Submission by Free TV Australia

Media Reform Green Paper

May 2021

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ATTACHMENTS

1. Executive Summary

A strong Australian media industry is in the national interest

- The growth of global media platforms has important implications for Australia's national and cultural identity, and for our access to local information. A strong local media sector is central to our ability to maintain public participation and trust in democracy and a shared sense of national identity.
- This is the lens through which all aspects of the discussion opened by the Media Reform Green Paper must be viewed. The rapidly changing media sector means that Australia needs a new framework to secure a strong future for free television broadcasting.
- It is critical that policy settings for future delivery of television services are set in such a way as to ensure that as a country we can continue to enjoy the benefits delivered by a viable and thriving local broadcast industry. Without this, we risk losing our access to local news, local stories and free sport.

A comprehensive approach to a future state for free broadcast television is needed

- The commercial free-to-air TV industry welcomes a conversation with Government about a roadmap for the future evolution of the free-to-air TV platform. The industry is willing to engage in the technical and wider policy aspects of this discussion, including whether it is possible to deliver an eventual reduction in broadcaster UHF spectrum. However, the overriding consideration must be on maintaining a sustainable, free, universally available and competitive TV industry in metropolitan, regional and remote licence areas.
- Securing a vibrant media industry, rightly considered in the Green Paper as 'essential for the economic and cultural health of the nation', requires a more comprehensive approach. Spectrum allocation and future transmission technology are two issues that warrant careful analysis as part of this process, but the discussion should be driven by the broader regulatory and commercial settings necessary to ensure a strong commercial television industry into the future.
- In particular there is a pressing need for early regulatory and other actions in a number of key areas, including:
    - Measures to safeguard the prominence and therefore accessibility of terrestrial broadcast channels and BVOD services[1], on connected TVs and other devices;
    - Ensuring internet providers cannot discriminate against different users on their networks based on the financial relationship between them (enshrining principles of net neutrality);
    - Ensuring Australians continue to have access to iconic sporting events for free by extending anti-siphoning regulations to apply to online video platforms;
    - Proceeding with the 2017 commitment to review the commercial broadcast tax (CBT) and the regional support package as stipulated under current legislation;
    - Addressing the financial pressures affecting the sustainability of free-to-air television broadcasting in regional and remote areas.

[1] "BVOD services" refers to both linear streaming and on-demand services provided by broadcaster video-on-demand (BVOD) applications. See the glossary at the end of this submission for further details.

Commercial television is an essential service with a vital long-term role supporting Australian culture and civic life

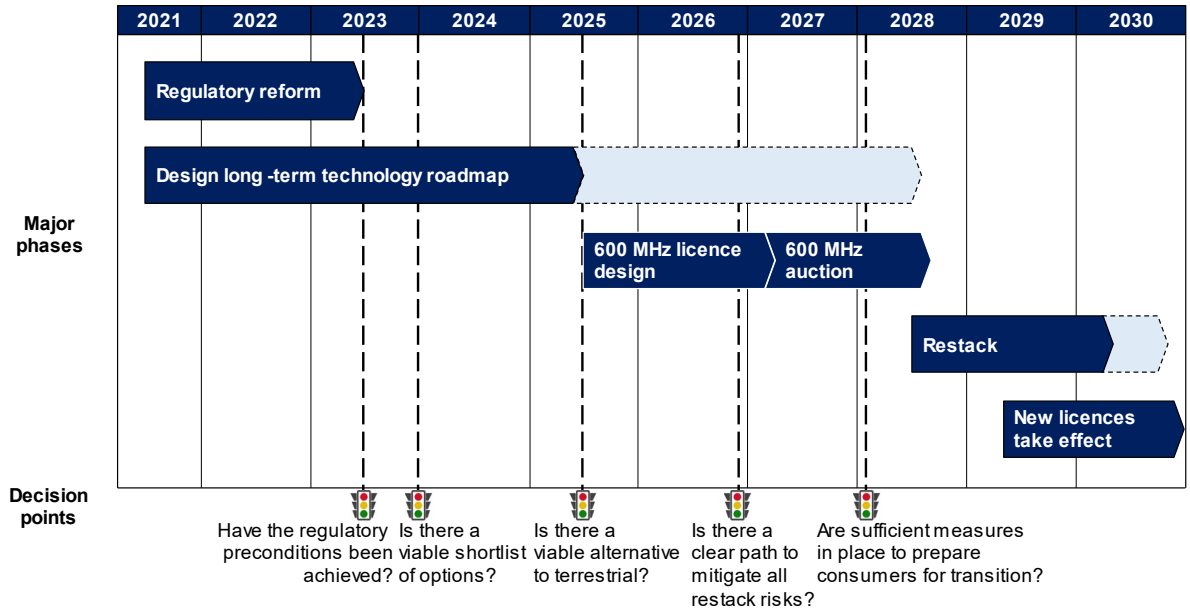
- Commercial free-to-air broadcasting is an essential service that remains the centrepiece for the universal and free delivery of socially inclusive and culturally relevant programming, including live sport, local news and entertainment programming. The industry's unique contribution to Australia's shared culture and civic life cannot and should not be understated.
- 6.5 million Australians tune into commercial television news and current affairs every day and more than 17 million people watch something on commercial television every week. Likewise, BVOD services continue to grow, with total viewing minutes growing by 40% over 2019-20.[2]
- Free-to-air TV delivers a wide range of public benefits and is highly valued by the overwhelming majority of Australians. 95% of Australians think that losing commercial free-to-air TV would have a detrimental impact on society.[3]
- These benefits include:
    - Providing one of the biggest sources of Australian stories and sport;
    - Being a highly trusted source of local news;
    - Contributing to a shared sense of Australian identity and underpinning our vibrant democracy;
    - Providing the above benefits at no cost to viewers, ensuring free and fair access for all;
    - Contributing over $2.3 billion per year to the economy and supporting 16,300 jobs;[4]
    - Investing $1.6 billion per year in the Australian content production sector, sitting at the heart of our screen content sector and making content for local not global audiences.[5]
- The industry is investing heavily to meet the demands of modern audiences by providing them the quality of content they demand and delivery through the platform of their choice.
    - Given the medium-term criticality and dominance of the terrestrial platform, Free TV broadcasters are already leveraging the full efficiency benefits of MPEG-4 to convert all services to high definition. A transition to MPEG-4 through the progressive rollout of MPEG-4 channels has been underway across the broadcast sector since 2013. This will enable broadcasters to improve the quality of the services they deliver to meet consumer demand, which is driven by improvements in consumer electronic equipment screen resolution.
    - Metropolitan broadcasters have also responded to the demand for internet-delivered as well as terrestrial broadcast services, investing over $550m in technology and innovation to build world-class BVOD services.
    - Regional broadcasters have maintained localised news and local advertising in segmented sub-markets to regional viewers.

[2] Oz TAM VPM. H2 2019 to H2 2020. Numbers rounded to nearest 1000.
[3] Deloitte Access Economics, 'Everybody Gets It: The Economic and Social Benefits of Commercial Television in Australia', 2020.
[4] Ibid.
[5] Ibid.

To ensure the sustainability of Free TV services, we need a broader conversation about the long-term TV technology platform

- Though the initial proposals in the Media Reform Green Paper do not meet the needs of viewers or the broadcast sector, we welcome the Government's openness to other suggestions. There is time to get this right.
- The industry commends a more holistic view of TV evolution, noting that TV delivery is already a 'hybrid' of multiple platforms and will remain so.
- The proper starting-point for this exercise is a detailed consultation process with all stakeholder groups, to understand how their requirements of free-to-air TV and the terrestrial broadcast platform will evolve over time.
- To inform our submission to the Green Paper, we have already consulted widely with a range of stakeholder groups over the time available, including broadcasters, consumer equipment manufacturers, transmission providers, consumers, Government and regulatory agencies. However, we would expect significant further work is required.
- A long-term roadmap might resemble the following figure (noting that the dates shown are indicative). The ultimate timeline and outcomes would need to address the objectives of Government, the industry and individual broadcasters, including achievement of regulatory reform and future pathways to a sustainable and competitive TV industry.
- Likewise, the milestone dates should be arrived at by consensus, having regard to the different business models and spectrum needs of each individual broadcaster.

Exhibit 1. Indicative timeline of the alternative process proposed by Free TV



The first step is regulatory reform ensuring the continued delivery and discoverability of free-to-air services on connected devices

- The single most urgent regulatory issue facing broadcasters in the connected environment is ensuring free-to-air content is prominent on connected TVs. The Government should regulate to require **prominence of free-to-air content** (both terrestrial broadcast TV and BVOD services) to ensure the Government's public policy goals in relation to Australian content are achieved.

- Likewise, principles of **net neutrality** should be embedded in the regulatory framework, to protect the social inclusivity of free-to-air TV in online environments. Net neutrality is required to maintain the status quo so that internet providers do not develop discriminatory practices against content providers based on the financial relationship between them.
- Finally, ensuring continued access to iconic sporting events to all Australians for free remains critical for audiences regardless of whether they access the content via terrestrial live TV or BVOD services. The **anti-siphoning list** should be updated by extending the regulations to online platforms to ensure the regime's original objectives are maintained.
- The Government should also commit to a proper **review of the existing commercial broadcast tax**. The Government introduced a five-year interim spectrum tax as part of the 2017 Media Reform Package, with a commitment to review the commercial broadcast tax (CBT) prior to 30 June 2021 stipulated in the accompanying current legislation.
    - The review should occur independently of the Green Paper process, in line with the commitments given to Free TV broadcasters when the CBT was introduced and in line with the legislative framework and associated statements in second reading speeches at the time.
    - The CBT is significantly higher in Australia than in comparable jurisdictions, and there is a strong case for the spectrum charge to be significantly reduced. Broadcasters could redirect these tax payments to focus on content, investing in broadcast infrastructure and future technologies.
    - Arrangements to compensate regional television broadcasters for the disproportionate impact of the 2017 spectrum tax arrangements are due to expire in 2022. Without these measures, some regional broadcasters could be required to pay spectrum taxes in excess of pre-2017 broadcast licence fees. The Government has not to date indicated any process to address this issue.
- Further, the regulatory proposals outlined in chapters five (CAST fund and PING Trust) and six (VOD content investment obligation) of the Green Paper risk undermining long-term industry sustainability by inflating the cost of local content production.

In addition to industry-level regulatory reform, consideration should be given to challenges facing each commercial television licence category

- In addition to the whole-of-industry regulatory concerns discussed above, metropolitan, regional and remote licensees have quite different operational requirements and cost structures.
- Metropolitan broadcasters face high input costs of obtaining and developing content and meeting content quota obligations. These costs are often, as in the example of sporting rights, locked in for the long-term irrespective of changes in revenue. Increasing competition for entertainment and drama programs has inflated costs.
- Regional Australian viewers expect a comparable level of service to that provided in metropolitan markets and any reform that emerges from the Green Paper process should ensure that this continues. However, regional broadcasters face much higher transmission costs per capita than metropolitan counterparts as many more transmitters are required to serve a smaller and more sparsely settled population. Long-term transmission contracts lock in the price of transmission irrespective of changes in advertising revenue or service uptake. Regional broadcasters cannot mitigate these changes in audience and revenue as they are unable to offer BVOD services.
- Remote commercial broadcasters are unsustainable in the absence of direct Government support.

- While remote broadcasting services are currently provided via a mix of terrestrial retransmission and satellite DTH (using the VAST platform), it would be far more cost effective and sustainable to deliver all services using satellite DTH, other than those in the largest population centres.
- To ensure the long-term sustainability of these services, the Government needs to provide funding to transition remote households to satellite DTH and to support ongoing satellite transponder costs and terrestrial retransmission to larger population centres in remote licence areas.

- While Free TV's submission represents the views of all commercial broadcasters, our members will lodge separate submissions dealing with additional individual or sectoral concerns.

To design the long-term technology roadmap, we need to retain optionality to upgrade the viewer experience over time

- The broadcast industry is open to exploring with the Government a platform upgrade path that would achieve both objectives of meeting future demand for television services while allowing some spectrum to be released for auction.
- Terrestrial delivery remains critical to viewers and our competitiveness.
  - Free-to-air television delivered via the terrestrial network will continue to be the primary way that Australians will access trusted news and local content over the medium term.
  - Australians therefore expect that the Government's policy settings will be consistent with a viable, sustainable, ubiquitous and freely available local free-to-air TV industry.
- Our current view is that the option of upgrading the existing terrestrial platform to DVB-T2 transmission technology and utilising HEVC compression technology needs to be preserved while the necessary further work is undertaken to assess the impact on viewers and available transition paths.
  - Relative to today's terrestrial platform,[6] DVB-T2 transmission and HEVC compression offer a long-term path to increased carrying capacity and improved picture quality, as consumer uptake of compatible TV receivers permits.
  - The spectral efficiencies generated by these newer technologies would collectively allow more content to be broadcast within a given spectrum allocation.
- Improvements in bandwidth utilisation and more effective data compression could open the door to a 600 MHz spectrum dividend while continuing to provide all Australians with competitive broadcast television service offerings.
- Vitally, a platform upgrade also offers a growth path to the improved picture quality TV viewers will expect. The additional capacity could be used to upgrade terrestrial broadcast TV to higher picture qualities (1080p HDR[7] and ultra high definition / 4K), which is essential for free-to-air TV to remain competitive.
- In addition to securing sufficient bandwidth for future broadcasting requirements, the full cost to broadcasters of any technology transition should be met by Government.

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[6] Currently, the terrestrial platform uses DVB-T transmission and a combination of MPEG-2 and MPEG-4 compression.

[7] 1080 progressive (1080p) with High Dynamic Range (HDR). Expected to deliver significant uplift in viewer experience relative to today's high definition services, which use 1080 interlaced (1080i).

- While operating on a common transmission platform, the technology roadmap should also allow for individual broadcasters to shape their own service offerings in accordance with their own strategic and commercial considerations.

The Green Paper proposal is not the way forward for terrestrial transmission – it cannot support the current number and quality of FTA broadcast services

- The proposal to achieve a 600 MHz dividend using three shared multiplexes and migrating all services to MPEG-4 compression will mean that broadcasters will have to either cut services or dramatically reduce picture quality.[8]
- MPEG-4 will not deliver the efficiency gains required to maintain service equivalence, because most high-definition services already use MPEG-4 – there is less 'low hanging fruit' than the Green Paper anticipates.
- Likewise, MPEG-4 is not an efficient enough compression standard to allow future improvements in picture quality, which the industry requires for long-term sustainability.

There is time to get the technology transition right – the lack of urgency of the 600 MHz 'digital dividend' supports TV's plans for a slower but sounder upgrade path

- More time is required for a suitable upgrade path for TV than the Green Paper proposals envisage.
- In part, this reflects the importance of ensuring sufficient penetration of compatible TV receivers. We expect the least-cost, least-disruption solution is to allow for natural replacement of TV receivers over time. This implies a late-2020s timeframe.
- Fortunately, broader market factors also support a late-decade timeframe:
    - First, the telecommunications carriers themselves have other sub-1GHz spectrum available sufficient to roll out 5G services, and do not seem to need or expect a mid-2020s timeline.
    - Second, independent economic modelling undertaken by CEG, included with our submission, has found that the economic value of the spectrum is likely to be maximised late in the decade.
    - Third, international precedent indicates that the Green Paper timeline would make Australia an early mover in the 600 MHz band, forcing us to 'make bets' on standards and technologies despite generally being a 'standards-taker'.
- The likely and unattractive outcome of the Government's proposed mid-2020s timeframe for completion of 600 MHz re-farming would be sharply diminished competition in the audio-visual entertainment industry (resulting from a diminished free-to-air offering), while successful mobile network operators 'warehoused' any vacated 600 MHz spectrum against future contingencies.

[8] We have reached this conclusion after extension consultation with commercial broadcasters, national broadcasters and transmission services providers.

2. Introduction

2.1 About Free TV

Free TV Australia is the peak industry body for Australia's commercial free-to-air broadcasters. We advance the interests of our members in national policy debates, position the industry for the future in technology and innovation, and highlight the important contribution commercial free-to-air television makes to Australia's culture and economy.

Free TV proudly represents all of Australia's commercial free-to-air television broadcasters in metropolitan, regional and remote licence areas.

Our members are dedicated to supporting and advancing the important contribution commercial free-to-air television makes to Australia's culture and economy. Australia's commercial free-to-air broadcasters create jobs, provide trusted local news, tell Australian stories, give Australians a voice and nurture Australian talent.

A recent report by Deloitte Access Economics *Everybody Gets It: The economic and social benefits of commercial television in Australia* highlighted that in 2019, the commercial TV industry supported 16,300 full-time equivalent jobs and contributed a total of $2.3 billion into the local economy. Further, advertising on commercial TV provided an additional $4.4 billion worth of economic benefit.

In addition to this economic analysis, Deloitte also undertook a consumer survey that highlighted the ongoing importance of the commercial TV sector to the community, including:

- 17 million Australians watch commercial television every week;
- 86% of people think that commercial television supports Australian culture;
- 76% think commercial TV is more important than ever; and
- 95% think losing it would have an impact on society.[9]

The commercial free-to-air broadcasting industry creates these benefits by delivering content across a wide range of genres. These include news and current affairs, sport, entertainment, lifestyle and Australian drama.

Free TV members are fully committed to the role that they play in telling Australian stories to Australians. They understand and appreciate the cultural and social dividend that is delivered through the portrayal of the breadth and depth of Australian culture on television.

Further, Free TV broadcasters also play a vital role in providing trusted news and current affairs during times of crisis, as shown by the audience response during the ongoing COVID-19 pandemic and the catastrophic bushfires of late 2019 and early 2020.

[9] Deloitte Access Economics, 'Everybody Gets It: The Economic and Social Benefits of Commercial Television in Australia', 2020.

2.2 Structure of our submission

For convenience, we briefly outline the structure of our submission. We begin in section 3 by outlining the essential services that commercial free-to-air TV provides to all Australians. These services and the immense value they provide to the country must be factored into any broader discussion of the industry.

Second, in section 4 we outline the immediate reforms that are required to ensure the ongoing delivery of these services to the Australian public.

In section 5, we then outline the industry's views on the long-term future of free-to-air content delivery, including the significant program of work that must be completed prior to any final decisions being made. Subsequently in section 6, we discuss in detail why the specific technical proposals contained in the Green Paper would not provide the right technology roadmap for the industry, in light of the considerations discussed in sections 3-5.

Finally, in the Appendix (section 7) we provide collated responses to the Green Paper consultation questions, further detail on the technical assumptions and analysis underpinning our submission, and a glossary of key terms.

3. TV a vital local service providing ongoing value to Australians

Key points:

- Commercial free-to-air television is a critical service to millions of Australians and remains fundamental to achieving many of the social and cultural objectives of the Government.
- These objectives include:
    - Providing a highly trusted source of local news, current affairs and information essential to a robust democracy.
    - Providing one of the biggest sources of Australian stories, including sport, and contributing to a shared sense of Australian identity.
    - Providing these services ubiquitously and for free to all.
    - Investing $1.6 billion per year in the Australian content production sector.[10]
    - Contributing over $2.3 billion per year to the economy and supporting 16,300 jobs.[11]
- The ongoing delivery of these social and cultural objectives to the public therefore requires a strong and sustainable free-to-air sector.
- A strong and sustainable free-to-air sector requires significant regulatory reform to address the issues outlined in section 4.

The growth of global media platforms has important implications for Australia's national and cultural identity, and for our access to local information. A strong local media sector is central to our ability to maintain public participation and trust in democracy and a shared sense of national identity.

This is the lens through which all aspects of the discussion opened by the Media Reform Green Paper must be viewed. The rapidly changing media sector means that Australia needs a new framework to secure a strong future for free television broadcasting.

It is critical that policy settings for future delivery of television services are set in such a way as to ensure that as a country we can continue to enjoy the benefits delivered by a viable and thriving local broadcast industry. Without this, we risk losing our access to local news, local stories and free sport.

While commercial television now needs to compete with a greater range of services than ever before, our recent experiences with bushfires, floods and COVID-19 demonstrate that Free TV broadcasters deliver a vital national public service. Australians expect and continue to rely on these services in times of national crisis to make sure they get the facts they need, and to bond with their communities over entertainment viewing.

The distinct role that free-to-air television plays in societies has been recognised in other jurisdictions. For example, in the UK the *Small Screen: Big Debate* consultation recently conducted by Ofcom found that: while public service content still matters hugely to people and society, and public service

[10] Deloitte Access Economics, 'Everybody Gets It: The Economic and Social Benefits of Commercial Television in Australia', 2020.
[11] Ibid.

broadcasters (PSBs)[12] underpin the creative economy, laws and regulations must be overhauled to support PSBs as audiences consume more content online.

In this section we outline five key public goods provided by the commercial free-to-air sector which would be put at risk if the regulatory framework is not significantly reformed to ensure a sustainable sector into the future:

- Trusted, accurate, fair and impartial news, current affairs and information services which support our democratic institutions;
- Supporting Australian cultural identity;
- Providing a free and ubiquitous service to all Australians;
- Being the bedrock of the local content industry; and
- Creating significant direct and indirect economic contributions.

In section 4, we then outline the key regulatory issues that must be addressed in order for these public policy objectives to continue to be delivered.

3.1 Supporting our democratic institutions

Trusted, accurate news, current affairs and information services are arguably the most important public policy good that commercial broadcasters deliver. These services are the key touchpoint for bringing Australian society together at critical times – including pandemics, fires and floods – facilitating understanding and informing debate in the community on local, national and international issues.

This is clear from the fact that TV is the main mechanism by which Australians access news.[13] Indeed, during 2020, 15.8 million Australians watched at least part of a news or current affairs program on commercial TV each month.[14] On average, 6.5 million Australians watch news and current affairs programming on commercial television every day, and the Monday to Friday main editions of the evening news bulletins on every commercial network had an average national audience of over 1.1 million during 2020.[15]

Our news services have always played a key role in providing important checks and balances on our political and legal processes by facilitating transparency and accountability. From matters such as challenging non-publication orders, reporting on court cases and investigating instances of alleged corruption, Australians have consistently relied on us to be their eyes and ears. In doing so, our public interest journalism plays a crucial role in a healthy functioning democracy.

[12] Public Service Broadcaster (PSB) is the term used in the UK to refer to all freely available terrestrial broadcast services, such as ITV, Channel 4 and the BBC.
[13] Deloitte Access Economics based on data from Deloitte, Media Consumer Survey, 2019. TV also includes SBS and ABC.
[14] OzTAM (5 City Metro) & Regional TAM (Regional FTA+WA database, Combined Aggregate Markets) | Overnight | 2020-21 by calendar month I Sun to Sat 06:00-23:59 | Total People I News / Current Affairs Genre I Cume Reach (1min TH), adjusted for overlap.
[15] OzTAM (5 City Metro) & Regional TAM (Regional FTA+WA database, Combined Aggregate Markets) | Overnight I 2020-21 by calendar month | Total People, Program based analysis - incl. Seven News & Seven News at 6.30, Nine News & Nine News 6:30, 10 News First & 10 News First 6pm | Mon-Fri.

In an internet age where the provenance of information provided to Australians is often unknown, these services are more important than ever. The continued accessibility of legitimate news is critical to ensuring that 'fake news' and misinformation do not 'drown out' credible information. This is a public policy challenge that has been recognised in a number of recent Australian Parliamentary inquiries and requires urgent attention.[16]

Free-to-air broadcasting services are licensed, regulated, local services accountable to Australians and are essential to countering the risks posed by the spread of misinformation and ensuring our democracy and public institutions remain strong. These services are regulated through the *Broadcasting Services Act 1992* and the *Commercial Television Industry Code of Practice*, with independent oversight from the Australian Communications and Media Authority (ACMA). Before the Code of Practice can be registered by the ACMA, the ACMA must be satisfied that the Code:

- Provides appropriate community safeguards for the matters it covers;
- Is endorsed by a majority of commercial television stations; and
- Members of the public were given adequate opportunity to comment.[17]

The reliability and credibility of free-to-air TV's news services can be seen from the fact that Australians trust commercial free-to-air television news more than almost any other source, with 75% of Australians trusting commercial TV news compared to only 31% trusting social media.[18] These services also ensure that there is a diversity in public interest journalism and that Australians are exposed to a plurality of viewpoints including via political analysis packages, dedicated current affairs and more discursive opinion-based panel programming.

For this reason, Free TV submits that the importance of the free-to-air broadcast platform to the functioning of Australia's democracy needs to be more explicitly recognised by the Government than was evident in the Green Paper—including the need to ensure that we have a viable, sustainable future growth path to maintain these vital services to Australians.

3.2 Supporting Australian cultural identity

Commercial broadcasters also play a critical role in informing, entertaining and enriching the lives of Australians. Seeing ourselves and our society represented on screen plays an important role that shapes who we are, reflects our shared history and binds us as a nation. It defines our culture and identity. It also lets us showcase Australia's people, our values – and our spectacular cities and landscapes – to the world.

In contrast to content on global platforms, Australian free-to-air broadcasters have a unique local perspective and commitment to local issues and the local content produced and broadcast by the free-to-air platform is made by Australians for a local audience. This places free-to-air television at the heart of building the Australian identity, through a socially inclusive and freely available platform.

An overwhelming majority of Australians (86%) believe commercial television supports Australian culture, across both metropolitan and regional areas.[19] Free-to-air TV is a fundamentally shared

[16] Inquiry into and report on all aspects of the conduct of the 2019 Federal Election; Select Committee Inquiry on Foreign Interference through Social Media.
[17] BSA, s 123.
[18] Deloitte Access Economics and Dynata, Consumer survey, 2020.
[19] Ibid.

experience, underpinning approximately 8 hours of 'family time' (co-viewing of free-to-air) every week.[20] This of course includes free-to-air TV's extensive coverage of a wide range of sports, which brings millions of Australians together on a weekly basis. Such connectedness is only made possible because the free-to-air platform is ubiquitous and free.

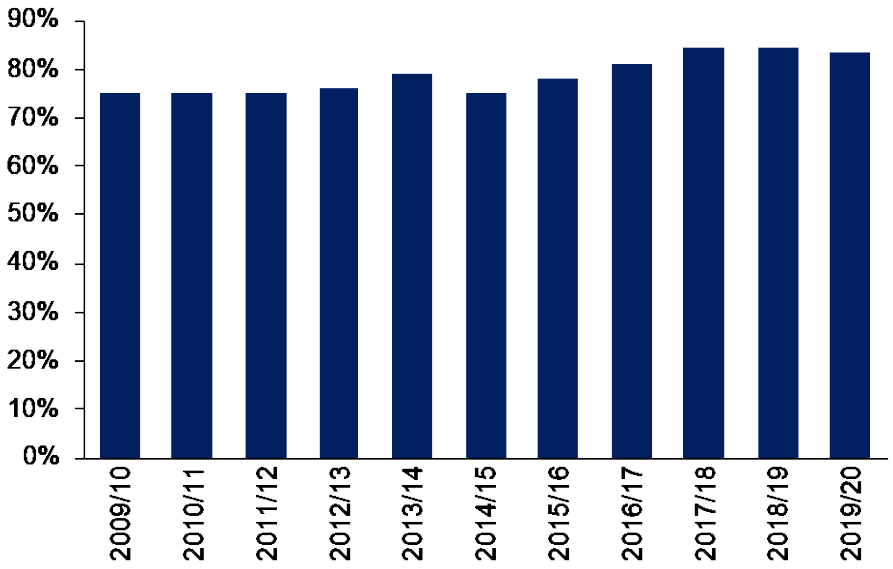
A strong commercial free-to-air broadcasting industry is key to a healthy local production ecosystem which in turn sustains Australian storytelling and local voices. As highlighted in section 3.3 below, despite recent changes in the media landscape, commercial free-to-air broadcasters remain the largest investors in the Australian screen production sector.

3.3 Local content supporting a strong local production sector

Commercial free-to-air plays a critical role in supporting the Australian screen sector. In 2018-19 alone, commercial TV broadcasters commissioned $1.6 billion in Australian content, including significant support for the independent screen sector. Collectively, the free-to-air industry in general, and commercial broadcasters specifically, are fundamental to supporting local content production.

Australian free-to-air broadcasters' commitment to Australian content is reflected in the fact that broadcasters have consistently exceeded the 55% local content quota on their main channels (see the following exhibit) and regularly achieve over double the required 1,460 hours on their multi-channels.[21]

Exhibit 2. Australian free-to-air programming expenditure as a proportion of total free-to-air programming expenditure



Source: ACMA

Globalising trends in TV production and distribution pose a threat to the ongoing production of Australian content for Australian audiences. Free TV broadcasters invest in a range of TV content, making programmes for Australian viewers. Many of these also sell internationally. By contrast, global content players, such as Netflix, Amazon or Apple, are making high quality content but for a global

[20] Deloitte Access Economics calculations, based on OzTAM data, 2019.
[21] ACMA, Program expenditure information July 2018 - June 2019, Aggregated data for commercial television, May 2020.

(rather than Australian) audience and in a much narrower range of genres (principally drama and comedy) than Australian broadcasters.

There is a very real prospect in the next few years of value being extracted from the Australian creative industries, particularly the free-to-air broadcast system, and moved to other jurisdictions – specifically to providers and platforms based in the US.

The new global players in TV production and distribution, valuable though they are to Australia in many ways, will not replace the benefit delivered by Free TV and national broadcasters and their role.

3.4 Ubiquitous and free access

The terrestrial network has a critical long-term role to play in the delivery of free TV to millions of Australians. In any given week, approximately 17.8 million (73%) Australians watch broadcast TV,[22] and consume 2:43 hours of commercial TV each day.[23]

The fact that free-to-air services are available to all Australians for free is key to delivering the public policy outcomes of the Government. Without access to this platform, the Government's policy objectives – the provision of trusted news and Australian stories – would not be able to be delivered as reliably or to the same number of people.

Australians are world leaders in having access to a ubiquitous and freely available platform. In an average week, approximately three in four Australians watch broadcast TV, while 97% of Australian households have an antenna to access TV. Viewer Access Satellite Television (VAST) provides services to viewers in remote areas of Australia, ensuring that 100% of Australians have access to free-to-air TV services. No other medium provides this level of reach. This is particularly important for regional communities, where poor connectivity can limit viewers' access to internet-delivered entertainment services.[24]

Terrestrial broadcast is also the most cost-effective way to distribute content to large audiences simultaneously. At present, point-to-point telecommunications networks cannot match this cost efficiency.

Importantly, free-to-air TV is the only medium that can deliver high quality video entertainment at no cost to end users. The terrestrial broadcast platform is best suited to deliver free-to-air TV (compared to other technologies like satellite direct-to-home), by virtue of its ubiquity. By contrast, OTT services require a broadband service with sufficient bandwidth for high quality video streaming, imposing a hidden cost on consumers.

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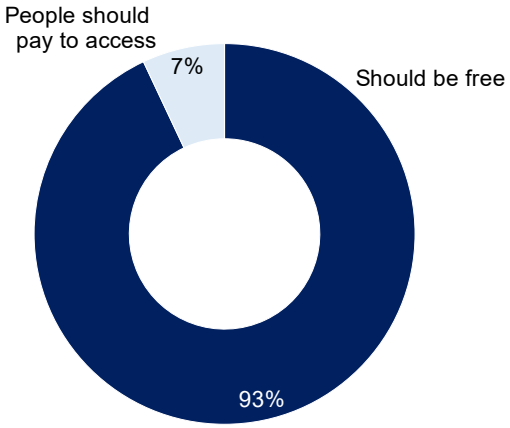
[22] Consolidated 28-day combined OzTAM Metro and Regional TAM databases with Overlap homes de-duplicated. Average time spent viewing [ATV 0200-2600 (2am-2am)] across the population in TV homes within metered markets. Includes free-to-air and subscription television viewing. Fractional minutes have been rounded; Average 1-minute weekly cumulative reach across the population in OzTAM and Regional TAM coverage areas. Includes live viewing and playback through the TV set within 28 days. Time bands use the industry standard 26-hour TV clock: 0200-2600 = 2am-2am.

[23] Deloitte Access Economics based on OzTAM/RegTAM data (2019). Calculated using reach data for commercial free-to-air networks.

[24] RMIT University and Swinburne University of Technology, 'Measuring Australia's Digital Divide: The Australian Digital Inclusion Index' (report commissioned by Telstra), 2019.

This fact is highly valued by Australians, regardless of where they live and irrespective of how often they watch free-to-air TV. As the following exhibit shows, 93% of Australians believe commercial TV should be free.

Exhibit 3. Proportion of Australians who believed commercial TV should be freely available



Source: Deloitte Access Economics and Dynata, Consumer survey, 2020

Clearly, the terrestrial broadcast platform has a critical long-term role to play in the delivery of free-to-air TV. At the same time, viewer expectations will continue to grow as television manufacturers introduce screens with ever higher picture quality. As a result, in order to remain competitive, free-to-air broadcasters must continue to invest to improve the capability of the terrestrial platform (see section 5 for details). Therefore, any short- and medium-term policy decisions regarding the sustainability of the free-to-air industry should ensure the terrestrial broadcast platform can support this long-term growth.

3.5 Direct and indirect economic contributions

In 2019, Free TV commissioned Deloitte Access Economics to analyse the contribution that the commercial free-to-air TV sector made to the Australian economy. Deloitte found that the commercial TV industry supported around 16,300 full-time equivalent jobs, both directly (7,500 staff employed by the industry) and indirectly (8,800 supported through the supply chain).

Further, the Deloitte report highlighted that the sector's economic contribution to GDP was $2.3 billion in 2019. Beyond this contribution, Deloitte found that by supporting competition and innovation, the economy was $4.4 billion larger in 2019 as a direct result of advertising on commercial television.

These are sizeable economic contributions that would be put at risk unless the free-to-air television sector remains viable, sustainable and retains a future growth path to meet the audience demands of tomorrow. In subsequent sections we set out the policy measures that are required to lock in these social and economic contributions and ensure a vibrant TV sector into the future.

4. Ensuring a sustainable local broadcast sector

Key points:

- There are immediate regulatory reform steps that the Government needs to work with industry to implement in the short-term. These are essential measures for the future sustainability of the industry:
    - Committing to a proper **review of the existing CBT**. The CBT is significantly higher in Australia than in comparable jurisdictions, and there is a strong case for the spectrum charge to be significantly reduced. Broadcasters could redirect these tax payments to focus on content, investing in broadcast infrastructure and future technologies.
    - Regulating to require **prominence of free-to-air television programming** (both terrestrial broadcast and BVOD services). Unless these services can be easily discovered by Australians, there is a risk that local content is lost on modern television sets undermining the public goods that free-to-air TV delivers.
    - Embedding principles of **net neutrality** in the regulatory framework, to protect the social inclusivity of free-to-air TV in online environments. Net neutrality is required to maintain the status quo so that internet providers do not develop discriminatory practices against content providers based on the financial relationship between them.
    - Updating the **anti-siphoning list** by extending the regulations to online platforms to maintain the regime's original objectives. This is essential to ensure Australians continue to have free access to iconic sporting events.
    - Addressing the financial pressures affecting the sustainability of free-to-air television broadcasting in regional and remote areas.
- The sector faces challenges across all of its segments (metropolitan, regional and remote). While Free TV's submission represents the views of all commercial broadcasters, some members may lodge additional submissions on individual or sectoral concerns, including:
- Metropolitan broadcasters face high, fixed content and programming costs and heavily rely on their multi-channels for a sustainable business model to drive substantial audiences and revenue.
- Regional broadcasters face high, fixed transmission costs.
- Remote commercial broadcasters are unsustainable in the absence of direct Government support to transition remote households to satellite Direct-To-Home (DTH) and to support ongoing satellite transponder costs and terrestrial retransmission to larger population centres in remote licence areas.
- The industry has not stood still in the face of these challenges and has instead invested heavily to meet the demands of modern audiences by providing them the quality of content they demand and delivery through the platform of their choice.
- Free TV broadcasters are already leveraging the efficiency benefits of MPEG-4 through an ongoing transition to convert all services to the newer compression standard. This will enable broadcasters to improve the quality of the services they deliver to meet consumer demand driven by improvements in television screen resolution.
- Metropolitan broadcasters have also responded to the demand for online as well as terrestrial broadcast TV, investing over $550m in technology and innovation to build world-class BVOD services.

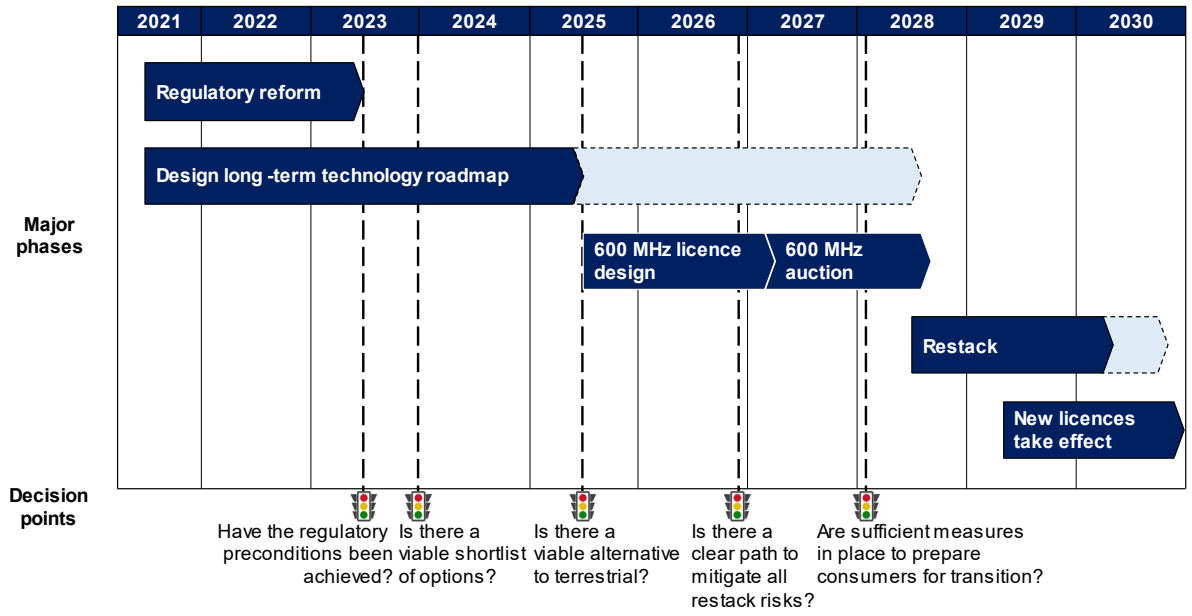
- Regional broadcasters have maintained localised news and local advertising in segmented sub-markets to regional viewers.

4.1 Immediate regulatory reforms needed

Free TV members would welcome the opportunity to work with the Government and other stakeholders to identify the right long-term solution for the delivery of free-to-air services. This process must start with a commitment to the immediate regulatory reform measures necessary to ensure a sustainable local broadcast sector into the future.

Free TV members are also willing to explore with the Government a roadmap for the future development of the terrestrial platform that serves the Government's objectives of ensuring a sustainable broadcast sector, while potentially allowing a portion of the existing UHF band to be reallocated. In this spirit, we also include an indicative timeline (below). As shown, there are a number of decision points that will impact the overall timeline. These decision points are predicated on building consensus across the broader industry and minimising disruption to viewers. The platform development roadmap is expanded on in section 5.

Exhibit 4. Decision points on the road to a sustainable broadcast sector



Note: dates are indicative and subject to achieving consensus at each major decision point

We also note that, while the indicative roadmap above requires a whole-of-industry approach, individual broadcasters' interests may legitimately diverge over time. Therefore, while operating on a common transmission platform, the technology roadmap should also allow for individual broadcasters to shape their own service offerings in accordance with their own strategic and commercial considerations.

4.1.1 Reviewing the commercial broadcast tax

The *Commercial Broadcasting (Tax) Act 2017* (CBTA) was introduced as a 5-year interim arrangement as part of the 2017 Media Reform package. Free TV broadcasters agreed at the time to a package of

measures, including a new $40m spectrum fee to be imposed on the industry, on the basis that this was a five-year arrangement that would be reviewed.

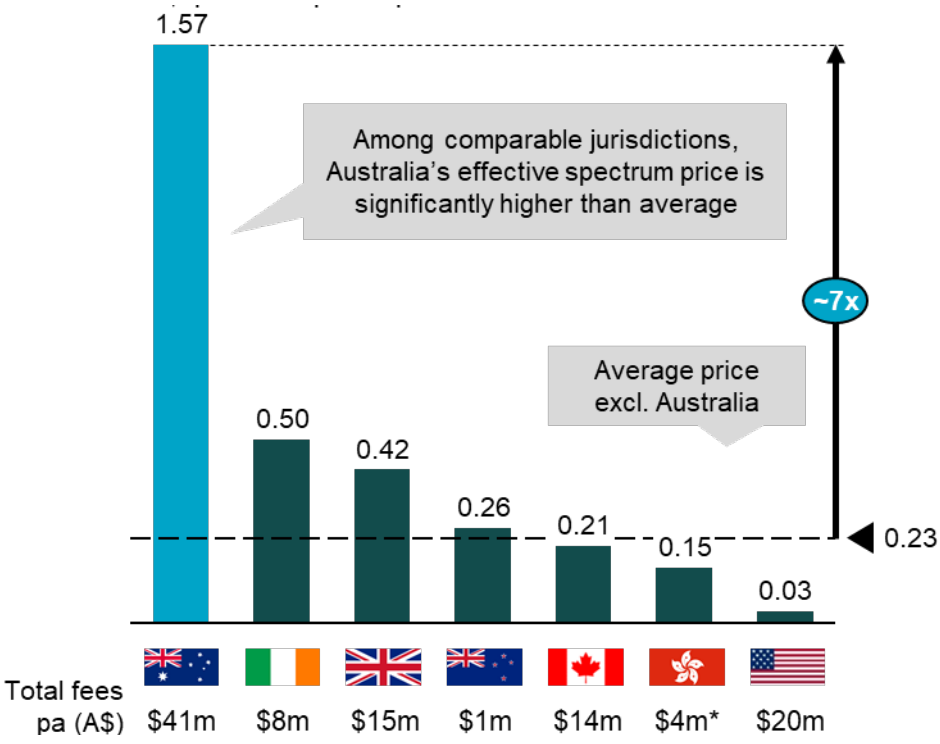
This is confirmed in the legislation and in the Second Reading Speech accompanying it, in which the then Assistant Minister Fletcher said:

> *"As a part of this package, the legislation will require the Australian Communications and Media Authority after 30 June 2019 to undertake a review and report on whether the new tax law should be repealed or amended on or before 1 July 2022. ACMA will consult on the review, enabling broadcasters to input into the development of future tax arrangements. The report would be tabled in parliament.*
>
> *This review will be a valuable input into future spectrum taxing arrangements…"*

The CBT represents a major financial impost on an industry facing serious challenges to its business model. These challenges in turn pose serious public policy problems, as we have outlined in earlier sections. We are concerned that without a genuine review of the taxation arrangements, as anticipated by the legislation and supporting materials, there is no clear pathway for the proper consideration of appropriate taxation arrangements going forward. We submit that a full examination of the appropriateness of the CBT, including international approaches to the level of taxation, would lead to a recommendation to repeal the CBTA. The Green Paper does not provide an avenue for the urgently needed and previously promised review of these taxation arrangements.

There are strong arguments that these spectrum fees should be immediately reduced. Work undertaken by Venture Consulting has revealed that the CBT is 52 times higher than equivalent per capita charges in the USA (see exhibit below). Consistent with international approaches, we submit that the aggregate amount of any tax levied should not exceed the ACMA's costs of managing the spectrum allocated to broadcasting.

Exhibit 5. Total broadcaster fees by country, A¢ per MHz-pop (FY19)



*Source: Venture Consulting Analysis. * HK licence fee calculated by estimating program hours by broadcaster and adding annual fee.*

The relationship of the present CBT to spectrum value is at best opaque. The present CBT appears to function as a 'disguised' tax on revenue or profitability. To adjust it to reflect the actual value of TV spectrum for alternative uses would, however, be undesirable, as it would create perverse incentives. First, a pricing structure based on the value for alternative uses of spectrum denied by TV transmissions would heavily penalise metropolitan and metro-adjacent TV broadcasters for continuing to provide services using 600 MHz, while falling more lightly than at present on other transmitters. Second, there would be an incentive for broadcasters to reduce their tax burden by withdrawing or rationalising services in areas reliant on 600 MHz spectrum, in direct conflict with the public policy principles of providing a ubiquitous and locally relevant television service to as many Australians as possible.

Spectrum value for other uses is the wrong basis for taxation of TV services using the broadcasting services bands. The widespread, free availability of TV to ubiquitous receivers is integral to the public benefits identified in the Green Paper. Any review of the CBT should give appropriate weight to Object (a) of the *Broadcasting Services Act 1992*, which is to promote the availability to audiences throughout Australia of a diverse range of television services.

The TV industry acknowledges the rising value of 600 MHz spectrum for alternative economic uses. As noted elsewhere in this submission, we are keen to work constructively with Government on a long-term spectrum management plan while ensuring that the policy objectives set out in the *Broadcasting Service Act 1992* continue to be achieved. To this end, we expect that Government, commercial broadcasters and the wider community share a common interest in finding a sustainable pathway forward for free-to-air TV that preserves commercial broadcasters' ability to provide these essential and valuable services.

The pressures that have emerged since 2017 on the profitability of TV, as well as the sustainability of regional and remote services, are well-documented in the Green Paper. They should be at the heart of Government's deliberations on the CBT.

4.1.2 Legislate to ensure free-to-air prominence on connected devices

Ensuring free-to-air content is prominent on connected devices is the single most critical regulatory issue facing broadcasters in the connected TV and digital environment. Prominence, discoverability and accessibility of terrestrial broadcast TV and BVOD services, are essential to ensuring the Government's public policy goals are achieved, including those relating to Australian content; accurate, impartial and trustworthy news; iconic sporting events; and provision of emergency information.

Terrestrial broadcast TV remains the most popular way to view TV content. The average Australian spends around 65 hours per month watching broadcast TV, and almost 90% of that viewing is of live TV.[25] More than half of all Australian homes now have connected TVs, and 6.7 video capable screens per household.[26] Our viewing is increasingly occurring through smart TVs and connected devices, with 52% of TV receivers in homes being 'connected'.[27]

The days when TV receivers were used solely to receive broadcast TV services are long gone. Connected TVs allow consumers to access a range of video content, including BVOD, SVOD,

[25] OzTAM VPM, 1 Jul 2020 00h00 - 31 Dec 2020 23h59.
[26] OzTAM & Regional TAM Establishment Survey, 1 Jul 2020 - 31 Dec 2020.
[27] https://thinktv.com.au/wp-content/uploads/2019/09/Fast-Facts_TVTechPen_H22020.pdf

TVOD, video games, YouTube and other content services as well as live terrestrial broadcast services that are at the heart of TV usage.

Connected TVs use operating systems that direct how these options are presented to viewers and how viewers can search for them. In this way they control the discoverability and accessibility of terrestrial broadcast channels and BVOD services via home screens and apps, giving rise to a risk that free-to-air broadcast content (whether terrestrial broadcast or BVOD services) will become more difficult to find amongst the multitude of other choices.

Manufacturers are increasingly striking lucrative arrangements with global streaming services to give greater prominence to those services over and above free-to-air broadcast services, using specialised remote-control buttons and favourable placement on connected TV home screens. For this reason, regulatory measures to ensure the prominence of terrestrial free-to-air broadcast services, particularly on connected TVs, is critical to ensuring that free-to-air television services remain freely available to the public and to the long-term sustainability of these businesses. Similar considerations apply to BVOD services offered by free-to-air television broadcasters.

A number of jurisdictions, including the UK, have recognised this risk and addressed it in their regulatory frameworks. However, the Australian regulatory framework currently does not have any rules requiring prominence of free-to-air content, whether for terrestrial broadcast TV or BVOD services. This creates a risk that free-to-air terrestrial broadcast TV and BVOD services will become less and less prominent over time.

While the free-to-air sector has taken important steps to respond to the challenges of prominence and discoverability on connected devices, for example, through the FreeView Platform in metropolitan markets and availability of individual broadcaster BVOD apps,[28] it cannot on its own address the risk of free-to-air content becoming less prominent over time. Broadcaster apps must compete with the range of other content available on the market and do not address the central issue of prominence of terrestrial broadcast channels on connected devices. In addition, while FreeView certifies set-top boxes and TVs that meet its requirements, there is no mandated standard that requires these devices to carry or even be technologically capable of carrying the broadcasters' BVOD services, nor the FreeView app.[29]

If we accept that the public policy goals of free-to-air television set out in this submission have ongoing relevance to Australian society, then it is critical that a regulatory framework is developed that requires broadcasters' content – both terrestrial broadcast and BVOD services – to be accessible and discoverable across the range of devices and interfaces where Australians access content. Without such a framework, broadcasters will be forced to divert significant resources towards simply being accessible on devices or risk becoming less and less discoverable over time, to the detriment of the quality of their services.

Access and discoverability are increasingly important

While terrestrial broadcast services still make up the lion's share of TV viewing, Australians are also accessing content online through streaming and on-demand services. In the case of both terrestrial

[28] FreeView recently launched the updated HbbTV service which combines terrestrial broadcast TV with BVOD services allowing users to move seamlessly between the various free-to-air services.
[29] https://www.freeview.com.au/

broadcast and BVOD services, viewing is often via connected TVs and devices. Data from Think TV, and OzTAM show:

- Live broadcast TV still makes up the largest proportion of total terrestrial TV viewing – 88% in July-December 2020 (vs 12% playback within 28 days).[30]
- BVOD viewing makes up approximately 5.5% of total TV content consumed (total terrestrial TV + BVOD minutes).[31]
- Total BVOD hours were up 40% year on year in June – December 2020 compared to the same time in 2019 (79m hours up from 56m hours).[32]
- Of the total 79m hours of BVOD consumption, 35% is now via live streaming and 65% is on-demand. Live streaming is up from 31% of total BVOD consumption in H2 2019.
- In addition to terrestrial broadcast consumption, most BVOD consumption is now also on the largest screen in the household with connected TVs now accounting for 66% of BVOD consumption.[33]
- 62% of TVs are internet capable and 52% are 'connected' (through smart TVs, set-top boxes or devices/dongles such as Chromecast, Apple TV and others).[34]
- Australian Households now have an average of 6.7 video capable devices (including on average 1.8 TV receivers, 1.8 PCs/laptops, one tablet and two mobiles).[35]

This snapshot shows that connected devices are an integral and growing way that Australian households access Australian content (including news and current affairs, sports, emergency and other public interest information). It also shows that free-to-air consumption habits are changing, with terrestrial viewing remaining critical, but a gradual transition to increased online viewing occurring.

This highlights why it is critical that Australians can easily find and access free-to-air content on connected TVs and other devices used to watch content on TV screens.

Market conditions necessitate intervention

Ensuring that terrestrial broadcast and BVOD services are accessible and prominent on connected TVs and other devices is increasingly challenging. Viewer access to both terrestrial broadcast and BVOD services on connected TVs and devices is generally via icons and apps on the device's user interface. The prominence of these icons and apps has a significant effect on whether or not viewers are aware of a particular service and whether they ultimately interact with that service.

However, each manufacturer's device generally has its own unique user interface and 'app marketplace' with different technical requirements and formats. Broadcasters are required to negotiate with each individual manufacturer in relation to:

- The cost for inclusion and prominence of free-to-air content on the device.

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[30] Think TV, Fact Pack, June-December 2020.
[31] https://oztam.com.au/documents/Other/Fast%20Facts%20BVOD%20Co-Viewing_2020.pdf
[32] Think TV, TV Everywhere H2 2020.
[33] OzTAM BVOD data 2020.
[34] Think TV, TV Tech Penetration H2, 2020. See also 2019 ACMA survey.
[35] Think TV, Fact Pack, June-December 2020.

- The prominence of the relevant icon and/or app on the platform, and whether it is accessible on the home screen.
- In relation to broadcasters' BVOD services, the prominence of the app in the platform's listings, whether an app will be 'preloaded' on the device and the technical specifications of the app.

Negotiating these terms is becoming increasingly difficult with significant growth in a) the number of connected devices on the market and b) the number of content services available. Principles of competition mean that manufacturers and suppliers can and are increasingly monetising their user interfaces. Without regulation, there is simply no incentive to include free-to-air services in prominent positions on devices when these spots can instead be used for advertising and promotions, or reserved for commercial partners.

Other jurisdictions have already moved to address these issues

A number of other countries have already moved to mandate prominence of free-to-air content. The UK for example has rules on prominence and availability of public service broadcaster (PSB)[36] TV channels within EPGs, arising from the *Communications Act 2003*. These rules underpin the delivery of terrestrial broadcast FTA content in the UK by ensuring it is easy to find and watch.

In 2019, Ofcom published a report, 'Review of prominence for public service broadcasting', which recognised that there are strong policy reasons to extend the existing terrestrial PSB rules to apply to PSBs' on-demand services and for prominence of all services to be mandated on new platforms and devices or smart TVs. The report recommended:

- Introduction of legislation and regulation to ensure PSBs' on-demand services and content, as well as their existing broadcast TV channels, were given prominence across connected devices including smart TVs, set-top boxes and streaming sticks.
- While the initial focus should be on connected TVs and those connected by a set-top box or streaming stick (given these are the main ways viewers select and watch TV online and on-demand), other platforms may be subject to the rules in future.
- The rules should extend to TV platforms' recommendations and search results – as viewers are increasingly able to use TV platforms' recommendations and search results to find content.
- The new rules should be flexible so that they can be adapted to changes in technology and viewer behaviour as they develop.
- Prominence of PSB content should be protected without charge.

Ofcom is currently engaging in its 'Small Screen: Big Debate Consultation', which is further considering the prominence framework, including:

- Whether any new legislation in relation to prominence for on-demand services should also be supported by 'must offer, must carry' rules.
- Whether an extended prominence framework should include rules in relation to access to audience data, measures to ensure audiences correctly attribute content to PSBs, access to advertising inventory and/or a proportion of advertising revenue from online services.

Canada is similarly reviewing the issue of ensuring the availability and discoverability of Canadian content. In January 2020, a wide-ranging Broadcasting and Telecommunications Legislative Review recommended ensuring discoverability become an object of Canada's communications legislation and

[36] Public Service Broadcaster (PSB) is the term used in the UK to refer to all freely available terrestrial broadcast services, such as ITV, Channel 4 and the BBC.

that discoverability and prominence obligations be introduced for Canadian content.[37] It found that, among other things, as consumers "now have access to an endless choice of content, making it difficult to find, or simply recognise, Canadian content," the Canadian Radio-television and Telecommunications Commission (CRTC) needed to be given the ability to impose discoverability measures on media content companies.[38]

The review's recommendations included that:

- The CRTC have the power to impose discoverability requirements on all media content undertakings other than text-based news services (recommendation 61).
- The CRTC "impose discoverability obligations on all audio or audiovisual entertainment media content undertakings, as it deems appropriate" in order to ensure that "Canadians are able to make informed choices and that Canadian content has sufficient visibility and is easy to find on the services that Canadians use."
- Such obligations could potentially include catalogue or exhibition requirements, prominence obligations, an obligation to offer Canadian media content choices, and/or transparency requirements in relation to the operation of companies' recommendation algorithms (recommendation 63).

The Canadian Government introduced *Bill C-10* in November 2020, which amends the Broadcasting Act and related legislation to include provisions empowering the CRTC to impose discoverability requirements.

Germany has also included 'findability' obligations in legislation in November 2020.[39] These obligations replace the previous broadcasting-specific treaty, adding broader regulation of digital media platforms, user interfaces and its 'gatekeepers', including search engines, smart TVs, app stores and social media.

Development of a prominence regulatory framework in Australia

In Free TV's view, to preserve the Government's policy goals, it is critical to ensure that all connected devices and major content distribution platforms (including user interfaces, devices and services used to consume TV-like content) must:

- Include or 'carry' terrestrial Free TV services and BVOD services at no cost to broadcasters. Terrestrial live TV must be available clearly and easily, without requiring viewers to first access a home screen on connected TVs or set-top-boxes.
- Offer terrestrial and BVOD services as an immediate option on the home screen (they must be significantly prominent) and preload free-to-air icons and/or apps where possible.
- Include a free-to-air button on remote controls accompanying connected TVs and devices.
- Ensure on-demand free-to-air services are easily searchable and discoverable including:

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[37] Broadcasting and Telecommunications Legislative Review. *Canada's Communications Future: Time to Act*, Final Report, January 2020, https://www.ic.gc.ca/eic/site/110.nsf/vwapj/BTLR_Eng-V3.pdf/$file/BTLR_Eng-V3.pdf, recommendations 59, 61 and 63.

[38] Broadcasting and Telecommunications Legislative Review. *Canada's Communications Future*, p.144.

[39] ABC, Die Midienanstalten. 'State media treaty (MStV) in force – new media concentration law in sight?' (via Google Translate), Media Release, 9 November 2020, https://www.die-medienanstalten.de/service/pressemitteilungen/meldung/medienstaatsvertrag-mstv-in-kraft-neues-medienkonzentrationsrecht-in-sicht.

- On aggregated platforms that allow content to be searched by criteria such as genre, creative talent or factors other than the platform/content service provider.
- Via alternative search controls such as voice-based controls or other biometrics.

- Ensure any underlying algorithms facilitate prominence of free-to-air services.

This could be done by amending the BSA to require the ACMA to maintain a code of practice setting out the detail of these requirements. The code of practice should also include rules to ensure the terms for inclusion set by manufacturers and TV platforms are fair, including in relation to:

- Broadcasters obtaining fair value from inclusion of their content;
- Attribution;
- Fair access to data;
- Ensuring a direct relationship between broadcasters and their viewers is maintained so that broadcasters are not disintermediated by platforms;
- Ensuring broadcasters can benefit from use of any additional functionality by the platforms (e.g. advertisement skipping, recording) and that broadcasters retain the ability to negotiate a broader content and functionality offering; and
- Prohibiting exclusive arrangements (free-to-air broadcasters should be on all platforms and suppliers should not be able to contract out of this requirement).

A comprehensive prominence regulatory framework setting out these rules would provide greater certainty for free-to-air broadcasters, manufacturers and TV platforms regarding the terms under which free-to-air services are delivered to audiences. Including the detail of the framework in a code of practice would provide necessary flexibility given it is likely that devices, platforms and user interfaces will change over time and any rules will need to be able to adapt quickly to changing technologies and audience preferences. Most importantly, a prominence framework would support viewer access not only to Australian content but to the range of critical services free-to-air broadcasters provide including news, current affairs, sport and emergency information.

4.1.3 Net neutrality

Net neutrality has been said to underpin a free and open internet. It refers to the idea that data on the internet should be treated equally. It means that organisations or users should not be charged for differences in data service access or quality, or discriminated against because they cannot afford the same level of service as their competitors.

Net neutrality is fundamental for the delivery of public interest content online. For free-to-air broadcasters to be able to reliably deliver content to the Australian public online, net neutrality must first be guaranteed in the regulatory framework.

Unlike some other jurisdictions, in Australia internet service providers (ISPs) are currently not required to comply with principles of net neutrality. For example, NBN Co and ISPs could adopt practices such as ‘traffic shaping’, slowing internet services for some uses and releasing the additional bandwidth gained for others. This already occurs under ‘fair-use’ policies.

It is therefore conceivable that, left unchecked, the market will develop in a manner that will see NBN Co or ISPs discriminate against some users in favour of others. Access to digital content would then be determined by the financial relationship between the user and the ISP, rather than the availability of

the content. Some ISPs have already indicated an intention to seek payment for the prioritisation of certain content services.[40]

Other jurisdictions have moved to address this issue

A number of jurisdictions have already recognised the risks to net neutrality by mandating it in their regulatory frameworks. In California for example, the *California Internet Consumer Protection and Net Neutrality Act of 2018* prohibits ISPs from:

- Blocking lawful traffic;
- Slowing lawful traffic;
- Receiving payments from an edge provider for many things;
- Paid-prioritisation;
- Receiving payment for zero-rating;
- Zero-rating some content in a category, but not all the content in that category;
- Preventing users from using their own devices;
- Not being transparent about "network management practices, performance, and commercial terms"; and
- Attempting to circumvent these laws.

In the Netherlands, article 7.4a of the *Telecommunications Act* prohibits the cessation or slowing down of services or applications by ISPs. This is subject to reasonable exceptions such as reducing congestion, blocking spam and compliance with a warrant.[41]

Chile was the first country in the world to implement net neutrality in its telecommunications legislative framework in 2010.[42] The law prohibits ISPs from arbitrarily blocking, interfering with, discriminating or restricting an internet user's right to use, send, receive or offer legal content, applications or services through the internet. Internet access must be offered in a manner so that content is not treated differently based on the ownership of that content.[43]

Canada has adopted principles of net neutrality in the CRTC's main regulatory instrument, the Telecom Regulatory Policy CRTC 2017-104.[44] The Canadian framework prohibits differential pricing based on content and also regulates internet traffic management practices.[45] ISPs are prohibited from blocking the delivery of content, degrading time-sensitive traffic, and slowing non-time-sensitive traffic to the extent that it amounts to blocking the content. The CRTC has also prohibited companies from zero-charging their own mobile television services.[46]

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[40] https://www.afr.com/companies/telecommunications/optus-wants-netflix-google-to-pay-data-premiums-20150420-1mp1vh

[41] https://wetten.overheid.nl/BWBR0009950/2014-01-25

[42] https://globalvoices.org/2010/09/04/chile-first-country-to-legislate-net-neutrality/ (accessed 30 April).

[43] https://www.bcn.cl/leychile/navegar?idNorma=1016570 (see 24 H, 24 I, 24 J) (accessed 30 April).

[44] https://crtc.gc.ca/eng/internet/diff.htm (accessed 30 April).

[45] Ibid.

[46] Ibid.

Developing an Australian model

In Free TV's view, net neutrality principles should be embedded in the Australian regulatory framework as a priority, to maintain the status quo and to ensure that NBN Co and ISPs do not develop discriminatory practices against different content providers. In the case of the NBN, this should be done before any change of ownership of the NBN takes place. In order to maintain the status quo, the regulatory framework should require NBN Co and ISPs to abide by principles including:

- No blocking;
- No quality-of-service differentiation or prioritisation and no bandwidth throttling;
- No charges for content delivery (or gatekeeping charges);
- No price discrimination for different content providers; and
- No preferences for an ISP's own content.

4.1.4 Extend the anti-siphoning list to online content services

The anti-siphoning list ensures that sporting events of national importance and cultural significance are available to all Australians free of charge. As noted in the Explanatory Memorandum to the *Broadcasting Services Bill 1992*, the anti-siphoning scheme was established to "ensure, on equity grounds, that Australians will continue to have free access to important events."[47] The list was intended to prevent major sporting events from migrating exclusively to pay TV resulting in viewers being forced to pay for access to national events that they should be able to access free.

The public policy basis for maintaining the list is stronger than ever. Events like the AFL and NRL Grand Finals are culturally iconic across the diversity of Australian society: In 2020 the AFL Grand Final peaked at over 4 million viewers while the NRL Grand Final peaked at close to 3.5 million. The Melbourne Cup was watched by close to 2 million.

However, the proliferation of telecommunications providers and digital platforms providing content services means continued access to iconic sports in an online environment is no longer guaranteed. The current limited application of the anti-siphoning rules to only pay TV means that streaming providers and telecommunications companies could acquire rights to sports on the list without contravening the law. Indeed, digital platforms and online streaming providers have already shown interest in and are starting to acquire sports rights. For example:

- Optus acquired exclusive Australian rights for the FIFA world cup in 2019,[48] and for the English Premier league in 2016 which was renewed for the 2019 – 2022 season.[49]
- Amazon Prime acquired various Australian swimming championship events globally including Australian swimming trials and qualifying events for the 2022 FINA World Swimming Championships and the 2022 Birmingham Commonwealth Games.[50]

[47] Explanatory Memorandum*, Broadcasting Services Bill 1992*, pg. 56.

[48] https://www.smh.com.au/business/companies/optus-secures-exclusive-rights-for-fifa-club-world-cup-20191203-p53ghb.html

[49] https://www.smh.com.au/business/companies/watch-this-space-optus-has-eyes-for-more-sports-rights-20190808-p52ezt.html

[50] https://www.smh.com.au/business/companies/watch-this-space-optus-has-eyes-for-more-sports-rights-20190808-p52ezt.html

- Telstra acquired AFL, NRL and netball rights. In early 2021, it effectively transferred the AFL and NRL rights to Kayo. Kayo will also have all netball rights (including those currently held by a FTA broadcaster) from 2022.[51] [52]
- AFL executives reportedly travelled to the US to meet with Facebook, Amazon, Google and Twitter ahead of its next rights deal.[53]

Internationally:

- Amazon has acquired rights to Thursday Night Football, the English Premier League and US Open Tennis.[54]
- Facebook acquired rights to La Liga and Major League Baseball in 2018 and has bid for the Indian Premier League.[55] [56] [57]
- YouTube acquired 13 Major League Baseball games exclusively in Canada, USA and Puerto Rico in 2019, in addition to non-exclusive rights in other international territories and is reported to be continuing to adapt is business model for sport.[58] [59]
- Hotstar (Disney-owned Indian company) acquired IPL and all domestic Indian cricket as part of a 5 year multi-billion-dollar deal with Star India in 2019.[60]

These examples show there is a real and impending risk that sports on the anti-siphoning list could be acquired by digital platforms, streaming providers and telecommunications companies. If this occurs, it would completely undermine the policy basis for the list. It would mean that iconic Australian sports would be inaccessible to Australians unless they have a) access to a reliable internet service and b) a paid subscription to the relevant service. Even in the case of viewers that are able to purchase multiple subscriptions, there is no guarantee that online platforms can provide a reliable service that is comparable to the ubiquitous coverage throughout Australia that free-to-air offers.

For this reason, the existing conditions on subscription television licensees should be harmonised across online content services. This would maintain the efficacy of the regime's original objective and ensure that commercial and national broadcasters continue to be supported in fulfilling their role of reflecting and developing a sense of Australian identity, through enabling Australians to access events of national importance and cultural significance.

4.2 Broadcast industry already investing to meet these challenges

As an industry, Free TV broadcasters have always prioritised viewer-led innovation and growth, leading to substantial investment in the ongoing improvement of our services to remain competitive.

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[51] https://www.afr.com/companies/media-and-marketing/foxtel-telstra-extend-afl-rights-deal-20201223-p56psu
[52] https://www.insidersport.com/2021/02/03/kayo-gains-nrl-and-afl-broadcasting-rights-in-high-profile-deal/
[53] https://www.afr.com/companies/media-and-marketing/the-game-has-changed-for-australian-sports-20190613-p51x90
[54] https://www.theguardian.com/technology/2019/dec/06/premier-league-brings-record-number-of-sign-ups-to-amazon-prime
[55] https://www.reuters.com/article/us-soccer-spain-facebook-idUSKBN1KY29Y
[56] https://www.businessinsider.com.au/facebook-indian-premiere-league-cricket-streaming-rights-bid-2017-9?r=US&IR=T
[57] https://www.nbcnews.com/tech/tech-news/facebook-acquires-exclusive-rights-25-major-league-baseball-games-n855291
[58] https://www.sportspromedia.com/analysis/youtube-sport-apac-highlights-cricket-australia-dazn
[59] https://www.sportspromedia.com/news/youtube-mlb-streaming-rights-baseball
[60] https://www.hollywoodreporter.com/news/general-news/2019-cricket-world-cup-how-disney-owned-hotstar-became-a-streaming-giant-1213762/

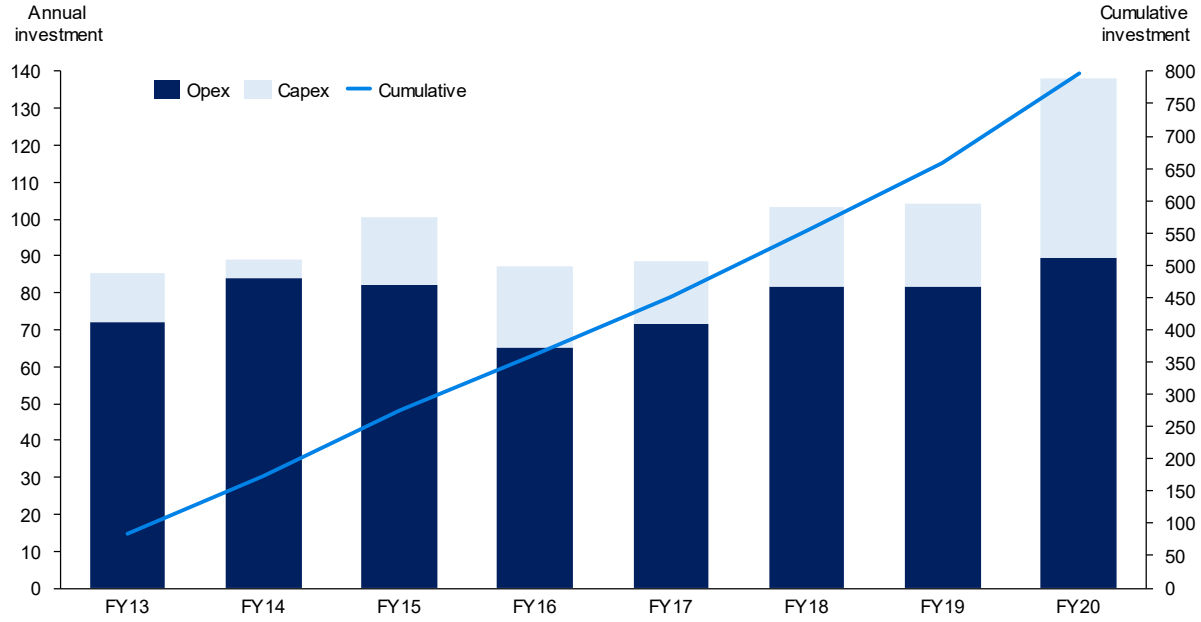
In this section we explore two crucial examples of this investment – the launch and growth of BVOD services, and the ongoing migration of remaining standard definition services to high definition.

4.2.1 Embracing BVOD services

BVOD services play a crucial complementary role to terrestrial broadcast TV, both in terms of the content and functionality offered to viewers, and in terms of the viewer demographics that use each service. As such, it is an important part of the service mix for the future of metropolitan broadcasters. It is, however, important to reiterate that BVOD services are a complement rather than replacement of terrestrial broadcast, in part because regional and remote broadcasters do not offer BVOD services.

Since 2010, our members have proactively invested to deliver their services to consumers in the VOD environment. As the following exhibit shows, the free-to-air industry has invested in excess of $550 million between FY13 and FY18 alone. This investment has funded a range of new technologies and innovations, including the development of world-class BVOD services.

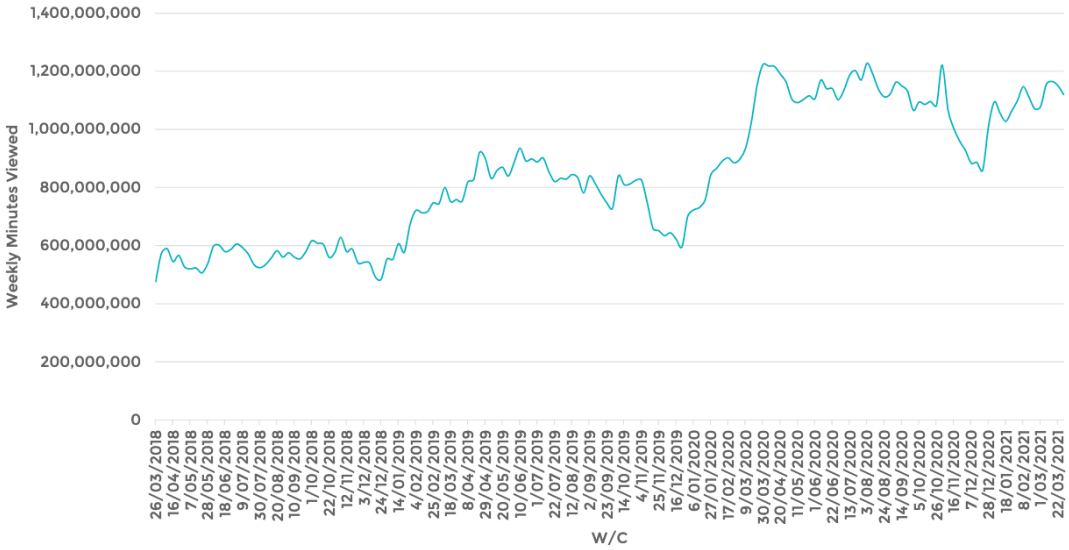
Exhibit 6. Technology investment by commercial free-to-air broadcasters, FY13-20 (A$m)



Source: Free TV, commercial free-to-air broadcasters

As a result of the industry's ongoing commitment to these services, BVOD consumption has seen consistent year-on-year growth. This was already the case before the COVID-19 pandemic, while the initial lockdowns in March and April 2020 coincided with a further surge in BVOD consumption. The following exhibit shows the scale of these uplifts.

Exhibit 7. Total weekly consumption of BVOD services (including live streaming)



Source: OzTAM VPM weekly data. March 2018 to March 2021. Live and VOD FTA + Foxtel minutes

It should be noted that regional and remote broadcasters do not provide BVOD services in their markets as they are not practically able to acquire BVOD rights or digital infrastructure. This adds to the challenges for regional broadcast licensees (discussed further in section 4.3.2 below), who cannot offset reductions in terrestrial advertising revenue in this manner. Regional broadcasters have, however, invested to maintain localised news and local advertising in segmented sub-markets to regional viewers.

4.2.2 Matters to be addressed prior to complete adoption of MPEG-4

The free-to-air TV platform has been on a transition path to complete adoption of MPEG-4/AVC (MPEG-4) for the better part of the last decade, since TV receivers capable of decoding these picture formats were first introduced into the market. Many services today, including HD simulcasts of the primary channels, are already provided in MPEG-4.

However, despite the fact that MPEG-4 is a relatively old technology, even today further work is required before the transition can be completed. There remains a risk of stranding viewers who have not yet upgraded their television receivers to be capable of decoding MPEG-4 and a carefully managed process is required to ensure that those impacted viewers are assisted in their transition.

The competitive landscape for video content has changed markedly since the last restack and is fundamentally a different market to the one that existed at the time of the analogue to digital switch-over. Today there is a very high risk that viewers could be lost forever if changes to the platform are not carefully managed and the benefits clearly communicated to viewers.

A program of work is required prior to the finalisation of the MPEG-4 transitions to ensure that neither our commercial imperatives nor the public policy objectives tied with the delivery of free-to-air service delivery are compromised. Indicatively, the steps involved in this program of work would be:

- Scoping the legacy issues – engaging with the Government and ACMA on the design of a consumer survey to determine the approximate number of MPEG-2 only receivers that are currently still in use in the market, including in relation to reliance on the Foxtel platform.

- Activation of communication strategy – engagement with equipment manufacturers as it is often their call centres that are the first port of call for viewers with reception issues, combined with a viewer campaign on the timing of the changes, improvements in services that will be enabled and how they can ensure continuity of service.
- Soft launch in all markets – networks are continuing to investigate the feasibility of swapping the Logical Channel Numbers of the MPEG-4 and MPEG-2 simulcast (where applicable) so that the MPEG-4 service becomes the "primary" channel.
- Testing MPEG-2 switch off by market – some networks already have experience in ceasing MPEG-2/4 simulcasts, which will provide useful insights into the likely consumer impact of a complete conversion and allow further consideration of a complete transition plan.

Government and ACMA assistance in consumer research

The fact that there is no reliable source of data on the size of the legacy receiver population has been a key stumbling block for the completion of the broadcast industry's ongoing transition to MPEG-4 and the discontinuation of MPEG-2 services. While television receivers that are capable of decoding MPEG-4 have been available since the early 2010s, it is not known how many households have either not refreshed their television receiver in this time, or have moved older receivers to other rooms for use as a second or third receiver.

It will be important for both industry and Government to have accurate data on which to base any plan for migrating viewers to upgraded TV technology. This includes information about domestic reception arrangements, including the age and capabilities of TV receivers already in use. Survey information will be vital to assess the penetration of future-proof (e.g. DVB-T2 / HEVC capable) receivers and will provide other useful insights to inform the development and execution of the broader technology roadmap.

To this end, the Government and the ACMA could assist the process by undertaking research on domestic consumer reception arrangements. Among other issues, the industry would welcome the opportunity to work with the Government and ACMA on how such a household survey would assess the prevalence and extent of reliance on older receivers that are not MPEG-4 capable.

Technical Issues for further consideration prior to completing MPEG-4 transition

Assessing likely costs of conversion

For most broadcasters the switch-off of MPEG-2 services will fall into two categories:

- MPEG-2 simulcast services that will incur no cost to discontinue.
- Upgrading MPEG-2 services to MPEG-4 via a new encoder licence that, depending on the individual playout arrangements of networks, may incur an approximate cost of $2,000 per service, per market (a potential significant total cost).

Consumer reliance on Foxtel platform

Historically, up to 30 per cent of free-to-air television viewing was undertaken via the Foxtel cable and satellite platforms. While subscriber numbers for Foxtel's cable and satellite delivered services have fallen, there likely remains a significant reliance on Foxtel equipment for free-to-air service delivery. The breadth of equipment and subscription plans currently in use on the Foxtel platforms makes this a complex legacy issue to resolve.

Free-to-air services on the Foxtel cable service are largely provided by Foxtel receiving and re-transmitting the off-air terrestrial transmission from most networks. As such, the encoded format

used ‘on-air’ is directly fed to the Foxtel cable set-top-box (STB). Foxtel has multiple models of STBs, some of which do not support MPEG-4. Early engagement with Foxtel will be required to assess the scope of this issue.

Foxtel has also announced its intention to migrate all cable customers to satellite by 2023. Further work is required to understand the impact on Foxtel’s existing and migrating satellite customers. For some networks, Foxtel undertakes the encoding for the free-to-air channels it carries and the switch off of MPEG-2 terrestrial services will not impact these viewers. However, there may be an impact on those networks that provide an encoded stream to Foxtel for retransmission.

Audio specific issues

Completing the transition to using MPEG-4 for all video content would logically include a change to the corresponding audio codec. Most MPEG-4 HD services use AC-3 as the corresponding audio codec and the current MPEG-4 capable receiver population has no issue with this combination.

However, the choice of audio codec for MPEG-4 SD services is not straightforward. While the logical choice would be AAC-LC (also known as HE-AAC v2), we understand that there is a cohort of MPEG-4 capable terrestrial receivers in the market that will not decode AAC-LC. Owners of these receivers would receive a picture but no sound. Further most Foxtel STB’s do not support AAC-LC.

As such, it likely that the industry will be required to use the inefficient MPEG-1 layer 2 audio codec for SD MPEG-4 content for maximum compatibility for some time after the transition is complete. Again, the absence of a reliable data source on consumer equipment capabilities is an issue here.

4.3 Commercial licence categories also facing distinct pressures

Broadcasting is a high fixed cost business; costs of content and transmission are central to the business model of all broadcasters. In addition to the whole-of-industry regulatory concerns discussed above, metropolitan, regional and remote broadcasters each face operational considerations and cost pressures specific to their business and operating environments. For example, the increasing cost of content has created sustained pressures on all broadcasters. For metropolitan broadcasters these high input costs are fixed in the short term. While for regional broadcasters the higher costs of content are variable with revenue, they are faced with very high costs of maintaining extensive transmission infrastructure. Remote broadcasting is a special case warranting direct Government support to migrate more of the licence area population to more cost-effective satellite DTH delivery of services, and to reduce the number of terrestrial retransmission sites.

While Free TV’s submission represents the views of all commercial broadcasters, our members will lodge separate submissions dealing with individual or sectoral concerns, including but not limited to issues where there is no industry-wide consensus.

4.3.1 Metropolitan broadcasters face high, fixed content and programming costs

Metropolitan broadcasters face high costs of obtaining and developing content and programming, and meeting content quota obligations. They must acquire and commission content across their services. While some variability in cost can be achieved, there is ultimately a significant fixed cost in making and acquiring the necessary programming. Metropolitan licensees also bear a high risk of rising prices in sport content, the risk of new formats and dramas, and the rising cost of production due to greater competition in the market. These costs are often, as in the example of sporting rights, locked in for the long-term irrespective of changes in revenue.

Further, to compete with increased competition from global online content businesses, metropolitan commercial broadcasters have had to invest significantly in their digital capabilities whilst also retaining the costs of broadcast operations.

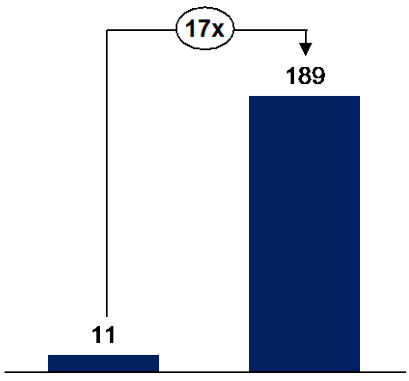
The scale of these twin factors – high fixed content costs and the need to invest in digital assets – should be acknowledged as an ongoing commercial and strategic challenge for metropolitan broadcasters.

4.3.2 Regional broadcasters face high fixed transmission costs

Notwithstanding the long-term growth ambitions and strength of the wider industry, regional broadcasters face short-term financial pressure, due to the impact of increasing content costs, higher per capita transmission costs and a greater rate of decline in the regional TV advertising market. This threatens their ability to continue providing regional Australians with high quality and locally relevant content, including trusted local news.

Regional broadcasters provide coverage to communities across large distances. Most of this coverage is provided by terrestrial transmission, with an infill service delivered by the Viewer Access Satellite Television (VAST) platform. Despite serving a population around half the size of the major capital cities, regional broadcasters must operate and maintain 17x more transmitters than their metropolitan counterparts on a per capita basis (see the following exhibit). Consequently, regional broadcasters must sustain a substantially higher transmission cost base, in absolute terms. This severely limits regional broadcasters' ability to provide any local news and other local content beyond the minimum required for compliance with broadcast regulations.

Exhibit 8. Number of transmitters per million people, 2019



	Metro	Regional
# transmitters	189	1,482
Population	17.5m	7.9m

Source: InformITV. Figures are for commercial broadcasters only

It is worth noting that while satellite direct-to-home might be more cost-effective for broadcasters than terrestrial in some of the most remote communities, households (other than those with Foxtel) would face an approximately $850 one-off migration cost (labour and parts to install new satellite dishes), with broadcasters unable to assist financially. Further, today's satellite technologies would deliver a poorer experience to viewers (e.g. inability to support local advertisement breakouts). We provide a more detailed consideration of the long-term potential of satellite technologies later in this submission (section 5.4.2).

4.3.3 Remote broadcasters require direct support for cost of transmission

Remote commercial broadcasters not commercially viable in their current form. They are a special case in that they will require direct Government support to ensure their continued delivery. Free-to-air broadcast in remote communities is fundamentally different to broadcast in metropolitan (and even regional) areas.

Terrestrial transmission economics are even more challenging for remote broadcast than for regional broadcast, due to vast coverage areas and low population densities. For example, SCA holds commercial television licences in the Remote Central East and Mt Isa licence areas, as well as a joint venture interest with Imparja operating the VAST service, providing free-to-air TV to Australians living and travelling in remote Australia and in black-spot areas. Equally, PRIME and WIN Television operate a joint venture servicing remote communities in Western Australia. Finally, Imparja Television delivers free-to-air content to approximately one million residents (and three million tourists) across six states and territories over an area of 3.6 million square kilometres. Imparja is the only non-Government funded not-for-profit, 100% Indigenous owned Broadcaster. Located in Alice Springs it services some of the most remote areas of Australia and provides television services to First Nations remote communities.

These licensing structures have been brought about as a result of previous Government interventions to create “equalisation” of service offerings in remote service areas. While equalisation of TV services to all Australians has been an important social inclusion measure, this has resulted in a legacy of high costs of operating more multiplexes in remote areas than is economic, despite the low population density of the areas they serve.

The low density of remote broadcast areas limits the size and attractiveness of the addressable advertising market, in turn limiting the revenue available to fund operations. Facing an increasingly competitive advertising market, as advertisers shift budgets to other channels, remote broadcasters are left with a similar choice to regional broadcasters in general: continue funding loss-making infrastructure or switch off less-profitable transmitters. The latter option would provide greater financial stability, at the cost of withdrawing locally relevant free-to-air services to millions of Australians.

Despite these challenges that suggest that remote broadcasting must be treated as a special case, the regulations governing remote broadcasters apply equally to metropolitan and regional broadcasters. These broadcasters are often providing the only available free-to-air service in remote communities that could not otherwise support commercial television. In this context, one-size-fits-all regulations inhibit their ability to operate in a sustainable fashion. To support the sustainable long-term delivery of free-to-air TV to remote communities, we need regulatory reforms and direct Government assistance that recognises the unique position of remote broadcasting.

In terms of remote transmission options, while satellite direct-to-home would be more cost effective to deliver free-to-air TV to remote communities from an operational perspective, neither remote broadcasters nor individual households have the resources to fund the conversion costs of non-Foxtel households. To ensure the long-term sustainability of these services, the Government should provide funding to:

- Equip remote households in very low population areas with satellite DTH; and
- Provide direct financial assistance to support ongoing terrestrial retransmission to larger population centres in remote licence areas.

Related to this is the issue of long-term funding certainty for the VAST platform. To date, the Government has extended VAST funding by short increments while examining alternative options for future delivery of TV to remote Australians. Our analysis of the alternative delivery options, including either fixed wireless or the Sky Muster (satellite IP) services of the NBN are not viable substitute for the free-to-air services provided via the VAST service. Both of these services are heavily data constrained and neither is designed for point-to-multipoint broadcast and this is unlikely to change in the short to medium term.

Further, this lack of funding certainty does not incentivise Optus, the satellite service provider for the VAST platform, to invest in capacity and capability upgrades. It also makes it difficult to control transponder costs, due to the short-term nature of the agreements.

Given that the VAST technology is and will remain critical to the reliable delivery of television services into the foreseeable future, the Government needs to commit to longer-term contracts for remote TV delivery.

5. The Future Roadmap of Free-to-Air: An Alternative Path Forward

Key points:

- In keeping with the spirit of the Green Paper, we have identified alternative long-term content delivery options for the free-to-air industry that balance the objective of a 600 MHz spectrum dividend with the public good of a sustainable free-to-air industry.
- Upgrading the terrestrial platform to DVB-T2 transmission and HEVC compression is likely to play a critical role in delivering long-term growth on the platform (keeping pace with viewer expectations towards the end of the decade).
- Hence, any short-term reform must retain the long-term option of DVB-T2 and HEVC. Specifically, further work is required across multiple stakeholder groups[61] to determine the timing and trajectory of a transition, before any decision can be made regarding the 600 MHz spectrum band.
- In addition to the question of terrestrial technology, there are a number of issues and challenges associated with any restack. These range from alternative planning models to achieve the same result, to interference and disruption issues during and following a restack. Each issue must be similarly resolved through extensive consultation and planning before final decisions regarding a restack can be made.
- While terrestrial broadcast (and satellite delivery in remote areas) will remain central to our members' businesses, we have identified alternative complementary content delivery platforms that, while unsuitable today, could become attractive as the decade progresses – we will continue to monitor these options and plan accordingly.
    - Delivering live streaming to a mass audience is not feasible at present due to reliability issues in times of crisis or peak demand. However, as multicast technologies mature, live streaming (over IP) may become a viable complement to terrestrial broadcast.
    - Satellite direct-to-home could be an effective solution to the high costs of remote transmission, subject to the cost of upgrading receiver antennas.

5.1 Long term planning for future of the broadcast platform

Free TV submits that the Government needs to take a more considered and holistic approach. This means engaging widely and deeply with the free-to-air industry and other relevant stakeholders to design the right long-term solution for free-to-air broadcast.[62]

While this alternative process is conducted, the Government needs to maintain long-term optionality on the terrestrial platform. Specifically, we submit that the 600 MHz band (including the sixth multiplex) should be retained for broadcast use, enabling future growth on the terrestrial platform, until the long-term future of free-to-air broadcast is agreed.

In the following exhibit, we provide a high-level plan for how this alternative process might operate, including the comprehensive stakeholder engagement that is required, and the potential timeframes involved. It is important to note that the timeline of a 600 MHz digital dividend will be affected by

[61] At a minimum, the following stakeholder groups should be involved: commercial broadcasters, national broadcasters, transmission services providers, device manufacturers, antenna manufacturers, the ACMA, Government and consumer groups. Consideration should also be given to including mobile network operators.
[62] We use the broader term 'free-to-air broadcast' to include terrestrial and satellite technologies.

other factors (discussed in section 5.3 below), beyond the workstreams outlined below. For example, if it is determined that more time is required for TV receivers to be naturally 'refreshed' in market, then the timeline of a 600 MHz dividend should be extended, even if implementation planning is complete.

Exhibit 9. Indicative plan to design the long-term technology roadmap for free-to-air broadcast

	1 Identify stakeholder requirements	Shortlist candidate solutions	Develop longterm technology roadmap	Detailed implementation planning

Activities	• Identify short-, medium- and long-term requirements of each stakeholder group
	  ○ Commercial
	  ○ Operational
	  ○ Technical
	  ○ Policy
	• Primary stakeholders: commercial broadcasters, national broadcasters, transmission services providers, Government, consumers / viewers, unlicensed spectrum users
	• Other stakeholders to be consulted: TV and antenna manufacturers, standards organisations, ACMA, mobile network operators
		• Identify different options, including hybrids, considering different time horizons
		• Understand expected technical improvements over the long-term
		• Cost / benefit analysis
		  ○ High level / indicative cost estimates
		  ○ Assess performance against stakeholder requirements
		  ○ Evaluate options against issues / challenges associated with restack
		• Stakeholder consultation throughout
			• Identify single technical solution (or suite of complementary technologies) for detailed planning
			• Identify transition pathway / roadmap
			• Develop plan to ensure sufficient penetration of compatible TV sets
			• Extensive stakeholder consultation
				• Refine transition pathway
				• Detailed cost analysis
				• Receiver standards amendments as needed to ensure compatible TV sets
				• Restack planning and vendor selection

Output	Definitive criteria, by stakeholder, for longterm broadcast solution	Shortlist of candidate solutions, backed by industry, for final assessment	Agreed long-term technology roadmap for free-to-air broadcast	Agreed restack timeline Agreed vendors to run implementation program
Timing	6-12 months	12-24 months	12-24 months	18-24 months

5.1.1 Identify stakeholder requirements

We have an opportunity to design a long-term evolution of free-to-air TV that will meet the needs of viewers and industry for years to come. The proper starting point for this exercise is a detailed consultation process with all stakeholder groups, to understand how their requirements of free-to-air TV and the terrestrial broadcast platform will evolve over time.

To inform our submission to the Green Paper, we have already consulted widely with many of the stakeholder groups identified in the exhibit above, over a period of six months. However, we would expect significant further discussions are required in the second half of 2021.

We submit that this phase should be led by the Department, perhaps with the support of a Steering Committee comprising representatives of all stakeholders.

5.1.2 Shortlist candidate solutions

This is the work that we believe is missing from the current Green Paper process. While the Green Paper seeks to propose a solution for terrestrial broadcast, it fails to consider the long-term importance of the terrestrial broadcast platform, as well as other technologies that may support free-to-air delivery over the coming decade. During the submission process, we have identified a number of potential technologies that could play a role in the medium- to long-term (discussed in section 5.4). However, there has been insufficient time to fully consider the long-term possibilities of these (and

other) technologies. Therefore, the purpose of this phase is to consider the long-term possibilities in detail and to identify a shortlist of candidate solutions for more detailed assessment, weighing each solution against stakeholder requirements.

This phase requires a combination of strategic, commercial and technical expertise. Under the oversight of the Department and Steering Committee, this phase would best be led by an expert independent consultant, working closely with all stakeholders.

5.1.3 Develop long-term technology roadmap

The purpose of this phase is to reach consensus on the long-term technology roadmap of free-to-air TV, through comprehensive stakeholder engagement.

Clearly, the stakeholder map is complex. For any long-term solution to be viable, it must be acceptable to all stakeholders. In addition to addressing the issue of funding, any solution must allow for individual broadcasters to shape their own service offerings in accordance with their own strategic and commercial considerations. Accordingly, the primary focus of this phase is to canvas the shortlisted solutions with each stakeholder group and refine the proposals so that a long-term plan can be agreed upon.

As with the shortlist phase, we submit that this phase should be led by an independent consultant reporting to the Department and Steering Committee.

5.1.4 Detailed implementation planning

This stage would depend on the chosen long-term technology solution and the migration pathway. The range of issues to be considered are explored in depth in the following sections.

However, we first consider the short-term actions that should be taken to keep options on the table for the longer term.

5.1.5 Early action to preserve optionality

Some implementation issues should not be left until the end of an 18-24 month process. Some will demand earlier, pre-emptive steps to preserve optionality. This is true in the case of two key implementation issues for any 600 MHz roadmap process:

- Relocation of wireless microphones out of the currently designated UHF spectrum, which may be reallocated to wireless broadband in 600 MHz or for re-stacked TV services in 500 MHz, into other suitable spectrum.
- Ensuring individual consumer TV purchase decisions support, and do not foreclose, likely outcomes of the roadmap process.

Reaching out to the wireless microphone sector

The implications for wireless microphones of the Green Paper, and of the proposed roadmap process, are discussed in detail at section 5.3.7. Two areas of work that would benefit from early, pre-emptive action ahead of finalisation of any roadmap are (1) the development of an initial communications strategy to build linkages into this disparate sector, and (2) preliminary work to identify alternative bands for wireless microphone operation, including consideration of the suitability of the ‘duplex gap’ in the FCC 600 MHz band plan. In a separate submission to the ACMA’s Five-year Spectrum Outlook

process, Free TV has called for early action to prepare for any repurposing of spectrum used by wireless microphones in the second half of the decade.

Working to ensure technical standards support long-term technology options

Industry develops technical standards for TV receivers collaboratively through Standards Australia. Though not currently binding, standards give critical guidance to TV receiver manufacturers and importers about the minimum functionality required of Australian TVs. Previous and ongoing technical upgrades (to DVB-T transmission and MPEG-2 compression, and to MPEG-4 compression) show that waiting for all viewers to 'swap out' older, non-compliant TVs can take at least a decade, with a 'tail' of viewers still likely to need help or advice. As there is also a time lag before changes to the standards work their way through to the TVs available in shops, Free TV is concerned that delaying action on developing these standards until the end of the roadmap process may tend to foreclose options that should have been kept open. Two issues of particular concern to the TV industry are that it should preserve credible upgrade paths to DVB-T2 transmission with HEVC compression, and to the newest version of Hybrid broadcast broadband (Hbb) TV, HbbTV 2.0.3.

The current receiver standard, AS4933 (DVB-T compliant TVs), currently allows importation of TVs that are neither DVB-T2 nor HEVC compliant. A review of this standard is underway and a new standard, dealing with DVB-T2 / HEVC, is being developed in parallel. There is consensus the new standard should require DVB-T2-compliant receivers to support HEVC compression. Free TV has called on the current standards review process to clarify the expectation that all future TVs sold in Australia should support DVB-T2 / HEVC. The two standards should make clear that the DVB-T standard (AS4933) exists only to ensure backwards compatibility; that is, future TV receivers sold should support both DVB-T and DVB-T2. Manufacturer representative organisations have advised that they do not have good data on what percentage of receivers sold already support DVB-T2 / HEVC, though it is believed to be high.

Similarly, while the current receiver standard, AS4933 (DVB-T compliant TVs) includes HbbTV version 1.5 as an optional feature, the new DVB-T2 / HEVC standard is expected to include HbbTV 2.0.3. Free TV has called on the current ongoing standards process to make HbbTV 2.0.3 a requirement in all TVs that are able to be connected to the internet, as is the case in New Zealand.[63] HbbTV and other candidate technologies for optional or mandatory inclusion in the TV receiver standard, are discussed in section 5.4.3.

Free TV suggests that the particular challenges posed by upgrading of wireless mics and householder TV receivers, as well as the scarcity of levers currently available to industry and Government to influence what equipment is sold, warrant consideration very early on in the roadmap development process. The TV receiver issue also highlights the dearth of good information about the functionality of sets that are sold today. As outlined in section 4.2, Free TV submits that the Government and the ACMA should work with industry to undertake research to understand the capability of receivers in households today.

5.2 The future of the terrestrial platform

The Green Paper invites consideration of alternative models that would facilitate a digital dividend and support long-term sustainability of the free-to-air industry.[64] In this spirit, we have begun

[63] Freeview New Zealand, 'Freeview Specification 2020, Free to air digital broadcast and IP TV', version 1.4, 20/10/2020.
[64] Cf. Media Reform Green Paper, consultation question 4.1.

exploring a number of such alternatives, consulting widely with our members and other industry stakeholders. We note that each of our members have different business models and any future roadmap needs to allow for individual broadcasters to shape their own service offerings in accordance with their own strategic and commercial considerations.

In this section, we first outline the industry's current view that the most likely development path that has the potential to meet the objectives of the Government is for the roadmap to lead to upgrading the terrestrial platform to DVB-T2 transmission technology. As will become apparent, moving towards DVB-T2 technology resolves some of the long-term challenges associated with the current DVB-T platform using MPEG-4 compression (discussed in section 6 below).

5.2.1 Preserving Optionality: Moving Towards DVB-T2 / HEVC

In order to ensure a free-to-air broadcast platform that is sustainable over the long-term, transmission technology is a critical first step. As we expand on in section 6.1.2, the current platform lacks the capacity and capability needed to support the long-term evolution of consumer expectations. By contrast, the next generation of terrestrial transmission and compression technologies, DVB-T2 and HEVC respectively, would meet these requirements.

To this end, our members are already exploring technology roadmaps that work towards DVB-T2 and HEVC over the course of this decade. What is clear is that decisions around the long-term technology platform have implications for today's platform and, specifically, for the timing of any 600 MHz dividend. That is, any long-term spectrum policy should preserve the optionality of a transition to DVB-T2 and HEVC while the detailed planning takes place.

In this section, we outline why it is important that the industry retain a viable transition path to DVB-T2 and provide a high-level overview of the necessary steps to get there.

The rationale for DVB-T2 / HEVC

Demand for better picture quality will be consumer led. There is a clear trend towards larger and more capable screens in Australian households. Indeed, as of 2018, 98% of households could receive high definition on every TV set in the home, and two-thirds of new receivers were capable of receiving ultra high definition content.[65] At the same time, higher resolution offerings from over-the-top streaming providers continue to improve. This is undoubtedly good for consumers, improving the quality and choice of the viewer experience. However, it also reinforces the need for free-to-air broadcasters to continue to innovate and improve the quality of their services. That is, the terrestrial platform must support significant further improvements, both for the industry to remain competitive and to ensure the ongoing achievement of the public goods identified earlier.

The best available technology option to deliver this long-term capability and growth pathway is DVB-T2, combined with HEVC encoding. As the next generation of Digital Video Broadcast, DVB-T2 uses more efficient modulation schemes to increase the data capacity of a radio signal. In practical terms, this means a DVB-T2 signal can deliver approximately 40% higher bitrate than the equivalent DVB-T signal.[66] In Australia, where 7 MHz channels are used, DVB-T2 would deliver approximately 32 Mbps, compared to the 23 Mbps possible using DVB-T today. As in a number of international jurisdictions, our technology roadmap couples DVB-T2 with the next generation of compression technology, HEVC.

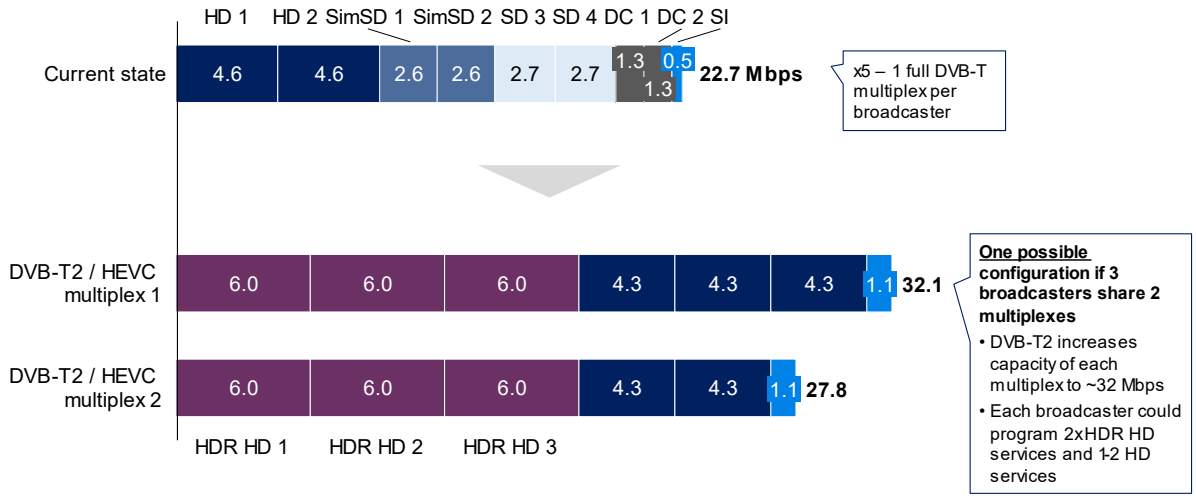
[65] Informitv, 'Future platform development', 2019.
[66] Ibid.

This newer compression standard offers an efficiency improvement over MPEG-4 encoding, effectively reducing the bitrate required to transmit compatible services.[67]

The greater use of 'single frequency networks' (SFNs) enabled by DVB-T2 may also permit up to four, rather than the three mooted in the Green Paper, 7 MHz TV channels to be retained in each market after any reallocation of the 600 MHz spectrum band. While boosting the capacity of the terrestrial platform by a third, any four-channel model would come at significant incremental cost and complexity to commercial broadcasters.

Taken together, upgrading the transmission and compression technology of the terrestrial platform would deliver an enhanced viewer experience and ensure the platform remains commercially competitive over the long-term. Indeed, even under the multiplex sharing scenario proposed in the Green Paper, our initial modelling suggests that upgrading to DVB-T2 and HEVC would allow a modest uplift in overall capability while delivering a 600 MHz dividend (see following exhibit).

Exhibit 10. Service mix under DVB-T2 / HEVC scenario, assuming multiplex sharing (example)



Source: Free TV Engineering Committee. Illustrative analysis uses Seven Network as example. DVB-T2 / HEVC scenario assumes three broadcasters share two multiplexes. As noted in section 6.1.1, however, in a three-multiplex scenario, this would impose more severe cuts on the two broadcasters sharing a remaining multiplex. Bitrates include video, audio, subtitles and service information. Services shown are high definition with High Dynamic Range (HDR HD)[68], high definition (HD), simulcast in standard definition (SimSD), standard definition (SD), datacast (DC) and an allowance for service information (SI).

Similarly, the terrestrial platform must be able to support improvements in picture quality over the coming decade, in line with consumer expectations. This likely means the ability to deliver improved high definition with High Dynamic Range (HDR), as well as ultra-high definition (4K) content. In the long-term, it is possible that terrestrial broadcast may need to deliver even higher resolution services, such as 8K.

Neither the current technology mix, nor that proposed in the Green Paper, will support this. As the following table shows, advances in picture quality require higher capacity transmission technology and more advanced compression standards.

[67] HEVC is not designed for use with standard definition services, so we do not expect any bitrate reductions for standard definition services compared to MPEG-4.
[68] 1080p with HDR. See section 6.1.2 for further details.

Exhibit 11. Long-term optionality of different technology options

Option	Technical feasibility of picture quality upgrades				Comments
	All HD (1080i)	HDR HD*	4K / UHD	8K	
Current state: DVB-T and MPEG-2 / 4	✓ *Only possible with fewer services*	✗	✗	✗	• Broadcasting all services in 1080i HD is already supported, but depends on available capacity
DVB-T and full MPEG-4 (Green Paper)	✓	✗	✗	✗	• MPEG-4 does not support 1080p or above (i.e. 4K, 8K) • Insufficient capacity for higher quality services (assumes 3 commercials share 2 multiplexes)
DVB-T2 and HEVC	✓	✓	✓	?	• HEVC codec supports higher quality HD services • Any service upgrades require trade-offs, but additional payload from DVB-T2 makes 4K possible if broadcasters retain a full 7 MHz channel each • Insufficient bandwidth for 8K at present, but next generation codecs could enable 8K

*Source: Free TV. * 1080p with HDR. See section 6.1.2 for further details*

The roadmap to DVB-T2

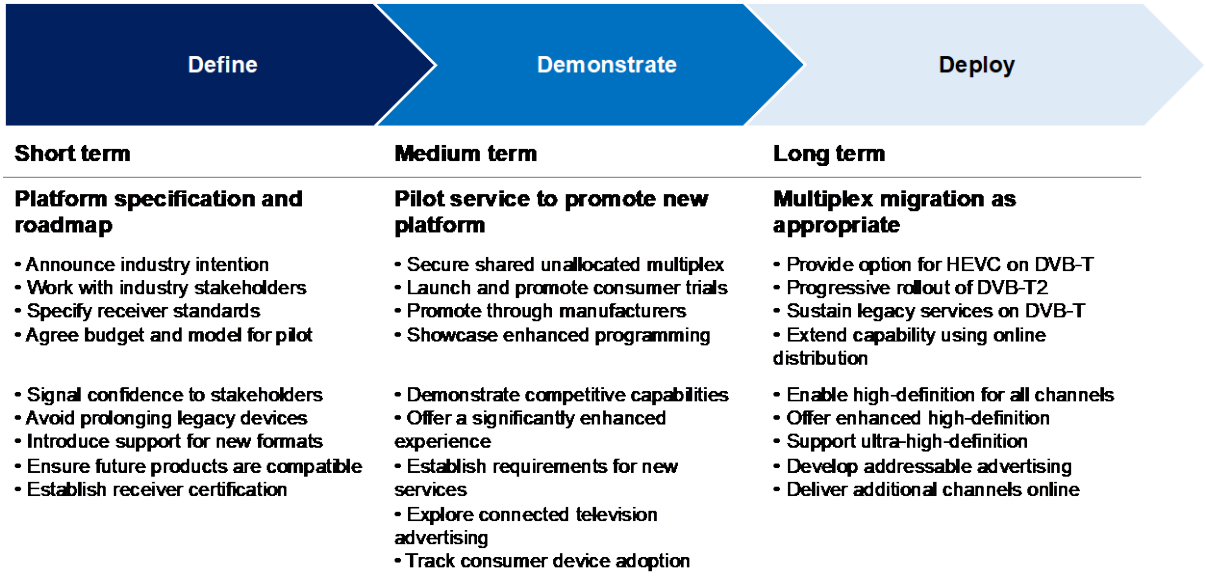
The long-term sustainability of the free-to-air industry depends on maintaining the optionality of the terrestrial platform. Decisions in the short-term are needed to maintain a transition path to DVB-T2 in the long-term. For example, transition late in the decade will be unlikely unless TV receivers sold over the intervening period are DVB-T2 / HEVC compatible, yet current TV receiver standards still allow importation of non-compliant receivers. Similarly, spectrum decisions taken in the short-term should leave room to accommodate the roadmap to DVB-T2, including any requirements for the vacant 'sixth' TV channel prior to closure of the DVB-T network.

As with the transition from analogue to digital TV, the transition path needs to be carefully planned and implemented. We would expect the transition to require much of the coming decade, in order to minimise the potential disruption to viewers and the commercial risk to broadcasters. This is principally about allowing sufficient time for a critical mass of consumers to have DVB-T2-compatible TV receivers, through natural upgrade and replacement cycles. The alternative, if the transition is poorly managed, is that viewers lose reception during the transition period, which would undermine the ubiquity and availability of the free-to-air platform, as well as the sustainability of the broadcast

industry. There is also a parallel objective of upgrading the broadcasters' transmitter fleet: with sufficient timeframes, this work will occur naturally within the context of routine maintenance capital expenditure.

The other critical component of the planning phase is to decide how to transition from DVB-T transmission to DVB-T2. One option is to use the sixth multiplex – largely vacant at present – to launch pilot DVB-T2 services in order to promote the new platform and encourage consumer uptake of compatible receivers. This option, outlined in the following exhibit, would achieve a gradual switchover and minimise viewer disruption. While feasible under current spectrum arrangements, this option would require deferring a 600 MHz dividend until the end of the decade.

Exhibit 12. Overview of DVB-T2 roadmap, assuming gradual transition using sixth multiplex



However, other migration options exist, such as a so-called 'hot swap', wherein individual broadcast areas are transitioned from DVB-T to DVB-T2 transmission effectively overnight. In such a scenario, a subset of the multiplexes in a chosen area would be migrated to DVB-T2, while maintaining other multiplexes in DVB-T. This scenario would remove the need for the sixth multiplex and would reduce the total infrastructure costs of the upgrade, but would introduce significant viewer disruption and uncertainty.

Regardless of the chosen option, the transition model has major implications for spectrum policy and planning.

Under any plausible scenario for introducing DVB-T2, re-farming of some or all of the 600 MHz TV spectrum would need to be delayed beyond 2026, to minimise the costs and disruption to viewers, broadcasters and Government of the transition to DVB-T2 and restack. The details of when and how to yield any 600 MHz spectrum dividend need to be approached as part of a broader conversation about the long-term technology path of the terrestrial platform. The rising value of the 600 MHz spectrum band represents an opportunity and should be part of the discussion.

5.3 Restacking TV to yield any 600 MHz dividend: issues and challenges

In addition to the macro question of broadcast technology, there are a number of critical practical considerations that are part of any restack, whether using DVB-T or DVB-T2. While the Green Paper

identifies broad principles and high-level technology options, it fails to consider several of these practical considerations. In this section, we provide an overview of the most significant (i.e. potentially disruptive) issues and challenges associated with a restack. We also outline how facilitating an upgrade to DVB-T2 mitigates some of these challenges, summarised in the following exhibit.

Exhibit 13. Overview of key considerations by technology path

Considerations	DVB-T	DVB-T2
Considerations at the time of a restack		
Alternative planning models allow for less broadcaster and viewer disruption while still potentially delivering a 600 MHz dividend	—	Higher payload provides more flexibility in planning models
Cost to restack – while detailed analysis is required, we have provided indicative costing information for various restack scenarios	—	Higher cost associated with new DVB-T2 transmitters. Costs vary depending on upgrade scenario
Considerations after a restack		
Loss of existing services and/or service quality due to a 600 MHz dividend reducing available spectrum	Unavoidable	Higher payload supports service equivalence
Sharing a multiplex is insufficient to support service equivalence, and may not be compatible with some receivers, leading to service disruption for affected viewers	Receiver-based service disruption common to both DVB-T and DVB-T2	Service equivalence supported using DVB-T2
Co-channel interference where signals that share the same channel interfere with viewer reception or broadcaster off-air feeds	Common to both DVB-T and DVB-T2	
Carrier interference where high power signals from mobile network operators interfere with viewer reception of DTT below 610 MHz	Common to both DVB-T and DVB-T2	
Interference with **wireless microphones** that operate within white space in the 600 MHz band	Common to both DVB-T and DVB-T2, though the longer DVB-T2 timeline would help an orderly transition	
Reception disruption where a subset of older UHF antennas, designed for 700 MHz signals and compatible with 600 MHz signals, are incompatible with services relocated to the 500 MHz band	Common to both DVB-T and DVB-T2, though the longer DVB-T2 timeline would mitigate the problem	

5.3.1 Alternative planning options

The issue

As part of this submission, we have engaged extensively across the sector to explore alternative planning models. This process, which is ongoing, has included all commercial free-to-air broadcasters, the national broadcasters, transmission service providers, industry bodies and equipment manufacturers. Given the complexity of the issues involved, we have not yet reached a concluded view, but our work has highlighted a number of the challenges with restacking.

The Green Paper does not outline the detailed spectrum planning assumptions underpinning its 600 MHz proposal. However, if we assume Australia wishes to harmonise with the US (FCC) 600 MHz allocation, with TV consolidated in Blocks A, B and C (i.e. the lower two UHF, 6-channel 'blocks' now in use as well as the VHF channels), the proposed solution of moving to three TV channels at every site is likely to be workable from a spectrum planning perspective. However, we emphasise that this option would not be workable from a broader technical perspective requiring service equivalence, nor from a commercial standpoint.

Direct adoption of the US (FCC) 600 MHz configuration would also imply a guard band of only 7 MHz separating TV from wireless broadband base stations. This is less than the 9 MHz separating TV from wireless broadband in the US, and whether it is sufficient will depend on the out-of-band emission and protection rules developed for this band in Australia. These will need to take appropriate account of the reverse duplex and carrier interference problem identified in section 5.3.6. At this very early stage of consideration, Free TV has serious reservations about whether a 7 MHz guard band would be enough to protect TV reception.

With three rather than the current six, 7 MHz (VHF or UHF) TV channels that are currently available in each area, and 12 rather than the current 24 UHF TV channels to choose from nation-wide, industry engineers accept that a restack plan should be possible that broadly matches current TV coverage, with broadly similar levels of co-channel interference in the most congested areas, to those we see today. This conclusion is subject to a need for more detailed planning work, in conjunction with ACMA, than industry has been able to undertake to date.

Our initial planning work also suggests that 'three channels everywhere' may not be the only option for rationalising TV services sufficiently to allow re-farming of TV blocks D and E (600 MHz). For example, if desired, a model providing for more TV channels in metropolitan than in regional markets might be developed. Though it may, depending on how it is done, come with additional costs and problems compared to the three-everywhere approach, the spectrum could be re-planned such that four, or even five, channels are retained in metropolitan markets, while regional markets moved to three channels at each site.

Similarly, it may be technically feasible to plan for four TV channels at every terrestrial site and still yield a digital dividend of up to 84 MHz. A possible planning model would see the remaining broadcasting spectrum (VHF and UHF) divided into four blocks of four channels, with three of those blocks in UHF. Compared to the option of three multiplexes everywhere, however, there would be significant additional broadcaster costs (up-front and ongoing), viewer costs or loss of service, and new reception problems. On the other hand, the option would increase the carrying capacity of the remaining TV spectrum by a third. By allowing use of 'single frequency networks' or SFNs, using DVB-T2 technology would make it much easier to fit in four channels while minimising costs and reception problems to viewers. Work by Free TV members to date suggests that 'four everywhere' is unlikely to

be practicable using DVB-T due to prohibitive viewer impacts. The option may be viable if DVB-T2 is used, though further work is required.

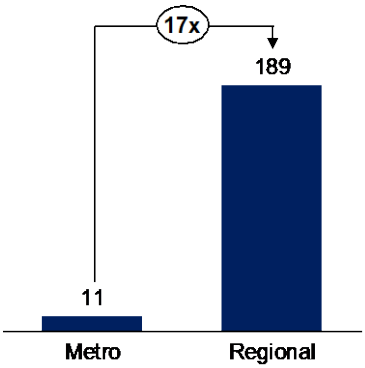
Finally, it would be premature to reject options that might deliver a dividend of somewhat less than 84 MHz. It may be that the balance of the public interest favours retention of slightly more spectrum for TV and that mobile network operators are able to find good uses for a differently configured 600 MHz allocation. Given the evidence presented in this submission that any spectrum reallocation and a 'digital dividend' may be preferable later in the decade than proposed in the Green Paper, a lot may change before 600 MHz spectrum licences are configured and sold.

Clearly, there are multiple pathways to deliver a potential 600 MHz dividend. We recommend working closely with industry and other stakeholders to identify the best path forward. Any future planning scenarios must allow for individual broadcasters to shape their own service offerings in accordance with their own strategic and commercial considerations and meet future consumer expectations.

Background: '4/3 model'

Given the sharply different per capita cost of providing TV services in metropolitan, regional and remote areas (see exhibit below), alternative models could be considered where more channels are provided in metropolitan areas than in regional areas. Such a model existed historically and is still a feature of radio in Australia.

Exhibit 14. Number of transmitters per million people (2019)



Source: InformITV. Figures are for commercial broadcasters only

Such an option could align with the different spectrum characteristics of metropolitan and regional broadcasters. The former predominantly operate in the VHF range, which has little value for telecommunications use, whereas the regional broadcasters primarily use UHF channels. Under the Government's planning proposal, VHF, as well as UHF, TV services would be compressed down from five into three channels at each site. As there is no other demand for the VHF spectrum, it may be possible for metropolitan area commercial broadcasters to continue using their present channels in the VHF band, while regional broadcasters consolidate multiplexes in the UHF band.

One issue would be that metropolitan services also use UHF channels for infill transmitters. By reducing the supply of available UHF channels in adjacent markets, retention of four (or more) TV channels in metropolitan areas would make it harder to fit everyone into the remaining UHF spectrum without increased levels of co-channel interference (or reduced coverage) at some locations. The problems would be hardest to fix in areas – such as the Central Coast region between Sydney and

Newcastle – where both the metropolitan and regional commercial TV services provide infill transmitters.

It is probably not feasible to make greater use of VHF spectrum than today. This is because most viewers in current areas of UHF reception would require a new external antenna to continue to receive TV. While moving some existing services into Block A might address some of the co-channel interference issues, the significant impact on consumers makes it a last resort.

The alternative is for the ACMA to plan the spectrum so as to accommodate one (or more) additional UHF channels required by the metropolitan operators – and accept that (depending on the exact details of what is sought), there may be new co-channel interference problems, or coverage reductions, needing to be resolved. Initial channel planning work suggests that if the full 84 MHz of 600 MHz spectrum is to be re-farmed, this is more likely to be practicable if four, rather than five, channels are retained in metropolitan areas. The co-channel interference problem is addressed later in this section. Free TV does not suggest that all commercial broadcasters would necessarily support a '3/4' or any other model at this stage.

Background: '4/4 model'

While a so-called '4/4 model' avoids the potential discrimination between metropolitan and regional service levels, this model also involves a series of challenges, which we briefly outline below. Critically, a 4/4 model would only work with DVB-T2 transmission, due to the need for larger distances between transmission sites, within the same SFN, than is possible using DVB-T.

Upgrading all transmission sites for single-frequency network capability

A single-frequency network is where multiple transmission sites use the same frequency to broadcast the same service. Currently, not all child transmission sites participate in this arrangement.

Because the option of 'four multiplexes everywhere' would require a greater use of SFNs, all transmission sites participating in the SFN would require an equipment upgrade. At a minimum the site would require a GPS receiver and associated distribution, in addition to any transmitter or translator upgrade to enable SFN functionality.

Need for new program feed arrangements to transmitters

Most commercial broadcasters make extensive use of off-air feeds to provide an input to downstream transmitter sites known as 'child' sites. These feeds may be via normal off-air reception from a 'parent' site or via an in-band link operating on the same frequency. This method of distribution is a simple and cost-effective way to convey signals to transmitters. In many cases broadcasters currently rely on 'daisy-chains' of off-air feeds to distribute programming to more remote transmitter sites.

For example, a broadcaster may currently be reticulating programming from a parent transmission site to a child site, which may in turn be feeding other child sites, using off-air reception of the upstream site.

Under the 4/4 model, or any other restack model where fewer channel blocks are available than at present, the large majority of these arrangements would not work, and an alternative distribution method would need to be found. All alternative methods will result in increased distribution costs. The population served by a child site at the end of a 'daisy chain' may be relatively small and may not justify the increased distribution cost.

At Appendix 7.3.1 we have included an example showing network transmission arrangements in the Central Coast, Newcastle and Hunter regions of NSW. Note the extensive use of SFNs, off-air inputs to child sites and daisy chain delivery to child sites.

If the child sites were made to operate as part of a single frequency network, programs would need to be fed to the downstream child sites via alternative means, such as microwave links, either from the studio or from another transmission site. The extra costs would be likely to have both a substantial capex (upfront) and opex (ongoing) component. However, these costs are difficult to estimate without more detailed location by location modelling.

This problem arises in both the DVB-T and DVB-T2 scenarios.

Free TV does not suggest that all commercial broadcasters would necessarily support a '4/4' or any other model at this stage.

Changed reception arrangements for some viewers

A possibly fatal objection to the 4/4 model, if existing DVB-T technology is used, is that the necessary greater use of SFNs may require some viewers to change their domestic reception arrangements (e.g. repointing antennas) in order to continue to receive services. Many viewers may also find themselves in a 'mush zone' between two or more SFN transmission sites, where signals from different sites interfere with each other and cause viewers to lose reception from these sites. An alternative transmission site, not in this SFN, would be required, thus requiring a change of antenna pointing or antenna type to restore reception. See appendix 7.3.2 for an example of this issue.

Use of DVB-T2 technology would obviate the need for changed viewer reception arrangements and substantially mitigate the 'mush zone' problem. Because DVB-T2 is capable of larger distances between transmission sites within the same SFN, the location of the mush zone can be better controlled. That is, mush zones can be planned to avoid areas that are dependent on reception from the sites in question.

5.3.2 Cost to restack

Summary

The Green Paper identifies that in the event of a television technology transition, "it is likely there would be some costs associated with upgrading transmission equipment and technology," and that Government would consider making "[a] contribution to these costs […] from the proceeds of the spectrum auction."[69]

As part of the planning process required for a restack, it is essential to build a detailed estimate of associated technology costs. This work should be done on a per-site and per-transmitter basis, across all networks, due to variations in topography, commercial requirements and audience characteristics between sites.

Due to time constraints in the submission process and the detailed planning involved, we do not provide detailed costings in this submission. However, capital expenditure is a material component in deciding on a future path for the terrestrial platform. Therefore, we have worked with our members

[69] Media Reform Green Paper, pp. 28-29.

to provide *indicative* estimates of the major costs associated with a range of technology scenarios, including the one proposed in the Green Paper.

To provide these estimates, we have modelled four broad scenarios:

- The **Green Paper scenario**, where broadcasters share multiplexes and migrate remaining services to MPEG-4 in a DVB-T environment (only for reference as this option is not technically feasible).
- A **compression upgrade scenario**, where broadcasters migrate some (high definition) services to HEVC. We assume multiplex sharing and DVB-T transmission as above. Some services, including standard definition services, would likely remain in MPEG-4 format.
- **Two compression and transmission upgrade scenarios**, where broadcasters migrate some services to HEVC and ensure all transmitters are compatible with DVB-T2.
    - The first of these assumes DVB-T2 compatibility for metropolitan broadcasters only; regional broadcasters continue to use DVB-T transmitters.
    - The second assumes all transmitters are upgraded across metropolitan and regional markets.

Importantly, these estimates only account for the cost of conducting the work of restacking the spectrum and upgrading necessary technology, and do not include the cost of mitigating interference issues or other challenges identified later in this section. These other costs could be substantial, and would likely entail both upfront and ongoing components. Therefore, it is critical that further, detailed costing work be completed before any final decisions are made.

As the following table shows, our initial analysis suggests that implementing the Green Paper option could cost upwards of $186m, while moving towards DVB-T2 capability for the industry could cost at least $250m-$350m. We note, however, that there are other scenarios not modelled here; these estimates should be considered carefully alongside the assumptions outlined below and in the Appendix. Likewise, these costs do not necessarily indicate a preferred option for the industry, but are intended to inform further discussion.

We also note that there is further (as yet unquantified) variability in the likely costs under a compression and transmission upgrade scenario. This is due to a series of key variables affecting the cost of transitioning to DVB-T2 transmission, including the following:

- Trade-off between investment in higher quality (DVB-T2) content to incentivise households to upgrade TV receivers, and in residual viewer interest in lower-quality (DVB-T) services. We expect this would vary over time.
- The timeline for the transition, which affects the incremental cost to upgrade transmitters (for broadcasters) and receivers (for consumers) outside of the natural refresh cycle.
- The likely end state. This depends on the size of any 600 MHz dividend, the final number of multiplexes (three everywhere; four in metropolitan areas only; or four everywhere using DVB-T2), and whether there are differential outcomes in metropolitan and regional licence areas.
- The trade-off between broadcaster costs and viewer disruption (i.e. information strategy costs). A ‘hot swap’ model (discussed in detail on p. 42) would minimise broadcaster costs (and reduce the cost estimate below), but would maximise either disruption for viewers or the costs of a consumer communication strategy; it may also slow the uptake of DVB-T2 receivers compared to other strategies.

Exhibit 15. Preliminary estimate of cost to restack under different technology scenarios (examples only and subject to revision based on specific scenarios)

	Technology option			
Cost component	**Green Paper**	**Compression upgrade**	**Compression and transmission upgrade**	
Transmission	*DVB-T*		*DVB-T2 (metro) DVB-T (regional)*	*DVB-T2 (nationwide)*
Compression	*MPEG-4*	*HEVC (and MPEG-4)*		
Restack	$114m	$114m	$114m	$114m
Encoders	$40m	$68m	$68m	$68m
DVB-T2 transmitters	Nil	Nil	$20m	$112m
Contingency	$15m	$18m	$20m	$29m
GST	$17m	$20m	$22m	$32m
Total	**$186m**	**$220m**	**$245m**	**$356m**

Source: Free TV Engineering Committee. Preliminary estimates, subject to more detailed costings. T2 upgrade costs also depend on transition strategy. These costs reflect a simulcast model, where new T2 transmitters would be required alongside existing transmitters. These costs do not include ongoing operational costs associated with each scenario. See the Appendix for detailed assumptions and exclusions.

Overview of assumptions

In each scenario, we have assumed that the commercial and national broadcasters share three multiplexes and that the size of the dividend is 84 MHz. There are many other possibilities, both in terms of multiplex sharing scenarios and the size of the dividend, but for illustration purposes we have used the assumptions contained in the Green Paper.

In each scenario we have considered, the work of the restack is the same. Fundamentally, this work would require retuning every transmission site in the country. We have used the cost of the first restack, during the transition from analogue to digital transmission, to estimate the cost of restacking to achieve a potential 600 MHz dividend, making allowances for likely changes in the scope of the work compared to the first restack (see the Appendix for detailed assumptions).

Likewise, in each scenario, there would be an associated cost to upgrade the encoding equipment to allow for multiplex sharing. This cost would be higher under HEVC scenarios due to the increased computational power (i.e. additional servers) required to run the newer compression standard.

Finally, we have estimated the cost of upgrading all necessary transmitters to be compatible with DVB-T2 transmissions. Notwithstanding the variability discussed above regarding transition models, we have assumed a simulcast model, wherein every transmission site would require new DVB-T2-capable transmitters for every multiplex. This is clearly a significantly more costly exercise in regional and remote Australia than in metropolitan areas alone.

5.3.3 Loss of existing services and/or service quality

As we outline in section 6.1.1 below, consolidating broadcasters from five to three multiplexes may, depending on the choice of TV transmission and compression technology, force broadcasters to reduce the number or quality of services to meet capacity constraints. This would be detrimental to

free-to-air broadcasters, which would lose audiences and (for commercial broadcasters) revenue. It would also negatively impact consumers, who would lose the choice and quality to which they have become accustomed. Accordingly, this would undermine the principles of media reform (see section 3), both in terms of Australians' access to high quality free entertainment, and in terms of broadcasters' long-term sustainability.

This is a weakness of the Green Paper proposals based on upgrading to MPEG-4 compression using DVB-T. As shown in section 5.2, however, the objection does not arise if DVB-T2/HEVC technology is used.

5.3.4 Sharing a multiplex between broadcasters

The Green Paper suggests that multiplex sharing between broadcasters may be part of an approach to realise a spectrum dividend. Specifically, the Green Paper posits that "[s]haring multiplexes is a more efficient way of using radiofrequency spectrum and should have little noticeable impact to viewers."[70] However, this assumption is flawed on two counts: (1) sharing multiplexes per se is unlikely to deliver significant efficiency benefits, and (2) doing so would likely impact the viewer experience. In addition, there are a number of practical challenges that would be introduced by a move to multiplex sharing between broadcasters.

Multiplex sharing is unlikely to deliver efficiency benefits

For shared multiplexes to deliver efficiency gains, broadcasters must make use of a technique called statistical multiplexing. This technique refers to a process of dynamically allocating the available bitrate in a given radiofrequency channel to different broadcast services. The principle is that by combining services with varying bitrate requirements, the total required bitrate at any given time is less than it would be if each service were given a dedicated channel. This is analogous to the concept of contention ratios in fixed line telecommunications, where flexible allocation of individual capacity allows a provider to meet consumer demands while provisioning a lower overall amount of capacity.

However, statistical multiplexing is already practised by the commercial broadcasters, yielding efficiency benefits of approximately 15%.[71] This occurs within each broadcaster's current 7 MHz channel. If most of today's 15% benefit is not to be lost, there would need to be statistical multiplexing between all broadcasters sharing each 7 MHz channel. That is, without dynamic bitrate allocation between broadcasters, the carrying capacity of each channel will actually decrease.

While theoretically appealing as a way of maximising channel capacity, statistical multiplexing between broadcasters is not only unlikely to deliver any incremental efficiency compared to the status quo, but it poses challenges for individual TV networks that may mitigate against its adoption.

Broadcasters currently control the quality of their content, including premium services like sport. As premium events such as major sports often go head-to-head, full multiplex sharing across 7 MHz channels (with the corollary of a 'multiplex manager' being required) poses hard and fundamental questions about how each network might retain an acceptable level of control of its own picture quality.

A second competitive concern for commercial broadcasters is that sharing needs to be equitable between networks, meaning all commercial broadcasters would need to share multiplexes on the

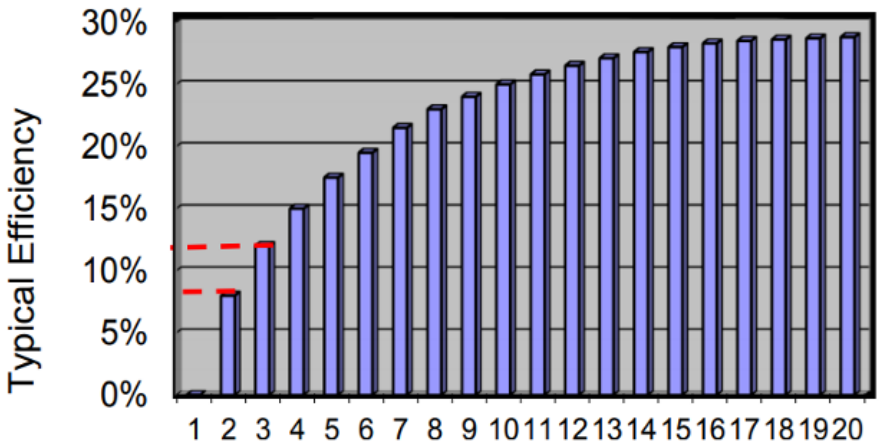
[70] Media Reform Green Paper, p. 6.
[71] Free TV Engineering Committee.

same terms. If three broadcasters shared two multiplexes, for example, equity demands that all three would need to deliver services to each of the two multiplexes, rather than only one of the three networks needing to split its programming between multiplexes. This will impose significant, ongoing costs on all three commercial broadcasters.

To address these concerns, less efficient, 'sequestered multiplex capacity' models would also need to be considered and evaluated. These models reduce the carrying capacity of a 7 MHz channel compared to the situation today.

The figure below depicts the efficiency that can be exploited from the statistical variance between channels/genres. The numbers along the X axis are streams of TV; the graph shows how a 7 MHz channel carrying 5-6 streams offers larger efficiency gains than can be achieved in a 'sequestered multiplex capacity' model, where each broadcaster's slice of the bandwidth can only carry 2-3 services.

Exhibit 16. Typical efficiency gains through statistical multiplexing



Source: ZetaCast / Ofcom, 2012. 'Local Television Capacity Assessment'. Note that the industry estimate of efficiency (15%) is lower than the theoretical figure above due to current simulcast arrangements: there is reduced statistical multiplexing benefit because both channels (primary and simulcast) call for bandwidth at the same time.

Multiplex sharing would impact viewer experience

The assumption that sharing multiplexes would not impact the viewer experience is flawed for two reasons. First, sharing multiplexes would not deliver the efficiency gains needed to maintain existing service levels. Broadcasters would be forced to reduce the number and quality of services to fit within the reduced capacity of a shared multiplex, necessarily impacting the viewer experience (addressed in the previous section).

The second reason is that a subset of viewer receivers is not designed to operate in a shared multiplex environment. This could manifest in several ways, including the possibility that shared multiplex signals could cause TV receivers to stop working entirely.

To inform this submission, we conducted preliminary tests using a small sample of commonly used TV receivers[72] and shared multiplex test streams. In our tests, no TV receivers were damaged and logical channel numbers (LCNs)[73] displayed correctly on all receivers. This would suggest that there are

[72] For these tests, we used TV receivers manufactured by Hisense, LG, Samsung, Sony and TCL. All receivers were certified by Freeview Australia and were manufactured between 2014-2020.

[73] A logical channel number (LCNs) is the 'channel' number that viewers associate with an individual TV service. For instance, in metropolitan markets the LCNs of the five primary services are 2 (ABC), 3 (SBS), 7 (Seven), 9 (Nine) and 10 (Ten).

unlikely to be broad or systemic issues associated with receiving shared multiplex signals. However, we emphasise that these results are both preliminary and based on a very small sample size.

It is also possible that our sample may have contributed to favourable test results. This is because the TV receivers tested were all FreeView compliant receivers, so one would reasonably expect a better result with these than with non-FreeView compliant receivers.

Therefore, further systematic studies would be needed as part of any further consideration of shared multiplexing.

Further practical considerations

If two or more broadcasters are to share a multiplex, their historically separate and different program distribution and transmission arrangements must be brought into sufficient alignment to permit carriage on a single transmitter everywhere where coverage of their services overlaps. While this will pose challenges for any two broadcasters who choose to share, the problems are overall more marked if commercial and national broadcasters share, due to the historically quite different coverage areas, program feed arrangements, and local breakout areas used by commercial services, compared to national services.

Different radiation patterns at transmission sites

At many transmission sites around Australia, the transmit antenna radiation patterns for commercial broadcasters and the national broadcasters are different. This stems from the need to contain commercial broadcasters to their respective licence areas whereas the national networks do not need to be restricted for commercial reasons. National broadcasters have a national coverage obligation.

In any scenario where the commercial and national networks share a common multiplex the transmit antenna radiation patterns would, by necessity, need to be the same for a given transmission site (i.e. the same building and the same tower).

This would result in one of two outcomes:

- The national networks' radiation patterns would need to be modified (reduced) to match the pattern of the commercial broadcasters they share with; or
- The commercial networks' licence areas would need to be modified (in most cases increased) to match the national networks.

This assumes that all multiplexes would utilise the same antenna at a given site. If this were not the case a further complication would occur: different multiplexes at a given transmission facility, with a mixture of national and commercial broadcasters, would have different transmit antenna radiation patterns. In a shared scenario this would result in some viewers receiving some services from individual networks but not others from the same network.

Transmission site real estate and related costs

At many transmission sites around Australia the commercial and national broadcasters occupy different buildings. These buildings often have a related transmission tower associated with them. This is often the case at major high power 'parent' transmission sites.

In any scenario where the commercial and national networks shared a common multiplex, the transmitters and combiners would, by necessity, need to be co-located in a single building and on a single tower.

This would result in one of two outcomes:

- The commercial networks would need to relocate their equipment into the national broadcasters' building and share the tower. This could raise the operating costs of the commercial operators as there would be no choice of an alternative real estate provider and would limit the commercial networks' negotiation power; or
- The national networks would need to relocate their equipment into the commercial operators' building and share the tower.

In either of the above scenarios the cost of any restack would be increased due to additional re-housing of transmitters, combiners and program input equipment when sharing a common tower. This may also extend to costs related to the potential upgrade of feeder cables and power dividers on existing towers where the current infrastructure is inadequate for combined commercial and national operation. Such a consolidation rearrangement would also consume considerable resources through the commercial negotiation of site access arrangements, and knock-on impacts arising from early termination of on-foot agreements.

A further factor to be considered is antenna aperture. The aperture determines the gain of the transmit antenna system. Where any network relocates its equipment to the alternate antenna at a transmission site, an assessment of transmitter power would be required. If a network relocates from higher gain infrastructure to lower gain infrastructure, there would be an increase in operating cost and the potential need to replace the current transmitter with a higher power unit to maintain the same coverage.

Overlap areas

In some multiplex scenarios where commercial and national broadcasters are within the same multiplex, the channel requirements for overlap areas would increase. This is due to the metropolitan and regional multiplexes both containing the national broadcasters, which results in presenting the national broadcasters twice. The net result is that an additional channel would be required in overlap areas such as the NSW Central Coast and Gold Coast (QLD).

The solution could be to create a 'special' multiplex for overlap areas without including the national broadcasters. This would alleviate the need for an additional channel in these areas. However, this would increase the headend encoding and distribution costs for those commercial networks servicing these areas. Viewers' program availability could also be impacted.

This issue is further complicated by the metropolitan and regional broadcasters having different radiation patterns in overlap areas. Any solution would need to ensure that all homes had access to the national networks.

Commercial sub-markets

In regional areas the commercial broadcasters divide their licence areas into sub-markets to maximise local news and advertising sales focused on the public in the area served. Although these sub-markets do not always align between the regional commercial networks there are many more sub-markets than the service areas covered by the (often) state-wide coverage of the national broadcasters. Commercial broadcaster services may also overlap state borders.

In a scenario where commercial and national broadcasters were to share a multiplex, the national broadcasters would need to increase the number of encoders to match the number of sub-markets served by the commercial broadcasters. This is because each sub-market would require its own

statistical multiplex pool and thus would require a unique encoder for each service in that pool. The program distribution costs of the two national broadcasters would also materially increase.

The example at Appendix 7.3.1, showing network transmission arrangements in the Central Coast, Newcastle and Hunter regions of NSW, illustrates the way different networks currently have widely differing break-out zones.

5.3.5 Co-channel interference

The issue

A major challenge for the ACMA and industry will be how to avoid or minimise co-channel interference at the planning stage, and how to mitigate it when it occurs. Co-channel interference occurs when two or more different signals are present within the same radiofrequency channel. These signals interfere with each other and can cause significant issues.

Co-channel interference is a problem that exists today with the current spectrum planning and channel allocation. This interference manifests in two different ways. The first is sporadic, often seasonal, interference directly to viewers' TV receivers resulting from 'ducting' of distant, co-channelled TV services into viewer antennas. It often affects peak-time viewing and can become an issue for viewers.

The second occurs when the interference affects the in-band links or off-air feeds broadcasters use to distribute programming from 'parent' to 'child' transmitters. When this happens, everyone viewing the downstream transmissions will experience the disruption. Use of in-band links and off-air feeds is widespread throughout the TV industry Australia-wide and substitution by alternative means of distribution (e.g. microwave links), is often too costly for industry.

After the first digital dividend, some co-channel interference was an inevitable consequence of reducing the amount of spectrum available to broadcasters, especially in areas where channels are scarce due to overlapping commercial licence areas (e.g. the Hunter, Illawarra and Gold Coast regions). With careful planning, it is possible co-channel interference will be no worse overall than following the first restack.

Prior to detailed implementation planning, however, the industry cannot rule out that problems may be worse than last time. For example, it is possible that the interaction of limited channel choices, the superior distance propagation of 500 MHz spectrum (compared to 600 MHz spectrum), and the pre-existing locations of transmission sites and their associated off-air feeds and in-band links, results in an intractable new set of problems emerging, which requires expensive remediation.

An important learning from the first restack is that areas experiencing unacceptable levels of interference are not always predictable. Problems may surface over time and in unexpected locations. To avoid further 'seasonal ducting' issues on the scale of those experienced in the Hunter region since the last re-stack, it is critical that Government support for any industry restack extends to funding that resolves unpalatable co-channel interference problems as and when they arise. Experience shows this should include a level of contingency funding for problems that emerge over time.

Background

Rectifying co-channel interference can be slow and disruptive for viewers, and can impose costs on Government, broadcasters and viewers. Mitigating the problem at just three sites in the Hunter – Wallaroo, Gan Gan and Bulladelah – has cost nearly $750,000 (shared between commercial

broadcasters and the Government). This excludes the costs faced by thousands of householders to repoint or upgrade their domestic antennas. The three sites are only phase one of a long-term plan (the Hunter Transmission Upgrade Project) to mitigate co-channel interference throughout the Hunter region.

As 500 MHz signals travel further than 600 MHz (increasing the interference risk), preventing higher levels of co-channel interference will require reductions to transmitter power. This may create other problems at the margins, such as marginal viewers losing reception.

If this doesn't work, more drastic options (each with varying degrees of downside risk) might include:

- Replacement of affected off-air feed arrangements (may be prohibitively expensive for broadcasters);
- Limited use of VHF channels in current UHF areas (many viewers will lack suitable antennas);
- Use of one or more channels from Block D (would shrink any potential 600 MHz dividend);
- Use of more robust signal modulation (would further reduce the data rate available to each broadcaster); or
- Moving viewers to VAST (loss of local programming; high satellite dish and receiver costs).

5.3.6 Carrier interference after a restack

The issue

Fixing interference to TV from telecommunications carriers operating in 600 MHz spectrum is something broadcasters expect the Government (or mobile network operators themselves) to prevent or remediate at their own expense, rather than leaving it to broadcasters or viewers. However, it is critical that the risks and the potential costs of prevention and remediation are well-understood and fully scoped early on so that appropriate contingency can be made.

We expect that any wireless broadband allocation will be separated from the top of the TV allocation by a 'guard band.' As discussed in section 5.3.1, adoption of the US (FCC) 600 MHz band plan could mean the wireless broadband allocation was separated from the top of the TV allocation by a guard band as little as 7 MHz wide. Commencement of wireless broadband (5G) services in the vacated 600 MHz spectrum band is likely to result in interference with free-to-air TV signals. This issue is well-known from the first digital dividend, where it usually required a specialised filter to filter out carrier interference. However, the 'reverse duplex' arrangement proposed for wireless broadband in the 600 MHz band means the problems may be more widespread and harder to mitigate this time.

Carrier interference has two causes:

- First, TV antennas or masthead amplifiers picking up **adjacent channel out-of-band emissions** by mobile base stations, in the same frequency as the TV channel viewers are watching. The 7 MHz guard band, and mandatory filters fitted to mobile base stations, should mitigate this problem but it may be unavoidable in some cases (e.g. if a nearby TV antenna is pointing directly at the base station).
- Second, TV antennas or masthead amplifiers picking up in-band emissions by mobile services operating in the 600 MHz band and causing **'receiver overload'**, meaning the TV is unable to 'hear' the wanted signal because of the strength of unwanted signals from the mobile base station.

Interference from adjacent channel out-of-band emissions cannot be fixed by fitting filters. Generally, the householder will either need to fit a new, and more directional rooftop antenna, or repoint their

antenna at another TV tower. If no other signals are available, a sub-set of viewers may need to obtain TV services from another source, such as DTH satellite (which would incur antenna installation costs).

The expectation is that interference from mobile services operating on their intended frequencies in 600 MHz would normally be fixed by fitting filters that 'screen out' 600 MHz signals. Although this was the experience with 700 MHz, it is possible that the challenge could be greater with 600 MHz.

In the case of 700 MHz, carriers use the lower part of the band (nearest to TV) for low-power and usually transitory transmissions from mobile devices back to a base station. These signals rarely disrupt household TV viewing. The mobile base stations themselves are potentially much larger sources of interfering signals. However, as they use the upper part of the band – separated from TV by over 50 MHz – any interference problem is usually readily fixed by fitting an inexpensive filter at an appropriate place in the viewer's antenna system and cabling.

However, there is every indication the proposed 600 MHz wireless broadband allocation will be 'reverse duplex,' meaning that base stations will operate in the lower part of the band, as little as 7 MHz from the nearest TV signals.

This is illustrated by the following spectrum chart for 5G services now standardised by the FCC in North America and the ITU in Europe. (Note the "reverse duplex" base station starts at 617 MHz, the new top end of the broadcast band after a second restack to yield 84 MHz.)

Exhibit 17. Spectrum chart for 5G services in North America and Europe

600MHz Band					700MHz Band				
Reverse Duplex FDD					Conventional Duplex FDD				
Base Station Down Link		Mid Band Gap	User Equipment Up Link		User Equipment Up Link		Mid Band Gap	Base Station Down Link	
617	652	11Mhz	663	698	702	743	10MHz	761	802

A 'reverse duplex' poses two, very serious challenges that require further scoping in the short-term and the development of mitigation strategies as part of any process to re-farm 600 MHz. The first is that many more households will experience interference from the much stronger signals coming from (elevated) 5G base stations, typically whenever a new base station is in the field of view of the household antenna.

The second is that in order to be effective, any filter fitted to shield TV reception will need to be far more expensive, and potentially bulkier, than the simple filters used for 700 MHz carrier interference problems. The expense arises because filters vary in complexity depending on how 'steeply' they cut off reception of the unwanted signal. In essence, the larger the guard band or spectrum interval, the less complex (and hence less expensive) the filter needs to be. In the 700 MHz band, filters can be gently sloped, right across the 50 MHz separating TV from 4G base stations. By contrast, a 600 MHz filter, assuming the reverse duplex arrangement, would need to be far 'steeper' (and hence more expensive), since the unwanted signals could begin as little as 7 MHz away from the TV signals.

Early indications suggest realistic filter pricing would be in the several hundreds, rather than the tens, of dollars. Of the two technologies available, one (used for professional-grade filters, such as for broadcasters' own in-band links) is prohibitively expensive, with a price in the thousands of dollars. The other is likely to be much cheaper (hundreds) but results in much greater diminution of the strength of the 'wanted' signal. Where such filters are fitted, a percentage of households would lose reception due to weak TV signals.

Further work is needed to scope out both the problem and the mitigations, before final decisions can be made on how 600 MHz is re-farmed. Specifically, work is needed to understand what kinds of filter products, and at what prices, industry can supply. We also recommend work to estimate the number of affected households.

Given the importance of TV reception in Australia, and depending on the outcomes of the above work, consideration should also be given to any mitigations possible at the spectrum planning stage, such as a wider guard band separating TV from wireless telecommunications. 'Time-division duplexing' or TDD arrangement of the 600 MHz band, as has been adopted for 5G services above 1 GHz, might also affect the scale and nature of the mitigations, although TDD would also see base station operation adjoining TV. Free TV expresses no view on whether TDD arrangements in 600 MHz are feasible.

The carrier interference problem will be resolved in different ways for different affected households, but common elements include the need for a tradesperson to visit, the need for a new filter, antenna or other change, and close temporal correspondence to the carrier rollout of 5G services in 600 MHz.

Whatever the final anticipated size of the problem, there are UK precedents in the Ofcom Award for the 800 MHz band for remediation to be funded collectively by all successful bidders for 600 MHz licences, with conditions on spectrum licences to deal with any later-emerging problems following expiry of the fund.

Background

In general, reception of free-to-air TV requires a suitable external antenna. The installed external antenna base in Australia is of widely varying ages, type and appropriateness to current TV services. Different external antenna arrangements may dispose neighbouring households to suffer different problems and mitigate against accurate forecasts of number of people affected, though ranges can be estimated.

Antennas divide into 'Yagi' and 'Phased Array' types, and may or may not have a signal booster or 'masthead amplifier' fitted. Yagis, because they have better directionality, may make carrier interference from a nearby base station less likely. By magnifying unwanted signals, signal boosters may create problems where none would otherwise exist. One antenna and signal booster may serve all TVs in a home, or in a block of apartments.

Fitting a filter to address carrier interference may require a visit to the rooftop or be possible in-house – depending on the nature and location of the device experiencing the signal overload. However, householders may have limited knowledge about their external antenna set up and, in general, industry and Government should discourage people from working on their own rooftops.

5.3.7 Interference with wireless microphones

The issue

The Green Paper does not acknowledge the existing low interference class licence users of spectrum in the 600 MHz band. These users, such as wireless microphones and in-ear monitors, are currently class-licensed to operate in so-called 'white spaces' in the UHF broadcasting services bands. Government will need to address the impact on these services of any decision to reallocate 600 MHz spectrum.

This will require:

- Strategies to clear existing low interference devices out of spectrum required for wireless broadband or for 'restacked' TV services, and
- Strategies to accommodate the wireless mic requirements of the broadcasting and entertainment industries in the future.

In the event of a restack, broadcasters and telecommunications companies will require interference-free use of 500 MHz and 600 MHz spectrum, respectively, which are currently also used by low interference devices. The following table outlines some of the uses of wireless microphones by different user classes.

Exhibit 18. Wireless microphone use cases by user class

Wireless microphone user	Example use cases
Broadcasters	Press conferences; etc.
Professional users in the film and entertainment industries	Live performances; etc.
Amateur users	Theatres, church halls, special events, etc.

The challenges

Implications for existing devices

Most current equipment will lack the re-tuning capability to move into any remaining available spectrum, so must be replaced. This is particularly problematic given many users have only recently refreshed their equipment following the 700 MHz re-farming process.

Similarly, class licence users may be unknown to the regulator and unaware they are affected, so a suite of effective communications strategies will be required in order to clear any spectrum required in future for wireless broadband, or for TV broadcasting. The need for effective communication starts immediately, as equipment retailers and users face an immediate 'crisis of confidence' about which parts of the current broadcast spectrum bands will be available for low interference devices in future.

Accommodating wireless mics going forward

Re-farming of 600 MHz and re-tuning of TV into 500 MHz may result in much less, and/or noisier, 'white space' spectrum suitable for low interference device operation. Especially in highly congested areas, such as the Gold Coast, this may affect the feasibility of using UHF 'white space' at all, or the operating range (and therefore the utility) of wireless mics. In the US, the 600 MHz 'duplex gap' was identified for migration of some wireless mic services. Free TV understands there have been serious problems due to 'noise'; there is an opportunity for Australia to learn from US experiences here.

While there are other bands already available for wireless mics, notably 1785-1800 MHz, inferior propagation of 1800 MHz spectrum makes it unsuitable as a direct replacement for some UHF equipment.

How to proceed

Re-farming of 600 MHz would necessitate a program of work, accompanied by consultation strategies, to tackle the challenges outlined above for wireless mics. Immediate steps include:

- Prompt Government measures to reach out to retailers and wireless mic user groups about 600 MHz re-planning.

- An ongoing communications strategy to keep retailers and wireless mic users apprised of the implications of re-planning of the broadcast spectrum bands.
- A program of work to ascertain sector requirements, determine future planning arrangements and consider whether any other assistance is required for wireless mic users.

5.3.8 Reception disruption during restack

As with the first TV restack, some disruption to TV reception could be expected after TV channels were retuned. This is for a range of reasons. Unlike last time, however, the wider availability of alternative sources of TV means that viewers may be less inclined to persevere or spend money than before. Restacking TV channels should not be allowed to deal local TV services a body-blow: a comprehensive communications strategy is needed, and potentially other assistance where appropriate. Solutions may differ depending on the cause of disruption.

If a potential restack were accompanied by a technical upgrade to a new compression or transmission standard, part of any strategy would be to alert viewers with older TV receivers to the problem and to any solutions.

Under the Government's preferred option of an early move to multiplex sharing using DVB-T / MPEG-4, there is also the issue of the unpredictable behaviour of viewers' TV receivers that are not designed for shared multiplexes (see section 5.3.4 above).

In some areas where TV would need to be re-tuned from the 600 MHz to the 500 MHz band, TV services may have been transmitted formerly using 700 MHz ('Band V') UHF spectrum prior to the last restack. Some old antennas that were optimised for Band V may have been able to receive 600 MHz signals reliably but would not reliably receive 500 MHz. The result may be drop-outs or unavailability of TV services for some households following any restack. Restoring coverage would generally need a new antenna. The industry's best estimates are that this problem is likely to be manageable. However, the Band V antenna problem should be further scoped and managed as part of the comprehensive information campaign to assist viewers with any restack.

5.4 The roles of other technologies in broadcasting TV

5.4.1 TV Distribution: Hybrid Today and Hybrid Tomorrow

Free-to-air broadcasters already use a mix of technologies to deliver content to audiences on a range of devices in a variety of formats. Terrestrial broadcast is the primary technology, used for the majority of live broadcast. In addition, satellite direct to home and cable (via Foxtel) also deliver live broadcast to a substantial minority of households. BVOD services, where offered, are delivered via fixed and mobile broadband connections.

We expect that terrestrial broadcast TV will continue to be the primary delivery mechanism for free-to-air content well into the medium term. While recognising that the viewing mix of terrestrial and IP delivered content is changing, IP streaming will not be a substitute for terrestrial broadcasting for the foreseeable future, and any proposal for wider use of satellite DTH must contend with high transition costs for viewers. Any roadmap for future delivery of free-to-air TV should take a holistic view of all these candidate technologies, noting the evolution of both satellite DTH and IP delivery options as well as ongoing changes in TV viewing habits. Such a roadmap also needs to account for the different implications of BVOD for the Seven, Nine and Ten networks and their regional affiliates.

The future is hard to predict, and we should accept that any roadmap is likely to be iterative, with some options falling by the wayside and others emerging or strengthening as the decade progresses. We are still at an early stage in the design phase, highlighting the need for continued work with all industry stakeholders to design a holistic set of long-term solutions for free-to-air broadcasting.

Similar to these 'delivery technologies', there is a related discussion regarding 'TV receiver technologies.' TV receiver technologies refer to standards and specifications within viewer receivers, which affect how signals are received and displayed, as well as the additional functionality and features that broadcasters can deliver to viewers.

In the following section, therefore, we explore the current state of each technology and its future potential in free-to-air broadcast.

5.4.2 Current State of Future Technologies: Delivery Platforms

As part of building our technological fact base in response to the Green Paper, we have also examined the current state of alternative delivery options, and their likely roadmaps. In this section we provide an overview of other content delivery technologies based on our analysis to date, giving a brief outline of the current capabilities of each technology and anticipated future developments.

Importantly, for reasons discussed above, these technologies are unlikely to replace terrestrial broadcast over the coming decade, not least because they would impose significant additional costs on individual households to implement. However, these technologies may offer effective supplementary platforms to terrestrial broadcast that reduce costs, increase capacity or improve the consumer experience. This underscores the need for a careful and considered approach to designing the future of free-to-air TV distribution. As an industry, we will continue to monitor the development of these and other technologies, as an input to such an approach.

IP streaming over fixed line

With the growing importance of internet-delivered TV to most Australians, it is worth considering whether and why free-to-air broadcasters and the Government have no choice but to persevere with expensive terrestrial (and satellite) TV broadcasting infrastructure. At the outset, we acknowledge that regional and remote broadcasters do not offer BVOD services. As such, this section is intended as a technology stocktake of internet protocol-based (IP) delivery options, and does not imply that the commercial TV industry supports, or has a position, on IP streaming as an alternative to terrestrial broadcast TV.

Given the NBN's central role as wholesaler of last-mile access to the majority of Australian households – with an access network that 'passes' approximately 12 million premises[74] and an overarching purpose of ensuring "all Australians have access to high-speed, resilient and secure broadband"[75] – it is important to consider what potential future role the NBN may play in TV delivery. Accordingly, we have engaged with the NBN in a fact-finding capacity as part of our submission process.

It is important to draw the distinction here between the existing live streaming offered in BVOD services that are effectively unicast bitstreams delivered via broadband networks to individual

[74] NBN Co, 'Weekly progress report (15 April 2021)', accessed 22 April 2021.
[75] NBN Co, 'Corporate Plan 2021', 2021.

consumers, and point-to-multipoint technologies such as terrestrial broadcast TV that simultaneously serve all householders in a coverage area with exactly the same live content.

Replacing terrestrial broadcast TV with internet delivery would require simultaneous delivery of live streaming to millions of people. IP delivery of live TV (via the NBN) is not a viable substitute for terrestrial delivery, at least for the time being. Although NBN developed a 'Multicast' product in the early 2010s (designed to support point-to-multipoint distribution of broadcasting services using NBN's fibre network), this was never adopted and is not a viable solution today – not least because it was only designed for fibre-to-the-premises (FTTP) connections, prior to the NBN's adoption of a multi-technology mix.

Indeed, for fixed line connections to be a suitable medium to replace terrestrial TV broadcasts in any area, a series of major challenges would need to be addressed:

- Ubiquity: to replace terrestrial TV, the approximately 25% of households not currently connected to the NBN would need to obtain suitable internet connectivity.
- Cost to viewers: many affected TV viewers would face the cost of upgrading TV receivers and acquiring and paying for a broadband connection, as necessary.
- Cost to Retail Service Providers (RSPs): complete migration of IP delivered live TV using the existing model of point-to-point delivery via broadband agreements between consumers and NBN's Retail Service Providers, even if it were technically feasible for all premises, would also impose prohibitive costs on broadband retailers. If RSPs were to carry all the free-to-air TV to all households that currently enjoy terrestrial TV, it has been estimated that the additional (CVC) payments to NBN would considerably exceed the entire cost of terrestrial transmission of TV.[76]
- Reliability: broadband-delivered viewer services will often lack the reliability of service required for live TV, which targets 99.999% uptime (equivalent to a maximum of 5 minutes 15 seconds of downtime per year). Increased reliance on fixed line delivery would also raise serious issues of network resilience requiring further study.
- Speed: many, although a minority, of broadband connections are still too slow. Even if the infrastructure can support the necessary speeds, consumer broadband plans may not. Recent research suggests this may be particularly acute in regional areas.[77]
- Commercial considerations: as noted elsewhere in this submission, regional broadcasters do not have the digital rights to content. This would need to be worked through as part of any fixed line solution. A secondary concern is regional sub-markets, which would need to be respected.
- Prominence: the challenge of remaining prominent or easily discoverable on viewers' devices would need to be addressed. This is the question of how to prevent local TV from becoming invisible in a borderless, online world of abundant choice.
- Duplication of costs: many broadcasters have long-term terrestrial contracts with transmission services providers. Implementing IP delivery for free-to-air live TV would effectively duplicate transmission costs for terrestrial broadcast TV, which would be unsustainable.

Our initial consultation with the NBN suggests that some of these challenges could be resolved over time, but that this would require a multi-year product development cycle on the part of the NBN, and

[76] Venture Insights, 'Taking Free-to-Air TV online in Australia: opportunities and challenges' (report commissioned by Swinburne University of Technology), 2020.
[77] RMIT University and Swinburne University of Technology, 'Measuring Australia's Digital Divide: The Australian Digital Inclusion Index' (report commissioned by Telstra), 2019.

clear requirements and commitments on the part of the free-to-air industry. As an industry, we will continue to consult with the NBN and other fixed line carriers as we develop the long-term technology roadmap for free-to-air TV.

IP streaming over wireless broadband

At present, delivery of free-to-air services via mobile broadband is not feasible. According to a recent report,[78]

> *[…] it is impracticable for mobile networks, even 5G networks, to play a leading role in any free-to-air migration to the online environment. Mobile networks are optimised, unsurprisingly, for mobility not capacity. According to the latest ACCC figures, Australia's fixed networks carry over 9 times more data annually than Australia's mobile networks, and this ratio is rising.[79] […] New data traffic from free-to-air television migration would roughly equal current fixed traffic levels, and there is no scenario where mobile networks could carry this much data.*

In the long-term, however, greater implementation of multicast or broadcast technologies over wireless networks may address the data traffic concerns outlined above. For instance, European initiatives are investigating multicast and broadcast capabilities as a core component of 5G systems, in addition to unicast, under the moniker of Enhanced TV.[80] However, the point remains that mobile broadband is not a suitable delivery medium for live free-to-air TV delivery, nor is it likely to be so for some years to come. Nonetheless, the industry will continue monitoring developments in this space as it considers the long-term technology roadmap of free-to-air TV.

Satellite and Direct-to-Home

Globally, satellite DTH is proven both as a supplement and as a substitute for terrestrial TV coverage. Its major advantage is it is more cost-effective to reach sparsely populated households than terrestrial broadcast. In Australia, satellite DTH has provided 'safety net' coverage for viewers that cannot access terrestrial broadcast since the 1980s. The current VAST satellite platform, which is heavily Government-subsidised, serves approximately 1m viewers in Australia who do not have access to terrestrial television. VAST is accessed by the following viewer segments:

- Remote, Central and Eastern (RC&E) licence area;
- Remote WA licence area;
- Travellers;
- Ships, oil rigs and small remote island communities; and
- As a safety net for viewers in terrestrially-served licence areas with poor or non-existent terrestrial reception due to local topography.

Historically there have been a number of impediments to wider use of satellite DTH. One is cost: there is a relatively high upfront cost to install the necessary equipment at each household. A recent industry estimate of the cost of replacing viewer antennas to receive DTH signals is $850 'as a guide'. This is based on $450 for equipment plus $400 in labour for installation.[81] While it is possible this cost might come down, either because of volume discounts or cheaper parts, it is likely to be too high for

[78] Venture Insights, 'Taking Free-to-Air TV online in Australia: opportunities and challenges' (report commissioned by Swinburne University of Technology), 2020.
[79] ACCC, 'Internet activity report', June 2020.
[80] Gibellino, D. 'How 5G will change your TV for good', 2019.
[81] Estimate based on informal discussions with the ABC and Optus.

individual consumers to fund. Indeed, without Government support for households to install DTH dishes, it is unlikely that the technology could be implemented beyond today's VAST network.

A second objection is that satellite DTH cannot carry enough live TV streams to address time zones, licence area boundaries and local content or advertising 'breakout' issues in regional markets. Newer satellite technologies – expected towards the middle of the decade – are likely to address this limitation. As well as addressing viewer concerns about local relevance of TV services, this also suggests that next generation satellites could improve monetisation of DTH beyond today's levels.

While not suggesting satellite is currently a viable alternative to regional terrestrial broadcast services, ongoing improvements in satellite DTH technology may offer a medium-term solution to reduce transmission costs in the least populous sites around the country, if the cost of transitioning viewers could be overcome. In practice, this would mean retiring low population (typically fewer than 2,000 residents) broadcaster re-transmission facilities in small communities and converting those communities to DTH.

However, there are a number of other challenges associated with this approach, which would need to be overcome for satellite DTH to be a viable medium-term substitute in areas that are currently terrestrially served. Upgrading of satellite DTH capability, including any future substitution of cheaper satellite DTH for terrestrial coverage, would require careful coordination. As viewers expect to receive all TV services via a single TV receiver or other device, satellite substitution needs to take place on a one-in, all-in basis. The respective costs and benefits to Government, the TV industry and viewers also need to be weighed up, as savings to one may otherwise be premised on additional costs or disruption to another. With these caveats, the ongoing rapid evolution of satellite DTH technology suggests the economics of satellite versus terrestrial TV delivery may continue to change over time, especially in the more lightly populated parts of the terrestrial TV footprint. The role satellite DTH plays, or could play in future, should be kept under review as a part of any future 'roadmap' for TV transmission.

5.4.3 Current State of Future Technologies: Receiver Technologies

In addition to the delivery technologies addressed above, there are a number of standards and specifications in development at the TV receiver level. These TV receiver technologies address how content is received and displayed on viewers' TV receivers. Developments in this space impact the functionality and overall experience that free-to-air broadcast can deliver.

Below we consider the industry's ongoing development of the HbbTV platform, which is in the process of being upgraded to HbbTV 2.0, and an emerging new standard, DVB-I. While DVB-I is only in the development phase, it offers opportunities for the future, and should be monitored as part of the development of a long-term technology roadmap for free-to-air TV delivery.

HbbTV 2.0

The free-to-air sector launched its first Hybrid Broadcast Broadband TV (HbbTV) product, FreeView, in 2008. As its name suggests, the HbbTV platform brings together the terrestrial free-to-air content with additional content provided over IP.

In those markets where the broadcaster has the IP streaming rights to content, when a viewer selects a terrestrial channel, a FreeView pop-up is displayed. The industry is in the process of launching a new FreeViewPlus product, based on the newer HbbTV 2.0 standard. Under the older HbbTV 1.5 product, the pop-up enabled viewers to press their red button to access the BVOD offerings of the network, with this content being delivered over IP or the green button to show the EPG.

With FreeView's recently released product, viewers are displayed a mini-guide, showing both upcoming programming and the ability to go 'back in time' to access the catch-up BVOD offerings of broadcasters. Both the old and new products provided a full 7-day EPG to viewers.

As discussed in section 5.1.5, ongoing revisions to the Australian TV receiver standards are expected to support HbbTV 2.0.3, which the free-to-air TV industry recommends making mandatory in all connected TVs. By allowing IP-delivered break-out content to be interposed directly over terrestrially-delivered broadcast content, HbbTV 2.0.3 opens the door to much more localised break-outs than current terrestrial transmission 'footprints' are able to support. This will allow for targeted news, advertising and other content of relevance to particular subsets of viewers, as well as more interactive content.

Some TV receiver manufacturers have already deployed functionality that is able to target advertising based on a viewer's location, interests and online viewing behaviour. Mandatory inclusion of HbbTV 2.0.3 on internet connected TV receivers will allow the free-to-air TV industry to match these alternative offerings. In addition, using HbbTV 2.0.3 commercial broadcasters will be able to deliver programming and advertising that is more relevant and engaging to audiences.

DVB-I

DVB-I is a relatively new standard under development by the industry-led Digital Video Broadcast (DVB) consortium. In essence, the specification enables live TV services to be delivered to internet-connected devices. It allows TV receivers to display terrestrial and IP-delivered services within the same onscreen environment, including the ability to access these services via the electronic programme guide (EPG).

According to DVB, the specification defines:[82]

- signalling of linear TV or radio services and content that are delivered over broadband;
- access to linear TV services that are delivered by broadband in a way that is consistent with access to linear TV services delivered by RF-based DVB technologies;
- the metadata and mechanisms to present electronic programme guides;
- the integration of linear services delivered by the RF-based DVB tuner and linear services delivered by broadband into a single coherent offering that is accessed through a single consistent UI; and
- a method for national TV regulators or their representatives, operators and trademark licensors to offer a list of trusted/legitimate/authorised/regulated services.

While the standard is still at a relatively early stage, we observe that DVB-I could be a useful development to raise greater awareness of Australian television broadcasters' programming rather than relying on service discovery methods currently in smart TVs. This functionality could also be developed via HbbTV with a fully integrated IP delivery platform. This may not necessarily use the Red or Green buttons on a remote for service selection, but a selection of a service via a logical channel number value, giving the viewer a seamless experience.

However, DVB-I's development life cycle has only recently commenced and therefore the technology should be seen as a long-term development for further observation.

[82] DVB, 'DVB-I Service Discovery: Service Discovery and Programme Metadata for DVB-I', 2020.

6. Industry Response to the Green Paper Proposals

Key points:

- The Government's technical proposal to achieve a 600 MHz dividend (using three shared multiplexes and a migration to MPEG-4 compression) is based on flawed technical assumptions and is not acceptable to our members.
    - MPEG-4 alone will not deliver the efficiency gains required to maintain service equivalence.
    - Likewise, MPEG-4 will not support improvements in picture quality on the terrestrial platform, which the industry requires for long-term sustainability.
    - Loss of the ability to remain competitive with other content service providers will have large and possibly unforeseen consequences on delivering public policy goals and threatens the economic and employment benefits directly associated with the free-to-air television sector.
- In addition, the regulatory proposals outlined in chapters five (CAST fund) and six (VOD content investment obligation) of the Green Paper risk undermining long-term industry sustainability by inflating the cost of local content production.
- Finally, the proposed timeline is too aggressive and should be extended.
    - There is no evidence of a telecommunications industry requirement for 600 MHz spectrum in the timeframe contemplated by Government, with sub-1GHz spectrum requirements for 5G rollout expected to be addressed using existing spectrum or spectrum to be auctioned late in 2021.
    - Independent economic modelling undertaken by CEG has found that the economic value of the 600 MHz is likely to be maximised towards the end of the decade at the earliest, rather than in 2025 as proposed in the Green Paper. We also note that moving too quickly risks jeopardising the material economic contributions made by the free-to-air industry, as outlined in section 3.
    - Restacking the 600 MHz band requires significant preparatory work; the proposed timeline does not allow sufficient time for this work to occur.
    - Australia is typically a 'standards-taker' from other jurisdictions. Restacking the 600 MHz band in mid-2024, as currently proposed, would be relatively early compared to other jurisdictions and would force us to make bets on technology and standards that we need not make.

6.1 Response to terrestrial proposals: unworkable and unattractive

In order to respond to the Green Paper in a comprehensive and constructive manner, we have conducted a detailed and complex program of work to assess the specific technical proposals outlined in the Green Paper. We have worked closely with the broadcast engineers of every free-to-air broadcaster (including the national broadcasters) as well as representatives from transmission services providers (TX Australia and BAI Communications), antenna and TV set manufacturers, the NBN, and the relevant standards organisations. The aim of this work has been to develop a shared fact base that is suitable for assessing the Green Paper's terrestrial proposals. We outline this assessment below.

Before addressing the specific Green Paper proposals, we make a brief comment on the proposed mechanism for taking up new licences. Free TV accepts there is a place for 'individual opt-in' to any future transmission arrangement, provided that all services in an area continue to be available through a single, ubiquitous and affordable TV receiver. Decisions about transmission, including whether and on what terms to share multiplexes, will be made on a network-by-network basis. Strategies may differ between national and commercial broadcasters, between metro and regional broadcasters, and between directly competing networks.

The Green Paper proposes a new class of broadcast licence that would see broadcasters vacate spectrum in the 600 MHz band in return for spectrum fee and regulatory relief. The Green Paper outlines a possible technology pathway[83] to achieve a 600 MHz dividend while supporting broadcasters' long-term sustainability.

While acknowledging the principle of allocating spectrum to its highest value use, in this context the Government should have regard to both financial and social value, including the substantial and wide-ranging public goods provided by the free-to-air industry (detailed in section 3). The industry is willing to work with Government to consider a technology roadmap that may lead to the eventual reallocation of some UHF spectrum, subject to the decision points and requirements identified in sections 4.1 and 5.1. However, any 'digital dividend' that is yielded through this roadmap must be at a time and in a way that is consistent with a viable, sustainable and freely available local TV industry and allow for individual broadcasters to shape their own service offerings in accordance with their own strategic and commercial considerations.

However, after extensive analysis and consultation, we have concluded that the 'new licence' proposal and the associated technical proposition would be untenable for our members, because this proposition would impose unacceptable commercial and strategic costs on the commercial broadcasters. Specifically, the Green Paper proposition would not support service equivalence for broadcasters and would also rule out future growth on the terrestrial platform, in addition to imposing a series of complex and costly practical issues. Finally, the new licence proposal is predicated on an assumption that, for free-to-air broadcasters, using less radiofrequency spectrum is principally "a path to a lower cost model."[84] In reality, reducing spectrum use and consolidating multiplexes will have minimal impact on broadcaster costs, while impacting revenue models to a far greater degree. Each of these issues is explored in further detail below.

6.1.1 No service equivalence

Summary

The industry's detailed modelling shows that adopting MPEG-4 encoding and consolidating to three shared multiplexes, as proposed in the Green Paper, will require cuts to picture quality and the number of services provided by each network. This would be unacceptable for the industry and for viewers. With fewer services put to air, broadcasters would be forced to forgo revenue and viewers would have less choice on their screens.

[83] The Green Paper proposes that "a viable digital dividend is likely to require the consolidation of the present five multiplexes on to three shared multiplexes" (p. 21) and that the "costs and impacts of transitioning […] would be minimised if broadcasters [migrated to MPEG-4]" (p. 23).
[84] Media Reform Green Paper, p. 4.

The Green Paper implies that a second digital dividend can be achieved while maintaining service equivalence simply by fully migrating services to MPEG-4 compression on the remaining three multiplexes:

> *The relative costs and impacts of transitioning to new spectrum and broadcasting arrangements would likely be minimised if broadcasters provided services using the existing DVB-T standards* ***coupled with the MPEG-4 compression technique***[85]

However, the technology roadmap outlined in the Green Paper will not deliver the efficiency gains necessary to achieve service equivalence under any sharing scenario.

The Green Paper is correct that MPEG-4 is more efficient at compressing video content than MPEG-2 (the industry estimates this improvement at approximately 30-35%[86]). That is, video encoded in MPEG-4 requires approximately 30-35% less bandwidth (measured in bits per second) than the same video encoded in MPEG-2 (see following table).

Exhibit 19. Example bitrates required using MPEG-2 and MPEG-4 codecs

Video quality	MPEG-2 required bitrate	MPEG-4 required bitrate	Efficiency gain
Standard definition	2.75 Mbps	1.75 Mbps	c. 36%
High definition	6.0 Mbps	4.1 Mbps	c. 32%

Source: Free TV Engineering Committee. Bitrates are for video only, and exclude audio, audio description, subtitles and other service information.

However, the Green Paper overestimates the proportion of these efficiency improvements that could be available to support a spectrum dividend, if the remaining MPEG-2-encoded services were switched off. First, all high definition services are already broadcast in MPEG-4 (except for 7QLD HD in MPEG-2), as well as some regional standard definition services. This means that the efficiency gain has already been realised for those services. Second, the industry is already in the process of migrating its remaining MPEG-2 services to MPEG-4 compression (see section 4.2.2 for further details). In other words, much of the improvement has already been factored into the business plans of our members. Accordingly, redeploying the efficiency gains to support a spectrum dividend would impose a significant commercial burden on the commercial broadcasters. As a result, the incremental benefit available to the industry is significantly lower than assumed in the Green Paper.

Impact on service mix

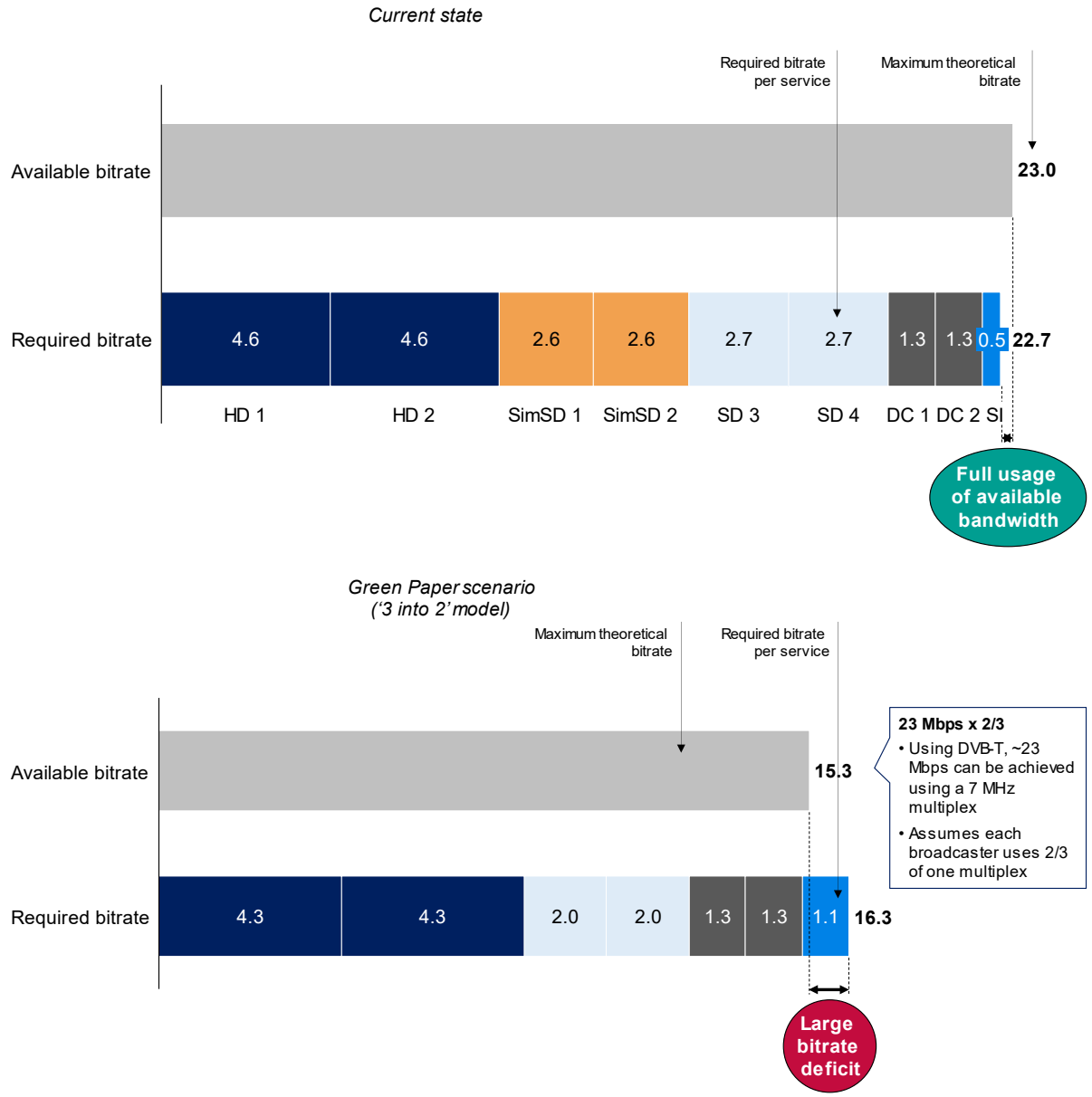
Currently, individual broadcasters typically program two high-definition channels and their standard definition simulcasts, two further standard definition channels, and two lower-definition multichannels (historically known as datacast services). In addition, broadcasters require a small additional amount of bandwidth to broadcast service information. As the following exhibit shows (upper panel), broadcasters currently use the full available carrying capacity of each 7 MHz channel.

Under the Green Paper proposal, this service mix is no longer possible (see following exhibit, lower panel). In our modelling, we have assumed that three commercial broadcasters would share two multiplexes, yielding a maximum carrying capacity of two-thirds of a full 7 MHz channel, or approximately 15.3 Mbps using current broadcast standards. Migrating MPEG-2 services to MPEG-4 yields some efficiency improvements for standard definition services (from 2.6-2.7 Mbps using MPEG-

[85] Media Reform Green Paper, p. 25 (emphasis added).
[86] Free TV Engineering Committee; Media Kind.

2 to 2.0 Mbps using MPEG-4), but there is insufficient improvement to offset the decline in total carrying capacity.

Exhibit 20. Carrying capacity and typical service mix of a commercial broadcaster, current state and Green Paper scenario (example)



Source: Free TV Engineering Committee. Illustrative analysis uses Seven Network as example. Bitrates include video, audio, subtitles and service information. Services shown are high definition (HD), simulcast in standard definition (SimSD), standard definition (SD), datacast (DC) and an allowance for service information (SI).

If all five broadcasters shared three multiplexes equally, the available carrying capacity to each broadcaster would be similarly reduced, and the capacity constraint would be more severe. Moreover, we note that 'three-into-two' yields the best outcome of any of the sharing scenarios (for the three participating broadcasters), but it also means the remaining two services would require much deeper cuts so as to fit onto the single remaining multiplex.

As a result, broadcasters would need to shut down services or reduce picture quality, or indeed explore a combination of the two. Clearly, this would not deliver on the principle of service

equivalence outlined in the Green Paper,[87] and so on behalf of our members we must reject the technical proposition put forward in the Green Paper.

6.1.2 No future growth path under the Green Paper's proposed technical solution

A related issue is that of future growth opportunities. Our members expect the terrestrial broadcast platform will remain a critical component of content distribution for the foreseeable future. As a growing part of the TV audience habituates to higher quality picture formats, it is likely that free-to-air broadcasters will need to invest to improve picture quality across terrestrial broadcast services in order to remain competitive with alternative entertainment platforms.

Higher picture quality is not just about 'resolution,' although the number of pixels, or individual points of colour, is one important variable. Other variables include the rate at which the image is able to be refreshed, the fidelity of the colours, and the contrast between light and dark.

- **Resolution**: A 'high definition' (HD) TV offers between one million and a little over two million pixels. An 'ultra high definition' (UHD) TV, often referred to as 4K, offers 8 million pixels. And an '8K' TV offers 33 million.
- **Frame rate**: This refers to how often the picture is refreshed. HD at 1080p or 'progressive' quality can refresh each pixel 50 times per second ('1080p50'), which is twice as quickly as 1080i, or 'interlace'. Live sports, for example, will look much better in HD 1080p50, than in today's HD 1080i.
- **Colour and contrast**: how good a TV looks also critically depends on two other variables, the contrast ratio (how bright and dark the TV can get) and colour accuracy, which is how closely colours on the screen resemble real life. The term 'HDR,' or High Dynamic Range, has come to signify two important technical improvements:
    - Higher dynamic range, which makes the bright parts of an image brighter, so the image seems to have more depth.
    - Wide colour gamut (WCG), which will allow screens to display a more comprehensive and life-like range of colours.

At this stage it appears HDR is only going to be available for higher resolution, high frame rate formats such as HD 1080p50 and UHD. It will not be available for the current HD formats used by free-to-air TV, including the best available, which is HD at 1080i. To display pictures optimised for HDR screens, broadcasters will need an upgrade path from the current HD at 1080i, at minimum to the faster HD 1080p50 format.

The industry believes this will result in three broad consumer expectations:

- **HDR HD**, or high definition in 1080p that is able to support 'high dynamic range' screens, which offer much greater contrasts in colour, brightness and contrast
- **Ultra high definition** (4K) picture quality, which provides much higher resolution
- As viewer picture quality expectations rise, a corollary is likely to be increasing **unacceptability of standard definition** viewing in a range of programming contexts.

However, the Green Paper's proposed technical solution will not support these expectations and so is unacceptable to our members. In addition to the broad capacity constraints that the Green Paper's proposed solution would require (discussed in section 6.1.1), there are further limitations specifically

[87] Media Reform Green Paper, p. 23.

associated with MPEG-4. Put simply, using the extra efficiency of MPEG-4 to move to three multiplexes and surrendering half of the UHF spectrum would be a technology dead-end for the industry, all but ruling out the future growth that the terrestrial platform must deliver.

Older standard not viable for medium-term improvements

Firstly, MPEG-4 is not a sufficiently efficient video compression standard to allow higher picture qualities using the broadcast spectrum available. A 4K service broadcast using MPEG-4 compression would require approximately 25 Mbps, which exceeds the current carrying capacity of one 7 MHz channel, let alone the estimated capacity of a shared channel as outlined in the Green Paper.

More fundamentally, while there is a profile ('level 5.2') of MPEG-4 that is capable of encoding 4K, there is no support for this profile in any of the international standards (Nordig, ETSI or DVB) for terrestrial transmission or reception. Thus MPEG-4 is not a viable coding choice for 4K on a terrestrial platform regardless of bitrate.

Therefore, the long-term competitiveness of terrestrial broadcast TV, and hence the sustainability of the entire free-to-air industry, depends on maintaining optionality beyond the MPEG-4 compression standard.

Older standard not compatible with future picture formats

Secondly, the MPEG-4 codec is already over ten years old (see the following table). It is not well-designed to support future video formats in resolutions higher than high definition up to 1080i. In essence, this is because the device manufacturers that develop and improve each codec have shifted focus to newer codecs like HEVC (and beyond), designed to support HDR HD, ultra high definition (UHD or 4K) and 8K. Manufacturers are highly unlikely to invest in improving MPEG-4 to support higher resolutions when newer, more efficient codecs exist. Likewise, the standards process has moved beyond older codecs; without appropriate standards in place, no further improvement is possible.

Underlining this point, HEVC is designed to offer a roughly 40% improvement in compression compared with MPEG-4, but these improvements are only available for HD 1080p50 or 4K pictures. At this stage it does not offer any improvement in efficiency over MPEG-4 for the SD and HD pictures currently transmitted by free-to-air TV. In other words, transition to HEVC is not about carriage of 'the same picture quality, but more'. Rather, it enables the carriage of services offering better picture quality than today's services.

Exhibit 21. Comparison of major encoding standards

Parameter	MPEG-2	MPEG-4	HEVC
Maturity	Launched in 1995	Launched in 2010 (UK)	Launched in 2017 (Republic of Korea)
International adoption	Being phased out in developed countries in favour of MPEG-4	Adopted by most countries	Early stages of adoption in Europe and North America
Maximum resolution possible in standard *Depends on available bitrate*	Standard supports up to HDTV	Standard supports up to HDTV	Standard supports up to 4K UHDTV

Source: Free TV research

6.1.3 Practical issues requiring further complexity and cost

In addition to the major strategic and commercial concerns detailed above, we have also identified four significant practical issues that would need to be resolved in order to implement the proposals outlined in the Green Paper. The four broad issues are reception disruption, co-channel interference, interference from telecommunications providers, and interference with wireless microphones. While some of these issues will, of course, add complexity and cost to any re-stack, regardless of the choice of TV technology, others would be mitigated if TV broadcasters converted to the DVB-T2 standard.

In this section we briefly outline each issue with reference to the Green Paper proposals, building on the more detailed discussion in section 5 above.

Reception disruption associated with multiplex sharing

The Green Paper proposals assume broadcasters share multiplexes to achieve more efficient spectrum use. However, there is a risk that a subset of older receivers will not display services sharing the same multiplex properly, discussed in more detail in section 5.3.4, above.

We have recommended more thorough exploration of this issue, beyond the limited testing TV broadcasters have been able to undertake to date, before any decisions were made to implement multiplex sharing using DVB-T/MPEG-4 technology. It would be important to understand how many viewers would be affected, to what extent, and what mitigation strategies might be available to them.

Co-channel interference

The next issue is that of co-channel interference, which occurs when two signals occupy the same frequency, leading to interference issues at the receiver. While it is difficult to predict all affected areas with confidence, we expect it would occur at broadly similar levels overall to the 700 MHz restack, if the Green Paper's '3 multiplexes everywhere' model were adopted (noting that this model is not feasible for the reasons outlined above).

As outlined in the following table, there are two possible manifestations of this phenomenon, and each form could cause significant disruption to existing services without sufficient mitigation.

Exhibit 22. Types of co-channel interference and expected effects

Type	Impact	Mitigants
Co-channel interference affecting **in-band links / off-air feeds** used to distribute programming from parent to child sites[88]	Disruption to off-air feeds could see widespread service disruption in areas covered by child sites	Can be mitigated but may be at a cost to viewers (e.g. repointing or replacing antennas) and broadcasters / Government (e.g. microwave links instead of in-band links; new infill transmitters). Costs (upfront and ongoing) may be prohibitive. Expected to be at broadly similar levels to 700 MHz restack
Co-channel interference, where overlapping broadcast coverage areas create **interference at the viewer receiver**	Sporadic interference for some viewers in overlap areas. Likely to be a major issue for viewers	

Source: Free TV Engineering Committee

Interference from telecommunications carriers

In a post-restack environment, we expect that telecommunications carriers would operate base stations in the 600 MHz band, likely separated from TV signals by only a 7 MHz guard band. In this scenario, we expect that carrier signals would interfere with TV signals, whether by adjacent channel 'out-of-band' emissions or by signal overload of the receiver equipment from the 600 MHz band. The first category is analogous to carrier signals 'spilling' over into TV channels, interfering with legitimate broadcast reception. The second is akin to a loud conversation drowning out a quieter one, where the loud conversation is a strong carrier signal in the 600 MHz band and the quieter conversation is a TV signal in the 500 MHz band.

Each type of interference would require mitigation strategies to be mapped out and agreed upon, with a baseline commitment that the carriers are responsible for managing this form of interference.

Interference with wireless microphones

Finally, while not specifically a broadcaster issue, wireless microphone users would be impacted by the reallocation of the 600 MHz band to telecommunications use. The following table outlines the key users and use cases of wireless microphones.

Exhibit 23. Wireless microphone use cases by user class

Wireless microphone user	Example use cases
Broadcasters	Press conferences; etc.
Professional users in the film and entertainment industries	Live performances; etc.
Amateur users	Theatres, church halls, special events, etc.

These users are currently class-licensed to operate in so-called 'white spaces' in the UHF broadcasting services bands. The Government will need to address the impact on these services of any decision to reallocate 600 MHz spectrum.

[88] 'Child' sites are downstream transmitter sites that receive off-air feeds from a 'parent' site operating on the same frequency. Child sites may in turn provide off-air feeds to other child sites in a 'daisy chain' arrangement.

6.2 Response to other regulatory proposals: beware unintended consequences

6.2.1 SVOD and AVOD Quotas

Free TV does not support the Green Paper's proposal that a formal investment obligation be imposed on SVODs and AVODs to invest a percentage of their Australian revenue in Australian content.

Risks SVOD quotas pose to local content production

We are concerned that the Green Paper has not considered the significant risks to the local content production ecosystem that implementation of investment obligations on SVODs would likely give rise to. These risks include:

- **Significantly increased pressure on already scarce production facilities as well as other production resources such as cast and crew.** This issue is already causing significant difficulties, particularly due to a greater number of international projects coming to Australia because of our relative success in managing the impacts of COVID-19. For example, a number of productions have had to make use of temporary studio spaces such as convention centres and converted warehouses this financial year.[89] This issue would be further exacerbated with the introduction of SVOD obligations. As highlighted in a report by Oliver & Ohlbaum, commissioned by Free TV together with the ABC and attached to this submission,[90] this would risk damaging broadcasters' ability to compete for production facilities and could put at risk important locally tailored content.[91] Scarce facilities and resources mean that those with the deepest pockets can gain preferential access to facilities and resources. If broadcasters do not have sufficient access to facilities and resources it will significantly impact their ability to tell Australian stories, to meet existing content quota obligations, and in turn, to generate advertising revenue to support further content creation. In this way, the flow on effects of this issue could have a significant detrimental impact on broadcasters' sustainability and the creation of local Australian stories.
- **Significant production cost inflation as a result**. Following on from the point above, scarcity of resources and facilities will necessarily lead to increased costs. For example, a recent a survey conducted by Screen Producers Australia of its members found that 95% of respondents reported production cost increases in the last year (with increased international production coming to Australia). The average increase was 24% with some costs increasing as much as 75%.[92]
- **A potential decrease in the diversity of content available to Australian consumers.** Investment obligations on SVODs could increase the pressure on these platforms to homogenise their local offering with that of broadcasters resulting in less diversity and choice in the ecosystem overall. Oliver & Ohlbaum in their report warn of this risk, noting the importance of considering unintended consequences, including the impact of direct investment obligations on overall content diversity, provider distinctiveness and consumer choice.[93]
- **A move to more 'globalised' local content to the detriment of production of local cultural material.** Broadcasters are uniquely placed to tell local Australian stories of cultural significance

[89] https://www.smh.com.au/culture/movies/we-re-certainly-busy-behind-the-boom-in-overseas-film-and-tv-production-20210119-p56vcv.html
[90] Oliver & Ohlbaum, Supporting Local Content Investment: International Policy Approaches to VOD Services, A report for ABC and Free TV, May 2021.
[91] Oliver & Ohlbaum report, p 7, 42.
[92] https://www.if.com.au/spa-survey-suggests-production-boom-is-leading-to-skill-shortages/
[93] Oliver & Ohlbaum report, p 6-9.

and the existing regulatory framework requires us to do that. However, as Oliver & Ohlbaum note, global platforms will always consider the total global audience potential as more important than local cultural value. Local content investment quotas are unlikely to address this issue, as the decision on which content to invest in will still be subject to global platforms' global audience imperatives. Rather, Australian entertainment companies are more likely to be the most effective vehicle for continuing to tell local stories. If sustainability measures are not taken to support the industry, weaker competitive pressure from broadcasters over time will only facilitate an increased emphasis on global content, leading to a decrease in the distinctiveness of Australian content over time.[94]

- **Disincentivising co-productions between SVODs and broadcasters.** Distorting market dynamics by imposing additional obligations on SVODs without recognising their contributions to co-productions would disincentivise existing co-production arrangements. Currently SVODs and broadcasters can partner together, enabling broadcasters to invest in higher value productions than they would be able to in the absence of these partnerships, and allowing this content to be broadcast on the free-to-air platform and to reach the maximum number of Australians for free. In this way, co-productions are hugely beneficial to the ecosystem as a whole; they can provide maximum exposure and reach for SVODs, an exclusive broadcast period for broadcasters, increased return on investment for Government and most importantly, a free access period for free-to-air viewers who may not have the relevant SVOD subscription.

These risks, if realised, have the potential to detrimentally impact both the local production ecosystem, as well as the sustainability of the television industry. Free TV is therefore concerned that interfering with the market in a manner that requires SVODs to behave more like local broadcasters will ultimately be counter-productive to the policy goals of the Government.

While SVODs have a legitimate role to play, their consumer proposition is fundamentally different to free-to-air television. SVOD services currently complement local services by offering additional local content investment and choice in certain genres, mainly in relation to global content. This also benefits local producers who can be commissioned from across the ecosystem. In Free TV's view, the regulatory framework should facilitate and encourage these complementary market dynamics, which ultimately benefit viewers and the industry.

In addition to the risks posed by direct investment obligations, it is unclear what benefits quotas would provide. The Oliver & Ohlbaum research shows that it is unclear that direct investment obligations would result in a significant proportion of new investment in Australian content, particularly culturally specific Australian content, and could instead exacerbate existing market weaknesses (cost inflation and limited production resources).[95]

Furthermore, it is worth noting that, as highlighted above, Free TV's investment in Australian content remains strong and consistent at around $1.6 billion every year and has only increased over the past decade. While the regulatory framework was recently adjusted to provide broadcasters with more flexibility to allocate their resources to the type of Australian content that audiences demand, their 55% Australian content transmission quota, sub-quota obligations which cover children's, documentary, and drama content and multichannel quotas, remain in place. SVOD content provides additional variety and consumer choice but is likely to continue to target global audience appeal. It is unlikely to match either the levels or diversity of specifically local content that broadcasters make.

[94] Oliver & Ohlbaum report, p 6.
[95] Oliver & Ohlbaum report, p 56.

Lessons learned from international approaches

The Green Paper notes that other jurisdictions are currently also grappling with the challenges of regulating SVODs. While this is true, we would note that a) very few jurisdictions have adopted investment obligations on SVODs to date and b) those jurisdictions that have adopted (or are in the process of adopting) SVOD obligations are specifically tailoring those obligations to their individual markets. For example:

- The EU Audio-visual Media Services Directive (AVMS) 30% exhibition requirement has a very EU-specific policy rationale of removing obstacles to freedom of movement for services, and to avoid distortion of competition in the EU single market. It was set at a level which approximated average levels of EU works at the time it was introduced (i.e. as a floor). It can be met with content from many audio-visual markets. While the EU model allows individual jurisdictions to incorporate the directive by including investment obligations, very few EU countries have chosen to do so – only Italy currently has rules in place and France has a Bill that would introduce investment obligations if the Bill were passed. In relation to the obligation in Italy, it applies broadly to EU content, not Italian content specifically. In the case of France, the obligation applies to EU content with a sub-quota requirement for national independent productions.[96]
- Mexico, a single country market like Australia, has recently considered whether or not to introduce direct investment obligations and looks likely not to progress implementation of the EU model, mainly because of significant criticism that it would not be the most appropriate tool for a single national production market. There is currently no quota on broadcasters in Mexico either, and the debate in relation to which tools are most appropriate to introduce in that jurisdiction is centred around supporting and stimulating the national production sector as well as funding public service broadcasting.[97]
- Canada's C-10 Bill currently before the Parliament would enable the national regulator (the CRTC) to require SVODs to invest in the development, financing, production or promotion of Canadian audio or audio-visual programs to be provided by broadcast or VOD services. However, the nature of the investment is not defined in legislation. Rather, the CRTC can define how the investment should be framed and calculated, including by reference to the CRTC's policy objectives. As this proposed new power has not yet passed into legislation, it is too early to assess if and how the regulator will use these powers and what impact this will have on industry.[98]

In assessing the approaches adopted internationally, Oliver & Ohlbaum highlight the need to consider a range of factors in the context of the Australian market.[99] These include:

- Current levels of investment by different players as compared to the policy goals. Does this mean regulation is not needed (market forces are delivering investment), or are there specific gaps that need addressing?
- Where there are gaps, which type of provider is best placed to fill these and at what investment level, considering their overall business model (funding type and revenue levels, genre focus, audience segments served)? Is there an equitable balance of contributions across broadcaster and VOD providers?
- What criteria will apply to any investments to promote the national content ecosystem and/or an overall balance of culturally specific content, 'global' content, or service provision?

[96] Oliver & Ohlbaum report, p17-21.
[97] Oliver & Ohlbaum report, p19.
[98] Oliver & Ohlbaum report, p22.
[99] Oliver & Ohlbaum report, p21-23.

- Should there be additional requirements or incentives on global providers to promote co-production with national partners, or access to IP?
- Should any requirement cover broader types of investment such as skills and training, and pre- and post-production?

They also note the importance of considering possible unintended consequences including exacerbation of cost inflation or scarcity of production resources free-to-air broadcasters and independent producers, and whether requirements would respect consumer preferences to consume certain genres on certain types of service, as well as overall content diversity, provider distinctiveness and choice.

Consideration of additional obligations under Australian framework is premature

In Free TV's view, the discussion and consideration of these issues is premature and out of step with the Government's recent introduction (as recently as January 2021), of reporting obligations on SVODs. As yet, no data is available in relation to the extent of SVOD investment currently taking place. This information is critical to understanding whether regulation is needed and if so, what form that regulation should take.

6.2.2 Content funds (CAST and PING Trust)

As Free TV broadcasters do not consider the Green Paper proposal for a transition to new spectrum arrangements is the way forward, we cannot support the establishment of new funds capitalised through the proceeds of such a process.

Furthermore, we cannot support the Green Paper's proposal that money from spectrum auctions would be allocated based on criteria which are not currently clear. Likewise, we cannot support the proposition that Free TV broadcasters would be required to apply for that funding alongside online services including foreign multinational companies.

Free TV welcomes support for local news services and strongly agrees that the sustainability of public interest journalism and Australian content of cultural significance is critically important at this time. However, while previous PING funding has assisted regional broadcasters to continue to provide news at a time of great uncertainty, we do not think the proposal as framed in the Green Paper would achieve sustainable local news services, particularly given the timeframe. In our view, as framed, it would risk further damaging the sustainability of the free-to-air sector, which would in turn be detrimental to the diversity of local content and public interest journalism in Australia.

Regional broadcasters in particular believe the PING Trust would not provide a viable or sustainable solution to the financial issues facing regional broadcasters. Regional broadcasters do not want to be reliant on Government funding via a process of continually applying and re-applying for grant funds with restrictions on how funds can be spent and without consideration of the commercial returns available.

6.3 Feedback on the proposed timeline: late 2020s more realistic

We submit that the timeline proposed by the Green Paper is not realistic for three key reasons. First, the telecommunications carriers themselves do not seem to expect such an aggressive timeline. Second, the economic value is likely to be maximised late in the decade. Thirdly, international precedent indicates that the Green Paper timeline would make Australia an early mover in the 600 MHz band, forcing us to 'make bets' on standards and technologies despite generally being a 'standards-taker'.

In addition, a restack late in the decade would allow the TV industry access to the competitive benefits of MPEG-4 conversion now (as already planned), while usage of the terrestrial platform remains very high. This later timeline would also allow adequate time for a more orderly upgrading to means of transmission that also support a viable and competitive TV industry moving forward, for example, by allowing time for most viewers to swap out TV receivers in favour of models that support more advanced TV standards. An incidental, additional benefit will be sufficient time for an orderly migration of class-licensed, low-interference devices to suitable new spectrum.

6.3.1 FYSO submissions from carriers demonstrate no urgency

Submissions by the three mobile network operators (MNOs) to the ACMA's 'Five year spectrum outlook 2020-2024' (FYSO) do not suggest any urgent need for the 600 MHz band. Indeed, while the MNOs signal the medium-term importance of the 600 MHz band, their submissions imply that the timeline proposed in the Green Paper is more aggressive than they require. Similarly, the submission from the relevant peak body AMTA implies that the desirability of starting replanning work on 600 MHz 'early' results from the likely lengthy nature of such a sensitive re-farming exercise, rather than any urgency in proceeding to auction. In the following exhibit, we highlight key excerpts from each submission.

Exhibit 24. Excerpts from carrier submissions

Carrier	Submission excerpt
Telstra	• "In the mid-term, the 47 and 46 GHz bands should also progress to the initial investigation stage, while at some point during the 2021-2024 period addressed in this FYSO, the future of 600 MHz should be revisited" (p. 7) • "While [the 600 MHz] band is not a high priority in the short term, and noting that this band is part of WRC-23 agenda item 1.5, we recommend the ACMA undertake a work program over the next few years to consider whether there are possibilities for releasing this spectrum for other uses, including IMT" (p. 8)
Optus	• "Optus considers the following band activities warrant further investigation […] consideration for the progression of the 600 MHz band to initial investigation in the near future" (p. 10) • "Given the experience and long lead times associated with the release of the original Digital Dividend, we consider that progression of the 600 MHz band should be considered in the near future" (p. 11)
Vodafone (now TPG)	• "In the medium term (1-3 years), VHA considers the focus should be on: (a) the successful allocation of additional C-band spectrum, (b) putting in place a roadmap for the replanning of the 600 MHz band, and (c) the progression of the 1.5 GHz and 2 GHz bands" (p. 2)
Australian Mobile Telecommunications Association	• "The bands 600 MHz, 3.3 GHz, 4.5/4.8 GHz have been listed in the FYSO for several years, and AMTA accepts that they remain at the Monitoring stage due to existing use of the bands by incumbent broadcasters and the Department of Defence." (p. 9) • "As such, we understand that the bands are unlikely to be progressed to auction in the near future, especially when there are alternative spectrum options. However, we support these bands remaining in the

	FYSO in particular due to the international developments noted by the ACMA in the FYSO." (p. 9) • "Specifically, with respect to the 600 MHz band, we remain interested in the band as a mid-term future spectrum option. For completeness, we believe it's worth noting the existing IMT identifications: including a number of Asia-Pacific nations including New Zealand (RR No. 5.296A), and in a number of American nations including Canada, USA and Mexico (RR. No. 5.308A). For this reason, we would like to see the 600 MHz band progress to Initial Investigation in the next revision of the FYSO (i.e. 2021-25), so that the ACMA and relevant industry stakeholders can begin to think about the issues involved in what will likely be a lengthy project." (p. 9)

Source: Telstra, Optus, VHA and AMTA submissions to the ACMA FYSO 2020-24 process

6.3.2 Maximising economic value of the spectrum

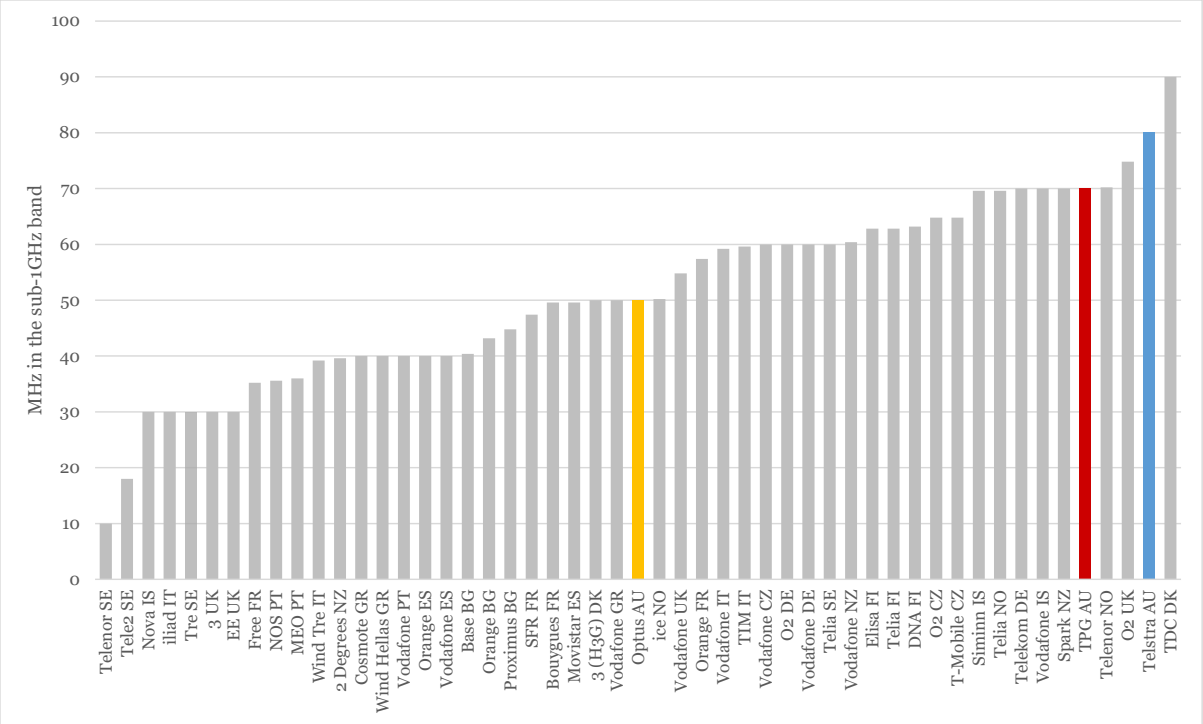
Independent economic analysis commissioned by Free TV from Competition Economists Group (CEG)[100] suggests that the timeline proposed in the Green Paper is unlikely to maximise the economic value of the 600 MHz band at auction. Specifically, by auctioning 600 MHz in 2025, supply could be inflated by the upcoming 850 / 900 MHz auction, while demand may be reduced falling outside of next generation mobile technologies (3G, 4G, 5G, etc.). Accordingly, CEG has found that these factors could lead to a discount of between 52% - 74% to the median price realised for low frequency spectrum bands in comparable jurisdictions. CEG concludes:[101]

> *We estimate that the potential revenue from reallocating 84 MHz of 600 MHz band is $2.42 billion based on prices paid for low frequency spectrum in comparable auctions in other jurisdictions. However, a discount of 52% - 74% implies likely revenues between $0.6 billion and $1.2 billion. The primary reason for this discount will be an oversupply of low frequency spectrum for 5G services in Australia should the 600 MHz allocation follow of the 850/900 MHz spectrum reallocation. The timing proposed in the Green Paper will likely lessen competition for the spectrum due to at least one of the three mobile network operators (MNOs) having an excess of low frequency spectrum.*

This economic analysis shows that auctioning the 600 MHz band in 2025 is likely to be early due to two factors. The first is the relative abundance of other low-band spectrum for telecommunications use. As the following exhibit shows, even without the 600 MHz band, the three Australian mobile network operators would have large low-band holdings relative to international benchmarks, due to the upcoming allocation of the 850 / 900 MHz band.

[100] Competition Economists Group, 'Value of 600 MHz spectrum band', 2021.
[101] Ibid, p. 3.

Exhibit 25. Sub-1GHz spectrum holdings by mobile network operator



Source: Spectrum Monitoring. CEG analysis. Assumes that in the upcoming 850/900 MHz auction, Optus wins three blocks, while Telstra and Vodafone/TPG each win two blocks of 2x5 MHz band.

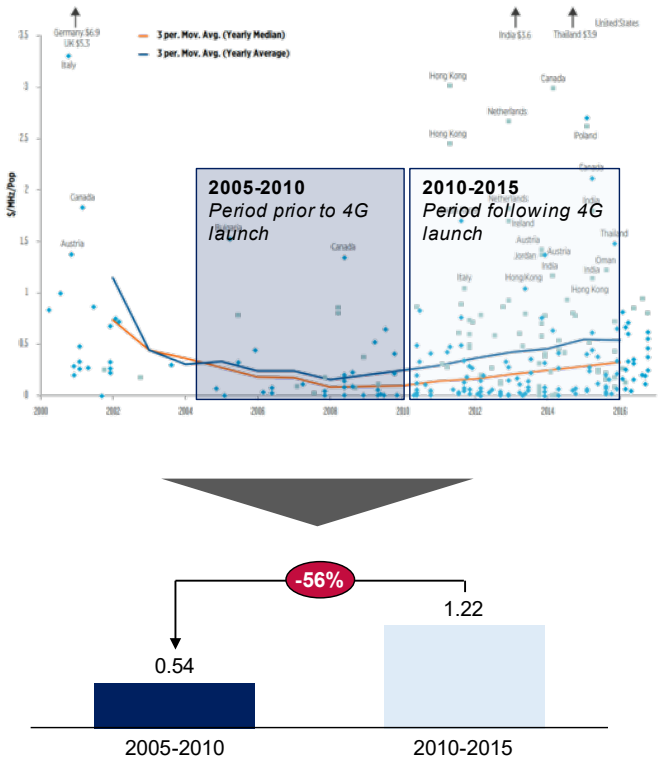
Second, CEG found that spectrum prices tend to fall between each generation of wireless technology (3G, 4G, 5G, etc.), whereas prices tend to peak following the launch of each new generation. The following exhibit summarises this analysis, which found that on average, low-band (sub-1 GHz) auction prices were 56% lower in the years leading up to the launch of 4G networks than in the years following the launch of 4G.

As GSMA, an industry organisation representing mobile network operators, notes, a similar pricing trend was observed in the lead-up to the rollout of 3G networks:[102]

> *The beginning of the 3G era coincided with the so-called "tech bubble", which generated huge enthusiasm regarding the potential of 3G data services. This was reflected in the very high prices achieved in some early awards, most notably the UK and German 3G auctions in 2000, which raised an exceptional $5.30 and $6.90 per MHz/pop respectively. Subsequently, there was a sharp drop in prices for 3G spectrum, and most awards for the remainder of the 2000s generated modest prices. Since 2008, however, there has been an upward trend in prices, coinciding with the take-off of 4G services.*

[102] GSMA, 'Effective Spectrum Pricing: Supporting better quality and more affordable mobile services', 2017.

Exhibit 26. U-shaped path of spectrum prices and average spectrum price (A$ / MHz / pop), by time period



Source: GSMA. CEG analysis. Green squares = Prices for coverage bands below 1 GHz; Blue diamonds = Prices for capacity bands above 1 GHz. Prices per MHz-pop are adjusted for inflation and were converted to USD purchasing power parity (PPP) rates. Prices are also adjusted for licence duration, based on a standard 15 years.

If this trend continues through the 5G rollout, which is underway currently, then CEG's analysis suggests that low-band spectrum prices may have passed their peak by 2024-5, when the Green Paper proposes auctioning the 600 MHz band. By contrast, assuming approximately ten years between each generation of mobile communications, the economic value is more likely to be maximised towards the end of the decade. As CEG notes in its report:[103]

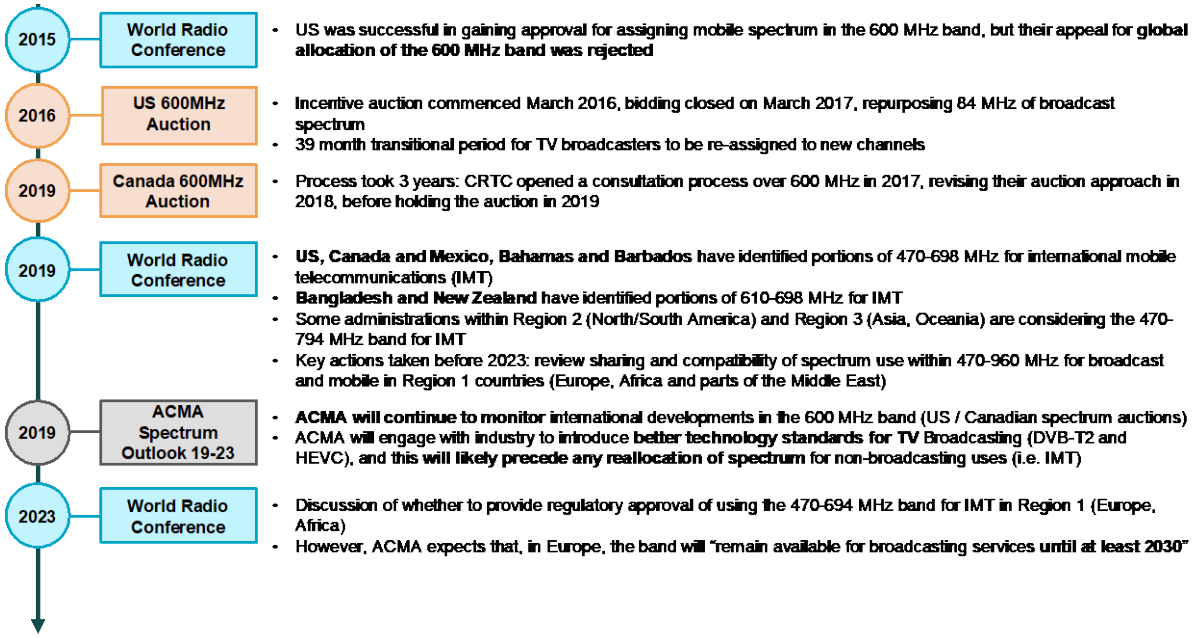
> *We would expect to see peaks coincident with the deployment of new technologies. On the basis of a technology evolution every 8 to 10 years, we may not expect to see another peak until late into the current decade.*

6.3.3 International comparison supports longer-term view

There is wide divergence in clearance of the 600 MHz band for telecommunications use – while some jurisdictions have already cleared the band, some are not expected to do so until at least 2030. The US and Canada are the only major jurisdictions to have completed the auction process, in 2016 and 2019, respectively, although the transition to telecommunications use is ongoing in both countries. Other jurisdictions like Mexico and Hong Kong are expected to begin the auction process imminently. However, as noted in the following exhibit, European jurisdictions are not expected to clear the 600 MHz band before 2030.

[103] Competition Economists Group, 'Value of 600 MHz spectrum band', 2021, p. 44.

Exhibit 27. Timeline of key events relating to the 600 MHz spectrum band

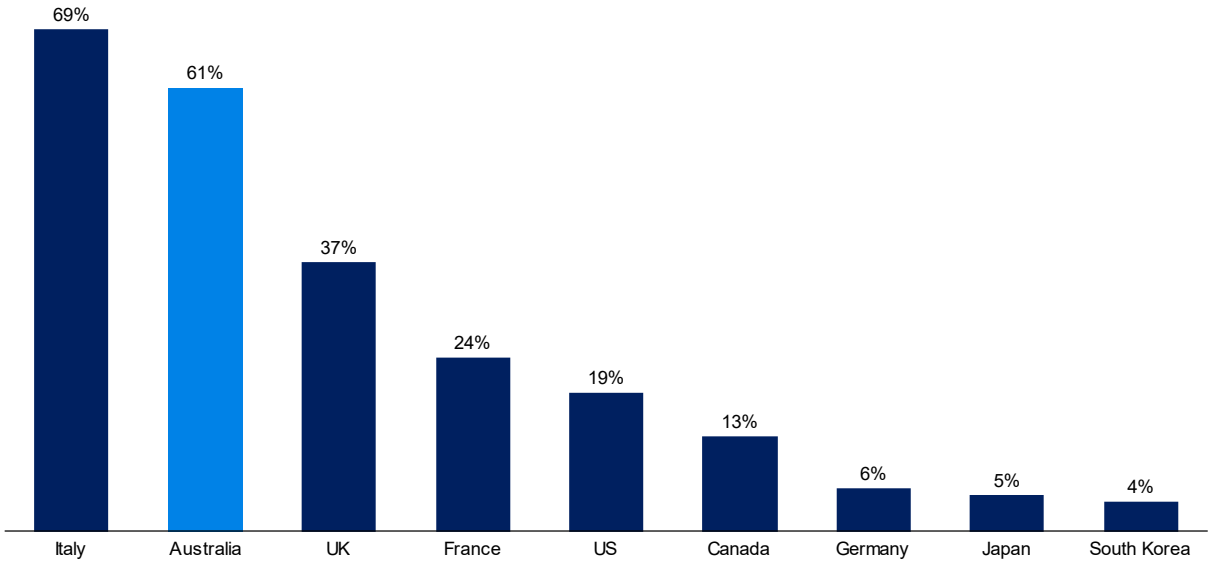


Source: FCC Media, CRTC Media WRC 2015, 2019 Final Results, WRC 2023 Agenda, ACMA Spectrum Outlook

Accordingly, the timeline proposed by the Green Paper would likely place Australia at the forefront of spectrum planning issues in the 600 MHz band. This introduces risks for the local market: Australia has historically been a 'standards taker', typically adopting standards developed overseas rather than forging a unique path. In vacating the 600 MHz band before major markets like the European Union, we would risk unnecessarily constraining options regarding transmission and receiver standards.

Further, the terrestrial platform is significantly more important to Australian free-to-air distribution relative to international jurisdictions (see following exhibit). Where the UK has a strong satellite platform and the US is dominated by cable networks, Australia's dependence on terrestrial implies two related principles for Australian spectrum policy. First, the headline lessons observed in international markets should be applied to the Australian context with great care, ensuring that market context is considered and that any precedents are suited to local market conditions. Second, Australian spectrum policy should afford greater importance to the terrestrial platform than is perhaps observed overseas, for the simple fact that terrestrial broadcast is significantly more important to the long-term distribution of free-to-air TV in Australia than it is in other markets.

Exhibit 28. Comparison of DTT platform penetration, 2016 (latest data available)



Source: Ofcom, IHS, BARB. Data include main TV receivers only and are based on % of TV homes. Where TV receivers have multiple platforms, a hierarchy-based approach has been applied (Sat > Cable > IPTV > DTT). All figures have been rounded to the nearest whole percentage. Other platforms (direct access to the internet via computer, console or dongles) not shown, but account for c. 1% in each case

7. Appendix

7.1 Responses to Green Paper consultation questions

For convenience, we have collated our responses to the consultation questions in the Green Paper.

Exhibit 29. Responses to consultation questions

Question	Comments	Refer to section/s
3.1	No, the deregulatory benefit on offer is not sufficient to incentivise commercial broadcasters. Moreover, any decision to vacate the 600 MHz band or share multiplexes would need to be a whole-of-industry decision rather than a decision for individual broadcasters.	6.1
3.2	We support the principle of deregulation for broadcasters. However, there are broader policy interventions that should be implemented independently of broadcast licences to ensure the ongoing delivery of free-to-air public policy goods (reviewing the commercial broadcast tax, prominence in an online environment, net neutrality, extending anti-siphoning to online video).	4.1, 4.3
3.3	The regulatory framework exists to uphold the public policy benefits of the free-to-air sector. Any measures that achieve this purpose should be retained and updated or strengthened where necessary.	3.1-3.5 4.1.4
3.4	Differential licence arrangements between metropolitan and regional / remote broadcasters could be considered. However, we note that any licence differences will undermine service equivalence between communities.	5.3.1
3.5	We submit that the 'new licence framework' needs to be reworked in the context of a more holistic approach to design the long-term technology roadmap for free-to-air broadcast. Regarding the specific question of restacking the 600 MHz band, we submit that this should occur in the late 2020s.	6.1, 6.3 5.1
3.6	We recommend legislating to ensure prominence of terrestrial broadcast TV on modern TV receivers.	4.1
4.1	There is a long-term need for terrestrial broadcast, both for consumers and broadcasters. The industry is already exploring technology upgrades to ensure the platform can support higher	4.2.2 6.1 5.1-5.4

	quality services over time. These options are explored in this submission. Any decisions regarding the 600 MHz band should be made in the context of developing a holistic long-term strategy for free-to-air broadcast. What is clear, however, is that DVB-T / MPEG-4 alone is not sufficient.	
4.2	It is premature to consider how shared multiplexes might operate. More work is required to determine the best model for free-to-air broadcast over the long-term.	6.1
4.3	In this submission we have outlined the major issues associated with restacking the 600 MHz band. In some cases, legislative or regulatory support may be required, while in others, targeted funding will be necessary.	5.3
4.4	Service equivalence is an essential criterion for metropolitan broadcasters and a preferred one for regional broadcasters. However, regional broadcasters would be willing to consider consolidation of services with the right incentives.	6.1.1, 5.3.1
4.5	It is not a binary choice between 'more' services and 'better quality' services. Broadcasters need optionality to program their service mix according to the evolving expectations of viewers in a way that makes commercial sense.	6.1.2
4.6	Due to the fundamental technical flaws in the Green Paper proposals, we have not sized the potential cost savings associated with sharing multiplexes. However, we expect that these savings would not be material in the context of each network's cost base. In addition, many commercial broadcasters have long-term transmission contracts that would likely delay any cost savings, such as they are, from being realised.	6.1
4.7	It is for transmission services providers to comment on the potential impact of the Green Paper proposals on their facilities.	N/A
5.1	In theory, the revenue from the sale of spectrum ('600 MHz dividend') could be used to support public policy initiatives. However, the industry's position is that specific proposals must be assessed on their merits, with due consideration of any indirect or unintended effects.	6.2

5.2	We can provide examples of best practice support in other jurisdictions as part of the broader process outlined in this submission.	5.1
6.1	We do not support investment obligations on SVODs, BVODs or AVODs.	6.2
6.2	We do not support any investment obligations on SVODs, BVODs or AVODs and do not comment on the appropriateness of alternative rates.	N/A
6.3	We do not think that alternative models such as the percentage of overall programming expenditure should be considered instead.	N/A
6.4	We do not support investment obligations on SVODs, BVODs or AVODs and so do not comment on the revenue threshold for their application.	N/A
6.5	We do not support investment obligations on SVODs, BVODs or AVODs and so do not comment on which genres of Australian content should be able to fulfill the obligation.	N/A
6.6	We do not support investment obligations on SVODs, BVODs or AVODS and so do not comment on whether they should apply to commissioned content or acquired content.	N/A
6.7	We do not support investment obligations on SVODs, BVODs or AVODs and so do not comment on whether such an obligation should capture pre- and post-production.	N/A
7.1	We do not comment on the level of Australian content produced and commissioned by the ABC and SBS	N/A
7.2	We do not comment on statutory obligations for the ABC and SBS	N/A
7.3	We do not comment on the imposition of an Australian content obligation on the ABC and SBS	N/A
8.1	We submit that the timeline proposed in the Green Paper should be extended.	6.3 5.1
8.2	More time is required for the initial planning phases, to ensure a holistic approach to the long-term future of free-to-air broadcast.	5.1

8.3	In this submission we have outlined the major issues associated with restacking the 600 MHz, which should be taken into account, as well as the reasons for delaying any 600 MHz auction until later in the decade.	6.3 5.3

7.2 Key cost assumptions

Exhibit 30. Estimated costs to implement Green Paper proposal (indicative only)

Component	Comments

Restack	• First restack cost $143m for labour and associated costs, plus consumer information campaigns
	• Second restack estimated to cost 80% of first restack:
	  • 60% for retuning: In first restack, blocks A-E were retuned; to implement Green Paper, it is estimated that blocks C, D and some of B would require return (i.e. ~60% of original labour)
	  • Additional 20% assumed to allow for new work on transport streams (in shared mux environment, every transmitter site requires technical work to ensure site can receive shared mux transport streams)
	• Restack costs include viewer education and publicity costs as per last restack
	• Includes commercial and national broadcasters

Encoders	• $20k cost assumed per encoder (complete headend system build) • Number of encoders gathered from all commercial networks and national broadcasters, based on the current number of services offered by each network today. However, a reduction in the number of services could result in a lower number of encoders to be upgraded • If the chosen multiplex operator already has similar infrastructure in place (example TBS, NPC or Mediahub) the costs would be substantially less as the core infrastructure (power, aircon, rack room) would already be in place
Exclusions	• No incremental opex (multiplex manager costs; cost to deliver services from broadcasters to mux manager) • Does not include costs to mitigate against interference issues (e.g. installing additional new sites or gap fillers) • Does not include consumer subsidies to encourage receiver upgrades (i.e. buying new TV receivers). Does not include costs for rectification of viewer home antenna systems • Does not include additional costs associated with Commercials and Nationals sharing transmission sites • Does not include fees for early termination of contractual arrangements with transmission service providers or real estate leases

Source: Free TV Engineering Committee

Exhibit 31. Estimated costs to implement alternative technology options (indicative only)

Component	Comments
Restack	• Restack cost estimate is the same as under Green Paper scenario, regardless of technology option
Encoders	• Baseline encoder cost applies to MPEG-4 options • HEVC encoding estimated 70% more cost vs. MPEG-4. Based on 2x server count (2x computational intensity) but allowing for common equipment (control, SI generation, etc.)
DVB-T2 transmitters	• Upgrade costs for new (DVB-T2 compatible) transmitters at every site in either: metro markets only, or nationwide • Includes transmitter unit cost (per channel) and installation • Assume a simulcast model, where new T2 transmitters would be required alongside existing transmitters
Exclusions	• Same exclusions as under Green Paper scenario

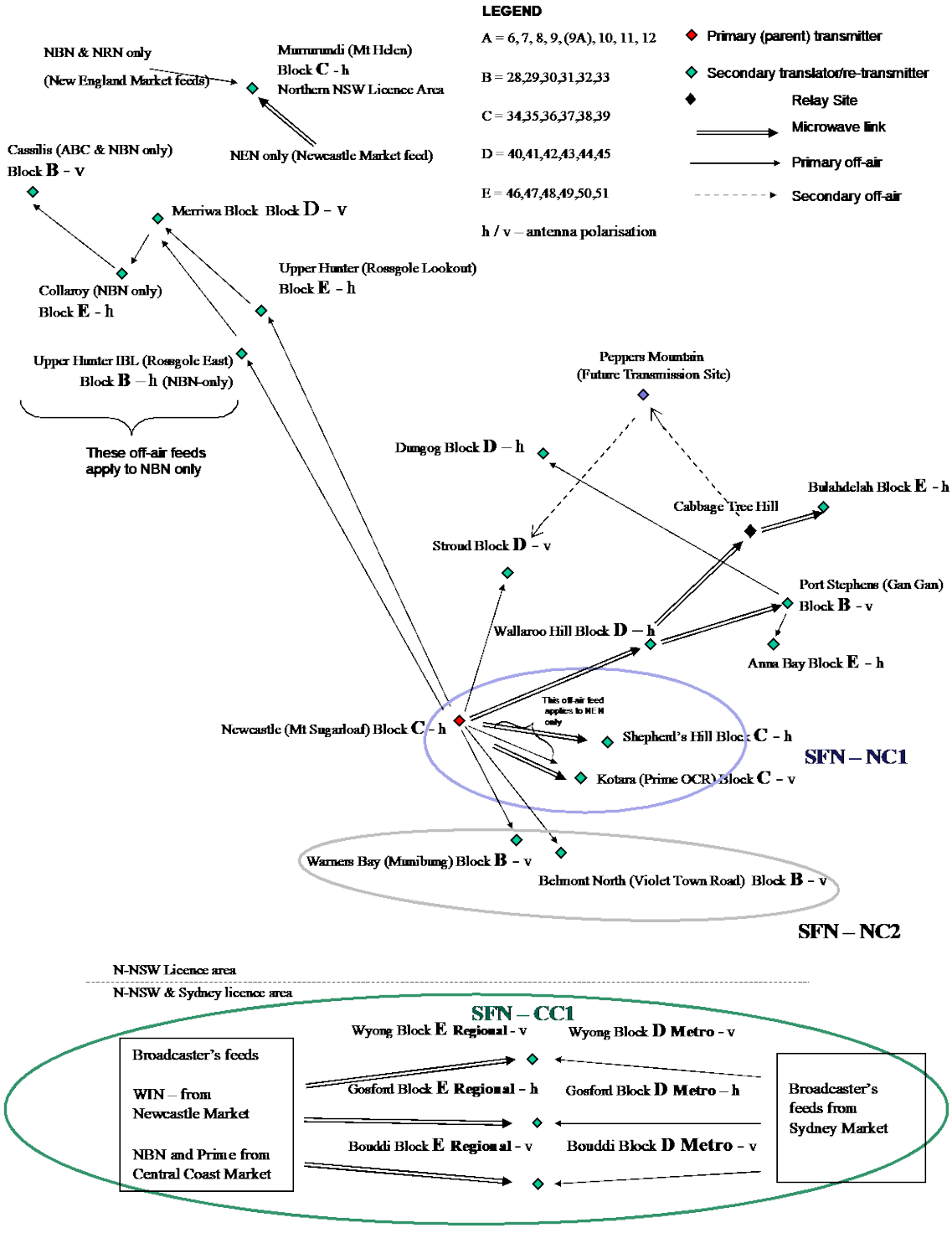
Source: Free TV Engineering Committee

7.3 Supporting technical analysis

7.3.1 Network transmission arrangements

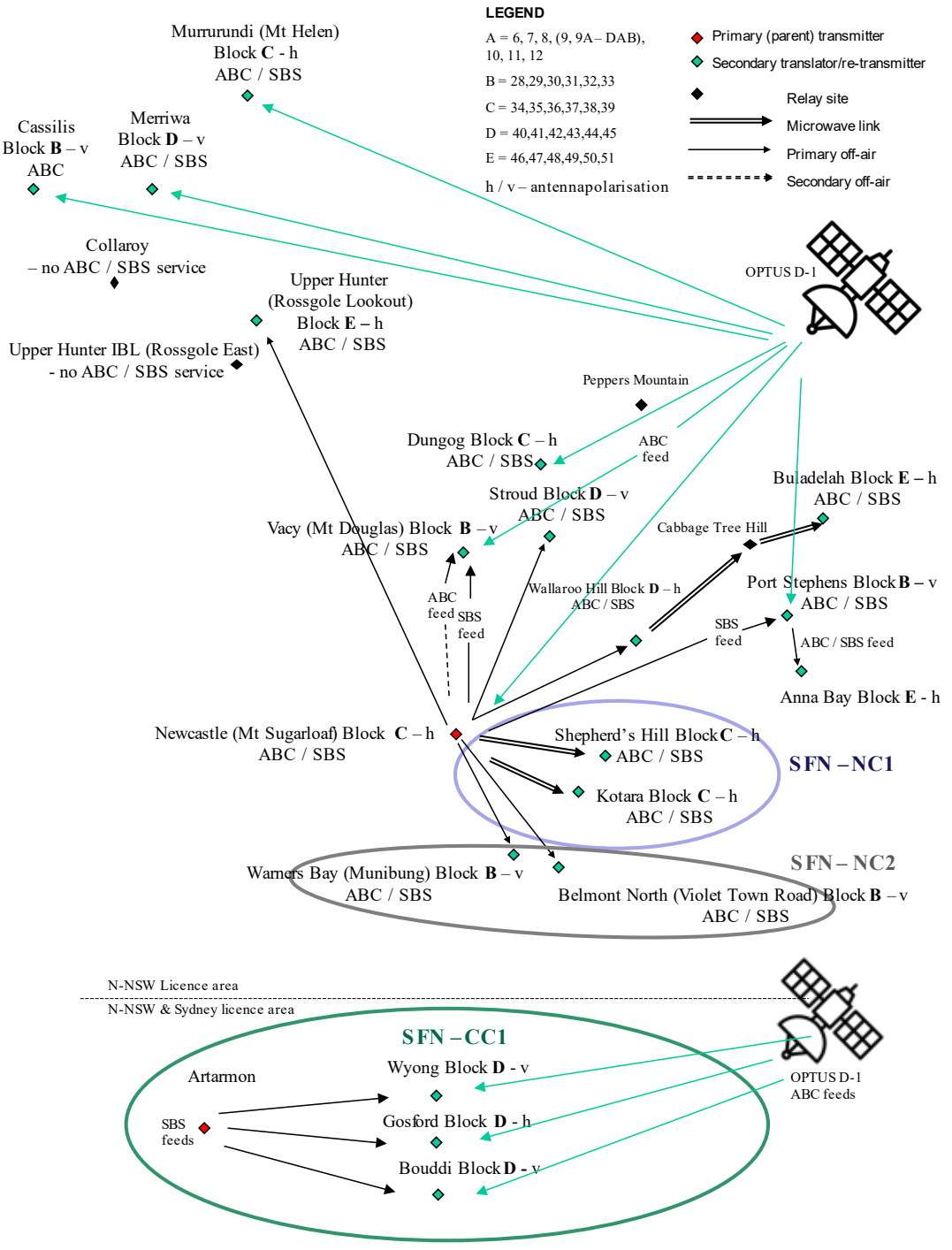
The Central Coast, Newcastle and Hunter regions of New South Wales provide an example of the complexity of both terrestrial and satellite delivery to broadcasting transmitter sites. Note the extensive use of single frequency networks (SFNs), off-air inputs to child sites and 'daisy chain' delivery to child sites. The following diagrams also show how submarkets, sometimes called 'local break-out areas', differ between national and commercial broadcasters, as well as between commercial networks, as broadcasters focus their programming and advertising on particular submarkets. To minimise co-channel interference, planning for these television services has made full use of the channels available in the UHF band (Blocks B, C, D and E).

Commercial network transmission arrangements in the Central Coast, Newcastle and Hunter regions (NSW)



Transmitter Network Configuration		
FreeTV Australia	Licence Area	Northern NSW
	Service Area(s)	Newcastle Central Coast
	Revision	May 2021

National network transmission arrangements in the Central Coast, Newcastle and Hunter regions (NSW)

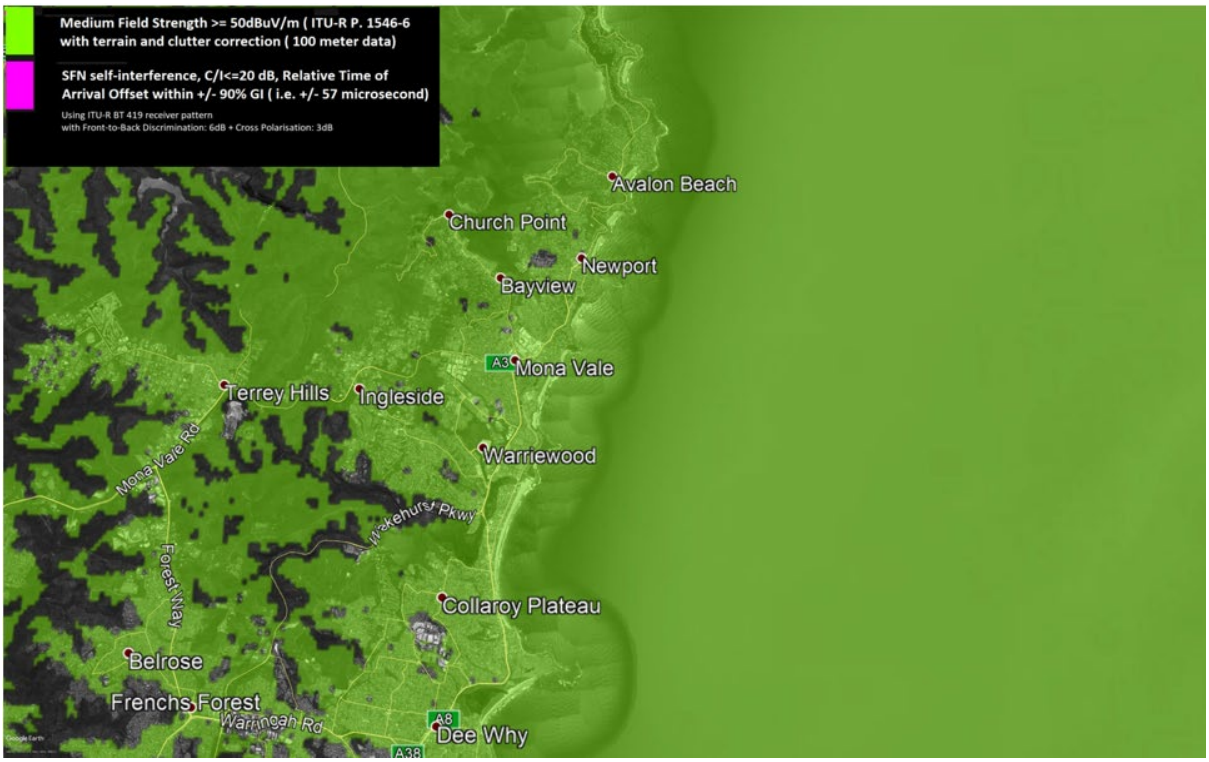


Transmitter Network Configuration		
ABC SBS	Licence Area	Northern NSW
	Service Area(s)	Newcastle Central Coast May 2021

7.3.2 Example coverage and interference ('splat') diagrams showing the challenges of a '4/4 model'

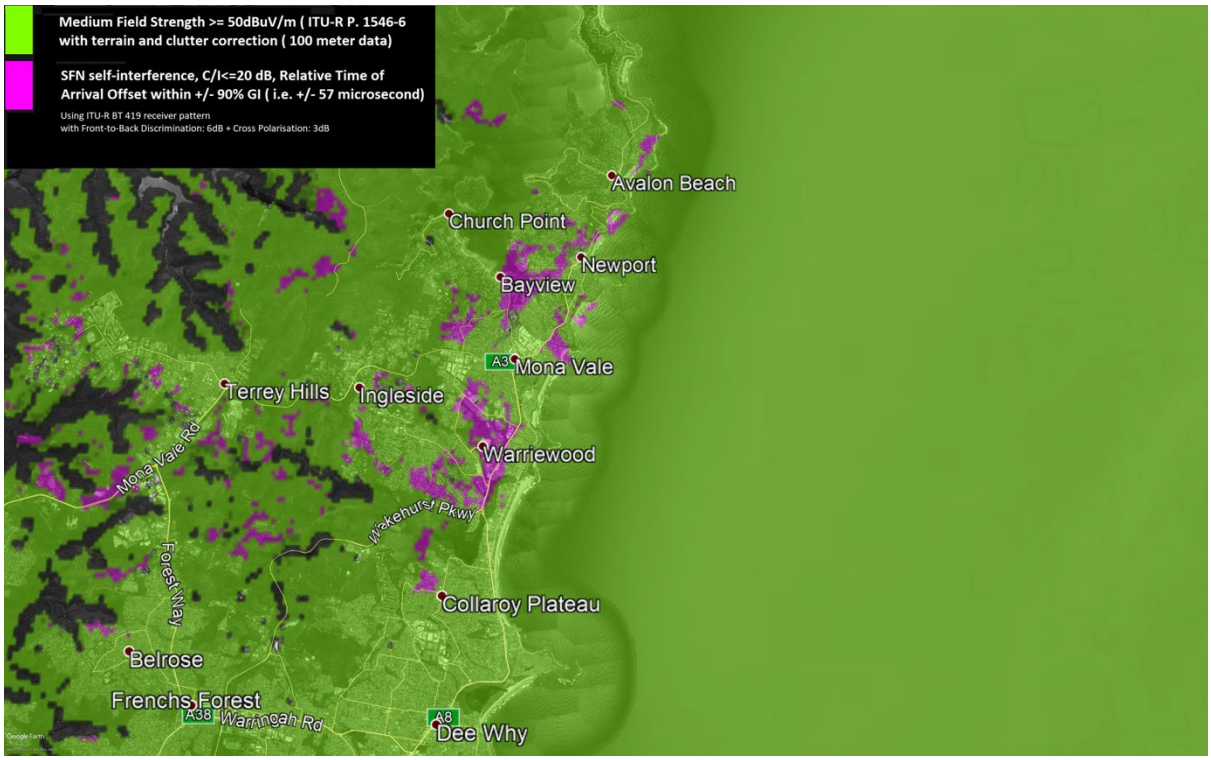
The following exhibits show two coverage and interference ('splat') diagrams generated by Free TV engineers as part of testing a '4 channels everywhere' planning model. The purple shows projected areas of single frequency network (SFN) self-interference, or 'mush zones,' in Sydney's Northern Beaches area, first under the current channel arrangement, and second, under a '4/4' channel plan using DVB-T technology. In many areas projected to suffer interference, there would be no ready alternative source of a terrestrial signal. Because it enables larger SFNs, a '4/4' network using DVB-T2 technology may be able to avoid or minimise these problems, at least at this location.

Exhibit 32. Splat diagram of current channel arrangement, Northern Beaches (Sydney) – example



Note: 2015 SFN model (Block D) – Long Beach – 50dBµVm

Exhibit 33. Splat diagram of 4/4 channel arrangement, Northern Beaches (Sydney) – example



Note: 4/4 SFN model – Long Beach – 50dBµVm

7.4 Glossary of key terms

Term	Definition
1080i	A set of high-definition (HD) video modes offering 1,920 pixels displayed across the screen horizontally and 1,080 pixels down the screen vertically. The i stands for interlaced scan, meaning that alternate lines of pixels are refreshed with each scan. In 1080i mode, while the frame is partially refreshed 50 times per second, each pixel is refreshed only 25 times per second
1080p	See definition for 1080i. The p stands for progressive scan, i.e. non-interlaced, meaning 1080p can refresh each pixel 50 times per second ('1080p50'). This is twice as quickly as 1080i, or 'interlace'. Live sports, for example, will look much better in HD 1080p50, than in today's HD 1080i
5G	The next (fifth) generation in mobile wireless telecommunications
Anti-siphoning list	The anti-siphoning list ensures that sporting events of national importance and cultural significance are available to all Australians free of charge. The scheme ensures that free-to-air broadcasters have the right of first refusal to acquire broadcast rights to listed events. The list currently only applies to pay TV providers
AVOD	Advertising Video On Demand. On demand video that is funded by advertising (i.e. no subscription required) and is delivered OTT. Providers include YouTube and others
Blocks A, B, C, D and E	VHF and UHF TV spectrum in Australia is divided into one 'block' of 6, 7MH VHF TV channels ('Block A') and four blocks of 6, contiguous 7 MHz UHF TV channels ('Blocks B, C, D and E'). The five networks usually found at each transmission site use 5 adjacent channels from the same block
BSA	*Broadcasting Services Act 1992*. The legislative instrument governing the free-to-air broadcast sector
BVOD	Broadcaster Video On Demand. On demand video that is funded by advertising, is provided by free-to-air broadcasters and is delivered OTT
CBT	The *Commercial Broadcasting (Tax) Act 2017* (CBTA) was introduced as a 5-year interim arrangement as part of the 2017 Media Reform package. Free TV broadcasters agreed at the time to a package of measures, including a new $42m commercial broadcasting tax to be imposed on the industry, on the basis that this was a five-year arrangement that would be reviewed.
Commercial broadcaster	A free-to-air broadcaster that uses advertising to fund its operations. Includes the metropolitan broadcasters (Seven, Nine and TEN) and the regional / remote broadcasters (Prime, SCA, WIN and Imparja)
Commercial sub-market	In regional areas the commercial broadcasters divide their licence areas into sub-markets to maximise targeted advertising sales and to insert other local content, which is focused on the public in the area served
Compression technology	Technologies that reduce the total number of bits needed to represent a given video or audio sequence, enabling more efficient use of available digital bandwidth to deliver content
Connected devices	Any device that is connected to the internet. Examples include connected TVs, set-top boxes, Chromecasts, Apple TVs, etc.
CRTC	Canadian Radio-television and Telecommunications Commission
DTT	Digital terrestrial television

DVB-I	DVB-I is a relatively new standard under development by the industry-led Digital Video Broadcast (DVB) consortium. In essence, the specification enables linear TV services to be delivered to internet-connected devices. It allows TV receivers to display terrestrial and IP-delivered services within the same onscreen environment, including the ability to access these services via the electronic programme guide (EPG)
DVB-T	The current terrestrial transmission technology used in Australia
DVB-T2	The next generation in the DVB-T family. Depending on configuration, DVB-T2 offers a ~40% increase in capacity compared to DVB-T (for a given spectrum allocation)
EPG	Electronic program guide. Displays all programming in a single, navigable interface
FCC 600 MHz band plan	A wireless broadband allocation developed by US spectrum regulator the Federal Communications Commission for spectrum in the range 617 – 698 MHz
Free-to-air broadcaster	Collective term used to describe commercial and national broadcasters
HbbTV	The HbbTV platform brings together the terrestrial free-to-air content with additional content provided over IP. When a viewer selects a terrestrial channel, a FreeView pop-up is displayed that can provide enhanced functionality (including access to BVOD services, where applicable)
HD	A range of video modes offering 'high definition TV,' or better picture quality than analogue TV ('standard definition', or SD). In a DVB-T context, HD refers to a set of video modes offering either 720 or 1080 horizontal lines
HDR	The term High Dynamic Range has come to signify both improvements in the dynamic range of a video image (i.e. the brightest parts will be brighter) and 'wide colour gamut' (WCG), meaning the colours will be more lifelike. HDR is only available for HD 1080p and higher resolution picture formats
HDR HD	High definition in 1080p that is able to support 'high dynamic range' screens, which offer much greater contrasts in colour, brightness and contrast
HEVC	High-Efficiency Video Codec. Next generation of compression technology, offering more efficient transmission of higher quality video formats than are supported by MPEG-2 or MPEG-4
In-band link	A wireless link that uses broadcasters' VHF or UHF spectrum to feed TV signals to a transmitter
Linear broadcasting	Content delivered in real-time, i.e. simultaneously to all viewers, using terrestrial broadcast (or satellite DTH) technology
Linear streaming	Content delivered in real time, i.e. simultaneously to all viewers, via the internet. Sometimes referred to as broadcast simulcast
Mbps	Megabits per second. The standard unit to describe bandwidth or throughput
MPEG-2	An older compression standard. Still in use on some free-to-air services (predominantly standard definition). Not as efficient as newer compressions standards
MPEG-4	The current compression standard. Used on most high definition free-to-air services
Multiplex	In a TV context, a device for combining several streams of linear TV content for transmission using a 7 MHz spectrum TV channel. Each broadcaster currently has one multiplex at each location

National broadcaster	A free-to-air broadcaster that is (wholly or partially) funded by the Government. Includes the ABC and SBS
Net neutrality	The principle that data should be treated equally by internet service providers, regardless of point of origin. It means that organisations or users should not be charged for differences in data service access or quality, or discriminated against because they cannot afford the same level of service as their competitors
Off-air feed	Technique used to distribute terrestrial broadcast content to other transmission sites. Where applicable, broadcasters use terrestrial transmission from a 'parent site' to provide an 'off-air' input to downstream transmitter sites known as 'child sites'
On-demand streaming	Online video content that is watched on-demand at the viewer's leisure, rather than as part of a linear programming schedule
Online video platforms	Collective term used to describe AVOD, BVOD and SVOD services
OTT	Over-the-top. Describes the delivery of content 'over-the-top' of existing telecommunications network infrastructure
Prominence	Refers to the idea of ensuring free-to-air services (terrestrial broadcast and BVOD services) are readily discoverable on internet-connected devices
Public service broadcaster	Public Service Broadcaster (PSB) is the term used in the UK to refer to all freely available terrestrial broadcast services, such as ITV, Channel 4 and the BBC
Restack	The process of retuning free-to-air TV services so as to clear part of the television spectrum for an alternative use. Typically follows a reduction in the number of TV channels in use at each site of transitioning free-to-air services from existing spectrum allocations and broadcast arrangements to an alternative model
Satellite DTH	Satellite direct-to-home. An alternative delivery technology to terrestrial broadcast that is most often used in regional / remote areas. See section 5.4.2 for further details
SFN	Single frequency network. Refers to using multiple transmission sites on the same frequency
Spectrum planning model - 3/3	A planning model that allows for three multiplexes (versus the six multiplexes available currently) in both metropolitan and regional licence areas. This is the planning model proposed in the Green Paper
Spectrum planning model - 4/3	An alternative planning model that assumes four multiplexes in metropolitan licence areas and three in regional licence areas
Spectrum planning model - 4/4	An alternative planning model that assumes four multiplexes in both metropolitan and regional licence areas
SVOD	Subscription Video On Demand. On demand video that requires a subscription and is delivered OTT. Providers include Netflix, Stan, Foxtel Now, Amazon Prime Video, Disney+ and others
Terrestrial broadcast	Transmission of TV from a terrestrial site using the DVB-T (or T2) transmission standards
Transmission site - child	A downstream transmission site that receives inputs from a parent transmission site using off-air feeds
Transmission site - parent	An upstream transmission site that feeds a child site
UHF	Ultra high frequency

VAST	Viewer Access Satellite Television (VAST) provides services to viewers in remote areas of Australia, ensuring that 100% of Australians have access to free-to-air television services
VHF	Very high frequency
Wireless microphones	A sub-set of mainly class-licensed, low-interference devices authorised to make use of UHF TV spectrum. Also includes in-ear monitors. Widely relied on by the entertainment and broadcasting industries, also in a range of amateur contexts