A nostalgic look at Colour TV in Aus

Although a sizeable proportion of readers will have never known anything else, it's incredible to think that March 1st, 2005 marks the 30th anniversary of the commencement of full-time colour television broadcasting in Australia. What is even more remarkable is the number of colour sets that were there for particular milestone and are still working, in many cases still with superb picture quality!

I personally have a 5-set "working museum" of 30-year old sets "billeted" at various relatives' houses, still in everyday use. And I'd have more if I had the room...

In the early 70s, we were piously informed that the maximum working life of a colour picture tube was "about seven years"!

In many ways the advent of Colour TV in Australia is a bit like the Second World War: for people like myself, born after 1945, WWII is an event that has always "been there" – but mainly in the sense of the lingering effect it has had on people who lived through that time.

Just as there are still plenty of people alive who can remember a dramatically different time before there had ever been a Second World War, there are plenty of older electronics technicians who remember what it was like when there were no colour TV sets!

As with WWII, a staggering number of things changed beyond recognition in just a few short years and there were many casualties left by the wayside.

I've watched the average 67cm colour TV that needed two people to lift it, had just a mechanical channel selector (usually VHF-only) and no remote controls, evolve into today's comparatively feather-light equivalent with a window-flat, absolutely rectangular screen, full remote control and multiple video inputs.

The average 1974 product cost around ten weeks of the average worker's net wages; you can typically pick up today's version for *3 days* net wages . . . or even less if you opt for an old-fashioned curved screen!

And people may baulk at the price of today's Plasma sets but in real terms they work out considerably cheaper than the first colour sets.

by Keith Walters

Right place, right time

I started my electronics career in early 1972 at the Brisbane branch of a well-known nation-wide TV service company, so I was right there at the transition to colour.

In those days, many electronics enthusiasts my age were keen to make some kind of career in electronics, often for no other reason than working for some sort of "official" organisation

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was about the only practical means of getting any regular access to the electronics "real world".

You have to understand that this was long before the advent of nationwide Dick Smith and Jaycar type specialist electronics supermarkets.

Things may have been easier in Sydney and Melbourne but for the rest of Australia, obtaining parts for magazine projects was an expensive and often frustrating business.

Electronic component sales were often seen as a relatively unimportant sideline for electrical wholesalers. Buying even fairly run-of-the-mill (by today's standards) semiconductors often entailed long trips out to obscure industrial estates on the other side of town!

I was certainly in the right place at the right time, as the early seventies were an exciting time for electronics in this country and elsewhere.

Up until then, apart from the proliferation of "transistor" radios, solid-state circuitry had made relatively little headway in consumer applications. Solid-state technology had certainly been advancing at an incredible pace but most of the activity was in more "serious" fields like the military and computers.

Computer manufacturers had started abandoning valves at least 15 years before – out of sheer necessity – but even here the seeds of the future were being sown; in March 1972 the robot space probe Pioneer 10 set out on its history-making mission to Jupiter and beyond.

Its on-board computer was based on Intel's (and the world's) very first microprocessor, the 4-bit 700kHz 4004, the direct ancestor of today's multi-GHz Pentium CPUs!

The mission was supposed to run for just two years but as it turned out, most of it was still working (computer and vidicon TV camera included) when the probe finally moved out of radio range in 2003!

Back on Earth, ICs were becoming steadily cheaper and more plentiful. In Australia in particular, changes in tariff policies were making imported electronic parts cheaper and more accessible, as decades of "stone wall" tariff protection were steadily wound back.

Electronics retailing changes

A now long-defunct company called Kitsets Australia (remember Kit: "Keep your irons hot, boys . . .") had just opened the first tiny "Dick-Smith-style" retail outlet in Brisbane. (Dick Smith was operating his first store in Sydney at the time but he didn't open in Brisbane until quite a bit later).

It was quite a big deal to be able to actually see what a magazine project looked like and speak to people who actually knew what we were talking about!

And for the first time, parts became a lot easier to get. They even offered mail order for those in the sticks.

Servicing changes

Those were interesting days in the servicing field too; transistors were finally beginning to catch on with TV manufacturers.

Prior to that, apart from portable sets, they had obviously seen little reason to change from the valves that had served them so well for the previous 15 years.

"Electronics service" then was pretty much "TV service". It's hard to imagine it now but in those days there were *no* DVD players, *no* personal computers, *no* microwave ovens and, apart from portable record players and AM radios, not all that much in the way of sound equipment.

If a household boasted any sort of "music system" at all, it was usually

My late father's pride and joy: his 34cm AWA colour portable – probably the reason I started writing this history in the first place! When I bought it for him in 1975 he didn't expect to be with us much longer and so he kept remarking that the little set would "see him out!" However he got over that illness but true to his word, when he finally passed on 28 years later in September 2003, aged 98, the set was still going, with the picture tube as good as the day we bought it!

a radiogram (an AM-only radio, perhaps with shortwave, plus a turntable – itself often capable of playing only 78 RPM records), or if they were *really* well-off, a "Three-in-One" TV and radiogram combination.

FM radio and CDs were still more than a decade in the future and even audio-cassette decks weren't all that common (reel-to-reel tape recorders were becoming popular). The nearest thing to a mobile phone was a (very expensive) dash-mounted two-way radio!

Philips had demonstrated "proof of principle" versions of both home VCRs and videodiscs even back then, but commercial versions were still some years off.

The 1960s serviceman

A typical field serviceman's tool kit consisted of a soldering iron (as often as not a "Scope" quick-heating type which could do a great job on guttering but not quite so good on delicate components!), some basic hand tools (side cutters, long-nose pliers and a few screwdrivers), a "20K per volt" analog multimeter, a small selection of plastic ferrite slug twiddling tools and most important, a "quarter inch" nut driver!

A large percentage of the wooden-cabinet TV sets had their backs fastened on with special screws that could only be removed with this particular tool, presumably to deter idle twiddling by the uninitiated handyman!

On my first day on the job I was assigned a vacant bench and amazingly, its previous occupant had cleared its drawer of every item, except for one of these esoteric and hard-to-get tools... I still have it too!

The rest of a travelling serviceman's accoutrement usually consisted of a briefcase full of the more common valves, some 100µF high voltage electrolytic capacitors, a selection of 600V polyester capacitors and usually, the full "E12" range of 1W resistors. There was also usually a small box of odds and ends, germanium and silicon diodes, a few common knobs and so on.

The more progressive tech might have carried a CRT "Zapper" (rejuvenator), often home-made and of dubious efficacy!

There was a reasonable degree of standardisation in Australian TV set manufacturing, which meant that there weren't too many different valve types used. There were really only two types of picture tube: the older, wide-necked 90° deflection type with the bakelite base, or the more modern, all-glass, 110° narrow-necked type.

If a set had to go to the workshop, it was more usual to simply "pull" the chassis and leave the tube and cabinet behind.

Most workbenches were equipped with one of each type of tube on a special stand, a loudspeaker and an audio output transformer combination terminated with crocodile clips and an orientable mirror. An oscilloscope was considered a luxury and it was more often a case of "one per workshop" than "one per tech"!

The winds of change

So until about 1970, setting up a TV workshop wasn't a particularly costly nor involved undertaking but the winds of change were starting to whistle around the door frames. By the end of the decade they would reach hurricane force but we weren't to know that.

It all started in a modest enough way. With the prospect of all-solid-state colour TV receivers on the horizon, some of the manufacturers obviously thought they should get in some "practice" by experimenting with all-transistor large-screen monochrome sets.

Actually, since the late '60s, most manufacturers had been flirting with "hybrid" designs of one sort or another, made from a mixture of valves, transistors and occasionally, even (the then dreaded) ICs!

The "grunt" sections (horizontal/vertical deflection and audio output) were handled by traditional valve circuitry, with transistors (and occasionally, ICs) in the low-power signal processing.

It's interesting to note, though, even when colour TV set sales were well underway, some local manufacturers were still manufacturing and selling all-valve large-screen monochrome sets!

From this distance, it's really hard to see what the point of a lot of this "hybrid" nonsense was. The simple replacing of a valve with a transistor in the low-power signal processing sections had no real cost advantage.

And since the bulk of the set's power was still consumed by the valve audio, vertical and horizontal output stages, there was little or no cost saving in manufacture or electricity consump-

tion either.

Apart from this, most valves used were multi-function, most usually a triode and a pentode in the same envelope, so you needed at least two transistors to replace most valves.

Maybe the engineers were merely trying to get some solid-state design experience under their belts – but if they were, they were fiddling with the least problematic parts of TV design!

This was an even more eccentric approach when you consider the case of European sets which usually didn't have power transformers. (AWA and Thorn made localised versions of the British Thorn "R" chassis but fitted them with power transformers).

In valved signal-processing stages the bulk of the power consumed is simply used by the valves' heaters. However, since all the heaters in a "transformerless" set were normally connected in series and fed from the 240V mains through a dropping resistor, to maintain the correct heater current in a hybrid set extra resistance had to be added, to substitute for the replaced valves. So practically the same amount of power is used, regardless!

(Of course it's an entirely different story with a colour set, because there's a lot more signal processing involved).

Just about all the major manufacturers produced monochrome portable sets and you'd think, well here at least is a reasonable justification for going for all-solid-state designs.

But ironically, two of the most popular "12 inch" portable designs were those made by AWA and General Electric and they were all-valve! At the same time, AWA was making "Hybrid" large-screen sets and all-valve 12 inch portables!

(It was also something of an industry joke toward the mid-70s that only remaining manufacturer of valve portables was National/Panasonic, whose slogan went: "Just slightly ahead of our time!").

Of course, if you wanted AC/DC operation, transistors were the only way to go, and although most manufacturers also produced all-solid-state designs, by far the most popular were the HMV models, starting with the infamous "Z1".

Popular?

Well, I don't know if "popular" is the right word but we certainly saw a lot of them.

Here's the rear view of the AWA set shown on the opposite page. It only broke down once in 28 years (actually after 22 years) when the damper diode suddenly went short-circuit. And at the time I happened to be staying there, with my tool kit, and with a suitable replacement on hand... Probably just as well, when you look at the way everything was shoe-horned in!

I don't know what sort of people they had in their design departments either but it appeared that none of them understood anything about RMS dissipation in rectifier circuits, because they all used the same cheap 1A power diodes in a bridge passing about 2.2A! This gave the diodes a life expectancy that could best be described as "toasty, brutish and short"...

They also nearly all used the same 11V regulator circuit based on a PNP germanium power transistor. This frequently went short-circuit, often taking out the high voltage germanium horizontal output transistor and/or the selenium EHT rectifier.

Then there were the dreaded "green lollies", a popular type of high-value polyester horizontal yoke coupling capacitor which was forever going short-circuit.

All in all, they were certainly a reliable meal ticket for the few technicians willing to put aside their technical insecurities and "have a go".

Kriesler were probably the most serious about large-screen all-transistor sets, with their (in)famous 49-7 chassis. Overall, the 49-7 wasn't a bad design and I believe there are still a few of them out there!

It featured a regulated 35V power supply based on a BDY20 (2N3055) power transistor, a horizontal output stage that used one of the new BU105 1500V silicon power transistors running from a boosted HT line of about 120V, another BDY20 for the vertical output, and a BF177 high-voltage video amplifier stage.

Valve jockeys

Why "infamous"? Well, all this high-tech stuff was good news for bright-eyed 19-year-olds like me, raised on a diet of EA/ETI magazine projects, but not so hot for the generation of "valve jockeys" that preceded us.

And there were a lot of these somewhat pathetic individuals (often ex-military with no real theoretical background), who one way or another, had learned to recognise the common faults that plagued old valve TV sets (usually the valves themselves) and could eke out a living armed with a screwdriver and case of spare valves!

Most of them eventually learned to recognise other common faults like dried-up electrolytics and leaky paper capacitors.

I suppose as long as there was a competent workshop to back them up, they

could usually be relied upon to put in a reasonable day's field work.

The new solid-state techniques changed all that, with the triple-whammy of all-soldered-in, all-solid-state components, mounted on printed circuit boards. Imagine how one of those guys would have felt, the first time he took the back off a sparkling new Kriesler all-solid-state chassis!

A new breed of technician was required, able to wield multimeter, oscilloscope and solder sucker with equal facility – and there weren't too many of those around! (Not for a while, anyway).

Well, I guess we should make that a "quadruple-whammy", what with colour looming on the horizon!

When I started, colour TV was still a few years away and so all the sets I encountered were monochrome, many of them dating back to 1959 when TV first started in Brisbane. (A few were even older, having "migrated" up from Sydney!)

Incredibly, until at least the early 1990s they still had some of these "originals" under service contract! It seems as long as the customers kept paying the money (and they could get the parts; mostly just valves and other common "generic" items), it wasn't considered any big deal to make a service call every two years or so!

And it's not all that surprising, really; some of those old sets were incredibly well made; most of them got the chop simply because they were replaced with colour sets!

About 15 years ago I helped in the restoration of an original Australian-made 1956 Admiral 21-inch TV. By an extraordinary stroke of luck we managed to locate a working reconditioned picture tube and some of the "oddball" valves that Admiral used. It still works, the printed circuit boards being in perfect condition after nearly 50 years!

So in 1972 the vast majority of day-to-day service work consisted of mostly elderly all-valve jobs, with a sprinkling of the "hybrid" types and the occasional all-transistor model.

In the case of the older all-valve sets, as with vintage radios, most of the problems were caused by the old style paper capacitors and other passive components.

If you have any notions about the new hybrid designs being more reliable, I can assure you, in those there were far more transistor failures than valves. At least with a valve it's just a matter of plugging in a new one! (Anybody remember those awful black "Anodeon" transistors?)

One of the "newer" Rank Arena sets – basically, a re-badged NEC. Legend has it that a consortium of local manufacturers was offered the choice of the British-designed "true" Rank chassis or a badge-engineered NEC chassis. They took one look at the British effort and took the NEC option!

Chroma locked colour TVs

Colour TV sets actually began to appear in Australia on a peculiar sort of "grey market" basis in the early 1970s, taking advantage of a technological quirk peculiar to the PAL system.

Although there were no official colour broadcasts (and no colour production or playback equipment in the studios), many TV programs sourced from the UK and Europe were supplied on colour videotape.

And although they were never designed for it, most of the more recent monochrome studio video recorders could reproduce the colour subcarrier to a certain extent.

The Government wasn't happy about some sections of the community jumping the colour gun, so to speak. So the TV stations were required by law to suppress the colour burst so that any PAL colour sets would only display the pictures in monochrome.

But "those in the know" discovered that by the use of an add-on gadget called a "chroma lock" this lack of burst could be overcome (with certain limitations) and quite often, excellent colour fidelity was obtained.

Sometimes the chroma lock locked the colours out-of-phase so that all colours were negative of what was expected (the "green face" syndrome often experienced on NTSC pictures those days). A tap of the chroma lock button usually fixed that little problem.

AWA imported and sold a few hybrid German Telefunken sets with this facility built in and most technicians with access to colour sets experimented with this technique, often sitting up until the wee hours to watch English Soccer in colour!

My first colour TV

The first colour TV I ever got to actually lay my hands on was a 26-inch all solid-state "Decca" (actually made by HMV), specially imported from the UK for training purposes in 1973.

It was a pretty conservative design, with an SCR-regulated 125V HT line, a 66cm 90° delta-gun picture tube, and mostly discrete components in the signal processing sections.

It was a fascinating piece of kit to those of us who'd never set eyes on a colour TV set before but as it turned out, it didn't have all that much in common with the designs that were

eventually manufactured and/or imported here.

Fitted with a chroma lock board borrowed from HMV, it did the rounds of a series of beer and prawn evenings held in various technicians' homes when certain programs known to be in colour were on. The management obviously hoped that curiosity would overcome their abject fear of the Technicolor monster!

There usually wasn't much on during the day. In fact, the first time we saw anything really significant was the 1973 Melbourne Cup. I remember I had the devil of a time dragging the office workers away from the old Pye B&W TV they were crowded around to show them this new marvel. This from a company whose offices were plastered with posters proclaiming their "Engineered for Colour" range of TV antennas!

Then we realised that the upcoming live-by-satellite telecast of the wedding of Princess Anne in November 1973 was not only sure to be in colour but also on in the early evening (as it would be morning in London then).

Unfortunately a lot of other people realised this too and a few days before the blessed event, HMV wanted their chroma-lock board back!

Luckily, I'd already been working on one of my own and I managed to get it ready in time for the big event. But as Murphy would have it, we couldn't find a single piece of colour material to test it on.

"Oh well", we thought, "we'll just stay back and see what happens anyway" but around 7pm other people started to arrive. Lots of people – managers and their wives, people carrying cartons of beer and real food!

Soon they were everywhere, dragging chairs out of the offices, sitting on boxes, whatever they could find, and eventually the whole loading dock was packed with slavering Royal watchers.

Did it work? Yes, thank God, it was actually the best colour broadcast we'd ever seen!

State stupidity

Of course, no amount of beer and prawns was ever going to substitute for proper technical training but at least it got some of the older guys to actually consider the possibility that they might possibly be of some use when colour came for real!

In Queensland at any rate, our quadruple-whammy was really a quintuple-whammy: the state-run technical colleges announced that their colour TV training courses would only be available to people who had undergone official apprenticeships.

This probably excluded about two-thirds of the Brisbane technical staff, and for that and other reasons, our parent company decided to set up its own in-house training program.

A jaundiced view

In mid-1972 I was fortunate enough to be struck down with a severe case of hepatitis, requiring a six-week stay in hospital.

Why "fortunate"? Well, it worked out rather well for me as I had just bought G.N. Patchett's excellent textbook: "Colour Television With Particular Reference to the PAL System". With nothing else to do I applied myself to the subject diligently and came out of hospital something of an expert in the field!

We also had the usual assortment of people with "overseas" experience who naturally made out they knew all there was to know about colour TV but when our Decca training set was finally unboxed with an enormous purity error, not one of them seemed to have any idea what to do about this common problem!

Yet the procedure given in Patchett's book couldn't have been much simpler: "Display a red screen. Loosen the two wing nuts attached to the deflection yoke and slide it backward; this should produce a circular red patch at the centre of the screen. Manipulating the purity magnets as you would picture centring magnets, centre the red spot on the screen, push the yoke back forward until the red fills the screen, and re-tighten the nuts."

Which I did . . . and it worked!

Training the untrainable?

At this point the management realised that there was a long way to go – they hadn't even gotten their technicians up to speed on solid-state technology and there was colour TV staring them in the face!

It was a very long, arduous and thankless process I can tell you. The only training material available was mostly from the US and the UK and although it covered the basic theory well enough, the descriptions of "typical" colour set designs were years out of date.

So we basically had to write our own, using whatever technical information we could scrounge from the local manufacturers and technical colleges.

There was also a severe discipline problem, typical of any situation where you're trying to teach a group of middle-aged people anything!

Every time we got a group of technicians together for whatever reason, the discussion would always degenerate into a discourse about how all their problems would be solved if the company simply stopped renewing service contracts on sets more than say, 10 years old.

In the end the managers got jack of this and in the first hands-on example I'd ever seen of the awesome power of computer technology, they ordered a special printout of the last three years' "activity" of a couple of thousand of their service contracts.

The printout showed the year of manufacture, the make, and the number of service calls for each of the three years.

I can still remember the General Manager laying down the law, too: "Look: There! 'Year of Manufacture: 1959; Service Calls: 1971 – none!; 1972 – none!; 1973 – none!' Look at this one: 'Year of manufacture: 1961': no calls! Here's one with just one call! I mean, all these people are paying us $39 year, mostly for doing nothing. Even if we do make a call, how much does that cost us? Half the time you don't even use any parts, and even if you do, most of them cost next-to nothing!"

I don't recall his closing comments but they were the 1972 equivalent of: "There's still money in it, guys; deal with it!"

If it had been me, I might have also added something to the effect that getting rid of a lot of the old sets would allow them to get rid of a lot of the "dead wood" in the company, whether this was actually true or not...

NEXT MONTH:

In the second part of this feature, we'll have a closer look at the good, the bad and the downright ugly: the TV sets that ushered in the colour TV era in Australia.

A nostalgic look at Colour TV in Aus

Last month, we looked at some of the interesting changes that the introduction of colour TV brought to the service industry some 30 years ago. This month, we're looking at some of those "interesting" locally-made colour TV sets . . . then again, for those in the industry at that time (and since), the word "interesting" is not the first adjective you'd use!

BEFORE THE WHITLAM Labor government announced sweeping changes to the tariff systems covering imported manufactured goods and components, there was a general agreement in the industry that colour TV sets would cost somewhere between $1200 and $1500 (ie, approximately 10 times the average gross weekly wage!). Moreover, there would probably be no more than five basic chassis designs: Philips, Sanyo, Panasonic, Thorn and Pye.

Of course, the changes to the tariff structure changed this drastically and these prices were drastically revised. In a bid to level the playing field a bit, Telefunken, the owners of the PAL patents, enforced a 6-month moratorium on the direct importation of colour sets with screen sizes of 51cm or less, from the date the first official "limited" broadcasts started in late 1974.

The locally manufactured line-up for 1974 consisted of the Philips K9, the Kriesler 59-01 (basically an electronic clone of the K9 but with different board layouts), the AWA/Thorn 4KA (an antipodean-ised version of the UK "hot chassis" Thorn 4000 series), the Panasonic 2000 chassis, the Sanyo CTP7601, the HMV C210, the PYE CT25 and the Rank Arena (NEC) 2601 and 2201.

Notably absent were any locally-made models with remote control, absurd though that may sound now. The problem was that remote control necessitates a varicap tuner and because Australia has a number of "oddball" TV channel frequencies that are not used anywhere else in the world, there was nothing available that could tune in all the Australian channels. There were some up-market fully-imported European models that did offer remote control but sales-wise they were problematic, because you couldn't guarantee they would work everywhere.

The first remote controls used ultrasonic transducers and were big, clumsy and unreliable. It wasn't until the appearance of infrared models in the 1980s that they started to become standard equipment.

Philips/Kriesler

The Philips K9 was a fascinating mixture of the antiquated and the futuristic. It featured a choice of 56cm and 66cm 110° delta-gun tubes, with an incredibly comprehensive convergence panel. When this worked, it gave very good results indeed and in fact K9s were widely used in TV studios as inexpensive substitutes for "studio" monitors. Sadly, its very complexity was also its downfall. It was the same

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old story – the more things you put in, the more things there are to go wrong! Nonetheless, a fully-working 66cm K9 forms part of my "living museum"!

The video drive to the picture tube used the "colour difference principle" – ie, a high-voltage luminance signal was fed in parallel to the three cathodes, while separate R-Y, G-Y and B-Y signals were fed to the appropriate control grids. Although this was common practice with earlier all-valve colour TV sets overseas, the K9 was the only mass-market all-solid state design I am aware of that used this technique.

Some time before this, Philips had decreed that the way of the future was highly "modular" chassis design, with most of the active circuitry contained in small plug-in units reminiscent of the "motherboard/expansion board" approach of PCs. You weren't supposed to try to repair them and none of the Philips circuit manuals included schematics of any modules used.

The K9 used a large number of these modules and naturally they wanted to charge an arm and a leg for replacements! Fortunately, Kriesler (owned by Philips) used a similar module system with almost identical circuitry and pin layout but their modules were physically larger and meant to be serviced. More importantly, Kriesler included the module circuits in their manuals, which were "close enough" to the Philips ones!

Like many of the other locally-made designs, the K9 also featured something else new and frightening: a switchmode power supply. Although all TV sets made these days (as well as VCRs and DVD players) use that technique, in 1974 this was something we'd only read about in English TV servicing magazines and then with reference to only one TV chassis – the Thorn 3000 series!

When it's all said and done, the Philips engineers got it mostly right with the K9, since as far as the power supply and deflection systems go, modern colour TV sets are remarkably similar to the classic Philips design, albeit with most of the discrete transistors now packaged into ICs. The Australian version of the K9 was unusual in that, while the power supply itself was "hot", it had an isolated secondary winding, which meant the rest of the chassis was "cold". With the modern requirement for direct A/V inputs, this is standard practice now but the original Dutch version of the K9 had a hot chassis.

The Kriesler models were basically very similar to the K9, although they'd dispensed with the colour difference drive and just used direct RGB drive to the tube. Kriesler also specialised in the manufacture of "prestige" models with elaborate teak veneer cabinets. Some of these cabinets were so good that a friend of mine used to make extra money "refurbishing" them for a large department store, basically by "retro-fitting" them with the innards of a modern plastic-cabinet TV!

And now for something completely different . . .

Then I suppose if you want to go from the sublime to the ridiculous, we also had the HMV C210. Unlike the K9, this was a veritable tour de force of dead-end design, in particular the use of a Thyristor-based horizontal deflection system.

The story behind this technique is quite fascinating and not terribly well known. First of all, in most countries, the bulk of valve TV sets did not use power transformers, a tradition the manufacturers were keen to maintain with their solid-state designs. The valve heaters were connected in series directly to the mains through a suitable "ballast" resistor and (usually)

Many of the early colour TV sets were real pieces of furniture, built to quite high standards of joinery. This AWA set (sorry, AWA Deep Image Colour set – what ever that meant!) was typical of the genre.

the 200V or so main HT line was derived by half-wave rectification on the mains. (You may have read about valve radios being configured the same way in the vintage radio column).

With any "conventional" horizontal deflection system, (ie, using either a pentode valve or a bipolar transistor as a 15,625Hz switch), there is an approximate 10:1 correspondence between the HT rail voltage used and the flyback pulse generated across the switching device. For example, a 100V supply rail will produce 1000V flyback pulses, 120V will produce 1200V flyback pulses and so on.

It's no trouble to produce power valves with breakdown voltages of thousands of volts, so they could be run more or less directly off rectified 240V mains. In fact, most valve horizontal stages used a so-called "HT Boost" circuit where the input HT voltage was stepped up to 500V or so by the horizontal damper diode. This had a number of advantages but in particular, manipulation of the grid bias of the output valve allowed the boosted HT rail voltage to be regulated by a feedback loop, which both stabilised the width and filtered out any residual mains ripple. They were in fact an early form of switchmode power supply.

Unfortunately, this approach is not possible with transistors. There is a definite technological brick-wall you run into with silicon which makes it impractical to manufacture transistors with breakdown ratings much above 1500V.

This means that the maximum supply rail voltage is limited to around 150-160V. This was all perfectly splendid with the US 117V AC mains, since that voltage could be directly rectified and filtered to produce around 150V DC, which could then be regulated down to 110-120V, giving a comfortable 1200V flyback.

Thus most US and Japanese sets were "hot chassis" designs, often using a simple linear series regulator.

With European 220/240V mains voltages, this was not possible. The raw rectified DC would be something over 300V; getting this down to 150V or so with a linear regulator at the typical current of 1A would give a dissipation of around 150W! Some manufacturers experimented with using two 1500V horizontal output transistors in series but this was a tricky and expensive option.

The most common approach in Europe was to use a single thyristor as both half-wave mains rectifier and voltage regulator, which worked on much the same principle as a light dimmer. The thyristor simply held off conducting until the positive mains cycle had passed its peak and dropped back to around 170V or so.

Although these worked well enough, the various electrical authorities weren't too thrilled about the way they chopped up the mains waveform, and so the manufacturers, particularly those with a sizeable export market, began to look for alternatives.

The Japanese for the most part took a pragmatic approach and simply fitted their European export models with stepdown transformers. This allowed them to retain their tried and proven series regulators and in fact, their European designs weren't all that different from their NTSC models.

Philips, as mentioned earlier, went for the new-fangled switchmode power supply, while others tried a more exotic approach, using a Thyristor-based horizontal deflection developed by RCA in the mid 1960s.

The full operation of a Thyristor (SCR) based horizontal deflection system is extremely complex but essentially, the energy is fed into the deflection yoke during the flyback period, something in the manner of a Capacitor Discharge Ignition system. The yoke winding then essentially "coasts" through the visible scan period, using a network of switching diodes and a second SCR to produce an approximation of a sawtooth scanning current.

In the 1960s, there was considerable doubt over whether it was even possible to manufacture silicon transistors with a breakdown rating of much over 500V, so for a while it seemed that the only practical way of making an all-solid-state colour TV chassis was to use a big (and heavy) mains stepdown transformer.

RCA's SCR horizontal deflection system was first demonstrated in 1967, as a possible solution to this problem. An unregulated +140V HT line derived directly from the 117V mains was fed to the flyback Thyristor via a saturable reactor, which basically formed the control element of an electronic regulator system. Without going into too many details, flyback pulses of about 120V amplitude were applied to the horizontal deflection yoke, resulting in a peak-to-peak scan voltage of about 24V. This operation is basically the reverse of that of a conventional line output stage.

Although the system did work, it never caught on for a number of reasons. First of all, although the basic principle was simple enough, the actual circuitry needed was quite complex, requiring several large ferrite inductors and high-value polyester capacitors.

Because of the very low scanning voltage used, the yoke current peaked at over 100A in large-screen sets, which meant extreme care was needed in manufacture to avoid dry solder joints, as the slightest resistance would result in major burn-ups. There were

also severe problems with "spooks" (line frequency harmonics) causing interference on the screen.

Ironically, it was RCA themselves who finally sealed the fate of the original system, when in the late 1960s their semiconductor division managed to produce power transistors with a 1500V rating, using a design not all that different from what is still standard today. US (and Japanese) solid-state designs thereafter tended to use bipolar transistors with a linear regulated power supply.

However in Europe, the SCR line output stage was re-invented in the early 1970s, with a new three-SCR design. This also was designed to run from filtered but unregulated mains-derived DC (this time from 220-240V mains) but in this case, a special flyback circuit stepped this voltage up to somewhere between 450V and 600V. The third SCR regulated this boosted voltage by bleeding a variable proportion of it back into the main unregulated supply during the horizontal scanning period.

The revised system worked on much the same principle as the earlier RCA one but because it applied higher voltage flyback pulses, a more conventional (cheaper) yoke design could be used. However, the Australian HMV C210 would have to take the biscuit as an example of taking the worst features of two technologies and combining them!

The C210 used the old-fashioned two-SCR design but they also used a switch mode power supply, which meant the main feature of the SCR design – the built-in voltage regulator function – wasn't actually used! The lack of a boosted HT rail also meant that they had to revert to a special low-impedance scanning yoke, with all the inherent problems of heavy circulating scan currents, dry joints and so on.

Worse still, for the switchmode power supply, they chose a peculiar self-oscillating design which, while economical to build, was barely good enough to drive a set with a conventional transistor horizontal output stage. SCR line output stages are notorious for occasionally drawing unpredictable and extremely heavy supply currents during start-up; in fact many sets that used them were equipped with mechanical circuit breakers as an afterthought! The C210 power supply was one of the least reliable on the market; it just couldn't cope with that sort of hammering.

This 1975 26-inch Lowboy Thorn 9064 also boasted "twin hi fidelity speakers" and a quality timber cabinet. As with most sets at the time, it was VHF-only.

To be fair, when the C210 chassis worked, it was quite a good set but they were hopelessly unreliable and easily the worst set on the Australian market in this regard.

The new "Euro-version" three-SCR line output stage fared somewhat better but manufacturers very quickly dropped the technique, out of simple economics if nothing else! When it was all said and done, it was simply cheaper to use a switchmode power supply and a transistor horizontal output stage and a damned sight more reliable!

But then a strange thing happened. Just when we thought the SCR line output stage had been relegated to the industrial bin of history, the Japanese cottoned onto the idea! After a fairly uneventful start with quite conventional designs, in 1975 Sharp started the ball rolling with a truly awful chassis called the C1831X. These were smart-looking little sets with state-of-the art 18-inch 110° inline-gun tubes, and performed very well. But after a year or so (presumably as the electrolytics started to dry out), they started to fall over like flies.

And they were just about unfixable! It was the same sad story as with many other SCR designs: you replace everything, and it still blows up at switch on! Apart from that, they had appalling chassis access, making them almost impossible to service in the home. From memory, I think they were the only colour sets we wouldn't accept under service contract!

But to give them credit, Sharp quickly realised the error of their ways and went over to the tried and proven switchmode power supply/transistor line output system.

However, just when we thought it was safe to go back into the workshop, National (now Panasonic) decided to have a go, or show Sharp how it was done, or something!

It was the same story – plagued by dry joints, blown up by even slightly tired electrolytics and "spooks" on Channel 0. Well, the flirtation didn't last loo long there either and the SCR line output stage finally bit the dust!

The C210 was such a disaster that HMV soon started selling fully imported British-made sets using the "Decca 33" chassis. This had the distinction of being the only mass-market colour TV sold in Australia with valves in it! After their flirtation with "hi-tech" SCRs, obviously HMV weren't about to take any more chances!

Ironically, they were damn good sets! In a store display, the Decca 33 would always stand out for picture quality and they were considerably more reliable than many of their all-solid-state competitors. This was

The C2201 was the first Rank Arena set available in Australia, along with the C2601. They were very successful and "The Bulletin" magazine reported that Rank Arena had 17% of the colour TV market in 1976.

probably at least partly due to the fact that they were fitted with power transformers with a special winding that provided the exact voltage needed for the series heater string, rather than a dodgy dropper resistor.

Their presence in the market also provided a handy source of valves for all the "odds and sods" colour TVs brought in to Australia by European migrants!

The Thorn 4KA

This chassis was almost as unreliable as the C210 but at least there was a reasonable possibility of fixing the 4KA and having it keep working long enough to get it out the door!

I think the 4000 chassis would have to be a leading contender for the most over-designed set in television history! Admittedly, the K9 was a pretty complex beast but at least they mostly used common parts and they didn't break down all that often. In fact, while there are quite a few K9s still working even to this day, I don't know of anybody who had a working 4KA past 1990!

The 4KA was the "Ocker-ised" version of the English Thorn 4000 chassis. The UK version had a live chassis and used a full-wave rectifier (ie, it was "hot" which ever way round the mains Active and Neutral leads were connected). For Australia, they simply fitted it with an isolation transformer, a move which was adopted by a number of European manufacturers as the easiest way to make their sets meet local safety standards.

It's interesting to ponder just what went through the designers' heads when they came up with the 4000. Like most of the locally-made sets, it came with a choice of 56cm or 67cm 110° picture tubes but unlike most of the other manufacturers' offerings, these were a special RCA narrow-neck delta gun tube (which didn't seem to work any better than the standard wide-neck Philips tubes). The matching deflection yoke was also from RCA and was originally designed for use with a Thyristor line output stage. That plus the fact that the 4000 uniquely had separate horizontal output and EHT generating transistors strongly suggests that it was originally meant to use SCRs in the horizontal deflection section.

The 4000 also had an incredibly comprehensive set of convergence controls, all brought out via a monstrous cable to a paperback-book-sized hand-held control box that could be unclipped and brought round to the front of the set. Instead of the usual conglomeration of variable inductors and wire-wound pots, the controls were all thumbwheels similar to those on a pocket radio. They were clearly marked with their functions and were a delight to use when the thing was working properly which sadly, wasn't all that often!

Thorn had developed an unfortunate fixation with thick-film modules, which still live on today in the form of the ubiquitous "Sanken" audio amplifier modules.

The notion was fine in theory: a resistor network could be formed onto an insulating ceramic substrate, trimmed with a laser, connecting wires, transistors and other components soldered on, and then the whole assembly dipped in epoxy. The idea was that complete circuit modules could be built this way and the heat-conductive ceramic substrate would ensure that all the components were kept at the same temperature and so avoid thermal drift problems.

There were several of these in the 4000 chassis and they were all hopelessly unreliable. Towards the end of the 4KA's production life, AWA-Thorn started substituting small circuit boards which were far more reliable but suffered horrendous thermal drift problems. The static convergence would often drift 5mm during warm-up!

The 4KA also had tremendous problems with its chroma decoding circuitry. This must have started fairly early in the piece because the subcarrier oscillator and chroma processing circuitry were all located on a small plug-in board and several different boards were used, none being particularly reliable.

I think the original idea was to have an elegant state-of-the-art two-chip colour processing system: a TBA395 for the chroma processing and subcarrier oscillator and an MC1327 for the decoder and output, but Thorn just couldn't get it to work properly.

The 4KA was so unreliable that, in 1975, following HMV's lead, AWA-Thorn started importing British-made 56cm and 67cm sets using the older Thorn 3500 chassis. Although this seemed like a huge step backwards for many, at least these sets with their antediluvian 90° delta gun tubes and strange transistor types were reliable and properly set up, they gave an excellent picture. The Australian version

of the 3500, (dubbed the 3504) was fitted with an isolation transformer and a standard 13-channel VHF tuner.

The above three models were probably the most noteworthy/notorious. Most of the other brands simply behaved themselves and so there's not much to say about them really. That is, while there were certainly a lot of these sets sold, they were not, as the police might put it, "models of interest" to us!

National

National's (Panasonic) first entry was a chassis known locally as the 2000 (also "M4"), which appeared in several screen sizes and models.

This chassis was actually the very first locally manufactured colour set I ever saw and I still have a working 56cm sample in my collection! It seemed the Matsushita designers didn't want to miss out on anything, since this chassis had a mains stepdown transformer, an SCR voltage regulator and a bipolar transistor as an electronic filter, which sadly, were the only unreliable parts of these otherwise excellent sets.

Our first reaction was one of abject horror when we saw how the chassis was constructed though, with quite poor service access!

Pye

For a home-grown effort, the Pye CT25 was quite well-designed and relatively trouble free and unlike many of its "countrymen", these sets tended to stay the distance.

Unusually for a "Euro-centric" design, it used a simple mains stepdown transformer and a Japanese-type series regulator for its 120V HT rail. Pye were also unusual in using an inline gun picture tube from the start; other manufacturers took a couple of years to catch up.

Otherwise, there was nothing whatever unusual about its circuitry, which is probably why so many of them lasted so long!

Sanyo

Another chassis that was "underrepresented in crime statistics", the Sanyo was another fairly conservative effort, with a simple linear regulator power supply using two transistors in parallel.

There are still a few of these in operation today, although at some point they would be in need of a bulk electrolytic transplant!

One of the early Philips colour sets – this was taken from an advert at the time complete with the then-standard "simulated picture" disclaimer . . . did they think that viewers would complain if the yacht sail did *not* poke out of the top of the television when it was installed in their loungeroom?

Rank Arena

These sets were basically a locally assembled version of an NEC chassis. The story went that a consortium of local manufacturers was offered the choice of the British-designed "true" Rank chassis or a badge-engineered NEC chassis. Legend has it that they took one look at the British effort and took the NEC option!

Although the NEC chassis worked reasonably well, construction-wise they were a bit of a mess, the earlier designs being pretty much an NTSC chassis with extra circuitry tacked on for PAL decoding.

They were less reliable than most of the fully-imported Japanese sets, but they were cheap and cheerful and most customers were satisfied with their purchases.

Their only real vice was that the insulation around their EHT triplers often used to fail without warning, unleashing a noisy fireworks display that traumatised many a snoozing household pet (and its owner!)

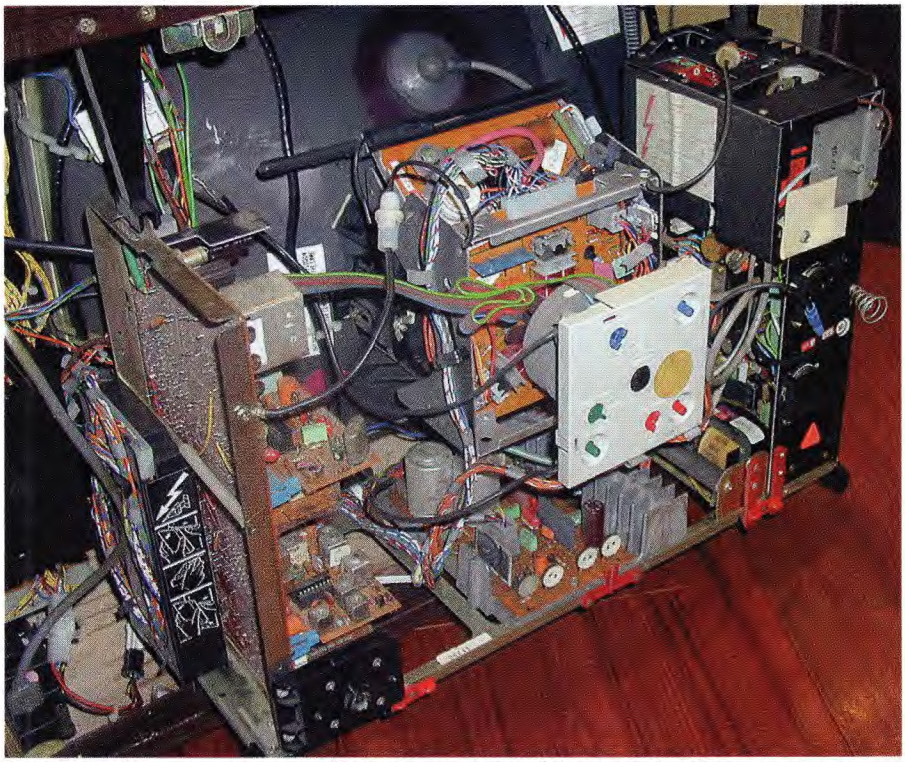
The Japanese invasion

To give the local manufacturers a sporting chance, Telefunken, the owners of the PAL patents, enforced a 6-month moratorium on the importation of sets with screen sizes 51cm and under, until the actual commencement of full-time colour broadcasts in March 1975.

As I said, we had good reason to fear an onslaught of cheap Japanese-made sets, in light of our experiences with their monochrome efforts!

I was working for AWA-Thorn when the imports began and we were frankly left open-mouthed when the first container of 1000 AWA-branded (and Thorn) 34cm Mitsubishi portables duly arrived – not with horror but rather with amazement. Every single one of them worked!

OK, a couple of them had purity errors that needed a touch of the degaussing wand and one or two of them had minor static convergence errors, but compared to what we'd been used to, this was unbelievable! With the 4KAs, as each shipment arrived from Sydney, it had become standard practice to take them all out of their cartons, sit them on top, and let them run without antenna input for about two weeks! Out of every lot of 100, after the first day there'd typically be 10-15 blank screens (some of which responded to switching off and then on again) and an equal number of screens with snow some colour other than white! Each day, the number of duds was a little bit



A view inside a Ferguson set (actually a 7C06) of the period – they sure knew how to fit a lot in in those days! Of course, most of what you see in today's sets would be replaced by a couple of large ICs and a few other components.

smaller, until eventually a week could go by without failures. Of course, then we'd go round plugging in an antenna, and the fun would start again!

The story was the same with just about every Japanese import: for sheer reliability and price, the Japanese were simply unbeatable. If I had to make a choice, I'd say that JVC gave the best all-round package of appearance, image quality, reliability and value for money. Apart from a couple of notable exceptions, you really couldn't go wrong!

Actually, "Dad's TV" is a bit of a family joke that is a case in point. My father turned 70 in July 1975 and so my brother and I decided we'd go halves in buying him one of the new "AWA" 34cm portables. I actually paid the "dealer price" of $333, which in those days was a ludicrously low price for a working colour TV set! He was as pleased as punch and as he was bedridden a lot of the time. He didn't expect to be with us much longer and so he kept remarking that the little set would "see him out!"

However he got over that illness but true to his word, when he finally passed on 28 years later in September 2003, aged 98, the set was still going, with the picture tube as good as the day we bought it! What's most remarkable is that it only ever broke down once in all that time (after 22 years).

Recently I saw an identical set at a flea market for the princely sum of $5 and I bought it for spare parts. Would you believe that when I got that set home, I found it was also still in working order? After a few minor adjustments, it is also producing as good a picture as it did the day it was made – just like the 56cm version of the same chassis which I found during a council clean-up 10 years ago and fixed for a few dollars!

There's another bit of irony here too. Many of the first wave of imported sets had the "instant picture" facility, where about 4V ("standby") was applied to the CRT heater while the rest of the set was off. This heater voltage was then increased to the normal 6V when the set was switched on.

Grave concerns were raised as to the effect this "convenience" feature might have on the longevity of the picture tube cathodes, particularly if the set was to be taken under service contract.

Well now we know! All of the sets I've seen with tubes still in perfect condition after 30 years were the ones with this feature! Far from shortening the life of the cathodes, it seems to have done them a power of good!

Bypass operation

One of the weirder aspects of the Telefunken's attempts to regulate the market via their control of the PAL patents was the "PAL bypass" fiasco.

In 1968, Sony announced the development of their revolutionary Trinitron picture tube. It certainly produced the best pictures available at the time, and Sony caused a lot of concern with their announcement that they would not be licensing the technology to any other manufacturer, presumably hoping to corner the market.

However, in retaliation, Telefunken refused to issue Sony with a license to manufacture PAL receivers, effectively locking them out of the lucrative European market. Sony then announced that they had developed a chroma decoder that didn't actually infringe on the PAL patents, because it essentially turned the PAL signal into NTSC.

The upshot of this was there were a few fully-imported sub-51cm sets imported into Australia before March 1975, some by Sony and a few from Mitsubishi. Because they didn't actually use PAL decoding, they were prone to the "green faces" problem of NTSC, although properly set up, I doubt that too many people would have noticed the difference.

However Telefunken insisted that these decoders did in fact infringe on the PAL patents, as they relied on certain characteristics of the PAL signal to determine which lines held PAL encoding and which held NTSC encoding. In the end, Telefunken relented, after experience with the US NTSC market showed that consumers weren't all that impressed with the Trinitron tube, not if it meant paying substantially more for the technology! Apart from that, neither the Sony sets nor the Trinitron tubes turned out to be particularly reliable, and even after the Trinitron patents lapsed, no other manufacturer seemed interested. It's rather sad now after all this time to see "Badge Engineered" Sony-branded TV sets with ordinary tubes in them.

One of the minor mysteries of all this carry-on cropped up when HMV started selling small Japanese-made "General" colour sets under the HMV and Healing brands. There was nothing particularly noteworthy about these sets except that they used a

These two Toshiba sets from 1978 show just how far TV sets progressed in three years. The set at left was a basic VHF/UHF model, while the unit at right featured an ultrasonic remote control!

"weirdo" two-crystal PAL chroma decoder system that would almost certainly have successfully sidestepped the Telefunken patents but they also used a perfectly standard PAL delay line system that most emphatically would not! It seems almost as though they changed their minds half way through!

The beginning of the end

The start of unrestricted importation of cheap colour sets pretty much marked the beginning of the end for the larger TV service companies. When colour was first on the horizon, the local manufacturers began to work out warranty service deals with the service companies and prices were agreed and so on, but this was on the basis of the original estimates of colour set prices before the tariff cuts were announced.

With their prices effectively cut in half, the manufacturers naturally wanted to halve the service contract prices as well – but of course, it doesn't work like that. For all practical purposes, the service cost was the labour cost, which remained stubbornly the same!

The result was that most of the manufacturers decided it would be more cost-effective for them to provide their own service departments and that was how I came to be working for AWA-Thorn. Unfortunately, most of them badly overestimated the reliability of their own products, and so their service departments became hopelessly overloaded. The problems were massively complicated by the actions of certain smaller concerns who suddenly started offering cut-rate service contracts to some of the big retailers, who had no way of knowing that these outfits hadn't spent a cent on staff training or upgrading their equipment. It was pretty much a case of "take the money and run", leaving the manufacturers (ie, us) to face the angry customers.

In the current climate of consumer protection laws for everything, it's hard to imagine what it was like back then. In those days it was perfectly normal for a customer to spend up to a thousand dollars on a colour TV set, have it fail the very first night, and then have to wait days or weeks for someone to even come and look at it! I had to make many a late-night house call with a 4KA chassis on the back seat of my car!

Of course, with the wafer-thin profit margins involved with the new cheap imports, the importers/manufacturers were obviously keen to screw an even lower service contract price out of the service companies, which was generally greeted with statements like "Yeah, right!" This was well before anybody realised how reliable the Japanese sets actually were. If the service companies had known that, they could have cleaned up with low-price contracts on sets that never broke down.

So in the end, the importers realised that it was probably going to be cheaper to simply keep a supply of spare sets on hand for replacement purposes or spare parts, which is pretty much the practice today.

By the early 1980s, TV set manufacture had pretty well ceased in Australia, although some manufacturers maintained a "screwdriver industry" presence, basically assembling some of their larger models locally from fully imported components. The arrival of VCRs and things like personal computers revived the fortunes of the servicing industry to a certain extent but slowly it regressed to the "Mom and Pop" style of independent operators typical of the 1950s.

Much the same thing happened in New Zealand, incidentally, although things happened a little differently there.

What used to be one very large service organisation with branches in most of the larger towns, became a sort of "McDonalds franchise" operation, with independently owned branches supplied by a centralised parts buying agency.

It's hard to know where the future lies. In this era of $95 34cm portable TVs, $98 VCRs, $50 DVD players and $495 2.5GHz PCs, obviously it's going to be a lot cheaper to throw things away than get them fixed.

Nonetheless, as "Serviceman's Log" can attest, people are still sometimes willing to pay an over-the-top price to get something fixed, purely on the basis of: "well, I know how to operate that set!"

Organisations like WES Components do a sterling job of keeping small servicing companies in business, combining an enormous parts inventory with fast delivery. It's truly amazing what you can still get parts for!

Having said that, my local electronics repair shop has just closed down for good and that's something that's occurring far too often these days! **SC**