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SBS Submission

Digital Television Regulation Consultation Paper

Department of Communications

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Executive Summary

There is a bright future for free-to-air television should the regulatory environment strike the right balance between stability, innovation and flexibility. As such, SBS welcomes the opportunity to provide input to the Government's review of digital television regulation.

SBS's position on the various issues raised by the Digital Television Regulation Consultation Paper can broadly be summarised as follows:

1. **Next-gen technology preferred** SBS believes that the next major transition for digital television should be to the future technology of DVB-T2 transmission and HEVC compression, bypassing any interim transition to out-dated MPEG-4 technology. Importantly, DVB-T2/HEVC next-generation technology will deliver five-fold spectrum efficiency compared to the current MPEG-2 on DVB-T and three-fold efficiency compared to MPEG-4 on DVB-T.

2. **MPEG-4 single multiplex not supported** SBS does not support a rapid move to a shared multiplex infrastructure with MPEG-4 on a DVB-T platform for the following reasons:

    - Detrimental impact on **audience satisfaction and reach** due to incompatibility of consumer equipment, reduced transmission quality (such as a reduction from HD to SD) and the restriction on growth of digital television technologies (such as 4K) due to limited capacity.
    - Detrimental impact on **services** due to reduction of existing services and / or potential restriction on growth of future services.
    - Multiple high **transition costs** of consumer education and infrastructure (including simulcast, distribution and encoding) in the event of an interim transition to MPEG-4 followed by a transition to HEVC at a later date. SBS suggests a singular transition to HEVC/DVB-T2
    - The substantial costs associated with terminating contracts with current infrastructure operators.

3. **Timeframe – not before 2026** While initial transition steps could be commenced as early as 2016 (with further milestones set out in this submission), SBS believes that a realistic adoption of DVB-T2 / HEVC and any sharing of multiplexes would not occur before 2026. This timeline closely aligns with the transition plans being considered in Europe for 'late majority' countries with a horizontal market and large legacy issues, similar to Australia. SBS's suggested timeline to HEVC and DVB–T2 would also allow for the sharing of a multiplex in a variety of ways that could free up spectrum while also allowing for the use of more efficient distribution systems.

4. **National Broadcaster lead** As one of two national broadcasters, SBS welcomes the Government's suggestion that the national broadcasters lead the transition pathway.

5. **Service restrictions and HD** SBS welcomes the proposals that there be no new restrictions on the number of television services offered by broadcasters, that the requirement for a broadcaster's primary channel to be transmitted in standard definition (SD) mode be lifted and that high-definition (HD) quotas not be reintroduced.

6. **Regulation for services such as HbbTV** SBS is of the view that there is a disconnect between the level and type of regulation for traditional broadcast content and online platforms and that a more consistent regulatory framework should be applied.

7. **Flexible use of spectrum** SBS supports the position that there should not be a limit on the number of services provided by broadcasters and that broadcasters should have the flexibility to provide services within their allocated spectrum and new online services as they may determine.

Support for Other Industry Submissions

SBS notes and welcomes the wide industry support for a transition to HEVC and DVB-T2 technology which has become apparent in preparing a response to the Consultation Paper.

In the event of any minor differences in approach between the submissions of other broadcasters, SBS believes these differences can be worked through in a clear transition plan and would not be so great as to detract from this broad alignment.

Introduction

SBS is Australia's multilingual and multicultural national broadcasting service, operating under the *Special Broadcasting Service Act 1991* (SBS Act). SBS's principal function is to provide multilingual and multicultural radio, television and digital media services that inform, educate and entertain all Australians, and, in doing so, reflect and promote Australia's multicultural society (SBS Charter).

SBS provides three national television services – SBS ONE, SBS 2, and NITV – on digital terrestrial and satellite television platforms. SBS Radio broadcasts 74 language programs on analogue and digital radio, the digital television platform, and via streaming and podcasting online. SBS Radio's analogue services are available on five analogue networks – AM/FM in Sydney (including Canberra and Wollongong) and Melbourne, and a national service. SBS Radio transmits eight digital services to Adelaide, Brisbane, Canberra (trial), Melbourne, Perth and Sydney. SBS ON DEMAND delivers online catch-up television and on demand video services. SBS also delivers services via a range of mobile applications.

SBS notes that the Consultation Paper is not intended to be a comprehensive review of all media regulation. Accordingly our responses focus on the principles for reform as set out in the Minister's keynote address at the RadComms 2014 Conference and the three key topics in the paper; namely: the availability of services, the technical evolution of broadcasting and the use of broadcasting spectrum.

Free-to-air (FTA) broadcasting should remain competitive and viable

The FTA television industry is a horizontal market where the broadcasters do not have control over the television receivers purchased by consumers. The Australian FTA horizontal market has adopted global open standards, with some localisation, acknowledging that such standards evolve and are upgraded over time in a controlled manner to ensure stability and compatibility of performance for the consumer. SBS does not believe that the choice of technology should be mandated by Government, but that industry should be allowed the flexibility to determine the best prevailing broadcast technologies that will benefit audiences.

It is critical for the success of the FTA television industry that the broadcasters can compete with other content providers and distributors, not only in terms of the range of content genres, but also in terms of video resolution and increasing quality expectations over time, as well as other 'value-adds'. Ultra-High Definition (UHD or '4K') television sets with internet connectivity are now widely available in the marketplace, currently priced at levels comparable to the 'Full HD' devices of only two or so years ago. Further significant price reductions are expected to continue as production volumes and take-up increase.

IPTV players, such as Netflix, are also making 4K content available to the market. Viewers with sufficient internet bandwidth and display devices can access some of this content today. Current trends suggest that UHD is emerging as the new 'premium' picture- quality option, with HD increasingly becoming the basic expectation of viewers. Other OTT IPTV operators

such as Presto, STAN and Quickflix will be expected to develop their HD and UHD/4K strategies over time and add to the plurality of content service providers.

In Europe and Asia, there has been significant growth in the number of FTA HD services available since the adoption of DVB-T2, and a number of countries are testing DVB-T2 and 4K with a view to its permanent introduction in coming years.

Aligning with the Department of Communications' 'Deregulation Roadmap 2014', SBS recommends a future approach to broadcast regulation that achieves a balance of regulatory certainty and consumer safeguards, while also allowing broadcasters to operate effectively and efficiently in an increasingly challenging global media environment.

1. Commercial and national broadcasters should be free to determine the most appropriate mix of services and formats for their audience

1. What factors will influence the decision to increase or reduce the number of services a broadcaster chooses to provide?

The financial viability of each individual service a broadcaster provides lies at the heart of the decision making process. This viability is influenced by, for example, its capacity to generate revenue or increase audience share, and is particularly sensitive to government standards and regulatory burden.

Beyond fulfilling basic broadcasting obligations (outlined in the SBS Act and Charter), SBS should be allowed the freedom to reach audiences as the Board determines appropriate to better serve our Charter. Broadly in line with the preliminary Government position, no new regulation limiting the number of services provided by broadcasters should be introduced that would limit SBS (or other broadcasters) to generate a solid return-on-investment or increased audience share from introducing or reducing services.

2. What safeguards, if any, should the Government put in place to make sure that an appropriate balance is maintained between giving broadcasters the freedom to use their spectrum how they see fit, providing audiences with a diverse range of television services and the appropriate and efficient use of spectrum?

Transmission cost savings and improved spectrum efficiency could be gained over time from the discontinued use of terrestrial DTTB infrastructure at those facilities where only a minority of FTA broadcasters' services are provided; for example, DTTB services would cease for singular or minority (that is, less than the full complement of) transmissions from these sites. Historically, the commercial broadcasters have extended their terrestrial networks only as far as it is commercially beneficial to do so. SBS considers the already-available VAST service to be a cost effective means of delivery to small and remote communities. In the longer-term, SBS envisages a further transition from terrestrially-based delivery (DTTB) to satellite and other emerging platforms (e.g. NBN). Determining factors will include the DTTB delivery cost-per-capita, the granularity of local and regional programming (e.g. local 'break-outs'), and consideration of the additional costs of consumer premises equipment (CPE) and ongoing charges.

3. What consequences, if any, could the removal of 'service deficient' declarations have on the content delivered to viewers in smaller regional and remote areas?

The current regulatory arrangements surrounding the declaration of 'service deficient' areas places the onus on viewers to apply to access the VAST service at their own expense. Any changes made to such arrangements must not negatively impact the quality and reliability of broadcast services in metropolitan and regional blackspot areas.

4. What impact, if any, will the removal of the requirement for the primary channel to be provided in SD have on viewers?

SBS supports the removal of the requirement for the primary channel to be provided in SD. The decision on whether to broadcast in HD or higher quality is best left to the discretion of individual broadcasters who are best placed to weigh up the benefits of content and quality considerations to serve their audiences.

Distinct HD programming has been available since 2009, and anecdotal information suggests that HD penetration in households has reached approximately 90%. Therefore, it is anticipated that there may be some impact if requirements for primary channels were removed, given the major technological changes that have occurred during the digital switchover.

SBS understands that the government has a responsibility to facilitate broadcast services for as much of the Australian population as possible, and minimum safety nets are required during periods of technological changeover. However, SBS believes that consumer expectations have progressed beyond SD content, and consumers are largely aware of any changes that would be necessary to take advantage of newer HD content. A public information campaign, rather than ongoing regulation, may be all that is necessary to 'groom' the remaining consumers to ensure they are aware of changes to technology. Furthermore, setting out requirements for 'primary' vs. 'secondary' (or indeed many other channels) creates artificial distinctions that are representative of a bygone period of broadcasting. The intended objectives of these requirements can more effectively be met through other, non-legislative mechanisms, such as industry codes and education campaigns. The removal of such requirements would ensure consistency across the broadcasting environment and ultimately reduce regulatory burden.

As explained further in the section 3 responses below, it will be critical in a future shared-multiplex environment that SBS and ABC have sufficient capacity in order to fulfil delivery of HD content and not be materially disadvantaged compared with the commercial television networks.

5. What factors will influence a television broadcaster's decision to continue to offer HD content?

There is evidence from a number of countries and regions of increased consumer interest in improved quality and HD services. As with *implementation Question 1*, the ability to increase revenue or audience share will be a substantial driver in influencing a broadcaster to offer HD content. Recently, internationally and locally, FTA and subscription television providers have expanded their HD services in efforts to improve consumer satisfaction. As more spectrally efficient transmission standards are introduced (e.g. DVB-T2), we are also seeing a greater adoption of HD as the 'new entry-level'. DVB-T2 has now been adopted by 68 countries worldwide, with actual deployment in 29 of those countries at December 2014.

Informa Telecoms & Media predicts that the number of active HD households will rise to over 600 million globally by 2017, with Asia Pacific emerging as the biggest HD market by that date, followed by North America and Western Europe.[1] It said that by 2017 several countries could be approaching the point where almost all viewers would be watching HD content, leading to the possibility of a SD switch-off and the possibility of introducing a new generation of HD technologies.

SBS will be strongly influenced by its ability to secure and broadcast sufficient HD content, as well as ongoing consumer demand for high quality content. While costs associated with digital broadcast development and content delivery are steadily increasing with consumer demand, new digital platforms and applications present opportunities for SBS to deliver tailored content to our audiences and develop strong brand relationships with consumers.

Rights holder preferences will likely be a factor too; whilst we may not be mandated to carry the FIFA World Cup and other major sporting events in HD our audiences would not appreciate a decision not to include a HD offering. Similarly not having a reasonable number of HD FTA DTTB streams available (or indeed an opportunity for UHD – whether as a DTTB, OTT, DTH or pay TV service) would indicate some misalignment with the Australian retail strategy.

SBS is not merely satisfied with following behind the competition on technological development – Australia's multicultural broadcaster strives for a digital television environment that is world class and future proof.

2. Commercial and national broadcasters should be increasingly permitted to use spectrum more flexibly

6. What form of regulation should there be for services that are indistinguishable to viewers from more regulated services and accessed with common equipment, such as HbbTV?

SBS agrees with the preliminary Government position stated in the Consultation Paper that further work should be undertaken on the commercial and regulatory implications of free-to-air television services being delivered using online platforms. This should focus on reducing the regulatory disparity between the broadcasting and internet regimes, and the maintenance of clear public policy objectives (as set out in the Department's Deregulation in the Communications Portfolio Policy Background Paper No. 1).

[1] Informa Telecom and Media's report: *Global HDTV Forecasts to 2017, 7th Edition* includes statistics and forecasts for 53 countries, defining active HDTV households as those with an HD set watching HD broadcasts. http://www.informatandm.com/global-hdtv-forecasts-to-2017-7th-edition/

7. **What arrangements may be required to allow currently established datacasting services provided by commercial broadcasters to continue where necessary after the repeal of the datacasting provisions in the BSA and RadComms Act?**

In their current forms, arrangements relating to datacasting appear to be limiting the take up and usage of such communication types. If this is in fact the case, opening up the regime may provide more opportunities for media players (including SBS and other operators) to engage in datacasting activities. In turn, such arrangements may more broadly improve the quality of the Australian media environment, by facilitating more voices and greater communication opportunities. This is based on the understanding that any increase in flexibility does not decrease SBS's ability to control its current spectrum resources.

8. **Other than narrowcasting services, are there any other types of services which broadcasters should offer on their television multiplexes?**

SBS is broadly in favour of any changes to current arrangements that allow us greater flexibility to provide services within our allocated spectrum. As above, this is based on the understanding that any increase in flexibility does not decrease SBS's ability to control its current spectrum resources.

9. **Is it likely that commercial television broadcasters will want to use their multiplexes and hence spectrum to offer third party content that they are not responsible for under the relevant broadcasting legislation? If so, what form of regulation would be appropriate to ensure such content was provided in a manner consistent with commercial broadcaster provided content?**

   SBS is a public broadcaster reliant upon commercial returns for a proportion of our revenue. As such, any future arrangements that might apply to the commercial broadcasters should also apply to SBS.

10. **How important is it that broadcasters have the regulatory flexibility to make greater use of new technologies to deliver their television services to viewers?**

It is absolutely necessary that maximum flexibility be provided to broadcasters to make greater use of new technologies to deliver television services to viewers.

SBS is internationally recognised for its technological innovation. After pioneering investment in the online area, SBS is beginning to enjoy scale benefits, in terms of increased audience share and a deeper understanding of those audiences.

The social and technological operating environment is changing and this has influenced our strategy, how we operate and how we achieve our purpose. As technology changes, SBS requires the flexibility to change and stay on-pace with cutting edge advancements.

Flexibility will allow SBS to deliver the best available content to audiences, and to understand our audiences better.

Commercial and national broadcasters should deliver their services through spectrally efficient mechanisms and this can only occur where flexibility allows more efficient means to be explored.

11. How can the Government support the broadcasting and manufacturing industry in managing a transition to MPEG-4 only television?

It is SBS's view that the next major transition for digital television technologies should be to combine DVB-T2 transmission and HEVC compression. This would put Australia in line with current international developments. SBS does not believe a transition to MPEG-4 only television should be a mandated middle step.

SBS supports the principles set out in the Minister's keynote address to the RadComms 2014 Conference regarding the drive to achieve maximum spectrum efficiency and the eventual spectrum sharing between the national broadcasters.

The Australian industry publicly stated in October 2013 that the FTA sector is seeking a migration pathway to more spectrum-efficient DTTB standards, including DVB-T2 and HEVC (high efficiency video coding)[2].

The national broadcasters could take a lead role in effecting this transition, which will impact a range of stakeholders over the medium-to-long term, including content providers, broadcasters, consumers, retailers and service providers. However, SBS believe this should be to achieve DVB-T2 transmission and HEVC compression.

Multiplex capacity and picture resolution

Current multiplex capacity in DVB-T, using existing coverage parameters, equates to 23Mbps for ABC services nationwide and SBS services in the metropolitan markets; SBS services are currently operating at 19Mbps in the regional markets as a result of legacy spectrum restrictions in single frequency network (SFN) planning.

Analysis undertaken for ABC and SBS by Ericsson reaffirms it is not possible to incorporate the full suite of existing ABC and SBS services utilising MPEG-4 into an existing DVB-T multiplex without a combination of dropped services and some material degradation of picture quality. Even with all services operating in SD mode, there would be a material loss of picture quality. Furthermore, any regression of picture resolution would likely have a negative impact on the retail sector where, currently, significant sales volumes and margins relate to large-screen, high-definition and UHD display devices.

Furthermore, the current DVB-T/MPEG-2 Australian receiver standard, first established in 1999/2000, never contemplated a shared multiplex incorporating discretely described network identifiers allocated to each broadcaster (e.g. SBS, ABC). Therefore, it is strongly suspected that all current MPEG-4-capable receivers would not function, or not function in a

[2] www.righttoknow.org.au/request/563/response/2145/attach/7/Document%204.pdf

predictable manner, in a shared-multiplex environment based on MPEG-4 and DVB-T. Our response to *implementation Question 14* provides further expansion of this issue.

Singular transition to spectrum-efficient, next-generation technologies

SBS suggests a singular transition to HEVC/DVB-T2 to avoid consumers upgrading to an interim standard (of MPEG-4) only to have to upgrade a second time at a later date.

The MPEG-4 standard was ratified in 2003 and has since been significantly superseded in terms of coding efficiency by HEVC. HEVC coding efficiency will continue to improve for some years to come, without material impact on the design of consumer equipment.

The combination of HEVC and DVB-T2 provides **five-fold spectrum efficiency** for the same suite of content when compared to current MPEG-2/DVB-T technologies; similarly this HEVC/DVB-T2 combination also provides **three-fold spectrum efficiency** when compared to MPEG-4/DVB-T technologies as proposed in the Consultation Paper. This five-fold spectrum efficiency benefit most closely aligns with the Minister's drive 'to achieve maximum spectrum efficiency'. Additionally, it offers material improvement over that obtained from the proposed and more limited MPEG-4/DVB-T transition.

Multiplex sharing in an HEVC and DVB-T2 environment will enable broadcasters to increase the technical quality of their current services as well as augment the number or type of services they provide. Importantly, broadcasters will maintain the capability for flexibility in a spectrally-efficient manner with cost-effective distribution at a time when it is anticipated that audiences will expect HD as the default quality standard. This raising of the expected quality standard and corresponding increased capacity requirements will be offset by the efficiency gains realised through the adoption of these next-generation technologies.

These next-generation technologies are already being trialled, planned and implemented in Europe and Asia as outlined at Attachment B - International Developments and Trends.

12. Should the Government consider any legislative mechanisms such as technical standards for MPEG-4 terrestrial transmitters and/or television receivers?

The Australian industry manages the development and ratification of broadcast standards through representations with Standards Australia. An updated digital television receiver standard (AS 4933.1) is currently in the process of being published, which makes references to the emergence of HEVC, IPTV and HbbTV and provides some guidelines, but does not include detailed specifications. For example, there is currently no provision for DVB-T2, 3D or 4K. The transmission standard (AS 4955) was last updated in 2011 and does not include DVB-T2. These standards have not been mandated by the ACMA.

SBS does not believe that legislative intervention is warranted at this time for consumer reception equipment standardisation, as the industry is able to set minimum performance specifications as it has done in the past. However, it would be beneficial for Government to

mandate that all imports must be fully compliant with these newly-established industry standards.

To support industry-led performance, next-generation receivers should be suitably labelled with compliance markers ('ticks') at the earliest opportunity to ensure consumers are not misled into purchasing non-compliant imports. A key driver for consumer take-up will be clear messaging from the industry and the retail sector, with the support of Government and its agencies.

13. By what date does the broadcasting and manufacturing industry consider that MPEG-4-only television could be achieved?

SBS advocates a transition directly to the next-generation technologies of HEVC and DVB-T2, bypassing any interim transition to MPEG-4 only. SBS considers that transition to HEVC and DVB-T2 may be possible by 2026; however, there are significant issues that need to be addressed in managing the transition (see response to *implementation Question* 14 below).

14. What does the industry consider should be the future standard(s) for broadcast television in Australia? Should a pathway to next generation technologies such as DVB-T2 or HEVC also be considered?

SBS firmly believes that a pathway to DVB-T2 and HEVC should be the main pathway considered and has outlined the necessary steps to achieve this below.

By 2026, 23 years will have elapsed since the ratification of the MPEG-4 standard and, by then, HEVC will have become a very mature global standard with low-cost receiver product pricing.

In the same way that in-home picture quality has advanced over the years—from analogue through SD- to HD-digital, largely driven by premium content and live sport—there is global expectation that HEVC/4K/UHD will make similar advances and help create the consumer proposition to upgrade ageing display devices. A further driver will be the new features and applications available in the fast-evolving smart TV/HbbTV environment.

Given the lack of evidence or research to quantify the extent of MPEG-4 penetration, not only in terms of households, but also the number of legacy MPEG-2-only devices, SBS considers the timetable to switch to MPEG-4 suggested in the Consultation Paper is not achievable without serious adverse material impact on the audience and the viability of the FTA industry.

Transition pathway to HEVC and DVB-T2

Detailed work will need to be undertaken by industry to ensure a smooth transition from current technologies across to the next-generation technologies and shared multiplexes. The scope of this work will include such matters as:

- test transmissions of HEVC and DVB-T2 to inform industry and assist the revision of existing standards by relevant study groups (which could commence in 2016);
- design and development of a detailed transition plan (including simulcast planning) to minimise audience impacts;
- establishment of a government and industry body to design and lead the publicity and consumer communications plan;
- procurement of simulcast transmission services utilising the next-generation standards;
- aggregation of multiple-sourced encoded content streams into a singular multiplex;
- planning and procurement of appropriate 'distribution' platforms (i.e. to provide carriage of playout-to-multiplex and multiplex-to-transmitter content signals); and
- management of audience impacts and coordination of public retune/rescan events by market area.

Test transmissions to inform industry

In order to stimulate the market and prepare for the transition, and for the FTA television sector to stay relevant to its audiences, it will be important to commence HEVC/DVB-T2 test transmissions at an early opportunity. Interoperability assessment is critical in a concatenated digital broadcast environment. These trial transmissions will be used to:

i. inform industry and standards study groups (such as the Standards Australia Committee CT-002, Broadcast and Related Services) in the revision and refinement of existing Australian standards;[3]

ii. assist manufacturers to assess and refine their products and features in a live DTTB environment; and

iii. assist the broadcasters and transmission service providers optimise the technical transmission parameters.

SBS considers that test transmissions could commence as early as 2016 and would utilise spectrum nominally reserved for a 'sixth multiplex'.

The DVB suite of standards each have a wide range of technical parameter options that can selected for use in a particular jurisdiction according to the application and other local

[3] For example *AS 4933.1-2005: Digital television – Requirements for Receivers Part 1: VHF/UHF DVB-T television broadcasts*; and *AS 4599.1: Digital television – Terrestrial broadcasting – Characteristics of digital terrestrial television transmissions*.

contextual and environmental factors. Country and regional industry bodies have selected and adapted particular options for specific regions. For example:

- the UK Digital Television Group (DTG) adopted particular options and defined the technical specification for UK digital terrestrial television in the 'D-Book';
- a similar European document defines the specifications for Europe – the 'E-Book'; and
- the Nordig group unified specifications for applications in Nordic countries.

DVB-T2 is a very flexible standard with many configuration options, which can impact on standardisation. To ameliorate this, the, industry will need to determine the modes of operation and the technical specifications for DVB-T2 transmissions in Australia or adopt existing specifications with minimal or no modification. These trials will be required to definitively determine the capacity of next-generation multiplexes and the associated coverage and error protection parameters; in addition, they will aid vendors and manufacturers in ensuring interoperability between their products and stability of the content services delivered to the audience.

As a smaller consumer market, Australia's approach to standards needs to be informed by international standards development and the adoption of technologies or technical standards in other markets. Further, there is increased trending towards the globalisation of television set designs, assisted by developments in silicon chip-set integration. Nevertheless, wide-ranging Australian industry consultation associated with the development and revision of standards, and ensuring alignment with international developments and manufacturing industry, requires meticulous attention. Industry estimates suggest a period of 2-3 years to attain published revisions of the requisite Australian standards (AS 4933 and AS 4599) incorporating the required next-generation features.

When Australian standards harmonise with international standards they allow for greater economies of scale in production by enabling common parts and specifications. This in turn impacts the price and range of products available in Australia.

Simulcast of next-generation services

On completion of the test transmissions and establishment of revised standards, simulcast transmissions in HEVC and DVB-T2 would progressively replicate existing transmissions across a wider number of markets. It is envisaged that these simulcast transmissions could commence from 2019/2020 and progressively be rolled out across the regional markets and metro infill areas. The contemplation of a 'hot changeover' (e.g. overnight) to a new suite of standards, or with an inadequate duration of simulcast transmissions would result in large audience groups losing the television services altogether and this would be unacceptable to the FTA industry.

The restack/retune project generally provisioned an additional antenna combiner port for use by a 'sixth multiplex' (currently described by the ACMA as the 'unallocated' channel, or 'UA') at those DTTB sites that were being restacked and where the whole combiner system was replaced. This port would facilitate access to the antenna system for a future simulcast service in the respective market. At these sites, the simulcast service would comprise an additional (single) transmitter, associated program input equipment and additional distribution circuits to deliver the simulcast program services in HEVC format from the multiplex centre to the site.

The simulcast of current services in an HEVC/DVB-T2 will incur substantial additional encoding, distribution and transmission costs for the duration of the simulcast period. It will be essential for industry and the ACMA to develop a detailed simulcast plan to identify suitable spectrum in each market and for the broadcasters and transmission service providers to assess the extent of the opportunity to utilise redundant transmission assets (e.g. standby transmitters) where these exist. Where feasible, the use of redundant assets will necessitate a risk management approach to the ongoing reliability of current infrastructure during faults and maintenance. There will also be the need to identify additional spectrum (in addition to the sixth multiplex) in many markets and/or adopt some form of stage-managed transition arrangement. The timed phasing of the encoding / multiplex changes in the context of existing outsource contractual commitments will also impact on broadcasters costs. It is not possible at this early juncture to estimate the cost of the simulcast program of works.

As described in the response to *implementation Question 2* above, SBS does not consider that all DTTB facilities would need to be augmented to provide the HEVC/DVB-T2 simulcast services, rather, only those facilities that provide a full suite of national broadcaster and commercial broadcaster services would be upgraded.

Where a full suite of FTA services is not provided from a particular DTTB transmission facility (or quasi-co-located facilities), the local audience will already be receiving a number of FTA services via the VAST facility – considered as a 'hybrid' reception area. Using VAST as the primary delivery source to replace DTTB for the audience in these hybrid reception areas will eliminate the need for simulcast transmission infrastructure upgrade costs as well as save on the ultimate end-of-life replacement of original transmission plant at these DTTB facilities.

The transition to an all-VAST solution in these hybrid areas could apply to a significant number of 'Class D' services over time and ultimately result in material transmission cost savings for the national broadcasters. The audience impact in the hybrid areas will require some people to procure additional satellite reception equipment for second and third televisions, and/or an in-home wireless distribution system.

Consumer drivers and the transition timeframe

Consumer adoption and transition will be greatly assisted by presenting and articulating a strong proposition for change and upgrade. New content and features at affordable prices, together with clear messaging and product compliance statements, are key prerequisites.

An ACMA report published in 2011, based on Newspoll respondent data, gave the mean age of a replaced television set as 8.3 years and of those replaced sets, 53% were retained for some form of further use.[4] Similarly, GfK conducted research for the second half of 2011 which from their evidence shows that the TV replacement cycle has dropped to 6.3 years from a previously longer cycle. This trend for a diminishing consumer 'lifespan' for TV equipment also mirrors Sony's observation of the Australian marketplace.[5]

The launch of HbbTV in 2014 and available consumer product in the marketplace, together with the strong promotion of catch-up TV services and other value-add applications will act to shorten the replacement lifecycle. The recent ratification of the HbbTV2.0 standard and its forecast incorporation into consumer products in 2016 will be a further catalyst to drive the consumer proposition.

On the basis of the replacement cycle evidence, SBS suggests the transition to a single national broadcaster multiplex utilising HEVC and DVB-T2 could not reasonably occur before 2026 at the earliest. The timeline projection also closely correlates with recent European market transition analysis undertaken by DigiTAG and Analysis Mason; refer Attachment B – International Developments and Trends.

We consider the expectations of spectrum sharing as contemplated in the Consultation Paper are therefore premature at this stage prior to 2026.

Aggregation of content streams into a single multiplex and revised distribution architecture

Currently, each broadcaster individually encodes each of its program streams into an MPEG-2 format and aggregates these into its respective multiplex for subsequent onward distribution (from each playout centre) to the third-party hill-top site for transmission in DVB-T format using its allocated 7MHz block of spectrum. Figure 1 below depicts the television services and multiplex arrangements in 2015 for each of the national broadcasters; radio services have been excluded for reasons of simplicity.

[4] Television Sets in Australian Households, ACMA (2011) – incorporating Newspoll respondent information;
http://www.acma.gov.au/webwr/_assets/main/lib310665/Television_sets_in_Australian_households.pdf

[5] Sony response to the ACMA Discussion Paper: "IFC 3/2012 - Beyond switchover: the future technical evolution of digital terrestrial television in Australia"
http://www.acma.gov.au/~/media/Digital%20Television%20Licensing/Issue%20for%20comment/pdf/Sony%20AustraliaSubmssion%20Beyond%20switchoverthe%20future%20technical%20evolution%20of%20digital%20terrestrial%20television%20in%20Australia.PDF

Digital encoding is a statistical technique which, for a defined level of subjective quality, demands a higher bit-rate for active material such as fast moving objects – e.g. sport or action movies; conversely, more tranquil scenes require less digital bits. In order to optimise the program stream quality of each of the services aggregated in a multiplex (of fixed capacity), a technique known as 'statistical multiplexing' (or 'stat muxing') is applied so that digital bits can be ascribed to those streams that demand extra data allocation – i.e. those that are 'hungry' at any instant in time – at the expense of the other streams.

Where there is insufficient capacity (not enough bits to be shared) a picture degradation or artefact is produced; not all of the artefacts may be subjectively noticeable or disturbing (e.g. particularly for slow moving images) except perhaps to the professional trained eye. If taken too far however, the picture quality is noticeably degraded in the form of pixel errors or block errors – noticeable blocks of the picture are not rendered as the human eye/brain would expect.

Figure 1: Current ABC and SBS 'exclusive' multiplex configurations in 2015 (Radio services excluded for simplicity)

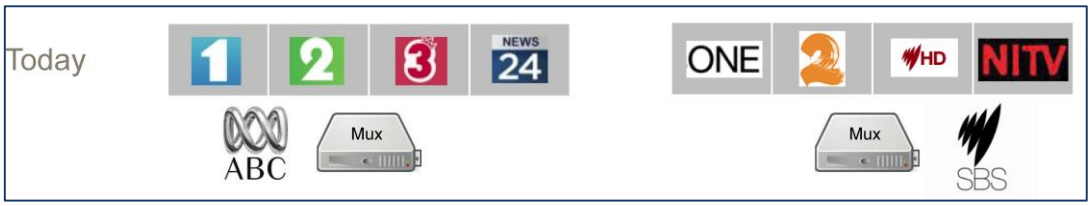


Figure 2 below compares the current exclusive-multiplex and a future shared-multiplex scenario and depicts the delivery chain from playout centre(s) (*encoding*) with delivery to a multiplex centre (*multiplexing* – which could be undertaken by the broadcaster or a third-party 'MuxCo'), and onward distribution to a network of third-party, hill-top transmitter sites (*transmission*).

Each of the program streams (ABC1, ABC2, SBS ONE, SBS2 etc.) is individually encoded – in the future scenario, HEVC encoding provides a number of option choices:

i. a greatly reduced bit stream for a given quality; or

ii. a significantly improved subjective quality for a given bandwidth; or

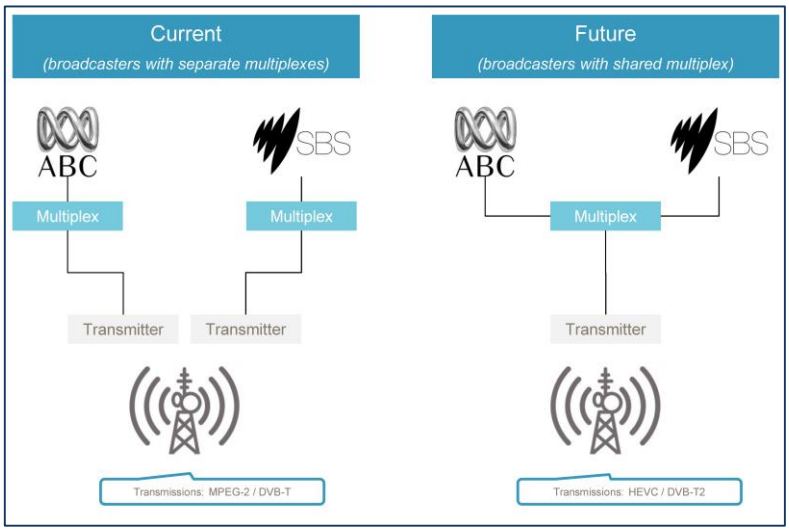
iii. a combination of the two.

The combined efficiency improvements of HEVC together with the DVB-T2 transmission standard facilitates the combination of all the program streams together in a single multiplex in high quality.

Early generation encoding and multiplexing technologies required both of these process elements to be co-located as a single headend; e.g. SBS Artarmon. With today's IP-based technology, the system architecture can be rearranged to provide significantly increased

flexibility and options. For example, the encoding of each broadcaster's services can be at its respective playout location (or elsewhere) and the multiplex function can be independently located. The statistical multiplexing can be remotely applied to each of the encoders in turn provided each of the elements are inter-connected by means of high-grade (i.e. high-bandwidth, low-latency, low-jitter) IP circuits. A further advantage of remote statistical multiplexing is that the bandwidth between playout sites and multiplex sites is of the order of a few Mbps per service rather than 270Mbps for uncompressed standard definition material; it also removes the requirement for the contribution feeds to be compressed and therefore improves the picture quality by eliminating concatenation effects.

Figure 2: Current and Future high-level multiplex architecture and infrastructure configurations



Current technology enables the MPEG-2 and MPEG-4 encoding functions to be realised using software-based 'cloud' encoding; in terms of far-end quality, industry opinion is currently split with some vendors maintaining they obtain better results with dedicated hardware encoders, whilst others strongly favour cloud-encoding. At present, the parallel-processing demands of HEVC encoding appear to be best realised using hardware encoders although software encoding is expected to catch-up in time and almost certainly within the timeframe of any likely transition to HEVC in Australia.

The adoption of a shared multiplex will impact the future distribution architectures. Not only can the multiplexing function be independently located from playout, it could also be provided in a number of ways, including by an independent third-party; e.g. MuxCo.

Existing shared-multiplex arrangements

ABC and SBS share a multiplex in delivering the national broadcaster DAB services and have established a vehicle (the National DAB Licence Company Ltd.) to purchase and manage the 'Category 3' digital radio multiplex licence; all day-to-day operational

and engineering elements are managed by the individual broadcasters. In a television shared-multiplex environment, ABC and SBS could elect to form a similar entity or they could jointly contract with a third-party.

The concept of a shared multiplex is not new; from the outset of DTTB in the UK in 1998, Digital 3 and 4 Ltd was established to address the sharing of a multiplex between ITV and Channel 4, on a fixed 50:50 partition basis; a small capacity element (approx. 730kbps) was also made available on commercial terms to Teletext UK Ltd. Arqiva is a third-party multiplex services provider to two national multiplex licensees; in addition, Arqiva is also the multiplex licensee for three commercial multiplexes, providing broadcast access to spectrum through content access agreements.[6] Whilst the technical realisation of MuxCo is relatively straightforward, careful consideration would need to be given by the broadcasters and the ACMA to ensure that its establishment is appropriately regulated, quality thresholds are carefully managed and monitored and equitable access to the multiplex is enabled.

Under the future scenario, revised distribution architecture would be implemented to align with the commencement and progression of simulcast transmissions. Timing would also allow the broadcasters to consider utilising more efficient distribution (i.e. multiplex-to-transmission site) technologies. There would be potential savings in the distribution costs between broadcasters in the longer term although this may be offset by establishment costs imposed by the telecommunication providers.

Management of audience impacts and coordination of public retune/rescan events by market area

There will be a need to establish a body with a similar remit to the Digital Switchover Taskforce to publicise and coordinate the timing of transmission changes and manage the impacts on the audience and associated CPE.

There are a number of additional elements that will need to be addressed initially as part of the receiver standard revision as well as during the simulcast planning and implementation stages. Some examples include:

Receiver intelligence

It might be reasonably expected that future generation receivers will contain considerably greater internal 'intelligence' that will be able to select the best quality reception and display option during and immediately post-simulcast. This again will be a feature for the industry to consider in revising the digital television receiver specification.

[6] http://www.digitaluk.co.uk/industry/Multiplexes

Receiver Navigation

Although a shared multiplex has been implemented in the UK from the outset of DTTB implementation in 1998, there is a fundamental technical roadblock to the implementation of a shared multiplex in the Australian DVB-T (current transmission technology) environment, whether with MPEG-2 or MPEG-4.

From the outset, the 1997 UK receiver specification incorporated parameters which specify how the receiver is to interpret and decode different broadcaster services within a shared multiplex – the DVB network 'Bouquet Allocation Table' (BAT); that is, a facility to differentiate between two digital streams with different 'network identifiers occupying a shared multiplex.

At the time of development in 1998, the Australian receiver standard excluded the BAT element; at this time DTTB services were planned on the basis of a singular HD service per broadcaster, and industry did not envisage that spectrum would ever be shared through a common multiplex. In Australia, virtually all receivers do not have the capability to interpret a BAT element even if it were to be inserted; furthermore, a suite/range of discrete network (transport and service) identifiers have been specified and published for each Australian FTA broadcast service.[7] Significant work would need to be undertaken to determine if it is even possible to 'redescribe' these discrete network identifiers in such a way as to facilitate receiver navigation and interpretation of the program services in a shared-multiplex operating in a DVB-T/MPEG-4 environment. Even if these discrete identifiers could be redescribed, it would be extremely difficult to be confident that all receivers would behave in a predictable manner. It is also SBS's understanding that some receivers may be 'hard-coded' and therefore unsuited to changes to the network identifiers.

The adoption of the new HEVC/DVB-T2 technologies will require such fundamental changes to the receiver standard that these legacy BAT shortcomings will be entirely bypassed (that is, re-written).

Logical Channel Number (LCN) management

The Logical Channel Number (LCN) is a descriptor that assigns a virtual channel number or label to each individual DTTB service by the broadcaster in accordance with an industry agreed operational practice document, Free TV OP-41.[8] Receivers which are compliant with the DVB-T receiver standard (AS 4933) will navigate to and correctly receive the appropriate service on selection of the requisite LCN. Furthermore, the receiver will behave in a predictable manner where an LCN is received from a number of sources in an area of

[7] Free TV Australia Operational Practice OP-40 (Dec 2012); http://www.freetv.com.au/media/Engineering/Free_TV_OP_40_Allocation_of_DVB_Service_Information_Codes_for_Australia_Issue%203_December_2012.pdf

[8] Free TV Australia Operational Practice OP-41 (Feb 2013); http://www.freetv.com.au/media/Engineering/Free_TV_OP_41_LCN_Descriptor_Issue_7_February_2013.pdf

coverage overlap. Any revision of the receiver specification (to address issues such as dual service illumination in both DVB-T and DVB-T2 modes) and subsequently arising from the simulcast planning and implementation works will require that LCNs are carefully managed and assigned.

During the simulcast periods associated with the metropolitan restack/retune program, the SBS Reception Advice Line team became aware of a small number of receiver models which did not behave in accordance with the standard and some viewers needed to be talked through a manual retune. This problem disappeared at the end of the simulcast, when there was only a single source (VHF) transmitted signal.

Service Information (SI) and EPG management

Similarly, as for LCN management, the receiver specification will need to be carefully revised to ensure that receiver navigation and EPG management is not adversely disrupted during periods of DVB-T and the shared-multiplex DVB-T2 simulcast.

15. What consumer issues are raised by the transition to a new transmission standard such as MPEG-4?

Consumer equipment readiness

As previously stated, SBS advocates a transition directly to the next-generation technologies of HEVC and DVB-T2, thereby bypassing any interim transition to MPEG-4.

SBS believes the penetration of MPEG-4-ready consumer equipment into the marketplace is likely not as high as has been represented. We note that there are no reliable consumer surveys that indicate with any certainty how many TV sets or other devices are capable of decoding an MPEG-4 broadcast transmission. SBS has not had access to the 'Presentation to the Department, 17 December 2013' referred to in the Consultation Paper, which stated that as of late 2013, 80% of main digital television receivers can decode MPEG-4.

MPEG-4 was only introduced into the Australian receiver standard in 2010 and at that time circa 68% of households had already converted at least their primary television receiver to digital. According to industry insights, the average replacement lifecycle of the primary television receiver is six to eight years, at which point the original receiver is often relegated to a second lounge or bedroom.[3,4] With an average of 2.2 TV sets per household (ACMA) and a large volume of pre-2010, MPEG-2-only receivers a significant number of viewers would lose their television services in the event of a conversion to all-MPEG-4 transmissions within the window envisaged in the Consultation Paper.

SBS notes that, while some manufacturers claim that they have been supplying MPEG-4-capable televisions since 2008 or 2009, these sets cannot be effectively counted as ensuring viewers will be able to watch MPEG-4 content, if it were delivered today. There have been many variations to the MPEG-4 standard over time and there is no clear picture to define which variant may have been adopted by the receiver manufacturers, therefore, there is no

way to definitively determine whether sets purporting to incorporate MPEG-4 supplied to the market prior to 2010 will operate as intended or with consistency between brands/models.

Definitive determination of how many receivers are capable of decoding MPEG-4 broadcast transmissions requires the application of an MPEG-4 test stream to the device. Consumers cannot be surveyed as currently there is no content to benchmark against.

Should the broadcasters be required to transmit MPEG-4-only content today, it is likely that they could lose over 30% of their audience reach. This could potentially limit the ability of FTA broadcasters to meet service level obligations, and would have an impact on commercial broadcasters' advertising revenue. Therefore, simulcast content must be provided to ensure that viewers and the FTA industry are not disadvantaged throughout the next transition period. In the short term, this is necessarily bandwidth-intensive, and the transition to new technologies will not yield immediate spectrum savings; however, significant potential 'spare' spectrum will accrue at the end of the simulcast period.

16. Are there any alternative arrangements to digital television multiplex licensing that the Government should consider?

In the UK, there are three tiers of licensing:

- Content licence (broadcasters or content providers);
- Mux licence (MuxCo – broadcaster JV or independent party); and
- Transmission (apparatus) licence

Until the advent of digital radio broadcasting (DAB), Australian broadcasters had direct access to their own exclusive spectrum. The national broadcasters exclusively share a 'category 3' DAB multiplex and have established a joint vehicle to purchase and manage the multiplex licence. 'category 1' DAB multiplexes incorporate a formal 'multiplex access' regime which facilitates shared access between up to seven commercial broadcasting licensees (each with an entitlement of one-ninth of the total multiplex capacity) and the remaining (two-ninths) capacity is available for sharing amongst digital community radio broadcasting services. The access obligations are set out in Part 3.3 of the *Radiocommunications Act 1992* and are regulated by the ACCC.[9]

Multiplex access regimes are imposed on UK multiplex licensees (Arqiva) for DTTB and DAB platforms to provide fair and reasonable access and are regulated by Ofcom.

SBS believes that the current Australian licensing model, predicated on broadcaster (including a consortium of broadcasters) management and control of the allocated spectrum, including the shared-multiplexes where applicable (i.e. current 'category 1' and 'category 3'

[9] An overview of the digital radio legislation; Communications Law Bulletin, Vol 26 No. 2 2007. http://www.austlii.edu.au/au/journals/CommLawB/2007/19.pdf

DAB multiplexes and a potential future national broadcaster DTTB multiplex) is preferable to the multiplex being managed by a non-broadcaster third-party entity (MuxCo). Broadcaster-management of the multiplex guarantees broadcaster control of the content 'quality vs. quantity trade-off' against the risk of quality compromises in an environment where the multiplex operator is seeking to optimise its revenue stream; the subjective quality of some of the non-core content streams on certain UK DTTB multiplexes serve as an example.

17. Are there other ways commercial television broadcasters can be encouraged to share or utilise their spectrum more efficiently?

SBS is supportive of establishing a more transparent and flexible approach for spectrum use and re-use, to maximise the efficiency of finite spectrum resources. Noting that changes in funding levels may be required to ensure that SBS has the financial resources to compete in a competitive spectrum market.

A clear and transparent framework for dealing with spectrum management could only improve the chances of spectrum sharing and greater spectral efficiency, as illustrated in international examples – refer Attachment B.

The United States FCC is preparing to embark on a 'Broadcast Incentive Auction' in early 2016 in which it hopes to recover a minimum of 84MHz of UHF BSB spectrum from broadcasters.[10] Broadcasters will bid in a 'reverse auction' to return spectrum to the FCC. The FCC's intention is to re-auction a minimum of 70MHz to wireless broadband providers. The FCC will conduct a 'repacking' or restack exercise so the auctioned spectrum can be accessed on a wide-area / near-national basis. The FCC has recently sought comment on the procedures that will govern this auction – responses were due for submission on 27 February 2015. The results of this process will provide further useful insights.

An incentive for Australian television broadcasters could revolve around a similar 'buy-back' arrangement, or in the case of commercial broadcasters, a reduction in the annual licence fee.

In order for government to optimise the financial benefit accruing from the spectrum efficiency improvements it will be necessary to implement a second restack program; without which, released spectrum would be in non-continuous, localised 7MHz blocks – akin to the post-analogue spectrum 'Swiss cheese'. Best value can only be obtained from creating nationally-cleared, wide contiguous spectrum blocks. However, it is essential that all current VHF and UHF BSB spectrum is retained until the transition to the HEVC/DVB-T2 is complete across all broadcast networks with an appropriate degree of spectrum / multiplex sharing.

[10] http://www.cooley.com/fcc-seeks-comment-on-complex-broadcast-incentive-auction-procedures

18. How might national broadcasters implement spectrum sharing while maintaining their distinct television services?

SBS considers it is important to ensure that any changes to the spectrum management framework – including any offering of spectrum sharing - do not, in the short-term, reduce its ability to provide its current suite of services, in terms of both range and quality.

Furthermore, in the longer-term, the framework needs to enable the SBS to evolve the quality and range of services to match the audience expectations to ensure that our Charter can be represented in the future media landscape.

An adequately funded SBS which is free to compete will be well positioned to maintain our distinct television services.

ATTACHMENT A: Future Digital Dividend

In his RadComms 2014 Conference keynote address, the Minister envisaged the sixth multiplex may "be replanned for alternative non-broadcasting uses, perhaps as the basis for a second digital dividend". A single interleaved 7MHz block, with a different frequency allocation in each market area, will be of very limited value unless it can be converted to a contiguous national block of spectrum through restacking.

The adoption of HEVC/DVB-T2 technologies, with their inherently improved spectral efficiency, opens the way to reconsider the future quantity of spectrum required for FTA terrestrial transmission set against appropriate quality standards of the time. Without doubt, it will be readily possible to release at least 2 × 7MHz blocks per market. In addition, the use of DVB-T2 and its increased flexibility for the deployment of wide-area single-frequency networks (SFNs) could release further amounts of spectrum. This would yield much greater value to the Government, offset by the cost of the associated second restack program which is expected to be more straightforward given the recent move to a block structure (currently 6 × 7MHz contiguous blocks) for each market.

The restack/retune program in Australia was well managed, completed ahead of schedule and heralded by the industry as a great success given the scale of the operation. Despite major broadcast program events (e.g. FIFA World Cup, Tour de France, Wimbledon) the invasive nature of the restack works were carefully integrated to reduce serious impact on the audience as much as reasonably practical. Similar programs in other jurisdictions have also been equally successful and therefore there is no reason to fear a second restack program of works provided it is adequately planned and resourced, as before.

As cited in the response to *implementation Question 17* above, the FCC is well advanced in its planning to implement a Broadcast Incentive Action in early 2016, to recover BSB UHF spectrum, auction the major part of wireless broadband services providers and subsequently restack to release the recovered spectrum in near-national, contiguous blocks. The FCC is targeting the release of up to 70MHz for auction; the recent 'AWS-3' United States auction of a 65MHz block of 1800MHz and 2100MHz paired spectrum generated total bids of over USD44 billion – more than four times the originally estimated outturn.

Although there is currently an 'overhang' of unsold 700MHz spectrum from the 2012 auction of BSB spectrum, partly arising from Vodafone Hutchinson Australia's decision to re-farm its existing holdings rather than purchase more spectrum, over time the increasing demand for 'waterfront' UHF spectrum for mobile broadband applications is expected to potentially consume current vacant and under-utilised spectrum. The completion of the transition to shared FTA multiplexes post-2025 and the anticipated spectrum scarcity in the lead-up to that date would be expected to put a premium of UHF spectrum and ultimately yield a significant return to the Government post restack activities. The demand for intensive file application streaming, such as video, is driving significant telco wireless infrastructure roll-out programs.

ATTACHMENT B: International Developments and Trends

The DVB-T2 and HEVC next generation technologies are already being planned and implemented in Europe:

- France: transmissions in DVB-T2 and HEVC are planned from 2018; [11, 12]
- Germany: a proposal under discussion to completely migrate to DVB-T2/HEVC by 2019/2020 at an accelerated pace;[13, 14, 15]
- Italy: in April 2014, Government mandated that all DTT receivers sold from Jan 2015 must include the DVB-T2 standard although this was subsequently postponed and a date looks set for 2016;[16] and
- Czech Republic: completed a 5-month trial of HEVC / DVB-T2 in Nov 2014.[17,18, 19]

DVB-T2 has now been adopted by 68 countries worldwide, with actual deployment in 29 of those countries at December 2014; a number of early-adopter European countries are preparing for, or are in the process of, transitioning from DVB-T to an all-DVB-T2 environment.[20] Recent adopters, including many African and some Asian countries, have moved directly to DVB-T2 due to spectrum efficiency benefits and considerable infrastructure implementation cost savings compared with DVB-T implementation.

European Developments: DigiTAG-Analysis Mason Report (Jan 2015)

A joint Digital Television Action Group (DigiTAG) and Analysis Mason report provides a current overview of the drivers and developments of DTTB services in Europe.[21]

Although most DTTB content provided in the countries studied in the report is in SD format, an increasing number of channels are already available in HD as shown in the table below (Figure 6 from the report). The transition from DVB-T to DVB-T2 has facilitated the drive to increased HD services in a number of jurisdictions. Some countries have been showcasing UHD during special events such as the FIFA World Cup, Wimbledon and the Commonwealth Games in Glasgow.

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[11] http://www.digitaltveurope.net/31596/csa-outlines-vision-of-future-media-regulation/
[12] http://www.broadbandtvnews.com/2014/05/24/csa-okays-first-ultrahd-4k-pilot-to-take-place-on-dtt/
[13] https://www.dvb.org/news/worldwide/list/country/germany
[14] http://www.broadbandtvnews.com/2014/11/18/germany-seeks-dvb-t2hevc-platform-operator/
[15] http://www.broadbandtvnews.com/2014/06/24/ard-to-speed-up-dvb-t2-transition/?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+broadbandtvnews+%28Broadband+TV+News%29
[16] http://advanced-television.com/2014/12/26/italy-postpones-dvb-t2-obligation/
[17] http://www.broadbandtvnews.com/2014/11/27/czech-dvb-t2hevc-test-successful/
[18] http://www.broadbandtvnews.com/2014/07/09/dvb-t2-first-for-czech-republic/
[19] http://www.digitaltvnews.net/?p=24379
[20] https://www.dvb.org/news/worldwide
[21] Roadmap for the evolution of DTT – A bright future for TV, published Jan 2015. http://www.digitag.org/wp-content/uploads/2015/01/0694-Roadmap-Report_web-3.pdf

Channel format	France	Germany	Italy	Netherlands	Norway	Poland	Spain	Sweden	UK
# of national channels	38	12-35	124	24	44	24	26	57	89
inSD	27	12-35	109	24	37	22	20	47	77
inHD	11	0	15	0	7	2	6	9	12
FTA channels in SD	18	12-35	84	3	1	22	19	7	75
Pay TV channels in SD	9	0	25	21	36	0	1	40	2
FTA channels in HD	10	0	4	0	3	2	6	2	12
Pay TV channels in HD	1	0	11	0	4	0	0	7	0

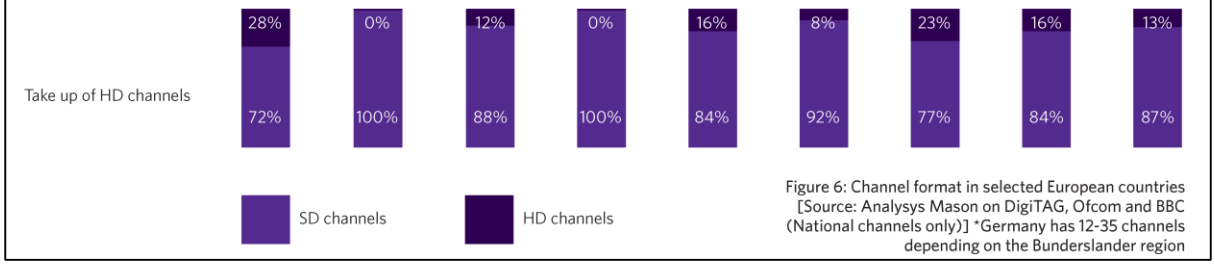


Figure 6: Channel format in selected European countries [Source: Analysys Mason on DigiTAG, Ofcom and BBC (National channels only)] *Germany has 12-35 channels depending on the Bunderslander region

The figures below show the hybrid situation in Europe with a mix of deployed encoding technologies (MPEG-2 and MPEG-4) and transmission standards (DVB-T and DVB-T2); some countries are part-way through an evolution to an all-MPEG-4/all-DVB-T2 environment. Serbia directly launched into MPEG-4 / DVB-T2 transmissions. In January 2015, Russia completed the transition to DVB-T2 in 16 regionals where DVB-T services had been launched prior to adoption of the newer standard.[22]

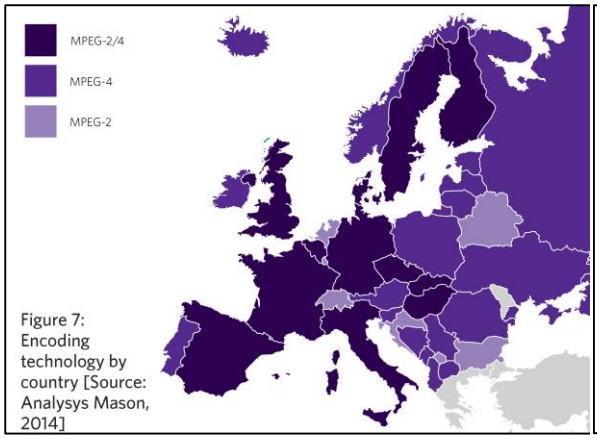


Figure 7: Encoding technology by country [Source: Analysys Mason, 2014]

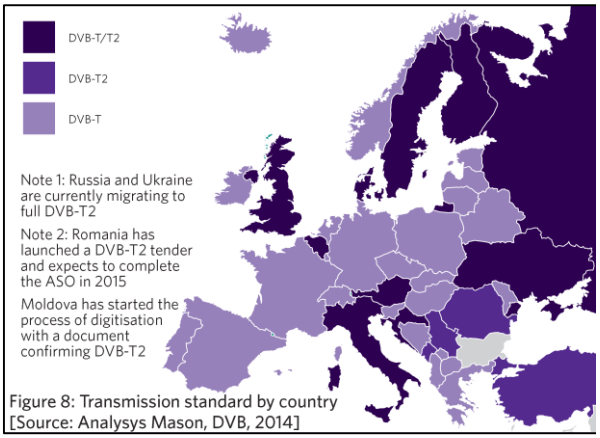
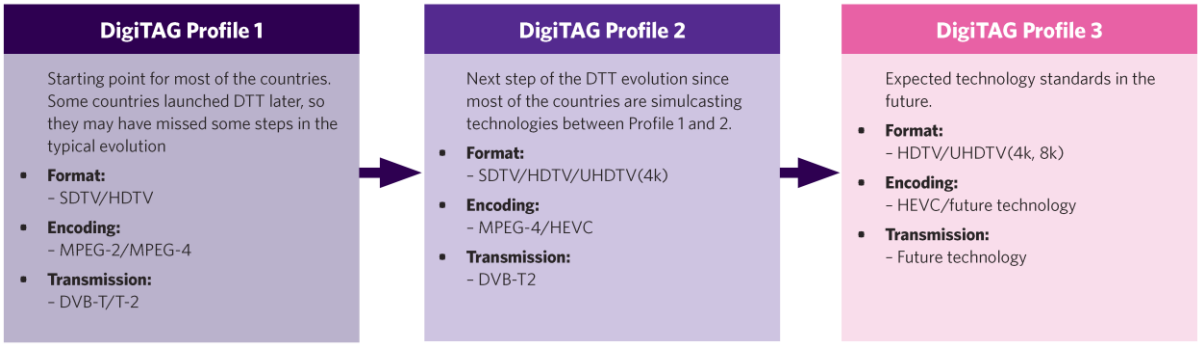


Figure 8: Transmission standard by country [Source: Analysys Mason, DVB, 2014]

European Profiles Roadmap

The joint DigiTAG and Analysis Mason report describes evolution of DTTB through three stages or 'profiles'; each profile shows a different level of development in terms of DTTB channel format, encoding and transmission standards as depicted below. DigiTAG Profile 2 best describes the HEVC / DVB-T2 technology combination the national broadcasters advocate for Australia.

[22] https://www.dvb.org/news/russia-completes-dvb_t2-transition



As part of the study, each country has been placed in a 'typology' group according to the status of four drivers: technology, market conditions, key players and regulation. The combined net impact of each variable results in three adoption categorisation groups:

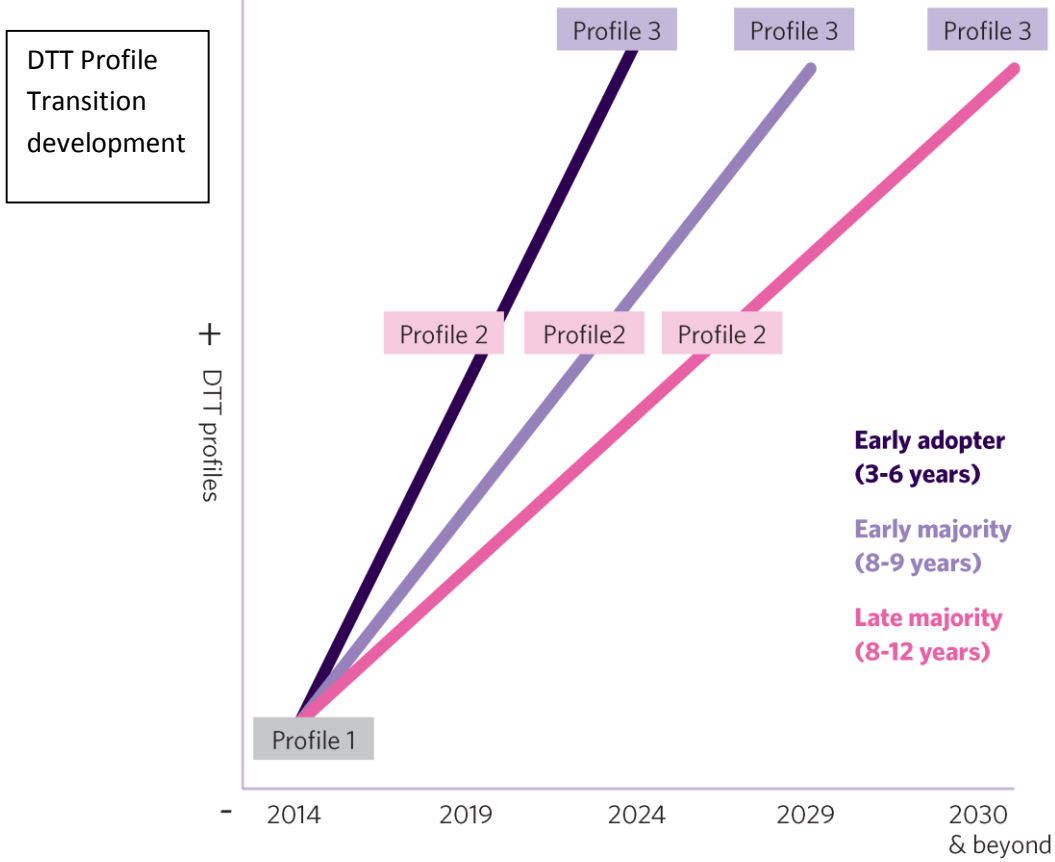
- **Early adopter/innovative:** Countries with faster adoption profiles are expected to quickly migrate to new standards once they are available. Usually early adopters are markets with a vertically integrated model, as the decision to innovate will be commercially driven (e.g. Sweden).

- **Early majority:** Within this group, countries such as the Netherlands, Norway and Spain present favourable conditions for the migration to new profiles. These markets have a more horizontal model. As a consequence, these countries are expected to form the second wave following the early adopters on the path to the next profile. Smaller countries, such as the Netherlands, do not have the major legacy issues seen in markets such as the UK and do not have the strong regulatory push seen in France and Italy.

- **Late majority:** Countries in this category tend to evolve towards new standards at a slower pace following the path designed by their predecessors. This can be a longer process due to lack of investment, large legacy issues, DTT not the main TV platform and level of wealth of consumers being low. This type of approach can follow more natural technology replacement cycles of 8-12 years for TV sets. The UK could be considered in this category with regard to new standards due to the legacy issues however with strong players in the market a decision to migrate could be pushed through at a greater speed than those countries where socio-economic issues play a factor. Markets which take a 'wait and see' approach to technology can also be placed in this category.

  The chart below depicts the adoption rate for each of the adoption categories. It is SBS's view that the Australia scenario is closely aligned with the UK categorisation under 'late majority'. Furthermore, this categorisation for Australia and the associated projections broadly align with the timeframes postulated in Section 3 of the Consultation Paper responses; that is, attainment of Profile 2, a completed transition to HEVC and DVB-T2, in the period post-2025.

Figure 24: Illustrative adoption roadmap for each country typology [Source: DigiTAG, Analysys Mason, 2014]



Asia-Pacific Developments

Singapore

All seven of Singapore's free-to-air TV channels provided by MediaCorp began broadcasting in digital in December 2013 using the DVB-T2. Of these, four are broadcast in HD format and the remainder are scheduled to be upgraded to HD in 2016. [23] [24]

Indonesia

The Ministry of Communications and Information Technology of Indonesia proposed the adoption of the next generation DVB-T2 standard for free-to-air broadcasts when Jakarta switches to digital broadcasts. [25]

[23] http://www.mda.gov.sg/PublicEducation/DigitalTvConsumers/Pages/Overview.aspx#sthash.6yoe024z.dpuf
[24] http://www17.mediacorp.sg/digitaltv/

The original plan was for introducing a DVB-T network but after consultation with industry players the Ministry decided to switch to the more advanced DVB-T2; in November 2013 the ITU Development Sector published a detailed roadmap for the transition. [26]

Thailand

Thailand's National Broadcasting and Telecommunications Commission (NBTC) selected DVB-T2 as the standard for Thailand's digital television broadcasting and the proposal was approved by the government in 2012. DVB-T2 was selected as it offers "the best transmission efficiency". [27]

TV5 and ThaiPBS are progressing the roll-out of their DVB-T2 networks, targeting to reach 95% population coverage by 2017. HD services are provided by TV5, NBT and ThaiPBS.

Malaysia

Malaysia plans a $2bn investment in a DTTB DVB-T2 network planned over the next 15-year license period. In January 2013, Malaysia published an updated revision to its specification for a DTTB receiver, predicated on the DVB-T2 standard. [28]

South Korea

In 2014, South Korea trialled UHD/4K terrestrial broadcasting using HEVC / DVB-T2 standards at frame rates of 30 and 60 progressive pictures per second. KBS and other broadcasters are in discussion with government about longer term trials and possible adoption in terrestrial, DTH and cable modes. [29]

Papua New Guinea (PNG)

PNG adopted DVB-T2 for its transition to digital television with planned launch in late 2014. Mobile phone provider Digicel PNG will use its tower infrastructure to deliver DTTB services.[30]

[25] http://www.abu.org.my/Latest_News-@-Indonesia_to_adopt_DVB-T2__standard.aspx
[26] http://www.slideshare.net/efmirza/roadmap-for-the-transition-from-analogue-to-digital
[27] https://www.dvb.org/news/thailand-prepares-for-digital-switchover-with-dvb_t2/country/thailand
[28] http://www.skmm.gov.my/skmmgovmy/media/General/pdf/SKMM-MTSFB-TC-T004-2013_Specification-for-Digital-Terrestrial-Television-Broadcast-Service-Receiver-100113-%283%29.pdf
[29] https://www.itu.int/dms_pub/itu-r/oth/0a/07/R0A070000350004PDFE.pdf
[30] https://www.linkedin.com/groups/Papua-New-Guinea-Go-DVBT2-151468.S.5902463103332814849

ATTACHMENT C: The Development of HEVC

The High Efficiency Video Coding (HEVC) standard is the most recent joint video project of the ITU-T Video Coding Experts Group (VCEG) and the ISO/IEC Moving Picture Experts Group (MPEG) standardization organizations. Version 1 of HEVC specification was formally ratified as a standard on April 13, 2013; Version 2 has since been approved as an ITU-T standard in October 2014.

HEVC is a development and optimisation of MPEG-4/H.264 and not an entirely new coding standard. It has been derived as an optimisation of many constituent elements of MPEG-4 – and is designed to achieve multiple goals including coding efficiency, ease of transport integration and data-loss resilience as well as increased use of parallel processing architectures. HEVC provides over 50% bit-rate saving for equivalent perceptual quality relative to MPEG-4; alternatively it can be used to provide substantially improved video quality at the same bit rate.[31] It is projected that further incremental efficiency improvements will be realised over time as was the case for MPEG-2 and MPEG-4 following initial ratification.

HEVC coding efficiency developments will continue apace in the years ahead, however, any decoder which is fully compliant with the HEVC standard will benefit from all future coding improvements and will not suffer any legacy impairment (as has historically been the case for MPEG-2 and MPEG-4 compliant decoders).

Future coding efficiency research and implementations will mostly be directed at the HEVC standard rather than its legacy predecessors: MPEG-2 and MPEG-4.

[31] TK Tan; Marta Mrak; Vittorio Baroncini; Naeem Ramzan (2014-05-18). "Report on HEVC compression performance verification testing"; http://phenix.it-sudparis.eu/jct/doc_end_user/documents/17_Valencia/wg11/JCTVC-Q1011-v1.zip

Glossary of Terms

ABC	Australian Broadcasting Corporation
ACMA	Australian Communications and Media Authority
AS 4933	Australian Standard: Digital television – Requirements for Receivers Part 1: VHF/UHF DVB-T television broadcasts
AS 4599	Australian Standard: Digital television – Terrestrial broadcasting – Characteristics of digital terrestrial television transmissions
AWS	Advanced Wireless Services; 'AWS-3' refers to specific spectrum blocks
BSB	Broadcasting Services Band(s); the blocks of radio frequency spectrum utilised by broadcasters
CPE	Consumer premises equipment (e.g. TV, set-top box, video recorder)
DAB	Digital Audio Broadcasting – digital radio
D-Book	Technical specification for UK digital terrestrial television published by the Digital television Group and its working groups across industry. First published in 1996; "D-Book 7" published in 2011 provides and industry agreed baseline specification and interoperability specifications.
DTH	Direct to home satellite delivery; e.g. VAST
DTT or DTTB	Digital Terrestrial Television Broadcasting: off-air reception of conventional hill-top transmissions using a domestic antenna system or master antenna system
DVB-T	Digital video broadcasting (terrestrial) – transmissions standard; ratified by ETSI in 1997
DVB-T2	The next-generation Digital video broadcasting (terrestrial) transmission standard; ratified by ETSI in 2009
E-Book	European digital television specification document
EPG	Electronic program guide
ETSI	European Telecommunications Standards Institute

FCC	Federal Communications Commission (US regulator)
FTA	Free-to-Air television services
FreeTV	The industry body which represents all of Australia's commercial free-to-air television licensees
HbbTV	Hybrid broadcast broadband television (ETSI standard TS 102 794)
HDTV or HD	High definition television
IPTV	IP Television – television services delivered in an IP format over the Internet or a private network
kbps	kilo-bits per second; data rate
LCN	Logical Channel Number
Mbps	Mega-bits per second; data rate
MPEG	Motion Pictures Expert Group
Mux/multiplex	A bundle of digital broadcast signals (video, audio, data services) amalgamated into a data-stream at the point of distribution and which can be separated into their individual elements at the decoder / receiver
Nordig	A unified platform for digital television specifications applied in the Nordic region (Denmark, Finland, Iceland, Norway and Sweden)
Ofcom	Office of Communications (UK)
OTT	'Over the Top'; internet-based delivery of IP media services
SBS	Special Broadcasting Service Corporation
SDTV or SD	Standard Definition television
SFN	Single Frequency Network
UHF	Ultra high frequency (300-1000 MHz)
VHA	Vodafone Hutchison Australia
VHF	Very high frequency (50-300 MHz)
VAST	Viewer Access Satellite Television; the satellite-based delivery platform funded by Government which utilises Optus satellites