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NEXUS
MEDIA COMMUNICATIONS

Reliability problems

Are new TV sets becoming less reliable? From reports we have seen and some feedback from readers it seems that the early failure rate has increased and that the situation has become worse with the growing number of flat-panel sets being sold. Plasma in particular seems to be having problems. You can, perhaps, put this down to the inevitable teething problems with new technology, but there is also the fact that plasma panels consume quite a lot of power. And, as we all know, where high powers are involved components are subject to stress and tend to fail. More generally however there is the problem of price deflation, which is probably getting worse as consumers worldwide curtail their spending at a time when there is excessive manufacturing capacity in the CE industry.

The trade is hit in two ways. It has the problem of dealing with faulty new products and, in addition, the pressure on prices means that manufacturers are less able to provide adequate service backup. You can't very well blame the move to manufacture in countries where production costs are cheap, but it doesn't help. Low prices also mean a tendency to scrimp on component quality.

The supermarkets get some of the blame because of their relentless price cutting. Asda for example is now selling 17in. LCD sets for £230, 20in. LCD sets for £280 and 26in. LCD sets for £490. Setmakers are in turn blamed for supplying the supermarkets instead of backing traditional trade outlets. But with current competition legislation they probably have little option in the matter: they are not allowed to refuse to supply customers.

There could, possibly, be a bright side to this. What happens to the faulty sets? They can't all be dumped in landfill sites – certainly not once the WEEE directive comes into operation. And it would be uneconomic to ship them back to wherever they came from for attention. So somewhere, presumably, there's an increase in servicing and repair work. This could be temporary, and certainly not lucrative, but could nevertheless provide employment for some of us in these difficult times.

Father of the IC

The 'transistor effect' was discovered at Bell Laboratories in late 1947 and was announced to the world in 1948. Use of transistors was slow to start with, because of reliability problems with the early germanium types. But the transistorisation of electronics didn't take long, nor was it long before the next major step forward, the integrated circuit, appeared. The first working prototype was, it seems, demonstrated in September 1958 by Jack Kilby, who died on June 20 at the age of 81.

Jack St Clair Kilby had the right start in life. He was born in Jefferson City, Missouri in 1923, his father being an electrical engineer, and took an early interest in radio and electronics, becoming a licensed radio amateur. He enrolled at the University of Illinois in 1941, just four months before the attack on Pearl Harbor. He was subsequently conscripted into the army, where he spent his time as a radio repairman. After graduating with a B.Sc. in electrical engineering in 1947 he took a job with the Centralab Division of Globe Union, an electronic components manufacturer. He subsequently obtained a master's degree and, in 1952, was sent on Bell Laboratories' first ten-day seminar on transistors. Centralab subsequently became one of the first transistor manufacturers.

In 1958 he moved to Texas Industries in Dallas. TI was getting into the transistor field and was already producing a transistor radio. Kilby was assigned to a miniaturisation project, where he came to the conclusion that it should be possible to build everything on a silicon substrate rather than using discrete components. He was given the go-ahead to develop this approach, which led to the prototype mentioned above.

TI was not the only firm looking into this however. In particular Robert Noyce developed practical IC technology at Fairchild Semiconductor – he went on to co-found Intel in 1968. Both Kilby and Noyce filed patents, and there was some dispute as to who had done what first.

In the mid Sixties Jack Kilby led a team that developed an electronic calculator. It first went on sale in 1971. Within five years a considerable reduction in price and weight had been achieved, and the pocket calculator business was born. Kilby was not interested in a management career however, and in 1978 took leave of absence from TI to work at the Texas A&M University. He finally retired from TI in 1983, but continued to work as a consultant. He filed sixty patents during his career.

In 2000 he shared the Nobel Prize in Physics. The citation attributed the invention of the integrated circuit jointly to Kilby and Noyce, who had died in 1990. He had also been awarded the National Medal of Science, the highest scientific honour in the US, in 1969.

BSkyB Latest

BSkyB has launched a new service that enables mobile phone users to keep up with the latest sports, news and weather reports around the clock. The service is available via a number of mobile networks. Its offerings include stories and updates from Sky News and Sky Sports; live scoreboards; tables, fixtures and results for key events; weather forecasts; and the ability to check odds and place bets with Skybet. There are also plans for entertainment-based mobile programming – this is in the development phase. The service is available to top-tier Sky World subscribers.

A new pricing structure has been announced by BSkyB. From September 1 there will be six genre-based 'mixes' of basic channels: variety; children's; knowledge; style and culture; music; and news and events. Subscribers build their own packages by selecting any two, four or all six of the channel mixes. Charges are £15 a month for a 'two-mix' pack, £18 for a 'four-mix' pack or £21 for all six (this is also known as the Entertainment Pack). Subscribers will be able to take any combination of Sky's premium channels in addition to their selection of mixes. In total the number of package options available has increased from 96 to 496. However the number of 'price points' for new customers has been streamlined from 96 to fifteen to provide greater simplicity at the point of sale. Under the new scheme the price of the top-tier package, Sky World with the Entertainment Pack, is £42.50 a month (up from £41 a month). This package is currently taken by about 50 per cent of Sky Digital's customers. BSkyB hopes that the new pricing structure will help it achieve its target of ten million subscribers by 2010, up from 7·7m at present.

Later this year Sky World subscribers who have a broadband internet connection will be able to download movies on demand and watch Sky Sports programming on a PC. A selection of some 200 movies will be available at launch, including a mix of new films and library titles. The number of titles will increase over time. Content available from Sky Sports via broadband will include match highlights, interviews, programme clips and Sky Sports news bulletins. A TV set with PC port could be used for viewing.

Business news

Sony is to close its TV plant at Bridgend, South Wales, because of reduced demand for CRT TV sets. The plant was opened in 1974 and will close by 2006, with 400 redundancies. There will be further redundancies of about 250 at the nearby Pencoed plant, which will retain some 300 staff for activities such as studio TV camera manufacture.

Thomson has ended its last link with TV set production by selling its loss-making CRT business to the Indian CE group Videocon for $290m. Videocon has a number of interests besides CE, including white goods manufacture. It produces TV sets, both own-band and OEM, and now has CRT plants in Italy, Mexico, Poland and China. OEM sets are supplied to Toshiba amongst other companies.

Dixons has decided to change its name to DSG International, to reflect its growing international operations. The Dixons name will continue to be used. The company has reported increased sales by volume but reduced sales by value, the result of current price deflation.

Samsung has developed a 40in. OLED (organic light-emitting diode) screen for flat-panel TV displays. The widescreen panel has an HD-compatible resolution of 1,280 x 800 pixels (WXGA), a contrast ratio of 5,000:1, and a lower power consumption than other types of flat-screen display. It's expected to be used in low-cost, high-quality digital TV sets.

BT services

BT is to launch a broadband TV trial early next year, using Microsoft's IPTV (Internet Protocol TV) technology. If successful a commercial service will be launched the following summer.

BT is also at present running a mobile-TV trial using the DAB standard. During the UK Livetime trial 1,000 users will have access to Sky news services, a music channel and fifty radio stations, using a smartphone or portable media centre. BT has had to produce its own handsets as no manufacturer can at present supply ones that can decode TV via DAB, though the technique is in use in Korea.

New Sony HD camcorder

Sony has recently launched in the US what it claims is the world's smallest and lightest consumer camcorder with full HD resolution, based on the 1080i standard (1,080 lines interlaced). Handycam Model HDR-HC1 weighs approximately 680g and includes a 2·7in wide hybrid touch-panel LCD screen to provide access to menu options, including 16:9 and 4:3 aspect ratios (in the DV mode). Other features include a 10x optical zoom, 120x digital zoom, steady-shot technology, NightShot and the ability to record 2·8 Megapixel digital still images and store them directly on a Memory Stick Pro Duo for transfer to a PC or other device. Price is the equivalent of about £1,300.

Disc developments

TDK has developed a prototype recordable Blu-ray disc with a storage capacity of 100GB. It can store approximately nine hours of high-definition video. Recording is at 72Mbits/sec, twice the rate of the current Blu-ray specification, which lists 25GB single-layer and 50GB dual-layer discs. To achieve the 100GB capacity, TDK's disc has four 25GB layers. As with all other Blu-ray discs, it's single-sided. TDK says that the new inorganic film formulation used provides strong stability with narrow track pitches and high recording densities. The formulation's optical qualities are so stable that TDK says it has already achieved six times recording speed (216Mbits/sec) in the laboratory with a blue laser.

Four manufacturers have announced the development of a prototype HD-DVD-R disc that can be produced at high volume using standard DVD-R production lines. The disc is single-sided with a storage capacity of 15GB. Hitachi Maxell and Mitsubishi Kagaku Media/Verbatim claim to have separately tested and verified the manufacturability of the write-once discs, which use a new organic dye developed specifically for blue-laser applications. The new dye is the result of a joint project by Hayashibara Biochemical Laboratories, a key manufacturer of dyes for DVD-R discs, Mitsubishi Kagaku Media/Verbatim and Toshiba Corporation. Hitachi Maxell and Mitsubishi Kagaku Media/Verbatim will start producing the discs next spring, when HD-DVD recorders and PCs with built-in HD-DVD drives are due to be launched by various manufacturers including Toshiba.

Standard DVD-R discs use a photosensitive organic dye as the data-storage medium in the recording layer. The newly-developed organic dye is highly sensitive to blue-laser light, provides readout stability, and has the solubility in organic solvent required for easy production of the recording layer in a spin-coating process. Hitachi Maxell and Mitsubishi Kagaku Media/Verbatim have both used the new dye in trial production of prototype HD-DVD-R discs on their DVD-R production lines and confirmed that the process is suitable for mass production.

Toshiba and Microsoft have agreed to investigate the development of HD-DVD players that use Microsoft's Windows CE technology. They are already collaborating on iHD, an interactive DVD format.

Negotiations between the Blu-ray and HD-DVD groups on a common format seem to have stalled.

Japanese manufacturer NHJ has launched the first TV watch in the UK, Model VTV201, at about £130. Other versions are sold in Japan and the US. Its analogue tuner can receive all five UK terrestrial channels, with automatic or manual tuning. There's a 1·5in. LCD screen for viewing and a headset for listening. The latter also incorporates the aerial. An on-board rechargeable lithium polymer battery provides viewing for up to an hour – a separate battery can be added to increase the viewing time to three hours. It comes with a recharging cradle, adaptor plug, wrist band, case and neck strap. The TV watch is part of an innovative range of products that includes personal video players, digital cameras and camcorders and MP3 players.

Video recorders

Hitachi is to launch a DVD recorder that enables TV commercials to be skipped. Model DV-DS81E, which is due for release this autumn, incorporates a feature called Commercial Advance. This uses image-recognition technology to detect commercials while recording and 'marks' their start and end. During playback it automatically skips through the commercials.

Panasonic has launched a 'four-in-one' video recorder, Model DMR-EH80V, that incorporates a 160GB hard drive, a DVD recorder, a VCR deck and an SD Memory Card slot that can be used for playing back MPEG-4 video stored on the cards. The price is about £550.

Akai has launched a combined DVD recorder and Nicam VCR, Model GBR-5801D, at about £280. The DVD section is multi-format, offering the same facilities at Model ADR5800Di (see page 324 April). A new version of Model ADR5800Di, with the same features plus some others, has been released at an even lower suggested price of about £150. It has a pan-European analogue tuner. Different recording levels can be set, depending on subject matter, using simple on-screen displays.

Pioneer has launched its first VHS/DVD recorder with a built-in hard-disc drive in Japan. Model DVR-RT7H has a one-button auto dubbing feature that enables VHS recordings to be transferred to DVD. Other features include up to 24 hours of continuous recording on to a single-sided, dual-layer DVD-R (DVD-R DL) disc and a maximum of x100 dubbing from the HDD to a DVD-R disc.

Toshiba is launching three new multi-drive format HDD recorders, Models RD-XS24, RD-XS34 and RD-XS64. All include PAL progressive and component-video outputs, time-slip recording, DV input, satellite control and a 32-event/two-month timer. Model RD-XS64 also has HDMI connectivity.

Ofcom opts for 64QAM

Ofcom has formally recommended that 64QAM should be the transmission standard for DTT in the UK when the final analogue closedown takes place. Curious. Back in 2002 the DTG, BBC Research and Development, Crown Castle and NTL carried out research which suggested that 16QAM provided greater coverage and more robust signals. But fewer channels per multiplex of course. Could Ofcom be making a decision based on political or commercial rather technical considerations?

The dubiousness of some of its other decisions does not give one great confidence. At least everyone seems to be agreed on 8k rather than 2k carriers, which just leaves a few early DTT STBs unable to cope.

Pace digital TV adapter

Converting to digital

Changes to our TV reception have been required before, with the end of the 405-line system, and there have been numerous technical changes in the video/TV field since then. The transition to digital TV reception is something quite different however. It has caused all sorts of problems, with winners and losers. Garry Smith and Keith Hamer review the current situation

Close down of the 405-line transmitter network across the UK was a staggered process, with the last transmitter being switched off in early 1985. Few viewers were aware of the network's final demise and, at one stage, it was estimated that only some half-dozen viewers in Wales used one particular transmitter before the service was terminated. Towards the end, many transmitters limped gracefully towards retirement on reduced power.

By the time of the final switch-off viewers were enjoying high-definition (625 lines) colour reception of four nation-wide channels with stereo sound and text services. VCRs had become an established part of the domestic scene, enabling viewers to record their favourite programmes in colour. In fact there was a radical improvement over what the 405-line service could ever offer. Viewers were happy, and 405 lines passed away peacefully.

The same cannot, unfortunately, be said about the change from analogue to digital, which faces growing resistance as the potential upheaval and expense of forced conversion becomes apparent. There is no doubt that conversion will cause a lot of pain. This is a great contrast with the changeover from 405 to 625 lines, which was an almost natural process that took place over sixteen years.

Digital target

The government has promised not to switch off the analogue services until digital signals can be accessed by 95 per cent of homes. One concern is that this figure includes subscription-based satellite and cable delivery of signals in addition to terrestrial-transmitter based reception. After all, it's the terrestrial-transmitter based analogue system that's to be replaced with a digital one.

The target could be difficult to achieve if there is resistance from stubborn viewers, and it's quite likely that there will be. Target dates change like the weather but, currently, the switch-off is forecast to commence in 2008 and be complete by the end of 2012 (until recently it was to be 2006 and 2010). Targets are targets of course, but the 2012 date is unlikely to be met easily. During this period about eighty key analogue transmitters

and their dependent relays will close.

A recent Ofcom report suggests that 55 per cent of homes can already receive digital TV. The government's hopes, and its eagerness to axe analogue broadcasts sooner rather than later, have always depended on this rising figure. But the disturbing fact is that the figure is totally misleading: it doesn't relate to the number of digital-only homes, which could probably be counted on one hand.

Cost per household is another consideration that affects the changeover. It could run into several hundred pounds per home, depending on whether full or partial conversion of equipment is undertaken.

Winners and losers

One aspect of conversion that has been ignored is comparative picture quality. Those who are currently able to enjoy perfect analogue pictures will feel that they are being offered a noticeably inferior digital replacement.

There will be winners and some losers, as letters in *Television* following Dr Les May's article in the January issue have highlighted. Dr May's problems are probably caused by excessive analogue signal causing his set-top box to crash. Viewers who suffer from second-rate analogue reception, with echoes, picture movement caused by trees, and other odd defects will certainly benefit in terms of a relative improvement in picture quality by going digital, but this does not mean that digital will provide an improvement for everyone.

The biggest headache is the conversion process itself, and the resistance of those who are quite happy with what they already have and have no wish to change.

We've had access to terrestrial digital TV reception since before the ONdigital service became available officially. Our experience over these years has highlighted the merits and shortcomings of DTT. It has massive potential but, with hindsight, the wrong path to conversion was chosen and the whole affair has developed into a somewhat hatchet job.

Picture break-up is a major concern, as many readers have discovered. An increase in transmitter power would improve the reputation of DTT no end – critical media reports gave DTT a bad name in the early days. During the transmitter 'equalisation' programme in 2000, many transmitter powers were increased and channels altered to enable the giant RF jigsaw puzzle to move closer to completion. Unfortunately there came a point where there was no further scope for manipulation, as further increases in output levels would have affected analogue and digital services elsewhere. This is why drastic action is being called for, in the form of analogue transmission switch-offs, so that the process can be given a kick-start to improve coverage and signal reliability.

Cramming the digital network into the already overcrowded UHF spectrum has not helped. It would have been ideal if a single-frequency network (SFN) could have been implemented from the start. But one of the attractions of the ONdigital subscription service, as a rival to Sky, was that it could be received via the existing aerial. Well, that was the theory! The natural migration to digital is frustrated because the viewer cannot see any worthwhile benefits at the end of the digital rainbow.

Analogue achievements

Until BBC2 arrived in 1964, in the London area only initially, there were just two TV services available, BBC and ITV. The start of UHF transmissions brought two benefits in addition to the extra channel, a higher line standard (625) and improved sound because of the use of FM instead of AM. Better sound was rather spoilt by manufacturers' tendency to fit smaller and smaller loudspeakers in their sets.

Then, on July 1, 1967 colour TV arrived – just in time for Wimbledon coverage and to be able to claim that we had beaten the Germans in introducing the first colour TV service in Europe. But only a handful of evening programmes were shown in colour: the full BBC2 colour service started on December 2, 1967. The benefit of colour was immediately apparent to viewers, even if they couldn't afford a set or the services of a resident technician for when things went wrong, which was often in those days! On November 15, 1969 the BBC1 and ITV services started to be duplicated in colour at UHF, but it was several more years before all the main transmitters and their associated relays provided almost full coverage across the UK.

Teletext became available on a regular basis on September 23, 1974 but was slow to catch on. More significant for many people was the introduction of Nicam sound on August 31, 1991. Channel 4 had opened in 1982 but many viewers were unimpressed and, where reception was poor, didn't feel that investment in an improved aerial system was justified. The same happened when Channel 5 started in 1997.

Enter digital

A technical breakthrough in the early Nineties made it possible to transmit multi-channel TV digitally via the terrestrial transmitter network. By using signal compression, several digital channels could be combined as a multiplex that occupied the same bandwidth as a single analogue channel. The type of compression adopted is known as MPEG-2. It paved the way for multi-channel TV without gobbling up valuable RF spectrum space.

The decision was made to fund such a service by subscription and, on November 1, 1998 the world's first digital terrestrial pay-TV service, ONdigital, started. It was later rebranded as ITV Digital but, under intense competition from satellite pay-TV services, went into receivership in the spring of 2002.

After a period of reassessment DTT was relaunched as Freeview at the end of October that year. The intention was to provide a truly free-to-air service, with set-top boxes that no longer required a CAM (conditional access module) slot for a subscription card. But it didn't take long before pay-TV returned, in the form of Top-Up TV. This was targeted at former ITV Digital subscribers, some of whom were allowed to keep their set-top boxes. More recently boxes with a CAM slot have become available as part of the Top-Up TV package.

Technophobia

Anyone in the trade who has lots of customer contact will appreciate the technical difficulties that people have during a period of transition. When mechanical push-button tuning was first introduced many viewers were unable to manage the simple art of station tuning. New problems arose when remote-control units appeared: a button would sometimes be pressed inadvertently, with the result that the picture disappeared unexpectedly. Further problems came with timed recordings, even single-event ones, when VCRs became popular. Technical difficulties and technophobia are


Left: An early ONdiigital set-top box, the Philips Model DTX6370. Right: the Panasonic Model TU-CT20, a simple to use digital adapter, was launched in mid-2002

something that hasn't been taken into account properly with respect to digital TV.

Picture quality

ONdigital was targeted at those who wanted extra channels. As a subscription service, more channels meant more income. Thus picture quality came second to quantity. But picture quality is subjective: some viewers might sense an improvement where others find certain aspects irritating.

With an analogue transmission picture quality depends on signal strength, the number of multipath reflections, etc. With digital reception the picture quality remains constant until the signal level drops below what is called the 'digital cliff'. At around this level the picture pixilates randomly or breaks up, with sound disruption evident. With a further reduction in signal strength the picture and sound disappear altogether. A digital picture is either there or it isn't, and its overall quality is the same wherever it's received.

There are some cases where a digital picture is perceived to be far better than its analogue counterpart. Some examples are where there is mild multipath reception or where there is an imbalance between the five analogue signals (assuming that Channel 5 is available). It does seem to be a matter of swings and roundabouts, but the losers with conversion will be those who enjoy perfect analogue reception.

In an experiment conducted three years ago close to the Sutton Coldfield transmitter nearly half the participants felt that digital reception provided better picture quality. But this was not surprising as many bedroom sets had previously been fed from set-top aerials, which provide inconsistent and usually inferior analogue signal delivery. Where digital reception was not possible using an existing set-top aerial the digital set-top box was connected to the main, freshly-installed aerial system. A noticeable improvement in Channel 5 reception was reported, but again no big surprises as the signal is transmitted from the Lichfield mast and in many cases was being received from the side or back of the Sutton Coldfield aerial.

Where we live, to the west of Derby about 50km from the Waltham transmitter, analogue reception is free from ghosting. In fact the pictures are perfect except when, during high-pressure periods with the inevitable tropospheric disruption, co-channel digital signals from Tacolneston reduce three out of the five channels to almost a snowstorm.

Critical appraisal of the digital pictures confirms that they are not as good as their analogue counterparts. While we were preparing this article an unprompted letter arrived describing the writer's own experiences with a newly-acquired digital set-top box. He reported that at best the digital pictures resemble those obtained with a good, up-market VHS recording, taking on a muddy, duller look and lacking highlights, with facial detail one of the casualties. A football pitch is another example of loss of texture, the grass being best described as a uniform 'splodge'. A switch to analogue produces an immediately noticeable improvement, with sharp, crisp, brighter pictures. The best results are obtained when the RGB option is selected to feed the TV set, but even with this a slight difference between analogue and digital quality is visible. In all fairness however the majority of viewers would be unaware of the digital picture imperfections once they are absorbed by the programme content.

Thus improved picture quality is certainly not an assured benefit with digital reception. Advertising has to be very cautious about this, avoiding claims such as "improved picture quality" so as not to be in breach of the Trades Descriptions Act. Instead, terms such as "digital quality pictures" are frequently used, leaving it up to the viewer to decide whether this means an improvement.

Perhaps poorer picture quality is inevitable with digital services, rather like DAB which sacrifices sound quality for quantity. As developments continue it might be possible to deliver better quality pictures in the future, but the danger is of greater signal compression to include more channels. Maybe HDTV will save the day. In decades to come maybe analogue will make a comeback. After all, valve amplifiers have and vinyl recordings are becoming popular in some quarters.

Text and interactive services

Freeview's text services have improved considerably, with easier navigation, but they seem to be

The Philips digital terrestrial TV receiver Mo

painfully slow to access initially. The ability to control page changing is a welcome feature, but the digital offerings are not as extensive as the analogue service.

Interactive TV seems to be over hyped. Many viewers are confused about what an interactive service really is and do not know what to expect when invited to press the red button. It often seems not to work and, when it does, usually offers trivia about the programme being watched or even totally unrelated information.

Maybe this is technology for the sake of it and better use of it will be made in future. What would be welcome is the luxury of an EPG (electronic programme guide) similar to that available with the Sky satellite service.

Radio

Access to a variety of radio stations is a plus point with the Freeview service, but to avoid having the TV set switched on connection to a hi-fi amplifier is required. The drawback with this is that many set-top boxes don't display a channel number, other than on-screen, so the TV set has to be switched on initially to be able to select the required radio channel reliably.

The extra channels

Much money has been spent on developing extra digital channels, but viewing figures have been a disappointment. Endless repeats are part of the problem. Sky Travel and FTN seem to be two of the worst offenders in this respect, with series of programmes cycling every couple of weeks or so. Even BBC3 and BBC4 are not exclusive: many programmes are later transmitted on BBC1 or BBC2 and then repeated several times. This is hardly an incentive to switch to digital. In published schedules a particular programme is not necessarily shown as a repeat unless it has been shown previously on the channel concerned.

Recording difficulties

At the end of 2001 a project in the Lichfield/Tamworth/Sutton Coldfield area recruited volunteers to see how they would cope with digital-only reception, using cable, satellite and terrestrial delivery. Homes in good reception areas were selected for the latter, and new outdoor aerials were fitted to ensure success – indoor aerials were used for some second and third sets where signal levels permitted. All the equipment in the homes was fed from set-top boxes.

This included VCRs, but none of the initial participants (about 30) were able to grasp the technicalities of one-event recording, let alone multi-event recording, which involved setting the set-top box and VCR timers in sympathy. To compound the problem, the VCR switched to its analogue default mode when repowered and, unless the volunteer realised this and reset the recorder to L1, its line input, it would attempt to record a blank channel, the original aerial feed having been disconnected for the trial.

The Welsh experiment

A much larger project began in South Wales at the end of November 2004. An entire community of almost 500 homes, served by the Ferryside relay, had free digital equipment installed. To avoid the problems associated with the use of existing VCRs, Pace twin-tuner hard-disk PVRs (personal video recorders) were supplied. These sweeteners were bound to ensure the success of the project but don't, unfortunately, represent the real world. When the analogue switch-off time comes there are going to be millions of unhappy viewers who will be deprived of their traditional recording facilities, such as Video Plus or manually-set, multi-event timers.

The Ferryside relay was adapted for digital and the analogue signals were subsequently switched off. The idea is to see how viewers cope with digital-only broadcasts. It's supposed to be the only such project before enforced analogue switch-off occurs across the country over the coming years.

There were early reports of various problems. Quite rightly, for safety reasons, the elderly switch off their equipment at night – then find that the TV set is in the analogue default mode when power is restored. Confusion with remote-control units causes viewers to switch to analogue without being aware of it. Other problems include the inherent quirks of digital such as pixilation, poor lip-sync and equipment locking up. This scenario is so familiar and predictable to anyone in the trade that you don't need a project to provide confirmation – unless the idea is to create a publicity stunt.

Only four digital multiplexes are being transmitted by the Ferryside relay transmitter, 1, 2, A and B. To avoid aerial upgrades they are in receiving group A, the same as the previous analogue transmissions. The channels are 26 for MUX 1, 30 for MUX 2, 34 for MUX A and 23 for MUX B. Multiplexes C and D are not being broadcast. The ERPs (effective radiated powers) are 1W for MUX 1 and MUX B and 5W for MUX 2 and MUX A. Presumably the reduced ERP for MUX 1 and MUX B is to avoid interference to the transmissions from the Pencader relay some 25km to the north – it transmits ITV1 on channel 23 and BBC2 on channel 26.

Ferryside transmitted analogue TV on channels 21 (BBC1), 24 (ITV1), 27 (BBC2) and 31 (Channel 4), at 23W ERP. Interestingly the power was increased from 7W a few years ago to drown out the effects of digital co-channel interference from the Caradon Hill and Kilvey Hill transmitters.

STB quirks

A large number of friends and relatives have acquired a Freeview set-top box, as a gift rather than a purchase. In all cases the box has been used only to supplement existing analogue channels, even when it works without an aerial upgrade. A few have abandoned the STB altogether, either because they are fed up with its quirks or because they have forgotten how to use it. The fact that these STBs have been bought adds to the statistics that suggest, wrongly, that another home has 'gone digital', thus getting ever closer to the government's magic target.

Owning a variety of STBs has its advantages and confirms that

el DTR4600 includes interactive operation.

Sky+, the UK's first PVR set-top box for BSkyB.

digital viewing is not completely trouble-free. An STB can become inoperative when changing channels, so that the power unit has to be unplugged for a second or so before viewing can continue. Occasional pixilation does occur, but not often enough to warrant investigation or spoil the continuity of the programme.

Lip-sync delay is frequently noticeable. Where this is excessive it can usually be remedied by using the remote-control unit to change channels momentarily. BBC News 24 seems to have a strange lip-sync defect with the presenter's jerky mouth movement best described as a cow munching grass! Maybe this is because of the low bit rate of the news broadcast.

Once you become aware of these irritating defects you tend to look out for them. But it's one thing electing to change to digital and tolerate these shortcomings, quite another being forced to do so against one's will.

Some of these glitches may have to be accepted as part of the digital revolution. Problems with PCs and other microprocessor-controlled equipment often respond to a rebooting. But for some viewers missing twenty seconds of a favourite soap might be total deprivation. How many viewers would be prepared to accept a TV receiver switching to standby a couple of times a night without threatening the rental company or branding the product as rubbish?

Recording from an STB is easy enough, but when lip-sync problems occur they spoil the remainder of the recording. The scart connector to the VCR occasionally becomes slightly adrift, which means loss of sound or picture unless the continuity is meticulously checked prior to a recording.

Conversion problems

The Channel 5 retuning project was a massive undertaking, and the popular press had a field day with blown-up stories about various problems. The target date for retuning was when the transmitter serving a particular area was switched on for test. But the process was not the intrusive inconvenience to viewers that digital conversion will be. Provided the Channel 5 signal didn't clash with that of the VCR's modulator, the reason for the retuning, little harm was done if the viewer couldn't actually receive the new programmes. There was no financial cost to the viewer.

Digital conversion will be wholly different, and it's doubtful whether the public is aware of the likely cost. Most homes have two or three TV sets with VCRs: when the plug is pulled, the cost of total conversion could be an enormous financial burden for viewers. Current estimates run at several hundred pounds per household. Millions of viewers will be genuinely unable to afford the cost of all this, and will be denied what they currently enjoy just to please the government. Set-top aerials are unlikely to provide reliable reception in the run-up to the switch off, and many outdoor aerials will have to be replaced. Ironically, after the switch-off transmitter powers are likely to be increased considerably, making some of the new installations unnecessary!

Affordable conversion should be possible for the vast majority of viewers, but what about replacing traditional VCRs and, now, DVD recorders with digital versions? New technology might in fact provide assistance with conversion, with the demise of the VCR. If it became mandatory for all new TV receivers to have digital and analogue front-ends, maybe with a subsidy from the government to keep prices down, the public would at least be prepared for digital.

The Ferryside project is likely to be hailed as a great success, but this will be mainly thanks to the free hard-disk PVRs, unlimited set-top boxes, aerials and technical support. The rest of us are unlikely to receive this generous treatment.

Most people have a vast collection of VHS tapes. Even if they do upgrade to a digital recorder to help resolve the conversion problems, interconnectivity complications will arise if the existing VCR is to remain part of the system.

In addition to the technical problems of conversion to digital there are personal ones to overcome. Many viewers will be reluctant to lose their analogue services and many already fear that their existing equipment will become redundant, which is not strictly true. It could well be that resistance to the change will build up, with many people refusing to buy digital converters – especially if concessions are made to some sections of the public. The government of the day could have quite a battle on its hands come 2012. ■

Plasma display technology

In Part 3 of this series Fawzi Ibrahim deals with video processing and display formatting for plasma panel drive

Much has to be done following reception of a conventional video signal, whether analogue or digital, to generate drives that are suitable for a plasma display panel. This also applies to baseband-video inputs. This month we'll take a look at the basic steps involved.

Video processing

Fig. 1 shows the basic video processing system in a plasma TV receiver. Video from various sources – tuners, a scart socket for external composite and RGB video inputs, and S video inputs – is fed to an input switching arrangement that selects input(s) for further processing and switching. The colour decoder separates the luminance and chrominance components of the composite video signal, using a comb filter, and produces RGB video outputs. These are fed to an analogue-to-digital converter that encodes each primary-colour signal as an 8-bit digital signal, ready for passing to the display formatting section.

The comb filter

For analogue TV transmission the picture's colour content (the chrominance signal, C) modulates a 4·43MHz subcarrier whose sidebands fit neatly within those of the basic luminance signal (Y). See Fig. 2. Separation of the Y and C components of the demodulated video signal must be as clean as possible to avoid high-frequency luminance information being contaminated by colour information and, conversely, colour being contaminated by luminance – this gives rise to 'rainbow swirls'. Traditionally notch filters are used for Y and C signal separation. A much more effective method however is to use a digital comb filter. There are several types of comb filter, all of which use the fact that the chrominance signal is phase-shifted by 180° on alternate lines.

The two-line (2L) comb filter mixes two consecutive lines of video information and takes the average. The two lines are added to produce the chroma information and subtracted to produce the luminance information. It's assumed that the two lines are much the same. This type improves the horizontal resolution and reduces rainbow swirls.

The three-line (3L) comb filter uses three consecutive lines, giving the first one half weight, the second one full weight and the third one half weight. Differences in line content are in this way reduced. If all three lines are identical, the result is perfect. It provides better resolution than the 2L type.

The two-dimensional three-line (2D-3L) comb filter uses three lines in the same way as the 3L type, but the way in which the weighting is allocated to each line depends on how similar the lines are. If all three lines are identical, the 3L weighting is applied. Otherwise the weighting is varied. It's called two-dimensional because the mixture is varied vertically.

The 3D (motion-adaptive) comb filter senses motion

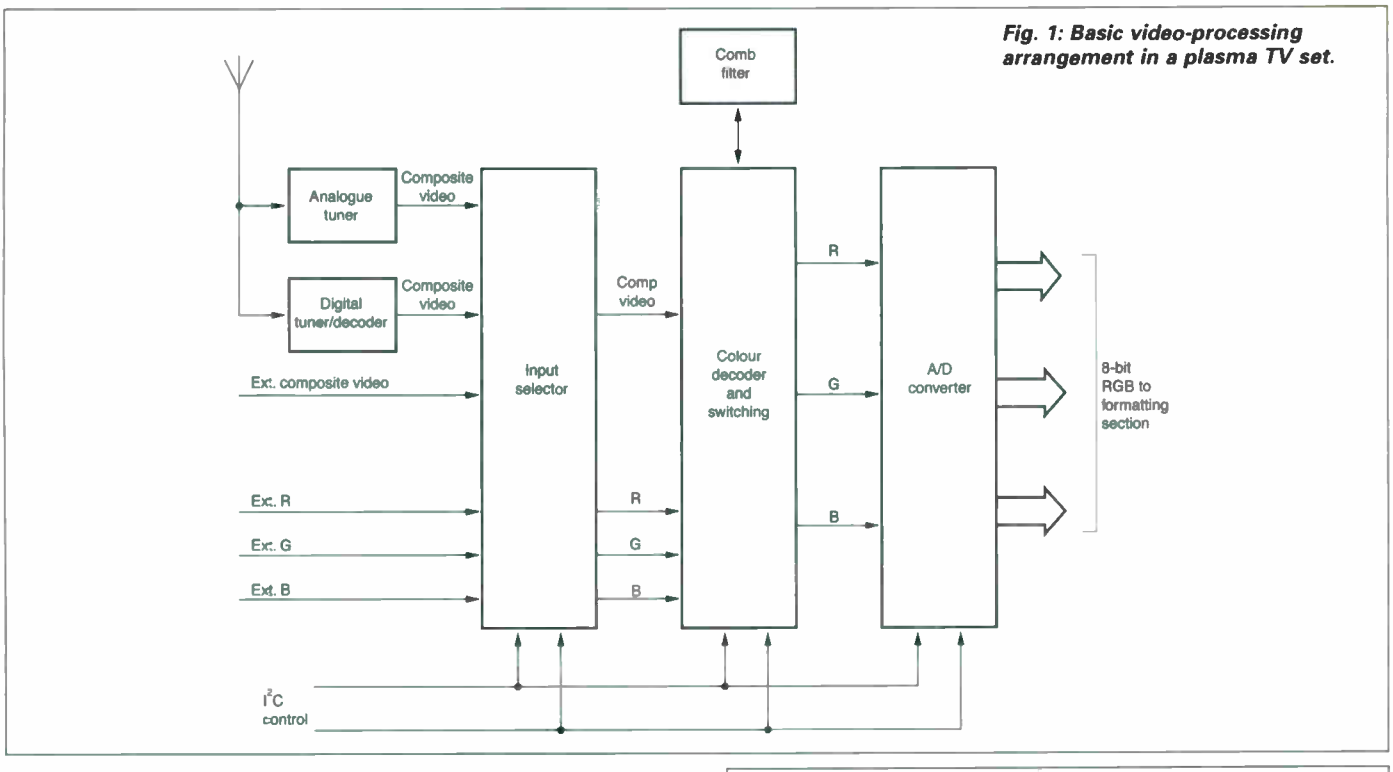

Fig. 1: Basic video-processing arrangement in a plasma TV set.

between one field and the next (hence three-dimensional) and adjusts the weighting given to the lines accordingly. If there is no motion, 2D filtering is used. This type of filter requires a large memory so that adjacent frames can be stored.

The A/D converter

The luminance and chrominance signals are sampled and converted into 24-bit video, consisting of three separate 8-bit groups for each primary colour, R, G and B. Each colour has a grey scale of 256. The total number of colours is thus 256 x 256 x 256 = 16·78 million.

Display formatting

The main elements of a display-formatting section for plasma-panel drive are shown in Fig. 3.

The received video is interlaced, so the first task is to de-interlace it. This is carried out by the I/P (interlaced/progres-

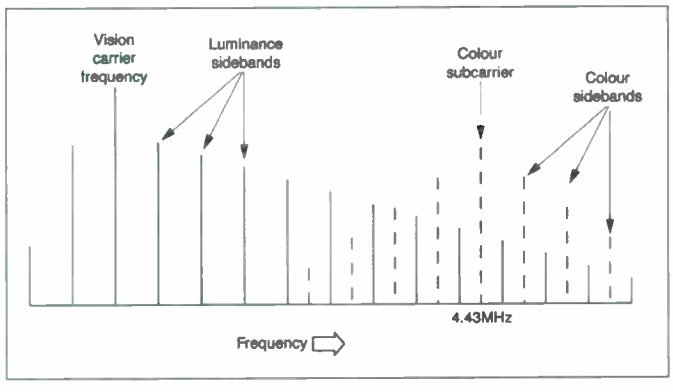

Fig. 2: Interleaved luminance and chrominance sidebands with a PAL colour transmission. The side frequencies cluster around multiples of the line frequency.

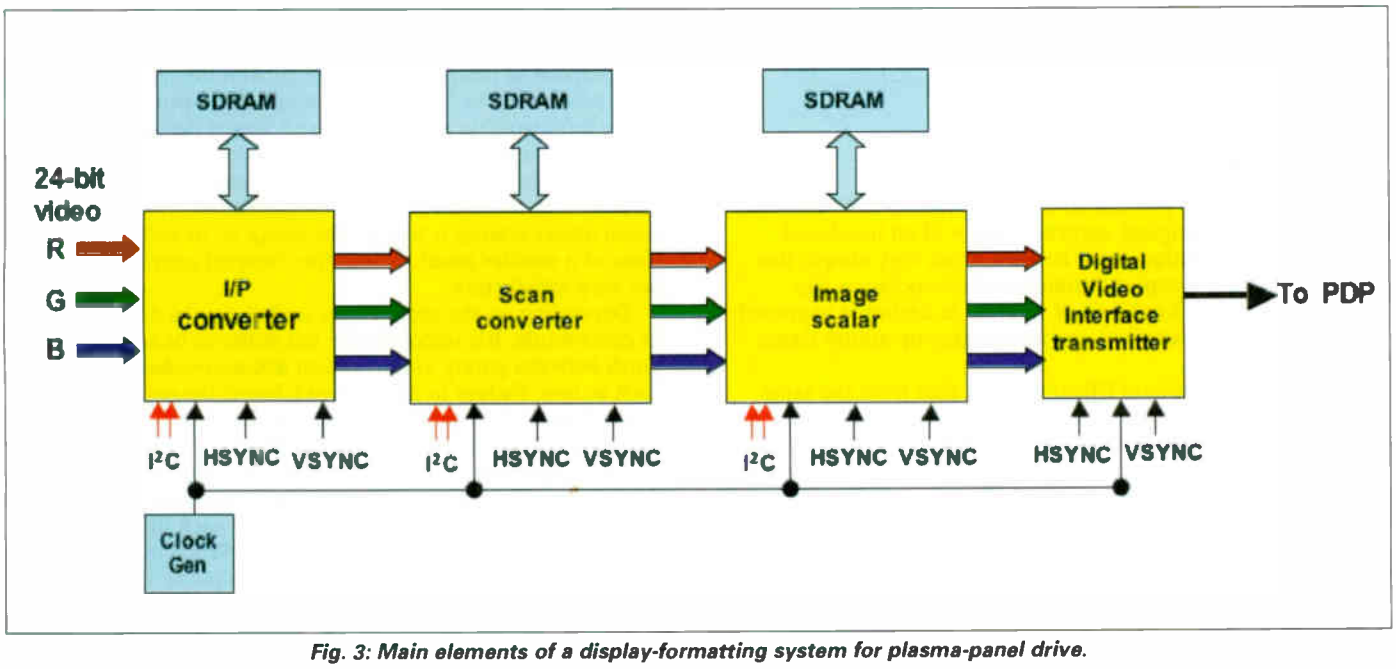

Fig. 3: Main elements of a display-formatting system for plasma-panel drive.

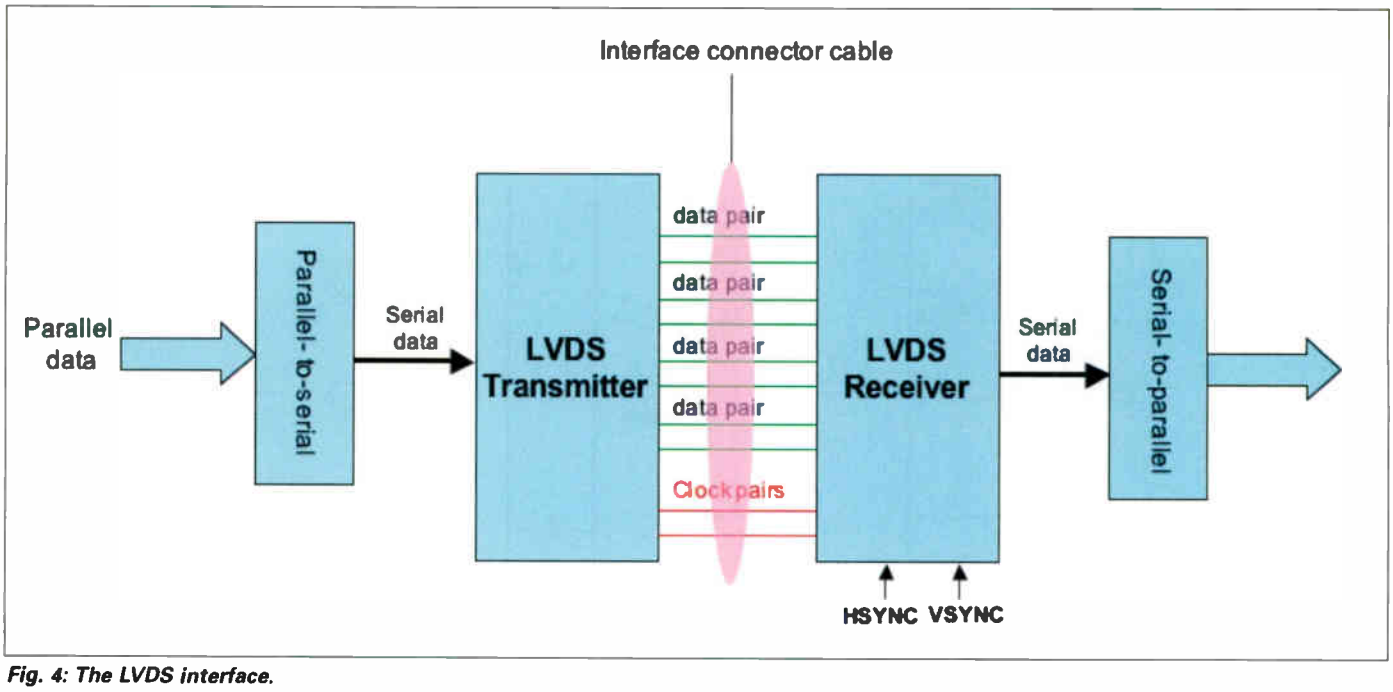

Fig. 4: The LVDS interface.

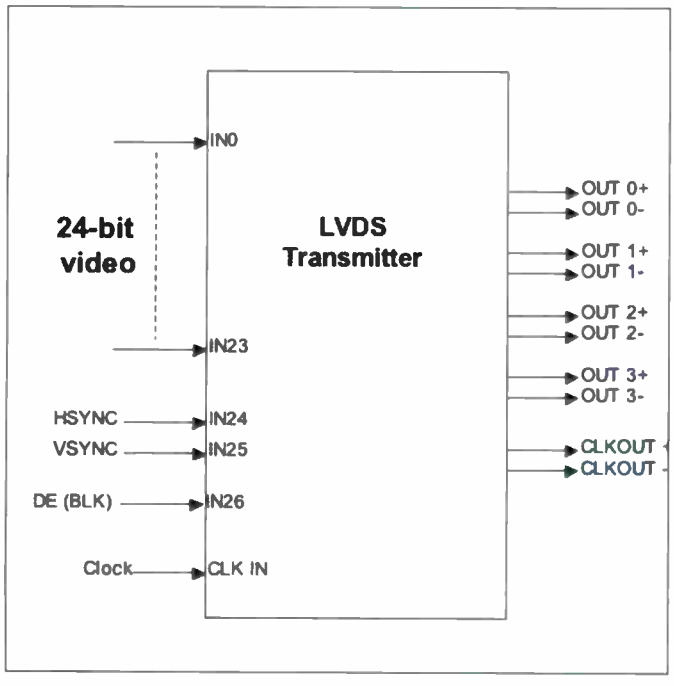

Fig. 5: Basic connections to an LVDS transmitter IC.

sive) converter. The process involves the creation of new scan lines between the original successive ones of an interlaced frame. Several techniques can be used, from very simple line repetition to very complex variations of interpolation and motion adaptation. Some sort of filtering is desirable to smooth out high-frequency artefacts caused by creating abrupt frame transitions.

With simple intra-field I/P conversion data from the same field are used, e.g. by repeating the previous line or creating a new line that's an average of two successive odd lines in an odd field or two even lines in an even field. The disadvantages of these methods include horizontal line flicker, still area flicker and low resolution.

With inter-field conversion data from odd and even fields are combined – two or more fields may be involved. New lines are created by referring to the current one and the one in the previous and/or next field. This method doesn't take into account motion between fields. As a result, a 'tearing' effect may appear in areas with movement.

The motion-adaptive method uses either intra- or inter-field conversion depending on the motion between successive interlaced fields. A 'motion value' is produced by comparing successive fields. This is used to determine the 'bias' towards intra- or inter-field conversion. Motion detection and estimation are thus critical.

With the motion-compensation method the picture content of successive fields is analysed to find out whether there is motion from one field to the next. If motion is detected, a full frame is woven into the intervening scan lines.

Scan-rate conversion

Once the video has been de-interlaced a scan-rate conversion process may be necessary to ensure that the input frame rate matches the output display-refresh rate. To equalise the two, fields may need to be dropped or duplicated. As with de-interlacing, some sort of filtering is desirable to smooth out high-frequency artefacts caused by creating abrupt frame transitions.

Image scaling

The purpose of image scaling is to convert the incoming signals, which may be NTSC, PAL or computer-generated VGA, into a form suitable to feed the fixed-format display panel, which in turn may be standard- or high-definition. Video scaling is very important, as it enables an output stream of different resolution to the input format to be generated. The only way to avoid image scaling is to crop the image to fit within the confines of a smaller panel. This is the cheapest approach, but is not very satisfactory.

Depending on the application, scaling can be either upwards or downwards. It's important for the scaler to be able to distinguish between purely video content and non-video elements such as text. Failure to do so would distort the non-video parts of the display, making text unreadable, or cause some horizontal lines in the scaled image to disappear.

The simplest scaling methods consist of either dropping or duplicating original pixels. For example when scaling down to a lower resolution a number of pixels along each line, and/or a number of lines per frame, are discarded. While this is a low processing load, the results will produce aliasing and visual artefacts.

A small step upwards in complexity uses linear interpolation

to improve the image quality. For example when scaling an image down, interpolation in either the horizontal or vertical direction produces new output pixels to replace initial ones. As with the previous technique, information is still lost so artefacts and aliasing will again be present.

If image quality is paramount there are ways of carrying out scaling that avoid reduced quality. These methods endeavour to maintain the high-frequency content of the image, consistent with the horizontal and vertical scaling, while reducing the aliasing effects. For example, consider an image being scaled by a factor of Y x X. To accomplish this, the image could be up-sampled by interpolation by factor Y, filtered to eliminate aliasing, then down-sampled by decimation by factor X. These two sampling processes can in practice be combined within a single multi-rate filter.

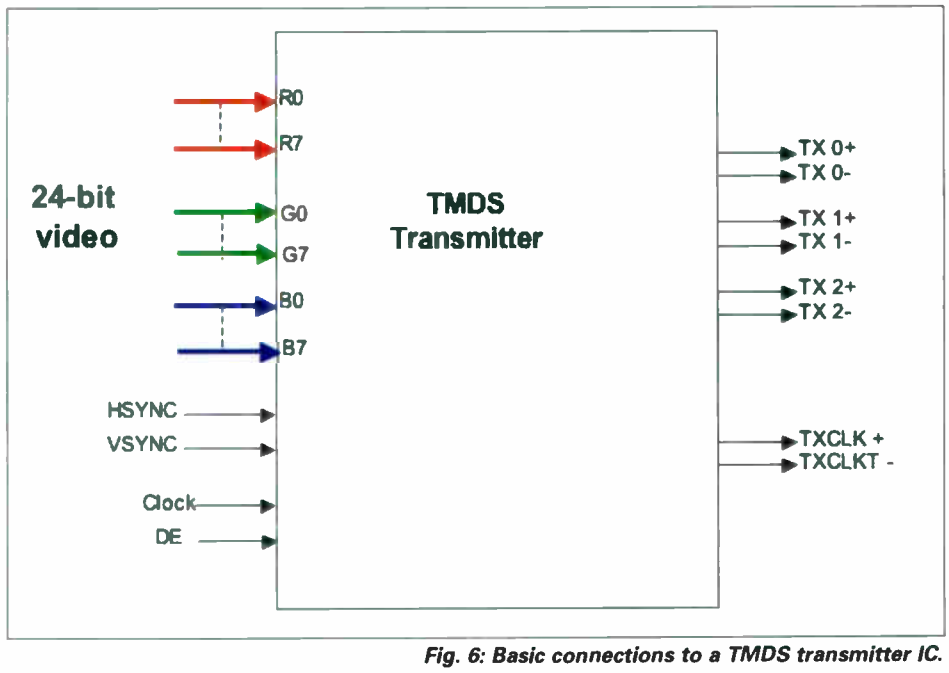

Fig. 6: Basic connections to a TMDS transmitter IC.

Digital video interface (DVI)

One of the problems of transferring data at a high bit rate is the bandwidth required. For example 24-bit, 1,280 x 1,024 resolution video at a refresh rate of 50Hz requires

$$1{,}280 \times 1{,}024 \times 24 \times 50 = 1{\cdot}57\text{Gbits/sec.}$$

The normal RS-422, RS-485, SCSI and other interfaces have limitations, in terms of bandwidth and interference, that make them unsuitable for use as connectors to an LCD or a PDP screen. Hence the need for an interface that's capable of handling such data rates, with low power consumption and low interference. This is what the DVI specifications provide. There are two main types of DVI: DVI-D for digital only and DVI-I for both digital and analogue signals.

Three main techniques are in use: LVDS (low-voltage differential signalling); PanelLink; and TMDS (transition-minimised differential signalling).

LVDS

The LVDS interface, see Fig. 4, is a unidirectional digital data connection that encodes 24 bits of data using four differential serial-data pairs (each pair consists of two twisted wires). The pixel clock is transmitted using a separate differential pair. The differential swing is low (355mV) and the nominal impedance is 100Ω, the speed being 500Mbits/sec to 1·5Gbits/sec.

Parallel input data are fed to a parallel-to-serial converter then to an LVDS transmitter that encodes the incoming data into four serial channels, to be sent out via four separate data pairs of wires. As shown, the clock is sent via a separate output pair. At the other end an LVDS receiver decodes the data back to its original format, or another one, as required.

The clock rate is seven times the original pixel rate. Thus, with four pairs of data,

bits per original pixel clock = 7 x 4 = 28 bits per pixel clock.

Of these, 24 are used for video. Three of the four remaining bits are allocated to frame sync, line sync and display enable (DE). The final bit is a 'custom bit' that can be used by the manufacturer as required for the application.

For 24-bit data a 65MHz connection will work with a panel that has a resolution of 1,024 x 768.

By virtue of its low switching voltages, soft transition and true differential data transmission LVDS achieves a high aggregated bandwidth, low power consumption and low EMI (electromagnetic interference).

PanelLink

This interface is similar to LVDS. The difference is that three data pairs are used instead of four. It also isolates the three primary colours and allocates one to each data pair. Capacity is retained by increasing the data rate per channel to ten times the original pixel clock instead of seven times as with LVDS. This is achieved by using an encoding technique known as Silicon Image.

The other basic difference is that PanelLink uses a fixed-current instead of a fixed-voltage transition. The advantage here is that, unlike LVDS which is suitable for only short distances, PanelLink can be used for distances up to a few metres. The only disadvantage with a fixed current is that a return path has to be provided. The voltage swing for PanelLink is between 500mV and 1·0V.

TMDS

Transition-minimised differential signalling is a derivative of PanelLink developed by VESA for computer LCD and PDP monitors. It has a speed of 165MHz, which is expected to be increased to 200MHz in the future. Additional pairs may be used for increased capacity. Fig. 6 shows the basic connections to a TMDS transmitter IC.

Chip count

The chip count with flat-panel TV sets continues to decrease as more and more functions are performed by fewer ICs. Functions such as tuner and IF demodulation plus video and audio selection may be incorporated into one chip, with colour decoding, video processing, gamma correction and LVDS encoding carried out by a second chip. The microcontroller may be embedded in one or both of the above chips, as well as memory stores including Flash memory.

Next month!

Power generation for plasma panels.

Fawzi Ibrahim is currently engaged in developing and running training courses on plasma and TFT/LCD at the College of North West London. He may be contacted by email at Fawzi.Ibrahim@cnwl.ac.uk or by phone on 07976 350724.

Latest Sony CE technology

Sony recently held a pan-European press event to show and demonstrate its new strategy in the consumer-electronics field and a raft of new products and technologies. These include HDTV, DVD recording and hard-disk audio and video devices. George Cole reports on the event

Earlier this year Sony held a massive pan-European event in Bordeaux, the idea being to show how Sony is repositioning itself in the fast-moving world of consumer electronics. Traditionally Sony has been a market leader, with products such as the Compact Disc (developed with Philips), Trinitron TV and the Walkman. However Chris Deering, president of Sony Europe, admitted that in recent times the company has not been as quick off the mark as others. A notable example is the success of the Apple iPod digital music player, which has been described as the Walkman of the 21st century. Sony has also been slow to produce flat-screen TV sets and DVD camcorders. But a firm with the technological expertise of Sony is not likely to get left behind indefinitely. At Bordeaux Sony unveiled a raft of new products that are expected to revive its fortunes. And Chris Deering announced that a new slogan, "Like. No. Other", will replace its "Go Create" slogan.

The V series 40in. model. Sony says that the 40-inch LCD set looks like replacing XGA plasma in this sector as the price between the two technologies narrows.

Television

There's an impressive range of flat display-screen TV sets with screen sizes from 19 to 50in. There were no CRT models on show, though Sony says that it has no plans to drop CRTs, adding that such sets remain a major part of its business. Sony has introduced seven new CRT sets this year.

The sets on display were a mixture of LCD, plasma and rear-projection models however. This year the emphasis is on digital TV and, in the UK, all models with 23in. and over displays will have an integrated DTT tuner. Eleven models are also HD-ready and include an HDMI (High Definition Multimedia Interface) connection – in fact 70 per cent of Sony's new flat-display models are HD-ready.

The S series of LCD models, with screen sizes 19, 23, 26 and 32in., include a picture freeze or "screen memo" feature. This enables any image to be held temporarily as a still picture, so that a viewer can for example jot down an address or recipe. The two largest models have an HDMI socket and the three largest a DTT tuner.

The V series consists of three LCD sets with screen sizes 26, 32 and 40in. and a 42in. plasma model. Sony sees the 40in. LCD set replacing XGA plasma in this sector as the price between the two technologies narrows. The company was quick to add that it has no intention of withdrawing from the plasma market however. All V series sets have an HDMI interface, a DTT tuner and Dolby Surround Pro-Logic II sound.

The W series consists of a 40in. LCD model and a 50in. plasma model. Both include a DTT tuner and an S-Master digital amplifier. The latter has an integrated speaker that includes a sub-woofer – a first according to Sony.

Sony has four new rear-projection sets, Models KF-E42A10E, KF-E42A12SU, KF-E50A10E and KF-E50A12SU, which all use three-LCD technology. The A10 versions are analogue models and the A12 versions digital.

Sony has also launched a new upmarket sub-brand, Qualia. One of the first products in this range is the Qualia 005, a 46in. LCD model that uses the Triluminos three-colour (red, green and blue) LED backlight system. Sony claims that this provides a 150 per cent wider

The Sony Qualia 005, a 46in. LCD model that includes the Triluminos three-colour (red, green and blue) LED back-light system. Sony says it offers a 150% wider colour gamut than conventional LCD backlight displays.

The BD-RE (rewritable) disc is now at version 2.0, while the BD-R (recordable) and BD-ROM (read only) are at version 1.0.

colour range than a conventional LCD back-light system. Other features include Wega Engine HD, which is a digital high-definition system with noise reduction technology, and a Digital Cinema Sound system. There are plenty of audio, video and PC interfaces including HDMI, USB, PC iLink and a Memory Stick slot. The XMB (Xross Media Bar) is an intuitive graphical user interface that enables the user to scroll across the screen quickly using the remote-control handset. It's a very impressive product, but it won't be cheap!

At the end of the session a Sony representative revealed that the company is looking at alternative forms of flat-display technology, including Electro-Luminescence (EL), but added that it would be some time before products became available using other types of flat display.

Blu-ray technology

Sony demonstrated its latest optical-disc products in a lively session. Sony is of course one of the strongest promoters of the Blu-ray disc, which it sees as the successor to the DVD. Yukinori Kawauchi, general manager of Sony's Blu-ray Disc Development and Promotion Department, outlined the current state of the technology. He said that the Blu-ray camp's strategy is to establish the disc as the next-generation home-recording format rather than focusing on the pre-packaged media market. Blu-ray is seen as the natural format for HDTV recording, and the group is also keen to see the discs becoming the next-generation storage device for PCs.

Discs with a protective caddy were originally going to be used, but a bare disc is now standard. There are plans to combine the disc with high-speed broadband services: you might, for example, be watching a film prerecorded on a Blu-ray disc and at the same time be able to download sub-titles and other information from a website related to the film. An eight-layer Blu-ray disc that can store 200GB of data at a rate of 216Mbits/sec is under development, also an 8cm disc for camcorders, with a one-third normal capacity.

At April 120 companies supported the format, including a number in the PC industry. There are at present three types of disc. The BD-RE (rewritable) disc is now at version 2.0, while the BD-R (recordable) and BD-ROM (read only) are at version 1.0. Mr Kawauchi said that the launch phase for the Blu-ray disc is set to begin in late 2005. This might have come as a surprise to some, as a player has been on sale in Japan for well over a year! But with the official Blu-ray launch apparently imminent there still seem to be some important gaps in the specification. It's not for example known whether, like DV, a Regional Coding system will be used, nor which anti-copy protection system will be adopted. Mr Kawauchi could not confirm whether the recorders will have HDMI connections, but it seems unlikely that the latest generation of recorders will include broadband connectivity.

The reason for this lack of clarification became clear subsequently. Not long after the Sony event it was confirmed that the Blu-ray camp and the rival HD-DVD group, which is supported by Toshiba, Sanyo and NEC, are in discussions on whether a single unified format could be agreed. A common format seems unlikely however, because of the different physical disc specifications. So one side would have to back down, and at present there are no signs of anyone being prepared to do this. There is in fact a real possibility that the Blu-ray disc and HD-DVD will go head-to-head in the market.

DVD recorders

Meanwhile Sony continues to press ahead with DVD recorder developments. The company has opted for multi-format recorders that can record and play both DVD+RW and DVD-RW discs. Sony's current range includes a number of models that incorporate hard-disk technology.

Many new models incorporate a system called Intelligent Scene Chaptering. It uses an algorithm to detect scene changes and insert a question mark, relying on the fact that with many scene changes the screen turns black. The Visual Chapter Scene function can then be used to search for specific scenes, by viewing thumbnail images. Scenes can also be deleted. When I asked whether the technology could be used to delete advertisements the representative said he couldn't possibly comment!

Another new feature is one-touch dubbing, which enables the user to connect a miniDV camcorder to the recorder and copy images from DV tape to a disc.

New DVD recorders include Model RDR-HX1010, which has a 400GB hard drive that can store up to 600 hours of video. Other features include an HQ+ recording mode that provides higher quality when recording on the hard disk by

DVD recorder Model RDR-HX510 has similar features to the RDR-HX1010, but uses an 80GB hard drive instead.

increasing the bit rate from 9Mbits/sec to 15Mbits/sec. The D-Matrix noise-reduction system uses several techniques including frame, block and mosquito noise reduction. Another feature, Pause Live TV, enables viewers to pause a live broadcast in a similar fashion to hard-disk and DVD-RAM recorders. The RDR-HX1010 has an HDMI interface, Intelligent Scene Chaptering, and compatibility with dual-layer DVD+R discs.

Model RDR-HX510 has similar features but uses an 80GB hard drive.

Camcorder Model PCR-PC55, which is being promoted as the world's smallest and lightest MiniDV camcorder, weighs just 290 grams.

Camcorders

Sony has a mixture of digital and analogue tape-based camcorders and DVD models. The latter use the DVD-RW format and include Model DCR-DVD7E, an eye-catching piece of equipment with a 2·5in. hybrid LCD monitor on the camcorder's back face.

Other DVD camcorders include Models DCR-DVD92E, DCR-DVD202E and DCR-DVD203E. These provide true 16:9 recording and can be used with a four-channel microphone to record 5.1-channel surround sound. They have a Carl Zeiss Vario-Tesar lens. The first model has a 20x optical zoom while the latter two have a 12x optical zoom.

MiniDV camcorder Model PCR-PC55 is being promoted as the world's smallest and lightest, weighing just 290g. It has a 10x zoom and uses a Handycam station – a powered cradle.

Qualia

As mentioned earlier, Qualia is Sony's new high-end sub-brand, aimed at consumers who want optimum performance and sleek design. It isn't the first time that Sony has gone down this path – there used to be the Esprit range of high-end audio equipment.

One of the first Qualia models is the 004 high-definition projector. It's an impressive-looking piece of equipment that provides 1,080-line progressive-scan resolution and uses SXRD (Silicon Crystal Reflective Display) technology. The latter consists of three 0·78in. SXRD panels that produce a reflective display with more than six million pixels. Its AV interfaces include two component video, HDMI and DVI-D. The 004 was demonstrated using a selection of film clips from Blu-ray and DVD sources. Two things impressed one: the projector's quietness the superb picture quality.

Digital music

Apple leapt ahead in the digital music market with its iPod digital music player and iTunes on-line music store. Sony's answer is the Connect on-line store and Network Walkman NW-HD5, which has a 20GB hard drive that can store up to 13,000 tracks and weighs 125g. There is also a limited 30GB version that can store up to 20,000 tracks.

It's a very impressive piece of hardware that, in some areas, outperforms the iPod. But whether Sony can catch up with Apple remains to be seen. The fact that Sony had little to say about its SACD (Super Audio CD) format – there was a Qualia model on show – suggests that, like many others, it sees most future activity in the audio field focused on on-line music and digital downloading.

Robot entertainment

Finally a bit of fun. The Sony Aibo robot dog has been on the market for several years now. The latest version, ERS-7, includes new control software called Mind 2, an MP3 music player, voice control and optional video monitoring. The QR10 Dream Robot is described as the world's most sophisticated humanoid, using voice and face recognition technologies. It can also walk and dance on two legs – during an entertaining sequence a troupe of QR10s danced the can-can on stage. The QR10 has a 64MB DRAM, a 64-bit processor and is internet compatible. It's almost 23in. tall and weighs 7kg.

Robot technology has certainly come a long way in a short time. I can't wait for the version that makes you a cup of tea! ■

The QR10 Dream Robot is described as the world's most sophisticated humanoid, using voice and face recognition technologies. It can also walk and dance on two legs.

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2002	PSU	ONWAKIT
11AK19 16:9	PSU & EW KIT	MODKIT52A
11AK19 4:3	PSU & EW KIT	MODKIT52
1427T	PSU	ONWAKIT
1452T	PSU	ONWAKIT
1455T	PSU	ONWAKIT
1456T	PSU	ONWAKIT
1458T	PSU	ONWAKIT
1459T	PSU	ONWAKIT
1499Y	STANDBY	MODKIT37
14SLTX	STANDBY	MODKIT37
1799Y	STANDBY	MODKIT37
2009B	PSU	ONWAKIT
2052T	PSU	ONWAKIT
2099TX	STANDBY	MODKIT37
2152T	PSU	ONWAKIT
BTV17	STANDBY	MODKIT37
CTV485	PSU	ONWAKIT
CTV501	PSU	ONWAKIT
CTV701	PSU	ONWAKIT
CTV840	PSU	ONWAKIT
CTV841	PSU	ONWAKIT
AKAI		
CT1417	PSU	ONWAKIT
CT2159U	PSU	ONWAKIT
CT2162UNT	PSU	ONWAKIT
CT2863UNT	PSU	ONWAKIT
AMSTRAD		
11AK19 16:9	PSU & EW KIT	MODKIT52A
11AK19 4:3	PSU & EW KIT	MODKIT52
BLACK DIAMOND		
11AK37	PSU	MODKIT51
BUSH		
11AK37	PSU	MODKIT51
2871NTX	PSU & EW KIT	MODKIT52
WS6673	PSU & EW KIT	MODKIT52
WS6674	PSU	MODKIT51
DECCA/TATUNG		
F SERIES	PSU	MODKIT30
TVC563	STANDBY	MODKIT37
GOLDSTAR		
CF25A50F	FRAME	MODKIT36
CF25C22C	FRAME	MODKIT35
CF28A50F	FRAME	MODKIT36
CF28C22F	FRAME	MODKIT35
CF28C28F	FRAME	MODKIT36
CF29C42F	FRAME	MODKIT35
GOODMANS		
11AK37	PSU	MODKIT51
1430RA	PSU	ONWAKIT
1430RS	PSU	ONWAKIT
1430RW	PSU	ONWAKIT
1450T	PSU	ONWAKIT
1455TS	PSU	ONWAKIT
147TT	PSU	ONWAKIT
149T	PSU	ONWAKIT
2019R	PSU	ONWAKIT
2029T	PSU	ONWAKIT
2029TA	PSU	ONWAKIT

MAKE & MODEL	KIT TYPE	CODE
GOODMANS..continued		
COMPACT 11	PSU	MODKIT47
F16	PSU	GOODKIT1
F16	VIDEO	GOODKIT1
F16 CHASSIS	FRAME	GOODKIT1
F16 CHASSIS	LINE	GOODKIT1
GRUNDIG		
CUC 2050	PSU	MODKIT48
CUC 2051	PSU	MODKIT48
CUC 2058	PSU	MODKIT48
CUC 2059	PSU	MODKIT48
CUC 2080	PSU	MODKIT48
CUC 7350		GRUNDIGKIT1
CUC 7301/3 (BUZ90)	PSU	GRUNDIGKIT2
CUC 7301/3 (MJF18004)	PSU	GRUNDIGKIT3
HINARI		
11AK37	PSU	MODKIT51
HIT14RC	PSU	ONWAKIT
HITACHI		
11AK37	PSU	MODKIT51
C28W440N	PSU	MODKIT54
JVC		
AV29SX1EK	FIELD O/P	JVCKIT1
AV29SX1EN	FIELD O/P	JVCKIT1
AV29SX1EN1	FIELD O/P	JVCKIT1
AV29SX1PF	FIELD O/P	JVCKIT1
AV29TSIE1	FIELD O/P	JVCKIT1
C14E1EK	PSU	ONWAKIT
C14T1EK	PSU	ONWAKIT
C21ET1EK	PSU	ONWAKIT
CS21M3EK	PSU	ONWAKIT
MATSUI		
1455	PSU	ONWAKIT
1498	PSU	ONWAKIT
2086	PSU	ONWAKIT
2098	PSU	ONWAKIT
1496R/T (BUZ90)	PSU	MODKIT44
1496R/T (H3N90)	PSU	MODKIT43
2096R/T (BUZ90)	PSU	MODKIT44
2096R/T (H3N90)	PSU	MODKIT43
21V1N (BUZ90)	PSU	GRUNDIGKIT2
21V1T(MJF18004)	PSU	GRUNDIGKIT3
TVR180R/208	STANDBY	MODKIT37
TVR185T	STANDBY	MODKIT39
MITSUBISHI		
AV1 SERIES	PSU	MITSKIT3
CT1M5B	PSU	MITSKIT3
CT21A2STX	TDA 8178S	MITSKIT1
CT21A3STX	TDA 8178S	MITSKIT1
CT21AV1BS	PSU	MITSKIT3
CT21AX1B	PSU	MITSKIT3
CT21M5BT	PSU	MITSKIT3
CT25A2STX	TDA 8178S	MITSKIT1
CT25A3STX	TDA 8178S	MITSKIT1
CT25A4STX	TDA 8178S	MITSKIT1
CT25A6STX	TDA 8178S	MITSKIT1
CT25AV1B	PSU	MITSKIT3
CT25AV1BD	PSU	MITSKIT3
CT25AV1BDS	PSU	MITSKIT3
CT25AV1BS	PSU	MITSKIT3

MAKE & MODEL	KIT TYPE	CODE
MITSUBISHI..continued		
CT25M5BT	PSU	MITSKIT3
CT28AV1B	PSU	MITSKIT3
CT28AV1BDS	PSU	MITSKIT3
CT28AX1BD	PSU	MITSKIT3
CT29A4	TDA 8178S	MITSKIT2
CT29A6	TDA 8178S	MITSKIT2
CT29AS1	TDA 8178S	MITSKIT2
CT29B2	TDA 8178S	MITSKIT2
CT29B3	TDA 8178S	MITSKIT2
CT29B6	TDA 8178S	MITSKIT2
CT33B3	TDA 8178S	MITSKIT2
M5 SERIES	PSU	MITSKIT3
NEI/NIKKAI		
C289FTXN	PSU	NIKKAIKIT1
C28F41FXN	PSU	NIKKAIKIT1
CE25 CHASSIS	PSU	NIKKAIKIT1
PANASONIC		
IC561	TDA 8175	PANKIT1
TC28XD60	VERT OUTPUT	PANKIT2
TX25XD60	VERT OUTPUT	PANKIT2
TX28XD70	VERT OUTPUT	PANKIT2
TX29XD70	VERT OUTPUT	PANKIT2
TX-W26D3	VERT OUTPUT	PANKIT2
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310.20491		PHILKIT2
310.20496		PHILKIT10
310.31994		PHILKIT6
310.32252		PHILKIT5
310.32253		PHILKIT4
310.32254		PHILKIT9
310.32255		PHILKIT7
310.32262		PHILKIT8
310.62264		PHILKIT1
28PT4457/05	PSU	MODKIT50
28PW5407/05	PSU	MODKIT50
28PW6006/05	PSU	MODKIT50
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G110 CHASSIS	SOPS	PHILKIT3
G90A CHASSIS	SOPS	PHILKIT10
G90B CHASSIS	SOPS	PHILKIT10
GR2.1 CHASSIS	SOPS	PHILKIT1
GR2.2 CHASSIS	SOPS	PHILKIT1
HSM VIDEO	SOPS	PHILKIT5
JSM VIDEO	SOPS	PHILKIT4
KSM VIDEO	SOPS	PHILKIT9
L01.1E CHASSIS	PSU	MODKIT50
LSM VIDEO	SOPS	PHILKIT7
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CI5944	FRAME	SAMKIT2
CI6844	FRAME	SAMKIT2
VI375	PSU	SAMSUNGKIT
VI395	PSU	SAMSUNGKIT
VIK310	PSU	SAMSUNGKIT
VIK320	PSU	SAMSUNGKIT
VIK350	PSU	SAMSUNGKIT
WINNER 1	PSU	SAMSUNGKIT
SHARP		
28HW53H	PSU + EW	MODKIT53
51CS03H	PSU	SHARPKIT1

MAKE & MODEL	KIT TYPE	CODE
SHARP..continued		
51CS05H	PSU	SHARPKIT1
56FW53H	PSU & DOLBY	MODKIT45
56FW53H	PSU + EW	MODKIT53
59CS03H	PSU	SHARPKIT2
59CS05H	PSU	SHARPKIT2
59CSD8H	PSU	SHARPKIT2
59DS03H	PSU	SHARPKIT3
59FW53H	PSU & EW	MODKIT49
66CS03H	PSU	SHARPKIT2
66CS05H	PSU	SHARPKIT2
66CSD8H	PSU	SHARPKIT2
66EW53H	PSU + EW	MODKIT53
66FW53H	PSU + EW	MODKIT53
66FW53H	PSU & DOLBY	MODKIT45
66FW53H	PSU & EW	MODKIT49
66FW54H	PSU & DOLBY	MODKIT45
66FW54H	PSU & EW	MODKIT49
66FW63H	PSU + EW	MODKIT53
76FG64H	PSU + EW	MODKIT53
76FW53H	PSU & DOLBY	MODKIT45
76FW53H	PSU & EW	MODKIT49
76FW53H	PSU + EW	MODKIT53
76FW54H	PSU & DOLBY	MODKIT45
76FW54H	PSU & EW	MODKIT49
DA-100 CHASSIS	PSU & EW	MODKIT49
SONY		
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SLV777UB	VCR - PSU	MODKIT40
THOMSON		
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35065920		THORNKIT1
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ICC8	FRAME	THOMKIT3
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R3000	PSU	THOMKIT2
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TOSHIBA		
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BD2951S	PSU	MODKIT51
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M 12-133	LOT2238	£26.00
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M12130	LOT2238	£26.00
M12133	LOT2238	£26.00
M12138	LOT2238	£26.00
M12157	LOT2238	£26.00
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10566060	LOT1505	£19.00
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680uF	CAP166	£1.20	10
1000uF	CAP119	£1.50	10
2200uF	CAP120	£2.10	10
3300uF	CAP167	£1.60	5
16 Volts			
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33uF	CAP122	£0.35	10
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330uF	CAP30	£1.75	10
470uF	CAP31	£1.75	10
680uF	CAP32	£2.10	5
1000uF	CAP33	£2.10	10
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1500uF	CAP170	£1.50	5
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3300uF	CAP35	£5.00	5
4700uF	CAP36	£6.10	10
6800uF	CAP171	£4.50	5
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68uF	CAP127	£0.55	10
100uF	CAP40	£0.70	10
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220uF	CAP42	£1.20	10
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3300uF	CAP49	£2.20	2
4700uF	CAP50	£3.65	2
6800uF	CAP51	£3.90	2
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3.3uF	CAP131	£0.40	10
4.7uF	CAP132	£0.45	10
10uF	CAP52	£0.50	10
22uF	CAP53	£0.45	10
33uF	CAP54	£0.50	5
47uF	CAP55	£0.85	10
68uF	CAP133	£0.55	10
100uF	CAP56	£0.85	10
150uF	CAP57	£0.95	5
220uF	CAP58	£1.45	5
330uF	CAP134	£1.60	10
470uF	CAP135	£1.75	10
680uF	CAP59	£6.50	10
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1500uF	CAP173	£4.00	5
2200uF	CAP61	£2.45	2
3300uF	CAP62	£10.00	5
4700uF	CAP136	£3.50	2
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2200uF	CAP175	£2.00	1
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2.2uF	CAP138	£0.35	10
3.3uF	CAP139	£0.35	10
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10uF	CAP63	£0.50	10
22uF	CAP64	£0.70	10
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47uF	CAP65	£0.85	10
68uF	CAP142	£0.90	10

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330uF	CAP68	£2.45	10
470uF	CAP69	£4.35	10
680uF	CAP70	£4.90	5
1000uF	CAP71	£5.25	10
1500uF	CAP143	£4.50	5
2200uF	CAP72	£3.25	2
3300uF	CAP144	£3.25	2
63 Volts			
0.22uF	CAP145	£0.45	10
0.33uF	CAP178	£0.35	10
0.47uF	CAP73	£0.35	10
1uF	CAP74	£0.35	10
1.5uF	CAP179	£0.35	10
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3.3uF	CAP76	£0.50	10
4.7uF	CAP77	£0.35	10
6.8uF	CAP180	£0.50	10
10uF	CAP78	£0.50	10
15uF	CAP79	£0.95	5
22uF	CAP80	£0.75	10
33uF	CAP81	£0.85	10
47uF	CAP82	£0.95	10
56uF	CAP181	£1.10	10
68uF	CAP83	£1.30	5
100uF	CAP84	£1.20	10
150uF	CAP85	£2.80	5
220uF	CAP86	£2.80	10
330uF	CAP87	£4.00	10
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1000uF	CAP90	£5.40	5
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4700uF	CAP183	£4.00	1
100 Volts			
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0.22uF	CAP185	£0.80	10
0.33uF	CAP186	£0.80	10
0.47uF	CAP91	£0.50	5
1uF	CAP92	£0.85	10
1.5uF	CAP93	£0.70	5

VALUE	CODE	PRICE	PER PACK
100 Volts...continued			
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3.3uF	CAP95	£0.50	5
4.7uF	CAP96	£0.50	5
6.8uF	CAP187	£0.80	10
10uF	CAP97	£0.95	10
22uF	CAP98	£1.05	10
33uF	CAP99	£1.55	5
47uF	CAP100	£1.75	10
68uF	CAP188	£1.30	5
100uF	CAP101	£2.10	10
220uF	CAP102	£6.00	5
330uF	CAP189	£3.00	2
470uF	CAP103	£6.00	5
680uF	CAP190	£3.00	2
1000uF	CAP191	£3.00	1
160 Volts			
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1uF	CAP193	£0.45	10
2.2uF	CAP146	£0.45	10
3.3uF	CAP194	£1.00	10
4.7uF	CAP195	£1.00	10
10uF	CAP147	£1.40	10
22uF	CAP148	£1.80	10
33uF	CAP149	£2.30	10
47uF	CAP196	£2.20	5
100uF	CAP150	£3.25	5
220uF	CAP197	£3.00	2
470uF	CAP198	£3.25	1
200 Volts			
22uF	CAP199	£1.60	5
100uF	CAP151	£3.25	5
220uF	CAP200	£2.50	1
330uF	CAP201	£2.50	1
250 Volts			
0.47uF	CAP202	£0.60	10
1uF	CAP152	£0.60	10
2.2uF	CAP203	£1.30	10
3.3uF	CAP104	£1.75	10
4.7uF	CAP204	£2.00	10
10uF	CAP105	£2.60	10
22uF	CAP153	£2.30	10

VALUE	CODE	PRICE	PER PACK
250 Volts...continued			
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47uF	CAP106	£4.35	10
100uF	CAP154	£4.50	5
220uF	CAP155	£2.00	2
330uF	CAP206	£2.50	1
350 Volts			
1uF	CAP156	£0.70	10
2.2uF	CAP207	£1.20	10
3.3uF	CAP157	£1.50	10
4.7uF	CAP208	£1.10	5
10uF	CAP158	£2.25	10
22uF	CAP159	£3.40	10
33uF	CAP209	£2.60	5
47uF	CAP210	£1.50	2
100uF	CAP211	£3.00	2
330uF	CAP212	£5.00	1
400 Volts			
0.47uF	CAP213	£0.60	10
1uF	CAP107	£2.15	5
2.2uF	CAP108	£2.25	5
3.3uF	CAP214	£2.25	5
4.7uF	CAP109	£3.15	5
10uF	CAP110	£4.00	5
22uF	CAP111	£2.50	2
33uF	CAP215	£2.50	2
47uF	CAP112	£3.50	2
68uF	CAP216	£3.50	2
100uF	CAP160	£4.00	2
150uF	CAP217	£3.20	1
220uF	CAP161	£7.00	2
560uF	CAP162	£4.00	1
450 Volts			
1uF	CAP113	£2.80	5
2.2uF	CAP114	£3.20	5
3.3uF	CAP218	£3.20	5
4.7uF	CAP115	£4.95	5
10uF	CAP116	£5.50	5
22uF	CAP117	£4.15	2
33uF	CAP219	£3.00	2
47uF	CAP220	£2.00	1
100uF	CAP221	£3.00	1

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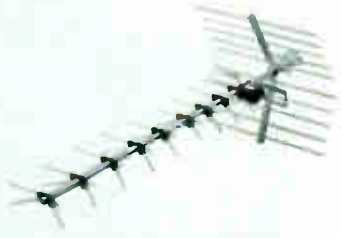

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Aerial Installation Accessories

Wireless technologies in CE products

In the second instalment in this series Graham Maynard takes a detailed look at Bluetooth technology

First a little bit of history. Bluetooth was named after the Danish Viking king Harald Blaatand, who ruled from 940 to 985 AD. Blaatand is Danish for Bluetooth. While Harald Blaatand united Denmark and Norway, today's Bluetooth technology unites the worlds of computers and telecommunications, hence the use of the name.

In 1994 Ericsson Mobile Communications initiated a study into the feasibility of a low-power, low-cost wireless interface between cellular phones and their accessories. In February 1998 five companies – Ericsson, Nokia, IBM, Toshiba and Intel – formed a Special Interest Group (SIG). The group contained the all-important mix of business sector members – two market leaders in mobile telephony, two market leaders in laptop computing and a market leader in digital signal-processing technology. The rest is history . . .

Fig. 1 shows an Infineon implementation of Bluetooth, as a module. Other manufacturers of Bluetooth technology include Infineon, Cambridge Silicon Radio (CSR), Texas Instruments (TI), Philips Semiconductors, RF Micro Devices and ST Microelectronics.

System basics

Think of Bluetooth as a cable replacement. It's a technology created to connect multiple personal devices in a small Personal Area Network (PAN) – a bubble of connectivity for say 10m around you. The idea is to have a technology that's cheap enough, with low enough power consumption, to be easy to implement in different devices.

Fig. 1: A typical Bluetooth hardware implementation, by Infineon. Size is 10·6 x 7·3mm.

Bluetooth uses the international 2·4GHz ISM band (2·4-2·4835GHz) at a gross data rate of 1Mbits/sec. The modulation technique used is Gaussian Frequency Shift Keying (GFSK), which provides a very robust link. Bluetooth is capable of carrying both voice and data traffic, using different techniques. The power consumption of a typical Bluetooth chipset is low enough for use in low-power battery-operated devices such as a mobile phone. With the scatternet technology described later, an aggregate data throughput of over 10Mbits/sec or twenty voice channels is achievable within a fully-expanded network.

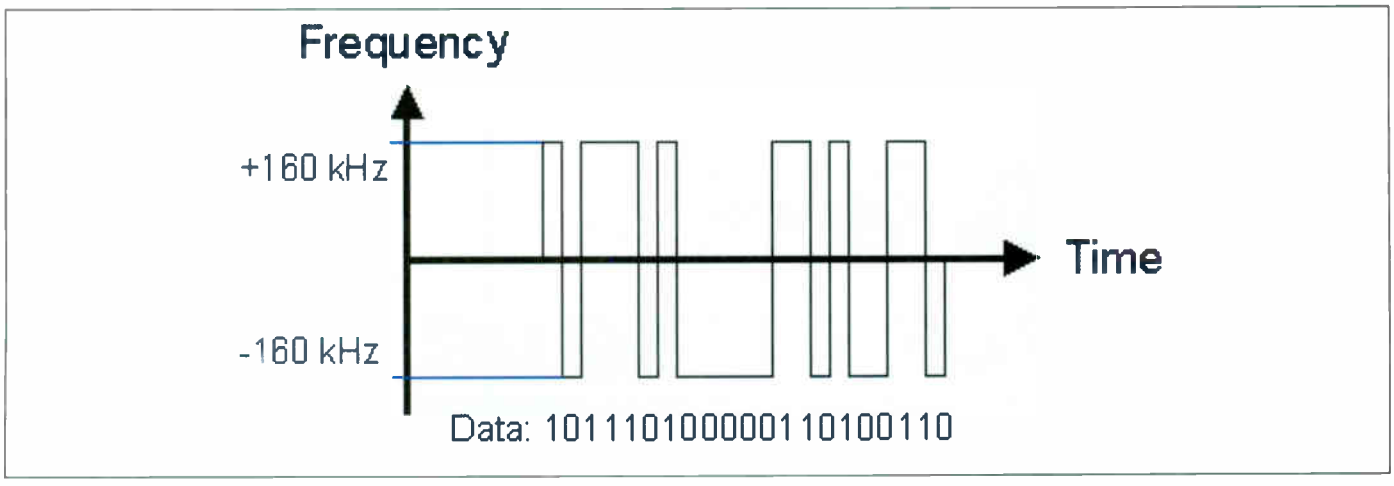


Fig. 2: Modulation of ones and zeros on to the carrier using GFSK.

The gross data rate of 1Mbits/sec includes overheads such as error correction, signalling information etc. So the maximum achievable data rate is 721kbits/sec; with 57·6kbits/sec in the reverse direction, the maximum achievable symmetric data rate is 432·6kbits/sec; or there can be three 64kbits/sec voice channels. In comparison the voice data rate with the second-generation digital mobile phone technology GSM is 13kbits/sec. A packet-switching protocol with frequency hopping and advanced coding techniques is used to maintain the transfer rate in a busy radio environment where other technologies, including microwave ovens, operate in the same frequency band.

There are three power output levels within the Bluetooth specification, Classes 1, 2 and 3. Class 3, for a 10cm-1m range, has a maximum output power of 0dBm (1mW) and is hardly ever used. Class 2, with a 1-10m range and a maximum output power of +4dBm (2·5mW), is the most widely used level. Class 1, with a 100m range and a maximum output power of +20dBm (100mW), is becoming more common for domestic products as it is powerful enough to get through walls etc. without too much signal degradation. For a discussion of dBm units of power, mW etc. if you are not familiar with this go to http://www.cisco.com/warp/puplic/102/wlan/powervalues-23231.html

Incidentally Bluetooth data and voice both degrade 'gracefully' in a busy environment, so the data rate decreases as the signal becomes weaker rather than the link becoming unusable

Fig. 2 shows how the ones and zeros are modulated on to the carrier using GFSK. The frequency deviation is ±140-175kHz (±160kHz typical).

Encryption is used to protect the privacy of connections. Bluetooth uses a stream cipher that's well suited to silicon implementation, with secret key lengths of 0, 40 or 64 bits. Key management is carried out by higher-layer software – see the Protocol Stack later.

Networks, piconets, scatternets, masters and slaves

Bluetooth can be used for both point-to-point and point-to-multipoint connections. The term piconet is used for a Bluetooth network or 'sub-net': it means the number of devices (two or more) that are transferring data between each other at any time. The scatternet idea means that several of these ad hoc piconets can be linked together. Each piconet has its own unique frequency-hopping channel, with all users participating in the same piconet synchronised to this channel.

All units in a Bluetooth network have a unique 48-bit Bluetooth address. At the start of a connection, the initiating unit is temporarily assigned as a 'master'. It provides the master clock that sets the unique hopping sequence for the piconet. The assignment as master can change after the connection has been established if it makes more sense for another device to control the piconet traffic. The master initiates the connection and controls the traffic between up to a maximum of seven units, described as slaves, in the piconet. With a scatternet a device can be a master in one piconet and a slave in another. Fig. 3 shows a scatternet with two overlapping piconets, one device acting as master in one piconet and slave in the other.

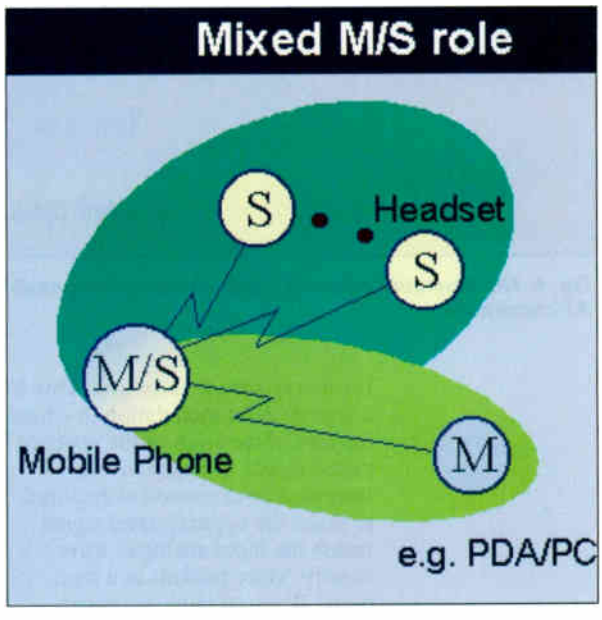


Fig. 3: A scatternet with two overlapping piconets, one device acting as master in one piconet and slave in the other.

Bluetooth uses a packet-switching protocol based on a frequency-hop scheme, with 1,600hops/sec (3,200hops/sec during connection set-up to reduce the set-up time). The entire frequency spectrum available is used, with 79 hops of 1MHz bandwidth (2·402-2·48GHz). Each Bluetooth time slot is 625μsecs in length. The bandwidth is less in France, Spain and Japan, primarily for military reasons, though the situation there is changing. Virtual channels are defined as using what are known as pseudo-random-hop sequences.

For data the frequency-hopping scheme is used in conjunction with fast ARQ (Automatic Repeat reQuest), CRC (Cyclic Redundancy Check) and FEC (Forward Error Correction). For voice a CVSD (Continuously Variable Slope Delta) coding scheme is used, giv-

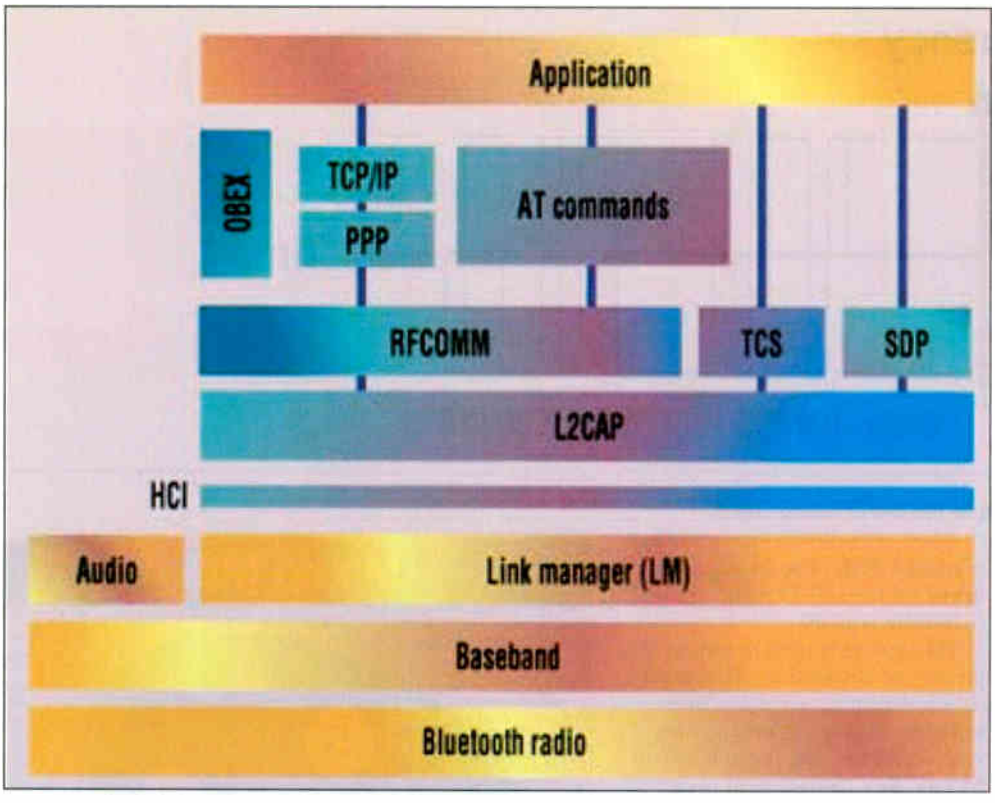


Fig. 4: The Bluetooth protocol stack, showing one possible application access method by AT commands.

ing a very robust voice link. This is a type of delta modulation in which the size of the steps of the approximated signal is progressively increased or decreased as required to make the approximated signal match the input analogue wave closely. Voice packets in a traditional Bluetooth link are never retransmitted (the new 2.0 specification however has a facility for enhanced voice quality, allowing retransmission of voice packets), and CVSD is a very robust way of handling dropped and damaged voice samples. With a voice link rising interference levels are experienced as background noise. Even at bit error rates of up to four per cent, CVSD-coded voice is still quite audible.

To save power and minimise radio interference problems with Class 1 operation, an RSSI (Received Signal Strength Indicator) is used. This measures the signals received from different units and adapts the RF output power to that required in each case. This is useful where the distance between communicating devices varies, e.g. with handsets, access points etc.

Links, packets, modes and states

When a network is first set up or units are added to a piconet the devices must be identified. Units can be connected and disconnected from a piconet dynamically at any time. The connection time is typically 0·64sec. This applies when the address of the device is known and not more than about five hours have elapsed since the previous connection. A device does not have to be connected at all times, as a typical delay of less than one second is required to start data transfer. Thus when it is not in use a device can be in a sleep state (standby) with only a low-power oscillator (LPO) running. This improves power consumption with battery-operated devices.

The following is a summary of the states a device can be in and the procedure for setting up a connection.

Standby: The device is not connected to a piconet. A device in this state 'listens' for activity every 1·28 seconds. It listens on a set of 32 hop frequencies defined for the unit (related to the Bluetooth address).

Inquiry: Trying to connect to an unknown device address – a typical connection time is two seconds. An inquiry is typically sent out to find public printers, faxes and similar equipment with an unknown address. Once the address is known connection is achieved by paging (see below).

Page: Connection to a known device address – 0·6sec is a typical connection time. This is similar to the Inquiry message but takes less time as the address in known. The device is assigned a member address on the piconet – temporary and different from the Bluetooth address.

Connected: On the piconet and able to transmit data.

Bluetooth also has some low-power modes as follows.

Park mode: This has the lowest power and duty cycle. Member address on the piconet is lost.

Hold mode: Only an internal timer is running, with connection to a piconet and a member address still assigned. Used where data transfer is very infrequent, e.g. a room thermostat.

Sniff mode: This has the highest duty cycle and power of the low-power modes. The slave 'listens' to the piconet at a reduced rate. The sniff interval is programmable and depends on the application.

It takes typically 2msec to go from the hold or park state to the connected state or vice versa, so it's very easy to switch into and out of these low-power modes to conserve battery power. Only seven slave devices can be active in a piconet at any time but, by using the low-power modes, there can be up to 256 inactive devices in a piconet ready at any time to transfer data as required.

When a Bluetooth device has been connected to a piconet it can communicate by means of two types of link, an SCO (Synchronous Connection Orientated) link or an ASC (Asynchronous Connectionless Link).

An SCO is a point-to-point full-duplex link between the master and a slave unit. The link is established by the master and maintained until disconnected by the master. This type of link is used for voice and other time-delay sensitive data traffic where it is important to maintain data quality. To achieve the data quality required the master reserves slots on the virtual channel.

An ACL is a momentary con-

nection between the master and any slave for the duration of one frame (a frame is one master-to-slave slot plus one slave-to-master slot). Slot reservation is not possible. It's intended for asynchronous data but, if the master uses the link to address the same slave at regular intervals, it becomes a synchronous link. ACLs provide both full duplex (Time Division Duplexing is used) and asymmetric modes, which can be with or without FEC and with or without CRC.

Different link types may be used between different master-slave pairs in the same piconet, and the link type may change arbitrarily during a session.

The Bluetooth protocol stack

A knowledge of systems software and embedded systems is a distinct help in understanding the Bluetooth protocol stack. It's a complex beast that's based on the OSI seven-layer model. You can read about this at

http://www.pcsupportadvisor.com/OSI_7_layer_model_page1.htm

If you aren't au fait with stacks, an understanding of the above will clarify the following description. Fig. 4 shows the stack in all its glory. The following is a layer-by-layer description of what each part does.

The radio layer is the physical RF hardware if you like. It takes care of sending and receiving modulated bit streams and doesn't care about packets, flow control etc.

The baseband (BB) layer is the digital hardware that takes care of the timing, framing, packets, flow control, error detection and correction. It uses circuit and packet switching (see ACL and SCO above).

The Link Manager (LM) layer manages the states, packets and flow control of the Bluetooth link.

The Logical Link Control and Adaptation Protocol (L2CAP) layer is responsible for multiplexing the user protocols, segmentation and reassembly of larger modules (datagrams) into packets, device discovery and statistical information. A small Bluetooth unit will not necessarily need to manage segmentation or more than one user protocol.

The RFCOMM layer provides simple serial-port emulation, which is analogous with IrCOMM used in the IrDA infra-red standard.

Audio is optional and is obviously used only with audio devices such as headsets etc. Audio data is in PCM (Pulse Code Modulation) form. It bypasses the stack, entering and exiting the hardware codec.

TCS (binary) is used in Telephony Control to set up and disconnect voice and data calls.

SDP is the protocol used by the SDAP profile in device discovery (see below).

IrOBEX, the correct term, is an optional application layer protocol that enables units which use infra-red communication to exchange a wide variety of data and commands in a resource-sensitive, standardised fashion. It's also used for business card (vCard) and diary/calendar (vCal) entries.

The TCP/IP layer is used in networking and when Bluetooth acts as a bridge to the internet (by use of internet protocol).

PPP (Point-to-Point Protocol) is designed to run with RFCOMM to establish point-to-point connections. PPP is a packet-based protocol, and therefore uses serial mechanisms to convert the packet-data stream to a serial-data stream.

HCI (Host Controller Interface) is a defined interface point in the Bluetooth stack for two-processor systems. Anything above the HCI runs on the 'host' processor, which performs the operation of the whole product, as opposed to the dedicated Bluetooth processor which runs everything below the HCI. With an embedded system only one processor runs the whole stack and the application software and there is no HCI. One way of sending commands to such an 'embedded stack' is via AT commands (as used in modems). See Fig. 4.

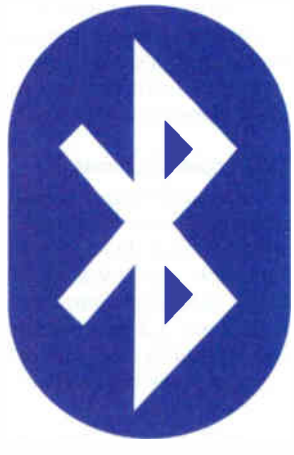


Fig. 5: The Bluetooth logo. Devices that do not carry this are not Bluetooth qualified.

Profiles

The profiles are a fundamental part of how Bluetooth works, and have led to more misunderstanding of the technology than anything else. In the early days of Bluetooth products and even, to an extent, today many people have bought Bluetooth devices thinking that they would carry out the exact tasks required, i.e. that data would just flow between devices which would do anything – synchronisation of data, serial-link replacement, voice, the lot. They got a shock because in those early days very little explanation was provided with products about how to do anything other than the most basic set-ups, and most of the products would work only in conjunction with some other Bluetooth devices from certain manufacturers – and even then only under certain conditions, i.e. correct operating system, and to perform only one task, e.g. serial data transfer. In one exceptional case a major mobile phone manufacturer released a Bluetooth headset that worked with most manufacturers' mobile phones but not with its own! Rehashed software was released pretty quickly to correct the problem.

The purpose of the profile is basically to ensure interoperability between different manufacturers' products, by ensuring that units have the same vertical profile of the protocols used. The Bluetooth SIG also ensures interoperability with its own qualification programme, whereby devices that have passed carry the Bluetooth logo (see Fig. 5) and it is illegal to supply a product with the logo if it doesn't comply with the official specification.

There are many Bluetooth profiles. New ones are released annually and define exactly how a certain task is performed. For example, HID defines exactly how a human interface device such as a mouse or keyboard communicates with PCs etc. For any pair of Bluetooth devices to be able to perform this function they must both have the HID profile. The information is usually on the box that contains the product or sometimes in the instruction manual.

When a Bluetooth device sends out an inquiry (see above) it gets a response back from all the Bluetooth units within range, telling it (amongst other things) their Bluetooth addresses and their capabilities, including the Bluetooth profiles incorporated. In this way the user can find out exactly which device he wants to

Fig. 6: Typical response to a Bluetooth 'inquiry', showing paired devices.

connect to and start the process of setting up a link with it. See below for how to get a Bluetooth device to connect with another one in a simple situation.

Here are some examples of Bluetooth profiles:

GAP (Generic Access Profile) is a mandatory profile for all Bluetooth devices, to allow connection via the inquiry/page mechanism etc.

SDAP (Service Discovery Application Profile) is a mandatory profile to enable devices to discover other devices and the facilities, features etc. they have, also the level of security, the standard (1.1, 1.2, 2.0, see below) etc.

SPP (Serial Port Profile) is a basic profile for sending RS232-like serial data.

DUN (Dial-Up Networking) is used for devices that need to carry out the modem dial-up function, e.g. access points.

CTP (Cordless Telephony Profile) is used for connections between a cordless handset and its base station (similar to DECT).

When you are buying a Bluetooth device, make sure that it has the profiles for what you want it to do, that it works with your hardware and operating system, and that the specification is at least Bluetooth 1.2 (see below).

Setting up a Bluetooth connection from scratch

If you want to get a Bluetooth device to talk to another one you first have to ensure that the Bluetooth function is turned on. Many mobile phones for example have a menu item that enables Bluetooth to be on, off or in automatic mode. Once it is on, you can 'discover' other devices. Carrying out this 'discovery' produces a list of in-range devices you could connect with, though not all of them will have the profiles you require – so you would not be able to do anything if you connected with them.

Once you have selected a device to which to connect you must carry out what is called pairing. This means that you have to enter a passcode on each device to authenticate the connection. In theory this prevents people connecting to your printer as they walk past your office and sending loads of files to it, but in practice many people leave their passcode at the default setting (typically 0000 or 1234) with the result that it's easy to get past this (Bluetooth has many security issues, but that's a whole subject in its own right! If used properly, Bluetooth is fundamentally secure). Once pairing is complete, the devices can connect via paging as described above.

When pairing has been carried out between two or more devices they become 'friendly' and get a special status with their own friendly address and name on your device. If you want to connect to the same device(s) in future you don't have to go through the pairing process. Fig. 6 shows a typical response to a Bluetooth 'inquiry', indicating paired devices.

Bluetooth specifications

Any device bought today should be at least up to Bluetooth specification level 1.2. Specification 1.1 was the first usable one: it was superseded with backward compatibility.

Specification 1.2 has three main mandatory features that provide an advantage over the original specification.

The first is adaptive frequency hopping. This provides trouble-free operation in the same radio space as WLAN and other technologies. Low-performance channels are detected and the hopping sequence is adapted dynamically to avoid interference. There is improved connection quality robustness (for disturbed environments and WLAN co-existence).

The second is enhanced SCO. This provides error detection and correction for synchronous (audio) connections, and improved audio quality for headset and hands-free operation.

The third is fast connection set up. It was theoretically possible for set up to take up to ten seconds with the Bluetooth 1.1 specification. With the 1.2 specification it takes less than two seconds and probably less than one second.

There was no change to the data rate (1Mbits/sec) with the introduction of the 1.2 specification.

A new specification revision, Bluetooth 2.0, has now been agreed however, featuring enhanced data rate (EDR). Some very different techniques are used to achieve greater throughput, with 1, 2 and 3Mbits/sec data rates including overheads.

New profiles

New profiles are being released regularly. Some recent ones include HCRP (Hardcopy Cable Replacement Profile) for printing; GAVDP (Generic Audio/Visual Distribution Profile) for sending audio and video using ACL; and A2DP (Advanced Audio Distribution Profile) for stereo sound quality, made possible by the new Bluetooth data rates.

Devices

Many different devices that use Bluetooth technology are on the market. You can get an idea by looking at the website www.blueunplugged.com

This is basically a one-stop shop for everything Bluetooth.

Next month's article will look at a number of Bluetooth devices in detail.

Further information

I recommend the following books for those who are interested in learning more about Bluetooth.

Bluetooth Connect Without Cables by Jennifer Bray and Charles F. Sturman, published by Prentice Hall. ISBN 0-13-089840-6.

Bluetooth Revealed by Brent A. Miller and Chatschik Bisdikian, published by McGraw-Hill. ISBN 0-13-090294-2.

Bluetooth De-mystified by Nathan J. Muller, published by McGraw-Hill. ISBN 0-07-136323-8.

Bluetooth Application Developer's Guide, published by Syngress. ISBN 1-928994-42-3.

Bluetooth Profiles – the Definitive Guide by Dean A. Gratton, published by Prentice Hall. ISBN 0-13-009221-5. ■

Service Casebook

Michael Maurice

Sony KVM2151U (BE2A chassis) and KVDX271U (AE1 chassis)

These two sets belonged to the same customer. I was called to repair the KVM2151U, which was stuck in standby because the line output transistor Q802 was short-circuit. It's type BU508AS2, which must be obtained from Sony. The replacement, together with a new circuit protector (PS801, 0·6A), cured the fault.

I was then shown the KVDX271U, which had poor audio from Sky and took a long time to come on. A previous engineer had said that the tube was faulty and the set was not worth repair. In my experience however replacing C615 (1,000μF, 25V) and C622 (2,200μF,16V) improves matters. I was right about this, but the Sky sound was still slightly distorted. The reason was that the Scart input with these sets is quite sensitive. Adjusting the sound at the Sky digibox, using the customer services menu, cured the problem.

Philips 46PP912A

This was a big beast of a projection set that lived up three flights of narrow stairs, so it had to be repaired in situ. It had a nasty audio fault – the sound was very crackly and distorted – that had started after some liquid spillage. The FL chassis is not the easiest to work on, and projection sets are even harder.

It didn't take me long to discover that the supplies to the audio output section were OK, and that the audio output circuits were blameless. The cause of the trouble was on the small signals board, where the –8V supply to the various op-amps was missing. It's derived from the –13V line and was missing because of a crack in the board. I used jumper wires to repair the crack, restoring the –8V supply and good sound.

This wasn't the end of the story however. A few days later I was called back because the sound was poor. In fact it was exactly the same as on the previous occasion, with the –8V supply very low at –1V. The cause this time was the liquid spillage, which had affected one of the op-amps. All was OK once a replacement had been fitted.

JVC AV21F1EK (JX chassis)

There was no sound from the right-hand speaker. Checks showed that it could be made to come and go when the audio output PCB was flexed. The cause was one of the audio coupling capacitors that had never been properly soldered.

Sony KVE2942U (AE2B chassis)

A phone call came late one Friday afternoon to say that the set was dead and the LEDs were flashing. I discussed prices, but the customer felt they were too expensive. On Monday afternoon he rang again. Apparently he had called someone else to fix the set but they hadn't been able to do so. So could I come out? After some discussion he agreed to my fees.

The first thing I did was to check the other engineer's work which, I believe, involved replacing the field output chip IC1501. After tidying up the soldering and checking the fusible resistors in the ±15V supplies I switched on. The EHT came up and the LEDs flashed – not the normal thirteen flashes however, which indicate a deflection fault, but three times. The other engineer had been looking in the wrong place!

I removed the signals board (A) and found that the TDA8138A 5/12V regulator chip IC681 was very badly dry-jointed, as were most of the other power components in this area. Resoldering and reassembling the set provided a complete cure. The delighted customer gladly handed over his cash!

Sony PMC301L

The problem with this machine was that the CD would skip and jump after it had been playing for a few minutes. A new laser unit failed to cure the fault, so I took the CD mechanism out and examined it. The sled drive appeared to operate smoothly, and none of the gears were damaged. I found that Grandata was selling complete mechanisms at a very reasonable price, so I obtained one and fitted it. This cured the trouble.

Philips 21GR2550 (G90AE chassis)

The fault was no sound. I quickly found that the 20V supply at pin 18 of the TDA8191 audio chip IC7220 was missing. There are two BAS32 surface-mounted diodes, D6262 and D6278, in series with this supply. D6278 proved to be open-circuit. A replacement restored normal sound.

Mitsubishi CT21A2STX (Euro 12 chassis)

This set was dead. It had received attention previously, when a number of capacitors had been replaced. The problem now was that C907 (30pF, 2kV) and D906 (BYV96E) in the chopper transistor's snubber network had become dry-jointed and had burnt a big hole in the board.

The customer was an elderly lady who really didn't want to replace her set. So I cleaned the board thoroughly, removed the burnt bits and fixed a piece of plain Veroboard over the hole with Araldite. Once it had set, C907 and D906 and other components in the power supply were replaced, as well as the usual electrolytics. The set then worked first time, with an excellent picture.

LETTERS

Send letters to "Television", Nexus Media Communications, Media House, Azalea Drive, Swanley, Kent, BR8 8HU or e-mail t.winford@highburybiz.com using subject heading 'Television Letters'.

Please send plain text messages. Do NOT send attachments. Be sure to type your full name, address, postcode, telephone and e-mail address (if any).
Your address and telephone number will not be published but your e-mail address will unless you state otherwise.

Lead-free solder

I was intrigued to read about Adrian Gardiner's experiences with lead-free solder (Bench Notes, June) and his recommendations regarding equipment etc. for handling this new technology. Whether or not this was deliberate, very little of what he had to say on the subject seemed to be in a positive vein. The time when the EU directive on the use of leaded solder becomes obligatory draws ever closer. But I still feel that we are very much stepping into unknown territory here, and abandoning a tried and tested technology in favour of a knee-jerk reaction to the call to "clean up the planet".

It has yet to be explained to me satisfactorily exactly what the issue is with leaded solder, particularly if a proper and responsible approach to the recycling of end-of-life electronic equipment is adopted. I fail to see how the lead in solder could have an appreciable effect on the public. As I understand it lead poisoning, particularly in small children, can lead to irreversible brain damage. But if the government is to be believed our kids are getting cleverer by the year and we're all living longer. Clearly any poisoning is not enough to be measurable.

Some time ago plumbers were banned from the use of leaded solder with open-pipework systems for hot and cold water (as opposed to closed systems for central heating etc.), on the basis that the lead in the solder previously used could contaminate the drinking-water supply. But the lead contribution from the solder on the inside of a water-pipe joint would be minuscule compared to the insides of the lead pipes that delivered all the household water when I was young.

I asked a friend who owns and runs a large local plumbing firm how the lead-free solder directive had affected his business. The exact wording of his reply is not printable, but amounted to lead-free solder being a pain in the backside. He contends that it's much a more difficult material to work with. Even when using a blowlamp the melting point is noticeably higher, and the solder has completely different flow and resetting characteristics. He says that the solder tends to flow very suddenly and rolls around in a less controllable way. It is apparently also harder to make a good watertight joint. Initially this caused problems, but they have now become sufficiently used to it to be able to make joints that are pretty much guaranteed to be satisfactory. Hmm.

Another point that will have to be sorted out is the implications of mixing different alloys. A directive in the Farnell catalogue warns against mixing leaded and lead-free solders. Apparently the warning came from Multicore. The implication is that the integrity of a lead-free joint may be compromised if leaded solder is used to rework it. But what are the possible problems if a manufacturer builds a board using alloy X and I, as a repairer, rework a joint on it using alloy Y? I understand that at least three different metallic compositions are now in common use. Can they be mixed? Would it cause another shift in the melting point? If a board was constructed using leaded solder the same presumably applies if I use lead-free solder to repair it. Can I continue to use leaded solder to repair and rework these boards?

I don't want to appear 'anti-green', having no more desire than anyone else to see the planet wrecked. But there need to be real justification and benefits as a result of changing from tried, trusted and mature technology.

Most readers will know that I'm less than impressed so far by the lead-free products I have come across, and I am not alone in this view. I have had some very interesting email conversations recently with a well-respected and regular contributor to the amateur radio journal *Radcom*. He directed me to the website www.avionicsmagazine.com
If you use the on-site search facility and look for 'lead free solder' you will find a couple of very interesting articles on the safety of passenger aircraft from people involved in the avionics industry.

I really hope that by this time next year we all know exactly what we are doing.

On a completely different topic, in his review of the Peak Atlas ESR tester in the same issue Eugene Trundle says he doesn't know of any such tester that has a digital readout facility. I would draw his attention to the Capacitor Genie, which was designed in Australia by Bob Parker and is available in the UK, as a kit or ready-built, from SatCure (check at www.satcure.co.uk). It's microprocessor based, auto-ranging and auto-zeroing, and has a large, clear two-digit LED display. It doesn't measure the capacitance value, but I've never found it necessary to measure this at the same time as a component's ESR. I have used one daily for some years, and have found it quick (it produces an almost instantaneous reading) and completely unambiguous and reliable for finding bad capacitors. To this end the table of typical values to expect, incorporated on the instrument's front-panel foil, is extremely useful. It is ruggedly built and has given me sterling service in a hard-working and often abusive workshop environment. I would happily recommend this extremely competitively priced meter to anyone thinking of buying one of these very useful instruments.

Geoff Darby, Monitech,
Earls Barton, Northampton.

White mould, Freeview

The problem of white mould with Scotch videotapes has come up several times recently in the magazine. I have numerous VHS tapes of various makes, including Scotch, that have accumulated over the past 23 years and have also encountered this problem. In my case only two Scotch tapes have been affected so far, the odd tape of another brand has been affected, but the problem has been most widespread with JVC SX240 tapes bought in the early 1990s – not all of them have been affected however.

The white mould usually starts as patches on the tape. In this early stage the tape still plays though with dropouts. At a later stage the tape starts to curl, becomes difficult to wind and clogs up the VCR's

heads, requiring a thorough clean-up job. So far I've had to dispose of seven of these tapes. Curiously I have not had the problem with JVC SX180 tapes bought at the same time, or the original Japanese-made tapes – also available as Akai, Ferguson, Thorn and Baird. These are superb and all my twenty year plus recordings made on them play back perfectly. They look as fresh as the day I recorded them.

A while back I commented on the abysmal quality experienced with the ONdigital DTT system. In contrast the current Freeview system gives excellent results with none of the problems associated with the earlier one, such as dissolving pictures and the like. This came as a great surprise when I connected a Freeview box to a poor group C/D aerial, which gave variable analogue reception including some ghosting. All available channels come through perfectly, with results equal to first-class analogue reception – both using my 20in. ITT CVC5 hybrid chassis main domestic TV receiver (RGD brand incidentally!). The ability to alter the aspect ratio at a touch of a remote-control button is an added bonus, allowing the choice to have full 4:3 pictures without the irritating gaps.

Those of you with 405-line receivers and conversion equipment will be pleased to know that perfect results are achieved with this system as well!

Brian Renforth,
Jarrow.

Care of your pennies

In the June issue Elaine Everest commented on reducing bank charges. I haven't paid any bank charges in fourteen years, can pay as many cheques in as I like and draw out as many as I like. It costs me nothing and I even get interest on my money while it sits there. What's the secret? Simple, get an account with the Cheshire Building Society. As far as I am aware this is, or used to be, the only building society that allows business transactions.

There are minor drawbacks, but who cares when it costs you nothing? One is that you have no cheque book. When you need to draw a cheque you have to go to the building society and ask for one to be made out. But as it's a building society cheque that wouldn't be issued if you had insufficient funds in your account it is guaranteed not to bounce. In fact it's as good as cash. The other drawback is that the Society doesn't do direct debits. The easy way round this is to run them through your personal banking account. I pay bills only one day a week, when the shop is closed: the money saved in bank charges far outweighs the inconvenience of going to the building society one day a week.

With customers demanding ever cheaper goods and repairs, money has to be saved wherever possible. To get rid of high bank charges is a good starting point.

Some of the most common phrases I hear in the shop are "if it costs less than a tenner to repair go ahead and don't bother ringing me with an estimate"; "how much! I'm not paying that, Sky are giving them away free"; and "there can't be much wrong with it, I've had it only eighteen months and it cost nearly forty pounds".

Michael Dranfield,
Buxton, Derbyshire.

White-Ibbotson

In a letter in the May issue (page 413) I referred to my experiences many years ago with a White-Ibbotson rear-projection TV set – another reader had also mentioned the set. I've since come across a photo of it, so readers might like to see what we were on about!

It used a small Mullard 2·5in. CRT, because the optical box required as small an image as possible. The brightness of its image was so intense that we were advised not to look at it directly.

The Mark 2 version of the set had a somewhat better presentation.

Alan Willcox,
Cardiff.

Too much volume!

Many years ago a customer consulted me about an unusual problem. It related to her son's massive radiogram, which he played too loudly – despite numerous requests, especially from the neighbours, to turn it down. The lady asked me if I could 'nobble' it to reduce the sound irrespective of the volume control setting. She wanted something cheap, so I fitted a 10Ω potentiometer across the speaker and adjusted it for a reasonable output.

A few days later however I was told that the boy had somehow discovered the potentiometer, and we were back where we started. I decided that we would have to be crafty. The single output valve in the set was an EL84. So I replaced it with a PL84, which only just worked! There were no further problems about excessive sound, and he never found out about the new modification!

Philip Bearman,
New Barnet, Herts.

Dedicated spares pricing

Recently I required a power supply repair kit for the Philips GR2.2 chassis. I ordered it from my usual supplier then found that there had been a price increase. It's out of order for suppliers to do this – I could have sourced the parts cheaper if I had ordered them separately. To add insult to injury, the chopper control chip in the kit was faulty. I didn't return it as this would have added to the cost.

The supplier phoned us recently to ask if there was any way in which it could improve its service to the trade. My reply was to keep the prices of dedicated spare parts realistic, otherwise they would have a warehouse full of spares because the repairs would be too costly. It also plays into the hands of the manufacturers, who don't want their equipment repaired.

Those in the trade can confirm this – the evidence is the current poor or absolutely diabolical designs. The rubbish that comes our way nowadays is often impossible to work on.

Sensible spare parts pricing is essential if this trade is to continue. Otherwise, say goodbye to good old-fashioned TV servicing – by the highly-intelligent, decent, hard-working people better known now as 'the few'.

Ray Withey, Borland TV,
Edinburgh.

DX and Satellite Reception

Terrestrial DX and satellite TV reception reports. Broadcast and satellite TV news. The infinite front:back ratio aerial. Roger Bunney reports

The bomb-digger arm in use "somewhere in the Iraq desert", a CBS transmission via Eutelsat W2 (16°E).

The 2005 season for Sporadic E signal reception started in mid-May, with several excellent periods. There's good news in that the Spanish TVE network is still using Band I: ch. E2 and, very strong, ch. E3 signals have been received, but Madrid ch. E2 is certainly running at much reduced power. This is curious, as from March this year the 50MHz amateur allocation in Spain has been opened to a wider group of radio amateurs, with operation over 50-51MHz at powers up to 100W allowed. Spanish amateurs must apply for a permit to operate at 50MHz however, as 'commercial services' share the band.

Here's a summary of SpE reception in the UK over the past few weeks:

30/4/05	RAI (Italy) chs. IA and IB.
3/5/05	RAI ch IA; Tele A (Italy) ch. E2–.
16/5/05	TVE (Spain) chs. E2 and 3; Tele A ch. E2–; TVA (Italy) ch. E3; RAI ch. IA; HRT (Croatia) ch. E4; also many unidentified signals.
18/5/05	RUV (Iceland) E4.
19/5/05	NRK (Norway) E2, 3; BTV (Belarus) R1; LRT (Latvia) R2; SLO (Slovenia) E3; YT (Ukraine) R1; Canal Plus (France) L2; TVE E2; RTP (Portugal) E3; TVA E3; RAI IA, B; also many unidentified signals in chs. R1, 2, E2-4.
20/5/05	TVE E2, 3; RAI IA, B; RTP E2; IRIB (Iran) E2.
21/5/05	NRK E2-4; SVT (Sweden) E2, 3; HRT E4; MTV (Hungary) R1; RAI IA, B; Tele A E2–; IRIB E2; also unidentified Arab ch E2 and E3 stations and MTB (?) ch. E4.
22/5/05	RAI IA, B; TVE E2, 3; RTP E3; Tele A E2–; HRT E4; MTV R1; RTL (Hungary) R2; SWR1 (Germany) E2.
23/5/05	RAI IA, B; Tele A E2–.
27/5/05	English-language movie on chs. E2/3 at 2000-2115 (no subtitles!)

The good SpE conditions faded away after the 23rd and up to the time of writing – just before the end of May. Unfortunately the ending of analogue TV across Germany has involved the closure of several Band I transmitters. As I write there appear to be only two Band I transmitters still on air, SWR1 Gottelborner Hohe and the mountain-top BR1 Grunten, both on ch. E2. Unlike TVE whose Band I transmitter closure plans have been subject to postponements, the Germans will stick to their announced schedule – this will be the last year for transmissions from the above two ch. E2 outlets.

Hugh Cocks in the Algarve experienced a lot of ch. E2 backscatter on May 16, as part of the SpE opening noted above. On the same day from about 1930 hours he heard weak 60Hz video buzz from his scanner at 55·25-55·26MHz (N. American ch. A2). The ch. E2 transmissions with a 'whining noise' (53·75MHz) are now thought to come from Equatorial Guinea; there is also ch. E2 Spanish sound with the same noise. Hugh has heard distorted French-language FM radio via his scanner at 46·19MHz and wonders whether this is a Band II sub-harmonic (46·19 x 2 = 92·38MHz).

Satellite sightings

Alan Richards (Skegness) notes that satellite reception has been rather quiet over the past few weeks, and I agree. The World Economic Forum held in Jordan on May 21-23 was seen (on the 21st only) via Eutelsat W2 (16°E) at 12·540GHz H (symbol rate 5,632, FEC 3/4), in NTSC colour for the US market. I can't say that speakers talking high finance were exactly exciting – a test card from Jordan would have been quite dramatic!

What was certainly dramatic appeared a few days earlier, again via W2, when CBS fed a very long VTR package back to New York showing life on the road for GIs in Iraq. Perhaps the most dangerous part was the convoy passing very slowly through the streets of Baghdad, with market traders on both sides and no chance of a quick getaway in the event of coming under fire.

Once out on the open road the convoy ground to a halt because of a suspect bomb. A crane arm extended from one of the vehicles and a fork at the end fumbled in the sand, discovering the suspect bomb with wires that ran away into the distance. The convoy moved forward once the bomb had been disposed of safely. This absorbing video was transmitted to London for onwards despatch to the US. The first hop was carried by W2 at 12·548GHz H (5,632, 3/4) with the service identification 'Service 1', starting at 2000.

At the beginning of May there was another CBS VTR package via W2, this time at 12·518GHz H, with commentary on the latest atrocities, another US hostage, several car bombs and at least a hundred people killed, all over one weekend. This had a more detailed identification, 'CBS News Baghdad'. In recent times CBS has tended to use a flyaway facility with just a six-number service identification. For example on Friday May 13 at 1930 hours 'Test broadcast. CBS News Moscow. L-sat –> New York' appeared via W2 at 12·562GHz H (5,632, 3/4) with test patterns and the identification '514044'.

Unrest in Uzbekistan too. Graphic images of the demonstrations were carried by the Turkish news agency IHA via Eutelsat W1 (10°E), showing angry crowds, the army firing into them and piles of bodies.

A new satellite is available to enthusiasts if you have a clear take-off towards the lower SW horizon. Roy Carmen sent me an email recently to report reception from the Amazonias satellite (61°W) in Dorking, with good signals. He received two channels at 12·562GHz V (27,500, 7/8) via his 1m Triax dish with Invacom 0·3dB universal LNB. The signal was initially found by his Fortec receiver, using a blind scan. This provided the frequency and SR. His RSD OMC302 receiver confirmed the FEC, while a Nokia 9600S receiver provided other data – PIDs etc.

There was extensive coverage of the UEFA Champions League match between Liverpool and AC Milan at Istanbul on May 25. A check at 16°E revealed the German sat-linker NTV at 12·525GHz H with pre-match inserts and reports showing the crowds. Commentary was in English for Channel 5. At 11·128GHz H there was a Sky Sports feed from the ground, via sat-linker 'AA DSNG'. These feeds were both in the clear, with SR 5,632 and FEC 3/4.

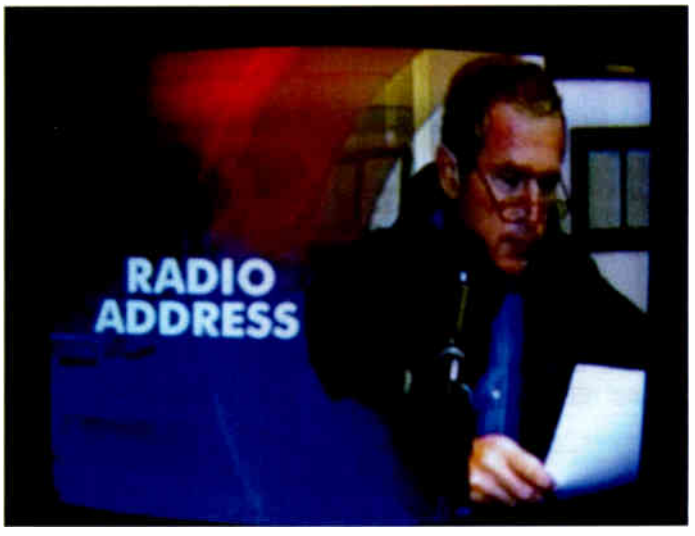
Alan Richards has bought a Clik-Clak badged glass dish that measures 86cm high by 80cm wide. It's intended for use in the Mediterranean area, and thus has higher elevation settings than those of UK-intended dishes, but cannot tilt below its horizontal setting – required at Skegness for Europe*Star at 45°E. A spacer added inside the Clik-Clak's top bracket tilts it forward sufficiently to give access as far as 58°E. Comparison between its performance and that of Alan's 70-75cm solid metal dish, both with an 0·3dB LNB, is still being assessed. It provides a slight improvement, but still not enough for Arabsat at 26°E. As a home-park dweller Alan finds that the transparent dish merges into the caravan structure and, apart from the rear support bracket, is almost invisible. An early May sports-car racing feed via PAS-9 (58°W), of unknown origin, provided high-action drama. At the end of the race the screen went blank and the BT Tower A slide came up. If you can see as far as 58°W, check at 11·477GHz H (26,463, 3/4). TV Azteca from Mexico City is also available via PAS-9 from time to time, at 11·556GHz H (3,680, 2/3).

Broadcast news

DTT: Telenor Broadcast group has expressed interest in operating a DTT network in Norway to run alongside its present analogue TV and radio networks. Broadcast Service Denmark (BSD) has selected contractors for the engineering work required to establish a DTT network in Denmark. Installation will be at existing analogue transmitter sites.

DAB: A digital radio network is to be set up in Galicia, Spain, with six regional and 66 local transmitters.

Pure has launched a new triple-band receiver, Model Evoke-1XT Tri-Band, with Band II (analogue FM), Band III and L band (DAB) coverage. L band is not used in the UK but limited transmissions are available in parts of France.



President Bush's weekly broadcast is carried by Atlantic Bird 1 (12·5°W).

Afghanistan: An Islamic TV channel is to be launched in Kabul later this year. President Karzai has promised support but has not commented on funding. At present Kabul has a state channel and four independent TV channels that provide mainly 'western' content such as pop videos and films. The Kabul TV mast for RTA (Radio Television Afghanistan) has recently been rebuilt with Japanese funding. The Taliban have opened a radio station that broadcasts Islamic content.

Cuba: The US government is to maintain funding for Radio and TV Marti, which transmits to Cuba from Miami. The TV transmissions are in Band III from a balloon tethered high above Key West. They started in 1990 – Radio Marti opened in 1985.

PLT: Scottish and Southern Electricity plc is to end its power line telecommunications evaluation tests and involvement in PLT. This is good news on the interference front – by using electricity distribution cabling for data transmission PLT could have produced widespread MF/HF interference. The rapid expansion of broadband services seems to have put an end to PLT. The results of PLT tests in the UK are available from Ofcom via the internet at www.ofcom.org.uk/research/technology/cet/powerline/

According to the EMC column in *Radcom* Panasonic has devised a domestic version of PLC, 'HD PLC', that uses the mains wiring in buildings and a data rate of 90Mbits/sec. This, with a switch-mode power supply, could give rise to interference problems.

Satellite news

Sirius 4 will be launched in the spring of 2007 to replace Sirius 2 and 3 at 5°E. It will have 52 Ku-band and two Ka-band transponders and in addition to coverage of Scandinavia, Eastern Europe and North Africa will have sub-Saharan coverage. Nordic Satellite, the operator, is owned 25 per cent by the Swedish Space Corporation and 75 per cent by SES Astra.

The Republic of Iraq Radio TV channel has been seen recently via Arabsat (26°E) at 11·747GHz V (27,500, 3/4) and 11·100GHz V (3,000, 3/4). It's easier to get via Hot Bird (13°E) at 12·655GHz H (27,500, 3/4).

Teleport UK Ltd., which was in administration, was auctioned on June 15. It's a fully-equipped freehold site at Lawford Heath, two miles west of Rugby, with eight dishes up to 11m, transmitting/receiving equipment for C- and Ku-band operation, encoding/decoding gear, test equipment etc.

DTH Bulgaria is to start as an encrypted service on October 1, with four TV and four radio channels intended for Bulgarians living overseas. Coverage will include Europe, western Russia, the Mediterranean region and North Africa.

Watch out for two important live NASA feeds covering the

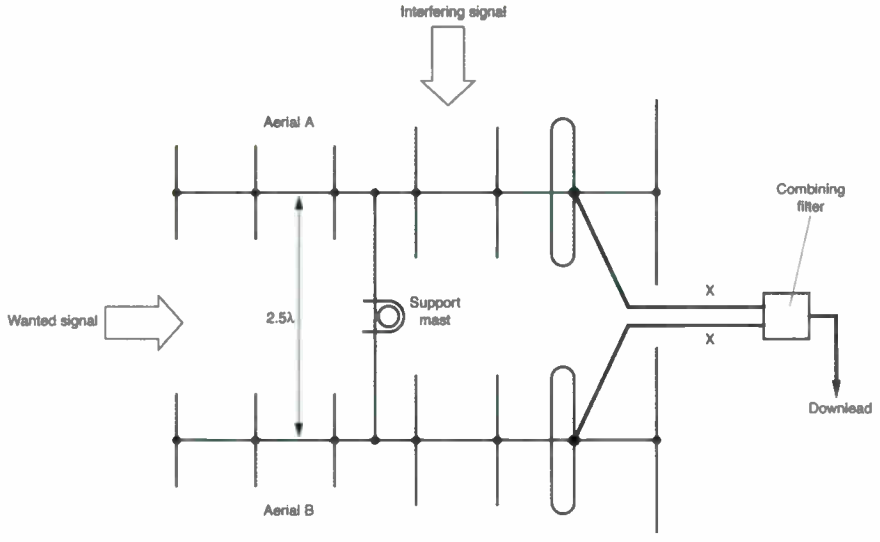


Fig. 1: Use of two stacked aerials to reduce co-channel interference arriving from the side. Horizontal aerials, viewed from above. X = equal lengths of coaxial cable.

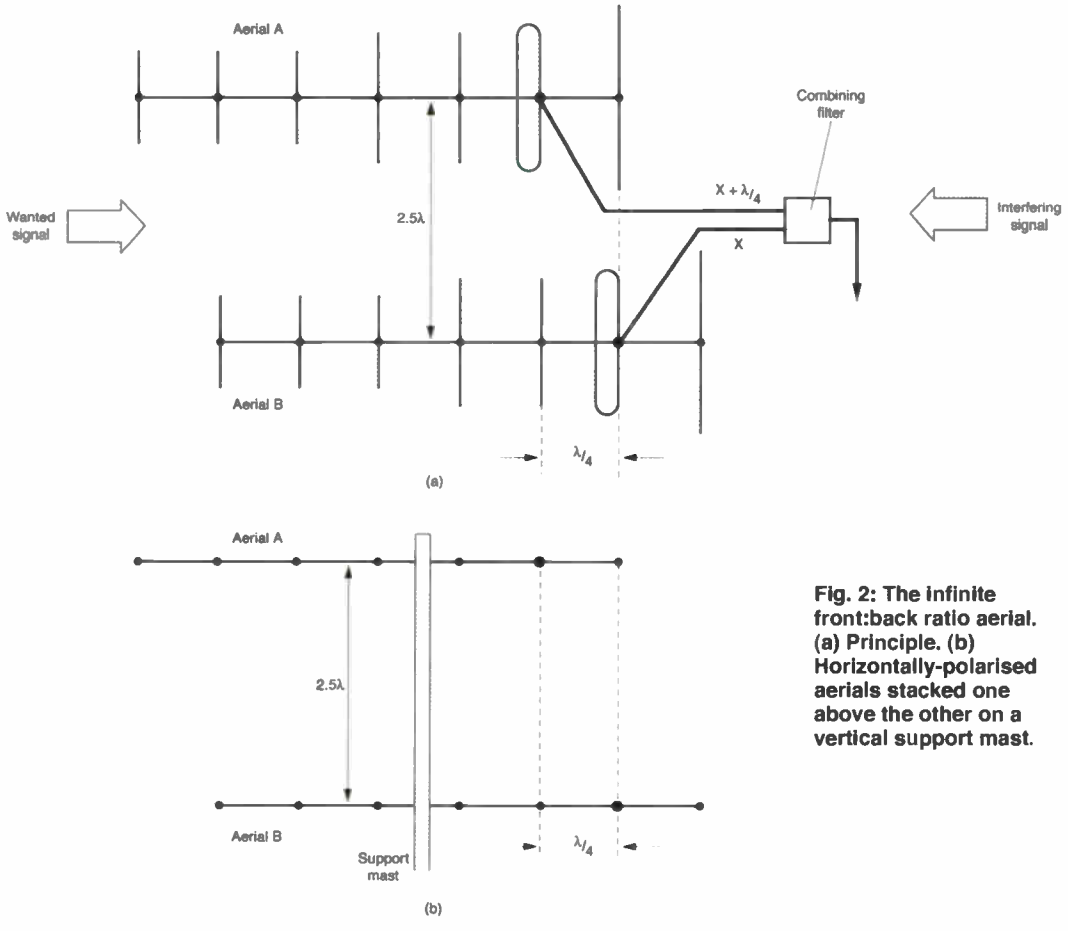


Fig. 2: The infinite front:back ratio aerial. (a) Principle. (b) Horizontally-polarised aerials stacked one above the other on a vertical support mast.

launch of the next Mars spacecraft on August 10 at 07.53.58 EDT onwards, with a two-hour launch window, and the launch of the new Shuttle during the July 13-31 period. NASA TV can appear at various slots, for example GlobeCast via Atlantic Bird 1 (12·5°W) at 11·015GHz H (20,145, 3/4) and UP4 via Eutelsat W1 (10°E) at 10·972GHz V (4,567, 5/6) or 11·081GHz V (5,632, 3/4).

The infinite front:back ratio aerial

Some months ago a reader asked about reducing co-channel TV interference. A distant transmitter was causing problems with his reception of not very strong local TV, particularly when there was a lift in tropospheric conditions. The result was line pairing and the occasional floating picture that could, when the interference was severe, cause break up of the local picture.

Here at Romsey I experience co-channel interference from the Mendip transmitter to my reception from the Solent TV RSL station on the Isle of Wight (ch. 54). The Solent TV signal is transmitted from Rowridge, about 25 miles to the south, at 2kW ERP. The Mendip transmitter, about 45 miles distant to the NW, runs at 500kW. A single flat-gain Triax Grid (UHF bow-tie) aerial is in use for domestic reception from Rowridge. It provides adequate Solent TV signal input, but line pairing is evident. The problem was largely overcome, unless tropospheric interference was severe, by erecting a higher-gain long-Yagi aerial, the Triax Unix 92W. This was my first suggestion.

The width of the main forward lobe of an aerial can be considerably reduced by stacking two similar aerials side-by-side. If interference is received from the side of the array, i.e. at 90° to the boom, it can be nulled out by adjusting the spacing between the two aerials. See Fig. 1. The interfering signal arrives at aerial A first then, a short time later, at aerial B. If the aerials are spaced apart by an exact number of half waves, for example 1·5, 2·5, 3·5, and the output from the two aerials is fed to a combining filter via equal lengths of cable, the signals will be in opposite phase at the filter and will cancel out. A bonus is that the wanted signals combine, providing a power gain of almost 3dB. This is a doubling of the signal strength, which reduces the interference further. At UHF the spacing would be perhaps 2·5 or 3·5 to maximise the forward capture area, i.e. gain.

The traditional formula for a half wave in free space is 492/f, where f is the nominal video carrier in MHz. This gives the answer in feet. Note that 0·1ft = 1·2in.

It follows that an interfering signal which arrives at an angle other than 90° from the side of the boom can be phased out by appropriate spacing of the two aerials. This can become extended when the interference arrives at say 20° from the direction of the wanted signal. Several decades ago J-Beam Aerials produced an excellent aerial booklet that discussed aerial problems in general. The booklet listed phasing-out spacings (in wavelengths) for interference arriving at many angles. Unfortunately I have been unable to find my copy of this booklet. If and when it reappears I'll pro-

vide the listing here. Or maybe someone could lend me a copy of the booklet.

Another technique recommended in the booklet, for reducing interference from the back of the aerial, is the infinite front:back ratio aerial, see Fig. 2. This variation of the phase shift/cancellation principle works for vertically- and horizontally-polarised aerials and is both simple and effective. It will considerably reduce co-channel interference that arrives from the rear of the aerial system.

The two aerials are spaced apart by say two wavelengths, but in this case the distance is of less importance. They should be stacked to maximise the capture area – with high-gain aerials the spacing will be two wavelengths or more. One of the aerials, A in Fig. 2, is mounted a quarter-wave ahead of the other aerial, B. This means that aerial A is a quarter-wave closer to the transmitter than aerial B. The combining cable harness is modified in comparison with the previous arrangement: this time the cable from aerial A is a quarter-wave longer than the cable from aerial B. The wanted signal arrives at aerial A first and travels along an extra quarter-wave of feeder to the combining filter in comparison with the conditions at aerial B. The result is that the outputs from the aerials are in phase at the combining filter and add, hopefully increasing the output to the maximum 3dB power gain possible.

The unwanted interference signal from the rear arrives at aerial B first. This time the signals at the combiner are in opposite phase and therefore cancel – almost.

When horizontally-polarised aerials are used they should be stacked one above the other on a vertical support mast with two-wavelength spacing.

An important point is that signals travel along a cable at a slower rate than through free air. Thus the velocity factor of the cable has to be taken into account when calculating the feeder lengths to the combiner. The velocity factor is quoted in coaxial cable data and is often about 0·8. All you have to do is to calculate the free-air figure then multiply this by the velocity factor to arrive at the correct cable length. If for example a half wave is 20in. in free air, multiplying this by 0·8 will give the figure as 16in., and the quarter-wave section of cable will be 8in. long.

Saturday tests for the Yugoslav Church, via Eutelsat W1 (10°E) at 11·008GHz V.

J-Beam Aerials was a prolific aerial manufacturer that exploited the skeleton-slot principle, introducing a high-gain Band III aerial of this type at the 1958 Radio and Television Show. As a footnote, I suspect that the company was named after the WW2 Gee electronic grid system for bomber navigation/DF use, the J-beams being an improved version of the German Knickebein system. See *Instruments of Darkness* by Alfred Price (1977), ISBN 0 354 01062 X, and *Most Secret War* by R.V. Jones (1978, 1998), ISBN 1 85236 699 X. ■

HELP WANTED HELP WANTED HELP WANTED HELP WANTED HELP WANTED

Wanted: Type A56-500X (22in. 20AX) CRT with good emission, or one in a scrap or working set. Phone Derek on 01214 224 724/07779 526 445 or email derekmj@tiscali.co.uk

Wanted: A remote-control unit and, if possible, handbook for the Bush Model DVD142TV, or information on a suitable 'lookalike'. Douglas Biggar, 27 Auld Lea Road, Beith, Scotland, KA15 2DA. Phone 01505 502 118.

Wanted: Rod aerial for the Ferguson DAB radio Model FRG-120D, or information on a source for this. Phone Stewart on 01316 672 426.

Wanted: Quad 33, 34 or 44 preamplifiers, 405 power amplifiers and FM3 or FM4 tuners for spares. Also boards and modules for these. Contact Mike on 01758 613 790.

Wanted: Circuit diagram or service manual (photocopy OK) for the Peavey powered monitor Model ES-12PM or any technical knowledge on it. The monitor is about fifteen years old. Rod Proctor, 8A Maliston Road, Great Sankey, Warrington, WA5 1JR. Phone 01925 635 582.

Wanted: Can someone tell me the value of R503 in the power-supply section of the Matsui TV/VCR combi Model TVR180? Also can anyone provide the pin connections for the AV socket in the Salora J chassis – I believe it's a DIN-type socket? Phone Michael Ashley on 01773 813 569 or email mick@michash.fsnet.co.uk

Wanted: Old half-inch diameter ferrite rods. Must be six inches or more long. Will pay very good money for them. Peter Tankard, 16A Birkendale Road, Sheffield, S6 3NL. Phone 0114 231 6321 between 9 a.m. and 10 p.m.

Wanted: Circuit diagram for the Ford LW/MW radio/cassette player fitted in a 1986 Fiesta. Paul Fairfield, 24 Hillside Road, Ashted, KT21 1RX. Phone 01372 275 351.

Wanted: Courier 10 print wheel for the Sharp PA3000 electronic typewriter. Phone 01637 851 945 (Newquay, Cornwall).

Wanted: Daewoo CTV Model DWX-28W5GB (WP895 chassis), either a complete set with faulty tube or a good main PCB. T. Milverton, 32 Lancaster Close, Birmingham, West Midlands, B30 2HW. Phone 0121 459 1050 (evenings).

For sale: One old used PC with EPROM/EEPROM read/writers. For details see http://www.satcure.co.uk/eprompc.htm

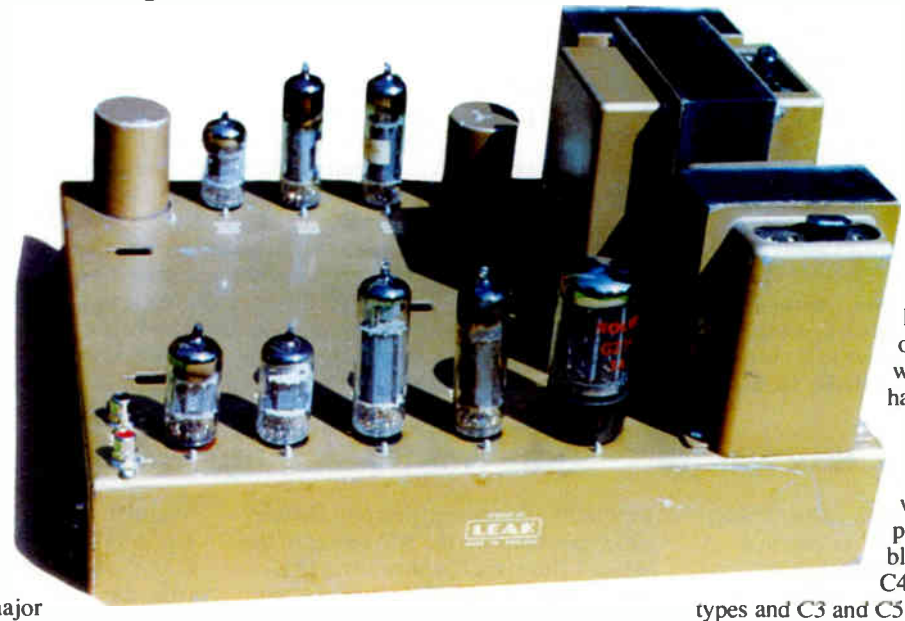
Wanted: Circuit diagram for the Silver 6in. AM/FM/CTV portable Model CA225. Good photocopy OK. Expenses paid. Can anyone supply or provide details of a source for the following line output transformers? Type 11.1/110°-058-541-TR1/10/04 for a Beko CTV chassis and type TLF15557F for a 33in. Panasonic set. Suresh C. Kinnoo, 3 C. Desrouledes Street, Curepipe Road, Republic of Mauritius.

For sale: *Television* magazines from 1987 to 1992. Total 62 copies (a few missing, mainly 1992). Phone Mike on 01758 613 790.

Wanted/for disposal: Require a high-impedance plastic bass loudspeaker for the Mitsubishi Model CT2027TX teletext TV set, also a service manual with circuit diagram. The loudspeaker has a diameter of 105mm (135mm including the four fixing lugs). Have for disposal six toner cartridges, type W, for a Xerox 1020 photocopier (would also suit Model 1030) plus a large quantity of new spares, most free of charge. There are several new drums and other consumables. Dave Mackrill, 13 Tower Road, St. Leonards-on-Sea, East Sussex, TN37 6JE. Phone 01424 427 996 or email dave.mackrill@virgin.net

The Leak Stereo Twenty

The Leak Stereo Twenty was one of the finest amplifiers available back in the early Sixties, so when he came across one in a batch of vintage electronics Michael Rathbone decided to carry out a general restoration. The results made it all worthwhile and the amplifier has been in regular use ever since



Earlier this year I acquired a batch of assorted vintage radio and electronic items and, among other interesting things, there was a Leak Stereo 20 power amplifier. As this amplifier is highly regarded by 'valve-sound' hi-fi enthusiasts, I decided that it would be well worth checking this out. It soon developed into a major rebuild and restoration project.

This type of gear was 'state of the art' in the mid Fifties to early Sixties. Transistors were just starting to be used, but they were noisy germanium types and the power transistors had a pretty feeble frequency response, high leakage current and a tendency towards thermal runaway. So, if you wanted reasonable power output with decent quality, it had to be valves.

Circuit description

Fig. 1 shows the circuit diagram for one channel – the other is identical of course. It's basic 'steam age' audio. The input signal is amplified by V1 and passed to V2, which is a cathode-coupled phase-splitter. The first triode in V2 acts as a normal amplifier while the second triode is operated in the grounded-grid mode, its grid being decoupled to chassis by C5. As the signal drive is at its cathode, the output at its anode has zero phase shift. There are thus opposite-phase outputs at the anodes of V2, and these are used to drive the output pentodes. There is a reason for the difference in value of the two anode load resistors R7 and R10. If the stages were perfectly balanced the signal currents would tend to cancel at the cathodes, giving no input to the second triode. The different values for R7 and R10 plus the fairly high value of R9 prevent this happening.

The output pentodes, driven in push-pull at their control grids, produce an amplified signal across the output transformer. Their screen grids are connected to transformer taps in what was known as the ultra-linear mode: this means that the operating point of the output pentodes is somewhere between that of a triode and a pentode valve, which has the effect of reducing distortion.

The power supply is a simple full-wave valve rectifier job – no regulators or switch-mode devices here! On the other hand I don't think they had to introduce repair kits as soon as the equipment hit the shops.

The restoration

Quick meter checks on the passive components, which all live on a big group board, soon convinced me that this was not going to be a quick fix. In fact I decided on a full rebuild.

The values of nearly all the resistors had drifted: high-value ones had increased while low-value ones had decreased, as is the habit with solid-carbon types. The capacitors had also deteriorated, with all the grid couplers showing measurable leakage. I replaced C4 and C6 with polyester types and C3 and C5 with some rather nice 2 per cent polystyrene capacitors I happened to have in stock. The 50μF cathode decouplers were replaced with good-quality modern types. The only small components that escaped the purge were the two 200pF capacitors (C9) in the feedback networks. These, being mica types, checked out OK for value and leakage. So they were left in place.

The main smoothing blocks, C10-11 and C12-13, looked in good shape, with no nasty rubber-insulation bulges. So I decided to keep them if the capacitors were all electrically sound, as they were – besides which the blocks are finished in bronze to match the rest of the chassis.

I then found and fitted a new set of valves. The self-tapping screws that hold the valve bases and transformers to the chassis were rather tarnished, so I replaced them with shiny new ones and polished the nuts and bolts on the transformer laminations. After polishing up the paint-work the whole thing looked quite respectable.

Reforming

It is not a good idea to apply the full HT

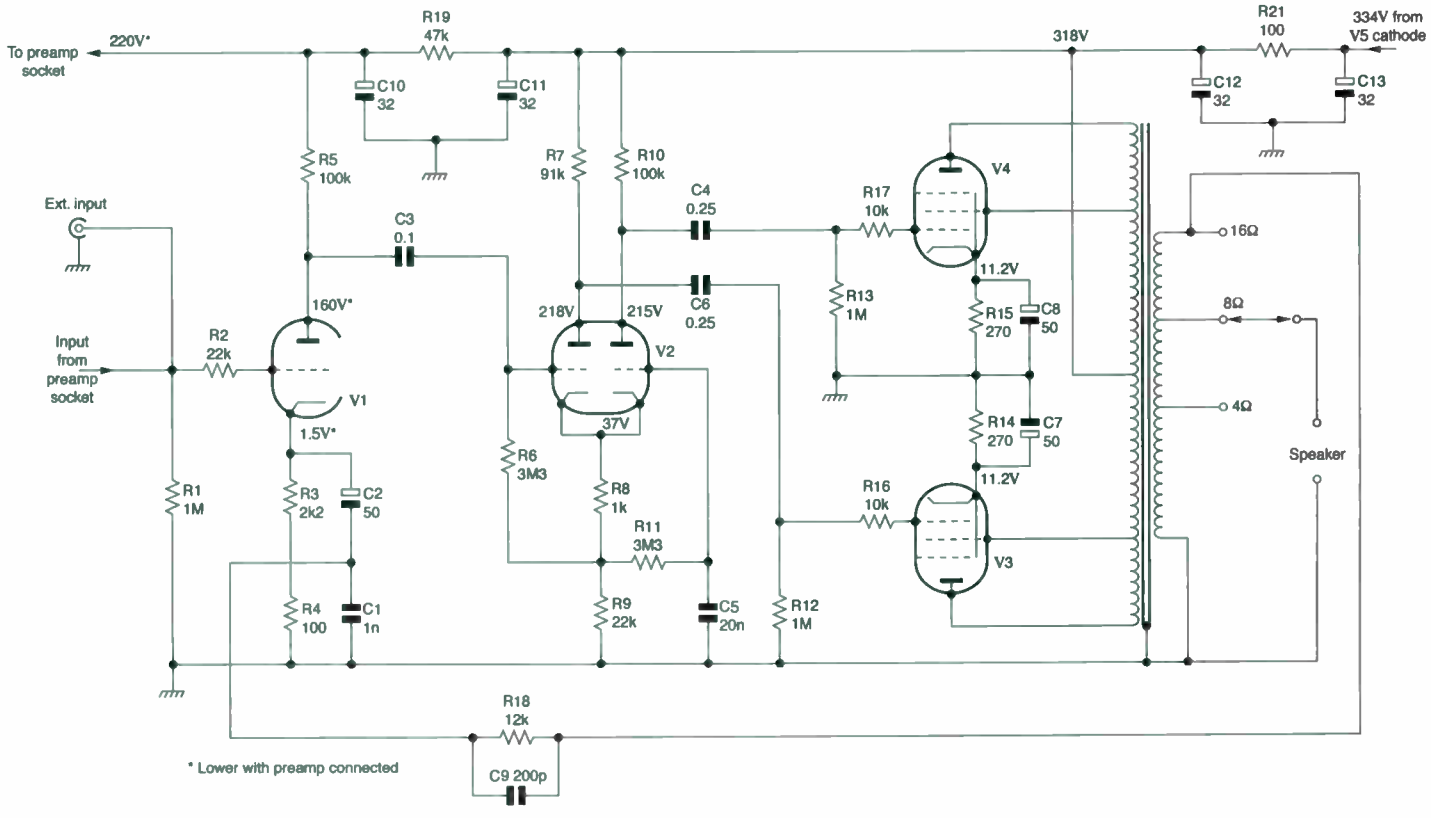


Fig. 1: Circuit diagram of the Leak Stereo 20 audio amplifier, one channel only. V1 and V2 are type ECC83, 12AX7 or B339; V3 and V4 are type EL84, 6BQ5 or N709; the full-wave HT rectifier (V5) is type GZ34 or 5AR4. The chassis is connected to mains earth.

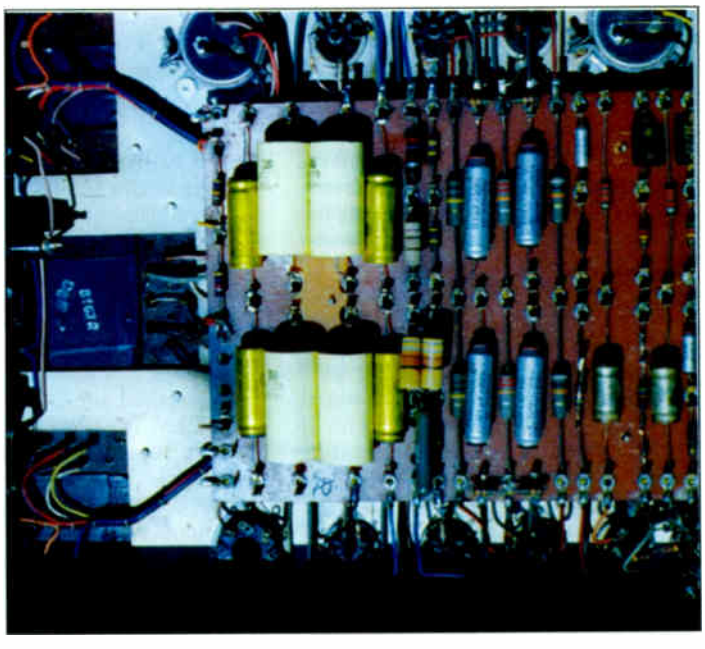
voltage to electrolytic capacitors that haven't been in service for some time. The dielectric layer consists of an oxide film that deteriorates with lack of a polarising voltage. If a high voltage is applied, there can be a heavy leakage current that causes heating of the electrolyte with, sometimes, explosive results! There is however a technique known as reforming.

This consists of applying the rated HT voltage for a period via a current-limiting resistor, to 're-grow' the oxide layer. As I had a 300V HT power pack to hand I clipped this across C13, via a 15kΩ resistor and an AVO meter switched to the current range. The current was about 10mA at first, but fell to less than 1mA and held steady at that figure. This action processed all four capacitors in one go, as they are connected via the HT dropper resistors.

Testing

Now that the rebuild had been completed it was time for a test. I wired the amplifier up to the bench speakers and fed it with signals from the tape output of the workshop audio system. As this is line level, a 'lashed-up' stereo potentiometer was needed at the input to control the volume.

After the odd silly mistake had been corrected and a dud 12AX7 valve had been replaced I was rewarded with good-quality sound. There was a slight problem however: the input circuit seemed to be very prone to hum pick-up. So I decided to fit a screening base plate. A sheet of aluminium was cut to size and drilled with some ventilation holes, then fitted to the underside of the chassis. I fitted rubber feet to raise the unit up and help air circulation, also an earthing lead to ensure continuity. There was another reason for this: as it was quite possible that I might sell the amplifier, I was not happy about exposed high-voltage points.



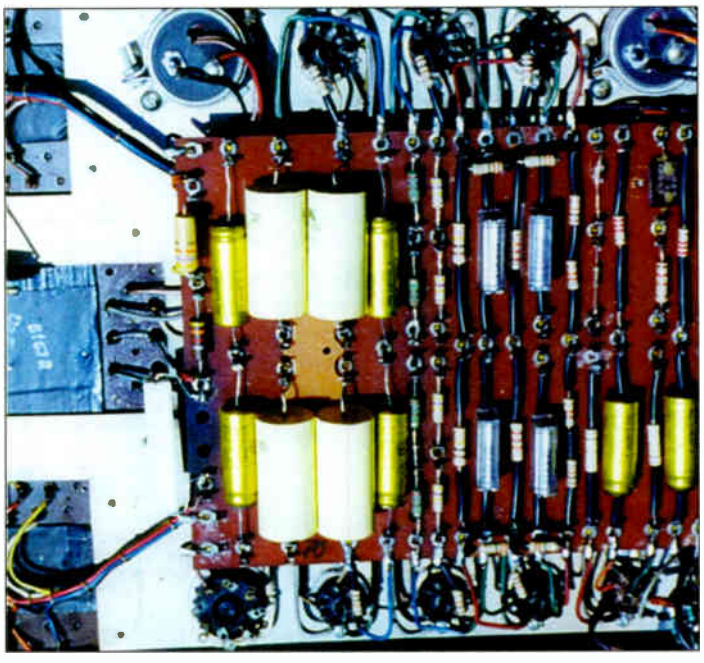
Underchassis view just after work started on the restoration. Most of the original components have not been replaced.

My next step, by now fired with enthusiasm, was to try the amplifier out in the domestic hi-fi system – with the big speakers. A remote-controlled switching system with volume control was devised to provide instant comparison. As a beefy four-pole, 12V relay was to hand, I wired this to change over the speakers from the existing Technics SUV470 amplifier, with the unused outputs terminated by a pair of 8Ω load resistors.

The audio input to the Leak amplifier came from the tape output socket. A motorised 50kΩ stereo potentiometer was connected up to control the input to the Leak

amplifier, with the changeover switch and up/down buttons on a small plastic box extended from the metal box that held the switch circuit. Power for this unit was obtained from an old answering machine power supply via a 12V regulator.

I hit a snag here. With the common earth returns of the speakers connected to the metal switch box and the audio phono input sockets similarly connected, I noticed a low-level but annoying hum. I had obviously got myself an earth loop. This problem was circumvented, with some difficulty, by mounting the phono sockets on rubber grommets, so that the input circuit was totally isolated from the output. I then had a totally silent background, and could sit back and select either amplifier at the flick of a switch.



Underchassis view after completion of the restoration work.

After all that, how does it sound? Well, without indulging in *Hi-Fi Review* hyperbole, very good. Clean and distortionless audio with plenty in reserve. With the tone controls on the main amplifier in the flat position, and the levels carefully matched, it is almost impossible to tell which power amplifier is in use. The switch gives me an inaudible changeover – I think the current term is 'seamless'. As the Technics amplifier's record out selector is passive, this must be what is known as minimal hi-fi.

In conclusion

So that's it, a piece of good old British hi-fi brought back 'on song'. The amplifier has been in regular use for several months, and will remain so unless I get an offer I can't refuse.

The restoration took quite some time, working on it when time permitted, but I found it quite relaxing work. You don't have to think as hard when working on simple circuitry like this.

It's a change from struggling to fix an obscure fault with a modern 'clockwork soapbox'. ■

Test Case 512

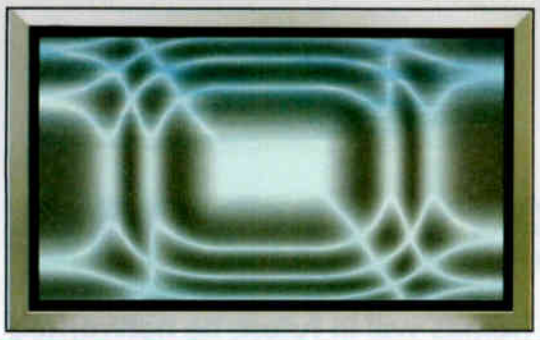
How can you have an LCD day? Well, one fine summer morning Pam gave our road-man Todd three job cards that all related to LCD equipment. It was going to be an LCD day! Todd had trouble enough with CRT technology, never mind this newfangled stuff. You can't repair LCD sets and monitors, can you? Todd looked at the fault symptoms listed: wrong-sized image; poor sound; dim display. What could he do with his grub-screwdriver and his little multimeter? Pam told him that he could at least go and look at them. Even Ted and Sage were unsympathetic!

So our bemused man set out. At least he wouldn't need any assistance to collect the sets, which he was convinced would be necessary. The first call was to a set that the customer had taken home only the previous day. It was a 28in. ex-showroom demonstration model. There had been quite a hefty discount to its price, because it wasn't in a sealed box. When the buyer had connected it up he found that the picture was somewhat smaller all round than the screen itself! Todd saw that this was so, and that the picture width actually contracted more with some geometry settings from the remote-control handset. Had this been a CRT set, he might have taken the back cover off. But it went straight into the van, nestling in a bed of blankets. One down, two to go . . .

The next set, on the other side of town, was also new. It had been installed a few days before by the shop crew. The complaint, made "under guarantee", was that the sound was weak and distorted. Todd was treated to a demonstration, using some action footage from a DVD. The cinema-style widescreen presentation looked somewhat incongruous on the 17in. panel, but what it lacked in size it made up for in picture quality. But the sound just wasn't up to this sort of programme material. It lacked bass, rattled at high settings and generally sounded 'thin'. It was obvious to Todd, when he looked at the tiny speaker grilles in this little set and visualised the diminutive speakers behind them, that this wasn't a fault, just a characteristic of the set – one likely to be shared by other makes and models at this end of the market. He could hardly suggest a separate surround-sound system to go with this 17in. screen! Even so a reasonable solution was found, with the help of shop manager Doc Colin. What was it? You will find out shortly!

Call number three was to a somewhat ancient LCD PC monitor. It lived in the office of an estate-agent crony of the boss, who had rashly offered to get his merry men to fix it. The problem was a flickering at switch on from cold, and dark patches in the two bottom corners of the display. No on-site cure here for Mr Town and Country! Into the van it went.

So Todd was 66 per cent right about having to bring them all in. And even the one that remained on site hadn't had its problem solved, had it? Plainly fault diagnosis and repair with flat-panel displays is very different from traditional servicing. Even so, all three problems were resolved, and only one involved dismantling the set – unfortunately to no avail! For the answers, turn to page 635. But give it some thought first: in real life there's no page 635!



Charles Arundel provides a further summary of fault conditions experienced with Daewoo models

Plasma panel fault conditions

Model DSP4210GM (SP110 chassis)

Blanked out square in the bottom right hand corner of screen: Check for a dry-joint or loose connector on the X sustain PCB, nearest to the screen area where the blanked square is present.

Thin yellow line down screen: Check for a loose connector on the Data High or Data Low PCB. Use the position of the line as a guide to where to look.

Several black lines down the screen, about 1cm apart: The cause is dry-joints at the data drive ICs on the Data High or Data Low PCB. The ICs can't be resoldered, so a replacement panel is required.

Poor quality picture after replacing a power or sustain panel: Symptoms include dark patches or speckled yellow areas, the video content having a negative/shimmering look. This is not a fault condition. All voltages need to be reset to those written on a white label at the rear of the screen. These are the voltages the particular screen requires for optimum performance. They must be adjusted on a white raster with the set in the service mode. To access this, press the following remote-control buttons: up arrow, mute, recall, mute. Use the right arrow to toggle through the various coloured rasters and the black and white screen.

Picture too dark: The sub-brightness is probably at zero. Check in the service mode (see above). The correct value is 60. Resetting to this should cure the fault.

Frame bounce: This can occur when the screw used for earthing at the top right-hand side of the Y sustain board is loose. Tighten the screw to cure.

Dark picture and bad shimmer: We have found the cause to be a poor connector at PA701 on the left up union PCB.

Two-inch wide band of coloured lines down the right-hand side of the screen: Check sockets P116 and PA116. They can be damaged if, while fitting a replacement power module, it falls on to the white flexiprint between the power module's centre lower connector and the right-hand lower connector PCB. As a result there are poor connections to the data driver ICs.

Thin black lines across the screen: Check for a loose connector on the scan board in the area of the lines. Alternatively there may be a faulty scan board, which will have to be replaced.

Dead, won't come out of standby: Remove the plug to the sustain boards. If the set still doesn't come out of standby, replace the power board.

Very negative picture, looks like low gain with shimmering – display OK with colour bars: This could be a faulty scan or Y sustain PCB. If so a replacement will be required. Alternatively there could be a loose flexible connector between the digital PCB and the lower centre and right connector PCB.

Set comes out of standby but no picture: Check that the 170V supply to the sustain boards is present at the power board. If not, it's likely that the X or Y sustain board is faulty. A faulty scan board can also be the cause however. Check boards by substitution.

Model DP42SP (SP115 chassis)

Broad black band down screen: It is likely that there are open-circuit 470Ω resistors on the left- or right-hand lower connector boards. If so the data drive ICs on the flexiprint connected directly to the screen could be short-circuit. Use a meter to check for a diode-type reading at the small printed squares beside each IC. A faulty IC normally reads short-circuit.

Thin vertical line, in any colour, down any part of the screen: The most likely cause is a faulty data drive IC. These are moulded on the flexiprint directly to the screen, which may have to be replaced. It's just possible however that the line is caused by a loose connector.

Only the top half of the picture shows: Check the lower scan board by replacement.

Only the bottom half of the picture shows: Check the upper scan board by replacement.

Incorrect colour patches, e.g. blue or yellow, over quite large areas of the picture: The most likely cause is poor discharge of individual pixel cells because of a faulty X or Y sustain board. The cause could also be incorrect setting of the power module voltages.

There is a slight possibility that the screen itself is faulty, especially if it has been dropped or transported on its back. This can reduce the integrity of individual pixels with the result that the plasma gas, and thus the colours, mix together.

Poor picture, i.e. with grainy background or ghosting, especially when an analogue transmission is being received: The most likely cause is an inadequate signal. This shows up much more on a plasma screen than a CRT. Signal inputs from digital sources should be much better, and those from a DVD player very good.

First check the signal input. If this is OK, it's possible that there is a problem with the video board.

When the video board is replaced a note should be made of all the settings in the service mode, so that these can be reset for the new board. Note especially the signal input settings, because the video board is married to a particular type of jack board: if this isn't done, it might not be possible to select some inputs with the new board fitted. In addition the replacement video board will probably result in the on-screen display messages being in Korean: in this case, reset the language country in the user menu to GB.

Several thin vertical lines grouped together: The usual cause is a loose connector at the lower left or right connecting board. The connector affected depends on the position of the lines.

CORRECTION

In the third fault condition mentioned last month in connection with Model DSP4210GM, flickering pixels, this was inadvertently described as being "in some blue areas of the picture" instead of "some areas of the picture".

The automated home

We've heard a lot of hype about how everything in our homes will in future be networked and linked to the outside world. Michael Maurice looks in his crystal ball and tells us what will go wrong

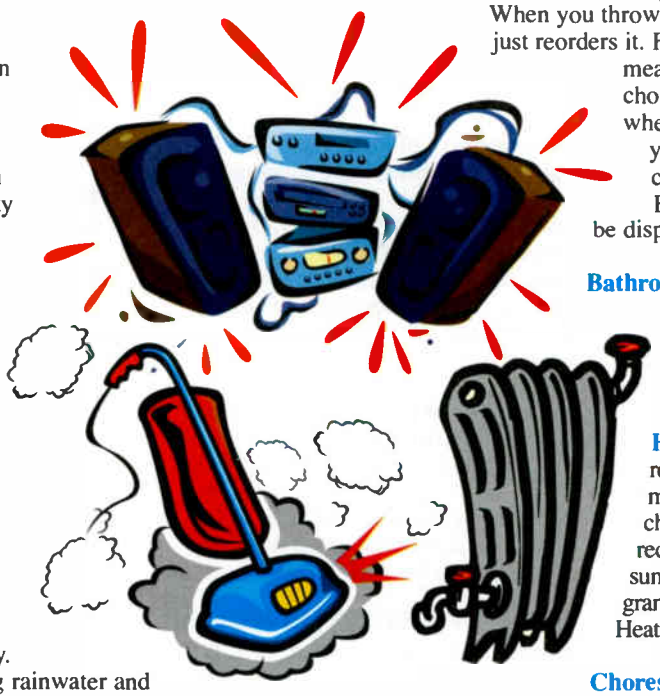
From Roman times to the Victorians and on to today the homes we live in have revealed a lot about us and our social structures. We are told that the homes of the future will be personalised before they are even built. Very soon it's said that they will be smarter than we are. Everything in the following list is on the market or being tested.

Lounge: Lights adjust to whoever is in; the hi-fi finds the right recording when you whistle a tune; a wireless network connects TV sets, hi-fis and speakers throughout the house; DVD recorders learn your tastes; a central touch panel controls all household functions.

Kitchen: The refrigerator keeps an inventory, suggests recipes and also orders food. It's also on the internet, as is the toaster. The voice-controlled cooker saves you having to touch anything with dirty hands. The kettle goes on when the bedroom alarm goes off.

Bathroom: The mirror recognises you, warns Dad about traffic holdups and tells young Johnny to clean his teeth. The medicine chest checks that you are taking the right pills. The toilet gives you a medical check-up.

Chores: The washing machine selects the right programme for the clothes and calls the repairman if it's about to break down. The robot vacuum cleaner and lawnmower operate automatically. Windows clean themselves, using rainwater and UV light.



Security: There's central locking of all doors and windows. When you are away simulated occupancy turns on lights and closes curtains. An internet-connected CCTV system monitors key areas. Remote control lets you admit a meter reader or check that the gas is turned off.

Heating: Intelligent, zoned temperature controllers create microclimates and save fuel. Solar heat exchangers boost water heating. Geothermal energy is accessed via a borehole. Combined heat and power units heat water, produce electricity and sell the surplus to the National Grid.

But we are not salespersons and, from our experience as practising engineers, can predict what is most likely to happen when it all starts to go wrong.

Lounge: When you whistle that tune the hi-fi turns the light to flashing red then tells you to shut up! Your new plasma TV is determined to show you that grainy black-and-white movie from the distant past no matter what channel you select. No sound either – the speakers have gone on strike because of your incessant whistling!

Bedroom: The alarm clock wakes you at 5 a.m. instead of 7 a.m. The CCTV cameras, which are meant to monitor intruders, are focused on the bedroom and, because of a security fault, the pictures are transmitted to everyone in the neighbourhood. Gives a new meaning to the TV soap *Neighbours*!

Kitchen: Inventory in the fridge throws a wobbly and orders double of everything. Food store sends a substitute instead of the correct item and programmes the fridge to accept it. When you throw the unwanted item out, the fridge just reorders it. For Jewish people like myself, that means double bacon, ham and pork chops! The kettle and toaster start up when the bedroom alarm goes off. When you've finally got up, the coffee is cold, the toast is burnt and the All Bran looks like something that should be disposed of hastily.

Bathroom: Fan in toilet blows back instead of extracts odours. Toilet gives wrong medical diagnosis. Magic mirror takes one look at you, makes a screaming noise and closes down.

Heating: Computer misinterprets your requirements in winter when there's a major snowfall. The air conditioning changes to the Siberian programme and reduces the house temperature to –15°. In summer it changes to the equatorial programme and thinks you need a sauna. Heating comes on and heats the house to 70°.

Chores: Your new robot is still learning your commands. It forgets to distinguish between whites and non-whites, so your white trousers go in with a red shirt, then instructs the washing machine to wash them at the 90° setting. When you disapprove of what it has done it gets its own back on you by putting the vacuum cleaner into reverse.

Security: Voice-recognition activated central locking shuts you out when you've got a cold. If you are persistent it calls the private security guards who arrest you then lock you up because your flu-type voice isn't recognised. Simulated occupancy turns lights on at 3 a.m. when you are at home and fast asleep in bed. Just to make sure everyone knows that it's in operation, it turns on the hi-fi to play at full blast that song you tried whistling earlier.

Maintenance: You've just spent the last few hours trying to rectify matters. But the call centre, based on the dark side of the moon, cuts you off yet again because of another solar eclipse!

And finally, just when you are tired and your weary head is resting on that pillow, a shrill, female American voice shouts out "Have a nice day!"

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KV29FX64E	5.95
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KV29LS35B	5.95
KV29LS35E	5.95
KV29LS35K	5.95
KV29LS60B	5.95
KV29LS60E	5.95
KV29LS60K	5.95
KV32FX68	5.95
KV32FX68B	5.95
KV32FX68E	5.95
KV32FX68K	5.95
KV32FX68U	5.95
KV32LS35B	5.95
KV32LS35E	5.95
KV32LS36U	5.95
KV32LS36U	5.95
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32WT98B	5.65
32ZD26B	5.65
32ZD26P	5.65
32ZD36P	5.65
32ZH36P	5.65
32ZH37B	5.65
32ZH37P	5.65
32ZP18Q	5.65
32ZP38B	5.65
32ZT29B	5.65
34VH26P	5.65
36ZD26P	5.65
36ZD36P	5.65
36ZP18P	5.65
36ZP18Q	5.65
36ZP38	5.65

MAKE/MODEL	PRICE £
36ZP38B	5.65
36ZP48P	5.65
36ZT29B	5.65
38VH26P	5.65
42PW23P	5.65
42PW33P	5.65
42PW33Q	5.65
42WH18B	5.65
42WH18D	5.65
42WH18P	5.65
42WH38B	5.65
42WH38P	5.65
42WT19B	5.65
42WT29B	5.65
43VJ13P	5.65
43VJ22P	5.65
43VJ33P	5.65
43VJ33Q	5.65
50VJ22P	5.65
50VJ23P	5.65
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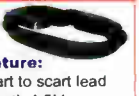

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1142.5081			
1142.5079			
10500980P1	HR8317	LT-157P	11.75
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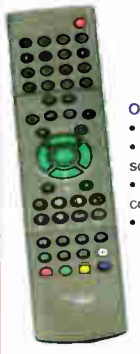

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Media House,
Azalea Drive, Swanley,
Kent BR8 8HU

or e-mailed to:
t.winford@highburybiz.com

Bush LSD40

I don't like repairing audio equipment: access is usually poor, and circuit diagrams are scarce. But I always fall for a sob-story, and this was no exception. It's a CD/radio with separate speakers, which the young lady had bought for her son last Christmas. It had now gone wrong and she had lost the receipt. The complaint was that the motor-driven lid wouldn't open by itself and that it wouldn't play CDs.

There was no sign of life from the CD section, though the front display lit up. As I had no circuit diagram I decided to open the unit up and check for anything that was obviously wrong on the PCB. The small panel is crammed full of components, especially in the power-supply area, and access if poor – lots of plugs have to be disconnected to get at the component side.

I found the drive IC for the lid motor (it's a top-loader). A voltage check at what seemed to be the supply pin – it's decoupled by a 470μF, 10V capacitor, C208 – produced a reading of 2V. When I traced the print back from here, via a diode (D101), a switching transistor (Q103) and a 1Ω resistor (R124), I came to a regulator transistor (Q113) near the heatsink area of the board. The voltage at its collector was 17V, but there was only 2·5V at its base and emitter. It's a 2SD882 and, much to my relief, a replacement restored normal operation. The BD131 is a suitable alternative. Another happy customer! **M.McC.**

Sony ZS-D55

There was no battery operation with this portable unit. When I looked inside the battery flap I saw that there was poor connection between the battery and the unit's terminal spring. The solution is to attach a spacer, part no. 3-238-529-01, to the cabinet behind the battery ± spring. Glue it in position carefully. It's best to use Sony tough bond, part no. 7-432-916-01. **C.B.**

Sony HCD-EP50

There was an inductive hum noise when the unit's upper left panel was touched. Sony technical provided the answer. Because of lack of shielding, inductive hum is picked up by the amplifier on the main board. The solution is to add a plastic shielding plate, part no. 4-244-033-01, which covers an earth lug 3 (terminal), part no. 7-623-508-01, that's secured with the screw on the main board, half way down. Use a 50mm length of lead wire, AWG24-28, soldered between the lug and the nearest ground point on the main board (below). **C.B.**

Sony HCD-CP500MD

The problem was skipping when this unit played CDs. Inspection inside, in the CD section, revealed a faulty optical base assembly, part reference no. 308. All that was required to restore normal CD playing was to fit a replacement, part no. A-4735-357-A. **C.B.**

Sony CDP-X229ES

When a disc had been loaded this CD unit showed the message 'no disc'. Inspection inside revealed the cause: there was a kink in the middle of the flat-wire that connects the optical pick-up (KSS-240A) to the BD board. A replacement wire, part no. 1-575-001-11, restored normal operation. **C.B.**

Fosdex FD8 digital multitracker

I'm not certain about the precise function of this unit. As far as I can determine, it's the modern-day equivalent of an eight-track tape recorder and an eight-channel mixing desk rolled together – a sort of mini recording studio if you like. The recording medium is a 2·1GB hard disc. The left-hand two-thirds of the front panel is a fairly conventional-looking mixer, with the usual mass of knobs, twiddlers and sliders for each channel. The right-hand third has a largish back-lit custom LCD, track-select buttons and function buttons for edit and record/play. A large jog/shuttle knob completes the array.

The reported problem was 'dead'. A quick ohms check across the mains input socket revealed an open-circuit. So my immediate suspicion was of either a faulty on/off switch, though it was a sturdy push-push TV type that felt OK, or a blown internal fuse. Once the upper unit had been separated from the lower chassis pan however I was a little dismayed to see a switch-mode power supply sitting there innocently. Its mains fuse was intact, and there were no signs of distress. So I set about removing it, taking care to avoid the terminals of the input reservoir capacitor in case it remained charged. I quickly discovered that it wasn't and couldn't have been, as on one terminal of the mains socket there was the biggest and worst dry and arced joint I'd ever seen. Closer inspection revealed multiple other poor joints at assorted regulators and power devices. I attended to them all while I had the power supply out.

Interestingly, all the poor joints had that grey, 'pasty' look of lead-free solder. I don't know for sure that it was this but, as I've said before in these pages, I'm yet to be won over by this new electric glue. I've seen many bad joints in unusual places in equipment known to use this new and, I think, immature and as yet long-term unproven soldering technology.

The unit sprang to life once it had been

reassembled and power had been connected. I was able to get it to play some sort of repetitive rap that had been laid down by the owner and his mate. It was punctuated with lots of "Yeah man – that's it! You got it! It's a learning curve innit man!" At which point I sighed, pressed stop, disconnected the unit and started on the paperwork . . . **G.D.**

LG LM-530D

This unit failed to play CDs because the carousel didn't revolve to move the discs into position. The cause in turn was a defective drive motor. A replacement restored normal operation. **G.D.**

Sony CDP-S207

This CD player came to me from another dealer in the hope that I might be able, where he had failed, to get to the bottom of some really bizarre behaviour. When I received it there was a disc jammed inside and the fault description read "CD jammed". It was explained to me that when power was applied with a disc inside it went ahead and read the TOC perfectly. As soon as any button was pressed however the display counted the tracks down, from 11 to 1, then it went to normal play. If you then tried to stop it, open the drawer, fast search or track skip it would always jump back to the start of track 1 and play again.

The first thing I did was to remove the front panel, then dismantle the PCB from it. The primary cause of the problem was then apparent. A very small 100μF, 10V electrolytic capacitor, C333, on the switch side of the PCB had leaked. Once this capacitor had been removed and the print had been cleaned up I was able to examine the area in detail – to check whether any damage had been done to the print tracks or nearby through-plated holes. As I couldn't see any problems, and meter checks on all the holes showed that they were making OK, I replaced the capacitor and hung the board back on its connectors. On test the results were exactly the same. So I stopped for a minute to think about the problem logically.

The unit always counted the tracks backwards, no matter what function was requested. This suggested to me that the problem was related to the reverse track-search button. A scope check at the pins of this switch did indeed reveal an odd waveform. So I removed the switch from the PCB. All other functions then worked correctly. A replacement switch, taken from a scrap Sony board, restored full normal operation.

Just for sport I checked across the offending switch with a meter. This revealed a leak of about 2MΩ. It would seem that electrolyte from the nearby failed capacitor had migrated to the switch and done some internal damage. **G.D.**

Sony MZ-G755

It's not often these days that I derive the same pleasure from fixing something that I once did, when I was young and first setting out down the slippery slope this trade has become. Every now and again however a unit comes along that's a genuine pleasure to get going again. This little personal MiniDisc player is an example.

Although it appeared to have been well cared for it also seemed to have seen a lot of service. The complaint was that it didn't read discs. When I tried it this proved to be the case. Something didn't look right about the laser when I looked into the mechanism through the open door. So I removed the top door cover, then the lower cover, to gain access to the display flexiprint. I was now able to remove the door/display completely and look directly into the top of the laser.

It was clear that the focus/tracking motor's magnetic pole-piece was leaning forwards. Its back edge was sticking up much too high and, as a result, the motor's coil was sticking. The assembly is like a tiny loudspeaker in its operation: the coil piece, which is attached to the lens suspension, should be completely free to move up and down (focus) as well as side-to-side (tracking).

Now that I knew what the problem was it took me only a few minutes to remove the main PCB, separate the sub-chassis from the main frame assembly, and strip the laser off. I took a new laser from stock to see what the position of the pole-piece should have been. It looked as if something had simply got caught on the piece of metal and bent it as the owner had tried to continue to push the (damaged?) disc in.

Then, using the metal edge of the laser body as the lever point for one jaw of my precision needle-nosed pliers, I carefully positioned the other jaw on the bent pole-piece and applied gentle but firm pressure. The pole-piece bent back upright with surprising ease, and the lens then moved freely and correctly.

Once I had the unit loosely reassembled I inserted a disc, which played immediately. To finish off I ran the auto set-up program. This progressed faultlessly with both CD and MO type discs, returning an OK message in both cases. I had, by applying a little good old-fashioned repair work, saved this little unit from possibly breathing its last rather earlier than was necessary, as the cost of a replacement laser is often regarded by the owners of such equipment as prohibitive. **G.D.**

Nakamachi 480

Sometimes this cassette deck wouldn't go into play after record had been selected. The deck has a servo system that rotates a cam to move the mechanism through the various functions. Occasionally the cam would rotate backwards and forwards and not go into the play position. As the voltages from the feedback potentiometer on the cam were about right, I looked for another cause. It turned out that the play lamp had blown! It's in the servo-control circuit and should light up over the play switch selector.

Another fault you can get with this deck is failure of the transistor that powers the motor. It goes into meltdown for unknown reasons.

The accompanying photograph shows the feedback potentiometer and the adjustment presets at the back the mechanism.

You need a service manual when there are problems with this deck's mechanism/cam, as it's not obvious what does what. The deck dates from 1978-81. **P.R.**

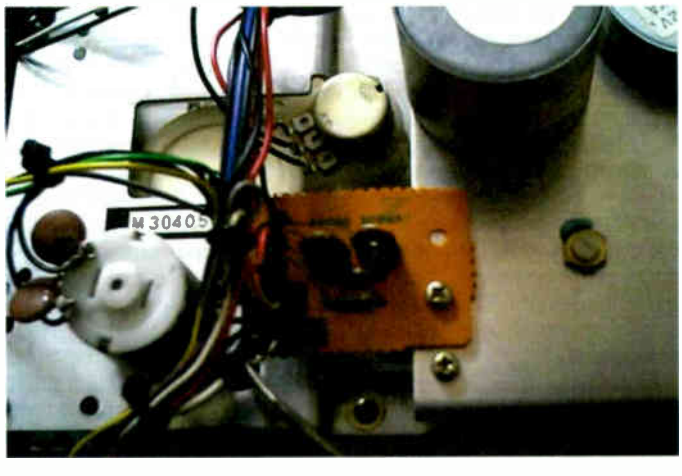


Photo 1: Back of the Nakamachi 480 cassette deck's mechanism, showing the feedback potentiometer and the presets.

Adrian Gardiner's concluding notes on how to run a successful, expanding service operation, including how to take care of admin. Some further recommended websites, for information and amusement

Bench Notes

Over the past four months we've been taking a look at business development, examining some of the procedures, policies and equipment you need to run a successful service operation in today's complex and difficult market. The series concludes this month with a final look at some practices that will maximise your profitability.

Admin

Administration is an inescapable part of any business operation. It's time-consuming and is often left to accumulate into a large pile, until you finally bow to the inevitable and devote a weekend to it. Although this is all too often overlooked, administration is a business expense that needs to be taken into account when you consider your scale of charges. For example a straightforward one-hour repair job may require a further half an hour for back-up functions – spares sourcing, ordering, processing, report filing, invoicing and accounting. These all add to the cost of the job.

Consolidation is one good way of keeping these costs under control. If you don't already use one, invest in a good-quality PC-based admin package. Several good ones are available, but it's not possible to review such packages here. Although most of them don't include spares ordering, they do generally provide order tracking and integrate this directly with the job in hand. Once the job report has been completed, any good package will automatically produce the invoice and insert the data in your accounts program. Indeed for a smaller undertaking many such programs will double up as a simple accounts ledger.

To enhance your PC further as an admin tool, make sure that you take full advantage of on-line ordering. Most suppliers now have powerful search facilities at their websites, and allow you to add parts to a shopping basket as you go along. You simply complete the order at the end of each day, without need to take any further time to process items individually.

Learn from the big boys

Large companies usually have strict policies when it comes to account control. There are lessons to be learnt from them if you want to avoid customer bad debt. This is especially the case if you carry out work for trade customers or networks for which you run monthly accounts.

If a customer fails to pay on time, put their account on stop immediately. Don't be tempted to accept excuses or pleas for more time – this just allows their debt to increase. You may have dealt with someone for years without problems, but this doesn't mean that they won't run into problems in the future and maybe go bust. Don't let them take you with them! If you fail to pay your spares suppliers on time you cannot order more parts until you have paid. Adopt the same policy!

Free quotes

This is a tricky one. In my opinion there is no room for free quotes nowadays. After all we are professionals, and our time is money. But at the same time you don't want to put off potential customers. I think the following is a good guide to striking a balance that doesn't put off genuine customers but filters out those who want the job done for a fiver!

Take your hourly rate and halve it (don't forget the VAT). Charge this as a non-refundable deposit. It gives you an average of half an hour to diagnose the cause of the fault and provide an estimate for the repair. When a customer accepts your estimate, the deposit can be deducted from the total bill. If the estimate is refused however at least the time spent has been paid for appropriately and, if the item is 'dumped' on you, you have recovered some of the cost associated with disposal.

Hourly rates

So, what do you charge? Many engineers undervalue themselves seriously and are still happy to repair a TV set for £20 plus parts. But electronics servicing is a professional occupation, and should be charged accordingly. It's true that CE products are becoming ever cheaper – but you still need to be paid!

As a general rule of thumb, a good rate for our industry is £40 an hour plus VAT. You should operate a minimum one-hour policy for most items – this should help compensate you for those awkward items that seem to take forever.

Taking into account all the costs of running a business, you should aim for an average repair charge of £60 plus VAT.

A simple way of checking your profitability is to take all the costs of running your business last year and divide it by the number of jobs you completed. You may be surprised to find out how expensive each job was!

Summary

The aim of this series has been to show you that there is life left in the service industry and that, with careful consideration and practice, you can run a successful business. Here's a summary of how to go about it:

(1) Make sure that your tools and test gear are up to date, especially your soldering equipment.

(2) The faster your turnaround time, the happier the customer. Aim to look at all items by the end of the next day.

(3) Good communication is essential. Keep your customers informed about progress.

(4) Use on-line service information, and sub-contract out items with which you don't normally deal.

(5) Have fair but firm company policies.

(6) Charge enough for your time!

Happy servicing, and the very best of luck in growing your business.

The Wacky Worldwide Web!

A few more websites for you this month. As before (see June, page 491) I hope you find that they are useful or interesting. Do get in touch, through the magazine, if you would like to suggest a site for next time!

http://fileshare.eshop.bg My thanks to Allan Lloyd of Plymouth for recommending this one. He suggested it after my list of similar sites in the May issue (see page 426), pointing out that it's free and that you can download fifty service manuals a month.

Having had a good look around the site, I agree with Allan that it really is an excellent technical source. It struggles with many new models, probably because it is run from outside the UK. It is continually maintained however and is therefore regularly updated. There's a vast database of service manuals, circuit diagrams and data sheets, and a reasonable search facility.

The company I work for has access to the various manufacturers' sites for new equipment, but we have already found this site useful for an older model for which we had long since lost the manual!

www.service-data.com Another site that I have recently found to be very useful. This one will be of interest to all those who are vintage restorers. It's packed with old service manuals for vintage valve equipment, scanned and converted to PDF format. The scan quality is good. You can search by make and model and, once you have found the required manual, you can purchase online for just £1.99. The manual is then delivered electronically by email, within minutes, ready for use or printing out.

www.vintage-radio.com This site, run by Paul Stenning, is the primary one of the vintage service data site mentioned above. It features a wealth of information from the golden age of radio, including history and model information with pictures. If you are just getting started with restoration work, or considering it, you will find a comprehensive section on how to go about it, the tools and equipment needed, and assistance on various matters – in particular aspects of restoration such as cabinet repair.

Paul Stenning is himself a vintage radio restorer and is on the committee of the British Vintage Radio Society.

www.websamba.com/colomor Finding valves for a restoration project can be difficult. The site above lists some suppliers, and others advertise in this magazine. One of my favourites is Colomor Electronics, which has been established in this field for many years. Its website is one of the few where you can search the company's catalogue on-line. The prices are good but, as yet, while you can place an order on-line you have to phone them to organise payment.

www.alldatasheet.com This is a very useful site that's packed full of data sheets for almost every semiconductor device you can think of. It has an excellent search facility, and is completely free. After carrying out a search, brief information on the device is displayed with the ability to download a complete PDF document.

Hardly a week goes by in our workshop without a visit. We find the site particularly useful for looking up obscure parts when we need to find a substitute.

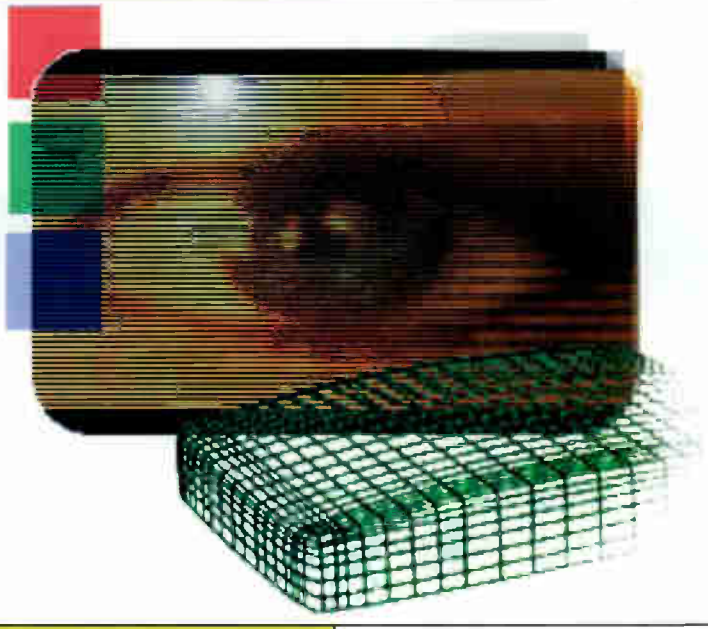
www.streetmap.co.uk Your map books too old? Can't afford satellite navigation? Then this is the site for you. Searchable in a variety of ways including post code, it quickly displays a scalable map ready for printing on the back of one of your job sheets. Best of all it even finds all those new cul-de-sacs that keep appearing in new housing estates. My stress levels have fallen dramatically since I started to use it for my field calls.

www.haveagoodlaugh.com "Normal people believe that if it ain't broke, don't fix it. Engineers believe that if it ain't broke it doesn't have enough features!" There are hundreds of joke sites on the internet. This is one of the better ones, with a whole range of jokes that are divided into categories. It also has a large collection of funny pictures and other humorous thoughts. Have a look and have a laugh!

www. slothmud.org/~hayward/mic_humor/mic_humor.html A hilarious collection of Microsoft humour (see the accompanying photo). Ideal for when you are frustrated about your latest software bug. Enjoy!

Microsoft humour – the only keyboard you ever need!

I hope you enjoy trawling through the suggestions above. If any of you have other wacky or unusual sites to suggest, please let me know through the magazine so that I can include them in a future article. ■



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t.winford@highburybiz.com

Alba CTV3419SIL (Vestel chassis)

The line output transistor (Q602) in this newish dead set was short-circuit, but no likely cause for its failure could be found. Unusually for a line output transistor it's a Darlington-pair device, type BU808DFI. Vestel has a technical bulletin for the problem however. In addition to fitting a replacement, add a 10kΩ resistor between the base and collector of the line driver transistor Q601 and replace C607 (10μF, 50V). It might also be a good idea to replace C604 (47μF, 50V) though the bulletin doesn't suggest this. **M.D.**

Genexia CTV10

The complaint with this 10in. mains/battery set was lack of height. When they were tried the height and linearity controls both worked all right but ran out of range. Without a circuit diagram, I spent more time looking for the cause of the fault than the set was worth. I did however eventually find the cause, which was an open-circuit 8·2kΩ, 1W resistor, RP05. I suspect that it is part of the ramp generator circuit. **M.D.**

Hitachi C28W410 (A7 chassis)

This set produced a very poor picture, just like a low-emission tube. As I'd never seen a worn out tube in one of these sets before I decided to carry out some further tests. The heater and HT voltages were spot on. Then, while making some checks on the CRT base PCB, I spotted a three-terminal regulator with 18V at the input and only 1·5V at the output. When I removed the device I found that it was type L78M15CV, so the output should have been 15V. A replacement brought back the excellent picture these sets normally provide. Several different types of CRT base panel seem to have been used in this chassis. **M.D.**

Tatung T28DG82S (G series chassis)

Another set with a short-circuit line output transistor. With this chassis the cause is usually a dry-joint at the line scan plug socket, but it was OK this time. I nevertheless resoldered it, along with some other suspect joints, but no definite cause of the failure could be found. Once a new line output transistor had been fitted the set worked fine on test, so I returned it.

A couple of days later the customer phoned to say that the screen was going bright blue, with flyback lines, intermittently. When the set was back in the workshop it was fine – until I tapped the neck of the tube. The screen then went blue and the line output transistor went short-circuit. Yes, you guessed it, the tube was one of those Philips ones that develop gun shorts. I've scrapped many an expensive set that required a new tube. In this case however the set was still under a four-year Tatung warranty, so a replacement was ordered FOC. **M.D.**

Bush DVD142TV (Vestel 11AK46 chassis)

The customer said there was no sound but the picture was OK. When I plugged the set in a popping noise came from the speaker in standby, clearing when the set was switched on. The picture came up, and a loud mains-hum type noise came from speaker.

As these sets suffer from dry-joints, I decided to start by looking for any that might be present. In the process I came across a three-terminal regulator, IC804, whose centre pin had not been pushed through the board from new. I removed the regulator, fitted it correctly and, guess what – the fault was still present! While taking measurements I found that the TDA7496 audio output chip's heatsink got very hot in a short space of time. A replacement IC cured the fault. **M.D.**

Philips 32PW9308/05 (SEM5.1EE AA chassis)

This set was dead with the internal 2·5A fuse blown and thyristor Thy7102 short-circuit. I couldn't find anything else

wrong in the power supply. When the new thyristor arrived I fitted it and, reluctantly, switched on. The fuse instantly splattered. A check at the website for a power supply kit didn't reveal anything but a phone call to Philips Technical confirmed that there is one, part no. 3122 7859 0310. All was well once this had been obtained and fitted. **P.S.**

Wharfedale 28PF1 (Vestel 11AK33 chassis)

Field distortion was the complaint with this set – there was a small strip of picture across the top of the screen. The STV9379FA field output chip IC600 requires an 11V supply at pin 2, a –11V supply at pin 4 and a 60V flyback supply at pin 3. The –11V supply was missing, because R606 (0·47Ω, 0·5W) was open-circuit and D604 (UF5404) short-circuit. Replacement of these two components restored a normal-size picture.

This particular type of diode has a tendency to go short-circuit in other positions in the chassis. **P.S.**

Panasonic TX28-MD4 (Euro-4 chassis)

Stuck in standby was the complaint with this set. A quick general check revealed nothing wrong apart from dry-joints at the LA7845 field output chip IC451. After attending to these the situation was the same but, when I forced the set on by using the remote-control unit, a picture with a rainbow effect appeared. This at least proved that the power and line timebase circuits worked.

When I carried out further checks around IC451 I found that the –14V supply at pin 1 was missing. This supply is derived from the line output stage. R559 (0·3Ω,0·5W) in the feed was open-circuit and the rectifier diode D558 was short-circuit. I used a BYV95C in the D558 position. After that the set produced a good picture. **P.S.**

Sharp 66FW-54H (DA100 chassis)

This set was dead with the red power light off, something I've not had before. The fuses in the plug and the set were open-circuit. A check across the mains bridge rectifier's reservoir capacitor C705 produced a short-circuit reading, but I couldn't find any faulty components in the power supply.

There's a two-pin plug next to C705. When it was removed the short disappeared. This took me to the other side of the chassis, into the audio module, where I found that Q1701 and D1704 were both short-circuit. Fortunately a friend had a spare panel that I was able to use for spares. **P.S.**

Hitachi C28WD2TN-311

This set would try to start up then revert to standby. Dry-joints at the regulator chips can cause this sort of thing, but what do you do when any resoldering required here fails to put matters right? You can start disconnecting various items, but you have to be careful. For example if you disconnect the sound output IC the set will start up but there will be no sound. You can't do this with the TDA8350Q EW/field output chip however, as the set will then go into a protect mode. This IC has to be replaced as a check. Needless to say the TDA8350Q chip was the cause of the trouble in this set. **P.S.**

Goodmans GTV76RF1 (Vestel 11AK45 chassis)

These sets continue to give trouble. This one was stuck in standby. When the set was started it tried to come on but reverted to standby. Fortunately the tube's heaters came on momentarily, and there was enough time to swing the A1 control to see if anything appeared on the screen. This revealed the field collapse symptom.

The only way to fault find was to carry out cold checks. I found that R611 and R614 (both 0·47Ω, 0·5W) in the ±11V supplies to the STV9379 field output chip IC600 were both open-circuit. Replacement resistors plus a new IC brought this in-guarantee set back to working order. **P.S.**

Toshiba 36ZP38B

This set was dead with the 2SC5570 line output transistor Q404 short-circuit. I could see no obvious reason for its failure so, to be on the safe side, I ordered three of these transistors (part no. 36374144). When I fitted a replacement and switched on I heard an EHT rustle then, after about five seconds, the set shut down again. Sure enough Q404 had once more gone short-circuit.

A quick check at the Toshiba Technical website revealed that this is a known fault condition. The recommendation is to replace Q510, a surface-mounted TA1360AFG chip on the signals board. Its part no. is 23009369. A new TA1360AFG IC and 2SC5570 transistor restored the sound and picture. **P.S.**

Daewoo DTY2880GB (CP520 chassis)

The picture was shifted three inches to the left and this couldn't be reset in the service mode. Replacement EEPROM and microcontroller ICs made no difference. The cause of the fault was eventually traced to C521 (2,200pF, 5V) which is connected to pin 16 (PH2) of the microcontroller chip I501. **C.A.**

Daewoo DTY2880GB (CP520 chassis)

This set died when the customer switched it to standby. The following items had to be replaced: the STR-F6653 chopper chip I801; R801 (220Ω, 1W); and the opto-coupler I804 (type KP1010C). **C.A.**

Alba 4858SIL (11AK30 chassis)

The complaint with this modern, silver 20in. set was 'dead'. In fact a quiet chirruping sound came from inside it. Checks showed that the output voltages on the secondary side of the power supply were lower than normal, though the red LED was lit. When an attempt was made to bring the set out of standby the HT rose to about 100V for a second then the set reverted to standby.

No shorts could be detected across any of the supplies, but I found that D800 (BA159) near the chopper FET measured 10Ω in both directions. It's in the snubber network. A replacement restored normal operation. **M.McC.**

Panasonic 14B4TB

If one of these portables produces an on-screen display but no sound or picture, replace the eight-pin EPROM IC. It's available preprogrammed from SEME as part no. X24C14B4TB. **M.McC.**

Sharp 51GT25H

This set was dead though HT was present at the drain of the chopper FET. There were no outputs on the secondary side of the power supply. Reverting to the primary side, I found that D817 was short-circuit. It's connected between the gate of the FET and chassis. The marking on it read C15PH, so I fitted a 15V zener diode. This failed to cure the fault however.

Further checks, on the secondary side of the power supply, revealed that D710 (1N4935) was short-circuit. A BYD33M is a suitable replacement. The new diode restored normal operation. **M.McC.**

Wharfedale M8 (PT92 chassis)

This widescreen set was stuck in standby. The HT voltage rose to over 140V, but didn't reach the line output transistor because of a bad joint at pin 1 of the transformer. It appeared to be perfectly

soldered, but measured open-circuit. **M.McC.**

Panasonic TX25A3 (Euro-1 chassis)

This set kept reverting to standby. The cause of this was the TDA8175 field output chip IC561, which in turn had been seen off by the associated 220μF, 50V flyback boost capacitor C563. The TDA8175 is no longer available, but a replacement kit is available from SEME, order code TZS9EK026. Fitting this and the 1·5Ω resistor in position R566 cured the fault – after adjusting the height etc. **D.P.**

Philips 32PW6506 (L1.01 chassis)

This set was tripping because the line output transformer was faulty. When you replace the plugs on the main chassis make sure that you fit the lead from the top controls in the black socket at the centre of the panel. Otherwise there will be a small, blank raster and no sound. **D.P.**

Philips A10E chassis

To enter the service menu, press 0 6 2 5 9 6 I on the remote-control unit with the set in standby. SAM will be displayed on the screen. Press 'menu' twice to get to the service menu. Scroll down to the adjustment you need – you can go past the bottom line for more options. To store, use the menu button to go back to the customer menu then turn the set off. **D.P.**

Sony KV29F1U (BE3D chassis)

The complaint with this set was interference on the screen with a crackling noise. I found that the safety resistor that protects the 200V RGB output supply, which is derived from the line output transformer, was dry-jointed – though it didn't look it. **D.P.**

Toshiba 2577DB

The symptoms with this set were intermittent line sync and intermittent line collapse. The cure was to resolder the 10V regulator transistor Q430 on the power-deflection PCB. It provides the H-VCC supply for pin 3 of the TB1229AN jungle chip Q501 on the signals PCB. **D.P.**

Panasonic TX29AD2DP (Euro-2S chassis)

The customer complained about a loud crack that occurred when the set was first switched on. The cause was a dry-joint at the A1 supply rectifier D544 in the line output stage. The other fault, not reported, was EW distortion. This was cured by going into the service mode and adjusting the width and EW settings.

To get into the service mode set bass to maximum, treble to minimum then press the F button on the set followed by volume down while pressing the reveal button on the remote control unit. Press N to exit the service mode. **D.P.**

Toshiba 43VJ22P

I've had two of these sets with the same fault: the red horizontal convergence was out. In both cases replacing the SLA4501M red drive amplifier chip Q753, followed by a little bit of setting up, cleared the fault. The part no. is 23000928. **M.S.D.**

Hitachi C2143S

This set didn't respond to the remote-control unit, though the latter was obviously transmitting code as verified by pointing it at a video camera. In the past the problem has been caused by either a faulty IR receiver in the set or sometimes the ceramic resonator in the RC unit has gone off frequency. But in this case the handset had 'locked' – I suppose that means its software had crashed. All I had to do was to reboot the remote-control unit, i.e. remove the batteries, discharge any residual power then reinsert them. Simple enough to sort out once you know. But the set had been transported over thirty miles to the workshop just to figure this out! **M.S.D.**

Loewe Aconda 9381 Art 59401

I'd never come across one of these sets before. It was dead and smelt a bit because the line output transformer had failed – the old one could be seen arcing across the top. The replacement was easy to fit and no setting up was required. Spares are available only from SEME. No problem there – we were sent a manual and transformer by description only, at very reasonable prices. But getting the back off was tricky, because of the silly Philips-type recessed clips at the top. I managed to break some small pieces of plastic somehow, but the back went on again OK. **M.S.D.**

Toshiba 21T01B

This little 21in. set was supposed to be dead but powered up all right on the bench. Flexing the PCB made it go off and come on again. The fault was obviously being caused by either dry-joints or perhaps a small crack in the board somewhere. A detailed inspection failed to reveal any obvious dry-joints, though link J127 appeared to be 'loose' in its solder blob. A thorough blanket soldering job in the power circuitry and around the jungle chip cleared the fault. **M.S.D.**

Hitachi C28W430 (A7 chassis)

At switch on the front LED lit up for a second then started to flash on and off as the degaussing relay chattered on and off. The cause of the fault was a short-circuit across the 26V line, because of failure of the TDA7263M sound output chip IC4000. The part no. is J2020012. **M.S.D.**

Toshiba 40PW13P

This large-screen set was dead. At switch on the relay could be heard clicking and the red standby light lit up. On a hunch I went straight to the line output transistor, which was short-circuit. In my experience this is very unusual with these large Toshiba sets. When a replacement had been fitted the set remained dead. The thing I'd overlooked was fuse Z856 on the power board – it had gone open-circuit when the transistor died. **M.S.D.**

Samsung WS28M64NS8XXEU

The complaint with this set was excessive width. A visual inspection revealed that C408 (4·7nF, 400V) was discoloured and, when checked, it was found to be leaky. Replacement cured the fault. **I.L.**

Hitachi C32WD2TN2 (A7 chassis)

This set was dead. All common dry-joints were resoldered, including the through-panel links, and the short-circuit line output transistor was replaced. At switch on the new transistor blew almost immediately, with a smell of burning. I then found that C717 (1nF, 2kV) in the line flyback pulse feedback network was leaky with signs of burning on the side. A replacement and a further transistor restored normal operation. **I.L.**

Tatung T28W440

The customer complained about intermittent shutting down. I put the set on soak test and eventually the fault appeared. The green power light was lit but there was no raster or sound. There was also no remote-control operation, except that the set could be switched on from standby by remote control with the fault present. Voltage checks revealed that the output from the BD441 5V regulator transistor TP6 was low. A replacement transistor cured the fault. **I.L.**

DVD

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Hitachi DV-PF3E

The reported problem with this DVD/VCR combi unit was "DVD drawer not staying shut". This was because the disc failed to clamp correctly. In addition when the tray opened it caught on something.

It turned out that there is a metal insert, a bit like a washer, that's set into the otherwise all-plastic turntable. It provides the metal for the disc-clamp magnet to adhere to. This insert had come adrift at one edge and was sticking up. Refixing it in place properly provided a complete cure. **G.D.**

Sharp DV-NC55H

The complaint with this DVD/VCR combi unit was "discs skipping". On test this was indeed the case. But when the skipping occurred the tracking servo could be heard going wild.

My first move was to check the mechanical freedom of the sled. This immediately revealed the nature of the problem. When the laser was pushed down its slides manually, the drive gears could be felt and heard to be producing a regular 'bump'. Closer examination showed that the cause of this was a split in the small pinion on the shaft of the sled-drive motor. This split made two of the gear's teeth move apart slightly. As a result it and its mating gear almost locked when this area came into mesh.

A hunt through the scrap box produced a deck with a pinion that seemed to be the same size as the damaged one. The mesh with the mating gear looked and felt OK, so I went ahead and fitted it. The mechanics then felt perfectly smooth and normal.

Just for sport I counted the number of teeth on the original pinion and on the one I had used as a replacement. They differed by one, the original having thirteen teeth and the replacement twelve. So, strictly speaking, the replacement must have been marginally smaller around its circumference, causing a tiny difference in the gear ratio. But neither of these factors seemed to be of any consequence, as a long soak test proved that the player was now performing faultlessly. **G.D.**

Sony HCD-SB200

A burning smell came from the top vent of this new SACD/DVD unit, and there were no front left-hand side and surround left-hand side speaker outputs. Checks on the amplifier board revealed that IC710 was short-circuit. It's under the heatsink block and fan. A replacement restored the outputs. **C.B.**

Philips DVD7555VR

The problem with this DVD/VCR combi unit was no display at the front. All other functions were OK. Not being familiar with this model, I wondered whether the display might have been switched off in the menu. But after checking through the menus I decided that this was not the case and seized my trusty multimeter. Voltage checks on the display showed that the 3V filament supply was missing while the –21V bias supply was present. As I didn't have a circuit diagram I had to trace the source of the filament voltage back to power supply, where I found that F102 had blown and D107 was short-circuit. Replacement of these two components produced a normal display. **P.E.**

Thomson TC6125B

This DVD player, actually manufactured by Samsung, had been accidentally connected to a three-phase supply during some construction work in the owner's neighbourhood. Usually this blows the mains bridge rectifier and the filter capacitor. In this case the mains fuse had held and the only failure was a diode on the secondary side of the chopper power supply. A new UF5408 got things up and running again. **C.H.**

Thomson DTH210U

This player was dead. Checks on the primary side of the power supply showed that everything was OK. Checks on the secondary side brought me to D809 (SR150), which was short-circuit. A replacement restored full operation. **B.L.**

Panasonic DVD/VCR

The DVD drawer refused to open and the display produced the word 'locked'. It transpired that the unit was in the 'sales demo mode', which prevents customers pinching show-room discs. To restore normal operation, press 'stop' at the DVD front panel then 'stop' at the remote-control unit.

Panasonic technical advise that this situation can occur as a result of dry-joints at IC37001, which is under the DVD drawer. I thought I would take the easy option at this stage and worry about the dry-joints if the machine bounced. **B.L.**

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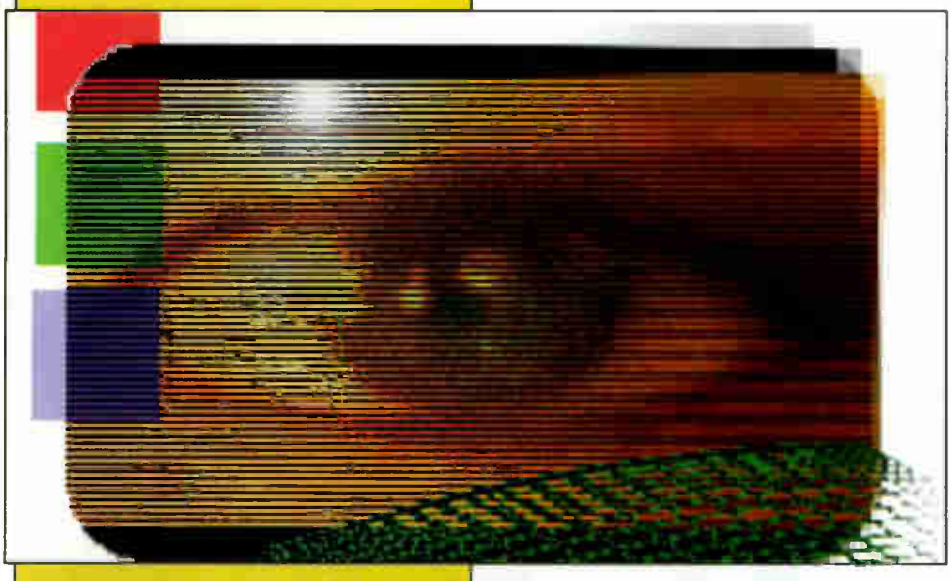

Extended Reports

Reports on complex or tricky TV fault conditions are sometimes too long for inclusion in our basic fault-finding section. We've put a few of them together in this extended fault report feature

Reports from
Arthur Jackson
Martin McCluskey
Philip Laws
Michael Dranfield and
Charles Ritchie

We welcome fault reports from readers – payment for each fault is made after publication.

Reports can be sent by post to:

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Media House,
Azalea Drive, Swanley,
Kent BR8 8HU

or e-mailed to:
t.winford@highburybiz.com

Fault

Thomson 14CB25UT (Eurocombo 2 chassis)

This combi portable model had a tape jammed inside and kept switching to standby every seven or eight seconds. During the brief on periods the TV sound and picture were perfect. I dismantled the mechanism as far as necessary to remove the tape, checked the mechanical timing and set the deck to the eject position. When the set was retried it came on but still shut down after a few seconds and refused to accept a tape.

Checks in the VCR section showed that there was no supply to the loading motor. When I traced back I came to resistor RW002 (1Ω, 0·3W) which was open-circuit. This resistor couples the 14V feed from the power supply to the loading, capstan and drum motors, and a replacement restored normal operation of both the VCR and TV sections. It had obviously failed as a result of the overload when the lift had jammed mid-way because of the faulty tape, but I wondered why the other problem, switching to standby, had also been cleared when the motor supplies had been restored.

With limited time I couldn't investigate this fully, but I noticed that at switch on the deck shuffles and the drum rotates briefly. I presume that this action generates a signal of some sort that's sent to the microcontroller IC to tell it that the VCR section has been checked and is OK. Absence of the motor supplies would remove such a signal, giving a deck-fault indication. Protection is then presumably initiated and the set returns to standby. **A.J.**

Mitsubishi CT1535TX (Euro 7 chassis)

This elderly 15in. portable produced no sound or picture. There was just a high-pitched screech. During initial checks I found that the 2SD1877 line output transistor Q522 was sort-circuit. Poor joints were then found at the line driver transformer T551, and were resoldered. I next checked the HT voltage, with a bulb connected as a dummy load. Just as well – the HT rapidly rose to 290V.

In the past I've found that the cause of this problem has been the STR54041 chopper chip IC901 or the regulation feedback smoothing capacitor C908 (10μF, 100V). So, considering the age of the set, I replaced these two items. The HT voltage remained at 290V however. Further checks showed that R911 (33Ω safety) in the feedback network was open-circuit. Once a replacement had been fitted the HT voltage was back at 115V. A replacement line output transistor completed the repair. **A.J.**

Philips 32PW9566 (EM3E chassis)

This huge model consists of a 32in. TV set and cabinet/stand complete. The stand, with its glass shelves, is part of the TV set's frame and cannot be separated, making servicing quite difficult. The following is an account of just how wrong things can go when you think you are following the correct servicing procedure.

The fault was simply no sound. The picture, features, functions etc. were all normal. So I started by checking the tuning and country settings, which were OK. Before delving too deeply, I decided to enter the service mode to check for any errors. None were found, but I noticed that one of the option codes didn't match those printed on the sticker attached to the tube. I also noticed an option to initialise the EEPROM. At this point I suspected some data corruption, and initialising seemed to be a good idea. So I noted the geometry values etc. then initialised the EEPROM and pressed store.

At this point the set went to standby and refused to come on again. It just sat there, with a rapidly flashing red LED. As there originally appeared to be data corruption I suspected a faulty EEPROM and ordered a replacement (IC7011, part no. 9322 156 81668). When this had been fitted the set at least came on again, but with badly misaligned geometry and no tuning stop. So, once again, I entered the service mode, initialised the EEPROM, set up the option codes then moved to the store line and pressed OK. The set immediately went to standby again and refused to restart, just flashing the red LED.

This was becoming a nightmare, and any information I could get on replacing the EEPROM from the symptom/cure service got me more confused. So I contacted Philips technical to discuss the symptoms. The technician was aware of the problem

and advised me to short-circuit the base-emitter of transistor Tr7529 in the power supply, switch on, enter the service alignment mode, set up the option codes and geometry, store them, then switch off and remove the short-circuit from transistor Tr7529. He didn't offer any explanation as to why this procedure was necessary.

When this had been done the set came on but required AFC and AGC adjustment via the 'general set up' line of the service alignment mode to allow correct tuning. I could now retune and receive a perfect picture, but it was no surprise to find that I was back with the original fault – no sound! The cause of this was simply a defective TDA7490 audio output chip, IC7700, and an open-circuit right loudspeaker. Once these two items had been replaced the repair was completed.

It appears that when the EEPROM in this model is initialised the default values for the geometry settings are far enough out to give the impression of a deflection fault, thus activating the protection system and shutting down the power supply via the enable line. Placing a short-circuit across the base and emitter of Tr7529 overrides the enable action, allowing the set to run while the geometry is set up and stored.

As I had now regained some confidence I decided to put the option code that was off when I received the set to the seemingly incorrect number, to see what effect this had. It didn't make a blind bit of difference, as the set performed faultlessly! We live and learn, though often at great expense. **A.J.**

Philips GR2.2AA chassis

This is a longish story and I'm still unsure about the cure. It all started after I had fitted a new line output transformer because of arcing. The set then produced an excellent picture, but I was amazed to find that there was not a trace of sound with either off-air or scart inputs.

There was a buzz from each speaker when the left and right input pins (1 and 9) of the TDA1521 audio output chip were touched with a meter probe. The sound was being muted because the two surface-mounted transistors Tr7246 and Tr7245 in the output chip's input circuit were biased on. Then, as I was making further voltage checks, the set switched to standby. In fact every time the set was switched on it would, after say 10-15 minutes (I didn't record the exact delay), switch itself to standby. Some sets do this when the microcontroller chip thinks there is no off-air signal.

Back to the circuit diagram. An ident voltage at pin 13 of the TDA2579B timebase generator IC is fed to pin 16 of the 42-pin TMP47C1637 microcontroller chip and also to the screened IF module, where muting is applied to the audio signal and, subsequently, to the audio output stage. The voltage at pin 13 of the TDA2579B IC should be 4·7V with signal, 0V with no signal. A meter check produced a reading of 2V. If an external 5V supply was connected, via a 1kΩ resistor, there was normal sound with correct muting when there was no signal.

A new TDA2579B IC made no difference. Pin 13 seems to be held at 4·7V by a potential divider that consists of two resistors, R3463 (18kΩ) and R3464 (12kΩ), which are connected between the +14E supply and chassis. Both resistors measured OK when checked out of circuit. But if another 18kΩ resistor was connected in parallel with R3463 the sound was restored and everything worked normally.

I don't like to make unofficial modifications like this but decided to leave the added resistor in place. If the set was not returned to the customer in working order I would have wasted money on a transformer not likely to be used again, not to mention many hours spent fault-finding. There were no other passive components that could have caused the problem in this area. Perhaps the internal working of the microcontroller IC had been altered slightly by the arcing. I'll probably never know. All this was several months ago, and the set has not been back since. **M.McC.**

Sony KVA2942U (AE2B chassis)

This set could be heard to start up but then reverted to standby, with the LEDs blinking. A check with the service manual revealed that thirteen blinks means vertical protection is active. So I carried out scope checks around the TDA8179 field output IC. There was drive at pin 1, +12V at pin 2 and –12V at pin 4, but no output at pin 5. A replacement IC restored the field output, but there was still no raster.

Much time was wasted looking for something I could have disturbed while removing the chassis. Then I reverted to fault-finding and soon found that there were no RGB drives from the jungle IC though everything else around this chip was present and correct. At this point I phoned the customer, to say that my original estimate would be exceeded, and was told that the set normally took up to an hour to produce a picture.

Sure enough after two hours a poor, smeary picture appeared. I suspected the CRT, but decided to press on with other tests. These revealed that the A1/G2 voltage range was only 200-300V. The cause was R701 (680kΩ) in the feed to the G2 potentiometer RV701. It had gone high in value. A replacement restored excellent pictures, the likes of which the delighted owner hadn't seen in years. **P.L.**

Thomson 14MK141G

This set was brand new out of the box. It had been brought in from the shop over the other side of the road – the owner, a good friend of mine, sells mainly new equipment. The problem was that at switch on it tripped three times, made a bit of noise then went to standby. There was not much time for fault-finding but I found that if I connected a 100W bulb across the collector and emitter of the line output transistor the line drive would be kept running while I took some measurements.

The line output transistor's collector waveform was found to be heavily damped, but I could find no shorts across the line output transformer's secondary windings. It seemed that the transformer was faulty and, indeed, my LOPT tester said it was. But it couldn't be – this was a brand new set! So I phoned the dealer to see if he had another set I could borrow in order to carry out some comparison tests. He had, and brought over another boxed set.

A check on this set's line output transformer produced a good reading, so it seemed that the one in the first set was indeed dud. As a test I removed both transformers and swapped them over. This transferred the fault to the second set, confirming the diagnosis.

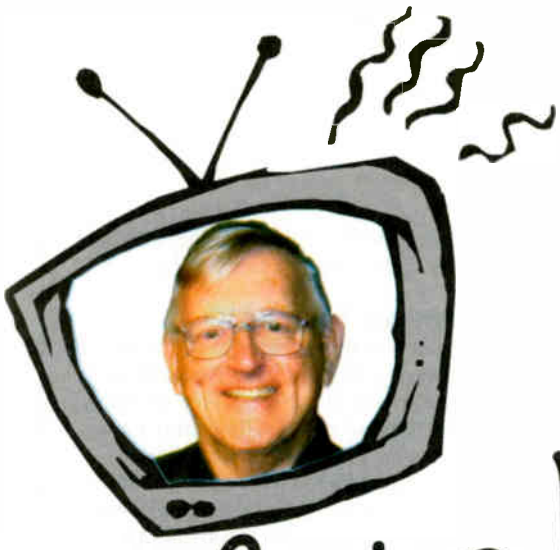
Who would have believed that a set which came off the production line working would have a faulty LOPT when unboxed? **M.D.**

Sharp 51DT25H (CA1 chassis)

This set was stuck in standby because the BU508DFI line output transistor Q601 was short-circuit. In fact it had clearly been overheating: the PCB in the area was discoloured and it was extremely difficult to remove the old heatsink compound from the heatsink.

The CA1 chassis uses a similar line drive arrangement to the DA100 chassis – the line output stage is a sort of synchronised self-oscillating system. A common cause of line output transistor failure in the DA100 chassis is C607 (330μF, 10V). The equivalents in the CA1 chassis are the two series-connected capacitors C604 and C622 (both 220μF, 10V). When these capacitors were checked with an ESR meter they were found to be open-circuit.

Once Q601, C604 and C622 had been replaced the set worked normally and Q601 ran at a normal temperature. C604 and C622 smooth the –5·2V supply to transistors Q603 and Q604 in the line drive circuit. **C.R.**



What a life!

Donald Bullock's servicing commentary

Mostly faults with larger TV models this month. And some assistance provided by a helpful teenager

Last month I was off down memory lane. Having got back, I returned to the workshop and what turned out to be a day of monsters.

Mr Buck's Hitachi

For starters I fell over a 28in. Hitachi set that was just inside the door. Draped over it, puffing and blowing, there was the weediest little chap I'd ever seen. Beside him, and clearly with him, stood Mr Buck, a giant of a man. He looked cool and collected and when he spoke, in his round Welsh accent, his deep voice quivered the battery pack.

"'Ello Mr Bullock!" he boomed, "I just got my neighbour Jimmy 'ere to 'elp me in with my telly. I've a bad back, see. Now come on Jimmy, on to the counter with 'im, there's a good chap."

"Oh, that's heavy Mr Buck" Jimmy squeaked, "really heavy, Mr Buck!"

"You'll be all right Jimmy" boomed Buck, "now run off and wait in the car." As Jimmy departed Buck added "worth his weight in gold you know".

"Must be worth all of ninepence then" I said. And, since that seemed funny to me, I had a good laugh.

The set turned out to be a Model C2886TN, which is fitted with the A7 chassis. I asked Buck what the trouble was.

"Stuck in standby, see" he replied. "If he was a chap I'd give 'im a good belting."

I had a look at the set when he'd gone, adopting a slightly more scientific approach than that suggested by Mr Buck. An in-circuit check on the line output transistor Q751, which seemed to be a good point to start, suggested that it was short-circuit. But for once the transistor was not the culprit. It turned out that C704 (2·2nF, 2kV) in the EW diode modulator network was short-circuit. I was relieved to get a picture once I'd fitted a replacement, but there was EW bowing. The EW drive circuit is incorporated in IC601, along with the field output stage. The cause of this further problem was here, a new TDA8350Q IC restoring correct geometry.

Buck duly returned, along with the luckless Jimmy, and walked about encouraging his efforts as he struggled to get the set into the car.

"Don't know what I'd do without little Jimmy!" he exclaimed.

"Roll up your sleeves for one thing" I replied.

"Ah, but it's my back that's the trouble" Buck said.

A Grundig with DVB

Our second caller that day was Fred Warbler, a happy fellow who is forever singing. He was just finishing off *Over the Rainbow* as he entered the shop.

"If happy little bluebirds fly across the rainbow, why oh why can't I?" he sang.

"Well for one thing Fred, you haven't any wings" I said, cleverly, "and for another there's no rainbow out there."

He looked a bit put out by this, but it seemed to me to call for a laugh. So I had one.

"I've got my Grundig digital telly in the car" he said.

"Oh dear!" I commented.

"It's a 28in. widescreen with built-in DVB" he continued.

We all trooped out to bring it into the shop, but my legs wanted to walk it towards the river. It turned out to be Model MW70-505RDT/DPL, with the CUC2059 chassis.

"When I switch it on the light comes on bright green for a second then turns red and the set doesn't do anything" Fred explained.

"Makes me want to go tench fishing" I muttered when he had left.

The Woodbines

Steven decided to attend to the Grundig set. As he was taking the back off I found myself confronted with what appeared to be one of the Simpson cartoon characters. She stood there complete with huge overhanging top lip and a square head. A fifteen year-old, or thereabouts, lad was with her – he seemed to be much the same. She was looking at me.

"Er, what can I do for you Mrs Simpson?" I asked.

"Woodbine" she said.

"Can't help you I'm afraid. I don't smoke" I replied.

"I'm Mrs Woodbine" she said, "and this is my son Cyril."

The lad smiled cheekily. "Which makes me Cyril Woodbine" he piped.

"My son's a bit misunderstood" she continued.

I looked at him and could understand that.

"He's ever so good at fiddling with wires and things though, aren't you dear?" Mrs Woodbine said to him.

"Yes" said Cyril.

"The other day he made his aunt's transistor radio work, didn't you dear?" she continued, "now tell Mr Bullock what the trouble was."

"The valve" Cyril said brightly.

I looked at him.

"So, if you could use him here now and again to do some odd jobs it would keep him off the streets during the holidays, and stop the other boys teasing him."

"Well, I'm afraid we haven't really got any vac . . ." I began, but Steven cut in.

"I wouldn't mind Cyril helping me out a bit, now and again" he said. "He might as well start by watching what goes on as we work on these sets."

Mrs Simpson grinned happily and departed, leaving Cyril with us.

"Nice fellow old Warbler" I said to Steven, "but what a terrible voice!"

"Yes. Bit under his wife's thumb though. And boy what a missus!" Steven replied, then turned his attention back to the Grundig.

Tripler trouble

The CUC2059 chassis is unusual these days in using an EHT tripler. All sets used them before the diode-split line output transformer came along.

As we were discussing this Cyril piped up. "What's tripler?" he asked.

"It's a high-frequency current rectifier and voltage multiplying device" I said, "it turns the high-voltage alternating current produced by the line output transformer into the very high DC voltage the tube requires."

"What's a line output transformer?" Cyril continued. Then he pointed to the fly lead that Warbler had left plugged into the aerial socket. "Is that the tube?" he asked.

But we had to get on with the set. Steven decided to disconnect the feed to the tripler to see if the set could then be brought out of standby. It could, which proved that the tripler was defective, probably shorting internally. A replacement restored normal operation. The type number is BG1899-02-644.

Another monster

Just then Mr Lowte started to manoeuvre himself through the door. He's a thick-set chap and was carrying another 28in. set. He was also chatting to the fellow who was helping him.

" ...Yeah, it was that tall thin chap at Snoddies. Told 'im straight like, 'I don't come 'ere for no sarcastic remarks, I come 'ere to get me telly mended. So watch out. I might just loose me temper'."

They eased the set on to the counter and, carefully avoiding any sarcasm, I asked Lowte what was wrong with it.

"Stuck in standby and there's a smell of burning" he replied.

When he had gone Paul decided to take a look at it. The set was a Naiko Model N2866, which is fitted with the PT20A chassis. "He's a big, ignorant fellow" Paul commented as he took the back off.

"Yes. Seems to clout people as soon as look at them" I added. "If he goes on like that he'll meet his comeuppance."

"Ah" Paul continued, "same trouble as with the Hitachi you did earlier, the 2·2nF, 2kV capacitor in the EW modulator network is short-circuit – split in two in fact. This one's labelled CD64. It's also blown the BU2525AF line output transistor TD02.

"What's a line output transistor? piped Woodbine.

"A high-current, high-voltage switching device that controls the tube's horizontal scanning" Steven explained.

"You speaking a foreign language?" Woodbine grinned.

I looked at him but, just then, the phone rang.

"Albie here" bawled a loud voice. "Now look 'ere. I don't want no arguments this time. I wants four bags of cement and two yards of sand. And I wants it 'ere on site before three o'clock. Got it?"

"Sure have" I said, and hung up.

Steven looked over. "I heard that" he commented, "who was it?"

"Dunno" I replied, "but I wasn't going to argue!"

A 28in Bush

Our next callers were Mick and Maisie Miller, a happy country couple.

"Hi, Don. Our Bush telly's in trouble again. Got it in the wagon" Mick said.

"Carrying it nearly killed us" Maisie added.

Paul and Woodbine went out to bring it in.

"Never seen a picture like it" said Mick, "one side's like this!" He stood with his bottom out and his arms up and pointing forwards.

"And the other side's like this" said Maisie, stretching herself with her bottom in.

"Another time just take it easy and say east-west distortion" I commented.

"Nice couple" Paul said when they'd left. "They get over the pub weekends. She gets quite merry after a few gins. Called him Old Egghead once. Maybe he wears a wig!"

Their 28in. Bush set was a Model 2877NTXSIL, fitted with the 11AK37 chassis. The bowing was quite severe.

"First thing is to access the service mode" Steven said as he took it over. He pressed menu on the remote-control unit, followed by 4 7 2 5. But geometry adjustment had no effect.

When he moved to the EW diode modulator circuit in the line output stage he found that C622 (12nF, 630V) was short-circuit. It's the lower of the tuning capacitors, the one that's connected to chassis. So it was shorting out the EW drive from Q602. There was a perfectly good picture once a replacement had been fitted.

Later that day . . .

The day was wearing on. After a phone call Fred Warbler called for his set. As it was being carried out, Woodbine pranced into the shop.

"You're a nice man, Mr Warbler" he trilled.

Warbler smiled shyly and wobbled his head slightly from side to side.

"But you've got a horrible voice" Woodbine added, "and you're under the thumb and, boy, what a missus you've got!"

Warbler's expression changed. He gave me an incredulous look then made a hasty retreat. I ran to the door and called after him.

"Sorry Fred" I stammered, "we're, ah, looking after this lad for an hour or two. His mother has gone to the, er, dentist."

Fred smiled wanly and drove off. Before I could take Woodbine to task he'd run out to the local sweet shop.

Mr Lowte called for his set next. As he was starting to manoeuvre it out through the door Woodbine came dancing back, clutching a bag of sweets. He had to let Lowte out first. As he went, Woodbine looked up at him and smiled.

"You're an ignorant fellow!" he said.

Lowte's jaw fell open and he looked around for somewhere to place the heavy set.

"Yeah, you clout people soon as look at 'em" Woodbine continued, " and the sooner you get your comeuppance the better!"

Woodbine danced off and Lowte turned to us.

"Who the hell was that?" he asked.

"No idea" we said, looking puzzled and offended on Lowte's behalf.

I looked at Steven and Paul. "I sure hope he doesn't show up before Mick and Maisie call for their set" I said.

They showed up as I spoke, as happy as ever.

"Step right in, Fred, Maisie" I called, "it's ready and waiting . . ."

While they were paying I sauntered over to the door and looked up and down the road anxiously. I was relieved to see no sign of Woodbine.

"I was just saying to Maisie, Mr Bullock, that we always get treated well here" said Mick, "it's always been a pleasure to call."

I put an appreciative smile on my face, but my eyes were focused through the windows, racing around the street while Mick and Maisie seemed to take an age collecting their set and then guiding it through the door. As they managed this, Woodbine bounded up.

"Ah, Mick and Maisie!" he cried out, grinning.

They started a bit at this forwardness, but managed a friendly grin all the same.

"When you get sozzled over the pub you hook Mick's wig off and call him Old Egghead, don't you Maisie?" he grinned.

They stopped, their jaws sagged and they looked askance as he danced away happily. Mick and Maisie seemed poleaxed.

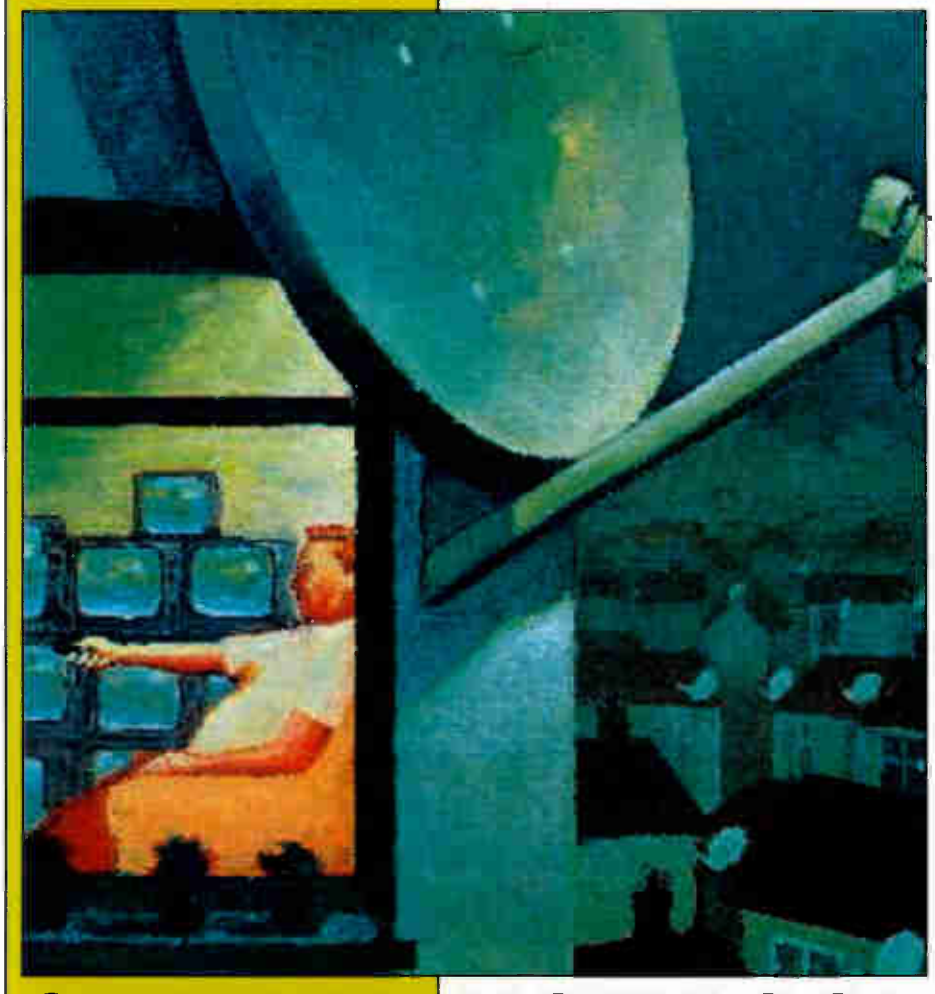
"Was that some sort of test, Mr Bullock?" asked Mick, "I mean, do you know him?"

"Never seen the nut before, Mick" I replied.

They went on their way, looking a bit shaken.

I turned round and looked at Steven and Paul. "Not all your ideas are so good, are they?" I ventured to Steven.

"I'll speak to his mother tonight" he said.



SATELLITE NOTEBOOK

Reports from
Christopher Holland
Pete Haylor
and
Michael Dranfield

HDTV tests in new format

Further high-definition TV tests are being carried out at 19·2° E (the Astra 1 slot) by the German pay-TV channel provider Premiere, which is due to start HDTV transmissions in November. The 1,080 x 1,920 line transmissions use the new H.264 transmission standard, which provides about three times more video data compression than the currently-used MPEG-2 standard and is also an improvement on MPEG-4. There is scope for confusion here however, as H.264 is also known as MPEG-4 part 10! From research on the internet I discovered that the MPEG-2 format was originally known as H.262. The compression provided by H.264 enables an HDTV film to be stored on a standard DVD. Until receivers become available, the only practical way to receive these transmissions is to use a PC-based system.

The frequency being used is 11·915GHz, with horizontal polarisation, a symbol rate of 27,500 and 3/4 forward error correction. Along with these tests there is a Premiere service promotion using standard MPEG-2 – a normal satellite receiver will handle these. A fast PC is required for H.264 reception, and even then the results are a little jerky in comparison with the Euro 1,080 MPEG-2 HDTV transmissions also available via Astra 1. This is probably because the PC has to do more work to cope with the higher video compression.

At present just a short promotional video loop is being transmitted, with no sound, but this is bound to change in the next few weeks. Photos 1-3 show pictures from the promotional video. As these tests have only just started I'll leave further comment until next month. If, in the meantime, you are interested in trying to receive the transmissions, go to www.dvbviewer.com on the internet and buy the program for 15 Euros. This allows a free download of a program called DVB Viewer GE, needed to view the tests, in the customer area of the website.

To see pictures the Moonlight Elecard MPEG Player Version 3 is also required – it contains the H.264 decoder to produce them. The program costs about $20, though a free 21-day evaluation download is available from the website at www.moonlight.co.il. A SkyStar 2 PC satellite tuner is also required – an article on this appeared in the September 2003 issue of *Television*, see pages 650-4. This mentioned the earlier versions of DVB Viewer and the Elecard player. **C.H.**

Digital channel update (28·2°E)

The latest channel additions at 28·2°E are listed in Table 1. Where allocated, the EPG number is shown in brackets after the channel name.

Film 4, Film 4 + 1, E4 and E4 + 1 have moved from Eurobird transponder D6S to Astra 2D transponder 42 (10·727GHz/V).

Setanta Sports has been slotted in at EPG no. 433. The Sky Premier Plus channel that was previously here has been moved to EPG no. 437.

Some ITV channels have moved from one transponder to another during the last month, apparently in preparation for the addition of some ITV1 sub-regions in the near future. ITV News (EPG no. 525) has moved from transponder 49 to transponder 41 (10·714GHz/H). ITV1 London (EPG no. 103, or 963 with viewing cards registered at

Table 1: Latest digital channel changes at 28·2°E

Channel and EPG no.	*Sat*	*TP*	*Frequency/pol*
Big Game TV (276)	EB	C4	11·343GHz/V
BT Tower tests	EB	D4S	11·527GHz/V
Discovery Home and Health + 1 (155)	2A	9	11·876GHz/H
Eternal World TV (680)	EB	D12S	11·680GHz/V
Setanta Soccer (434)	EB	C1	11·222GHz/H
South Asia World (540)	EB	C4	11·343GHz/V

EB = Eurobird 2A = Astra 2A

addresses outside the London area) has moved from transponder 49 to transponder 44 (10·757GHz/V). ITV2 (EPG no. 118) and Men and Motors (EPG no. 136) have moved from transponder 54 to transponder 44.

The EPG no. for Sound TV (EB transponder D9S) has changed from 588 to 277.

The Musicians channel (EPG no. 475) has ceased transmissions.

Prior to Big Game TV coming on air, colour bars titled London B Video A were displayed, see Photo 4.

Photo 5 shows a BT Tower test transmission. **C.H.**

Sky RC extender problems

The ability to change channels in a different room from the Sky digibox is very handy for some customers. But problems do occasionally happen, with the digibox refusing to change channels when asked from the remote location.

The second pickup eye (often referred to as the mouse) is line powered at 9V via the coaxial cable that carries the UHF signal to the second location. This applies when the RF2 UHF output socket is used, the supply being activated via the digibox installer's menu.

In some cases the in-line coaxial body that connects to the infra-red pickup sensor and plugs directly into the second TV set's aerial socket is damaged when the set is pushed too close to the wall. When you come across this situation it's a good idea to connect the assembly to the TV set via a standard coaxial plug and socket lead, with the in-line unit's coaxial plug connected directly to the coaxial lead to the set. This enables the unit to be secured neatly and safely behind the set. Typical problems when the unit has been damaged mechanically are poor internal coaxial plug and socket contacts and fracturing of some chip resistors and capacitors on the PCB.

The signal from the remote-control unit is converted to RF at a fundamental frequency of just over 7MHz and a level of about 100mV and sent via the coaxial cable to the digibox. Photo 6 shows a typical spectrum-analyser display of the mouse's fundamental frequency plus second/third harmonics above 14MHz and 21MHz when a button is pressed. Internal damage can reduce the output by about 20dB, which is sufficient to prevent digibox channel changing via the eye.

Poor coaxial connections between the remote extender and the digibox can create problems. Channel changing may be intermittent, despite the LED on the remote eye's body being lit to indicate that power is being received and a good UHF-modulator signal from the digibox being present at the second TV set.

Passive signal splitters used in the link between the eye and the digibox provide a

Photos 1 - 3: Pictures from the promotional video for the Premiere H.264 service via Astra 1. See text for further details.

Photo 4: Colour bars transmitted prior to Big Game TV coming on air.

Photo 5: BT Tower test transmission.

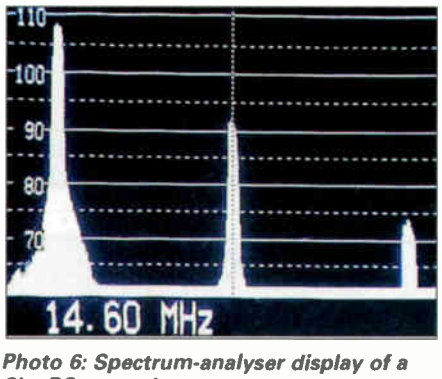


Photo 6: Spectrum-analyser display of a Sky RC mouse's output.

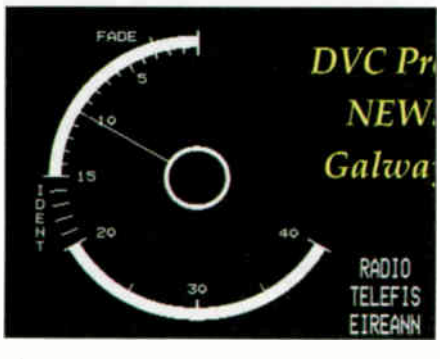


Photo 7: RTE newsfeed via Intelsat 903.

DC path for line powering but are best avoided, as they usually pass the LF return signal from the mouse with greater loss than the UHF signal. The result can be intermittent operation.

If several mice in different rooms are to be provided it's best to use a multi-output amplifier that also amplifies the LF mouse signal. It can be line-powered from the digibox's RF2 socket. Some amplifiers have their own power supply, which avoids the 9V from the digibox being loaded down where several mice are connected.

An irritating habit with some older digiboxes is normal remote channel changing for a few hours after which it stops until mains power is removed from the box and then reapplied to reboot the box. The whole slow process is then ready to repeat itself! In this case, after checking all the connections as mentioned earlier, it's worth changing the mouse, preferably for one of a different make, to see if things improve. The problem is usually a digibox one however. Some early Grundig receivers seemed to be prone to this, particularly if more than one mouse was used. **C.H.**

Intelsat 903 (34·5°W)

A while back we looked at the C-band output from Intelsat 903 at 34·5°E, but we've never mentioned its 11GHz Ku-band signals. The satellite has separate European and North American Ku-band footprints – the latter doesn't produce any signals in Europe and needn't concern us here.

Irish broadcaster RTE uses the satellite for newsfeeds and sports relays. It mainly uses the MPEG 4:2:2 video format, which requires either an expensive satellite receiver or, more practically, a PC-based one for reception.

Newsfeeds are found at 11·131, 11·137, 11·143 and 11·149GHz, with vertical polarisation, a symbol rate of 4,700 and 3/4 FEC. 11·131GHz is used very infrequently, presumably not to clash with 11·133GHz (see below) with its wider symbol rate when this on air.

Sports feeds are found at 11·133, 11·139 and 11·145GHz, with vertical polarisation, a symbol rate of 5,632 and 3/4 FEC.

11·133GHz is also used for newsfeeds, transmitting long periods of BBC1 in 14:9 picture format and sometimes BBC Television Centre colour bars.

Newsfeeds predominate during weekdays, with sports feeds taking over at the weekends, particularly on Saturday and Sunday afternoons.

Some newsfeeds and sports feeds previously used an SR of 9,400, with FEC 3/4, but I've not come across this since the 5,632 SR came into use.

RTE newsfeeds are generally most active around lunch time and early evening, prior to its news programmes.

Photos 7-12 show what is likely to be seen before a feed transmission. The RTE SMU colour bars (Photo 9) are very common, suffixed with either 1 or 2 (SMU possibly stands for satellite mobile unit), also the Digisat SNG1 identification (Photo 12).

So far I've not seen any other Ku-band signals via this satellite. **C.H.**

Holiday problem

Stavros the Greek had been back home on holiday and, while there, had organised a Nova card, had it switched on and seen it working. On his return he inserted it in his satellite receiver, which then didn't work. I told him to try several things over the phone, to no avail.

When I arrived and checked the receiver I noticed that only about twenty channels were tuned in for Hotbird – and they were the wrong ones for this satellite: the names of the channels listed belonged to Hellas, not Hotbird. But the set-up said that the dish was set for Hotbird. So I went to the dish location and discovered that the customer had only the Hellas satellite, not Hotbird.

It seems that when the customer went to Greece someone messed with the satellite system and lost all the channels, then managed to mix up the settings. The receiver was retuned to the correct Hellas satellite, and new channels were added, but the customer was then told that his Nova card would work only when another dish had been installed! **P.H.**

Missing channels

The old chap on the phone asked whether I repaired satellite boxes. On being told that I do, he started to explain his tale of woe in great detail. It seemed that the receiver concerned belonged to a lady friend of his who loves the "God Channel" and other religious channels at 28·2°E. These were sometimes missing.

He arrived with the box, which turned out to be a Grundig. The power supply showed signs of distress, with bulging capacitors, so a new one was fitted. The receiver was then left on soak test while we had a drink. Half an hour later everything seemed to be OK and he left, having paid the bill. I thought that was the end of that.

Later that night I received a phone call from him. He was in a right panic. From what I could make out the picture had been pixellating. He had retuned the TV set, and was now totally lost. Could I call

next day? The customer was a woman of whom he was afraid, so I was to be careful.

When I called the following day a small West Indian woman answered the door. I decided to stay outside initially and checked the alignment of the dish, then fitted a new LNB.

When I tested the receiver I found that he had lost most of the TV set's channels, so a retune was required. Once this had been done everything was OK and, by way of payment, I was given a sermon on God's work! **P.H.**

LNB problem

The phone went on Saturday just as I was having lunch. I was asked if I could call that day to get a new receiver working. On arrival I found a Topfield receiver connected to a motorised 1m dish. The first error was that instead of going east the dish went west. So the motor's leads were swapped over, and a scan of the customer's favourite transponder was then carried out. This was the start of the problem . . .

When the receiver was fully tuned to Hotbird it found only 700 channels instead of about 1,000. To make matters worse, the package he was paying for was missing. A second scan after adjusting the elevation and azimuth of the dish increased the signal strength, but the paid-for package was still missing. The offending frequency was 12·015GHz/H (SR 27,500, FEC 3/4).

The fault was cured when the Cambridge LNB was replaced with one of a different make. It's not the first time I have come across a Cambridge LNB that has caused this problem – one frequency missing. So beware! **P.H.**

Pace 2200

This digibox displayed the 'no satellite signal being received' message after a thunderstorm. Usually with this model a lightning strike causes trouble in the modem department, but this was OK. I then discovered that the LNB supply was missing, because the LNB current-sensing resistor R114 (0·3Ω) was open-circuit. A replacement restored the supply but the message was still displayed.

A scope check showed that the 22kHz tone was missing at the LNB socket. It was present at the ST20 main micro chip and could be seen up to C102, where it went missing. C102 couples the signal to an LM358M dual op-amp chip, U103, which produced a low resistance to chassis reading at its non-inverting input. But when a replacement was fitted the fault was still present, with no 22kHz signal at output pin 7. This pin goes to a couple of diodes that are connected to the LNB switch-off FET. D101 (BAS16) and D107 (15V zener diode) were both open-circuit while Q103 (2SK2414) was short-circuit.

I replaced these three components and confidently switched on. Guess what, the digibox was still displaying the no satellite signal message. The next step was to check the supply to U103. There should be 27V at pin 8, but this was missing because D51 (4·7V zener diode) in the power supply was open-circuit. Once this item had been replaced the digibox sprang to life. I assume that the lightning had struck the dish. **M.D.**

Photo 8: RTE sports feed via Intelsat 903.

Photo 9: RTE SMU colour bars via Intelsat 903.

Photo 10: IRL011 colour bars via Intelsat 903.

Photo 11: TVM ident via Intelsat 903.

Grundig GDS3000

I bought this digibox via eBay for only £12. It seemed to be too good to be true, and I had been the only bidder. When it arrived it was dead with the power supply tripping, because the KA1M0365R chopper control chip was faulty. When I replaced this the red LED at the front was cycling on-off every three seconds. My experience of Grundig and Pace digiboxes has shown that the usual cause of this is failure of the modem to initialise. As a test, I plugged in another modem PCB. The box then booted up, and examination of the original PCB showed that the soldering around the CX88168-12 modem microchip was poor. I reflowed this and refitted the PCB. The digibox then worked apart from the fact that there was no sound. A replacement audio DAC chip, U10 (AK4317VA), cured that.

You might wonder why the box had three different faults. I think that panels from this box had been used to repair others, and that the one I had bought had been reassembled with the faulty items. This would also explain the lack of interest from other bidders, who had probably been caught out before by this seller. **M.D.**

Photo 12: RTE Digisat SNG ident via Intelsat 903.

MONITORS

Fault reports from
Bob Bradley
and
Alun Rawson-Williams

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NEC LCD1525M

This 15in. LCD monitor worked briefly at switch on then went dead, with the power LED flashing orange. I set about stripping it down, first by removing the screws that hold the stand in place, then removing from the back of the monitor the screws that hold the front mask in place. I next turned the monitor face up, unclipped the front mask, then removed the four screws that hold the LCD and chassis in place on the rear casing. After disconnecting the audio cable from the speaker sub-PCB, near the front control panel, I finally lifted the chassis and LCD from the casing. I carefully laid the LCD face down on a cushioned surface and removed the screws that hold the screening metalwork in place, so that I could inspect the PCBs etc.

As I couldn't see any problems with the PCBs, I reconnected the power supply AC adapter and video cable and switched on. To my amazement the monitor came on and remained on. What had I done or missed to make the monitor work now that it was out of its case? It took me a few long minutes to realise that the cause of the problem was one of the first things I had removed to strip the monitor down – the stand. It contains the AC power adapter and a USB-port PCB that gets its supply from the main chassis via a plug and socket. Because of my strip down, it was now disconnected.

Inspection of the USB-port PCB revealed the cause of the fault: IC I202 and diode D205 were both short-circuit, with evidence of burning around them on the PCB. Fortunately I had a spare replacement PCB from a scrap monitor. This cured the problem. **B.B.**

Compaq V710

The customer's complaint with this 17in. monitor was that the colour changed intermittently. So I put it on test at the side of my bench, where I could keep an eye on it. After a couple of hours or so I noticed that the colour had indeed changed, to an almost cyan shade, indicating loss of red. I hastily removed the back cover, while the fault was present, suspecting a thermal fault. But when I reconnected the monitor the fault had disappeared.

At this point I inspected the video-data cable for any damage near the VGA plug, or at the cable gland where it goes into the monitor. Both are weak points that can give similar faults, but the cable seemed to be OK at both ends. As it goes through the gland and into the monitor the cable splits into two parts. Three leads plus an earth lead carry the red, green and blue data up to the CRT base panel, where they terminate at a four-way plug and socket. The remaining leads, that carry sync and other data, terminate at a plug and socket on the main chassis.

I found the cause of the problem at the plug that carries the RGB data to the CRT base panel. The red lead had not been inserted and crimped properly to its intended pin during manufacture, the result being a loose connection. It's strange how a fault like this can go unnoticed for over three years and then suddenly make itself known.

I removed the pin from the plug, recrimped the lead in place, then reinserted the pin in the plug. This cured the fault, as a long soak test confirmed. **B.B.**

Acer/Jean JD256N/29J56N

A very frightened young lady brought this monitor into the workshop, saying that it had exploded in her face and would it be possible to repair it? The 5A ceramic fuse in the mains plug has shattered and, when I dismantled the monitor, I found that the internal 2·5AT mains fuse F801 had disintegrated. I then noticed that there was new flux on two of the mains bridge-rectifier diodes, D801 and D803, which had obviously been replaced recently. D804 was now short-circuit.

When a single 1N4007 diode in a bridge-rectifier circuit has failed it has always been my policy to replace all four. I also noticed that the soldering around the line output transformer and the scan-coil connector was rather thin. This was attended to as well before the cover was replaced and the monitor was returned to a delighted customer. She later told me that our charge was about half what she had paid for the original repair. **A.R-W.**

Smile CA6515DL/KFC 6515

This monitor was dead but the degaussing circuit could be heard in operation when it was switched on from cold. The front LED lit during this operation, then went out. There was 343V across the mains bridge-rectifier's reservoir capacitor C503 but there were no outputs on the secondary side of the chopper circuit. I checked all the rectifiers on the secondary side and, in addition, the B+ regulator transistor Q119 and the line output transistor Q105. They were all OK. It then came back to me – I'd had the fault before with this chassis. The thing to check is the start-up resistor R509 (560kΩ, 0·5W), which was open-circuit. It's connected between the base of the chopper transistor Q610 and the primary-side HT supply. **A.R-W.**

Solutions to Test Case 512

– see page 612 –

Our first LCD day! One thing that did arrive that day, for the workshop, was a shiny new 19in. flat PC monitor. With 1,280 x 1,034 pixels it's wonderful for use with electronic service manuals, and it cost little more than £200. But we digress.

LCD case number one, the ex-demonstration model, went back to the shop. There it was soon found that the screen had been sent out with an outboard media box that belonged to another model with a different-sized screen! When they had been swapped over, both sets displayed correctly-proportioned pictures.

Set number two with its tiny speakers was not faulty of course, but it was never going to satisfy its new owner in terms of sound quality. Colin Doc's brainwave was to connect it, via a scart out to 3·5mm stereo jack adapter, to an add-on audio amplifier and speakers of the sort intended for domestic PCs. Some of these audio systems sound as bad as the TV set involved here, but the more expensive ones are better – you can even get them with little subwoofers!

The estate agent's office PC monitor was suffering from a worn fluorescent backlight. This was very soon diagnosed by the workshop crew when it arrived here. It nevertheless had to be scrapped, because a replacement couldn't be found. And these 1·5 per cent people can well afford a new one!

NEXT MONTH IN TELEVISION

Lead-free solder

It will soon be obligatory to change over to the use of non-toxic solder. This is likely to cause all sorts of problems. Eugene Trundle sets out the pros and cons.

A constant-current load

Whenever a power supply needs to be tested or repaired there's the problem of providing some sort of load across the output to ensure that it will deliver its rated output current. Christopher Jones describes a unit that enables power supplies with output voltages from 1-30V to be checked at current values up to 25A and voltages up to 100V. Because of the components used the build cost is small. Variations can be carried out to suit particular requirements.

Plasma display panels

Plasma display panels consume quite a lot of current and generate a lot of heat. The power-supply requirements are quite complex and specific. Fawzi Ibrahim describes the basic supplies needed and some of the circuitry used.

Vintage repair: an Ultra Coronation Twin

Malcolm Burrell turns his attention to a mains/battery portable receiver that dates from about 1953. It required both electronic and cabinet renovation.

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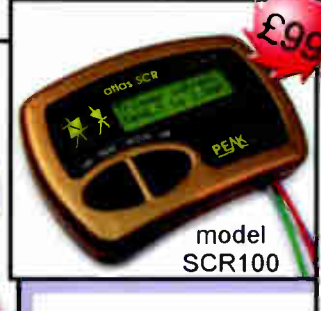

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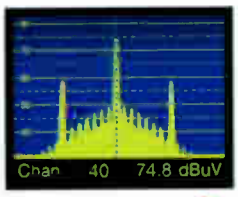

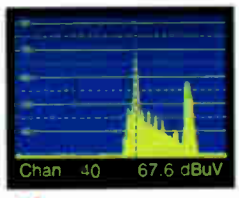

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