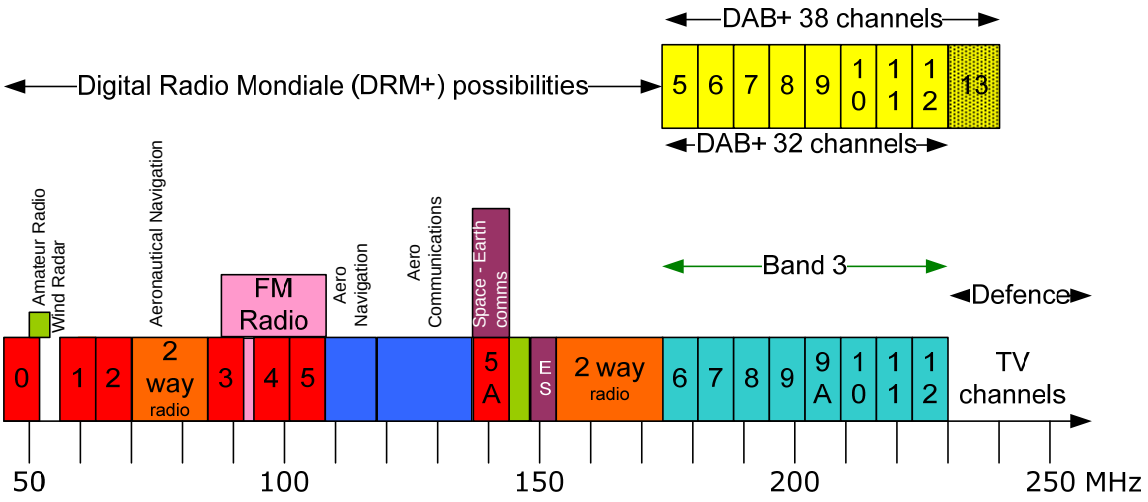
Chapter one: What is the digital dividend?

Current Spectrum Use (including shared use)



VHF allocations

Comments on the current VHF allocations

Ch	Frequency MHz	Reg Tx	LP Tx	# DRM+ Chs	Comments
0	45-52	2	2	49	Amateur band returned
1	56-63	6	4	69	
2	63-70	10	15	69	
3	85 - 92	4	4	23	87.5 – 92 MHz returned to FM broadcast
4	94 - 101	1	1		All returned to FM
5	101 - 108	1	0		All returned to FM
5A	137 - 144	5	10		Returned to Space-earth communications
6h	174 - 181	13	9		
6v		1	2		
7h	181 - 188	6	16		
7v		2	2		
8h	188 - 195	9	7		
8v		0	1		
9h	195 - 202	0	9		
9v		3	2		
9Ah	202 - 209	6	7		Not to be used for TV after restack
9Av		3	2		DAB+
10h	209 - 216	4	5		Not to be used for TV after restack
10v		1	2		Digital Radio
11h	216 - 223	10	6		Not to be used for TV after restack
11v		2	2		DAB+
12h	223 - 230	9	3		Not to be used for TV after restack
12v		5	3		Digital Radio

Ch = channel, Reg Tx = high powered regional transmitters, LP = community Tx which are currently on air, # DRM+ Chs refers to the number of DRM+ 100 kHz wide channels.

If TV channels 6 – 12 are restacked to channels 6 – 9 and channels 27 – 28, then TV channels 9A – 12 can be used for DAB+ digital radio. This leaves 48 RF channels for DAB+ radio, where each RF channel contains a minimum of 9 program streams each.

High powered transmitters whether they are DTV or DAB+ need geographic spacing.

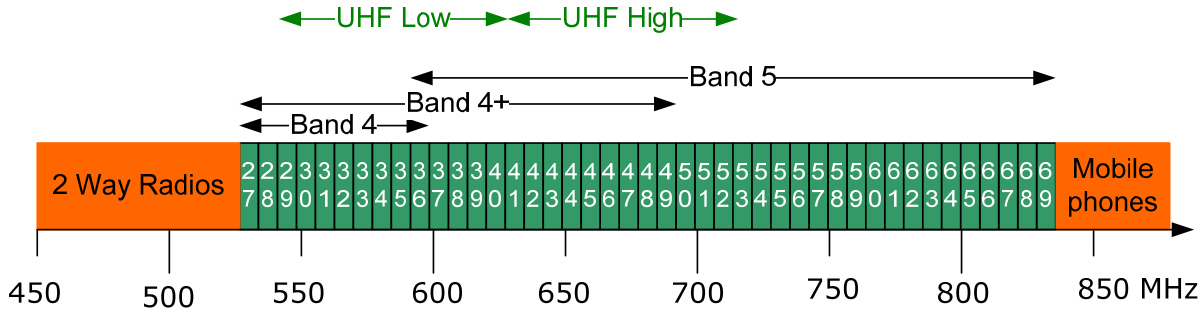
All DAB+ transmissions are vertically polarised, so transmitters on the same DAB+ channel need to be > 400 km apart.

Transmitters on the same TV channel and of the same polarisation need to be >400 km apart, where as when differing polarisations are being used the spacing needs to be >300 km apart.

Pressure to move Band 3 Digital TV to UHF for more digital radio stations.

Fortunately, there is a new digital radio technology called DRM+, which has recently been standardised and can be transmitted in the space left by TV channels 0 - 3. The DRM+ channel generally has only one program and is ideal for regional broadcasters and community broadcasters. DRM30 is available for digital broadcasting in remote areas. Channel 0 is available in Sydney and Melbourne for testing DRM+.[1]

The above being the case there should be little pressure from radio broadcasters to cause TV transmissions to be moved to the higher cost UHF channels.



UHF Allocations

Comments on the current UHF allocations

When designing UHF TV, the Australian Broadcasting Control Board decided to make UHF channels the same bandwidth as the VHF ones. ie 7 MHz. All other DVB countries are using 8 MHz wide UHF channels. This action released channels 21 – 26 (470 – 519 MHz) which have been sold off to the two way radio industry. This channel width reduction reduces the data carrying capacity of UHF TV channels here.

[1] http://www.dbcde.gov.au/radio/digital_radio/rollout_of_digital_radio_in_australia. The DRM+ system needs to be trialled here prior to the review in 2011

Similarly above channel 69, 42 MHz is already being used for mobile phones.

The fact that our UHF TV channels are narrower than that everywhere else (excluding the ATSC/NTSC countries) means that there may be more pressure for DVB-T2 than elsewhere.

Channel availability by comparison

Analog Band	Australia	Europe	USA
1 – 3 (VHF)	13	11 or 0	12
4, 5 (UHF)	43	49	56
Total	56	60 or 49	68
Digital Band	**Australia**	**Europe**	**USA**
3 (VHF)	8	8 or 0	7
4, 5 (UHF)	26	36	38
Total (inc Dividend)	34	44 or 36	45

We currently use Single Frequency Networks and 2 types of polarisation. This is not the case in the USA.

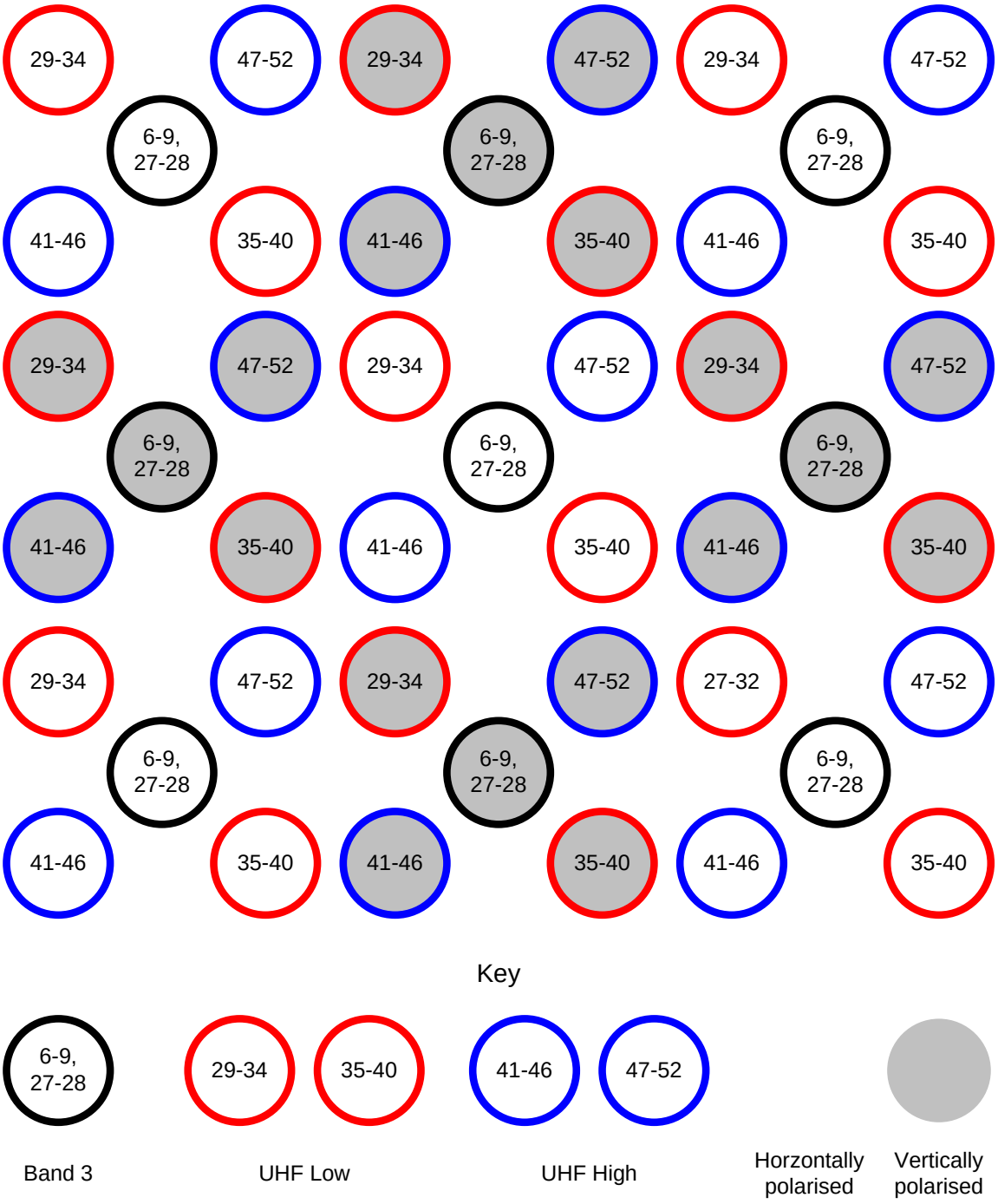
On the "Site layout and their channel and polarisations" diagram below:

- For clarity the circles have been separated, but in fact the coverage areas partially overlap to provide continuous coverage.
- Each site has 6 RF channels per viewing area. Each RF channel can carry multiple program streams. Any black spots within these viewing areas will use single frequency networks within that area.

TV retains channels 6 – 12, 27 – 52 (174 – 230, 519 – 701 MHz). **This is a total of 238 MHz.**

The digital dividend is 217 MHz of which 119 MHz is between TV channel 51 and the existing mobile phone/WiFi network frequencies.

Site layout and their channel and polarisations



Maximising the efficiency of channel allocation

Questions

3.1 Should digital dividend spectrum be used to provide mobile telephony and broadband services?

In North America and to a lesser extent Europe the Phone/Wifi industry is getting a 700 MHz band. These devices will be mass produced for large markets so will be inexpensive, as a result there will be pressure to use them. So the answer is yes.

Questions

3.4 What would be the benefits of this use? Arguments should focus on the value this use of spectrum presents for the Australian community and economy.

The benefits are economic, social and personal as already demonstrated, but can become greater with more bandwidth. The large amount of graphical information required a higher data rate and hence more RF spectrum. The large amount of spectrum will allow many more simultaneous users.

Questions

3.5 How might the roll-out of the NBN impact on the provision of fixed wireless broadband services?

The digital dividend should be used in populous areas for WiFi and phones, however in the less populous areas it should be used to maximise the speeds used in areas where the NBN fibre optic rollout does not reach.

Questions

3.6 How much spectrum would be required to provide these services?

The CSIRO has been using a TV channel 57 low powered transmitter for research into high speed broadband in the less populous regions.http://www.csiro.gov.au/science/Broadband-to-the-bush.html They should be consulted with regard to the data rate vs bandwidth which can be gained in the digital dividend channels.

The balance between WiFi and wireless NBN in the bush should be decided by the Department of Broadband, Communications and the Digital Economy through the use of licence areas. This is the way the TV interference is controlled now.

Question

3.13 Should digital dividend spectrum be used to provide mobile television services?

Competing systems for handheld TV.

- DMB
  - is in competition with Band 3 DTV, and DAB+ digital radio.
  - is in competition with DAB+ channels in 1.452 – 1.492 GHz.
  - channels are 1.5 MHz wide
- DVB-H
  - If restacking of UHF channels is performed then DVB-H must take channels above channel 52 or 701 MHz. 701-729 MHz is required for DVB-H instead of being used by Phone/WiFi use.
- Mediaflo
  - is an alternative to DVB-H
  - Satellite broadcasting 2.520 – 2.67 GHz

Implications for the Digital Dividend

- Unlike some European countries we extensively use 174 – 230 MHz for digital TV. So for this frequency range there is competition between DTV, DAB+ radio and possibly DMB for handheld TV.
- A DVB-H/Mediaflow can carry around 20 handheld quality programs in a UHF TV RF channel. Single Frequency Networks (SFN) can easily be used to carry this UHF single channel over large areas using multiple transmitters.
- SFNs require identical signals to work. This could be provided from a satellite to give national coverage. This will have the following problems;
  - Extra competition for regional TV broadcasters.
  - Time Zones also cause problems with adults only content being shown 3 hours "earlier" in Western Standard Time.
- If a single 7MHz RF channel is used nationally, no regionalisation can be used in the Eastern States. If 14 MHz is allocated to handheld TV then different programs can be transmitted at time zone borders or edges of licence areas.

The main benefit would be that sporting events can be seen live where ever you are. This can have a negative effect on productivity and in Korea has caused many accidents in taxis.

Handheld TV can be distributed by;

- phone companies using "broadcast" mode of their mobile phone network.
- TV companies using a TV transmitter.

Restacking will cause a high density of transmitters per RF channel. This will not allow for the addition of handheld TV in RF channels 27 – 52. This will mean that if TV broadcasters use DVB-H or Mediaflo they will need to be allocated 14 MHz, instead of this allocation going to the phone companies for 4G networks. Perhaps this can be decided by a spectrum auction.

Questions

3.18 How much spectrum would be required to provide these services?

14 MHz

Question

3.19 When would this spectrum be required?

The audience would probably like it to be required from the date the restack is complete

Question

3.20 What would be the benefits of this use? Arguments should focus on the value this use of spectrum presents for the Australian community and economy.

This is for others to decide.

Question

3.21 Should digital dividend spectrum be used to implement DVB-T/MPEG-2 to DVB-T2/MPEG4 or DVB-T/MPEG-4 conversion strategies? If so, which strategies?

Lessons from Other Conversions

1. Analog Terrestrial TV.

Monochrome TV 1956 – 2014

PAL analog colour TV 1975 – 2014

- Colour conversion required no simulcast, ie a pair of transmitters, one transmitting the monochrome signal and another transmitter transmitting the colour signal.
- No duplication of transmission infrastructure.
- Viewers can upgrade to analog colour at their choice
- DVB-T started 2001 for 60 % of the population. It's still expanding.

Simulcast time ≤ 13 years, no subsidies

2. Addition of UHF to VHF only TVs

- 1980 SBS started in Sydney and Melbourne on a simulcast 28/0.
- UHF antennas have to be installed for reception.
- 1976 ABCB told all importers of Video Cassette Recorders that they must include a UHF tuner. VCRs were used as a PVR is today.
- UHF tuners were added to TVs.
- 1983 SBS starts expansion on UHF only. This was followed by most stations in regional areas. Eventually UHF translators were installed in metropolitan areas.

Simulcast time 6 years, Sydney/Melbourne only. No subsidies

3. Remote area Satellite, direct to home reception

- 1975 The Homestead and Community Broadcast Satellite System (HACBSS) started using analog BMAC.
- 1998 was the start of 'Aurora' using DVB-S digital receivers.

- For those with a HACBSS receiver a $700 voucher was given for the changeover

Simulcast time ≤½ year, $700 changeover subsidy

4. USA Method - DTV Tuner Mandate[2]

"On August 8, 2002, the Commission adopted an Order that required digital **TV tuners to be included in nearly all new TV sets by July 1, 2007**. The Commission's mandate, and its authority under the 1962 All Channel Receiver Act, was upheld by the Court of Appeals for the D.C. Circuit

The mandate required that all TV receivers with screen sizes greater than 13 inches (32 cm) and all television receiving equipment such as video cassette recorders (VCRs) and digital versatile disk (DVD) players/recorders, have DTV reception capability as of July 1, 2007. The mandate adopted a phased-in schedule, starting with the largest sets in an effort to minimize the costs for equipment manufacturers and consumers."

Simulcast time ≤5 years, 2 x ½ price STB subsidy/household[3]

5. Current upgrade path for MPEG-4

The Freeview ® company is owned by nearly all the Free to Air broadcasters, including the Commonwealth Government broadcasters. It has a receiver approval scheme. Their exact specifications are secret; however it is known that it includes HD MPEG-4 decoding. There approval proposal includes a testing scheme which is paid for by those applying for approval.

"By being dragged along by the rest of the world".

Many other countries are using MPEG-4 for broadcasting, so the manufacturers are installing a single integrated circuit chip de-compressor which can be fed with MPEG-4 or MPEG-2 into all their products. This is similar to the way that Australian radio was upgraded from AM to FM.

Simulcast time yet to start

[2] http://www.fcc.gov/ola/docs/chessen052605.pdf
[3] http://www.fcc.gov/cgb/consumerfacts/converterboxfeatures.pdf

Factors Affecting Upgrading of the Broadcast System

- Upgraded signals, which prevent the reception of existing programs e.g. **DVB-T2** requires a new modulator in each transmitter and a new tuner in every receiver

  N.B. Requires all receivers to be able to receive the present and future signal, prior to changeover otherwise wasteful simulcasting is required.

- Upgraded signals which can be added as new services. E.g. **MPEG-4**
  - The new programs can be used as a motivator for change, however this may only motivate parts of the audience to upgrade.
  - The presence of an upgraded signal within a multiplex warns the public of a change. It also allows the public to find out if their equipment is compatible.
- Inconvenience to the viewer
  - If possible the upgrade should not require more remote controls
  - No additional operational confusion (more buttons to chose from and decisions to be made when viewing)
- Confusion in the shop
  - Rather than multiple stickers, it is better for the regulator to make the technology decisions by mandating capabilities for example DVB-T2 and HD MPEG-4. This will remove the temptation to buy the cheapest (incompatible) receiver even if the price difference is small, which greatly slows the change over.
  - MPEG-4 transmissions are stored in a Personal Video Recorder in that form, this will extend the amount of stored program time by 30 – 50 % than MPEG-2 transmissions.
  - Multiplicity of stickers. A single recognisable sticker should be applied for example the Australian Standard triple ticks AS 4933.1-2010. This is to indicate it is not old stock.
  - The specifications in the instruction manual must contain the new technologies in their specifications. These are international standards so there is no disadvantage in doing this in all manuals.
- Value for money as perceived by the viewer
  - This can be justified by large changes in quality for example monochrome to colour or from 2D to 3D.

- Additional program choices can be a motivator provided the type of programming is popular.
- The viewer must be able to perceive an improvement of technical quality.
- Those with worse than average eyesight and or hearing may not detect the improvement in technical quality.
- It must also be remembered that most of us do not go to the retailers of TV products often which will show the improvement.
- The lighting and acoustic environment in of a lot of retailers, make it hard to see the improvements in quality.
  - Too much light falling on the screen from overhead lighting.
  - Too noisy and echoic for sound assessment.

- The cost vs average income
  - A longer time is required if a display has to be changed vs a receiver upgrade due to the cost differences
- The period allowed for change over.
  - Calculate the following;

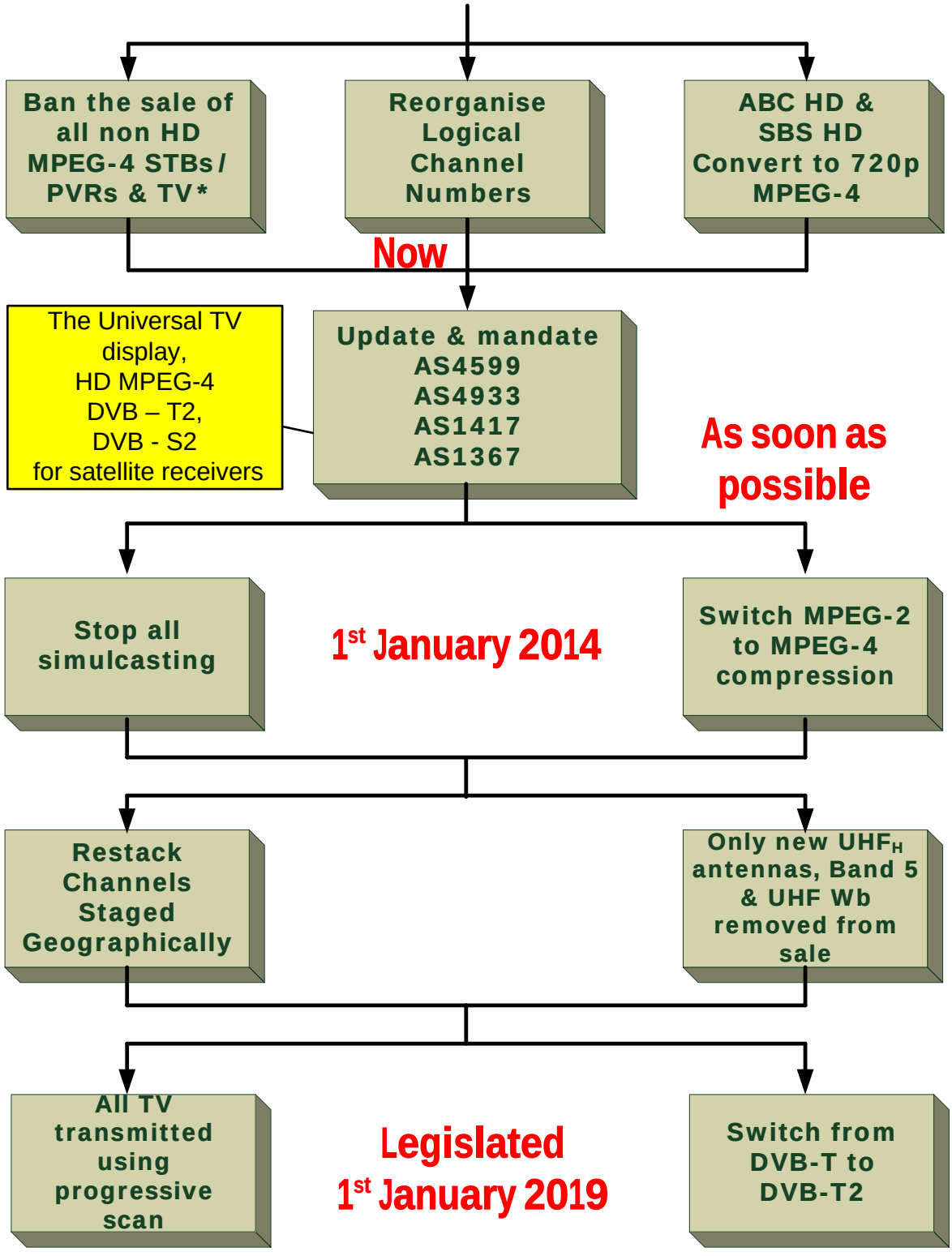
$$\text{Receivers/dwelling} = \frac{\text{Total Receiver sales over last 10 years}}{\text{Total number of dwellings during The last pair of censuses}}$$

$$\text{\% conversion} = \frac{\text{Total Receiver sales since conversion started} \times \text{Receivers/dwelling} \times 100}{\text{Total number of dwellings in the current census}}$$

The dwelling numbers are available from the Australian Bureau of Statistics.

- Excessive time allowances are not effective. The first 7 years of the Analog Switch Over did not produce a very large percentage of converted receivers.
- All importers/manufacturers must submit sales records of the number of units sold so that a change over date for all services to be converted to the new standard can be determined.

A Proposed Digital TV Upgrade Path



* must be able to produce a viewable program from HD MPEG-4 signals. Display may have less resolution

- Immediately stop the sale of non HD MPEG-4 Set Top Boxes, PVRs and DVB-S2 satellite receivers.
- Immediately change the Logical Channel Numbers
  - to make the single digit channel selection, the network's premium program stream. This means that any HD original programs will be seen on an HD display in HD. This will maximise the HD audience.
  - to impress upon the networks that they are primarily HD broadcasters, with the DBCDE and Freeview® advertising that you need an HD set top box.

Current Logical Channel Numbers and their Titles

1	2	3	5	6	7	8	9
1 One HD	**2** ABC1	**3** SBS1	**5** Sthn X	**6** Prime	**7** Digital	**8** WIN/ NBN	**9** Nine Digital
10 TEN Digital	**20** ABCHD	**30** SBSHD	**50** One HD	**60** Prime HD	**70** 7HD Digital	**80** WINHD/ NBNHD	**90** Nine HD
11 One HD	**21** ABC1	**32** SBS2	**51** One	**62** Prime 2	**71** 7 Digital 1	**88** GO!	**99** GO!
12 ONE	**22** ABC2	**33** SBS3			**72** 7TWO		
	23 ABC3	**34** SBS4			**73** 7 Digital 3		

http://www.freetv.com.au/media/Engineering/OP41_LCN_Descriptor_Issue_5_September_2008.pdf states" The single digit LCN is recommended to be allocated to the primary SD service." This is not taking advantage of the transmission of HD signals.

DBCDE has been heavily promoting the use of HD receivers as is Freeview®.

The logic for the table below is that for all those with Freeview® and HD boxes can easily select the HD signals as the first option. This means that any HD original program will be seen by this audience in its "full" glory. The program down button then shows the other network's programs.

SD viewers can select the channel number and push the up arrow button for their wanted program.

SBS Radio will have to change the signals from 38 and 39 to 301 and 302 respectively.

Proposed Logical Channel Numbers and their Titles

	1	2	3	5	6	7	8	9
HD	**1** ONE	**2** ABC1	**3** SBS1	**5** SC/One	**6** Prime	**7** Seven	**8** WIN/ NBN	**9** Nine
To be HD	*10 TEN*	**22** ABC2	**32** SBS2	*50 Sthn X*	**62** Prime TWO	**72** 7TWO	**82** GO!	**92** GO!
SD		**23** ABC3						
		24 ABC News						
SD to be drop-ped	**19** ONE SD	**29** ABC1 SD	**39** SBS1 SD	**59** SC/One SD	**69** Prime SD	**79** Seven SD	**89** WIN SD/ NBN SD	**99** Nine SD

Row 1.

All single digit channel numbers are to be HD streams. HD logos can only appear on HD original programs and their advertising. (720p or better, Super 16 film or better, scanned by an HD telecine). Up-conversions are not HD. The stream is not to be labelled as HD, just the programs.

Row 2.

With the exception of 10 all second programs' LCNs end in 2. With the exception of ABC & SBS these program streams will become HD MPEG-4 on 1st January 2014

The viewer can select the network by number and push the down arrow key to get the second program.

Bottom Row.

All simulcasts end with the same number. The program up key can be pushed to get the second program.

1st January 2014 these simulcast channels using #9 will stop. This will make more data available for the HD signals.

Using the above LCNs makes rescans easier because there is less need to use favourites to delete unwanted channels. No other LCNs should be used unless they have unique programs.

The only costs are

- Publicity campaign to indicate that to fit ABC News channel and ABCHD in to the ABC's channel they will be transmitted in MPEG-4. All transmissions will be in MPEG-4 from 1st January 2014.
- The ABC only has one on-air MPEG-2 HD encoder. This means that their HD program contains NSW programs including news, so elsewhere the viewers tend to use the SD service so they don't miss their news. The ABC will have to buy 6 HD MPEG-4 encoders. Regional commercials may have also to increase the number of their HD encoders as well.
- If any broadcaster is to buy HD encoders they should be capable of Full HD MPEG-4 ready for the next step of the upgrading.
- SD boxes will have to be rescanned and the favourites set to remove the numbers 1 – 9 which will not display the program. The favourites will become 10, 19, 29, 22, 23, 24, 39, 32, etc.
- Publicity campaign for viewers' to rescan their receivers. The reason is so that those who have large screens can benefit from sharper pictures.

Background tasks

- DBCDE should monitor the European Telecommunications Standards Institute and the International Standards Organisation for new standards with respect to Television and Radio.
- Once another country with a larger population has adopted a standard relevant to Australia, a meeting of the CT002 of the Australian Standards Association should be convened and a draft proposal produced. The submissions should be analysed and a new standard produced. The latest versions of AS 4933 Digital Television receiver, AS 4599.1-2007, Digital television - Terrestrial broadcasting and AS 4943.1-2009 Digital radio - Terrestrial

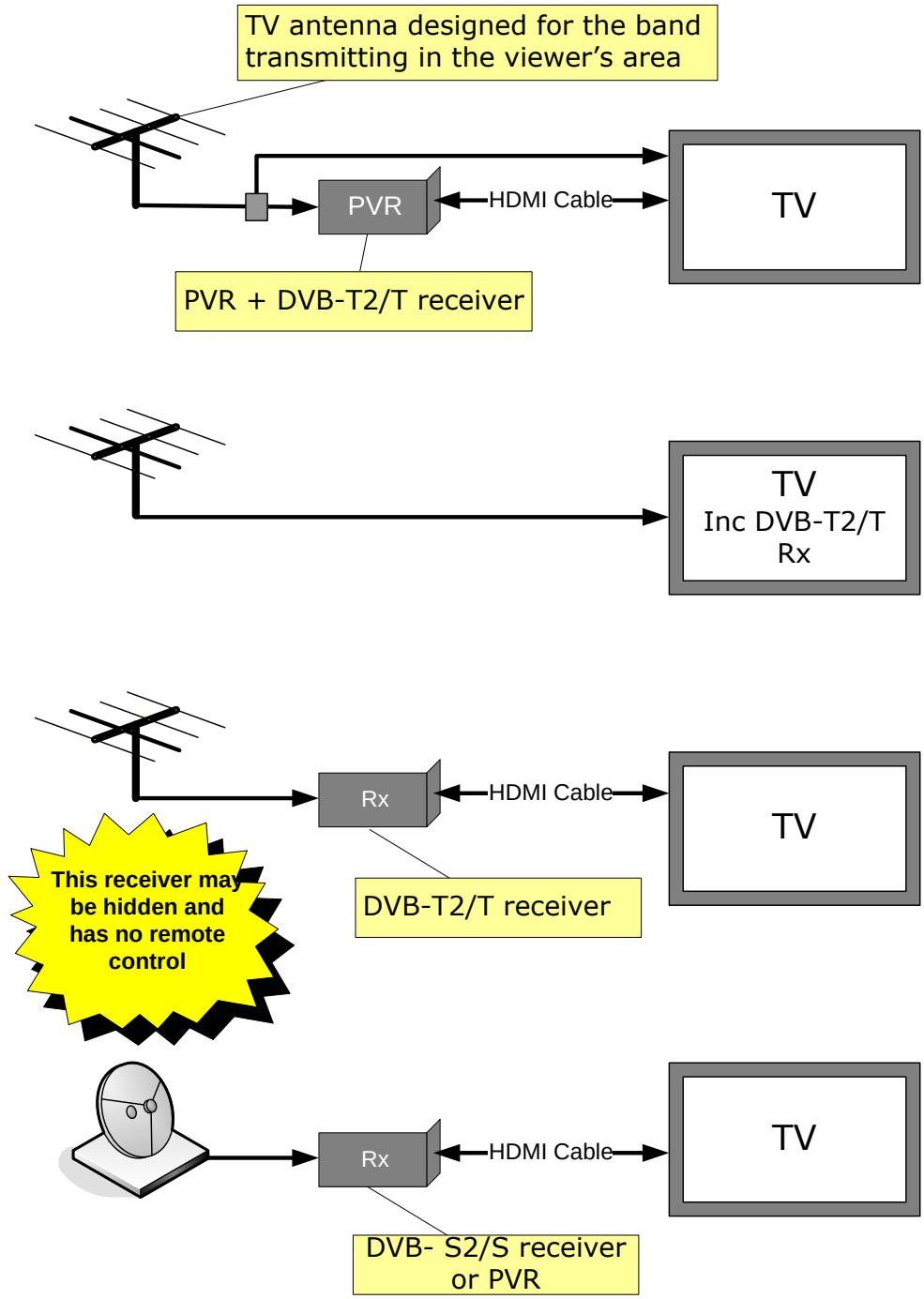
broadcasting may need to be modified. This is a preferable method to the Freeview ® path, which is not open to public scrutiny in its design and implementation.

TV displays

- Many new displays can do all or some of the functions listed below. They make for a single specification which can be used worldwide. These proposals only require minor modifications to the current generation of displays.
- All must have at least 3 HDMI inputs and one output (to sound amplifier).
- The HDMI connections must be capable of sending all commands. These commands must be to the HDMI standard and not be brand (manufacturer) specific as they are currently advertised.
- Many displays can display 24 frame/s (24p) from Blu-ray discs
- Many displays display frames more than once, so they should have to be able to show images at 24, 25, 30, 48, 50 and 60 frame/s progressively scanned. 25 and 29.94 frame/s should also be capable of interlaced inputs.
- 1920 x 1080, 1280 x 720, 720 x 576 and 702 x 483 signals must produce a viewable picture at all of the above frame rates, however the native resolution is up to the manufacturer. Native resolution must be stated in specifications.
- The requirement of the myriad of analog inputs should be dropped in 5 years time.

TV tuner(s) in TV sets, PVRs, and STBs

- DVB-T2/DVB-T tuner for terrestrial reception
- DVB-S2/DVB-S tuner in satellite receivers for satellite reception of 'Aurora' Free to Air transmissions where terrestrial signals are not available.
- HD MPEG-4/MPEG-2 decompressor
- PVRs/STBs/Satellite receivers must be able to carry out the appropriate commands from their HDMI output.
- PVRs and Digital Video Recorders must have a composite PAL/ NTSC input. This will allow displays to only have HDMI inputs and power only.
- Retailers are to supply an HDMI cable and not the RCA cables as at present.



HDMI Cable is to carry pictures and sound to the TV and commands from the TV's remote control to the source device.

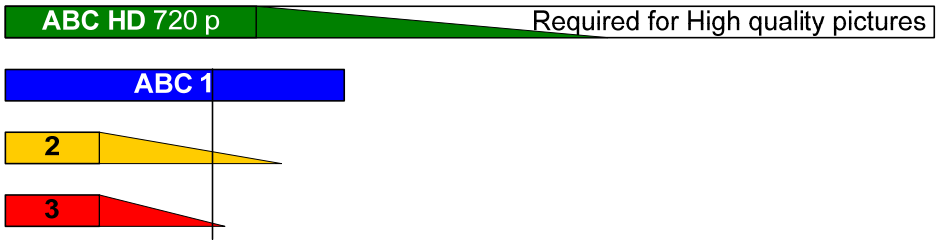
Golden Opportunity Lost!

The ABC has announced that they will be using their HD channel for a news channel.

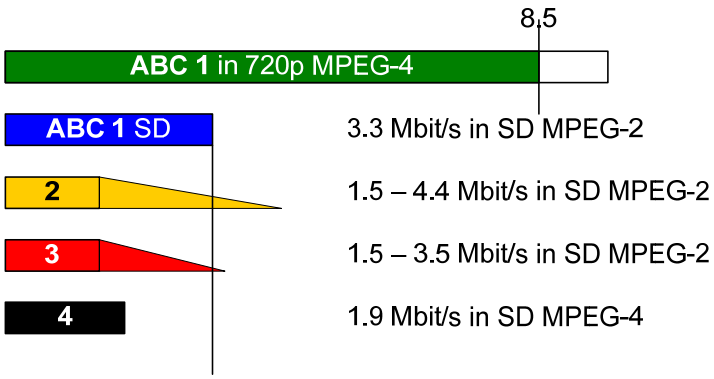
ABC1 is the program most people watch and should be available in HD where as ABC News is for a specialised smaller audience. Most of the original news material will not be HD anyway.

Data rates for the ABC

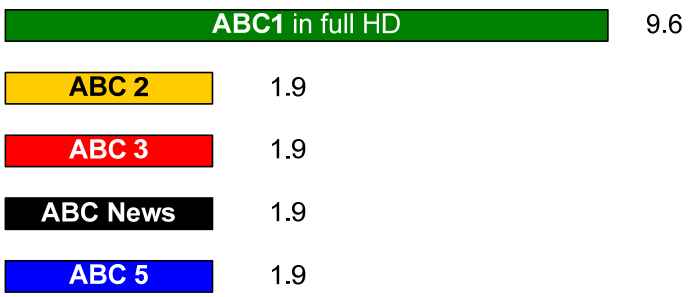
MPEG-2 as it is now



Proposed, to retain all current programs & promote MPEG-4



From 1/1/2014 all programs MPEG-4



Freeview® can advertise the ABC News channel as an additional new channel requiring a Freeview® approved receiver. Some other non approved receivers can also receive this and ABC HD as well.

No one will miss out on programs because ABC1 SD is still on air in MPEG-2 compression.

Statistical multiplexing should be applied to all program streams except ABC1 in HD because it contains the most viewed programs.

Question

3.22 Would additional spectrum be required? If so, how much?

No additional spectrum is required.

Question

3.23 When would this spectrum be required?

Never, however all receivers will need to be capable of receiving the new standards which will take time to occur.

1st January 2014 for MPEG-4 compression on Free to Air TV, 1St January 2019 for DVB-T2. I say this because Pay TV will start satellite transmission of 3D using MPEG-4.2 and DVB-S2 this year in Australia.

Question

3.24 What would be the benefits of this use? Arguments should focus on the value this use of spectrum presents for the Australian community and economy.

The only source of signals which are "Full HD[4]" quality are on Blu-ray discs. The current broadcasting system is not capable of this quality even for the HD channels. This is because the amount of data which can be transmitted in a single TV channel is insufficient.

MPEG-2 to MPEG-4 compression conversion

- For the same picture quality MPEG-4 compression produces **30% - 50 % less data.** The freed data should be used to improve the picture quality to Full HD.
- The Department should fund satellite distribution to remote areas. The use of MPEG-4 compression will **reduce the cost of this subsidy for satellite charges by 30 – 50 %.**
- Three dimensional TV will start on HD pay TV this year. Those HD pay TV operators are using MPEG-4 compression for their signals already.

[4] Full HD is 1920 x 1080 resolution using progressive scanning at 24 frame/s

- The three dimensional TV compression standard is MPEG-4.2. This means that an existing MPEG-4 receiver can show a 2D signal and the 3D receiver will use the 2D signal and the additional "depth" signal to create the 3D image. This is why HD+ Pay TV can transmit 3D this year and not loose their existing HD+ audience who can watch the same signal in 2D.

- Once the DTV system is MPEG-4 capable, the economic benefit is that a 3D signal can be viewed by the whole audience without the need for a separate TV transmitter network. The costs are to those who wish to buy 3D TVs and the broadcaster's studio facilities as well as program purchase costs.

DVB-T to DVB-T2 modulation conversion for Terrestrial TV

- This new modulation system increases the data capacity from 23 Mbit/s to 35 Mbit/s
- Compare the 35 Mbit/s to the 54 Mbit/s of a Blu-Ray disc and this is for a single program.
- All DVB-T2 receivers are HD MPEG-4 capable.
- **The advantage of DVB-T2/MPEG-4 system is that for an unchanged picture/sound quality the efficiency has been increased by 51- 65 % more efficient.** This can be used to improve picture quality and/or increase the number of programs broadcast

DVB-S to DVB-S2 modulation conversion for Satellite TV.

- This new modulation system increases the data capacity by around 30 %
- All DVB-S2 receivers are MPEG-4 capable.
- The advantage of DVB-S2/MPEG-4 system is that for an unchanged picture/sound quality the **efficiency has been increased by 51-65 % more efficient**. This can be used to improve picture quality and/or increase the number of programs broadcast
- DVB-S2 satellite receiver can output MPEG-4 ready for terrestrial transmitter broadcasting MPEG-4 signals. This will eliminate the need for MPEG-4 decompression followed by MPEG-2 compression.

The current model of TV infrastructure is to have a single "playout" centre per network in a single location. This makes all the programs emanate from either, Sydney, Melbourne, Canberra or Wollongong. This model would make it easy to licence program streams instead of licensing RF channels. This would create media diversity. The existing broadcasters would not like having to transmit a competitors' programs.

DVB-S2 reduces the satellite transmission costs by 30 % compared to DVB-S which is used in the original Aurora DVB-S = 38.4 Mb/s DVB-S2 51.2 Mb/s

The ability to transmit your own programs to your own audience improves the likelihood of local program production. Some of this production can be exported, particularly in the early stages of 3D because there are few programs available for broadcast.

The ticket sales for "Avatar" in 3D have been record breaking, indicating the popularity of 3D with Australian audiences. Australian company "Radio Pictures" has already produced a 3D movie called "Cane Toad – The conquest".[5]

One of the benefits from the Digital Dividend could be to use some of the profit to pay for promotion of and the removal of any GST and customs duty on DVB-T2 receivers during the conversion period. This is to speed the conversion to this standard. All receivers have to be DVB-T2 capable before the switch can be made. Otherwise viewers loose TV viewing.

Question

4.1 What issues will arise through viewers being required to rescan? Can receivers be developed that are able to automatically rescan?

There are two meanings here;

1. Looking for transmitters

   By the start of 2014 all DTV transmitters should be on air, so the only time this is required is when the viewer moves or on installation.

   Provided all channel changes in transmitters occur simultaneously and simulcasting has stopped then the once only rescan will become much easier. It will require however, that the receiver firmware can, when it finds more that one signal from the one broadcaster, evaluate these signals and only store the best quality one. A typical example is where there is a signal from a translator as well as the main transmitter.

2. Looking for additional programs on existing transmitted signals.

   This is probably what the question is referring to. This function was proposed in Australian Standard Draft - DR 09019 CP Digital television - Requirements for receivers - VHF/UHF DVB-T television broadcasts[6]

   Note: If the Logical Channel Numbers are changed now as proposed in my upgrade path, then the only effect at the start of 2014 is that the ABC1 SD, SBS1 SD, Sthrn X SD, Prime SD, Seven SD WIN/NBN

[5] http://www.canetoadstheconquest.com
[6] http://infostore.saiglobal.com/store/Details.aspx?ProductID=1102642

SD and Nine SD disappear when simulcasting stops. No other changes will be required. For example if the second channel which is currently SD becomes HD normally a rescan will not be required.

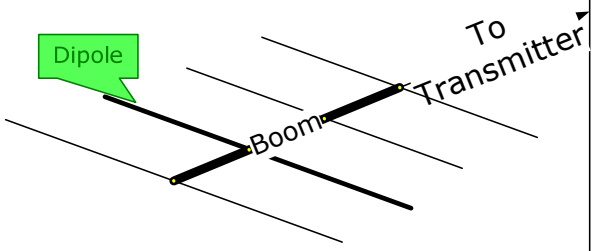
Question

4.2 In the small number of cases potentially affected, what is the likely cost for viewers associated with replacing their existing UHF antennas? It would be helpful if the cost per antenna and the likely total cost for all affected viewers could be identified.

- VHF Channels 0 – 5A will not be used for DTV. One third of the "analog" VHF-UHF combination antenna used for analog TV will never be used for digital TV. This type of antenna is more susceptible to interference and is less sensitive to the DTV channels. **As a result sales of new TV antennas for this channel range should be banned.**
- Restack Band 3 into channels 6 – 9, 27 and 28. TV channels 9A – 12 can be allocated to DAB+ only.
- UHF channels 21 – 26 are already being used for non TV applications, however many imported antennas are designed for these channels and results in interference being received.
- Restacking Band 4 channels 28 – 36 will not require new antennas however if all transmitters on that site are UHF you will need channels 29 – 34 on one site for 6 RF channels. The next nearest site could use channels 35 – 40. So an existing Band 4 antenna should be re designed to cover channels 29 – 40.
- Restacking band 5 channels 36 – 69 means that those transmitters will be stacked from channels 41 – 46, 47 – 52. So an existing band 5 antenna will work after restacking.
- Update AS 1417.2—1991 – "Receiving antennas for radio and television in the frequency range 30 MHz to 1 GHz Part 2: Performance" and make it mandatory. All new TV antennas (including phased arrays) should be designed for the following frequency ranges
    - Band 3: 174 – 202 MHz (Channels 6 – 9)
    - UHF low: 519 – 617 MHz (Channels 27 – 40)
    - UHF high: 617 – 701 MHz (Channels 41 – 52)
    - All masthead amplifiers must have filters to the above frequency ranges. The existing 820 MHz filter should be switchable to 701 MHz until restacking is complete. Then the 820 MHz option is to be removed. This filter is essential to allow WiFi and Phone interference to be eliminated.

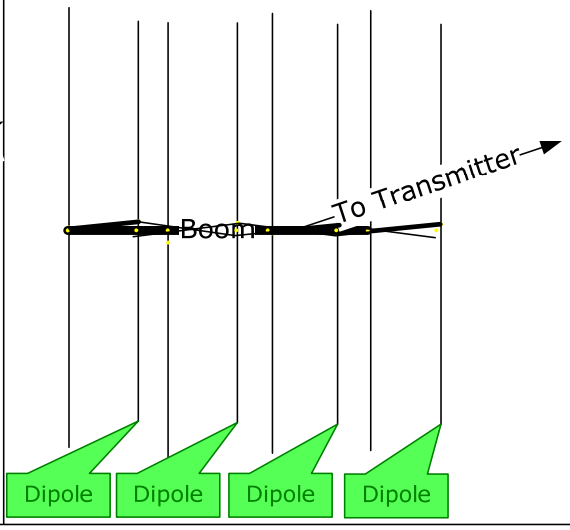
Antenna Types

Horizontally Polarised Yagi-Uda



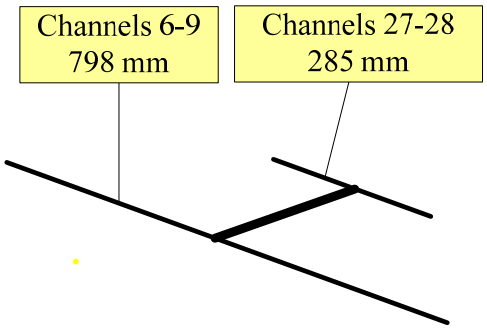
Dipole is connected to the receiver

Vertically Polarised Phased Array

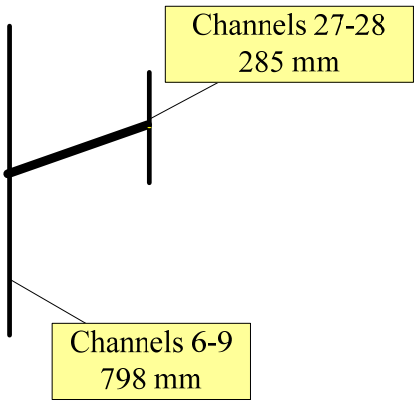


Only a dipole is shown below

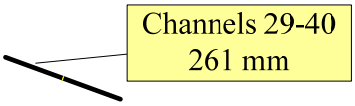
Combo



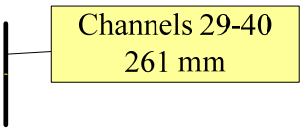
Combo



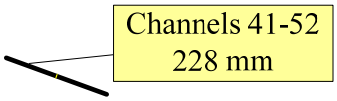
UHF Low



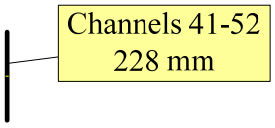
UHF Low



UHF High



UHF High

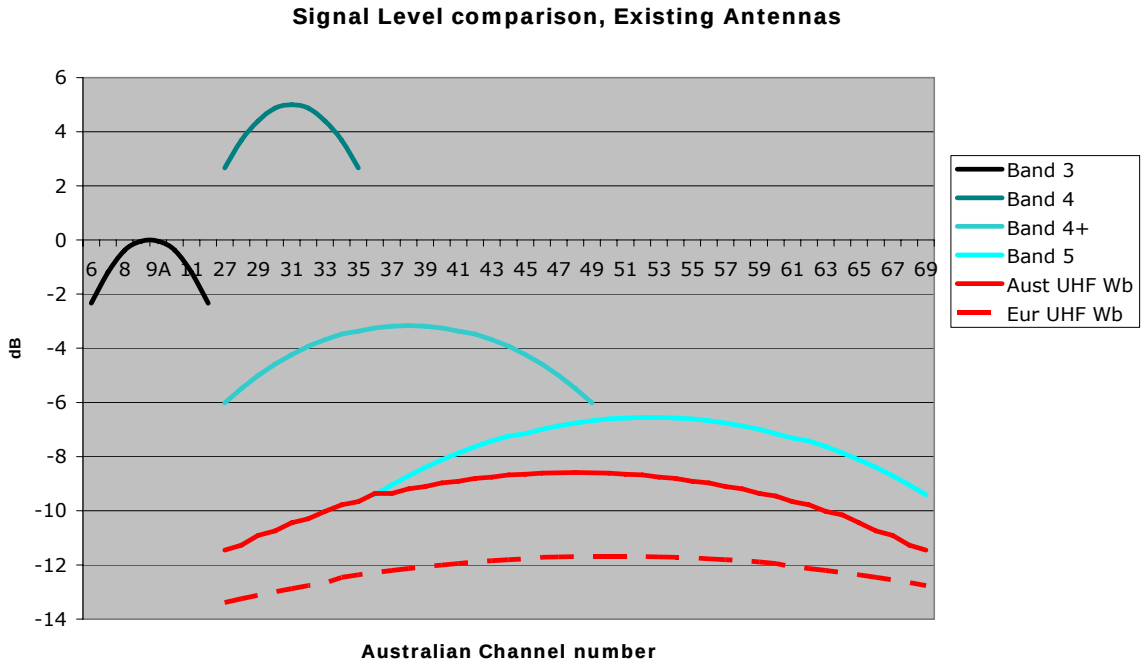


Note: DVB-T2 achieves a higher data rate by increasing the number of different transmitted power levels. This makes the signal more susceptible to noise. An improved error correction system is used to overcome some of the effects of this increased noise. The use of more sensitive antennas for the same price as the current antennas will help maintain reliable reception.

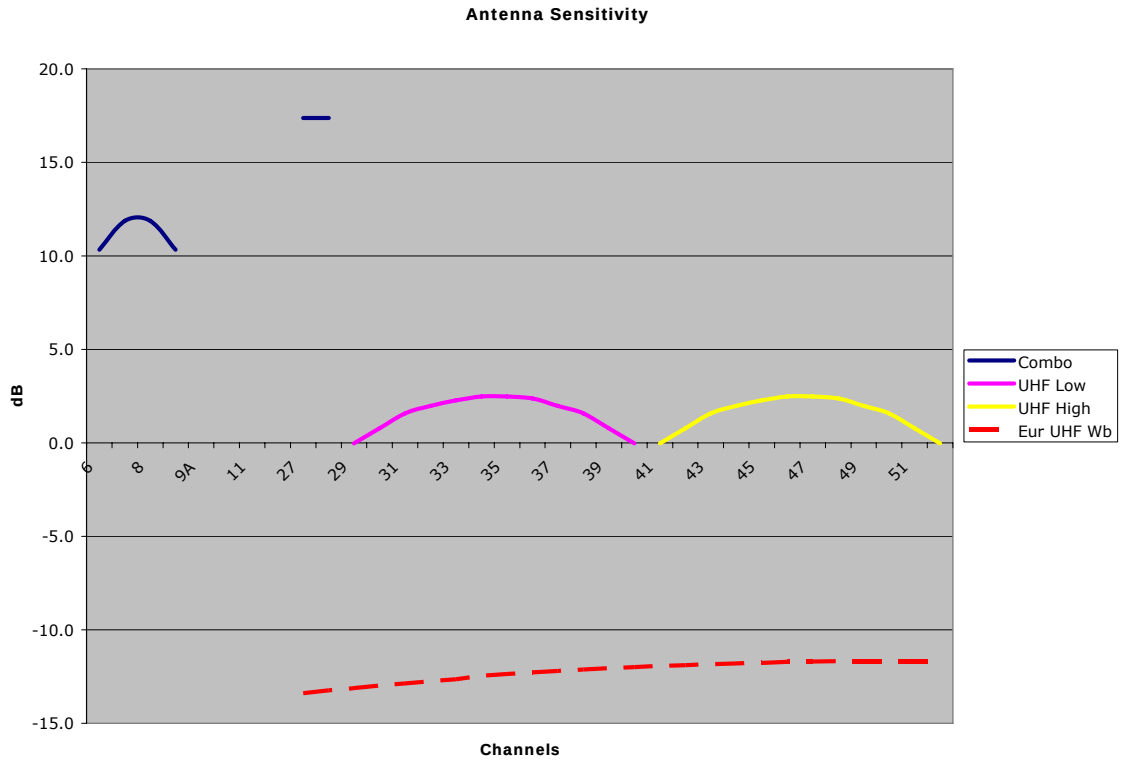
UHF and combined VHF/UHF antennas are designed in the bands of channels called band 4, 4+, 5 and wideband. Unfortunately the sensitivity of these antennas decreases in the order just quoted.

The next page shows a comparison of the sensitivity of the old antennas and antennas designed for the channel ranges above.

Graphs include the 6 dB transmitter power increase for UHF.



Existing "Digital" Antennas which can receive analog TV within this range



The sensitivity of an antenna designed for the TV channels left after restacking.

Note the sensitivity of an antenna designed for the restacked channels is much greater.

This will make UHF reception more reliable and black spot areas smaller.

The costs of restacking at the viewer end.

- **After the upgrading of Master Antenna TV systems for multiple dwelling buildings, the channel amplifiers will have to be retuned to the new channels. During this time simulcasting will be required during the restacking while each area is converted. The previous upgrade to digital reception should have fixed the installation problems. This should make the retuning a quick inexpensive adjustment per installation.**

Question

4.6 How would low-interference potential devices be best accommodated in the UHF bands in light of the proposed digital dividend and the restacking of digital broadcasting services?

I am unaware of this sharing with TV. Since virtually all of these devices are fully imported it is up to the World Radio Conference to set

the frequency band for these devices. Otherwise each device will have to be modified prior to use in Australia.

The increasing density of use for 519 – 701 MHz for TV it would be desirable for low power devices to not be in the TV bands. This has already been a problem with medical monitoring devices in the 188 - 195 MHz range which was to be used for DTV channel 8.

Alan Hughes.