

UTS Programmers' Society

Submission to the Inquiry into the Uptake of Digital Television in Australia

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At its outset ten years ago, the promises for the digital TV landscape were quite varied. These included:

- A. perfect reception
- B. widescreen pictures
- C. CD-quality and surround sound
- D. multiple angles of suitable events
- E. interactivity
- F. additional programme information
- G. more channels (for new players or incumbents)
- H. cinema quality
- I. antenna-based pay TV (restricted access)
- J. future augmentable video formats for added efficiency

The first five can be recognised as being in common with the familiar DVD format.

At the time, a technical standard was selected with unanimous support, because it provided the ability to support all these possibilities — or at least, all of them, some of the time.

Contention followed when the regulatory regime was selected, because some of these options (D and H) required the assignment of limited resources of radio spectrum to a limited number of players in the market. All of the other options were still available, with or without this decision.

The contentions generally centred around the provision of some options full-time, versus other options full-time. The assertions are generally provided on the basis of an all-or-nothing approach, but the technical standard allows for all of these things, some of the time.

Indeed, some networks have demonstrated the ability to show HDTV and multiview programming in successive timeslots¹. Others have shown how different channel numbers can reuse the same limited video resources, thus providing the ability to constantly advertise availability of these services — for example, playing an HDTV demonstration loop followed by an HD movie on different channel numbers², or, providing three different multichannels in the space of two³.

The following recommendations are based largely on these capabilities being possible, being promised and demonstrated to the viewer, and being beneficial to the viewer, but being underemployed by the networks.

This is in an environment where the *spectrum was given away freely*, and the competing players in the subscription industry are *actively challenging these innovations from a much smaller revenue base*.

¹ Nine Network, 2005 (channels 90, 91)

² Network Ten, 2001-2 (channels 10, 19)

³ ABC, 2001-3 (channels 2, 21, 22)

Recommendation 1

Introduce a quota for multiview and interactive content, in the same manner and in concert with the quota on high definition content	<i>Introduction</i> <i>July 2006</i>
<p>Multi-angle viewing was a major drawcard for digital TV, even before its launch. In fact, all three commercial networks provided real transmissions as proof of the benefits of digital, all before the first decoders were available in late 2001 after the launch date.</p> <p>Multi-angle viewing, as well as interactivity, provides compelling new content for viewers to switch from analogue to digital. All three commercial networks have done multiview, and interactivity has been trialled (or in one case is being performed) by all five free-to-air networks.</p> <p>This is why this kind of content should be mandated in a quota, with the same leniencies for the networks with insufficient resources as is done with the present HD quota. The networks should be offered the choice of multiview or interactivity to count towards their quota, to best suit their individual requirements.</p> <p>It should be stipulated whether a single electronic scoreboard channel would indeed comprise multi-angle viewing, for the purposes of the new quota. Bear in mind that true multiple-angle selection was available on Nine's cricket and Ten's motorsport around 5 years ago. Seven also provided multiple distinct cameras at their tennis coverage in early 2001.</p>	

Recommendation 2

Amend the high definition quota to include 100 hours of sport per year (2 hours per week)	<i>Introduction</i> <i>July 2008</i>
<p>HD sports are a large driver of HDTV in the USA. Sports provide compelling content for the casual observer who may be considering the uptake of digital TV, and can be impressed with in-store demonstrations of this content.</p> <p>A token quota, with a generous lead-time, will kick-start the HD outside-broadcast industry in this country.</p>	

Recommendation 3

Regulate for the inclusion of digital tuners where all analogue tuners are newly sold, including any CRTs, flat screens, and time-shifting devices with analogue tuners	<i>Application</i> <i>July 2008</i>
<p>This move is inspired by the FCC mandate in the USA. The recommendation is to exclude any devices that do not currently hold analogue tuners, and to include all devices that are designed to function independently — including some plasma screens and DVD recorders.</p> <p>This will make it much easier to convert to digital, those TVs that are used in bedrooms, kitchens and for other extra areas.</p> <p>It may be decided to exclude devices such as analogue tuner cards for computers, where they are expressly developed for an industrial purpose; it will be in the consumer's interests to remove confusion and ensure all available devices are digitally capable, in a future environment with many exclusively digital services. However for regulatory simplification, an arbitrary price point of \$200 may need to be set.</p>	

Recommendation 4

Lift multichannelling restrictions in 2008, in readiness for Beijing Games	<i>Application</i> <i>July 2008</i>
<p>Events such as Olympic Games, tennis tournaments and soccer tournaments need to be fully leveraged by broadcasters who have licences to a full spectrum channel, as our free-to-air networks do. Australian terrestrial networks have a fairly unusual opportunity to deliver an integrated multichannel package, live to the viewer, and promote it as such. If restrictions were lifted to allow for this, Australians would be given unparalleled value in their free and accessible coverage of sports.</p> <p>With appropriate quotas on multiview, interactive and high definition content, multichannelling could be left without further restrictions on its use, thus preventing the rise of a de-facto regime of multiple "networks" which are available 24/7/365 and are in truth owned by the incumbent industry players. It may be decided to increase the quota levels to allow for the complete easing of multichannel restrictions.</p>	

Recommendation 5

Maintain proscription of encrypted content on terrestrial signals	<i>Application</i> <i>now</i>
<p>Lifting this proscription could feasibly slow the uptake of digital terrestrial receivers, as people realise they have to make more expenditure than the one-off purchase they have to make today; today's market has already tapped people's spending on subscription television.</p> <p>It is also disingenuous to provide non-free content on spectrum freely given by the government to the broadcast industry.</p>	

Recommendation 6

Ease genre restrictions on ABC and SBS multichannelling	<i>Application</i> <i>July 2006</i>
<p>ABC and SBS have the ability to provide the greatest promotion of digital free-to-air terrestrial in Australia, while simultaneously presenting a minimal threat to all commercial broadcasters in the free-to-air and subscription industries. Genre restrictions do not promote digital uptake.</p> <p>This recommendation is made with a view to:</p> <ul style="list-style-type: none">(a) allowing ABC to screen any programming it has produced(b) allowing ABC to rebroadcast all its radio networks on digital TV, each of which reduce the available TV picture quality by 1%(c) allowing SBS to include the English language news services of its overseas partners, from whom SBS already broadcasts the foreign language versions(d) allowing SBS to include any self-produced news services with an overseas focus, which is a specialty it already provides(e) expressly allowing ABC to screen sport and comedy, which it has already done on ABC2 and FlyTV(f) allowing SBS to provide its viewers the maximum benefit from its World Cup football rights	

Recommendation 7

Encourage integrated cross-promotion of multichannels	<i>Application</i> <i>now</i>
<p>For promotional purposes of an emerging technology, there is a large inherent advantage to having one network operating two or more channels; we have this fairly rare advantage in Australia but it is not being used. When BBC launched a second channel in the 1960s, they immediately started promoting the programming of one channel on the other — despite, or because of, the fact that the new service was only available on an incompatible higher-quality transmission signal. BBC have reused this technique for the launch of their digital channels; and this has also provided the convenience to all viewers on all channels of promoting the programming on the main channel(s).</p> <p>ABC should be asked to mix all their program lineups with names and times of programmes from both channels (ABCTV and ABC2), and SBS should be asked to do the same for SBS1 and SBS2. The current situation is absurd, with both networks seemingly avoiding any mention of their new services for fear of complexity, or dilution of the perceived quality of their original service; shows from ABCTV repeated on ABC2 are promoted as such, only on ABC2.</p> <p>When the viewer sees a lineup of shows “coming up tonight”, and is informed of both channels at once, this will immediately promote digital TV uptake, and simultaneously answer the viewers’ curiosity of “what is on there”. Ironically, ABC’s website works like this right now.</p>	

Recommendation 8

<p>Amend the HD quota to only allow content that has not had its quality stripped – by being converted to SDTV and back to HDTV again</p>	<p><i>Introduction</i> <i>July 2006</i></p>
<p>There is an inadvertent loophole in the regulations that allows HD programming to be counted towards the quota as long as the content was “originated” or “sourced” from HD material, and broadcast as HD material (using “upconversion”, a process designed to show SDTV content on an HDTV channel). Unfortunately this allows any network to process the entire programme within their facilities using cheaper SDTV equipment. Unless the entire chain of the process is HD, no HD quality will be seen by the viewer.</p> <p>This loophole should be closed, or else HD content will be allowed without in fact having HD quality.</p>	

Recommendation 9

<p>Redefine the Australian minimum standard of HDTV to 720p</p>	<p><i>Introduction</i> <i>July 2006</i></p>																				
<p>720p offers all of the benefits of 576p, but with over twice the potential image quality.</p> <p>The current classification comes about as a pure function of the equipment capabilities: 576p is a format unsupported by SDTV hardware, and is therefore classified as HDTV.</p> <p>However, standards in Europe, Japan, China and Britain do not recognise 576p as “high definition” for the purposes of industrial classification and marketing. USA and Canada, which have an equivalent called 480p, also do not classify this as “high definition”. 576p and 480p are recognised as “enhanced definition” in every country other than Australia.</p> <p>This is for the simple reason that 576p is far too similar to the maximum quality of 576i (SDTV).</p> <table border="1" data-bbox="148 1357 1342 1473"> <thead> <tr> <th></th> <th>576i</th> <th>576p</th> <th>720p</th> <th>1080i</th> </tr> </thead> <tbody> <tr> <td>Sports: Effective quality</td> <td>0.2 megapixels</td> <td>0.4 megapixels</td> <td>0.9 megapixels</td> <td>1.0 megapixels</td> </tr> <tr> <td>Films: Effective quality without processing⁴</td> <td>0.2 megapixels</td> <td>0.4 megapixels</td> <td>0.9 megapixels</td> <td>1.0 megapixels</td> </tr> <tr> <td>Films: Effective quality with processing⁴</td> <td>0.4 megapixels</td> <td>0.4 megapixels</td> <td>0.9 megapixels</td> <td>2.0 megapixels</td> </tr> </tbody> </table> <p>Note that this is a discussion of the quality of the broadcast data, not the quality of the display device. An assumption is also made that the networks do not apply sharpening filters to interlaced formats, which can degrade interlace format detail.</p> <p>Because of the effects of multichannelling on compression quality, it may be wise to allow 576p for any broadcaster that has already received dispensation to use upconverted material under the HD quota — but <i>only during times of upconversion</i>. 576p is an ideal format⁵ for the purposes of upconversion from 576i.</p> <p>For networks that do not already have an upconversion dispensation, it will be wise to activate and deactivate the HD signal, as permitted under the HD quota. This is a practice successfully applied by the Nine Network, and has previously been used by Network Ten. Any additional SDTV services can be temporarily withheld during an HD broadcast, as “special event” programming, as done by the Seven Network during the Olympic ceremonies.</p>			576i	576p	720p	1080i	Sports: Effective quality	0.2 megapixels	0.4 megapixels	0.9 megapixels	1.0 megapixels	Films: Effective quality without processing ⁴	0.2 megapixels	0.4 megapixels	0.9 megapixels	1.0 megapixels	Films: Effective quality with processing ⁴	0.4 megapixels	0.4 megapixels	0.9 megapixels	2.0 megapixels
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⁴ Optimal processing will display all the detail available in the broadcast data. When an interlaced format is used to broadcast a film, it becomes equivalent to a progressive format of the same size. This is due to every pixel in a film *frame* being *segmented* across two interlaced fields. A film broadcast under 1080i50 becomes 1080sF25, equivalent to 1080p25 (all MPEG-2 macroblocks are progressive).

Recommendation 10

Mandate all TV networks to insert information for a full week's programming into the pop-up information	<i>Introduction</i> July 2006
<p>The basic standards for digital TV allow the pop-up information to contain more than merely the "Now" and "Next" data that all viewers currently see. It is in the basic capability of the digital TV standard for more than this basic information to be provided.</p> <p>Only a few Australian broadcasters, outside the eastern seaboard, currently provide this information. It is standard practice in many DTV markets worldwide, and can be seen by some existing decoders in homes today.</p> <p>This change will significantly encourage the uptake of digital PVRs to replace VHS VCRs, because the programming and viewing of time-shifted programs is made much more interactive and viewer-friendly this way. It will become one of the key selling points of digital.</p>	

Recommendation 11

Amend the decoder standards to include 14:9 widescreen letterboxing as well as 16:9	<i>Standard ratified</i> July 2006 <i>Standard mandated on all new boxes sold</i> July 2008
<p>This is a minor amendment to the minimum feature requirements, to provide parity with the standard practice on all analogue channels when a widescreen programme is shown. It also provides parity with this feature on Foxtel Digital decoders.</p> <p>This will allow widescreen programme producers to better leverage their new format, thus promoting a format unique to digital TV. Widescreen programme producers will no longer have to accommodate the lowest common denominator when producing for both 4:3 and 16:9.</p> <p>While this is a negligible cost factor in a decoder worth \$300, especially in the context of using the same processing requirements as already provided by 16:9 letterboxing and 4:3 centre-cutting, this will have an impact on the lowest priced decoders unless given a generous lead-time as suggested.</p>	

⁵ If converted optimally: see Appendix B.

Recommendation 12

Instruct ABC to broadcast the HD version of a programme when the HD media is offered to them	<i>Application</i> <i>July 2006</i>
<p>The cheapest way to show HDTV is to buy an overseas show produced in that format. ABC has been given, at no cost, enough spectrum to display HD formats. However, despite showing some recent shows from North America available on HD tape, ABC has either requested only the SD tape or has only been offered the SD copy. Whether an HD copy is available for the same price is confidential information that ABC does not wish to disclose; however, this point is rendered moot because the ABC has never made an attempt to request the HD copy, but rather, has acted with the same behaviour as a British network that is not setup to broadcast an HD signal. This is despite the fact that ABC has invested in the acquisition of in-house HDTV production facilities.</p> <p>As a consequence, some viewers are misled into believing that the ABC HDTV service, which is intermittently active, broadcasts HD quality when it is indeed active. But by showing only upconverted content, these viewers are given an underwhelming example with which to gauge HDTV quality, and no explanatory note is easily found other than the label of "ABC HDTV".</p>	

Recommendation 13

Hold an investigation into the possibility of aggregating the (metropolitan) SDTV signals into single multiplex broadcasts, using a single unused channel per market	<i>Findings</i> <i>July 2006</i> <i>Implementation</i> <i>July 2008</i>
<p>Such a move would allow the broadcasters to keep their dedicated spectrum previously allocated, and maximise their potential under a more rigorous multiview and HD regime. The five free-to-air networks would share a channel where their main signal, currently mandated under triplecasting, would be relocated. It would replace the triplecast signal on their main signal where it is currently occupying valuable bitrate that could be more useful for experimental and innovative purposes.</p> <p>It would also have the valuable side-effect of allowing a viewer to simultaneously see all five main programmes of the broadcast networks, with only one digital tuner. This would be possible on certain decoders, home-theatre PCs and on most computers with digital TV.</p>	

Recommendation 14

Launch a fourth commercial network on digital only, for the purposes of promoting digital.	<i>Licence</i> July 2006 <i>Launch (latest)</i> July 2008
<p>This would provide a similar incentive for digital uptake as is provided by Network Ten's digital-only service in Tasmania.</p> <p>An investigation would be necessary to determine whether enough spectrum was available in metropolitan areas, nationwide, or both. A tender process, or a "beauty pageant" to compete for public benefit, will then determine the licence allocation. This recommendation would possibly be mutually exclusive to Recommendation 13.</p>	

Recommendation 15

Formalise the conventional method of displaying film content	<i>Application</i> July 2006
<p>Since the launch of television in Australia in the 1950s, film has been shown in one way on Australian TV, which is identical to the convention used in Britain, Europe and other PAL/SECAM countries.</p> <p>However, some networks have begun displaying occasional high definition films with a different method. This has been detrimental to the SDTV image as well as providing an inferior HDTV image.</p> <p>Because film usually operates at a speed of 24 frames per second, and Australian television operates at 50 fields per second, the logical method is to increase the film speed by 4% to 25fps. Each film frame can then be simply displayed twice.</p> <p>Some film content is supplied from America on tape based at 60 fields per second. In these cases the film is not sped up, but the frames need to be laid down on tape in a special order, to divide 24 into 60.</p> <p>Historically, films supplied from America in this way have not been a problem⁶, because equipment exists to perform the relatively simple task of reversing this process to recover the 24 frames of film from the American tape. Then, as usual, this is sped up to 25fps and broadcast in Australia.</p> <p>However, for a small proportion of high definition films, this has not been done⁷. Instead, the tapes have been treated as any other American non-film content would be, and this produces a frame rate that is not designed for Australian TV.</p> <p>Without an industry code of practice on this matter, films incorrectly broadcast will pause quickly (jitter) twice per second, as the gap in the 25/50 broadcast waits for the slower 24fps film to catch up. On the SDTV triplecast, this effect is exacerbated, as the field order is reversed twice per second, thus making it impossible to automatically recover the full 576 lines of detail in each film frame. This problem will also be evident on the HDTV channel if the HD format is 1080i.</p>	

⁶ However the remastered version of *Terminator 2* was only remastered in the American video format.

⁷ Three examples include Seven's HD broadcast and repeat broadcast of *The World is Not Enough* and Ten's HD broadcast of *Top Gun*.

Recommendation 16

Hold a future inquiry into the progress of HDTV in Europe	<i>Timeframe</i> 2006-2008
<p>This enquiry would be held with a view to replacing our MPEG-2 HD broadcasting with MPEG-4 HD broadcasting, for increased quality in our triplecasting regime.</p> <p>(This is to be suggested whilst maintaining a base-level MPEG-2 SD broadcasting to allow the continued use of low-price decoders, in the original spirit of our triplecasting regime).</p> <p>This increased quality will therefore provide an incentive for HD viewers to replace their decoders — which will remain able to view SDTV services, nonetheless. HD decoder owners are more likely to be open to the benefits of a future incompatibility, and have more budget to spend on upgrades, than SD decoder owners.</p> <p>A future MPEG-4 broadcast regime, using simple profiles or the latest H.264 technology, could allow HDTV quality that is only possible today without triplecasting. This would mean the networks could feasibly provide a 24/7 broadcast of one or two SDTV channels compatible with today's decoders, plus a video EPG, and still provide a 24/7 HDTV service at quality approaching the future HD-DVD standard.</p>	

Appendix A

Seven's High Definition Demonstration: Promoting an Unfit Illustration of the Format



Figure A1:
The picture as broadcast on Channel 70,
on-air most weekdays since 2004.

Figure A2:
The same picture with the quality partly restored,
reconstructed⁸ for the purposes of this document.

examine: • the stripes in the reflection • the stripes in the HD logo • the edges of the white letters • the vertical stripes in the lights

Figure A1 shows a single frame of the promotional video created by the Seven Network. There is a serious issue with the technical quality of the entire 15-minute loop, which becomes a concern when it is considered that this video was designed with the single intention of promoting technical quality.

The basis of the fault is that each frame of the entire video — not only the image above — has only half the vertical detail that it should have, and that pairs of frames shimmer⁹ with the characteristics of interlaced SDTV video — an defect normally alleviated by this particular kind¹⁰ of HDTV.

For this reason it is surmised that Seven's HDTV loop since 2004 has been produced using SDTV technology, in part. In the overall process, one deliberate effect was to reduce the frame rate:

Demonstration Loops on SD-DVD or HDTV	Seven loop: 576p	Nine & Ten loops: 1080i	Potential with SD-DVD	Potential with 576p	Potential with 720p
Effective ¹¹ vertical detail in a moving image	288 lines	540 lines	288 lines	576 lines	720 lines
Effective ¹¹ vertical detail in a still image	288 lines	1080 lines	576 lines	576 lines	720 lines
Number of unique images per second	25	50	50	50	50
Vertical flicker (no processing applied)?	yes	yes	yes	no	no

From a political perspective, it must be remembered that the Seven Network has opposed the regime of HDTV. For this reason it can also be surmised that it is in Seven's interests to reduce the quality of what consumers see labelled as "HD", in order that they form incorrect conclusions about HDTV.

⁸ Using software partially written by this document's author.

⁹ A symptom that is, regrettably, difficult to illustrate in a document such as this.

¹⁰ There are different varieties of HDTV, and Seven chose to use a "progressive" format (576p).

¹¹ Represents the amount of detail contained in the broadcast data; this is the maximum amount of detail that can be visible, depending on the viewer's equipment and configuration.

Appendix B

Seven, SBS and ABC HDTV:

Converting SDTV content into Lower Quality, not Higher Quality



Figure B1:

ABC HDTV uses an upconversion¹² process that takes 6 unique moments of an SDTV video to produce each frame of HDTV. This produces visible smearing on moving images (such as in this figure), and removes film grain detail on still images.

examine: • the trails to the right of David Stratton • the extra pre-emptive trail that appears in the other direction, to the left of the vertical white line • the dark trails of the orange text • the horizontal smearing around Dave Hughes

Three networks have chosen to use a progressive format to provide their HDTV services. Therefore, when an HD programme is not available, these networks must convert their interlaced video into progressive video, effectively producing something from nothing.

Such a requirement is not unique to this process — it is also necessary in the common processes of correcting aspect ratios for widescreen programming, or when converting North American video into formats compatible with our systems and vice-versa. All of these must deal with reintroducing detail removed in the interlacing process.

To reintroduce that detail, some of the options¹³ will sacrifice half the spatial detail to achieve motion detail; others will sacrifice half the motion detail to gain more spatial detail; and yet others will analyse the picture to see when each of the two previous options are better suited to different parts of the picture. ABC's method is a variation of the first option with multi-frame blending.

An HDTV decoder from DGTEC, with a mere price of \$700 in 2001, uses a simple analysis to achieve the third option, when tuned in to an SDTV channel viewed from its progressive video HD output.

Upconversion system	Seven & SBS upconverter	ABC upconverter	DGTEC \$700 upconverter	Nine & Ten upconverter ¹⁴
Effective ¹¹ vertical detail in a moving image	288 lines	288 lines	288 lines ¹⁵	288 lines
Effective ¹¹ vertical detail in a still image	288 lines	576 lines	576 lines ¹⁵	576 lines
Number of distinct images seen at once	always 1	always 6	1 or 2	1 or 2
Interlace-style vertical flicker	yes	yes	usually no	yes ¹⁴ w/o processing

¹² Upconversion is a policy of generating HDTV simulations using SDTV footage, when no true HDTV footage is available. In the case of ABC HDTV, this is 100% of the programming output (see Recommendation 12).

¹³ There is no one "correct" option; but some of these take more effort and produce more pleasing results than others.

¹⁴ Nine and Ten produce (500% better) interlaced output. This cannot be directly compared to the other conversions.

¹⁵ The DGTEC truncates 36 of these lines to produce 540 lines (in 'AV2' mode), but those remaining have the same detail as 576 would.

About the Author

Christian Kent has experience in the broadcast industry in the production of interactive digital applications for both the free-to-air and subscription networks. He also worked for the Sydney Olympic Broadcast Organisation in 1998-2000, coordinated the coverage of the Australian Law Students' Association Conference in 2004, and is part of a team that produces commercial MPEG-4 codecs for the personal computer market.

Christian has written the syllabus on digital video and sound for the University of Technology, Sydney and has offered his services as a part-time academic to lecture in Digital Multimedia at UTS.

He is currently working on the Limited Symmetric Downconverter, a new standards converter that will be able to carry PAL-quality signals across NTSC, SDTV widescreen quality across letterboxed PAL, and HDTV quality across SDTV.