor and a 130Ω NTC thermistor normally provides about 160mV of base bias for the output stage. However, as its temperature increases, the thermistor's resistance falls and the bias automatically reduces.

The combined effect of the thermistor and transistor characteristics ensures a fairly constant quiescent collector current in the output stage, regardless of temperature changes. This ensures that the output transistors have enough bias to minimise crossover distortion at all operating temperatures while eliminating the possibility of damage due to thermal runaway.

A small common emitter resistor (4.7Ω) provides some local feedback and helps balance the differing gains in the two output transistors.

In the Bush TR82C, the bias was set via a trimpot to give the lowest possible crossover distortion, a feature that the 41-47 lacks. On the other hand, the TR82C has no form of temperature compensation in its bias network and



This solder-side view of the PCB shows the dial-drive arrangement used in the 41-47. The PCB is easily removed from the case and the set is straightforward to service.

may have been more prone to failure when operated in the extreme temperature conditions often encountered in Australia.

Dead on arrival

When I first acquired my Kriesler 41-47, it was completely dead. One common problem I've found with such sets is corroded/tarnished contacts on headphone jacks and power switches. The 41-47's headphone jack was one such offender but some 800 grade wet-and-dry soon had it clean again. That done, the moving contact in the headphone switch was re-tensioned and the output stage then began working.

This revealed that the volume pot was also noisy but that was easily fixed with a spray of contact cleaner. The set then appeared to be "quiet" – too quiet in fact. Most six (or more) transistor sets have enough gain for mixer noise to be quite obvious at full audio volume but not this one.

Further investigation revealed that the IF stages were badly misaligned. The IF transformers have slotted plastic adjustments and these had obviously been fiddled with by someone who didn't know what they were doing at some stage in the set's past. Careful adjustment with a plastic screwdriver gradually brought the IF stages back to life, the 'noise' increasing as it was brought back into alignment.

Next, I turned my attention to the front-end which was intermittent. The 100Ω resistor between the antenna and the mixer circuit was "touchy" and resoldering it eliminated a dry joint at one end. The tuning was also a bit erratic, due to the tuning-gang shifting about. This was fixed by removing the dial drum and tightening its mounting screws which had become quite loose, after which the front-end alignment was adjusted.

How good is it?

With the radio now operating correctly, I set about checking its performance. This showed that the audio response from the volume control to the speaker terminals is rather ordinary, covering from 210Hz to just 3kHz. The 4.7nF feedback capacitors are among the culprits. They were left in-circuit though, as the three highly selective IF transformers reduce the high-frequency -3dB point to just 1.8kHz.

The audio performance was adequate, with a total harmonic distortion (THD) of around 5.5% at 1kHz for a 10mW output. This THD figure is higher than expected and is partly due to the fact that the output stage bias lacks adjustment. Another common cause is output transistor mismatch although, in this case, the gains of the two AC132s tested within 10% of each other.

At 50mW, the distortion was around 6%, rising to around 7% as the set just begins to clip at 100mW output.

The selectivity is ±23kHz at -60dB or better, which is reasonable. The same goes for the sensitivity, although it's less sensitive than the TR82C which has an extra audio stage. Its best sensitivity figures were obtained at the extremes of the band (ie, 200μV/m at 540kHz and 120μV/m at 1600kHz) but at a relatively poor 15dB S/N ratio.

Again, it's not as good as the Bush TR82C but it is comparable to the 7-transistor Raytheon T-2500.

Unfortunately, the AGC is not particularly good, a 3dB increase in audio output requiring only about an 11dB signal increase (from 1mV to 3.5mV). As a result, it's necessary to ride the volume control when tuning across the band.

The set does, however, withstand RF/IF overload much better than the Bush TR82C. It will accept an RF level of nearly 100mV/m before showing significant distortion due to RF/IF overload.

Summary

While this set is less complicated than the TR82C, it performs quite well for a relatively simple design. It's easily carried in one hand, the tuning and volume controls can be thumb-operated, and the slide-rule dial gives clear and accurate tuning indications.

Basically, it's one of those sets that just begs to be picked up and used. In a word, it's "cool".

Further Reading

If you've not already done so, take a look at Kevin Chant's excellent website at **www.kevinchant.com** ("Kev's free resource for [mainly] Aussie vintage wireless information, circuits, pictures, parts etc"). There you'll find lots of vintage radio circuits and a great deal of other useful information.

In addition, take a look at Ernst Erb's excellent radio museum site at **www.radiomuseum.org** **SC**