1 December 1999

Professor Richard Snape
Presiding Commissioner
Inquiry into Broadcasting
Productivity Commission
Locked Bag 2
Collins Street East
Melbourne VIC 8003

Dear Sir

ntl response to Draft Productivity Commission Report on Broadcasting

[1] ntl wishes to thank the Commission for providing the opportunity for comment on the Commission's draft report on Broadcasting. ntl has been scheduled to address the Commission and would like to provide the following supporting comments.

[2] ntl supports the general thrust of the Commission recommendations. In responding, we have restricted our comments to those areas in which our specific expertise may be of assistance to the Commission, specifically the introduction of digital transmission, broadcasting licences and spectrum allocation.

[3] It is our view that the vigorous debate within Australia about the realities associated with the introduction of digital high definition television (HDTV) has led to some confusion, particularly around the conditions which have been set by the current Australian standard.

[4] The following comments reflect ntl's experience in the United Kingdom (UK), where the company has been at the forefront of the ***technical*** standards underpinning the introduction of digital television and radio, as well a substantial ***commercial*** player in the new digital broadcasting domain. On this basis, we aim to clarify some of realities associated with the introduction of digital television in Australia.

1. Background and Context

[5] In its May 1999 submission to the Productivity Commission, ntl articulated a number of principles that it saw as being central to the efficient and effective introduction of digital broadcasting (particularly television) in Australia. It is appropriate to reiterate and expand on these:

- The ***efficient management and allocation of spectrum*** will be a critical success factor in the digital conversion process (where 'success' is measured by provision of new and enhanced services to the community and the rate of acceptance of these services). As a finite resource, the availability of spectrum correlates directly with the potential for new service offerings.

- The establishment of appropriate ***digital broadcasting technical standards*** is also of vital importance to the success of the digital conversion process. The specification of reception equipment (ie. set-top boxes and digital televisions), for example, will determine what services can be accessed by the consumer and how affordable this equipment is (and, therefore, the rate of take-up).

- ***'Datacasting' or interactive services*** potentially represent a revolution in terms of the provision of information to consumers, particularly in regional and rural Australia where existing communications infrastructure is inferior to that available in metropolitan communities. The definition of 'datacasting' should not be unduly limited in terms of permissible content and this new industry should be as competitive as possible.

[6] In putting this current submission to the Commission, we acknowledge the political reality, that the framework for the introduction of digital television in Australia will include a high definition television (HDTV) component. On this basis, we do not seek to canvass the arguments for standard definition digital television (SDTV) to the exclusion of HDTV, but focus on the issue of the desirability of ***the simultaneous transmission of both HDTV and SDTV***.

2. HDTV and SDTV Standards

[7] In summary and recognising the existing legislative framework for the introduction of digital television, ntl believes that the simultaneous transmission of HDTV and SDTV is both technically achievable and highly desirable from a public policy perspective. The information that follows seeks to verify both of these propositions, and respond to the Commission's uncertainty on this point in the Draft Report (page 128).

a) Technical Issues

[8] The Australian transmission standard provides for varying levels of HDTV and suggests three which are likely to be used in Australia (1080i, 720p and 576p). ntl understands that any resolution beyond the Main Profile @ Main Level including 1080i, 720p and 576p qualify as HDTV within the definitions of the Motion Picture Expert Group (MPEG) and Digital Video Broadcasting (DVB) technical standards.

[9] Each of these HDTV levels result in a picture of particular quality and utilise a different bit rate. The bit rate required for a particular outcome can vary depending on the attributes of the particular ***encoder*** used and the quality and type of the ***source material***. A good encoder with clean, film-based source material would utilise 10Mbits/sec more effectively than 20 Mbits/sec with a poor encoder. A bandwidth of 7 MHz provides a bit rate capacity of approx 19.35 Mbits/sec when using the nominal parameters suggested in the Australian Broadcasting Authority (ABA) Planning Handbook.

[10] Technical experts in the US differ as to whether 1080i or 720p provides better picture quality. The quality of a HDTV picture generated by ***both*** 1080i and 720p is comparable with the quality generated in the production of motion picture films. The quality of a HDTV picture generated by **576p** is still far superior to either an analog or an SD picture and is 'true' HDTV.

[11] Depending on the particular encoder used and source material quality, as discussed above, a HDTV picture generated using 1080i can take from 10 Mbits/sec up to virtually the whole 7 MHz bandwidth capacity (ie around 19Mbits/sec). However, typically, HDTV at resolution 1080i requires a bit rate of 16-18 Mbits/sec (ie. effectively the whole bandwidth), 720p requires a bit rate of 12-14 Mbits/sec and 576p a bit rate of 8-10 Mbits/sec. Both 720p and 576p utilise less than the available capacity within the 7 MHz of available spectrum leaving ***capacity for both SDTV*** (typically requiring 4-6 Mbits/sec), ***and other services such as datacasting*** (which could utilise a portion or the whole of the available bit rate) to be transmitted within the same bandwidth.

[12] The following table identifies the number of HDTV, SDTV and other services which could be provided within the 7MHz bandwidth or 19.35Mbits/sec channel capacity, for each of the proposed DTV standards.

Service	**Typical bit rate requirement (Mbits/sec)**	**Number of HDTV and SDTV services within 7MHz Capacity (19.35Mbits/sec)***	**Other potential services (Datacasting)**
HDTV 1080i	16-18	HDTV x 1 SDTV x 0	Yes, but opportunistic only
HDTV 720p	12-14	HDTV x 1 SDTV x 1	Yes Potential for fixed bit rate and opportunistic datacasting
HDTV 576p	8-10	HDTV x 1 SDTV x 2	Yes Potential for fixed bit rate and opportunistic datacasting
SDTV	4-6	SDTV x 4	Yes Potential for fixed bit rate and opportunistic datacasting

*Based on final Australian Standard utilising a 1/8th guard interval, 64 QAM modulation and 2/3 rd Forward Error Correction Code Rate (consistent with ABA Digital Terrestrial Television Broadcasting Planning Handbook July 1999 ref 2.2.1).

b) Public Policy

[13]   In ntl's view, the public policy benefits in the HD/SD simulcast proposition are simple. Simulcasting will deliver the benefits of true HDTV picture and sound (either 720p which experts concede is difficult to distinguish from 1080i, or the highly acceptable 576p), together with the superior technology take-up rate that will result from giving consumers greater choice (in terms of quality of service as well as reception equipment prices and characteristics).

[14]   As a corollary, it is reasonable to suggest that the HDTV/SDTV simulcast will significantly stimulate datacasting usage and competition, and therefore the viability of this new and promising industry (ie. availability of more affordable reception equipment and more capacity for non-traditional broadcasting uses).

3. Receivers

[15] There has been much debate centred around the cost of HDTV receivers and the impact that this may have on the take-up rate of HDTV. This is an issue that the Productivity Commission commented on at some length in its Draft Report.

[16] ntl wishes to table a number of further comments with the Commission.

[17] HDTV receivers are clearly significantly more expensive than SDTV receivers and, importantly, will probably remain significantly so for ***at least the foreseeable future***. This is due to the requirement for more video memory and more powerful decoder chips. Price is clearly also influenced by the smaller market for these receivers, bearing in mind that there are no HDTV receivers currently being made under the DVB-T technical standards (HDTV's in the US are manufactured in accordance with substantially different technical standards).

[18] We concur with the Commission's thoroughly researched view on HDTV pricing in its Draft Report (table 6.2, page 124), with HDTV receivers in the US costing around US$7,000. These receivers incorporate display, demodulator and decoder and have the capacity to 'up-convert' programs transmitted in SDTV to HDTV. ***It should be noted that it is not possible to display HDTV pictures on an existing TV by means of a set top box***.

[19] This in turn raises the issue of down-conversion. A proportion of material will be produced in 1080i making down-conversion necessary prior to transmission at 720p, 576p or SDTV. From ntl's experience, provided a good quality professional down-converter is used, down-conversion degrades picture quality only slightly and transmissions of down-converted HDTV (ie to 720p or 576p), would be barely differentiable from the same material had it been produced in that HDTV standard originally.

[20] Conversely, material transmitted in SDTV and up-converted to HDTV in the receiver can result in perceived improved picture quality. There is no improvement in picture quality when transmitted HDTV material (which has been up-converted from SDTV) is then down-converted to SDTV in the receiver. In fact, this double conversion process (which could represent the majority of material transmitted for some time) is not only an inefficient use of spectrum but can result in noticeable picture degradation.

[21] In order for viewers to receive digital transmissions on their existing analogue TV sets, they will need to purchase a set top box (STB). However, if only HDTV signals are transmitted, then the viewed picture will be no better than a SDTV transmission, due to limitations in the display device. However, in the situation where a SDTV picture is transmitted, viewers will have the benefit of an improved digital picture (when compared with analogue) as well as access to datacasting services at lower cost.

[22] As outlined above, it is our view that given the high cost of HDTV receivers in Australia where parliament has mandated HDTV, simulcast of both HDTV and SDTV will be required to deliver the required take-up rate. This will require utilisation of

the 720p or 576p HDTV standard rather than 1080i currently being proposed in order to ensure that both HDTV and SDTV can be accommodated within the 7 MHz bandwidth.

4. Cost of Receiving equipment

[23] ntl experience with receiver costs in the UK suggests the following in relation to initial equipment pricing in Australia:

- Digital HDTV capable set top boxes - around A$500-1000
- HDTV capable 'integrated' digital televisions sets (with in-built Digital Terrestrial Television Broadcasting (DTTB) receiver)- around A$10,000
- SDTV capable 'integrated' digital television sets - around A$3,000
- Digital SDTV capable set top boxes – around A$200

[24] The most significant cost element of a HDTV integrated receiver is the display device, where a large screen is essential to obtain the full benefit of high definition. The above costs can be compared with the cost of a large screen PC monitor (which is small by TV standards) and typically costs around $3500 for a 22" screen.

[25] Some of the 'next generation' STB's are likely to contain a hard drive with several gigabyte capacity. Once again a comparison can be made with the cost of PC devices. A 25Gb hard disk would typically 'retail' at around $550 while a 10 Gb hard disk would 'retail' at $350.

[26] Whist such a hard disk facility would only be available in the middle and upper range of STBs, this additional cost is small when compared with the cost the display device.

5. Spectrum Efficiency and Potential of SFNs

[27] The Commission may be aware that ntl has conducted a trial of the use of large area single frequency networks (SFNs), in order to assist in the more efficient use of broadcasting spectrum. The issue has arisen in the particular context of digital channel planning for the Sydney area, given the likelihood that ***conventional spectrum management techniques will only give rise to one unassigned 7MHz channel available for datacasting in Australia's largest market***.

[28] SFNs allow a number of transmission sites to operate on the same frequency. They are spectrum efficient as they utilise less spectrum by requiring fewer frequency assignments. SFNs are being used successfully by ntl and other broadcasters in numerous overseas locations eg Spain, Portugal, Germany and Singapore, but only in situations where the distance between transmission sites is less than 38km.

[29] ntl firmly believes that SFN technology, if applied to the Australian situation, would have the potential to deliver improved spectrum efficiency, particularly in congested areas such as Sydney. As mentioned above, the indications are that spectrum congestion will result in less than the target number of channels being made available to broadcasters and datacasters during the simulcast period using conventional spectrum planning techniques. Any SFN operating in the Sydney would

need to operate over large areas ***ie up to distances of 70km*** to deliver improved spectrum efficiency.

[30] In June 1999, after extensive modelling of SFN operations to confirm the viability of large area SFNs, ntl established a SFN in the Canberra region and trialed its operation. The purpose of the trial was to test whether a ‘real life’ large area SFN functioned in accordance with the theoretical study.

[31] The ntl trial conformed to the proposed technical guidelines for DTTB transmissions as set out in the ABA Planning Guidelines. The two test sites chosen were Black Mountain Tower, Canberra and Bowning Hill, 60km from Canberra.

[32] The trials were conducted over a two month period and fully confirmed ntl modelling predictions of the viability of large area SFNs . However, as expected, and consistent with the development of all digital broadcasting and transmission equipment, the trials underlined the importance of setting standards, particularly for the receiver industry. It will be important that both the digital television and datacasting industries work with receiver manufacturers to ensure the development of receivers which have been appropriately designed to receive signals transmitted via SFNs.

[33] While the development of large area SFNs will be important for Australia it will also be of significant interest to other countries that are experiencing spectrum shortages.

[34] Following the trials, ntl has investigated the potential consequential impact of SFN usage on existing analogue transmissions in the Sydney region. ntl is satisfied that the ***use of SFNs will deliver five unassigned channels with little significant impact*** and overall less impact than is expected with the introduction of digital transmissions in Melbourne.

[35] As discussed above, the usage of SFN's within Australia and overseas will impact on receiver standards and receiver manufacture. Consequently, receiver manufacturers have been invited to attend the SFN working group set up by the ABA. ntl does not believe that the requirement to ensure reception for SFN transmissions will impact on the cost of digital receivers as manufacturers will only need to ensure that existing receiver components have the capacity to tolerate SFN usage. Furthermore receivers which are designed to operate in an SFN environment, will automatically result in a general improvement in reception in multipath environments (which result in ghosting).

6. Spectrum clearing

[36] The introduction of digital transmission will result in consequential effects on some viewers though the impact is expected to be small. In the first instance, some analogue services will need to be moved to different frequencies to avoid interference from new digital services (eg Ballarat, Bendigo). The ABA requires that the cost associated with these changes be borne on a ‘polluter-pays’ principle.

[37] There may also be a need to re-orient household antennas or for households to change antennas (say from VHF to UHF) as a result of digital transmissions.

[38] In the UK, the introduction of a new digital service brought with it the responsibility to clear spectrum and resolve related transmission difficulties. The total cost of spectrum clearance in the UK was approximately £6.5mStg for the introduction of six DTTB channels for a total capital expenditure of around £250mStg.

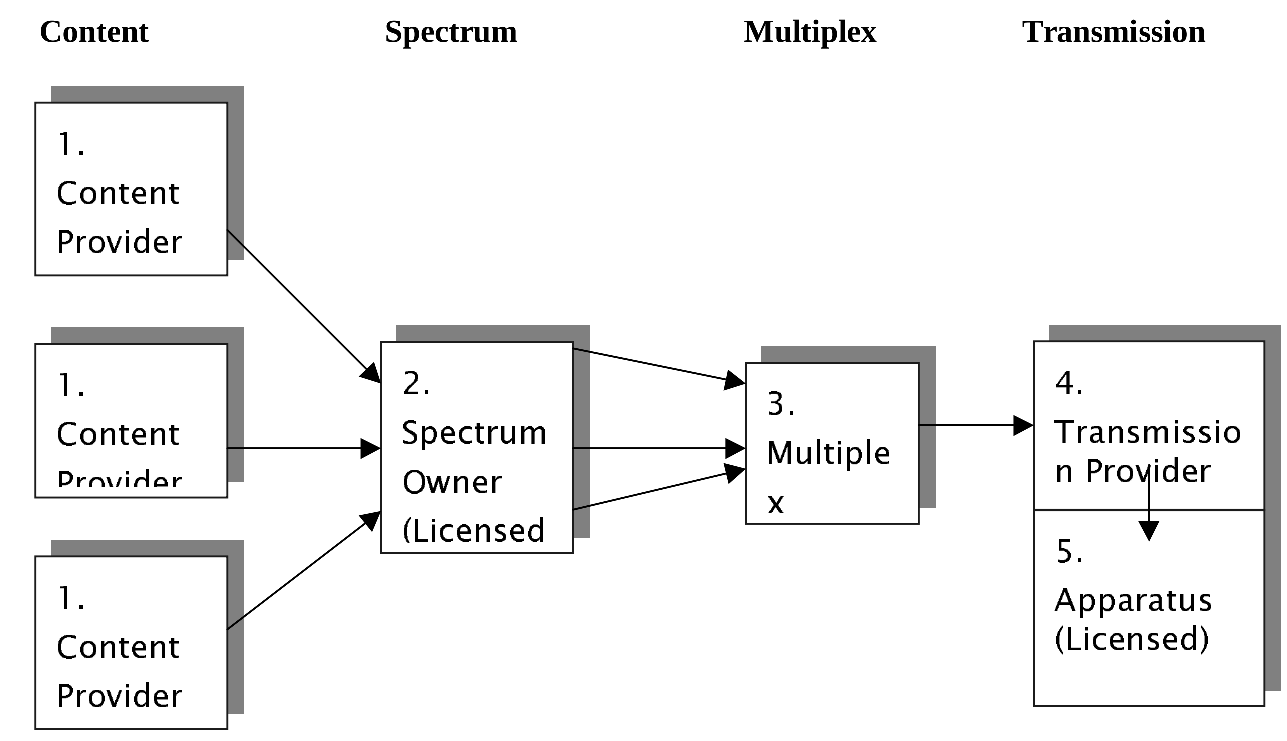
[39] ntl suggests that this model could be relevant in the Australian environment and be used to fund the consequential impacts of the introduction of digital transmission. ntl proposes that such entry costs apply to both incumbent and new entrants. These costs would of course be traded off against a lower bid price for spectrum.

7. Multiplexing

[40] One of the advantages of digital transmissions is the capacity to 'multiplex' or combine separate program signals and transmit them through a single transmitter (compared with analogue which requires a transmitter for each program stream). This capacity means that the 7 MHz of spectrum allocated to a particular broadcaster could incorporate a number of separate program signals rather than be taken up by a single program as currently occurs with analogue transmissions. Multiplexing therefore becomes an additional function in the transmission of digital signals and part of the transmission chain.

[41] The following diagram was developed by ntl as part of its submission to the Australian Communications Authority (ACA) relating to the regulatory framework for datacasting and illustrates the place of the multiplex and or multiplex manager.

Datacasting Model



[42] The interposing of the multiplex operator in the transmission chain clearly has potential policy and regulatory implications in relation to digital broadcasting and datacasting. The following summarises the position put by ntl to the ACA (which has clear similarities to the general broadcasting licensing model advocated by the Commission in Section 4.2 of the Draft Report):

- Datacasting content providers should be separately licensed to datacasting spectrum owners.

- Datacasting content providers should be licensed under the Broadcasting Act (as are existing commercial television licensees).

- The appropriate ‘competitive point’ for datacasting is the awarding of a datacasting licence in the form of a spectrum licence (eg. through an auction system). Bundles of spectrum (ie. 7 MHz channels) would be allocated for specific geographic areas or markets, and bidding would be open to a wide range of industry participants including content providers, transmission providers and potential multiplex operators.

- Ownership of a spectrum licence would bring with it automatic entitlements to transmitter / apparatus licences under the Radiocommunications Act.

- Should it be deemed appropriate in a policy sense to ensure plurality in the provision of datacasting services (eg. to avoid domination of the new medium by one or two content providers), one possible model could provide for an obligation on all spectrum owners to make a certain amount of their spectrum (eg. 50%) available on reasonable commercial terms to other prospective datacasters/content providers, subject to the relevant level of demand existing in the market.

8. Transparency for community broadcasters

[43] ntl believes that whatever model is introduced for the allocation of spectrum to community broadcasters, it should incorporate an open and transparent process.

[44] The Government has a number of options. These include:

1. the allocation of specific spectrum for use by community broadcasters;
2. subsidising the cost of transmission;
3. imposing a "must carry" provision on a datacaster either nationally or within license area; and
4. imposing the cost of transmission of the community broadcaster on a datacaster

[45] In its submission to the ACA, ntl proposed that the government impose a "must carry provision" on one datacasting channel within any license area. This means that the government would require the datacater allocated that particular channel (perhaps through a bid process) to provide spectrum to the community broadcaster so that it can transmit SDTV. This would effectively reduce the capacity available to the datacaster and would be expected to have an impact on the price paid for that spectrum.

[46] ntl further proposed that the community broadcaster be required to pay for its own transmission costs, unless the government proposed to provide a direct subsidy.

[47] Implementation of this proposal would directly impact on the revenue which the Government could receive through the auctioning the datacasting channel.

Thank you again for the opportunity to comment on this matter.

Yours faithfully

TOM BENNIE
Managing Director